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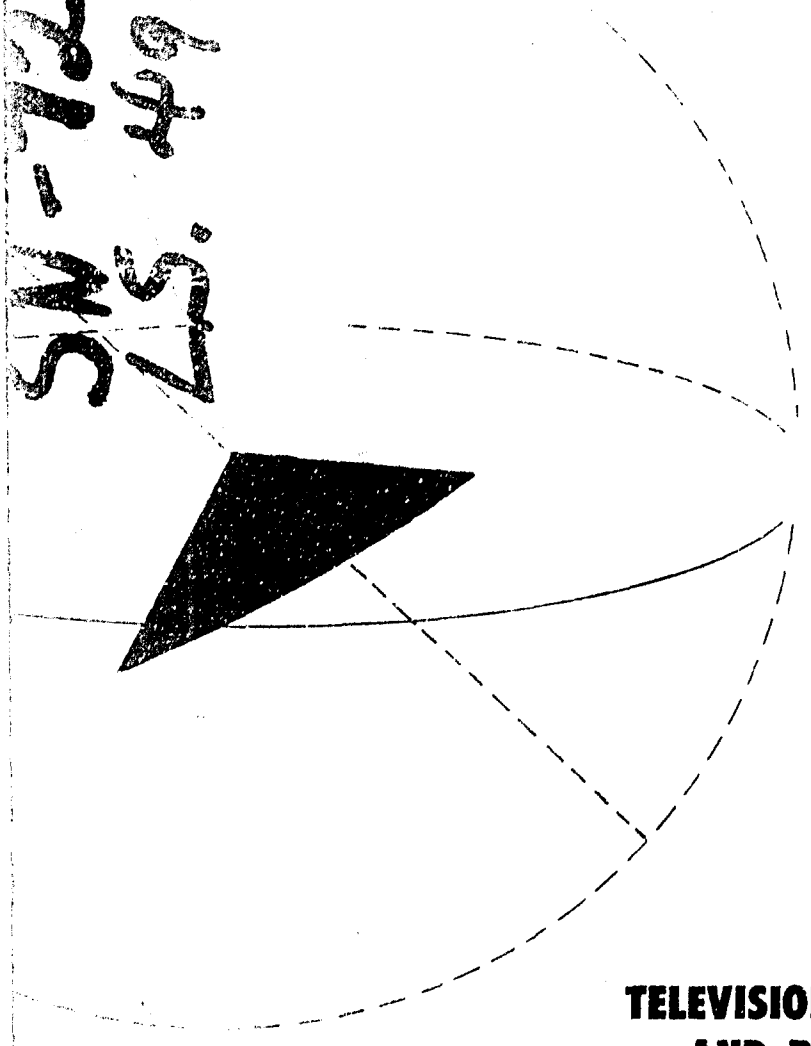

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# TELEVISION, PHOTOGRAMMETRY, PHOTOMETRY, AND RADIOMETRY ADAPTABLE TO SPACE RECONNAISSANCE

LITERATURE SEARCH NO. 490

NOVEMBER 1963

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JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY, PASADENA, CALIFORNIA

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# ASTRONAUTICS INFORMATION

## TELEVISION, PHOTOGRAMMETRY, PHOTOMETRY, AND RADIOMETRY ADAPTABLE TO SPACE RECONNAISSANCE

LITERATURE SEARCH NO. 490

COMPILED BY
JUDITH HAYES

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA

NOVEMBER 1963

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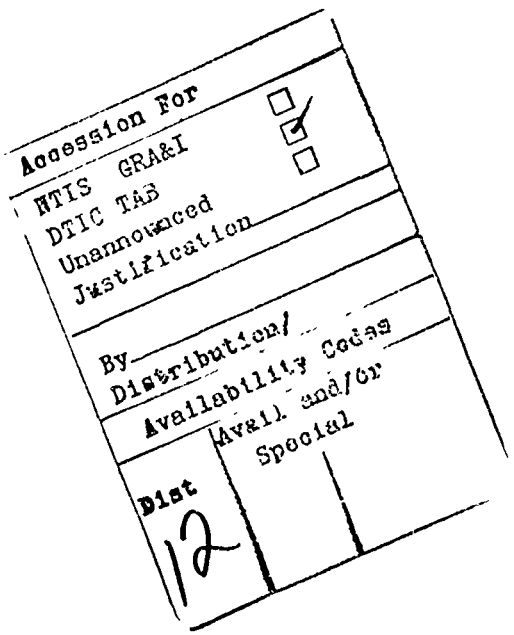

## FOREWORD

This literature survey has been compiled at the request of engineering personnel at the Jet Propulsion Laboratory (JPL) and is published for distribution to interested organizations working in the field of astronautics.

To facilitate its use, the survey has been divided into the following sections:

**Airborne Photography**—This section contains references on aerial photography and photogrammetry, with special emphasis on Earth reconnaissance and the adaptation of television.

**Astronomical Photography**—Television-telescope systems, space probe reconnaissance systems, and observations (other than radiometric or photometric) of the Moon and planets are included.

**Television Development**—General references on new developments in television, standards, and the history of specialized groups are found in this section.

**Television Scanning**—Electronic scanning, rather than mechanical, is investigated.

**Television Bandwidth**—Methods of reducing bandwidth while achieving maximum efficiency are covered.

**Television Systems**—References on television cameras are combined with those on amplifiers, generators, infrared and electron image intensifiers, focusing signals, modulation, gating, and circuits.

**Television Noise, Resolution, and Coding**—Methods of optimum coding, of achieving maximum resolution, and of eliminating or reducing noise are referenced.

**Colorimetry and Illumination**—Types of illumination and the analyses of colorimetry applied to television are covered.

**Photometry and Radiometry**—These references pertain to photometric, spectrophotometric, and radiometric methods of studying the surfaces and atmospheres of the Moon and planets.

Within each of these sections the references have been arranged in chronological order. For the convenience of the user, the sections on **Astronomical Photography** and **Photometry and Radiometry** have been further subdivided, within each year general information precedes an alphabetical arrangement of the Moon and planets.

An author index and a corporate source index have been included to further assist the user.

Sources searched for this material were:
*Astronautics Information Abstracts* (*AI/A*), Vol. I, Part D, 1959 through Vol. VII, No. 6, 1963
*Astronautics Information Survey* (*AI/S*), Vol. I, 1959 through Vol. V, No. 6, 1962
*Astronomischer Jahresbericht* (*AJ*), 1959 and 1960
*Applied Science and Technology Index* (*AS&T*), 1960 through June 1963
*Electrical Engineering Abstracts* (*EEA*), 1958 through June 1963
*Engineering Index* (*EI*), 1958 through June 1963
*Physics Abstracts* (*PA*), 1959 through June 1963
Defense Documentation Center, TABS No. 13, 1959 through No. 63-36, 1963
JPL IBM Subject Listing, 1961 through June 1963
JPL Book File
Publishers Guide to Books in Print, 1961 and 1962

Material on television prior to 1959 can be found in JPL AI/LS#160, "Photographic and Television Equipment and Techniques Adaptable to Spaceflight." JPL AI/LS#345, "Radiometry and Photometry of the Moon and Planets," includes references on planetary observations prior to 1961.

The compiler wishes to acknowledge the assistance of William Schaefer and Cary Fultz in the selection of material, and Dorris M. Wallenbrock for the translation of references from *Astronomischer Jahresbericht*.

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# AIRBORNE PHOTOGRAPHY

1. ELEMENTS OF PHOTOGRAMMETRY
Church, E., Quinn, A. O.
Syracuse University Press, Syracuse, N.Y., Revised Edition, 1948

2. A SYMPOSIUM ON RECENT TRENDS IN AERIAL PHOTOGRAPHY
March 15, 1952
Boston University, Optical Research Laboratory, Mass.
Report TN-84, AF 33(038)-15615, W33-038-ac-14075
ATI-147,104

Papers presented cover the following: analysis and synthesis of optical systems; microorganisms as photosensitive receivers; psychological research in aerial photo-interpretation; and experiments on the deterioration of pictorial image quality with resolution.

3. MATHEMATICAL METHODS USED TO DETERMINE THE POSITION AND ATTITUDE OF AN AERIAL CAMERA
Strand, O. N.
March 1956
Naval Ordnance Test Station, China Lake, Calif.
NOTS 1585, NAVORD R-5333

Two mathematical methods are presented for determining the position and attitude of an aerial camera from the positions of the images of surveyed ground markers. The first method is presently in use at NOTS, while the second method is a least-squares solution which is being coded for machine computation. A procedure for determining the precision of the present solution is given in the appendix.

4. METEOROLOGICAL UTILIZATION OF IMAGES OF THE EARTH'S SURFACE TRANSMITTED FROM A SATELLITE VEHICLE
Glaser, A. H.
October 31, 1957
Harvard University, Blue Hill Meteorological Observatory, Cambridge, Mass.
AFCRL-TR-57-241, AF 19(604)-1589, Phase II
AD-146,764

Images sent back to Earth by radio communication from a satellite are measured by the amount of information contained in each image. The amount of information that appears in the final image on the ground is determined in large measure by the capacity of the communication channel to transfer this information. Investigation of the limitations to the capacity of a channel, leading to corresponding limitations to the quality of the images that may be received at Earth is presented.

5. ANALYTICAL PHOTOGRAMMETRY
Merritt, E. L.
Pitman Publishing Corporation, New York, N.Y., 1958

6. EARTH SATELLITE PHOTOGRAMMETRY
Rosenberg, P.
*Photogrammetric Engineering*, v. 24, no. 3, pp. 353–360, June 1958
(*AI/S*, 1959, #10,599)

7. AEROTRIANGULATION TESTS
Tewinkel, G. C.
*Photogrammetric Engineering*, v. 24, no. 5, pp. 709–713, December 1958

A test of the accuracy of horizontal aerotriangulation was conducted by the Coast and Geodetic Survey. A basis was found for predicting the nature of errors to be expected from the flight strip of a given number of models, control points, etc. The results are expressed in the form of an equation for use in project planning. (*EI*, 1959)

8. THEORETICAL INVESTIGATION OF AERIAL TRIANGULATION AS PROBLEM OF MAXIMA AND MINIMA
Hallert, K. B. P.
*Photogrammetric Engineering*, v. 24, no. 5, pp. 716–721, December 1958

The main problem when planning aerial photography for aerial triangulation is to find the flying altitude where the maximum of accuracy is obtained for the minimum of control points. The mathematical solution for this problem is presented. The fundamental importance of error propagation formulas in aerial triangulation is described. The most effective aerial triangulation is obtained from short strips. The use of high-flying altitudes over areas with sparse ground control is discussed. (*EI*, 1959)

9. PROPOSED AERIAL TRIANGULATION TECHNIQUES
Misulia, M. G.
*Photogrammetric Engineering*, v. 24, no. 5, pp. 725–731, December 1958

Novel techniques utilizing stereo-photogrammetric instrumentation are advanced for establishing control in areas containing insufficient geodetic control for producing topographic maps. Because of the complexity and limited range of airborne devices for recording positional information and the time-consuming correlation of data, an improved system is needed for securing and handling these data. An approach to the problem is proposed which may alleviate some of the limitations. (*EI*, 1959)

10. KC-2—MODERN CONVERGENT CAMERA SYSTEM
Crouch, L. W., Sewell, E. D.
*Photogrammetric Engineering*, v. 24, no. 5, pp. 737–740, December 1958

Modern Air Force camera systems have to be designed smaller in size, lighter in weight, and able to operate in heat up to 300°F. The convergent mapping camera with rigidly fixed relationships between the inner cones will open up new fields for stereo plotting equipment and aerial triangulation techniques. (*EI*, 1959)

11. KC-2 CONVERGENT MAPPING CAMERA
Levine, S. R.
*Photogrammetric Engineering*, v. 24, no. 5, pp. 741–744, December 1958

To utilize the advantages of the convergent system of photography, a special camera and mount system are needed. This camera is specifically engineered to cope with the problems of camera operation at high temperatures and unlimited altitudes. Design problems of shutter synchronization, weight reduction, minimization of film transfer unbalance, heat condition, vacuum system, and pressurization are discussed. Details are given for fixed mounts with an insulating blanket. (*EI*, 1959)

12. TORQUE STABILIZED MOUNT FOR CONVERGENT MAPPING CAMERA
Roberts, A.
*Photogrammetric Engineering*, v. 24, no. 5, pp. 744–750, December 1958

The design and performance of photo-reconnaissance equipment capable of operating reliably without altitude limitations and in widespread ambient temperature ranges are presented. A stabilization system for high resolution and verticality is discussed, as well as a new twinplex camera design and a specially designed thermal protector. The tailoring of the mount design to this specific camera is detailed. (*EI*, 1959)

13. PHOTOGRAMMETRIC APPLICATION OF RADAR-SCOPE PHOTOGRAPHS
Hoffman, P. R.
*Photogrammetric Engineering*, v. 24, no. 5, pp. 756–764, December 1958

Ten years of studies on radar-scope photographs used as standard photogrammetric source material are reported. The development of special compilation procedures and equipment is presented, as well as procedures and techniques for applying the specialized kind of photogrammetric knowledge in extracting topographic information from radar-scope photographs. (*EI*, 1959)

14. ANALYSIS OF PANORAMIC AERIAL PHOTOGRAPH
Le Resche, J.
*Photogrammetric Engineering*, v. 24, no. 5, pp. 772–775, December 1958

A panoramic photograph must be rectified to recover the essential elements of the photo image, namely, position, alignment, and dimensions. The problems of rectification may be simplified by utilizing certain advantages inherent in the geometry of the panoramic photograph. The principal line of the photograph is a segment of a circle rather than a straight line. Each light ray intersects each point along the principal line at right angles; therefore, radian measurements rather than linear measurements should be used in rectification. (*EI*, 1959)

15. UNIVERSAL PHOTOGRAMMETRIC ELECTRONIC RECTIFIER
Ross, L. E., Jr., Levine, S. W.
*Photogrammetric Engineering*, v. 24, no. 5, pp. 789–793, December 1958

An electronic line-scanning machine to automatically produce rectified print is discussed. The machine incorporates optical-mechanical scanning and reproduces by means of an ultrasonic light modulator. Scanning is done at 500 lines per min. The theory of line scanning for aerial-image rectification and the equations for the computer which are required for the machine are given. (*EI*, 1959)

16. STEREOSCOPIC SPACE-IMAGE
Miller, C. I.
*Photogrammetric Engineering*, v. 24, no. 5, pp. 810–815, December 1958

A new method is presented for evaluating the amount of distortion obtained in space-image when aerial photographs are viewed stereoscopically. The method is based on the hypothesis that to produce "scale model" space-image, the apparent distance of a given frontal plane and the interpupillary distance must be in the same ratio as the actual distance of the given frontal plane from camera base-line and length of base-line. (*EI*, 1959)

17. AN ANALYTICAL APPROACH TO THE VIBRATION DESIGN OF AIRBORNE ELECTRONIC EQUIPMENT
(Presented at the National Electronics Conference, Chicago, Ill., October 7–9, 1957)
Gurtin, M. E.
In "Proceedings of the National Electronics Conference, Volume 13," pp. 694–706
National Electronics Conference, Inc., Chicago, Ill., 1958

A technique is presented which will permit design for a vibration environment. Placement methods for resonant frequencies and quick, approximate methods for the determination of their values are illustrated. A method for utilizing the analog computer to predict the response of equipment to sinusoidal vibration, random vibration, and shock is shown. (*EEA*, 1958, #4864)

18. **TELE-MAP (Presented at the 1958 IRE National Convention, New York, N.Y., March 24–27, 1958)**
**Hoffmann, H., Jr.**
***1958 IRE National Convention Record*, pt. 8, v. 6, pp. 314–322, 1958**

A system is described for reducing the redundancy of information in weather maps and converting the data into a form suitable for teletype transmission. Compressions of 64 to 1 of the Time-Bandwidth Product have been achieved when compared to conventional facsimile transmissions.

19. **PHOTOGRAMMETRY**
**Moffitt, F.**
**International Textbook Company, Scranton, Pa., 1959**

20. **OUTLINE OF PHOTOGRAMMETRY**
**Schwidefsky, K.**
**Pitman Publishing Corporation, New York, N.Y., 1959**

21. **ANTI-VIBRATION MOUNTING FOR LOW FREQUENCIES**
***Engineering*, v. 187, no. 4854, pp. 372–373, March 20, 1959**

Fairey's principal tools for vibration analysis are two typical low frequency isolators developed for supplying anti-vibration mountings on the camera installation in jet reconnaissance aircraft. (*EI*, 1959)

22. **MAGNESIUM IN AIRBORNE PHOTO GEAR**
**Mraz, M. J., Ellman, C.**
***Modern Metals*, v. 15, no. 2, pp. 86–88, March 1959**

A description is given of the photographic equipment, made by Chicago Aerial Industries, Melrose Park, Ill., to be installed in typical reconnaissance aircraft. The problem of weight is solved by employing magnesium, usually in the form of castings. Other examples of magnesium in military photographic equipment are included. Casting and machining costs are lowered, the number of rejections is reduced, and a finer finished product is obtained. (*EI*, 1959)

23. **RECONSIDERATION OF QUADRUPLE CAMERA**
**Zurlinden, R.**
***Photogrammetric Engineering*, v. 25, no. 1, pp. 97–99, March 1959**

The quadruple camera is compared to vertical or convergent systems. The conclusion is reached that this tool may possibly offer significant advantages of economy, accuracy, or availability. Further investigation is suggested, particularly by camera designers. (*EI*, 1959)

24. **NOTAS SOBRE FOTOGRAMETRIA (NOTES ON PHOTOGRAMMETRY)**
**Medina Vela, G.**
***Asociacion Mexicana de Geologos Petroleros—Boletin*, v. 11, no. 5–6, pp. 177–357, May–June 1959**

The principles and practice of taking photograms having horizontal axes, vertical axes, and inclined axes are considered. (*EI*, 1959)

25. **BRIGHTNESS OF FINE DETAIL IN GROUND PHOTOGRAPHY**
**Carman, P. D., Brown, H.**
***Optical Society of America, Journal of the*, v. 49, no. 6, pp. 629–636, June 1959**

For a number of typical outdoor photographic scenes on cloudless days, a statistical study was made of logarithmic brightness and of differences of log brightnesses on adjacent pieces of fine detail, as they would be seen by a representative camera. Values were obtained photographically on Super XX film and also by means of a photoelectric telephotometer corrected to Super XX spectral response. The results do not disagree seriously with accepted values for the photographic brightness range. However, the uncertainty in the meaning of "brightness range" is illustrated and a definition is proposed for a "99 percent range." For differences of log brightness on fine detail, low values are found to predominate, with two-thirds of the differences below the average value of 0.15. (*PA*, 1959, #7716)

26. **DUAL AIRCRAFT MAPPING SYSTEM**
**April 30–July 30, 1959**
**Fairchild Camera and Instrument Corporation, Fairchild Aerial Surveys Division, Los Angeles, Calif.**
**Interim Technical Report 1, DA 44-009-eng-3948**
**AD-233,068**

A dual aircraft mapping system consists of two aircraft flying in formation, taking aerial photographs simultaneously. An electronic measuring device determines the horizontal distance between the aircraft at the instant of exposure. Both aircraft carry airborne profile recorders for continuous vertical profiles. Forward overlap between successive photos taken from each aircraft and sidelap between adjacent simultaneous photographs are enough for conventional stereoscopic models. Thus, a photogrammetric mapping system has been outlined which is internally self-sufficient for vertical and horizontal control. This study encompasses a test of such a system including design of the necessary equipment, acquisition of data, photogrammetric establishment of a control network through the use of the data, and evaluation of the test. This report covers Phase 1, which was to consist of the study and planning necessary to determine the equipment required and to develop the detailed plans for the operational, compilation, and evaluation phases.

27. **SPACE AND TIME RESPONSE OF AIRBORNE SENSORS FOR THE MEASUREMENT OF GROUND PARAMETERS**
**Dutton, J. A.**
**September 1959**
**Wisconsin, University of, Madison**
**Technical Report 1, Nonr-120207, DA 36-039-sc-80282**
**AD-234,789**

The relationships between true values of ground parameters and the values recorded by an airborne system for measuring those parameters are presented. The effects of altitude and speed of the airplane, complexity of the ground surface, lags, and other distortions of the instrument system are considered. The general conclusion is that airborne systems are suitable for measuring averages, but that the measurement of specific values requires greater care. Weighting functions are derived which theoretically allow the reconstruction of the spectral distribution of the ground parameters from the spectrum of the recorded values. In addition, relations are obtained which allow an estimate of the probability of observing small features of various size and number with a given flight path over a large area.

28. PROBLEM OF EXTERIOR ORIENTATION IN PHOTOGRAMMETRY
Rosenfield, G. H.
*Photogrammetric Engineering*, v. 25, no. 4, pp. 536–553, September 1959

The designation of orientation parameters in a different manner by almost every investigator caused a near chaotic situation, and has resulted in the need for a universal nonambiguous system which depicts the actual physical orientation of the photograph. A discussion is given of the basic concept involved in various systems in use at this time. Consideration is given to the system with the basic framework of the July 1956 Stockholm resolution concerning sign convention to be used in photogrammetry. (*EI*, 1960)

29. ANALYTICAL AEROTRIANGULATION BY DIRECT GEODETIC RESTRAINT METHODS
Dodge, H. F.
*Photogrammetric Engineering*, v. 25, no. 4, pp. 590–595, September 1959

The history of the United States Geological Survey's research project on analytical aerotriangulation is presented. A description is given of the geometry of the Direct Geodetic Restraint Method of analytical aerotriangulation. A summary of tests conducted or in progress is included. (*EI*, 1960)

30. HOW TO SELECT AERIAL CAMERAS
Bousky, S.
*Space/Aeronautics*, v. 32, no. 5, pp. 117–121, November 1959

Parameters controlling selection of aerial cameras are functions of either the target, the vehicle, or the camera itself. Target parameters are brightness, contrast, coverage, and definition. Vehicle parameters are speed, altitude, drift, rotational instability, vibration characteristic, and photo mission distance. Camera parameters include format dimension, depression angle, focal length, relative aperture, optical transmission, filter factor, image motion compensation, cycling rate, exposure time, film supply and type, and emulsion sensitivity. A simple way of finding the parameters to consider for a camera for a specific mission is described.

31. TESTS ON THE LENS OF THE GALILEO-SANTONI PHOTOGRAMMETRIC CAMERA, MODEL VI
Trombetti, C.
*Atti della Fondazione Giorgio Ronchi e Contributi dell'Istituto Nazionale di Ottica*, v. 14, no. 6, pp. 585–598, November–December 1959 (in Italian)

Tests of resolving power and distortion have been carried out on the wide-angle (90 deg) 6-in. lens used in the model VI camera. The camera gives 50 lines/mm on axis, 20 lines/mm at 45 deg for a high contrast test object and Kodak Super XX film. The distortion has a maximum value of 0.012 mm at 35 deg. A brief account of the methods of making the tests is given. (*PA*, 1960, #3664)

32. ELECTRONIC SPACE CAMERA UNDER DEVELOPMENT
*Journal of the Franklin Institute*, v. 268, no. 6, pp. 523–524, December 1959

A compact, single unit is described which utilizes electrostatic tape and an electron gun in a combination of television and electronic printing techniques to take continuous strip weather pictures.

33. AERIAL PHOTOGRAPHY BY MEANS OF MINIATURE CAMERAS FOR GEOLOGICAL MAPPING
Hiemstra, S. A., Verwoerd, W. J.
*Geological Society of South Africa, Transactions and Proceedings of the*, v. 62, pp. 167–177, 1959

The main advantage of this method is its adaptability to individual requirements. Photography for detailed mapping of small areas can be planned with due consideration of the geology. The use of infrared photographs is also possible. Camera and film selection, flying technique, and examples of application and results are included. (*EI*, 1960)

34. THE USE OF THE SPECTROVISOR FOR THE STUDY OF THE SPECTRAL REFLECTING POWER OF SMALL LAND OBJECTS FROM AN AIRPLANE (A translation; Russian included in document)
Koltsov, V. V.
*Akademiia Nauk SSSR, Laboratorii Aerometodov, Trudy*, v. 7, pp. 58–69, 1959

35. IMAGE SIMULATION AND INTERPRETATION
(Presented at the National Electronics Conference, Chicago, Ill., October 12–14, 1959)
Meyer, G. L.
In "Proceedings of the National Electronics Conference, Volume 15," pp. 335–345
National Electronics Conference, Inc., Chicago, Ill., 1959

Technological difficulties limit the excellence of sensing-transmitting systems for use in satellites. Two experiments were conducted to determine the relation between the quality of the image and the quality of the information that can be extracted from the image. An image simulator was constructed

to produce imagery that could be used with trained photo-interpreters in the experiments. As a result of the experiments, a technique of evaluating the usefulness of various quality imagery began to solidify. Much work in evaluation still remains to be done, especially in the areas of subjective analysis as opposed to form recognition. (*EEA*, 1960, #8322)

36. **DISTORTION IN PHOTOGRAMMETRY (Presented at the Optics of All Wavelengths Meetings, Jena, East Germany, 1958)**
**Schoeler, H.**
**In "Optics of All Wavelengths," pp. 192–199 (in German)**
**Görlich, P., Tiedeken, R., Editors**
**Akademie-Verlag, Berlin, Germany, 1959**

Typical equipment for photogrammetry is briefly described. The gaussian definition of distortion is extended to cover the photogrammetric distortion from a calibrated principal distance. The use of compensating plates for removal of residual distortion is mentioned. (*PA*, 1961, #4488)

37. **THE PRACTICAL DETERMINATION OF THE PHOTOGRAMMETRIC DISTORTION OF ULTRA-WIDE-ANGLE OBJECTIVES FOR FINITE CONJUGATES (Presented at the Optics of All Wavelengths Meetings, Jena, East Germany, 1958)**
**Wolf, E.**
**In "Optics of All Wavelengths," pp. 209–215 (in German)**
**Görlich, P., Tiedeken, R., Editors**
**Akademie-Verlag, Berlin, Germany, 1959**

The methods of determining distortion for lenses with the object at infinity are well known. For plotting equipment, such as the Multiplex, it is necessary to determine the distortion at finite conjugates. Equipment for making such measurements is described and results quoted for a projection lens covering 122-deg field. (*PA*, 1961, #4489)

38. **PHOTOGRAMMETRY: DEVELOPMENTS AND APPLICATIONS (Papers presented at the National Research Council 38th Annual Meeting, Washington, D. C., January 5–9, 1959)**
**1959**
**National Research Council, Highway Research Board, Washington, D.C.**
**Bulletin 228**

Papers presented at this meeting were:

"North Dakota's Use of Aerial Inventory for County General Highway Maps," by E. T. Bowen, C. J. Crawford, and J. B. Kemp, pp. 1–7

"Photogrammetric Approach to Highway Route Location and Reconnaissance," by A. C. Quinnell, pp. 8–11

"Photogrammetry in Highway Planning," by D. S. Johnson, pp. 12–20

"Adjustment of Photogrammetric Surveys," by L. L. Funk, pp. 21–27

"Relationship of Topographic Relief, Flight Heights, and Minimum and Maximum Overlap," by W. T. Pryor, pp. 28–48

"Terrain Data for Earthwork Quantities," by L. L. Funk, pp. 49–65

"General Discussion," pp. 66–68. (*EI*, 1960)

39. **CAMERAS FOR AEROSPACE VEHICLE R & D (TABLE)**
***Space/Aeronautics, Research and Development Handbook*, v. 3, pp. J12–J17, 1959–1960**

Functional characteristics of ground and airborne cameras are listed, and special features of interest to instrumentation engineers are outlined. (*AI/S*, 1960, #20,353)

40. **ELEMENTS OF PHOTOGRAMMETRY**
**Baker, W. H.**
**The Roland Press Company, New York, N.Y., 1960**

41. **PHOTOGRAMMETRY, BASIC PRINCIPLES AND GENERAL SURVEY**
**Hallert, K. B. P.**
**McGraw-Hill Book Company, Inc., New York, N.Y., 1960**

42. **IMAGE SENSING AS APPLIED TO METEOROLOGICAL SATELLITES**
**Johnson, D. S.**
***SMPTE, Journal of the*, v. 69, no. 1, pp. 14–18, January 1960**

Earth satellites provide meteorology with an observing platform commensurable with the global nature of weather. One of the most promising observations is of cloud distribution and type. Image-sensing requirements with respect to resolution, sensitivity, and infrared are presented. Cloud image-sensing techniques, such as object scanning and electronic-image scanning, are discussed. Given consideration are data storage, transmission, and processing. (*EI*, 1960)

43. **INFRARED IMAGING FROM SATELLITES**
**Hanel, R. A., Stroud, W. G.**
***SMPTE, Journal of the*, v. 69, no. 1, pp. 25–26, January 1960**

Infrared images of the Earth's surface and atmosphere obtained from a satellite, important to the study of meteorology of the Earth, present problems in systems design and in image conversion techniques. Known and inferred infrared properties of the Earth are the basis on which detector systems and the sensors may be considered. Techniques of scanning and detecting are discussed, and a block diagram of the infrared imaging system is presented. (*EI*, 1960)

44. **ELECTROSTATIC IMAGING AND RECORDING**
**Hutter, E. C., Insle, J. A., Moore, T. H.**
***SMPTE, Journal of the*, v. 69, no. 1, pp. 32–35, January 1960**

The ability to put instrument packages into orbit provides a wide range of possibilities for obtaining data about the

Earth and its environment. Pictorial information can be obtained for mapping some of the remote portions of the Earth or for preparing a daily photographic weather map of the entire Earth. A satellite camera to perform these functions is discussed. (*AI/S*, 1960, #20,355)

45. SOME RECENT PROGRESS IN AIR SURVEY WITH PARTICULAR REFERENCE TO NEWLY-DEVELOPED TERRITORIES
Smith, W. P.
*Royal Aeronautical Society, Journal of the*, v. 64, no. 589, pp. 1–23, January 1960

The following subjects are considered: (1) progress made in aerial surveying cameras, (2) aircraft and navigational methods, (3) applications of photographs in geology, forests, and agriculture, (4) air survey as applied to mapping, (5) airborne electronic aids designed to reduce the need for ground framework control, and (6) airborne geophysical survey as an aid to mineral prospecting. (*EI*, 1960)

46. THIN GLASS PLATES SHARPEN AERIAL PHOTOS
*Product Engineering*, v. 31, no. 9, p. 47, February 29, 1960

The use of thin meniscus-shaped pressure plates to hold negatives and paper in an aerial photograph printer has resulted in a resolution of 20 lines per mm.

47. NEW ATTACKS ON SPECIAL PHOTOGRAMMETRIC PROBLEMS
Kowalczyk, C. E., Strees, L. V.
*Photogrammetric Engineering*, v. 26, no. 1, pp 44–47, March 1960

The U.S. Navy Hydrographic Office conducted a program of investigations on special photogrammetric problems. Given special consideration were: (1) stereophotogrammetric control extensions in areas of inadequate geodetic control, (2) underwater depth determination by stereophotogrammetric techniques, (3) identification and delineation of hydrographic information, (4) utilization of high-altitude photography for cartographic mapping, and (5) measurement of sea waves from aerial and shipboard photography. (*EI*, 1960)

48. 20-DEGREE CONVERGENT VERSUS VERTICAL PHOTOGRAPHY FOR AEROTRIANGULATION
Griffin, E. P.
*Photogrammetric Engineering*, v. 26, no. 1, pp. 59–64, March 1960

Test extensions were conducted to determine the relative accuracies of 20-deg convergent and vertical photography. Simultaneously exposed photography was used and every phase of the test was planned. Use was made of both Bausch and Lomb 720 Plotter with Stereopontometer and Zeiss C-8 Stereoplanigraph. The relative merits of each type of photography are discussed. (*EI*, 1960)

49. REPORT ON A8 AEROTRIANGULATION AND ITS ADJUSTMENT
Kavanagh, B.
*Photogrammetric Engineering*, v. 26, no. 1, pp. 77–80, March 1960

Experiments were carried out to determine the practicability of using Wild A8 for aerotriangulation of the rugged parts of the province of British Columbia. Only grid plates have been used for control. In this type of terrain the method appears to be economical and compares favorably with field costs. (*EI*, 1960)

50. QUANTITATIVE PHOTOGRAPHY—GEOLOGIC RESEARCH TOOL
Ray, R. G., Fischer, W. A.
*Photogrammetric Engineering*, v. 26, no. 1, pp. 143–150, March 1960

Measurements for geologic research may be made from aerial photographs. These measurements include not only height and distance determinations, but also involve colorimeter and densitometer measurements. The field of measurements as quantitative photography is defined. Possible uses in geologic research are considered. (*EI*, 1960)

51. EXPERIMENTAL STUDIES ON COLOR AERIAL PHOTOGRAPHS IN JAPAN
Maruyasu, T., Nishio, M.
*Tokyo, University of, Report of the Institute of Industrial Science*, v. 8, no. 6, (Serial no. 62), March 1960
(in Japanese with English summary)
(Also available in *Japan Society of Civil Engineers, Transactions*, v. 60, extra papers (3-2), February 1959)

Studies were conducted to establish ground-to-photo color correlation by considering the conditions for exposure, selection of film and filter, and the printing method. The problems of compensating for the effect of haze and describing the actual ground-color condition on print are discussed. The application to cartography and photogeology is considered. (*EI*, 1960)

52. Rx FOR AERIAL LENS DISTORTION
*Industrial Photography*, v. 9, p. 12, March 1960
(*AS&T*, 1960)

53. U. S. METEOROLOGICAL SATELLITE CAMERAS PHOTOGRAPH CLOUD COVER
*Science*, v. 131, no. 3406, pp. 1031–1032, April 8, 1960

The U.S. meteorological satellite *Tiros 1* which was launched at 6.40 a.m. on Friday, April 1, 1960 is discussed. (*AI/S*, 1960, #21,565)

54. SHOOTING FROM JETS
Church, R.
*Industrial Photography*, v. 9, pp. 20–21, May 1960
(*AS&T*, 1960)

**55. SEEN FROM TWO MILES UP; L. A. AIRPORT**
*Industrial Photography*, v. 9, p. 46, May 1960

Application of a new lens system is described.

**56. RECONOFAX MAKES POSSIBLE DETAILED AERIAL NIGHT PHOTOS**
McLucas, J. M.
*Electrical Engineering*, v. 79, p. 436, May 1960

A scanning camera with an improved detector highly sensitive to infrared radiation is used. Radiation differences between objects are recorded on film using a recording lamp. Utilizing a radio-relay system, the picture can be developed almost simultaneously at a ground station.

**57. CORRECTION GRAPH IN PHOTOGEOLOGY**
Howard, A. D.
*Photogrammetric Engineering*, v. 26, no. 3, pp. 412–424, June 1960

An explanation of theory and application is presented. Certain modifications of computation form are discussed, and the problems of best values of photo base and flying height are considered. A linear interpolation procedure based on 11 control points is presented as an alternative to Visser's more complicated parabolic interpolation procedure. An explanation of readings of parallax bar is given. (*EI*, 1960)

**58. TESTING SUITABILITY OF CROWN GRAPHIC CAMERA FOR PHOTOGRAMMETRY**
Turpin, R. D.
*Photogrammetric Engineering*, v. 26, no. 3, pp. 436–440, June 1960

Testing of press-type Crown Graphic camera used precisely measured targets to give photograph scales varying from 1:1 to 1:100. Quality checks compared well with those obtained from precise aerial cameras or phototheodolites. Little difference in quality was noted for different scales, though some variation was detected between glass plates and sheet film. Methods are discussed for testing a camera to be used for close range photogrammetry. (*EI*, 1960)

**59. LOCATION OF PLANE OF BEST AVERAGE DEFINITION FOR AIRPLANE CAMERA LENSES**
Washer, F. E., Tayman, W. P.
*Photogrammetric Engineering*, v. 26, no. 3, pp. 475–488, June 1960

Consideration is given to the effectiveness of the use of average value of resolving power, both as a means of locating the plane of best average definition and as a figure of merit in rating optical performance of lenses and lens-camera combinations. Various methods of arriving at the average value of resolving power are presented, including area weighted average resolution, area and depth-of-focus weighted average resolution, and root mean-square mean resolution. (*EI*, 1960)

**60. RESOLUTION AND SINEWAVE RESPONSE AS MEASURES OF PHOTO-OPTICAL QUALITY**
Yost, E. F.
*Photogrammetric Engineering*, v. 26, no. 3, pp. 489–494, June 1960

A description is given of methods for evaluating the quality of images in aerial photography. Empirical methods are used in measuring the composition of noncoherent photo-optical images. (*EI*, 1960)

**61. SOME ADJUSTED THOUGHTS ON ERRORS IN AERIAL TRIANGULATION**
Ghosh, S. K.
*Photogrammetric Engineering*, v. 26, no. 3, pp. 494–497, June 1960

Discussion is presented of a situation in the aero-polygon method of aerial triangulation with vertical or near-vertical photography, where data available from horizon camera, statoscope, solar periscope, gyroscope, etc., are not considered and triangulation is performed in first-order stereo-plotter. (*EI*, 1960)

**62. OBSERVATION SATELLITES: PROBLEMS AND PROSPECTS**
Katz, A. H.
*Astronautics*, v. 5, no. 6, pp. 26–29, 52–54, June 1960

The photographic equipment used by aircraft in reconnaissance work is described and considered for satellite application. (*AI/S*, 1960, #21,976)

**63. EIN LICHTSTARKES OBJEKTIV MIT GERINGEM ASTIGMATISMUS (POWERFUL WIDE-APERTURE OBJECTIVE WITH SMALL ASTIGMATISM)**
Gaj, M.
*Optik*, v. 17, no. 7, pp. 365–382, July 1960

A new apochromatic lens-mirror objective with aspheric surface has been computed. The correction of aberrations is such that the angle of the field of $2u = 20°$ and relative aperture 1:0.7 can be attained for a focal length of $f/ = -100$ mm. The system can be applied to photography of X-ray pictures, photography of terrain by night, to meteor photography and, in astronomy, to photography of sky sections. (*EI*, 1961)

**64. TELEVISION PHOTO-TAPE RECONNAISSANCE CAMERA AND GROUND REPRODUCER EQUIPMENT**
Oakley, C.
March–July 1960
Radio Corporation of America, Astro-Electronic Products Division, Princeton, N. J.
QER-1 on Research and Development, AF 33(616)-7284
AD-242,961

Developmental problems of a photo-tape camera and ground reproducer equipment were evaluated and revealed areas requiring major study, analysis, and experimentation. The

results of measurements and experiments on focus-field conditions for the tape camera readout gun show that focus coil requirements are not too severe if good dynamic focus characteristics can be obtained. A study on maintaining film (tape) flatness in critical areas showed that a combination of rollers and edge guides yields a satisfactory solution.

A decision was made on an optimum approach to the design of a tape camera housing. The designs for a transistorized deflection circuit, the electron-beam film recorder housing, and the tape transport mechanism have been completed. Electronic circuit design for the camera is under consideration and circuit requirements for generation of the dynamic focus voltages are being determined. A regulated current supply is being purchased as well as other components. Electron guns were investigated and some with promising results were tested. A text fixture for electron guns and storage targets, which will operate independent of the system, was designed and is being constructed. This test fixture will permit evaluation of these and associated components for the system on a direct basis.

**65. ANALYSIS OF PROJECT HUGO TEST FIRING DECEMBER 5, 1958: APPENDIX—PHOTOGRAMMETRY AND MATHEMATICS OF ROCKET PHOTOGRAPH INTERPRETATION**
**Hubert, L. F.**
**August 1960**
**U.S. Department of Commerce, Weather Bureau, Meteorological Satellite Laboratory, Washington, D. C.**
**MSL-R-2**

The purpose of Project *HUGO* is to photograph meteorological phenomena by means of a rocket-borne camera system. Analyses of standard meteorological data are shown for time of this test. It is concluded that large scale patterns are useful in deducing the atmospheric field of motion.

**66. OFF-THE-SHELF TELEMETRY TRANSMITTER FOR RECON SATELLITES**
**Kovit, B.**
***Space/Aeronautics*, v. 34, no. 2, pp. 149–151, August 1960 (*AS&T*, 1960)**

**67. RESULTS IN GEODETIC PHOTOGRAMMETRY, PART II: A STUDY OF THE FEASIBILITY OF A PHOTOGRAMMETRIC SURVEY OF AMR TO AN ACCURACY OF 1 PART IN $10^6$**
**Brown, D. C.**
**September 15, 1960**
**Radio Corporation of America, Camden, N. J.**
**TR-65, AFMTC TR 61-2, AF 08(606)-3413**

**68. EXPERIENCES WITH ANALYTICAL METHODS IN PHOTOGRAMMETRY**
**Schut, G. H.**
***Photogrammetric Engineering*, v. 26, no. 4, pp. 564–570, September 1960**

Investigations made by the National Research Council of Canada are presented. For block adjustment of plane coordinates, a new, purely numerical method has been devised, coded for electronic computation, and tested. The method promises to give excellent results with a minimum expenditure of time and effort. Concerning analytical, aerial triangulation, only tentative conclusions could be reached and further experiments are necessary. (*EI*, 1960)

**69. NEW PHOTOGRAMMETRIC SUPPORT EQUIPMENT**
**Sime, K. T.**
***Photogrammetric Engineering*, v. 26, no. 4 pp. 574–579, September 1960**

Results of tests by the Aeronautical Chart and Information Center are presented. A test was made of the AR-25 Universal Scanning Stereoscope, designed to afford stereoscopic inspection from roll film, negative or positive, accommodating 9 × 9 in. and 9 × 18 in. vertical photography. The design of the Ke-2 copy camera for producing photographic copy on aerial film, and the Plotting Board for the handling of radar film was found to be generally satisfactory. A report on certain deficiencies is available from the Center. (*EI*, 1960)

**70. APPLICATIONS OF PHOTOGRAMMETRIC FLASH TRIANGULATION TO GLOBAL SURVEYS**
**Kelley, R. A.**
***Photogrammetric Engineering*, v. 26, no. 4, pp. 590–592, September 1960**

The azimuth of the Hiran long line is determined with a resolution of two seconds of arc or better. Ballistic cameras at both ends of the long line record the flashes emanating from stroboscopic light or from a flare package on an aircraft carrying Hiran equipment as the aircraft crosses the long line near its midpoint. Details are given of the application to the technique of ballistic photogrammetry to yield positional data sufficient for intercontinental and interdatum ties. (*EI*, 1960)

**71. SATELLITE PHOTOGRAPHY WITH STRIP AND FRAME CAMERAS**
**Ockert, D. L.**
***Photogrammetric Engineering*, v. 26, no. 4, pp. 592–596, September 1960**

Problems associated with satellites as camera-carrying vehicles are quite different from those of conventional aircraft. This paper discusses the use of strip cameras and frame cameras in satellite operations. The desirable and undesirable characteristics of each camera type are discussed and compared. It is shown that both cameras will have a place in future satellites. (*EI*, 1960)

**72. PROGRESS AND PROBLEMS IN RADAR PHOTO INTERPRETATION**
**Hoffman, P. R.**
***Photogrammetric Engineering*, v. 26, no. 4, pp. 612–618, September 1960**

The development of the use of mechanical and electronic equipment in various phases of radar photo interpretation is presented. Factors to be considered for interpretation are listed. A description is given of a radar-data plotting board AR-8. Color-processing techniques to aid in differentiating original images and the separation of various intensity levels by electron/optical instruments are considered. (*EI*, 1960)

**73. SKETCHING PROJECTOR FOR SIDE-LOOKING RADAR PHOTOGRAPHY**
**Claveloux, B. A.**
***Photogrammetric Engineering*, v. 26, no. 4, pp. 644–646, September 1960**

New side-looking radar presentation is a film strip recording which visually displays electromagnetic-energy returns from terrain under both sides of an airborne vehicle. A radar projector provides the capability for transferring, by sketching, mapping data from side-looking radar photography to a controlled manuscript or plotting sheet. (*EI*, 1960)

**74. PHOTOGRAPHIC METHOD FOR TRANSFORMATION OF BLACK AND WHITE RADAR-MAP INTO FULL-COLOR PRESENTATION**
**Leonardo, E. S., Tolliver, R. A.**
***Photogrammetric Engineering*, v. 26, no. 4, pp. 647–651, September 1960**

A method has been devised which will produce radar-maps on color film or paper, using a conventional black-and-white radar-map original. Each general level of returns on the original black-and-white radar-map is assigned to a separate color. The complete photographic process is described and illustrated. (*EI*, 1960)

**75. VARIATION OF RESOLVING POWER AND TYPE OF TEST PATTERN**
**Washer, F. E., Tayman, W. P.**
***Journal of Research of the National Bureau of Standards, Section C—Engineering and Instrumentation*, v. 64, no. 3, pp. 209–223, July–September 1960**

The plane of best average definition is located for a number of lenses of a type used in airplane mapping cameras. Three different types of test pattern are used for each lens. These patterns are the long-line, short-line, and annulus. Results of measurement that show the variation of resolving power throughout the region of usable imagery are given for each type of test pattern with two types of photographic emulsion. It is found that the plane of best average definition can be located equally well with each type of pattern. There are, however, pronounced differences in the numerical magnitudes of the values of resolving power determined with the various types of test pattern. In general, the highest values are attained with the long-line patterns. Values of the various rating indices $\sqrt{R_\beta T_\beta}$, AWAR (area weighted average resolution), and ADWAR (area and depth-of-focus weighted average resolution) are given, together with a comparison of the different order of merit assigned by these indices. (*PA*, 1960, #19,402)

**76. GAMMA-RAY PINHOLE CAMERA**
**DiIanni, E. J., Cooley, H. J.**
**July 1–October 1, 1960**
**Nuclear Corporation of America, Denville, N. J.**
**Final Report on Theoretical Investigation, DA 36-039-sc-84977**
**AD-254,977**

An engineering research study and development to make available suitable airborne equipment for gamma radiation aerial survey which would provide quick, visual presentation of the distribution and intensity of radiation in contaminated ground areas are presented. The work is divided into three phases: (1) theoretical, (2) design-experimentation, and (3) construction of an experimental model. An analysis is made of the problems associated with the theoretical investigation of aerial survey.

The factors influencing distortions of a gamma field caused by interposing a large thickness of an air absorber between the source and detector are discussed. These factors include attenuation, geometric considerations, relative humidity, angular distribution of scattered flux, and energy distribution of scattered flux. Practical design goals are outlined for an instrument to aerially map a radioactive ground area and available photon flux seen by the aerial monitor for a particular field of intensity. Techniques for accomplishing the aerial survey as specified in the contract are presented. Conclusions and recommendations for further development are included.

**77. DUAL AIRCRAFT MAPPING SYSTEM**
**Glicken, M.**
**July 31, 1959–October 15, 1960**
**Fairchild Camera and Instrument Corporation, Fairchild Aerial Surveys Division, Los Angeles, Calif.**
**Final Technical Report, DA 44-009-eng-3948**
**AD-249,443**

A dual aircraft mapping system consists of two aircraft flying in formation, taking aerial photographs simultaneously. An electronic measuring device determines the horizontal distance between the aircraft at the instant of exposure. Both aircraft carry airborne profile recorders for continuous vertical profiles. Forward overlap between successive photos taken from each aircraft and sidelap between adjacent simultaneous photographs are enough for conventional stereoscopic models. The photogrammetric mapping system is internally self-sufficient for vertical and horizontal control except for datum. The following phases of system development are discussed: (1) a test of the system including design of the necessary equipment, (2) instrumentation of two aircraft, (3) acquisition of data, (4) photogrammetric establishment of a network of control through use of the data, and (5) comparison of the results with existing control. A statistical

and graphical analysis of results is made. The technique is a feasible one and will yield good results, particularly in horizontal control.

78. PHOTOGRAMMETRIE (PHOTOGRAMMETRY)
Manek, F.
*Österreichische Ingenieur Zeitschrift*, v. 3, no. 10, pp. 337–343, October 1960

Present day knowledge and the application of photogrammetry are summarized. (*EI*, 1960)

79. OPERATION FLYING SMALL TV STATION; MISSILE-BORNE MOTION PICTURE CAMERAS
Mollberg, B. M.
*Industrial Photography*, v. 9, pp. 56–57, October 1960 (*AS&T*, 1960)

80. PHOTOGRAMMETRY: ITS PURPOSE AND APPLICATIONS
Burnett, D. I.
*Chartered Surveyor*, v. 93, no. 5, pp. 259–264, November 1960

The fundamentals of photogrammetry are summarized. Air navigation and navigational aids, scale of photography, emulsion types, principles of aerial triangulation, map making, and stereoplotting machines are considered. The article also discusses the special uses of photogrammetry for (1) reconstruction of ancient monuments and buildings, (2) engineering drawings, (3) the evaluation of road traffic accidents, (4) town planning, (5) tracing of guided missiles, and (6) bomb trials. (*EI*, 1960)

81. OPERATIONAL EVALUATION OF DRONE RECONNAISSANCE TELEVISION SYSTEM: Revised Plan of Test
November 1960
Army Electronic Proving Ground, Fort Huachuca, Ariz.
AEPG-SIG 930-133, Revision 1 (supersedes AEPG-SIG 930-133, May 1960)
AD-253,165

Test plans are presented of tests to determine the capabilities of the Drone Reconnaissance Television System in providing surveillance data from drone or manned aircraft. The system is designed to supply target orientation and map coordination by working in conjunction with the Radar Tracker Plotter AN/GPG-1. The Drone Television System includes the AN/MXQ-1 ground control station and AN/AXT-14 drone reconnaissance airborne package.

82. PHOTOGRAMMETRIC ANALYSIS OF PANORAMIC PHOTOGRAPHY
Abraham, V.
December 7, 1960
Fairchild Camera and Instrument Corporation, Syosset, N.Y.
SME-AA-47, RADC-TR-61-17, AF 30(602)-2132
AD-251,232

The photogrammetric capabilities and limitations of panoramic photography were investigated. An analysis was made of the errors inherent in panoramic camera systems. Based on this analysis, an optimum panoramic camera configuration is recommended, considering primarily (1) ground resolution, (2) stability of camera interior orientation, (3) the ground coverage capabilities, and (4) the accuracy of target location.

83. HYPERSONIC RECONNAISSANCE INVESTIGATIONS
Burke, J. J., Kapany, N. S., Stater, P. N., Wilson, L. N.
December 1960
Armour Research Foundation, Chicago, Ill.
ARF 1140-21, Final Report on Research in the Form of Experimental and Theoretical Investigation on the Influence of Hypersonic Flight on Aerial Reconnaissance,
WADD TR 60-891, AF 33(9616)-6322
AD-250,474

Investigations of the influence of near field hypersonic effects on aerial reconnaissance are described. Determinations were made of the aberration of the image of a point object caused by the aerodynamical conditions surrounding a hypersonic vehicle. An order of magnitude assessment was made to determine if the emission in the plasma sheath surrounding a hypersonic vehicle can cause the fogging of the film. The interferometric and high resolution photographic measurements verified that the photograph of a high contrast test object taken through the Mach 7 flow surrounding a 20-deg, wedge-shaped model suffers no degradation in resolution providing that the boundary layer covering the model surface is laminar. For the particular flight conditions chosen, the luminosity level in the plasma sheath surrounding the vehicle corresponded to an exposure on the film in a conventional aerial reconnaissance camera which was well below the fog level.

84. PERFORMANCE EVALUATION OF TRI-SERVICE PHOTO TRANSMISSION SYSTEM: Plan of Test
December 1960
Army Electronic Proving Ground, Fort Huachuca, Ariz.
AEPG-SIG 930-189
AD-253,162

An analysis is made to determine the performance characteristics of the tri-service photo transmission system in transmitting imagery obtained from an airborne camera to a ground station by electronic means.

85. WIDEBAND MAGNETIC RECORDING SYSTEM
(Presented at the Western Electric Show and Convention, Los Angeles, Calif., August 23–26, 1960)
Anderson, M. E., Grenath, J. A., Reukauf, D. C.
*1960 IRE WESCON Convention Record*, pt. 5, pp. 40–45, 1960

A video-magnetic recording and reproducing technique suitable for satellite applications is described. The use of nonmechanical scanning for long head and tape life is discussed.

The main features of the technique are HF recording capability with low-tape speed, low-power drain through the use of solid-state circuitry, and high-area density of information stored on tape by use of multichannel multiplexing. (*EI*, 1961)

**86. INVESTIGATIONS INTO ACCURACY OF VARIOUS METHODS OF PHOTOGRAMMETRIC TRIANGULATION**
**Hallert, K. B. P.**
**In "Transactions of the Royal Institute of Technology, Number 162"**
**Royal Institute of Technology, Stockholm, Sweden, 1960**

General analytical expressions are derived to determine the accuracy which can be expected from different methods of aerial triangulation. The statistical expression for errors is the standard error of the unit of fundamental measurements according to the method of least squares. Errors of stereo-radial method, of independent model triangulation method, and of ordinary aerial strip triangulation are discussed. (*EI*, 1961)

**87. AERIAL PHOTOGRAPHS IN GEOLOGIC INTERPRETATION AND MAPPING**
**Ray, R. G.**
**1960**
**U. S. Department of the Interior, Geological Survey, Washington, D. C.**
**Professional Paper 373**
**(Also available through U. S. Government Printing Office, Washington, D. C.)**

**88. DIE MATHEMATISCHEN GRUNDLAGEN DER ANALYTISCHEN PHOTOGRAMMETRIE (MATHEMATICAL FOUNDATIONS OF ANALYTICAL PHOTOGRAMMETRY)**
**Rinner, K.**
***Wissenschaftliche Zeitschrift der Technischen Hochschule bei Dresden*, v. 9, no. 3, pp. 689–698, 1959–1960**

The mathematical relations between image coordinates, picture beams, and terrain systems are analyzed by the use of vector algebra and matrix display, and equations are derived. Various approximation methods of linearization and sources of error in photogrammetry are considered. (*EI*, 1961)

**89. DESIGN CONSIDERATIONS OF TELEVISION SATELLITE RECONNAISSANCE SYSTEMS**
**(Presented at the 1960 IRE International Convention, New York, N. Y., March 21–24, 1960)**
**Zastrow, R., Ritchie, D. J.**
***1960 IRE International Convention Record*, pt. 5, v. 8, pp. 87–107, 1960**

This survey covers the following aspects of civilian and military reconnaissance systems. camera-tube sensitivity, optical resolution, satellite–ground transmission systems, and equipment. Included are 27 references. (*EEA*, 1961, #2077)

**90. NATIONAL SPECIALISTS MEETING ON GUIDANCE OF AEROSPACE VEHICLES (Presented at the National Specialists Meeting on Guidance of Aerospace Vehicles, Boston, Mass., May 25–27, 1960)**
**Institute of the Aeronautical Sciences, New York, N. Y., 1960**

Among the papers presented at this meeting were the following: "Horizon Sensors for Vertical Stabilization of Satellites and Space Vehicles," by M. H. Arck and M. M. Merlen, pp. 34–39; "Accurate Determination of Attitude by Optical Means for Application in Space Vehicles," by G. von Pahlenfedoroff, pp. 40–46; and "Application of Optical Techniques to Interplanetary Navigation," by W. J. Haywood, Jr., pp. 47–52.

**91. PROCEEDINGS OF UNITED NATIONS SEMINAR ON AERIAL SURVEY METHODS AND EQUIPMENT 1960**
**United Nations, Economic Commission for Asia & Far East, Bangkok, Thailand**
**Mineral Resources Development Series 12**

The following information is reported: (1) aerial survey activities in the Economic Commission for Asia and the Far East region; (2) techniques, equipment, and applications of aerial photography, photogrammetric mapping, photointerpretation, and airborne geophysical surveys. (*EI*, 1962)

**92. ANALOGUE TELEMETRY EQUIPMENT AND SYSTEMS**
**Yound, R. E.**
***Electronic Engineering*, v. 33, pp. 16–20, 77–83, January–February 1961**

An air-to-ground television installation and automatic-radome evaluation equipment are described.

**93. GEODESY IN THE SPACE AGE (Symposium sponsored by the Institute of Geodesy, Photogrammetry, and Cartography, and the Department of Geodetic Science, Ohio State University, Columbus, Ohio, February 6–8, 1961)**
**February 1961**
**Ohio State University, Institute of Geodesy, Photogrammetry, and Cartography, Columbus**
**Publication 15**

The aim of this symposium was to discuss the new problems the space age has brought to geodesy, the most important developments needed to solve these problems, and the education of the men who have to improve techniques and solve the problems of tomorrow.

**94. SOME PRACTICAL APPLICATIONS OF MULTIBAND SPECTRAL RECONNAISSANCE**
**Colwell, R. N.**
***American Scientist*, v. 49, pp. 9–36, March 1961**

Several specific applications of multiband spectral reconnaissance are presented. Included are: (1) distinguishing between types of surfaces in the same area by using different film-filters in aerial photography, (2) determining planetary features from photographs made in several spectral bands, (3) identifying areas of diseased crops, and (4) a variety of microscopic and medical applications.

95. SATELLITE'S VIEW OF EARTH
Strees, L. V.
*Photogrammetric Engineering*, v. 27, no. 1, pp. 37–41, March 1961

Photography of Earth taken from beyond the atmosphere will include distortions not encountered in conventional aerial photography. Known information on these distortions is presented and remedial measures are proposed. (*EI*, 1961)

96. PHOTOGRAMMETRY, NAVIGATION, AND SPACE PROBLEMS
Brandenberger, A. J.
*Photogrammetric Engineering*, v. 27, no. 1, pp. 41–44, March 1961

A discussion is presented of the application of photogrammetry to flight testing and navigation, satellite and missile tracking, and lunar investigations. The Baker-Nunn satellite-tracking camera is described and a cross section is shown. The accuracy of the tracking is considered. (*EI*, 1961)

97. PRESENT AND FUTURE CAPABILITY OF OPTICAL SYSTEMS WITH EMPHASIS ON BALLISTIC CAMERA OPERATION
Rosenfield, G. H.
*Photogrammetric Engineering*, v. 27, no. 1, pp. 51–55, March 1961

Three basic optical instrumentation systems, comprised of the Ballistic Camera, CZR-1 Fixed Camera, and the Askania Cine-Theodolite, which are in use at the Air Force Missile Test Center for obtaining missile trajectory information are described. A discussion is included of intersection photogrammetry with associated random and systematic error propagation. (*EI*, 1960)

98. PHOTOGRAMMETRIC TECHNIQUE FOR STUDYING ATMOSPHERIC DIFFUSION
Wesko, P. E., Moses, H.
*Photogrammetric Engineering*, v. 27, no. 1, pp. 92–98, March 1961

The experimental use of three K-24-type aerial cameras, operating simultaneously to photograph fog-oil smoke plumes emitted from a 111-ft stack, is discussed. The photographs are analyzed by means of a photogrammetric analyzer which simulates actual field conditions. Measurements of the cross-sectional area of the plume, the rate of its change, and a measure of the area covered by the meander of the plume's center line at various distances from the stack are presented. (*EI*, 1961)

99. DETERMINATION OF ANGLE BETWEEN FIDUCIAL AXES (90° CONDITION)
Barth, W.
*Photogrammetric Engineering*, v. 27, no. 1, pp. 128–135, March 1961

A theoretical study is presented in which the deviation of an angle between fiducial axes from rectangularity is determined without the use of a right-angle master. The difference between supplementary angles is measured after superimposing a calibration-negative plate with a calibration-positive plate. The algebraic expression for the angle of deviation is given. Precise collineation of the two calibration plates is not required. (*EI*, 1961)

100. MEASUREMENT OF CONTRAST IN AERIAL IMAGE
Rosberry, F. W.
*Photogrammetric Engineering*, v. 27, no. 1, pp. 155–159, March 1961

Methods of analyzing the image of a lens as a means of judging its quality or capabilities are presented. A testing instrument has been developed which scans an aerial image directly with a slit and photomultiplier tube. Resultant variations in luminosity in the image are recorded on moving chart paper. Results are shown in which contrast is plotted against the image frequency for several *f*-values of lens. (*EI*, 1961)

101. PHASOMETER WITH SERVO SYSTEM
Kalashnikov, N. I.
*Instruments and Experimental Techniques* (English translation of *Pribory i Tekhnika Eksperimenta*), no. 2, pp. 326–329, March–April 1961

A phasometer for use in aero-electroreconnaissance is described. The phase register uses selective properties of phase-sensitive (synchronous) detection, and has uniform sensitivity as levels of reference voltage and voltage being measured change by 20 db. (*EI*, 1961)

102. RECONNAISSANCE SATELLITES
Coates, G. P.
*Spaceflight*, v. 3, no. 3, pp. 100–104, May 1961

An investigation is presented of image-forming processes and possible achievements when used in a satellite having military and civil applications. Orbits of reconnaissance satellites and the launching of these satellites into suitable orbits are discussed. A description is given of a photographic observation process and the capability of a long-range aerial-reconnaissance camera. Two interrogation processes are feasible with this photographic system: a flying spot-scanner system, and film recovery. The use of a TV system for pictorial survey and radar system, and the ground equipment are considered.

103. TIROS I: CAMERA ATTITUDE DATA, ANALYSIS OF LOCATION ERRORS, AND DERIVATION OF CORRECTION FOR CALIBRATION
Hubert, L. F.
April 1961
U.S. Department of Commerce, Weather Bureau, Meteorological Satellite Laboratory, Washington, D.C.
MSL-R-5

A nomogram is presented along with tabular data for *Tiros 1* orbit to enable users of *Tiros 1* pictures to derive location of the pictures on the Earth.

In the course of this data reduction, it is frequently necessary to check picture-taking time of the tape-recorded pictures. A photogrammetric method of accomplishing this from the pictures and the nomogram is presented. A systematic error in the camera calibration is shown to influence this time determination, and equations to correct this error are derived.

The location errors inherent in the procedures and data are discussed so that users will be able to evaluate the accuracy of mapping various photographed features they may be studying. (*AI/A*, 1961, #3697)

104. INSTRUMENT OPERATIONS ON TEST DEPARTMENT RANGES
**June 1, 1961**
**Naval Ordnance Test Station, China Lake, Calif.**
**NOTS-TP-2692**

This report describes the organization and personnel, the test equipment and capabilities, and typical test activities of the Instrument Operations Division of the NOTS Test Department. Branches covered are the photographic laboratory, optical instrumentation, telemetry and timing, metric electronics, and atmospheric studies.

105. CANADIAN GRIDS FOR TIROS I; ADDITIONAL ORIENTATION DATA; ERRATA
**Hubert, L. F.**
**June 1961**
**U. S. Department of Commerce, Weather Bureau, Meteorological Satellite Laboratory, Washington, D.C.**
**Supplement to MSL-R-5**

A library of Canadian grids is presented which can be used for rectification of *Tiros 1* photographs. The geometry involved in their construction and the procedure for picture rectification are discussed.

A few additional orientation data points for *Tiros 1* camera axis are presented and an errata list for Meteorological Satellite Laboratory Report 5 are included. (*AI/A*, 1961, #4255)

106. HIGH-RESOLUTION EXPOSURE DETERMINANT FOR AERIAL FILMS
**Levy, M.**
***Photographic Science and Engineering*, v. 5, no. 3, pp. 159–165, May–June 1961**

A simplified system for determining exposure, yielding the maximum detail from any sensitometric H & D curve, was developed after analyzing resolution vs. exposure curves of representative aerial films at varying development times. Exposure required is the same as that required to yield density of 0.85 above fog. The system can also be modified to obtain exposure required for 0.9 maximum resolution. (*EI*, 1961)

107. WEATHER MAPPING SPACE CAMERAS
**Langford, M. J.**
***Industrial Photography*, v. 10, p. 8, June 1961.**
(*AS&T*, 1961)

108. NAV-SCAN—DUAL PURPOSE PANORAMIC CAMERA
**McNeil, G. T.**
***Photogrammetric Engineering*, v. 27, no. 3, pp. 407–414, June 1961**

The Nav-Scan camera produces highly resolved and dimensionally precise photographic records of horizontal and panoramic views from a ground exposure station. This camera is used for both quality and metrical photography, and its operation is based on rotation of the lens about the rear nodal point. Horizontal coverage, with the film remaining stationary, is less than 180 deg and by moving the film, coverage is 360 deg. Formulas for determination of image movement, slit width, and scale are presented. (*EI*, 1961)

109. PARABOLIC IMAGE-MOTION
**Rosenau, M. D., Jr.**
***Photogrammetric Engineering*, v. 27, no. 3, pp. 421–427, June 1961**

Reasons why transverse-scanning panoramic aerial cameras have residual image-motion despite their optimum image-motion compensation (IMC) are explained. Image displacement is a parabolic function of time, and is also proportional to the film's transport velocity, airplane velocity, and sine of transverse scan-angle. Improvement in modulation transfer function can be achieved by matching the film's IMC velocity to the image velocity at the middle of the slit rather than at slit jaw. (*EI*, 1961)

110. ENVIRONMENTAL EFFECTS OF SUPERSONIC AND HYPERSONIC SPEEDS ON AERIAL PHOTOGRAPHY
**Nielsen, J. N.**
***Photogrammetric Engineering*, v. 27, no. 3, pp. 427–435, June 1961**

Metric distortion caused by the refraction of light rays by a flow field surrounding a vehicle is discussed. The loss of resolution by the scattering of light by turbulent boundary layers over the camera window is considered as well as the loss of contrast between the ground object and its background by luminous air in the flow field. Metric distortion is caused by temperature-induced window curvature. Rayleigh scattering between the ground and the vehicle can cause reduction in contrast. (*EI*, 1961)

111. LOOK AT THE PROBLEMS INVOLVED IN DESIGNING HIGH RESOLUTION CAMERAS FOR ARTIFICIAL SATELLITES
Sherman, B.
*Modern Photography*, v. 25, pp. 20–21, June 1961
(*AS&T*, 1961)

112. INTERESTING PROBLEMS IN OUTER SPACE
Singer, S. F.
*Photogrammetric Engineering*, v. 27, no. 3, pp. 371–376, June 1961

The interesting problems existing in outer space which will confront photogrammetrists, surveyors, cartographers, and mappers were the subject of this speech delivered at the ASP-ACSM general assembly. (*AI/S*, 1961, #40,125)

113. MAJORITY LOGIC COMPOSITE PHOTOGRAPHS
Stewart, R. M.
July 31, 1961
Space-General Corporation, El Monte, Calif.
RM-5

There are many cases in which fragmentary and noisy data are obtained for one area by several different methods and on different occasions. This paper discusses how to (1) choose the sensor and/or methods of signal-processing which give maximum internal consistency (or invariance) under varying unpredictable conditions, and (2) construct an "ideal" or "best composite" synthetic map based on all available data.

114. MOVING WINDOW DISPLAY MWD-5A
Berley, E. F.
July 1961
General Aniline and Film Corporation, Ansco Division, Binghamton, N. Y. (in cooperation with HRB-Singer, Inc., State College, Pa., DA 36-039-sc-78070)
Final Report 179F for November 1959 to July 1961
AD-283,248
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The design of the Moving Window Display, MWD-5A, involving the primary functions of CRT recording, rapid (5 to 6 sec) access to the record photographed on light-sensitive silver media, and the display thereof is discussed. More specifically the report covers: CRT selection, equipment configuration, CRT image-recording optical components and over-all system resolution attainable, film and processing technique selection, film drying, film transport in line-scan recording, power supply requirements, and the operational reliability aspect of the equipment.

Highlights of the display are functions with moderate cost CRT, 5.5 sec minimum access time to the displayed record, and the minimum system resolution of 20 lines/mm on film, capable of 50 lines/mm. Also featured were film and processing capacity 400 ft of 5-in.-wide film, maximum film transport speed 42 IPM, occupies 2.8 $ft^3$ of space at a flying weight of 138 lb, and requires less than 1100 w of power in maximum mode. Recommendations leading to the design of an advance display are discussed.

115. NEW ADVANCES IN INFRARED
Cade, C. M.
*Industrial Photography*, v. 10, no. 7, pp. 68, 99–101, July 1961

Image converters allow the shooting of infrared images from a phosphor screen with ordinary high-speed emulsions. For infrared photomicrography, the ocular lens of a microscope is replaced with an image converter. Factors in applications in biology, metallurgy, haze penetration in aerial mapping, for televising or cinematography in darkness, etc. are considered. (*EI*, 1961)

116. SPURIOUS RESOLUTION BY IMAGE MOTION
Nagel, M. R.
*Optical Society of America, Journal of the*, v. 51, no. 7, pp. 780–783, July 1961

A case of complex spurious resolution in airborne photographic resolution tests is studied and explained by establishment of the exposure distribution in the motion-blurred image of a triple-strip white-on-black resolution target. The conditions in black-on-white targets and in targets with $n$ strips are also discussed. (*PA*, 1961, #10,612)

117. TIROS II RADIATION DATA CATALOG, VOLUME I
August 15, 1961
National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
Catalog, Volume I

The NASA *Tiros* 2 launched on November 23, 1960, carried a medium-resolution, five-channel, scanning radiometer. This catalog describes the mapping procedures which have been employed in processing the *Tiros* 2 radiation data utilizing "Final Meteorological Radiation (Magnetic) Tapes" and automatic data-processing equipment. Sample grid point analyses of radiation data from 50 orbits are presented and serve to introduce *Tiros* 2 radiation data to the meteorological community.

118. IMAGE ORIENTATION CAMERA
Goldfarh, L.
August 1961
Army Signal Research and Development Laboratory, Fort Monmouth, N. J.
ASRDL TR 2222
AD-266,919
(Also available through U. S. Dept. of Commerce, Office of Technical Services, Washington, D. C.)

The interpretation of aerial photographs is becoming increasingly more difficult with the use of high-performance vehicles and camera equipment. An approach to the problem

from the sensor aspect is discussed. Basically the camera utilizes two focal-length lenses imaging at the same time, on the same film side by side. The large angular coverage of the short focal-length lens aids in orienting the image produced by the longer focal-length lens.

### 119. LOCATION OF PLANE OF BEST AVERAGE DEFINITION WITH LOW CONTRAST RESOLUTION PATTERNS

**Washer, F. E., Tayman, W. P.**
*Journal of Research of the National Bureau of Standards, Section C—Engineering and Instrumentation*, v. 65, no. 3, pp. 195–202, July–September 1961

The plane of best average definition is located for each of several airplane-camera lenses using two types of low-contrast test pattern and two emulsions. Results of measurements indicate that the position of plane of best focus and numerical magnitudes of root-mean product-mean ($R_\beta T_\beta$) value of resolving power are not significantly affected by this reversal of contrast. (*EI*, 1961)

### 120. RESEARCH AND DEVELOPMENT OF A FLYABLE BREADBOARD MODEL OF AN AERIAL CAMERA WITH A TWO-STAGE IMAGE INTENSIFIER TUBE

**Butterwick, G. N., Pury, T.**
**September 1961**
**Radio Corporation of America, Lancaster, Pa. (in cooperation with General Electric Company)**
**ASD TN 61-70, AF 33(616)-6675**
**AD-265,338**

The development of the low light level aerial camera with a two-stage image intensifier tube extends photographic capabilities into the nighttime portion of the 24-hour day without the aid of artificial illumination. Preliminary tests with the camera revealed photographic capabilities with one-fourth moonlight illumination. The heart of the aerial camera is a magnetically focused, two-stage image intensifier tube. This tube amplifies the brightness of images which are focused on its photocathode and reproduced on its fluorescent screen. The image on the screen is then coupled optically to photographic film.

### 121. SOME MEASUREMENTS OF THE EFFECT OF AIR TURBULENCE ON PHOTOGRAPHIC IMAGES

**Djurle, E., Bäck, A.**
*Optical Society of America, Journal of the*, v. 51, no. 9, pp. 1029–1030, September 1961

Experimental measurements of the effect of air turbulence upon the image of a distant object are described. The contrast transfer (CT) function was measured by an electrophotometer for a 36-in. focal length $f/6.3$ lens imaging a slit-shaped light source over a ground distance of seven miles. Some correspondence between meteorological conditions and the value of the CT function was found. Under the conditions of measurement, the deterioration in imaging properties caused by air turbulence may be the limiting factor on performance. (*PA*, 1961, #13,003)

### 122. TELEVISION WEATHER SATELLITE MAY SPOT HURRICANES

**Suomi, V.**
*Journal of the Franklin Institute*, v. 272, no. 3, pp. 244–245, September 1961

A description of *Tiros 3* is presented. (*AS&T*, 1961)

### 123. TRENDS IN AUTOMATIC PHOTOGRAMMETRY

**Tewinkel, G. C.**
*Photogrammetric Engineering*, v. 27, no. 4, pp. 537–542, September 1961

A nearly automatic photogrammetric system for the future is foreseen. The system will comprise, for preliminary operations, signalized control stations on the ground, premarking of pass points, use of a calibrated camera and glass plate. For aerotriangulation and compilation operations, a new stereoscopic point marker, a partly automatic comparator for measuring and recording coordinates of marked images, and a better and faster compilation machine are outlined. (*EI*, 1961)

### 124. MAXIMUM BRIDGING DISTANCE IN SPATIAL AEROTRIANGULATION

**Karara, H. M.**
*Photogrammetric Engineering*, v. 27, no. 4, pp. 542–545, September 1961

A universal chart is presented for the determination of the maximum allowable bridging distance for wide ranges in parameters affecting the accuracy of spatial aerotriangulations. The expected accuracy in aerotriangulated elevations is discussed. Two practical formulas are given for the determination. (*EI*, 1961)

### 125. INVESTIGATIONS OF WEIGHTS OF IMAGE COORDINATES IN AERIAL PHOTOGRAPHS

**Hallert, K. B. P.**
*Photogrammetric Engineering*, v. 27, no. 4, pp. 555–565, September 1961

It is pointed out that coordinates and coordinate differences measured in photographic images are not of equal weights. Due to the nature of central projection of photographic imaging procedure, image coordinates, measured orthogonally to image surface, are affected. Weights of image coordinates decrease with radial distance of points from center of image. Determination of the errors of image coordinates from adjustment according to the method of standard errors is discussed. (*EI*, 1961)

126. KC-2 CONVERGENT PHOTOGRAPHY AERIAL TRIANGULATION RESULTS
Lawrence, C. H.
*Photogrammetric Engineering*, v. 27, no. 4, pp. 579–582, September 1961

Evaluation of the KC-2 camera by the U. S. Army Map Service as part of an investigation of several types of convergent material is presented. The camera was flown simultaneously with a vertically mounted KC-1 camera over Phoenix, Ariz. at an altitude of 10,000 ft. Results of the tests, with simultaneous KC-2 convergent and KC-1 vertical, are presented and compared in detail. (*EI*, 1961)

127. VARIATIONS IN AERIAL PHOTO IMAGE RECOVERY RESULTING FROM DIFFERENCES IN FILM AND PRINTING TECHNIQUE
Myhre, D. W., Meyer, M. P.
*Photogrammetric Engineering*, v. 27, no. 4, pp. 595–599, September 1961

The image quality on infrared and panchromatic photographs printed by electronic and conventional methods is evaluated in terms of percent of actual tree-crown images observed by forest photo interpreters. No significant difference between printing methods was indicated, but a difference at a 1-percent probability level existed between film/filter combinations. (*EI*, 1961)

128. PERCEPTION APPLICATIONS IN PHOTO INTERPRETATION
Murray, A. E.
*Photogrammetric Engineering*, v. 27, no. 4, pp. 627–637, September 1961

Perceptron is the general name for perceiving and/or recognizing automata. When equipped with sensory elements, resembling an eye, the perceptron can reliably recognize or classify simple visual patterns. Results of the testing laboratory model are given, where the device could visually identify simple, compact, well-defined objects, either alone or in company with other objects. A plan is outlined for the development of a large, automatic photo classification machine. (*EI*, 1961)

129. SOME CHARACTERISTICS OF PANORAMIC CAMERAS FOR AERIAL SURVEILLANCE
Leistner, K. G., Paris, D. P.
*Photographic Science and Engineering*, v. 5, no. 5, pp. 257–262, September–October 1961

Differences in modes of operation between old and new cameras, and advantages of panoramic systems over wide angle and multiple camera arrangements are presented. A panoramic image rectifier is now often needed, and an image motion compensation has had to be devised. A camera under development by the U.S. Army Signal Corps has a scan angle of ± 70 deg. Deformations inherent in panoramic photography from the air are described. (*EI*, 1961)

130. GENERATING TANGENTIAL SWEEPS FOR INFRARED MAPPING
Woika, J. L.
*Electronics*, v. 34, pp. 64–66, October 13, 1961

An eight-transistor circuit is described which affords simple and direct adjustment of positive-slope wave-shapes formed by straight-line segments. The system was used in generating a straight-line approximation of the tangent function for the sweep waveform in a cathode-ray tube display of the video signal from an airborne rotating scanner.

131. USE OF AIRBORNE PROFILE RECORDER AND ALTERNATIVE METHODS TO SUPPLEMENT HEIGHT CONTROL FOR PHOTOGRAMMETRIC SURVEYING
Eden, J. A.
*Chartered Surveyor*, v. 94, no. 4, pp. 204–209, October 1961

The Airborne Profile Recorder (APR) consists of a radar altimeter, which measures the distance of the aircraft from the ground, and a hypsometer, which measures the distance of the aircraft from a constant pressure surface. It can be used only when the ground surface is level and unobstructed by trees, etc. Such places are selected by the use of a positioning camera. Calibration of the radar and hypsometer is discussed: Applications of this instrument in Great Britain, Canada, and Nigeria are considered. (*EI*, 1962)

132. COMPARISON OF IR VIDICON AND SENSITIVE VISIBLE LIGHT CAMERA TUBE FOR APPLICATION IN AIRBORNE-TV GUIDANCE/RECONNAISSANCE SYSTEMS
Dunn, G. L.
November 6, 1961
General Electric Company, Santa Barbara, Calif.
R-61 SPC-7
AD-273,614
(Also available through U. S. Dept. of Commerce, Office of Technical Services, Washington, D. C.)

The basic principles of radiation from a heated surface are examined. Equations are developed that provide a means of determining the performance of an infrared or visible-light TV system in terms of the camera tube, quantum efficiency, the noise current and the lens diameter and $f$ number. The overall system performance is given in terms of RMS current S/N ratio, and frame repetition rate at a S/N ratio of 2. In the case of the visible light sensitive tube, the relationships between object illumination and S/N ratio, and resolution vs. lens diameter are tabulated and plotted. This study indicates that the IR vidicon would have greater application for use in the TV Guidance/Reconnaissance Systems than the visible light sensitive camera. The advantages of the IR vidicon over the visible light tube are discussed.

133. **DISCUSSION OF IMAGE MOTION IN AERIAL PHOTOGRAPHS WITH THE AID OF A CONTRAST TRANSFER FUNCTION**
**(Translated from *Bildmessung und Luftbildwesen*, v. 2, pp. 65–77, 1960)**
**Meier, H. K.**
**November 1961**
**Ministry of Aviation, Technical Information and Library Services, London, Great Britain**
**R-TIL/T. 5240**

134. **CONTRAST TRANSFER FUNCTIONS FOR EVALUATING PICTURE QUALITY IN PHOTOGRAMMETRY**
**(Translated from *Bildmessung und Luftbildwesen*, v. 2, pp. 86–101, 1960)**
**Schwidefsky, K.**
**November 1961**
**Ministry of Aviation, Technical Information and Library Services, London, Great Britain**
**R-TIL/T. 5239**
**AD-267,443**

Different concepts have been proposed for characterizing the quality of optical and photographic images, such as brilliance, sharpness, definition, resolution, detail rendition, tone reproduction, range of contrast, enlarging capacity, etc. For quantitative evaluations, measuring rules are indispensable. The criteria of image quality should take into consideration the nature of the use of the image in order to obtain rational image-producing systems and avoid unnecessary technical expense. It has been found useful to characterize the manner in which an optical system transfers the contrast of the object to the image. It is possible to define contrast transfer functions which are applicable for objects of different structures and are independent of subjective judgement. Furthermore, these functions may be either measured or calculated and may therefore be established for combinations of several components. The advantages of contrast transfer functions for aerial photography and photogrammetry are discussed.

135. **PHOTOGRAMMETRIC METHODS FOR EXPERIMENT AND RESEARCH**
**Schurz, D. R.**
***Industrial Photography*, v. 10, pp. 34–35, 66–69, November 1961**
**(*AS&T*, 1962)**

136. **PROJECT FIREFLY**
**Schurz, D. R.**
***Industrial Photography*, v. 10, pp. 58–60, November 1961**
**(*AS&T*, 1962)**

137. **SKYSCRAPER AIRBORNE INSTRUMENTATION SYSTEM LABORATORY TESTS**
**December 1, 1961**
**The Bendix Corporation, Bendix Systems Division, Ann Arbor, Mich.**
**Scientific Report 3, BSR-604, AFCRL-1085, AF 19(604)-6129**
**AD-269,348**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

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I. Introduction

II. Laboratory Testing
- A. Electrical and mechanical mating
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III. Radiation measuring subsystem test report
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  2. Foreoptics
  3. Electronics
  4. Mechanical components and controls
  5. Spectrometers
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IV. Optical tracking subsystem test report
- A. 10-in. optics and slit-mirror tests
- B. Servo-system test
  1. Tracking mode
  2. Acquisition mode
  3. Search mode
- C. Sensitivity tests
- D. Subsystem testing with all units on platform
  1. Search-loop stability tests
  2. Tracking and acquisition loop stability test
  3. Tracking accuracy and repeatability
  4. Search-loop frequency response
  5. Multiple-target tests
  6. Dynamic tests of system

138. **ELECTROSTATIC LATENT IMAGE PHOTOGRAPHY**
**December 1961**
**General Electric Company, Advanced Electronics Center, Cornell University, Ithaca, N. Y.**
**Final Engineering Report for December 1, 1959–September 30, 1961, ASD TR 61-715, AF 33(616)-6746**
**AD-269,410**

A summary is presented of the electrostatic latent image photography program, an applied research program directed toward a long mission-life electrostatic photographic capability for reconnaissance. Principal areas of research effort were photoconductor development and the investigation of charge image transfer techniques. A laboratory breadboard was designed and constructed and a demonstration was made in September 1961. Feasibility was shown for a technique incorporating a high resolution electrostatic receptor to acquire an image, with thermoplastic film as the image storage

medium. Also included were a readout capability and a device for reconstructing a permanent record from telemetered signals.

139. FIBER-OPTIC FACE PLATES FOR LIGHT TRANSMISSION
*Journal of the Franklin Institute*, v. 272, no. 6, p. 536, December 1961

Descriptions are given of two new image orthicons with fiber-optic face plates that eliminate the requirement for lenses. The devices can be used in aerial reconnaissance, satellite observation, and astronomy.

140. SLIT-SCAN ELECTRO OPTICAL RECTIFIER
Levine, S. W.
*Photogrammetric Engineering*, v. 27, no. 5, pp. 740–747, December 1961

The machine described can rectify practically all types of oblique aerial photography. It takes advantage of optical projection for transforming photographic information, and electronic computer controlled distortion for achieving dimensional restitution. Resolution figure of 80 lines/mm is achieved in rectified photograph, with speed of operation being less than 15 min for 100 in$^2$ of copy. (*EI*, 1962)

141. PRECISION PHOTOGRAMMETRY TOOL OF GEODESY
Schmid, H.
*Photogrammetric Engineering*, v. 27, no. 5, pp. 779–786, December 1961

Requisites which would put photogrammetric techniques on an equal plane with those of traditional triangulation are presented. Also discussed are errors caused by radial distortion components. A graph gives a picture of error sequences, with double summation curves for seven of them, and maximum mean errors for *XYZ* coordinates at the center of the strip. The accuracy of the Z coordinate along the strip is composed of nine models. (*EI*, 1962)

142. CUMULUS CLOUD PHOTOGRAMMETRY
Orville, H. D.
*Photogrammetric Engineering*, v. 27, no. 5, pp. 787–791, December 1961

In the method described, cameras are fixed on the ground to provide terrestrial stereophotographs, a stereoplanimetric plotter is used to trace outlines of clouds, and time sequences of outlines are used to give quantitative information on growth rates and sizes of clouds. Better than 1-percent accuracy in 20,000-ft heights and 10 to 20-mi perpendicular ranges of clouds is expected. (*EI*, 1962)

143. AUTOMATION OF PHOTOGRAMMETRIC PROCESS
(Presented at the ISA Winter Instrument-Automation Conference and Exhibit, St. Louis, Mo., January 17–19, 1961)
Johnson, O. S.
1961
Instrument Society of America, Inc., Pittsburgh, Pa.
Preprint 14-SL-61

Logical development of man-machine systems for achieving the optimum in photogrammetric information processing is discussed. A typical solution is considered which is representative of combined development efforts. (*EI*, 1961)

144. PHOTOSCAN RECONNAISSANCE SYSTEM (Presented at the IRE International Convention, New York, N. Y., March 20–23, 1961)
McMann, R. H., Jr.
*1961 IRE International Convention Record*, pt. 5, v. 9, pp. 322–333, 1961

Details are given of a system capable of transmitting gathered information directly to a ground interpretation center, and there displaying it in visual form, with a minimum of delay between the initial data acquisition and final display. High resolution film scanner-reproducer equipment is discussed. (*EI*, 1961)

145. PHOTOSCAN—RAPID HIGH-RESOLUTION IMAGE TRANSMISSION
1961
Columbia Broadcasting System, Inc., CBS Laboratories Division, Stamford, Conn.
Technical Bulletin 463-1

The CBS Laboratories PHOTOSCAN System is an advanced electronic intelligence processing and transmitting system which now makes possible rapid, long-distance transmission of high-resolution images obtained from photographic or other sensing devices. The acquired data may be transmitted from an airborne platform to another airborne relay station or directly to distant ground receiving equipment for nearly instantaneous display and storage on film.

146. TOPOGRAPHIC INSTRUCTIONS OF THE UNITED STATES GEOLOGICAL SURVEY: PHOTOGRAMMETRIC RECTIFICATION
1961
U. S. Department of the Interior, Geological Survey, Washington, D. C.
Paper

Methods are given for the graphical determination of tilt, the development of the tilted configuration, and the graphical rectification of high obliques. Methods of computing the elements of rectification to meet the required conditions are given for several types of single-stage rectifiers. Formulas are also derived for multiple-stage rectification, which extends the range of the standard instrument. The characteristics of five different rectifying instruments are described and tabulated for ready comparison. Procedures for two-stage rectification, required for high obliques such as trimetrogen wing photographs, also are explained in detail.

147. ELECTRONIC CORRELATION TECHNIQUES FOR CHANGE DETECTION
Harley, T. J., Jr.
February 17, 1962
Philco Corporation, Blue Bell, Pa.
R-9034-F, Final Report for April 17, 1961–January 17, 1962, RADC-TDR-62-128, AF 30(602)-2473
AD-276,746
(Also available through U. S. Dept. of Commerce, Office of Technical Services, Washington, D. C.)

Several alternative electronic-correlation techniques to detect significant change in repeat-cover aerial photography are considered. The most promising techniques are shown to involve analyzing each photograph for its local significance before attempting detection of change. Success in distinguishing significant from trivial change appears directly related to ability to first analyze significance. A particular system organization is developed based on cross-correlation of transformed, abstracted, and spatially quantized representations of the photography called feature maps. Through simulation on the Philco 2000 computer, the system is shown effective in detecting the appearance or disappearance of man-made structures while ignoring changes in shadowing and/or minor misregistrations. Desired improvements in detailed system logic are discussed. To maximize utility, the change-detection equipment should be supported with automatic rectification equipment and an image-information storage and retrieval system that automatically locates the repeat-cover images in the library and aligns them with the new photographs for analysis. Candidate systems to perform these supporting functions are reviewed and evaluated.

148. PANORAMIC PROGRESS—1, 2
*Photogrammetric Engineering*, v. 27, no. 5, pp. 747–754, December 1961; v. 28, no. 1, pp. 99–107, March 1962

This discussion covers resolving power vs. angle of coverage. The role of aberrations, such as coma, lateral color distortion, field curvature, and astigmatism, is included as well as ground coverage obtainable with frame, strip, and panoramic cameras. Panoramic cameras are direct-scanning cameras with swinging lenses and cameras that scan by means of rotating mirrors. Various types are described (Part 1).

A technical analysis of panoramic photography which includes a discussion of instrumentation for use of panoramic photographs is also presented (Part 2). (*EI*, 1962)

149. OPTICAL INSTRUMENTATION FOR TIROS
Harper, M. H., Jr.
*Applied Optics*, v. 1, no. 2, pp. 139–146, March 1962

A brief description is given of the *Tiros* satellite and ground equipment in order to illustrate the need for optical testing. The methods of determining resolution, distortion, and brightness response of the system are reported, along with the instrumentation used in the measurements. (*PA*, 1962, #11,200)

150. SPURIOUS RESOLUTION IN INFRARED SCANNERS
LaRocca, A. J., Zissis, G. J.
*Optical Society of America, Journal of the*, v. 52, no. 3, p. 345, March 1962

It is pointed out that spurious resolution effects analogous to those described by Nagel are found in infrared air-to-ground scanning systems. (*PA*, 1962, #7458)

151. ICE PHOTOGRAPHY FROM THE METEOROLOGICAL SATELLITES TIROS I AND TIROS II
Wark, D. Q., Popham, R. W.
March 1962
U. S. Department of Commerce, Weather Bureau, Meteorological Satellite Laboratory, Washington, D. C.
MSL-R-8

The Meteorological Satellite Laboratory of the U.S. Weather Bureau and the U.S. Navy Hydrographic Office, with support from the National Aeronautics and Space Administration and the Commander Barrier Forces Atlantic, have cooperated on a program to determine to what extent *Tiros* meteorological satellite photographs can be used for ice surveillance and to lay a foundation for further *Tiros* and *Nimbus* satellite ice surveillance studies. This report summarizes the observational program, presents the results graphically, and discusses analytically a limited portion of the material.

152. PROCEEDINGS OF THE FIRST SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT (Held at the University of Michigan, Ann Arbor, February 13–15, 1962)
March 1962
Michigan, University of, Institute of Science and Technology, Infrared Laboratory, Ann Arbor
R-4864-1-X, Nonr 1224(44)

The purpose of the symposium was to review the state of the art of remote sensing technology and to explore possible applications to the Earth science fields. The subjects covered were: (1) basic considerations related to the problem of remote-sensing airborne geophysical devices, (2) state of the art and applications, radar technology and remote sensing, (3) discussion of examples of radar imagery, passive microwave technology and remote sensing, (4) infrared technology and remote sensing, (5) aerial photography, and (6) a reappraisal of the technology.

153. PHOTOGRAMMETRY IS KEY TO EXPLORATION OF SPACE
Fairchild, S. M.
*Photogrammetric Engineering*, v. 28, no. 1, pp. 37–40, March 1962

The state of the science of photogrammetry in the world today is described. Reasons for space exploration, past exploratory accomplishment of photogrammetry, and four phases of lunar exploration are considered. Cameras and instruments required are described. (*EI*, 1962)

154. PRACTICAL SYSTEMS FOR PRESERVATION OF OPTICAL PERFORMANCE IN AIRBORNE VEHICLE
Sanders, R. G.
*Photogrammetric Engineering*, v. 28, no. 1, pp. 40–43, March 1962

The information content of photo recordings made from vehicles in sensible atmosphere as well as in outer space is presented. Optical systems for photographs of both types are discussed. Details of improvement of system performance which has resulted from part-by-part perfection of component elements of today's stabilized high-performance systems are also described. (*EI*, 1962)

155. PRACTICAL TESTS OF THE THEORETICAL ACCURACY OF AERIAL TRIANGULATION
Hallert, K. B. P.
May 31, 1962
Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.
Research Note 1
AD-288,296
(Also available through U. S. Dept. of Commerce, Office of Technical Services, Washington, D. C.)

The effectiveness of a method for predicting the accuracy of aerial triangulation by means of a theoretical analysis after a numerical correction procedure is tested. The method used involves the summation formulas of aerial triangulation, the measured residual y-parallaxes in the individual models, elevation discrepancies in the scale transfer points, and general statistical procedures. The parallaxes and elevations were first corrected for known and specially determined regular (systematic) errors of the fundamental operations (the image coordinates of the photographs, the projection devices of the instrument, and the operator). The accuracy of the corrections was determined as standard errors with the aid of error propagation formulas and the basic standard errors of unit weight. The discrepancies between the final photogrammetric coordinates and the corresponding (true) geodetic coordinates in check points were determined and compared with the theoretically predicted values of the standard errors. Statistical methods were finally applied for a test of the significance of the deviations between theory and practice. The agreement between theory and practice was found to be so good in this experiment that the basic theory can be accepted. It is also concluded that further experiments are necessary, particularly for investigation of the fundamental operations and the sources of the errors and discrepancies.

156. OPERATIONAL EVALUATION OF EN-29A PHOTOGRAPHIC PROJECTION PRINTER (ORTHOPHOTOSCOPE)
Gettys, R. F.
May 1962
Hydrographic Office, Washington, D. C.
TR-129
AD-286,243

The Photographic Projection Printer EN-29A, or Orthophotoscope, was tested under operational conditions to determine the horizontal accuracy and photo quality of the orthophotograph, the problems likely to be encountered during extended operation of the instrument, and the adequacy of performance in possible future applications. Seven areas of representative terrain and cultural features were compiled and evaluated in terms of photo-image quality. One orthophotograph was prepared and the image positions measured to determine the horizontal accuracy of the instrument. Two orthophotograph compilations, each comprised of 12 stereo models, were processed by a photo-masking technique to transform the photos into map line-type images and printed experimentally as map substitutes. Tests indicate that the Orthophotoscope has the capability for transforming 1:50,000 scale perspective photography into orthophotographs meeting National Map Accuracy Standards for reproduction scale 1:50,000. The same criterion can be roughly applied for other scales on a 1:1 basis if the elevation differences within the photograph area are not too large. The Orthophotoscope produces the equivalent of constant-scale photographs which may be processed for rapid creation of map substitutes.

157. NATIONAL BUREAU OF STANDARDS MEASUREMENT PROGRAM ON UHF AIRBORNE TELEVISION
Kirby, R. S., Barsis, A. P., McQuate, P. L.
June 30, 1962
National Bureau of Standards, Boulder, Colo.
NBS-R-7274
AD-282,460

A description is given of a series of propagation measurements made over several air-ground propagation paths during the 1961–1962 school year. Altogether six continuous recordings were made at four locations ranging from 87 to 222 miles from the transmitter. Two transmitters operate simultaneously on Channels 72 and 76 while the aircraft orbits 23,000 ft over Montpelier, Indiana. All recordings of transmission loss are made on paper charts, and are later transferred to magnetic tape. The analysis of the date has a twofold purpose: (1) it is desirable to study the total variability of a signal of this type, including the component of variability introduced by the aircraft pattern, and (2) it is possible to isolate the variability component introduced by the aircraft either by path geometry considerations or by analysis methods. The remaining variability should ideally be solely due to the atmosphere, and its characteristics can be compared with those obtained from point-to-point within-the-horizon paths using substantially lower transmitting terminals.

158. RESEARCH ON THE PROCESSING OF SATELLITE PHOTOGRAPHY BY DIGITAL TECHNIQUES
Mach, R. E.
June 30, 1962
International Business Machines Corporation, Command Control Center, Federal Systems Division, Kingston, N.Y.

Final Report, AFCRL-TR-62-822, AF 19(604)-8432
AD-282,612
(Also available through U. S. Dept. of Commerce, Office of Technical Services, Washington, D. C.)

A three-part study of the application of digital techniques to the processing of *Tiros 1* weather satellite images is reported. Aspects of the study include: (1) development of a digital method to rectify *Tiros* images to a mercator projection; (2) incorporation of latitude and longitude grid lines on the rectified images; and (3) an automatic digital method to assemble overlapping images into a single mosaic. The method is described by which images were converted to digital data. The philosophies of the computer programs are discussed. Quality, accuracy, and processing time requirements are analyzed, and sample results are shown. Equipment configurations suitable for operational generation of digital data, and reproduction of images from digital data are considered.

159. EARTH SCAN ANALOG SIGNAL RELATIONSHIPS IN THE TIROS RADIATION EXPERIMENT AND THEIR APPLICATION TO THE PROBLEM OF HORIZON SENSING
Conrath, B. J.
June 1962
National Aeronautics and Space Administration, Washington, D. C.
TN D-1341

The five-channel medium-resolution scanning radiometers employed in the *Tiros* meteorological satellites provide data applicable to the problems encountered in selecting the optimum spectral region for horizon sensor systems. Simultaneous measurements are made in five spectral regions. Data from three thermal channels are presented with the corresponding television pictures in a manner allowing easy correlation of the thermal data with surface and cloud features. (*AI/A*, 1962, #60,108)

160. PHOTOGRAMMETRIC DATA REDUCTION ANALYSIS —CALIBRATION OF A PRECISION COORDINATE COMPARATOR
Rosenfield, G. H.
June 1962
RCA Service Company, Missile Test Project, Air Force Missile Test Center, Patrick AFB, Fla.
MTC TDR-62-5, AF 08(606)-3413

The procedures for calibrating a screw-type, precision coordinate comparator are described. The errors to be calibrated are: periodic screw error, scale error and secular screw error, curvature and weave of the ways, and misperpendicularity of the axes. Periodic error is calibrated using a 2-mm scale graduated into 0.1-mm increments. The calibration model is formed by a least squares sine wave fit. Scale error and secular screw error are calibrated using a 240-mm calibrated scale graduated into 1-mm increments.

161. APPLICATIONS OF INERTIAL GUIDANCE TO PHOTOGRAMMETRY
Harvell, J. F.
June 1962
Massachusetts Institute of Technology, Cambridge, Mass.
Master's Thesis
AD-290,133

162. RESEARCH INVESTIGATIONS ON PHOTO FACSIMILE TRANSMISSION TECHNIQUES
Hell, W. H., Case, B., Howard, J. A., Rogers, E. E., Whitmer, J. A.
September 30, 1962
Marquardt Corporation, Van Nuys, Calif.
R 25062, Quarterly Progress Report 1 for July 1–September 30, 1962, DA 36-039-sc-90862
AD-295,019

Advanced photofacsimile transmission techniques were investigated in the areas of system analysis and component and material research. Five parameters characterizing the performance of image transducing were defined and a mathematical expression interrelating these parameters was devised. Performance requirements of image transducing for a particular mission were studied by examining luminance and spectral properties of the scene that the transducer will be viewing. A method was evolved for categorizing scenes in terms of their excitation, geometry and spectral properties. This method was utilized to establish performance criteria of an idealized image transducer for the graphical or facsimile mission. Injection electroluminescence appears to offer greater advantages in accomplishing a matrix light source than other physical phenomena. A study was initiated to investigate fabrication techniques for matrix light sources. Test experience, literature studies and manufacturer contacts indicate Hackmanite is the most promising tenebrescent material for application in an image transducer. Studies are being continued.

163. GENERAL THEORETICAL STUDIES (TERMINAL GUIDANCE PROJECT—ARS PROGRAM)
Ellis, T. R.
July 28, 1962
AVCO Corporation, Research and Advanced Development Division, Wilmington, Mass.
RAD-TM-62-51, Report on Advanced Re-entry Systems, AF 04(694)-158
AD-288,667

A set of analytical expressions has been developed to describe the correlation function as well as its first and second derivatives at and in the vicinity of the matchpoint. These equations, derived for sliced and unsliced data with and without errors, are used to obtain a quantitative description of the effects of position shift errors on the matchpoint. Analysis of these expressions indicate that random position shift errors introduce a matchpoint location error whose standard devia-

tion is proportional to the standard deviation of the target location error and inversely proportional to the square root of the number of targets. These same errors reduce the amplitude of the matchpoint and its curvature. The autocorrelation function of black-and-white maps may be found explicitly, if the statistics of the black-and-white intervals in the direction of the offset are known. If one or both of the correlated copies are corrupted by black and white noise, the statistics of which are also known, the cross correlation function of the two copies may also be found explicitly and in a similar manner. The separate statistics of signal and noise (black and white) statements may be made about the statistics of the noisy signal.

164. A DIGITAL AUTOMATIC MAP COMPILATION SYSTEM
Hempel, H. P., Schulman, F. D., Williams, C. W., Kerl, R. R., Ralston, J. R., Reynolds, M. L.
July 31, 1962
International Business Machines Corporation, Federal Systems Division, Rockville, Md.
Final Technical Report for January 1, 1961–July 31, 1962, DA 44-009-eng-4724
AD-285,258

The Digital Automatic Map Compilation System has three major components: (1) a photo digitizer unit for scanning and digitizing the data in a pair of stereo serial diapositives, (2) a general-purpose digital computer and associated mathematical programs for correcting photographic errors to produce rectified photo data, and then from pattern matching and ortho correction techniques, producing orthophoto map data with or without contour and grid tic information, and (3) a photomap printer for printing a rectified photo or orthophoto map with or without contour and grid tic information by utilizing the computer output. A scanner-reproduction system was constructed to provide the photo digitizing and photomap printing operation. In addition, mathematical analyses were made of analytic photogrammetric techniques, and computer programs were developed for photo rectification and orthographic correction as well as for contouring and pattern matching.

165. AIRBORNE GEOSCIENCE RESEARCH
Neal, J. T.
*Photogrammetric Engineering*, v. 28, no. 3, pp. 438–441, July 1962

The program and philosophy of airborne terrain sensing under study at the Air Force Cambridge Research Laboratories are presented, with initial emphasis on examination of sensing techniques which appear feasible in preliminary study. Eventual plans call for instrumentation of C-130 aircraft to include airborne gravity, magnetics, photography, radar, infrared, and other terrain sensing devices. Plans for using the information obtained are discussed. (*EI*, 1962)

166. APPLIED PHOTOGRAPHIC TECHNIQUES IN HIGH DEFINITION REPRODUCTIONS OF AERIAL PHOTOGRAPHY
Jablonski, A., Jr.
*Photogrammetric Engineering*, v. 28, no. 3, pp. 518–522, July 1962

Efforts made at the Aeronautical Chart and Information Center, St. Louis, Mo., in applying photographic theory, instrumentation and data collecting techniques to reproduction processes, to establish a quality control program are discussed. Procedures and quality standards were established through sensitometric and densitometric techniques, chemical analysis, and precise photographic measurements. (*EI*, 1962)

167. DETERMINATION OF THE GEOMETRICAL QUALITY OF COMPARATORS FOR IMAGE COORDINATE MEASUREMENTS
Hallert, K. B. P.
August 1, 1962
Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.
Research Note 3
AD-297,137
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The development and practical application of test procedures are used to determine the geometrical quality of comparators for image coordinate measurement. The procedures are founded upon grid coordinate measurements under operational conditions. First the basic principles for the determination of the accuracy of the measurements have been treated under different assumptions concerning the number and the positions of the test points. The principles of the method of least squares have been applied throughout, for the determination of regular (systematic) errors of the measured data as well as for the estimation of a statistical value of the irregular errors and for the error propagation in functions of the basic observations. The derivations have been made for grids, the given coordinates of which can be regarded to be errorless, and for grids where certain regular errors are assumed to be present in the given coordinates. The theoretical derivations have been used for testing a number of comparators of different types. Also some determinations of absolute scales have been performed. The lowest standard error of unit weight found in a comparator is of the order of magnitude $1\mu$. Normal distribution tests of the residuals have been performed throughout.

168. INVESTIGATIONS OF BASIC GEOMETRIC QUALITY OF AERIAL PHOTOGRAPHS AND SOME RELATED PROBLEMS
Hallert, K. B. P.
August 17, 1962
Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.

Research Note 4
AD-297,351
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

A series of tests are presented of the basic geometrical quality of photographs obtained from aerial camera calibrations in a multicollimator and from aerial photography obtained under operational conditions. The elements of the interior orientation and the most important regular (systematic) errors of the image coordinates are determined as parameters in least squares adjustments, and the remaining irregular errors of the image coordinates are estimated as standard errors of unit weight of the image coordinates. In the multicollimator tests, film and glass plate negatives were tested and compared concerning the geometrical quality. A criterion for tangential distortion is developed, and some correlation effect between residual image coordinate errors is studied. A variation of the geometrical quality (weight) of image coordinates was found, and some possible reasons for this variation are more closely investigated. The resolving power, the thickness variations of films, and the locations of developed grains (details) within the emulsion were preliminarily studied. Some tests of diapositive printers were made.

169. SOME RELATIONS BETWEEN THE GEOMETRICAL QUALITY OF TOPOGRAPHIC MAPPING AND AERIAL PHOTOGRAMMETRY
Hallert, K. B. P.
August 17, 1962
Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.
Research Note 7
AD-298,737
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

170. INVESTIGATION OF THE GEOMETRICAL QUALITY OF THE RELATIVE AND ABSOLUTE ORIENTATION PROCEDURES AND THE FINAL RESULTS OF THE PHOTOGRAMMETRIC PROCEDURE
Hallert, K. B. P.
August 24, 1962
Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.
Research Note 6
AD-297,352
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

A theoretical investigation is presented of the determination of the basic geometrical quality of the relative and absolute orientation procedures and the propagation of the errors from these operations to the final results of the photogrammetric procedure, including the elements of the exterior orientation. The geometrical quality is determined as standard errors from the standard error of unit weight of the basic data: image coordinates, parallaxes, and model coordinates. The principle of compensation between the elements of the absolute and the relative orientations is applied. Comparisons of the geometrical quality to be expected from normal-angle, wide-angle, and superwide-angle photographs have been made. It is concluded that: the method of least squares and its laws of error propagation allow a well-defined theoretical determination of the geometrical quality to be expected in the final results of the photogrammetric procedure in terms of the standard errors of the y-parallaxes; the theoretical geometrical quality of the elements of the exterior orientation after double- and single-point resections in space can be determined in this way only, the influence of the errors of the interior orientation must be taken into account, and tolerance limits for the relative and absolute orientations can be derived from the results of these investigations.

171. TESTS OF BASIC GEOMETRICAL QUALITIES OF PHOTOGRAMMETRIC PLOTTING INSTRUMENT
Hallert, K. B. P.
August 28, 1962
Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.
Research Note 5
AD-292,971
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Some basic geometrical qualities of various photogrammetric plotting instruments were investigated. From grid-method tests of the interior orientation of different projectors, the basic geometrical quality of the reconstruction of bundles of rays was determined. Weight variations were determined, and the statistical distribution of residual errors was tested after comprehensive practical measurements. Numerical procedures for the determination and adjustment of certain regular errors in projectors with mechanical projection were derived and applied to practice. Significance tests were applied. Through y-parallax tests, some relations between varying image resolutions and geometrical quality were investigated in a superwide-angle plotter. Similar tests were also applied to two other instruments with optical projection.

172. SEMI-AUTOMATIC IMAGERY SCREENING RESEARCH STUDY AND EXPERIMENTAL INVESTIGATION
Harley, T. J., Jr., Bryan, J. S.
August 31, 1962
Philco Corporation, Blue Bell, Pa.
R-9043-1, Quarterly Progress Report 1 for June 1–August 31, 1962, DA 36-039-sc-90742
AD-293,616

A portion of an imagery-screening system was hypothesized to illustrate some of the critical technical problems. The principal problem is to find ways to process high-resolution aerial photography in a way that utilizes all the image data at a rate fast enough to be useful to the human photo-interpreter. Comparative sequential and parallel-access implementations

are discussed. Sample aerial photography, showing armor under field conditions, was studied. An attempt was made to list those logical subdecisions likely to be useful in the detection of armor, and to specify a logical structure required to combine these subdecisions effectively. A preliminary statement of a set of readily verbalized subidentifications useful in this context was developed. A figure of merit for an imagery-screening system is suggested and discussed. Specification of this figure must be in terms of false alarms and missed targets. Problems arise in specifying the distribution as well as the number of false alarms. A preliminary bibliography is included to cover various pattern-recognition techniques with possible application to imagery screening.

173. INTERPRETATION TECHNIQUES FOR A SINGLE FREQUENCY AIRBORNE ELECTROMAGNETIC DEVICE
Wieduwilt, W. G.
*Geophysics*, v. 27, pp. 493–506, August 1962
(*AS&T*, 1962)

174. THE DEVELOPMENT OF AN AERIAL CAMERA WITH CELESTIAL ORIENTATION
Menne, D. F.
August 1962
Aberdeen Proving Ground, Ballistic Research Laboratories, Md.
BRL-Memo-1425

An aerial camera system which records an image of the Sun or other celestial objects simultaneously with a terrestrial photograph has been developed. The addition of precise astronomical measurements serves to counteract the unfavorable accumulation of errors in the determination of orientation parameters for extended aerial triangulations. The camera has two 100-mm focal length, *f*/5.6 lenses incorporated in a camera body in such a way that the respective fields of view are diametrically opposed. A pulse operated shutter system provides synchronization of exposures within .001 sec for exposure durations of 0.010, 0.005, 0.003 or 0.002 sec. The occurrence of exposure is determined to 0.050 sec as part of the astronomical measurements. (*STAR*, 1963, N63-10213)

175. IMAGE INFORMATION PROCESSING FOR PHOTO-INTERPRETATION OPERATIONS
Mumbower, L. E., Richards, T. W.
*Photogrammetric Engineering*, v. 28, no. 4, pp. 569–578, September 1962

An investigation and analysis of photo interpretation operations to identify and develop techniques such as image information processing, photo and graphic indexing, retrieval of data from files, and image identification through signature correlation are described. (*EI*, 1963)

176. PHOTOGRAMMETRIC AND VISUAL COMPILATION OF LUNAR CHARTS
Cannell, W. D.
*Photogrammetric Engineering*, v. 28, no. 4, pp. 579–583, September 1962

This study includes a discussion of photo identification of small craterlets, low pressure ridges, and surface features obscured by intense shadows on the Moon. The use of the 24-in. Lowell Refractor at Flagstaff, Ariz., equipped for both visual and photographic observations is described. Supplementary photography is obtained through use of a motion picture camera, observational results and the method of transforming observational data are also included. (*EI*, 1962)

177. EVALUATING COLOR, INFRARED, AND PANCHROMATIC AERIAL PHOTOS FOR FOREST SURVEY OF INTERIOR ALASKA
Haack, P. M.
*Photogrammetric Engineering*, v. 28, no. 4, pp. 592–598, September 1962

Aerial photographs were made at a scale of 1:5000, using a 12-in. focal-length camera flown over the interior of Alaska. Infrared and panchromatic, both with minus-blue filter, and color film were used. To determine the type best suited for interpretation of vegetative classes on proposed Forest Survey, film types were tested on the basis of land-and-forest-class recognition. Another test compared ability to measure tree heights on panchromatic and infrared film, and although no significant difference between film types was found, several desirable features of infrared film led to its selection. (*EI*, 1963)

178. POSITION DETERMINATION OF ARTIFICIAL CLOUDS IN UPPER ATMOSPHERE
Albritton, D. L., Young, L. C., Edwards, H. D., Brown, J. L.
*Photogrammetric Engineering*, v. 28, no. 4, pp. 608–614, September 1962

A computer-oriented procedure is developed for calculating the position of artificial clouds by the method of triangulation. Data are obtained from photographs made from two observation stations. Each photograph contains cloud and background of stars. From the positions of stars and the cloud, angular position of line of sight from each station to the cloud is determined. (*EI*, 1962)

179. CLOSE-RANGE PHOTOGRAMMETRY—USEFUL TOOL IN MOTION STUDY
Brewer, R. K.
*Photogrammetric Engineering*, v. 28, no. 4, pp. 653–657, September 1962

Three basic techniques are being used in industrial methods of study. Most popular in the United States is personal observation of studying time and motion, the second involves use of high speed motion pictures; and the third is the cyclegraph

process. The Zeiss SMK wide-angle stereometric camera was designed exclusively for close-range photogrammetry. (*EI*, 1962)

180. APPROACH TO AUTOMATIC PHOTOGRAPHIC INTERPRETATION
Rosenfeld, A.
*Photogrammetric Engineering*, v. 28, no. 4, pp. 660–665, September 1962

An approach to automatic identification of images of targets on aerial photographs involves extraction from the photographic image of two basic types of information. One type relates to presence in the image of figures having given shapes and sizes; the other relates to the "textural" nature of image. (*EI*, 1962)

181. ALTERATION OF OBJECT MODULATION BY REAL ATMOSPHERES AS IT AFFECTS AERIAL PHOTOGRAPHY
Rosenau, M. D., Jr.
*Photographic Science and Engineering*, v. 6, no. 5, pp. 265–271, September–October 1962

Before an aerial camera is built, it is necessary to predict its performance. When the system is being flight tested, it is necessary to sort out both effects of processing and atmospheric alterations of object modulation so that only the effect of camera mechanisms on performance can be assessed. A nomograph was derived for use in prediction. Supplementary brightness measurements are proposed to allow analysis of performance of camera mechanisms which are being flight tested. (*EI*, 1962)

182. STUDY OF IMAGE-EVALUATION TECHNIQUES
Brock, G. C., Attaya, W. I., Myskowski, E. P.
October 10, 1962
Itek Corporation, Waltham, Mass.
Itek 9048-1, Interim Engineering Report 1 for July 10–October 10, 1962, AF 33(657)-9158
AD-286,488
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D. C.)

A study is presented of image evaluation for reconnaissance photography. The objectives were: (1) to assess the possible advantages of new concepts such as modulation transfer function, and how far they can replace resolving power for system evaluation and specification; (2) to examine questions of accuracy and convenience concerning the new measurement techniques; and (3) to establish criteria for the detection of targets of specific shape and contrast. Research included preparation for laboratory simulation of aerial photography, including a study of the problems of realistic simulation by transparencies; simulated photography with various transfer functions; studies in system analysis; initial measurements of lens transfer functions; and emulsion threshold modulations.

183. SPACE SURVEILLANCE SYSTEM EVALUATION BY A METHOD OF PHOTOGRAMMETRIC RESECTION
Merchant, D. C.
October 1962
Rome Air Development Center, Space Defense Systems Laboratory, Griffiss AFB, N. Y.
RADC-TDR-62-442

The successful development of efficient data-handling procedures, in connection with photogrammetric computations using réseau-type photography, has suggested the feasibility of handling the large number of resection solutions necessary in an accuracy evaluation program for a space surveillance system. The report develops the procedure for correcting the significant systematic errors in the measured coordinates, describes an adjustment for application to stabilized aerial photography, and finally, develops the method for calculating errors in the adjusted results. Theoretical investigations indicate that an accuracy of one foot (standard error) in location of the target aircraft along each axis for each ten thousand feet of altitude above the control is likely. (*STAR*, 1963, N63-11356)

184. AERIAL MAPPING EQUIPMENT
*Engineer*, v. 214, no. 5571, p. 785, November 2, 1962

The Swiss firm Wild Heerbrugg, Ltd., has introduced a new autograph and small-scale plotter for use with RC9 aerial camera equipped with Super-Aviogon *f*/5.6 wide-angle lens of 120 deg. The A9 autograph is a stereoscopic plotting instrument for reduced aerial photographs taken vertically with wide-angle or superwide-angle lenses, and uses 4½ in.$^2$ diapositives obtained from original negatives of 5½, 7, or 9 in. size. Focusing can be adjusted to within 0.01 mm. The B9 Aviograph small-scale plotter is for mapping and uses the same diapositives. (*EI*, 1963)

185. RESEARCH ON ADVANCED PHOTOELECTRIC INFORMATION STORAGE AND RETRIEVAL TECHNIQUES FOR RECONNAISSANCE
Reininger, W. G., Jenson, A. S.
November 30, 1962
Westinghouse Electric Corporation, Baltimore, Md.
R-1074A, Final Report for July 1959–August 1962, ASD TDR 62-990, AF 33(616)-6666
AD-299,029

186. PHOTOGRAMMETRY AND CARTOGRAPHY, INSTRUMENTS AND METHODS
Gardiner, R. A.
*Chartered Surveyor*, v. 95, no. 5, pp. 262–266, November 1962

This report covers work carried out in Great Britain by major organizations during the period 1958–1962. The two most important conferences and congresses were held there, discussing some new instruments and cartographic developments. (*EI*, 1962)

187. ORTHOPHOTOSCOPE DESIGN ANALYSIS
Halberstam, M.
*Photogrammetric Engineering*, v. 28, no. 5, pp. 716–724, November 1962

This paper analyzes, quantitatively, design parameters of the automatic orthophotoscope. The function of the apparatus described is to reposition image-points from their photo position to their correct map location. (*EI*, 1962)

188. PANEL—COMPUTATIONAL PHOTOGRAMMETRY
*Photogrammetric Engineering*, v. 28, no. 5, pp. 740–765, November 1962

A series of eight related articles was presented:
"Computational Relationship of Geodesy to Photogrammetry," by C. A. Whitten, pp. 741–742
"Case for First-Order Photogrammetry," by T. M. Schafer, pp. 742–745
"Status of Computational Photogrammetry at Air Force Missile Test Center," by G. H. Rosenfield, pp. 745–747
"Report on U.S.G.S. System of Analytical Aerotriangulation," by M. L. McKenzie, pp. 747–749
"Progress on Computational Photogrammetry at IBM," by J. V. Sharp, p. 749
"Mathematical Photogrammetry at Army Map Service," by C. J. Born, pp. 750–751
"Computational Photogrammetry," by H. Schmid, pp. 751–754
"Mathematical Analysis of Blur on Photographic Film Caused by Motions of Vehicle," by P. Nolan, pp. 754–765. (*EI*, 1962)

189. PHOENIX APR-HIRAN TEST
Masek, F. W.
*Photogrammetric Engineering*, v. 28, no. 5, pp. 765–773, November 1962

Simultaneously flown Airborne Profile Recorder (APR) and HIRAN controlled aerial photography is discussed. An average of RMS errors for all strips flown at 20,000 ft above sea level was 7.82 ft on vertical check points and 5.83 m on horizontal check points, when APR and HIRAN were used to control adjustment of each strip. Test results show that the bridging accuracies which can be achieved with Mark-VI APR and HIRAN control located in every stereo model of flight strip are the same as can be obtained with vertical ground-control in every other stereo model and horizontal ground-control spaced seven models apart along flight line. (*EI*, 1962)

190. OPTIMUM UTILIZATION OF AIRBORNE SENSORS IN MILITARY GEOGRAPHY
Van Lopik, J. R.
*Photogrammetric Engineering*, v. 28, no. 5, pp. 773–778, November 1962

A research program for optimum utilization must recognize the importance and interdependency of studies concerning terrain quantification. The effect of terrain and climate on military activities is described. Airborne sensors and associated imagery or displays are included, as well as interpretation, storage and retrieval of sensor data. (*EI*, 1963)

191. STRIP-TRIANGULATION WITH INDEPENDENT GEODETIC CONTROL
Ghosh, S. K.
*Photogrammetric Engineering*, v. 28, no. 5, pp. 810–818, November 1962

Aeroleveling and aeropolygon types of strip-triangulation were studied. In each case, again, particular experiments were carried out to investigate the precision obtained from such adjustments with different amounts of control in strip. Photographic and observation data are included. Formulas are derived and computations and results given. (*EI*, 1963)

192. PHOTOELECTRIC DEVICE FOR ESTABLISHING IDENTICALNESS OF TEXT AND ILLUSTRATION ORIGINALS, FOR EXAMPLE, GEOGRAPHICAL MAPS AND REPRODUCTIONS OF THE LATTER
(Translated from Russian Patent 141502 660295/28, pp. 1–9, March, 28, 1960)
Chekalov, D. N., Matveyeva, M. A., Krasikov, V. I., Gildebrandt, N. T.
December 11, 1962
Air Force Systems Command, Foreign Technical Division, Wright-Patterson AFB, Ohio
FTD-TT-62-1507
AD-296,431
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The known photoelectric devices for establishing the identicalness of text and illustration originals, for example, geographic maps, and reproductions of the latter, are not very effective and prove to be very time-consuming and tiring. A proposed device is designed in the form of two photoelectric heads, a modulator of voltage, an electron amplifier of alternating current, a phase-sensitive circuit, an electron unit of comparison, and a system of light and sound signaling. This makes it possible to eliminate the laborious visual process and it heightens the precision of the collation.

193. METHOD OF OPTICAL COMPENSATION OF LINEAR DISPLACEMENT IN PANORAMIC PHOTOGRAPHY
(Translated from *Izvestiya Vysshikh Uchebnykh Zavedenii, Geodeziia i Aerofotos*, no. 3, pp. 127–138, 1961)
Yukhin, I. I.
December 27, 1962
Joint Publications Research Service, Washington, D. C.
JPRS-16853
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

A theory of angular optical compensation for the linear displacement of the image in plane-panoramic aerial photography is presented, and a compensating assembly using a revolving mirror is proposed for use with a plane-panoramic camera. In this assembly, the mirror rotates at an angular velocity cor-

responding to the displacement velocity for certain image points; the mirror's axis of rotation is parallel to the aerial film and to the perpendicular direction of image displacements. The condition of corresponding longitudinal overlap between adjoining frames of the photographs is met by adjusting the panoramic rate of the camera. (*STAR*, 1963, N63-11463)

194. **AUTOMATIC RECOGNITION TECHNIQUES APPLICABLE TO HIGH INFORMATION PICTORIAL INPUT (Presented at the Institute of Radio Engineers International Convention, New York, N. Y., March 26–29, 1962)**
**Rosenfeld, A. (Budd Company, Budd Electronics Division, Long Island City, N. Y.)**
***1962 IRE International Convention Record*, pt. 4, v. 10, pp. 114–123, 1962**

Automatic recognition techniques are described which are applicable to inputs having high information content, such as aerial photographs. The techniques make it possible to generate automatically a simplified description of a given complex picture which corresponds, at least in general terms, to what a human observer might report in describing the picture. The key step of the statistical analysis makes use of the very multiplicity of information which the picture contains as a basis for simplification. It is felt that this statistical approach or its equivalent will become increasingly important in the development of cognitive systems to handle highly complex pictorial inputs. (*IAA*, 1963, A63-13589)

195. **THE INSTRUMENTS FOR NUMERICAL PHOTOGRAMMETRY (Presented at the International Society for Photogrammetry Symposium on Numerical Photogrammetry, Milan, Italy, October 1–5, 1962)**
**Solaini, L. (Politecnico di Milano, Italy)**
**International Society for Photogrammetry, London, Great Britain, 1962**

Two types of instruments are used in numerical photogrammetry to obtain the coordinates of ground points precisely and automatically: coordinate recorders added to the normal plotting apparatus, and stereocomparators. The use of electronic computers with stereocomparators has solved the double problem of relating plate coordinates and ground coordinates. Analytical plotting apparatus are being developed to supply the same spatial coordinates for each plotted point as the conventional plotting apparatus, and yet offer the advantages of the stereocomparator-computer system. Plastic films are being developed which are rigid enough to be flattened out and yet are free from sensitive local deformations, and photographic lens distortions are being reduced. All of these developments are increasing the precision of photogrammetry. (*STAR*, 1963, N63-11591)

196. **NUMERICAL PROCEDURES IN PHOTOGRAMMETRY (Presented at the International Society for Photogrammetry Symposium on Numerical Photogrammetry, Milan, Italy, October 1–5, 1962)**
**van der Weele, A. J.**
**International Society for Photogrammetry, London, Great Britain, 1962**

This paper presents a review of the problems encountered in the application of numerical procedures to photogrammetry. This is done to point out subjects for discussion at the next congress. The reduction of photographic data to digital form is discussed for both visual and automatic scanning methods. (*STAR*, 1963, N63-11345)

197. **PHOTOGRAMMETRY—VERSATILE MEASURING TECHNIQUE**
**Turpin, R. D.**
***Photogrammetric Engineering*, v. 29, no. 1, pp. 64–66, January 1963**

Photogrammetric principles, including measurement of volume and of objects in motion, are discussed. The current and future use of photogrammetry, in fields such as medicine, materials, travel, traffic, and space operations, is examined. (*EI*, 1963)

198. **CAPABILITIES AND LIMITATIONS OF SPATIAL AEROTRIANGULATION**
**Karara, H. M.**
***Photogrammetric Engineering*, v. 29, no. 1, pp. 99–104, January 1963**

Potentialities and limitations of spatial aerotriangulation in reducing the amount of ground control necessary for photogrammetric mapping are discussed. The importance of advance planning in projects involving bridging is pointed out. The design criteria for aerotriangulation projects, sharply reducing the necessity of relying heavily on chance or extensive experience, are presented. (*EI*, 1963)

199. **ABSOLUTE ACCURACY OF PHOTOGRAMMETRY**
**Doyle, F. J.**
***Photogrammetric Engineering*, v. 29, no. 1, pp. 105–108, January 1963**

Modern mapping systems which eliminate or reduce ground control by providing auxiliary devices to record camera station position, altitude, and angular orientation are described. Formulas are developed to investigate elevation accuracy. It is shown that the feasible contour interval is three to eight times larger than that obtainable with complete ground control. (*EI*, 1963)

200. **ACCURACY AND PRECISION IN PHOTOGRAMMETRY**
**Hallert, K. B. P.**
***Photogrammetric Engineering*, v. 29, no. 1, pp. 108–112, January 1963**

The main task of photogrammetry is to measure geometrical data with the aid of photographs at the lowest possible costs and within the shortest possible time. Methods to determine this quality, and some points of highly desirable standardization of terminology for quality in photogrammetry are given. (*EI*, 1963)

201. IMAGE ABERRATION
Merritt, E. L.
*Photogrammetric Engineering*, v. 29, no. 1, pp. 119–126, January 1963

Aberration is the sum of image displacements if the object and photogrammetric system are in motion. Total displacement, therefore, varies with image distance, object distance, image velocity vector, and object velocity vector. The pertinence of these factors to satellite photogrammetry is discussed. Data reduction equations for orbital velocity aberration, including correction equations for camera and object velocity, are described. (*EI*, 1963)

202. VALUES AND USES OF PHOTOGRAMMETRY
Norcross, T. W.
*Photogrammetric Engineering*, v. 29, no. 1, pp. 146–148, January 1963

Photogrammetric operations which may be involved or needed in accomplishing various types of objectives on land, sea, or coastal areas are listed. Classification is by major field of interest. (*EI*, 1963)

203. AUTOMATIC MAP COMPILATION
Bertram, S.
*Photogrammetric Engineering*, v. 29, no. 1, pp. 184–188, January 1963

A discussion is presented of research and development resulting in a successful prototype model of an optical-electronic system that can be added to existing conventional plotters to produce both altitude information and orthophotos automatically from pairs of aerial photographs. (*EI*, 1963)

204. AN/USQ-28 MAPPING SURVEY SUB-SYSTEM
Robson, W. M.
*Photogrammetric Engineering*, v. 29, no. 1, pp. 188–192, January 1963

New equipment is described for Air Photographic and Charting Service in which HIRAN (high accuracy SHORAN) equipment will be replaced by SHIRAN (S-band) distance measuring equipment offering greater portability, reliability, accuracy, and flexibility. Details of cameras, navigational and electronic equipment, digital units, and other subsystem components are discussed. (*EI*, 1963)

205. OB IZMERENII OB'EMA INFORMATSII PRI DESHIFRIROVANII AEROSNIMKOV (MEASUREMENT OF THE EXTENT OF INFORMATION IN THE INTERPRETATION OF AERIAL PHOTOGRAPHS)
Gonin, G. B. (Akademiia Nauk, Laboratoriia Aerometodov, Leningrad, USSR)
*Zhurnal Nauchnoi i Prikladnoi Fotografii i Kinematografii*, v. 8, pp. 21–28, January–February 1963 (in Russian)

Various criteria used in the interpretation of aerial photographs by the microphotometric method are discussed. Statistical relations between the objects and the photometric characteristics of their photographic images are established. (*IAA*, 1963, A63-16455)

206. GEODESY'S NEWEST DIMENSION
Sheldon, L. L. (Cambridge Research Laboratories, Geophysics Research Directorate, Bedford, Mass.)
*Photogrammetric Engineering*, v. 24, pp. 346–351, March 1963

Three-dimensional geodesy, the many methods and projects of which make use of the photographing of a light source against a star background, is discussed. Tested methods covered include rocket-flash triangulation and long-line azimuth determination. Some of the projects discussed are: the geodetic satellite, *Anna;* Project *Scorpio*, a satellite system primarily designed for other purposes but which will also provide geodetic and geophysical data; and *LARGOS*, a laser-activated reflecting geodetic optical satellite. Also noted is a geodetic equatorial synchronous satellite which could provide valuable information on gravitational harmonics. (*IAA*, 1963, A63-15134)

207. CORRECTION OF AERIAL PHOTOGRAPHIC TESTS FOR ATMOSPHERIC SCATTERING
Rosenau, M. D., Jr., Scott, F., Thiessen, W. F., Jr. (Perkin-Elmer Corporation, Norwalk, Conn.)
*Photographic Science and Engineering*, v. 7, pp. 92–95, March–April 1963

In-flight investigations show that the application of a previously proposed means of correcting the image modulation of a sinusoidal target improves the determination of the modulation transfer function of aerial cameras by reducing the spread of data. The data reduction presented illustrates the proposed correction. The results, shown tabularly, indicate a two-to-one reduction in the relative deviation of the function factors when the correction is applied. (*IAA*, 1963, A63-15291)

208. THE RELATION OF PICTURE DEFINITION OF AERIAL PHOTOGRAPHS TO SOLAR AZIMUTH
(Presented at the Society of Photographic Scientists and Engineers Annual Conference, Boston, Mass., May 8, 1962)
Wolfe, R. N., Tuccio, S. A. (Eastman Kodak Company, Research Laboratories, Rochester, N.Y.)
*Photographic Science and Engineering*, v. 7, pp. 109–112, March–April 1963

The orientation of the point image or spread function generating a picture relative to the solar azimuth, when the image is not radially symmetric, affects the picture definition of aerial photographs. The effect is noted in an aerial photograph of an urban area in which tall buildings have distinct shadows adjacent to them. This photograph is reproduced in such a way that the size, shape, and orientation of the generating image are constant over the area of each picture. Subjective evaluations of relative picture definition made on a series of pictures having various orientations of the generating image with respect to the solar azimuth show a small, but definite, systematic variation. (*IAA*, 1963, A63-15292)

(See also Entry #1441.)

# ASTRONOMICAL PHOTOGRAPHY

### *General — 1957*

209. ON REFLECTION IMAGES IN THE SCHMIDT CAMERA
Haffner, H.
*Optik*, v. 14, no. 7–8, pp. 335–344, July–August 1957 (in German)

Unwanted reflections at the correcting plate surfaces give rise to halation of stellar images, unless the correcting plate is bloomed. The size and intensity distribution of these concentric halos are calculated and these agree well with those found experimentally. (*PA*, 1959, #3032)

210. THE POSSIBILITY OF PHOTOGRAPHING ARTIFICIAL SATELLITES OF THE EARTH
Iranikov, V. I.
*Astronomicheskii Tsirkuliar*, no. 187, pp. 5–7, 1957 (in Russian)
(*AI/S*, 1959, #13,654)

### *Mars — 1957*

211. THE GREAT YELLOW CLOUD AND THE ATMOSPHERE OF MARS; REPORT OF VISUAL OBSERVATIONS DURING THE 1956 OPPOSITION
Miyamoto, S.
1957
Kyoto, University of, Institute of Astrophysics and Kwasan Observatory, Japan
Contribution 71

A general description of the surface markings during the 1956 opposition before the appearance of the great yellow cloud is presented as well as the emergence of the cloud, its development and disappearance. The motion of the cloud was assumed geostrophic, and derived the pressure distribution in the southern summer. The south polar region was occupied with the anticyclone. A characteristic feature of the Martian atmosphere is the smallness of its water vapor content. A list of observational data and drawings is included.

### *General — 1958*

212. A TELEVISION CAMERA WITH PROLONGED STORAGE TIME FOR TELEVISING WEAKLY ILLUMINATED OBJECTS, IN PARTICULAR FOR THE APPLICATION OF TELEVISION TO ASTRONOMY
Piepereit, P.
*Rundfunktechnische Mitteilungun*, v. 2, no. 1, pp. 18–19, February 1958 (in German)

For use in a television telescope, it was necessary to have a camera with a higher degree of photosensitivity. An image-orthicon with reduced storage capacity gave a rise in sensitivity that was insufficient. The storage time of the camera was then increased in the following manner. A train of rectangular pulses on the control grid of the electron gun produces an adequate increase of sensitivity (the same output voltage as with ordinary scanning with only 5 percent of the light usually required and a storage time of one second). The changed operational conditions permit a lower working temperature of the storage plate, which partly compensates for the loss in sharpness. The increased flicker of the picture is remedied by inserting a picture monitor with a long-afterglow screen and a second television camera. (*EEA*, 1958, #1679)

### *Mars — 1958*

213. TENTATIVE RESULTS OF MARS OBSERVATIONS MADE DURING THE 1956 OPPOSITION
Barabashov, N. P.
*Kharkov Universitet, Astronomicheskaia Observatoriia, Tsirkuliar*, no. 18, pp. 3–9, 1958 (in Russian)

Between June 15 and November 15, 1956, about 3000 photographs of Mars in six colors (360, 460, 520, 640, 750, and 840 m$\mu$) were obtained on 52 observation days. Added to these were 140 drawings in three colors, and 15 integral spectra with objective prisms. Numerous individual formations and the changes taking place in them are described. (*AJ*, 1959, #8405)

214. TENTATIVE RESULTS OF MARS OBSERVATIONS MADE AT THE SEKTOR ASTROBOTANIKI DURING THE PERIHELION OPPOSITION OF 1956
Tikhov, G. A.
*Akademiia Nauk Kazakhskoi SSR, Trudy, Sektor Astrobotaniki*, v. 6, pp. 3–6, 1958 (in Russian)
(Abstracted in *Referativnyi Zhurnal, Astronomiia i Geodeziia*, no. 10, p. 73, 1959)
(*AJ*, 1959, #8458)

215. THE NATURE OF THE SURFACE OF MARS
Vladimirskii, B. M., Lyubarskii, K. A.
*Akademiia Nauk Kazakhskoi SSR, Trudy, Sektor Astrobotaniki*, v. 6, pp. 34–38, 1958 (in Russian)
(Abstracted in *Referativnyi Zhurnal, Astronomiia i Geodeziia*, no. 10, p. 73, 1959)
(*AJ*, 1959, #8462)

216. THE INFLUENCE OF THE REFLECTION SPECTRUM ON THE FLOOR OF MARS ON THE REFLECTION SPECTRUM OF ITS VEGETATION
Stanko, S. A.
*Akademiia Nauk Kazakhskoi SSR, Trudy, Sektor Astrobotaniki*, v. 6, pp. 55–64, 1958 (in Russian)
(Abstracted in *Referativnyi Zhurnal, Astronomiia i Geodeziia*, no. 10, pp. 73–74, 1959)
(*AJ*, 1959, #8455)

217. OBSERVATIONS ON MARS AND VENUS
Richardson, R. S.
In "Proceedings of Lunar and Planetary Exploration Colloquium, Volume I, No. 3, Pasadena, Calif., October 29, 1958"
North American Aviation, Inc., Space and Information Systems Division, Downey, Calif., 1958

### *Moon — 1958*

218. THE CRATER LINNÉ
Alter, D.
In "Proceedings of Lunar and Planetary Exploration Colloquium, Volume I, No. 3, Pasadena, Calif., October 29, 1958"
North American Aviation, Inc., Space and Information Systems Division, Downey, Calif., 1958

219. GAMMA RAY SPECTROSCOPY OF THE MOON'S SURFACE
Arnold, J. R.
In "Proceedings of Lunar and Planetary Exploration Colloquium, Volume I, No. 3, Pasadena, Calif., October 29, 1958"
North American Aviation, Inc., Space and Information Systems Division, Downey, Calif., 1958

220. COMPARISON OF LUNAR OBJECTS WITH TERRESTRIAL ROCK FORMATIONS
Barabashov, N. P.
*Kharkov Universitet, Astronomicheskaia Observatoriia, Tsirkuliar*, no. 19, pp. 3–26, 1958 (in Russian)
(*AJ*, 1959, #8373)

### *Saturn — 1958*

221. PLANET SATURN
Ljubić, M.
*Zemlja i Svemir*, v. 1, pp. 51–56, 1958
(*AJ*, 1960, #8713)

### *General — 1959*

222. A SCIENTIFIC INVESTIGATION INTO PHOTOGRAPHIC RECONNAISSANCE FROM SPACE VEHICLES
Chapman, S., Andersen, N. Y., Hart, G. G., Rosenzweig, S.
January 15, 1959
Cornell Aeronautical Laboratory, Inc., Buffalo, N. Y.
R-VF-1260-P-2, Quarterly Report 2 for October 1–December 31, 1958, AF 33(616)-5870
AD-289,667

A scientific investigation was conducted of technical requirements for photographic reconnaissance from space vehicles, and new techniques were sought where current state of the art is inadequate. Image motion tolerances for various lens-film combinations are presented. Mathematical expressions for magnitudes and tolerances of image motion due to vibration and vehicle motion are derived. Environmental considerations, including temperature, pressure, haze and contrast, and radiation, are summarized. A detailed mathematical analysis of the transformations involved in determining vehicle orientation by stellar photography is presented.

223. THE PHOTOGRAPHIC EXPOSURE TIME FOR ASTRONOMICAL PICTURES
Gebel, R. K. H.
January 1959
Wright Air Development Division, Aeronautical Research Laboratory, Wright-Patterson AFB, Ohio
WADC-TN-59-54
AD-210,752

An analysis is made of the factors affecting the photographic exposure time for celestial objects. The minimum number of quanta that must be received from a star and the minimum number per unit solid angle that must be received from an extended source to reach the photographic threshold are determined for the case when the camera is carried on an astronomical mount. The treatment is then extended to the case of a satellite or other rapidly moving object near the Earth, when the camera position is fixed with respect to the Earth. (*AI/A*, 1960, #2640)

224. SEVERAL RESULTS OBTAINED WITH ELECTRONIC PHOTOGRAPHY BY COUNTING ELECTRON TRACKS
Lallemand, A., Duchesne, M., Goldzahl, L., Duflo, J., Banaigs, J.
*Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 15, pp. 2191–2193, April 13, 1959 (in French)

Instead of determining image details from the optical density of a photographic plate in an electron image intensifier of the type used in astronomy, in which a photographic plate is placed inside the vacuum system, a count is made of the number of electron tracks per unit area. By this means an intensity gain of 1000 has been obtained over the normal method. The new method depends on the operator's ability to distinguish electron tracks caused by the image from those occurring at random. (*PA*, 1959, #11,705)

225. USING TV TECHNIQUES IN ASTRONOMY
Borgman, J.
*Electronics*, v. 32, no. 19, pp. 66–68, May 8, 1959

Variable stars can be detected by using flying-spot scanning of two photographs of the same sky area taken at different times. Similar signals are canceled leaving residual signals from variable stars for presentation on a monitor. (*EEA*, 1959, #5601)

226. PHOTOGRAPHIC TRACKING OF ARTIFICIAL SATELLITES IN THE USSR (Soviet Open Sources 1957–1959)
May 18, 1959
U.S. Department of Commerce, Office of Technical Services, Washington, D. C.
OTS: 59-16,481

This paper is divided into the following sections: Photographic Stations, Limitations of the Network, Meteor Stations; Aerological Stations; Photography at Visual Stations; Cameras

and Shutter Systems, Standard Meteorology, Oscillating Plate Method; Moving Grid Method, Moving Film Method, Spectrophotography; Optical-Electronic Transducers, Photoelectric Registration of Passage; and Change of Brightness Studies. (*AI/A*, 1960, #2330)

227. MINIATURE MOVIES OF PLANETS
Baker, S. C., Kelso, J. M.
*Astronautics*, v. 4, no. 5, pp. 26–28, 104, May 1959

The limitations of image systems operating from space vehicles are presented. The system proposed makes use of vehicle spin. Motions of a planetary payload provide the opportunity for "built-in" scanning. Vehicle spin can furnish line scanning, and vehicle travel along its trajectory can produce frame scanning. An optical device designed to see a small spot of light in a particular direction may consist of a photosensor and pinhole. Details and a block diagram of optical and electronic units for a planetary probe are given, as well as readout over the telemetry system. (*EI*, 1959)

228. CONSTRUCTION OF A SCHMIDT CAMERA
Mallick, S. L.
*Journal of Scientific and Industrial Research*, India, v. 18A, no. 6, pp. 268–273, June 1959

A brief outline of the theory of a Schmidt camera is given, and the grinding, polishing and optical testing of a 12-in.-D mirror and its corrector plate are described in detail. Mechanical construction is not considered as this paper is concerned only with the optical components of the camera. (*PA*, 1959, #12,937)

229. SPACE AGE PHOTOGRAPHY AT AVCO
Burton, C. J.
*Industrial Photography*, v. 8, no. 6, pp. 21–23, June 1959
(*AI/S*, 1959, #11,965)

230. MEASURING TIME AND SPACE
Hanson, A. G.
*Industrial Photography*, v. 8, no. 6, pp. 28–29, 60, June 1959
(*AI/S*, 1959, #12,338)

231. A RECOVERABLE INTERPLANETARY SPACE PROBE: VOLUME I–IV
July 1959
Massachusetts Institute of Technology, Instrumentation Laboratory, Cambridge
R 235

A recoverable interplanetary space probe has been comprehensively investigated and its feasibility established. A preliminary design is presented of a vehicle whose mission is to return safely to Earth with a useful payload which could be a high-resolution photograph of a neighboring planet. Navigational techniques and interplanetary orbits have been studied in detail to determine basic performance and accuracy attainable for a variety of interplanetary missions. These numerical results, assuming reasonable navigational instrument errors, indicate that only moderate propulsion requirements for orbital velocity corrections are necessary. The vehicle weight in the preliminary design is well within the capability of soon-to-be-available rocket vehicles for initial boost into a planetary transfer orbit. The vehicle presented contains an automatic navigation and attitude control system using a digital computer and electromechanical-optical accessories, a microrocket system for making navigational corrections, a long-range communication system for transmitting useful intelligence, and a re-entry vehicle with associated radio and light beacon aids for the physical recovery of the payload. The overall vehicle weight is approximately 340 lb.

Included in the four volumes are the following chapters and appendices: Electrical System; Description of the Accessories; Photographic Prospect; Radiation Environment; and Disk Scanning. (*AI/A*, 1959, #1636)

232. PHOTO-ELECTRIC IMAGE TECHNIQUES IN ASTRONOMY
Somes-Charlton, B. V.
*British Institution of Radio Engineers, Journal of the*, v. 19, no. 7, pp. 417–435, July 1959

The underlying scientific principles of light detectors such as the human eye, photographic emulsion or photoelectric device, are explained and their quantum efficiencies compared in terms of S/N ratio. Television techniques can be applied to aid astronomical observations and help to overcome, in some measure, the fundamental problems in observing celestial objects through the semi-transparency of the Earth's atmosphere. The television techniques in the detection of threshold and extremely low light-level stellar and planetary images are described. Achievements to date are summarized and the results illustrated by photographs of the Moon and of Mars obtained in 1956. On the latter occasion a low light-level television system was used to record pictures showing the fine surface structure of the planet. A survey of proposals for the construction of a space orbiting astronomical telescope is included. (*EEA*, 1959, #7654)

233. THE PROCEEDINGS OF THE NATIONWIDE AMATEUR ASTRONOMERS CONVENTION, UNIVERSITY OF DENVER, COLO., AUGUST 28–31, 1959
Astronomical League, Millvale, Pittsburgh, Pa.

Papers presented at the convention include:

"Observations of Venus and Mercury With Large Apertures," by D. P. Cruikshank, p. 42 (See Entry #295)

"Lunar and Planetary Photography," by F. J. Eastman, Jr., p. 55

"The Figure of the Moon," by K. H. Engel, p. 60

"The Amateur Mars Observer and Some Notes on the 1958 Apparition," T. R. Cave, p. 69 (See Entry #274)
"Observing the Blue Clearing of Mars With a Photoelectric Photometer," by J. S. Miller, p. 77
"The Ashen Light of Venus," by M. Rushton, p. 147

234. SPOTLIGHT ON INSTRUMENTATION
*Industrial Photography*, v. 8, no. 8, p. 36, August 1959
(*AI/S*, 1959, #12,754)

235. MULTIPLE IMAGE PRINTING FOR PLANETARY PHOTOGRAPHY
*Astronomical Society of the Pacific, Publications of the*, v. 71, no. 421, p. 334, August 1959
(*AI/S*, 1959, #13,222)

236. ON THE PERFORMANCE OF THE BENDIX LUMICON WITH ASTRONOMICAL OBJECTS
Kuiper, G. P. (Yerkes Observatory, Williams Bay, Wis.)
September 1959
Air Force Cambridge Research Center, Geophysics Research Directorate, Bedford, Mass.
AFCRC-TN-59-637, GRDST-9

A series of astronomical and some laboratory tests were made with the Bendix-Friez Lumicon, a closed-circuit TV device, to determine the suitability of the Lumicon as a tool for astronomical research, including the discovery and observation of artificial satellites.

It was found that the Lumicon is very fast in recording faint detail, provided this detail is stationary, but its usefulness is limited when employed on moving objects, and as yet does not compete with photography. (*AI/A*, 1960 #2392)

237. SYSTEM DESIGN CRITERIA FOR SPACE TELEVISION
Viterbi, A. J.
*British Institution of Radio Engineers, Journal of the*, v. 19, no. 9, pp. 561–570, September 1959

A narrow band television system for relaying to Earth images of the planets is described, with principal consideration given to the necessity of communicating over extremely long ranges. Due to the resulting high noise environment, the channel bandwidth is severely restricted. Bandwidth compression is achieved by storing the video signal on magnetic tape or photographic film and transmitting at a reduced information rate. An FM-PM telemetry system is utilized. The doppler-shifted carrier is recovered from the noise by a very narrow tracking filter or phase-locked loop. The derived carrier is mixed with the incoming signal to yield the noisy video information. The discriminator is also a phase-locked loop with sufficient bandwidth to track the information signal. The recording operation is reversed at the receiver to present the video image at periodic intervals, or a facsimile technique may be employed. Special attention is directed toward the theory and design of the very narrow band telemetry system and the unconventional discriminator required for ultra-long-range television communication. (*EEA*, 1960, #507)

238. A SCIENTIFIC INVESTIGATION INTO PHOTOGRAPHIC RECONNAISSANCE FROM SPACE VEHICLES
October 15, 1959
Cornell Aeronautical Laboratory, Inc., Buffalo, N.Y.
R-VF-1260-P-5, Quarterly Report 5 for July 1–September 30, 1959, AF 33(616)-5870
AD-289,887

A discussion is presented of the continuing efforts on the imaging cascade, of an analytical investigation of contrast reduction in a Rayleigh atmosphere, of cloud cover effects, and of image-motion compensation. Results are presented for the high-altitude, exposure-contrast investigation.

239. TELEVISION JOINS TELESCOPE IN STRATOSCOPE I BALLOON FLIGHTS
*Electrical Engineering*, v. 78, pp. 1058–1060, October 1959

A description of the television system, including airborne camera, transmitter, antenna structure, and ground-based monitors, of *Stratoscope I* is presented. Operation of the system in conjunction with the solar telescope camera is described.

240. SOVIET PROBE PIONEERS NEW TECHNIQUES
Clark, E.
*Aviation Week*, v. 71, no. 18, pp. 26–28, November 2, 1959
(*AI/S*, 1959, #13,399)

241. THE THIRD SOVIET COSMIC ROCKET
(Translated from *Pravda* and *Izvestia*, October 27, 1959)
Zygielbaum, J. L., Translator
November 14, 1959
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
AI/Translation 15

A description of the "automatic interplanetary station" used by the Soviets to photograph the hidden side of the Moon is presented. The orbital characteristics of the station are analyzed, and the methods using a photo-television system for photography and transmission of images of the hidden side of the Moon are described. (*AI/A*, 1960, #2235)

242. COMBINED PHOTOGRAPHIC AND RADIO ECHO OBSERVATIONS OF METEORS
Davis, J., Greenhow, J. S., Hall, J. E.
*Royal Society, Proceedings of the*, v. 253, no. 1272, pp. 121–129, November 17, 1959

Observations were made by means of a meniscus Schmidt camera and two pulsed radio transmitters operating at frequencies near 36 Mc. Radio echo and photographic measurements of a bright Geminid meteor were analyzed. Radio echo was found to be several orders of magnitude less than expected on a simple diffusion theory. Behavior is explained in

terms of electron attachment to neutral oxygen molecules to form negative ions, and the attachment coefficient value is determined. (*EI*, 1960)

243. OBSER 'ACIONES PLANETARIAS EN 1958 (PLANETARY OBSERVATIONS IN 1958)
Compte Porta, R.
*El Universo*, v. 13, pp. 135–138, 1959
(*AJ*, 1959, #8106)

244. CONSIDERAZIONI SULLA VISIONE AL TELESCOPIO DEI PIANETI DA UNA STAZIONE DI OSSERVAZIONE SITUATA AL DI FUORI DEL-L'ATMOSFERA TERRESTRE (CONSIDERATIONS OF TELESCOPIC PLANETARY OBSERVATIONS FROM AN OBSERVATORY SITUATED OUTSIDE THE TERRESTRIAL ATMOSPHERE)
Ruggieri, G.
*Astronautica*, v. 8, pp. 102–113, 1959
(*AJ*, 1959, #8118)

245. CONSIDERAZIONE SULLA VISIONE DEI PIANETI AL TELESCOPIO (CONSIDERATION OF TELESCOPIC OBSERVATION OF PLANETS)
Ruggieri, G.
*Astronautica*, v. 8, pp. 54–60, 184–187, 1959
(*AJ*, 1959, #8117)

246. INFRA-RED SPECTROSCOPY FROM BALLOONS AND THE POSSIBILITY OF SOME OBSERVATIONS ON THE BIOSPHERE (Presented at the 27th Annual Meeting of the Institute of the Aeronautical Sciences, New York, N. Y., January 26–29, 1959)
Gates, D. M. (National Bureau of Standards, Washington, D.C.)
1959
Institute of the Aerospace Sciences, Inc., New York, N. Y.
Paper 59-47
(*AI/A*, 1959, #1464)

247. REQUIREMENTS OF HIGH-RESOLUTION PHOTOGRAPHY OF THE PLANETS (Presented at the 27th Annual Meeting of the Institute of the Aeronautical Sciences, New York, N. Y., January 26–29, 1959)
de Vaucouleurs, G. H. (Harvard College Observatory, Cambridge, Mass.)
1959
Institute of the Aerospace Sciences, Inc., New York, N. Y.
Paper 59-73
(*AI/A*, 1959, #1464)

248. THE PHOTOGRAPHIC OBSERVATION OF ARTIFICIAL SATELLITOIDES (Presented at the Ninth International Astronautical Congress, Amsterdam, The Netherlands, 1958)
Jaschek, W. J. (Kuffner Observatory, Austria)
In "Proceedings of the 9th International Astronautical Congress," pp. 88–91
Hecht, F., Editor
Springer-Verlag, Vienna, 1959

The artificial satellitoides of the present time have angular velocities of about 1 deg/sec. The photographic observation of such objects, in order to determine their positions, is superior to the visual method. Prerequisites for photographing are sufficient brightness of the satellitoides and a suitable photographic arrangement. The chief problem of both methods is precise timing. Considering those circumstances and assuming an accuracy of timing within ±0.01 to ±0.02 sec, photolenses with focal lengths of 5 cm will prove to be sufficient, i.e., the commercial 35-mm cameras may be used. The tolerances of the various parameters obtained from observation are estimated. It is imperative that the data of the place of observation be known with fairly high precision. (*AI/A*, 1960, #2098)

249. THE (RIVAL) CLAIMS OF SOME IMAGE STORAGE METHODS IN ASTRONOMICAL MEASURING TECHNIQUES (Presented at the Colloquium on Image Convertors and Image Storage Tubes, Heidelberg, Germany, April 28–29, 1958)
Seidentopf, H.
*Sitzungsberichte der Heidelberger Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse*, no. 5, pp. 4–16, 1959 (in German)

A comparative study is presented of modern photoelectric (photomultipliers and image-storage devices) and photographic methods used in astronomical research for detecting and measuring the very low radiation fluxes of great importance in current astrophysical and cosmical problems. Operational data for the two methods are tabulated. A discussion of the comparative cost of apparatus needed to provide the same amount of information on each of the two systems is included. (*PA*, 1961, #5124)

250. SPECIAL STORAGE TUBES FOR USE IN ASTRONOMY (Presented at the Colloquium on Image Convertors and Image Storage Tubes, Heidelberg, Germany, April 28–29, 1958)
Theile, R.
*Sitzungsberichte der Heidelberger Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse*, no. 5, pp. 50–53, 1959 (in German)

Three types of tubes, which operate on the storage principle and are suited for astronomical work, are described. The first uses a storage grid mounted near the fluorescent screen and an auxiliary gun to render the stored image visible on the screen. The design of the other two tubes follows suggestions made by McGee and makes use of mechanical movement of the storage plate. (*PA*, 1961, #5125)

251. SHORT REPORT ON AMERICAN, ENGLISH AND FRENCH WORK ON THE USE OF IMAGE STORAGE TUBES AND IMAGE INTENSIFIERS IN ASTRONOMICAL OBSERVATIONS (Presented at the Colloquium on Image Convertors and Image Storage Tubes, Heidelberg, Germany, April 28–29, 1958)
Dachs, J.
*Sitzungsberichte der Heidelberger Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse*, no. 5, pp. 54–58, 1959 (in German)

The methods in use for intensifying the optical image in an astronomical telescope are reviewed. These include the sealed-off phototube, devised by Lallemand, which contains a photographic plate and has a working life of half an hour, and the demountable version by Hiltner. Other tubes rely on a series of screens coated on one side with a phosphor which is bombarded by electrons and on the other with a photosensitive layer. Finally, the application of conventional storage tubes to small telescopes is discussed. (*PA*, 1961, #5126)

252. SPACE VEHICLE TELEVISION (Presented at the National Symposium on Extended Range and Space Communication, Washington, D. C., October 6–7, 1958)
Sonett, C. P.
1959
George Washington University, Washington, D. C.
Institute of Radio Engineers, Inc., New York, N. Y.
Report, pp. 4–19

The feasibility of an astronomical telescope based on a scanning technique which uses intrinsic spin of simple spin-stabilized vehicle is demonstrated. Using systems of this type, relatively inexpensive astronomical surveys of the sky can be made from outside the atmosphere, and video pictures of terrestrial planets are feasible over extremely restricted pass-bands. (*EI*, 1960)

253. ASTRONOMICAL PHOTOGRAPHY AT THE TELESCOPE
Rackham, T.
Faber and Faber, Ltd., London, 1959

### *Jupiter — 1959*

254. AMATEUR OBSERVATIONS OF JUPITER
McIntosh, R. A.
*Royal Astronomical Society of New Zealand, Journal of the,* v. 18, pp. 5–8, 1959
(*AJ*, 1959, #8623)

255. OBSERVATIONS OF JUPITER, SATURN, AND VENUS IN 1958
Lenham, A. P.
*British Astronomical Association, Journal of the,* v. 69, pp. 163–167, 1959
(*AJ*, 1959, #8620)

256. SIND VISUELLE BEOBACHTUNGEN DER JUPITEROBERFLÄCHE HEUTE ZWECKLOS? (ARE VISUAL OBSERVATIONS OF THE JUPITER SURFACE PURPOSELESS TODAY?)
Löbering, W.
*Die Sterne*, v. 35, pp. 107–110, 1959

On the basis of numerous observations of changes on Jupiter's surface, it is pointed out that even today visual observations are of value since they are the only means of noting sudden processes which would otherwise be lost to science. (*AJ*, 1959, #8621)

257. PRIME OSSERVAZIONI DEL PIANETA GIOVE DURANTE L'OPPOSIZIONE 1958–1959 (FIRST OBSERVATIONS OF THE PLANET JUPITER DURING THE OPPOSITION 1958–1959)
dall'Olmo, U.
*Coelum*, v. 27, pp. 109–111, 1959
(*AJ*, 1959, #8625)

258. OBSERVATIONS OF JUPITER IN THE YEARS 1953–1958
Hambálek, V., Kaláb, D.
*Říše Hvězd*, v. 40, pp. 71–73, 1959 (in Czechoslovakian)
(*AJ*, 1959, #8618)

259. OBSERVATION OF JUPITER AT THE POPULAR OBSERVATORY PRAGUE IN THE YEAR 1958
Prihoda, P.
*Říše Hvězd*, v. 40, pp. 71–73, 1959 (in Czechoslovakian)
(*AJ*, 1959, #8628)

260. JUPITER—BEOBACHTUNGEN 1959 (1959 JUPITER OBSERVATIONS)
Bartha, L., Vrabez, F.
*Veröffentlichungen der Urania-Sternwarte*, Vienna, no. 2, pp. 39–40, 1959
(*AJ*, 1959, #8603)

261. CENTRAL MERIDIAN TRANSIT OBSERVATIONS ON JUPITER
Budine, P. W.
*Strolling Astronomer*, v. 13, pp. 3–6, 1959
(*AJ*, 1959, #8607)

262. OBSERVAÇOES DE JÚPITER EM 1958 (OBSERVATIONS OF JUPITER IN 1958)
Muniz, Barreto, L., de Freitas Mourão, R. R., Barroso, J., Jr., Cardoso Tavares, O.
*Observatorio Nacional, Publicacões Do Serviço Astronomico,* Rio de Janeiro, no. 5, 1959
(*AJ*, 1959, #8601)

### *Mars — 1959*

263. THE PROBLEM OF THE MARTIAN BLUE HAZE (Presented at the Fourth Meeting of the Lunar and Planetary Exploration Colloquium, January 12, 1959)
Wilson, A. G.
January 12, 1959
Rand Corporation, Santa Monica, Calif.
P-1593

The similarities of the atmospheres of Earth and Mars permit the application of many terrestrial meteorological principles to the study of the Martian atmosphere, the differences reveal phenomena which have not yet been observed in the Earth's atmosphere. However, in addition to these terrestrial-like properties of the atmosphere of Mars, a very interesting phenomenon has been observed which seems to have no rec-

ognizable counterpart in the Earth's atmosphere. This is the phenomenon of the blue or violet haze and its occasional disappearance. Whether the Earth may have a similar daytime haze is rather improbable, but nonetheless is a question which should be investigated.

**264. AN EXAMPLE OF THE BLUE CLEARING OBSERVED 74 DAYS BEFORE OPPOSITION**
Richardson, R. S., Roques, P. E.
*Astronomical Society of the Pacific, Publications of the,* v. 71, no. 421, pp. 321–323, August 1959

Images of Mars taken in violet light on September 3, 1958, showed that a "blue clearing" (abnormal transparency of Martian atmosphere in blue light) had definitely occurred. This "blue clearing" observed 74 days from opposition indicates that alignment of Sun, Earth, and Mars is not a critical factor, as was formerly believed, in the production of the effect. (*AJ*, 1959, #8449)

**265. OBSERVATIONS OF MARS IN 1958**
de Vaucouleurs, G. H. (Harvard College Observatory, Cambridge, Mass.)
September 15, 1959
Air Force Cambridge Research Center, Bedford, Mass.
AFCRC-TN-59-476
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Visual and photoelectric observations of Mars in October and November 1958, which were made at the Lowell Observatory, Flagstaff, Arizona are reported. Monochromatic magnitudes and albedos are given of λ 3300, 3600, 4550, 5550, 6900 Å. Thirty-two drawings illustrate the main visual surface features and cloud phenomena. Several surface changes and an outstanding moving cloud system are discussed. (*AI/A*, 1959, #1720)

**266. SELECTED TRANSLATIONS ON SOVIET SPACE RESEARCH**
October 26, 1959
U.S. Department of Commerce, Office of Technical Services, Washington, D.C.
OTS: 59-13,963
(Also available as JPRS-1965-N, U.S. Joint Publications Research Service, New York, N. Y.)

This paper presents translations of the following: "Basic Results of Observations of Mars in 1956 at the Kharkov Astronomical Observatory," by N. P. Barabashov, and I. K. Koval; "The Latest on the Study of Mars," by N. P. Barabashov; "Auto-Ionization Effect and Its Influence on the Intensity of Certain Lines in Stellar Spectra," by A. A. Nikitin; and "Some Results of Preliminary Observations of Resonance Scattering by Meteor Trails," by Ye. K. Nemirova. (*AI/A*, 1960, #2574) (See Entry #269)

**267. NEW INFORMATION ON THE INVESTIGATION OF MARS**
Barabashov, N. P.
*Priroda*, v. 48, no. 6, pp. 13–18, 1959 (in Russian)

This comprehensive report is primarily concerned with the results of Soviet observations made during the 1956 opposition. (*AJ*, 1959, #8406)

**268. THE COLOR INDEX OF MARS DURING THE OPPOSITION OF 1958**
Teifel, V. G.
*Astronomicheskii Tsirkuliar*, no. 202, p. 1, 1959 (in Russian)

The author obtains values between $1^m.50$ and $1^m.66$. (*AJ*, 1959, #8456)

**269. THE PRINCIPAL RESULTS OF THE MARS OBSERVATIONS MADE IN 1956 AT THE ASTRONOMICAL OBSERVATORY, KHARKOV**
Barabashov, N. P., Koval, I. K.
*Akademiia Nauk URSR, Kiev, Visnyk*, no. 1, pp. 15–23, 1959 (in Ukrainian)
(Abstracted in *Referativnyi Zhurnal, Astronomiia i Geodeziia*, no. 11, p. 71, 1959)
(*AJ*, 1959, #8404)

**270. MARS IN THE YEAR 1956**
Kutyreva, A. P.
*Akademiia Nauk Kazakhskoi SSR, Trudy, Sektor Astrobotaniki*, v. 7, pp. 8–46, 1959 (in Russian)
(Abstracted in *Referativnyi Zhurnal, Astronomiia i Geodeziia*, no. 9, p. 70, 1960)
(*AJ*, 1959, #8439)

**271. THE BRIGHTNESS DISTRIBUTION IN THE MARS "MARIA"**
Barabashov, N. P., Koval, I. K.
*Akademiia Nauk URSR, Kiev, Trudy*, no. 2 pp. 153–155, 1959 (in Ukrainian with Russian and English references)
(Abstracted in *Referativnyi Zhurnal, Astronomiia i Geodeziia*, no. 1, pp. 65–66, 1960)
(*AJ*, 1959, #8407)

**272. TENTATIVE RESULTS OF VISUAL OBSERVATIONS OF MARS MADE IN 1956**
Perevertun, M. P.
*Akademiia Nauk Kazakhskoi SSR, Trudy, Sektor Astrobotaniki*, v. 7, pp. 47–53, 1959 (in Russian)
(Abstracted in *Referativnyi Zhurnal, Astronomiia i Geodeziia*, no. 8, p. 78, 1960)
(*AJ*, 1959, #8447)

**273. MARS OBSERVATIONS AT THE PIC DU MIDI**
Camichel, H.
*Sky and Telescope*, v. 18, pp. 600–604, 1959
(*AJ*, 1959, #8414)

274. THE AMATEUR MARS OBSERVER AND SOME NOTES ON THE 1958–1959 APPARITION
Cave, T. R.
*Strolling Astronomer*, v. 13, pp. 128–134, 1959
*(AJ*, 1959, #8416)

275. ON THE MARTIAN YELLOW CLOUD IN 1956
Burrell, B.
*Observatory*, v. 79, pp. 107–109, 1959
*(AJ*, 1959, #8412)

276. LA PLANÈTE MARS (THE PLANET MARS)
Camichel, H.
*l'Astronomie*, v. 73, pp. 297–300, 363–367, 1959
*(AJ*, 1959, #8413)

277. A ROCKET BORNE VIDEO TELESCOPE FOR OBSERVING MARS
Kobey, D. H.
*Astronautica Acta*, v. 5, no. 6, pp. 313–327, 1959 (in French)

The problem of returning photographs of the Martian surface from space vehicles is considered. An unsophisticated cassegrainian telescope in conjunction with a modified image orthicon pickup tube is suggested. Video bandwidth and system resolution are discussed. (*AI/S*, 1959, #21,488)

278. LA OPOSICIÓN DE MARTE DE 1958 (THE OPPOSITION OF MARS OF 1958)
Bréan, C.
*El Universo*, v. 13, pp. 71–74, 1959
*(AJ*, 1959, #8410)

279. MARSBEOBACHTUNGEN AUF DER URANIA-STERNWARTE WIEN 1958/59 (MARS OBSERVATIONS MADE AT THE URANIA OBSERVATORY, VIENNA, 1958–1959)
Wähnl, M.
*Veröffentlichungen der Urania-Sternwarte*, Vienna, no. 2, pp. 42–43, 1959
*(AJ*, 1959, #8461)

280. OBSERVATIONS OF MARS DURING 1954 OPPOSITION
Narayana, J. V.
*Kodaikanal Observatory Bulletin*, India, no. 154, pp. 2–8, 1959

A description of drawings at the 6-in. refractor is presented. (*AJ*, 1959, #8443)

281. RELATIVE INTENSITY DISTRIBUTION OF MARS IN RED LIGHT DURING THE 1954 OPPOSITION
Bandyopadhyay, K. K.
*Kodaikanal Observatory Bulletin*, India, no. 154, pp. 9–25, 1959

Eleven selected photographs were registered microphotographically. The resulting isophote sketches are presented. (*AJ*, 1959, #8403)

282. OBSERVATIONS OF MARS AT KODAIKANAL DURING THE 1956 OPPOSITION
Narayana, J. V., Viswanathan, N.
*Kodaikanal Observatory Bulletin*, India, no. 154, pp. 26–28, 1959

Six photographic observations for the period September 5 to September 19, 1956 are described. (*AJ*, 1959, #8444)

283. NEDERLANDSE WAARNEMINGEN VAN MARS IN 1958 (DUTCH OBSERVATIONS OF MARS MADE IN 1958)
Jansen, A. G.
*De Meteoor, Sterrenwacht Utrecht*, v. 15, pp. 34–39, 1959
*(AJ*, 1959, #8431)

284. MARSWAARNEMINGEN OP DE PIC DU MIDI (MARS OBSERVATIONS ON THE PIC DU MIDI)
de Jager, C.
*De Meteoor, Sterrenwacht Utrecht*, v. 15, pp. 46–47, 1959
*(AJ*, 1959, #8430)

285. OBSERVATIONS DE MARS, 1943–1959 (OBSERVATIONS OF MARS, 1943–1959)
Antonini, E.
*Archives des Sciences*, Geneva, v. 12, pp. 31–50, 1959

The observations made at various observatories and with different instruments pertain to seasonal and nonperiodic variations, color tones, canals, and atmosphere (clouds, atmospheric pressure, temperature) surface, and perspectives of visual observations. (*AJ*, 1959, #8402)

286. SOME OBSERVATIONS OF MARS—1958
Brickett, I. R. H.
*Astronomical Society of Southern Africa, Monthly Notes of the*, v. 18, pp. 39–45, 1959

Information is given on the appearance and condition of numerous Mars formations in the 9-in. refractor of the Union Observatory. (*AJ*, 1959, #8411)

287. NUOVE CARTE DEL PIANETA MARTE SULLA BASE DELLE FOTOGRAFIE DEL PIC DU MIDI (NEW MAP OF THE PLANET MARS ON THE BASIS OF PHOTOGRAPHS OF THE PIC DU MIDI)
de Mottoni, G.
In "Società Astronomica Italiana, Atti dei Convegni Astronomici di Venezia e Napoli, September 1955–September 1957," pp. 123–128
Industria Grafica Mario Ponzio, Pavia, 1959
*(AJ*, 1959, #8442)

288. VISUELLE BEOBACHTUNGEN DES MARS 1954 UND 1956 (VISUAL OBSERVATIONS OF MARS MADE IN 1954 AND 1956)
Heintz, W. D.
*Astronomische Nachrichten*, v. 285, pp. 3–8, 1959
(Also available in *Veröffentlichungen der Urania-Sternwarte*, Munich, v. 5, no. 5, 1959)

Observations of two perihelion oppositions of Mars (1956, with filters) are combined in one map, and changes in the southern polar environment, clouds, veils, and polar caps occurring during the observation period are mentioned individually. The Martian canals are realistic on a large scale; however, the canals should not necessarily be considered as very small-scale, sharp images. (*AJ*, 1959, #8428)

289. RESULTS OF MARS OBSERVATIONS DURING THE PERIHELION OPPOSITION OF 1956, IN THE USSR
Akademiia Nauk, USSR, Moscow, 1959
(*AJ*, 1959, #8466)

290. OSSERVAZIONI DE MARTE NELL' OPPOSIZIONE 1958 (OBSERVATIONS OF MARS MADE DURING THE 1958 OPPOSITION)
Ruggieri, G.
*Atti della Accademia Gioenia di Scienze Naturali in Catania*, (6), v. 12, pp. 131–166, 1959
(Also available in *Osservatorio Astrofisico Pubblicazioni, (N.S.)*, Catania, no. 23, 1959)

The results are presented of visual observations of Mars made at the Catania Observatory with the 30-cm-aperture Merz refractor and, in part, the 25-cm Macron reflector, during the 1958 opposition. Dimensions and position of the southern and northern polar caps were measured, and a series of estimates of brightness levels of various regions of the planet were made using the de Vaucouleurs method. Areographic details with respect to form and color, as well as regular and irregular changes, are examined critically. Some data on the atmospheric formations are reported. (*AJ*, 1959, #8450)

291. MARTE (MARS)
López L., E.
*El Universo*, v. 13, pp. 43–45, 1959
(*AJ*, 1959, #8440)

292. MARS 1958/59
Carnuth, W.
*Mitteilungen für Planetenbeobachter*, v. 12, pp. 55–59, 1959
(*AJ*, 1959, #8415)

293. THE DEGREE OF ELEVATION OF THE CONTINENTS AND SEAS OF MARS
Koval, I. K.
*Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia*, no. 1, pp. 85–92, 1959 (in Russian)
(Translation available as AID 62-143, AD-285,342, Library of Congress, Aerospace Information Division, Washington, D.C., September 19, 1962, Supplement to AID 61-138, AD-266,481; and through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Changes in contrast between the continents and seas were examined in pictures of Mars, from the center to the edges of the photographs, which were taken with infrared and red filters. In addition, the positions of the brightness maxima for continents and seas were determined at various phase angles at the equator. The contrasts diminish toward the edges, and the positions of the brightness maxima do not coincide. An earlier conclusion drawn by the author, that the reflection law is not the same for the middle continents and seas, is confirmed. (*AJ*, 1959, #8436)

### *Mercury — 1959*

294. DIE WELT DES MERKUR (THE WORLD OF MERCURY)
Sandner, W.
Lux, Sebastian, Verlagsbuchhandlung, Innsbruck, Austria, 1959
(*AJ*, 1959, #8204)

295. OBSERVATIONS OF VENUS AND MERCURY WITH LARGE APERTURES
Cruikshank, D. P.
*Strolling Astronomer*, v. 13, pp. 108–115, 1959
(*AJ*, 1959, #8209)

296. VISUAL OBSERVATIONS OF MERCURY AND VENUS IN 1957 AND 1958
de Freitas Mourão, R. R.
*Royal Astronomical Society of New Zealand, Journal of the*, v. 18, pp. 17–20, 1959
(*AJ*, 1959, #8217)

### *Moon — 1959*

297. STUDIES IN LUNAR TOPOGRAPHY, I. DETERMINATION OF THE HEIGHTS OF MOUNTAINS ON THE MOON
Kopal, Z., Fielder, G.
March 1959
Air Research and Development Command, European Office, Brussels, Belgium
Technical Scientific Note 1, AFCRC-TN-59-411
AD-232,260

A brief introduction summarizes the previous work on the determination of the heights of lunar mountains. This paper contains an exhaustive discussion of the geometrical aspects of the problem of determination of the altitudes of lunar elevations by triangulation of the shadows cast on the surrounding landscape during sunrise or sunset, and formulae are deduced

relating explicitly the desired heights with the observed shadows to the requisite degree of accuracy.

The procedure followed in securing the cinematographic data essential for this purpose at the Observatoire du Pic du Midi, and the subsequent microphotometric measurements at Manchester, are described. (*AI/A*, 1960, #2852)

298. THE PHYSICAL NATURE OF THE SURFACE OF THE MOON
Fielder, G.
*British Interplanetary Society, Journal of the*, v. 17, no. 2, pp. 57–58, March–April 1959

Evidence concerning the structure of the lunar rock is reviewed. It is probable that the surface is vesicular in nature. (*AJ*, 1959, #8386)

299. NATURAL ENVIRONMENT OF THE MOON
Bobrovnikoff, N. T.
June 1959
Wright Air Development Division, Wright-Patterson AFB, Ohio
WADC Phase Technical Note 3
AD-242,177

The near lunar environment is discussed, with special reference to the nature of the lunar surface. The surface features are classified and described, and their possible modes of origin discussed. An extensive bibliography is included. (*AI/A*, 1961, #3184)

300. STUDIES IN LUNAR TOPOGRAPHY, II. TECHNIQUES OF PHOTOGRAPHIC DETERMINATION OF LUNAR MOUNTAINS, WITH APPLICATION TO THE REGION OF THEOPHILUS
Clarke, D.
June 1959
Manchester University, Department of Astronomy, Great Britain
Technical Scientific Note 2, AFCRC-TN-59-611, AF 61(052)-168

The paper discusses the techniques of measuring shadow lengths on the Moon from photographs, and lists the results that have been obtained for the region of Theophilus. (*AI/A*, 1960, #2384)

301. STUDIES IN LUNAR TOPOGRAPHY, III. ERRORS INVOLVED IN THE PHOTOGRAPHIC DETERMINATION OF HEIGHTS AND A PRELIMINARY STUDY OF THE REGION OF PTOLEMAEUS AND ALPHONSUS
Turner, G.
June 1959
Manchester University, Department of Astronomy, Great Britain
Technical Scientific Note 3, AFCRC-TN-59-612, AF 61(052)-168

A brief recapitulation of the cine-photographic method used in the measurement of relative lunar altitudes is given, and the errors arising from photographic and seeing effects together with the measuring technique are discussed. The limitations imposed by our present inadequate knowledge of basic selenographic coordinates are described, and the need for further positional measures is stressed. Heights are given for the eastern ramparts of the crater Ptolemaeus and the eastern ramparts and central mountain of the crater Alphonsus. (*AI/A*, 1960, #2385)

302. LUNAR AND PLANETARY PHOTOGRAPHY WITH A 12½-INCH REFLECTION
Eastman, F. J., Jr.
*Sky and Telescope*, v. 18, no. 9, pp. 510–511, July 1959
(*AI/S*, 1959, #11,631)

303. AN EXPERIMENT ON PENUMBRAL LUNAR ECLIPSES
Fujinami, S., Yamasaki, Y.
*Sky and Telescope*, v. 18, no. 11, pp. 620–621, September 1959

Color photography can be used in a simple experiment to determine the threshold magnitude of the penumbra during a penumbral lunar eclipse. A description of the experiment made from color photographs of the eclipse of November 29–30, 1955 is given, and results are tabulated and analyzed. (*AJ*, 1959, #8353)

304. MOON PICTURES SHOW "MONOTONOUS" OTHER SIDE
*Science*, v. 130, no. 3384, pp. 1241–1242, November 6, 1959
(*AJ*, 1959, #83,132)

305. STUDIES IN LUNAR TOPOGRAPHY, V. A SYSTEMATIC MICRODENSITOMETRIC TECHNIQUE AND ITS APPLICATION TO FORMATIONS IN THE MARE IMBRIUM
Rackham, T.
November 1959
Manchester University, Department of Astronomy, Great Britain
Technical Scientific Note 5, AFCRC-TN-60-269, AF 61(052)-168

The first part of this paper discusses a special application of microdensitometric techniques as used in the systematic measurement of lunar shadows obtained on 35-mm cine film at the Pic du Midi Observatory.

The second section contains the resultant tabulated relative heights and relevant data for Aristillus, Autolycus, Piton, Archimedes C, and Archimedes $\epsilon$. Scale diagrams of the first four objects are also included. (*AI/A*, 1960, #2387)

306. STUDIES IN LUNAR TOPOGRAPHY, VI. MEASURED HEIGHTS OF MOUNTAINS IN THE SOUTHEASTERN PART OF MARE TRANQUILITATIS
Turner, G.
November 1959
Manchester University, Department of Astronomy, Great Britain
Technical Scientific Note 6, AFCRC-TN-60-270, AF 61(052)-168

Measured heights for craters in the southeastern part of Mare Tranquilitatis are given for the western inner walls and eastern outer walls. The new values are compared with earlier determinations made by other techniques. Panoramic profiles of the apparent skyline have been made for two points in the region which illustrate the short range of visibility of features due to the Moon's curvatures. The photometric determination of the gradient of gentle slopes is discussed, and some results are given. (*AI/A*, 1960, #2386)

307. ESSENTIALS FOR MAPPING THE MOON
Kopal, Z.
*American Scientist*, v. 47, no. 4, pp. 505–508, December 1959
(*AI/S*, 1960, #20,312)

308. OBSERVATION OF LUNAR OCCULTATIONS AND OF ECLIPSES OF THE MOON AND THE SUN (Lunar Eclipse, March 13–14, 1957)
Buchar, E.
*Ceskaslovenska Akademie Ved., Biulletin' Astronomicheskikh Institutov Checkhoslovakii*, v. 10, pp. 198–202, 1959

Brightness and crater contacts are discussed. (*AJ*, 1959, #8356)

309. THE LIGHT RATIOS AT THE TERMINATOR
Kolessov, A. K.
*Leningrad Universitet, Vestnik*, no. 1, pp. 103–110, 1959
(in Russian with English reference)
(Abstracted in *Referativnyi Zhurnal, Astronomiia i Geodeziia*, no. 1, p. 30, 1960)
(*AJ*, 1959, #8113)

310. PROSTA METODA POSLUGIWANIA SIĘ ATLASEM WEIMERA
Mietelski, J.
*Postępy Astronomii*, Kraków, v. 7, pp. 263-265, 1959

A graphic method is presented for determining the lunar profile with the aid of data from the Weimer Atlas (Paris, 1952). (*AJ*, 1959, #8324)

311. VERGRÖBERUNG DES ERDSCHATTENS BEI DER MONDFINSTERNIS 1957 MAI 13 (ENLARGEMENT OF THE EARTH'S SHADOW DURING THE LUNAR ECLIPSE OF MAY 13, 1957)
Bouška, J.
*Die Sterne*, v. 35, pp. 140–142, 1959
(*AJ*, 1959, #8357)

312. THE BRIGHTNESS OF OBJECTS IN THE SHADOW OF LUNAR ELEVATIONS
Livshiz, G. S.
*Gosudarstvennyi Pedagogicheskii Institut, Alma-Ata, Trudy*, v. 12, no. 2, pp. 194–196, 1959 (in Russian)
(Abstracted in *Referativnyi Zhurnal, Astronomiia i Geodeziia*, 5A452, 1961)
(*AJ*, 1960, #83,146)

313. UN ESSAI POUR EXPLIQUER LES MOUVEMENTS DES APSIDES ET DES NOEUDS DE LA LUNE (AN ATTEMPT TO EXPLAIN THE MOTIONS OF THE APSES AND THE NODES OF THE MOON)
Protitch, M. B.
*Belgrade Univerzitet, Observatoire Astronomique, Bulletin*, v. 23, no. 3–4, pp. 9–11, 1959

The perihelion shift of the Moon is derived from the theorem of conservation of areas, and it is shown how this yields the secular motion of the node as a simple corollary. (*AJ*, 1959, #8327)

314. FOTOGRAFIA DEL OTRO LADO DE LA LUNA (PHOTOGRAPHY OF THE OTHER SIDE OF THE MOON)
*Asociación Peruana de Astronomía, Boletín*, Lima, v. 5, pp. 284–285, 1959
(*AJ*, 1959, #83,131)

315. COLOUR CONTRASTS OF LUNAR CRATERS
Barabashov, N. P., Yeserskii, V. I.
*Astronomicheskii Tsirkuliar*, no. 205, pp. 9–10, 1959 (in Russian)

From two red and two blue photographs (6500 and 4150Å) taken in 1953, special arithmetically averaged color excesses and their deviations from the median were determined and tabulated for 18 crater regions with reference to Mare Crisium. All craters are redder than Mare Crisium. No change in color was observed as a function of distance from the center of the crater. Occasionally, the color appears to be distributed in a mosaic-like manner. (*AJ*, 1959, #8370)

316. ÉCLIPSE TOTALE DE LUNE DU 2 AVRIL 1950 (TOTAL ECLIPSE OF THE MOON OF APRIL 2, 1950)
Arend, S., Dommanget, J.
*Bulletin Astronomique de l'Observatoire Royal de Belgique*, v. 5, p. 29, 1959
(*AJ*, 1960, #83,103)

317. ÉCLIPSE TOTALE DE LUNE DES 6–7 OCTOBRE 1949 (TOTAL ECLIPSE OF THE MOON OF OCTOBER 6–7, 1949)
Arend, S., Dommanget, J.
*Bulletin Astronomique de l'Observatoire Royal de Belgique*, v. 5, p. 29, 1959
(*AJ*, 1960, #83,102)

318. ÉCLIPSE TOTALE DE LUNE DES 18–19 JANVIER 1954 (TOTAL ECLIPSE OF THE MOON OF JANUARY 18–19, 1954)
Arend, S., Dommanget, J.
*Bulletin Astronomique de l'Observatoire Royal de Belgique,* v. 5, p. 29, 1959
(*AJ*, 1960, #83,105)

319. ÉCLIPSE TOTALE DE LUNE DES 13–14 MAI 1957 (TOTAL ECLIPSE OF THE MOON OF MAY 13–14, 1957)
Arend, S., Dommanget, J.
*Bulletin Astronomique de l'Observatoire Royal de Belgique,* v. 5, p. 30, 1959
(*AJ*, 1960, #83,106)

320. PHOTOGRAPHS OF THE INVISIBLE LUNAR HEMISPHERE
Klepešta, J., Rükl, A.
*Říše Hvězd,* v. 40, pp. 225–227, 1959 (in Czechoslovakian)
(*AJ*, 1959, #83,124)

321. CRATERS ON THE MOON
*Nature,* v. 183, pp. 864–865, 1959
(*AJ*, 1959, #83,107)

322. THE PROFILES OF LUNAR OBJECTS. A SEMI-GRAPHICAL METHOD OF ANALYSIS
Richards, T. J.
*Royal Astronomical Society of New Zealand, Journal of the,* v. 18, pp. 32–38, 1959
(*AJ*, 1959, #8399)

323. LUNAR TOPOGRAPHY
*Royal Astronomical Society of New Zealand, Journal of the,* v. 18, p. 38, 1959
(*AJ*, 1959, #83,108)

324. A CAMERA FOR THE OBSERVATION OF THE MOON WITH THE NORMAL ASTROGRAPH AT THE MAIN ASTRONOMICAL OBSERVATORY OF THE ACADEMY OF SCIENCES, USSR IN PULKOVO
Potter, H. I., Streletskii, Y. S.
*Astronomicheskii Zhurnal,* v. 36, no. 6, pp. 1047–1052, 1959
(Translated from the Russian in *Soviet Astronomy—AJ,* v. 3, no. 6, pp. 960–964, May–June 1960)

The camera uses the Markowitz method for stopping the Moon's motion by rotating a plane parallel dark filter near the focal plane during the exposure period. The theory of the method is given and used to determine the optimum filter thickness for an exposure in the range ½–2 minutes. The rotation is nonuniform and this is achieved by using an ac driving motor with variable frequency power supply. Practical details of the equipment are given. (*PA*, 1961, #10)

325. THE METHODS OF MAKING USE OF THE MOON FOR GEODETIC PURPOSES
Amelin, V. M.
*Institut Teoreticheskoi Astronomii, Biulletin,* v. 7, pp. 19–42, 1959 (in Russian with English summary)

The methods of making use of results of occultations, eclipses, and special photographic observations of the Moon for geodetic purposes are discussed, and some numerical examples are given. (*AI/S*, 1960, #21,319)

326. AUSWERTUNG VON SCHATTENANTRITTSBEOBACHTUNGEN WÄHREND DER TOTALEN MONDFINSTERNIS 1957 MAI 13/14 (EVALUATION OF OBSERVATIONS OF BEGINNING UMBRA DURING THE TOTAL LUNAR ECLIPSE OF MAY 13–14, 1957)
Winkler, H.
*Mitteilungen der Archenhold-Sternwarte,* Berlin–Treptow, no. 51, pp. 2–4, 1959
(*AJ*, 1959, #8357)

327. FARBAUFNAHMEN DES VERFINSTERTEN MONDES (COLOR PHOTOGRAPHS OF THE ECLIPSED MOON)
(Lunar Eclipse, May 13, 1957)
Neumann, K. H.
*Mitteilungen der Archenhold-Sternwarte,* Berlin–Treptow, no. 51, pp. 11–14, 1959
(*AJ*, 1959, #8357)

328. L'ÉCLIPSE TOTALE DE LUNE DU 13 MAI 1957 OBSERVÉE À HASNON (THE TOTAL ECLIPSE OF THE MOON OF MAY 13, 1957 OBSERVED IN HASNON)
Hémez, B.
*l'Astronomie,* v. 73, p. 42, 1959
(*AJ*, 1959, #8357)

329. A NEW PROCEDURE FOR ESTIMATING THE BRIGHTNESS OF LUNAR ECLIPSES FROM THE VISIBILITY OF DETAILS OF THE LUNAR DISC
Sharonov, V. V.
*Vsesoiuznoe Astronomo-Geodezicheskoe Obshchestvo Biulleten,* no. 24, pp. 18–23, 1959 (in Russian)
(*AJ*, 1959, #8354)

330. LUNAR LATTICE PATTERNS AND THEIR TIME OF ORIGIN
Fielder, G.
*Astronomical Society of the Pacific, Publications of the,* v. 70, pp. 308–310, 1959
(Also available as Astronomical Contribution 56, Manchester University, Great Britain, 1959)
(*AJ*, 1959, #8385)

331. DIE FIGUR DES MONDES. ERLÄUTERUNGEN ZU EINER NEUEN HÖHENSCHICHTENKARTE DES MONDES (THE FIGURE OF THE MOON. EXPLANATION TO A NEW CONTOUR MAP OF THE MOON)
Schrutka-Rechtenstamm, G., Hopmann, J.
*Sitzungsberichte der Österreichischen Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse, Abteilung II*, v. 167, pp. 283–290, 1959
(Also available in *Universitäts-Sternwarte, Mitteilungen*, Vienna, v. 10, no. 3, 1959)

Proposal of a contour map of the Moon, which G. Schrutka had constructed on the basis of the absolute altitude of 150 fixed points, is given. These fixed points had been derived in an extensive earlier work by Schrutka, on the basis of measurements by J. Franz. The 150 heights are separated into two groups, one of which, with 23 points, lies about 3.5 km higher than the other. This results in one guaranteed, if also very weak, correlation between the high and low points on one hand, and between the "Continents" and "Maria" on the other. These lie, in general, 1 to 2 km deeper than those. The points of the small group lie essentially in a locally bordered horst near the center of the face of the Moon. All the remaining 127 points lie, with slight deviation, on a sphere. Exclusive of this horst, the deviation of the figure of the Moon from a sphere cannot be proven. The contour map of the Moon drawn by Ritter and the figure derived from it turned out to be unsuccessful, which will be proven in detail. (*AJ*, 1958, #7340)

332. THE NATURE OF THE MOON
Sytinskaya, N. N.
Fizmatgiz, Moscow, USSR, 1959
(*AJ*, 1959, #8332)

333. MEASUREMENT OF THE PROFILE OF A LUNAR WRINKLE RIDGE
Fielder, G.
*Royal Astronomical Society, Monthly Notices of the*, v. 118, pp. 547–550, 1959
(Also available as Astronomical Contribution 61, Manchester University, Great Britain, 1959)
(*AJ*, 1959, #8384)

334. ZUM ASCHGRAUEN MONDLICHT (THE ASH-GRAY MOONLIGHT)
Langenbeck, U.
*Mitteilungen für Planetenbeobachter*, v. 12, pp. 61–62, 1959
(*AJ*, 1959, #8319)

335. FIRST RESULTS OF INVESTIGATION OF THE OTHER SIDE OF THE LUNAR SURFACE
Barabashov, N. P., Lipskii, Yu. N.
*Astronomicheskii Tsirkuliar*, no. 206, pp. 1–4, 1959
(in Russian)
(*AJ*, 1959, #83,118)

336. FIRST RESULTS DERIVED FROM THE PHOTOGRAPHS OF THE MOON'S BACK SIDE
Barabashov, N. P., Lipskii, Yu. N.
*Akademiia Nauk SSSR, Doklady*, v. 129, pp. 1000–1002, 1959
(in Russian)
(*AJ*, 1959, #83,119)

337. MONDKARTEN (LUNAR MAPS)
Klepešta, J., Lukeš, L.
Rais, A., Translator
Institute of Cartography and Reproduction, Prague, Czechoslovakia, 1959
(*AJ*, 1959, #8318)

338. THE FIRST PHOTOGRAPHS OF THE BACKSIDE OF THE MOON
Akademiia Nauk, USSR, Moscow, 1959 (in Russian)

The following chapters are covered in this book: "Introduction," p. 7; "The Construction of the Cosmic Rocket," p. 9; "The Flight of the Cosmic Rocket," p. 14; "Photography and Picture Transmission," p. 24; "The Invisible Side of the Moon," p. 31. (*AJ*, 1959, #83,117)

339. INVESTIGATION OF THE DEGREE AND ANGLE OF POLARIZATION OF LIGHT IN THREE SPECTRAL REGIONS REFLECTED FROM LUNAR FORMATIONS
Kokhan, Ye. K.
*Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia*, no. 1, pp. 41–53, 1959 (in Russian)

The author reports on the processes used in and the results of polarization observations of the Moon in total light and through blue and yellow filters, made in Pulkovo and Abastumani between 1955 and 1958. Outstanding among the numerous individual results are the following: (1) The degree of polarization ($p$) of all details is greater in the blue than in the yellow region. (2) At phase angles of 0 and $\pm 27.5$ deg, $p = 0$ in all colors and is negative between them. (3) The maria yielded the greatest polarization. (4) The maximum degree of polarization depends on the maximum brightness of the formation(s). (5) The position of the polarization plane is a function of phase angle; at full Moon, a rapid rotation takes place. (*AJ*, 1959, #8391) (See also Entry #1976)

### *Pluto — 1959*

340. THE OBSERVATIONS OF PLUTO IN 1959
Antalová, A., Antal, M.
*Ceskaslovenska Akademie Ved., Biulletin' Astronomicheskikh Institutov Chekhoslovakii*, v. 11, pp. 231–232, 1959
(*AJ*, 1959, #8901)

### *Saturn — 1959*

341. THE DEDUCTION OF THE THEORETICAL PHASE FUNCTION OF THE BRIGHTNESS OF SATURN'S RINGS AND ITS COMPARISON WITH OBSERVATIONS
Bobrov, M. S.
*Astronomicheskii Zhurnal*, v. 36, pp. 129–133, 1959
(in Russian with English reference)

Neglecting refraction, a theoretical investigation is made of the dependence of the surface brightness of a two-dimensional layer of macroscopic spheres on the phase angle of the illumination from a distant, nonpunctiform light source. The observations of Saturn's B-ring are well represented by such a purely geometric shadow effect. (*AJ*, 1959, #8701)

### *Venus — 1959*

342. DIE DICHOTOMIE DER VENUSSCHEIBE (THE DICHOTOMY OF THE PLANET VENUS)
Schoenberg, E., Sandner, W.
*Annales d'Astrophysique*, v. 22, no. 6, pp. 839–844, November–December 1959

The dichotomy of the planet Venus is always observed at a phase angle different from 90 deg—advanced for eastern elongations, retarded for western elongations—the mean difference being five days, corresponding to a phase angle of 86 deg. Since the terminator of the planet does not appear curved as a result of this, the diffusion of light in Venus' atmosphere is assumed to be responsible. (*AI/S*, 1960, #21,124)

343. VENUS OBSERVED
*Flight*, v. 76, no. 2648, p. 706, December 11, 1959
(*AI/S*, 1960, #20,662)

344. STRATOLAB LOOKS AT VENUS
*Electronics*, v. 32, no. 51, p. 41, December 18, 1959
(*AI/S*, 1960, #20,663)

345. THE PLANET VENUS
Moore, P.
Faber and Faber, Limited, London; The Macmillan Company, New York, N.Y., 1959
(*AJ*, 1959, #8215)

346. VENUS: WESTERN ELONGATION 1958
Moore, P.
*British Astronomical Association, Journal of the*, v. 69, pp. 108–111, 1959
(*AJ*, 1959, #8216)

347. SCHATTENWURF BEIM LICHT DER VENUS (CASTINGS OF SHADOWS IN THE LIGHT OF VENUS)
*Monatsschrift für Österreichs Amateurastronomen—Der Sternenbote*, v. 2, pp. 86–87, 1959
(*AJ*, 1959, #8238)

348. VENERE 1959 (VENUS 1959)
*Coelum*, v. 27, pp. 144–145, 1959
(*AJ*, 1959, #8232)

349. VENUS IM FRÜHJAHR 1959 (VENUS IN EARLY 1959)
*Mitteilungen für Planetenbeobachter*, v. 12, pp. 23–24, 1959
(*AJ*, 1959, #8235)

350. VENUS IN OSTLICHER ELONGATION 1959 (VENUS IN EASTERN ELONGATION 1959)
Sandner, W.
*Mitteilungen für Planetenbeobachter*, v. 12, pp. 33–34, 1959
(*AJ*, 1959, #8221)

351. VENUS—BEOBACHTUNGEN IM FRÜHJAHR 1959 (VENUS—OBSERVATIONS IN EARLY 1959)
Spangenberg, W. W.
*Mitteilungen für Planetenbeobachter*, v. 12, pp. 59–61, 1959
(*AJ*, #8227)

352. DICHOTOMIE DER VENUS IM NOVEMBER 1959 (DICHOTOMY OF VENUS IN NOVEMBER 1959)
Sandner, W.
*Mitteilungen für Planetenbeobachter*, v. 12, p. 62, 1959
(*AJ*, 1959, #8222)

### *General — 1960*

353. A TV CAMERA TO CHECK TELESCOPE ORIENTATION IN A SATELLITE
Bailey, N. R.
January 1960
Royal Aircraft Establishment, Farnborough, Great Britain
TM-GW 367
AD-233,646

A TV camera to observe star patterns for checking telescope orientation in a satellite is considered. A camera with a 10 × 10 deg field of view should give reliable detection on seventh magnitude stars and marginal detection on ninth magnitude. Direct transmission of the signal is suggested, recording and retransmission at lower speeds being unnecessary for the satellite range considered. The data rate is one picture every ten seconds. Full details of working parameters are given, together with estimates of size, weight, and power consumption.

354. SATELLITE ASTRONOMICAL TELESCOPES
Roman, N. G.
*SMPTE, Journal of the*, v. 69, no. 1, pp. 35–38, January 1960

The NASA program includes several projects designed to obtain astronomical observations from satellites. Telescopes with apertures up to at least 36 in. appear to be practical for satellite use. Individually designed for particular spectral regions and experimental objectives, the telescopes will be based on photodetectors and electronic imaging devices which will substitute for the camera and the human eye. (*AI/S*, 1960, #20,351)

355. ON THE UTILIZATION OF LONG-FOCUS CAMERAS FOR DETERMINING THE COORDINATES OF FAINT ARTIFICIAL EARTH SATELLITES
Abele, M. K.
*Astronomicheskii Zhurnal*, v. 37, no. 1, pp. 140–145, January–February 1960

The possibility of using long-focus cameras with a small focal ratio for the purpose of photographing artificial Earth satellites is considered. (*AI/S*, 1960, #22,254)

356. AMERICAN STANDARD METHODS OF DESIGNATING AND MEASURING FOCAL LENGTHS AND FOCAL DISTANCES OF PHOTOGRAPHIC LENSES
February 5, 1960
American Standards Association, Inc., New York, N.Y.
PH 3.35-1960 (revision of Z 38.4.21-1948, UDC 771.35)

This Standard covers those lenses intended for use with very distant objects. The focal plane, the principal focus, the equivalent focal length, the calibrated focal length, the front focal distance, the back focal distance, the flange focal distance, and the front vertex, back focal distance are all defined, and methods for their measurement are provided.

357. AXICONS AND THEIR USES
McLeod, J. H.
*Optical Society of America, Journal of the*, v. 50, no. 2, pp. 166–169, February 1960

The most common axicon is a flat cone. A small source of light on the axis of the cone is imaged into a line along a portion of the axis. In lenses the spot diagram has been useful in evaluating image quality. In axicons a corresponding line diagram where lines take the place of dots is useful. In general, axicon instruments correspond to the usual optical instruments. For example, an axicon may be used as an objective to form a telescope. The resulting axicon telescope may be used in aligning machinery such as paper mills. Similarly, an axicon autocollimator may be used to precisely set mirrors perpendicular to a line. One form of axicon microscope has been tried out for the special purpose of locating the position of shiny surfaces without touching them. A most useful form of optical aligner is the reflection cone axicon, used as a straight edge. One example is a 6-in.-D reflecting cone with maximum range of 40 ft and precision of five or six wavelengths over the entire range. Another example is a 5-in.-D cone with a range of 10 ft and precisions of about 1 wavelength. In this case the use of a suitable radius for the reflecting surface had the effect of making the image brightness substantially uniform over the 10-ft range. Photocell pickup has been shown to be successful with very high precisions of setting. This opens the way for automatic machine guiding to very high precisions. (*PA*, 1960, #2232)

358. PLANETARY ASTRONOMY FROM SATELLITE-SUBSTITUTE VEHICLES
Strong, J., de Vaucouleurs, G. H., Zwicky, F.
March 1960
Air Force Missile Development Center, Holloman AFB, N. Mex.
AFMDC-TR-60-6

This volume consists of three chapters. The first chapter, by J. Strong, discusses the use of the balloon to carry a differential fluxmeter through the atmosphere to measure Earth radiation. It also is concerned with the use of a telescope for planet and Moon observation above atmospheric interference and for the observation of the Sun and stars without the effect of an atmospheric filter.

Chapter 2, by G. H. de Vaucouleurs, details the optical and other technical problems of planetary astronomy, including modern photographic methods. It also discusses the overall accuracy required in a great many of the conventional problems of planetary astronomy.

Chapter 3, by F. Zwicky, invites attention to the value of observation in the infrared spectral range from a location where nearly all of the atmospheric water vapor is below the observer. This chapter also points out the advantage of extremely high-altitude observation of natural and artificial meteors. Instruments in the balloon could also be used to study stellar scintillation and corpuscular or cosmic-ray phenomena as a function of altitude. (*AI/A*, 1960, #2490)

359. ASTRONOMICAL OBSERVATION BY MEANS OF HIGHLY SENSITIVE ELECTRONIC LIGHT INTENSIFICATION
Gebel, R. K. H., Devol, L., Wylie, L. R.
March 1960
Wright Air Development Division, Aeronautical Research Laboratory, Wright-Patterson AFB, Ohio (in cooperation with Wittenberg University, Springfield, Ohio)
WADC-TN-59-404, Report on Research on the Quantum Nature of Light
AD-236,046

The advantages of observing and photographing celestial bodies with a light amplifier that employs the closed circuit television principle are explored. Special pickup tubes were developed to insure optimum performance. The electrical signals from the pickup tube are electronically amplified and modified. The image is reproduced by a cathode ray tube and photographs may be obtained from the screen of this tube. The electronic amplification of the electrical signal permits light intensification of $10^9$ times. The modification of the signal makes almost complete suppression of the background possible. It permits astronomical observations during the day and also at night that are not possible with systems in which the background cannot be suppressed. Photographs of celestial bodies taken at the Weaver Observatory of Wittenberg University are included.

360. BIG FUSED SILICA MIRROR MADE FOR BALLOON FLIGHT
*Missiles and Rockets*, v. 6, no. 13, p. 30, April 4, 1960

The largest fused silica mirror in existence has been fabricated by the Corning Glass Works for Project *Stratoscope* 2. Project *Stratoscope* 2 will photograph solar and celestial bodies above the turbulence of the Earth's atmosphere through a 36-in. telescope. (*AI/S*, 1960, #21,550)

361. TELEVISION CAMERAS FOR SPACE EXPLORATION
Mesner, M. H., Staniszewski, J. R.
*Astronautics*, v. 5, no. 5, pp. 36–37, 126–130, May 1960

Miniature television cameras will take a major role in satellite and space probe reconnaissance, Moon exploration, biological monitoring, and other space technologies. (*AI/S*, 1960, #21,847)

362. THE USE OF A VERY WIDE ANGLE CAMERA FOR CATALOGUE WORK
Brouwer, D.
*Astronomical Journal*, v. 65, no. 4, pp. 228–229, May 1960

It is proposed to experiment with the use of cameras covering fields of 15 × 15 deg or 20 × 20 deg on 17 × 17 in. plates for the measurement of the reference stars observed with meridian circles. The object would be to smooth out the errors in the reference system, reduce the number of meridian circle observations, or make it possible to concentrate the meridian circle observations on fewer stars. The flatness requirements will be more severe than for plates covering smaller fields. Also, the reduction may present new problems. (*PA*, 1960, #12,245)

363. THE APPLICATION OF MIRROR-LENS OBJECTIVES FOR PHOTOGRAPHING ARTIFICIAL EARTH SATELLITES
Yakovlev, N. V.
*Astronomicheskii Zhurnal*, v. 37, no. 3, pp. 550–554, May–June 1960
(Translated from the Russian in *Soviet Astronomy*—AJ, v. 4, no. 3, pp. 523–527, November–December 1960)

Brief dimensional data and main optical characteristics of a high-speed mirror-lens objective are given. The objective makes possible the photographing of artificial Earth satellites of the sixth magnitude on film with a sensitivity of about 500 $lux^{-1}$ $sec^{-1}$. (*AI/S*, 1961, #30,350)

364. TELEVISION SYSTEM FOR STRATOSCOPE I
Flory, L. E., Gray, G. W., Morgan, J. M., Pike, W. S.
*Electronics*, v. 33, no. 25, pp. 49–53, June 17, 1960

The stratoscope is a balloon-borne telescope for high-altitude solar photography, and the television transmitter installed in it is used to monitor the telescope so that the latter can be controlled remotely by ground signals. A vidicon camera is employed and as the rate of film exposure is 1/sec, the television frame scanning rate is the same. The line-scanning rate, however, is 500/sec without interlace. Under these conditions a 200-kc bandwidth is adequate. Frequency modulation is employed and the 225.7-Mc transmitter gives an output of 10 w. A four-element aerial of the turnstile type is provided. The airborne and ground equipment, which is almost entirely transistorized, is described in detail. (*EEA*, 1960, #8348)

365. ON THE OBSERVATION OF UNRESOLVED SURFACE FEATURES OF A PLANET
Isaacs, J. D., Tyler, J. E.
*Astronomical Society of the Pacific, Publications of the*, v. 72, pp. 159–166, June 1960

Models of planetary surfaces, incorporating three basic types of idealized terrestrial relief features, are used in an attempt to obtain from carefully planned observing programs reliable quantitative data for those major planets and asteroids that have recognizable surface features. Some specific problems related to the observation of the planet Mars are discussed in the light of these idealized results. (*PA*, 1961, #1631)

366. THE STROTOSCOPE I TELEVISION SYSTEM
Flory, L. E., Gray, G. W., Morgan, J. M., Pike, W. S.
*RCA Review*, v. 21, no. 2, pp. 151–169, June 1960

*Stratoscope 1* is a balloon-borne astronomical telescope designed for solar photography. When aloft, the telescope is remotely operated by radio command signals transmitted from a control station on the ground. A special television system was developed to assist in aiming and focusing *Stratoscope 1*. This equipment is comprised of a camera and transmitter on the telescope and a ground receiver driving several monitors. It permits the astronomers at the ground control station to aim and focus the telescope visually by inspection of the television monitors. The use of this technique significantly increases the yield of useful photographs obtained. (*EEA*, 1960, #6476)

367. X-RAY PHOTOGRAPHS OF SUN
Blake, R. L., Unizker, A. E., Friedman, H.
June 1960
Office of Naval Research, Naval Research Laboratory, Washington, D.C.
Monthly NRL Progress Report, pp. 14–15
(Also available as OTS: PB-161,282, U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Photographs of the Sun in soft X-ray emission, less than 60 Å, were taken by a pinhole camera flown on April 19, 1960 in an *Aerobee-Hi* rocket which reached a peak altitude of 130 miles. A photograph shows coronal brightness and intense sources which appear to originate in the photosphere of the Sun, but are in reality in the corona directly over the disk of the Sun. A schematic diagram of the camera is given. (*EI*, 1960)

368. RCA PROPOSES MANEUVERING SATELLITE-CHASING CAMERA
*Missiles and Rockets*, v. 7, no. 1, p. 38, July 4, 1960
(*AI/S*, 1960, #22,296)

369. THE ELECTRONIC CAMERA, ITS INSTALLATION, AND RESULTS OBTAINED WITH THE 120-INCH REFLECTOR OF THE LICK OBSERVATORY
Lallemand, A., Duchesne, M., Walker, M. F.
*Astronomical Society of the Pacific, Publications of the*, v. 72, pp. 268–287, August 1960

Tests of the Lallemand electronic camera made during September–October 1959 at the focus of the Lick Observatory 36-in. refractor, and the 120-in. coudé spectrograph are reported. A detailed description is given of main and ancillary equipment used for the tests, together with an account of the principal results obtained. For direct photography at the 36-in. telescope, the limiting stellar magnitude obtained with a 45-min. exposure was $18^m.0$, using a narrow-cut Schott OG 1 filter. Loss of contrast caused by enhanced sky background was negligible for exposures up to 72 min. The spectrographic tests with the 120-in. instrument showed that the electronic camera can secure adequate records of spectra so faint that conventional methods would fail to yield a satisfactory result. The present equipment may be used, without further modification, for spectrographic observations of stars down to $14^m.0$ (pg). (*PA*, 1961, #2591)

370. OUTER SPACE PHOTOGRAPHY FROM YOUR BACK YARD
Paul, H.
*Modern Photography*, v. 24, pp. 58–63, September 1960
(*AS&T*, 1960)

371. OPTICAL SYSTEMS WITH HIGH RESOLVING POWER
Kartashev, A. I.
*Optika i Spektroskopiya*, v. 9, no. 3, pp. 394–398, September 1960
(Translated from the Russian in *Optics and Spectroscopy*, v. 9, no. 3, pp. 204–206, September 1960)

Two new imaging systems, a dispersion type (similar to television systems) and an interference type, are described. An object is placed between two spectrographs or two interference wedges, and the resultant resolving power is much higher (10–20 times) than that obtainable with the usual optical systems. (*PA*, 1961, #2847)

372. A MINIATURE PHOTOGRAPHIC CAMERA FOR SPACE PROBE INSTRUMENTATION
Stuart, J. L.
October 28, 1960
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TR 34-137

A camera has been developed for possible use in future space experiments. It is a 3-lb pressurized container capable of photographing an object and of processing, scanning, and telemetering the image in the form of a telemetry code. Information is recorded on Tri-X which is processed in a monobath solution. After a short period the film is scanned by an optical densitometer. The information from the densitometer is contained in 200 scan lines, each of which has 1000 elements. Each element is capable of storing up to 10 gray levels. Total power consumption of the camera is 100 Mw. Two ground receivers and techniques used in recovering the telemetered signal are described. (*AI/A*, 1960, #3010)

373. A COMPARISON OF THE PHOTOGRAPHIC DETECTIVITIES ATTAINABLE WITH AND WITHOUT ELECTRONIC LIGHT INTENSIFICATION
Gebel, R. K. H., Devol, L.
October 1960
Wright Air Development Division, Aeronautical Research Laboratory, Wright-Patterson AFB, Ohio
ARL TR 60-315, Report on Research on the Quantum Nature of Light
AD-249,415

A comparative mathematical analysis is made regarding the limits of performance of the closed circuit television-type optical amplifying system and of conventional methods. These systems are used to obtain and observe photographs of faint celestial bodies having a magnitude comparable to that of the sky background. Primary attention is given to the cases in which detection is accomplished by visual observation of a photograph, but the potentialities of electronic counting of the developed grains in a photographic emulsion are also considered. When using either conventional photography or photography aided by an image converter, the contrast between the celestial body and background, necessary for visual discrimination, is determined by the photographic emulsion or the limitations of the human eye, and an optimum exposure time exists. With the closed circuit television system the instrumental and sky backgrounds can be suppressed electronically. The brightness of the image of the celestial body then increases as the exposure time, but the brightness of the remaining background fluctuations, being statistical in nature, increases only as the square root of the time. Thus, as long as the device is capable of effective storage and integration of the electronic charge image, the contrast increases as the square root of the exposure time, and the ability to detect increases also.

374. COMBINED SCHMIDT TELESCOPES
Vandekerkhove, E.
*Observatory*, v. 80, pp. 200–202, October 1960

A Schmidt camera which is convertible to a Cassegrain telescope, based on a 120-cm-D $f/1.75$ primary mirror, is described. The Schmidt aperture ratio is $f/2.5$ and the Cassegrain is $f/5.5$, converting to $f/10$ with a Barlow lens. (*PA*, 1960, #2587)

375. TELEVISION TECHNIQUE IN ASTRONOMY (TELEVISIONNAYA TEKHANIKA ASTRONIMII)
Koprovich, N. F.
November 1, 1960
Joint Publications Research Service, Washington, D.C.
JPRS-5990, CSO: 5160-W
(Also available as OTS: 60-41,727, U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The possibility of using television apparatus for astronomic observations is considered. This brochure is intended for radio amateurs interested in problems concerning different applications of radio-electronics.

376. LIGHT AMPLIFICATION AND ITS USEFULNESS IN ASTRONOMICAL OBSERVATIONS
Gebel, R. K. H.
November 1960
Wright Air Development Division, Aeronautical Research Laboratory, Wright-Patterson AFB, Ohio
WADC-TN-59-290, Report on Research on the Quantum Nature of Light
AD-249,692

Some limitations in detecting extragalactic nebulas when using conventional photographic emulsions are investigated. The applicability of the present state of the art in light amplification, using the closed circuit television system, for detecting such nebulas is analyzed. The possible use of the latter system for Mars observations is discussed.

377. SPACE RECONNAISSANCE
Sandefur, K. L.
*Aero/Space Engineering*, v. 19, no. 11, pp. 28–31, November 1960

The capabilities and limitations of image-forming sensors (photography, infrared, television, "passive radar," and radar) which can be used in reconnaissance are presented. Briefly discussed are nonimage-forming reconnaissance devices. It is concluded that photography is the most practical available technique for space reconnaissance. Areas of special concern in photography, i.e., shape and contrast of target, ground resolution, scale, aperture and equipment size, and parameter curve, are outlined.

378. AN INTERIM TELEVISION ACQUISITION AND AUTOMATIC TRACKING CONFIGURATION TELESCOPE
Manning, W. H., Jr., Poulsen, A. S.
November 1960
Air Force Missile Test Center, Patrick AFB, Florida
AFMTC TR 60-25
AD-289,195

379. A CELESTIAL MOVING TARGET INDICATOR
(Presented at the AAS Sixth National Annual Meeting, New York, N.Y., January 18–21, 1960)
Dubner, H. (ACF Industries, Avion Division, Paramus, N.J.)
1960
American Astronautical Society, Inc., New York, N.Y.
Paper 60-19

A celestial moving target indicator technique is described which supplies an electrical processing analog to the photo-processing technique where short observation intervals are required. (*AI/A*, 1960, #2454)

380. SPACE-BORNE SPACE SURVEILLANCE
Rosenfeld, A.
In "Transactions of the Fifth National Symposium on Space Electronics and Telemetry, Washington, D.C., September 19–21, 1960," Paper 5.5
Institute of Radio Engineers, Inc., New York N.Y., 1960

A method of optical space surveillance in which objects detected against star field background can be automatically located and tracked is described. A space-borne television camera continually scans the sky and looks for objects of interest.

381. PHOTOGRAPHY AS A MEANS FOR THE OBSERVATION OF ARTIFICIAL EARTH SATELLITES
Guntzel-Lingner, U.
*Die Fotografie*, v. 14, no. 7, pp. 259–260, 279–281, 1960
(Translation available as OTS: 61-20,057, U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

382. RECONNAISSANCE—RADIO, RADIATION, INFRARED, AND OPTICAL
Pulling, B. S.
*1960 IRE International Convention Record*, pt. 5, v. 8, pp. 270–272, 1960

Practical space communications are considered and the requirements illustrated briefly.

383. INFORMATIONAL CONSIDERATIONS IN THE DESIGN OF ASTRONOMICAL SPECTROGRAPHS
Linfoot, E. H.
*Royal Astronomical Society, Monthly Notices of the*, v. 121, no. 1, pp. 115–122, 1960

The problem of designing spectrographs so as to maximize their information rate on random low-contrast spectral distributions is considered. It is shown how spectrographs can be discussed within the general framework of Fourier optics. The effects of optical aberrations, of photographic spread and granularity, and of variation of slit width are briefly considered, and the implications of the band-limitedness of optical images in the problem of allowing for instrumental bandwidth are pointed out. An approximate expression for the information rate is obtained in the special case of an aberration-free spectrograph. (*PA*, 1960, #18,585)

384. THE ACTUAL POSSIBILITIES OF ELECTRONIC PHOTOGRAPHY (Presented at the Galactic and Extragalactic Research and Electronic Photography Conference—Colloques Internationaux du Centre National de la Recherche Scientifique No. 95, Paris, France, June 30–July 3, 1959)
Lallemand, A., Duchesne, M., Wlerick, G., Augard, R., Dupre, M. F.
*Annales d'Astrophysique*, v. 23, no. 3, pp. 320–330, 1960
(in French)

Results achieved by the electronic camera as an astronomical instrument indicate a gain in sensitivity of 1000 to 10,000 in comparison with ordinary photography, if the plate is reduced by counting the trails of the photoelectrons. Microphotometric measurements give further gains of 50 to 100. Contrast and definition of the images are also definitely improved. (*PA*, 1960, #18,591)

385. SOME RESEARCH INTO THE GRADUAL DEVELOPMENT OF ELECTRONIC PHOTOGRAPHY
(Presented at the Galactic and Extragalactic Research and Electronic Photography Conference—Colloques Internationaux du Centre National de la Recherche Scientifique No. 95, Paris, France, June 30–July 3, 1959)
Lehrenbach, C.
*Annales d'Astrophysique*, v. 23, no. 3, pp. 335–343, 1960
(in French)

The possibilities of the sensitivity and contrast of the electronic camera, especially when it is associated with various spectrographs, is considered. The proposed use for the camera is in the study of Type II stellar populations, interstellar calcium lines, line profiles, and the rotation and expansion of galaxies. (*PA*, 1960, #18,592)

386. PLANETARY SPECTRA FROM BALLOONS
Strong, J.
In "Recent Advances in Astro-Geophysics," Proceedings of a topical symposium based on lectures delivered at the Summer Conference for College Professors of Physics and Astronomy, Georgetown University, Washington, D.C., August 1–24, 1960, pp. 51–52
Thekaekara, M. P., Editor
Georgetown University, Georgetown College Observatory, Washington, D.C., 1960
Monograph 14
(*AJ*, 1960, #1339)

## *Jupiter — 1960*

387. HIGH-DISPERSION SPECTRA OF JUPITER
Kiess, C. C., Corliss, C. H., Kiess, H. K.
*Astrophysical Journal, The*, v. 132, no. 1, pp. 221–231, July 1960

In May 1957 the spectrum of Jupiter was photographed with concave gratings of high dispersion at the Slope Observatory on Mauna Loa. The spectrograms covered the region from 3600 to 8900 Å. Tables are presented listing the wavelengths and estimated intensities of lines that comprise the structures of the ammonia bands at 6450 and 7900 Å, and of the methane bands at 6200, 7250, 8420, and 8620 Å. In the infrared, four lines of the (3, 0) band in the quadrupole rotation-vibration spectrum of $H_2$ were measured. In the violet and ultraviolet regions of the planet's spectrum a continuous absorption was recorded that closely resembles the continuous absorption of the nitrogen tetroxide molecule.

388. LA PLANÈTE JUPITER EN 1959 (THE PLANET JUPITER IN 1959)
Hémeret, J.-L.
*l'Astronomie*, v. 74, pp. 27–30, 1960
(*AJ*, 1960, #8617)

389. JUPITER—BEOBACHTUNG (OBSERVATION OF JUPITER)
Sandner, W.
*Veröffentlichungen der Urania-Sternwarte*, Vienna, no. 3, p. 51, 1960
(*AJ*, 1960, #8633)

390. JUPITER EM 1959 (JUPITER IN 1959)
Muniz Barreto, L., de Freitas Mourão, R. R.
*Observatorio Nacional, Publicacoes Do Serviço Astronomico*, Rio de Janeiro, no. 11, 1960
(*AJ*, 1960, #8601)

391. JUPITER IN 1959: SECOND INTERIM REPORT
Budine, P. W.
*Strolling Astronomer*, v. 14, pp. 34–43, 1960
(*AJ*, 1960, #8607)

392. THE 1958–59 APPARITION OF JUPITER, FINAL REPORT
Budine, P. W.
*Strolling Astronomer*, v. 14, pp. 66–80, 1960
(*AJ*, 1960, #8608)

393. LE OSSERVAZIONI VISUALI DI GIOVE (VISUAL OBSERVATIONS OF JUPITER)
Tronfi, A.
*Coelum*, v. 28, pp. 137–141, 1960

Some practical suggestions are made concerning the visual observation of Jupiter. The possibility of using small instruments is examined, and a few formulas are presented in graphic form. (*AJ*, 1960, #8639)

394. OBSERVATIONS OF THE PLANETS JUPITER AND SATURN IN 1960
Botham, J. H.
*Astronomical Society of Southern Africa, Monthly Notes of the*, v. 19, no. 11, pp. 175–177, 1960

Estimated brightness values (visual and photographic) are given for major features of the two planets. The observations were made with the 9-in. Grubb refractor of the Union Observatory, Johannesburg, from February to September 1960. (*PA*, 1961, #4193)

395. THE LOCATION OF THE BANDS AND DETAILS ON JUPITER, 1957
Zvetkov, V. I.
*Vsesoiuznoe Astronomo-Geodezicheskoe Obshchestvo Biulleten*, no. 27, pp. 20–26, 1960 (in Russian)
(*AJ*, 1960, #8644)

396. THE LOCATION OF BANDS AND DETAILS ON JUPITER, 1958
Rutkovskaya, M. J.
*Vsesoiuznoe Astronomo-Geodezicheskoe Obshchestvo Biulleten*, no. 28, pp. 37–41, 1960 (in Russian)
(*AJ*, 1960, #8631)

397. INTENSITÄTS-SCHÄTZUNGEN VON JUPITER-DETAIL 1960 (INTENSITY ESTIMATES OF JUPITER DETAILS 1960)
Sandner, W.
*Mitteilungen für Planetenbeobachter*, v. 13, pp. 70–71, 1960
(*AJ*, 1960, #8632)

### *Mars — 1960*

398. SOME NOTES ON THE ORIGIN OF THE COLOUR OF THE MARTIAN DESERTS
French, H.
*British Astronomical Association, Journal of the*, v. 70, no. 3, pp. 136–138, March 1960

Terrestrial geology is applied to the analysis of color of Martian deserts. Oxidation of ferrous oxide (black) yields ferric oxide (mineral hematite) which is brick-red in color. In the presence of water or water vapor, ferric oxide becomes hydrated to ferric hydroxide (mineral limonite) which is buffish yellow. Mixed ferric oxide and ferric hydroxide rocks would yield the orange-red color observed.

399. OBJECTIVE: PHOTOS OF MARS
*Electronics*, v. 33, no. 21, p. 49, May 20, 1960

The Massachusetts Institute of Technology's interplanetary space probe which would collect data from Mars is discussed. (*AI/S*, 1960, #21,953)

400. MARS THROUGH COLOUR FILTERS, 1958
Heath, A. W., Robinson, J. H., Firsoff, V. A.
*British Astronomical Association, Journal of the*, v. 70, no. 6, pp. 270–272, August 1960

A description and illustrations of observations are presented.

401. GETTING ACQUAINTED WITH ASTRONOMY
*Sky and Telescope*, v. 20, no. 5, pp. 277–278, November 1960

A brief summary of data concerning the planet Mars is given. (*AI/S*, 1960, #23,404)

402. WIENER MARSBEOBACHTUNGEN 1956 (OBSERVATIONS OF MARS MADE IN VIENNA, 1956)
Riehs, A.
*Monatsschrift für Österreichs Amateurastronomen—Der Sternenbote*, v. 3, pp. 32–33, 1960
(*AJ*, 1960, #8442)

403. DER JAHRESZEITLICHE RÜCKGANG DER MARSPOLKAPPEN (THE SEASONAL RETROGRESSION OF MARS' POLAR CAPS)
*Monatsschrift für Österreichs Amateurastronomen—Der Sternenbote*, v. 3, p. 107, 1960
(*AJ*, 1960, #8471)

404. MARS
*Urania*, Copenhagen, v. 17, pp. 92–93, 1960
(*AJ*, 1960, #8474)

405. RESULTS OF MARS OBSERVATION IN CZECHOSLOVAKIA DURING THE OPPOSITION 1958–1959
Šadil, J.
*Říše Hvězd*, v. 41, pp. 86–91, 1960 (in Czechoslovakian with French references)
(*AJ*, 1960, #8444)

406. OBSERVATIONS OF THE PLANET MARS DURING THE OPPOSITION 1958–1959
Šadil, J.
*Říše Hvězd*, v. 41, pp. 112–114, 1960 (in Czechoslovakian)
(*AJ*, 1960, #8445)

407. L'OBSERVATION DE LA PLANÈTE MARS EN 1958 (OBSERVATION OF THE PLANET MARS IN 1958)
*l'Astronomie*, v. 74, pp. 336–341, 1960
(*AJ*, 1960, #8461)

408. OBSERVATIONS PHYSIQUES DE MARS (PHYSICAL OBSERVATIONS OF MARS)
*l'Astronomie*, v. 74, p. 342, 1960
(*AJ*, 1960, #8462)

409. OBSERVATIONS PHYSIQUES DE MARS (PHYSICAL OBSERVATIONS OF MARS)
*l'Astronomie*, v. 74, p. 474, 1960
(*AJ*, 1960, #8463)

410. CONSIDERAZIONI SUI CAMBIAMENTI STAGIONALI DI COLORI DELLE MACCHIE DI MARTE (THE SEASONAL CHANGES IN COLOR OF THE MARTIAN BANDS)
Ruggieri, G.
In "Società Astronomica Italiana. Atti del Convegno Astronomico di Padova–Asiago Ottobre 1959," pp. 73–79
Industria Grafica, Milan, Italy, 1960
(*AJ*, 1960, #8443)

411. ON THE EXISTENCE OF COLOUR-PHASE RELATION FOR MARS
Sharonov, V. V.
*Astronomicheskii Tsirkuliar*, no. 208, p. 11, 1960
(in Russian)

Between October 18, 1958 and April 16, 1959, only minor color changes appeared as a function of phase angle. No distinct relationship to phase exists. (*AJ*, 1960, #8452)

412. THE CONTRASTS BETWEEN "SEA-LAND" AND "EDGE-CAP" [POLAR] ON MARS, 1956 AND 1958
Dluzhnevskaya, O. B.
*Vsesoiuznoe Astronomo-Geodezicheskoe Obshchestvo Biulletin*, no. 27, pp. 10–14, 1960 (in Russian)
(*AJ*, 1960, #8413)

413. PHOTOGRAPHS OF MARS
*Strolling Astronomer*, v. 14, p. 190, 1960
(*AJ*, 1960, #8473)

414. DE POOLKAPPEN VAN MARS: SNEEUW OF RIJP? (THE POLAR CAPS OF MARS: SNOW ON RIME?)
Jansen, A. G.
*Hemel en Dampkring*, v. 58, pp. 29–34, 1960
(*AJ*, 1960, #8423)

415. REMARKS ON MARS AND VENUS
de Vaucouleurs, G. H.
In "The Exploration of Space," Proceedings of the Symposium on Space Physics, Washington, D.C., April 29–30, 1959, pp. 94–99
Jastrow, R., Editor
The Macmillan Company, New York, N.Y., 1960
(*AJ*, 1960, #1316)

416. ON THE ORIGIN OF THE COLOUR OF THE MARTIAN DESERTS
Saheki, T.
*Heavens*, v. 41, pp. 242–244, 1960 (in Japanese)
(*AJ*, 1960, #8448)

417. SIND DIE "GRÜNEN" GEBIETE AUF DEM MARS WIRKLICH GRÜN? (ARE THE "GREEN" REGIONS ON MARS REALLY GREEN?)
Schmidt, I.
*Weltraumfahrt, Zeitschrift für Astronautik und Raketentechnik*, v. 11, pp. 9–11, 1960
(*AJ*, 1960, #8455)

418. VISUAL OBSERVATIONS OF MARS IN 1958
de Freitas Mourão, R. R.
*Mitteilungen für Planetenbeobachter*, v. 13, pp. 8–9, 1960
(*AJ*, 1960,#8437)

419. MARS IN OPPOSITION 1960, DEZEMBER 30$^{d}$ (MARS IN OPPOSITION, DECEMBER 30, 1960)
*Mitteilungen für Planetenbeobachter*, v. 13, p. 62, 1960
(*AJ*, 1960, #8465)

420. ERSTE BEOBACHTUNGSMELDUNG VON MARS (FIRST OBSERVATIONAL REPORTS OF MARS)
*Mitteilungen für Planetenbeobachter*, v. 13, p. 74, 1960
(*AJ*, 1960, #8466)

421. MARS AS AN ASTRONOMICAL OBJECTIVE
Hess, S. L.
1960
Florida State University, Tallahassee
Paper

This paper includes the following topics: general description; the surface; the atmosphere; the vertical variation of temperature, pressure and density; the Martian stratosphere; the blue haze; general considerations of a space-observation program; observations from Earth; observations from Earth satellite; and observations from space probes. (*AI/A*, 1961, #4600)

422. OBSERVATIONS DE MARS EN 1958 (OBSERVATIONS OF MARS IN 1958)
de Saussure, M.
*Orion, Bulletin de la Société Astronomique de Suisse*, Schaffhausen, v. 5, pp. 668–669, 1960
(*AJ*, 1960, #8451)

423. REPORT OF MARS OBSERVATIONS DURING THE 1958 OPPOSITION
ON THE GENERAL CIRCULATION OF THE MARTIAN ATMOSPHERE
PLANISPHERE OF MARS WITH THE LIST OF THE NAMES OF ITS SURFACE MARKINGS
Miyamoto, S., Matsui, M., Ebisawa, S.
1960
Kyoto, University of, Institute of Astrophysics and Kwasan Observatory, Japan
Contributions 87, 88, 89

A general description of the surface markings and clouds observed during the 1958 opposition is given. The pattern of general circulation of the Martian atmosphere in the equinoctial season was derived from these data and compared with those obtained in 1956 for southern summer and with the terrestrial case. This pattern was found to be similar to that of the Earth's atmosphere and considerably different from the 1956 pattern, as was expected theoretically.

### *Mercury — 1960*

424. THE PLANETS—MERCURY—II
*Sky and Telescope*, v. 19, no. 5, p. 275, March 1960

The surface features of Mercury and the best observation times are discussed. (*AI/S*, 1960, #20,878)

425. MERKUR IN ÖSTLICHER ELONGATION (MERCURY IN EASTERN ELONGATION)
Frisch, R.
*Nachrichtenblatt der Vereinigung der Sternfreunde*, Berlin, v. 9, pp. 66–67, 1960
(*AJ*, 1960, #8201)

426. INTERIM REPORT ON MERCURY IN 1958 AND 1959
Gaherty, G., Jr.
*Strolling Astronomer*, v. 14, p. 96, 1960
(*AJ*, 1960, #8202)

## *Moon — 1960*

427. IN FOCUS
Ashbrook, J.
*Sky and Telescope*, v. 19, no. 3, p. 151, January 1960

The Yerkes Observatory photograph of the lunar Sea of Serenity and its surroundings, which was taken with the 40-in. refractor by G. W. Ritchey around 1901, is described and analyzed. (*AI/S*, 1960, #20,318)

428. OBSERVING THE MOON—BESSEL
*Sky and Telescope*, v. 19, no. 3, pp. 169–170, January 1960

Bessel, the largest crater of the major lunar sea, Mare Serenitatis, is described. (*AI/S*, 1960, #20,317)

429. TELEVISION AND LUNAR EXPLORATION
Spaulding, S.
*SMPTE, Journal of the*, v. 69, no. 1, pp. 39–43, January 1960

Television techniques are planned to aid in lunar surface exploration, with emphasis on obtaining high-resolution pictures from an impacting probe. A television link back to Earth will permit controlled soft-landings on the Moon and subsequent surface examinations. The optics, the television, and the communications parameters are considered. (*AI/S*, 1960, #20,323)

430. THE OTHER SIDE OF THE MOON
Moore, P.
*British Astronomical Association, Journal of the*, v. 70, no. 1, pp. 60–62, January 1960

The significant features of the "backside" of the Moon, as seen in Russian photographs, are described.

431. THE LUNAR STRAIGHT WALL
Ashbrook, J.
*Astronomical Society of the Pacific, Publications of the*, v. 72, no. 424, pp. 55–58, February 1960

The observations, made visually with a 6-in. reflector on seven nights in 1957–1959, consisted of estimates of shadow length in terms of the diameters of neighboring craters. (*AI/S*, 1960, #22,514)

432. ARMY WORKING ON MOON MAP BETTER THAN SOME OF EARTH
*Missiles and Rockets*, v. 6, no. 14, p. 16, April 11, 1960

The Army Map Service announces plans to produce a map of the Moon that will give "the first to set foot on the Moon better maps than are in existence now for many of the remote parts of the Earth." (*AI/S*, 1960, #21,316)

433. OBSERVING THE MOON-BURG AND LACUS MORTIS
Herring, A. K.
*Sky and Telescope*, v. 19, no. 6, p. 357, April 1960
(*AI/S*, 1960, #21,320)

434. A SYSTEM FOR LUNAR PHOTOGRAPHY AND DATA TRANSMISSION
Scull, J. R.
May 28, 1960
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TR 34-142
AD-247,440

At the time the first U.S. lunar photographic vehicle was being developed, data from *Explorer 4* indicated the presence of high intensity ionizing radiation surrounding the Earth. As a result, an alternate approach was developed, using a slow scan vidicon television camera in conjunction with 2000:1 bandwidth compression by means of a special 650-gm low power tape recorder. The performance of the prototypes along with the engineering philosophy which led to their development is presented in some detail. Special attention is given to the development of methods for generating, storing, and transmitting video information over long distances using low power and subaudio bandwidths.

435. THE EXPLORATION OF THE MOON
Jastrow, R.
*Scientific American*, v. 202, no. 5, pp. 61–69, May 1960

The programs of scientific exploration and their use in the investigation of the solar system historical record are reviewed in simple terms. (*PA*, 1962, #15,309)

436. HOW GOOD IS THE LUNIK III PHOTOGRAPHY?
Davies, M. E.
*Astronautics*, v. 5, no. 5, pp. 28–29, 112–113, May 1960

A selection of full-moon lighting indicates that the objective was to record maximum area without particular regard to quality. Ground resolution, estimated from a close study of the photographs, is about 30 miles. (*AI/S*, 1960, #21,678)

437. THE FIRST RESULTS OBTAINED FROM PHOTOGRAPHS OF THE INVISIBLE SIDE OF THE MOON
Barabashov, N. P., Lipskii, Yu. N.
*Soviet Physics—Doklady*, v. 4, no. 6, pp. 1165–1169, May–June 1960
(*AI/S*, 1960, #22,231)

438. STUDIES IN LUNAR TOPOGRAPHY, VIII. A CATALOGUE OF MEASURED HEIGHTS IN THE REGIOMONTANUS AND HELL PLAIN REGION OF THE MOON
Turner, G.
June 1960
Manchester University, Department of Astronomy, Great Britain
Technical Scientific Note 8, AFCRL-TN-60-831, AF 61(052)-168
AD-267,981
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

A catalog is presented of measured relative heights in the region of the Moon around the craters Regiomontanus, Purbach, and the Hell Plain. The coordinates of the tip of the measured shadows are given in each case, and the method of their computation is described. Quoted for this region are 510 measures of 209 points.

**439. HORIZONTAL AND VERTICAL CONTROL FOR LUNAR MAPPING. PART I: METHODS**
**Marchant, M. Q.**
**August 1960**
**Army Map Service, Washington, D.C.**
**TR 29**
**AD-262,889**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

The methods used at the Army Map Service for the determination of first- and second-order lunar control are presented.

**440. PROJECT LAMP**
***Aircraft & Missiles*, v. 3, no. 9, p. 86, September 1960**

The Lunar Analysis and Mapping Program (LAMP), directed by the Army Corps of Engineers, is planning detailed studies of the lunar surface in an attempt to produce accurate lunar topographic maps. (*AI/S*, 1960, #22,763)

**441. THE MOON AND ITS SURFACE**
**(Translated from *Pravda Ukrainy*, no. 214, p. 1, September 15, 1959)**
**Portsevskii, K.**
**October 24, 1960**
**U.S. Department of Commerce, Office of Technical Services, Washington, D.C.**
**OTS: 61-23,461, MCL-411**

Accumulated data from years of astronomical observations of the Moon are reviewed. The lunar surface and various geographical characteristics are described. (*AI/A*, 1963, #71,471)

**442. RESEARCH ON LUNAR PHOTOMETRIC AND TOPOGRAPHIC ANALYSIS**
**Kopal, Z.**
**October 1960**
**Manchester University, Department of Astronomy, Great Britain**
**Final Technical Report, AFCRL-650, AF 61(052)-168, AF 61(052)-380**
**AD-268,126**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

The development is reported of methods for lunar cinephotography, which should record the growth and diminution of shadows cast by the lunar mountains and other formations on the surrounding landscape during sunrise or sunset on the Moon, the measurements of which by suitable microphotometric methods could lead to a determination of heights of the shadow-casting obstacles, essentially by triangulation. Test results show that the shadow technique permits determination of relative altitudes of lunar mountains within the errors of less than 10 m at the center of the apparent lunar disk, growing proportionally toward the limb. Selenographic positions can be measured on negatives with a precision of the order of 1 ft in either selenographic coordinate. The errors inherent in such positions constitute, in fact, also the principal source of errors affecting the computed heights. It is expected that both sources of error will be appreciably reduced in further development of the work. There appear to be no steep slopes on the Moon, of sizes larger than a few kilometers, which would be inclined to the horizontal direction by more than 10 deg.

**443. RECENT STUDIES OF THE KNOWN PHYSICAL CHARACTERISTICS OF THE MOON AND THE PLANETS**
**Kiess, C. C., Birney, D. S.**
**December 1960**
**Georgetown University, Georgetown College Observatory, Washington, D.C.**
**Monograph 15, AFCRL-TN-60-666**

The more recent literature concerning the known characteristics of the Moon, Venus, Mars, and Jupiter is described in this supplement to a summary which was published in July 1958 and abstracted in *Astronautics Information Abstracts*, v. 2, no. 1–3, January–March 1960. (*AI/A*, 1963, #71,183)

**444. A METHOD FOR STUDYING THE REVERSE SIDE OF THE MOON AND OBTAINED RESULTS**
**Lipskii, Yu. N.**
***Astronomicheskii Zhurnal*, v. 37, no. 6, pp. 1043–1052, November–December, 1960**
**(Translated from the Russian in *Soviet Astronomy—AJ*, v. 4, no. 6, pp. 976–989, May–June 1961)**

The reverse side of the Moon was photographed with a camera equipped with two objectives having focal lengths of 20 and 50 cm. Photographs were taken during a 40-min period at distances of 65,200 to 68,400 km from the center of the Moon. The film was developed, fixed, and dried, and the image transmitted to Earth in the form of electrical signals whose variation corresponded to the varying transparency of the negative along the line being scanned. Signals were modulated before transmission to reduce interference along the line of propagation. Earth-based stations transcribed the signals onto magnetic tape, then demodulated and recorded them by a variety of devices. This paper discusses only the photographic recorder which reproduced the images on 35-mm film and the magnetic recorder which registered the images on magnetic tape. The method used for studying these photographs is described, and some of the results obtained are given.

445. THE COLOUR OF THE BRIGHT RAYS ON THE LUNAR SURFACE
Radlova, L. D.
*Astronomicheskii Zhurnal*, v. 37, no. 6, pp. 1053–1055, November–December 1960
(Translated from the Russian in *Soviet Astronomy—AJ*, v. 4, no. 6, pp. 990–992, May–June 1961)

The color distribution along some bright rays, belonging to the systems of the craters Tycho, Copernicus, and Kepler, was studied by methods of visual and photographic colorimetry. For some rays a very insignificant variation of color along the ray is found. However, the detected differences in color are within the limits of errors of measurements and therefore it can be assumed that in the mean the layer of the bright rays is of the same color as the surrounding background of the lunar surface. (*PA*, 1961, #18,029)

446. LUNAR CARTOGRAPHY
Arthur, D. W. G.
*Sky and Telescope*, v. 20, no. 6, pp. 320–324, December 1960

A brief history of mapping of the lunar surface is presented. (*AI/S*, 1960, #23,420)

447. SOME CURRENT PROBLEMS OF LUNAR TOPOGRAPHY
Kopal, Z.
In "Recent Advances in Astro-Geophysics," Proceedings of a topical symposium based on lectures delivered at the Summer Conference for College Professors of Physics and Astronomy, Georgetown University, Washington, D.C., August 1–24, 1960, pp. 1123–1131
Thekaekara, M. P., Editor
Georgetown University, Georgetown College Observatory, Washington, D.C., 1960
Monograph 14
(Also available as Astronomical Contribution 78, Manchester University, Great Britain, 1960)
(*AJ*, 1960, #1339)

448. PHOTOGRAPHIC OBSERVATIONS OF THE MOON IN KASAN
Risvanov, N. G.
*Astronomicheskii Tsirkuliar*, no. 213, pp. 2–3, 1960
(in Russian)
(*AJ*, 1960, #8367)

449. TOTAL LUNAR ECLIPSE OF SEPTEMBER 5, 1960
Chistiakov, V. F.
*Astronomicheskii Tsirkuliar*, no. 216, pp. 4–6, 1960
(in Russian)
(*AJ*, 1960, #83,110)

450. FOTOGRAFÍAS LUNARES CON PEQUEÑOS INSTRUMENTOS (LUNAR PHOTOGRAPHS WITH SMALL INSTRUMENTS)
Barangé, A.
*Urania. Revista de Astronomiá y Ciencias Afines*, Barcelona, v. 45, pp. 35–39, 1960
(*AJ*, 1960, #8306)

451. SOBRE LA NATURALEZA DE LA CORTEZA LUNAR (ON THE NATURE OF THE LUNAR CRUST)
Suñé Coma, E.
*Urania. Revista de Astronomiá y Ciencias Afines*, Barcelona, v. 45, pp. 65–100, 1960
(*AJ*, 1960, #8383)

452. AMATEURS PHOTOGRAPH THE LUNAR ECLIPSE
(Lunar Eclipse, September 5, 1960)
*Sky and Telescope*, v. 20, pp. 256–258, 1960
(*AJ*, 1960, #83,110)

453. SOME NOTES TO THE PHOTOGRAPHS OF THE INVISIBLE LUNAR HEMISPHERE
Šadil, J.
*Říše Hvězd*, v. 41, pp. 3–6, 1960 (in Czechoslovakian)
(*AJ*, 1960, #83,189)

454. A SIMPLE METHOD OF MAPPING LUNAR FEATURES, WITH NOTES ON THE GUERICKE–FRA MAURO GROUP OF CRATERS
Both, E. E.
*Strolling Astronomer*, v. 14, pp. 43–49, 1960
(*AJ*, 1960, #83,121)

455. DIE RÜCKSEITE DES MONDES UND DIE URSACHEN DER LUNAREN OBERFLÄCHENENTWICKLUNG (THE BACKSIDE OF THE MOON AND THE ORIGINS OF LUNAR SURFACE DEVELOPMENT)
Witt, A.
*Nachrichtenblatt der Vereinigung der Sternfreunde*, Berlin, v. 9, pp. 61–62, 1960
(*AJ*, 1960, #83,192)

456. OBSERVATIONS OF LUNAR ECLIPSES IN DALNY
(Lunar Eclipse, August 5, 1952)
Kuklin, G. V., Khanzhin, A. G.
*Astronomicheskii Tsirkuliar*, no. 211, pp. 12–13, 1960
(in Russian)
(*AJ*, 1960, #83,104)

457. EARTH SATELLITES AND LUNAR FORMATIONS
Jaschek, C. O. R.
*Observatory*, v. 80, pp. 119–120, 1960
(Also available as Separata Astronómica 18, Universidad Nacional de La Plata, Observatorio Astronómico, Argentina, 1960)

To confirm the theory that lunar craters stem from the impact of earlier planetoid-type Earth satellites, it can be demonstrated that the mass distribution of these bodies, as derived from the magnitudes of the craters, agrees with that of the planetoids (determined from their brightnesses). (*AJ*, 1960, #8113)

458. EVOLUTION OF THE MOON
Alter, D.
In "Proceedings of Lunar and Planetary Exploration Colloquium, Volume II, No. 2, Downey, Calif., March 17, 1960" North American Aviation, Inc., Space and Information Systems Division, Downey, Calif., 1960

459. SEISMIC ACTIVITY OF THE MOON
Macdonald, G. J.
In "Proceedings of Lunar and Planetary Exploration Colloquium, Volume II, No. 2, Downey, Calif., March 17, 1960" North American Aviation, Inc., Space and Information Systems Division, Downey, Calif., 1960

460. ANALYSIS OF LUNIK III PHOTOGRAPHS
Katz, A. H.
In "Proceedings of Lunar and Planetary Exploration Colloquium, Volume II, No. 2, Downey, Calif., March 17, 1960" North American Aviation, Inc., Space and Information Systems Division, Downey, Calif., 1960

461. ORIGIN OF LUNAR DOMES
Salisbury, J.
In "Proceedings of Lunar and Planetary Exploration Colloquium, Volume II, No. 2, Downey, Calif., March 17, 1960" North American Aviation, Inc., Space and Information Systems Division, Downey, Calif., 1960

462. BALLISTICS OF THE COPERNICAN RAY SYSTEM
Shoemaker, E. M.
In "Proceedings of Lunar and Planetary Exploration Colloquium, Volume II, No. 2, Downey, Calif., March 17, 1960" North American Aviation, Inc., Space and Information Systems Division, Downey, Calif., 1960

463. LUNAR ECLIPSE, LOW BUDGET AND STUDENT INGENUITY
(Lunar Eclipse, March 13, 1960)
Aron, I.
*Astronomical Journal*, v. 65, p. 340, 1960
(*AJ*, 1960, #83,109)

464. LUNAR THERMAL EMISSION MEASUREMENTS DURING THE TOTAL LUNAR ECLIPSE OF 13 MARCH 1960
Castelli, J. P., Ferioli, C. P., Aarons, J.
*Astronomical Journal*, v. 65, pp. 485–486, 1960
(*AJ*, 1960, #83,109)

465. L'ÉCLIPSE TOTALE DE LUNE DU 13 MARS 1960, OBSERVÉE À CHICAGO (U. S. A.)
(TOTAL LUNAR ECLIPSE OF MARCH 13, 1960, OBSERVED IN CHICAGO)
Lipinski, S.
*l'Astronomie*, v. 74, pp. 475–476, 1960
(*AJ*, 1960, #83,109)

466. ECLIPSE
(Lunar Eclipse, March 13, 1960)
*El Universo*, v. 14, p. 65, 1960
(*AJ*, 1960, #83,109)

467. AMATEUR PHOTOGRAPHS OF THE MARCH LUNAR ECLIPSE
(March 13, 1960)
*Sky and Telescope*, v. 19, pp. 402–405, 1960
(*AJ*, 1960 #83,109)

468. THE EARTH'S SHADOW SIZE AT THE MARCH LUNAR ECLIPSE
(March 13, 1960)
Ashbrook, J.
*Sky and Telescope*, v. 19, pp. 474–476, 1960
(*AJ*, 1960, #83,109)

469. SOME SUGGESTED OBSERVATIONS OF THE TOTAL LUNAR ECLIPSE ON MARCH 13, 1960
Haas, W. H.
*Strolling Astronomer*, v. 14, pp. 28–32, 1960
(*AJ*, 1960, #83,109)

470. TOTAL LUNAR ECLIPSE ON MARCH 13, 1960
*Strolling Astronomer*, v. 14, p. 64, 1960
(*AJ*, 1960, #83,109)

471. REPORT OF THE A.L.P.O. OBSERVATIONS OF CRATER TIMES AT THE MARCH 13, 1960, LUNAR ECLIPSE
Ashbrook, J.
*Strolling Astronomer*, v. 14, pp. 163–167, 1960
(*AJ*, 1960, #83,109)

472. BEOBACHTUNG DER MONDFINSTERNIS 1959 MÄRZ 24 (OBSERVATIONS OF THE LUNAR ECLIPSE OF MARCH 24, 1959)
Sandner, W.
*Die Sterne*, v. 36, p. 36, 1960
(*AJ*, 1960, #83,107)

473. THE EARTH'S SHADOW DURING THE LUNAR ECLIPSE OF 1959, MARCH 24
Bouška, J.
*Říše Hvězd*, v. 41, pp. 50–53, 1960 (in Czechoslovakian)
(*AJ*, 1960, #83,107)

474. OBSERVATIONS OF THE PARTIAL LUNAR ECLIPSE ON MARCH 24, 1959 IN IRKUTSK
Kuklin, G. V., Smolkov, G. J., Shilina, G. I.
*Astronomicheskii Tsirkuliar*, no. 208, pp. 9–11, 1960
(in Russian)
(*AJ*, 1960, #83,107)

475. OBSERVATIONS OF THE PARTIAL LUNAR ECLIPSE OF MARCH 24, 1959
Milkhiker, M. A.
*Vsesoiuznoe Astronomo-Geodezicheskoe Obshchestvo Biulleten*, no. 27, pp. 32–36, 1960 (in Russian)
(*AJ*, 1960, #83,107)

476. THE EARTH'S SHADOW DURING THE PARTIAL LUNAR ECLIPSE ON MARCH 24TH, 1959
Bouška, J.
*Ceskaslovenska Akademie Ved., Biulletin' Astronomicheskikh Institutov Chekhoslovakii*, v. 11, pp. 145–148, 1960
(*AJ*, 1960, #83,107)

477. DIE NATUR DER MONDOBERFLÄCHE (THE NATURE OF THE LUNAR SURFACE)
Focas, J. H.
*Ethnikon Asteroskopeion, Astronomikon Institouton*, Athens, v. 10, pp. 8–11, 1960 (in Greek)

The most recent results of observations with respect to the nature of the lunar surface are briefly presented. (*AJ*, 1960, #83,132)

478. DESCRIPTION OF THE FIRST SPACE STATION PHOTOGRAPHING THE MOON
Blagonravov, A. A.
In "Space Research," Proceedings of the First International Space Science Symposium, Nice, France, January 11–16, 1960, pp. 1109–1113
Kallman, H., Editor
North-Holland Publishing Company, Amsterdam, The Netherlands; Interscience Publishers, Limited, London, England; Interscience Publishers, Inc., New York, N.Y., 1960
(*AJ*, 1960, #1330)

479. NOTE ON THE MOON'S APPEARANCE IN TOTAL ECLIPSE
Drake, S.
*Isis*, v. 51, p. 204, 1960
(*AJ*, 1960, #8396)

480. THE COLOUR-BRIGHTNESS DEPENDENCE FOR 62 LUNAR REGIONS NEAR THE EPOCH OF FULL MOON
Teifel, V. G.
*Astronomicheskii Tsirkuliar*, no. 209, pp. 8–10, 1960 (in Russian)

The color brightness gradients (table) obtained on September 16–17, 1960, vary between 0.46 and 3.00 about the mean value of 1.17. The frequency maximum is between 0.6 and 0.8. There is almost no recognizable correlation with the color indexes. (*AJ*, 1960, #83,158)

481. PHOTOGRAPHIC ATLAS OF THE MOON
Miyamoto, S., Matsui, M.
1960
Kyoto, University of, Institute of Astrophysics and Kwasan Observatory, Japan
Contribution 95

Photographs of the Moon were taken with the 30-cm Cooke refractor of the Kwasan Observatory for the purpose of geological study of the lunar surface during the period 1958–1960. Eighty-five pictures showing each region under different phases of illumination were selected from the compilation and reproduced. These photographs may be significant for the study of the general geological features of the lunar surface.

482. ECLIPSE PENUMBRAL DE LA LUNA VERIFICADO EL 16 DE SEPTIEMBRE ÚLTIMO, Y OBSERVADO EN LA SOCIEDAD ASTRONÓMICA (PENUMBRAL LUNAR ECLIPSE, VERIFIED LAST SEPTEMBER 16, AND OBSERVED AT THE ASTRONOMICAL SOCIETY) (September 16, 1959)
López L., E., González Solís, A., Martínez García, D., Velazco, A., López, G.
*El Universo*, v. 14, pp. 47–49, 1960
(*AJ*, 1960, #83,108)

483. CÓMO SE OBSERVÓ EN LA SOCIEDAD ASTRONÓMICA DE MÉXICO EL ECLIPSE TOTAL DE LUNA DEL 12–13 DE MARZO DE 1960 (OBSERVATION BY THE ASTRONOMICAL SOCIETY OF MEXICO OF THE TOTAL LUNAR ECLIPSE OF MARCH 12–13, 1960)
López L., E.
*El Universo*, v. 14, pp. 152–159, 1960
(*AJ*, 1960, #83,109)

484. ELEVATIONS OF THE MOON'S LIMB DETERMINED FROM PHOTOGRAPHIC OBSERVATIONS
Gorynya, A. A., Drofa, V. K.
In "Publikationen der 14. Astrometrischen Konferenz der UdSSR," Proceedings of an astronomical conference, Kiev, May 27–30, 1958, pp. 404–408 (in Russian with English references)
Sverev, M. S., Editor
Akademiia Nauk, USSR, Moscow, 1960
(*AJ*, 1960, #1307)

485. DIE MONDRANDGEBIETE UND IHRE BEOBACHTUNG (THE LUNAR-EDGE REGIONS AND THEIR OBSERVATION)
Oberndorfer, H.
*Mitteilungen für Planetenbeobachter*, v. 13, pp. 9–12, 1960
(*AJ*, 1960, #83,152)

486. WAS SIEHT MAN AUF DER RÜCKSEITE DES MONDES? (WHAT CAN BE SEEN ON THE BACKSIDE OF THE MOON?)
*Mitteilungen für Planetenbeobachter*, v. 13, p. 44, 1960
(*AJ*, 1960, #83,197)

487. THE OTHER SIDE OF THE MOON (A translation from the Russian)
Sykes, J. B., Translator
Pergamon Press, Ltd., London, England, 1960
(*AJ*, 1960, #83,195)

488. MONDKARTEN—ERSTES UND LETZTES VIERTEL (LUNAR MAPS—FIRST AND LAST QUARTER)
Klepešta, J., Lukeš, L.
Rais, A., Translator
Franckh'sche Verlagshandlung, Stuttgart, Germany, 1960

Two large lunar maps and two skeleton maps are included. (*AJ*, 1960, #83,140)

489. THE REDUCTION OF OBSERVATIONS OF THE MOON TO THE BARICENTRIC SPHERE
Yokovkin, A. A., Gorynya, A. A.
In "Publikationen der 14. Astrometrischen Konferenz der UdSSR," Proceedings of an astronomical conference, Kiev, May 27–30, 1958, pp. 398–403 (in Russian with English references)
Sverev, M. S., Editor
Akademiia Nauk, USSR, Moscow, 1960
(*AJ*, 1960, #1307)

490. LUNAR EXPLORATION BY PHOTOGRAPHY FROM A SPACE VEHICLE
Davies, M. E. (Rand Corporation, Santa Monica, Calif.)
In "Proceedings of Tenth International Astronautical Congress, London, 1959," Volume I, p. 268
Hecht, F., Editor
Springer-Verlag, Vienna, 1960

A panoramic camera which should get pictures superior to those obtained by telescope or TV is advocated. The camera would utilize the lunar vehicle's spin stabilization to perform scanning. However, the vehicle would have to sense its spin rate and the approximate direction of the ground. (*AI/A*, 1959, #1550)

### *Saturn — 1960*

491. SATURN IN 1958
Heath, M. B. B.
*British Astronomical Association, Journal of the*, v. 70, no. 1, pp. 29–32, January 1960

No very marked changes in color, or distribution, of the main surface features of Saturn were observed during 1958. Boggis of Perth, Australia made visual observation of the equatorial zone, north equatorial belt, north polar regions, and rings A, B, and C through six different color filters. The results are tabulated. (*PA*, 1960, #8492)

492. SOME REMARKS ON OPTICAL PROPERTIES OF SATURN'S RINGS
Bobrov, M. S.
*Astronomical Journal*, v. 65, no. 5, pp. 337–338, June 1960

Some optical properties of Saturn's rings are discussed in connection with the papers of F. A. Franklin and A. F. Cook. Special attention is paid to the objection of these authors to Bobrov's conclusion about the nondiffractional character of the light scattering by the B-ring. It is shown that this objection is unfounded.

493. SOME OBSERVATIONS OF SATURN IN 1958 AND 1959
Cruikshank, D. P.
*Strolling Astronomer*, v. 14, no. 9–10, pp. 129–132, September–October 1960
(*AI/S*, 1960, #23,462)

494. SATURNO EM 1959 (SATURN IN 1959)
Muniz Barreto, L., de Freitas Mourão, R. R.
*Observatorio Nacional, Publicacaes Do Serviço Astronomico*, Rio de Janeiro, no. 10, 1960
(*AJ*, 1960, #8716)

495. SATURN IN 1959
de Freitas Mourão, R. R.
*Mitteilungen für Planetenbeobachter*, v. 13, pp. 30–32, 1960
(*AJ*, 1960, #8714)

496. SATURN 1960
*Mitteilungen für Planetenbeobachter*, v. 13, p. 61, 1960
(*AJ*, 1960, #8723)

### *Venus — 1960*

497. RESULTS OF THE OCCULTATION OF REGULUS BY VENUS, JULY 7, 1959
de Vaucouleurs, G. H., Menzel, D. H.
*Nature*, v. 188, no. 4744, pp. 28–33, October 1, 1960

Geometric and photometric data are tabulated, and a tentative atmospheric model of Venus is derived. (*AI/S*, 1960, #23,511)

498. THE MARKINGS OF VENUS
Firsoff, V. A.
*British Astronomical Association, Journal of the*, v. 70, no. 8, pp. 359–360, October 1960

Comments on observations made by Patrick Moore and P. J. Cattermole are presented. (*AJ*, 1960, #8215)

499. LE OSSERVAZIONI VISUALI DI VENERE (VISUAL OBSERVATIONS OF VENUS)
Tronfi, A.
*Coelum*, v. 28, pp. 174–175, 1960
(*AJ*, 1960, #8240)

500. ÉTUDE PHOTOGRAPHIQUE DE VÉNUS EN LUMIÈRE VIOLETTE ET ULTRA-VIOLETTE (PHOTOGRAPHIC STUDY OF VENUS IN VIOLET AND ULTRAVIOLET LIGHT)
Dollfus, A., Boyer, C., Camichel, H.
*l'Astronomie*, v. 74, pp. 375–381, 1960
(*AJ*, 1960, #8212)

501. VENUSDURCHGÄNGE IN VERGANGENHEIT UND GEGENWART (VENUS TRANSITS OF PAST AND PRESENT)
*Monatsschrift für Österreichs Amateurastronomen—Der Sternenbote*, v. 3, pp. 119–120, 1960
(*AJ*, 1960, #8248)

502. ERFAHRUNGEN UND ERGEBNISSE BEI DER BEOBACHTUNG DES PLANETEN VENUS (EXPERIENCES AND RESULTS OF THE OBSERVATION OF THE PLANET VENUS)
Oberndorfer, H.
*Die Sterne*, v. 36, pp. 142–150, 1960
(*AJ*, 1960, #8234)

503. NACHTHIMMELLEUCHTEN AUF DER VENUS (NIGHT-SKY LUMINESCENCE ON VENUS)
*Die Sterne*, v. 36, p. 211, 1960
(*AJ*, 1960, #8247)

504. VENUS FROM SUPERIOR CONJUNCTION, 1957, THROUGH SUPERIOR CONJUNCTION, 1958
Bartlett, J. C., Jr.
*Strolling Astronomer*, v. 14, pp. 167–179, 1960
(*AJ*, 1960, #8209)

505. PLANETEN VENUS (THE PLANET VENUS)
Lodén, K.
*Populär Astronomisk Tidskrift*, v. 41, pp. 105–111, 1960

A nontechnical review is presented of the investigation of the physical relationships of the planet Venus, with special consideration given to the most recent results of Menzel, Whipple, Lyot, Kuiper, and Kosyrev. In addition, the attempts to determine the distance of Venus by radar are discussed in some detail. (*AJ*, 1960, #8227)

506. THE ENIGMA OF VENUS
Martynov, D. Ya.
*Priroda*, v. 49, no. 10, pp. 8–15, 1960 (in Russian)
(*AJ*, 1960, #8229)

507. THE PLANET VENUS
Gomólka, B.
*Urania, Polskie Towarzystwo Milósników Astronomii*, Kraków, v. 31, pp. 176–179, 1960

The fact is emphasized, in this nontechnical article, that the principal problems of the physical structure of the planet remain unsolved to date. (*AJ*, 1960, #8216)

508. ZUR DICHOTOMIE DER VENUS (ON THE DICHOTOMY OF VENUS)
Brustat, J.
*Mitteilungen für Planetenbeobachter*, v. 13, p. 30, 1960
(*AJ*, 1960, #8210)

509. VENUS—BEOBACHTUNGEN 1959 (VENUS—OBSERVATIONS 1959)
Langenbeck, U.
*Mitteilungen für Planetenbeobachter*, v. 13, pp. 47–48, 1960
(*AJ*, 1960, #8226)

### *General — 1961*

510. ELECTRON IMAGE AMPLIFIER FOR APPLICATIONS IN ASTRONOMY
Lewin, G.
*Review of Scientific Instruments*, v. 32, no. 2, pp. 206–207, February 1961

A Lallemand image amplifier is provided with a differential thermal-expansion valve between the photographic and photo-electronic sections, making possible the use and exchange of photographic plates without impairing the photo-emissive surface. With the use of a very weak ion pump, it is estimated that the photo-emissive surface will not deteriorate for several months. (*PA*, 1961, #5123)

511. PHOTOGRAPHY OF LUMINOUS EXTENDED OBJECTS AGAINST A TWILIGHT SKY
Levy, R. J., Manring, E. R.
March 1961
Geophysics Corporation of America, Bedford, Mass.
GCA TR-61-4-N

Filter and film types for discrimination of the various wavelengths are discussed. Developing techniques to insure the required contrast and photographic latitude are considered. Film calibration and processing for subsequent densitometry are described. Consideration is given to the changing background intensities encountered during twilight, and to the optimum exposure under these various conditions. (*AI/A*, 1961, #4080)

512. OPTICAL SYSTEM FOR LARGE TELESCOPES
Rosin, S.
*Optical Society of America, Journal of the*, v. 51, no. 3, pp. 331–335, March 1961

An optical system composed of a large primary mirror and a closely spaced two-element lens system in the convergent beam delivers a high-quality image over a flat field of appreciable size. The mirror is hyperboloidal in form. (*PA*, 1961, #4445)

513. FLAT-FIELDED MAKSUTOV-CASSEGRAIN OPTICAL SYSTEMS
Waland, R. L.
*Optical Society of America, Journal of the*, v. 51, no. 3, pp. 359–366, March 1961

Theoretical and experimental studies are discussed of optical systems suitable for astronomical photography, using a pierced primary concave and a secondary convex mirror, with the smallest number of correcting lenses to cancel out aberrations resulting from use of spherical or nearly spherical mirrors. The field covered is just under 4 deg. (*EI*, 1961)

514. THE PERFORMANCE OF A NUMBER OF PHOTOGRAPHIC MATERIALS WHEN USED FOR STAR TRAIL PHOTOGRAPHY
Husbands, C. W.
March 1961
Royal Aircraft Establishment, Farnborough, Great Britain
TN-T.D. 59

A method and apparatus for investigating the performance of photographic materials for star trail photography are described, and the results obtained from a number of emulsions are given.

515. PHOTOGRAPHY OF SPACE ROCKETS
Lozinskii, A. M.
*Soviet Astronomy—AJ*, v. 4, no. 5, pp. 876–877, March–April 1961

A device which enables the Abele calibrated plate holder to be effectively used for photographing space rockets is described. (*AI/S*, 1961, #31,270)

516. PROBLEMS IN FUTURE TELESCOPE DESIGN
Bowen, I. S.
*Astronomical Society of the Pacific, Publications of the*, v. 73, pp. 114–124, April 1961

Future telescopes will be used chiefly with photoelectric devices rather than with direct-photography instrumentation. Careful consideration should therefore be given to the developing information on these devices in the design of any future major telescopes. Present predictions as to the properties of image intensifier tubes suggest that future telescopes should be designed with primaries of low focal ratio and with provision, at the prime or Newtonian focus, for image tubes and enlarging equipment to handle plates of substantial size. They also point to a return to lens optics for spectrographs and to the use of echelle gratings for the higher dispersions. (*PA*, 1961, #15,399)

517. THE LIMITING DETECTIVITY OF OPTICAL AMPLIFYING EQUIPMENT
Gebel, R. K. H., Devol, L.
April 1961
Wright Air Development Division, Aeronautical Research Laboratory, Wright-Patterson AFB, Ohio
ARL-17, Report on Research on the Quantum Nature of Light (supersedes WADC TN 59-405, AD-239,553)
AD-260,219
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The limitations in the ability to produce photographic recordings for visual detection of very faint celestial bodies in the presence of the sky background by using conventional photography and by employing optical amplification with contrast enhancement and high-capacity storage-target plates are investigated and compared. Equations are given which show the effects of the different variables involved for three types of imaging systems: (1) the conventional photographic system, (2) the image converter, and (3) the closed circuit television type of optical amplifier. The third system was found to be superior.

518. OPTICAL ASTRONOMICAL SEEING. A REVIEW
Wimbush, M. H.
May 1961
Hawaii Institute of Geophysics, Honolulu
Scientific Report 1, Report 16, AFCRL-697, AF 19(604)-2292
AD-265,402
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Certain optical disturbances which hinder astronomical work are ascribed to turbulence in the Earth's atmosphere, and are designated seeing effects. These effects are described and classified, and from empirical observations their relations to various parameters, including atmospheric conditions, are discussed. It is shown that the available data can be accounted for by supposing that while the turbulence responsible for seeing effects is present throughout the lower part, at least, of the Earth's atmosphere, it is particularly strong in certain layers. Typically, there are two of these layers—one near the ground and the other near the tropopause. Particulars are given of two important applications: (1) the selection of a site for an astronomical observatory, and (2) the design of telescope and observatory to minimize local air turbulence and so minimize image motion. Methods of measuring astronomical seeing and devices to reduce its harmful effects are described.

519. THE PERFORMANCE OF SOME AIR CAMERA LENSES WHEN USED FOR STAR PHOTOGRAPHY
Husbands, C. W., Benger, P.
May 1961
Royal Aircraft Establishment, Farnborough, Great Britain
TN-T.D. 60

A method is described for testing the suitability of lenses for star-trail photography. Test results for a number of air camera lenses are given and are discussed in relation to the theoretical performance of the lenses. (*AI/A*, 1962, #5197)

520. DARKROOM IN THE SKY; JPL CAMERA
Stuart, J. L.
*Industrial Photography*, v. 10, p. 8, May 1961
(*AS&T*, 1961)

521. AIRBORNE TV SYSTEM TO HELP GUIDE TELESCOPE FLOATING IN STRATOSPHERE
Flory, L. E.
*Electrical Engineering*, v. 80, p. 391, May 1961
(*AS&T*, 1961)

522. PHASE CURVES AND ALBEDOS OF TERRESTRIAL PLANETS
de Vaucouleurs, G. H.
June 1961
Geophysics Corporation of America, Bedford, Mass.
GCA TR-61-26-A
AD-261,165

This study was undertaken as part of an investigation of navigation within the solar system by optical means. The objective of the investigations was to evaluate the suitability of various physical phenomena as sources of navigational information and to estimate the accuracy of navigational information obtained by various techniques. Ten figures and seven tables are included. (*AI/A*, 1963, #71,949)

523. HEADQUARTERS, SPACE COMMAND
Badler, M. M.
*Industrial Photography*, v. 10, no. 6, pp. 28, 30, 62, June 1961
(*AI/S*, 1961, #40,607)

524. VISUAL OBSERVATIONS OF THE PLANETS WITH COLOUR FILTERS—ILLUSION AND REALITY
Firsoff, V. A.
*Discovery*, v. 22, no. 6, pp. 230–236, June 1961
(*AI/S*, 1961, #40,613)

525. AURORA AND AIRGLOW FROM COLOUR FILM OBSERVATIONS
Sandford, B. P.
*Journal of Atmospheric and Terrestrial Physics*, v. 21, no. 2–3, pp. 177–181, June 1961

Color photography is used as a tool for studying auroral glows not observable visually or on black-and-white film. (*AI/S*, 1961, #40,471)

526. SUPPORT PHOTOGRAPHY
*Industrial Photography*, v. 10, no. 6, pp. 26–27, 94–95, June 1961
(*AI/S*, 1961, #40,608)

527. A NEW TECHNIQUE IN THE USE OF THE ELECTRONIC CAMERA
Duchesne, M.
*Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 253, no. 3, pp. 417–419, July 17, 1961
(in French)

To obviate some of the major difficulties involved in dismantling and reloading the Lallemand camera between exposures at the telescope, a new technique is described in which activated charcoal is used to maintain the high vacuum necessary for the proper functioning of the camera. During a night's operation a vacuum better than $10^{-7}$ torr can be maintained without difficulty. (*PA*, 1961, #17,990)

528. OPTICAL REFRACTION IN A PLANETARY ATMOSPHERE WITH APPLICATION TO THE APPARENT DIAMETER OF A PLANET AND TO OCCULTATION
Menzel, D. H.
July 1961
Geophysics Corporation of America, Bedford, Mass.
GCA TR-61-33-A
AD-261,170

This study was undertaken as part of an investigation of navigation within the solar system by optical means. (*AI/A*, 1962, #5088)

529. PROJECT STRATOSCOPE; BALLOON-BORNE CAMERAS AND TELESCOPES
Hughes, J.
*Industrial Photography*, v. 10, p. 28, August 1961
(*AS&T*, 1961)

530. AUTOMATIC FIXED-CAMERA ORIENTATION PROCEDURES
Bannister, C. L.
August 1961
National Aeronautics and Space Administration, Washington, D. C.
TN D-607

Spatial triangulation employing two or more fixed cameras which record the same flash event is used to determine the precise position of a vehicle or missile-borne flash. The triangulation procedure requires that the position and calibration of the cameras used must be accurately known. An accurate position may be found by survey. The cameras are fixed phototheodolites with electronic shutter control. Since they are employed at night, the star backgrounds recorded on the camera plates provide an excellent means of obtaining precise analytical calibrations by a method known as star calibration. This paper presents the formulas for this method of calibration as programmed for the IBM-7090 computer. Briefly, the program uses the camera dial settings, the times of the exposures, and the measurements of the star images on the plate to identify the stars automatically and execute a least-squares solution to obtain an essentially error-free camera orientation calibration. (*AI/A*, 1961, #4395)

531. CAMERA PHOTOGRAPHS PLANETS, SATELLITES IN DAYLIGHT
*Journal of the Franklin Institute*, v. 272, no. 2, pp. 159–160, August 1961

The camera consists of 19 long-barrelled 5-in. refracting telescopes linked to 19 image-orthicon tubes. Images are transmitted to indoor viewing screens and photographed.

532. NEW FRONTIERS OF ASTRONOMICAL TECHNOLOGY
Meinel, A. B.
*Science*, v. 134, pp. 1165–1171, October 20, 1961

The problems and developments of astronomical instrumentation are surveyed in the light of space research. (*PA*, 1962, #2519)

533. AN ALL-SKY CAMERA FOR AURORAL PHOTOGRAPHY
Park, F. R.
*Royal Astronomical Society of Canada, Journal of the*, v. 55, no. 5, pp. 203–210, October 1961

Problems which limited the usefulness of cameras previously designed for all-sky auroral observations are enumerated. A newly designed camera for this purpose is described. (*AI/S*, 1962, #50,215)

534. EXTRA-TERRESTRIAL TV
Gernsback, H.
*Radio-Electronics*, v. 32, p. 33, October 1961
(*AS&T*, 1962)

535. CONFERENCE ON OPTICAL INSTRUMENTS AND TECHNIQUES—LONDON 11–14 JULY 1961
Bates, W. J.
*Journal of Scientific Instruments*, v. 38, no. 1, p. 417, November 1961

A report is given of a conference arranged by the British National Committee for Optics under the auspices of the International Commission for Optics. About 200 people were present, drawn from 22 countries. The topics covered were extremely diverse, the emphasis being on modern developments, for example (1) the optical systems associated with rocket and satellite programs, and (2) optical masers. (*PA*, 1961, #18,585)

536. TECHNIQUES TOMORROW; CAMERA FOR USE IN SPACE
Sherman, B.
*Modern Photography*, v. 25, pp. 24–25, November 1961
(*AS&T*, 1962)

537. MINIATURE TV RECORDER FOR SPACECRAFT
*Flight*, v. 80, no. 2755, p. 979, December 28, 1961
(*AI/S*, 1962, #50,276)

538. LIMITATION IN DETECTION OF CELESTIAL BODIES EMPLOYING ELECTRONICALLY SCANNED PHOTOCONDUCTIVE IMAGE DETECTORS
Gebel, R. K. H.
December 1961
Wright Air Development Division, Office of Aerospace Research, Aeronautical Research Laboratory, Wright-Patterson AFB, Ohio
ARL-153
AD-276,417

Theoretical limitations in the detection of celestial bodies by means of photoconductive sensors are investigated. Applicable simplified basic equations are derived for the maximum apparent magnitude number of a celestial body that is detectable with the commercially available vidicon tube, assuming the most optimistic conditions, and as determined by background radiation during the day and the night, load resistor noise, and other practical limitations. The equations are extended to cover the possible gain in sensitivity obtainable by using preamplification with additional image converter type tubes, and by integration over several scanning fields. The schematics of an easily constructed, very sensitive experimental vidicon system used for the investigation are appended.

539. ELECTRONIC AND MOTION-PICTURE SYSTEMS IN THE SPACE AGE
Kreuzer, B.
*SMPTE, Journal of the*, v. 70, no. 12, pp. 961–966, December 1961

The role of the motion picture and television industries in space exploration is expounded. (*AI/S*, 1962, #50,608)

540. TOOLS OF THE ASTRONOMER
Miczaika, G. R., Sinton, W. M.
Harvard University Press, Cambridge, Mass., 1961

541. MINIMUM POWER WIDEBAND COMMUNICATION SYSTEM FOR SPACE VEHICLES (Presented at the 1961 National Telemetering Conference, Chicago, Ill., May 22–24, 1961)
Gagliardi, R. M., Miller, T. (Hughes Aircraft Company, Culver City, Calif.)
In "Proceedings of the National Telemetering Conference," pp. 10-11–10-29
Institute of the Aerospace Sciences, Inc., New York, N.Y., 1961

This study was aimed at determining the most favorable form of modulation, in the interests of transmitter power reduction, for application to a wideband, high resolution Moon-to-Earth television link. With specified system parameters, including a picture frequency of the order of 1/sec, the following types of modulation are considered: FM, FMFB (frequency modulation with negative feedback), SSB, AM, PCM, digilock coding and error-corrected PCM. With FMFB, frequency feedback is employed at the receiver to maintain the effective IF filter bandwidth, preceding the discriminator, at approximately twice the video bandwidth, regardless of the modulation index employed at the transmitter. This system, occupying a bandwidth of 4.4 Mc, appears to require one fifth the power demanded by any other and would be the most favorable for applications of medium accuracy. For the highest accuracy, a digital technique might be necessary. (*EEA*, 1962, #13,800)

542. EARTH AND PLANETS SEEN FROM A SPACE VEHICLE. A STUDY IN PERSPECTIVE
Burdecki, F.
*Astronomical Society of Southern Africa, Monthly Notes of the*, v. 20, no. 10, pp. 125–133, 1961

The fundamental characteristics of the azimuthal perspective projection, represented by photographic pictures of the Earth's surface taken from a space vehicle, are presented. The results of the study are applied also to observations and photographs of the surface of any planet or moon of the solar system. Tables of selected angles and distances of the "points of origin" of the projection are computed. The use of the tables is explained. (*PA*, 1962, #2573)

543. ASTRONOMICAL PHOTOGRAPHY; FROM THE DAGUERREOTYPE TO THE ELECTRON CAMERA
de Vaucouleurs, G. H.
Wright, R., Translator
The Macmillan Company, New York, N. Y., 1961

### *Jupiter — 1961*

544. THE CONCEPTUAL DESIGN OF A NUCLEAR ELECTRIC POWER SPACECRAFT FOR THE EXPLORATION OF JUPITER
Beale, R. J.
May 24, 1961
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TR 32-115
AD-257,754

The conceptual design of a Jupiter capture spacecraft which utilizes the electrical power output of 1.3 Mw from a nuclear power source to drive an ion engine is described. Starting with a gross spacecraft weight of 45,000 lb in a 300-nm Earth orbit, the tradeoff between terminal mass at Jupiter and flight time to Jupiter utilizing the electric propulsion system is shown. A summary of typical system weights and power requirements is listed, and a sequence of operations is described, beginning with reactor startup in the Earth orbit, following through to the power switchover from the thrust unit, to the scientific experiments upon arrival at the target planet. The high power level available at the completion of the thrust period is utilized to operate a high-powered wide bandwidth transmitter which will allow for transmission of high quality video pictures back to Earth.

545. RECENT DECAMETER-WAVELENGTH OBSERVATIONS OF JUPITER, SATURN AND VENUS
Carr, T. D., Smith, A. G., Bollhagen, H., Six, N. F., Jr., Chatterton, N. E.
*Astrophysical Journal*, v. 134, no. 1, pp. 105–125, July 1961

Decameter-wavelength radio observations of Jupiter, Saturn, and Venus were made at a number of frequencies from both northern and southern hemispheres of the Earth during 1959 and 1960. While the results are negative for Venus and inconclusive for Saturn, extensive nonthermal radio noise was recorded in the case of Jupiter. The observations permitted a redetermination to be made of the rotational period of the Jovian radio sources, and a statistical analysis was made of the polarization of the noise bursts. Jupiter radio outbursts showed a maximum probability of occurrence near a frequency of 18 Mc, with individual pulses displaying spectral widths of less than 1 Mc. Overall Jovian activity showed an inverse correlation with sunspot number, although there is evidence that individual noise storms may be triggered by solar particles. Photoelectric observations made of Jupiter during radio-noise storms showed no light variations within the sensitivity limits of the equipment used. (*PA*, 1961, #11,685)

### *Mars — 1961*

546. SOURCES OF AREOGRAPHIC COORDINATES. 1909–1954
de Vaucouleurs, G. H., Wright, R.
February 25, 1961
Harvard College Observatory, Cambridge, Mass.
Scientific Report 2, AFCRL-257, AF 19(604)-7461
AD-253,186

All published areographic coordinates measured since 1909 were compared and cross-identified after a thorough search for usable data was made in the existing Mars literature. The collected data for 586 points of the Mars surface were found to contain various errors of measurement and identification, which were corrected in the individual notes, and which were taken into account in compiling a basic master map and list of points.

547. A STUDY OF THE OPTICAL SYSTEM FOR A MARS PROBE
de Vaucouleurs, G. H., Baker, J. G.
June 30, 1961
Harvard College Observatory, Cambridge, Mass.
Final Report

This report is arranged in chapters as follows: "Photometric Parameters of Mars," by G. H. de Vaucouleurs; "Trajectory Relationships Affecting the Choice of Optical System for a Mars Probe," by J. G. Baker; "A Comparative Study of Optical Systems for a Mars Probe," by J. G. Baker; and an appendix, "Planetary Telescopes," by J. G. Baker. (*AI/A*, 1961, #4602)

548. FIRST DEEP-SPACE TELEVISION DESCRIBED
*Electrical Engineering*, v. 80, no. 7, p. 560, July 1961

A method for receiving television from deep-space vehicles probing Mars and beyond was described at the National Symposium on Global Communications. (*AI/S*, 1961, #40,503)

549. POSITIONS OF MARTIAN SURFACE FEATURES — 1960–1961
Chapman, C. R.
*Strolling Astronomer*, v. 15, no. 7–8, pp. 118–120, July–August 1961

Areographic positions of some of the surface features on Mars are listed. (*AI/S*, 1962, #50,293)

550. AREOGRAPHIC COORDINATES FOR 1958
de Vaucouleurs, G. H.
August 1961
Harvard College Observatory, Cambridge, Mass.
Scientific Report 4, AFCRL-818, AF 19(604)-7461, AF 19(604)-3074
AD-261,529
(Also available through U. S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Areographic coordinates of 546 points of the surface of Mars derived from 2321 measurements on 32 drawings made in October and November 1958 are listed. Longitudes are corrected for phase effect. Probable errors are of the order of 1 deg or 60 km on Mars. Comparisons are made with longitudes derived from transit observations in 1939, 1941, and 1958. Reduction constants to a system of absolute longitudes are given.

551. PREMIÈRES PHOTOGRAPHIES DE MARS OBTENUES AU TÉLESCOPE DE 193 CM DE L'OBSERVATOIRE DE HAUTE-PROVENCE (FIRST PHOTOGRAPHS OF MARS TAKEN BY THE 193 CM TELESCOPE AT THE HAUTE-PROVENCE OBSERVATORY)
Guérin, P.
*l'Astronomie*, v. 75, pp. 331–333, September 1961
(*AI/S*, 1962, #50,091)

552. ATMOSPHERE OF MARS. REVIEW OF SOVIET LITERATURE (Chapter III of a Study of Soviet Research on the Atmospheres of Venus, Mars, and the Moon)
October 31, 1961
Library of Congress, Aerospace Information Division, Science and Technology Section, Washington, D.C.
AID 61-138
AD-266,481
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Soviet findings and opinions are reviewed on the nature of the Martian atmosphere as based upon visual, photographic, and spectroscopic studies antecedent to the launching of a rocket probe. The report is based on materials available at the Library of Congress.

553. RECONNAISSANCE OF THE NEARER PLANETS — A SURVEY OF PLANETARY PROBLEMS IN THE SPACE AGE
de Vaucouleurs, G. H.
November 1961
Air Force Office of Scientific Research, Washington, D.C.
AFOSR/DRA-61-1

The first part of this report summarizes the best present information on the planets Mercury, Venus, and Mars, gained almost entirely from ground-based observatories. The second part outlines how these methods could be extended to observations from balloon observatories, and especially from space probes and orbiters in the immediate vicinity of the planets. (*AI/A*, 1962, #60,435)

554. SURFACE FEATURES ON MARS IN 1956 AS OBSERVED FROM JAPAN
Saheki, T., Sato, T.
*Strolling Astronomer*, v. 15, no. 11–12, pp. 191–202, November–December 1961

The observation of Mars during its closest approach in 1956 is reported by the members of the Mars Section of the Oriental Astronomical Association. The surface markings of the planet are the main consideration. (*AI/S*, 1962, #50,292)

555. BLUE CLEARING DURING THE 1960–61 MARS APPARITION
Smith, B. A. (New Mexico State University, Research Center, University Park)
*Astronomical Society of the Pacific, Publications of the*, v. 73, no. 435, pp. 456–459, December 1961

During the 1960 to 1961 Mars apparition, the New Mexico State University Research Center conducted a photographic study of Mars in red, blue, and ultraviolet light. Blue clearing and an extensive network of fine and coarse lines on blue and ultraviolet plates were recorded. Blue plates of sufficiently good quality for determination of blue clearing were obtained. Opposition of Mars occurred on December 30, 1960, and a higher percentage of dates of blue clearing occurred following this date. This survey, at an effective wavelength of $\lambda$ 4500, recorded many blue images with complete obscuration, but found none that showed complete visibility of surface markings. The survey does indicate that partial weak clearings are probably more common than is generally supposed. (*IAA*, 1963, N63-11920)

556. THE ATMOSPHERES OF MARS AND VENUS (A report by the Ad Hoc Panel on Planetary Atmospheres of the Space Science Board)
Kellogg, W. W., Sagan, C.
1961
National Academy of Sciences, Washington, D.C.
Publication 944

A conference on planetary atmospheres, with special reference to Mars and Venus, was held by the Space Science Board of the National Academy of Sciences on June 24, 1960 at Arcadia, California. The purpose of the conference was to discuss the present state of knowledge of planetary atmos-

pheres, as known from ground-based observations, to consider the most important characteristics about which additional information is needed, and to discuss space experiments that best promise to yield such information.

In view of the importance of the subject, and as a sequel to the Arcadia conference, the Board appointed an Ad Hoc Panel to study, in greater detail, the state of knowledge and some of the controversies concerning planetary atmospheres and to explore experimental approaches most likely to lead to the resolution of these controversies. This is the report of the panel.

The following papers are included as an appendix:

"Direct Photography in the Exploration of Planetary Atmospheres," by A. G. Wilson

"Visual and Photographic Observations of Venus and Mars," by C. W. Tombaugh

"Radio Frequency Radiometry of the Planets," by B. F. Burke

"Potentialities of Radar for the Study of Planetary Atmospheres," by V. R. Eshleman

"Observations With Satellite-Substitute Vehicles," by J. Strong

"Spacecraft Experiments on Planetary Atmospheres," by R. W. Davies, A. R. Hibbs, G. Neugebauer, R. L. Newburn

"Interpretation of Planetary Probe Measurements," by L. D. Kaplan

"The General Circulation of Planetary Atmospheres," by Y. Mintz

"The Interpretation of Ultraviolet Spectra of Planetary Atmospheres and the Near-Infrared $CO_2$ Bands of Venus," by J. W. Chamberlain. (*AI/A*, 1962, #5445)

557. METEOROLOGICAL OBSERVATIONS OF MARS DURING THE 1960–61 OPPOSITION; EROSION ON THE SURFACE OF MARS
**Miyamoto, S., Nakai, Y.**
**1961**
**Kyoto, University of, Institute of Astrophysics and Kwasan Observatory, Japan**
**Contributions 105, 106**

In this report, the meteorological phenomena of Martian atmosphere during the 1960–1961 opposition secured by the visual and photographic observations at the Kwasan Observatory have been described. The first two sections are concerned with the general appearance of the surface markings in this opposition. Three dark belts, namely, through Nodus Laocoontis-Sinus Gomer, Nilokeras-Lunae Lacus, and Cerberus-Propontis, connecting the northern and southern hemisphere, were remarkably developed. The remaining parts are concerned with the records and interpretations of the meteorological phenomena.

## *Mercury — 1961*

558. MERCURY IN 1960
Gaherty, G., Jr.
*Strolling Astronomer*, v. 15, no. 11–12, pp. 187–191, November–December 1961

This report covers the period from January 26, 1960 to January 5, 1961 in which a total of 75 drawings and 23 sets of intensity estimates were made. (*AI/S*, 1962, #50,298)

## *Moon — 1961*

559. A NOTE ON THE POSSIBILITY OF PHOTOGRAPHING A SATELLITE NEAR THE MOON
Courtney-Pratt, J. S.
*Journal of Photographic Science*, v. 9, no. 1, pp. 36–55, January–February 1961

It would be desirable when a missile is sent to the Moon to be able to determine the point of impact. Optical methods are possible. The light levels are considered with regard to the photographic requirements. Calculations are presented of the light reflected by a matt white spherical satellite near the Moon. The brightness of the image of the satellite in a photographic telescope is compared with the brightness of the image of the Moon. Quantum considerations would in any case set a lower limit to the size of the satellite that could just be detected. Recent work on the granularity of photographic emulsions, and on probability criteria for detection of a signal in the presence of noise, shows that a photographic emulsion falls far short of an ideal detector. Nevertheless, it would certainly be possible with any of a number of existing telescopes to detect small satellites with a high degree of certainty. The minimum satellite radii for a number of particular cases for photographic detection against the sunlit side of the disk of the Moon are given, together with the more interesting results of minimum satellite radii for detection against, as background, the dark, or earthlit, side of the Moon. It is shown that with any of a number of existing telescopes, by proper choice of emulsion and exposure conditions, it would be possible to record and detect satellites with radii less than one meter. However, half of this figure would be about the extreme limit. (*PA*, 1961, #2669)

560. MERIDIAN OBSERVATIONS OF THE MOON, 1958–1959
Adams, A. N., Bestul, S. M.
*Astronomical Journal*, v. 66, no. 1, p. 36, February 1961

Latitude and longitude residuals from ephemeris lunar positions are given for the lunations of 1958–1959. (*PA*, 1961, #4190)

561. U.S. CHARTS SURFACE OF MOON
LaFond, C. D.
*Missiles and Rockets*, v. 8, no. 14, pp. 34–35, April 3, 1961 (*AI/S*, 1961, #31,269)

562. THEORETICAL AND EXPERIMENTAL PROCESSING OF LUNAR TELEVISION PICTURES
Lorens, C. S., Boehmer, A. M., Gallagher, J.
May 23, 1961
Space-General Corporation, El Monte, Calif.
SGC-203R-1, Bimonthly Report 1

The extraction of data from a picture rather than the conventional enhancement and suppression processing is reported. The pictures under consideration are sampled lunar pictures. A broad outline is presented covering possible linear and nonlinear theoretical and experimental work which can be made applicable to processing lunar pictures. The theoretical material presented is limited to linear processing plus an additive constant. The material includes the general discrete solution, stationary solutions in translation and rotation, construction of artificial pictures having controlled correlation functions, error expressions indicating the limits of linear processing, conditions under which linear processing results in only a scale change, orthogonal pre-processing, and numerous examples of the matrix expressions.

563. PROCEEDINGS OF A CONFERENCE ON PROBLEMS OF LUNAR TOPOGRAPHY, HELD AT BAGNERES-DE-BIGORRE BETWEEN APRIL 19TH AND 23RD, 1960
Kopal, Z., Finlay, E. B., Editors
May 1961
Manchester University, Department of Astronomy, Great Britain
Technical Scientific Note 1, AFCRL-62-645, AF 61(052)-400
AD-277,724
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Consideration was given to some basic problems of lunar surface mapping encountered in connection with the current charting of the Moon by the U.S. Air Force. As a result of the discussions, it was recommended to (1) reduce anew all past heliometric observations of the crater Mosting A by a standard procedure which should improve our present knowledge of the libration constants of the Moon; (2) set up, on the Moon, a system of 100–200 control points of second order, defined by the positions of small craters (5–10 km in diameter) which are sufficiently shallow and geometrically well defined to enable us to measure their positions with sufficient accuracy; (3) employ the lunar plates taken with the Markovitz cameras in the course of the recent IGY to determine the positions of such craters with respect to a fundamental frame of reference as represented by the neighboring stars, in order to determine their absolute three-dimensional coordinates with respect to the Moon's center; (4) use the standard shadow method for the determination of relative heights above the osculating surface of the mean solenoid, between three or more adjacent points of second order; and (5) employ purely photometric methods for the measurement of small gradients for contour maps of the Moon.

564. THE FAR SIDE OF THE MOON
*Discovery*, v. 22, no. 6, pp. 242–245, June 1961

Locations and brief descriptions of formations photographed and named by the Russians in their "Atlas of the Far Side of the Moon" are given. (*AI/S*, 1961, #40,587)

565. SELECTION OF OPTIMUM PARAMETERS FOR LUNAR MAPPING SATELLITE
Duggan, R. S., Jr.
*Western Aviation, Missiles and Space*, v. 41, no. 6, pp. 6–7, 24–26, June 1961
(*AI/S*, 1961, #40,106)

566. PHOTOINTERPRETATION OF LUNAR SURFACE
Hackman, R. J.
*Photogrammetric Engineering*, v. 27, no. 3, pp. 377–386, June 1961
(Also available through U.S. Dept. of the Interior, Geological Survey, Washington, D.C.)

Since photographs taken at different libration positions have angular difference of perspective, stereoscopic interpretive methods may be applied. The interpreter must adapt to the novelty of extremely small-scale photography and must modify certain procedures and instruments used. Methods of determination of ages are described, as well as development of lunar features. Generalized geologic and physiographic maps at a scale of 1:3,800,000 are discussed. More detailed maps at a scale of 1:1,000,000 are being made. (*EI*, 1961)

567. PHOTO TOPOGRAPHY FOR 1:1,000,000 LUNAR CHARTS
Carder, R. W.
*Photogrammetric Engineering*, v. 27, no. 3, pp. 386–390, June 1961

A compilation is provided of 1:1,000,000 scale lunar charts at the Aeronautical Chart and Information Center, St. Louis, Mo. New techniques for determining heights of lunar features through shadow measurements are discussed. Work is supplemented by visual observations carried out at the Lowell Observatory, Flagstaff, Ariz., and by extensive photographic material provided by the Pic du Midi Observatory in the Pyrenees Mountains of southern France, including prolonged cinephotography of the whole of the visible Moon on 9-in. aerial film. (*EI*, 1961)

568. OBSERVING THE MOON — LASSELL
Herring. A. K.
*Sky and Telescope*, v. 22, no. 1, p. 33, July 1961

A brief description of the small crater Lassell is presented. (*AI/S*, 1961, #40,329)

569. PROCEEDINGS OF LUNAR AND PLANETARY EXPLORATION COLLOQUIUM, VOLUME II, NUMBER 3
August 15, 1961
North American Aviation, Inc., Space and Information Systems Division, Downey, Calif.
AD-264,352

The proceedings are divided into the following sections: Lunar Physics and Topography; Planetary Studies; Lunar Experiments–Physical and Biological, and Lunar Exploration Vehicles. (*AI/A*, 1961, #4514)

570. SURVEYOR ELEVATED TELEVISION EXPERIMENT
Rennilson, J. J.
September 11, 1961
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TM 33-56

The instrumentation for the television experiment of the *Surveyor* program, as presently envisioned, consists of four fixed cameras, three of which are located around the spacecraft at intervals of approximately 120 deg. The fourth camera is positioned in a downward manner and is used mainly for approach pictures. An added optical system in conjunction with one of the three upper cameras forms high-resolution pictures of a 120-deg sector in the vicinity of the spacecraft. Since the position of the television cameras restricts observation primarily to a small area of the lunar surface, the investigation of the feasibility of extending the television system to greater heights (i.e., greater area) was initiated.

An engineering study of the feasibility of an elevated television system was done for the Jet Propulsion Laboratory by Hughes Aircraft Co. A summary of this study is included. A resultant configuration provides for two television cameras mounted one meter apart on a bar raised above the lunar surface by an extensible boom. The bar is rotatable in azimuth and elevation for accomplishing the scanning. One camera contains a zoom lens of the same type as in the first configuration (variable from 25- to 100-mm focal length) and the second contains a different zoom-type lens with a range of 100 to 400 mm. (*AI/A*, 1961, #4455)

571. HIGH-CONSTANT ELECTRONIC IMAGE-ORTHICON TECHNIQUE APPLIED TO THE LUNAR SURFACE
(Presented at the 108th Meeting of the American Astronomical Society, Maria Mitchell Observatory, Nantucket, Mass., June 18–21, 1961)
Aikens, R. S., Powers, W. T., Hynek, J. A.
*Astronomical Journal*, v. 66, no. 7, p. 277, September 1961
(Abstract)
(*AI/S*, 1961 #40,939)

572. TOPOGRAPHIC LUNAR MAPPING AT THE ARMY MAP SERVICE
Nowicki, A. I.
September 1961
Army Map Service, Washington, D.C.
TR 37
AD-265,049
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

With the advent of the space age and subsequent studies suggesting the possibility of landings on the Moon, the requirements for a topographic lunar map became apparent. This report describes the steps taken by the Army Map Service, Corps of Engineers, U.S. Army, to prepare such a map, in two sheets, of the visible surface at a scale of 1:5,000,000 with 1000-m contours (plus 500-m auxiliary contours) on a modified stereographic projection.

573. AUTOSTEREOSCOPIC LUNAR PHOTOGRAPHY
Dudley, L. P.
*SMPTE, Journal of the*, v. 70, no. 10, pp. 799–803, October 1961

When soft, manned landings on the Moon become practicable, efficient visual aids for group briefing and topographic instruction will be needed. The production of autostereoscopic photographs from information transmitted from an orbiting space vehicle is discussed. (*AI/S*, 1961, #41,360)

574. THE MOON TODAY, AN OBJECT OF INTERNATIONAL EXPLORATION
Kopal, Z.
*ICSU Review*, v. 3, no. 4, pp. 173–183, October 1961
(*AI/S*, 1962, #50,109)

575. COMMUNICATION SYSTEMS ANALYSIS FOR LIGHTWEIGHT ROVING LUNAR VEHICLE
Dunn, G. L.
November 2, 1961
General Electric Company, Santa Barbara, Calif.
R-61 SPC-4
AD-273,812
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Efforts were made to determine the transmitter power requirements as a function of data transmission rate for the *Prospector* Moon-to-Earth TV link. An analysis based on the utilization of PCM-PS modulation at an RF carrier frequency of 2250 Mc is presented. The ground-based receiver station utilizes the DSIF equipment. The video input is obtained from the output terminals of an image orthicon camera located aboard the tank. The maximum data rate assumed is $1.5 \times 10^6$ bits/sec, i.e., 1000 vertical lines, 500 horizontal lines, and eight levels of grey. The video output from the communications system consists of a train of binary pulses that will have a digit error of 1 in 100,000.

576. SCIENTIFIC EXPERIMENTS FOR RANGER 3, 4, AND 5
December 5, 1961
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TR 32-199
AD-269,878

Descriptions are presented of the scientific experiments to be carried on *Ranger 3, 4,* and *5* spacecraft, the first spacecraft designed to land operating instrument packages on the Moon's surface. The experiments include a vidicon camera to obtain close-up pictures of the Moon's surface and show small-scale geological land forms and features. A gamma-ray experiment will determine the approximate concentration of the different radioactive materials present in the surface of the Moon. An altimeter will obtain radar reflectivity data. These data should be valuable in the determination of the lunar surface structure. A seismometer will be landed to obtain data regarding the inner structure of the Moon and the magnitude and depth of any thermal activity.

577. STUDIES IN LUNAR TOPOGRAPHY
Kopal, Z.
December 1961
Manchester University, Department of Astronomy, Great Britain (in cooperation with the Observatoire du Pic du Midi, France)
GRD Research Note 67, AFCRL-852, AF 61(052)-168
AD-275,135
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

This study covers the following:

Determination of the Heights of Mountains on the Moon. (See Entry #297)

Techniques of Photographic Determination of the Heights of Lunar Mountains, With Application to the Region of Theophilus. (See Entry #300)

Errors Involved in the Photographic Determination of Lunar Heights, and a Preliminary Study of the Region of Ptolemaeus and Alphonsus. (See Entry #301)

Measured Profiles of the Moon's Surface and the Estimates of Magnitudes of the Errors in Relative Altitudes.

A Systematic Microdensitometric Technique and Its Application to Formations in the Mare Imbrium. (See Entry #305)

Measured Heights of Lunar Mountains in the Southeastern Part of Mare Tranquilitatis. (See Entry #306)

Measurements of the Heights of the Walls of the Crater Archimedes.

A Catalog of Measured Heights in the Regiomontanus and Hell Plain Regions of the Moon. (See Entry #438) (See also Entry #656)

578. LUNAR TOPOGRAPHY (Presented at the Lunar Flight Symposium, Denver, Colo., December 29, 1961)
Whitaker, E. (University of Arizona, Tucson)
1961
American Astronautical Society, Inc., New York, N.Y.
Paper

All types of lunar surface features down to a size of about one-half mile are listed. Either alone or in various combinations, these topographic features represent over 99 percent of those visible on the lunar surface. (*AI/A*, 1962, #60,855)

579. RESULTS OF STUDIES OF THE FIRST PHOTOGRAPHS OF THE REVERSE SIDE OF THE MOON
Lipskii, Yu. N.
*Iskusstvennye Sputniki Zemli*, no. 9, pp. 3–19, 1961
(Translated from the Russian in *Planetary and Space Science*, v. 9, pp. 565–580, September 1962)

A brief account is given of the methods used in the analysis of the photographs (superposition of negatives, photographic masking, photometric examination). A large number of original photographs are reproduced, together with lunographic charts of surface details deduced from the analysis of the photographs. It is concluded that the Moon is asymmetric with respect to the plane dividing it into the visible and reverse sides: the surface formations are not as extensive on the reverse side as they are on the visible side; however, their nature and structure are the same. In particular, there is no doubt as to the presence of craters. (*PA*, 1962, #17,244)

580. RELIABLE DETECTION OF OBJECTS ON THE FIRST PHOTOGRAPHS OF THE REVERSE SIDE OF THE MOON
Breido, I. I., Markelova, A. A., Shchegolev, D. E.
*Iskusstvennye Sputniki Zemli*, no. 9, pp. 30–40, 1961
(Translated from the Russian in *Planetary and Space Science*, v. 9, pp. 581–588, September 1962)

The aim of this work was to catalog all the objects which have been reliably detected on the first photographs of the reverse side of the Moon, to determine their selenographic coordinates and to obtain a schematic chart of the reverse side of the Moon with an approximate distribution of the "brightness" of the various details. The catalog which is now given includes 107 items. The coordinates of about 20 of these are reported. A schematic halftone chart showing the position of the objects is appended. (*PA*, 1962, #17,246)

581. THE NATURE OF SOME OF THE CHARACTERISTIC DETAILS ON THE MAP OF THE REVERSE SIDE OF THE MOON
Khabarov, A. V.
*Iskusstvennye Sputniki Zemli*, no. 9, pp. 52–55, 1961
(Translated from the Russian in *Planetary and Space Science*, v. 9, pp. 961–968, December 1962)

An examination of photographs of the Moon's other side reveals details which are constant on many frames and which

are undoubtedly features of the lunar surface. A comparison of outlines, dimensions, relative position, etc., leads to theories regarding the physical nature of the Moon. (*AI/A*, 1963, #70,835)

582. SURVEYING AND MAPPING OF THE MOON FROM AN ORBITER
Aschenbrenner, B. C.
*1961 IRE International Convention Record*, pt. 5, v. 9, pp. 69–86, 1961

A lunar satellite carrying a radio altimeter, two television cameras (one looking out from each side of the satellite), a star seeker, a multiple frequency radar, and a gamma spectrometer could obtain the data necessary to prepare lunar maps. These would show the main physical features and the nature of the various rock formations. During a month's observation the whole surface could be mapped to an accuracy of ±125 m laterally and ±50 m in height. The data would be stored and transmitted back on command. (*PA*, 1962, #4732)

583. THE STRUCTURE OF THE LUNAR SURFACE AND A STUDY OF THE FIRST PHOTOGRAPHS OF THE REVERSE SIDE OF THE MOON
Barabashov, N. P.
*Iskusstvennye Sputniki Zemli*, no. 9, pp. 56–61, 1961
(Translated from the Russian in *Planetary and Space Science*, v. 9, pp. 835–840, November 1962; and *AIAA Journal*, v. 1, no. 3, pp. 744–747, March 1963)

Data are analyzed on the structure of the surface of the Moon obtained by telescopic observations as long ago as 1918, and by the October 1959 photographs of the reverse side of the Moon. The most noticeable characteristics of the lunar surface are its low reflective power and the small difference in the color of the various sections of its surface. It is found that the greatest gradation of its albedo (the ratio of the albedo of the darkest places of the lunar surface to the brightest at full-moon) is 1:3.46, in addition to which the brightest regions of the Moon's surface have a luminosity of 0.180, and the darkest regions a luminosity of 0.052. From the examination of the processed photographs, it is concluded that the reverse side of the lunar surface differs from the side which is visible from Earth, since it is covered with a multitude of craters, but there are very few seas. The albedo of many regions on the invisible part of the Moon is considerably increased. The bottom of many of the craters is very dark and is similar in darkness to the darkest regions on the visible side of the Moon. On the reverse side of the Moon, to the south-southeast of Humboldt's Sea, there is a vast and very bright luminous ray emanating from a crater surrounded by a bright radiance. The central peak of some craters is so bright that doubts are raised whether luminescence alone could bring this about. Preliminary investigations show that the porosity (microrelief) of the surface of the invisible side of the Moon is apparently the same, if not greater, as that of the visible side, and that the brightness distribution over the surface of the full-moon is almost a straight line. (*IAA*, 1963, A63-11000)

584. INNER RINGS IN LUNAR CRATERS
Warner, B.
*British Astronomical Association, Journal of the*, v. 71, no. 3, pp. 115–116, 1961
(*AI/S*, 1961, #40,583)

585. ATLAS OF THE FAR SIDE OF THE MOON
(Translation of "Atlas Obratnoi Storony Luny," Akademiia Nauk, SSSR, Moscow, 1960)
Barabashov, N. P., Mikhailov, A. A., Lipskii, Yu. N., Editors
Rodman, R. B., Translator (Harvard College Observatory)
Interscience Publishers, Inc., New York, N.Y., 1961
(Also available as MCL-878/1 + 2 + 3 + 4, Air Research and Development Command, Wright-Patterson AFB, Ohio; R-2914-1-T, University of Michigan, College of Engineering, Ann Arbor; and TT 61-21955, U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The first section of this paper discusses the results of processing of the first photographs of the far side of the Moon. A catalog of the discovered details and an atlas are then presented. The atlas includes integral photographs and photometric cross sections of the photographs of the far side of the Moon, along with a map drawn in an equatorial orthographic projection with the central meridian at 120 deg and to a scale of 1:10,000,000. The map was compiled on the basis of studies of the first photographs of the far side of the Moon obtained by the Soviet automatic interplanetary station.

586. ENGINEER SPECIAL STUDY OF THE SURFACE OF THE MOON
Hackman, R. J., Mason, A. C.
1961
U.S. Department of the Interior, Geological Survey, Washington, D.C.
Miscellaneous Geological Investigations Map 1–351

Charts are given representing a photogeologic analysis of lunar photographs. The approximate scale of 1.3,800,000 was used to show the principal physiographic divisions, the geologic features, and the lunar rays. A table of miscellaneous geologic investigations is included. (*STAR*, 1963, N63-12785)

587. PHOTOGRAPHIC METHODS USED IN OBTAINING THE FIRST PHOTOGRAPHS OF THE REVERSE SIDE OF THE MOON
Antonov, S. M., Bogomolov, K. S., Kirillov, N. I., Ovechkis, N. S., Uspenskii, V. I.
*Iskusstvennye Sputniki Zemli*, no. 9, pp. 20–29, 1961
(in Russian)

The measures are described which were taken to ensure the appearance of maximum possible detail on the first photographs of the reverse side of the Moon. The effect of cosmic radiation on the properties of the emulsions is considered, and a description is given of the methods used to expose the films and process them on board the spaceship. A brief account is

also given of the methods used in the reconstruction of the photographs from telemetric data. (*PA*, 1962, #17,245)

588. ON THE DETERMINATION OF THE NATURE AND STRUCTURE OF DETAILS ON THE REVERSE SIDE OF THE MOON FROM PHOTOGRAPHS OBTAINED AT LOW PHASE ANGLES
Markov, A. V.
*Iskusstvennye Sputniki Zemli*, no. 9, pp. 41–47, 1961
(Translated from the Russian in *Planetary and Space Science*, v. 9, pp. 589–595, September 1962; also available as Translation 15, Scientific Translation Service, Glendale, Calif.)

The Maksutov telescope at the Pulkovo Observatory was used to obtain photographs of the full Moon. The latter were then rephotographed using an optical system identical with that employed to obtain the first photographs of the reverse side of the Moon, and the resulting negatives were exhibited on the screen of a television set. Thus, most of the conditions under which the original photographs of the reverse side of the Moon were obtained were simulated in the laboratory. It was found that this was an adequate method of estimating the reliability with which surface details on the reverse side of the Moon were established. (*PA*, 1962, #17,247)

589. A STUDY OF THE FIGURE OF THE MOON FROM PHOTOGRAPHS OBTAINED NEAR TOPOCENTRIC FULL MOON
Potter, Kh. I., Bystrov, N. F.
*Astronomicheskii Zhurnal*, v. 38, no. 5, pp. 946–953, 1961
(Translated from the Russian in *Soviet Astronomy — AJ*, v. 5, no. 5, pp. 722–727, March–April 1962)

In order to study the figure of the Moon and to check proposed models and also maps of the marginal zone, the use of photographs of the Moon taken when the wane is less than 0.1 is recommended. It has been found from photographic observations of the full Moon made at Pulkovo on September 27–28, 1958, that the most probable figure of the lunar disk is an ellipse with flattening 1:1200. The major axis is inclined to the axis of rotation at an angle of 36 deg. The model of the Moon proposed by Yakovkin and the maps of the marginal zone compiled by Hayn and also by Nefedyev do not give a satisfactory representation of the Moon's limb as obtained from the measured photographs. (*PA*, 1962, #24,088)

590. SELECTED LUNAR OBSERVATIONS MADE AT THE PIC-DU-MIDI OBSERVATORY IN 1956 AND 1959
Fielder, G.
*British Astronomical Association, Journal of the*, v. 71, no. 5, pp. 207–214, 1961
(*AI/S*, 1961, #40,589)

591. A CLASSIFICATION OF THE PROFILES OF LUNAR CRATERS
Warner, B.
*British Astronomical Association, Journal of the*, v. 71, no. 6, pp. 246–249, 1961

The results of a study of the properties of conoidal craters are presented. (*AI/S*, 1961, #40,590)

### *Saturn — 1961*

592. AMATEUR OBSERVATIONS OF SATURN
Budine, P. W.
*Strolling Astronomer*, v. 15, no. 5–6, pp. 80–82, May–June 1961
(*AI/S*, 1961, #40,393)

593. ROTATION PERIODS OF SPOTS ON SATURN NEAR LATITUDE 60° NORTH IN 1960
Cragg, T. A.
*Strolling Astronomer*, v. 15, no. 5–6, pp. 96–98, May–June 1961
(*AI/S*, 1961, #40,394)

### *Venus — 1961*

594. THE OCCULTATION OF REGULUS BY VENUS
Menzel, D. H., de Vaucouleurs, G. H.
January 10, 1961
Harvard College Observatory, Cambridge, Mass.
Final Scientific Report 1 for July 7, 1959–January 10, 1961, AFCRL-227, AF 19(604)-7461
AD-251,664

The occultation of the first-magnitude star, Regulus (Alpha Leonis), by the planet Venus on July 7, 1959, was observed photographically, photoelectrically, and visually by seven groups. The observations are reported in detail. Corrections to the ephemeris coordinates differences between the planet and the star, and a determination of the height, $h = 70$ km, of the occulting layer above the cloud layer are given. The photometric observations are used to derive the scale height, $H = 6.8$ km, and its first derivative $= 0.01\ H$ and the total pressure $p = 2.6$ dynes/cm$^2$, at the occulting layer.

595. MEASUREMENT OF THE RADIAL VELOCITY OF VENUS BY ELECTRONIC PHOTOGRAPHY
Duchesne, M., Gallouet, L., Guinot, B.
*Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 253, no. 4, pp. 613–614, July 24, 1961 (in French)

A description of an interferometric-spectrographic method for evaluating the constant of aberration from spectra of Venus and the Sun is given. A Fabry–Perot etalon is used in front of the spectrograph slit, and the consequent large increase of exposure is avoided by using a Lallemand camera for recording the spectra. Typical spectrograms are reproduced. (*PA*, 1961, #18,041)

596. THE LIMB BAND OF VENUS: A PIECE FOR THE PUZZLE
Bartlett, J. C., Jr.
*Strolling Astronomer*, v. 15, no. 7–8, pp. 133–137, July–August 1961

The observations of the bright limb band and its relation to the daily changes in the interior shading pattern may be

helpful in collecting more information about Venusian weather. (*AI/S*, 1962, #50,408)

597. LIFE ON VENUS?
Croome, A.
*Discovery*, v. 22, no. 9, p. 373, September 1961

Observations of Venus during the 18-month period when it is nearest to the Earth are very briefly discussed. (*AI/S*, 1962, #50,411)

598. OBSERVATIONS OF VENUS BY THE MONTREAL CENTRE OF THE R.A.S.C.
Brasch, K. R.
*Strolling Astronomer*, v. 15, no. 9–10, pp. 156–159, September–October 1961
(*AI/S*, 1962, #50,412)

599. PHOTOGRAPHIC OBSERVATIONS OF THE PLANET VENUS
Boyer, C., Camichel, H.
*Annales d'Astrophysique*, v. 24, no. 6, pp. 531–535, 1961 (in French)

Venus was photographed regularly after 1953 in the violet and ultraviolet, and dark and ill-defined formations, obscuring either the center or the horns, were frequently encountered. The variation in appearance of these spots can be accounted for by a retrograde displacement. Noting that similar formations are observed at intervals of roughly four days, it is suggested that such an interval corresponds to the rotational period of Venus. (*PA*, 1962, #6992)

600. THE OBSERVATION OF DETAIL ON THE PLANET VENUS
Warner, B.
*British Astronomical Association, Journal of the*, v. 71, no. 5, pp. 202–205, 1961
(*PA*, 1961, #10,380)

## General — 1962

601. VIDEO RECORDER BUILT FOR ADVANCED SATELLITES
*Aviation Week & Space Technology*, v. 76, no. 5, p. 81, January 29, 1962

A photograph of a 30-lb video recorder capable of receiving and storing four million bits of data each second for 30 min is accompanied by a brief description. (*AI/S*, 1962, #50,498)

602. ENDOSCOPE
Langford, M. J.
*Industrial Photography*, v. 11, p. 8, February 1962
(*AS&T*, 1962)

603. BALLOON'S EYE VIEW
Langford, M. J.
*Industrial Photography*, v. 11, pp. 8–9, February 1962
(*AS&T*, 1962)

604. SPACE TELEVISION: AN ANNOTATED BIBLIOGRAPHY
Graziano, E. E., Compiler
March 1962
Lockheed Missiles and Space Company, Sunnyvale, Calif.
SB-61-63, R 3-79-61-1, AF 04(647)-791
AD-296,805

605. OPTICS IN THE ORBITING ASTRONOMICAL OBSERVATORY
Hallock, H. B.
*Applied Optics*, v. 1, no. 2, pp. 155–163, March 1962

The NASA *Orbiting Astronomical Observatory (OAO)* is a precisely stabilized spacecraft designed to carry large photoelectric astronomical telescopes. General background information is presented, and the specific optical systems currently planned for the *OAO* are described. The optical sensors which are required for attitude stabilization and control are emphasized in the discussion. (*PA*, 1962, #9117)

606. ULTRAVIOLET INSTRUMENTATION FOR CELESCOPE—AN ASTROPHYSICAL RECONNAISSANCE SATELLITE
Davis, R. J., Rustgi, O. P.
*Applied Optics*, v. 1, no. 2, pp. 131–137, March 1962

Project *Celescope* of the Smithsonian Astrophysical Observatory is designing, as part of NASA's *Orbiting Astronomical Observatories (OAO)* program, instrumentation for mapping the sky in wavelengths between 1000 and 3000 Å. The *Celescope* will consist of three telescopes and a slitless spectroscope. Each telescope will consist of a Schwarzschild camera with an ultraviolet-sensitive television camera tube at the focus; three different wavelength bands will be covered by use of television tubes of different spectral sensitivities. The slitless spectroscope will consist of a diffraction grating ruled onto the primary of a similar Schwarzschild camera. The optical structure will be self-compensating, eliminating the need for refocusing in orbit. Calibration lamps will be carried on board the satellite to transfer the laboratory calibration to the sky. This system is scheduled to be contained in the first *OAO*, to be launched in late 1963 or 1964. (*PA*, 1962, #11,198)

607. DIFFRACTION TELESCOPE FOR ASTRONOMY IN SPACE
Wells, W. H.
April 15, 1962
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TR 32-230

A novel design for a space telescope is proposed. The aperture limitation, which exists because of the need to hold optical tolerance over the face of the focusing element, is removed by accepting two conditions: (1) diffraction focusing instead of refraction or reflection focusing, and (2) immense focal lengths, practical only in the force-free environment of outer space. (*AI/A*, 1962, #5670)

608. SPACE TELEVISION. A DOCUMENTARY SURVEY
May 23, 1962
North American Aviation, Inc., Space and Information Systems Division, Downey, Calif.
SID 62-613
AD-282,473
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

A survey of the literature since 1957 on the uses of television as a component of space research systems is reported. Included are developments in television display tubes, antenna theory and design, instrumentation, and astronomy.

609. ÜBER DIE GENAUIGKEITSFORDERUNGEN BEI DER HERSTELLUNG OPTISCHER FLÄCHEN FÜR ASTRONOMISCHE TELESKOPE (CONCERNING THE PRECISION CONSTRAINTS FOR THE CONSTRUCTION OF OPTICAL SURFACES FOR ASTRONOMICAL TELESCOPES)
Scheffler, H.
*Zeitschrift für Astrophysik*, v. 55, no. 1, pp. 1–20, May 1962

The influence of irregular small deviations from the ideal shape of optical surfaces on the intensity distribution in the focal image is examined and discussed in detail for a single telescope mirror. These results are of special interest in the case of balloon- or satellite-borne telescopes since the resolution is then determined by instrumental effects only. Taking scintillation ("seeing") into account the following statements can be made: (1) the effective diameter of the focal image of a star formed by a perfect large telescope (aperture $< 1$ m) does not decrease permanently proportional to the root mean square fluctuation (rmsf) of the star's direction caused in the atmosphere, but reaches practically its amount valid for vanishing atmospheric disturbances of the rmsf of image motion as measured by very small aperture is about 0."3, i.e., in general, before the "seeing" parameter drops below the theoretical limit of telescope resolution; and (2) a large real telescope mirror can practically reach its theoretical resolving power if the rmsf of the deviations from its ideal shape does not exceed 0.03 wavelength, and the "seeing" parameter is about 0."3, a value which occurs at favored locations. (*AI/A*, 1962, #60,172)

610. RADIO-OPTICAL OBSERVATORY SET UP FOR DEEP-SPACE EXPERIMENTS
Anderson, R. E., Spalding, J. F.
*Space/Aeronautics*, v. 37, no. 5, pp. 211–213, May 1962

General Electric's radio-optical observatory near Schenectady, New York, is described. Instrumentation information is given for both the cassegrainian telescope and radio antenna portions of the total system. (*AI/A*, 1962, #60,288)

611. TELEVISION APPLICATIONS IN SPACE
Proceedings of the International Television Conference, London, Great Britain, May 31–June 7, 1962
Institution of Electrical Engineers, Electronic and Communications Section, Great Britain

612. TRANSCONTINENTAL SATELLITE TELEVISION TRANSMISSION
Hamilton, D. H., Jr., Hoover, H. H., Jr., Locke, R. V., Jr., MacLellan, D. C., Morrow, W. E., Jr., Nichols, B. E., Rogers, T. F., Waldron, P.
*IRE, Proceedings of the*, v. 50, no. 6, pp. 1522–1523, June 1962
(*AS&T*, 1962)

613. SATELLITE OBSERVATORY
(Translated from *Veda Technika Meadezi*, no. 9, pp. 305–307, 1962)
Dobrichovsky, Z.
July 24, 1962
Library of Congress, Aerospace Information Division, Washington, D.C.
AID 62-107
AD-288,158
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

614. EFFECTS OF OBSERVATIONAL CONDITIONS
Sato, T.
*Strolling Astronomer*, v. 16, no. 7–8, pp. 162–164, July–August 1962

Some examples of the effects of (1) observer ability, (2) equipment accuracy, and (3) atmospheric conditions on lunar and planetary observations are discussed. (*AI/A*, 1963, #70,783)

615. SPECULATIONS ON SPACE OBSERVATORIES
Cohlan, B. F.
*Astronautical Sciences, Journal of the*, v. 9, no. 2, pp. 35–40, Summer 1962

The limitations of terrestrial astronomy are examined, as well as the potential extensions and improvements of space astronomy in the period of 1960 to 1970. Qualitative space observation platform requirements are proposed, and an optimum satellite observation platform is suggested. Various types of space observatories are qualitatively discussed and compared. A bibliography of 22 references is included. (*AI/A*, 1962, #60,472)

616. FUTURE OF OPTICAL ASTRONOMY
Blackwell, D. E.
*Nature*, v. 195, pp. 854–856, September 1, 1962

The future prospects of British astrophysical research are discussed, with emphasis on programs sponsored by the universities. The need for an expansion of research by university departments is stressed. In such work the aim should be to break new ground, and not to fill in the trivial gaps in our present astronomical knowledge. Some ways of achieving these aims are suggested, including research from space-based observatories, and cooperative ground-based programs using existing world-wide instrumental facilities. (*PA*, 1963, #5230)

617. STRATOSCOPE AIMS AT HIGH-ALTITUDE PHOTOS
Plattner, C. M.
*Aviation Week & Space Technology*, v. 77, no. 16, pp. 73–75, October 15, 1962

A 300-ft effective focal length balloon-borne telescope is described which will operate at 80,000 ft, which is above 96 percent of the Earth's optically distorting atmosphere. The 36-in. aperture telescope for Project *Stratoscope* will provide photographic and spectroscopic resolution three times greater than that of telescopes on the Earth's surface. A proposed spectral analysis flight for *Stratoscope 2* is discussed, as well as details of its primary mission—to photograph stars, planets, nebulae, and galaxies. (*AI/A*, 1963, #70,300)

618. PLANET OF ENIGMAS
(Translated from *Komsomolskaya Pravda*, November 2, 1962)
Maksimov, L.
December 11, 1962
Air Force Systems Command, Foreign Technical Division, Wright-Patterson AFB, Ohio
FTD-TT-62-1775
AD-295,457
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

619. THE VISIBILITY OF AN OBJECT IN A SPACE ENVIRONMENT (Proceedings of the Aerospace Forum II Session presented at the IAS 30th Annual Meeting, New York, N.Y., January 22–24, 1962)
Martin, D. J. (National Aeronautics and Space Administration, Langley Research Center, Langley Field, Va.)
1962
Institute of the Aerospace Sciences, Inc., New York, N.Y.
Sherman M. Fairchild Fund Paper FF-31

Since manual assistance will undoubtedly be required during terminal and final docking maneuvers in a rendezvous, it is important to develop means of determining the visibility of an object. Three methods of increasing visibility are discussed. (*AI/A*, 1962, #5613)

620. AN INVESTIGATION INTO THE USE OF COLOUR FILTERS IN VISUAL OBSERVATION
Hyde, F. W., Fulford-Jones, R.
*British Astronomical Association, Journal of the*, v. 72, no. 4, pp. 162–175, 1962

A new approach to the visual observation of planetary detail is discussed. (*AI/A*, 1962, #61,268)

621. THE USE OF TELEVISION CAMERA TUBES IN SCIENTIFIC OBSERVATION
McGee, J. D.
*Scientia Electrica*, v. 8, no. 4, pp. 109–132, 1962

The possibilities of using television camera techniques for scientific observation of faint optical images are discussed and present limitations and future possibilities outlined. The characteristics of the three main types of television camera tube (the C.P.S. Emitron, Image Orthicon and Vidicon) are reviewed and the advantages and limitations of each for scientific purposes are discussed. Future developments that should give more useful devices are then considered and some of the methods that might be employed are described. These include image-intensifiers and charge-storage signal generating tubes which can be used for long time-exposure observations. The ultimate goal is that the observations should be limited only by the inherent shot noise of the primary photoemission. (*EEA*, 1963, #4434)

622. IMAGE TUBES FOR SPACE RESEARCH
(Presented at the International Symposium on Space Age Astronomy, Pasadena, Calif., August 7–9, 1961)
McGee, J. D. (University of London, Imperial College of Science and Technology, London, England)
In "Space Age Astronomy," pp. 81–102
Academic Press, Inc., New York, N.Y., 1962

A detailed discussion is presented of operation of electron image intensifiers, electron image multipliers, a proposed UV photocathode, cascade image intensifiers, cascade electron image multipliers, and signal generating tubes. When used with a telescope, these devices can convert the photons of an image into photoelectrons with at least 100 times the efficiency of photography. The photoelectrons can be multiplied and the image intensified to a degree where the image quality is limited only by the shot noise of the primary emission. The image can then be integrated, if need be, over a long exposure period, as a charge image which can then be scanned to produce a picture signal which can be recorded and relayed back to Earth to reproduce the original image. This would permit a small telescope to have a performance many times better than that achieved in the conventional operation. (*IAA*, 1963, A63-14341)

623. STEREOSCOPY FROM SPACE SATELLITES
(Presented at the International Symposium on Space Age Astronomy, Pasadena, Calif., August 7–9, 1961)
Menzel, D. H. (Harvard College Observatory, Cambridge, Mass.), Moreton, G. (Lockheed Aircraft Corporation, Lockheed Solar Observatory, Burbank, Calif.)
In "Space Age Astronomy," pp. 412–413
Academic Press, Inc., New York, N.Y., 1962

It has been suggested that successive photographs of the same field of view at appropriately spaced intervals be used to obtain stereoscopic views of planetary surfaces. This technique has been applied to solar prominences, and satisfactory three-dimensional illusion was obtained.

### *Jupiter — 1962*

624. COMMISSION DES SURFACES PLANÉTAIRES: LA PLANÈTE JUPITER (COMMISSION OF PLANETARY SURFACES: THE PLANET JUPITER)
Marin, M.
*l'Astronomie*, v. 73, pp. 181–184, May 1962
(*AI/A*, 1962, #61,066)

625. ADVANCED VIDEO IDEAS TO HAVE SPACE USE
Miller, B.
*Aviation Week & Space Technology*, v. 77, no. 10, pp. 59–65, September 3, 1962

Two new camera systems being developed by the Jet Propulsion Laboratory as part of an overall effort in advanced video techniques for lunar and planetary exploration are described. These systems may enable deep space probes to take and return pictures of Mars, Mercury, and Jupiter. The more unique of the two cameras represents a radical departure from conventional camera techniques and is expected to evolve into a compact, all-solid-state device using thin photoconductive ferroelectric and electroluminescent films to realize the triple functions of imaging, storage, and readout. The other is a vidicon camera with associated encoder for converting video signals into digital form for tape storage before telemetering back to Earth. Other related developments are also discussed, including a 400 × 400 matrix of individual picture points, a digital tape transport machine, reel-to-reel recorders, and an endless tape loop. (*AI/A*, 1962, #61,847)

626. PHOTOGRAPHING JUPITER IN COLOR
Glaser, P. R.
*Strolling Astronomer*, v. 16, no. 11–12, pp. 247–251, November–December 1962

Methods used to photograph Jupiter in color in 1962 are cited. Results obtained by this attempt are described. (*AI/A*, 1963, #70,730)

627. RECENT OBSERVATIONS OF JUPITER
Fox, W. E.
*British Astronomical Association, Journal of the*, v. 72, no. 2, pp. 63–65, 1962

A description is given of changes observed on the planetary disk following the notable disturbance of 1958 in the region of the South Equatorial belt. Beginning in 1959, renewed activity of surface features involved both Southern Tropical and Southern Temperate belts, in addition to the equatorial zone. By 1961 a "new" equatorial belt had developed. (*PA*, 1962, #15,315)

## *Mars — 1962*

628. OBSERVATIONS OF MARS MADE IN 1961 AT THE PIC DU MIDI OBSERVATORY
Focas, J. H. (Athens Observatory, Hellas, Greece)
January 30, 1962
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TR 32-151
AD-274,663

Results of observations of Mars made in 1961 through the 24-in. refractor of the Pic du Midi Observatory are presented. The following measurements were included in the observation program: polarimetric measurements of the properties of polarized light coming from various regions of the planet; photometric measurements, using photographic negatives, of the contrast between selected areas; and photographic and visual observations of the upper atmosphere of Mars (in ultraviolet and blue light) and of the fine surface markings of the planet.

629. LIFE ON MARS
*Space World*, v. 2, no. 2, pp. 36–37, 58, 61–62, January 1962

The controversial question of whether or not life exists on Mars is discussed. Observations and theories concerning the planet's atmosphere, surface features, and natural satellites are related. (*AI/S*, 1962, #51,097)

630. THIRD REPORT ON MARS, 1960–1961
Both, E. E.
*Strolling Astronomer*, v. 16, no. 1–2, pp. 24–31, January–February 1962

Observations of Mars in 1960 and 1961 are discussed. A table is presented giving the areographic positions determined from drawings and transits. (*AI/S*, 1962, #51,095)

631. OPTICAL PROPERTIES OF THE ATMOSPHERE AND SURFACE OF THE PLANET MARS
Kurchakov, A. V.
*ARS Journal*, v. 32, no. 3, pp. 490–495, March 1962

In the determination of quantities characterizing optical properties of the planet's atmosphere, it is not safe to assume that Mars has either a scattering or an absorbing atmosphere —both effects must be considered. The comparison of theoretical calculations with observational data makes it possible to explain the correlation between scattering and absorption in the atmosphere of Mars.

632. COMMISSION DES SURFACES PLANÈTAIRES: LA PLANÈTE MARS (COMMISSION OF PLANETARY SURFACES: THE PLANET MARS)
Marin, M.
*l'Astronomie*, v. 73, pp. 130–135, April 1962
(*AI/A*, 1962, #61,086)

633. PLANETARY PHOTOGRAPHY: TELEVISION CAMERA FOR A GEOLOGICAL SURVEY OF THE PLANET MARS
Malling, L. R.
July 20, 1962
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TM 33-76

High-resolution pictures of the planets may be obtained with an electronic camera mounted on a spacecraft. Special techniques must be used to process the pictures to allow transmission back to Earth at planetary distances. An electro-

static vidicon is shown to be a particularly useful transducer for planetary photography. Results obtained in the laboratory are used to describe an experimental flight camera system. (*AI/A*, 1962, #60,479)

634. SEASONAL EVOLUTION OF THE FINE STRUCTURE OF THE DARK AREAS OF MARS
Focas, J. H.
*Planetary and Space Sciences*, v. 9, pp. 371–381, July 1962

The seasonal darkening of the dusky areas of Mars starts with maximum thickness of the winter polar clouds. The regional brightness of the polar caps is connected with the profile of the relief. The average intensity of the dark areas increases from the poles toward the equator; the amplitude of the darkening waves decreases from the poles toward the equator. The combined action of the two darkening waves shows that the action of the darkening generating element is constant for all areographic latitudes during the Martian year. The distribution of the total intensity of the dark areas, the sizes and frequency in areographic latitude of dark blocks or nuclei composing the dark areas of the planet, depend on the duration of the action of the darkening generating element. (*PA*, 1962, #19,285)

635. MOLECULAR OPTICAL THICKNESS OF THE ATMOSPHERES OF MARS AND VENUS
Coulson, K. L., Lotman, M.
July 1962
General Electric Company, Space Sciences Laboratory, Philadelphia, Pa.
R62SD71
AD-283,055
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The volume scattering coefficient and optical thickness for molecular scattering of sunlight in several different models of the atmospheres of Mars and Venus are presented. The computations are based on Rayleigh's well-known scattering law. Data are given for eight different wavelengths from 2500 to 10,000 Å, as a function of altitude above the planetary surface. Fractional transmission of direct solar radiation is then computed for selected cases. Comparison of results with similar data for Earth's atmosphere shows that light scattering techniques are applicable up to higher altitudes in the atmospheres of both Mars and Venus than in Earth's atmosphere. Under the assumption that a normal optical thickness of 0.001 represents a lower limit for practical application, it is found that light-scattering techniques can yield useful results up to altitudes of 90 to 100 km on both Mars and Venus. The corresponding altitude for Earth's atmosphere is less than 60 km.

636. CLARK R. CHAPMAN'S 1960–61 MAP OF MARS
Chapman, C. R.
*Strolling Astronomer*, v. 16, no. 7–8, pp. 168–169, July–August 1962

A map based on 60 drawings made during the 1960–1961 apparition of Mars is presented. (*AI/A*, 1963, #70,754)

637. DIMENSIONS OF MARS
(Translated from *Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia*, no. 2, pp. 41–45, 1960)
September 19, 1962
Library of Congress, Aerospace Information Division, Washington, D.C.
AID 62-145
AD-285,344
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

638. FOURTH REPORT ON MARS: MARS IN 1962–1963 (GENERAL COMMENTS)
Both, E. E.
*Strolling Astronomer*, v. 16, no. 11–12, pp. 241–242, November–December 1962

The circumstances surrounding the 1962–1963 apparition of Mars are given. (*AI/A*, 1963, #70,756)

639. SOME IMPORTANT MARTIAN PHENOMENA IN 1958
Saheki, T.
*Strolling Astronomer*, v. 16, no. 11–12, pp. 264–268, November–December 1962

An occultation of a star by Mars on November 21, 1958 was recorded by observers located at the region near 35-deg latitude in Japan. Flashes of flare-like spots on Mars were detected and are described. (*AI/A*, 1963, #70,757)

640. SIMPLE VIDICON MICROSCOPY
Soffen, G. A. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena)
In "Proceedings of the Lunar and Planetary Exploration Colloquium, Volume III, No. 2, Santa Monica, Calif., May 23–24, 1962," pp. 47–48
North American Aviation, Inc., Space and Information Systems Division, Downey, Calif., 1962

While specimens of the Martian soil may be collected by means of a string probe, there remain problems of enriching the sample, transporting it to a microscope slide, and transmitting what is actually observed. A special instrument is being developed that includes a microscope with an aerosol medium of transportation and vidicon transmission. (*AI/A*, 1963, #80,029)

641. SOME PROPERTIES OF THE YELLOW HAZE OBSERVED ON MARS IN 1956
Koval, I. K., Morozhenko, A. V.
*Astronomicheskii Zhurnal*, v. 39, no. 1, pp. 65–72, 1962
(Translated from the Russian in *Soviet Astronomy—AJ*, v. 6, no. 1, pp. 45–50, July–August 1962)

The approximate values of the optical thickness $\tau_\lambda$ of the "dust cloud" in red and infrared light have been computed from the washing-out of contrasts between light and dark

regions of Mars. Observational data given in the catalog of Barabashov and Koval are used. The radius of particles composing the "dust cloud" is found (1.45$\mu$), using the values of $\tau_\lambda$ obtained from computations by Shuleikin. Approximate data, characterizing the time of descent of particles of the computed size from different heights and at a given density of the particles, are derived by applying the Stokes formula for the velocity of descent of such particles in the atmosphere. It is found that the time of descent from a height of 1 km is not less than 40 days, if the density of a particle does not exceed three. (*PA*, 1962, #21,701)

642. A PHOTOGRAPHIC HISTORY OF MARS, 1905–1961
Slipher, E. C.
Lowell Observatory, Flagstaff, Ariz., 1962
AF 19(604)-5874, AF 23(601)-3602
AD-298,548 (ASTIA does not furnish copies.)

## Mercury — 1962

643. BEOBACHTUNGEN AM "SCHWARZEN TROPFEN" BEIM MERKURDURCHGANG VOM 7. NOVEMBER 1960 (OBSERVATIONS OF THE "BLACK DROP" DURING THE MERCURY TRANSIT OF NOVEMBER 7, 1960)
Spangenberg, W. W.
*Astronomische Nachrichten*, v. 286, no. 4, pp. 153–156, March 1962
(*AI/A*, 1962, #61,090)

644. ON OBSERVATIONS OF THE TRANSIT OF MERCURY 1960 NOVEMBER 7
Addey, F.
*British Astronomical Association, Journal of the*, v. 72, no. 3, pp. 141–149, 1962

Twelve observations of the transit of Mercury on November 7, 1960 are analyzed mathematically. (*AI/A*, 1962, #61,422)

## Moon — 1962

645. SYNCHRONIZED RANGER TV CAMERAS TO PHOTOGRAPH LUNAR IMPACT AREA
*Aviation Week & Space Technology*, v. 76, no. 2, p. 29, January 8, 1962

Six vidicon cameras, synchronized for obtaining sequential high-resolution television pictures of the lunar impact area, will be carried by *Rangers 6–9*. (*AI/S*, 1962, #50,338)

646. THE CRATER CONTRIBUTION TO SURFACE ROUGHNESS OF THE MOON
Kornhauser, M.
*Astronautical Sciences Review*, v. 4, no. 1, pp. 23–24, 26, January–March 1962

The sizes and shapes of lunar craters and their distribution over the lunar surface are calculated. Their contribution to the overall surface features of the Moon is discussed. (*AI/S*, 1962, #51,348)

647. SCIENTIFIC SUBSYSTEM OPERATION: RANGER 3, 4, 5
Wagner, H. E.
February 2, 1962
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TM 33-80

Special flight and ground instrumentation developed to perform four scientific experiments—vidicon camera, gamma-ray, lunar seismometer, and radar reflectivity—on the *Ranger 3, 4,* and *5* missions is discussed. System test philosophy and procedures are outlined, and data reduction and presentation are discussed briefly. The scientific instrumentation and ground support equipment are described in some detail.

648. RANGER VIDICON TV CAMERA USES ELECTROSTATIC DEFLECTION
Mason, J. F.
*Electronics*, v. 35, no. 8, pp. 26–27, February 23, 1962

The TV camera used in the *Ranger 3* is described. (*AI/S*, 1962, #50,446)

649. THE SEGMENTAL STRUCTURE OF WRINKLE RIDGES AND THE LUNAR GRID SYSTEM
Fielder, G., Kiang, T.
*Observatory*, v. 82, pp. 8–9, February 1962

From a detailed study of the orientation of major wrinkle ridges in Mare Imbrium, recorded in the "Orthographic Atlas of the Moon," edited by G. P. Kuiper, it is concluded that these ridges are associated with the grid system. (*PA*, 1962, #15,308)

650. SURFACE AND ATMOSPHERE OF THE MOON, REVIEW OF SOVIET LITERATURE
March 20, 1962
Library of Congress, Aerospace Information Division, Washington, D.C.
AID 62-4
(Also available as OTS: 62-24,481, U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

This report represents the final chapter of a four-chapter review of Soviet research on the atmospheres and surfaces of Venus, Mars, and the Moon.

651. RESEARCH STUDY AND DEVELOPMENT OF 1 METRE-MIRROR FOR MOON TRACKING AND PHOTOGRAPHY
Kopal, Z.
March 1962
Manchester University, Great Britain
Annual Summary Report 2, AFCRL-62-1100, AF 61(052)-400
AD-292,741
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The optical equipment for the 43-in. telescope was delivered and installed at the Observatoire du Pic du Midi in November 1961. Extensive optical tests on the 43-in. mirror revealed the optical surface to be correct within $\pm \lambda/20$ over 90 percent of its effective arc; slightly larger deviations were encountered only within the last 7 cm of its free aperture. The first photographs of the Moon, secured with the aid of this mirror in a $f/15$ cassegrain combination, are of excellent quality and augur well for the future. The Secasi oscillator to control the drive of the 43-in. telescope was delivered and functions to specifications. The infrared pyrometer for measurements of the lunar and planetary temperatures was designed and built in the laboratories at Manchester, and used during winter months for the studies of lunar temperature distribution in the neighborhood of certain ray craters. The results revealed the crater floors to be cooler in daytime than their surroundings by several degrees.

652. EXPLORATION OF THE MOON'S SURFACE
Shoemaker, E. M.
*American Scientist*, v. 50, no. 1, pp. 99–130, March 1962

A brief history and complete details of the physical properties of the lunar surface are given. (*AI/S*, 1962, #51,378)

653. PHOTOGRAPHIC RESOLUTIONS AND COVERAGES OBTAINABLE WITH THE RANGER IMPACTING SPACECRAFT
Campen, C. F., Heftman, K., Willingham, D. E.
April 6, 1962
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TM 33-78

The *Ranger* series of spacecraft have been designed to obtain, in part, relatively high-resolution photographs of limited areas of the front face of the Moon. The camera designs were predicated on an essentially vertical descent and did not include allowances for possible effects due to angular separations of the optical axis and the direction of descent. Because of constraints set by other experiments and changes in mission concept, trajectories now being considered for the *Ranger* spacecraft may produce impact angles up to 60 deg from the vertical and rotations of the line of sight during descent photography of as much as 20 deg. The effects of these factors on performance of the *Ranger* cameras are assessed.

654. BIBLIOGRAPHY ON THE MOON AND ITS CHARACTERISTICS
Forlini, J. B.
April 1962
Army Engineer Research and Development Laboratories, Fort Belvoir, Va.
LTIS Bibliography 15
AD-277,125
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

This bibliography on the Moon lists articles published by the USSR from 1959 through 1961. (*AI/A*, 1963, #70,178)

655. NEW APPLICATIONS OF LUNAR SHADOW STUDIES
(Presented at the Astronomical Society of the Pacific Meeting, Los Angeles, Calif., June 12–14, 1961)
Pohn, H., Murray, B. C., Brown, H.
*Astronomical Society of the Pacific, Publications of the*, v. 74, no. 437, pp. 93–105, April 1962

Information on the topography of the surface of the Moon can be obtained from the study of lunar shadows. In this particular study the primary aim is to investigate the variation in the amount of shaded regions as a function of the Sun's elevation. Only those areas which appear completely black on the photographic prints are considered as shadows. (*AI/A*, 1962, #60,162)

656. STUDIES IN LUNAR TOPOGRAPHY, IX. LUNAR SHADOW MEASURING TECHNIQUES AND TABULATED RESULTS FOR THREE CRATERS
Rackham, T.
May 8, 1962
Manchester University, Great Britain
Technical Note 2, AF 61(052)-496

The first part of this paper is concerned with methods of assessing the lengths of lunar shadows derived from microdensitometric tracings. Errors arising from atmospheric image distortion and positional uncertainties are discussed. The latter part of this work contains tabulated topographical data for the craters Tycho, Copernicus, and Theophilus. (*STAR*, 1963, N63-14855)

657. THE APPLICATION OF OPTICAL SENSORS FOR LUNAR AND PLANETARY SPACE VEHICLES
Scull, J. R.
May 31, 1962
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TR 32-274

Examples of optical sensors used for lunar and planetary missions are presented. The results of tradeoff studies on sensitivity, accuracy, and field of view are discussed. Ground testing and simulation techniques which are unique for interplanetary optical sensors are described. Flight tests results from the *Ranger* spacecraft are reported. (*AI/A*, 1962, #60,171)

658. FEASIBILITY STUDY OF A CIRCUMLUNAR PHOTOGRAPHIC EXPERIMENT
Michael, W. H., Tolson, R. H., Gapcynski, J. P.
May 1962
National Aeronautics and Space Administration, Langley Research Center, Langley Field, Va.
TN D-1226

A study has been made to investigate the feasibility of a high-resolution, lunar-surface photographic experiment, with

the use of a circumlunar trajectory and with recovery of the film on return to the surface of the Earth. Particular attention has been given to procedures for obtaining high-resolution photographs of the lunar surface, for returning the undeveloped film to the Earth, and for recovering the data package on completion of such a mission. The characteristics of the *Ranger* spacecraft have been used in applicable portions of the study.

659. THE LUNAR ATMOSPHERE
Öpik, E. J.
*Planetary and Space Science*, v. 9, pp. 211–244, May 1962

Optical and radio estimates of the upper limit of density of the lunar atmosphere are reviewed. Properties of the lunar ionosphere in contact with the surface are analyzed theoretically and applied to an estimate of its composition and density. Considering the balance between injection and escape, the daytime average probable number density at the surface is rated at 3 to $5 \times 10^5 cm^{-3}$, with an uncertainty ratio of about 2 and with 50–70 percent $CO_2$, 45–27 percent $H_2O$, and 4–2 percent $H_2$. The electron density, in equilibrium with contact recombination at the surface, is then 200–300 $cm^{-3}$. The sources of the atmosphere are solar wind, its interaction with, and sputtering of, the surface, meteor impact degassing, and somewhat dubious "volcanic" sources. The surface electric charge is slightly negative or neutral; only when the total density falls below $3 \times 10^5$, and the electron density below 200, will there be a positive charge. The photoelectric efficiency of silicates is estimated to be of the order of 1/80, and the electron emission as depending on surface potential is estimated accordingly from the solar ultraviolet emission.

Mechanisms of escape, thermal, collisional with solar wind, and ionic, are evaluated quantitatively. Thermal escape prevails for hydrogen; the other two processes for the heavier molecules. The longest escape time scale is about two years for xenon, provided the layer is thin (exospheric). No permanent atmosphere can exist on the Moon. The conditions of static and escaping plasma equilibrium are reviewed. Conservation of space charge in an escaping plasma stream requires the establishment of turbulent electric fields which force the electrons to oscillate with thermal velocities around the mean motion determined by the momentum of the ions. The fields prevent direct escape of the photoelectrons from the lunar surface, and play a decisive role in the structure of the lunar ionosphere. From cometary phenomena and optical data for the zodiacal light, the persistent and principal component of solar wind is estimated to correspond to $N_e = 50\ cm^{-3}$, $v = 200$ km/sec, a relative electron temperature of about 400–500°K at the Earth's orbit, and a translational energy of 210 ev for the protons and ~1000°K for the electrons. Whereas other constituents of the lunar atmosphere are escaping to space, water molecules created chemically by solar wind chiefly sublimate into the cold spots of permanent shadow where lunar glaciers up to 100-m equivalent thickness may have accumulated over the ages. (*PA*, 1962, #17,243)

660. INSTRUCTIONS FOR THE USE OF MUTUAL MOON VISIBILITY CHARTS
Nagy, F.
June 7, 1962
Massachusetts Institute of Technology, Lincoln Laboratory, Lexington
R-52G-3, AFESD-TDR-62-95, AF 19(604)-7400
AD-276,879
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

661. LUNAR ORBIT PHOTO MISSION WINS APPROVAL
Miller, B.
*Aviation Week & Space Technology*, v. 77, no. 4, pp. 22–23, July 23, 1962

The *Surveyor* orbiter, a stripped-down version of the spacecraft, has been elected to assist the *Apollo* lunar programs by obtaining stereoscopic photographs of the Moon's surface. Principal mission of the orbiter will be to take and transmit to Earth pictures of the lunar surface bounded by 50°E and W selenographic longitude and 20°N and S selenographic latitude. (*AI/A*, 1962, #60,568)

662. THEORETICAL AND EXPERIMENTAL PROCESSING OF LUNAR TELEVISION PICTURES
Lorens, C. S., Boehmer, A. M.
July 23, 1962
Space-General Corporation, Research and Advanced Development Division, El Monte, Calif.
SGC-203R-2, Bimonthly Report 2

It is estimated that large quantities of lunar pictures are to be obtained from forthcoming experiments. This report is the second progress report on a theoretical and experimental study of techniques for processing these lunar pictures. The theoretical work of this report deals with exploiting the geometry of pictures principally through the assumption of statistically stationary properties under translation and rotation. Pictures are defined as functions of one index where the index is a two-dimensional vector corresponding to the two-dimensional coordinates of the picture.

663. LUNAR PHOTOGRAPHY
Eastman, F. J., Jr.
*Strolling Astronomer*, v. 16, no. 7–8, pp. 145–154, July–August 1962

Methods of lunar photography are discussed, and equipment considered necessary for amateurs is described in detail. (*AI/A*, 1963, #70,782)

664. RANGER TV SUBSYSTEM
August 15, 1962
Radio Corporation of America, Astro-Electronics Division, Princeton, N.J.
AED 1532, Bimonthly Progress Report 6 for June 1–July 31, 1962

The Sixth Bimonthly Progress Report documents the progress of the Radio Corporation of America on the *Ranger* TV Subsystem for the period June 1 through July 31, 1962. Environmental and electrical acceptance testing of the PTM was completed during this reporting period, and the PTM was scheduled for delivery to JPL on August 2, 1962. Delivery and acceptance testing of the assemblies for Flight Models No. 1 and 2 progressed satisfactorily, however, limitations in the assembly schedule became apparent at the conclusion of the reporting period as a result of vidicon-delivery problems. This report discusses in detail the progress achieved in each major technical area of the *Ranger* TV Subsystem Project.

665. LUNAR SURFACE FORMATIONS
(Translated from *Vsesoiuznoe Astronomo-Geodezicheskoie Obshchestvo Biulleten*, no. 30:37, pp. 33–38, 1962)
Shemyakin, M. M.
September 4, 1962
Library of Congress, Aerospace Information Division, Washington, D.C.
AID 62-121
AD-284,767
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

666. THEORETICAL AND EXPERIMENTAL PROCESSING OF LUNAR TELEVISION PICTURES
Lorens, C. S., Boehmer, A. M.
September 23, 1962
Space-General Corporation, Research and Advanced Development Division, El Monte, Calif.
SGC-203R-3, Bimonthly Report 3

The processing of lunar pictures through digital computer techniques offers one possibility for handling the large number of pictures which are to result from lunar experiments. This report is the third progress report on a theoretical and experimental study of techniques for processing these lunar pictures. Many of the techniques being developed in this study require an iterative computing procedure which converges on the desired process. The solution of a first order difference equation provides a number of interesting properties about the iterative computation which are sufficient for convergence of the process. The theoretical details of the properties of the difference equation are developed in the report.

667. THE PLATE CONSTANTS OF MOON PHOTOGRAPHS
Aghassi, B.
September 1962
Boston University, Mass.
Research Report 2, Astronomical Contributions, Series II, no. 18
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

A computational method is presented for obtaining the selenographic coordinates of points on a fragment of a photograph of the Moon, without translating and rotating the systems of axes to fit Saunder's concentric solution. In this method, the loci of constant $\xi$, $\eta$, and $\zeta$ are considered as three families of parallel coaxial circles. Since in an orthographic projection these circles project as three families of ellipses of the same ellipticity, an equation of conics can be written which fits $\xi$ and $\eta$ as polynomial functions of the vectors $x$ and $y$. A correction for the deformation caused by the conic projection is given, although this is considered to be negligible. Results were computed for the coordinates of the center of the disk and for the scale and inclination of the photograph. (*STAR*, 1963, N63-12041)

668. GUIDANCE AND DATA TRANSMISSION CONSIDERATIONS FOR A LUNAR MAPPING SATELLITE
Webb, J. A.
*AIEE, Transactions of the, Part I—Communication and Electronics*, no. 62, pp. 225–229, September 1962

Guidance considerations and satellite orientation for optimum orbital coverage of a lunar satellite are discussed. The requirements for a data transmission system are outlined, including antenna orientation, data bandwidth, and location of ground receiving stations. The probable vehicle configuration is described, and a summary of the equipment to be used on a lunar satellite is presented. (*AI/A*, 1963, #70,751)

669. A RELIEF MAP OF ERATOSTHENES
Westfall, J. E.
*Strolling Astronomer*, v. 16, no. 9–10, pp. 209–214, September–October 1962

An experimental selenographic project, the large-scale, three-dimensional mapping of a single formation, is described. The formation selected was the crater Eratosthenes. (*AI/A*, 1963, #71,037)

670. FINDING THE HEIGHT OF A LUNAR MOUNTAIN
Ashbrook, J.
*Strolling Astronomer*, v. 16, no. 9–10, pp. 214–216, September–October 1962

A method for computing the height of a lunar mountain is described. (*AI/A*, 1963, #71,163)

671. RANGER TV SUBSYSTEM
October 15, 1962
Radio Corporation of America, Astro-Electronics Division, Princeton, N.J.
AED 1631, Bimonthly Progress Report 7 for August 1–September 30, 1962

This is the seventh in a series of bimonthly progress reports to be submitted by the Astro-Electronics Division of RCA on the *Ranger* TV Subsystem.

672. LUNAR SURFACE CHARACTERISTICS BASED ON RADAR AND PHOTOGRAPHIC DATA
Lenhert, D. H., Koepsel, W. W., Bechtel, R., Ahmed, N., Janza, F.
October 1962
New Mexico University Engineering Experiment Station, Albuquerque, N.Mex.
Semiannual PR-39
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Lunar surface characteristics based on radar and photographic data include the following investigations: (1) correlation of radar and photographic data, with major emphasis upon the use of the reflected radar pulse envelope and a photograph of the area of return to determine possible correlation between radar scattering and light scattering from a given terrain; and (2) variations and effect of $R^{-11}$ Fresnel zone transitions in the estimation of lunar surface roughness. To avoid the problems occurring at microwave frequencies, data were taken using an acoustic radar simulator. Results indicate that the power return varies as $R^{-4}$ when the excitation phase is less than $\lambda/4$ across the reflector. An $R^{-3}$ power return occurs when the phase difference is between $\lambda/2$ and $\lambda/4$ and finally an $R^{-2}$ power return occurs for phase difference greater than $\lambda/4$ across the plate. (*STAR*, 1963, N63-12043)

673. THEORETICAL AND EXPERIMENTAL PROCESSING OF LUNAR TELEVISION PICTURES
Lorens, C. S., Boehmer, A. M., Gallagher, J.
November 29, 1962
Space-General Corporation, Research and Advanced Development Division, El Monte, Calif.
SGC-203R-4, Final Report

It is estimated that large quantities of lunar planetary pictures are to be obtained from forthcoming experiments. The processing of pictures through digital computer techniques offers one possibility for handling the large number of pictures which are to result from these experiments. This is the final report on a theoretical and experimental study of techniques for processing pictures.

674. RESEARCH INTO METHODS OF DETERMINING THE RELATIVE HEIGHTS OF PHYSIOGRAPHIC FEATURES OF THE MOON
Kopal, Z.
November 1962
Manchester University, Great Britain
Annual Summary Report 1, AFCRL 63-406, AF 61(052)-524

Progress reported in selenography includes: (1) redetermination of the libration constants of the Moon; (2) evaluation and measurement of the Paris Observatory photographic plates of the Moon (obtained between 1890 and 1910 and covering the full range of lunar libration) to determine the departures of the actual surface of the Moon from a sphere; and (3) development of methods for the determination of small differences in height or depth of very shallow lunar surface features above or below the surrounding landscape. A microrelief method is described by which topographic features less than 20 m in height and with an inclination of less than one degree can be measured significantly by comparing the photographic density of the negative on a sloping and on a level region. (*STAR*, 1963, N63-15223)

675. STANDARD LUNAR CRATER OUTLINES
McIntosh, P. S.
*Strolling Astronomer*, v. 16, no. 11–12, pp. 254–256, November–December 1962

Standard lunar crater outlines are proposed as a method for increasing the accuracy of lunar observations by amateurs. (*AI/A*, 1963, #70,739)

676. RANGER TV SUBSYSTEM
December 15, 1962
Radio Corporation of America, Astro-Electronics Division, Princeton, N.J.
AED 1719, Bimonthly Progress Report 8 for October 1–November 30, 1962

Sections of this report discuss in detail the progress achieved in each technical area of the *Ranger* TV Subsystem Project. These sections include: System engineering; subsystem engineering-structure, electrical integration, environmental testing, electronics, thermal control, ground support equipment; and product assurance and reliability-component-part control, design reviews, engineering test evaluation, failure reporting, failure analysis product improvement.

677. A CORRUGATED MODEL FOR THE LUNAR SURFACE
Gear, A. E., Bastin, J. A.
*Nature*, v. 196, p. 1305, December 29, 1962

It is suggested that a number of previously uncorrelated visual and IR lunar observations may be explained by assuming that the surface of the Moon has indentations, the scale of which is too small to be resolved optically by terrestrial observations. Models similar to that suggested have been found to give good agreement with lunar photographic measurements. (*IAA*, 1963, A63-11859)

678. FLIGHT MODEL OF RANGER TV SUBSYSTEM; VOLUME I: OPERATION AND MAINTENANCE MANUAL
December 31, 1962
Radio Corporation of America, Astro-Electronics Division, Princeton, N.J.
AED 1570, Vol. I & II

The purpose of this manual is to provide operating personnel with the information necessary to perform the following requirements. align and calibrate individual components of the *Ranger* TV Subsystem during assembly and/or mainte-

nance; perform a detailed checkout of the *Ranger* TV Subsystem after assembly; and interpret and evaluate telemetry data obtained during the *Ranger*'s mission.

679. THE GEOLOGY OF THE MOON: A PARTIAL BIBLIOGRAPHY OF MEASUREMENTS AND OBSERVATIONS
Weide, D. L.
December 1962
Douglas Aircraft Company, Inc., Missile and Space Systems Division, Santa Monica, Calif.
SM-42553
AD-296,779

This compilation was prepared as a general guide to the literature available concerning selenology. The bulk of the material cited covers the period from 1920 to November 1962. Some earlier works significant in the development of lunar theories are also cited. The bibliography is divided into eight sections, each dealing with a different selenological phase and related observations. (*AI/A*, 1963, #71,166)

680. ASTROMETRIC OBSERVATION OF THE ANNULAR ECLIPSE AT TANEGASHIMA ISLAND ON APRIL 19th 1958. I. GEODETIC WORK AND INSPECTION OF THE LUNAR PROFILE
Fujinami, S., Hurukawa, K., Furuta, K.
*Memoirs of the College of Science, University of Kyoto, Series A*, v. 30, no. 2, pp. 193–203, December 1962

The lunar profile was measured on the plates taken at the annular eclipse in April, 1958. The mean square error in the measurement of limb height at a point was of the order of ± 0″.15, but that of personal difference between two observers was estimated as ± 0″.25. The result was compared with those of Hayn (1914) and Weimer (1951). In addition the geodetic work for determining the longitude and the latitude of the observation site is briefly reported. (*PA*, 1963, #9177)

681. THE MEASUREMENT OF LUNAR ALTITUDES BY PHOTOGRAPHY.
I. ESTIMATING THE TRUE LENGTHS OF SHADOWS
Fielder, G.
*Planetary and Space Science*, v. 9, pp. 917–928, December 1962

All known sources of error in the apparent length of a lunar shadow recorded photographically and measured with a microdensitometer are considered. The discussion is general but is illustrated by reference to sunrise shadows of various lengths cast by the lunar Straight Wall. Measurements of shadow lengths made between half-density points of a microdensitometric scan along a shadow may contain systematic errors due to the nonlinearity of the characteristic of the photographic emulsion. The most important sources of systematic-error are seeing (especially in the case of short shadows), penumbrae, and uncertain selenographic coordinates. Other errors, due to seeing, effects at a shadow-tip, and procedures of measurement, are also important but probably apply in a more nearly random manner. (*PA*, 1963, #9172)

682. THE MEASUREMENT OF LUNAR ALTITUDES BY PHOTOGRAPHY.
II. SOME MEASUREMENTS ON THE LUNAR STRAIGHT WALL
Fielder, G.
*Planetary and Space Science*, v. 9, pp. 929–938, December 1962

Measurements of shadows cast by the lunar Straight Wall are corrected, where possible, for systematic errors and relative altitudes are obtained. All known sources of error are taken into account to compute the most probable error in a result, which is commonly ± 10 percent of the altitude. The results from the photographic method are compared with visual estimates. It is shown that the top of the Straight Wall is level to within ± 100 m. For several different shadow lengths, the greatest relative altitude of the Straight Wall is ~300 m for short shadows and ~380 m for long shadows. (*PA*, 1963, #9173)

683. THE AUTOMATION OF ASTROMETRIC MEASUREMENTS OF MOON PHOTOGRAPHS BY MEANS OF A PHOTOELECTRIC INSTRUMENT
Bystrov, N. F.
*Astronomicheskii Zhurnal*, v. 39, no. 1, pp. 146–150, 1962 (Translated from the Russian in *Soviet Astronomy—AJ*, v. 6, no. 1, pp. 109–112, July–August 1962)

An automatic photoelectric instrument for measuring photographs of the Moon is described. The instrument is used for obtaining the coordinates of the Moon's center. Results on the precision of measurements with the instrument are given, and a comparison is made with the results obtained using visual measuring instruments. (*PA*, 1962, #21,684)

684. THE MICROSTRUCTURE OF THE LUNAR SURFACE
Barabashov, N. P., Garazha, V. I.
*Astronomicheskii Zhurnal*, v. 39, no. 2, pp. 305–314, 1962 (Translated from the Russian in *Soviet Astronomy—AJ*, v. 6, no. 2, pp. 237–243, September–October 1962)

It is shown that a model of volcanic tufa honeycombed by square-shaped cells (the side of the square being $m$, the thickness of the wall 0.20 $m$ and the depth from 1.5 to 2 $m$) can satisfy all the observed characteristics of light reflection from the lunar surface. However, as the origin of square cells on the lunar surface can hardly be explained by the action of natural factors, six-sided cells, which are closer to a circular form, have been considered, the presence of these on the Moon being more natural. The study showed that six-sided cells (and even more circular cells) do not satisfy the characteristics of light reflection from the Moon. Therefore, the presence of rectilinear cell-like formations on the Moon is unlikely. It is natural to expect that the lunar surface is covered by chaotically located fragments of rocks. Fragmented

tufa with grains of the size of one to several millimeters is in good agreement with the peculiarities of light reflection from the lunar surface. Fragmented tufa also satisfies the spectrophotometric and polarizational characteristics of the lunar surface. It is similar to the Moon in its thermal conductivity, density, electrical conductivity, and other characteristics. (*PA*, 1962, #24,089)

685. DETERMINATION OF THE POSITION OF THE MOON'S CENTER OF MASS FROM PHOTOGRAPHIC OBSERVATIONS
Bystrov, N. F.
*Astronomicheskii Zhurnal*, v. 39, no. 3, pp. 527–531, 1962
(Translated from the Russian in *Soviet Astronomy—AJ*, v. 6, no. 3, pp. 412–415, November–December 1962)

The factors affecting the accuracy of the photographic determination of the position of the Moon's center of mass are discussed. The precision of visual and photoelectric measurements of the Moon's limb is compared. A method is suggested for obtaining the position of the center of mass relative to details on the lunar disk. (*AI/A*, 1963, #70,778)

686. EXPERIMENTS ON THE PHOTOGRAPHY OF THE MOON CARRIED OUT AT THE PULKOVO OBSERVATORY AT WAVELENGTHS 0.8–2.3 $\mu$
Kuprevich, N. F.
*Astronomicheskii Zhurnal*, v. 39, no. 6, pp. 1136–1139, 1962
(Translated from the Russian in *Soviet Astronomy—AJ*, v. 6, no. 6, pp. 883–885, 1963)

The results are given of observations of the lunar surface in the spectral region $\lambda\lambda$ 8000–23,000, using television, at Pulkovo Observatory. The photographs in the infrared are compared to those in the visual region obtained previously by other authors. It is found in the infrared that there is an increase in the contrast of the photographs with increasing wavelength. Details not usually visible on ordinary photographs are revealed. It is suggested that the increase in contrast and the appearance of new details on the lunar image can be explained by a decrease of luminescence radiation in the infrared. (*PA*, 1963, #9167)

687. LUNAR TV CAMERA MANIPULATOR
Grimm, F., Sullivan, R. (General Mills, Inc., Automatic Handling Equipment Dept., Minneapolis, Minn.)
1962
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
Report

A three-motion lunar TV manipulator was designed and built by General Mills, Inc., to specifications of the Jet Propulsion Laboratory. Manipulator features believed to be unique are (1) automatic temperature control; (2) compactness, efficiency, and low weight of the actuators for their torque output; and (3) means of providing lubrication. Both the general design philosophy and that pertaining to friction problems are discussed, and the manipulator is fully described. Detailed specifications for the camera manipulator preliminary study, the manipulator target, and components and procurement are given. Component and procurements specifications are included for the motor, motor winding, bearings, lubrications, actuator seal, component materials, and bearing material. Test data are given for the motors and actuators, and results of gear analyses are presented. Thermal analyses are described which concerned (1) temperature control by polished metal and by insulation, (2) TV camera temperature, and (3) a bimetal spring control mechanism. Data gained from these analyses are given as well as general conclusions and recommendations for testing and evaluation. Six large drawings are included. (*AI/A*, 1963, #71,596)

688. USAF CARTOGRAPHIC SUPPORT OF LUNAR MISSIONS (Presented at the Lunar Missions Meeting of the American Rocket Society, Cleveland, Ohio, July 17–19, 1962)
Carder, R. W. (USAF, Aeronautical Chart and Information Center, St. Louis, Mo.)
1962
American Rocket Society, New York, N.Y.
Paper 2474-62

The United States Air Force, in response to the advance of the national space program, is publishing a series of photographic and cartographic products of the Moon. A Lunar Atlas containing a comprehensive selection of lunar photography has been published, followed by several supplements. USAF Lunar Mosaics in several sizes are now available and a series of Lunar Aeronautical Charts, Scale 1:1,000,000, sheet size 22 × 29 in. are under construction. These charts, lithographed in four colors, contain 300-m contours. This program is being accomplished jointly by the Air Force Cambridge Research Laboratory and the Aeronautical Chart and Information Center in collaboration with the scientific community.

689. LUNAR CRATER PROFILES
Warner, B.
*British Astronomical Association, Journal of the*, v. 72, no. 3, pp. 138–139, 1962

The Photographic Lunar Atlas (1960) is not suitable for an application of Cross's method of determining the profiles of individual craters from photographs. Different coverages of the same region yield inconsistent results, and for a given crater there is often an apparent change in profile between photographs taken under opposite lighting conditions. (*PA*, 1962, #17,241)

690. THE DEPTHS OF SMALL LUNAR CRATERS
Fielder, G.
*British Astronomical Association, Journal of the*, v. 72, no. 5, pp. 216–223, 1962

The relationship between the depths and the diameters of craters of $< \sim 20$ km in diameter is not known with sufficient

accuracy. By observing what fractions of the E–W diameters of craters are covered by shadow at given times, observers can help to fill this gap in present knowledge. The theory of the method, the sources of data, and some results are given. (*PA*, 1962, #21,697)

691. SOME PROBLEMS OF LUNAR OROGENY
Warner, B.
*British Astronomical Association, Journal of the,* v. 72, no. 6, pp. 280–285, 1962

Three types of lunar surface features are discussed: (1) central elevations within craters, (2) summit craterlets, and (3) ringwall craters and craterchains. (*AI/A*, 1962, #61,123)

692. SOME LUNAR OBSERVATIONS AT THE YERKES AND McDONALD OBSERVATORIES
Lenham, A. P.
*British Astronomical Association, Journal of the,* v. 72, no. 7, pp. 347–348, 1962

Lunar observations made on August 18, 1956, January 13, 1957, July 5, 1957, and June 26, 1958 are reported. (*AI/A*, 1962, #61,437)

### *Pluto — 1962*

693. OBSERVATIONS OF PLUTO IN 1960
Antalová, A., Antal, M.
*Ceskaslovenska Akademie Ved., Biulletin' Astronomicheskikh Institutov Chekhoslovakii,* v. 13, no. 1, pp. 26–27, 1962

Five positions of the planet Pluto, obtained at the Skalnaté Plese Observatory in 1960, are given. The mean residual against the current ephemeris is $+0''.64 \pm 0''.02$ in right ascension and $-0''.4 \pm 0''.3$ in declination. (*AI/A*, 1962, #60,488)

### *Saturn — 1962*

694. OBSERVATIONS OF SATURN'S OCCULTATIONS IN JUNE
*Sky and Telescope,* v. 24, no. 2, pp. 92–93, August 1962

Pertinent data on the occultation of Saturn by the Moon on June 21 at Dallas, Texas are presented. Reports from many observers who witnessed the phenomenon are included. (*AI/A*, 1962, #60,511)

695. A PRELIMINARY REPORT ON THE OCCULTATION OF BD-19°5925 BY SATURN ON JULY 23, 1962
Goodman, J. W.
*Strolling Astronomer,* v. 16, no. 11–12, pp. 243–245, November–December 1962

The occultation of the eighth magnitude star, BD-19°5925, by Saturn on July 23, 1962, was extensively observed. The primary purpose of these observations was to map optical densities of Saturn's rings or to determine the positions of intensity minima. The findings of various observers are discussed. (*AI/A*, 1963, #70,826)

696. OCCULTATION OF SATURN BY THE MOON, 1962 NOVEMBER 4
Meeus, J.
*British Astronomical Association, Journal of the,* v. 72, no. 5, pp. 225–226, 1962

The position of the northern limit of the occultation in England is given. (*AI/A*, 1962, #61,524)

### *Venus — 1962*

697. VENUS IN 1959
Bartlett, J. C., Jr.
*Strolling Astronomer,* v. 16, no. 1–2, pp. 9–24, January–February 1962
(*AI/S*, 1962, #51,264)

698. VENUS SECTION REPORT: EASTERN APPARITION, 1960–1961. PARTS 6–8
Hartmann, W. K.
*Strolling Astronomer,* v. 16, no. 7–8, pp. 171–185, July–August 1962

Part Six of this Venus Section Report deals with the terminator; Part Seven contains 46 weighted observations of the observed dichotomy; and Part Eight presents confirmation of detail on Venus. Several sets of near-simultaneous observations are given in eight pages of drawings. (*AI/A*, 1963, #70,922)

699. VENUS SECTION REPORT: THE SCHRÖTER DICHOTOMY EFFECT IN A.L.P.O. OBSERVATIONAL RECORDS, 1951–1961
Hartmann, W. K.
*Strolling Astronomer,* v. 16, no. 9–10, pp. 222–230, September–October 1962

The 1951–1961 observations of Venus by the Association of Lunar and Planetary Observers are described, and the nature of the Schröter dichotomy effect is discussed. (*AI/A*, 1963, #71,229)

700. THE TELESCOPIC APPEARANCE OF VENUS
Brinton, H., Moore, P.
*Strolling Astronomer,* v. 16, no. 11–12, pp. 253–254, November–December 1962

During recent observations of Venus, a new effect was noticed. It takes the form of a telescopic image of the planet which appears to be part of a less than half-illuminated sphere, i.e., the line joining the cusps is less than a diameter. The telescopes used were a 12-in. reflector and an 8.5-in. reflector. (*AI/A*, 1963, #70,923)

7C1. THE CUSP CAPS OF VENUS
Pither, C. M.
*British Astronomical Association, Journal of the,*
v. 72, no. 1, pp. 14–17, 1962

This is an account of the appearance of bright areas, called cusp caps, seen at the cusps of Venus. Observations were made from May 1959 to June 1961 in both white light and with the aid of filters. (*AI/A*, 1962, #61,593)

702. VENUS
Moore, P.
*British Astronomical Association, Journal of the,*
v. 72, no. 1, p. 79, 1962

Venusian observations made during the latter part of 1961 are discussed. (*AI/A*, 1962, #61,592)

703. VENUS: EASTERN ELONGATION OF 1960–1961
Moore, P.
*British Astronomical Association, Journal of the,*
v. 72, no. 6, pp. 262–265, 1962

The visual observations of Venus made by Section members are reported. The period covered is from June 23, 1960 to April 11, 1961. (*PA*, 1962, #24,099)

704. PHOTOGRAPHY OF THE PLANET VENUS
Heath, A. W.
*British Astronomical Association, Journal of the,*
v. 72, no. 6, pp. 278–279, 1962

Simple photography of Venus can be carried out with an alt-azimuth mounted telescope. The procedure, choice of film, development of the film, exposure and magnification are detailed. Photography with color filters is also mentioned. (*PA*, 1962, #24,100)

## *General — 1963*

705. A PHOTOSERVOSYSTEM
(Translated from Soviet Patent 140226 [683412/26], October 25, 1960)
Polonnikov, R. I.
January 25, 1963
Air Force Systems Command, Foreign Technical Division, Wright-Patterson AFB, Ohio
FTD-TT-62-1528
AD-295,192
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

706. CATALOGUE OF TIROS V–VI CLOUD PHOTOGRAPHY FOR OCTOBER 1962
TIROS V (PASSES 1486 THRU 1927)
TIROS VI (PASSES 187 THRU 635)
February 1963
U.S. Department of Commerce, Weather Bureau, National Weather Satellite Center, Washington, D.C.

This is one in a series of catalog preprints describing the television cloud photographs obtained by *Tiros* 5 and 6. Material in this issue covers October 1962. (*AI/A*, 1963, #71,607)

707. IMAGE ORTHICON ASTRONOMY AT THE DEARBORN OBSERVATORY
Powers, W. T., Aikens, R. S.
*Applied Optics*, v. 2, no. 2, pp. 157–164, February 1963

For a given S/N ratio, the image orthicon can record stars to a theoretical magnitude limit set primarily by skylight. A "skylight suppression" technique under development appears capable of increasing available integration time and hence the limiting magnitude. Short-exposure pictures of the Moon under high magnification show about ½-sec resolution with good seeing, and an 18.5-in. (47 cm) telescope. Under certain conditions the image orthicon can be used to provide better resolution than possible with emulsions, owing to the shorter exposures which are feasible even with high-magnification projection optics. Among other electronic devices which have been used are the intensifier orthicon, the image isocon, and, most promising, the field mesh orthicon. Brief descriptions of these devices are given as a matter of general interest, although they are not in use at Dearborn Observatory. A list of some Dearborn Observatory projects in electronic astronomy is presented to suggest the wide range of application of this new technique. (*PA*, 1963, #9144)

708. THE OBSERVATORY GENERATION OF SATELLITES
March 1963
National Aeronautics and Space Administration, Office of Scientific and Technical Information, Washington, D.C.
SP-30

The American Astronautical Society held its second annual regional meeting as part of the 129th Meeting of the American Association for the Advancement of Science in Philadelphia, Pennsylvania, December 1962. Session II of the Special Astronautics Symposium, "Scientific Satellites—Mission and Design," on December 27, 1962, was comprised of the following six papers:

"The Mission of the Orbiting Geophysical Observatories," by W. E. Scull

"The Engineering Design of the Orbiting Geophysical Observatories," by G. E. Gleghorn

"The Mission of the Advanced Orbiting Solar Observatory," by J. C. Lindsay

"One Approach to the Engineering Design of the Advanced Orbiting Solar Observatory," by A. J. Cervenka

"The Mission of the Orbiting Astronomical Observatory," by R. R. Zeimer and J. E. Kupperian, Jr.

"The Engineering Design of the Orbiting Astronomical Observatory," W. H. Scott. (*AI/A*, 1963, #71,859)

709. TV ASTRONOMY
*Journal of the Franklin Institute*, v. 275, p. 454, May 1963
(*AS&T* 1963)

710. EXPLORING THE SOLAR SYSTEM WITH SPACE PROBES
Hibbs, A. R. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena)
In "Space Science," pp. 200–225
John Wiley & Sons, Inc., New York, N.Y., 1963

The spacecraft and instrumentation designed for the NASA solar-system exploration program are described. A discussion of the lunar program includes the present model of the lunar surface. Described in detail are the following. (1) *Ranger*, which is an attitude-controlled vehicle, deriving its electrical power from solar batteries, and which communicates with Earth by means of a 4-ft parabolic directional antenna; (2) *Surveyor*, which is designed to soft-land a package of instruments for a detailed inspection of the lunar surface; and (3) *Prospector*, which is a surface-roving vehicle, larger than the *Surveyor*. Instrumentation for each spacecraft is described. The scientific objectives of the lunar and planetary exploration programs are briefly defined. The vehicles for the planetary exploration include *Mariner R*, *Mariner B*, and *Voyager*. The major features of these vehicles, and their instrumentation, are briefly outlined. (*IAA*, 1963, A63-13868)

## *Mars — 1963*

711. STRUCTURE OF PLANETARY ATMOSPHERES
Rasool, S. I.
*AIAA Journal*, v. 1, no. 1, pp. 6–19, January 1963

The properties of the atmospheres of Mars, Venus, and Jupiter are reviewed in light of the most recent observational results. The factors that determine the Earth's observed temperature profile are outlined as an introduction to a discussion of the atmospheric structure of the other planets. The composition, pressures, temperature, and clouds of the planets are discussed, as well as the red spot and radiation belts of Jupiter, the blue haze layer of Mars, and three proposed atmospheric models for Venus. (*AI/A*, 1963, #71,111)

712. ON THE TOPOGRAPHY OF MARS
Fielder, G.
*Astronomical Society of the Pacific, Publications of the*, v. 75, no. 442, pp. 75–76, February 1963

The canals which appear on the Martian surface are briefly considered. (*AI/A*, 1963, #80,555)

713. SOME GEOLOGIC PROBLEMS OF MARS
Loomis, A. A.
March 4, 1963
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TR 32-400

Geological and geophysical knowledge and uncertainties concerning the surface and body of Mars are briefly discussed and evaluated. It is pointed out that accurate values for the figure of the planet and the radii, seismic evidence of internal structure, and measurements of the outward heat flux across the surface are necessary and important in order to achieve a satisfactory description of the body of Mars. Some geological inferences which can be drawn from available photographic and photometric data concerning topography, areas of water accumulation, and biological activity are discussed. The priority of scientific geologic experiments is presented, and some present instrumentation capabilities and deficiencies are listed. (*AI/A*, 1963, #71,823)

## *Moon — 1963*

714. SUPPLEMENTARY REPORT ON THE ATMOSPHERES OF VENUS AND MARS AND ON THE LUNAR SURFACE AND ATMOSPHERE
January 15, 1963
Library of Congress, Aerospace Information Division, Washington, D.C.
AID 62-97
(Also available as OTS: 62-32,103, U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

This is the first in a projected series of irregular reports supplementing the basic studies already released which describe the present status of Soviet investigations in the field represented.

715. BARYCENTRIC HIGH RELIEF OF THE LIMB ZONE OF THE MOON
(Translated from *Glavnoi Astronomicheskii Observatoriia, Kiev, Izvestiia*, v. 3, no. 2, pp. 68–76, 1961)
Gavrilov, I. V.
January 29, 1963
Joint Publications Research Service, Washington, D.C.
JPRS-17363, Soviet Astronomical Reports, pp. 53–64
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Barycentric high relief of the limb zone of the Moon was investigated, using data on the lunar shape. (*STAR*, 1963, N63-12203)

716. TOPOGRAPHY AND TECTONICS OF THE LUNAR STRAIGHT WALL
Fielder, G.
*Planetary and Space Science*, v. 11, no. 1, pp. 23–30, January 1963

The Straight Wall region of the Moon is surveyed, and the Wall is found to be a dip-slip fault with the upthrow dipping gently away from the fault. Data are drawn from (1) measurement of sunrise shadows, (2) measurement of the width of the face of the Straight Wall at sunset, (3) photometric measurements of the slope of the country in the immediate vicinity of the Wall, and (4) photographic and visual observations. Igneous activity undoubtedly caused the dominant tectonic forces in the region. (*AI/A*, 1963, #71,904)

717. OBSERVING THE MOON—LUBINIEZKY
Herring, A. K.
*Sky and Telescope*, v. 25, no. 1, p. 41, January 1963

Lubiniezky, one of the partially ruined lunar craters on the southern portion of Mare Nubium near Bullialdus, is described and illustrated. (*AI/A*, 1963, #71,421)

718. OPTICAL PROBLEMS OF TELEVISION RECORDING OF THE MOON AND PLANETS FROM APPROACHING SPACECRAFT
Martz, E. P., Jr.
*Applied Optics*, v. 2, no. 1, pp. 41–50, January 1963

The type and quality of scientific information desired from television cameras on spacecraft approaching the Moon and nearby planets are reviewed. The desired accuracy of the optical data is compared with that presently secured from Earth-based telescopes. The fundamental limitations due to the vibration and shock of the rocket launch and to the vacuum, radiation, and temperature environment of interplanetary space are considered. The influences of solar illumination, phase angle, and altitudes of recording on the resolution obtained are discussed. Optical television systems employed on certain lunar and planetary probes are described. Methods of improving optical television images received on Earth by reduction of the background noise are noted. (*PA*, 1963, #7014)

719. THE MOON—I
*Sky and Telescope*, v. 25, no. 1, pp. 26–27, January 1963

An instructive description of the Moon is given—as if viewed from Venus. Information concerning the Moon's mass, gravitational action, and orbital motion is discussed, and the increasing usefulness of lunar observations to geodetic studies is described. (*AI/A*, 1963, #71,478)

720. PITON—A LUNAR PROTEUS
Bartlett, J. C., Jr.
*Strolling Astronomer*, v. 17, no. 1–2, pp. 3–12, January–February 1963

The apparent protean transformations of the lunar mountain Piton during a series of systematic observations, beginning in April 1961 and ending in October of the same year, are discussed in detail. The cause of high-Sun darkenings in the semicircular area immediately east of Piton is explored. (*AI/A*, 1963, #71,903)

721. A NOTE ON THE DARWIN DOME AS SEEN IN SMALL AND LARGE APERTURES
Olivarez, J.
*Strolling Astronomer*, v. 17, no. 1–2, pp. 34–35, January–February 1963

An account is given of recent observations (made with a 12½-in. reflector) of the Darwin dome—one of the largest, most rugged, and spectacular domes on the lunar surface. (*AI/A*, 1963, #71,800)

722. RANGER TV SUBSYSTEM
February 15, 1963
Radio Corporation of America, Astro-Electronics Division, Princeton, N.J.
AED 1812, Bimonthly Progress Report 9 for December 1, 1962–January 31, 1963

As a result of a series of system-concept-and-design reviews with the Jet Propulsion Laboratory, RCA was requested by JPL to study alternative configurations of the TV Subsystem. The objective of this study is to evolve a configuration for the TV subsystem with improved capability of obtaining pictures of the Moon either during a nonstandard mission or under conditions of partial failure of the TV subsystem. As a result of this study, RCA has proposed a configuration with a maximum degree of dependence, from both the signal and power standpoints, for the two-camera TV subsystem. This design concept known as the "split system," was reviewed and accepted by JPL, and RCA was instructed to modify the PTM to the split-system configuration.

723. LIMB REGIONS OF THE MOON
Firsoff, V. A.
*Discovery*, v. 24, no. 2, pp. 28–31, February 1963

The technique of spherical projection is described, and its application to obtaining a clearer picture of lunar limb features is considered. (*AI/A*, 1963, #80,200)

724. GETTING ACQUAINTED WITH ASTRONOMY, THE MOON—II
*Sky and Telescope*, v. 25, no. 3, pp. 146–147, March 1963

The state of the art of selenography is discussed, and a brief survey of the various lunar features is presented. (*AI/A*, 1963, #71,553)

725. PROPERTIES OF THE LUNAR SURFACE AS REVEALED BY THERMAL RADIATION
Muncey, R. W.
*Australian Journal of Physics*, v. 16, no. 1, pp. 24–31, March 1963

On the assumption that the thermal properties are proportional to the temperature, the uniform lunar surface corresponding to the observed optical values is calculated. Possible mixed surfaces are also evaluated. These are examined to estimate the likely variation in microwave radiation, and by comparison with observed results it is shown that the most probable surface consists (1) partly of rock or gravel overlain by a thin layer of fine dust, and (2) partly of areas with dust extending to beyond the depth from which the microwave radiation emanates. (*AI/A*, 1963, #71,905)

726. OBSERVING THE MOON'S SHADOW AND THE DEGREE OF DARKNESS AT THE TOTAL SOLAR ECLIPSE OF JULY 20, 1963
Glenn, W. H.
*Strolling Astronomer*, v. 17, no. 3–4, pp. 55–59, March–April 1963
(*AI/A*, 1963, #80,204)

### *Venus — 1963*

727. ON THE VENUS CUSP EFFECT REPORTED BY BRINTON AND MOORE
Cruikshank, D. P.
*Strolling Astronomer*, v. 17, no. 1–2, pp. 1–2, January–February 1963

Filar micrometer measurements of Venus both in visual light and with color filters indicate that the reported cusp anomaly is due entirely to contrast. The view is also expressed that low magnification and consequent high contrast logically explain many "phenomena" of Venus. (*AI/A*, 1963, #72,000)

728. A NOTE ON PHASE ANOMALIES OF VENUS
Hartmann, W. K.
*Strolling Astronomer*, v. 17, no. 1–2, pp. 2–3, January–February 1963

It is concluded that no real evidence has been given to show that any of the phase anomalies associated with Venus are due to anything more unusual than contrast effects and the rapid decrease in brightness near the terminator. (*AI/A*, 1963, #72,001)

729. BANDS AND BELTS ON VENUS
Devadas, P.
*British Astronomical Association, Journal of the*, v. 73, no. 4, pp. 165–169, 1963

Observations of the south polar cap, bright bands, and dusky belts along parallel circles around the planet are described. These observations were made during the 1961 eastern elongation. (*AI/A*, 1963, #80,358)

730. MERCURY AND VENUS SECTION
Moore, P.
*British Astronomical Association, Journal of the*, v. 73, no. 5, pp. 184-187, 1963

Reports by several amateur astronomers concerning the eastern elongation of Venus in 1962 are summarized. (*AI/A*, 1963, #80,359)

**(See also Entries #35, 63, 94, 112, 139, 1954, 2015.)**

# TELEVISION DEVELOPMENT

731. RETMA STANDARD: GOOD ENGINEERING PRACTICE REGARDING I.F. REJECTION OF TELEVISION RECEIVERS
March 1954
Radio-Electronics-Television Manufacturers Association, Washington, D.C.
REC-140

732. RETMA STANDARD: STANDARD OF GOOD ENGINEERING PRACTICE REGARDING THE ANTENNA INPUT IMPEDANCE OF A TELEVISION RECEIVER
May 1954
Radio-Electronics-Television Manufacturers Association, Washington, D.C.
REC-110-A

733. TELEVISION: THE ELECTRONICS OF IMAGE TRANSMISSION IN COLOR AND MONOCHROME
Zworykin, V. K., Morton, G. A.
John Wiley & Sons, Inc., New York, N.Y., Second Edition, 1954

734. ZUSAMMENHANG ZWISCHEN ZEITFUNKTION A(t) UND SPEKTRALFUNKTION (CONNECTION BETWEEN TIME FUNCTION A(t) AND SPECTRAL FUNCTION)
Kirschner, U.
*Elektronische Rundschau*, v. 11, no. 3, pp. 87–92, March 1957

A definition is given of the spectral function by unilateral Laplace integral, and of the transfer function in excited condition by Wagner operational function. A possible application of the derived relations to circuit design in picture transmission engineering is presented. Pulse technique and television engineering are discussed. (*EI*, 1958)

735. ALTERNATIVE COLOUR TV SYSTEM
Gargini, E. J.
*Wireless World*, v. 63, no. 8, pp. 361–364, August 1957

A critical discussion of the NTSC system is presented with a view to its eventual adoption by Great Britain. Chromacity signal vs. chrominance signal is discussed, as well as gamma correction signal synthesis. Segregating color information is given and possible alternatives for the NTSC system are discussed. (*EI*, 1958)

736. THE COLOUR SUB-CARRIER FREQUENCY IN A 625-LINE VERSION OF THE N.T.S.C. SYSTEM
Schwartz, E.
*Rundfunktechnische Mitteilungen*, v. 1, no. 5, pp. 191–195, October 1957 (in German)

The different color subcarrier frequencies which have been proposed for adaptations of the NTSC system to the European 625-line standards are listed. A direct transportation without modification leads to a frequency of 4.17 + 0.04 Mc for the color subcarrier. The nearest frequencies which could be chosen are 4.2109375 and 4.1015625 Mc. It is mentioned that, with a low frequency for the subcarrier, a symmetrical sideband system can be adopted, and not only the information $I$, but also the information $Q$, can be radiated without one sideband being suppressed. (*EEA*, 1958, #1040)

737. THE PHYSICAL ASPECT OF INFORMATION THEORY. APPLICATION TO THE CHOICE OF MULTIPLEX LINKS AND TO TELEVISION
Ortusi, J.
*Annales de Radioélectricité*, v. 12, pp. 299–314, October 1957 (in French)

Some fundamental definitions of information theory are restated and the relationship between Brillouin's two classes of information is discussed, i.e., information which is related to the properties of a physical system and information which arises whenever the human factor somes into account. The concept of a "rate of usable information" is introduced and is defined as the rate of transformation of the particular coding which represents the change from the former class to the latter. This rate is calculated by decomposing the signal into elementary signals and drawing the analogy between their distribution in time and the distribution in phase of the particles carrying the signal. The minimum characteristics to secure a suitable rate of information for an audio international telephone link, as recommended by the C.C.I.F., are enumerated and discussed. Efficiency of a link is defined as the ratio of rate of usable information per channel to the channel capacity at the maximum rate, and this ratio is calculated for some common multiplex systems. Suitable systems for picture transmission with a high rate of information are discussed. (*EEA*, 1958, #902)

738. INTERNATIONAL SYMPOSIUM ON THE PHYSICAL PROBLEMS OF COLOUR TELEVISION HELD IN PARIS, FRANCE, JULY 2–6, 1957
*Acta Electronica*, v. 2, no. 1–2, 1957–1958 (in French with English summary)

The following papers were presented at the Symposium:

"Physical Problems of Colour Television: General Survey With Special Reference to American Experience," by B. K. Zworyken, pp. 17–24

"Physiological Optics and Colour Television: Survey," by W. D. Wright, pp. 26–32 (See Entry #1522)

"Quantum Limitations in Vision and Television," by A. Rose, pp. 33–36

"Energy Theory of Resolution Power," by V. Ronchi, pp. 37–43 (in French)

"Visibility of Details of Moving Object," by G. van den Brink, pp. 44–49

"Measurements About Fusion Frequency of Colours," by P. L. Walraven, H. J. Leereek, M. A. Rouman, pp. 50–54

"Saturation in Chromatic Perception," by H. Pieron, pp. 55–59 (in French)

"Perceptions of Colors in Projected and Televised Pictures," by D. L. MacAdam, p. 60

"Visibility of Recurrent Patterns in Television Systems With Interlaced Scanning," by G. A. Boutry, P. Billard, pp. 61–70 (in French)

"Contrast in Perception of Field With Blurry Edges Stationary or Moving," by A. Fiorentini, pp. 71–76 (in French)

"Subjective Visual Effects of A.N.T.S.C. Colour Television Receiver Tolerances," by P. S. Carnt, G. B. Townsend, pp. 77–86 (See Entry #1523)

"Choice of Chrominance Axes for Colour Television," by K. Hacking, pp. 87–94 (See Entry #1524)

"Investigation Into Subjective Effects of Some Differences Between Red, Green, and Blue Transfer Characteristics of Colour Television System," by T. Jacobs, R. N. Jackson, pp. 95–102 (See Entry #1525)

"Choice of Chrominance Signals in NTSC System with View to Differential Sensitivity of Human Eye to Colour," by F. W. de Vrijer, pp. 103–109 (See Entry #1526)

"Comparative Study of Properties of Electron Tubes Used as Image Scanners in Colour Television," by F. Schröter, pp. 112–123 (in French) (See Entry #843)

"Lead Oxide Vidicon," by L. Heijne, pp. 124–131 (See Entry #973)

"Comparative Study of Electronic Tubes Used for Reproduction of Color Television Pictures," by C. J. Hirsch, pp. 132–142

"Phosphors for Colour Television," by H. A. Klasens, pp. 143–152

"Measurement of Colour Purity in Colour Tubes," by J. C. Francken, R. R. Bathelt, pp. 153–158 (See Entry #1527)

"Design Problems of Colour Television Kinescopes," by I. Bornemann, pp. 159–167 (See Entry #975)

"Dispersion Process," by P. M. G. Toulon, pp. 168–173 (in French) (See Entry #739)

...nation of Television Color Image by Aid of Lenticular Grid," by E. Allard, pp. 174–180 (in French)

"Colorimetry of Sequential Displays," by R. G. Clapp, pp. 181–188 (See Entry #1528)

"Postfocusing Colour Tube," by E. F. de Haan and H. Zimmer, pp. 189–193

"Experimental Colour Television Projection System," by D. V. Ridgeway, pp. 194–200

"Projection Objective Incorporating Wide Aperature Mirror for Use in Television," by J. Pouleau, pp. 201–205 (in French) (See Entry #976)

"EMI Flying-spot Film Scanner for Colour Television," by H. E. Holman, G. C. Newton, S. F. Quinn, pp. 206–213 (See Entry #844)

"Spectral Response Curves of Devices for Image Analysis," by A. K. Koustarev, p. 214 (in French)

"Color Kinescope Recording on Embossed Film," by C. H. Evans, R. B. Smith, p. 215

"Definition of Picture Quality in Black-and-White and Colour Television," by P. Neidhardt, pp. 218–226 (See Entry #1371)

"Compatibility and Image Definition of Color Image as Compared with Black and White Image," by M. L. D'Atri, U. Pellegrini, pp. 227–229 (in French)

"Random and Impulsive Noise in Colour Television," by P. S. Carnt, G. B. Townsend, pp. 230–239 (See Entry #1372)

"Use of Spot-Wobble, Synchronous Spot-Wobble and Sampled Synchronous Spot-Wobble in Television," by L. C. Jesty, pp. 240–241

"Relation Between Picture Size, Viewing Distance, and Picture Quality with Special Reference to Spot-Wobble Techniques," by L. C. Jesty pp. 242–255 (See Entry #1386)

"Improvement of Contrast in Photographic Image Detail by Filtration of Spatial Harmonics," by A. Marechal, P. Croce, K. Dietzel, pp. 256–262 (in French)

"Apparatus for Measuring Transmission Factor of Spatial Frequencies of Photographic Objectives," by P. Lacomme, pp. 263–264 (in French)

"Influence of Aberrations in Image Quality of Optical Systems," by H. H. Hopkins, p. 265

"Measurement of Frequency Response," by D. Kelsall, pp. 266–270

"Lens-Testing Apparatus," by K. G. Birch, pp. 271–273 (See Entry #1529)

"Calculation of Influence of Spherical Abberation on Frequency Response of Lens System," by A. M. Goodbody, pp. 274–276 (See Entry #977)

"Apodization and Frequency Response in Incoherent Light," by J. A. MacDonald, pp. 277–278

"Interferometric Study of Fourier Spectrum of Photographic Image," by J. C. Vienot, pp. 279–282 (in French)

"Differential Threshold of Luminance in Television," by P. Billard, pp. 283–292 (in French)

"Improvement of Optical Transmission Factors," by A. Lohmann, pp. 293–298 (in German)

"On Transmission Theory of Incoherent Optical Images From Standpoint of Geometric Optics," by W. Lukosz, pp. 299–306 (in German)

"Calculation of Luminance for Television Color Receiver," by S. V. Novakovskii, pp. 307–315 (in French)

"Exponential Function for Uniform Chromaticity Scale," by R. Taguti, M. Sato, pp. 316–319

"Coding System Used in Colour Television," by M. J. Haantjes, pp. 320–326

"Problems of Transmission in Colour," by J. Haantjes, K. Teer, pp. 327–332 (in French)

"Communication Theory Applied to Television Coding," by R. E. Graham, pp. 333–343 (See Entry #1373)

"Intrinsic and Subjective Quality of Images and Information Theory," by A. L. Rorive, pp. 344–351 (in French) (See Entry #1374)

"Optimum Coding for Industrial Colour Television," by G. Valensi, pp. 352–362 (in French) (See Entry #1375)

"Economic Study of Industrial Color Television," by J. Perilhou, p. 363 (in French)

"System for Reducing Pass Band and Its Application in Colour Television," by Y. L. Delbord, pp. 364–370 (in French) (See Entry #919)

"Image Presentation with NTSC and Double Message Systems," by R. Geneve, pp. 371–377 (in French)

"Some Relations Between Television Picture Redundancy and Bandwidth Requirements," by K. H. Powers, H. Staras, G. L. Fredendall, pp. 378–383 (See Entry #920)

"Color Signal Distortions in Envelope Type of Sound Detectors," by B. D. Loughlin, pp. 384–390

"NTSC Color Receiver Decoder," by D. Richman, p. 391

"Sequential-Simultaneous System of Colour Television," by H. de France, pp. 392–397 (in French) (See Entry #978)

"Influence of Multipath Propagation on Spectrum of Received Television Signal," by K. Bernath, H. Brand, pp. 398–410

"Colour Television Problems of Today. Attempted Survey," by G. A. Boutry, pp. 411–416. (*EI*, 1958)

**739. THE "DISPERSION" METHOD. SOME SUGGESTIONS FOR COLOUR RECEPTION FROM "COMPATIBLE" TRANSMISSION SYSTEMS USING A "BLACK AND WHITE" TUBE (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Toulon, P. M. G.**
***Acta Electronica*, v. 2, no. 1–2, pp. 168–173, 1957–1958**
**(in French)**

Because of high costs, in particular those of the three-gun tube, the commercial development of NTSC color TV has not kept pace with its technical progress. Therefore, a method of utilizing conventional black and white tubes to receive color TV is of great interest. The "dispersion" process produces a vibration of the electron beam at dot frequency in addition to the conventional $x$ and $y$ movements. The first dot impinges at the first dot position of line 1, the second dot reaches the first dot position of line 41, and the third dot impinges at the first dot position on line 81. The beam then returns to the second dot position of line 1, and so on, in a similar manner to that of an oscilloscope beam which traces out two curves simultaneously. Electronic circuitry has been devised to locate the red information on the first line, the green on line 41, and blue on line 81. A system of dichroic mirrors, having a moving shutter in front of them, superposes the colors in front of the observer. Several methods of spot movement and of achieving superposition of colors are described. (*EEA*, 1958, #4963)

**740. COLOUR TELEVISION EXPERIMENTS**
**Mayer, N.**
***Rundfunktechnische Mitteilungen*, v. 2, no. 2, pp. 75–85, April 1958 (in German)**

The American NTSC system is briefly described. Details are given of the apparatus with which some experiments concerning that system were carried out. The experiments are described which relate to the effect of the bandwidth of the chrominance signals, the visibility of the auxiliary color carrier in a monochrome receiver with several auxiliary carrier frequencies, and on the effect of the auxiliary carrier frequency on the resolution of the color receiver. (*EEA*, 1958, #4971)

**741. 16 mm FILM PROCESSING; A COMPARISON OF METHODS USED BY THE FRENCH TELEVISION SERVICE**
**Doin, J.**
***EBU Review, Part A*, no. 50, pp. 2–7, August 1958**
**(*EEA*, 1958, #5610)**

**742. TELEVISION IN SCIENCE AND INDUSTRY**
**Zworykin, V. K., Ramberg, E. G., Flory, L. E.**
**John Wiley & Sons, Inc., New York, N.Y., 1958**

743. DIE KORREKTUR NICHTLINEARER ÜBERTRAGUNGSFEHLER VON FARBFERNSEH-SYSTEMEN (CORRECTION OF NON-LINEAR TRANSMISSION ERRORS IN COLOR TV SYSTEMS)
Baumann, E.
*Bulletin de l'Association Suisse des Électriciens*, v. 50, no. 10, pp. 458–465, May 9, 1959

A study is made of correction possibilities for existing and new transmission systems, using line function introduced by V. Volterra (1913). (*EI*, 1959)

744. TELEVISION RETRANSMITTERS [TRANSLATORS] OF THE COMPAGNIE GÉNÉRALE DE TÉLÉGRAPHIE SANS FIL
Boxberger, M.
*Onde Électrique*, v. 39, pp. 362–367, May 1959
(in French)

Translators are used to provide coverage in areas not reached by the main transmitter signals and, for maximum coverage in mountainous countries, may greatly exceed the number of primary transmitters. A study of technical requirements and methods is made. A description is then given of the operation and performance, with block schematics and photographs, of the following: (1) Translators with transmitted peak powers on the vision carrier of 0.3 to 3 w, corresponding to AM sound and other standards of sound modulation respectively. Type RE120 can receive one channel in either Band I or III, the selected channel being retransmitted on another Band I channel after suitable frequency-changing. Type RE320 receives as above, but retransmits, after double frequency-changing, on a clear Band III channel. (2) Translators type RE123/RE323 (3 to 20 w) comprise the above types with additional power stages. (3) Translators type RE122/322 (500 w): the vision carrier is transmitted at 500 w, without intermediate demodulation, when working with AM sound, which is tapped off the IF amplifier, demodulated and then retransmitted via a conventional transmitter on a different frequency. For other sound modulation standards, both vision and sound are retransmitted on a single channel, as in (1) and (2). (*EEA*, 1960, #1033)

745. BASIC OPTICAL DATA FOR ELECTRONICS ENGINEERS
Levi, L.
*Electronics*, v. 32, no. 28, pp. 48–49, July 10, 1959

Formulas are given to determine imaging performance of any object-lens arrangement at small aperture and field conditions where lens aberrations are negligible. Application is made to imaging systems, flying spot scanners, etc. (*EI*, 1959)

746. EUROVISIETRANSPORT (EUROVISION)
Bordewijk, J. L.
*Electro-Techniek*, v. 37, no. 18, pp. 405–414, September 3; no. 20, pp. 464–474, October 1; no. 21, pp. 481–490, October 15, 1959

The organization and growth of Eurovision and the role played by The Netherlands in its development are described. Video transmission and transmission quality are examined as well as the cables and relay system used in The Netherlands. The Eurovision video transmission circuit is analyzed and suppression of null component of video signal discussed. Problems of nonlinear distortion, noise, etc., are also covered. (*EI*, 1960)

747. COLOR VIDEOTAPE RECORDER
Anderson, C. E., Roizen, J.
*SMPTE, Journal of the*, v. 68, no. 10, pp. 666–671, October 1959
(*AS&T*, 1960)

748. TRANSLATED ABSTRACTS FROM FOREIGN JOURNALS
*SMPTE, Journal of the*, v. 68, no. 10, p. 714, October 1959
(*AS&T*, 1960)

749. DE LA TELEVISION EN NOIR ET BLANC A LA TELEVISION EN COULEURS (FROM MONOCHROME TO COLOR TELEVISION).
Santos, D.
*Onde Électrique*, v. 39, no. 391, pp. 823–826, October 1959

A system developed by Petit organization, originally for medical purposes, needs only two channels for picture transmission. Simultaneous transmission ensures good definition and faithful color reproduction. The simplicity of the system has resulted in a small camera (5 kg). (*EI*, 1960)

750. N.T.S.C. COLOUR-TELEVISION SIGNALS. I. MEASUREMENT TECHNIQUES
Davidse, J.
*Electronic and Radio Engineer*, v. 36, no. 10, pp. 370–376, October 1959

Some statistical properties of NTSC color-television signals obtained from normal picture material are described. Numerical data are given on the average signal excursion of the $I$ and $Q$ signals, and on the distribution of the momentary levels of the sub-carrier amplitude and of the luminance signal. Some measurements on monochrome signals are included. The measurements are discussed briefly and a short description is given of the measuring circuits. The given values are restricted to first-order statistics; no measurements have been carried out on correlation problems and the like. (*EEA*, 1960, #506)

751. STRATOVISION: NEW BUSINESS
*Electronics*, v. 32, p. 42, November 6, 1959
(*AS&T*, 1960)

752. N.T.S.C. COLOUR-TELEVISION SIGNALS II. EVALUATION OF MEASUREMENTS
Davidse, J.
*Electronic and Radio Engineer*, v. 36, no. 11, pp. 416–419, November 1959
(*EEA*, 1960, #1891)

753. AN ENGINEERING APPROACH TO TELEVISION FILM I: STANDARDIZED GRAY-SCALE CHARACTERISTIC FOR VIDICON TELECINE
Murch, L. J.
*SMPTE, Journal of the*, v. 68, no. 11, pp. 740–743, November 1959

Factors which influence the gray-scale characteristics of a vidicon chain are investigated, and a standard characteristic is developed by deciding upon the optimum adjustment of each of these factors. Test material is developed to set up and maintain this standard characteristic which, subsequently, is used for evaluating the suitability of film material for television reproduction.

754. AN ENGINEERING APPROACH TO TELEVISION FILM II: TELEFILM DENSITY AND EXPOSURE CONTROL
Wright, H.
*SMPTE, Journal of the*, v. 68, no. 11, pp. 744–756, November 1959

A system for making 16-mm film for television broadcasting is called Teledexicon. It is based on the establishment and maintenance of standardized characteristics for telecine reproduction, the film process and the printing operation. It permits relatively inexperienced personnel to achieve high accuracy in negative exposure and predictable TV gray scale from release prints. Live TV studio output and telecine film output may be made to have matched gray-scale characteristics. Exposure is determined by measuring scene element luminances with a spot photometer and relating it to telecine video voltage with simple rotary calculators. Teledexicon permits accurate control and prediction of gray scale, lighting key and mood while shooting is in progress and before the film is processed. Objective measuring techniques are used throughout.

755. AN ENGINEERING APPROACH TO TELEVISION FILM III: CONSTANT DENSITY LABORATORY PROCESS FOR TELEVISION FILM
Ross, R. J.
*SMPTE, Journal of the*, v. 68, no. 11, pp. 756–763, November 1959

The requirements are outlined for a negative-positive laboratory process to obtain predictable waveforms at the output of a calibrated telecine camera chain for measured luminance of scene elements. By utilizing the inherent reproducibility of the photographic process, a constant density and density difference system may be established utilizing conventional processing and printing equipment and materials. Techniques are described for controlling the output of processing machines of the Houston Fearless type, particularly applicable to smaller laboratories associated with television broadcasting agencies. Statistical analysis of sensitometric control strips is employed to evaluate processing reproducibility. Chemical analysis of bromide content provides sufficient information to maintain image-forming conditions, when the replenishers for negative and positive developers have the same composition as the starting solutions (before the addition of bromide) and are added directly to processing machine tanks. Tolerances that may be readily achieved in the practical operation of a system of this type are given.

756. ELECTRONIC COMPOSITES IN MODERN TELEVISION
Kennedy, R. C., Gaskins, F. J.
*SMPTE, Journal of the*, v. 68, no. 12, pp. 804–812, December 1959
(*AS&T*, 1960)

757. PORTABLE TELEVISION OUTSIDE-BROADCAST EQUIPMENT
Legler, E.
*Rundfunktechnische Mitteilungen*, v. 3, no. 6, pp. 253–256, December 1959 (in German)

A camera, which can be easily carried by one person, is described for television outside-broadcast purposes. The equipment, which consists of a camera unit and a case carried on the back, weighs 11.4 kg; the case, including the transmitting aerial and support, weighs 8.5 kg and the camera unit weighs 2.9 kg. The case measures $26 \times 41 \times 9$ cm and the camera $9 \times 13 \times 22$ cm. The equipment includes a vidicon camera with optical viewfinder, a pulse generator, and a Band IV transmitter. With the exception of the transmitter, the apparatus uses transistors throughout, supplied from a built-in Ag–Zn battery which has a maximum operational duration of 4 hr. Extensive stabilization and automatic functioning make the equipment extremely simple to use. (*EEA*, 1960, #3793)

758. TRANSISTORIZED VIDEO SWITCHING
Monro, C. R., Wentworth, J. W., Luther, A. C., Jr.
*1959 IRE National Convention Record*, pt. 7, v. 7, pp. 130–139, 1959

An outline is given of the principles of a method by which a television studio controller may switch from one camera to another by a process lasting about 1 μsec, timed to occur at the interval between successive pictures. The switch used is a diode, turned on or off by two transistors which form a bistable flip-flop. Up to 11 cameras can be in use at any one time, and a "tally" circuit indicates which of these 11 has been selected by the controller to be "on the air." Simplicity and reliability are claimed. Block diagrams and photographs are included, but no circuit component values. (*EEA*, 1960, #516)

759. MOBILE MICROWAVE TELEVISION PICKUP OPERATIONAL EXPERIENCES
Hamilton, C. E.
*1959 IRE National Convention Record*, pt. 7, v. 7, pp. 198–207, 1959

A unit is described that is designed to provide fixed or mobile television service for coverage of disaster events, public

service affairs, etc. Equipment used and operating experiences are described briefly. (*EI*, 1960)

760. ADAPTIVE SAMPLED-DATA SYSTEMS—STATISTICAL THEORY OF ADAPTATION
Widrow, B.
*1959 IRE WESCON Convention Record*, pt. 4, v. 3, pp. 74–85, 1959

An adaptive sampled-data system model is described and evaluated. The model is quasistatically linear and makes use of performance feedback for self-optimization. The model points to solution of many practical problems in control systems and communication theory; in addition, it resembles living structures that adapt to environment. (*EI*, 1959)

761. EVOLUTION OF THE CATHODE-RAY TUBE; A SURVEY OF DEVELOPMENT OVER THREE DECADES
von Ardenne, M.
*Wireless World*, v. 66, pp. 28–32, January 1960
(*AS&T*, 1960)

762. SETTING UP AN INDUSTRIAL TELEVISION CAMERA
Noll, E. M.
*Radio-Electronics*, v. 31, pp. 32–35, January 1960
(*AS&T*, 1960)

763. TELEVISION MASTER SWITCHER
Mardsen, B.
*British Institution of Radio Engineers, Journal of the*, v. 20, no. 1, pp. 47–54, January 1960

A survey is made of the following standard methods presently in use for switching video signals: mechanical switches, electromechanical relays, and systems using thermionic relays. A method of video selection is then described in which the switch elements are made up of semiconductor diodes. Both master control room and studio-type switches are discussed. Reference is made to development work in which transistorized pulse generators are being used to achieve vision switching between successive frames of the television waveform. (*PA*, 1960, #2553)

764. MICROWAVE TELEVISION MOBILE RELAY FOR OUTSIDE BROADCASTING
Polonsky, J.
*British Institution of Radio Engineers, Journal of the*, v. 20, no. 2, pp. 91–102, February 1960

A brief account is given of the principal qualities required in mobile links. These qualities include: transmission of picture and sound without degradation of the quality and stability in time of the technical performances, and ease of operation regarding transport, installation, monitoring, and maintenance. The essential causes of distortion introduced in the transmission by a microwave link are reviewed, and the problem of crosstalk between picture and sound channels and the transmission of a color television program are dealt with in some detail. A short description is given of an equipment operating in the 6400- to 6900-Mc band. (*PA*, 1960, #3156)

765. RECENT DEVELOPMENTS IN TELEVISION
Schröter, F.
*Scientia Electrica*, v. 6, no. 1, pp. 28–52, March, 1960
(in German)

The following fields are reported on: (1) color transmission —a physiological-based improvement of the NTSC system uses pure AM of the color subcarrier by either the red or blue components on alternate lines, signals from each line being reproduced, at the receiver, in the next line by a suitable line-period delay, (2) large screen projection—an assessment of performance limits for the high potential CRT, shows its inferiority compared to the Eidophor system; (3) program storage—transverse scanning on magnetic tape is shown to be currently superior; developments in electrostatic-xerographic methods are discussed; (4) wire distribution—a seven-wire pulse code modulation transmission system using a seven-bit electron-beam encoder is described. Sections 5 and 6, dealing with received picture storage and frequency-band compression, are interrelated and reported in detail. Progress in the design of CRT storage devices with simultaneous excitation of all picture points, minimum flicker rate, and register error is also instrumental in the solution of bandwidth economy; velocity modulation of scan speed offers only limited possibilities in this field. Prediction methods based on autocorrelation in the picture sequence are found to be complicated. For TV broadcasting, the AM video signal of about 5-Mc bandwidth must be reduced to a fraction of this figure. Psychological-physiological considerations forecast the practicability of picture-difference transmission within one quarter of the currently used bandwidth, using a high resolution store in the receiver. Further band compression can be realized by means of low-pass filtering in two channels with different cut-offs. A comparator assesses the high-frequency content of the original signals and controls an auxiliary deflection of the writing beam in the storage tube, thus producing a crispening effect equivalent to the original bandwidth. Four references are included. (*EEA*, 1960, #5860)

766. ARMCHAIR COMMUNICATIONS
*Engineering*, v. 189, p. 538, April 15, 1960

Description of a closed-circuit TV system for monitoring several areas at one time is included.

767. COLOUR TELEVISION SYSTEM
Chaste, R., Cassagne, P.
*Engineer*, v. 209, p. 746, April 29, 1960 (Abstract)
(*AS&T*, 1960)

768. PICK-UP DEVICES FOR TELEVISION MULTIPLE-IMAGE CAMERAS AND TRANSISTORIZED EQUIPMENT
Geneve, R.
*Acta Electronica*, v. 4, no. 2, pp. 127–149, April 1960
(in French)

The complementary roles of the cinema camera and the television camera are discussed, and the basic technique is indicated for employing a television pick-up tube to act as a viewfinder and photometer combined for a cinema camera. The recording of television programs on tape and film is reviewed and compared. Techniques for using one camera unit in the studio to serve two television systems are briefly discussed. Finally, the possibilities of designing a portable transistorized television camera and the characteristics of the transistors to be employed are considered. (*EEA*, 1961, #437)

769. USE OF OPTICAL ABERRATION COEFFICIENTS IN OPTICAL DESIGN
Cruickshank, F. D., Hills, G. A.
*Optical Society of America, Journal of the*, v. 50, no. 4, pp. 379–387, April 1960

A general account is given of the way in which the aberration coefficients introduced by Buchdahl (1954) are used in the design of optical systems. Experience shows that for many applications the coefficients of third, fifth, and seventh orders provide a new and adequate technique for the analysis of the correction state of a system, the understanding of the *raison d'etre* of a particular type of system, and the differential correction of a rough design. The geometrical representation and classification of the individual terms of the aberration polynomials is discussed. The method is exemplified by excerpts from the design of a telephoto objective. (*PA*, 1960, #5145)

770. SEQUENTIAL RECEIVERS FOR FRENCH COLOR TV SYSTEM
Chaste, R., Cassagne, P., Colas, M.
*Electronics*, v. 33, no. 19, pp. 57–60, May 6, 1960

A method for compatible television is described that features a simple chrominance circuit. Called Henri de France (HDF) system, it uses sequential transmission of chrominance along with one-line memory in receiver. (*EI*, 1960)

771. VIDEO-FREQUENCY EQUIPMENT FOR TELEVISION CENTRES OF THE SOVIET UNION
Berlin, B. A.
*British Institution of Radio Engineers, Journal of the*, v. 20, no. 5, pp. 381–386, May 1960

Details are given of the present state of the television broadcasting network and the proposals for its extension over the next seven years. A brief classification of the equipment for television centers is given in accordance with its program potentialities. New television equipment designed for mass production is briefly described. Technical performances of television cameras are briefly discussed, and the reasons for certain principles adopted in their design are outlined. (*PA*, 1960, #6482)

772. PROGRESS COMMITTEE REPORT FOR 1959; COLOR TELEVISION
*SMPTE, Journal of the*, v. 69, no. 5, p. 317, May 1960
(*AS&T*, 1960)

773. TECHNIQUES OF DYNAMIC DISPLAY PART III. FROM TV PICKUP TO MATRIX CELLS
Baker, R. A.
*Control Engineering*, v. 7, pp. 97–102, June 1960

Parts I and II have discussed cathode ray tube and optical techniques. In this part, a wide variety of special techniques are described which include TV pickups, character displays, drum storage systems, and matrix cells.

774. INDUSTRIAL TELEVISION; A SURVEY OF HISTORY, REQUIREMENTS AND APPLICATIONS
Brace, J. E. H.
*British Institution of Radio Engineers, Journal of the*, v. 20, no. 6, pp. 441–447, June 1960
(*AS&T*, 1960)

775. APPLICATION OF TELEVISION IN INDUSTRY AND SCIENCE IN THE U.S.S.R.
Sardyko, V. I.
*British Institution of Radio Engineers, Journal of the*, v. 20, no. 6, pp. 449–456, June 1960
(*AS&T*, 1960)

776. HENRI DE FRANCE COLOUR TELEVISION SYSTEM
*Electronic Engineering*, v. 32, pp. 356–358, June 1960
(*AS&T*, 1960)

777. IRE STANDARDS ON TELEVISION; METHODS OF TESTING MONOCHROME TELEVISION BROADCAST RECEIVERS, 1960
*IRE, Proceedings of the*, v. 48, no. 6, pp. 1124–1154, June 1960
(*AS&T*, 1960)

778. CLOSED CIRCUIT TV
Vendeland, R. E.
*Progressive Architecture*, v. 41, pp. 1173–1175, July 1960
(*AS&T*, 1960)

779. TELEVISION IN GERMANY
Möller, K.
*Television Society, Journal of the*, v. 9, no. 7, pp. 247–269, July–September 1960

A general survey of the post-war television development in Western Germany is presented and illustrated by statistical

charts, maps, diagrams and photographs. Transmission networks (including satellites and microwave lines), studio equipment, and technical standards (including test procedures), transmitters, and receivers are surveyed briefly. A useful bibliography and discussion are appended. (*EEA*, 1961, #5845)

780. TELEVISION
(Translated from *Vestnik Sviazi*, no. 5, pp. 5–8, 12, 1960)
Greybo, G. A., Gomer, G. I.
August 18, 1960
Joint Publications Research Service, Washington, D.C.
JPRS-5350
(Also available as OTS: 60-41,213, U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Advances in television and television equipment in Russia are discussed.

781. TELEVISION EARTH SATELLITES
(Translated from *Nauchno-Teknicheskie Obshchestva SSSR*, Moscow, no. 6, pp. 23–27)
Litvinenko, V.
August 22, 1960
Joint Publications Research Service, Washington, D.C.
JPRS-3749
(Also available as OTS: 60-31,720, U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The submitted data tend to prove that, at the present time, there exist indispensable technical and economic foundations for the creation of systems guaranteeing long-distance radio communications and television transmission. These systems present the prospect of future links with spaceships, and a televised picture transmission from other planets.

782. MICROTELEVISION; EDITORIAL
Gernsback, H.
*Radio-Electronics*, v. 31, p. 25, August 1960
(*AS&T*, 1960)

783. OPERATION AND ADVANTAGES OF THE SECAM COLOUR TELEVISION SYSTEM
Chaste, R., Cassagne, P.
*Elektronische Rundschau*, v. 14, no. 9, pp. 361–362, 365–366, September 1960 (in German)

A brief description of the line sequential compatible SECAM color TV system is given, with block diagrams of the encoding transmitter and decoding receiver equipments. The reproduction of an electronically generated color bar signal is chosen to explain the principle of the system. Effects of amplitude and phase response tolerances and distortion in transmission, and of noise and impulsive interference are briefly discussed. The alternative modulation possibility, FM instead of the present AM, of the chrominance subcarrier is presented. (*EEA*, 1961, #1668)

784. STANDARDIZATION OF EUROPEAN COLOUR TV
Gerber, W.
*Bulletin de l'Association Suisse des Électriciens*, v. 51, no. 20, pp. 994–999, October 8, 1960 (in German)

Full agreement on some system parameters is not yet in sight. Existing and proposed systems are discussed in relation to international feasibility, economics, and channel requirements. Twenty-four references are included. (*EEA*, 1961, #5848)

785. FIBER OPTICS—A NEW TOOL IN ELECTRONICS
Krolak, L. J., Siegmund, W. P., Neuhauser, R. G.
*SMPTE, Journal of the*, v. 69, no. 10, pp. 705–710, October 1960

Fiber optics, the technology of transmitting a light image element-by-element from one point to another, solves many knotty problems where photometric efficiency and flexibility in design are important. Fiber optic bundles, consisting of many thousands of small diameter (less than 0.003 in.) glass fibers, can be either solid blocks or flexible light tubes. A variety of configurations of fiber optics bundles were developed to demonstrate the importance and versatility of this new tool in electronics. The most challenging, and perhaps the most important, use of fiber optics is as an image shape transducer. A brief review of basic principles is given, preceding descriptions of various applications of fiber optics in electro-optical systems. (*EEA*, 1961, #2718)

786. A NEW STUDY OF THE BBC EXPERIMENTAL COLOUR TRANSMISSIONS
Atkins, I. R., Stanley, A. R., Watson, S. N.
October 1960
British Broadcasting Corporation, London, Great Britain
Engineering Division Monograph 32, pp. 6–31

The experimental program transmissions which took place from Alexandra Palace between October 1957 and April 1958 are described in some detail, and the results obtained are assessed and compared with the previous year's results. Some of the more important technical and operational experience obtained at Alexandra Palace is described. The experimental work and the experience obtained in connection with the application of color to television are reported from the point of view of the program producer. The result of experimental work to determine the suitability of the existing distribution network for television programs is given and is followed by an account of the small amount of experience gained in outside broadcast work. The paper ends with a description of the type of color transmission which has been radiated since the end of 1958 and is continuing at the present time. (*EEA*, 1961, #434)

787. HENRI DE FRANCE COLOUR TELEVISION SYSTEM
Chaste, R., Cassagne, P.
*Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering,*
v. 107, pp. 499–511, November 1960
(Also available as Paper 3251E, Institution of Electrical Engineers, Great Britain, April 1960)

The work done by the Cie Francaise de Télévision (C.F.T.) on the Henri de France system of color television is described. The objectives of the team of research workers who have carried out this development are defined. The fundamental aspects, the special features of the system, and the encoding and decoding units are described. Finally, the practical results and theoretical aspects on the ease of transmission of the coded signals are given. (*EEA*, 1960, #3786)

788. SLIDES AND OPAQUES FOR TELEVISION FILM CAMERA CHAINS; PROPOSED AMERICAN STANDARD REVISION OF PH 22.94—1954
*SMPTE, Journal of the,* v. 69, no. 12, p. 893, December 1960
(*AS&T*, 1961)

789. NEW TELEVISION NETWORK SWITCHING FACILITIES
Bachelet, A. E., Collins, C. A., Taylor, E. R.
*AIEE, Transactions of the, Part I—Communication and Electronics,* v. 79, no. 52, pp. 625–634, January 1961

New video switching equipment is described which forms part of an integrated nationwide plan for furnishing broadband transmission facilities. These can be improved later to give bandwidths up to 10 Mc. A general description of the system is given, with photographs of the equipment used. (*EEA*, 1962, #6154)

790. THE APPLICATION OF ELECTROLUMINESCENCE TO TELEVISION TECHNIQUES
Jung, L.
*Technische Mitteilungen BRF,* v. 5, no. 1, pp. 25–36,
March 1961 (in German)

After setting up the necessary background for the physical properties and problems involved, the image-intensifier, light-amplifiers (of the single element type and the two-layer grooved photoconductor type), ELF screen, and Transfluxor control are described. Electroluminescence offers excellent possibilities in the construction of image-intensifiers and flat imaging- and storage-screens. According to the latest trends, extensive developments can be anticipated in the field of electro-optical image-reproduction. The most important of these is the two-layer image-intensifier, for which type at least the problems of inertia have been thoroughly overcome. Meanwhile in achieving inertia-lessness, further advances are possible with the help of an intermediate ferroelectric amplifier-layer. In the imaging equipments the control elements employed for the electroluminescent-cells possess a "memory," based on their hysteresis properties. Screens using "ferroelektrika" or "ferromagnetika" are suitable for storing individual images too. Exciting them with cathode rays shows definite advantages over and above the cathode ray tubes. However, the final goal of this development is a flat screen. For distributing video-signals over the individual image elements, switches with ferrite rings were specified. Application of electroluminescence to color-TV is also touched upon. A large number of illustrative sketches, diagrams and graphs are included. (*EEA*, 1962, #423)

791. STANDARDS CONVERSION OF TELEVISION SIGNALS OF DIFFERENT FIELD FREQUENCY
Sennhenn, E.
*Radio Mentor,* v. 27, no. 3, pp. 184–188,
March 1961 (in German)

Since the introduction of American Videotape recordings, the need of 525 line 60 frame to 625 line 50 frame conversion has become important. This article is an addition to Dillenburger's paper on the vidicon standard convertor. The basic problem in the 60- to 50-cps frame frequency conversion is the spurious amplitude modulation of the signal at the rate of 10 cps, and this is illustrated by oscillograms. This rate is beyond simple solution by means of a long-persistence writing tube; it is suggested that a compensating waveform be generated from a synchronized reference voltage derived from both systems' time bases. The recommended automatic compensating system should reduce the 15-percent video signal variation to about 0.4 percent. A complete dimensioned circuit diagram of the equipment, consisting of 13 valves (including 4 thermionic double diodes) and seven semiconductor diodes is reproduced; the waveforms of signals at various stages are also reproduced. The apparatus is described in detail, and its operation and tolerances are also considered, with emphasis on the accuracy of the horizontal alignment of the writing receiver and the reading vidicon, the nonlinearity of the decay characteristics of both tubes, and the time constant of the compensating circuit. (*EEA*, 1961, #4822)

792. TELEVISION ANOMALIES; PAST, PRESENT, AND FUTURE
Bedford, L. H.
*British Institution of Radio Engineers, Journal of the,*
v. 21, pp. 291–299, April 1961
(*AS&T*, 1961)

793. THE SECAM COLOUR SYSTEM COMPARED WITH THE N.T.S.C. SYSTEM
Cassagne, P., Sauvanet, M.
*Annales de Radioélectricité,* v. 16, pp. 109–121,
April 1961 (in French)

Having stated the problems raised by the introduction of color in television, the authors describe the memory sequential transmission process, or SECAM, devised and developed by M. Henri de France. They give an example of a design for a decoder and describe the functions provided. The

examination of the performance obtained, compared to that of the NTSC system, shows the substantial superiority of the SECAM in regard to quality and economical operation. (*EEA*, 1961, #5846)

794. EUROVISION
Holmes, J. H.
*Television Society, Journal of the*, v. 9, no. 10, pp. 408–421, April–June 1961

A descriptive historical survey of the development of Eurovision is presented, and is illustrated by many photographs and maps. Problems of standards conversion and coordination of transmissions (communications and test signals) are treated in somewhat more detail. The juxtaposition of maps of West Europe showing the Eurovision links of 1954 and of today indicates the rapid growth of transmission facilities. (*EEA*, 1962, #6117)

795. CLOSED-CIRCUIT TV GROWS WITH ITS USES
*Engineering*, v. 191, p. 650, May 12, 1961
(*AS&T*, 1961)

796. TELEVISION TECHNIQUES WITH THE 5 IN., 7 IN. AND 9 IN. IMAGE INTENSIFIERS
Stevenson, J. J.
*British Journal of Radiology*, v. 34, pp. 273–285, May 1961

The advantages of the use of image intensifiers in clinical radiology are described. Various observational techniques using closed-circuit television are discussed, and an appraisal is made of their success in various diagnostical and surgical situations. A number of photographs of the instruments are shown. The use of the television image intensifier techniques is expected to increase rapidly. (*EEA*, 1961, #5874)

797. PROGRESS COMMITTEE REPORT FOR 1960; COLOR TELEVISION
*SMPTE, Journal of the*, v. 70, no. 5, pp. 344–345, May 1961
(*AS&T*, 1961)

798. TELEVISION BROADCASTING FROM SATELLITES
(Presented at the National IAS/ARS Meeting, Los Angeles, Calif., June 13–16, 1961)
Ives, G. M.
June 1961
Institute of Aerospace Sciences, Inc., New York, N.Y.
Paper 61-185-1879

The purpose of this paper is to indicate both the technical and fiscal feasibility of using a satellite for television or other types of broadcasting.

799. IRE STANDARDS ON VIDEO TECHNIQUES: DEFINITIONS OF TERMS RELATING TO TELEVISION, 1961
*IRE, Proceedings of the*, v. 49, no. 7, pp. 1193–1195, July 1961

A list of terms relating to television and their definitions are given. (*EEA*, 1961, #6468)

800. B.B.C. TELEVISION 1939–1960: A REVIEW OF PROGRESS
Pawley, E. I. E.
*Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering*, v. 108, pp. 375–397, July 1961
(Also available as Paper 3588, Institution of Electrical Engineers, Great Britain, July 1961)

A review of broadcasting and television was presented to The Institution by Sir Noel Ashbridge in 1938. The further development of sound broadcasting in the United Kingdom during the years 1939–1960 has recently been reviewed by the author. During the same period, and particularly since 1946, there has been continuous and remarkable progress in television. The present paper deals mainly with BBC television, although reference has been made where appropriate to other major developments in this field both at home and abroad. It shows that the original engineering conception on which the BBC television service was based when it opened in 1936 has proved fundamentally sound and capable of development to meet the much more complex requirements of the present day. The BBC Engineering Division is organized in such a way that, except on the operational side, sound and television are closely integrated. Developments common to both have been described in the companion review of progress on sound broadcasting. (*EEA*, 1961, #5387)

801. STUDY OF THE INFLUENCE OF COMMERCIAL COMMUNICATIONS ON THE DESIGN OF FUTURE SATELLITES
Vincent, W. R.
August 8, 1961
Stanford Research Institute, Menlo Park, Calif.
Bimonthly Progress Report 6 for April 1–May 31, 1961

An investigation of the feasibility of television broadcast from satellites was concluded during the report period. The relay of television over long distances by satellites is feasible and can be used to connect existing networks from one country to another.

802. CBS TELEVISION STANDARDS CONVERSION TECHNIQUES
Benson, K. P.
*SMPTE, Journal of the*, v. 70, no. 8, pp. 628–632, August 1961

The advent of video tape has provided a means for the rapid intercontinental exchange of television programs wherein the transmission delay need not exceed the travel time of modern jet aircraft. However, the difference in picture scanning parameters employed by various nations often prohibits broadcasting the video signal in its original form and necessitates a conversion to the appropriate transmission standards.

Problems related to the design of convertors for this purpose are discussed, and the equipment used by CBS is described. (*EEA*, 1962, #10,181)

803. SYMPOSIUM ON THE PHYSICAL PRINCIPLES OF ELECTROPHOTOGRAPHY
(Translated from *Uspekhi Fizicheskikh Nauk*, v. 74, pp. 567–570, July 1961)
Fridkin, V. M.
September 15, 1961
Library of Congress, Air Information Division, Science and Technical Section, Washington, D.C.
AID 61-133
AD-265,371
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Results are reported from a symposium in the USSR on the physical principles of electrophotography. More than 15 scientific organizations with 100 representatives met, and 22 reports covering specific areas of electrophotography were presented.

804. METHOD OF PRODUCING TELECINE TEST MATERIALS OF SPECIFIED DENSITY
(Presented at SMPTE Convention, Toronto, Canada, May 9–12, 1961)
Holmes, L. H.
*SMPTE, Journal of the*, v. 70, no. 9, pp. 699–701, September 1961

Ten-step staircase test wedges on 2 × 2-in. slides and 16-mm film have been manufactured to predetermined density values. A general account is given of a method of correlating subject reflectance with negative density, preparation of flashed paper strips to serve as a master copy, and the problems associated with producing a predicted scale of densities.

805. MEASUREMENT TECHNIQUES FOR TV RECEIVERS
Macek, O.
*Archiv für Technisches Messen und Industrielle Messtechnik*, no. 309 (Ref. V3734-1), pp. 229–232, October 1961
(in German)

Based on international committee recommendations, a number of standard tests, their interpretation, and necessary test equipment are discussed. Part 1 deals with adjustment and tuning of the receiver, aerial simulation and input levels, and adjustments being made for the best results with a number of test cards shown. Part 2 covers tests for picture quality. Sweep nonlinearity is defined and measured. Finally, measurement techniques for picture brightness, contrast, gray scale and definition are given. (*EEA*, 1962, #8304)

806. PROGRESS IN THE SECAM COLOUR TV SYSTEM
Peyroles, H.
*Radio Mentor*, v. 27, no. 10, pp. 862–863, October 1961
(in German)

Already reported in recent abstracts, the SECAM is here again reviewed and compared with the NTSC system. Practical experience with this system shows that anticipated advantages are fulfilled, receivers are somewhat cheaper and more easily serviced, and video signals are more easily recorded on magnetic tape. (*EEA*, 1962, #7299)

807. TWENTY-FIVE YEARS OF BBC TELEVISION
Bishop, H.
October 1961
British Broadcasting Corporation, London, Great Britain
Engineering Division Monograph 39

The events are discussed which led to the start of the BBC's high-definition television service and the engineering developments since then. Noteworthy techniques originated or utilized by the BBC are reviewed, as well as its contributions to probable future developments. (*EEA*, 1962, #1238)

808. HEADSIGHT TELEVISION SYSTEM PROVIDES REMOTE SURVEILLANCE
Comeau, C. P., Bryan, J. S.
*Electronics*, v. 34, pp. 86–90, November 10, 1961

A closed-circuit television system with the monitor mounted on a helmet worn by the operator is described in some detail.

809. MECHANICAL AND MANUFACTURING ASPECTS OF THE BANANA-TUBE COLOUR-TELEVISION DISPLAY SYSTEM
Howden, H.
*Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering*, v. 108, pp. 596–603, November 1961
(Also available as Paper 3562E, Institution of Electrical Engineers, Great Britain, May 1961)

The major mechanical components of the Banana-tube color-television display system are described, together with the materials and manufacturing techniques used to achieve results consistent with the requirements of the system. Development has proceeded to a stage where a fully engineered version more suitable for quantity production can be considered. (*EEA*, 1961, #3512)

810. BLACK-AND-WHITE TELEVISION MONITORING AND VIDEO LEVELS
Wright, H.
*SMPTE, Journal of the*, v. 70, no. 11, pp. 882–897, November 1961

A general engineering survey of problems and techniques of picture and waveform monitoring in black-and-white television is presented and illustrated by a large number of photographs, diagrams and oscillograms. After briefly explaining the composite waveform and the concepts of gamma, black level and contrast-brightness relationships, descriptions are given of monitoring usage in the U.S., generalized treatment

of setting-up, adjusting and monitoring techniques for live studio, and tape and film transmissions of various picture contents. Standardization of monitoring equipment is advocated as well as a specification of setting-up standards, particularly for telefilm reproduction. (*EEA*, 1962, #7312)

811. CONSIDERATIONS ON SOME FUNDAMENTAL PROBLEMS IN COLOUR T.V.
Spătaru, A.
*Telecomunicatii*, v. 5, no. 6, pp. 241–248
November–December 1961 (in Roumanian)

A brief survey of functions and requirements for such systems is followed in more detail by a description of the French SECAM system. The latter is described as simultaneous-sequential, using a memory device for the sequential storage of the line information. Seven references are included. (*EEA*, 1962, #8298)

812. ENGINEERING DEVELOPMENTS (TV) 1961
*Electrical Engineering*, v. 80, p. 931, December 1961
(*AS&T*, 1962)

813. CURRENT TELEVISION RESEARCH: SOME CONTRIBUTIONS BY THE B.B.C. RESEARCH DEPARTMENT
Maurice, R. D. A., Monteath, G. D.
*British Communications and Electronics*, v. 8, no. 12, pp. 902–909, December 1961

Some of the rather specialized developments arising from modern television broadcasting are described. Of particular interest are: (1) change of line standards from 405 to 625 using UHF, (2) cable film, (3) standards conversion, (4) bandwidth compression, (5) co-channel interference, (6) computers, (7) television sound, and (8) propagation. Under (1), for example, the field strength pattern of the UHF (650 Mc) transmission is far inferior to that of the standard 45 Mc and hence presents a big coverage problem. Under (2), the 3-Mc bandwidth has been reduced by various devices to 4.5 kc for transatlantic news transmission. A 1-min news item then takes 100 min to transmit; this is much less than the time involved in using aircraft. Computers are in great demand for Fourier transforms, aerial radiation patterns, etc. Under (8), considerable attention is being given in this and other European countries to the occasional propagation of exceptionally high level signals over sea paths at UHF causing interference. Photographs of some of the equipment, field strength measurements, and 17 references are given. (*EEA*, 1962, #4647)

814. AN ANALYSIS OF POSSIBILITY OF INTERWORKING OF COLOUR TELEVISION NETWORKS USING DIFFERENT TYPES OF THE NTSC SYSTEM
Kielkiewicz, A.
*Prace Instytutu Łączności*, v. 8, no. 2 (23), pp. 35–55, 1961 (in Polish)

This study analyzes the interworking of color television networks with 8- and 7-Mc bands and 625 line standard, arriving at the following conclusions. (1) to accept a system fulfilling the condition of compatibility and one subcarrier frequency, e.g., 4.43 Mc; (2) to obtain, for network planning, levels of interference of monochrome and color television of NTSC systems; and (3) to investigate mutual reception of signals $I/Q$ and $R$-7/$B$-7 of NTSC system. (*EEA*, 1962, #7298)

815. ELECTRON OPTICS IN TELEVISION
Tsukkerman, I. I.
(Translated from the Russian by L. A. Fenn)
Pergamon Press, Inc., New York, N.Y., 1961

816. COLOUR TELEVISION
Gabor, D.
*Endeavor*, v. 21, no. 81, pp. 25–34, January 1962

Although color television was demonstrated in 1940, it has not yet become fully successful commercially. Many problems were solved by development of a "compatible" system of color television that would give the black and white picture on ordinary sets and required no wider wavebands than are used in black and white transmissions. The theory of compatible color television is described, as well as different television tubes that have been developed, including one in the form of a box only a few inches deep. (*EI*, 1962)

817. TOUGHENED TV ZEROS-IN WHERE SCIENTISTS CANNOT TREAD
Hiatt, R. S.
*Research/Development Magazine*, v. 13, pp. 49–50
February 1962
(*AS&T*, 1962)

818. SPACESHIP 2—A RECORD PERFORMANCE OF TELEVISION ELECTRONICS
(Translated from *Nachrichtentechnik*, v. 10, no. 11, p. 469, 1960)
Neidhardt, P.
June 29, 1962
Air Force Systems Command, Foreign Technical Division, Wright-Patterson AFB, Ohio
FTD-TT-62-459
AD-290,104

819. COPING WITH NEW PROBLEMS: NOMOGRAPHS SELECT TV STANDARDS—REFERENCE SHEET
Wipson, J. W.
*Electronics*, v. 35, p. 56, August 17, 1962
(*AS&T*, 1963)

820. RECENT RESULTS IN THE INTERNATIONAL DEVELOPMENT OF COLOUR TELEVISION
Neidhardt, P.
*Technik*, v. 17, no. 9, pp. 642–647, September 1962
(in German)

Descriptions are given of: (1) the construction and operation of the Banana tube; (2) N. Mayer's system of simulta-

neous FM and AM of the color carrier; (3) a Russian invention in which electroluminescent elements are controlled by silicon diodes in combination with a capacitor, giving continuous luminescence during the repetition period; (4) another Russian system for stereoscopic color television with reduced bandwidth, in which only the luminosity component is transmitted from the left hand system while luminosity and color difference signals are transmitted from the right hand side; (5) systems of color television projection for closed circuit working, as in the viewing of surgical operations; (6) a method of producing positive rasters in monochrome, blue, yellow, and red for color printing. (*EEA*, 1963, #3392)

821. TENTH ANNUAL MEETING OF THE TV TECHNIQUES SOCIETY, FTG. I
*Radio Mentor*, v. 28, no. 11, pp. 895–902, October 1962 (in German)

An introduction is given dealing with development in the last ten years of color TV principles, systems, and special color CRTs. Then follows a series of short descriptions of some of the papers presented on the following subjects: (1) comparison of results in propagation trials with NTSC and SECAM systems (shows the insensitivity of the SECAM system to differential phase errors); (2) interference from the sound carrier in compatible reception of NTSC color signals; (3) dynamic behavior of color synchronization with picture blending; (4) a simple color modulator for equiband operation; and, finally, (5) improvement in color picture sharpness with the SECAM system. (*EEA*, 1963, #3389)

822. BEFORE COLOUR TV IN EUROPE
Nymoen, H.
*Teknisk Ukeblad*, v. 109, no. 47, pp. 1215–1222, December 20, 1962 (in Norwegian)

Fundamental principles of the proposed color television system in Europe are presented. Research work on color television in France and the USSR is briefly mentioned, and reviews of different television tubes are given, such as Banana tube, Apple tube, Chromatron, and Shadow mask. (*EEA*, 1963, #4425)

823. GRUPPOVOI POLET V KOSMOS (GROUP FLIGHT INTO SPACE)
*Radio*, pp. 7–9, December 1962 (in Russian)

This study contains a general description of the characteristics and the principles of operation of the radio, TV, and telemetry equipment used in the *Vostok 3* (*1962 $\alpha\mu$ 1*) and *Vostok 4* (*1962 $\alpha\nu$ 1*) spaceships. In addition, some data on control and ground receiving stations are presented. (*IAA*, 1963, A63-12765)

824. G.E.C. COLOUR-TELEVISION
Biggs, A. J.
*G.E.C. Journal of Science and Technology*, v. 29, no. 1, pp. 32–40, 1962

Included in this study are essential features of communication systems by which color television can be broadcast, descriptions of receiving equipment with emphasis on color part of circuits and how they are controlled, and G.E.C. receivers and monitors. (*EI*, 1962)

825. A REVIEW OF SOME OF THE RECENT DEVELOPMENTS IN COLOR TV
Loughlin, B. D.
*1962 IRE International Convention Record*, pt. 7, v. 10, pp. 121–136, 1962

Developments over the past five to six years, relating mainly to receiver picture tubes and circuitry, are discussed. After an outline of the theory of the main systems, a more detailed account is given of the various types of picture tube, including the Banana tube. Other European developments are briefly reviewed. There are 16 figures and 42 classified references. (*EEA*, 1963, #4424)

826. IRE STANDARDS ON ELECTRON TUBE METHODS OF TESTING, 1962
Institute of Radio Engineers, Inc., New York, N.Y.
62-IRE 7.S1

827. ADVANCES IN ELECTRONICS AND ELECTRON PHYSICS (Volumes 12 and 16)
Academic Press, Inc., New York, N.Y., 1962

828. PHOTOGRAPHIC INSTRUMENTATION: TECHNIQUES, EQUIPMENT, APPLICATIONS
Shaftan, K., Hawley, D.
Society of Photographic Instrumentation Engineers, Redondo Beach, Calif., 1962

829. A HISTORICAL REVIEW OF TELEVISION-RECEIVER TECHNIQUE DURING THE PAST TEN YEARS
Reuber, C.
*Rundfunktechnische Mitteilungen*, v. 7, no. 1, pp. 42–57, February 1963 (in German)

A study of the development of the past ten years shows which developments have remained, which proved to be permanent, and which technical novelties were abandoned after a few years. Some information concerning this has been summarized in curves on the features of television receivers and the equipment of the separate stages in the different years. The material on the development of television-receiver technique is supplemented by block schematics of a 1951 receiver and of a 1962 receiver and by some sections of circuits in which the technical details of the years of development are shown. (*EEA*, 1963, #9213)

830. PROGRESS COMMITTEE REPORT FOR 1962; COLOR TELEVISION
*SMPTE, Journal of the*, v. 72, pp. 379–380, May 1963 (*AS&T*, 1963)

(See *also Entries* #608, 916, 918, 1354, 1512, 1530.)

# TELEVISION SCANNING

831. THE TRANSIENT RESPONSE OF PHOTOCONDUCTIVE CAMERA TUBES EMPLOYING LOW-VELOCITY SCANNING
Redington, R. W.
*IRE Transactions on Electron Devices*, v. ED-4, no. 3, pp. 220–225, July 1957

The transient signal resulting from the characteristics of a low-velocity electron beam and the capacitance of a scanned surface was calculated. A very slow, hyperbolic type of transient can result from stabilizing the scanned surface at a retarding field potential. The calculations were verified by tests on a 6198 Vidicon which was taken as an example. The relative contributions of the "electronic transient" and the photoconductive decay to the observed transient response were determined for this tube and found to make comparable contributions to the total transient. (*EEA*, 1958, #1528)

832. 90-DEGREE SCANNING [FOR TELEVISION PICTURE TUBES]
Morgan, R. H. C., Martin, K. E.
*Television Society, Journal of the*, v. 8, no. 7, pp. 285–297, July–September 1957

The problems encountered are the same as those arising with 70-deg scanning but take a more acute form. Increased efficiency is gained by allowing the scanning coils to extend a short distance up the flare. The tendency toward increased astigmatism is countered by providing small permanent magnets at the front end of the yoke. Line distortion with castellated yokes is reduced by increasing the number of teeth from 8 to 16. Two designs of scanning-coil assemblies are described in detail. Although the design of the frame time-base circuits remains unchanged, the power requirement is three times as great as with 70-deg scanning. The line time-base circuits are studied in detail, particularly the output transformer design. Here, third-harmonic tuning reduces both power input requirements and peak voltage on the valve, provides a greater extra-high-tension voltage, and reduces "ringing." A technique of using short-circuited turns for improving linearity is described (*EEA*, 1958, #2300)

833. SCANNING OF 90° TELEVISION PICTURE TUBES
Lutz, H.
*Radio Mentor*, v. 24, no. 3, pp. 147–149, March 1958 (in German)

A brief treatment of efficient, modern scanning methods and the components for 90-deg deflection tubes is given, with particular emphasis on energy distribution. The choice of the optimal ferrite core for high-flux density operation of the line output transformer and its electrical design are described. (*EEA*, 1959, #6135)

834. THE TELEVISING OF OPAQUE PICTURES USING THE FLYING-SPOT SCANNING SYSTEM (TELEVISION EPISCOPE)
Theile, R., Pilz, F.
*Rundfunktechnische Mitteilungen*, v. 2, no. 2, pp. 54–63, April 1958 (in German)

With increasing expansion of television programs, the transmission of opaque pictures, such as facsimile, photographs, and sketches, is of increasing interest. Instead of using the standard television or a specially made transparency, it is advantageous, on both technical and economic grounds, to use a special pick-up device in the form of a "television episcope." The methods of signal production that would be suitable for such a device are discussed, as well as the main features of the design of a television episcope with flying-spot scanning which appears to be particularly suitable. An experimental device for the transmission of still pictures of $7.5 \times 10$ or $18 \times 24$ cm, with automatic fine adjustment by changing the reproduction scale, is described in detail. The possibility of using a combined television epidiascope is also mentioned. (*EEA*, 1958, #4973)

835. TOPOLOGICAL TRANSFORMATIONS BY ELECTRONIC SCANNING TECHNIQUES
Aid, D. G., Balding, G. H., Süsskind, C.
*IRE Transactions on Instrumentation*, v. I-7, no. 2, pp. 121–125, June 1958

A method of producing two-dimensional topological transformations electronically is described, together with the circuits required, and some examples. The transformation is achieved in the driving circuits of a standard flying-spot camera tube equipped with a dual deflection system (i.e., two sets of orthogonal deflection yokes or plates). Possible applications include scale expansions, conversions from linear to nonlinear scales, and correction of distortion. (*EEA*, 1958, #6420)

836. PICKUP TUBE PERFORMANCE WITH SLOW SCANNING RATES
Shelton, C. T., Stewart, H. W.
*SMPTE, Journal of the*, v. 67, no. 7, pp. 441–451, July 1958

A theoretical and experimental study is made of the performance of image orthicons and vidicons at scanning rates varying from 1/20 to 10 frames per second. At these slow rates, sensitivity and (in the vidicon) resolution, are improved. A lower limit on scanning rate consistent with good image quality is discussed. (*EEA*, 1958, #6414)

837. TRANSISTORS IN TELEVISION RECEIVERS
Overton, B. R.
*Television Society, Journal of the*, v. 8, no. 11, pp. 444–468, July–September 1958

A completely transistorized receiver, operating from a 12-v battery with 12-w power consumption, is described. Special attention is given to the following three major technical problems of incorporating transistors in television receivers: RF and IF amplification, video drive, and line scanning. New techniques for coping with these problems are discussed, with particular reference given to an unusual scan-magnification system. (*EI*, 1959)

838. EFFICIENCY-DIODE SCANNING CIRCUITS. I
Beauchamp, K. G.
*Electronic Enginering*, v. 30, pp. 490–497, August 1958

This circuit is universally employed for the line-output stage of television receivers and results in an appreciable saving in energy. Detailed descriptions are given of the two variants of the circuit: (1) return of the energy in the coils to the supply source (shunt); and (2) return of the energy to a storage capacitor (series). The influence of valve characteristics and the modes of operation employed to avoid non-linear effects are discussed. The use of a controlled triode, in place of the usual diode, and of saturated-reactor circuits, is studied. A means of controlling the scan width is outlined. (*EEA*, 1958, #5617)

839. STOP-GO SCANNING SAVES SPECTRUM SPACE
Haynes, H. E., Hoger, D. T.
*Electronics*, v. 31, no. 39, pp. 84–88, September 26, 1958

A type of fascimile transmission in which scanning is halted at transitions from black to white, and vice-versa, for a known, precisely controlled time interval is described. The scanning velocity between transitions is ten times greater than that which the same channel would handle with conventional scanning. Detailed schematics are given. (*EEA*, 1959, #579)

840. EFFICIENCY-DIODE SCANNING CIRCUITS. II
Beauchamp, K. G.
*Electronic Engineering*, v. 30, pp. 549–556, September 1958

Derivation of the extra-high-tension supply from the line-output circuits is described and analyzed. The existence of a maximum attainable voltage value, owing to stray capacitance, is pointed out. Practical design of the complete circuit is studied, including such features as (1) construction of the scanning coils; (2) overcoming the heater-cathode voltage problem in the boosting diode when the output transformer is auto-connected; and (3) the means employed to reduce ringing, scan distortion, and transformer resonances. (*EEA*, 1958, #6415)

841. ELECTRONIC SCANNING METHODS FOR COLOUR PRINTING
Allen, G. S.
*Journal of Photographic Science*, v. 6, no. 5, pp. 125–140, September–October 1958

A survey of research and development work on electronic color correction is presented. Both the basic problem of scientific color correction and the essential requirements of any color scanner are considered. All known color scanners are described, and their technical development is outlined. (*EEA*, 1959, #2548)

842. PRACTICAL METHODS OF TESTING TELEVISION SCANNING CIRCUITS
Lutz, H., Petersen, K.
*Radio Mentor*, v. 24, no. 11, pp. 755–760, November 1958 (in German)

Methods are given for obtaining cathode-ray-oscilloscope displays of the various waveforms involved. Typical results are shown. (*EEA*, 1959, #6147)

843. A COMPARATIVE STUDY OF THE CHARACTERISTICS OF ELECTRON TUBES USED AS SCANNING TUBES IN COLOUR TELEVISION (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)
Schröter, F.
*Acta Electronica*, v. 2, no. 1–2, pp. 112–123, 1957–1958 (in French)

The classification of scanning tubes is based on the following considerations: (1) direct pick-up or film or slide pick-up; (2) sequential or simultaneous transmission system: (3) number of units required; and (4) transmitter signal compatibility with black-and-white reception conditions. This comparative study concerns such physical and technical considerations as resolution of photoelectric sensitivity over the spectrum, utilization of filter devices, efficiency, time-constants, gamma values, and general system performance. The scope of the investigation is limited to an analysis of current types of tubes of known specifications, and stresses the importance of the storage properties that permit transition from conventional sequential scanning (rotating filters) to simultaneous three-color components transmission (NTSC). The improved performance of modern storage devices introduces the possibility that a satisfactory solution based on the "chromacoder system," which is more simple and more efficient, might be found. The problem of instantaneous simultaneous transmission cameras operating with a single-beam tube with an optical filter screen of special design is also studied. (*EEA*, 1958, #4977)

844. THE E.M.I. FLYING-SPOT FILM SCANNER FOR COLOUR TELEVISION (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)
Holman, H. E., Newton, G. C., Quinn, S. F.
*Acta Electronica*, v. 2, no. 1–2, pp. 206–213, 1957–1958

Although color television signals may be generated from motion-picture film by many techniques, the flying-spot scanning method introduces the fewest problems of registration

and color matching. An example is described which offers a choice of scanning cycles adaptable to 405/50, 525/50, and 525/60 television frequencies, and which employs electronic means to immobilize the continuous motion of either a 16- or 35-mm gauge film. The choice of color coordinates and its effect upon both S/N ratio and the best utilization of available light is discussed, as well as methods of minimizing color- and brightness-flicker. From these considerations, an efficient beam-splitter has been designed which is matched to the spectral characteristics of three photomultiplier tubes and instantaneously provides an accurate, trichromatic analysis for each object point. Individual correction for gamma and color-masking may be applied to these output signals which, with appropriate synchronizing pulses, are then combined to provide a color signal in accordance with any standard specification. (*EEA*, 1958, #4978)

845. **LINE TIMEBASES TO SCAN 90° PICTURE TUBES AT 16 AND 18 kv E.H.T.**
**Martin, K. E., Matthews, W. E.**
***Mullard Technical Communications*, v. 3, pp. 304–311, April 1958**

Two-line timebase designs are described, incorporating improved methods of linearity correction and width control. Both of the transformers are "third harmonic" tuned. Nomograms are given for determining the design value of peak anode current for the output pentode. (*EEA*, 1958, #3598)

846. **ANWEDUNG UND SCHALTUNGSTECHNIK VON BEGRENZERN IN FERNSCHGERAETEN (APPLICATION AND CIRCUIT TECHNIQUE OF LIMITERS IN TELEVISION EQUIPMENT)**
**Dillenburger, W.**
***Frequenz*, v. 12, no. 8, pp. 255–261, August 1958**

A study of camera tubes and scanners, head amplifiers, and mixers. (*EI*, 1959)

847. **A THEORETICAL ANALYSIS OF THE OPERATION OF FLYING-SPOT AND CAMERA TUBE MICROSCOPES IN THE ULTRAVIOLET**
**Ramberg, E. G.**
***IRE Transactions on Medical Electronics*, no. PGME-12, pp. 58–64, December 1958**

The minimum specimen exposure at television scanning rates required to yield pictures with acceptable S/N ratio and the best resolution optically attainable is computed for flying-spot, image-orthicon, and vidicon television microscopes for the ultraviolet. This exposure is found to be slightly less for the flying-spot microscope than for the image-orthicon microscope. For microscopes employing experimental ultraviolet-sensitive vidicons with optimal quantum efficiency, the exposure is greater than for the image-orthicon microscope by a factor of 2, and it may be greater by a factor up to 10 for vidicon microscopes with less favorable characteristics. Picture lag is absent in flying-spot microscopes and is not a serious consideration in image-orthicon microscopes, but may limit the permissible motion in the field of an ultraviolet vidicon microscope. On the other hand, the attainable radiance of flying-spot tube screens limits the usefulness of the flying-spot microscope in high-resolution studies, particularly when examination with sharply defined spectral bands is desired. No similar limitation exists for the image-orthicon and vidicon microscopes. (*EEA*, 1959, #3213)

848. **METHOD OF INTERLACE SCANNING MEASUREMENT IN TELEVISION RECEIVERS**
**Kamler, J.**
***Prace Instytutu Tele- i Radiotechnicznego*, v. 2, no. 1 (4), pp. 71–81, 1958 (in Polish)**

The method described is based on objective measurement with an oscilloscope and does not require any controlling instruments connected to points inside the receiver. Therefore, the measurement can be performed during normal operation. A definition of the scanning coefficient is given, as well as the mathematical basis of this method. A general description of the equipment and the results of measurements for several receivers are also included. (*EEA*, 1958, #4983)

849. **AN ACCURATE METHOD OF FILM SCANNING WITH ELECTRICAL COMPENSATION OF THE FILM MOVEMENT**
**Szánto, L.**
***Slaboproudý Obzor*, v. 19, no. 4, pp. 228–232, 1958 (in Czechoslovakian)**

The system considered consists of a cathode-ray tube fitted with two scanning generators, a focusing lens, and a photocell. The light emitted by the moving spot of the tube is focused by the lens, projected on to a moving film, and then received by the photocell. The main cause of picture distortion in such a system is nonlinearity of the vertical scanning generator. Therefore, a special vertical scanner was constructed which consists of a compensator, a sawtooth voltage generator, and a rectangular pulse generator. The outputs of these three circuits are combined in an adding network and applied to the output valve which drives the deflection coils. The compensator, driven by a sawtooth waveform, produces a waveform in which the amounts of various harmonics can be controlled accurately. The above scanner was tested experimentally and the performance was found to be fully satisfactory. (*EEA*, 1958, #4456)

850. **DETAIL VISIBILITY OF MOVING OBJECTS IN TELEVISION**
**Bornemann, I.**
***Nachrichtentechnik*, v. 9, no. 1, pp. 8–12, January 1959 (in German)**

A brief analysis of scanning is presented, based on the work of Mertz and Gray, indicating the relationships between

factors such as quantizing resolution of the camera tube and of the human eye (number of photons), storage time in tubes and the eye, transient response errors due to inherent system, information-content and communication-channel limitations, and technological factors such as dependence of beam current on video signal and spot size on brightness, etc. The specific case of a wheel rolling across the screen is singled out for a more detailed analysis, with emphasis on peculiar effects on reproducing moving objects by an interlaced scanning system. (*EEA*, 1959, #4381)

851. OPTICS AND PHOTOGRAPHY IN THE FLYING-SPOT STORE
Purvis, M. B., Deverall, G. V., Herriott, D. R.
*Bell System Technical Journal*, v. 38, no. 2, pp. 403–424, March 1959

The flying-spot store is a semipermanent binary information storage system in which a CRT display is imaged on a photographic emulsion by parallel optical channels. One section of the lens system provides the CRT with spot-positioning information for a closed-loop servo and the remaining channels are used to store the desired information. Some of the optical and photographic problems are discussed. (*EEA*, 1959, #4305)

852. AUTOCORRELATION AND GRANULARITY. III. SPATIAL FREQUENCY RESPONSE OF THE SCANNING SYSTEM AND GRANULARITY CORRELATION EFFECTS BEYOND THE APERTURE
Zweig, H. J.
*Optical Society of America, Journal of the*, v. 49, no. 3, pp. 238–244, March 1959

Although the granularity correlogram of a uniformly exposed and developed black-and-white photographic emulsion ordinarily extends only over a correlation distance equal to the scanning aperture diameter, it is shown experimentally that correlation is exhibited over significantly greater distances when clumping is produced; e.g., by exposing to X-rays or developing to a high density. The difference between the effects produced by both large and small scanning apertures is discussed, and it is shown that the variance for one aperture size cannot always be predicted from the variance for another. The procedure for combining the correlogram of a negative as affected by the printing procedure with the correlogram of the positive stock to give the correlogram of the print is discussed and examples are provided. In the appendix, it is shown that the ordinates of the correlogram of the negative, as transferred to the print, are proportional to the square of the gamma of the positive stock and to the density of the negative. The importance of knowing the behavior of the microphotometer that is used to obtain the correlograms is demonstrated by a practical example. (*PA*, 1959, #6432)

853. THE PROBLEMS OF TELECINE
Whatley, R. W.
*British Kinematography*, v. 34, no. 5, pp. 122–127, May 1959

On many occasions it is necessary to televise film shortly after it has been made because there is no time for rehearsal. The methods now used are derived from the Mechau instrument, where each frame dissolves into the next, thus eliminating some difficulties of matching frame frequency to scanning frequency. By using flying-spot scanning, the film may be run at continuously varying speeds and retain a coherent picture during speed changes. Thirty-five mm film is used wherever possible, but the machine can be adapted to 16 or 8 mm if required. All machines now in use have phase inversion available, so that a positive picture can be transmitted from negative film. For transmission of cinema film with the aspect ratio widely different from the television screen, there are two alternatives: (1) panning across the picture, showing the most important part, or (2) ganging line and frame scanning amplitude controls in a suitable manner. Further developments under consideration include reversible machines, instantaneous starting, and a rotating gate to reduce film wear and emulsion deposition. (*EEA*, 1959, #6137)

854. FLYING-SPOT SCANNING FOR OPAQUE COLOUR PICTURES
Mayer, N.
*Rundfunktechnische Mitteilungen*, v. 3, no. 3, pp. 123–131, June 1959 (in German)

Flying-spot scanning offers a simple method (Vitascan) for deriving red, green, and blue color signals even from opaque color pictures. The flying spot of a scanning tube is thrown onto the picture to be transmitted and, in the simplest case, the three color signals are produced by means of three photoelectric cells, thus avoiding the difficulties of three-fold registration of color rasters that occur with color television cameras having three pick-up tubes. After describing the arrangement for signal production and the calculation of the signal-to-interference ratio, some peculiarities of the method are discussed and partly demonstrated with a color photograph of the screen, which was produced with simple experimental equipment. (*EEA*, 1960, #4510)

855. RELATION BETWEEN GRAININESS AND GRANULARITY FOR BLACK-AND-WHITE SAMPLES WITH NONUNIFORM GRANULARITY SPECTRA
Stultz, K. F., Zweig, H. J.
*Optical Society of America, Journal of the*, v. 49, no. 7, pp. 693–702, July 1959

In order to determine the relation between the visual impression of graininess and the objectively determined granularity of a wide range of granularity types, a series of samples was prepared containing uniformly exposed black-and-white materials and prints (transparencies) containing varying degrees of mottle. These samples were judged by the method

of paired comparisons at different magnifications and scanned to obtain the standard deviation $\sigma(D)$ for a wide range of scanning apertures. The psychophysical relationship between the two functions: (1) graininess versus magnification, and (2) granularity $\sigma(D)$ versus the square root of the scanning area, depends on the character of the scanning operation performed by the eye. An estimate of the size of the effective scanning spot of the eye can be obtained from these data. (*PA*, 1959, #10489)

856. AUTOMATISCHE WEISS- UND SCHWARZWERTREGELUNG BEI VIDIKON-FILMABTASTERN (AUTOMATIC WHITE AND BLACK LEVEL LOCKING FOR VIDICON FILM SCANNER)
Sennhenn, E.
*Elecktronische Rundschau*, v. 13, no. 9, pp. 319–323, September 1959

The control circuit adjusts the white level of film scanners automatically, thus balancing the level of fluctuations caused by varying blackening of film highlights. The circuit works through a magnetic amplifier on the film-projector lamp. The automatic black-level control keeps the signal of the darkest picture spot at a constant-voltage output signal, and the special circuit locks the darkest-point signal to the gradation characteristic. (*EI*, 1960)

857. THE ULTRA-VIOLET FLYING-SPOT TELEVISION MICROSCOPE
Montgomery, P. O'B., Bonner, W. A.
*IRE Transactions on Medical Electronics*, v. ME-6, no. 3, pp. 186–189, September 1959
(Also available in "Proceedings of the Second International Medical Electronics Conference, Paris, France, June 24–27, 1959," pp. 488–492, Smythe, C. N., Editor, Iliffe and Sons, London, 1960)

Extensions of the basic ultraviolet television microscope technique now permit a variety of experimental living cell research problems to be attacked. It is now possible to produce a focal beam of intense ultraviolet irradiation of any size down to 1 $\mu$. This focal area of irradiation can be visually adjusted in size, shape, and position to fit any component area of the living cell. Ultraviolet absorbing areas not being subjected to this intense irradiation may then be visualized by additional ultraviolet light, or the nonirradiated area may be illuminated entirely by visible light. Alternatively, one may present simultaneously on each half of one monitor screen two images of one specimen. One image is an ultraviolet absorption image, while the other is a visible-light image. This simultaneous presentation of the same specimen on one monitor tube in two wavelengths of light permits instant evaluation of the absorption image in comparison with the nonabsorption image. (*EEA*, 1961, #4145)

858. EXPERIMENTAL STUDY OF R.M.S. GRANULARITY AS A FUNCTION OF SCANNING-SPOT SIZE
Higgins, G. C., Stultz, K. F.
*Optical Society of America, Journal of the*, v. 49, no. 9, pp. 925–929, September 1959

Experimental data on the constancy of Selwyn granularity, $S = \sigma(D) \times (2a)^{1/2}$, with variations on scanning-aperture diameter are presented. Selwyn granularity, S, is found to be essentially constant for a series of aperture diameters from 7.5 to 384 $\mu$, if the sample is clean and has no macroscopic variations in density. The effect of sample imperfections, such as density wedging, streaks, scratches, and dirt, is discussed. (*PA*, 1959, #11,701)

859. NEW MEASUREMENTS TO DETERMINE THE TRANSMISSION CHARACTERISTICS OF OBJECTIVES IN TELEVISION SYSTEMS
Frenzel, D.
*Rundfunktechnische Mitteilungen*, v. 3, no. 5, pp. 235–241, October 1959 (in German)

A brief discussion of the significant contribution to resolution losses due to optical objectives is given, followed by a description of the general theoretical analysis of finite aperture scan (unit step response through a low-pass filter). A novel experimental technique which enables quick assessment of the overall effect of given objectives on television transmission quality is also described. This effect can be expressed with reasonable accuracy in terms of a single-resolution frequency. In principle, the experimental method consists of viewing moving test bars through the objective by means of a narrow scanning slit. Movement of the test bars is achieved by rotation of an illuminated polygon which carries test strips of varying widths. The output light current is converted into pulses by a photomultiplier and displayed on an oscilloscope. An extensive bibliography is quoted. (*EEA*, 1960, #1902)

860. ELECTRONIC SCANNING SYSTEM FOR INFRARED IMAGING
Lasser, M. E., Cholet, P. H., Emmons, R. B.
*IRE, Proceedings of the*, v. 47, no. 12, pp. 2069–2075, December 1959

A new electronic infrared imaging system has been designed and constructed. The infrared image of a given field of view is focused into a scanning tube which dissects the image; after passing through the scanning tube, the radiation is then refocused onto a separate infrared detector. The tube face is a semiconducting window. An electron beam, striking the window, generates free carriers and reduces the transmission of the window locally. As the electron beam is swept across the scanning tube face, the moving opaque spot produces a video signal at the detector. Both the conditions for the operation of the device and the overall sensitivity are analyzed. It is found that the sensitivity and information rate of the system are limited only by the sensitivity and time constant of the detector employed. (*EEA*, 1961, #816)

861. A VERY HIGH-SPEED FACSIMILE RECORDER
Stamps, G. M., Ressler, H. C.
*IRE Transactions on Communication Systems*, v. CS-7, no. 4, pp. 257–263, December 1959

An operating facsimile system is described which is capable of transmitting black and white graphic information at the rate of 24 in. of copy feed per second. The system uses conventional line-by-line sequential scanning at the transmitter and a multistylus recorder with 100 lines/in. resolution at the receiver. The electrolytic recording medium employed is characterized by a relatively low internal impedance, which permits close spacing of the stylus electrodes and the use of direct-coupled transistors for the individual marking amplifiers. The high transmission speed results from using individual stylus electrodes for each elemental area along the scanning line and from holding the video marking signal at each stylus for time intervals approximating the duration of a complete scanning line. The system described uses a 100-stylus block assembly, restricting the length of the scanning line to one inch. Block assemblies with $10^3$ styli have been made and will permit reproduction of copy 10 in. wide. (*EEA*, 1960, #4505)

862. TRANSISTOR LINE DEFLECTION CIRCUITS FOR TELEVISION
Helsdon, P. B.
*Marconi Review*, v. 22, no. 132, pp. 38–70, 1959

The conventional shunt diode energy recovery system used for transistor line scan generators is very efficient; however, due to hole storage effect, it is often difficult to obtain the required small flyback time. Automatic phase control and base current drive, applied to the shunt diode circuit, allow the production of sawtooth currents that are sufficient to scan a full-sized picture tube to normal television standards. (*EI*, 1959)

863. SYNCHRONIZING TWO SINUSOIDAL VOLTAGES OF NEARLY EQUAL FREQUENCY FOR SCANNING PICTURE TUBES
Curie, C., Cazeneuve, B.
*Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 250, no. 3, pp. 491–493, January 18, 1960 (in French)

A description of a scanning method for closed circuit television systems is given, based on the Lissajou figures obtained by using two sinewave signals of approximately equal frequency. Both frequencies are derived from a single quartz oscillator by frequency division. Circuits for a scanning system which operates on 30 pictures/sec, using 16,200 to 16,170-cps scan frequencies, are presented. This definition is claimed to be comparable to that obtained in commercial television. (*EEA*, 1960, #3151)

864. TWO-OSCILLATOR SCAN STABILITY
Joseph, H. M.
*AIEE, Transactions of the, Part I—Communication and Electronics*, v. 78, no. 46, pp. 1022–1028, January 1960

While conventional television scan waveforms are generated by frequency division from a 2 × line frequency master oscillator, the author investigates the feasibility and stability requirements for raster generation by two separate oscillators. This is of particular interest for isotropic systems, and for instruments for electronic image processing. Symmetrical triangle-scan waveforms are assumed and both algebraic and graphic methods are employed to illustrate effects of scan speed variation. Practicable stability limits, derived in terms of perceptible interference (drift) between adjacent lines, successive lines in a field, and permissible deterioration of interlace, are valid for sinusoidal, triangular, and sawtooth waves. The results indicate that crystal oscillators are capable of generating a satisfactory raster. (*EEA*, 1960, #5254)

865. PEREKHODNYE, AMPLITUDNO-CHOSTOTNYE I FAZO-CHASTOTNYE KHARAKTERISTIKI TELEVIZIONNYKH KAMER BEGUSHCHEGO LUCHA (TRANSITIONAL, AMPLITUDE-FREQUENCY AND PHASE-FREQUENCY CHARACTERISTICS OF FLYING SPOT TELEVISION CAMERAS)
Perevezentsev, L. T.
*Elektrosvyaz*, v. 14, no. 3, pp. 17–25, March 1960
(Translated from the Russian in *Telecommunications*, no. 3, pp. 265–278, 1960)

A theoretical and experimental analysis is given of the influence of scanning tube ray aperture and phosphor after-shine on light flux modulation in flying-spot transmitters. (*EI*, 1960)

866. A SINUSOIDAL SCANNING TELEVISION SYSTEM
Sinman, S.
*Revue de la Faculté des Sciences de l'Université d'Istanbul*, v. 25, no. 1–2, pp. 71–78, January–April 1960

A brief but comprehensive engineering description is presented of a closed-circuit industrial television system which uses a flying-spot scanner of modest specification. The sinusoidal line frequency is 15 kc and the sawtooth field frequency is 50 cps. The line oscillator is kept in synchronism by the common 50-cps pulse generator. Complete circuit diagrams of the transmitter and receiver, waveform oscillograms, and photographs of the complete equipment are shown. (*EEA*, 1961, #5855)

867. SIGNAL GENERATION IN A SUPERICONOSCOPE WHEN SCANNED BY A DOT RASTER
Khromov, L. I.
*Radiotekhnika*, v. 15, no. 6, pp. 45–50, June 1960
(in Russian)

Although the dot-scanning process (pulse-amplitude modulation of equal resolution in frame and line direction) is well-known in memory tubes, it has not been applied to icono-

scopes. A squarewave pulse input will cause a composite signal having a dc component, an instantaneous current pulse of secondary electrons, leaving the scanned "read" element toward unscanned areas of the target, and an instantaneous current pulse of secondary electrons joining the collector. The mechanism of secondary electron movements is discussed and verified experimentally. It is shown that field effects near the target and the primary electron beam jointly produce a retarded secondary electron "cloud," slowly falling back onto the target. The video signal generation and dot scanning of a nonilluminated supericonoscope target are described in detail. Waveform and decay diagrams are given which show the generation of positive pulses from the dark target, due to the fact that the returning secondary electrons take longer than the scanning period of $10^{-7}$ sec. "Overlapping" effects due to the rise of the scanning rate and/or scan beam increase are also studied. (*EEA*, 1960, #6463)

868. VERTICAL APERTURE EQUALIZER FOR TELEVISION
Gibson, W. G., Schroeder, A. C.
*SMPTE, Journal of the*, v. 69, no. 6, pp. 395–401, June 1960

A vertical aperture equalizer employing delays of one scanning line has been built and used on commercial broadcasts to increase the subjective sharpness of television pictures. Optical aperture defects can be corrected by using both vertical and horizontal aperture equalization. By using vertical aperture equalization and scanning apertures with suitable responses, television in the future may become almost free of line structure and spurious pattern effects due to the scanning-line structure.

869. TRANSISTORIZED DEFLECTION CIRCUITS FOR 110° PICTURE TUBES
Sager, R. L., Strachanov, G., Fyler, G. W.
*IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 2, pp. 3–9, July 1960

The design of scanning circuits for a conventional (as compared with electrostatic or electromagnetic scan-magnification tubes of lower deflection-power demand) 23-in., 110-deg deflection tube, operated at 18 kv, is described. The line time-base requires 17 w, and the frame time-base requires 6 w. The first employs three transistors, a combined synchronous automatic frequency control amplifier, and a blocking-oscillator transistor using a separate transformer to drive the output transistor. Both transformers of the driver-oscillator stage employ efficiency diodes, which also limit inverse voltage peaks. The single output stage has a shunt energy-recovery diode. The design of the output transformer and yoke is described in detail; an analysis of losses, methods of third harmonic tuning of the extra high tension winding, regulations, picture centering and ringing, and linearity adjustments are discussed. The frame time-base also uses three transistors: a blocking oscillator, a buffer-driver, and a single output stage. A circuit diagram and waveform oscillograms are given. Particular emphasis is placed on the achievement of good linearity. (*EEA*, 1961, #2063)

870. A NEW WIDE ANGLE REFLECTION SYSTEM AND PICTURE TUBE
Bisbing, P. E., Bloomsburgh, R. A., Pietrolewicz, J. P., Quinlan, E. J., Snyder, J. W.
*IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 2, pp. 15–19, July 1960

A new short television cathode ray tube display of 122-deg deflection angle is described. The required deflection power is held below conventional 110-deg levels by a reduced yoke diameter and a new optimum neck contour. The constricted tube neck permits the use of a conventional diameter gun and base. Other features of the system are a shortened gun, a small diameter hinged yoke, and a more efficient sweep circuit. (*EEA*, 1961, #981)

871. SCAN MAGNIFICATION IN TV PICTURE TUBES
Dolon, P. J., Niklas, W. F.
*IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 2, pp. 20–29, July 1960

Methods available to scan power savings are surveyed. Pencil-neck tubes, television picture tubes with reduced neck diameter at the deflection center, structures applicable to scan conservation (applying post-acceleration without convergent lens action), and true scan magnification by means of axially symmetric and axially asymmetric structures are discussed. As mesh lens structures presently command a wide interest within the industry, design equations which govern their performance parameters are listed. Mesh lens structures suffer from brightness loss due to beam interception; thus, the question of electron transmission vs. the light transmission of these structures is investigated in detail. It is shown that the electron transmission does not differ substantially from the light transmission. (*EEA*, 1961, #980)

872. THE USE OF TELEVISION AND SCANNING TECHNIQUES FOR ULTRAVIOLET IRRADIATION STUDIES OF LIVING CELLS
Montgomery, P. O'B., Hundley, L. L.
*IRE Transactions on Medical Electronics*, v. ME-7, no. 3, pp. 135–138, July 1960

One of the major uses of the ultraviolet flying-spot television microscope technique is the study of ultraviolet irradiation damage to living cells. Recent advances now enable experiments to be performed that are designed to elucidate the relationship between total cellular damage and cellular component damage. Methods for the simultaneous utilization of two wavelengths of light for the illumination of different portions of a single living cell are described. This technical advance now makes it possible to produce ultraviolet irradiation damage in any area of the cell while illuminating the remainder of the cell with nondamaging visible light purely for image production purposes. (*EEA*, 1961, #830)

873. SLOW-SCAN VIDEO DATA SYSTEM
August 1960
Army Electronic Proving Grounds, Fort Huachuca, Ariz.
AEPG-SIG 930-156, Final Report
AD-250,652

Tests were conducted to evaluate the performance of the slow-scan video data system and to determine the feasibility of transmitting static display information over field wire and other circuits of the area communication system. Based on the limited results obtained, a properly designed and fabricated slow-scan video data transmission system appears feasible for transmitting static display information over narrow bandwidth circuits; however, this particular equipment was inadequate to conclusively demonstrate feasibility.

874. MODERN CONSIDERATIONS IN THE DESIGN OF COLOUR TELEVISION FILM SCANNERS USING FLYING SPOT TUBES
Neidhardt, P.
*Elektronische Rundschau*, v. 14, no. 8, pp. 307–313, August 1960 (in German)

Storage-system camera tubes have the advantage of relatively simple optical and mechanical equipment but suffer from specific electronic difficulties, whereas flying-spot scanners, though superior in this respect, require complex non-electronic equipment. The latter is considered in detail. The application of dichroic mirrors for separate chromatic processing is discussed first, followed by the engineering aspects of continuous film transport, speed stabilization, and film shrinkage compensation. Vertical scan correction with 50 field sec systems can be solved by a partitioned twin optical compensating device using either lenses, or more simply, lenses with 45-deg mirrors or prisms, or by a Russian method of using a double mirror arrangement with the mirror planes parallel to the beam. Afterglow and aperture correction are considered next, and electronic masking and black level clamps are singled out for a more detailed description, illustrated by dimensioned circuit diagrams. Twenty references are given. (*EEA*, 1961, #1667)

875. EFFECTS OF THE SCANNING APERTURES ON THE IMAGE QUALITY
Shinoda, G., Suzuki, T.
*Technology Reports of the Osaka University*, v. 10, pp. 681–691, October 1960

For rectangular, sinusoidal, or similar apertures, the effects on the image quality have been analyzed from the viewpoint of spatial frequency response. The sinusoidal or similar aperture showed more desirable results than the rectangular or circular apertures. If incoherent illumination is used, more desirable results are expected because it has a sharp cutoff frequency characteristic. The overlapped aperture may be effective not only in reducing the extraneous images on the scanned image but also in reducing the appearance of scanning lines on the image. (*EEA*, 1962, #7311)

876. EFFECTIVE SPOT SIZE IN BEAM SCANNING TUBES
Sandor, A.
*SMPTE, Journal of the*, v. 69, no. 10, pp. 735–738, October 1960

The gaussian current distribution does not hold in practical electron beams because of aberrations, space-charge, and masking conditions. Only an overall effect of the total current is useful for defining spot size; thus, observation of the visible spot boundaries on phosphor screens is adopted. Because of the prevailing bell-shaped current density distributions, this definition comes closest to a practical measure of spot size, based on center peak brightness. Experimental evidence is given for the formation of vertically reduced spot sizes during beam scanning in the form of ellipses, manifesting itself in a significant improvement on vertical picture resolution. (*EEA*, 1961, #2725)

877. DYNAMIC SPOT FORMATION IN COLOR TUBES
Sandor, A.
*SMPTE, Journal of the*, v. 69, no. 10, pp. 738–742, October 1960

The dynamic spot formation and its size-reducing property during scan are visualized for square- and circle-shaped beam spots. While feedback-type color tube systems require an extremely small spot, grid-focusing and masking systems can utilize conventional spot sizes because of additional, short-range focusing facilities and beam-shaping external to the electron gun. Alternative operational modes with different scan-to-grid relations in the Lawrence color tube system are critically investigated. An optimum spot size condition is found when operated with wire-parallel scan and with a high grid-deflection rate which also removes the moiré effect. (*EEA*, 1961, #2724)

878. ELECTRON TRANSMISSION OF MESH LENSES FOR SCAN MAGNIFICATION IN TELEVISION PICTURE TUBES
Dolon, P. J., Niklas, W. F.
*British Institution of Radio Engineers, Journal of the*, v. 20, no. 12, pp. 911–919, December 1960

The principles of scan magnification and scan conservation are outlined. Magnetic and electrostatic lenses showing a diverging action, and thus applicable to scan magnification, are discussed. The question of the electron optical mesh transmission is investigated both theoretically and experimentally. Numerical integration of the paraxial ray equation and its analytic solution indicate that the electron optical transmission of these mesh electrodes increases with increasing strength of the interstitial lenses; however, appreciable increases are obtained in only very strong lenses. Methods of determining experimentally a possible change of mesh transmission with changing strength of the interstitial lenses are discussed. It is shown that the mesh transmission may increase with increasing lens strength. (*EEA*, 1961, #1666)

879. DEFLECTION PROBLEMS IN A COLOUR TV RECEIVER WITH A THREE GUN SHADOW MASK
Möbius, J.
*Nachrichtentechnik*, v. 10, no. 12, pp. 546–550, December 1960 (in German)

A condensed account of engineering problems in the scanning techniques of present color television receivers is given. An explanation is also given, covering the three-gun shadow-mask operation; the origin and compensation, by static and dynamic convergence correction, of trapezium and pincushion distortion; and the practical methods of achieving this correction. (*EEA*, 1961, #4295)

880. MULTIPLE INTERLACED SCANNING OF A TELEVISION PICTURE
Bruk, Yu. M.
*Radiotekhnika*, v. 15, no. 12, pp. 61–66, December 1960 (in Russian)

The method of scanning by imposing the vertical cam sawtooth on another sawtooth or a step voltage is described, and its advantages, particularly the reduction of the transmitted frequency band, are pointed out. The effect of scan oscillator parameters, that are not ideal, on scanning quality is discussed, and it is concluded that multiple scanning is practicable especially for industrial television. (*EEA*, 1962, #3239)

881. STUDY OF TELEVISION AND FLYING-SPOT DIGITIZING TECHNIQUES
Becker, R. A.
December 31, 1960
Army Ordnance Missile Command, White Sands Missile Range, Range Instrumentation Development Division, N. Mex.
Final Report

Two optical-electronic approaches to the problem of digitizing shaft-angle data have been proposed. One approach is to use television scanning; the other would use a flying-spot scanner. Problem areas such as resolution, sweep linearity, synchronization, sampling time, and phosphor persistence are discussed. It is concluded that the television approach may be feasible, but difficult, because of sweep linearity requirements, and that the flying-spot scanner approach is marginal because of phosphor persistence.

882. THE EFFECT OF BEAM APERTURE ON THE COMMUTATION OF THE POTENTIAL RELIEF IN THE VIDICON
Gurevich, S. B., Bykov, R. E.
*Radioteknika i Elektronika*, v. 5, no. 4, pp. 638–648, 1960 (in Russian)

Experimental data have shown that, using standard scanning methods, the storage time in the vidicon is no greater than the 0.02 sec scanning time of a single field. Six references are given. (*EEA*, 1962, #4335)

883. FLYING-SPOT SCANNERS FOR COLOUR TELEVISION
van Ginkel, H.
*Philips Technical Review*, v. 21, no. 8, pp. 234–250, 1959–1960

Two types of systems have evolved: one for color slides and one for opaque matter (color prints, small objects). In both systems the flying-spot is generated in a special scanning tube. The optical system of the slide scanner consists of an objective lens, a cruciform arrangement of dichroic mirrors, and correction filters. Three photomultiplier tubes are used. The three video channels each contain an afterglow compensation circuit, a gamma correction circuit, and an output amplifier that distributes the signals. The print scanner is designed around the principle of the integrating-sphere photometer. (*EEA*, 1961, #446)

884. RECENT DEVELOPMENTS IN SCAN MAGNIFICATION
Parker, N. W., Csorba, I. P., Frihart, H. N.
*1960 IRE International Convention Record*, pt. 7, v. 8, pp. 167–174, 1960

A short discussion on the growing need for significantly reducing the heat dissipation in television receivers is followed by a discussion of one of the possible means by which this may be accomplished—scan magnification. A brief review of the concept of scan magnification and some of the known ways in which it can be accomplished is given. The idea of the negative lens in electron optics is discussed and the use of this type of lens in electron beam refraction is described. A development is shown of the relationships in negative electrostatic lenses which describe the magnitude of scan magnification and the effect on spot size. A discussion is also given of some of the electrical and physical problems encountered in the construction of a negative electrostatic lens scan magnifier. (*EEA*, 1961, #976)

885. S.C.F.M.—AN IMPROVED SYSTEM FOR SLOW-SCAN IMAGE TRANSMISSION
MacDonald, C.
*QST*, v. 45, no. 1, pp. 28–32, January; no. 2, pp. 32–35, February 1961

Tests conducted with the equipment previously described, in which video signals from a slow-scan flying-spot scanner modulate the amplitude or frequency of a subcarrier, are described. The superiority of FM over AM for this purpose was fairly clearly demonstrated. Proposed standards are given for a 120-line transmission, for 50- and 60-cps supply areas. The subcarrier frequencies chosen were 1200 cps for synchronizing, 1500 cps for black level, and 2300 cps for white level. Circuits of the modulator and demodulator used are given. (*EEA*, 1961, #5856)

886. A HIGH-SPEED FACSIMILE SYSTEM WITH ELECTRONIC SCANNING
Kubota, K., Kobayashi, K., Okajima, Y., Nanbo, S.
*Reports of the Electrical Communication Laboratory*, Tokyo, v. 9, no. 3–4, pp. 214–219, March–April 1961

An experimental system is described with electronic horizontal scanning and mechanical vertical scanning. This system uses a vidicon at the transmitting terminal and a flying-spot CRT at the receiving terminal, where the signal is recorded on electrophotographic paper. The transmitting speed of this type of system is limited by the recording speed which is dependent on light sensitivity of the electrophotographic paper, brightness of flying-spot CRT, etc. The present maximum transmitting speed is a 100-cps horizontal repetition rate and a 10-mm/sec vertical paper speed. Facsimile systems with electronic scanning generally are suitable for high-speed transmission of small copy and have the additional advantage that pictures can be enlarged or contracted during reception. (*EEA*, 1962, #2245)

887. SCAN CONVERTER BANDWIDTH GOES TO 10 MC; RADAR TO TELEVISION
*Electronics*, v. 34, p. 33, June 30, 1961
(*AS&T*, 1961)

888. CRITERIA FOR THE ACHIEVEMENT OF EQUAL RESOLUTION WITH LINE AND SPIRAL SCANNING
Saprykin, K. V.
*Radiotekhnika*, v. 16, no. 7, pp. 46–51, July 1961
(in Russian)

The popularity of spiral scanning in industrial television applications poses the problem of comparable resolution with more conventional systems. Starting with equal ratios of both picture elements and total picture areas, it is shown that for equal resolution, the raster steps are also equal. In the linear system this is $Y/Z$, where $Y$ is the line distance between lines and $Z$ the number of lines; in the spiral system, it is $R/Z_0$, where $R$ is the picture radius and $Z_0$ the number of spiral terms. Calculations are made to produce graphs of $Z/Z_0$ vs. the aspect ratio of the linear system. This figure varies for varying relationships between respective picture areas; thus, assuming the conventional aspect ratio of 4:3 for the linear system and identical picture areas, $Z:Z_0 = 1.53$, but in the case of the rectangular raster being within the outermost spiral turn, the ratio becomes 1:2. (*EEA*, 1962, #4653)

889. CHUVSTITELNOST TELEVIZIONNYKH SISTEM S RAZLICHNYMI PARAMETRAMI RAZIOZHENIYA (SENSITIVITY OF TELEVISION SYSTEMS WITH DIFFERENT SCANNING PARAMETERS)
Gurevich, S. B.
*Radiotekhnika i Elektronika*, v. 6, no. 7, pp. 1165–1169, July 1961
(Translated from the Russian in *Radio Engineering and Electronic Physics*, v. 6, no. 7, pp. 1036–1039, July 1961)

A formula is derived for specific and total sensitivity of TV systems. The relationship between sensitivity and amount of transmitted information is included. (*EI*, 1962)

890. SOUND SYNTHESIS BY ELECTRONIC IMAGE SCANNING
Heck, L.
*Elektrotechnische Zeitschrift, Ausgabe B*, v. 13, no. 17, pp. 454–458, August 21, 1961 (in German)

The methods used in modern radio and television offer new possibilities in electronic sound synthesis. Of great importance are the electro-optical methods which produce sounds by scanning diagrammatic curves. Electronic image scanning offers advantages for scanning fixed drawings on the principle of the slide-scanner or television camera. The fact that the scanning system has no weight makes it possible, by synchronizing a sound and amplitude record, to reproduce very accurately all balancing processes and, hence, the build-up phenomena. The amplitude-controlled sound images of several harmonics can be added and, in this way, a fine structure of sounds can be produced synthetically. (*EEA*, 1962, #6150)

891. STEREO COLOR TV SYSTEM MAY GUIDE MOON ROBOT
*Electronics*, v. 34, pp. 30–32, October 13, 1961

The stereo television system is briefly outlined, and a description of a scan-conversion system is given.

892. A PHOSPHOR-BELT DISPLAY SCAN SYSTEM FOR PROVIDING AN ENDLESS RASTER LINE SCAN
Nudelman, S., Trytten, G., Hickmott, J.
October 1961
Michigan, University of, Institute of Science and Technology, Ann Arbor
2900-292-T, DA 36-039-sc-78801
AD-265,898

A luminescent display device, suitable for operation with airborne sensors that provide an endless raster line scan, has been assembled and tested. This device consists of a continuously moving flexible plastic belt, coated with a long-decay photoluminescent phosphor, and an ultrasonic, ultraviolet light modulator. The phosphor is excited to luminescence by the video-modulated ultraviolet light spot. An image is formed by sweeping the light spot perpendicular to the direction of belt motion. The system has zero flyback time and provides an instantaneous inflight examination of data for the image of a flight path. The phosphor-belt light output is also sufficient to permit image reproduction on a Lumincon television-type of display, and is well suited to operation as an integral part of a sensor system, or at a distance, by a communication link.

893. A FLYING-SPOT INTERFERENCE TELEVISION MICROSCOPE
Montgomery, P. O'B., Hundley, L. L.
*Nature*, v. 192, pp. 1059–1060, December 16, 1961

An interference microscope is described which uses a flying-spot scanning system, a photomultiplier, and a device for continuous solution of the intensity-phase angle equation. The instrument has been designed to give rapid determination of cellular dry mass. (*EEA*, 1962, #7316)

894. ULTRA-VIOLET TELEVISION MICROSCOPY
Barer, R., Wardley, J.
*Nature*, v. 192, p. 1060, December 16, 1961

The application of a new "vidicon" television camera tube with quartz window as the detector in an ultraviolet microscope is described. The sensitivity at 2537 Å is approximately 0.1 $\mu A/\mu w/cm^2$ enabling magnifications of 3000 to be used and exposures of 1/25 sec on 35-mm film. By immersing the specimen in a medium of suitable refractive index, the contrast of detail may be enhanced. (*EEA*, 1962, #7316)

895. THE ENHANCED-SCAN, POST-ACCELERATION KINESCOPE
Law, H. B., Davne, L., Ramberg, E. G.
*RCA Review*, v. 22, no. 4, pp. 603–622, December 1961

An experimental deflection system is described in which a spherically curved mesh is placed in a conventional black-and-white tube where the neck joins the funnel of the tube. It is shown that, by operating the mesh and the deflection region of the tube at low potential, the scan power is much less than that required in conventional systems. Scan sensitivity, raster distortion, resolution, contrast, and brightness available with the experimental kinescope are discussed, and the data obtained are compared with that of a conventionally operated black-and-white tube. Best resolution is obtained with magnetic focus. The effect on contrast of secondary electrons scattered by the mesh is minimized by applying a bias voltage which tends to draw the secondary electrons toward the gun. A small residual effect is substantially eliminated through the use of specially shaped apertures in the mesh. The brightness potential of the tube is reduced by interception of beam electrons by the mesh. (*EEA*, 1962, #7092)

896. SCANNING MICROSCOPE FOR PHOTOELECTRIC DATA EVALUATION
Tove, P. A., Brolin, S., Hellman, B.
*Review of Scientific Instruments*, v. 32, no. 12, pp. 1343–1346, December 1961

A mechanical scanning device for evaluation of microscopic data over a large area is described, as well as an electronic system for collecting and sorting information approximately the size of light and dark patches on a plate. Preliminary experiments for measuring size distribution of the islets of Langerhans in histologic sections of the pancreas are also described. (*PA*, 1962, #1260)

897. FIBER OPTICS YIELDS A NEW SCANNER CONCEPT
Day, R., Krauss, D. M.
*Control Engineering*, v. 8, no. 12, pp. 101–104, December 1961

The fiber optic geometry converter makes possible an electromechanical scanner which can compete with electron beam scanners in their lower ranges of speed and resolution, while offering simplicity, stability, and long life. It is based on the light transmission properties of optical fibers. These are flexible strands of optical quality glass, of diameters as small as 0.001 in. which are coated or clad with a glass of lower refractive index. They can be gathered together into tight bundles and used to carry a complex image by breaking it up into small components and transmitting each one independently from one end of the bundle to another. The scene to be scanned is imaged by an objective lens onto an array of fiber ends. The output ends of these fibers are arranged around the circumference of a circle in a suitable sequence. A rotating radial slit disk then allows light from each fiber in turn to be focused onto a photomultiplier, the slit scanning all the elements of the image in one revolution. The advantages of this method over other types of area scanners are stressed, and its application to automatic high speed bacon-slicing control and to the automatic frequency analysis of analog strip chart records is discussed. (*EEA*, 1962, #7300)

898. A SCANNING FABRY-PEROT INTERFEROMETER
Barr, W. L., Gardner, A. L.
*Optical Society of America, Journal of the*, v. 51, no. 12, pp. 1400–1401, December 1961

A simple method of photoelectrically scanning a Fabry-Perot interferometer pattern is described. Scanning is accomplished by parallel displacement of the incident beam of light across the face of an interferometer whose plate separation varies in the direction of the displacement. This method of scanning allows a slightly distorted plot of the line profile to be continuously displayed on an oscilloscope. (*PA*, 1962, #114)

899. RESEARCH ON OPTICAL AMPLIFICATION EMPLOYING ELECTRONIC SCANNING TECHNIQUES
Hall, J. A., Shabanowitz, H.
December 1961
Westinghouse Electric Corporation, Research Laboratories, Pittsburgh, Pa.
ARL-154, AF 33(616)-3254

The primary objective of this investigation was to determine, through research, a basis for subsequent development of a highly sensitive optical-to-electrical transducer or television camera tube. Such equipment would be used to obtain useful images at extremely low illumination levels. The research accomplished the objective by supplying the basis for developing a new type of scanned optical amplifier. This amplifier has a better sensitivity and resolution potential than presently known television camera tubes.

900. SCAN CONVERTER FOR BROADCAST USE
Malang, A. W.
*1961 IRE International Convention Record*, pt. 7, v. 9, pp. 3–7, 1961

A very brief description is given, with some photographs of an optically coupled vidicon standards converter. (*EEA*, 1962, #2254)

901. HORIZONTAL SCAN NON-LINEARITY IN TELEVISION RECEIVERS AND THE SATURABLE REACTOR
Claypool, H. W.
*1961 IRE International Convention Record*, pt. 7, v. 9, pp. 61–67, 1961
(Also available in *IRE Transactions on Broadcast and Television Receivers*, v. BTR-7, no. 1, pp. 14–20, April 1961)

After explaining the causes of asymmetrical nonlinearity of horizontal scan circuits (mainly due to the resistive component of the scan yoke), and of symmetrical nonlinearity (due to the shape of modern wide-angle cathode ray tubes), a thorough circuit analysis of the basic energy recovery circuit, by means of a booster diode, is presented and illustrated by equivalent circuits, waveform diagrams, and valve characteristics. Various methods of dealing with asymmetrical nonlinearity are described, including the use of a resonant circuit, triode booster, and a shorted turn coil placed between the tube neck and yoke, and their shortcomings are discussed. The preferred method compensates for undesirable scan current curvature by means of a saturable reactor (a well-known method in UK and Europe), and the principles and performance are described in some detail. The standard correction of symmetrical nonlinearity, with the aid of a capacitor of critical value in series with the scan yoke is also described. (*EEA*, 1961, #7069)

902. DESIGN OF FRAME SCANNING OUTPUT STAGE
Bate, F. D.
*Television Society, Journal of the*, v. 10, no. 1, pp. 10–23, January–March 1962

A theoretical analysis is made of the frame output stage. This leads to two sets of equations: one, where there is no dipping of anode current during scan, and the other, where dipping occurs. Graphs provided enable the design to be quickly made for several sizes of transformer. (*EI*, 1963)

903. ABOUT SCAN MAGNIFICATION OF TV PICTURE TUBES
Gundert, E., Lotsch, H.
*IRE Transactions on Electron Devices*, v. ED-9, no. 2, pp. 197–203, March 1962

In a television receiver the line deflection is critical because of the high deflection power. Recently various proposals were published, according to which the electron beam is to be deflected only over a small angle in order to reduce the deflection power. Subsequently this small deflection angle is to be enlarged by an electrostatic or magnetic lens. Here with the aid of general laws of electron optics, it is shown that such a scan magnification by an electrostatic or magnetic lens necessarily causes a decrease in resolution and thereby of the quality of the television picture, unless the methods known for increasing the resolution are employed simultaneously. The calculation also affirms that at a constant resolution, in the case of magnetic deflection the deflection power cannot practically be reduced by post-acceleration of the beam electrons, contrary to the case of electrostatic deflection. (*EEA*, 1962, #10,180)

904. NARROW-BAND TV USES PSEUDO-RANDOM SCAN
Deutsch, S.
*Electronics*, v. 35, no. 17, pp. 49–51, April 27, 1962

An ingenious, very narrow bandwidth (10 kc only) television system is proposed, relying on the statistical rarity of fast motion and the fact that the eye, while sensitive to flicker, is more tolerant to gradual fade. The proposed system has a resolution of approximately 45,000 picture elements which is of the same order as an indifferently adjusted inexpensive receiver. The principle consists of a random dot scan, so that despite the very long frame period of 2.667 sec, every region of the screen is covered by the scanning dot several times during that period. The scanning process proceeds in three steps: (1) A coarse vertical scan at 768 cps is moved horizontally at 24 cps to give 32 lines per field. (2) This 768-cps rate is derived from the master generator at 18,432 cps, which waveform is superimposed to give a stepped dot pattern, the beam remaining stationary for approximately 0.25 $\mu$sec. (3) Finally, square waves are added to this dot pattern to produce the small-area pseudo-random sampling, the entire dot array being slightly shifted every 1/24 sec, the process repeating after the full "local" scan of the small area containing 64 picture elements has been completed. Hence the frame period of $64/24 = 2.667$ sec. All three scan processes are produced with six square waves only, all derived by division from the 18,432-cps source. They are explained by means of block diagrams and waveform diagrams including those of synchronizing and shaping circuits. A brief description of the transmitter and receiver follows; the receiver contains a 9216-cps oscillator which is locked by the transmitter vertical sync pulse. (*EEA*, 1962, #11,399)

905. SLOW-SCAN TV VIDICONS DEVELOPED
MacDonald, C.
*Electronics*, v. 35, p. 104, May 11, 1962
(*AS/T*, 1962)

906. A THEORY OF SEQUENTIAL PATTERN RECOGNITION
Costanza, J. L., Mergler, H. W.
June 1962
Case Institute of Technology, Numerical Control Laboratory, Cleveland, Ohio
EDC 1-62-14

The logical organization and functional design considerations of a pattern recognition system are presented. It is proposed to effect pattern recognition by a process of sequentially scanning a pattern field which is considered as quantized into a finite number of areas. It is shown that because of redundancy present in the specification of a pattern, it will not be necessary, in general, to interrogate the entire pattern field to effect recognition. Taking advantage of the pattern field's finite structure, it is possible to formulate the mechanism of pattern recognition in terms of a finite state, sequential automata. In so doing, it is possible to define a measure of system performance in terms of the mean number of pattern field interrogations required to effect recognition. The system performance is found to be closely associated with the scanning policy used during the course of the sequential pattern field interrogation. A method of computing an optimum scanning policy is developed which, if used, results in an optimum system performance. Experimental verification of the techniques proposed is included. (*STAR*, 1963, N63-13262)

907. EIN GRADATIONSENTZERRUNGSGERAET FUER FARBABTASTER (GRADATION EQUALIZER FOR COLOR TV SCANNERS)
Strauss, H.
*N.T.Z. Nachrichtentechnische Zeitschrift*, v. 15, no. 8, pp. 371–379, August 1962

An equalizer for use in the transmission of color films or color diapositives operates on the principle of multiplicative gradation equalization. For the purpose of simplifying level adjustments, the equalizer contains a control circuit which permits continuous supervision of equality of gradation curves and of compensation adjustment for correcting the signal in three channels. (*EI*, 1963)

908. SCAN-CONVERSION STORAGE TUBE BASED UPON THE PERMACHON
Doyle, R. J.
September 30, 1962
Westinghouse Electric Corporation, Elmira, N.Y.
Quarterly Progress Report 9 for July 1–September 30, 1962, DA 36-039-sc-85051
AD-291,829

The development effort was focused on the fiber-optics scan-conversion target. Evaluation of the transparent conductive coatings required for the fiber-optics target commenced, and the interlamina capacitance was calculated and measured. Unenhanced erase measurements were also made. A low capacitance mount was completed to hold the fiber-optics target, and it is described in detail. The test equipment was augmented with a power supply isolated for 15 kv and a dual preset field and frame counter.

909. TÉLÉVISION INFRAROUGE
Boutry, G. A., Desvignes, F., Geneve, R.
*Revue Générale de Thermique*, v. 1, no. 10, pp. 25–32, October 1962

The characteristics of infrared detectors make it possible to obtain an image forming device with a scanning system, which is called "infrared television." Selection of operating wavelength range, a camera with a mechanical image analyzer, the development of a vidicon-type electronic analyzer and the use of a photovoltaic effect of *p-n* type junction for reverse polarization by a scanning electron beam are discussed. (*EI*, 1963)

910. INFRARED DIFFRACTION PATTERN SCANNING STUDY
Redden, R. C., Clow, R. G., Day, R. P.
October 1962
Lockheed Missiles and Space Company, Sunnyvale, Calif.
Final Report for March 11, 1961–September 1, 1962, SSD-TDR-62-157, AF 04(647)-688

The central hypothesis of target-to-background discrimination by diffraction pattern scanning is that the target apparent size is identified with higher spatial frequencies in the Fourier transform of the optical scene, and a space filter (telescope with two-beam interference) that transmits the higher frequencies can be used to produce an electro-optical system with improved discrimination capabilities. An experimental program was conducted, both to test the hypothesis and to evaluate the feasibility of implementing the technique for practical applications to weapon systems. A theoretical study was conducted to analyze the hypothesis and to formulate general criteria and concepts for target-to-background discrimination. Mathematical models and descriptions of backgrounds were reviewed and analyzed, and a particular model was developed. The methods of Fourier analysis, matched filter theory, and statistical decision theory were applied to an electro-optical system concept. A practical optimum filter was specified. Experiments were conducted both in the visible and infrared spectra. A high-resolution infrared scanning telescope was designed and fabricated. Diffraction patterns from different sources and backgrounds were produced and detected by both infrared scanning and photographic recording. The theoretical predictions of an improvement in target-to-background discrimination over conventional systems were not tested sufficiently for final opinions, due to a need for outdoor tests. However, the experimental results on scanning the diffraction patterns of sources, large enough to exhibit partial coherency effects, were in agreement with theory. (*STAR*, 1963, N63-10313)

911. UNSCREENING OF IMAGES FOR OPTIMUM VISUAL INFORMATION (LE DETRAMAGE DES IMAGES COMME PROCEDE D'UTILISATION OPTIMALE DES INFORMATIONS) (Translation of a paper presented at the Sixth Annual Conference of Agard Avionics Panel, Paris, France, July 1962)
Surget, J., Veret, C. (ONERA)
December 6, 1962
Joint Publications Research Service, Washington, D.C.
JPRS-16539
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

An optical system which makes it possible to reproduce an object may be considered as a filter of the spatial frequencies of the object. In this system, there is a specific plane in which the distribution of the luminous vibrations corresponds to the frequency spectrum of the object function. By placing suitable masks in this plane, it is possible to act selectively on the spatial frequencies so as to stress some of them in relation to others. Examples of the application of the technique are given for the unscreening of photographic prints, for the suppression of the scanning lines in television images, and for the unscreening of striograms taken through the perforated walls of a supersonic wind tunnel. (*STAR*, 1963, N63-10660)

### 912. AN ELECTROLUMINESCENT-PIEZOELECTRIC FLAT-PANEL DISPLAY DEVICE

**Nudelman, S., Mudar, J., Trytten, G., Lambe, J.**
***Solid-State Electronics*, v. 5, pp. 381–390, November–December 1962**

A flat-panel, line display, consisting of electroluminescent ZnS-Cu phosphors (EL) adjacent to piezoelectric voltage transformer elements (PE), has been fabricated to provide a controlled-movement luminescent light spot. Electroluminescence is excited by the electric fields generated at the surface of a piezoelectric element driven at its resonant frequency. The display is made up of thirty PE-EL units connected electrically in parallel, each unit resonating at a different frequency. Movement of the light spot over the face of the display is produced by frequency modulation of the voltages applied to the piezoelectric array, in the manner of a sweep frequency. Synchronized amplitude modulation permits the light spot to be localized and its movement to be controlled. The display has a sweep frequency range extending from 30 to 60 kc. PE-EL units under continuous operation generate 40-ft L at 8.8 $v_{rms}$, and can generate over 100-ft L by overdriving at 40 $v_{rms}$. In sweep operation at 100 cps, the light output is 40-ft L at 35 $v_{rms}$. Power consumption in this mode is less than 10 mw. EL fatigue is analyzed and minimized in this display sweep technique. (*EEA*, 1963, #6215)

### 913. VERTICAL RESOLUTION AND LINE BROADENING

**Monteath, G. D.**
**December 1962**
**British Broadcasting Corporation, London, Great Britain**
**Engineering Division Monograph 45, pp. 5–22**

This monograph is concerned with the effects of scanning in lines on a television picture, and with methods of broadening the scanning lines so as to reduce or eliminate these effects. The results of earlier work on the optimum number of lines for a given bandwidth are summarized, and a precise definition of the Kell factor is suggested. Scanning is treated theoretically as a sampling process, and the ideal form of the line profile is deduced. A similar result is shown to follow from consideration of polynomial interpolation. A number of methods of line broadening are discussed. Two of these enable the profile to attain negative values, so that vertical aperture correction is possible. Subjective experiments are proposed. (*EEA*, 1963, #3394)

### 914. OPTICAL SCANNING USING ELECTRICALLY-MODULATED MEMBRANE MIRRORS

**Jones, H. S., Astwood, E. J., Clarke, H.**
**1962**
**Irco Corporation, New York, N.Y.**
**Semiannual Technical Report 2, Final Report for January–December 1962, Nonr-3649(00)**

Optical scanning using electrically modulated membrane mirrors encompassed: (1) membrane casting, (2) membrane casting solution, (3) membrane removal from the water surface, (4) membrane handling, (5) membrane application apparatus, (6) membrane baking, (7) rotary evaporation system for application of metal coatings to the membranes, (8) optical test apparatus, (9) use of the first experimental membrane-mirror assembly, (10) analysis of difficulties experienced with the first experimental membrane-mirror assembly, (11) review of membrane-mirror functional requirements and possible designs, (12) description of the final experimental membrane-mirror assembly, (13) calibration of the potential distribution between deflection electrode segments, (14) voltage distribution between deflection electrode segments, and (15) use of final experimental membrane-mirror assembly. (*STAR*, 1963, N63-12808)

### 915. INFINITELY VARIABLE FERRITE PHASE SHIFTER

**Kitsuregawa, T., Nakahara, S., Kondo, T. (Mitsubishi Electric Manufacturing Company, Ltd., Research Laboratory, Amagasaki, Japan)**
***Mitsubishi Denki Laboratory Reports*, v. 4, no. 1, pp. 15–30, January 1963**

This paper describes new types of ferrite phase shifters which have the continuously and infinitely variable phase shift and quick response. These are used to perform high-speed continuous beam scanning and to receive microwave power from several antennas. These infinitely variable ferrite phase shifters consist of ferrite phase shifters and ferrite switches. The structures and behaviors of various types are described. It is evident from the experimental results that the phase shifts can be varied continuously with the scanning speed of 18,000 deg/sec. The amplitude variation during the phase shift, and the phase discontinuity of the microwave power during the switching time are less than 0.3 db and 5 deg, respectively. (*STAR*, 1963, N63-14106)

### 916. STANDARDIZATION OF TV SCANNING RATES: CONSIDERATION OF CONVERSION FACTORS

**Barlow, M. W. S.**
***SMPTE, Journal of the*, v. 72, no. 2, pp. 104–107, February 1963**

Intercontinental exchange of TV programs raises the problem of standards conversion. The case is examined for changing the 525-line system to 625 lines, and vice versa. Common standards are proposed for the video signal but channel spacing, allocation, and sound-to-vision carrier spacing would remain as at present. No changes would be required to receivers or transmitters, and only small changes to studio

equipment. Conversion of the 625-line system to 525 lines would give a larger improvement in picture quality than the reverse procedure. No problem is anticipated with NTSC, Iowa, or SECAM color systems. (*EEA*, 1963, #6467)

**917. ONE- AND TWO-DIMENSIONAL PROCESSING IN LINE SCANNING SYSTEMS**

**Callahan, L. G. (U.S. Army Research Office, Durham, N.C.), Brown, W. M. (University of Michigan, Department of Electrical Engineering and Institute of Science and Technology, Ann Arbor)**

***Applied Optics*, v. 2, pp. 401–407, April 1963**

The performance of line scanning systems is analyzed, with results applicable to systems such as IR scanners, TV systems, and radar systems. The main objective is a comparison of the performance obtainable when optimum two-dimensional processing of the data is used with that obtained when only one-dimensional (along the lines) processing is used. Quantitative comparisons are made for top-hat and cone-shaped frequency responses of the aperture. Three performance criteria are used: least-square error, maximum-peak signal to rms noise ratio, and minimum system resolution. A table shows the improvement of arbitrary two-dimensional filtering over one-dimensional filtering along the lines. (*IAA*, 1963, A63-14405)

**(See *also Entries* #15, 538, 765, 984, 986, 1013, 1028, 1102, 1201, 1221, 1252, 1387, 1440, 1448, 1561.)**

# TELEVISION BANDWIDTH

**918. VERSUCH ÜBER DIE ANPASSUNG DES NTSC-FARBFERNSEHSYSTEMS AN DIE EUROPAEISCHE 625-ZEILEN-NORM (EXPERIMENTS CONCERNING ADAPTATION OF NTSC COLOR-TV SYSTEM TO EUROPEAN 625-LINE STANDARD)**
**Davidse, J.**
*N.T.Z. Nachrichtentechnische Zeitschrift*, v. 11, no. 9, pp. 461–466, September 1958

The problems concerning the chrominance carrier frequency which arise from this adaptation are discussed as well as the choice of color information and the bandwidth of these signals. The effects of bandwidth reductions in color channels, and the effects of the sub-carrier frequency chosen for the video band upon both luminance and chrominance reproduction are also considered. (*EI*, 1959)

**919. BANDWIDTH REDUCTION SYSTEMS AND THEIR APPLICATION TO COLOUR TELEVISION (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Delbord, Y. L.**
*Acta Electronica*, v. 2, no. 1–2, pp. 364–370, 1957–1958 (in French)

The various bandwidth reduction systems used up to now in television applications are discussed. They are: (1) non-sequential field interlacing (order of interlacing: 1, 3, 4, 2); (2) dot interlace and "multiplex" systems with recurring transmission of video-frequency sample signal; (3) use of the idle regions in the spectrum; and (4) spectrum sequential systems in which a fraction of the whole spectrum is transmitted over a certain period (corresponding to one line or one vertical scan), the other parts of the spectrum being transmitted over subsequent scanning periods. Most of these systems were designed for monochrome television and present obvious advantages in color television. Their respective merits and demerits are examined, and some experimental results are discussed. (*EEA*, 1958, #4954)

**920. SOME RELATIONS BETWEEN TELEVISION PICTURE REDUNDANCY AND BANDWIDTH REQUIREMENTS (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Powers, K. H., Staras, H., Fredendall, G. L.**
*Acta Electronica*, v. 2, no. 1–2, pp. 378–383, 1957–1958
(Also available in *AIEE, Transactions of the, Part I—Communication and Electronics*, v. 76, no. 32, pp. 492–496, September 1957)

An analysis is presented of the concept of statistical redundancy. It is shown that the redundancy can be separated into two parts, nonpredictive redundancy and predictive redundancy. The nonpredictive redundancy results from the message not possessing the most efficient first-order probability distribution while the predictive redundancy results from the statistical correlation of the present value of a signal with its past history. The analytical procedure presented in this paper is then applied to the television communication problem. The results of this analysis compare very favorably with existing experimental evidence. The analysis indicates that by suitable statistical coding, a bandwidth of reduction of about 2-to-1 might be obtained, although even this modest gain would require complex equipment. The conclusion is reached that the best way of achieving bandwidth reduction in television communication is by degrading the information in a picture in such a way that the human observer would not notice it appreciably. (*EEA*, 1958, #4955)

**921. TRANSMISSION OF COORDINATES OF TELEVISION PICTURE ELEMENTS**
**Tsukkerman, I. I.**
*Radiotekhnika*, v. 13, no. 4, pp. 77–79, 1958 (in Russian)

A mathematical analysis of bandwidth saving methods of television transmission is given, based on a new proposal of direct transmission of coordinates of picture elements which indicate a brightness change by at least one minimum perceptible brightness increment, and sync. signals, ignoring completely conventional scanning. A formula for the probability of new picture elements is deduced.

$$\frac{K}{N.z} \cong \frac{\lg m}{\lg.m + \lg N}$$

where $K$ is the number of new elements per frame, $N$ is the maximum possible number of elements per line, $Z$ is the number of lines, $m$ is the number of possible brightness steps and all lg = logarithms to the base Z. The achievable bandwidth saving is

$$\frac{W_1}{W_0} = \frac{N \cdot Z}{K(\log_n N + Z)}$$

where $n <\sim m$ under conditions of interference. A very brief indication of possible physical realization of such a scanning system with the aid of memory storing camera tubes is appended. (*EEA*, 1958, #5611)

**922. T.V. BANDWIDTH REDUCTION BY DIGITAL CODING**
**Schreiber, W. F., Knapp, C. F.**
*1958 IRE National Convention Record*, pt. 4, v. 6, pp. 88–99, 1958

A device has been constructed which uses statistical redundancies in video signals and certain characteristics of human vision to reduce transmission bandwidth. Fine detail is transmitted by using a variant of run-length coding in which a code group is created and stored at each brightness change or run-end. The code groups, which indicate the run-end

position, are then transmitted at a uniform rate and restored at the receiver. The original signal timing is recreated by reading a code group out of storage and comparing it with the output of a local code group generator until identity is indicated. The macro brightness information is handled in a parallel channel. (*EEA*, 1959, #580)

923. THEORETICAL POSSIBILITIES OF COMPRESSING BANDWIDTH OF TELEVISION CHANNEL
Deryugin, N. G.
*Telecommunications*, no. 8, pp. 805–810, 1958

The possible compression of channel bandwidth is calculated on the basis of statistical data on the power spectrum of a television signal. (*EI*, 1959)

924. VIDICON CAMERA AND TAPE RECORDER SYSTEM DEVELOPMENT
Atkinson, T. R., Eichwald, W. F., Heyser, R. C., Perkins, G. S., Vivian, H. C.
June 8, 1959
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
Memo 30-4
AD-228,352

A slow scan television camera and a bandwidth compression magnetic tape recording system are described. These units were developed especially for incorporation into *Juno 2B* to replace the originally planned photographic equipment. The performance of early prototypes and the engineering philosophy which led to their development is presented in some detail. Work is still being done on the device to eliminate the remaining problems which are concerned primarily with the mechanics of the tape recorder and ground recovery equipment. (*AI/A*, 1960, #2165)

925. THE PRACTICAL EFFECTS OF BANDWIDTH LIMITATION ON COLOUR TV IMAGES
Neidhardt, P.
*Nachrichtentechnik*, v. 9, no. 7, pp. 318–323, July 1959 (in German)

A thorough investigation of the transient response of color receivers is made using Fourier analysis and Laplace transforms to evaluate a finite-bandwidth amplifier. Idealized color-triangle diagrams are reproduced which plot chrominance subcarrier vectors of equal phase in both a linear NTSC system and a nonlinear system with a $\gamma = 2.2$. These diagrams lead to the graphic construction of the $R/Y$, $B/Y$, $(R-Y)/Y(B-Y)/Y$, $I/Y$, and $Q/Y$ lines which enable determination of unit step-function responses for $I$- and $Q$-signals, as well as for sudden transition from a saturated color to black, from white to a saturated color, and from one saturated color to another. An experimental setup for measuring transient responses is briefly described, in which the most important constituents are phase-linear Dietzold filters of substantially flat amplitude response and adjustable delay networks. The results are interpreted in tables and graphs, and comparisons are made between a unit step-transition in a monochrome system and a $Y$-signal-transition in the NTSC system. It is shown that the principle of constant brightness applies accurately only in stationary conditions, and an attempt to reduce brightness distortion by the circular subcarrier system is only partially successful. An extensive bibliography is appended. (*EEA*, 1960, #5858)

926. SYNTHETIC HIGHS—AN EXPERIMENTAL TV BANDWIDTH REDUCTION SYSTEM
Schreiber, W. F., Knapp, C. F., Kay, N. D.
*SMPTE, Journal of the*, v. 68, no. 8, pp. 525–537, August 1959

A complete system is described which codes a standard video signal to match a narrower band channel and subsequently decodes the received signal for display on a standard monitor. The system transmits the low-frequency, or macrocontrast signal, in analog form. The location and amplitude of the edges are transmitted by a digital code. At the receiver, the edge information is used to synthesize the highs content of the video, which is then added to the lows to reconstruct the original video signal. Bandwidth reduction is achieved by exploiting both statistical correlations and psychophysical phenomena. Apparatus for separation of low frequencies, detection of edges, quantization and binary digital coding of edge amplitude, and synthetic reconstruction of highs is described. Picture-tube photographs of the resulting pictures are shown. Factors affecting the degree of bandwidth reduction and the effect of variation of system parameters, such as separation frequency and quantization levels, are discussed. (*EEA*, 1959, #7637)

927. THE INFLUENCE OF CAMERA OPTICS ON A TELEVISION CHANNEL
Frenzel, D.
*N.T.Z. Nachrichtentechnische Zeitschrift*, v. 13, no. 1, pp. 1–8, January 1960 (in German)

Performance of the optical channel is translated into equivalent electrical phenomena; i.e., defocusing and other lens aberrations are represented by an equivalent bandwidth and phase characteristic. Measuring methods are described for the determination of such parameters. Different camera lenses were investigated under a number of representative settings and the results are plotted and tabulated. Twenty-four references are given. (*EEA*, 1960, #6372)

928. INVESTIGATIONS INTO REDUNDANCY AND POSSIBLE BANDWIDTH COMPRESSION IN TELEVISION TRANSMISSION
Teer, K.
*Philips Research Reports*, v. 14, no. 6, pp. 501–556, December 1959; v. 15, no. 1, pp. 30–96, February 1960

Three different aspects of the redundancy present in normal television transmission are considered: (1) the statistical aspect, conceived with probability distributions of brightness; (2) the physiological aspect, conceived with properties of the eye; and (3) the psychological aspect, related to levels of consciousness. Following this analysis, transmission systems with narrow bandwidths are described in which bandwidth compression is effected by a decrease in the number of frames per second; i.e., by decreasing the field frequency of the information per field. A suitable memory device is needed for practical realization of the former method. Considerations are restricted to this memory device and, in particular, to a vidicon type of camera tube. A decrease of the information per field can be realized by using the dot-interlace and subcarrier techniques; both techniques are examined in detail. The use of these principles in color television is considered also, mainly with the NTSC system and a two-subcarrier system. (*EEA*, 1960, #2542)

929. REDUCTION OF TELEVISION BANDWIDTH BY FREQUENCY-INTERLACE
Howson, E. A., Bell, D. A.
*British Institution of Radio Engineers, Journal of the,* v. 20, no. 2, pp. 127–136, February 1960

A method analogous to the NTSC color television system is used to obtain bandwidth reduction of a black-and-white video signal by a factor of approximately 2:1. The normal signal is split into two frequency bands, nominally zero to 1.5 Mc and 1.5 to 3.0 Mc. The latter is used to amplitude-modulate a subcarrier whose frequency is an odd multiple of half the line scanning rate. The lower sideband of the modulator output is selected and combined with the original zero-to-1.5 Mc band, so that the spectra of the two signals interleave. The combined signal may now be sent over a channel of 1.5 Mc nominal bandwidth. At the receiving end of the channel, the composite signal is applied to a synchronous demodulator, also fed with subcarrier of the same frequency as at the transmitter. The lower sideband of this demodulator is taken and combined with the received signal, to yield a "normal" video signal extending from zero to approximately 3 Mc, together with an "interleaved" signal. The interleaved signal gives an interference pattern on the display which, in a stationary picture, should optically cancel after four successive frame scans. However, the pattern is built up in such a way as to give rise to a "crawling" motion which is very noticeable at close viewing distances. Photographs of typical pictures obtained with an experimental apparatus are given, showing various interference effects produced. (*EEA*, 1960, #3149)

930. STORAGE AND FREQUENCY BAND COMPRESSION IN TV
Schröter, F.
*Bulletin de l'Association Suisse des Électriciens,* v. 51, no. 20, pp. 999–1004, October 8, 1960 (in German)

Redundance of information and various methods of band-compression are discussed. A system, based on the resolution time of the eye, is then proposed which combines the techniques of intermediate storage, halving of scan velocity, and a twin-frequency low-pass discriminator. This combination produces a theoretical band compression ratio of 8:1; however, practical considerations limit this figure to 4 or 5. Twelve references are given. (*EEA*, 1961, #5853)

931. NEW MEASUREMENTS FOR THE DETERMINATION OF TRANSMISSION PROPERTIES OF OBJECTIVES FROM THE STANDPOINT OF TELEVISION TECHNIQUES
Frenzel, D.
*Hausmitteilungen Jos. Schneider & Co.,* v. 12, no. 5–6, pp. 64–72; no. 7–8, pp. 90–96, 1960 (in German)

In a television system, both optics and electronics influence the bandwidth of the complete system. The performance of the optical system can be defined by the limiting frequency which is transmitted through a fixed bandwidth electronic system. An apparatus is described for determining this limiting frequency. Results for a number of lenses as a function of aperture and field angle are quoted. (*PA*, 1961, #12,974)

932. EXPERIMENTS WITH A SLOPE-FEEDBACK CODER FOR TELEVISION COMPRESSION
Beddoes, M. P.
*1961 IRE Transactions on Broadcasting,* v. BC-7, no. 2, pp. 12–28, March 1961

Experiments with a slope-feedback variable velocity scanning method for compressing the bandwidth of television signals are described. The test conditions were intended to demonstrate the method under favorable conditions and only one test pattern of moderate complexity (test card "C") was used. The experiments showed that smoothing of the signal by narrow bandwidth can be overcome by using this method. However, even at best (corresponding to the least compression ratio observed—1.7:1), spatial distortion of the received picture is noticeable. The spatial distortion seems, by a process of elimination, not due to the effects of noise but characteristic of the method itself. It would occur even in a theoretically noiseless system because the "slope signal" controlling the spot movement at the transmitter differs from the corresponding signal at the receiver which has added to it anticipatory and overshoot ripples in the vision channel. This is a basic fault and rules out the application of slope- feedback compression to pictures of the complexity of test card "C." (*EEA*, 1961, #3510)

933. SOME EVALUATIONS OF S/N RATIO AND BANDWIDTH RESTRICTION EFFECTS ON TELEVISION PICTURE QUALITY
Kohlmeyer, R. B.
April 19, 1961
Space Technology Laboratories, Inc., Los Angeles, Calif.
R-8949-0005-NU-000

This investigation consists of systematically reducing the bandwidth of the video signal path between a camera and a display monitor and then observing the picture quality. Random noise, corresponding in distribution to that in the output of an analog FM, and also to that in a single or double sideband AM system, is added to the link and evaluated pictorially. The results are shown by photographs of the display monitor. A brief discussion of the factors which determine the resolution in a television system is included. Picture defects which occur with various coding and modulation techniques are also discussed. (*AI/A*, 1962, #5280)

934. TELEVISION BAND COMPRESSION BY CONTOUR INTERPOLATION
Gabor, D., Hill, P. C. J.
*Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering,* v. 108, pp. 303–315, May 1961
(Also available as Paper 3507E, Institution of Electrical Engineers, Great Britain, May 1961)

Band saving in television transmissions can be achieved by utilizing redundancies in single lines, between lines, between fields, and between frames. The latter two are exploited by the contour interpolation method. This method is based on the facts that (1) field and frame frequencies in conventional television transmission had to be chosen with a view to reducing flicker rather than for conveying more information, (2) the eye fixes mainly on contours which are usually the edges of objects, (3) these contours are usually smooth enough to allow interpolation over two line spacings, and (4) changes from one picture to the next come about mostly by the horizontal motion of objects which are sufficiently uniform to allow interpolation over at least two frame intervals. There is almost no loss in information or picture quality if the interlaced frame is suppressed in the transmission and reconstructed in the receiver by interpolation between the lines of the transmitted field, and there is not much loss if only one field in four is transmitted. In the method of contour interpolation the reconstructed edges are as sharp as the originals and appear in their correct positions, i.e., in the positions which they would occupy if the edges were straight in small sections, and if their motion were uniform for short times. The waveband gain can be estimated as 4:1 without appreciable deterioration in picture quality, and 8:1 if some deterioration is allowed in the case of rapid and vertical motions. In combination with other methods which utilize redundancies in single lines and which by themselves achieve a gain of 3:1, total compression ratios of 12:1 to 24:1 appear feasible. The principle was realized and tested in a photomechanical model working at low speeds. Electronic realizations are proposed and discussed. (*EEA*, 1961, #4286)

935. CABLEFILM EQUIPMENT
Wood, C. B. B., Padel, S. H., Rainger, P.
*SMPTE, Journal of the,* v. 70, no. 7, pp. 494–498, July 1961

The equipment described is intended for transmission of short lengths of 16-mm news film over a program channel in very long cables or radio-link systems. The transmission time is 100 times the normal running time of the film. The corresponding reduction in bandwidth and other frequency economies enable the signal to be restricted to a 4.5-kc video bandwidth which occupies a band between 0.5 and 5.5 kc for transmission over the circuit. The equipment has been used successfully over the trans-Atlantic cable. (*EEA*, 1962, #2251)

936. ISKAZHENIYA TSVELOVOSPROIZVEDENIYA PRI PEREDACHE SIGNALOV TSVETNOSTI (CHROMATICITY DISTORTIONS DURING TRANSMISSION OF CHROMINANCE SIGNALS IN CHANNELS WITH LIMITED FREQUENCY BANDWIDTH)
Yefimkin, V. I.
*Elektrosvyaz,* v. 15, no. 10, pp. 31–39, October 1961
(Translated from the Russian in *Telecommunications,* no. 10, pp. 31–40, October 1961)

Questions dealing with the selection of the frequency bandwidth for chrominance channels in compatible color television are discussed. Chromaticity distortions, due to color signal finite rise time and overshoots in the transient characteristics of chrominance channels, are analyzed. Luminance distortions of color boundaries are investigated. (*EEA*, 1963 #1090)

937. TELEVISION BANDWIDTH AND THE KELL FACTOR
Lewis, N. W.
*Electronic Technology,* v. 39, no. 2, pp. 44–47, February 1962

Attention is drawn to the confusion that may arise in using the term "Kell factor" with the popular meaning involving a video bandwidth, and to the inadequacy of any single definition of bandwidth to describe a practical system. To facilitate consideration of television and other waveform transmission systems, the concepts of "pulse bandwidth" and "slot bandwidth" are proposed. (*EEA*, 1962, #7292)

938. COLOUR TV BY SATELLITE (RELAY)
Valensi, G.
*Annales des Telecommunications,* v. 17, no. 3–4, pp. 66–76, March–April 1962 (in French)

To reduce bandwidth requirements the following are derived from the composite video signal: luminance and color signal, each converted into five coded pulses and, for saturated color, a single pulse. These pulses, transmitted in time multiplex, are received by the satellite, retransmitted, and finally decoded at the receiving station. This principle is applied to the following studies: (1) intercontinental relay, with the color subcarrier modulated in phase by the dominance signals and in amplitude by the saturation; and (2) a system based on the division of the color triangle into discrete sectors, with the color subcarrier modulated in amplitude only by an amount proportional to the sector number of the instantaneous color information. (*EEA*, 1962, #13,616)

**939. REDUCTION OF BANDWIDTH IN TELEVISION TRANSMISSION SYSTEMS**
**Buck, A. L.**
***IRE Transactions on Broadcast and Television Receivers*, v. BC-8, no. 1, pp. 29–33, April 1962**

A problem which urgently needs solving is the tremendous waste in bandwidth created by our present nonstatistical analog system of television transmission. Attempting to reduce bandwidth while maintaining the same channel capacity is seen to yield poor results. (*EEA*, 1962, #10,176)

**940. THE BANDWIDTH COMPRESSION OF TELEVISION AND FACSIMILE**
**Cherry, C.**
***Television Society, Journal of the*, v. 10, no. 2, pp. 40–49, April–June 1962**

The desirability of reducing the bandwidth required for the transmission of pictures is expounded and the possibility of doing so is reviewed. The nature of visual scenes and the perception of form is examined and various suggested methods of compression are evaluated. Work which has been carried out in the Imperial College, University of London, is described in some detail. (*EEA*, 1962, #14,906)

**941. BEITRAG ZUR ÜBERTRAGUNG ODER AUFZICHNUNG EINES BREITEN NACHRICHTENBANDES (CONTRIBUTION ON THE TRANSMISSION OR RECORDING OF A WIDE-BANDWIDTH SIGNAL)**
**Springer, A. M.**
***Elektronische Rundschau*, v. 16, no. 6, pp. 259–260, June 1962 (in German)**

Three methods are discussed for transmitting a television signal via a telephone channel by division into a large number of narrow bands. Relevant patent numbers are quoted. (*EEA*, 1963, #2302)

**942. TESTS OF THREE SYSTEMS OF BANDWIDTH COMPRESSION OF TELEVISION SIGNALS**
**Newell, G. F., Geddes, W. K. E.**
***Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering*, v. 109, pp. 311–324, 1962**
**(Also available as Paper 3613, Institution of Electrical Engineers, Great Britain, July 1961)**

An investigation into three similar methods of reducing the bandwidth required for transmission of television pictures is described. The methods all involve the isolation of essential brightness changes in the picture, which are redistributed to occur at a uniform rate for transmission. A second signal must be transmitted to allow correct repositioning of brightness changes in the final picture. Partial instrumentation has been completed and the methods have been assessed for bandwidth requirements and resulting picture quality. (*EEA*, 1961, #5383)

**943. EKSPERIMENTALNOE IZUCHENIE VYBORA SIGNALOV TSVETNOSTI V TSVETNOM TELEVIDENII (EXPERIMENTAL INVESTIGATION OF COLOUR SIGNAL CHOICE IN COLOUR TELEVISION)**
**Novakovskii, S. V., Belyanin, S. G., Marina, N. I.**
***Radiotekhnika*, v. 17, no. 8, pp. 43–52, August 1962**
**(Translated from the Russian in *Telecommunications and Radio Engineering*, pt. 2, no. 8, pp. 41–51, August 1962)**

Six possible color channel choices are investigated: (1) $I$ and $Q$ axes, $I$ bandwidth 1.5 Mc, $Q$ bandwidth 0.6 Mc; (2) same axes, $I$ bandwidth increased to 2 Mc; (3) same axes, $I$ bandwidth decreased to 0.6 Mc; (4) same axes, $I$ bandwidth decreased 1.5, $Q$ bandwidth reduced to 0.35 Mc; (5) $R$–$Y$ and $B$–$Y$ axes; both bandwidths = 1.5 Mc; (6) $R$–$Y$ band = 1.5, $B$–$Y$ band = 0.6 Mc. In all cases the luminance channel $Y$ had a 6-Mc bandwidth. Two groups of subjective tests were undertaken: general impression of picture quality, with participation of 431 observers, and assessment of transient response (sudden color transition), by 124 observers. As control, uncoded direct transmission of $E'_R$, $E'_G$ and $E'_B$ was used. A detailed scale of 11 marks (from 1 = totally unacceptable, to 11 = not perceptible or excellent) was employed. Test pictures consisted of diapositives and color bar images. The results are summed up in numerous tables and indicate that transmission (1) and (5) yield identical quality, that variant (4) is slightly poorer, and variant (3) definitely poorer than (1), that the slight improvement of (2) is not worthwhile, and that diapositives are better reproduced by the $I/Q$ than by the $R$–$Y$, $B$–$Y$ system. (*EEA*, 1963, #1089)

**944. ACCURACY IS IMPROVED IN VIDICON BANDWIDTH TESTS**
**Pirkle, J.**
***Electronics*, v. 35, pp. 63–64, September 14, 1962**
**(*AS&T*, 1963)**

**945. ÜBER DIE WAHRNEHMBARKEIT VON STATISTISCHEN STOERUNGEN IN FARBFERNSEHBILDERN NACH DEM NTSC-SYSTEM (THE PERCEPTIBILITY OF STATISTICAL INTERFERENCE IN COLOUR-TV PICTURES USING THE N.T.S.C. SYSTEM)**
**Müller, V., Wengenroth, G.**
***N.T.Z. Nachrichtentechnische Zeitschrift*, v. 15, no. 9, pp. 438–441, September 1962 (in German)**

As in the case of monochrome TV, the S/N ratio for the limit of perceptibility of statistical interference (noise) as a function of frequency has been determined by human tests in color-TV using the NTSC system. By means of a bandpass filter with a variable center frequency a uniform level noise band with a width of approx. 0.5 Mc is filtered out of a uniform noise spectrum and added to the video signal in order to determine the perceptibility limit for this particular

frequency range. Noise evaluation curves for the saturated primary colors and their complementary colors as well as for some ordinary color slides have been determined. (*EEA*, 1963, #230)

946. SOME PROPERTIES OF DIGITAL TELEVISION SYSTEMS WITH A VARIABLE NUMBER OF LINES AND FIELDS
Mandrazhi, V. P., Novik, D. A.
*Radiotekhnika*, v. 17, no. 10, pp. 35–44, October 1962 (in Russian)

The information capacity of a television channel is given by $C = k.Z^2/2T.\ \log_2 m$ (bit. sec$^{-1}$), where $k$ is the aspect ratio, Z the number of scanning lines, $m$ the number of discernible brightness gradations, and $T$ the frame period. The obvious way of reducing $C$ is to increase $T$; this is limited by flicker and lack of practicable receiving tubes of storage type similar to pickup cameras. A universal idealized television transmission system is characterized by continuous optimal adjustment of all parameters; reduction of $T$ is limited by smoothness requirements (reproduction of moving objects), the limit being 5–8 frames/sec; Z can also drop during intervals (sudden picture content changes) and scenes of low brightness; $m$ can be reduced when viewing "small" objects, i.e., subtending small angle, from the maximum 16–32 down to 3–4. A statistical analysis of possible bandwidth saving compared with the maximum resolution ($k.Z^2$) follows. All three types of redundancy are investigated; picture element to element, line to line, frame to frame. A digital alphabet is proposed, quoting probabilities and binary codes for: probability of gradation change (dm), represented by 11 codes, corresponding to 11 brightness steps; probabilities of no change from line to line, and from frame to frame (one code each); and also codes for end of line and end of frame signals. The complete system does not make use of the possible line to line redundancy.

The system chosen employs the optimal nonuniform binary code suggested by Shannon. It contains an encoder and a decoder and does not need memory systems and stores like most bandwidth-saving television systems. Reproduction times for line and frame are variable and expressed by formulae in terms of $k$, Z and relevant probabilities. Synchronization technique and associated problems are only touched upon; one of the main tasks is to correlate the decoder output with the correct placement of the beam. Precautions must be taken that errors and obliteration of signal are restricted to a single line, if possible (interval protection). Special tubes utilizing the storage principle are dealt with next; ideally, the storage cycle should also vary with the statistical information content, but the practical preference is for tubes storing charges over a frame with the advantage of freedom from flicker. An experimental verification of the system was undertaken by employing a conventional receiver tube in connection with a memory device. Seventeen references are included. (*EEA*, 1963, #3387)

947. A STUDY OF GAIN AND BANDWIDTH IN TRANSISTOR VIDEO AMPLIFIERS
Steggerda, C. A.
1962 (?)
Philco Corporation, Philadelphia, Pa.
R-242

This report is concerned with loading and feedback techniques for one- and two-transistor iterative amplifiers. It is shown theoretically and experimentally that feedback from the second emitter to the first base of a pair of grounded-emitter amplifiers provides the most variability in bandwidth and the largest gain for any prescribed bandwidth. Most of the analysis described in this report is concerned with the derivation of equations defining the optimum values of emitter degeneration and feedback resistance. The results of the analysis are tested experimentally and are found to be in close agreement.

948. BANDWIDTH ECONOMY IN TELEVISION
Schröter, F.
*Technische Mitteilungen PTT*, v. 40, no. 10, pp. 354–363, 1962 (in French and German)

The television signal transmitted in present systems has a large redundancy, brought about by the transmission of detailed information which has not changed from earlier images, and by the need to transmit 50 interlaced frames per second to avoid flicker. In a system proposed, signals from the camera which correspond to a particular picture element would be compared with those of the previous image. If there were no change in the information, the signal would be blocked, but if a change takes place, a signal would be passed to a memory tube. The horizontal scanning velocity would not be constant, but would be reduced by switching action initiated by received signals. Storage tube display would eliminate flicker and would allow a further reduction of bandwidth by halving the frame repetition frequency. By suitable choice of potentials and velocities, the required bandwidth could be reduced to one-fourth of that used at present. A further step is envisaged, in which the detail factor would be measured continuously and made to react on the system to reinstate the conditions needed for reproduction of steeply rising waveforms, while giving a further bandwidth reduction of about a half. (*EEA*, 1963, #3393)

949. PROBLEMS OF WORLD-WIDE TELEVISION
Gerber, W.
*Technische Mitteilungen PTT*, v. 40, no. 11, pp. 395–402, 1962 (in German and Italian)

Some striking polar diagrams of the distribution of world population and of television receivers by latitude and longitude are given, and are followed by a discussion of satellite relay stations and ways of reducing bandwidth. Among these are mentioned a reduction of the number of frames per second and appropriate production of programs, e.g., the sub-

stitution of close-ups requiring narrow bandwidths for scenes with more detail and movement in which the quality is inevitably poorer. (*EEA*, 1963, #3386)

**950. A TWO-CHANNEL METHOD FOR COMPRESSING THE BANDWIDTH OF TELEVISION SIGNALS**
**Beddoes, M. P.**
***Institution of Electrical Engineers, Proceedings of the*, v. 110, no. 2, pp. 369–374, February 1963**

The results of experiments with a coder for compressing the bandwidth of television signals are reported. A complete television system was used consisting of a transmitter, a receiver, and two channels. At the transmitter a "slope-feedback" coder reduced the bandwidth of the television signal before transmission; waveforms specifying scanning-spot brightness and scanning-spot position were separately conveyed to the receiver; the two waveforms were used to reconstruct the television picture at the receiver. It is shown that, under virtually noiseless conditions, the total bandwidth for the television signal can be reduced some 3.7 times below the normal one. For this extreme compression ratio, some distortion is evident in the received picture even when slope-feedback coding is used. This mainly takes the form of incorrect shading of large surfaces and some defocusing where the white dots are excessively reproduced; some spatial distortion is also evident. These detrimental effects could be reduced with improved experimental techniques. The experiments show quite definitely that cyclic patterns which were suppressed by narrow channel bandwidth can be restored by slope-feedback coding using the same bandwidth. Some features of the method are: (1) the irregular scanning motions in the horizontal and vertical directions, (2) the variation of about 10 percent in the number of pictures per sec (each picture contains the same number of scanning lines), (3) that sychronizing pulses are not needed, and (4) that relatively standard apparatus is required, although the cathode-ray tube at the receiver must have a wide contrast range. The lowest S/N ratio which can be tolerated in each of the channels does not appear to be excessive; for one channel it is much the same as for normal television (approximately 30 db), and for the other it is higher, i.e., 45 db. It is pointed out that the experiments were limited to indicating some of the potential features of the two-channel method and do not constitute a crucial test of the method. The final value must be assessed with more refined experimental techniques than were available. (*EEA*, 1963, #5438)

**(See *also Entries* #18, 237, 765, 887, 904.)**

# TELEVISION SYSTEMS

951. BEITRAG ZUR MESSTECHNIK AN FERNSEH-KAMERA-VORVERSTAERKERN (CONTRIBUTION TO MEASUREMENTS RELATING TO TELEVISION CAMERA HEAD AMPLIFIERS)
Dillenburger, W.
*Frequenz*, v. 11, no. 5, pp. 137–142, May 1957

Methods are described for measuring gain and frequency response of super-iconoscope head amplifiers. Details are given of a novel method which utilizes the camera itself by modulating the scanning beam with signal generator output and by providing a visual display of preamplifier output. Application is made of this method to vidicon, superorthicon, and other cameras. (*EI*, 1958)

952. EIGENSCHAFTEN VON ALLPASSGLIEDERN (PROPERTIES OF ALL-PASS NETWORKS)
Taeger, W.
*Frequenz*, v. 11, no. 5, pp. 145–153, May 1957

Transfer functions of bridged-T and lattice networks are analyzed. It is shown that by suitable choice of components attenuation may be made zero or small for all frequencies, while phase shift is frequency-dependent. The use of such filters for phase compensation in television systems is described. (*EI*, 1958)

953. VERATAERKEREINGANGASTUFE VON VIDIKONFERNSEHKAMERAS (AMPLIFIER INPUT STAGE FOR VIDICON CAMERAS)
Spiegel, E. F.
*Elektronische Rundschau*, v. 11, no. 5, pp. 135–139, May 1957

The importance of noise factor attainable for light sensitivity of cameras, especially in industrial applications and for quality of reproduced image, is discussed. Calculation is made of optimum attainable values used for the design of an amplifier input stage based on a compromise between output and expense. (*EI*, 1958)

954. FERNSEHKAMERA MIT SPEICHERROEHRE MIT GEKRUEMMTER KENNLINIE (DEVELOPMENT AND OPERATION OF CAMERA WITH CURVED CHARACTERISTIC STORAGE TUBE)
Dillenburger, W.
*Elektronische Rundschau*, v. 11, no. 5, pp. 143–146, May; no. 6, pp. 174–178, June 1957

Contrast characteristics of vidicon and other camera tubes are discussed, as well as circuits for combined automatic gamma and aperture correction. Other aspects considered are (1) measurement of contrast range and sensitivity; (2) operational techniques of complete transmission chains, including vidicon film scanner equipment; and (3) novel black level clamp. (*EI*, 1958)

955. NEW DEVELOPMENTS IN INDUSTRIAL TELEVISION
Spiegel, E. F.
*Elektronische Rundschau*, v. 11, no. 9, pp. 261–263, September 1957 (in German)

An engineering description of new industrial television equipment is presented, illustrated by numerous photographs. The new miniature vidicon has a diameter of 13.5 mm and a length of 90 mm, is capable of 250 lines resolution and 2 lux sensitivity for 0.02 $\mu$a signal current. The complete camera is 52 mm in diameter and 130 mm long, and employs subminiature valves and components. An infrared-sensitive vidicon has also been developed. Several applications of the new miniature equipment are discussed, particularly the use of two pulse-switched cameras for thickness measurement of rolled steel strip, of which a more detailed description is supplied. (*EEA*, 1958, #1039)

956. NEUENTWICKLUNGEN AUF DEM GEBIET DES INDUSTRIELLEN FERNSEHENS (NEW DEVELOPMENTS OF CLOSED CIRCUIT TELEVISION)
Spiegel, E. F.
*Elektronische Rundschau*, v. 11, no. 9, pp. 261–264, September 1957

A miniature camera developed by Grundig GmbH, Fuerth, using a miniature vidicon tube is described. Application of pulses supplied by the camera for contact free width measurement in control of sheet rolling mill lanes, and to position the control of work units in automatic production is also described. (*EI*, 1958)

957. STUDY OF TELEVISION MULTIPLE INSERTION TECHNIQUES
Herud, E.
October 25, 1957 (Revised August 1, 1962)
DuMont, Allen B., Laboratories, Inc., Clifton, N. J.
Final Engineering Report, N61339-90, NAVTRADEVCEN 90-1
AD-291,762
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

An effort was made to explore the technique of television image presentation in general, and, specifically, to examine certain problems pertinent in the solution of training problems. In this study the means of combining several moving images to form a composite picture, within a common background, is reported. Video insertion in itself is not new, but the method developed in this study is. Five separate targets may be included at the same time. These targets have the capability of moving independently of each other. Additional

data have also been collected on general systems considerations, pickup and display devices, and equipment recommendations.

**958. ERROR-PREDICTING D-C-RESTORING CIRCUITS FOR TELEVISION SIGNALS**
**White, E. L. C.**
***Electronic Engineering*, v. 29, no. 356, pp. 472–477, October 1957**

An analysis of circuit performance of direct and negative feedback types shows that by a combination of techniques, for a specified degree of distortion, low frequency cutoff of circuit prior to dc restoring may be raised by a factor of 11, compared with that required for methods commonly employed. Experimental techniques are particularly useful for long transmission circuits. (*EI*, 1958)

**959. COLOR SIGNAL DISTORTIONS IN ENVELOPE TYPE OF SECOND DETECTORS**
**Loughlin, B. D.**
***IRE Transactions on Broadcast and Television Receivers*, v. BTR-3, no. 2, pp. 81–93, October 1957**

The characteristics of envelope detectors which produce color signal distortions are reviewed. The expected magnitude of these distortions is discussed, and methods used to reduce them to a tolerable level are presented. Several detector system arrangements in which distortions can be cancelled or eliminated are described. (*EI*, 1958)

**960. A NEW APPROACH TO TELERECORDING**
**Sarson, A. E., Stock, P. B.**
***British Kinematography*, v. 31, no. 5, pp. 119–131, November 1957**

A detailed account of telerecording is presented in which alternate fields are recorded on successive film frames and synchronous spot wobble (SSW) is employed. With SSW, the spot wobble is applied to both the original camera, or scanner, and to the display tube in synchronism. The bandwidth of the closed-circuit recording system must be increased to at least 6 Mc, and preferably 9 Mc, but this increase is not required by, and does not affect, simultaneous broadcast transmission. The techniques of extracting the signal for transmission are explained, and the additional requirements associated with the camera circuits are enumerated. Contrasting illustrations show the improvements brought about by SSW. (*EEA*, 1958, #6413)

**961. SLALOM FOCUSING**
**Cook, J. S., Kompfner, R., Yocum, W. H.**
***IRE, Proceedings of the*, v. 45, no. 11, pp. 1517–1522, November 1957**

In the search for a scheme of electron focusing which would permit a beam to weave in and out through an RF structure, it was discovered that a linear array of line charges in free space produces two equipotential surfaces which contain exact electron trajectories. The field about such an array may be nearly duplicated by an array of positive wires sandwiched between two negative plates. It has been found that such a structure will effectively focus a ribbon-type electron beam of surprisingly high perveance. A backward-wave oscillator was built which utilized this "slalom"-type focusing. Although this tube was of the rough, experimental variety, oscillations were obtained throughout the range of 3.3 to 4.3 kMc. A beam tester was constructed which has a beam-focusing structure just ten times the size of that of the oscillator. Ninety-seven percent transmission through 27 wires of a beam of perveance ($2 \times 10^{-6}$) has been achieved with this tester. Slalom focusing may also find application in the field of switching. (*EEA*, 1958, #895)

**962. BIPERIODIC ELECTROSTATIC FOCUSING FOR HIGH-DENSITY ELECTRON BEAMS**
**Chang, K. K. N.**
***IRE, Proceedings of the*, v. 45, no. 11, pp. 1522–1527, November 1957**

A focusing scheme employing two counteracting periodic fields without the use of any magnet is shown to be superior to schemes which involve only a periodic focusing field. The potential valley formed by the combination of these two counteracting fields is steeper than all previous focusing systems and thus is capable of maintaining a very stable beam flow. The combined field also gives rise to proper cancellation of the space-charge field. This field cancellation not only results in an ideal focusing for high-density beam but also compensates for the potential depression inside the beam. With a periodic voltage variation of 5 percent on the beam, it is theoretically possible to focus, with an ideal gun, an electron beam of perveance in the order of $10^{-5}$ amp/$v^{3/2}$. With a nonoptimized gun, a beam of perveance $2 \times 10^{-6}$ amp/$v^{3/2}$ has been focused to a 97-percent current transmission. A 10-db RF gain was observed at a frequency of 2.95 kMc. (*EEA*, 1958, #896)

**963. THE PROBLEM OF INERTIAL EFFECTS IN TELEVISION CAMERA TUBES OF THE VIDICON TYPE**
**Kunze, C.**
***Hochfrequenztechnik und Elektroakustik*, v. 66, no. 3, pp. 84–89, November 1957 (in German)**

Vidicon's inertia is due to three causes: (1) its high (almost 100 percent) storage capacity, leading to blurring effects similar to photography of moving objects at ½₅-sec exposure; (2) the inner photoeffect, particularly long with semiconductors—it can be shortened only by sacrificing some sensitivity; and (3) partial discharge only of the target capacity, which is then mopped up at the next scan. The recharge inertia is calculated by obtaining the resistance and the capacitance of the individual picture element. Of particular interest is the experimental technique of measuring these inductances by means of a special tube which simulates a

vidicon. The target plate is represented by a chromium–nickel plate, and the resistance by externally connected resistors in the $10^7$ to $10^9$ Ω range. A large number of measurements is described and illustrated by families of curves, plotting-beam current, potential drop, surface potential contours of the Cr–Ni plate, secondary emission $v$ bombardment velocity of primary electrons for CuNi and $Sb_2S_3$ layers, potential on the photocathode $v$ signal current, and various current-bias characteristics. The results are discussed, and various methods of reducing the inertial effects are considered. The most effective method is the roughening of the target plate, the technique being a repeated deposition of the photo-sensitive surface—first, a $Sb_2S_3$ layer in vacuum and then a $Sb_2S_3$ layer in a gas atmosphere. (*EEA*, 1958, #1527)

**964. RECENT DEVELOPMENTS IN TV CAMERA TUBES**
**Veith, F. S.**
***IRE Transactions on Broadcast Transmission Systems*, no. PGBTS-9, pp. 21–31, December 1957**

Image orthicons and vidicons have been improved substantially to fulfill requirements for better TV broadcasting. The advantages of "micromesh" and "super-dynodes" are explained and the performance characteristics of a new image orthicon with very high photocathode sensitivity described. Recommendations concerning studio practices to obtain best black-and-white and color pictures are presented. Vidicon characteristics are analyzed with respect to best performance of existing commercial types. Electron optical problems in vidicon chains are considered, and operational information for optimum performance recommended. Characteristics of a new developmental vidicon with increased "effective sensitivity" are described. (*EEA*, 1958, #2744)

**965. REDUCTION OF IMAGE RETENTION IN IMAGE ORTHICON CAMERAS**
**Bendell, S. L., Sadashige, K.**
***IRE Transactions on Broadcast Transmission Systems*, no. PGBTS-9, pp. 52–58, December 1957**

In television cameras employing image orthicon tubes, the problem of picture sticking or image retentivity often limits the effective life of these tubes. Methods are discussed which minimize this problem by slowly rotating the image on the tube in a small circular orbit by either optical or electronic means for color or monochrome cameras. (*EEA*, 1958, #2290)

**966. NEW EQUIPMENT AND METHODS FOR THE EVALUATION OF THE PERFORMANCE OF LENSES FOR TELEVISION**
**Sproson, W. N.**
**December 1957**
**British Broadcasting Corporation, London, Great Britain**
**Engineering Division Monograph 15**

An outline of the photoelectric method of testing lenses is provided, together with some details of the two types of test pattern in use in the BBC Research Department and the form of aperture correction necessitated by the finite width of the scanning slit. The photoelectric test bench is described and a few preliminary results are quoted. The integration of response curves obtained from the photoelectric bench is made to yield a single figure which indicates the performance of a lens over the whole of its field. Factors affecting the quality of a picture, such as variation in definition over the field and vignetting, are discussed. The experimental basis for an index is given, and formulae are developed for monochrome television and color television indices. (*EEA*, 1958, #1669)

**967. THE MECHANISM OF ELECTRON COMMUTATION IN ENERGY-STORAGE TELEVISION TUBES**
**Ryftin, Ya. A.**
***Zhurnal Prikladnoi Mekhaniki i Tekhnicheskoi Fiziki*, v. 27, no. 8, pp. 1870–1885, 1957**
**(Translated from the Russian in *Soviet Physics—Technical Physics*, v. 2, no. 8, pp. 1742–1755, August 1957)**

Assuming a gaussian current density distribution in the scanning beam approaching the target of a charge-storage pickup tube, the discharge of a target element is analyzed, taking into account its secondary emission. It is shown that the target is discharged primarily by the leading edge of the beam, to an extent determined by the illumination, ratio of line width to beam radius, and method of scanning. The effective transverse aperture is calculated, and estimated contrast is compared with that of measurements on tubes. Both cathode- and anode-potential-stabilized tubes are considered. (*EEA*, 1958, #5616)

**968. IMAGE ORTHICON, TYPE 61 QM 40**
**Gadźuk, B., Prchlík, J., Steinhauser, M.**
***Slaboproudý Obzor*, v. 18, no. 12, pp. 851–854, 1957**
**(in Czechoslovakian)**

A general description (electrical characteristics, some construction details, functioning and production technology) of this Czechoslovak camera tube is given. The device has an overall length of 385 mm and a maximum diameter of 76 mm. It is fitted with a semi-transparent photocathode giving a minimum sensitivity of 20 μA/lu and having a maximum spectral sensitivity at 4800 A. The photocathode is operated at supply voltages of −240 to −450 v, while the five dynodes of the tube are given potentials ranging from 250 to 1400 v. The collector operates at 1.5 kv and gives a maximum current of 150 μa. Minimum signal current of the tube is 8 μa. (*EEA*, 1958, #2291)

**969. QUANTICON, TYPE 41 QV 40**
**Holý, B., Vágner, S.**
***Slaboproudý Obzor*, v. 18, no. 12, pp. 855–857, 1957**
**(in Czechoslovakian)**

This is a Czechoslovak made photo-conductive camera tube. A brief description of the functioning, construction,

technological details, physical and electrical characteristics, and applications of the device is given. The tube has a length of 150 mm and a diameter of 26 mm. It consists of an electron gun, a control grid, two focusing coils and one deflecting coil, three anodes and a photoconductive electrode. The device can be operated satisfactorily at illuminations above 6 lux and it has a maximum spectral sensitivity at 600 m$\mu$. The tube was designed primarily for industrial and scientific applications (power stations, blast furnaces, mines, railways, astronomical observations). (*EEA*, 1958, #2292)

**970. RESISTICON, TYPE 65 QK 40**
**Buchar, J., Dvořak, M., Prchlík, J.**
***Slaboproudý Obzor*, v. 18, no. 12, pp. 858–860, 1957**
**(in Czechoslovakian)**

A general description of this Czechoslovak high-velocity camera tube is given. The device consists of: (1) a thermocathode operated at −1050 v, which is provided with an electron gun, (2) a focusing coil and a deflection coil for the thermal electrons, (3) a photocathode operated at −1050 v, (4) a focusing coil for the photo-electrons, and (5) a storage or scanning electrode which is made of special glass having a resistivity of $2 \times 10^{12}$ Ω cm and operates at about −90 v. The tube has a maximum spectral response at 4800 Å, and its sensitivity is 60 μÅ/lu. (*EEA*, 1958, #2293)

**971. IMAGE TUBE UTILIZING BOMBARDMENT INDUCED CONDUCTIVITY**
**Decker, R. W., Schneeberger, R. J.**
***1957 IRE National Convention Record*, pt. 3, v. 5, pp. 156–158, 1957**

A television pick-up device utilizing a layer of material which has electron bombardment-induced conductivity as the amplifying and storing element is described. The device operates in the simplest type of television camera systems. The performance of present experimental tubes indicates an ultimate sensitivity comparable to that of the image orthicon. This sensitivity is expected to reach the theoretical limits imposed by the efficiency of the photocathode, with resolution adequate for television broadcasting. (*EEA*, 1958, #890)

**972. IMPROVEMENTS IN TELEVISION RECEIVERS. V. STABILISATION OF LINE AND FRAME OUTPUT CIRCUITS**
***Electronic Applications*, v. 18, no. 4, pp. 129–142, 1957–1958**

The desirability of stabilizing the line and frame deflection circuits against supply voltage fluctuations, spread of components, and deterioration of tubes is emphasized. It is shown that a satisfactory solution can be obtained without unduly increasing the cost of the receiver. Detailed descriptions are given of three stabilized line output stages, with flyback ratios of 18, 16, and 21 percent, respectively, designed for a 110° CRT, and of a protection circuit which effectively limits the beam current to any desired value. A detailed description is also given of a stabilized frame output stage. (*EEA*, 1959, #2544)

**973. THE LEAD OXIDE VIDICON (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Heijne, L.**
***Acta Electronica*, v. 2, no. 1–2, pp. 124–131, 1957–1958**

A description is given of an experimental photoconductive television pick-up tube, the light sensitive element of which consists of an evaporated layer of lead monoxide. The layer used is microcrystalline. The most important properties of the tube are: (1) negligible dark current (approximately 0.003 μa); (2) high sensitivity (100–200 μÅ/lu); (3) approximately linear light transfer; and (4) fast response at low light levels. The sensitivity is a maximum in the blue or green parts of the spectrum, depending on the thickness of the photoconductive layer. The speed of signal decay after a sudden interruption of the light is primarily determined by the discharging mechanism of the scanning beam, not by inherent inertia of the photoconductor itself. At high illumination levels the photocurrent may become saturated, as a result of progressive target discharge. At short wavelengths space-charge in the interior of the photoconductor may also limit the signal current. The influence of target thickness on decay, gamma, and spectral response is discussed in detail. (*EEA*, 1958, #4979)

**974. COMPARATIVE STUDY OF ELECTRONIC TUBES USED FOR REPRODUCTION OF COLOR TELEVISION PICTURES (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Hirsch, C. J.**
***Acta Electronica*, v. 2, no. 1–2, pp. 132–142, 1957–1958**

NTSC color television transmits simultaneously all the colorimetric information required by each element of the picture. The simultaneity results in the ability to use displays which can process color information simultaneously or sequentially. This flexibility has encouraged the development of many types of color displays. Among the simultaneous displays are (1) the three-gun shadow-mask tube, (2) the three-gun focus grid tube, and (3) projection displays. The first two types guide each of three electron beams to phosphors of the respective required primary by one or more of the following means: positioning of the three electron guns, collimation of the electron beams, and electron focusing. The projection display superimposes three images, one for each primary color. The sequential displays which have been demonstrated select the primaries one at a time and include. (1) the Chromatron in which the single electron beam is

deflected sequentially to select the primary corresponding to the selected signal, (2) the Apple tube which selects the signal corresponding to the phosphor being illuminated. The principles of operation are described, and the several types of displays are compared for availability and relative cost. Performance is then discussed in terms of contrast, sharpness, color gamut, registration, spurious color effects, spurious patterns, and the ability to produce a good black-and-white picture. (*EEA*, 1958, #4986)

**975. DESIGN PROBLEMS OF COLOUR TELEVISION KINESCOPES (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Bornemann, I.**
*Acta Electronica*, v. 2, no. 1–2, pp. 159–167, 1957–1958

Persistence of luminescence is considered. There are three phosphors in the "normal type of picture tube" in the form of dots or strips on the screen. If these phosphors show differential behavior in persistence, color-breakup will take place, important mainly at the outlines of movable objects. Two fundamental laws which determine persistence are derived, one being utilized in analytical form to calculate the luminance of each of the three primary phosphors during the period of persistence. Luminance and chromaticity are derived according to the center-of-gravity principle for the time under consideration. The expression for the behavior of these factors is used to find the resulting movement of the chromaticity-point of the color mixture during the time of decay. Depending on the relation of decay-time of the primary phosphors, two important types of transition characteristics in the $x$, $y$, chromaticity values with sudden changes of the chrominance are briefly examined. Results are explained by means of a colored sketch. An analytical expression is derived for the uniform movement of the locus of chromaticity with time on the transition characteristic in the $x$, $y$ diagram. Practical methods for the design of color picture tubes are deduced. (*EEA*, 1958, #4991)

**976. MIRROR PROJECTION OBJECTIVE OF LARGE NUMERICAL APERTURE SUITABLE FOR TELEVISION USE (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Pouleau, J.**
*Acta Electronica*, v. 2, no. 1–2, pp. 201–205, 1957–1958
**(in French)**

This paper discusses various wide-aperture optical devices incorporating spherical concave mirrors and correcting elements suitable for TV-projector lens uses. A new system based on the Schmidt plate principle is discussed and compared to objectives of known types, the system being considered both from the point of view of correction performance and of simplicity of manufacture. Correction of mirror spherical aberration is obtained by using a set of two complementary aspherical plates cemented together, the refractive indexes being somewhat different. The chief advantage of the system is that plate cutting accuracy requirements depend only upon the difference between the respective indexes of the two plates. Assuming a difference in the order of $5 \times 10^{-3}$, the accuracy requirement is approximately 3/100 mm, a degree of precision that can easily be achieved by purely mechanical means, without final correction. With Schmidt plates of conventional type, the accuracy requirement would have been 0.2 $\mu$. (*PA*, 1959, #5599)

**977. THE INFLUENCE OF SPHERICAL AND CHROMATIC ABERRATION ON THE FREQUENCY RESPONSE OF A LENS (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Goodbody, A. M.**
*Acta Electronica*, v. 2, no. 1–2, pp. 274–276, 1957–1958
**(in French)**

A method of numerical integration suitable for the evaluation of oscillatory functions is briefly described. This has been programmed for the English Electric "Deuce" computer. Frequency response curves have been calculated for different states of correction in different planes of focus. (*PA*, 1959, #5481)

**978. THE "SEQUENTIAL-SIMULTANEOUS" COLOUR TELEVISION SYSTEM (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**de France, H.**
*Acta Electronica*, v. 2, no. 1–2, pp. 392–397, 1957–1958
**(in French)**

A method of color television signal transmission is described which is designed to obtain simple conversion of existing monochrome transmitters, normal reception, and compatibility. Such a result can be obtained only if the limitations of color vision, which permit a marked reduction of chromaticity information, are fully exploited. The transmission principle involves the generation of a luminance signal and of a single chromaticity signal. The luminance signal shows the structure as well as the lights and shades with the same characteristics as a conventional monochrome signal. This system ensures correct conditions of reception on black-and-white receivers. The chromaticity signal is transmitted concurrently over the frequency band 6–10 Mc by means of an amplitude modulated subcarrier, the frequency of which is an odd multiple of half-line frequency. At the receiving end, the signal is restored by simple filtering and detection. The necessity of transmitting two independent sets of information on chromaticity implies the use of a special signal structure. The chromaticity signal is made up alternately of two signals limited to a bandwidth of 2 Mc, corresponding respectively

to red and blue scanning. With respect to time, discrimination between the two is synchronized with the horizontal scan rate. In the case of a color receiver, a storage device, associated with an electronic switch, restores the two permanent signals; these two signals, combined with the luminance signal, provide the three sets of information necessary for color display. It will be noted that color resolution is reduced in both the horizontal and vertical directions. However, this involves no loss in geometrical resolution, the latter getting the full benefit of the 10-Mc channel transmission capacity. Using this system, no special channel differential phase performance is required, and the receiver circuitry remains quite conventional. (*EEA*, 1958, #4966)

**979. TRANSISTORIZED IMAGE ORTHICON TELEVISION SYSTEM**
**Doland, G., Schurak, K.**
**October 14, 1957–January 31, 1958**
**Admiral Corporation, Chicago, Ill.**
**Quarterly Report 1, DA 36-039-sc-74945**
**AD-239,475**

The study program is discussed with reference to problems encountered in components and circuits. Particular attention is given to effects of low temperatures on electrolytic capacitors, transistors, and the image orthicon. Circuits investigated for use in the camera are described, and difficulties encountered in obtaining desired performance are discussed. Circuits required for the monitor are described, and difficulties encountered are cited. Tentative block diagrams and schematics for the equipment are included, and conclusions reached in the study phase are enumerated. In the appendix the preliminary system design plan discusses the solution of temperature problems and briefly outlines the method of completing the contracted work.

**980. THE FUNCTIONAL BEHAVIOUR OF THE IMAGE-ORTHICON TELEVISION CAMERA TUBE UNDER INTENSE ILLUMINATION**
**Theile, R., Pilz, F.**
***Rundfunktechnische Mitteilungen*, v. 2, no. 1, pp. 1–9, February 1958 (in German)**

Following earlier investigations into the typical functional faults of the image-orthicon camera tube, this article describes further experiments in this connection, with special reference to its functioning with very high photo-electric currents, when the storage time of the tube amounts only to the duration of about one line. Under these conditions of operation, the characteristic plastic effects and edge blurring at the vertical transitions of brightness are practically nonexistent. This confirms the correctness of the reasons previously put forward for these forms of distortion. The picture quality is surprisingly good with extreme over-lighting of the scene so that, in exceptional cases, this abnormal method of operation may be of practical interest. (*EEA*, 1958, #1531)

**981. THE INFLUENCE OF THE OPTICAL SYSTEM OF A TELEVISION CAMERA ON THE FREQUENCY RESPONSE OF THE TELEVISION SYSTEM**
**Frenzel, D.**
***Rundfunktechnische Mitteilungen*, v. 2, no. 1, pp. 20–28, February 1958 (in German)**

The effect of optical systems on the overall performance of a television chain is discussed. Every measurement is made according to two different methods—pattern and step-function. In both cases, the light pulses which have been transformed into current pulses by a photo-electric cell are recorded. The pattern method has the basic disadvantage that the rectangular variation of brightness must be transformed into a sinusoidal form for purposes of evaluation. With the step-function method, a single brightness transition is measured. The recorded curve is represented analytically. Thence, it is possible to effect a transformation from path length to time, and then from time to frequency. The frequency characteristic and the limiting frequencies, as a function of the main angle of incidence and of the relative aperture of the iris, are then determined. The optimum iris-aperture is two to three iris settings below the maximum, but it is further displaced in the direction of smaller irises by an increase in the main angle of incidence. Objective lenses may be considered electrically as low-pass devices. (*EEA*, 1958, #1672)

**982. MAXIMUM PERFORMANCE OF HIGH-RESISTIVITY PHOTOCONDUCTORS**
**Redington, R. W.**
***Journal of Applied Physics*, v. 29, no. 2, pp. 189–193, February 1958**

It is shown that the transit time in a photoconductor cannot be less than the charge relaxation or storage time if the photoconductor has contacts of the "space charge," or ohmic, type. The principal consequence of the observation is that the photoconductor cannot simultaneously act as a detector, an amplifier, and a storage element and still have a response time as short as the storage time. This puts a restriction on the performance of high-resistivity photoconductive devices. For example, with present television standards and acceptable response times, the maximum quantum efficient possible for a photoconductive camera tube of the vidicon type, with space-charge limited dark current, is less than unity. (*EEA*, 1958, #5721)

**983. ÜBER ENTSTEHUNG UND MESSUNG PEGEL-ABHÄNGIGER PHASENUND AMPLITUDENÄNDE-RUNGEN BEI DER HILFSTRÄGERÜBERTRAGUNG IM FARBFERNSEHEN (CAUSE AND MEASUREMENT OF LEVEL SENSITIVE PHASE AND AMPLITUDE FLUCTUATIONS IN TRANSMISSION OF COLOR TELEVISION CHROMINANCE CARRIERS)**
**Piening, J.**

*N.T.Z. Nachrichtentechnische Zeitschrift*, v. 11, no. 2, pp. 70–77, February 1958

A quantitative investigation is made of the most important causes of differential gain and differential phase in color television transmission. The measuring equipment is also described. (*EI*, 1958)

984. AN IMAGE ORTHICON WITH A NARROW RANGE OF ELECTRON ENERGY IN THE SCANNING BEAM
Gebel, R. K. H.
April 1958
Wright Air Development Center, Aeronautical Research Laboratory, Wright-Patterson AFB, Ohio
WADC-TN-58-118
AD-155,505
(Also available as OTS: PB-151,589, U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

A method is outlined and discussed for improving the low light level performance of image orthicon devices by making certain basic design changes in tube geometry. The electron-optical relationships for the scanning beam are developed. In the development, it is shown that, for a scanning beam of narrow electron energy range, the beam modulation factor can be made very low, thereby improving the performance of the tube. It is also shown how a very accurate control over both the energy range and the direction of the electrons in the scanning beam can improve both focus and resolution of the scanned picture.

985. SOME NEW STRUCTURE-TYPE TARGETS FOR THE VIDICON—AN ANALYSIS OF THEIR OPERATION
Ochs, S. A., Weimer, P. K.
*RCA Review*, v. 19, no. 1, pp. 49–61, March 1958

Severe physical requirements are imposed on the photoconductive layer used in the conventional vidicon camera-tube target. In particular, its resistivity must be of the order of $10^{12}$ ohm-cm for frame storage operation, and its thickness must be sufficient to prevent capacitive lag. New vidicon targets of a complex structure permit a relaxation of these requirements on the photoconductor. Two types of target are discussed: (1) an experimental "lateral-flow" structure in which the photocurrent flows parallel to the target plane instead of transversely, as in the standard vidicon; (2) an experimental "bridge-type" structure in which each picture element provides an internal closed circuit so that the charge pattern is established independently of the scanning beam. Both types of target can make use of sensitive photoconductors having too low a resistivity for the standard vidicon. An interesting feature of the bridge target is that it can be made self-discharging, thus removing the usual restrictions on beam impedance and target capacitance which apply for conventional targets. The full sensitivity of the photoconductor cannot be utilized in the bridge target, since only a fraction of the photocurrent appears as video signal. The efficiency of utilization of photocurrent is less for bridge-type targets of lower resistance. Structure-type targets are more difficult to fabricate than conventional layer-type targets. Experimental targets capable of several hundred lines resolution have been built. (*EEA*, 1958, #3266)

986. THE MODERN CAMERA TUBE AND ITS LIMITATIONS
Jennings, A. E.
*British Communications and Electronics*, v. 5, no. 4, pp. 250–255, April 1958

Television pickup tubes and an exploration of future possibilities are reviewed. Fundamental photo-electric limitations on S/N and methodological classification of all types are discussed. A photo-emissive tube is described which uses flying-spot scanning with maximum noise in the highlights, which should approach the ultimate in sensitivity. The future importance of photoconductive tubes is stressed. (*EEA*, 1958, #2745)

987. DIFFERENTIAL METHOD OF LAG COMPENSATION IN PHOTOCONDUCTIVE DEVICES
Borkan, H., Weimer, P. K.
*RCA Review*, v. 19, no. 1, pp. 62–76, March 1958

The slow response time often observed in devices utilizing photoconductivity may be caused by the slow rise and decay of conductivity in the photoconductor, or by the RC time-constant of the photoconductor in its associated circuit. In imaging devices, such as television camera tubes and light amplifiers, the lag is manifested by smearing of the image for moving scenes. A method for reducing the effective response time of the device, regardless of the source of lag, is described. By taking the difference of the signals from two photoconductive elements having unlike transient responses, a resultant signal can be obtained having a faster response than either element alone. Measurements have been taken on pairs of vidicons set up to view the same scene simultaneously. The lag-corrected video signal, formed by the external combination of the two outputs, showed improved speed of response with a moderate loss in signal. Similar results have been obtained with pairs of photoconductive cells, and the method can also be applied to light amplifiers and to experimental camera tubes designed to yield a lag-corrected signal directly. (*EEA*, 1958, #3139)

988. TIMER SHUTTERS C.R.T. FOR SINGLE FRAME PHOTOS
Tarnowski, A. A., Lisk, K. G.
*Electronics*, v. 31, no. 15, pp. 83–85, April 11, 1958

This electronic timer uses four thyratrons to switch on a CRT picture for the 1/30-sec interval required to complete two interlaced TV fields. Vertical drive pulses from a sync generator provide time-reference triggering. Clean, single-frame photographs of the presentation are made with an open-shuttered still camera. A stabilized high-voltage supply minimizes defocusing. (*EEA*, 1958, #2934)

989. EIN EINFACHES VERFAHREN ZUM EINBLENDEN EINES FARBHILFSTRAEGERS VARIABLER FREQUENZ IN EIN SCHWARZ-WEISS-BILD (SIMPLE METHOD OF INCORPORATING COLOR SUB-CARRIER OF VARIABLE FREQUENCY INTO BLACK AND WHITE PICTURE)
Bolle, G.
*Frequenz*, v. 12, no. 4, pp. 103–108, April 1958

A description is presented of a mixer arrangement, and of equipment developed by Telefunken for the NTSC system, consisting essentially of a tunable keyed oscillator symmetrically phased-locked to line frequency. (*EI*, 1958)

990. A NEW CATHODE-RAY TUBE FOR MONOCHROME AND COLOUR TELEVISION
Gabor, D., Stuart, P. R., Kalman, P. G.
*Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering*, v. 105, pp. 581–606, May 19, 1958
(Also available as Paper 2661R, Institution of Electrical Engineers, Great Britain, May 1958)

A flat, thin television CRT for monochrome or color, whose thickness is only about one-quarter of its screen diagonal, has been sufficiently developed so that the feasibility of its essentially novel features could be tested singly, and partly in combination. In the flat tube, the electron beam—and in the case of a color tube, three beams—issuing from the same gun is launched vertically downward. A line-deflection system imparts to it a pendulating motion in a vertical plane, and a reversing lens turns this plane by 180 deg, increasing the deflection angle by a factor of about 4. Just before reaching the screen region the beams are turned into the vertical direction by a magnetic collimator. The beams now enter a narrow space between the phosphor screen and a "scanning array," consisting of parallel, horizontal conductors, arranged in a plane parallel to the screen. At a certain level the beam is thrown against the phosphor screen by an electric field, which travels downward with the speed of the frame scan. This traveling field is produced by the beam itself, which, in the intervals between line scans, falls on the conductors of the array in a narrow zone, discharges them, and thereby pushes the field to a lower level. Recharging of the array after the frame is also effected by the electron beam, making use of the secondary emission of the array conductors. This is the principle of self-scanning. Color is produced by shooting three beams, on parallel lines and close together, into the screen region. The deflecting field between screen and array acts as an efficient short-focus lens, and unites the three beams in one small spot at the screen, which they approach at different angles. Color discrimination is produced by a line shadow mask about 0.5 mm from the screen, and fixed to it by means of small, invisible bridges. This also serves as a mask in producing the color-phosphor strips by a powder-settling process in air. The extensive electron-optical development work is described in detail, and mention is also made of special technological problems raised by the new CRT design, and of their solution. (*EEA*, 1958, #3269)

991. STANDARDS CONVERTER USING THE VIDICON CAMERA
Dillenburger, W.
*Archiv der Elektrischen Übertragung*, v. 12, no. 5, pp. 209–224, May 1958 (in German)

Selected vidicons of high resolution are shown to be superior to superorthicons, which suffer from too short linear characteristics leading to halation effects when overdriven, and to supericonoscopes with a deleterious photoeffect. The vidicon is particularly suitable for standards conversion as it does not respond to a discontinuity in frame pulses, i.e., the output image need not be synchronized with the input. The often met "smear" effect is avoided by assuring an illumination of at least 500–1000 lux of the photo target; this corresponds to a density of 20,000 *asb*. The optimal phosphors (willemites) EHT and peak beam current are discussed in detail. The S/N attainable is 42 db, about 12 db higher than with superorthicons, and curves of S/N performance for a bandwidth of 5 Mc are plotted, with gamma as parameter. Geometry, focusing and transient response are also described. Selected parts of the circuitry, such as peak white and black "stretcher" and a noise-immune sync separator, are discussed, and a complete block diagram of a converter, switchable to 405-, 625-, and 819-line operation, is reproduced and explained. In a transmission from 819 to 625 lines, the transient response is such that a square pulse with an initial rise time of 0.08 $\mu$sec is reproduced at 0.15 $\mu$sec. Numerous waveform diagrams and photographs of converted images are included. (*EEA*, 1958, #4976)

992. EIN NTSC-FARBMODULATION FÜR DIE CCIR-NORM (NTSC COLOR MODULATOR FOR CCIR STANDARDS)
Jaeschke, F.
*Archiv der Elektrischen Übertragung*, v. 12, no. 6, pp. 271–288, June 1958

Circuit examples and design rules are described, with particular attention to the conversion of three monochrome signals supplied by the picture sender into luminance and the chrominance components used for coding in the NTSC system. Circuits required for leveling and operation of modulator are discussed. (*EI*, 1958)

993. EFFECTS OF RADIATION ON VIDICON PERFORMANCE
Davidson, R. A., Rosen, B. H.
*IRE Transactions on Nuclear Science*, v. NS-5, no. 2, pp. 46–49, August 1958

A commercial 1-in. vidicon was exposed to a total radiation dosage of approximately $10^{15}$ *nvt* in a nuclear reactor. Quantitative tests were devised for measuring tube aperture response, signal, noise, and photoconductor "dark" current. No measurable degradation of performance occurred, except for a decrease in signal output, which was attributed to radiation browning of the glass faceplate. (*EEA*, 1958, #6037)

994. SPACE-CHARGE GRID HIGH-TRANSCONDUCTANCE GUNS
Gleichauf, P. H.
*IRE, Proceedings of the*, v. 46, no. 8, p. 1542, August 1958

The development of a CRT for transistorized TV receivers, in which the grid base should be short, is described. Space-charge control is used, with a preliminary grid at a small positive voltage. The modulation is applied to this grid. A virtual cathode is formed between this grid and an electron-optical grid (aperture grid). (*EEA*, 1958, #6043)

995. A NEW SERIES OF LENSES FOR VIDICON-TYPE CAMERAS
Hayes, J. D.
*SMPTE, Journal of the*, v. 67, no. 9, pp. 593–595, September 1958
(*EEA*, 1959, #1811)

996. VIDICON CAMERA LENSES
Cook, G. H.
*SMPTE, Journal of the*, v. 67, no. 9, pp. 596–598, September 1958
(*EEA*, 1959, #1812)

997. ZOOM LENSES FOR CLOSED-CIRCUIT TELEVISION
Back, F. G.
*SMPTE, Journal of the*, v. 67, no. 9, pp. 598–600, September 1958

The different characteristics of these lenses are described, their advantages and disadvantages discussed, and their functions explained. (*EEA*, 1959, #1221)

998. A METHOD OF FLASH SYNCHRONIZATION FOR HIGH-SPEED CINEMATOGRAPHY
Lewis, J. D., Peck, G. T.
*Journal of Scientific Instruments*, v. 35, no. 9, pp. 338–340, September 1958

A description is given of the method used to synchronize a high-power stroboscope for use as the light source for high-speed cinematography. The essential requirements which had to be met were that the camera modifications should be kept to a minimum, and that the synchronization should be effective over a speed range from 200 to 8000 frames/sec. (*EEA*, 1958, #5525)

999. TRANSISTOR CIRCUITRY UTILIZED IN A NEW TV SYNC GENERATOR
Leeds, L. M.
*IRE Transactions on Broadcast and Television Receivers*, v. BTR-4, no. 4, pp. 60–67, September 1958

The use of transistors in this waveform generator results in a set of basic circuits having the advantages of simplicity and reliability. A full description is given of these circuits—bistable flip-flops, gates, pulse steering circuits, "and" and "or" circuits, inverters, and pulse-forming circuits. The design of the generator is derived from the concept that all control information comes from a binary counter and a lumped delay line, and results in pulses of preset length with no drifting. (*EEA*, 1959, #1624)

1,000. A NEW APPROACH TO KINESCOPE BEAM CONVERGENCE
Schwartz, J., Kaus, P. E.
*IRE Transactions on Electron Devices*, v. ED-5, no. 4, pp. 275–282, October 1958

Misconvergence of the beams in color kinescopes because of deflection has been corrected in the past by the use of dynamic convergence devices. Six independent fields are required to deflect three beams without misconvergence. Conventional deflection yokes supply two of these fields; the remaining four are supplied by convergence magnets. A more general system that uses six coexistent deflection fields is described. Such a system is capable of producing deflection without misconvergence, and, in contrast to conventional systems, produces no loss in color purity tolerance. A particular embodiment of this system is discussed in detail. It employs a six-coil "converger" used in combination with a conventional deflection yoke. The results of an experimental investigation of this embodiment are given. (*EEA*, 1959, #2547)

1,001. SEMI-CONDUCTING MATERIALS IN VIDICON-TYPE TELEVISION PICKUP TUBES
Babits, V. A.
*Television Society, Journal of the*, v. 8, no. 12, pp. 498–502, October–December 1958

The principles of the vidicon are described with the aid of energy level diagrams and equivalent circuits of the target elements. A table shows combinations of materials used in the construction, specifically for the transparent base metal or oxide, and the semiconducting layer of Se, $Cu_2O$, $Sb_2S_3$, CdS, etc. Spectral sensitivities are given, as are some details of time constants and signal currents. (*EEA*, 1959, #3850)

1,002. THE FARADAY CELL IN COLOUR TELEVISION
Wells, R. W.
*Television Society, Journal of the*, v. 8, no. 12, pp. 503–505, October–December 1958

The faraday effect, in which the plane of polarization of a light beam passing through a medium in a magnetic field is made to rotate, is used in conjunction with cellophane filters to produce a color picture from the normal black and white on a CRT. In the past, filters have been considered but found too impractical due to the necessity of using unwieldy mechanical devices. During manufacture, the cellulose particles in a cellophane sheet become aligned due to stretching. These sheets are mounted, with the molecular orientation of each layer turned through a small angle with respect to each other.

When viewed using plane polarized light, complementary interference colors are seen on rotating the plane of polarization through this small angle. Previously it had been thought essential to r tate through 90 deg. In a two-color sequential television system, the faraday cell operated at frame frequency, the coil being resonant at 50 cps. The field provided by 2000 AT was sufficient to rotate the plane of polarization 6 deg. The design of a practical circuit is given showing a two-color switching method employing magenta-green and blue-yellow with zero signal giving white as the center of a balanced system. A summary of the advantages and limitations is given, as well as diagrams and circuits. (*EEA*, 1959, #4390)

**1,003. OPERATIONAL EVALUATION OF VIDEO INTEGRATING GROUP OA-671/CPN-18**
**Beech, H. W., Reinhold, J. G.**
**December 1958**
**Air Force Proving Ground Command, Eglin AFB, Fla.**
**APGC TR-58-131**
**AD-293,916**

This test was conducted to determine the effectiveness of the Video Integrating Group, OA-671/CPN-18 and to enhance the radar video presentation of the AN/CPN-18 radar. Emphasis was placed on the increased capability for maximum and minimum target detection ranges, improved manual and automatic (VOLSCAN) tracking capabilities, functional reliability, and maintenance aspects. Two references are also included.

**1,004. BEAM-LANDING ERRORS AND SIGNAL-OUTPUT UNIFORMITY OF VIDICON TUBES (Presented at the National Electronics Conference, Chicago, Ill., October 7–9, 1957)**
**Neuhauser, R. G., Miller, L. D.**
**In "Proceedings of the National Electronics Conference, Volume 13", pp. 846–855**
**National Electronics Conference, Inc., Chicago, Ill., 1958**

The uniformity of signal output from vidicon-type tubes is greatly affected by the beam-landing characteristics of the tube as determined by the electron optics of the tube and the associated scanning and focus components. Sensitivity and dark-current characteristics of the photo-conductor are shown to vary respectively as the square and the cube of the applied signal-electrode voltage. Beam-landing errors, although low in absolute voltage levels, change the applied voltage on the photo-conductor as a function of the deflection angle and thus determine, to a great extent, the uniformity characteristics of the signal output of these tubes. This beam-landing error can be used to advantage in tubes made with standard manufacturing techniques to produce signal-output uniformity. Vidicon tubes made with new manufacturing techniques have a photo-conductor layer of more uniform thickness and have characteristics that make the tubes more suitable for applications requiring maximum sensitivity. A comparison of the signal-output characteristics of these tubes is made and related to the specific types of applications in which each tube will find its best usage. A simple circuit modification that can be used to cancel out beam-landing errors is also described. (*EEA*, 1958, #4980)

**1,005. A NEW IMAGE ORTHICON EMPLOYING A MULTI-ALKALI PHOTOCATHODE FOR COLOR CAMERAS (Presented at the National Electronics Conference, Chicago, Ill., October 7–9, 1957)**
**Kaseman, P. W.**
**In "Proceedings of the National Electronics Conference, Volume 13", pp. 856–861**
**National Electronics Conference, Inc., Chicago, Ill., 1958**

The new tube has two to three times the sensitivity of present image orthicons, as well as substantially longer life. The performance of the new Sb-K-Na-Cs type multi-alkali cathode is described, and problems resulting from introduction of the highly active alkali metals into a tube as complex as the image orthicon are discussed. Improvements in tube operating characteristics are described which permit more economical studio operation, particularly with respect to lighting requirements and air-conditioning costs. (*EEA*, 1958, #4981)

**1,006. VIDEO AMPLIFIER WITH 30 MC BANDWIDTH**
**Zins, W. A.**
**In "Proceedings of the Fifth Annual East Coast Conference on Aeronautical and Navigational Electronics, Baltimore, Md., October 27–28, 1958", pp. 213–217**
**Institute of Radio Engineers, Inc., New York, N.Y., 1958**

The design of a transistorized video amplifier with a 30-Mc bandwidth and a 40-db voltage gain is described. The unit has four stages of amplification and a low impedance output stage. (*EI*, 1960)

**1,007. INVESTIGATIONS OF A FACSIMILE LINE APPARATUS**
**Anderfuhren, E.**
***Technische Mitteilungen PTT*, v. 36, no. 5, pp. 205–210, 1958 (in German)**

A report on the Kleinfax-Transceiver KF 108 is presented. This facsimile apparatus operates on basically conventional principles, but the picture signals—1260-kc maximum frequency—are transmitted as amplitude modulation of a 1850-cps carrier, and at the receiving end the signals are printed on ordinary paper. The latter feature has the advantage of avoiding the expense of special paper but does not provide half-tone effects. The apparatus is criticized on three points: (1) the transmission time of a page of script is 3½ min, which is excessive, (2) the HF end of the upper sideband is too high for transmission by certain cables, resulting in degradation of the received picture, and (3) the required transmission power, 1.2 mw into 600 ohm, is too high. (*EEA*, 1958, #6410)

**1,008. DISTORTION REDUCTION IN T.V. RECEPTION**
Ruston, J., Judge, W. J.
*1958 IRE Wescon Convention Record*, pt. 7, v. 2, pp. 65–73, 1958

The demodulated video signal of a standard television system exhibits significant degradations below 1 Mc principally due to quadrature and phase distortion. A brief analysis of the system indicates that the standard demodulator is the prime offender. Although this degradation is not too severe for home consumption, the usefulness of standard demodulators for off-the-air relay is questionable. Both the quadrature component and low-frequency delay distortion may be virtually eliminated by allowing the receiver RF characteristic to duplicate that of the transmitter. Equilization for the vestigial side band is performed after demodulation via a 0- to 6-db attenuation equalizer. The demodulated video signal exhibits low-frequency delay distortion which is only a fraction of that encountered in a standard demodulator and requires no correction for color. The quality of the demodulated signal may be further enhanced by equalizing, in the video circuitry, nonuniformities in the transmitter and receiver RF characteristics and via correction networks for transmitter amplitude nonlinearities. The resultant signal, therefore, can be substantially equal to that at the originating station. Consequently, a number of demodulations can be realized before serious distortion sets in. These concepts have been successfully employed in a six-hop off-the-air system extending over 450 miles. (*EEA*, 1959, #3221)

**1,009. THEORY OF THE FORMATION OF THE LATENT ELECTROPHOTOGRAPHIC IMAGE AND THE LAW OF MUTUAL SUBSTITUTION**
Fridkin, V. M.
*Akademiia Nauk SSSR, Doklady*, v. 121, no. 4, pp. 627–630, 1958 (in Russian)

The problem is formulated and discussed in terms of the transition of electrons between levels in the normal, the conducting, and the attachment zones. (*PA*, 1959, #12,928)

**1,010. NEW PHOTO-LAYERS FOR TELEVISION CAMERA TUBES WITH A PHOTO-CONDUCTING TARGET**
Yumatov, K. A., Perevodchikov, V. I.
*Radiotekhnika i Elektronika*, v. 3, no. 3, pp. 415–420, 1958 (in Russian)

The use of high resistance photo-layers of lead oxide–lead sulfide to enlarge the range of television camera tubes in the infrared region is examined. Results of measurements of the characteristics of such layers are described. (*EEA*, 1959, #2540)

**1,011. ENERGETICHESKII SPEKTR TELEVIZIONNOGO SIGNALS (ENERGY SPECTRUM OF TELEVISION SIGNALS)**
Ignatev, N. K.
*Elektrosvyaz*, v. 13, no. 1, pp. 21–26, January 1959 (Translated from the Russian in *Telecommunications*, no. 1, pp. 25–33, 1959)

An analytic expression is derived for such a spectrum, considering the correlation characteristics of a television image in space and time. (*EI*, 1959 and 1960)

**1,012. TELEVISION ZOOM LENSES**
Cook, G. H.
*SMPTE, Journal of the*, v. 68, no. 1, pp. 25–28, January 1959

A variable focal length objective is described in which two components move independently but the movements are connected by a geometrical linkage, not by cams. A movement depending on the same linkage is used for focusing objects at different distances. (*PA*, 1959, #9383)

**1,013. SINGLE-LINE-SCAN TELEVISION**
Harris, F. H., Ainsworth, J.
*Review of Scientific Instruments*, v. 30, no. 2, pp. 76–78, February 1959

Equipment was constructed to demonstrate the practicability of using a vidicon camera tube for measuring the space orientation of spin stabilized *Aerobee-Hi* research rockets. While ordinary television pictures are badly blurred by camera rotation, laboratory photographs which were obtained by means of a spinning, line-scan camera demonstrated that this method can be used to obtain pictures whose quality is similar to those of standard television. (*EEA*, 1959, #4924)

**1,014. SIGNAL DISTORTION IN THE SUPERICONOSCOPE**
Dillenburger, W.
*Archiv der Elektrischen Übertragung*, v. 13, no. 2, pp. 63–75, February 1959 (in German)

The supericonoscope with potential equalization ("Riesel" or "irrigation" iconoscope) is dealt with in detail, mainly from the point of view of typical faults (spurious signals etc.), and methods of suppression are described. Large area spurious signals can be overcome by irrigation with slow electrons (1 to 1.5 v); corner halation is corrected by providing auxiliary frame electrodes, and by applying adjustable voltages to them. In contrast, detail distortion due to storage charge irregularities cannot be compensated by irrigation techniques, since deleterious effects on the gamma characteristic are caused if the irrigation current exceeds a few microamps. Thus the irrigation and the cathode temperature have to be kept constant. The investigation is illustrated by a large number of oscillograms and photographs, and contains many valuable engineering recommendations toward optimal camera operation by means of close control and continuous monitoring; the importance of keeping the heater voltage within ±1 percent is particularly stressed. (*EEA*, 1959, #4923)

**1,015. THE MARCONI 16mm FAST PULLDOWN TELEVISION RECORDER**
**Pemberton, M. E.**
***SMPTE, Journal of the*, v. 68, no. 2, pp. 87–90, February 1959**

A recording monitor which produces a high-quality picture, and a new 16-mm fast pulldown camera which is used to record the picture are described, and performance data are presented. (*EEA*, 1959, #4385)

**1,016. KUSOCHNAYA APPROKSIMATSIYA TELEVIZIONNOGO SIGNALA S ISPOLZOVANIEM SVOISTV ZRENIYA (QUANTIZED APPROXIMATION OF TELEVISION SIGNAL USING PROPERTIES OF SIGHT)**
**Makhonin, V. A.**
***Akademiia Nauk SSSR, Izvestiia, Otdelenie Teknicheskikh Nauk, Energetika i Avtomatika*, no. 3, pp. 50–54, March 1959**

The regulations of release systems to increase effects of vision are discussed. (*EI*, 1959)

**1,017. A VIDICON CAMERA FOR INDUSTRIAL COLOUR TELEVISION**
**James, I. J. P.**
***British Institution of Radio Engineers, Journal of the*, v. 19, no. 3, pp. 165–182, March 1959**

The choice of systems, i.e., field-sequential or simultaneous, is discussed, and the conclusion is reached that it would be expedient to exploit the simultaneous color camera using three vidicons. The main features of the camera and its associated control equipment are described. The novel optical system employed allows for a maximum light efficiency and reduces vidicon lag to a minimum; there is a combined focus-and-turret control. The signal amplifiers and line and field scanning circuits are discussed. It is emphasized that negative feedback forms an essential feature of reliable color equipment, especially for continuous operation by relatively unskilled personnel. Particular attention has been given to monitoring facilities for checking the amplifier operation. All of the electrical registration controls are situated at the camera control unit instead of in the camera itself, thus considerably simplifying the problem of remote control of the camera. The picture quality obtainable is adequate for 625-line broadcast standards and the equipment is of universal application for general industrial use. (*EEA*, 1959, #4382)

**1,018. MINIATURIZED INSTRUMENTATION TELEVISION SYSTEM**
**April 8, 1959**
**Lockheed Aircraft Corporation, Missiles and Space Division, Sunnyvale, Calif.**
**LMSD-49838**

The Miniaturized Instrumentation Television System was developed specifically for missile and satellite applications. Its minimal size, weight, and low power-consumption characteristics make it adaptable to many other applications. This report describes the television system and presents the governing specifications in order that its adaptability to any visual monitoring application may be analyzed. Some possible applications are also indicated. (*AI/A*, 1960, #2357)

**1,019. AN IMPROVED VIDICON FOCUSING-DEFLECTING UNIT**
**Castleberry, J., Vine, B. H.**
***SMPTE, Journal of the*, v. 68, no. 4, pp. 226–229, April 1959**

The effect known as beam-landing error or "porthole" in vidicon cameras is eliminated through the use of a suitable coil configuration. The axial positions of the coils are chosen so that the beam electrons approach the target with only an axial component of velocity at all times. Exceptional signal uniformity independent of signal-electrode voltage and focus field strength is then obtained with a vidicon having a uniform photoconductor. A particular coil design and the results obtained with it are discussed. (*EEA*, 1959, #5595)

**1,020. RECENT INVESTIGATIONS INTO THE OPERATION OF IMAGE ORTHICON CAMERA TUBES**
**Theile, R.**
***Television Society, Journal of the*, v. 9, no. 2, pp. 45–59, April–June 1959**

The image orthicon is the most sensitive all-purpose television camera tube which gives, on the average, very satisfying picture quality. When televising high-contrast scenes, there are, however, characteristic defects in the picture quality. This paper deals primarily with (1) typical and characteristic spurious signals, which appear in the picture as white borderlines, (2) loss of definition in horizontal white-to-black transients, and (3) geometrical distortion in the picture details. It is explained that these effects are due to capacitive coupling between adjacent picture elements and additional deflection of the scanning electrons in front of the target by the potential pattern of the storage charges. These explanations have been confirmed by experiments with an unusual method of operation of the tube (line storage operation), where the characteristic spurious signals disappear in the vertical direction resulting in a surprisingly good picture quality. (*EEA*, 1959, #6131)

**1,021. MODERN OPTICS IN RELATION TO TELEVISION**
**Cook, G. H.**
***Television Society, Journal of the*, v. 9, no. 2, pp. 61–69, April–June 1959**

Some aspects of the optical components used in television are discussed. These include resolving power, television image transmission, varying focal length, electronic correction, vidicon camera lenses, and zoom lenses. (*EI*, 1959)

**1,022. AUTOMATIC CONTROLS FOR COLOR TELEVISION**
Wiencek, Z.
*Electronics*, v. 32, no. 20, pp. 58–59, May 15, 1959

Automatic hue and chroma control circuits are described which improve the stability of hue, saturation, noise, and pull-in characteristics of received color TV signals. A low frequency diode gate corrects the subcarrier oscillator phase from synchronous demodulator signals. (*EI*, 1959)

**1,023. HOLDING VIDEO LEVEL WHILE SWITCHING STUDIOS**
Schroeder, J. O.
*Electronics*, v. 32, no. 22, pp. 96–98, May 29, 1959

This automatic video-processing amplifier instantaneously compensates for wide variations in color or monochrome input signal levels to maintain the output signal components at their correct levels. The amplifier can feed a video tape recorder in order to obtain the maximum S/N capabilities. (*EEA*, 1959, #5599)

**1,024. POSSIBILITIES OF THE REDUCTION OF LAG-EFFECTS IN CAMERA TUBES OF THE VIDICON TYPE**
Heimann, W.
*Archiv der Elektrischen Übertragung*, v. 13, no. 5, pp. 221–225, May 1959 (in German)

A progress report on investigations of internal lag effects in vidicon photoconductive layers is given. A method of layer formation was found which approximately halved the lag without impairing sensitivity. A proposal is made to reduce lag also by interposition of an image transformer. (*EEA*, 1959, #6132)

**1,025. CARRIER TRANSMISSION FOR CLOSED-CIRCUIT TELEVISION**
Schimpf, L. G.
*Electronics*, v. 32, no. 24, pp. 66–68, June 12, 1959

A simple and inexpensive coaxial cable transmission system passes a high quality television signal with a 4.5-Mc bandwidth. Transistorized terminal and repeater circuits minimize space and power requirements. An unusual power supply sends dc repeater power through the signal cable. (*EI*, 1959)

**1,026. DETECTING LOW-LEVEL INFRARED ENERGY**
Dubner, H., Schwartz, J., Shapiro, S.
*Electronics*, v. 32, no. 26, pp. 38–41, June 26, 1959

Present materials and techniques are inadequate for the infrared vidicon proposed, in which an electron gun scans a thermoresistive or photoconductive film. Many of the advantages can, however, be obtained with materials available. Three methods are described which enable many cells to be fed to a common amplifier, and a fourth uses an electronically scanned mosaic of discrete infrared elements. A distributed RC filter constructed of barium titanate and palladium is also described. (*EEA*, 1959 #7160)

**1,027. LINEAR DISTORTION IN T.V.-SYSTEMS WITH A SPECIAL REFERENCE TO THE TOLERANCES**
Bruun, G., Funch, O.
*Ingeniøren C*, v. 3, no. 2, pp. 67–80, June 1959

The transfer characteristic of a system can be estimated from the step response of the system. Tolerances for the step response of the European 625-line system have been worked out by Müller. Tolerances for the transfer characteristic are developed in agreement with a set of modified tolerances for the step response. The methods used are graphical Fourier analysis and the method of paired echoes. A brief review of these tools is given. Tolerances for the amplitude and phase characteristics are expressed for typical forms of pure amplitude and pure phase distortion. A brief treatment of combined amplitude and phase distortion is also given. Forty-seven references are included. (*EEA*, 1959, #6127)

**1,028. TELEVISION TRANSMISSION OF FEEBLY ILLUMINATED OBJECTS BY THE USE OF LONG STORAGE TIMES**
Pilz, F., Habermann, W.
*Rundfunktechnische Mitteilungen*, v. 3, no. 3, pp. 132–144, June 1959 (in German)

The practical limit to storage time is set by conductivity of the target plate in the case of the image orthicon, vidicon and orthicon, and by ionization effects with the image iconoscope. The last-named tube is, however, the most promising, particularly if a photoscan technique, such as is commonly employed in televising film, is used. Analysis shows that the S/N ratio is dependent upon the number of photoelements per picture element and is raised by the use of secondary-emission multiplication. For reception a display-storage type of tube is advocated. (*EEA*, 1960, #5252)

**1,029. DEVELOPMENT OF A RUGGEDIZED VIDICON AND DEFLECTION COMPONENTS**
Marschka, F. D.
July 1959
Radio Corporation of America, Harrison, N.J.
Report on Electronic Tubes and Transistors, WADC-TR-59-329, AF 33(600)-32346
AD-227,238

Efforts were made to develop a ruggedized military version of the RCA 6198 vidicon together with its associated deflection assembly. Extensive operational vibration and temperature-altitude tests, along with non-operational impact shock and temperature-humidity tests, led to the design and development of the RCA C73453D vidicon and RCA XD3010A deflection assembly. Results of these tests indicated compliance with the environmental requirements.

1,030. PROGRESS IN THE FIELD OF TELEVISION REPORTING. A NEW ULTRA-LIGHT CAMERA SYSTEM
Cahen, R., Fontenit, R.
*Onde Électrique*, v. 39, pp. 673–679, July–August 1959 (in French)

The new camera (CP 102) can be held in the hand and contains a sensitive vidicon tube. The lens has a focal length variable from 20 to 80 mm. A case carried on the back contains transistorized synchronization circuits, video amplifiers and a transmitter. This may be for Band III, Band IV or for 7000 Mc. No circuits are given. (*EEA*, 1960, #515)

1,031. PROFESSIONAL EQUIPMENT FOR COLOUR TELEVISION USING SIMULTANEOUS TRICHROMATIC ANALYSIS
Nepomiastchy, A.
*Onde Électrique*, v. 39, pp. 680–685, July–August 1959 (in French)

The equipment described is for the NTSC system and includes cameras, a control bay, a flying spot scanner for color positive, and a color monitor. (*EEA*, 1960, #514)

1,032. TRANSISTORIZED IMAGE ORTHICON TELEVISION SYSTEM
Tanner, D., Schurak, K.
November 1, 1957–September 30, 1959
Admiral Corporation, Chicago, Ill.
Final Report on Design and Fabrication,
DA 36-039-sc-74945
AD-239,639

Work on the project is described in terms of Task A—the camera, and Task B—the monitor, and the various phases of each task. These phases include: study, electrical breadboard, electrical and mechanical prototype, prototype and first unit testing, manufacturing, and final testing. Data are included substantiating satisfactory compliance with specifications for the system. Conclusions on work performed and recommendations for future systems are included, as well as complete personnel identification. A description of the completed equipment is given, with photographs and specifications tables.

1,033. BLACK LEVEL INFORMATION AND AVERAGE TELEVISION SIGNAL LEVEL
Gurevich, S. B., Bykov, R. E.
*Radioteknika*, v. 14, no. 9, pp. 57–62, September 1959 (in Russian)

This is a survey, based on well-known investigations by Theile, McGee and others, containing a lengthy criticism of a paper by D. A. Novik. Relationships between average scene brightness, average television signal and transmitted black level are explained and discussed, including fundamental differences between orthicon and vidicon pick-up tubes, in which the retrace scan process reproduces true black level, and iconoscope devices, where a difference between black and average level depends on ambient light and image content and the gamma of the tube. (*EEA*, 1960, #1896)

1,034. NEW VARIANT OF ELECTRON-OPTICAL CHRONOGRAPHY
Fanchenko, S. D.
*Pribory i Tekhnika Eksperimenta*, no. 5, pp. 51–53, September–October 1959
(Translated from the Russian in *Instruments and Experimental Techniques*, no. 5, pp. 749–751, June 1960)

A new variant of the electron-optical method of investigating fast processes by scanning the image in electron-optical image converters is proposed. The suggested variant is distinguished by the employment of an image converter with a special "homo-centering" system of electron focusing. Estimates made for electron-optical systems of this type show that the proposed method is capable, in principle, of providing a time resolution of $10^{-12}$–$10^{-13}$ sec in investigation of weak, diffuse light flashes. (*EEA*, 1962, #4334)

1,035. A TEST SIGNAL GENERATOR FOR COLOUR TELEVISION
Wobst, J.
*Technische Mitteilungen BRF*, v. 3, no. 1–2, pp. 26–31, October 1, 1959 (in German)

A detailed technical description of a color-bar generator is given, illustrated by numerous waveform diagrams, by reproduction of the color triangle with the $I$ and $Q$ families of curves, and by several color photographs of color-bar patterns. A discussion on optimal choice of chrominance subcarrier is included, with notes on setting-up procedure and on the design and application of a separate two-color step-function generator. The generation of the color sync signal is singled out for separate consideration. A useful bibliography is included. (*EEA*, 1960, #5253)

1,036. CLOSED CIRCUIT TELEVISION EQUIPMENT
*Engineer*, v. 208, p. 438, October 16, 1959
(*AS&T*, 1960)

1,037. MONITOR-SYNCHRONIZER FOR ROTATING MIRROR CAMERAS
Farrand, W. B., Gagnon, G. E.
*Review of Scientific Instruments*, v. 30, no. 10, pp. 939–941, October 1959

This device shows when the angular velocity of the mirror has attained a chosen value. A signal from a transducer near the rotating mirror is compared with the standard signal. A Lissajous Figure is displayed on a CRT when synchronization is achieved. When the camera shutter is opened, the next pulse from the transducer initiates the explosion with the mirror in the correct angular position. (*PA*, 1960, #3665)

1,038. CINEFLUOROGRAPHY EMPLOYING SPLIT-IMAGE TELEVISION TYPE IMAGE AMPLIFIERS
Hodges, P. C., Moseley, R. D., Jr.
*Radiology*, v. 73, no. 4, pp. 548–556, October 1959

A CRT directly sensitive to X-rays is described and compared with the existing systems of X-ray image amplification

devised by Morgan, Westinghouse, Philips and Moon. The X-ray image falls on an Al anode plate surfaced with a layer of lead oxide which becomes semiconducting corresponding to the image. The cathode beam scans the anode and the change in anode current can be amplified and transferred to monitor screens by conventional television electronics. Storage properties of the screen are good; the resolving power of the system depends on the size of the cathode-ray scanning beam. X-ray sets mounted at right angles and feeding two such cameras have been used in angiography, together with a remote monitor for motion picture recording. (*PA*, 1960, #5541)

1,039. AN X-RAY IMAGE AMPLIFIER USING AN IMAGE ORTHICON CAMERA TUBE
Garthwaite, A., Haley, D. G.
*British Institution of Radio Engineers, Journal of the,* v. 19, no. 10, pp. 615–623, October 1959

Special requirements of a television camera for use as an X-ray image amplifier are outlined. In television, illumination can be controlled, whereas in this X-ray application, illumination is controlled by thickness of the subject under examination. Details are given of the special camera tube developed to operate under these conditions, and of the ancillary apparatus required to obtain maximum sensitivity and definition from such a tube. The reason for adopting a scanning system not compatible with any of the accepted standards is also discussed. (*EEA*, 1960, #533)

1,040. EPIDOPHOR COLOUR PROJECTION SYSTEM
*Television Society, Journal of the,* v. 9, no. 4, pp. 127–131, October–December 1959

Features of the Eidophor system which may be used to project images on a large screen by means of line-sequential scanning are discussed. A monochrome projector, which is the basis of the system, is described. Color pictures are projected by addition of a synchronous, tri-color filter disk mounted in front of a projected beam. (*EI*, 1960)

1,041. TRACKING ERROR MEASURING DEVICE
Kruse, J. R.
November 5, 1959
United Aircraft Corporation, Norden Division, White Plains, N.Y.
190-R-0022, Quarterly Technical Progress Note for July 1–September 30, 1959, on Phase 2 Development of Automatic Tracking Error Measuring Device, APGC TN-59-79, AF 08(603)-4574
AD-231,490

This note contains a summary of the technical progress made in this phase of development of the automatic tracking-error measuring device. A detailed description of the television camera, synchronizer, and gates generator is included.

1,042. A GATING CIRCUIT FOR SINGLE-GUN COLOUR TELEVISION TUBES
Freeman, K. G.
*British Institution of Radio Engineers, Journal of the,* v. 19, no. 11, pp. 667–677, November 1959

The requirements of an ideal gating circuit with single-gun color television tubes and the limitations of some existing circuits are discussed. A new type of gating circuit which employs low-level gating of the red, green, and blue video signals in conjunction with a wideband amplifier is described. Such a circuit is believed to have a performance superior to that of most existing circuits and by fairly simple modification is applicable to either reversing color sequence, continuous color sequence or to color difference operation. (*EEA*, 1960, #511)

1,043. EFFECT OF SCANNING FIELD ON SUPER-ICONOSCOPE SIGNALS
Khromov, L. I.
*Radiotekhnika,* v. 14, no. 11, pp. 28–35, November 1959 (in Russian)

Based on well-known work by Knoll, Kazan, Theile, and Townsend, a general survey of the optimal operational conditions of supericonoscope is presented. The basic principles of operation, explaining the relationships between video signal current, instantaneous value of scanning beam, potential barrier (secondary emission), and average conductivity of a target element are analyzed. Methods of measurement are described, proceeding in three steps: (1) with controlled photocathode illumination, a test signal image is recorded for 40 ms at controlled collector potential without a scanning (reading) beam; (2) with the writing process completed, a constant predetermined voltage is applied to the collector, and the reading scan memorizes the potential barrier, the signal amplitude being measured during the first few scanning lines; (3) an auxiliary process consisting in bringing the target to zero collector potential by exposing it to a uniform high velocity electron beam is carried out. The results of such measurements are discussed in detail, and some practical recommendations as to optimal scanning (reading) potential and S/N improvement are given. (*EEA*, 1960, #1897)

1,044. LOW COST CLOSED CIRCUIT TV CAMERA
Swaine, D.
*Radio-Electronics,* v. 30, pp. 122–125, November 1959
(*AS&T*, 1960)

1,045. VECTORSCOPE UNIT
Freeman, K. G.
*Electronic Engineering,* v. 31, pp. 655–658, November 1959
(*AS&T*, 1960)

**1,046. COLOUR-BAR GENERATOR FOR THE N.T.S.C. SYSTEM**
**Bolle, G.**
*Telefunken Zeitung*, v. 32, pp. 237–243, December 1959
(in German)

After a brief discussion of the NTSC system and the composition of a color-bar pattern for test purposes, the principle of a versatile precision instrument is described. Following the conventional generation of the line sync, color burst and the relevant blanking pulses, a switch-key arrangement enables the selection of any of the available color bars which are generated by a chain of monostable multivibrators. These vibrators are locked in such a way that the trailing edge of the first univibrator will fire the next, so that any colors or sequence of colors can be chosen for display. Circuit diagrams, waveforms, and typical oscillograms of the essential parts of the color-bar generator are reproduced and described in detail. The accuracy is indicated by the transit time from bar to bar ($< 0.2$ $\mu$sec) and by the phase fidelity of the chrominance subcarriers ($\Delta\phi < 1°$). (*EEA*, 1960, #3152)

**1,047. THE TESTING AND OPERATION OF 4½-in. IMAGE ORTHICON TUBES**
**Brothers, D. C.**
***British Institution of Radio Engineers, Journal of the,***
**v. 19, no. 12, pp. 777–805, December 1959**

The method used by a broadcasting organization to check the performance of image orthicon tubes is described. Aspects dealt with include: the transfer characteristic; sensitivity; contrast handling ability; S/N ratio; picture sharpness; geometrical distortion and linearity; microphony; uniformity of picture background; freedom from spurious effects; lag, movement blur, sticking, etc; color response; freedom from drift; and ease of adjustment. Some conclusions are drawn on particular aspects of operating these tubes. (*EEA*, 1960, #2547)

**1,048. A NARROW BAND IMAGE TRANSMISSION SYSTEM WITH TRANSISTORIZED RECEIVER**
**Riordon, J. S.**
***Transactions of the Engineering Institute of Canada,***
**v. 3, no. 4, pp. 113–118, December 1959**

The relationship between bandwidth, frame rate, and resolution in an image transmission system is derived. An experimental all-electronic slow scan system is described. A frame with a resolution of approximately 100 × 100 elements is transmitted in 3.5 sec with a bandwidth of 2 kc. The transmitted signal is proportional to reflected, rather than transmitted, light; so that it is not necessary to make photographic slides of the material to be scanned. Considerable saving in size and power consumption is effected by the use of audio transistors in the receiver. (*EEA*, 1960, #5854)

**1,049. GAMMA RADIATION INSENSITIVE TELEVISION CAMERA LENSES**
**Hayes, J. D.**
***SMPTE, Journal of the,*** **v. 68, no. 12, pp. 816–818, December 1959**

Vidicon and image-orthicon types of television camera lenses have been designed to utilize only those "non-browning" optical glasses especially developed to maintain their transparency in gamma-radiation fields. The optical and mechanical characteristics of these lenses as well as the performance test data are described. (*EEA*, 1960, #2556)

**1,050. MODULATION CHARACTERISTIC OF A PICTURE TUBE**
**Jedlička, M., Zeman, J.**
***Slaboproudý Obzor,*** **v. 20, no. 1, pp. 55–59, 1959**
**(in Czechoslovakian)**

Measurements of the screen brightness and the cathode current, as a function of the moduating grid voltage $E_{mod}$, were made on six different picture tubes (four types of tubes). It was found that the brightness $L$ obeyed the law $L = k_1 E\gamma_{mod}$, while the current changed in accordance with the law $i_k = k E^n_{mod}$. The parameter $\gamma$ had values ranging from 1.72 to 2.18, while $n$ was about 2.7. The characteristics of $L$ and $i_k$ are shown graphically and the method of determining $\gamma$ and $n$ is discussed in detail. (*EEA*, 1959, #5596)

**1,051. COLOUR DISTORTION OF LARGE PICTURE AREAS IN THE COLOUR TELEVISION SYSTEM WITH QUADRATURE MODULATION**
**Ptáček, M.**
***Slaboproudý Obzor,*** **v. 20, no. 11, pp. 676–682, 1959**
**(in Czechoslovakian)**

Quadrature modulation by means of balanced modulators is employed in color television to produce a color-carrying signal with a single carrier wave. Nonlinearity of the modulation process leads to color distortion of "large picture areas". These are defined as colored areas reproduced by the three signals in the steady-state. The problem of distortion is analyzed in some detail and it is found that the region of purple hues is the most critical (as regards the distortion). A number of graphs is given which show distortion as a function of nonlinearity factor $k$. It is also shown that distortion can be reduced by limiting the amplitudes of the carrier-carrying components. A graph giving maximum permissible amplitudes is given. (*EEA*, 1960, #1892)

**1,052. ON THE PHOTOCONDUCTIVE PROPERTIES OF LEAD MONOXIDE**
**Wada, M., Takahashi, T., Seki, T.**
***Reports of the Research Institute of Electrical Communication of Tôhoku University,*** **v. 11, no. 1, pp. 55–61, 1959**

A lead monoxide film was made on a silica glass substrate by evaporating lead *in vacuo* and then oxidizing the film in air

in an oven. The film had specific dark resistivity of the order of $10^{12}$ ohm cm or greater at room temperature and exhibited good photoconductive response in the visible region. Measurements were made of thermal activation energies, absorption properties, spectral responses, $\gamma$ characteristics, photocurrent-applied voltage characteristics, and the temperature dependence of the photocurrent. (*EEA*, 1961, #6272)

**1,053. ON THE WORKING MECHANISM OF THIN LAYERS IN PICK-UP TUBES**
**Fryszman, A.**
***Bulletin de l'Académie Polonaise des Sciences, Séries des Sciences Mathématiques, Astronomiques et Physiques,* v. 8, no. 12, pp. 733–740, 1959**

A mathematical analysis is given of the behavior of a thin semiconducting layer subjected to periodic electron bombardment, showing a dependence on the form of the secondary electron emission characteristic of the semiconductor. The treatment has special reference to the mechanism of operation of photosensitive layers in vidicon tubes. (*EEA*, 1961, #445)

**1,054. FM CARRIER TECHNIQUES IN RCA COLOR VIDEO TAPE RECORDER**
**Thompson, R. D.**
***1959 IRE National Convention Record*, pt. 7, v. 7, pp. 109–116, 1959**

The extreme bandwidth range required for color television signals rules out the use of direct recording systems normally used in audio practice. A frequency modulated carrier system is described that permits excellent utilization of the restricted range of the magnetic tape system. (*EI*, 1960)

**1,055. POSSIBILITIES OF MAJOR SIMPLIFICATION IN COLOR TELEVISION LIVE CAMERAS AND RECORDING DEVICES THROUGH USE OF CHROMA FIELD SWITCHING AND SUBSEQUENT AUTOMATIC COLOR BALANCE**
**Hughes, W. L.**
***1959 IRE National Convention Record*, pt. 7, v. 7, pp. 146–149, 1959**

The cost, complexity, and critical nature of equipment used for live pickup, network transmission of signal, film recording, and video tape recording pose major problems. Means are proposed for making major simplifications in these areas while maintaining compatibility with all current NTSC and FCC standards for home receivers. (*EI*, 1960)

**1,056. EFFECTS OF FREQUENCY CUTOFF CHARACTERISTICS ON SPIKING AND RINGING OF TV SIGNALS**
**Fowler, A. D., Iglehart, J. D.**
***1959 IRE National Convention Record*, pt. 7, v. 7, pp. 208–214, 1959**

Spiking and ringing of TV signals depend upon amplitude and delay characteristics associated with frequency cutoff of transmission. The effects of the variety of cutoff characteristics of both ideal and practical systems on rectangular and sine-squared pulses are illustrated by computed waveforms. Reductions in transient response that can be achieved by in-band delay equalization and amplitude roll-off are discussed. (*EI*, 1960)

**1,057. TRANSMISSION OF COLOUR TELEVISION SIGNALS**
**Davidse, J.**
***Tijdschrift van het Nederlands Radiogenootschap*, v. 24, no. 5, pp. 255–272, 1959**

Transmission of color television signals according to the NTSC system is described. The choice of the chrominance signals, their bandwidths, and of the subcarrier frequency is discussed. The consequences of the method of $\gamma$ correction and of deviations from the constant luminance principle are considered. The significance of the statistics of the chrominance signals is pointed out. (*EEA*, 1960, #5242)

**1,058. THE TECHNOLOGY OF THE PRESENT-DAY TELEVISION CHARGE STORAGE TUBES, ORTHICON AND SUPERORTHICON, SUPERICONOSCOPE, VIDICON**
**(Presented at the Colloquium on Image Convertors and Image Storage Tubes, Heidelberg, Germany, April 28–29, 1958)**
**Pilz, F.**
***Sitzungsberichte Heidelberg Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Klasse*, no. 5, pp. 40–44, 1959 (in German)**

The mode of operation of each of the above camera tubes and the sensitivity, are briefly described, together with various technical limitations. Reference is made to more complete treatises. (*EEA*, 1961, #2572)

**1,059. THE PROBLEM OF LAG IN PHOTORESISTIVE TUBES OF THE "VIDICON" TYPE**
**Oksman, Ya. A., Epifanov, M. V.**
***Radiotekhnika i Elektronika*, v. 3, no. 12, pp. 1501–1515, 1959 (in Russian)**
**(English summary available as OTS: PB-141,106T-11, U.S. Dept. of Commerce, Office of Technical Services, Washington, D. C.)**

Lag in photoresistive tubes is generally ascribed to incomplete discharge of a picture element by the electron beam and photoelectric relaxation in the target material. An experimental and theoretical study of the effect is carried out. It is shown that the target can be represented by an equivalent circuit consisting of a two-stage RC network. The experimental results indicate that transient processes in photoresistive tubes can be explained if it is assumed that the high-resistance layer of the semiconductor contains a space charge, the size of which depends on the illumination, and that the lifetime of the carriers is shorter than the time of establishment of diffusion-drift equilibrium. (*EEA*, 1960, #2548)

**1,060. PROBLEMS IN MILITARY TECHNOLOGY PART II (Z ZAGADNIEN TECHNIKI WOJENNIJ)**
(Translated from "Biblioteka Wiedzy Wojskowej," Warsaw, Chapters 5–11, pp. 153–371, 1959)
Sejnenski, H.
1959
Scripta Technica, Inc., Washington, D.C.
T-1301(e-k)
AD-285,958

Information on television and infrared equipment is included.

**1,061. OPTICS, PHYSICS AND OPTICAL PHYSICS (Presented at the Optics of All Wavelengths Meetings, Jena, East Germany, 1958)**
Ronchi, V.
In "Optics of All Wavelengths," pp. 22–31 (in Italian)
G.rlich, P., Tiedeken, R., Editors
Akademie-Verlag, Berlin, Germany, 1959

A general review of the terminology used in optics is presented. In particular it is suggested that the term "optics" be limited to cases where the eye is the receiver. Obvious extensions to other receivers give one "photography" and "photoelectrics." In cases where electromagnetic radiation of any wavelength is considered without a particular receiver, the term "physics" is appropriate. (*PA*, 1961, #2835)

**1,062. A HIGH-GRADE INDUSTRIAL TELEVISION CHANNEL WITH REFERENCE TO INFRA-RED OPERATION**
Taylor, J. H.
*British Institution of Radio Engineers, Journal of the*, v. 20, pp. 77–85, January 1, 1960

The range and scope of the uses of television for industrial purposes are indicated to give some of the design requirements and to show broadly how they have been met with reference to a particular television channel employing a vidicon camera tube. In addition, two special applications are described, namely, the use of this channel with infrared and ultraviolet light. (*EEA*, 1960, #2555)

**1,063. MAGNETIC RECORDING OF COLOR TELEVISION**
Roizen, J.
*Electronics*, v. 33, no. 1, pp. 76–79, January 1, 1960

Errors due to mechanical difficulties in the magnetic recording of color television signals will visibly alter the hue or dominant wavelength of reproduced color. Electronic timebase correction to the magnetic record and playback color television images is described. (*EI*, 1960)

**1,064. GAMMA-RAY PINHOLE TELEVISION CAMERA**
Cohen, A. E. (Army Signal Research and Development Laboratory, Fort Monmouth, N.J.)
*Review of Scientific Instruments*, v. 31, pp. 29–31, January 1960

An experimental camera has been devised which is capable of viewing a gamma-ray or X-ray source both statically and dynamically with a kinescope readout suitable for quantitative measurements. Experiments are described indicating sensitivities to X-rays of about 1 to 2 r/hr.

**1,065. VACUUM DISTILLATION CAMERA USING RADIO-ACTIVE METAL SOURCE**
Preuss, L. E.
*Nucleonics*, v. 18, no. 1, pp. 102–103, January 1960

A camera is used to investigate the properties of the metal source, e.g., whether it is a true point source, as well as amount of creep and of elastic scatter of the distilling metal atoms.

**1,066. MEDIUM SCREEN COLOUR PROJECTOR**
Lance, T. M. C.
*Television Society, Journal of the*, v. 9, no. 5, pp. 176–178, January–March 1960

A projector is described designed to provide a complete self-contained unit which would produce a picture of dimensions of 6 × 4½ ft with adequate brightness to meet the needs of industrial color television. Problems of extreme accuracy of registration and definition together with maintenance of white balance and color rendition with minimum of adjustment are also discussed. (*EI*, 1960)

**1,067. AN IMPROVED IMAGE ORTHICON**
Hendry, E. D., Turk, W. E.
*SMPTE, Journal of the*, v. 69, no. 2, pp. 88–91, February 1960

Design considerations and performance characteristics are given of 2-in. and 4½-in. image orthicons, in respect of S/N ratio, halo, white edging, unstable transfer characteristic, burn-in, microphony and resolution. Special emphasis is placed on the improvements in the English Electric Valve Co.'s 4½-in. series. (*EEA*, 1960, #3789)

**1,068. THE DESIGN OF A 4½-INCH IMAGE-ORTHICON CAMERA CHANNEL**
Partington, G. E.
*SMPTE, Journal of the*, v. 69, no. 2, pp. 92–98, February 1960

The apparatus, which includes associated units as well as the camera, constitutes an advance on an earlier similar equipment. Numerous changes have been made, aimed mainly at weight reduction, simplicity of control, accessibility, and easy replacement. The description covers the turret and focusing technique, temperature control of the camera tube, exposure control, viewfinder (a 7-in. rectangular kinescope), cables and audio monitoring. The equipment external to the camera includes four units—a power unit, camera control unit, control panel, and picture and waveform monitor. Printed circuits

are widely used. The electrical performance, operating technique, and stability and requisite staging and lighting are also discussed. (*EEA*, 1960, #4521)

**1,069. SIMPLIFIED METHODS OF CONVERSION OF STANDARD INTERMITTENT MOTION-PICTURE PROJECTORS FOR USE WITH TELEVISION PICKUP TUBES**
**Chandler, J. S.**
***SMPTE, Journal of the*, v. 69, no. 2, pp. 102–104, February 1960**

A 35-mm Simplex projection head was converted for use as a television projector with the 3:2 field-sequence method of utilizing film taken at the rate of 24 frames/sec for the 30 frames/sec television standard. A 35 percent application time is obtainable with a 5-in.-D shutter blade running at 3600 rpm. The entire mechanism, including the feed and holdback sprockets, shutter and intermittent Geneva, is driven from a single 1800-rpm synchronous motor. A timing belt drive is used for the intermittent mechanism. An eccentric toothed idler pulley of twice the diameter of the Geneva drive pulley is interposed between the motor and the Geneva drive to produce the required advance and retard modification of the rotary motion. The timing and change of acceleration are illustrated by curves. This method of conversion offers the advantages of simplicity and economy. Very little added noise or acceleration loading is produced and long operating life may be expected.

**1,070. A HIGH-RESOLUTION TELEVISION SYSTEM**
**Pourciau, L. L., Altman, M., Washburn, C. A.**
***SMPTE, Journal of the*, v. 69, no. 2, pp. 105–108, February 1960**

A television system capable of better than 1000 lines horizontal and 700 lines vertical resolution is described. Frame rate is 30 cps, field rate 60 cps with 2:1 interlace. Lines per frame may be varied from 675 to 1035. System bandwidth is 20 Mc. The camera employs a standard 1-in. vidicon. (*EEA*, 1960, #3795)

**1,071. A SECURE NARROW BAND CLOSED CIRCUIT TELEVISION SYSTEM FOR MILITARY APPLICATIONS (TELEVISION COMMUNICATIONS SYSTEM AN/FXC-1)**
**Benoit, R. C., Jr., Coughlin, F., Jr.**
**February 1960**
**Rome Air Development Center, Griffiss AFB, N.Y.**
**RADC-TN-60-2**
**AD-232,767**

Television communication system AN/FXC-1 is a voice bandwidth monochrome television system capable of transmitting printed, scenic, graphic briefings, and other visual data between two or more distant points. It provides full communications security when used with a standard code generator. Secure duplex audio facilities are also provided when the equipment is used with approved security devices. Transmission media are three standard toll quality voice circuits. Picture definition is a function of transmission time. Because several different frame times are provided, pictures of varying quality may be transmitted. As an example of picture variation, the rate of 1 frame/3 min gives an effective horizontal resolution of 391 lines while the rate of 4 frames/min gives an effective horizontal resolution of 113 lines. The "real time" pointer information is an inherent feature of the system. It may be used to highlight specific situations and incidents.

**1,072. IRE STANDARDS ON TELEVISION: MEASUREMENT OF DIFFERENTIAL GAIN AND DIFFERENTIAL PHASE, 1960**
***IRE, Proceedings of the*, v. 48, no. 2, pp. 201–208, February 1960**
**Standard 60 IRE 23.S1.**

The operational and maintenance test is presented for determining whether phase or amplitude of the chrominance component of a color television signal is being altered by virtue of its being superimposed on a varying base, i.e., monochrome component. (*EI*, 1960)

**1,073. SUPERSENSITIVE IMAGE ORTHICON TUBE DEVELOPED**
**McAllister, J. F.**
***Electrical Engineering*, v. 79, pp. 168–169, February 1960**

This tube requires from 1/10 to 1/20 the light required by standard image orthicons, and will permit the origination of studio colorcasts under normal black-and-white lighting levels. It is capable of 25 to 50 percent more resolution than present image orthicons because its extreme thinness inhibits sideways leakage.

**1,074. SOME ASPECTS OF CINEMATOGRAPH CAMERA**
**Robertson, D. A.**
***British Kinematography*, v. 36, no. 2, pp. 29–38, February 1960**

Historical background and a description of some early cameras, such as B & H camera, etc., are included. Modern requirements, classified under studio cameras for sound shooting, cameras for location, hand cameras, and cameras for special purposes are discussed. Examples of each group of cameras in use are given. (*EI*, 1960)

**1,075. STORAGE VIDICON CAMERA TUBE**
***Electronic Technology*, v. 37, no. 3, p. 98, March 1960**
**(*AS&T*, 1960)**

**1,076. MONOCHROME REPRODUCTION OF COLOUR TV SIGNAL**
**Maurice, R. D. A.**
***Electronic Technology*, v. 37, no. 3, pp. 116–119, March 1960**

In a color television system, using the standard NTSC method of gamma correction, deterioration in orthochromatism of a monochrome compatible picture can be reduced by

the presence of a dot pattern due to the chrominance subcarrier. In the case of a true constant luminance type of NTSC system, the presence of the chrominance signal on the monochrome screen is deleterious. (*EI*, 1960)

**1,077. SIMULTANEOUS SIGNAL SEPARATION IN THE TRICOLOR VIDICON**
**Borkan, H.**
***RCA Review*, v. 21, no. 1, pp. 3–16, March 1960**

The operation of the tricolor vidicon, a single camera tube for color television, presents a novel circuit problem. The target structure contains considerable capacitance which couples the three output electrodes. Extraction of separate color signals in the presence of this cross-coupling impedance must be performed while maintaining a satisfactory S/N ratio. A general analysis of the problem is presented and several practical solutions are suggested. The system described involves low input impedance, feedback preamplifiers, and mixed-highs circuitry. (*EEA*, 1960, #5244)

**1,078. SPECIAL-EFFECTS AMPLIFIER FOR NON-COMPOSITE OR COMPOSITE MONOCHROME OR COLOR TELEVISION SIGNALS**
**Kennedy, R. C.**
***SMPTE, Journal of the*, v. 69, no. 3, pp. 166–172, March 1960**

A switching circuit has been designed to produce a doublet impulse transition of 0.05 $\mu$sec. The problem of clamping a color signal during the burst interval by means of crystal diodes is discussed and a solution presented. Nonlinear amplification of the switching data prior to regenerative clipping has been found to permit dependable switching with much smaller brightness changes.

**1,079. REACTIVATION OF IMAGE ORTHICONS UNDER LOW TEMPERATURES**
**Wolfe, B.**
***IRE Transactions on Broadcasting*, v. BC-6, no. 1, pp. 27–28, March 1960**

A brief description is given of statistical evidence on reactivation and S/N improvement of image orthicons discarded because of excessive "sticking," noise, or loss of target. Best results are obtained with tubes which have "rested" 90 days or longer in cold storage. (*EEA*, 1960, #5861)

**1,080. FUNDAMENTAL AND HARMONIC DISTORTION OF WAVES FREQUENCY-MODULATED WITH SINGLE TONE**
**Medhurst, R. G.**
***Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering*, v. 107, no. 32, pp. 155–164, March 1960**
**(Also available as Paper 3182E, Institute of Electrical Engineers, Great Britain, 1960)**

A new approximation formula for the distortion of single-tone FM by passive networks whose amplitude and phase characteristics are nonlinear with frequency is discussed. Particular attention is given in analysis to distortion of the amplitude and phase of the fundamental, this being of importance in connection with television baseband requirements. Twenty-five references are included. (*EI*, 1960)

**1,081. RECOVERY OF A BAND-LIMITED SIGNAL, AFTER INSTANTANEOUS COMPANDING AND SUBSEQUENT BAND LIMITING**
**Landau, H. J.**
***Bell System Technical Journal*, v. 39, pp. 351–361, March 1960**

If $f(t)$ is a band-limited function, with band limit $-\Omega$ to $\Omega$, the result of instantaneously companding $f(t)$ is in general no longer band-limited. It has been proved that knowledge of merely those frequencies of the compandor output which lie in the band from $-\Omega$ to $\Omega$ is sufficient to recover the original signal $f(t)$. An iteration formula has been proposed that, in theory, performs the desired recovery. Questions raised by this formula are studied in detail. It is shown that the approximations converge to the solution $f(t)$ at a geometric rate, uniformly for all $t$, and that the iteration procedure is stable.

**1,082. CAMERA CONTROL SYSTEM FOR ROCKET SLED TESTS**
**Gardner, F. M., Hawn, L. R.**
***Electronics*, v. 33, pp. 63–65, April 1, 1960**

A sled-mounted UHF receiver-controller converts radio link signals into camera control commands. The receiver uses a bandpass filter made of etched-board transmission line. The camera control unit is transistorized and specially packaged to withstand the severe shock and vibration encountered at supersonic speeds.

**1,083. TECHNIQUES OF DELAY EQUALISATION**
**Thiele, A. N.**
***Institution of Radio Engineers, Australia, Proceedings of the*, v. 21, no. 4, pp. 225–241, April 1960**

Curves and formulas for frequency delay and transient responses of low-pass networks, and the method for deriving and describing all-pass networks in terms of equivalent low-pass networks are discussed. The nature of delay errors in vestigial sideband transmission, and the method for compensating these RF delay errors in video circuits are also described. (*EI*, 1960)

**1,084. DELAY AND TRANSIENT PROBLEMS IN TELEVISION BROADCASTING**
**Brownless, S. F.**
***Institution of Radio Engineers, Australia, Proceedings of the*, v. 21, no. 4, pp. 253–264, April 1960**

Definitions are given of observed effects of transient distortion. Methods of transient response measurement are

discussed as well as the relation between transient and steady-state response. Various ways of specifying delay, and methods of measuring them are indicated. Amplitude, decay, and waveform correctors are discussed. (*EI*, 1960)

1,085. TELEVISION FOCUS INDICATOR UNIT
Potter, J. B.
*Electronic Engineering*, v. 32, no. 386, pp. 240–241, April 1960

A transistorized television focus indicator is described which allows objective criterion to be applied to electrical and optical focusing of any television picture signal source. The operation is based on the fact that with correct focus of image conversion equipment, the high frequency content in the picture signal is relatively maximum. (*EI*, 1960)

1,086. WIDE-BAND TELEVISION SWITCHING SYSTEM
Aha, R. S.
*SMPTE, Journal of the*, v. 69, no. 4, pp. 256–258, April 1960

The development by the Tarc Electronics Corp., Westbury, N.Y., of a system using standard techniques, but incorporating a distribution amplifier used as input and output amplifier capable of a bandwidth of more than 17 Mc, is discussed. A small, very low-capacity relay is an integral part of the system. The design of relays, amplifier stages, video distribution system, and switching system operation, capable of accommodating an input of 5 v and providing an output signal of up to 2½ v peak-to-peak with a negligible amount of distortion on the sine-wave signal is described. (*EI*, 1960)

1,087. AUTOMATIC SENSITIVITY CONTROL FOR MONOCHROME FILM CAMERAS
Bendell, S. L., Sadashige, K.
*SMPTE, Journal of the*, v. 69, no. 4, pp. 259–260, April 1960

The problem of accommodating unpredictable variations in average density of films and slides used in TV programming and the need to develop devices for automatic control of signal levels from vidicon camera chains are discussed. Details are given of the device, built by RCA, Camden, N.J., which provides control over a wide range of densities, with the particular advantage being that the method of injecting control avoids introduction of "bounce" into video signals. (*EI*, 1960)

1,088. TWO NEW *f*/1.9 LENSES FOR 16MM AND VIDICON CAMERAS
Aklin, G. H.
*SMPTE, Journal of the*, v. 69, no. 4, p. 288, April 1960

Improved resolution and matched spectral transmission of the two lenses are offered.

1,089. MULTIPLE-BEAM PICKUP CAMERAS. PRINCIPAL PROBLEMS ENCOUNTERED
Billard, P.
*Acta Electronica*, v. 4, no. 2, pp. 151–188, April 1960 (in French)

A study is presented of cameras with optical systems designed to transmit at least two images for simultaneous application to television camera tubes and to light-sensitive film. The different sensitivities of film emulsions and photosensitive camera screens are studied and compared. Similarly, numerous beam-splitting techniques, together with their associated optical systems and focusing methods, are described in detail. Finally, the criteria for selecting the optimum system to suit the application are briefly discussed. (*EEA*, 1961, #442)

1,090. COMBINATION OPTICAL SYSTEMS WITH CONSTANT FOCUSING APPLICATION TO THE DESIGN OF MULTIPLE-IMAGE CAMERAS
Billard, P., Oliffson, M.
*Acta Electronica*, v. 4, no. 2, pp. 189–214, April 1960 (in French)

The design of such a system is studied for the case where the objective-focal phase distance approximates to the focal length and for telephoto and wide-angle lenses. Five such objectives with focal lengths ranging from 50 to 300 mm are described. The same procedure can be extended to the design of a system giving images of different size for a television and a motion-picture camera. (*EEA*, 1961, #443)

1,091. THE DESIGN OF TRANSISTOR VIDEO AMPLIFIERS
Audebert, M.
*Acta Electronica*, v. 4, no. 2, pp. 215–228, April 1960 (in French)

For such an amplifier, having a pass band of 10 Mc, the common-emitter configuration alone is to be considered. From the Miller effect within the transistor and the cut-off frequency, an expression is derived for the optimum load resistance of a stage corresponding to a maximum value of the product gain × bandwidth. To compensate for the fall in response at HF, it is possible to include either (1) an RC network in the emitter circuit which reduces the gain at LF; or (2) an inductance in the collector circuit, so providing, if desired, over-compensation. A mixture of both is advocated. Input noise is made up of two components—the normal calculable circuit noise, and the abnormal noise which is inversely proportional to frequency. The noise amplitude for various input-impedance conditions is studied. (*EEA*, 1961, #438)

1,092. TRANSISTOR PREAMPLIFIER FOR TELEVISION CAMERA
Enselme, L.
*Acta Electronica*, v. 4, no. 2, pp. 229–245, April 1960 (in French)

The noise components of a transistor are studied and a practical method of measurement is described. The fluctuation in noise level between different transistors of the same type is emphasized. The S/N ratio of a wideband amplifier stage is then studied. As a result, in the design of the amplifier, the first stage has a high input impedance and high gain but the response starts to fall at a comparatively low frequency. The second stage has a flat response but, thanks to a feedback loop to the input stage, the overall characteristic for the two stages is improved. A third stage has a rising characteristic so that the resultant characteristic is now flat. The amplifier is terminated with two further flat stages, giving an overall characteristic flat within 3 db from 40 cps to 8.5 Mc with a total current gain of 25,000 and a S/N ratio of 25 db. (*EEA*, 1961, #439)

**1,093. A TRANSISTORIZED GENERATOR OF TELEVISION SYNCHRONIZING AND BLANKING SIGNALS**
**Borne, J.**
***Acta Electronica*, v. 4, no. 2, pp. 247–256, April 1960**
**(in French)**

This generator is designed to meet the requirements of the French 819-line, 50-frame interlaced system. The reference frequency source is provided by either: (1) a crystal-controlled 40,950-cps transistor oscillator when operating independently of the local mains supply; or (2) a multivibrator of about this frequency for use when the television system is tied to the mains supply, the exact frequency being automatically controlled by phase comparison of the power supply frequency and the resulting frame pulses. The line pulses are derived from the reference oscillator by a single binary divider; the frame pulses by a 10-stage binary divider modified by appropriate feedback loops to convert the 1024 ($= 2^{10}$) count to 819. A series of transistor uni-vibrators shape the final sync and blanking signals. (*EEA*, 1961, #440)

**1,094. A PORTABLE TRANSISTORIZED TELEVISION CAMERA**
**Fournol, J. M., Enselme, L.**
***Acta Electronica*, v. 4, no. 2, pp. 257–271, April 1960**
**(in French)**

The equipment consists of two units, the camera proper, which is designed for supporting on the shoulder, and a pack carried on the back. The first unit incorporates the vidicon camera tube, a monitoring receiving CRT mounted above the vidicon, and the video pre-amplifier. The second unit includes the scanning generator, the power supply circuits, batteries, and the main video amplifier. Many of the normal controls, such as gamma correction and black level adjustment, are omitted, but video alignment correction is included and described. Descriptions are also given of the aperture correction circuit, and the EHT supply circuit and its stabilization. (*EEA*, 1961, #1669)

**1,095. AN ELECTRONIC VIEW-FINDER FOR MOTION-PICTURE CAMERAS**
**Billard, P., Maillard, J.**
***Acta Electronica*, v. 4, no. 2, pp. 273–288, April 1960**
**(in French)**

The viewfinder takes the form of a simple "closed system" television equipment, consisting of a vidicon camera tube feeding a television picture tube. A single multiple-image optical system is provided for both television and film cameras. The design of the equipment and the means whereby it is used to provide information on illumination intensity are studied in detail. The controls are described but not the circuitry. (*EEA*, 1961, #441)

**1,096. A DOUBLE-STANDARD TELEVISION CAMERA**
**Billard, P., Enselme, L., Fournol, J. M., Maillard, J., Oliffson, M.**
***Acta Electronica*, v. 4, no. 2, pp. 289–314, April 1960**
**(in French)**

The design of such a camera, giving identical pictures on a 819- and a 625-line system, is described. The camera embodies a beam-splitting optical system and two image-orthicon cameras. The optical, photometric and cross-talk problems are studied. The main constituent parts are described and details given regarding lens changing, focusing, and gamma control. Brief mention is also made of the associated rack-mounted channel amplifiers and monitors. Possible applications for the equipment to color television and stereoscopic working are suggested. (*EEA*, 1961, #1670)

**1,097. TRANSMISSION OF SLOW TELEVISION IMAGES ON TELEPHONE OR RADIO LINKS**
**Cazalas, A., Picot, B.**
***Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 250, no. 19, pp. 3140–3141, May 9, 1960**
**(in French)**

To transmit a high definition picture of 1 $cm^2$, consisting of 200,000 raster elements over a bandwidth of 1000 cps, a scan duration of 100 sec is required, and an analyzer without storage properties would yield a signal current of $5 \times 10^{-13}$ amp when using a cell with a sensitivity of 100$\mu$A/lu. It is proposed to employ the Isoscope, a slow electron-scan camera tube developed by R. Barthelemy. Best reproduction is achieved by means of a light-sensitive screen treated with potassium chloride, which turns violet purple under electron bombardment. To erase the image, a mica sheet, backing the screen, is heated by means of an incorporated transparent conductor grid. As an alternative display device, a standard converter tube could also be used. (*EEA*, 1960, #5245)

**1,098. QUADRATURE NETWORK FOR GENERATING VESTIGIAL-SIDEBAND SIGNALS**
**Gouriet, G. G., Newell, G. F.**
***Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering,* v. 107, no. 33, pp. 253–260, 281–284, May 1960**
**(Also available as Paper 3054E, Institution of Electrical Engineers, Great Britain, 1960)**

A method of generating an approximately quadrature signal from a given signal, using a linear network comprising a tapped delay line, is discussed. A vestigial-sideband signal free from phase distortion can be produced by this means. Results obtained with an experimental version of the quadrature network in producing a vestigial-sideband of a 405-line television signal with a video bandwidth of 3 Mc is included. (*EI*, 1960)

**1,099. NEW IMAGE ORTHICON HAS DOUBLED LIFE EXPECTANCY**
***Westinghouse Engineer*, v. 20, p. 96, May 1960**
**(*AS&T*, 1960)**

**1,100. THE ADAPTATION OF THE N.T.S.C. SIGNAL TO SEQUENTIAL COLOUR TELEVISION SYSTEMS**
**Wirth, K.**
***Onde Électrique*, v. 40, pp. 411–414, May 1960 (in French)**

In color television there are two systems, the RCA, using three scanning beams, and the sequential, as represented by the Chromatron and more recently the Apple tubes. In these, the beam from a single gun applies the signal sequentially to the three phosphors. In the Chromatron the beam passes through a grid near the screen. The grid produces a sinusoidal deviation of the spot, the phosphors being arranged in horizontal lines. The grid voltage at the same time registers the beam position. In the Apple tube the phosphors are in vertical lines, the beam passing over them in sequence horizontally. Behind the phosphors are parallel lines of a high secondary emission material, the beam position being given by the secondary emission current. Sequential tubes are not only simpler in construction but the electronic circuits are simpler if an appropriate code is used. It is shown that the American NTSC signal can be used provided specially modified circuits are employed. However, these can be omitted if a different ratio of colors is used in the chrominance signal. One such combination is worked out mathematically. Vector diagrams and three references are given. (*EEA*, 1962, #1241)

**1,101. LINEAR DISTORTION STUDY IN A TELEVISION TRANSMISSION SYSTEM**
**Kinoshita, K., Yasuhiro, T.**
***Onde Électrique*, v. 40, pp. 415–420, May 1960 (in French)**

It is shown that, in a limited band, the characteristic of a television transmission system of which the response to a square wave presents a minimal distortion is given by a curve of the second degree. In practice one must fix the allowable tolerances of this characteristic in both amplitude and phase. The rise time and rate of decay are calculated by the response of a square wave as a function of the variation of amplitude and phase. In this case all parts of the system are taken into account from the optics of the camera to the screen of the receiver. The tolerances are suitably proportioned between the various parts of the system, and in considering any particular part it may be necessary to choose a waveform other than square. In order to determine the optimal characteristic several hypotheses are laid down. Formulae are developed to determine the characteristic in the general case, the individual effects in practice due to amplitude and phase distortion, and finally the effect of the combination of the two. (*EEA*, 1962, #1239)

**1,102. FIRST MISSILE-BORNE TV SUCCESSFULLY DEMONSTRATED**
**Malcarney, A. L.**
***Electrical Engineering*, v. 79, pp. 432–433, May 1960**

The television system developed for this test incorporates a "slow scan" technique which transmits a series of high resolution still pictures. Only 1/100 of the bandwidth normally used to transmit such pictures is required.

**1,103. SUPPORTING RESEARCH AND DEVELOPMENT PROGRAM FOR ADVANCED TELEVISION CAMERA TUBES**
**Choi, O., Gray, S., Handel, R. R., Heil, H., Hoffman, R. E.**
**March 15–June 14, 1960**
**Radio Corporation of America, Harrison, N. J.**
**Scientific Report 4, AF 33(616)-6633**
**AD-240,235**

Eleven more tubes were constructed, some with nickel plug storage elements and some with aluminum oxide storage elements. A suitable target sealant was found. Pure chromic acid anodic films free of sulfuric acid doping were successfully etched into mesh structures. One 750-line nickel plug target with separate collector mesh was processed and operated in a tube. A combination oxidation-plus-reduction firing schedule was developed for photo resist removal.

**1,104. NEW RECEIVING TUBES AND SPECIAL PURPOSE TUBES**
***Electronic Industries*, v. 19, pp. 83–85, June 1960**

Tables are presented of pertinent data on camera tubes, magnetrons, multiplier phototubes, thyratrons, etc., released from June 1959 to May 1960.

**1,105. PERFORMANCE OF TELEVISION CAMERA LENSES**
**Cook, G. H.**
***SMPTE, Journal of the*, v. 69, no. 6, pp. 406–410, June 1960**

Optical aberrations are unavoidable in lens systems, and suitability of the lens is dependent on the extent of these and the manner in which they are balanced. Optical requirements for television can be well defined, and it is worthwhile to design lenses specifically for television purposes. Advantages obtained can be expressed qualitatively by test methods based on these requirements. (*EI*, 1960)

**1,106. RUGGED TV CAMERA NEEDS NO AUXILIARY HOUSING**
*Electrical Engineering*, v. 79, p. 544, June 1960
(*AS&T*, 1960)

**1,107. SINE-SQUARED PULSES IN TELEVISION SYSTEM ANALYSIS**
Kennedy, R.
*RCA Review*, v. 21, no. 2, pp. 253–265, June 1960

Methods of pulse generation are presented, as well as methods of testing various portions of system bandwidths by use of shaped bars. Rating factors, T and 2T pulses, time-series computations, envelope delay, and linearity testing, are also considered. (*EI*, 1960)

**1,108. OPTIC-MECHANICAL CONSIDERATIONS FOR THE DESIGN OF TV CAMERAS**
Lindner, P., Kosche, E.
*Technische Mitteilungen BRF*, v. 4, no. 2, pp. 52–60, June 1960 (in German)

Constructional data for the optimal setting of camera controls are derived from given optical and lighting conditions. For picture angle variation, focusing, beam current, and contrast regulation, some new kinematic and constructional solutions are indicated. Eleven references are included. (*EEA*, 1961, #444)

**1,109. AN INFRARED IMAGE TUBE FOR THE SPECTRAL REGION OF 1 TO 40 MICRONS**
Keyes, R. J.
July 5, 1960
Massachusetts Institute of Technology, Lincoln Laboratory, Lexington
R-85G-0004 (supersedes R-85G-0004, AD-239,488), AF 19(604)-5200
AD-258,795
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Efforts were made to fabricate a device that will continuously transform infrared images into visible reproductions. Converters which utilize the photoconductive process in general have high sensitivity, high speed of response, and spectral characteristics which are intrinsic to the particular photoconductor. This type rather than one based on the thermal principle or the photoemissive principle was selected. The tube proposed utilizes a photoconductor sensitive to 40 $\mu$ and a photoemitting surface sensitive in the visible portion of the spectrum. Characteristics of this tube are described. The proposed tube has all the advantages associated with vidicon operation, plus the additional advantage that a wide variety of photoconductors can be used whose resistivity is not suitable for vidicon conversion. The pilot tube has demonstrated the validity of the image conversion concept.

**1,110. A PNEUMATIC ULTRASONIC TRANSMITTER FOR A LOW-COST REMOTE CONTROL (OF TELEVISION RECEIVERS)**
Tappan, W., Vaccaro, A. C., Babcock, L.
*IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 2, pp. 31–34, July 1960

A pneumatic ultrasonic transmitter capable of generating a high-output 40-kc tone burst was developed and applied to a low-cost wireless television remote control. Advantages over the more conventional transmitters, such as the struck gong or transistorized radiators, are economy, no batteries, higher output, durable construction, and ease of tuning. Because of the higher output, fewer and less expensive components are required in the receiver. Design parameters, circuit design, and operating results are discussed. (*EEA*, 1961, #982)

**1,111. A NEW TV CONTROL PACKAGE, TRANSISTORIZED FOR COMPACTNESS**
Wolff, R., Marks, M.
*IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 2, pp. 35–39, July 1960

The adaptation of remote control to television is somewhat limited by the size of the remote control receiver. As the size of contemporary television sets decreases, space allocation becomes increasingly important. The use of transistors for the remote amplifier not only alleviates the space problem, but also makes continuous standby operation attractive because of the negligible power consumed. Among the many problems that are important in designing an ultrasonic multifunction remote control system, the five that are most significant are noise immunity, efficient power detection of selected frequencies, variation in transistor characteristics, temperature, and power consumption. The solution of these problems has made possible a very small low-cost unit, comparable in quality to existing vacuum-tube versions. (*EEA*, 1961, #983)

**1,112. DESIGN FOR A TRANSISTORIZED CLOSED-CIRCUIT TV CAMERA**
Clark, R. J.
*Electronic Industries*, v. 19, pp. 176–178, July 1960

A complete description of the General Electric Type TE-9-A transistorized camera is given.

**1,113. MOBILE TELEVISION CAMERA AND RECORDING VEHICLE**
Harris, A.
*British Institution of Radio Engineers, Journal of the,* v. 20, no. 7, pp. 553–559, July 1960

Television pictures may be recorded while the unit is in motion or at rest. Details are given of vision and sound facilities and a power supply system. Mechanical arrangement of vehicle and equipment mounting is also described. (*EI*, 1960)

**1,114. A DEVELOPMENT TRICOLOR VIDICON HAVING A MULTIPLE-ELECTRODE TARGET**
Weimer, P. K., Gray, S., Beadle, C. W., Borkan, H., Ochs, S. A., Thompson, H. C.
*IRE Transactions on Electron Devices,* v. ED-7, no. 3, pp. 147–153, July 1960

Color television cameras which are now widely used require three separate camera tubes to supply the simultaneous primary color information transmitted by the compatible system. A developmental tricolor camera tube of the vidicon type for use in a single-tube color camera is described. The ability to generate the three simultaneous signals is achieved in the tricolor vidicon by means of a multiple-electrode target structure having three interlocking groups of color-sensitive strips connected to separate output terminals for each primary color. A single low-velocity electron beam scans the photoconductive target. No special requirements are made on the beam with respect to focus or scanning accuracy. Registry of the three signals is inherent in the design of the target. The performance of the developmental cameras which have been constructed to date does not equal the three-tube image orthicon camera from the standpoint of sensitivity, color fidelity, and uniformity. In its present state, the tube is potentially useful for industrial and scientific purposes where sufficient light is available and structural defects do not obscure the information desired. To extend its range of application, the development of more sensitive photoconductors and improved methods of fabrication are required. (*EEA*, 1961, #979)

**1,115. APPLICATION OF TRANSISTORS TO VIDEO EQUIPMENT. III.**
Hiwatashi, K., Fujimura, Y., Suzuki, K., Mii, N.
*Semiconductor Products,* v. 3, no. 7, pp. 26–28, July 1960

The head amplifier, horizontal-deflection circuit, and power-supply units for a portable image-orthicon camera are described. (*EEA*, 1960, #6984)

**1,116. ELECTRONIC CAMERA TAKES MOVIES**
*Radio-Electronics,* v. 31, p. 33, July 1960
(*AS&T*, 1960)

**1,117. TRANSISTORIZED CARRIER SYSTEM FOR TV**
Schimpf, L. G.
*Bell Laboratories Record,* v. 38, pp. 253–255, July 1960

An explanation of how transistors are used to transmit television signals over the coaxial-cable portion of a TV transmission system is given, with particular emphasis on the advantages of transistors and engineering factors involved in designing the transistorized system.

**1,118. PROJECT EYE**
Chwalow, M. L. K.
August 1960
Frankford Arsenal, Philadelphia, Pa.
Memorandum Report M61-4-1
AD-245,973

Project EYE grew out of the realization that a fruitful approach to the problem of increasing the capability for passive seeing at low ambient levels of illumination in order to accomplish fire control under any night conditions lay in the direct modification of standard television tubes and techniques. Adoption of this approach has led to equipment capable of providing fire control under any conditions of starlight (no Moon) illumination yet encountered in test. The critical pickup tube can be made available in production quantities, from three sources, *a priori* at the same rate as standard image orthicons. The use of EYE equipment by the U.S.S. Skate on its epic initial subpolar voyage is reported. Also contained in the report are descriptions of the lash-up systems and prototype equipment efforts to date. Experimental and theoretical research and development efforts to effect an increase in the sensitivity of the systems are reported in detail.

**1,119. CV-668 (XA-1) AAR VIDEO SIGNAL CONVERTER**
Wion, D. A.
August 1960
HRB-Singer, Inc., Development Department, State College, Pa.
WADD TR 60-696, AF 33(600)-38391
AD-253,534

The considerations which prompted the design methods used for the Video Signal Converter are discussed. Photographs of main assemblies as well as main assembly drawings are included to supplement the discussion. Reliability and serviceability of individual subassemblies of the equipment are discussed in detail. An Alignment and Tests Section, covering a discussion on optical alignment, crater lamp alignment, first breadboard tests and other pertinent tests, is included. Also included is a section on the major problems encountered during the course of the contract. Finally, a complete circuit description of the Video Signal Converter, supplemented with a block diagram and schematic diagram, is presented.

**1,120. DESIGNING TRANSISTORIZED TELEVISION CAMERAS**
Carreon, D.
*Electronics*, v. 33, no. 37, pp. 72–75, September 9, 1960

Problems faced in transistorizing a TV camera include low frequency noise of transistors in video amplifiers, difficulties in the use of transistors in crystal oscillators, blocking oscillator frequency stability, and a wide variation in transistor characteristics. A camera that overcomes these problems is described. (*EI*, 1960)

**1,121. SYNCHRONIZER FORMS COMPOSITE TV PICTURES**
*Electronics*, v. 33, p. 104, September 30, 1960

A description is given of a Japanese-developed synchronizing system called an intersynchronizer which enables television images from one source to be superimposed on those from a second source. The unit can also wipe out part of the picture from one source and replace it with that from another to form a composite display.

**1,122. TRANSMISSION OF COLOUR TELEVISION SIGNALS**
Davidse, J.
*IRE Transactions on Broadcasting*, v. BC-6, no. 3, pp. 31–40, September 1960

Transmission based on the application of NTSC principles to the 625-line system is discussed, along with choice of chrominance signals, their bandwidths, and of subcarrier frequency. Consequences of the method of gamma correction, and of deviations from the constant luminance principle are given. (*EI*, 1960)

**1,123. VIERPOLNETZWERKE ZUR PHASENENTZERRUNG IN TIEFPASS-UND BANDPASSVERSTAERKERN (FOUR-TERMINAL NETWORKS FOR PHASE EQUALIZATION OF LOW-PASS AND BAND-PASS AMPLIFIERS)**
Coldewey, G.
*Frequenz*, v. 14, no. 9, pp. 299–305, September 1960

A discussion of envelope delay of practical TV transmission systems as a function of frequency is presented. The functions of equalizer circuit for linearization of frequency response of envelope delay are discussed. The calculating procedure for the equalization of any given frequency response of envelope delay is also included. Equalizer circuits are examined. (*EI*, 1961)

**1,124. PROTOTYPE TELEVISION CAMERA**
*Engineer*, v. 210, pp. 438–439, September 1960
(*AS&T*, 1960)

**1,125. FOCUSING RETURN OF SECONDARY ELECTRONS FROM THE TARGET OF IMAGE ORTHICON**
Ninomiya, T.
*Institute of Electrical Communication Engineers of Japan, Journal of the*, v. 43, no. 9, pp. 952–958, September 1960
(in Japanese)

A double-mesh type of image orthicon has recently been developed in the NHK Technical Research Laboratories, Tokyo, and is found to reduce the black-border defect and ghost images in highly lighted television pictures. Tubes of this type have been used by the NHK TV network since February 1960, with satisfactory results. Introduction of a new idea, the focusing return of secondary electrons, results in further improvement of the characteristics of the double-mesh type of tube and eliminates the white halo and the clouding defect. Theoretical analysis is carried out for the condition in which the uniform focusing magnetic field is parallel to the accelerating electric field. The focusing return of all the secondary electrons emitted from the target is found to occur when a certain stated relation is fulfilled. In practice it is difficult to satisfy this relation exactly, but the approximate focusing return is attained easily when a positive-potential region exists close to the target. To realize the desired linear potential distribution in this region, two meshes are used, one positive and the other negative with respect to the target mesh, the positive mesh being adjacent to the target. (*EEA*, 1961, #4287)

**1,126. AN EXAMPLE OF A GENERATOR OF "STANDARD SIGNALS" "TEST LINES"**
Tasso, J.
*Onde Électrique*, v. 40, pp. 624–629, September 1960
(in French)

Problems arising from the insertion of standard signals into the vertical blanking period in television are discussed. The equipment subsequently constructed to generate these signals is described with the aid of block diagrams and photographs. It is claimed that the different utilization of even and uneven frames does not, in practice, lead to extra complications, while any disturbance to the viewer is reduced to a minimum. (*EEA*, 1961, #5858)

**1,127. TV CAMERA WITHSTANDS NUCLEAR RADIATION EXPOSURE**
*Electrical Engineering*, v. 79, p. 779, September 1960
(*AS&T*, 1960)

**1,128. DEVELOPMENT OF A HIGH SLOPE TELEVISION PICTURE TUBE**
Gundert, E., Lotsch, H.
*Telefunken Zeitung*, v. 33, pp. 223–230, September 1960
(in German)

With a view to transistorized television receivers, the development of a special CRT is described, requiring 7- to 8-$v_{p\text{-}p}$ drive for an 800-$\mu$a beam current. This is achieved in

principle by the introduction of a mesh of rigid frame grid construction adjoining the grid orifice and facing the cathode. The performance obtained in drive improvement is predicted theoretically. Electron dispersal across the mesh (normal to the beam) causes a flattening of the beam; this can be overcome by special design of the electron-optical acceleration system and the use of dynamic post-focusing. One of the achievements of the new design is the low interaction between beam current and spot size. The salient points of the mechanical design are described. Several enlarged raster photographs indicate the resolution achieved. A useful specialized bibliography of 23 items is included. (*EAA*, 1961, #7072)

**1,129. BLACK-BORDER EFFECTS IN THE IMAGE ORTHICON**
**Miyashiro, S.**
***Institute of Electrical Communication Engineers of Japan, Journal of the*, v. 43, no. 10, pp. 1083–1090, October 1960**
**(in Japanese)**

The generation and characteristics of the secondary electrons emitted from the target mesh, and to which spurious effects such as the black-border effect are due, are investigated in detail. Experiments with a Type 5820 image orthicon are described which show how the black-border width depends on such factors as the contrast ratio of the bright body to its background, the size of the bright body, and the ratio of the bright-slit width to the picture height. (*EEA*, 1961, #4289)

**1,130. ANALYSIS OF THE ANTI-BLACK-BORDER TYPE IMAGE ORTHICON**
**Miyashiro, S.**
***Institute of Electrical Communication Engineers of Japan, Journal of the*, v. 43, no. 10, pp. 1102–1109, October 1960**
**(in Japanese)**

In order to minimize the black-border effect, an experimental image orthicon was made with another mesh (collector mesh) inserted between the target mesh and the photo cathode. To obtain reasonably good focusing in the image-section, it was found that the distance between the collector mesh and the target assembly must be $< 10$ mm. There is an optimum collector-mesh voltage which gives a minimum black-border effect. The general characteristics of this type of tube are discussed, and other methods of minimizing the black-border effect are described. (*EEA*, 1961, #4288)

**1,131. SYNCHRONOUS DEMODULATOR FOR TELEVISION: FOR VESTIGIAL-SIDEBAND SYSTEMS**
**Walker, P. J.**
***Electronic Technology*, v. 37, pp. 378–382, October 1960**
***(AS&T*, 1960)**

**1,132. DEVELOPMENT OF AN AUTOMATIC TRACKING ERROR MEASURING DEVICE**
**October 1960**
**United Aircraft Corporation, Norden Division, White Plains, N.Y.**
**APGC TN-60-94, AF 08(603)-4574**
**AD-246,199**

The reported quarter produced finalization of equipment design and construction, system operation and testing, operational improvements resulting from this testing, and preparation for the acceptance tests and scheduled field engineering tests. A detailed description is given of the Camera Control Unit, photographic equipment, reticle generator, and the Error Measurement Unit. A system block diagram is appended to aid in understanding the system as a whole.

**1,133. CABLEFILM EQUIPMENT**
**Watson, S. N.**
***British Institution of Radio Engineers, Journal of the*, v. 20, no. 10, pp. 759–761, October 1960**

Cablefilm motion picture facsimile equipment has been developed for transmitting short lengths of 16-mm film over long distances as quickly as possible. A good quality music circuit for about 6-kc bandwidth is required. Techniques similar to those found in television are used, and although, in view of the narrow bandwith of transmission circuit, a considerable time is employed in transmission, the system is nevertheless many times faster than previously used facsimile systems. The reasons for the choice of the particular transmission standards employed are given. (*EEA*, 1961, #432)

**1,134. RESEARCH ON A PASSIVE RANGING METHOD**
**November 15, 1960**
**RCA Defense Electronic Products, Burlington, Mass.**
**Final Report CR-558-49 for May 9–November 9, 1960, DA 44-009-eng-4474**
**AD-255,238**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

An experimental investigation was made of a passive ranging method. The research evaluates human operator performance on a stereoscopic ranging task as a function of image quality and characteristics. Visual photographs, photographs degraded by scan lines, thermal photographs, and video photographs were presented in a stereoscopic trainer, and operators' performance was assessed. The results indicate that accuracy decreases with increasing image degradation. The results suggest that image enhancement techniques may increase ranging accuracy with very poor quality images. Twelve references are included.

**1,135. A CLOSED CIRCUIT TV SYSTEM FOR PASSIVE USE AT NIGHT**
**Hicks, G. T., Whitfield, C. M., Jr.**
**November 23, 1960**
**Office of Naval Research, Naval Research Laboratory, Washington, D.C.**
**NRL R-5557**
**AD-248,511**

Experiments were performed with a closed-circuit TV system designed for applications involving nighttime viewing. Various lenses and recently improved TV camera tubes designed for low light levels can be used in the system. Aero-Ektar 24-in. *f*/6 and 12-in. *f*/2.5 lenses can be used with the RCA C-73410 image orthicon tube, the RCA C-73477 image intensifier orthicon tube, or the General Electric Z-5294 image orthicon tube, and a 10-in.-D Schmidt optical system can be used with the C-73477 tube. Information is displayed in final form on a 10-in. monitor screen at a luminance level adequate for conventional photography or for viewing without the necessity of prior dark adaptation of the eyes The system was tested under low light level conditions on rocket flights, outdoor scenes, stars, and a resolution chart. The highest sensitivity was obtained with the Schmidt collector and the C-73477 tube, visibility thresholds being about the same as for a dark-adapted eye with a 7 × 50 binocular. The use of storage would increase the sensitivity beyond that of the dark-adapted eye. Under these moonlight-to-starlight conditions, the pictorial results indicate that these new camera tubes have a sensitivity increase of 20 to 100 over studio-type camera tubes.

**1,136. A TRANSISTORIZED VIDICON CAMERA FOR INDUSTRIAL USE**
**Diehl, M. H.**
***SMPTE, Journal of the*, v. 69, no. 11, pp. 795–800, November 1960**

Problems encountered in transistorizing video, sync timebase and power supply circuits are discussed. There are four integrated optical accessories: remote focus, remote iris, remote turret and douser. Performance characteristics of the camera under conditions of shock and vibration, temperature extremes, and high acoustical noise level are given. (*EEA*, 1961, #2719)

**1,137. FOCAL-PLANE SHUTTERS AND THE DESIGN OF HIGH-FRAME-RATE CAMERAS (Presented at the Fifth International Congress on High-Speed Photography, Washington, D.C., October 20, 1960)**
**Jacobs, S. J.**
***SMPTE, Journal of the*, v. 69, no. 11, pp. 801–807, November 1960**

Operating principles for a new family of rotating-mirror framing cameras which make use of focal-plane shutters are described and examples are given. The basic concept is an extension of the idea of isotransport of image and film, presently found only in moving-film cameras. The rotating mirror and a number of prisms, plane mirrors, or concave mirrors are used to produce a sequence of connected frames which move past a fixed slit in the camera at constant velocity. The moving image segments seen through the slit are then relayed to a stationary film by means of a smear camera employing the same rotating mirror. The optics of the smear camera is arranged to stop the motion of each image on the film. As a consequence, a series of stationary images which have been scanned by a focal-plane shutter in a known way are formed on the film. Use of the focal-plane shutter offers the possibility of very precise time definition. Focal-plane shutter characteristics have both advantages and disadvantages with between-the-lens shutters. One advantage is that multiple slits may be employed. If the images from several equally spaced slits are relayed to independent film areas, it is possible to increase the number of frames and the effective framing speed of a camera without increasing rotor speed or sacrificing *f* number. Other possible uses of multiple-slit recording are described.

**1,138. ROTATING-MIRROR FRAMING CAMERA WITH MULTIPLE FOCAL-PLANE SHUTTERS (Presented at the Fifth International Congress on High-Speed Photography, Washington, D.C., October 20, 1960)**
**Jacobs, S. J., McLanahan, J. D., Donovan, P. F.**
***SMPTE, Journal of the*, v. 69, no. 11, pp. 808–812, November 1960**

This camera uses a number of concave mirrors with a single rotating mirror to create a connected sequence of images which pass several slits that act as focal-plane shutters. The images seen by the slits are relayed to form separate rows of frames by means of a smear-camera arrangement. By combining 36 concave mirrors with six properly phased slits, a total of 216 frames can be recorded in approximately 1/8 revolution of a rotating mirror. The camera, when constructed, will use two mirrored faces, 6 × 2 in., of a rectangular rotating mirror. At the anticipated rotor speed of 600 rps, approximately $10^6$ frames/sec will be attained. Each frame will be about 0.75 in. high and 1.0 in. wide. It will be possible to vary the shutter-to-framing-time ratio from about 0.5 to about 0.02 by varying the width of the slits used in the camera. The effective aperture will remain fixed at about *f*/22.

**1,139. A LINE SELECTOR FOR TV RESEARCH**
**Endacott, K. A., Cherry, E. M.**
***Institution of Radio Engineers, Australia, Proceedings of the*, v. 21, no. 11, pp. 820–821, November 1960**

Any line pulse in a composite TV waveform may be gated by the delayed output from a multi-vibrator and used to trigger a CRO at the start of the selected line. The circuit of a nine-valve unit is given. (*EEA*, 1961, #4823)

1,140. A STUDY IN THE APPLICATION OF TELEVISION TO OPTICAL RANGE FINDING TECHNIQUES
Hallermeier, W. D.
November 1960
Frankford Arsenal, Philadelphia, Pa.
Memorandum Report M61-12-1
AD-252,827

A study was made (1) to determine the feasibility of a televisual range finder system, and (2) to ascertain the modifications which would be needed in present television equipment and optical range finders in order to develop a combined television and complex optical system. Target ranging via closed-circuit TV is feasible where direct visual use of a range finder is prohibited by system configuration. It is recommended that a contrast enhancement study be started and that a system with improved light transmission and sensitivity be investigated. The development of more practical and sophisticated electro-visual equipment to improve ranging should be initiated.

1,141. GENERATOR SINUS-KVADRATICHNYKH IMPULSOV (GENERATOR OF SINE-SQUARE IMPULSES)
Evnevichchekan, O. V., Eremin, V. I.
*Elektrosvyaz*, v. 14, no. 11, pp. 21–25, November 1960
(Translated from the Russian in *Telecommunications*, no. 11, pp. 1203–1210, 1960)

A form of test signal for determining transfer characteristics of television components is discussed. The advantages of the sine-square type are pointed out, and a description of a signal generator is included. (*EI*, 1961)

1,142. A SUPER-FAST RECORDER FOR DAY AND NIGHT OBSERVATIONS OF SPACE VEHICLES USING A LIGHT AMPLIFIER CAPABLE OF SUPPRESSING THE BACKGROUND AND DISCRIMINATING MOVING OBJECTS
Gebel, R. K. H.
November 1960
Wright Air Development Division, Aeronautical Research Laboratory, Wright-Patterson AFB, Ohio
ARL TN 60-109, Report on Research on the Quantum Nature of Light
AD-250,256

The usefulness of the closed-circuit television light amplifier system capable of suppressing the background and discriminating moving objects is emphasized for detecting, tracking, and photographing missiles, etc. in flight. Special pick-up tubes were developed which produce video signals from moving objects only, and the mechanism involved is explained for two different solutions. These solutions are important in that it is the pick-up tube itself rather than any auxiliary electronic computer which delivers a signal representing the moving object only. The improvements which may be expected by using an image converter tube as light intensifier between an optical system and the photographic camera are briefly discussed. Fifty-six references are included.

1,143. RESEARCH ON ELECTRON BOMBARDMENT INDUCED CONDUCTIVITY TARGETS IN CAMERA TUBES
Lempert, J., Klotzbaugh, G.
November 1960
Westinghouse Electric Corporation, Pittsburgh, Pa.
Report on Research on the Quantum Nature of Light for June 1959–November 15, 1960, WADD TN 60-307, AF 33(616)-6496
AD-269,134
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

A method for calculating the resolution capabilities of a camera tube as a function of input illumination and tube design parameters is described. A description of experimental work on a successful method for obtaining a high minification image in a combination magnetic and electrostatic focused image tube is given. Results of an investigation of different target materials of the electron-bombardment-induced-conductivity type are reviewed. The construction and test of experimental camera tubes, consisting of high voltage variable-minification image sections, high gain targets of the electron-bombardment-induced-conductivity types, and scan sections with return beam multipliers, are discussed. Sixteen references are included.

1,144. CONTROLLED INTERFERENCE GENERATOR
Matthews, W. E., Mothersole, P. L.
*Electronic Engineering*, v. 32, pp. 685–688, November 1960
(*AS&T*, 1961)

1,145. MARCONI MARK IV TELEVISION CAMERA
*Engineering*, v. 190, pp. 758–760, December 2, 1960
(*AS&T*, 1961)

1,146. METHODS AND LIMITATIONS OF THE TELEVISION CAMERA TECHNIQUE
Theile, R.
*Elektrotechnische Zeitschrift, Ausgabe A*, v. 81, no. 25, pp. 895–903, December 5, 1960 (in German)

Flying-spot scanning and charge-storage systems for generating picture signals are explained in general terms. Superorthicon, super-iconoscope and vidicon camera-tubes are described in greater detail. Resolution is limited by the prescribed number of lines and picture elements for a given bandwidth. Further deterioration is caused by the finite dimensions of the scanning spot, imperfections of the optical system, and interaction between adjacent picture elements. The limit of sensitivity is dependent on random variations of charges of single elements, due to the relatively low number of electrons per element. Other noise sources are also important, among them thermal effects in the network, coupling the camera tube to the amplifier, and amplifier noise itself. (*EEA*, 1961, #2062)

**1,147. INFRA-RED AND ULTRA-VIOLET TELEVISION CAMERAS**
*Engineering*, v. 190, p. 873, December 23, 1960
(*AS&T*, 1961)

**1,148. KERR CELL FRAMING CAMERA (Presented at the Fifth International Congress on High-Speed Photography, Washington, D.C., October 20, 1960)**
Goss, W. C.
*SMPTE, Journal of the*, v. 69, no. 12, pp. 889–891, December 1960

The design of a high-speed Kerr cell framing camera is described. A single Kerr cell, pulsed once, is used in conjunction with a system of optical delays to provide six consecutive pictures at interframe times of $1.5 \times 10^{-8}$ sec and exposure times of $5 \times 10^{-9}$ sec. The camera is $f/10$ at the 35-mm film plane, and the pictures have approximately $240 \times 600$ information lines content. Source image threshold energy is expected to be at an effective blackbody temperature of $\sim$0.5 ev for Tri-X film.

**1,149. ELECTROSTATIC LATENT IMAGE PHOTOGRAPHY**
Lester, H. L., Fisher-Colbrie, E.
December 1960
General Electric Company, Advanced Electronics Center, Cornell University, Ithaca, N.Y.
QER-4 for September 1–November 30, 1960,
AF 33(616)-6764
AD-250,325

During this reporting period, increased effort has been placed in the area of photoconductor investigation and evaluation, and in applied research in the study of and experimentation with the image transfer process. In addition to continuation of work in vacuum evaporation of cadmium sulfide, it is planned to experiment with vacuum deposition of cadmium selenide, antimony trisulfide, and other materials.

**1,150. ELECTRON-OPTICAL PROPERTIES OF A FLAT TELEVISION PICTURE TUBE**
Ramberg, E. G.
*IRE, Proceedings of the*, v. 48, no. 12, pp. 1952–1960, December 1960

Ray paths and focusing properties are calculated for the deflection and acceleration fields of a flat picture tube with lateral beam injection. The results give insight into the measures which must be taken to achieve linearity of deflection and to assure sharp spot focus over the picture area. Specifically, it is found that linear deflection can be obtained by the application of voltage variations to the deflection electrodes which do not depart greatly from linear variations between the prescribed maximum and minimum values. Horizontal focus is determined almost entirely by the focusing action of the gun and the horizontal deflection plates. The focusing action of the latter is such that the beam incident on the deflection field must be, in general, divergent. The point of divergence required shifts with the horizontal scan, resulting in the need for some kind of dynamic control of gun focus. The horizontal deflection fields, the fields between the accelerating electrodes, and the vertical deflection fields all contribute to vertical focusing. If the separation of the side plates of the horizontal deflection system is of the same order as, or less than, the height of the deflection structure, the first focus formed by the horizontal deflection field is re-imaged at the screen by the remaining focusing elements. The vertical deflection field alone will not focus a parallel incident pencil in the plane of the screen. (*EEA*, 1961, #2720)

**1,151. MODERN TRENDS IN CINE LENSES**
Cook, G. H.
*British Kinematography*, v. 37, no. 6, pp. 140–153, December 1960

Factors which affected the art of lens making are examined, and procedures adopted for the assessment of television camera lenses are described. A definition of photographic lens performance and resolving power is included. The introduction and use of polished glass surfaces which are not spherical in shape within photographic lens systems are discussed. (*EI*, 1961)

**1,152. COLOUR-TELEVISION TRANSMISSION WITH SIMULTANEOUS FREQUENCY AND AMPLITUDE MODULATION OF THE COLOUR CARRIER (FAM METHOD)**
Mayer, N.
*Rundfunktechnische Mitteilungen*, v. 4, no. 6, pp. 238–252, December 1960 (in German)

By modulating the color carrier simultaneously in frequency and amplitude, a color transmission system which is considerably simpler in comparison with other systems may be obtained. The properties of such a system, in which a luminance signal and the color-difference signals $(R'\text{-}y')$ and $(B'\text{-}y')$ are transmitted are presented. It is shown that, taking into account values of the color difference signals occurring in practical pictures, the method is comparable with the NTSC method in the principal quality characteristics. Reproduction of the composite color-signal on a color and monochrome receiver is demonstrated by means of screen photographs. (*EEA*, 1961, #5852)

**1,153. CONTRAST LAW CORRECTION IN TELEVISION PICTURE GENERATORS**
Brothers, D. C.
*Television Society, Journal of the*, v. 9, no. 8, pp. 324–339, December 1960

The transfer characteristics of the various links in the television chain are given, including those arising in motion picture film transmission and in telerecording. Sources of distortion, apart from those due to incorrect gammas, are incorrect black level, halation, veiling glare, black halo in image

orthicon tubes, and the effects of AGC. The gamma characteristics of camera tubes are then discussed in greater detail and possible corrective laws suggested. A method of setting up the equipment is explained and tables of data on camera tubes are given. Two appendices covering the "derivation of constants of multi-slope contrast law correctors" and the "relation between sensation and brightness changes" are included. (*EEA*, 1961, #5854)

**1,154. A PLUG-TYPE IMAGE ORTHICON TARGET**
Ochs, S. A.
*RCA Review*, v. 21, no. 4, pp. 558–569, December 1960

A new structure-type target for image-orthicon camera tubes has been investigated in the laboratory. It consists of an array of metal plugs embedded in an insulating film of aluminum oxide. Several experimental image orthicons containing such targets, in a 750- or 1000-mesh pattern, have been made. These tubes show very little or no image retention (sticking), either initially or after extended operation, and they perform well over a wide range of target temperatures. Due to the high resistance between elements, the plug-type target can store a high-resolution picture for a long time. Camera tubes containing plug-type targets are particularly useful for viewing low-light-level scenes, possibly at reduced scanning rates. (*EEA*, 1961, #1664)

**1,155. ELECTROSTATIC TAPE CAMERA FOR SATELLITE INSPECTION (Presented at the ARS Semiannual Meeting, Los Angeles, Calif., May 9–12, 1960)**
Spaulding, S. (Radio Corporation of America, Princeton, N.J.)
1960
American Rocket Society, New York, N. Y.
Paper 1199-60

An electrostatic tape television camera is described which could be used in an orbiting inspection vehicle to monitor the external aspects of test satellites. Placed in orbit with these satellites, the inspector vehicle can give visual data on the test performance of stabilization systems, the condition of the communication reflectors, and the performance of any exterior moving parts of the satellite.

The camera uses a tape constructed on the principles of the storage vidicon. The images are stored in charge patterns until read by an electron beam. An illumination source is included to permit frequent exposure throughout the complete orbit. (*AI/A*, 1960 #2789)

**1,156. ELECTRON BEAM MODULATION BY USE OF THIN LAYERS**
Fryszman, A.
*Archiv für Elektrotechnik*, v. 9, no. 4, pp. 655–676, 1960 (in Polish)

The current modulation of the scanning electron beam in television camera tubes and memory tubes is discussed, and modes of operation are analyzed by considering secondary emission characteristics and other parameters. (*EEA*, 1960, #1242)

**1,157. A NEW TELEVISION CAMERA WITH AN OPTICAL VIEW FINDER**
Michael, W.
*Hausmitteilungen Jos. Schneider & Co.*, v. 12, no. 5–6, pp. 49–64, 1960 (in German)

A general account of a new television camera with a four-lens turret is given. A new mechanism for reducing parallax between taking and finder lens is a major feature of the design. The errors in the mechanism are derived and their practical effects considered. (*EEA*, 1961, #3509)

**1,158. THE VIDICON**
Fryszman, A.
*Przeglad Elektron*, v. 1, no. 1, pp. 19–22, 1960 (in Polish)

Development work done in Poland on television camera tubes of vidicon type is briefly described. (*EEA*, 1960, #8325)

**1,159. THE DESIGN OF TELEVISION CAMERA HEAD AMPLIFIERS WITH PARTICULAR REFERENCE TO USE WITH VIDICONS**
Gibbs, J.
*A.W. A. Technical Review*, v. 11, no. 2, pp. 97–105, 1960

An expression is derived for the maximum gain-bandwidth product of a negative feedback head amplifier. Under these conditions, the amplifier may be represented by a constant-$k$ filter. Practical circuits are analyzed and the conditions for minimum noise discussed. (*EEA*, 1960, #3593)

**1,160. ON APERTURE DISTORTION (IN TV CAMERA TUBES)**
Valsa, J.
*Slaboproudý Obzor*, v. 21, no. 7, pp. 413–417, 1960 (in Czechoslovakian)

The aperture distortion produced by television camera tubes is analyzed. Non-storage tubes are first considered, and it is assumed that the scanning is done by means of an aperture (e.g., Nipkow disk). Such systems are characterized by the following parameters: light flux distribution function $R(\eta)$, a transient characteristic $A_r(\eta)$, and an equivalent amplitude and phase characteristic $A_r(\eta)$. These characteristics are determined for uniformly "transparent" square and circular apertures, a circular aperture whose light transmission coefficient is variable, and a symmetrical aperture whose transmission coefficient obeys the gaussian law. The above analysis is extended to storage-type tubes, where $R(\eta)$ represents the current distribution in the scanning beam. The transient characteristics of these tubes are evaluated. (*EEA*, 1960, #8334)

**1,161. ON THE OPERATING MECHANISM OF THE SUPERSILICON CAMERA TUBES. I.**
Fryszman, A.
*Bulletin de l'Académie Polonaise des Sciences. Séries des Sciences Techniques*, v. 8, no. 5, pp. 33–38, 1960

A mathematical analysis of the variations of potential of the target of an operating image orthicon is given. (*EEA*, 1962, #2974)

**1,162. ON MAXIMUM CURRENT IN PICKUP TUBES**
Fryszman, A.
*Bulletin de l'Académie Polonaise des Sciences. Séries des Sciences Techniques*, v. 8, no. 5, pp. 247–252, 1960

Using results of an earlier analysis of modulation of an electron beam by target layer, theoretical estimates of maximum values of the ratio of target current to beam current were obtained in terms of parameters of the layer's secondary-emission characteristic; this is done for the cases of cathode-potential as well as high-potential stabilization. (*EEA*, 1962, #2975)

**1,163. ELECTRON BEAM MODULATION BY MEANS OF A THIN LAYER IN A DECELERATING FIELD**
Fryszman, A.
*Bulletin de l'Académie Polonaise des Sciences, Séries des Sciences Techniques*, v. 8, no. 11–12, pp. 647–654, 1960

A mathematical analysis is carried out, using a simple model of the target current in a pick-up tube of the high-potential type (e.g., iconoscope), taking into account the return of photo and secondary electrons to the target. The dependence of signal current on an area of illumination and on potential of the illuminated part of the target agrees with observation. (*EEA*, 1961, #7068)

**1,164. DESCRIPTIONS AND RESULTS OF INVESTIGATIONS OF AN ELECTRONIC ULTRASONIC IMAGE CONVERTER**
Freitag, W., Martin, H. J., Schellbach, G.
In "Proceedings of the Second International Conference on Medical Electronics, Paris, June 24–27, 1959," pp. 373–379
Smyth, C. N., Editor
Iliffe and Sons, London, 1960

This description deals with a supersonic image converter which, because of its electronic mode of operation, operates with a picture frequency of 50 cps without inertia, and has a relatively high sensitivity, which makes it particularly useful in medico-diagnostic examinations. The results obtained with this converter are demonstrated. (*EEA*, 1961, #4131)

**1,165. O PLOTNOSTI ZAPISI SHIROKOPOLOSNYKH SIGNALOV (RECORDING DENSITY OF WIDEBAND SIGNAL)**
Goron, I. E., Drobyshev, Yu. P.
*Radiotekhnika*, v. 16, no. 1, pp. 59–66, January 1961
(Translated from the Russian in *Radio Engineering*, v. 16, no. 1, pp. 53–61, January 1961)

Possible methods of magnetic recording of wideband signals based on various principles of signal division are presented, and the concept of surface density of recording is introduced. A comparison of RCA, BBC, Ampex, and Bing Crosby TV recording systems is also included. (*EI*, 1961)

**1,166. PHASE FRESNEL LENS**
Miyamoto, K.
*Optical Society of America, Journal of the*, v. 51, no. 1, pp. 17–20, January 1961

The use of phase Fresnel lens in the pupil of an optical system to deform wave surface by a specified amount to improve image quality is described. The properties of such lenses are discussed. Applicability to the infrared region is also presented. (*EI*, 1961)

**1,167. DESIGN CHARTS FOR STABILIZED TELEVISION TIMEBASES**
Ciuciura, A.
*Mullard Technical Communications*, v. 5, no. 46, pp. 210–217, January 1961

Design charts are described which determine operating conditions of output tubes in stabilized television timebases. Limiting conditions are given in terms of maximum peak anode current and minimum anode potential at the end of the scan. Practical steps in construction of design charts for line output and field output tubes are also given. (*EI*, 1961)

**1,168. ELECTRONIC BRIGHTNESS CONTOURING**
Hallows, R. L.
*SMPTE, Journal of the*, v. 70, no. 1, pp. 23–27, January 1961

An unorthodox circuit technique is described in which a standard penode amplifier is operated to obtain a reversal of transfer characteristic slope. Projecting selected amplitude increments of a video signal over this reversing characteristic, and deleting remaining video portions not in the immediate vicinity of the reversal result in a signal having "off" response to levels on both sides of the input incremental level and a surprisingly well-defined "on" response to the included level. The contour signal thus derived may be added to the input signal to form a composite display in which the level of the contour may be continuously varied for observation or analysis. (*EEA*, 1961, #3506)

**1,169. TRAINING ERROR MEASURING DEVICE**
January 1961
United Aircraft Corporation, Norden Division, Stamford, Conn.
190 R 0035, Final Technical Report, APGC TR-61-4, AF 08(603)-4574
AD-250,276

A complete technical description is given of a tracking error measuring device, as well as the details of its final design. This device is a feasibility equipment capable of producing immediate coordinate readout of angular error between a desired target and reference bore-sight when used with a contraves cinetheodolite. It consists of a small optical system with a narrow field of view, a vidicon television camera, and control console. The control console contains a television monitor for visual observation of the field of view, a tracking unit that automatically senses the position of a desired target within the field of view, and a film recording equipment to provide a permanent record of the televised presentation. System performance as obtained in laboratory testing is included.

**1,170. A NEW TYPE OF VESTIGIAL-SIDEBAND FACSIMILE SYSTEM**
**Kubota, K., Kobayashi, K.**
***Review of the Electrical Communications Laboratory,* Japan, v. 9, no. 1–2, pp. 85–90, January–February 1961**

A vestigial sideband system for the high-speed transmission of facsimile signals is described. Simple methods are used for performing homodyne detection and eliminating quadrature distortion. At the transmitter, the maximum modulation factor is set at a small value, and a carrier frequency is transmitted. At the receiver, phase and amplitude-modulated components of the received signal are respectively eliminated by a bandpass filter and a limiter. The limiter output serves as the carrier for homodyne reception, obviating the need for an AFC system. (*EEA*, 1961, #7066)

**1,171. PROBLEMS OF UHF TELEVISION TRANSMISSION**
**Jaskolski, T. M. J.**
***Television Society, Journal of the,* v. 9, no. 9, pp. 351–366, January–March 1961**

These problems are surveyed under the headings: (1) "Transmitting Output Valves"; (2) "UHF Technique in the RF Amplifier Design"; (3) "Aerials and Transmission Lines"; and (4) "Combining Filters." Tetrodes and klystrons are studied; tables of operating data for these valves are given; and a detailed comparison of the two types is provided. The design of the UHF bypass capacitors, probes, and sliding contacts is briefly discussed. Of the three possible types of aerial — helical, slot, and stacked-dipole — the helical types with a practical gain of 25 are preferred and an actual design is described in some detail. For transmission lines elliptical waveguides are favored, but surface-wave lines might be preferred in the future. With regard to combining filters, the main problems—achievement of high $Q$-factor and stability—are emphasized. (*EEA*, 1961, #5866)

**1,172. BEAM INDEXING TUBES. I. AN ALTERNATIVE TO THE SHADOW-MASK PRINCIPLE FOR COLOUR TELEVISION DISPLAYS. II. CIRCUIT DETAILS OF THE COLOUR TELEVISION DISPLAY UNIT**
**Macwhirter, I.**
***Wireless World,* v. 67, no. 1, pp. 2–7, January; no. 2, pp. 92–98, February 1961**

The deficiencies of the shadow-mask color display tube are outlined, and proposals are made for the design of a tube which is completely free from these deficiencies. It is shown that the NTSC type of color television signal is not suitable for direct application to the new tube, and means are described for transforming the NTSC signal into a suitable form. The problems of synchronizing the color signal with the instantaneous beam position are discussed and various solutions suggested. Comments are made on the advisability of modifying the formulation of the NTSC type of signal into a form better suited to the new display. (*EEA*, 1961, #2066)

**1,173. ELECTROSTATIC LATENT IMAGE PHOTOGRAPHY**
**December 1, 1960–February 28, 1961**
**General Electric Company, Advanced Electronics Center, Cornell University, Ithaca, N.Y.**
**QER-5, AF 33(616)-6746**
**AD-254,238**

Partial success of binder-type photoconductors during this period has resulted in the decision to concentrate on the three-step sequential image transfer method, at least for the laboratory demonstration model. Binder-type photoconductors display much higher bulk resistivities and, therefore, can hold a high resolution charge image for the time required for the sequential transfer method. Experience so far with homogeneous layers of low-resistance photoconductors has shown that present techniques being used for simultaneous exposure and transfer are inadequate to produce high-resolution, high-contrast pictures (steep slopes in thermoplastic grooves). Basic difficulties with this method center around spreading of the charge pattern due to the low bulk resistivity.

**1,174. NEW TYPE OF TELEVISION SYSTEMS**
**Valik, I. L., Khromov, L. I.**
***Radiotekhnika,* v. 16, no. 2, pp. 74–78, February 1961 (in Russian)**

A "memory" type of industrial and scientific television transmission is proposed, with divided writing and reading processes—thus an identical bandwidth for transmission and display is no longer required. A qualitative and very brief survey of the main problems of high definition-low field frequency transmissions is given that concerns storage, camera exposure, erasure, pulse operation of camera tubes, separation of all three processes—writing, reading and erasing—and the use of auxiliary optical and magnetic recording devices. (*EEA*, 1962, #7294)

**1,175. IMAGE ORTHICON TUBES WITH AN ELECTROSTATIC SCREEN**
**Frank, K.**
***Elektronische Rundschau,* v. 15, no. 2, pp. 66–68, February 1961 (in German)**

The inclusion of such a screen adjacent to the mosaic and lying between it and the gun structure results in a homogeneous retarding field and reduces the radial forces acting on the electron beam. Accordingly, sharpness of focus and contrast over the whole picture area are enhanced; however, steps have to be taken (1) to avoid deterioration of the S/N ratio due to secondary electrons emitted from the screen, and (2) to safeguard against moiré patterns, associated with the mesh structure of the screen, appearing in the reproduced picture. The first defect is eliminated by raising the potential of the screen well above that of the internal coating of the tube or by introducing a blocking electrode in front of the electron multiplier. The second fault is eliminated by consideration of the relationship between the separation of the screen from the mosaic and the field strength in that region. (*EEA*, 1961, #5860)

**1,176. EXAMINING IMAGE-ICONOSCOPE CAMERA TUBES BY MEANS OF A SPECIAL TEST EQUIPMENT**
**Kaufmann, A.**
***Rundfunktechnische Mitteilungen*, v. 5, no. 1, pp. 27–34, February 1961 (in German)**

Equipment for testing camera tubes is briefly described and its possibilities from the measurement point of view are shown. Suitable methods of measurement are indicated for a test specification that corresponds to the requirements of studio practice. Special examinations concern shading signals, detail spurious signals, and statistical fluctuations in the signal current. It appears that, in spite of extensive stabilization, the shading signal still depends on the temperature of the tube, and that residual faults at the picture edges require improvement. The detail spurious signal is examined as a function of beam current and collector voltage, as well as at several levels of grey and fineness of detail. According to the type of scene, it is more or less disturbing. Statistical fluctuations in signal current influence the S/N ratio to a not inconsiderable extent. It is shown that, in addition, the spectral composition of the background noise is altered and, in consequence, the subjective impression of interference deteriorates. (*EEA*, 1961, #5868)

**1,177. ULTRA CLOSE ZOOMS**
**Matzkin, M. A.**
***Modern Photography*, v. 25, pp. 106–107, February 1961 (*AS&T*, 1961)**

**1,178. SPEED CONTROL FOR TELEVISION CAMERA ATTITUDE**
***Electronic Engineering*, v. 33, p. 93, February 1961 (*AS&T*, 1961)**

**1,179. RASCHET VIDEOUSILITELEI NA POLUPROVODNIKOVYKH TRIODAKH (CALCULATION OF VIDEO-AMPLIFIERS WITH TRANSISTORS)**
**Rizkin, A. A.**
***Elektrosvyaz*, v. 15, no. 2, pp. 42–52, February 1961 (Translated from the Russian in *Telecommunications*, no. 2, pp. 178–196, 1961)**

Relations for calculating three types of semiconductor video stages (with common emitter, common collector, and common base) are presented. The video-amplifier circuit with a compound triode, and two circuits with feedback are described. (*EI*, 1961)

**1,180. CATHODE-RAY-TUBE AND PHOTOGRAPHIC-FILM CHARACTERISTICS RELATED TO FILM RECORDING FOR TELEVISION (Presented at the SMPTE Convention, Los Angeles, Calif., May 5, 1960)**
**Sadowsky, M.**
***SMPTE, Journal of the*, v. 70, no. 2, pp. 81–85, February 1961**

The spectral emission and decay characteristics of phosphors pertinent to photography are described. The effects of the physical characteristics of the phosphor and screen are evaluated in relation to problems of uniformity and impurities. Methods of exposure and the response characteristics of commercially available film are evaluated. The relation of phosphor screen characteristics to film in the optical system is shown.

**1,181. CORE CAMERA: CONTINUOUS RECEPTIVITY—ONE ROTATING ELEMENT (Presented at the Fifth International Congress on High-Speed Photography, Washington, D.C., October 20, 1960)**
**Whyte, J. N.**
***SMPTE, Journal of the*, v. 70, no. 2, pp. 111–113, February 1961**

The advantages of a streak camera having continuous receptivity and employing only one rotating element are discussed. The essential element of such a camera is a prism-mirror combination which is rotated at high speed. Various arrangements of this combination are possible, and have been investigated with a view to compensating for the aberrational and "splitting" effects. The theory of image formation through the combination is reviewed and alternative schemes are discussed.

**1,182. INFRA RED HORIZON SCANNERS**
**Goetz, R. A.**
***ARMA Engineering*, v. 4, no. 1, pp. 6–13, March 1961**

Problem areas and design techniques are presented of a passive device used for compensating the space vehicle's inertial system through the establishment of the Earth's horizon by the detection of the thermal discontinuity between the Earth and space. Features of the sensing system of the device (which consists of an infrared detector, collecting optics, and a scanning mechanism) are included. (*EI*, 1961)

**1,183. A STUDY OF VISUAL SIMULATION TECHNIQUES FOR ASTRONAUTICAL FLIGHT TRAINING**
**Buddenhagen, T. F., Wolpin, M. P.**
**March 1961**
**Bell Aerosystems Company, Buffalo, N.Y.**
**Report on Training Equipment, Simulators and Techniques for Air Force Systems, WADD TR 60-756,**
**AF 33(616)-7028**
**AD-260,093**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

A study was made of the engineering requirements for visual simulation in astronautical flight training and of the basic techniques available to accomplish such simulation. An evaluation of the potentialities of the various techniques led to the choice of closed circuit television as an image transfer technique. A preliminary design concept using this technique was formulated to determine the areas in which development work will be required prior to the design of a complete simulator. This report includes a compilation of applicable techniques, a determination of the probable visual environment of space, and an investigation of a method to predict the perceptual fidelity achieved by various simulation techniques as an aid in optimizing the training value of a simulator. One hundred twenty-two references are included.

**1,184. FEASIBILITY TEST OF HIGH-RESOLUTION CLOSED-CIRCUIT TELEVISION SYSTEM**
**March 1961**
**Army Electronic Proving Ground, Fort Huachuca, Ariz.**
**AEPG-SIG 930-202, Final Report**
**AD-259,864**

A high-resolution closed-circuit television system was tested to determine its feasibility for disseminating detailed information from Army situation maps and typewritten copy within a command post. Situation maps and typewritten copy were not readable because the equipment did not meet the horizontal and vertical resolution requirements of 850 TV lines. The equipment was also too heavy to be readily transportable, the audio intercommunication circuits were unsatisfactory, and adjustments were too critical and time consuming. It was concluded that the system is not feasible for disseminating detailed information within a command post.

**1,185. A STUDY OF PHOTOCONDUCTIVE CAMERA TUBES: THE C.F.T.H. (COMPAGNIE FRANCAISE THOMSON-HOUSTON) VIDICONS**
**Blamoutler, M.**
***Onde Électrique*, v. 41, pp. 229–238, March 1961**
**(in French)**

The basic operation of the vidicon type of camera tube is discussed in detail, including the mechanism whereby charges are generated and accumulated, the generation of the VF signal, and the focusing. In the new tubes quoted, the sensitivity has been increased some six times by the development of coatings of greater sensitivity—although the base material remains the same—and by achieving a more homogeneous coating. Curves show the resolution and spectral characteristics, and a table comparing these tubes against earlier models is provided. (*EEA*, 1961, #5867)

**1,186. EVALUATION OF A TRACKING ERROR MEASUREMENT DEVICE**
**Edwards, D. J., Long, J. F.**
**April 1961**
**Air Force Proving Ground Command, Eglin AFB, Fla.**
**APGC TR-61-21**
**AD-255,991**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

Evaluation tests were conducted on a breadboard TEMD (tracking error measuring device) developed to investigate and study the feasibility of using television techniques to measure tracking error of optical and electronic tracking instrumentation. In spite of shorter focal length optics, the TEMD detection, discrimination, and maximum range performance compared favorably with that of a Contraves cinetheodolite. It was observed that TEMD manual tracking extended the present range of the Contraves cinetheodolite by approximately 25 percent. Feasibility of the TEMD was not completely evaluated because the dynamic tracking accuracy could not be measured. Static tracking accuracy was measured in the laboratory.

**1,187. THE MODULATION OF TELEVISION TRANSMITTERS IN THE INTERMEDIATE-FREQUENCY STAGE**
**Klopf, P.**
***Rundfunktechnische Mitteilungen*, v. 5, no. 2, pp. 79–87, April 1961**

Problems of television-transmitter technique are discussed, the solution of which, by adopting an intermediate frequency and low-level modulation, results in a number of advantages. The proposed measures indicate a way to the optimum transmission of television signals with a high degree of contrast, that is, with the maximum effect on the modulation characteristics of the transmitter system. The properties of such a system are discussed first by means of the usual test signals; first results obtained with modified NTSC color-television signals are mentioned. In addition, a description is given of experience gained in the modulation of a 10-kw klystron transmitter for Band IV (Haardtkopf, S.W.F.) which had been modulated with color signals and color transparencies for the purpose of propagation tests. (*EEA*, 1961, #5869)

**1,188. OPERATION OF VIDICONS IN UNUSUAL ENVIRONMENTAL CONDITIONS**
**Robinson, G. A.**
***SMPTE, Journal of the*, v. 70, no. 4, pp. 264–266, April 1961**

The influence of unusual environmental conditions on the performance of commercially available vidicons is reported. It is found that increasing the faceplate temperature to 90°C does not affect the resolution, increases the dark current, and decreases the sensitivity when the dark current is held constant. Data are presented for the durations of application of greater than normal cathode radiation at which image burn is produced. It is found that the envelopes of most commercial types of vidicons do not fail at pressures below 50 atm. The only observed effect of nuclear radiation was the reduction of sensitivity caused by browning of the glass faceplate. (*EEA*, 1961, #4821)

**1,189. IMAGE-CONVERTER SYSTEM WITH FAST IMAGE GROUP REPETITION RATES**
**King, R. W., Hett, J. H.**
***SMPTE, Journal of the*, v. 70, no. 4, pp. 270–274, April 1961**

Three different types of image-converter cameras were designed with various characteristics, but all emphasizing fast exposure rates. The three cameras all use the converter tube Type 1201 with short-persistence blue phosphor for photographic recording. The first camera produces a sequence of six rectangular images having an aspect ratio of about 5:1. The exposure time of 0.4 μsec was used and a fixed exposure interval of 5 μsec. This camera takes one group of six exposures at a time with a relatively long recovery time. The second camera has considerably advanced characteristics. This camera makes six exposures on a single frame at rates varying from $2 \times 10^6$ to $2 \times 10^4$ exposure sec. The frame rate extends from zero to 5000, the upper limit depending on exposure rates. Exposure durations have these values: 0:1, 0:3, 3:0 and 10:0 μsec. Repetition-rate and exposure-time duty cycle may not exceed 20 percent. Deflection of the image takes place on both axes, producing two rows of three exposures. The third and latest camera design is similar to the second, having exposures of 0:1, 0:3, 1:0, 3:0 and 10 μsec and corresponding exposure rates of $2 \times 10^6$ to $2 \times 10^4$ exposure sec. The sequence of pulse and shutter pulse generator is very similar; however, the sweep is wholly on one axis and therefore similar to that of the first camera described. The mechanism of sweep generation is quite different, however, the basic sweep form being generated by a diode-pump counting circuit. Displays of four or eight images may be selected. (*EEA*, 1961, #4827)

**1,190. SOME ASPECTS OF OPTICAL LENS PERFORMANCE. I. SECONDARY FLARE IN LENSES**
**Hacking, K.**
**April 1961**
**British Broadcasting Corporation, London, Great Britain**
**Engineering Division Monograph 36, pp. 5–14**

The image formed by a lens is often reduced in contrast by extraneous light spread extensively over the image plane as a result of specular interfacial reflections within the lens and scattering by surface irregularities. A method of measuring the magnitude of the flare light is described. The theoretical relationship between the transmission factor of the lens and the flare component due to specular reflections is discussed. The nonuniform distribution of flare was investigated experimentally and the importance of lens cleanliness was demonstrated. The average results of flare measurements on a number of lenses used in television applications are given. (*EEA*, 1962, #513)

**1,191. ELEMENTARY TELEVISION CHANNEL AND ITS CHARACTERISTICS**
**Makovetskii, P. V.**
***Radiotekhnika*, v. 16, no. 4, pp. 52–62, April 1961**
**(in Russian)**

The elementary channel is by definition the transmission channel beginning with the photosensitive element of the pick-up device and ending with the human retina via picture element of the receiver tube. Channels are time-divided and area-distributed. Frequency vs. frequency transmission characteristics are dealt with under consideration of the acuity of the eye and of stroboscopic phenomena, followed by the amplitude-frequency transmission characteristics, plotted for various luminescent materials. Relationships between lag properties of modern camera tubes and stroboscopic effects are investigated, indicating the possibility of reducing the latter by the use of long persistence storage devices. The problems of S/N improvements are analyzed, and it is shown that instead of long decay techniques the addition of low-pass frequency filters (electron-optical cathode and electroluminescent devices of special characteristics) can lead to improvements of several magnitudes; this applies to the transmitting side only, because bandwidth compression on the receiver display is already "shunted" by the narrow channel of the viewing eye. (*EEA*, 1962, #7295)

**1,192. DEMODULATOR CIRCUITRY FOR NTSC COLOUR TELEVISION SIGNALS**
**Jaeschke, F.**
***Archiv Elektrotechnik Übertragung*, v. 15, no. 4, pp. 187–199, April 1961 (in German)**

A general technical treatment of the known art of synchronous detector design for NTSC color receivers is presented, including diode ring demodulators, automatic phase control circuits, and crystal subcarrier oscillators. Both equi-narrow band, full *J*- and *Q*-band systems, and their respective matrix circuits are considered. A number of fully dimensioned circuit diagrams are reproduced and discussed. Of particular interest are several vectorscope oscillograms and full circuit information on a special test equipment for quantitative assessment of demodulator performance which contains a triple electronic switch. (*EEA*, 1961, #5847)

**1,193. COLOUR TELEVISION CAMERA PROBLEMS**
James, I. J. P.
*Television Society, Journal of the*, v. 9, no. 10, pp. 422–429, April–June 1961

After a brief summary of the deficiencies of existing simultaneous color television cameras, image orthicons and vidicons are compared in detail. With vidicons, dichroic mirrors are placed in front of the three objective lenses. In the case of the image orthicon, a single moving objective lens is needed, followed by an astigmatism corrector and neutral density balancing filters. Problems of geometrical registration leading to great mechanical and circuit precision requirements are treated next, including dynamic misregistration (due to beam bending caused by charge patterns of the separate color picture contents). To cope with the latter, the Weimer vidicon with a single signal plate and color strips has been proposed; it suffers, however, from crosstalk and poor S/N ratio. Automatic shading correction is described next, with an ingenious servomechanism using a magnetic storage drum of 150-kc bandwidth for canceling spurious signals being employed. S/N ratios, resolution, sensitivity, and amplifier stability are also discussed. A tabulated comparison of physical and circuit characteristics indicates the considerable superiority of the vidicon, its only inferior property being lag. (*EEA*, 1962, #6142)

**1,194. INFRARED PHOTOCONDUCTORS**
Schultz, M. L., Harty, W. E., Rowley, C. D.
May 31, 1961
Radio Corporation of America, Electron Tube Division, Harrison, N.J.
Interim Report 10, Nonr-2225(00)
AD-260,051

The extrinsic infrared photoconductors which have been developed or are now under development at various laboratories permit the fabrication of infrared detectors which have long wavelength thresholds at virtually any desired position in the spectrum, even at wavelengths as great as several millimeters.

**1,195. SECAM—FIRST COMPLETE DESCRIPTION OF THE SECAM COLOUR SYSTEM—FRANCE'S REPLY TO THE BBC**
Fisher, E. P. L.
*International TV Technical Review*, v. 2, pp. 13–16, May 1961

Designated as a "memory sequential system," the SECAM system is fully compatible and transmits luminescence in the normal video spectrum to which a single subcarrier (FM) is added, modulated sequentially (line sequence) by the two chrominance informations. If, in addition, each of these informations is delayed at the receiver by one line period and can be used on two successive lines, the primary signals (*R*, *G*, and *B*) may be displayed simultaneously. Advantages quoted for this system are: insensitivity to interference, absence of crosstalk between chrominance signals, minimum interaction between luminance and chrominance signals, insensitivity to echoes and transmission variations, receiver simplicity with no tight specification on phase response, and simple receiver adjustments. Waveforms for a standard test signal are shown; in addition, the encoder and decoder operations are discussed and block diagrams given. Among tests carried out are the Hamburg-Munich 2000-km return link, the Paris-London route, and various French unmodified, RTF and PTT equipments. (*EEA*, 1962, #3234)

**1,196. TELEVISION TECHNIQUES WITH THE 5 IN., 7 IN. AND 9 IN. IMAGE INTENSIFIERS**
Stevenson, J. J.
*British Journal of Radiology*, v. 34, pp. 273–285, May 1961

The advantages of the use of image intensifiers in clinical radiology are described. Various observational techniques using closed-circuit television are discussed, and an appraisal is made of their success in various diagnostical and surgical situations. A number of photographs of the instruments are shown. The use of the television image intensifier techniques is expected to increase rapidly. (*EEA*, 1961, #5874)

**1,197. A UNIT FOR MEASURING AMPLITUDE- AND PHASE-DISTORTIONS OF THE CHROMINANCE-CARRIER AS A FUNCTION OF MODULATION-DEPTH**
Coenning, F.
*N.T.Z. Nachrichtentechnische Zeitschrift*, v. 14, no. 5, pp. 248–253, May 1961 (in German)

A new unit for measuring chrominance-carrier distortions as a function of modulation-depth is described. The elaborate equipment has a high sensitivity. Gain-fluctuations of a few tenths of one percent and phase fluctuations of approximately 0.1 deg can be measured. This high sensitivity in conjunction with the ease of operation will make this equipment suitable for many applications. The testing of studio equipment, radio links, and TV transmitters is one of these applications. (*EEA*, 1962, #2248)

**1,198. NEW IMAGE ORTHICONS ROLL OFF LINES**
Colledge, C. H.
*Electronics*, v. 34, no. 22, p. 64, June 2, 1961 (Abstract)
(*AS&T*, 1961)

**1,199. MODIFYING VIDICON CAMERA CHAIN FOR SLOW-SCAN TELEVISION SYSTEMS**
Martin, F. F., Shelton, C. T.
*Electronics*, v. 34, no. 23, pp. 101–103, June 9, 1961

Reducing television scan rates allows the use of a low-power, narrow-band transmitter. An experimental camera is described, and problems occurring in a system of this type are discussed. (*EI*, 1961)

**1,200. STUDY OF TELEVISION REMOTE-TRACKING TECHNIQUES**
**Becker, R. A.**
**June 30, 1961**
**Army Ordnance Missile Command, White Sands Missile Range, Range Instrumentation Development Division, N. Mex.**
**Final Report**

The system requirements and a recommended approach are presented for an impact area instrumentation complex which would provide trajectory, attitude, and data on missile firings and bomb drops at the White Sands Missile Range. The system would be composed of four mobile tracking units which would photographically obtain the required data, and a series of control stations from which the tracking units would be remotely operated. A television camera on each tracking unit would transmit the image contained in the field of view of that unit to the control station. A tracking operator would monitor the televised scene at the control station and transmit tracking correction signals back to the tracking mount. No human beings would be located in the danger area.

**1,201. VIEWING SET TELEVISION AN/FXC (XW-1)**
**Hoag, N., Holsinger, J.**
**June 30, 1961**
**ITT Federal Laboratories, Fort Wayne, Ind.**
**Final Technical Report, RADC-TR-61-89, AF 30(602)-1951**
**AD-259,970**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

Viewing set television AN/FXC (XW-1) is capable of transmitting graphic information such as weather charts, briefing status boards, etc., over telephone lines having a bandwidth of approximately 300 to 3000 c, phase equalized from 1000 to 2500 c. Picture definition is a function of transmission time and as several different frame times are provided, pictures of varying qualities may be transmitted. A 400-line picture is the highest resolution information that can be transmitted. A two-way audio link and a real-time pointer system at the transmitter provide a system of maximum utility. Secure transmittal of information is assured when the system utilizes approved security devices. Also presented are the relative merits of two approaches, the scan conversion and direct slow scan modes, performed on this development. A summary of the AN/FXC (XW-1) performance is included.

**1,202. A NEW MAGNETIC-DRUM TYPE MEMORY DEVICE FOR TELEVISION SIGNALS**
**Kimura, E., Yokoyama, K.**
***Institute of Electrical Communication Engineers of Japan, Journal of the*, v. 44, no. 6, pp. 948–955, June 1961**
**(in Japanese)**

The equipment described is stated to be more practical, and to give better picture quality and easier operation than conventional kinescope recording systems. It corsists of the magnetic drum, the head driving mechanism, high-speed drum-driving motor, and slow-speed mechanism. To avoid difficulties involved in recording TV signals having a .wide frequency band, the signals are frequency-modulated and electronically sampled to pick up four fields/sec. Two recording heads, which make contact with the magnetic tape alternately, are provided to pick up the reproducing signals continuously. The magnetic drum has a diameter of 25.3 cm and is driven by an induction-type synchronous motor at 3600 rpm; 44 slots, 1 mm wide, in the periphery of the drum, and parallel to the axis, ensure close contact of the recording heads with the magnetic tapes. Details of the head driving mechanism are described. Typical monoscope patterns recorded by the equipment illustrate the high quality of the results obtained. (*EEA*, 1962, #7308)

**1,203. ELECTRONIC ULTRA-VIOLET IMAGING TECHNIQUES (Presented at the National IAS/ARS Meeting, Los Angeles, Calif., June 13–16, 1961)**
**Gray, S.**
**June 1961**
**Institute of the Aerospace Sciences, Inc., New York, N.Y.**
**Paper 61-112-1806**

The purpose of this discussion is to survey the possibilities of obtaining solar and stellar images in the far ultraviolet in a form suitable for transmission by television techniques by modifications in the structure of existing camera tubes, and through the development of new camera tubes, specifically designed to handle the problems of imaging in this energy range.

**1,204. ON THE CAUSES OF DIFFERENTIAL GAIN AND PHASE ON FREQUENCY-MODULATED TELEVISION LINKS**
**Castelli, E.**
***EBU Review, Part A*, no. 67, pp. 90–102, June 1961**

The behavior of a quadripole is examined, with reference to the influence of its gain and delay characteristics versus frequency, on differential gain and phase. General conclusions are stated, and the effects of limiters are discussed. These theoretical considerations are finally applied in relation to a radio link chain, which is already in operation for monochrome TV, so as to gather an indication as to precautions to be taken for the transmission of color signals. Photographs are shown to demonstrate the effects of gain and delay equalization. (*EEA*, 1962, #2131)

**1,205. SYNCHRONIZATION METHODS FOR MAGNETIC VIDEO SIGNAL STORAGE**
**Zöbisch, W.**
***Technische Mitteilungen, BRF*, v. 5, no. 2, pp. 66–71, June 1961 (in German)**

A concise analysis of permissible speed fluctuations in video tape recording systems for the following two basic methods is

presented: (1) recording of video information without sync signals, which are re-inserted in replay, and (2) simultaneous recording of the composite signal. The analysis is undertaken for all four cases, i.e., separately for line and frame sync transmissions for both methods, and the results are compared graphically by plotting the acceptable speed tolerances versus frequency (CCIR 625 line transmission). The results indicate clearly the necessity of composite signal recording with a rigid relationship between video and sync, the revelant response being as follows: from 0 to 10 cps a very small constant deviation only is permissible ($<2 \times 10^{-4}$); from 25 to 150 cps deviation rises linearly, to become constant again in the range from 150 to 3000 cps at the level of $15 \times 10^{-4}$; finally, above and from 8 kc upward, speed variation can increase with frequency. Some general notes on applications leading to fixed- and rotating-head video tape systems are appended, to be fully treated in Part II. (*EEA*, 1962, #6010)

**1,206. ELECTRONIC-CAM, A NEW PICTURE GENERATING METHOD FOR FILM AND TELEVISION**
**Jetter, A.**
***Rundfunktechnische Mitteilungen*, v. 5, no. 3, pp. 101–107, June 1961 (in German)**

After a brief explanation of the advantages of the parallel operation of film and electronic cameras, and after a historic survey of development of the art up to the present, an engineering description of a comprehensive equipment is presented which provides simultaneous, or alternate, use of three camera units, rapid focusing, synchronization of tone and vision, counting and comprehensive monitoring, mixing and cutting facilities. The choice of vidicon cameras is justified in some detail, and of particular interest is the method of queueing and synchronization, illustrated by timing diagrams of film transport, intermittent shutter pulldown and timebase frame pulses. Several photographs and optical and electrical block diagrams are included. (*EEA*, 1961, #7071)

**1,207. SIGNAL DISTORTIONS IN TELEVISION SYSTEMS WITH FREQUENCY-MODULATED CARRIER**
**Schönfelder, H.**
***Archiv der Elektrischen Übertragung*, v. 15, no. 6, pp. 273–284, June 1961 (in German)**

A report is made of a study of vestigial sideband transmission of FM signals, the symmetrical effects, the daily errors, and the result of these signal distortions on the picture quality of color television (SECAM system). (*EEA*, 1962, #3236)

**1,208. OPTIMUM BAND SHAPE FOR TELEVISION INTERMEDIATE-FREQUENCY AMPLIFIER**
**Murakami, T.**
***RCA Review*, v. 22, no. 2, pp. 245–279, June 1961**

In a phase linearized television IF amplifier, the optimum bandshape is "haystack," or parabolic. With this bandpass characteristic, the system transient response to stepped carrier has single precursory undershoot and single overshoot with no associated transient ringing. The optimum carrier position is approximately at the 40-percent response point on the selectivity curve. (*EI*, 1961)

**1,209. THE HIGH-BEAM-VELOCITY VIDICON**
**Dresner, J.**
***RCA Review*, v. 22, no. 2, pp. 305–324, June 1961**

One of the barriers to the construction of vidicons with high sensitivity and fast response is the phenomenon of capacitive lag which, when the scanning beam lands at low velocity, necessitates the use of porous photoconductors having generally low sensitivity. It is demonstrated that this capacitive lag can be reduced to a very low value by making use of a scanning beam landing at high velocity. It is then possible to utilize glassy photoconductive layers of high sensitivity and large capacitance. The redistribution problems associated with high-beam-velocity operation are studied in detail. Means are described by which they can be reduced to the point where their effect on image quality is minimal. An experimental tube has been constructed which uses a glassy $Sb_2S_3$ photoconductive layer with a capacitance of 8000 $\mu\mu F$. The speed of response with a high-velocity beam is considerably faster than with a low-velocity beam. The image quality is adequate for many purposes. (*EEA*, 1962, #1243)

**1,210. INFRARED VIDICON**
**(Translated from *Tekhnika Kino i Televideniya*, no. 4, pp. 15–19, April 1961)**
**July 10, 1961**
**Library of Congress, Air Information Division, Science and Technical Section, Washington, D.C.**
**AID 61-102**
**AD-261,445**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

The principal requirements for infrared-sensitive vidicons are presented together with the development of special target electrodes. Special investigation methods and measuring equipment were developed to obtain the basic characteristics of infrared-sensitive vidicons and were used to compare them with non-Soviet makes, particularly the American RCA-7038. Results of such a study are presented.

**1,211. NEW CAMERA TO PHOTOGRAPH PERIPHERIES**
***Engineering*, v. 192, pp. 98–100, July 28, 1961**
**(*AS&T*, 1961)**

**1,212. COLOUR VIDEO TAPE RECORDING USING THE LINE-SEQUENTIAL SYSTEM WITH CONSTANT LUMINANCE**
**Inatsu, M.**
***Institute of Electrical Communication Engineers of Japan, Journal of the*, v. 44, no. 7, pp. 1091–1097, July 1961 (in Japanese)**

The special features of a new color video tape recording system developed in the NKH Technical Research Laboratories, Tokyo, are described. The principle of the color recording system differs from that of the RCA or Ampex system. Chromacity variations due to the different characteristics of the four magnetic heads used are eliminated by using the LSC (line sequential composite) signal as the recording signal. This signal is composed of the Y signal and the color subcarrier, which is frequency modulated by the line-sequential chrominance signal. Since the NTSC system is used as the standard color TV system in Japan, signal converter circuits from NTSC to LSC and from LSC to NTSC are required at the input and output, respectively, of the video tape recorder (VTR), so that the majority of the parts of the color adapter of the VTR consist of signal converters. These are described, with block diagrams. The waveforms obtained at different points in these converters are also shown. The methods used to eliminate fluctuations of dc level and amplitude are noted, and the various advantages of the LSC recorder are enumerated. (*EEA*, 1962, #7191)

**1,213. PROJECT ECHO: BORESIGHT CAMERAS**
**Warthman, K. L.**
***Bell System Technical Journal*, v. 40, pp. 1227–1233, July 1961**

Motion picture cameras equipped with telephoto lenses were installed on the Project *Echo* transmitting and receiving antennas at Holmdel, N. J. When the *Echo* satellite was visible, a camera obtained a photographic record of the pointing accuracy of the antenna. These data were then used to correlate variations of signal strength with deviations in antenna pointing angle.

**1,214. PROBLEMS OF THE STATISTICS OF THE AUTOMATIC REPRODUCTION OF IMAGES IN THE CASE OF A MULTIFRAME OBSERVATION**
**Basharinov, A. E.**
***Radiotekhnika i Elektronica*, v. 6, no. 7, pp. 1035–1040, July 1961 (in Russian)**

The statistics of devices for the automatic reproduction of shapes are considered for the case where a number of scans of the frame of cells is made for each observation and the selection of the signal sequence is attained by comparison of the data from several scans. Relations are given for calculating the loading of the memory of an electronic computer in the steady state for algorithms with random duration. The variance of the memory capacity and the probability of errors due to overloading a memory of finite capacity are determined. The possibility of economizing in memory capacity by the use of a two-threshold selection procedure is considered. (*EEA*, 1962, #4649)

**1,215. ON THE TRANSIENT STATE OF THE LOADING OF THE MEMORY OF A CYBERNETIC DEVICE FOR THE STATISTICAL REPRODUCTION OF IMAGES**
**Fleishman, B. S.**
***Radiotekhnika i Elektronika*, v. 6, no. 7, pp. 1041–1048, July 1961 (in Russian)**

Expressions are derived for the generating function of the number of occupied cells of the memory of a cylindrical device for serving a number of cells. The transient loading of the memory of such a device is calculated. The cases of constant and exponential waiting time and the Wald distribution of waiting time are obtained as particular cases. It is proved that Wald's result is universally true for the distribution of the number of tests for the sequential analysis of similar hypotheses, and curves are given for the loading of the memory in this case. (*EEA*, 1962, #4650)

**1,216. THE CONVERSION OF AN NTSC COLOUR-TV SIGNAL INTO A SIGNAL WITH A DIFFERENT CHROMINANCE-CARRIER**
**Görling, H.**
***N.T.Z. Nachrichtentechnische Zeitschrift*, v. 14, no. 7, pp. 336–344, July 1961 (in German)**

This paper explains the purpose of the investigations and the test equipment. The design considerations for a converter are discussed. A double mixing process is required and only two out of 16 possible signal combinations can be used. A practical design of the converter is described. Tests have shown that the picture quality after conversion of the chrominance carrier is not substantially reduced in comparison with the quality of pictures transmitted directly. Only the reduced resolution as a result of bandwidth restriction in the luminance channel of the converter is noticeable. Further tests have revealed that practically no crosstalk interference is noticeable in normal receivers when the bandwidth for the color-TV signal is made larger at the transmitting end than it is intended at the receiving end because of restrictions of the video bandwidth. (*EEA*, 1962, #2247)

**1,217. CONSTANT-TIME, VARIABLE-INTENSITY MICROSECOND EXPOSURE SENSITOMETER**
**Herrnfeld, F. P.**
***SMPTE, Journal of the*, v. 70, no. 7, pp. 500–501, July 1961**
**(*AS&T*, 1961)**

**1,218. KERR-CELL CAMERA WITH SYNCHRONIZED LIGHT SOURCE FOR MILLIMICROSECOND REFLECTED LIGHT PHOTOGRAPHY**
**Theophanis, G. A.**
***SMPTE, Journal of the*, v. 70, no. 7, pp. 522–527, July 1961**
**(*AS&T*, 1961)**

**1,219. SAFE TITLE AREA FOR TV TRANSMISSION**
*SMPTE, Journal of the*, v. 70, no. 7, p. 541, July 1961
(*AS&T*, 1961)

**1,220. ELECTRONIC CIRCUITS. TRANSISTORIZED V.F. EQUIPMENT, H.F. FILTER, DOUBLE T FILTER, TRANSISTORIZED V.F. EQUIPMENT IN TV CAMERAS**
Verdier, J.
*Revue Générale Électronique*, v. 15, pp. 32–36, July–August 1961 (in French)

Circuits are given for a video amplifier and for a line scanning circuit giving 2.8 amp peak-to-peak into deflector coils with $L = 250\mu H$ and dc resistance = $1\Omega$. Abacs are also given for the design of a $50\Omega$ low pass filter and a parallel $T$ rejector. (*EEA*, 1962, #7307)

**1,221. A ONE-SHOT SLOW SCAN TELEVISION CAMERA**
Wilson, A.
August 1961
Royal Aircraft Establishment, Farnborough, Great Britain
TN-T.D. 62

A television camera is described which produces a 400-line picture and requires a transmission bandwidth of only 120 kc by using a slow scanning speed. A mechanical shutter in front of the camera tube provides a sufficiently brief exposure to arrest subject movement. The resulting charge pattern on the tube is then scanned off slowly to give one picture in one second. At the receiver, the picture is reproduced on a storage-type CRT. Additionally, a continuous film camera photographing a CRT displaying only the lines of the picture can give a permanent record.

**1,222. HIGH TEMPERATURE, HIGH VACUUM, DIFFRACTOMETER ATTACHMENT**
Intrater, J., Hurwitt, S.
*Review of Scientific Instruments*, v. 32, no. 8, pp. 905–906, August 1961

A high-temperature, high-vacuum diffractometer camera, which fits the Norelco Wide Range Goniometer, has been designed. The construction details of the camera are presented.

**1,223. TRANSISTORIZING THE INDUSTRIAL IMAGE ORTHICON CAMERA**
Cook, R. W.
*IRE Transactions on Industrial Electronics*, v. IE-8, no. 2, pp. 1–9, August 1961

The advantages of transistors in areas such as the preamplifier, shading circuits, and focus current regulator are pointed out. These advantages show themselves in the form of substantial reduction in weight, size, cost, and operating power. Charts and photographs are used to describe in detail the sensitivity, capabilities, and applications of such a camera. Schematics are used in describing pertinent circuit advantages. (*EEA*, 1962, #1244)

**1,224. PHOTOGRAPHY OF CURVED SURFACES: SHELL RESEARCH LTD. PERIPHERY CAMERA**
*Automobile Engineer*, v. 51, pp. 350–351, September 1961
(*AS&T*, 1961)

**1,225. PICTURE CHARACTERISTICS OF IMAGE-ORTHICON AND VIDICON CAMERA TUBES (Presented at the SMPTE Convention, Toronto, Canada, May 9–12, 1961)**
Neuhauser, R. G.
*SMPTE, Journal of the*, v. 70, no. 9, pp. 696–698, September 1961

The secondary electron redistribution characteristics of the image orthicon can contribute to making the picture appear to be a somewhat better picture than the TV system is normally capable of producing, when the human eye and brain are considered as part of the system. These characteristics also compensate for some of the basic aberrations in a TV electron-optical system. Basic differences in the signal characteristics generated by the image orthicon and the vidicon are described in detail. Methods for obtaining the best performance from each are suggested.

**1,226. MOTION PICTURE AND TV LENS DIRECTORY**
*Industrial Photography*, v. 10, pp. 80–82, September 1961
(*AS&T*, 1961)

**1,227. HUMAN FACTORS OF REMOTE HANDLING IN ADVANCED SYSTEMS—SYMPOSIUM, APRIL 18–19, 1961**
September 1961
Wright Air Development Division, Aeronautical Systems Division, Wright-Patterson AFB, Ohio
ASD TR 61-430

Papers are compiled which were presented at the Human Factors of Remote Handling in Advanced Systems Symposium, sponsored by the Aerospace Medical Laboratory in April 1961. Human factors in remote handling as viewed by the psychologist and the engineer are discussed. Problems of operator selection and training are presented, and both manned and unmanned ground support equipment for nuclear-powered aircraft are reviewed. Space environmental constraints on extravehicular space operations are assessed. A representative remote-handling system for space operations is described, and a three-dimensional color television system for remote handling is analyzed and evaluated. Human factors in design of remote-handling equipment are discussed. (*AI/A*, 1962, #61,262)

1,228. THE SECAM SYSTEM OF COLOUR TELEVISION: COMPARISON WITH THE NTSC SYSTEM
Cassagne, P., Sauvanet, M.
*Onde Électrique*, v. 41, pp. 689–703, September 1961 (in French)

Double modulation of a carrier demands close tolerance to reduce crosstalk. By halving the vertical chrominarie definition and using sequential transmission with a memory, double modulation is avoided and frequency modulation used. The chrominarie signal does not then need filtering out. In alternate lines the signals are: (1) $E_{r-y} = 1.43\ (E_r - E_y)$, and (2) $E_{b-y} = 1.12\ (E_b - E_y)$ where $E_y$ is the luminarie and $E_r$ and $E_b$ the red and blue signal. An ultrasonic delay line is used to store one chrominarie signal while the other is being received. The subcarrier is 4.43 Mc with ±7 Mc modulation. Wider tolerances and less effect from noise are claimed for no increase in the number of valves. (*EEA*, 1962, #3235)

1,229. AUTOFOCUS RECTIFIER MODIFIED FOR ELECTRONIC DODGING AND AUTOMATIC EXPOSURE CONTROL
McHail, R. R.
*Photogrammetric Engineering*, v. 27, no. 4, pp. 611–617, September 1961

A modified rectifier is described. This new instrument has increased capability of performing electronic dodging during photographic printing and automatic exposure control. A CRT was added as a photographic source from which a flying spot is scanned with a sensing unit using fiber optics. This feeds back through electronics to modulate the velocity of the spot inversely with the density of the photographic negative resulting in electronic dodging. (*EI*, 1961)

1,230. THE VIDEOGRAPH TUBE—A NEW COMPONENT FOR HIGH-SPEED PRINTING
Crews, R. W., Rice, P.
*IRE Transactions on Electron Devices*, v. ED-8, no. 5, pp. 406–414, September 1961

A CRT having a faceplate penetrated by an array of many fine wires has been developed for high-speed printing applications. Charge patterns are deposited on moving paper in response to a modulated electron beam which scans the inner ends of the wires in the CRT. The pattern on the paper is dusted with electroscopic powder to make it visible. Copy having a resolution of $10^4$ picture elements/in.$^2$ can be produced at a rate of 2 ft$^2$/sec. The tube is being used in high-speed facsimile equipment and in a computer output printer which prints magazine address labels at a speed of 130,000 labels per hour from digital information stored on tape. Television pictures have been reproduced field-by-field at standard rates. The tube has wide application in systems where high-speed, remote printout or local reproduction of copy is required. The cost of the recording paper is about one-tenth that of light-sensitive materials. (*EEA*, 1962, #4336)

1,231. SUR UN NOUVEAU PRINCIPE DE PHOTOGRAPHIE (NEW PRINCIPLE OF PHOTOGRAPHY)
Dauvillier, A.
*Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences* v. 253, no. 18, pp. 1691–1694, October 30, 1961

"Daguerreotron," a photocathode tube which gives electron optic amplification of image, is described. It needs exposure time and cannot be used instead of current photography, except in radiography, electron microscopy, and astronomy. (*EI*, 1961)

1,232. ELECTRON OPTICAL PROBLEMS OF MODERN FLAT PICTURE TUBES
Schmidt, U.
*Nachrichtentechnik*, v. 11, no. 10, pp. 462–466, October 1961

Some examples of different types of flat picture tubes are given in order to discuss problems connected with the use of new electron-optical devices (deflection focusing, electron reflector). (*EEA*, 1962, #2259)

1,233. THREE WAYS TO EFFECTIVE ZOOMS
Matzkin, M. A.
*Modern Photography*, v. 25, pp. 76–77, October 1961 (*AS&T*, 1962)

1,234. AN AUTOMATIC TV TRACKING THEODOLITE FOR RANGE INSTRUMENTATION
Wisnieff, R. E.
*IRE Transactions on Military Electronics*, v. MIL-5, no. 4, pp. 326–330, October 1961

The factors affecting the design of a gated automatic TV tracking system are discussed, and a system mechanization to achieve the design objectives is outlined. Only the composite video of a closed-circuit TV system is required as an input. A study of the dynamic performance of typical targets indicates that the unpredictable target motion in a frame period of 1/30 sec must be an extremely small fraction of the field of view required for initial target acquisition. This permits the use of a small tracking gate in the larger acquisition field, since the target coordinates of the previous frame may be used to position the gate. This small gate permits S/N enhancement and effectively rejects extraneous targets outside the tracking gate. The tracking is effected by subdividing the tracking area into equal early and late video gates in each coordinate. The differential video between these gates is applied to an electronic integrator in such a manner that the integrator output voltage, which is also the reference for the generation of the early-to-late gate transition, changes to place this gate transition on the target. The integrator voltages are, therefore, a measure of the target coordinates in the TV field. The operation of an experimental system fabricated to determine the feasibility of applying this technique

to a range instrumentation system has produced tracking accuracies of better than 0.05 millirad in an acquisition field of 10 × 10 millirad. Current developments and additional applications of the technique are discussed briefly. (*EEA*, 1962, #4751)

**1,235. TELEVISION IN UNDERWATER WEAPONS TESTING**
Metzler, A. R.
*IRE Transactions on Military Electronics*, v. MIL-5, no. 4, pp. 357–362, October 1961

At the Naval Ordnance Test Station sea ranges at San Clemente Island, closed-circuit television is used both over and under water for certain phases of underwater weapons testing. The functions of this instrumentation are to provide: real-time data, engineering surveillance, monitoring, underwater launcher positioning, range surveillance, time-event data, trajectory data, and to assist in underwater search and recovery. At present, 17 closed-circuit systems are in use above and below the surface of the ocean and more systems are being built. The new systems include an image orthicon camera for underwater search and a vidicon-type system for operations at a depth of 6000 ft. (*EEA*, 1962, #4648)

**1,236. VIDICON LIGHT-TRANSFER CHARACTERISTICS AND FIRM REPRODUCTION (Presented at the SMPTE Convention, Toronto, Canada, May 9–12, 1961)**
Neuhauser, R. G.
*SMPTE, Journal of the*, v. 70, no. 10, pp. 791–794, October 1961

The light-transfer characteristics of the vidicon cannot be used directly to predict light-transfer characteristics of a television-film system. The practice of setting the darkest excursions of the video portion of a TV signal to black level, or cutoff of the TV picture tube, changes the effective light-transfer characteristic of the vidicon. Additional gamma correction of the electrical signal is required to reproduce film properly on television. The type of correction necessary for the proper reproduction of film meeting the new proposed specifications for density range and transfer characteristics of television film is described.

**1,237. CAMERA UNWRAPS CYLINDER: TRAVERSING PLATE SCANS 360-DEG. SURFACE**
*Machine Design*, v. 33, no. 23, p. 180, November 9, 1961
(*AS&T*, 1962)

**1,238. MULTI-STAGING IMAGE INTENSIFIER**
November 1961
E.M.I. Research Laboratories, Ltd., Great Britain
Report RP5-8 for period ending November 1, 1961
AD-268,523

Work on multi-stage cascade image intensifiers using SbNa-K photocathodes throughout has continued. Four-stage tubes with blue photon gains exceeding $10^5$ were constructed with resolutions up to 18 line pairs/mm.

**1,239. ALL-ROUND PHOTOGRAPHY: CAMERA FOR PHOTOGRAPHING CURVED SURFACES**
*Mechanical Engineering*, v. 83, no. 11, p. 85, November 1961
(*AS&T*, 1962)

**1,240. VISIBILITY THROUGH TELEVISION SYSTEMS**
Galbraith, D. S.
November 1961
Canadian Armament Research and Development Establishment, Valcartier, Quebec
CARDE Memo 663/61
AD-271,415

The properties of a target, the atmosphere, and a television viewing system are discussed in relation to the detection of stationary targets viewed horizontally against terrestrial backgrounds. A method is given by which detection and recognition ranges may be computed. Eighteen references are included.

**1,241. DISPLAY SYSTEMS**
November 1961
Armed Services Technical Information Agency, Arlington, Va.
Bibliography
AD-265,432

This bibliography concerns specific types of displays, their application in various electronic systems, and related human engineering factors. It is divided into the following categories: CRT screens, CRT, radar displays, sonar displays, storage tubes, television displays, and three-dimensional displays. Sections on applications are presented for: air traffic control systems, airborne display systems, anti-aircraft defense systems, battlefield surveillance, combat information centers, computers, direction finders, ground support equipment, meteorological radar, naval vessels, nuclear reactors, radar interception, radar tracking, recording devices, space flight, submarines, telemetering systems, and training devices. Human engineering is represented as: auditory factors, operator factors, operator performance, psychomotor reactions, systems design, and visual factors.

**1,242. MODIFIED N.T.S.C. COLOUR T.V. SIGNAL FOR SINGLE-GUN DISPLAY SYSTEMS**
Davidse, J.
*Electronic Technology*, v. 38, no. 11, pp. 388–392, November 1961

The possibility of modifying the standard NTSC signal in order to obtain a better adaptation to the needs of single-gun display systems is discussed. A practical proposal is made, and its consequences for the transmission of the signal are inves-

tigated. It appears that the proposed modification does not essentially affect the outstanding transmission characteristics of the system. (*EEA*, 1962, #1240)

**1,243. MEASURING APPARATUS FOR THE INVESTIGATION OF INERTIA PHENOMENA IN THE ENDIKON**
**Abraham, W.**
***Nachrichtentechnik*, v. 11, no. 11, pp. 504–507, November 1961 (in German)**

The total inertia effect in a vidicon camera tube is made up of two components: one a scanning effect, explainable by the fact that in the short time in which a picture element is illuminated by the scanning beam a charge sufficient to bring the capacitance to its final condition cannot be imparted to the element, the other component being a phenomenon of the semiconductor, due to the fact that the electrons released by light energy have a short life. In order to study the two effects separately, an arrangement was devised in which a pulsed light source was used so as to provide an interval in which the signal plate capacitance could be brought to the final value of potential. The signal plate waveforms show that the internal photo effect of the semiconductor plays the larger part in the inertia phenomena. (*EEA*, 1963, #2074)

**1,244. MAGNETIC SYSTEM FOR THE SUPPRESSION OF LINE STRUCTURE IN THE T.V. IMAGE**
**Kratochvil, F., Schaffstein, G.**
***Radio Mentor*, v. 27, no. 11, pp. 934–936, November 1961 (in German)**

In modern high definition TV tubes, the luminous spot on the screen has a diameter which is smaller than the distance between two image lines. A common factor of the various ideas for suppressing the line structure is to magnify the luminous spot itself (or its visible image), in the vertical direction, so that two adjacent lines partially overlap. One of the methods for obtaining an elliptical instead of a round luminous spot is based on the use of magnetic focusing in addition to electrostatic focusing of the electron beam. The magnetic focusing, however, is modified so that an axial magnetic field becomes effective only in the horizontal direction but not in the vertical direction, as compared to the focusing formerly used with the older type of image tubes for obtaining a round spot. (*EEA*, 1963, #1091)

**1,245. LOW BRIGHTNESS PHOTOGRAPHY WITH ELECTRO-OPTICAL INTENSIFIERS**
**Bouwers, A., Nawijn, A., Krebs, R. G. F. P.**
***Journal of Photographic Science*, v. 9, no. 6, pp. 375–378, November–December 1961**

The development of a system for photography at low brightness level, comprising highly luminous optical systems and a large-size brightness intensifier, is presented. The requirements for such systems are: large aperture optics, large brightness gain, high-sensitivity emulsions, and reasonable resolution. Less obvious but equally important requirements are. large dimensions of the optics, high cathode sensitivity of the image tube, and low "dark current." The size of the optics and high cathode sensitivity are important because of the noise resulting from the statistical fluctuations of a limited number of effective electrons during exposure. Optical systems up to 20-in. D have been designed with aperture ratio of 1:0.7. Mirror systems have a curved field which just fits the curvature of the cathode surface of the intensifier tube. A new large-size intensifier tube is described with high brightness gain, good anode resolution, and extremely low "dark current." Twin lenses $f/0.75$ are used between anode and film. (*PA*, 1962, #1288)

**1,246. IMAGE INTENSIFIER ISOCON FEASIBILITY STUDY**
**Hoffman, R. E.**
**December 4, 1961**
**Radio Corporation of America, Lancaster, Pa.**
**Interim Engineering Report for June 1–November 30, 1961, AF 33(616)-7696**
**AD-267,759**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

Image intensifier isocons were built to test glass targets, magnesium oxide targets, and aluminum oxide-nickel plug targets. Two different glasses were used, one a high resistivity glass used on previous image intensifier orthicons, the other a lead glass used for image orthicon targets. The tube with the high resistivity glass target, when operated in the orthicon mode, performed on a par with standard intensifier orthicons with the same target. The performance of these tubes indicates the need for an extremely smooth, fine-grained surface on the scanned side of the isocon target. The ability of the present intensifier isocon to present low light level information appears to be limited mainly by the background imperfections in the target, phosphor screen, intensifier coupling element, and photosurfacer rather than the electron beam noise. (See Entry #1308 )

**1,247. THE DESIGN OF OBJECTIVES FOR TELEVISION TECHNIQUES**
**Below, F.**
***Nachrichtentechnik*, v. 11, no. 12, pp. 547–549, December 1961 (in German)**

Although the optical resolution required in television is less than that for photography, photographic objectives are not necessarily the most suitable for television cameras. This fact arises from the existence of Fresnel and Fraunhofer effects and since television transmission involves a linear scanning procedure in time, the optimum design of the lens cannot be achieved by conventional optical technique. In some respects the requirements are analogous to that of an electronic circuit subjected to a step function, but a corresponding mathematical approach is so far not possible. Accordingly, some experimental work was carried out to observe the response to a

combination of lens and photocell when scanned with optical slits of various widths and at various angles of incidence. Test results indicate that this technique enables the suitability of a particular lens to be established in a few minutes. (*EEA*, 1962, #13,623)

**1,248. NEW TELEVISION CAMERA TUBES IN PERSPECTIVE (Presented at the SMPTE Convention, Toronto, Canada, May 9–12, 1961)**
**Neuhauser, R. G.**
***SMPTE, Journal of the*, v. 70, no. 12, pp. 979–982, December 1961**

The performance of several new television camera tubes (image orthicons and vidicons) is discussed in terms of their suitability for different applications and the conditions under which they must operate.

**1,249. IMAGE INTENSIFIER SYMPOSIUM (Held at Fort Belvoir, Va., October 24–26, 1961)**
**1961**
**National Aeronautics and Space Administration, Washington, D. C.**
**SP-2**
**(Also available through U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va.)**

This volume presents the results of the Image Intensifier Symposium held October 24–26, 1961, at Fort Belvoir, Va., and jointly sponsored by the National Aeronautics and Space Administration and the U. S. Army Engineer Research and Development Laboratories. In addition to introductory papers, articles in the following general fields are considered: image intensifier tubes, performance of image intensifier tubes, components of image intensifier tubes, and applications of image intensifier tubes.

**1,250. SOLID STATE CAMERA SYSTEM**
**1961**
**Electro Radiation, Inc., Los Angeles, Calif.**
**Final Report**

The purpose of a solid state camera is to store a visible image within a short interval of time. The device must be capable of retaining the initial contrast over a long and controllable period of time. The present report contains only the test results obtained on the feasibility system. The ultimate capabilities of the system and the technical advancements required to obtain the characteristics are discussed.

**1,251. PROGRESS REPORT ON THE DEVELOPMENT OF A PHOTO-ELECTRIC BEAM-INDEX COLOUR-TELEVISION TUBE AND SYSTEM**
**Graham, R., Justice, J. W. H., Oxenham, J. K.**
***Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering*, v. 108, pp. 511–523, 1961**
**(Also available as Paper 3468E, Institution of Electrical Engineers, Great Britain, February 1961)**

The progress in the development of an index color-television display using photo-electric indexing is reported, and some of the basic problems associated with index systems are outlined. The effect of cross-modulation between the writing and index signals is examined, and a method of overcoming this cross-modulation is suggested. The effect of the delay around the index loop and its relationship with the horizontal time-base linearity are discussed, and a preferred circuit arrangement which relaxes the tolerances on this linearity is described. Some comparisons are drawn between index and other color-television displays, and details are given of the practical verification of the system described. The present system may lead to a simplification of the color display tube. (*EEA*, 1961, #2064)

**1,252. DEVELOPMENT OF THE BANANA TUBE**
**Eastwell, B. A., Schagen, P.**
***Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering*, v. 108, pp. 587–595, 1961**
**(Also available as Paper 3566E, Institution of Electrical Engineers, Great Britain, May 1961)**

The unconventional system of beam deflection and spot formation in the Banana tube is considered in detail. The discussion of electron optics includes a formulation of the requirements for the permanent magnetic deflecting field, with a detailed description of the effect of this field on the electron spot, as well as the scanning and focusing means employed. The tube technology is considered in broad outline, including certain aspects of manufacture. (*EEA*, 1961, #3516)

**1,253. CIRCUITS FOR THE BANANA-TUBE COLOUR TELEVISION DISPLAY SYSTEM**
**Freeman, K. G.**
***Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering*, v. 108, pp. 604–612, 1961**
**(Also available as Paper 3561E, Institution of Electrical Engineers, Great Britain, May 1961)**

The circuits necessary to operate the Banana-tube color display are described under the headings of tube supplies, drum synchronization, and video-signal processing. Circuit techniques which are peculiar to this form of color-picture display are described in some detail. (*EEA*, 1961, #3511)

**1,254. PHYSICAL AND TECHNICAL PROBLEMS IN THE DEVELOPMENT OF TELEVISION CAMERA TUBES**
**Eckart, F.**
***Experimentelle Technik der Physik*, v. 9, no. 6, pp. 261–282, 1961 (in German)**

Signal generation is achieved in three steps: (1) the storage system is scanned with a focused electron beam, either fast (secondary emission coef. $\delta>1$), or slow ($\delta<1$); (2) the standing potential is modulated by picture content—external or internal photoeffect or secondary emission; (3) it is then

restored by repeat of scan, the recharge of storage elements yielding the signal, separated at the anode and either directly amplified or fed to a secondary electron multiplier. Two popular cameras are chosen for detailed treatise: the image-orthicon ($\delta<1$, use of secondary emission), and the vidicon ($\delta<1$, use of internal photoeffect). A detailed description of the mechanism of signal generation is given, followed by an explanation of the camera tube construction, illustrated by cross-sectional drawings of the tubes. The storage mosaic plate of the image-orthicon is dealt with in detail, including equivalent electric circuit and description of the preparation supplied (glass-foil, sputtering processes of MgO, nickel and lacquer layers, etc.), followed by a description of the photocathode construction and preparation. Properties like frequency response, sensitivity, and therman emission are tabulated for various photocathodes. After discussing the principle and construction of the vidicon family, its main weaknesses—inertial effects, i.e., lag—are discussed and compared for variants like endicons, resistrons, and staticons. Of particular interest are the indications of frequency range extension into the infrared region, important to industrial television applications. An extensive bibliography (23 items) is appended. (*EEA*, 1962, #7301)

**1,255. SOLID STATE DISPLAY DEVICE**
**Yando, S.**
***1961 IRE International Convention Record*, pt. 3, v. 9, pp. 45–52, 1961**

A solid state display device based on a new principle is described. The device consists of a thin flat panel of piezoelectric material, one surface of which supports an electroluminescent layer. Voltage pulses applied to several electrodes on the panel edges produce traveling acoustic waves in the material. Electric fields accompanying these waves interact with the electroluminescent layer to produce localized illumination. This is controlled in position by varying the relative timing of the pulses to produce either a raster or a pattern. The light intensity may also be modulated. Possible applications in television are discussed, and results achieved to date are described. (*EEA*, 1962, #3238)

**1,256. TRANSISTORIZING THE INDUSTRIAL IMAGE ORTHICON CAMERA**
**Cook, R. W.**
***1961 IRE International Convention Record*, pt. 6, v. 9, pp. 48–56, 1961**

A completely-transistorized image-orthicon camera system for closed-circuit applications is described. The advantages of transistorization are discussed, and the characteristics of a typical camera system shown. Some block and circuit diagrams are given. (*EEA*, 1962, #512)

**1,257. MINIMIZING THE EFFECTS OF VIDICON LAG WITH A LONG VIDEO DELAY LINE**
**Hughes, W. L.**
***1961 IRE International Convention Record*, pt. 7, v. 9, pp. 8–10, 1961**

A method of reducing the "lag" effect encountered in vidicon cameras at low illumination is briefly discussed. (*EEA*, 1962, #2252)

**1,258. IMPROVED VIDEO RECORDING SYSTEM**
**Gillette, W.**
***1961 IRE International Convention Record*, pt. 7, v. 9, p. 11, 1961 (Abstract)**

Uniform terminology and a method of graphical representation are established. Factors affecting exposure uniformity are described by reviewing fundamental relations between the film exposure cycle and the television scan. Practical arrangements for recording television pictures on motion-picture film are described and analyzed. Effects of phosphor persistence are considered, and a detailed analysis of persistence effects in single-field recording is offered.

**1,259. RECENT ADVANCES IN VIDICONS**
**Rome, M.**
***1961 IRE International Convention Record*, pt. 7, v. 9, pp. 12–18, 1961**

The characteristics, i.e., sensitivity, lag, response, resolution, and miniaturization of newly introduced vidicon camera tubes are reviewed. The variation of gamma with dark current and light level of broadcast vidicons is briefly discussed. (*EEA*, 1962, #2253)

**1,260. THE ULTRA-VIOLET COLOUR-TRANSLATING TELEVISION MICROSCOPE AND ITS APPLICATIONS**
**Zworykin, V. K., Berkley, C., Geduldig, D.**
**In "Proceedings of the Third International Conference on Medical Electronics, London, 1960, I. Measurements in Medicine and Biology," pp. 52–53**
**Institution of Electrical Engineers, London, 1961**

The optical characteristics of biological material make most cells in the living state appear transparent in visible-light microscopy. More common current methods of visualizing living cells make use of physical differences in the cell constituents which do not directly supply information as to the chemical state of the cell. In order to detect the chemical differences in the cellular constituents, ultraviolet microscopy may be used. A device which translates the three images of three arbitrarily chosen ultraviolet wavelengths into three primary visible colors by means of color television is briefly described. In addition, several applications which show a portion of the wide range of work possible using this instrument are described. These include studies of capillary circulation, amoeboid motion, ultraviolet-radiation damage, and metabolite uptake. (*EEA*, 1962, #5827)

**1,261. REMOTE CONTROL FOR MOTION-PICTURE CAMERAS**
**Lawrence, L. G.**
***SMPTE, Journal of the*, v. 71, no. 1, pp. 13–14, January 1962**

The classic simplicity of the on-off switch undergoes considerable modifications for use on remote and/or unattended control cameras operated without the benefit of a human specialist. Discussed are the incorporation of design elements which, via sensed data on magnetic-striped film, are able to supply the camera with one-shot lubrication, set the selsyn-coupled zoom lens, provide continuous electromagnetic readjustment of pulldown claw, start and stop the camera at preset intervals and, finally, make a record of all control functions executed by the system. This type of secondary intelligence is useful whenever a coherent performance record must be obtained over very long periods of time. The magnetic stripe is precoded with given audio frequencies under darkroom conditions and is read out by common pickup models. Tuned resonators allow for proper discrimination and channel the cue to an associated electronic trigger.

**1,262. PINCHED-IMAGE MOVIE CAMERA**
***Machine Design*, v. 34, no. 3, pp. 108–109, February 1, 1962 (*AS&T*, 1962)**

**1,263. AUTOMATIC SENSITIVITY CONTROL FOR VIDICON TV CAMERA**
**Kidd, P. C.**
***Electronics*, v. 35, p. 52, February 9, 1962 (*AS&T*, 1962)**

**1,264. SYSTEMS QUARTERLY PROGRESS REPORT**
**February 15, 1962**
**Massachusetts Institute of Technology, Lincoln Laboratory, Cambridge, Mass.**
**Quarterly Progress Report Systems Division-2**

Work is continued on: Project *West Ford* support; 7090 input-output equipment; CCIS Program; estimation and control studies; deghosting of families of ballistic trajectories; minimal time control; logical systems; data transmission; intercom; optical maser studies; and solid state image converter.

**1,265. STUDY OF THE INTERACTION BETWEEN PHOTOCATHODES AND TARGET PLATES**
**Hall, J. A., Shaffer, R. A., Bonney, L. G. (Electronic Technology Laboratory, Wright-Patterson AFB, Ohio)**
**February 1962**
**Westinghouse Electric Corporation, East Pittsburgh, Pa.**
**Final Report for March 16, 1959–September 15, 1960, ASD TR 61-631, AF 33(616)-6422**

Thin aluminum oxide films for storage target plates in image orthicons have been studied. These films are extremely rugged and adaptable to various modifications. Ruggedized tubes made using these films meet or exceed the 10-g vibration tests of MIL-E-5272 with no image degradation. In standard 30-frame/sec scanning systems, these image orthicons with S-10 photocathodes produced 100 TV line images with only $10^{-6}$ ft-c incident on the photocathode. Tubes with multialkali S-20 photocathodes have produced 200 TV line images with $8.3 \times 10^{-7}$ ft-c on the photocathode. These tubes will store 600 line images for times longer than 10 sec. Secondary emission gains of six were measured. Performance of these aluminum oxide storage targets compares exactly to that obtained in tests of tubes with magnesium oxide target plates. Reasons for the substantial sensitivity improvement over glass target tubes are discussed. (*STAR*, 1963, N63-15738)

**1,266. CHARACTERISTICS OF FLYWHEEL SYNCHRONIZING CIRCUITS IN TELEVISION RECEIVERS**
**Maurice, D., Rout, E. R.**
***Electronic Engineering*, v. 34, no. 408, pp. 77–81, February 1962**

The results of two investigations (one purely theoretical and the other empirical) into the behavior of these circuits are presented. The effects on a typical line flywheel circuit of various steady-state and transient timing errors present in the applied synchronizing signal are analyzed, and the performance of six actual receivers presented with similar stimuli is reported. (*EEA*, 1962, #7306)

**1,267. COLOUR TELEVISION RECEPTION WITH THE BANANA TUBE**
**Neidhardt, P.**
***Elektronische Rundschau*, v. 16, no. 2, pp. 61–64, February 1962 (in German)**

A short description of this tube is followed by a brief review of its advantages over other color-television tubes. The design problems and drawbacks are then discussed at length. These include noise-free rotation of the glass envelope and heat dissipation from the luminescent screen. The optical system, comprising the cylindrical lenses and the hyperbolic mirror, provides a virtual image which inevitably changes in size and position with movements of the observer. The electron optics are then considered, particular attention being paid to the permanent magnet which ensures that the angle of incidence of the beam on the screen is constant over the whole length of the tube. (*EEA*, 1962, #7302)

**1,268. CONSIDERATION OF THE SATISFACTORY MEASUREMENT AND LIMIT SETTING OF TRANSIENT RESPONSE OF TELEVISION APPARATUS**
**Springer, H.**
***N.T.Z. Nachrichtentechnische Zeitschrift*, v. 15, no. 2, pp. 57–62, February 1962 (in German)**

A comparative study is given of the two forms of signals employed for this purpose: (1) the German 250-kc square pulse with a steepness corresponding to the transient time $T$ of

the system, where $T = \frac{1}{2}f_g$, $f_g$ being the cutoff frequency of 5 Mc; and (2) the English $\sin^2$ pulse with a duration at half maximum amplitude of $T$ and a second pulse of twice the duration. The frequency spectra covered by the different forms of pulse employed are considered, and the irrelevant distortion effects arising from the top cutoff of the systems pointed out. Methods of measurements are briefly discussed and maximum and minimum limits indicated. The English procedure, although precise, is considered over-elaborate, and it is claimed that practically the same results can be achieved by a combined study of the pulse response and the amplitude and phase characteristics. (*EEA*, 1962, #8299)

**1,269. A STANDARD SIGNAL SOURCE FOR TELEVISION TRANSMISSION TECHNIQUE**
**Kuntze, R.**
***N.T.Z. Nachrichtentechnische Zeitschrift*, v. 15, no. 2, pp. 63–65, February 1962 (in German)**

This is a portable mains-driven instrument for checking signal level over various links in the transmission chain. It generates line-synchronizing pulses of the correct frequency and rectangular picture signals of 0.3 and 0.7 $\pm$ 0.5 percent, respectively. A stabilized two-valve square-wave generator feeds into a two-stage picture-signal limiter which is used in turn to drive the line-sync pulse generator. Three long-tailed pair stages are included to ensure output constancy. No level indicator is included, but a clock registering the time during which the instrument is switched on ensures that the calibration is checked at the requisite intervals. (*EEA*, 1962, #8300)

**1,270. IMAGE CONVERTER CAMERA MEASURES FLIGHT OF LIGHT**
***Nucleonics*, v. 20, no. 2, p. 66, February 1962**

In this camera, an image-converter tube changes the optical image of a light flash to an electron image, thus allowing electronic shuttering (by use of a grating grid), light amplification, and image deflection to take place. The electrons cross over an anode and are accelerated to a focus on a fluorescent screen at the end of the tube. Framed photographs can be taken at exposure times varying from 3 to 200 m$\mu$sec, and streak photographs can be taken at writing speeds of 4 to 1,000 mm/$\mu$sec.

**1,271. RESEARCH SUMMARY NO. 36-13 FOR THE PERIOD DECEMBER 1, 1961 TO FEBRUARY 1, 1962**
**March 1, 1962**
**Jet Propulsion Laboratory, California Institute of Technology, Pasadena**

**1,272. SISTEMA TSVETNOGO TELEVIDENIYA S VYNESENNYMI PODNESUSHCHIMI (COLOR TV SYSTEM WITH REMOTE SUBCARRIERS)**
**Sevalnev, L. A.**
***Elektrosvyaz*, no. 3, pp. 13–18, March 1962**
**(Translated from the Russian in *Telecommunications*, pt. 1, no. 3, pp. 12–18, March 1962)**

A system in which color information is transmitted over two subcarriers removed beyond the limits of the brightness signal bandwidth is discussed. The bases for selection of the number of parameters of the system, and results of experimental investigations are given. (*EI*, 1962)

**1,273. ON THE AUTOMATIC PHASE CONTROL SYSTEMS USED IN THE CARRIER-SUPPRESSED VESTIGIAL-SIDEBAND TV TRANSMISSION SYSTEMS**
**Kawashima, M.**
***Institute of Electrical Communication Engineers of Japan, Journal of the*, v. 45, no. 3, pp. 310–316, March 1962**
**(in Japanese)**

A description is given of the special features of two automatic phase-control (APC) systems for TV transmission systems in which the receiving terminal uses the frequency and phase synchronized carrier-reproducing system having phase accuracy within $\pm$5 deg for NTSC color TV. In the second APC system described, a block diagram of which is given, use is made of three periodic informations in the modulated signal for more effective carrier reproduction and phase control, namely, the carrier component of the blanking period, and the horizontal and vertical components of the synchronizing signal waveform. A sampling technique is used to pick up the in-phase burst in the blanking period of the modulated carrier; the system includes a quick-response digital time scaling circuit (termed "self-holding gate") in the synchronous function generating circuit to get reliable regeneration. Accuracy within $\pm$5 deg is easily obtained. (*EEA*, 1962, #14,907)

**1,274. A TRANSISTORIZED CAMERA FOR CLOSED-CIRCUIT TELEVISION**
**Jetten, G., Van Lookeren, P. O., Roselek, E., Valeton, J. J. P.**
***Radio Mentor*, v. 28, no. 3, pp. 197–202, March 1962**
**(in German)**

The camera tube is a resistron requiring a maximum high-tension supply of 300 v. Its output circuit embodies automatic regulation of light sensitivity, but this involves the inclusion of 1000 M$\Omega$ resistor which would pose severe insulation problems in the tropics. The video amplifier includes four stages with one resonant circuit and negative feedback to give a response substantially flat up to 5 Mc. The HF oscillator can be switched to three different frequencies and consists of a single transistor with a diode serving as modulator. Frame synchronizing is derived from the main frequency and is simpler than in broadcast television: line synchronizing pulses are obtained from a single 15,625 cps oscillator. The maximum signal output is 250 mv effective. (*EEA*, 1962, #10,182)

**1,275. NOVEL SHUTTER AND INTERMITTENT FOR VIDEO-RECORDING CAMERA**
Palmer, W. A.
*SMPTE, Journal of the*, v. 71, no. 3, pp. 167–169, March 1962
(*AS&T*, 1962)

**1,276. PRISMS FOR MULTIPLE MOVIE IMAGES**
Matzkin, M. A.
*Modern Photography*, v. 26, p. 92, March 1962
(*AS&T*, 1962)

**1,277. HIGH-APERTURE, HIGH-SPEED FRAMING CAMERA USING AN IMAGE-CONVERTER TUBE**
Martone, M., Segre, S. E.
*Journal of Scientific Instruments*, v. 39, no. 3, pp. 112–114, March 1962

A high-aperture framing camera is described which uses a Mullard ME 1201 image-converter tube. The aperture is $f/1.9$, and six frames can be obtained with a framing time of 1.8 $\mu$sec and an exposure time of 0.2 $\mu$sec. The limitations to the framing frequency are discussed. (*EEA*, 1962, #6144)

**1,278. INVESTIGATION OF SOLID-STATE DELAY LINES**
April 30, 1962
Kaiser Industries Corporation, Palo Alto, Calif.
Final Report, Nonr-107600
AD-275,764
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Research was conducted on solid-state display circuitry. Of the two basic items needed for a display panel — a control apparatus and a light controlling medium — efforts were directed only toward the control apparatus. The work has progressed to a point where it stands as a major breakthrough in electronic switching (commutating) or crossed-field (crossed-grid) panels, using electroluminescent phosphor or other light controlling media. The switching system is described, including the digital arrangement which removes the normal limitations on resolution. An automatic phasing scheme is also explained. The 40 × 40 and the 100 × 100 line breadboard displays and the 100-element bar graph are described. Also covered are the various types of delay lines studied, as well as nanosecond pulse techniques and pulsers, and assembly methods of EL panels.

**1,279. STUDY ON MATERIAL INTERACTION AND MIGRATION IN CAMERA TUBES**
Upshaw, V. (Electronic Technology Laboratory, Wright-Patterson AFB, Ohio)
April 1962
Westinghouse Electric Corporation, Elmira, N.Y.
Final Summary Report for December 1, 1960–November 30, 1961, ASD TDR 62-78, AF 33(616)-7723

To study the interaction and migration of materials in camera tubes, the image orthicon target was selected. A demountable structure was built incorporating matrix cathodes for target testing. The demountable seal permitted conventional exhaust and test processing without special equipment. Storage tests on aluminum oxide targets in tubes made without alkali showed resolution of better than 500 lines after an image storage time of 90 min. Three references are included. (*STAR*, 1963, N63-15508)

**1,280. VIDEO TRANSMISSION BY DELTA MODULATION USING TUNNEL DIODES**
Balder, J. C., Kramer, C.
*IRE, Proceedings of the*, v. 50, no. 4(I), pp. 428–431, April 1962

A method is described which enables video signals to be transmitted by the pulse code modulation system known as delta-modulation. A tunnel-diode balance pair (Goto pair) is used for converting the video signal into a binary signal. With a new and very simple circuit, operating at a bit rate of 100 Mc, a ratio of signal-to-quantizing noise of 42 db is obtained. A more conventional circuit that combines tunnel-diodes with transistors makes an even lower quantizing noise possible. (*EEA*, 1962, #9581)

**1,281. COLOUR TELEVISION PICTURE DISPLAY WITH THE "BANANA" TUBE**
Neidhardt, P.
*Elektronische Rundschau*, v. 16, no. 4, pp. 161–168, April 1962 (in German)

Circuit operation and design of a Banana-tube television system are dealt with. Tube supply, focus circuits, and correction arrangements to achieve good linearity of horizontal deflection are described. The prevention of reversed sequence in the primary color section by a third harmonic control is explained. Features of optical perspective are also discussed. (*EEA*, 1962, #10,184)

**1,282. A CONSTANT LUMINANCE COLOUR TELEVISION SYSTEM**
James, I. J. P., Karwowski, W. A.
*British Institution of Radio Engineers, Journal of the*, v. 23, no. 4, pp. 297–306, April 1962

A color television signal employing three basic components— $E_Y^{1/\nu}$ ($E_R^{1/\nu} - E_Y^{1/\nu}$), and ($E_B^{1/\nu} - E_Y^{1/\nu}$)— is proposed for use in NTSC- and SECAM-type systems. It is shown that this leads to certain improvements both in the quantity and quality of the transmitted information. Methods of receiving such a signal are described, and it is concluded that theoretical consideration of the system has reached such a stage that experimental work would be both desirable and justified. (*EEA*, 1962, #8295)

**1,283. SOME ASPECTS OF V.S.B. TRANSMISSION OF COLOUR TELEVISION WITH ENVELOPE DETECTION**
**Newell, G. F.**
***British Institution of Radio Engineers, Journal of the,* v. 23, no. 4, pp. 316–320, April 1962**

The assessment of the merits of a color television system in fulfilling the principle of constant luminance must take into account the errors that can result from the use of a vestigial-sideband emission with envelope detection. Comparison is made between the NTSC system and the modified form of this proposed by James and Karwowski. In regard to the reproduction of color in large areas, the NTSC system is in some aspects superior to that of James and Karwowski. (*EEA*, 1962, #8297)

**1,284. SHELL SOLVES OILY PROBLEM: PERIPHERY CAMERA**
**Langford, M. J.**
***Industrial Photography*, v. 11, pp. 22–23, April 1962**
**(*AS&T*, 1962)**

**1,285. TOTAL PICTURE CONTROL—CONTROL SIZE AND SPACE WITH INTERCHANGEABLE LENSES**
**Feininger, A.**
***Modern Photography*, v. 26, pp. 68–69, April 1962**
**(*AS&T*, 1962)**

**1,286. MICROSPOT TUBE WITH VERY HIGH RESOLUTION**
**Schlesinger, K.**
***IRE Transactions on Electron Devices*, v. ED-9, no. 3, pp. 281–288, May 1962**

Characteristics of a 5-in. microspot tube with a spot size of 8 to 9 $\mu$ and beam current of 1.5 $\mu$a are described. The tube features a resistive helix in the neck section, an extremely small object aperture, a spot-size control section, a miniature electron gun for high-intensity illumination of the object, a magnetic neck assembly for centering and for control of astigmatism, and grainless evaporated phosphor with a very high overload capability. (*EI*, 1963)

**1,287. THE PRESENT LIMITS OF VIDICON PERFORMANCE**
**Dillenburger, W.**
***Elektronische Rundschau*, v. 16, no. 5, pp. 205–211, May 1962 (in German)**

Vidicon cameras, originally intended for industrial purposes only, suffered from a number of shortcomings which are briefly discussed. Steady progress has been made, and a description is given in detail of appraisals by the Fernseh Gmbh on new 1- and 1½-in. vidicons designed by RCA and PTW (Physikalisch-Technische Werkstaetten in Wiesbaden). The following six characteristics are investigated: (1) definition imp.ovement in both directions with higher anode voltage—at 1000 v (compared with the usual 250 to 300 v), 60-percent modulation depth at 5 Mc is possible; (2) S/N ratio—safe 46 db is obtainable on tubes with aperture correction; (3) displacement of black-white transition edges due to crossfields on storage plate—again, high voltage achieves considerable improvement; at a signal current of 0.35 no shift is discernible; (4) inertial effects—at normal movement speed live pictures can now be transmitted with a scene illumination of >1000 lux, aperture 2 and 50 percent reflection factor, (5) gradation — as illustrated by staircase test oscillograms, a contrast range of 100–1 is resolved, (6) halation, i.e., lighting up of dark picture areas in the immediate neighborhood of white elements—the vidicon is still poor. Summing up, the modern vidicon seems to be improving rapidly and to be imminently suitable for still pictures, some experimental cameras made with lead oxide photo layers will probably be satisfactory for all purposes. A series of excellent photographs of screen pictures and test waveforms compare various vidicons with superorthicons and a 16-mm film scanner. Seven references are quoted. (*EEA*, 1962, #13,626)

**1,288. BEAM-DEFLECTION AND PHOTO DEVICES**
**Schlesinger, K., Ramberg, E. G.**
***IRE, Proceedings of the*, v. 50, no. 5, pp. 991–1005, May 1962**

Both the historical development and the more significant recent advances are described for beam-deflection devices such as the cathode-ray oscillograph, storage tubes, and television display tubes. Similarly, advances are indicated in the field of photo devices such as photoemissive, photoconductive, and photovoltaic cells; multiplier photo-tubes; image tubes; and light amplifiers. (*EEA*, 1962, #11,133)

**1,289. INVESTIGATION OF 360-DEGREE NON-PROGRAMMED VISUAL PRESENTATION**
**Clay, B. R., Kidd, M. C., Whistler, R., Wendt, H. W.**
**June 5, 1962**
**RCA Defense Electronic Products, Burlington, Mass.**
**N61339-1053, NAVTRADEVCEN 1053-1**
**AD-291,468**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

A study was made to determine whether recent advances in electronics, optics, and data recording could be utilized, in judicious combination, to produce a 360-deg closed-circuit panoramic television system that could be used to simulate the external visual environment in vehicle operator training devices. A three-dimensional scale model of the desired operating area provides the visual input information to a closed-circuit multi-channel television system. The television pickup moves over the model in response to the computer-processed control actions of the trainee. The television system acquires full 360-deg panoramic image information by virtue of a scan that is optically rotated in azimuth. The video information thus acquired is transmitted to the display system mounted directly above the student. The projection system

produces a real image on the focal surface on an ellipsoidal mirror that surrounds the observer. The scene that he sees is thus made to appear at infinity. The study resulted in a survey of potentially applicable components, systems and techniques, selection of the most useful, and the qualitative design of two system configurations.

1,290. RESEARCH AND DEVELOPMENT TO IMPROVE THE RESOLUTION OF IATRON DIRECT VIEW STORAGE TUBES
**Clayton, R. H.**
**June 12, 1962**
**ITT Industrial Laboratories, Fort Wayne, Ind.**
**Interim Development Report for February 22–May 1962, NObsr-87264**
**This report includes:**
**MECHANICAL COLLIMATION OF IATRON IMAGE SECTION, April 27, 1962, RR 169**
**ON THE DESIGN OF AN IATRON WITH SOLENOIDAL FOCUS FIELD, June 7, 1962 (Revised June 19, 1962), RM 363**
**AD-276,897**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

Elemental aperture lenses in the storage mesh of Iatron display storage tubes form highly divergent cones of flood electrons in the phosphor region which greatly reduce resolution at high brightness levels. Solution of this problem may be achieved, in general, by: (1) weakening aperture lenses, (2) reconverging elemental cones, and (3) gross electrostatic or magnetic focus of the entire storage screen. The general solutions listed were expanded into specific approaches, and an estimate of the relative promise of each was attempted. The technologies which presently limit mechanical collimation are described. Gross magnetic focusing options are explored theoretically. Both theoretical and experimental data are presented relevant to electrostatic microlens design. A technology of mesh thickening is described in detail. References are also included.

1,291. RESEARCH AND DEVELOPMENT OF A CAMERA TUBE FOR NIGHT VIEWING
**Lempert, J., Klotzbaugh, G.**
**June 12, 1962**
**Westinghouse Electric Corporation, Pittsburgh, Pa.**
**RR 62-912-255-R2, Report 10, Quarterly Progress Report 5 for March 1–May 31, 1962, DA 36-039-sc-87397 (continuation of DA 36-039-sc-78920)**
**AD-281,846**

The S/N ratio required for visual detection of an image having a given line number has been determined using the test equipment employed in evaluating Ebicon tubes. Rough agreement at low line numbers has been obtained between the experimental data and that published in the literature, although the general shape of the curve has not been duplicated. The general structure of a test position capable of being converted into a component of a linear anaerobic position, in which critical tube components can be fabricated, tested, and injected into the final tube, is discussed. Test data are in reasonable agreement with results obtained on a separate demountable test position. The revision of the design of the transmission secondary emission (TSE) Ebicon is discussed, and the projected program is outlined. Four references are included.

1,292. APPLIED RESEARCH ON TSEM IMAGE AMPLIFICATION CAMERA TUBE
**Kalafut, J., Mansfield, W. O., Shabanowitz, H.**
**June 21, 1962**
**Westinghouse Electric Corporation, Elmira, N.Y.**
**Interim Engineering Report 2 for September 16, 1961–March 15, 1962, AF 33(616)-8017**
**AD-276,964**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

A summary of work performed on transmissive secondary emission (TSE) films and their applications as prescanning beam amplifiers in camera tubes for low light level performance is presented. The work performed involves a feasibility study of intensifier-orthicon devices employing TSE amplification. In general, two approaches were pursued. One is an intensifier-orthicon which utilizes TSE films as prescanning beam dynodes in the image section in combination with a thin film storage target. The other approach is the use of a high gain, low density film as a TSE-EBIC (transmission secondary emission-electron bombardment induced conductivity) storage target in an orthicon structure.

1,293. SOLID STATE PANELS: WILL THEY BRING FLAT-DISPLAY TV?
**Binggeli, B., Fatuzzo, E.**
***Electronics*, v. 35, no. 26, pp. 67–70, June 29, 1962**

The panels described have 225 electroluminescent cells arranged in 25 subgroups of nine each. Scanning voltages are applied to rows and columns of subgroups through ferroelectrics which are biased in descending order of voltage and act as gates for the ac excitation for the luminescent cells. Excitation is applied simultaneously to all cells of a subgroup by means of nine carriers at different frequencies, modulated with the video information. The same carrier is used for the corresponding cells of all subgroups. Each modulated carrier is fed through a filter. The combination of sequential and simultaneous display enables satisfactory performance to be obtained at television frame frequency. The system can handle $10^4$ dots. (*EEA*, 1962, #13,632)

**1,294. RESEARCH AND DEVELOPMENT OF MINIATURE, ENVIRONMENTALIZED, ELECTROSTATIC IMAGE ORTHICON**
**Schaefer, D. L.**
**June 30, 1962**
**General Electric Company, Syracuse, N.Y.**
**Quarterly Progress Report 4 for April–June 1962,**
**DA 36-039-sc-88964**
**AD-282,643**

Work has continued on the design of a miniature, environmentalized, electrostatically focused and deflected image orthicon. A return-beam path through the einzel lens and velocity selector has been found to be too critical to set up. A short return-beam path, with the first dynode located on the target side of the einzel lens, is more satisfactory and less critical. The sensitivity of the latter design to magnetic fields is considerably reduced. Tubes with the short return-beam path using photoconductive targets have been built, and preliminary video tests were made.

**1,295. STUDY OF ELECTRON FOCUSING BY NON-LINEAR SPIRALS**
**Schlesinger, K.**
**June 30, 1962**
**General Electric Company, Syracuse, N.Y.**
**Interim Engineering Report 1, AF 33(657)-7682**
**AD-278,094**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

The problem of a plane-to-plane electrostatic image-tube was attacked by theoretical, as well as by experimental, methods. Large spiral-lens cylinders were designed and built to handle focusing and accelerator functions involved. High transmission meshes, both flat and spherical, were prepared for use in test tubes. Ray-tracing studies revealed that an internal convex mesh-anode can produce a convex virtual-image surface from a flat cathode-plane under certain conditions. Tubes built on that basis showed definite effects from the convex versus the concave shape of the mesh. These effects, however, were too weak to be usable. A triode system, using a strongly convex mesh of conchoidal shape, facing a plane cathode behind a flat first anode mesh, was giving good results. The theory of this aplanatic system, along with some pictorial evidence, is given. Ten references are included.

**1,296. FURTHER DEVELOPMENT OF TRANSMISSION TYPE INTENSIFIER BY 20TH CENTURY ELECTRONICS LTD.**
**Emberson, D. L.**
***IRE Transactions on Nuclear Science*, v. NS-9, no. 3,**
**pp. 107–114, June 1962**

An improved transmission secondary emission image intensifier incorporates a larger dynode area and multi-alkali photocathode. Preliminary performance data with respect to resolution and dark current are reported. Results of measurement of operational fatigue are given. (*EI*, 1963)

**1,297. TRANSMISSION SECONDARY EMISSION IMAGE INTENSIFIERS**
**Slark, N. A., Woolgar, A. J.**
***IRE Transactions on Nuclear Science*, v. NS-9, no. 3,**
**pp. 115–117, June 1962**

In the tubes described, electrons from a trialkali photocathode are accelerated and focused onto a series of dynodes where multiplication takes place by transmitted secondary emission. Electrons from the final dynode are then focused onto the output phosphor. Characteristics are discussed. (*EI*, 1963)

**1,298. SOME MEASUREMENTS OF EFFICIENCY FOR OBSERVING PHOTOELECTRONS IN IMAGE INTENSIFIERS**
**Waters, J. R., Reynolds, G. T., Scarl, D. B., Zdanis, R. A.**
***IRE Transactions on Nuclear Science*, v. NS-9, no. 3,**
**pp. 239–242, June 1962**

A method for measuring the efficiency with which photoelectrons can be detected in an image intensifier system is described. A weak light is shone onto the first cathode and the photoelectron current is measured. Light is then attenuated by a large known factor and compared with the number of spots observed in a given time. A simple system is used to demonstrate the method. A maximum efficiency of 85 percent is achieved. (*EI*, 1963)

**1,299. STABILITY CRITERIA FOR TELEVISION CAMERA TUBES**
**Sadashige, K.**
***SMPTE, Journal of the*, v. 71, no. 6, pp. 419–428, June 1962**
**(*AS&T*, 1962)**

**1,300. NEW INFRARED-GENERATING DIODE TRANSMITS TELEVISION OVER MODULATED LIGHT RAY—GALLIUM ARSENIDE DEVICE**
**Maguire, T.**
***Electronics*, v. 35, pp. 24–25, July 27, 1962**
**(*AS&T*, 1962)**

**1,301. K VOPROSU O NAKOPLENII V PEREDAYUSHCHIKH TELEVIZIONNYKH TRUBAKH S FOTOPROVODYASHCHIMI MISHENYAMI (STORAGE PROBLEM IN TRANSMITTING TELEVISION TUBES WITH PHOTOCONDUCTING TARGETS)**
**Zelenoborskii, S. P.**
***Radiotekhnika i Elektronika*, v. 7, no. 7, pp. 1185–1195,**
**July 1962**
**(Translated from the Russian in *Radio Engineering and Electronic Physics*, v. 7, no. 7, pp. 1110–1119, July 1962)**

Vidicon camera tubes using photoconductive effect have been investigated mainly from the commutation point of view.

The storage effect is analyzed in detail, and relationships between the number of current carriers, induced charge, mean free diffusion path, electron spacing, mobility, carrier life time $t$ in free state, mean drift time of carriers between electrodes $T$, photocurrent, integral photocathode sensitivity, and mean number of photons/lu/sec are enumerated and discussed. It is shown that the storage current in the case of the inner photoeffect is equal to that of the external photoeffect multiplied by the photoconductive gain $G = t/T$. The physical meaning of $G$ and other above parameters is dealt with in detail, particularly the connection between the quadratic recombination of current carriers, photocurrent and $G$, including the important fact that photoelectric lag, typical for vidicons, does not affect the derived relationships which are independent of the dark current. The process of the potential buildup on the target is explained and calculated, and measured values of the integral photocathode sensitivity for varying areas, time constant, and resistivities are compared in a table. High values for $G$ (100 and more) can be obtained. Noise characteristics of vidicons are considered next; formulae are given for thermal, shot, and photon noise contributions for a single target element, indicating a considerable similarity between inner photoconductive and secondary emission amplification mechanisms. It is shown that, with a $G$ of 500 and some required characteristic values to achieve this figure quoted, the vidicon itself does not add any noise to the S/N of the handled photo-input. (*EEA*, 1963, #862)

**1,302. UNDERWATER TELEVISION INSPECTION**
**Sonne, R.**
***Canadian Municipal Utilities*, v. 100, no. 7, pp. 36, 39, 41, July 1962**

The origin and development of underwater closed-circuit television, as well as advances in equipment manufactured by the International Underwater Contractors, are discussed. Infrared and ultraviolet lamps have proved very effective in underwater lighting. Problems in television sewer inspections are presented. Applications of underwater television in water supply inspection are also discussed. (*EI*, 1963)

**1,303. A TIME-RESOLVING IMAGE INTENSIFIER**
**Walters, F., Brown, R. P.**
**July 1962**
**Associated Electrical Industries, Ltd., Great Britain**
**R-H619, Progress Report for January–April 1962 on CVD Development**
**AD-287,157**

**1,304. AN INFRARED TELEVISION PICKUP TUBE**
**Gaedke, W.**
***Nachrichtentechnik*, v. 12, no. 7, pp. 256–260, July 1962 (in German)**

A vidicon type pickup tube employing a Pbs-PbO photoconductor is described. Its maximum sensitivity is in the visible region but can be used up to the wavelength of 2 $\mu$. (*EEA*, 1963, #3157)

**1,305. THE POSSIBLE USE OF THE CLOSED CIRCUIT TELEVISION SYSTEM FOR OPTICAL RANGEFINDING**
**Gebel, R. K. H.**
**July 1962**
**Wright Air Development Division, Office of Aerospace Research, Aeronautical Research Laboratories, Wright-Patterson AFB, Ohio**
**ARL-62-383**

A new transducer capable of automatic background compensation is suggested for use in an electronic comparator system employed as a passive optical rangefinding technique. The transducer, which is a vacuum tube similar to the image orthicon, achieves the background compensation by neutralization of opposite charge patterns on a special target plate structure. Some of the theoretical capabilities and sensitivities of such a system are analyzed.

**1,306. HIGH QUALITY TELEVISION LINK**
**Broadbent, G. A.**
***Institution of Radio Engineers, Australia, Proceedings of the*, v. 23, no. 8, pp. 465–472, August 1962**

A television link between the studio and transmitter, or outside telecast link, is described. This system employs frequency modulation and operates in a 5925- to 7980-Mc band, with transmitter power output of 1 w. Equipment performance permits eight systems to be cascaded, using a transmitter and receiver back-to-back as a repeater. Automatic frequency control, on both transmitter and receiver, is used with the system, and the sound diplexers operate on a subcarrier of 6.8 Mc. (*EI*, 1963)

**1,307. DER EINFLUSS VON SYSTEM—UND ÜBERTRAGUNGSFEHLERN BEI EINER FARBFERNSEHÜBERTRAGUNG NACH DEM SECAMVERFAHREN (EFFECT OF TRANSMISSION ERRORS IN SECAM COLOR TV TRANSMISSION)**
***Archiv der Elektrischen Übertragung*, v. 16, no. 8, pp. 385–399, August 1962**

An experimental study of signal distortion introduced by relatively strong band-limiting of the FM color signal and influence of delay errors is discussed. The effects of reflection interference on residual influence of differential phase errors, and a comparison of color subcarrier and internal interference with brightness signal in the NTSC and SECAM-FM systems are also presented. (*EI*, 1963)

**1,308. IMAGE INTENSIFIER ISOCON FEASIBILITY STUDY**
**Hoffman, R. E.**
**August 1962**
**Radio Corporation of America, Lancaster, Pa.**
**Final Report for December 1960–February 1962 on Electronic Tube Technology, ASD TDR 62-529, AF 33(616)-7696**
**AD-287,223**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

A comparison is made of the operating principles of image orthicons and image isocons. The superiority of the image isocon is shown by a graphic representation of the output signal resulting from an image of black, gray, and white stripes. Experimental intensifier image isocons having electrostatic focus intensifier sections were constructed for evaluation of the performance of the combination. The tube performance is expressed in terms of resolution, aperture response, S/N ratio, and dynamic range. Information on the equipment necessary for operation of the intensifier image isocon and operating procedure is included.

1,309. MORE ON THE TV CAMERA
Parker, W. E.
*Radio-Electronics*, v. 33, p. 41, August 1962
(*AS&T*, 1962)

1,310. IMPROVED CHARACTER SELECTION AND BEAM COMPENSATION AMPLIFIER FOR THE PLAN POSITION DATA DISPLAY
September 7, 1962
General Precision Laboratory, Inc., Pleasantville, N.Y.
Final Engineering Report, ARDS-462
AD-298,932
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

1,311. RESEARCH AND DEVELOPMENT OF A CAMERA TUBE FOR NIGHT VIEWING
Lempert, J., Klotzbaugh, G.
September 12, 1962
Westinghouse Electric Corporation, Pittsburgh, Pa.
RR 62-912-255-R3, Report 11, Quarterly Progress Report 6 for June 1–August 31, 1962, DA 36-039-sc-87397
(continuation of DA 36-039-sc-78920)
AD-290,941

Determinations of the S/N ratio required for visual detection of an image on a vidicon camera system at a given line number using refined circuitry agree with previous results on this camera system. Test results are given for experimental tubes using transmission secondary emission films as preamplifying stages. Factors affecting gain and focus of the different stages are discussed. An analysis is made of the pressure differentials that may be expected across a tube having an internal vapor seal as a function of the pumping parameters of the system.

1,312. RESEARCH AND DEVELOPMENT OF MINIATURE ENVIRONMENTALIZED, ELECTROSTATIC IMAGE ORTHICON
Day, B. E.
September 30, 1962
General Electric Company, Syracuse, N.Y.
Quarterly Progress Report 5 for July 1–September 30, 1962, DA 36-039-sc-88964
AD-288,278

Progress is reported on the design of a miniature, environmentalized, electrostatically focused and deflected image orthicon. Effort was made to yield a design that is miniaturized and reduced in weight by the elimination of large and massive focusing and deflecting coils commonly used in image orthicon design. Effort was also made on a design that is environmentalized within the present state of the art.

1,313. SHELL DEVELOPS NEW DOWNHOLE TV SYSTEM
*World Oil*, v. 155, no. 4, pp. 102, 104, September 1962
(Also available in *Oil and Gas Journal*, v. 60, no. 32, pp. 82–83, August 6, 1962)

A new downhole TV system has been developed. The present outside diameter of the camera housing is 4¾ in., allowing its use in a 5½-in. casing or in an open hole. The camera incorporates high light sensitivity, automatic accommodation to changing light level, and low power consumption, and requires a minimum of separate conductors in the operating cable. Formations, fractures, and mechanical conditions in the well can be viewed continuously at the surface by use of a TV monitor screen. (*EI*, 1963)

1,314. PRACTICAL EVALUATION OF IMAGE INTENSIFIER SYSTEMS
Becker, J. A., Henny, G. C.
*Radiology*, v. 79, no. 3, pp. 483–488, September 1962

A critical study is made of 23 types of image intensifier or intensifier plus TV combinations. A wire mesh grid is used for determination of image detail, as well as a Burger phantom of 1 cm. Perspex with multiple holes, and the dose rates for equal information content are obtained. The greatest sensitivity is given by the Keleket 9-in. tube with mirror periscope, requiring a dose rate of 0.01 r/min. It is stressed that the apparent value of light amplification far exceeds the real value in image detail, and TV reproduction does not give the additional gain expected on the basis of light value alone. (*EEA*, 1963, #861)

1,315. AN X-RAY TELEVISION SYSTEM WITH IMAGE STORAGE AND AUTOMATIC EXPOSURE-RELEASE
Seyler, A. J.
*British Institution of Radio Engineers, Journal of the*, v. 24, no. 3, pp. 229–240, September 1962

The design of an X-ray television system containing an electronic recording storage tube is described. The sequence of storage tube functions and X-ray exposure is automatically controlled by a central timing device, and all time intervals are synchronized with the vertical scanning period of the television system. By actuating a single exposure release button when a new image is required, erasure of the previous image and storage of the new one are completed within half a second. During this interval the X-ray source is energized for not more than one quarter of a second but generally less. Continuous display times of useful pictures of up to 30 min were obtained.

Apart from the single-shot operation, provision is made for automatically repeating the exposure at intervals variable between 2 and 6 sec. In this cycling mode, slowly varying phenomena and surgical manipulations may be observed in quasi-motion. Any number of ordinary television display units may be supplied with composite television signals from the output of the storage unit, and one such device may be permanently set up for still or moving photographic recording of the images. The unit is presently undergoing tests for quantitative evaluation of its performance and for the investigation of its medical potential. One objective for further development is already under consideration, i.e., the exploitation of the potential of the storage tube for the storing of four images. Thus, when required, two images obtained in two planes of the object could be stored simultaneously with those of a previous exposure which would be retained for reference. (*EEA*, 1963, #900)

1,316. GALLIUM-ARSENIDE DIODE SENDS TELEVISION BY INFRARED BEAM
**Rediker, R. H., Keyes, R. J., Quist, T. M., Hudson, M. J., Grant, C. R., Burgess, R. G.**
***Electronics*, v. 35, no. 40, pp. 44–45, October 5, 1962**

Infrared output power above 1 w was obtained from diodes with active areas above $10^{-3}$ $cm^2$. Infrared output can be modulated at frequencies up to and above 100 Mc by modulating the diode current. The system was shown to transmit high quality TV pictures. (*EI*, 1963)

1,317. IMAGE ORTHICONS GET SPECIAL HANDLING
***Electronics*, v. 35, pp. 78–79, October 12, 1962**
***(AS&T*, 1963)**

1,318. STUDY OF ELECTRON FOCUSING BY NON-LINEAR SPIRALS
**Schlesinger, K.**
**October 31, 1962**
**General Electric Company, Syracuse, N.Y.**
**Interim Engineering Report 2 for June 30–October 31, 1962,**
**AF 33(657)-7682**
**AD-268,512**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

Image-tube systems with spiral optics were investigated in the demountable stage. All tubes are imaging a plane cathode (2½-in. D) on a plane screen. A first optical system uses only one spiral-lens section and produces an essentially fixed magnification of 0.67. A second refined tube uses a tandem spiral lens, giving it a capability for zoom-lens operation. A range of magnification of 4:1 is reported. This occurs in three distinct conditions of ⅓, ⅔, and ⅓, which are practically noncontingent. Several of the test tubes have employed spirals coated by a thin, protective film having an electronic conductivity of $10^{10}$ ohms per square.

1,319. SUPPORTING RESEARCH AND DEVELOPMENT PROGRAM FOR ADVANCED TELEVISION CAMERA TUBES
**Borkan, H., Choi, O., Gray, S., Handel, R. R., Heil, H.**
**October 1962**
**Radio Corporation of America, Lancaster, Pa.**
**Final Report for June 1959–December 1961,**
**AF 33(616)-6682**
**AD-290,592**

A high-performance target structure was developed consistent with the requirements for a high-sensitivity camera tube (capable of 1500 television lines/in. at 50 percent sine wave response over a 2 × 2-in. format). Techniques were also developed for sealing and firing plug targets which were flat and tight, and were suitable for useful resolution tests. Plug targets produced good pictures with exceptionally low afterimage. In the case of enlarged-pore targets, a tube containing such a target produced a picture of proper polarity (i.e., the target gain is in excess of one). A method was demonstrated whereby geometry and resolution may be simultaneously maintained in an image section which has been improperly designed. Information was accumulated to implement the design for an image section in an advanced television camera tube.

1,320. DEVELOPMENT OF A MAGNETICALLY FOCUSED IMAGE TUBE WITH A 10-INCH PHOTOCATHODE AND SCREEN
**Butterwick, G. N.**
**October 1962**
**Radio Corporation of America, Lancaster, Pa.**
**Final Report for January 1961–September 1962,**
**AF 33(616)-7819**
**AD-292,970**

The development of a magnetically focused image tube (10-in.-D cathode and screen) capable of uniform image intensification with little or no distortion in the reproduced image is described. Included are discussions of the theory and design of the C70059 (RCA development-type number for tube prototype), encompassing designs of the bulb and faceplate, electron accelerating electrode, and the evaporator system. Also discussed are special problems in fabrication and processing, such as faceplate sealing, screening and evacuation, problems inherent in the physical size of the C70059, and their solutions. Included are tube operational data and recommendations for future improvement.

1,321. SIGNIFICANCE OF FATIGUE IN LEAD OXIDE VIDICON TARGET
**Bigelow, J. E., Haq, K. E.**
***Journal of Applied Physics*, v. 33, no. 10, pp. 2980–2982, October 1962**

To understand "fatigue" or "burn-in" in the target of a PbO Vidicon, experiments were made with sandwich cells of evaporated PbO. It was demonstrated using chopped radia-

tion that as the PbO layer fatigues, there is an increase in short-term dark conductivity. Further, it was shown that the phenomenon is associated with loss of oxygen from the surface of the crystals during irradiation with photons. A surface chemistry model similar to one proposed by Morrison and Melnick in connection with ZnO is used to explain the observed results. (*EEA*, 1963, #863)

**1,322. NEKOTORYE SVOISTVA TSIFROVYKH TELEVIZIONNYKH SISTEM S NEPOSTOYANNOI CHASTOTOI STROK I KADROV (CERTAIN PROPERTIES OF DIGITAL TV SYSTEMS WITH CHANGEABLE FREQUENCY OF LINES AND FRAMES)**
**Mandrazhi, V. P., Novik, D. A.**
***Radiotekhnika*, v. 17, no. 10, pp. 35–44, October 1962**
**(Translated from the Russian in *Telecommunications*, pt. 2, no. 10, pp. 34–43, October 1962)**

The principles of construction of digital TV systems which are nearly all-purpose are described. Questions of synchronization are discussed. Properties of operation in these systems of transmitting tubes with charge accumulation, and the requirements for reproducing the receiver are presented. (*EI*, 1936)

**1,323. MINIATURE ELECTROSTATIC VIDICON CAMERA**
**Gunn, T. A.**
**October 1962**
**Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.**
**SELWS-E-104**
**AD-288,873**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

A miniature, lightweight vidicon television camera has been developed for closed-circuit television systems. The camera, including vidicon and control circuitry, employs only 54 transistors instead of the usual 107. The self-contained system requires only ac line voltage and a television monitor for complete operation. The picture quality and resolution are similar to commercially available models but greatly improved because of the unique method of electrostatic deflection and focus. This eliminates the complex magnetic yoke and circuitry required by conventional vidicon cameras. (*STAR*, 1963, N63-10208)

**1,324. AN ELECTROSTATICALLY FOCUSED VIDICON**
**Kuehne, J. E., Neuhauser, R. G.**
***SMPTE, Journal of the*, v. 71, no. 10, pp. 772–775, October 1962**

An electrostatically focused and magnetically deflected vidicon produced improvements in geometry and corner focus, in addition to providing a lightweight small diameter camera package. The tube, together with lightweight and small deflecting yokes, is well suited for transistorized cameras and employs a low heater-power gun for minimum current drain and low temperature gradients. The performance and design of the tube are described and compared with those of the magnetically focused vidicon. (*EEA*, 1963, #4428)

**1,325. APPLIED RESEARCH ON HIGH RESOLUTION CAMERA TUBES**
**Choi, O., Gray, S., Herold, T., Murray, P.**
**November 30, 1962**
**Radio Corporation of America, Lancaster, Pa.**
**Interim Engineering Report 3 for August 1–November 30, 1962, AF 33(657)-7939**
**AD-292,650**

Research on positive-grid electron guns is concerned with cathode, electron gun, and electron beam problems, and with the development of a system for cycled operation of a camera tube of the image orthicon type. It is also a continuation of work in developing a target structure consistent with the requirements for a high-sensitivity camera tube capable of 1500 television lines/in. at 50 percent sine wave response over a 2 × 2-in. format. This report covers tentative findings on the performance of smoothed cathodes, studies related to high resolution image orthicon guns and targets, and work done on integral-mesh, plug alumina targets and enlarged-pore targets.

**1,326. LARGE-AREA ELECTRONIC DISPLAY PANEL**
**Gethmann, R. B., Noble, M. L.**
**November 30, 1962**
**General Electric Company, Syracuse, N.Y.**
**Quarterly Progress Report 2 for September 1–November 30, 1962, DA 36-039-sc-90755**
**AD-294,845**

An effort is made to advance the state of the art of large-area electronic display by developing a new high-resolution electron-beam-deformation system for thermoplastic film and a novel optical projection system. Also discussed are the optical system and a number of tasks of lesser importance. The major emphasis is placed on the recently completed deformation system electronics and sync generators. The design, construction, and preliminary testing of the new Gethmann-Modified-Gleichauf electron gun are described, and an appendix is included to give a detailed account of the digital sync generator.

**1,327. THE DESIGN AND PERFORMANCE OF A HIGH-RESOLUTION VIDICON**
**Neuhauser, R. G., Vine, B. H., Kuehne, J. E., Robinson, G. A.**
***SMPTE, Journal of the*, v. 71, no. 11, pp. 833–837, November 1962**

The performance characteristics of a 1½-in. high-resolution vidicon are described and an insight is given into its design. Techniques of obtaining and measuring the high resolution are related, and $N_e$ values of equivalent resolution developed. The electron optical design of the tube yoke and focus coil combination are shown to produce zero beam landing error,

excellent geometry, and uniform focus. Other factors that have guided the choice of the design features are the availability of 35-mm lenses, adequate signal output level for wideband amplifiers, and a compromise between sensitivity and lag. (*EEA*, 1963, #4427)

1,328. A SUPER-FAST RECORDER FOR DAY AND NIGHT OBSERVATIONS OF SPACE VEHICLES USING A LIGHT AMPLIFIER CAPABLE OF SUPPRESSING THE BACKGROUND AND DISCRIMINATING MOVING OBJECTS
Gebel, R. K. H. (Office of Aerospace Research, Aeronautical Research Laboratories, Wright-Patterson AFB, Ohio)
*Zeitschfift für Flugwissenschaften*, v. 10, pp. 423–427, November 1962

The usefulness of a closed-circuit television light amplifier system is discussed. It is capable of suppressing background and discriminating moving objects, and detecting, tracking, and photographing missiles in flight. Special pickup tubes, which produce video signals from moving objects only, are used. Two procedures by which video signals from moving targets can be obtained are described. The first method employs a field-sequential-operated transducer, similar to an image orthicon, as the pickup tube. The second modifies the image orthicon into a differentiating orthicon. (*IAA*, 1963, A63-10882)

1,329. RESEARCH AND DEVELOPMENT OF MINIATURE, ENVIRONMENTALIZED, ELECTROSTATIC IMAGE ORTHICON
Day, B. E.
December 31, 1962
General Electric Company, Syracuse, N.Y.
Quarterly Progress Report 6 for October 1–December 31, 1962, DA 36-039-sc-88964
AD-297,857

1,330. D.C. ELECTROLUMINESCENT IMAGE CONVERTER AND/OR INTENSIFIER
Franks, J., Hobbs, R. E., Keating, P. N., Vecht, A.
December 31, 1962
Associated Electrical Industries, Ltd., Great Britain
R-H725, CVD Annual Report
AD-294,899

The quantum yield obtainable from an image intensifier consisting of a combination of a photoconductor and dc electroluminescent phosphor is discussed. From data presently available it is concluded that, with CdS as the photoconductor and ZnS as the phosphor, an amplification of 10,000 in photon flux may be possible for low incident fluxes. This amplification factor should be sufficient to render objects at night clearly visible. The preparation of CdS and ZnS powders, sintered and evaporated layers, as components of the intensifier and of a composite panel, is described. The image produced by the panel was patchy because of difficulties in obtaining intergranular electrical contacts over a wide area. Experimental results are given for series combinations of photoconductive layer and dc powder phosphor layers giving gains up to 250 times.

1,331. STUDY OF ELECTROSTATIC IMAGE CONVERTER TUBES FOR NIGHT VIEWING
Woodhead, A. W., Taylor, D. G.
December 1962
Mullard, Ltd., Great Britain
CVD Annual Report
AD-295,064

The study of electrostatic image converter tubes for night viewing has been continued. Some sealed-off tubes have been made and tested, and their performance agrees reasonably well with the results achieved in the demountable system. However, the magnification range has been larger than that which was expected. A complete equipment has been constructed and measurements of the performance are in good agreement with theoretical predictions. One or two simple tests with the equipment in the field have been encouraging. Some measurements of eye acuity, with varying contrast, and for monocular and binocular vision have been made in order to verify certain assumptions which were made on the theoretical assessment. Nine pages of illustrated references are included.

1,332. MODULATION, INTERMODULATION, BALANCED MODULATORS FOR COLOUR TELEVISION
Tasso, J.
*Onde Electrique*, v. 42, pp. 992–1013, December 1962 (in French)

After an attempt at defining, as precisely as possible, intermodulation and modulation, there is an account of the principal methods of calculation which can be used for the study of intermodulators and other nonlinear networks such as frequency changers and detectors. These methods of calculation are then used for the study of balanced modulators using tubes and diodes. Prominence is given to the elimination of residual unwanted components, having regard to the importance of this question in the field of color television. (*EEA*, 1963, #5095)

1,333. RIDING ON THE ROCKETS TRAIL: CLOSED CIRCUIT TELEVISION AT NASA'S WALLOPS STATION
*Industrial Photography*, v. 11, p. 38, December 1962 (*AS&T*, 1963)

1,334. AN INFRA-RED VIDICON
Heimann, W., Kunze, C.
*Infrared Physics*, v. 2, pp. 175–181, September–December 1962 (in German)

Photoconductive films of PbS were used as cathodes. The long wavelength limit was about 1.9 $\mu$. Measurements of the dependence of signal on the temperature of a blackbody imaged on the tube are described. Temperature measurement and other applications are suggested. (*EEA*, 1963, #6249)

**1,335. DISPLAY AND CONTROL IN MANNED SPACE VEHICLES (Presented at the Eighth Annual National AAS Meeting, Washington, D. C., January 16–18, 1962)**
**Shulman, A.**
**1962**
**American Astronautical Society, Inc., New York, N.Y.**
**Preprint 62-13**

This paper describes the results of a study aimed at formulating a display and control system particularly suited to the manual operation of manned space vehicles. A system plan has evolved that features closed-circuit television for presenting either symbolic displays derived from vehicle sensor data or television picture video from vehicle TV cameras. The system plan calls for the translation of sensor data and operator control commands to be carried out primarily by a digital control unit. The control unit is comparable to a special-purpose digital computer facility. The symbol-video generating equipment and the vehicle functions are required to be responsive to digital commands from the control unit. An important feature of the system is selective control over a large number of vehicle functions by a small assortment of operator controls. Provision is also made for the augmenting of manual controls by a limited repertoire of vocal commands through a speech-recognition system.

**1,336. UNIVERSAL TELEVISION STANDARDS CONVERTER**
**Helsdon, P. B.**
***Marconi Review*, v. 25, no. 147, pp. 217–224, 1962**

When field frequencies are different, a simple conversion system gives objectionable flicker. This system removes flicker by first locking two field frequencies in integral ratio and then modulating video input waveform with pre-adjusted correcting waveform. (*EI*, 1963)

**1,337. LINEAR DISTORTIONS AND THEIR INFLUENCE ON THE TELEVISION PICTURE**
**Chabłowski, J.**
***Przeglad Telekomunkacyzny*, no. 10, pp. 291–296, 1962 (in Polish)**

The relation between amplitude and phase characteristics and pulse response is illustrated by some examples. Transmission with a narrow band and a sharp cutoff at higher frequencies, with linear phase characteristic, and phase distortions at the lowest, medium or higher frequencies, with a flat amplitude characteristic, are discussed. The distorting effect of vestigial sideband transmission and of filters used in the transmitter is described, with particular attention paid to the Nyquist slope. A typical characteristic of the group delay of a transmitter filter is shown. Methods for reducing the effect of distortions are briefly surveyed, i.e., phase compensation near the carrier in the transmitter, shaping of the characteristic of IF stages and compensation of the phase characteristic in the receiver, correcting circuits improving response at higher frequencies, and pulse improving circuits adding differentiated signal to the original signal. (*EEA*, 1963, #4404)

**1,338. ELECTRON GUNS FOR LOW MODULATING VOLTAGES**
**Jareš, V.**
***Slaboproudý Obzor*, v. 23, no. 2, pp. 83–90, 1962 (in Czechoslovakian)**

Picture tubes with high-slope electron guns are of particular importance in transistorized television receivers where the video signals have an amplitude not exceeding 10 v. The following high-slope systems have been developed in recent years: a deflection modulation electron gun, a space charge grid tube, a tube with a built-in amplifier, an electron gun with a negative grid before the cathode, and an electron gun with annular geometry. These systems are described in some detail (including the experimental results obtained by the author) and critically evaluated. It is concluded that the above picture tubes are generally more complex and less reliable than the standard tubes. It appears that the electron guns with space charge grid and annular geometry are the most promising. (*EEA*, 1962, #8303)

**1,339. AN INFRARED SENSITIVE VIDICON TUBE**
**Heimann, W., Kunze, C.**
***Technische Mitteilungen, PTT*, v. 40, no. 12, pp. 413–415, 1962 (in German)**

An infrared-sensitive vidicon (tube with high resistance semi-conducting screen) is described. The screen is made by heating an evaporated lead oxide layer in an atmosphere of sulfur, and consists of small grains of semiconductor in an insulating matrix. The spectral sensitivity of such layers decreases slowly from 0.5 to about 1.7 $\mu$ and then drops sharply. (*EEA*, 1963, #4075)

**1,340. THE ELECTROSTATIC VIDICON AND METHODS OF EVALUATION**
**Doyle, R. J.**
***1962 IRE International Convention Record*, pt. 3, v. 10, pp. 185–193, 1962**

The electrostatic vidicon, developed by Westinghouse, is an image tube sensitive to visible and near visible electromagnetic radiation. It has resolution capabilities similar to those of the electromagnetic types. The tube also incorporates high deflection sensitivity, low power consumption, and sturdy construction. Specialized testing procedures were devised and used during its development. (*EEA*, 1963, #2073)

**1,341. LOW COST INDUSTRIAL TELEVISION SYSTEM**
**Walker, H. R.**
***1962 IRE International Convention Record*, pt. 6, v. 10, pp. 158–162, 1962**

A television camera utilizing an electrostatic camera tube of the vidicon type is described. The camera also contains unusual circuitry in its dual tetrode video amplifiers and in its built-in intercarrier 4.5-Mc sound system. (*EI*, 1963)

**1,342. TV BROADCAST FROM AN EARTH SATELLITE**
**(Presented at the IRE International Convention, New York, N.Y., March 26–29, 1962)**
**Gould, R. G. (Stanford Research Institute, Menlo Park, Calif.)**
***1962 IRE International Convention Record*, pt. 8, v. 10, pp. 96–103, 1962**

The feasibility of direct continental TV broadcast to conventional home receivers from an orbiting stationary satellite is discussed. Among the factors considered are: (1) time and language differences of the potential audience; (2) the lack of suitable programming material; and (3) frequency allocation problems. Required transmitter and primary power are calculated for several coverage situations on both VHF and UHF channels. These powers are significantly above previous estimates published elsewhere, including the power capability of the proposed *SNAP-8* 60-kw nuclear reactor, except for coverage of limited areas on the ground. Tables are included which show Western Hemisphere, Eastern European, and Western European TV broadcast standards and number of TV sets, the foreign channel frequencies, and the principal TV systems of the world. (*IAA*, 1963, A63-12485)

**1,343. A FRAMING IMAGE CONVERTER USING MAGNETIC DEFLECTION**
**Martone, M., Segre, S. E.**
**In "Proceedings of the Fifth International Conference on Ionization Phenomena in Gases, Munich, August 28–September 1, 1961," pp. 2023–2026**
**Maecker, H., Editor**
**North Holland Publishing Co., Amsterdam, 1962**

The use of an image converter as a framing camera is described. Results are reported for a Mullard ME 1201 tube which produces frames with an exposure time of 0.3 $\mu$sec and a framing time of 4 $\mu$sec. (*EEA*, 1963, #4074)

**1,344. A CLOSED CIRCUIT TELEVISION SYSTEM PROVIDING AUTOMATIC TRACK-CENTERING AND TRACK-FOLLOWING IN CLOUD CHAMBER PHOTOGRAPHS (Presented at the Symposium on Nuclear Instruments, Harwell, England, September 1961)**
**Pullan, B. R.**
**In "Proceedings of the Symposium on Nuclear Instruments," Paper N4/7, pp. 232–235**
**Birks, J. B., Editor**
**Academic Press, Inc., New York, N.Y., 1962**

A measuring projector being built for the analysis of cloud-chamber photographs enables two-dimensional measurements to be made in three stereo photographs. A closed-circuit TV system is used to produce (1) a magnified picture of the region being studied, (2) error signals which depend on the distance of the track from a fiducial mark and which are used for track-centering, and (3) signals to provide automatic steering along a track. Where a track is interrupted the motion continues until the track can again be picked up. (*EEA*, 1962, #10,169)

**1,345. RESEARCH ON STORAGE TARGETS FOR CAMERA TUBES**
**Goetze, G. W., Boerio, A. H.**
**January 7, 1963**
**Westinghouse Electric Corporation, Pittsburgh, Pa.**
**RR 62-912-253-R1, Interim Engineering Report 1 for July 1–November 1, 1962, AF 33(657)-8676**
**AD-294,622**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington D.C.)**

The performance of a camera tube, especially its sensitivity, can be improved by employing a means of multiplying the electronic charge emitted by the photocathode in response to radiation prior to storage and subsequent scanning for read-out. One possible approach to achieve such a prebeam gain is the use of electron bombardment induced conductivity (EBIC) in a thin layer of an insulator or semiconductor. The basic problems encountered with this type of target are briefly reviewed and summarized. Another method of achieving prebeam gain is by secondary electron emission and conduction (SEC) in a porous layer of a suitable insulator. Because of promising results obtained with this type of target in a parallel program, effort was concentrated on the low density KCl-target. A description of the mode of operation and the expected and achieved performance of these targets is given. In order to evaluate target performance in a sealed off tube containing a cesium antimony photocathode, such a tube was built and evaluated. Twelve pages of illustrated references are included.

**1,346. MONTHLY PROGRESS REPORT**
**Bird, A. N., Jr.**
**January 9, 1963**
**Southern Research Institute, Birmingham, Ala.**
**DA 18-108-AMC-32-A**
**AD-293,269**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D. C.)**

A detailed study of the aerosol-flash camera was started, and the equipment was assembled for the experimental work on the electrochemical detector. Four main components of the aerosol camera are: flash illuminator, objective lens, image intensifier tube, and the TV camera. The flash illuminator freezes the motion of the droplets as they pass through the

field of view of the objective lens. The objective lens projects an image of the particles onto the photocathode of the image intensifier tube. The electron optics of the image tube produce a brightened image on the output phosphor screen of the tube. Through a relay lens the vidicon will view the image intensifier, and the output signal of the vidicon will contain particle size information. The use of the image intensifier tube and the sheet illuminator represent the main difference between our aerosol-flash camera and the spray particle analyzer. The source for the flash illuminator will be a high-speed, electronic flash lamp. Experimental work on the electrochemical cell continued.

**1,347. BASIC OPTICS OF TELEVISION FILM CHAIN**
**Lyman, D. F., Neumer, A. E., Jr.**
***SMPTE, Journal of the*, v. 72, no. 1, pp. 6–10, January 1963**

Optical principles involved in the projection of film into a television camera are reviewed. Direct projection into the vidicon tube is discussed, and a description is given of the relay system with its intermediate image in terms of the function of each optical element, importance of proper alignment, and mistakes to be avoided. Requirements of multiplexing systems are defined, and three basic optical formulas by which approximate values can be obtained to aid in design and coordination of equipment are presented. (*EI*, 1963)

**1,348. APPLICATION OF F.M. TO THE TRANSMISSION OF THE CHROMINANCE SIGNAL IN COLOUR TELEVISION. EXAMINATION OF S.E.C.A.M. MODULATION; COMPARISON WITH THE N.T.S.C. SYSTEM**
**Fagot, J.**
***Annales de Radioélectricité*, v. 18, pp. 3–14, January 1963 (in French)**

Signals used in color television and general principles adopted for their transmission in broadcasting for the NTSC and SECAM (sequential) systems are discussed. Performance regarding frequency modulation in the SECAM system, for chrominance, is examined under the following headings, and compared with the NTSC system: sub-carrier visibility; S/N ratio; action of phase and of differential amplitude; magnetic recording. A comparison table is given. (*EEA*, 1963, #5439)

**1,349. TV CAMERA TUBES FOR X-RAY MOTION STUDIES**
***Steel*, v. 152, pp. 119–120, February 11, 1963 (*AS&T*, 1963)**

**1,350. LASER BEAM CARRIES TV VIDEO AND AUDIO**
**Weber, S.**
***Electronics*, v. 36, pp. 28–29, February 22, 1963 (*AS&T*, 1963)**

**1,351. IMAGE ORTHICON**
***Compressed Air Magazine*, v. 68, p. 20, February 1963 (*AS&T*, 1963)**

**1,352. THE "STEP" SYSTEM. A UNIQUE, LOW-COST T.V. AUTOMATION SYSTEM**
**Freilich, A., Meyer, S.**
***IEEE Transactions on Broadcasting*, v. BC-9, no. 1, pp. 16–25, February 1963**

The STEP System (Sequential Television Equipment Programmer) is a low-cost TV automation system designed to automate the "panic period" switching during breaks. The STEP memory, a flexible pinboard memory with preprogramming capabilities, is described. Overall system requirements, system organization, system operation, installation, and maintenance are discussed. Operating experience with the system during the past year at WTVR, Richmond, Virginia, is described. (*EEA*, 1963, #6460)

**1,353. RECENT DEVELOPMENTS IN COLOR-TELEVISION CAMERA EQUIPMENT**
**Kozanowski, H. N., Bendell, S. L.**
***IEEE Transactions on Broadcasting*, v. BC-9, no. 1, pp. 31–36, February 1963**

The many factors which have brought color television to its present state of acceptance in the United States are reviewed. A detailed description of a recently developed color-television camera is presented. This camera, operating within the already established United States standards, achieves improved performance, higher stability, and ease of operation. (*EEA*, 1963, #6456)

**1,354. CLOSED CIRCUIT TELEVISION TECHNIQUES**
**Rosner, I. S.**
***IEEE Transactions on Broadcasting*, v. BC-9, no. 1, pp. 90–94, February 1963**

Closed-circuit television operations are able to make use of the vidicon camera to advantage, and its use is suggested for particular broadcast applications. Where high illumination and flat lighting are available, the vidicon is preferable to the image orthicon as a pickup device because of its greater economy, stability, ruggedness, simplicity of circuitry and small size, and excellent picture quality. Radio frequency signal distribution systems offer advantages over video frequency distribution systems in their ability to transmit several channels of information over the same cable, their ability to use bridging devices that are simple and do not appreciably deteriorate the signal, and the use that can be made of conventional receivers as display devices. More general use of television for communications will come about with the acceptance of the limited quality of narrow bandwidth television information and the development of more sophisticated narrow bandwidth systems that will improve the apparent quality as seen by the eye. (*EEA*, 1963, #6468)

**1,355. OPERATION IMPROVEMENTS IN IMAGE ORTHICON CAMERA EQUIPMENT**
**Shepard, W. L., Gula, A., Wiggin, J. F.**
***IEEE Transactions on Broadcasting*, v. BC-9, no. 1, pp. 101–108, February 1963**

A modern broadcast TV camera adaptable for use with either 3- or 4½-in. image orthicon tubes is described. Circuit and mechanical innovations are discussed which result in improved stability and reliability. Simplified operation and maintenance of the camera are emphasized. (*EEA*, 1963, #6457)

**1,356. A SIMPLE MINIATURE TELEVISION CAMERA**
**Rutherford, N. S.**
***Television Society, Journal of the*, v. 10, no. 5, pp. 137–141, January–March 1963**

The basic requirements for a low-priced closed-circuit television camera are discussed both in retrospect and in relation to present-day requirements. The basic circuits of a simple radio frequency output television camera which will feed into a domestic television receiver are described in a general outline. The importance of mechanical design in relation to cost is discussed in detail, and the paper concludes with a general assessment of the performance of this camera, together with some pointers for future designs. (*EEA*, 1963, #7827)

**1,357. THE OPERATION OF THE ANODE NETWORK OF THE FINAL MODULATED STAGE OF A TELEVISION V.H.F. TRANSMITTER**
**Lebedev-Karmanov, A. I.**
***Radiotekhnika*, v. 18, no. 3, pp. 42–53, March 1963 (in Russian)**

In the Russian television waveform standard, the center frequency of the final tuned circuits is displaced by 39 percent due to the vestigial side-band characteristics. Thus, at carrier frequency, the response of the output network is asymmetrical and complex. Both tetrodes and grounded grid triodes are considered, and formulae are given for the peak efficiency $\eta$ in terms of the load impedance, valve output impedance, the current angle of flow, amplification, and slope. Two types of networks are considered, consisting of two- and three-tuned circuits. Their frequency- and phase-characteristics are plotted, and their behavior is discussed in detail from the power efficiency point of view, normalized $\eta$ being plotted against a special parameter in terms of peak slope, dynamic impedance, and supply voltage utilization coefficient. The mode of operation described is compared with the more popular system outside USSR where the output circuits are frequency-symmetrical and the required SSB response is obtained with a side-band suppression filter; it is shown that the efficiencies in both cases are within $\pm 10$ percent. A detailed appraisal of the generated distortion due to the change in modulation depth follows, illustrated by dynamic $i_a/e_g$ characteristics of elliptical form for the cases of full modulation (black level) and for a mean level picture. The appendix contains the mathematical derivation of the required optimal anode voltage for a linear modulator with a frequency displaced load, a graphical analysis of phase errors in a grounded grid linear modulator, and a comprehensive table for the seven considered modes (various degrees of coupling for the two- and three-tuned circuits), quoting basic parameters, special coefficients for the asymmetrical carrier operation, and distortion factors. (*EEA*, 1963, #6453)

**1,358. A NEW SUBMINIATURE TV CAMERA FOR UNDERWATER OBSERVATIONS AND FOR INSTRUMENTATION IN EXPLOSION TESTING ROOMS**
**Schultz, K.**
***Verein Deutscher Ingenieure*, v. 105, no. 12, pp. 489–492, April 3, 1963 (in German)**

Television equipment can be utilized for the examination of cavities, pipes, and drillings. A recently developed subminiature TV camera is described which enables observations to be made both radially and axially. The camera has a maximum diameter of 43 mm, and its optical and lighting systems can be controlled over a cable length of 400 m, enabling considerable depths to be attained. The camera with special adaptations can be used in dangerous environments, e.g., water, gas, heat, high pressure, and radioactive situations. (*EEA*, 1963, #9211)

**1,359. TV CAMERA TRACKER—CAN IT DETECT MISSILE DECOYS?**
**Poppelbaum, T. L. (General Electric Company, Light Military Electronics Department, Utica, N.Y.)**
***Electronics*, v. 36, pp. 51–55, April 26, 1963**

A low-light-level, modified-vidicon camera for use in missile-launch surveillance, battlefield missile control, and orbital rendezvous is described. The camera supplies two-dimensional data about a tracked target by locating video information relative to the horizontal and vertical scans. (*IAA*, 1963, A63-16189)

**1,360. VERTICAL APERTURE CORRECTION USING CONTINUOUSLY VARIABLE ULTRASONIC DELAY LINES**
**Howorth, D.**
**May 1963**
**British Broadcasting Corporation, London, Great Britain Engineering Division Monograph 47**

Part I describes the principle of operation, construction, and calibration of a simple vertical aperture corrector which has been made possible by the use of ultrasonic delay lines.

The performance of this aperture corrector and some of the problems involved in the design of an operational version are discussed. The method of calibration is based on a "Calibration Factor" obtained by a simple and convenient pulse procedure. It is shown that the steady-state amplitude/frequency characteristic, and also the effect of the aperture corrector on S/N ratio, can be determined from this factor. In Part II the construction and characteristics of an ultrasonic delay line using mercury as the transmission medium are discussed in some detail, and an experimental variable delay unit suitable for a 405-line television system is described. An account is given of the difficulties in constructing the video delay unit, and the possibility of extending the use of the line to television systems requiring a higher video bandwidth is indicated. In addition to its use in the vertical aperture corrector, such a unit may have other television applications. (*EEA*, 1963, #9212)

1,361. **INVESTIGATIONS INTO THE DETECTION SENSITIVITIES AND RESOLUTION OBTAINABLE WITH ELECTRONIC IMAGE ENHANCEMENT TECHNIQUES** (Presented at the AIAA Space Flight Testing Conference, Cocoa Beach, Fla., March 18–20, 1963)
Manning, W. H., Jr. (USAF, Missile Test Center, Patrick, AFB, Fla.)
1963
American Institute of Aeronautics and Astronautics, Inc., New York, N.Y.
Paper 63094-63

The ultrasensitive image orthicon TV tube and its detection sensitivity and resolucion characteristics are discussed. The application of the image tube to the detection, acquisition, and tracking of space vehicles is examined, as is the capability of such tubes to produce high-resolution photographs when coupled to long-focal-length telescopes. (*IAA*, 1963, A63-15211)

**(See *also Entries* #120, 138, 139, 145, 353, 379, 576, 608, 761, 768, 785, 790, 846, 860, 866, 870, 873, 891, 895, 898, 908, 909, 933, 1424, 1426, 1428, 1454, 1465, 1484, 1530, 1543, 1553, 1595, 1710, 1847.)**

# TELEVISION NOISE, RESOLUTION, AND CODING

**1,362. METHOD FOR DETERMINING THE RESOLVING POWER OF PHOTOGRAPHIC LENSES**
**Washer, F. E., Gardner, I. C.**
**May 20, 1953**
**National Bureau of Standards, Washington, D.C.**
**NBS Circular 533 (supersedes Circular 428)**

This circular provides the photographer with two sets of charts by which the resolving power of a photographic lens may be numerically measured with respect to a definite scale of values. A detailed description is given of the procedure and technique to be followed in order that comparable values may be obtained by different observers. The test provides an objective method of testing a photographic lens. Additional uses of these charts are also described. These uses include the testing of goggle lenses for definition and prismatic power and the testing of telescopes and binoculars for definition.

**1,363. INFLUENCE OF QUASI-IMPULSIVE NOISE ON RADIO RECEIVERS**
**Treter, A.**
***Prace Instutu Lacznośći*, v. 3, no. 4, 1956 (in Polish with English summary)**

The essential features of quasi-impulsive noise are summarized, and the sources of such noise are discussed, atmospheric noise being particularly considered, together with its mechanism and mode of propagation. Experimental methods of investigating this type of noise are described, as well as mathematical methods of analysis. The effect on radio receivers is then treated, single short pulses being first considered. For a receiver comprising a bandpass filter, a linear detector, and a low-pass filter, the parameters determining the response to short pulses depend on the bandwidth. The effect of single pulses containing HF sine waves, such as telegraph signals, is discussed. A sinusoidal voltage of frequency considerably different from that to which the receiver is tuned produces a response qualitatively similar to that for a unit-function signal. This applies both to the beginning and the end of the signal, the two effects overlapping or not, according to the duration of the signal. The effect of pulse trains is next considered. The influence of the discharge time-constant of the detector is discussed for the case of periodic pulses, and the variation of the output power-density spectrum of the pulse train, when the regularity of the pulses is disturbed in a random way, is investigated. The problem of determining the optimum bandwidth is discussed and the principal types of noise limiter are described. The essential features of the effect of quasi-impulsive noise on FM receivers are presented, and it is shown that the magnitude of the interference at the output of the receiver depends on the phase of the IF voltage resulting from the noise pulse, relative to that of the signal voltage. In the case of television receivers, quasi-impulsive noise mainly results in distortion of the video signal, with resultant spurious spots and patterns on the CRT screen. The AVC may also be affected, thus reducing image contrast, and synchronization may be impaired. Receivers for color television on the NTSC system have the same sensitivity to impulse noise as receivers for monochrome television, though their sensitivity to continuous noise is about 1 db greater. (*EEA*, 1958, #2696)

**1,364. ÜBER DIE PEGELHALTUNG UND EINIGE STOEREINFLUESSE IN FARBFERNSEH-ÜBERTRAGUNGSANLAGEN (LEVEL CLAMPING AND INTERFERENCE IN COLOR TELEVISION TRANSMISSION INSTALLATIONS)**
**Dillenburger, W.**
***Archiv der Elecktrischen Übertragung*, v. 11, no. 5, pp. 195–213, May 1957**

Equipment developed for the investigation of channel level variations due to variations in the shape of amplitude characteristics of individual amplifiers, amplification values, lift, etc., is described, and results of measurements which agree fairly well with results obtained elsewhere are given. (*EI*, 1958)

**1,365. MEASUREMENT AND EVALUATION OF GRAIN [NOISE] IN THE VIDEO BAND**
**Sennhenn, E.**
***Elektronische Rundschau*, v. 11, no. 9, pp. 271–274, September 1957 (in German)**

The conceptions of white noise, peak noise voltage, and average noise value are explained and discussed mathematically. The video amplifier is regarded as a low-pass filter, and the noise spectrum as a superposition of a large number of "Stoss-functions" in a gaussian distribution. A formula is also derived for the probability of occurrence of an arbitrary peak value of noise. The experimental investigation is undertaken with the aid of a noise generator with controlled injection; subjective tests on noise vs. video frequency are described, and the results are plotted as injected noise voltage vs. frequency with viewing distance as parameter for a constant impression of interference. Several photographs of screen images with varying noise content are reproduced. (*EEA*, 1958, #1046)

**1,366. THE DEFINITION OF PICTURE QUALITY IN MONOCHROME AND COLOUR TELEVISION**
**Neidhardt, P.**
***Nachrichtentechnik*, v. 7, no. 9, pp. 389–398, September 1957 (in German)**

A thorough, well-illustrated, and documented treatment of the problem of picture-quality appraisal in television is presented.

The author defines "Sehscharfe" $S = \frac{H}{X_B - X_A} \int_{X_A}^{X_B} \left(\frac{dh}{dx}\right)^2 dx$

where $X$ = scanning direction, $A$ and $B$ – edges of a black–

white transition step, $h$ = brightness increment and $H$ = brightness. This ideal formula is modified to include the resolution of the overall system and the effect of gamma. A discussion on the effect of noise follows, introducing the concept of the objective "detail recognizability" and a general law that the contrast of a poorly outlined detail can be regarded as equal to the same detail in sharper outline but of poorer contrast. The methods of general information theory are applied to an analysis of detail entropy which becomes particularly useful in assessing the quality of color images. A description of experimental methods such as the test by means of Landolt rings, primary color filters, and standard test charts is also given. (*EEA*, 1958, #1670)

**1,367. COLOUR TELEVISION TRANSMISSION**
**Teer, K.**
***Electronic and Radio Engineer*, v. 34, no. 8, pp. 280–286, August; no. 9, pp. 326–332, September 1957**

The practical aspects of a two-subcarrier system for the transmission of chrominance information are discussed. A choice of subcarrier is given, with the applicable modulator. Also included is a discussion of: pre-emphasis of subcarrier sidebands, crosstalk compensation, demodulation, matrixing, automatic matrix control, and receiver diagrams. (*EI*, 1958)

**1,368. SIGNAL-TO-NOISE RATIOS IN STRONG-CARRIER FM SYSTEMS**
**Urkowitz, H.**
***AIEE, Transactions of the, Part I—Communication and Electronics*, v. 76, no. 33, paper 57-61, pp. 599–602, November 1957**

S/N ratios are derived for a frequency modulated system in which the radio-frequency carrier is strong compared with noise. General formulas for determining the S/N ratio with periodic modulation or with pulse modulation are discussed. Numerical results are given for a special case of a flat symmetrical RF passband, and the effect of a mistuned frequency detector is described. (*EI*, 1958)

**1,369. SIMULATING SHARPNESS IN COLOR TELEVISION**
**Baldwin, M. W., Jr.**
***Bell Laboratories Record*, v. 35, no. 12, pp. 481–484, December 1957**

A color television simulator and other apparatus are described which are used at the Bell Laboratories to analyze and measure complex parameters of a television system, determining the subjective quality of picture sharpness. (*EI*, 1958)

**1,370. THE GENERATION OF PHASE DISTORTION IN VESTIGIAL SINGLE-SIDEBAND OPERATION**
**Polonskii, A. B.**
***Radiotekhnika*, v. 12, no. 9, pp. 29–37, 1957 (in Russian)**

A mathematical and experimental investigation was made of the transient response of a vestigial single sideband transmission system, based on the appraisal of the reproduction of a Heavy-side step-function with the aid of the Duhamel integral method. The treatment follows the well-known work by Nyquist, Goldman, and van Weel. (*EEA*, 1958, #1677)

**1,371. THE DEFINITION OF PICTURE QUALITY IN BLACK-AND-WHITE AND COLOUR TELEVISION (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Neidhardt, P.**
***Acta Electronica*, v. 2, no. 1–2, pp. 218–226, 1957–1958**

The question of information content of a television image is a problem of perceptibility of details, a statistical statement which suggests the use of information theory for defining picture quality. The fundamental idea is to obtain a formula representing detail perceptibility by means of its connection with the probability data of the picture elements. Information entropy is derived for detail perceptibility as an entropy of high order. On the basis of this assumption, all theorems of information theory are applicable to the calculation of reproduction quality in monochrome and color television. (*PA*, 1959, #6414)

**1,372. RANDOM AND IMPULSE NOISE IN COLOUR TELEVISION (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Carnt, P. S., Townsend, G. B.**
***Acta Electronica*, v. 2, no. 1–2, pp. 230–239, 1957–1958**

The subjective effects of introducing noise into domestic color television receivers designed for 405-line adapted NTSC transmissions have been investigated under certain controlled conditions. Using laboratory-generated noise and an artificial color bar signal, the dependence of the visibility of noise on the hue and saturation of the reproduced color has been examined. The effects due to noisy synchronization of the receiver's reference oscillator have been isolated from those due to color area noise *per se*. The consequences of introducing noise into the various components of the composite television signal prior to coding are briefly reported. (*EEA*, 1958, #4995)

**1,373. COMMUNICATION THEORY APPLIED TO TELEVISION CODING (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Graham, R. E.**
***Acta Electronica*, v. 2, no. 1–2, pp. 333–343, 1957–1958**

The problem of encoding a continuous television signal for efficient transmission over a digital channel is discussed. Two arbitrary categories of available techniques—"time-warping" and "hyperquantizing"—are set forth, and some of their idiosyncrasies are described. An experiment is described in which point-by-point prediction of a television picture is carried out

by a human being; the indicated channel saving, by means of statistical coding, is calculated from the prediction error statistics. Some drawbacks of straightforward prediction-error coding are pointed out, including the effects of random noise embedded in the signal prior to processing, and the disadvantages of conventional amplitude quantization as a prelude to coding. These limitations are to some extent avoided in an alternative approach to channel capacity economy through efficient numerical description of the original picture. Illustrations of such "hyperquantizing" methods include a combination of band splitting with conventional amplitude quantization, and a variant of differential quantizing. An experimental trial of differential quantizing of picture signals is described, in which an information transmission rate of three binary digits per picture sample is required. A number of examples of the resulting pictorial reproduction are shown. (*EEA*, 1958, #4957)

1,374. **INFORMATION THEORY AND INTRINSIC AND SUBJECTIVE QUALITIES OF THE PICTURE**
**(Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Rorive, A. L.**
***Acta Electronica*, v. 2, no. 1–2, pp. 344–351, 1957–1958**
**(in French)**

The information capacity of a video channel 4 to 5 Mc wide is convenient for the transmission of moving color images. Using the theory of games, in which prior knowledge of the results is assumed and the results are exploited to increase successive stakes (Kelly's interpretation), it can be shown that continuous trains of moving images present high data redundancy and necessitate, essentially, a lower value of channel information capacity than that calculated by conventional methods. Redundancy can be improved by fictitious means through a psychological knowledge of part of the information to provide, for a majority of moving image sets, the essential factor of intelligibility—the primary aspect of image subjective "quality." Statistic (intrinsic) redundancy, increased by the fictitious addition of the predetermined (subjective) psychological element, permits a reduction of the information capacity in a monochrome video channel, so that chromatic information elements can be located in a monochrome channel without any loss of overall information. Broadcasting and receiving of the video signal necessitate a transfer from the video frequency spectrum to the high frequency spectrum and reciprocally by transmitters, aerial propagation, and subsequent demodulation in the receivers. Owing to this spectrum transfer process and to various factors introduced by transmission circuitry, an additional bandwidth becomes necessary. Investigations show that single subcarrier and reference-pulse color TV systems can use existing monochrome transmission channels having an overall RF bandwidth of 6 to 7 Mc, and this without appreciable loss of intrinsic and subjective image quality. (*EEA*, 1958, #4956)

1,375. **OPTIMUM CODING FOR INDUSTRIAL COLOUR TELEVISION (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Valensi, G.**
***Acta Electronica*, v. 2, no. 1–2, pp. 352–362, 1957–1958**
**(in French)**

From various laboratory tests, it would seem that the transmission of millimetric waves ($H_0$ tor $TE_{01}$), modulated by coded pulses, through 5-cm-D wave guides is quite possible. Such a wave guide would handle several scores of 500-Mc-wide channels, distributed over a whole frequency band, from, possibly, 35,000 to 75,000 Mc. Each channel could handle several video "trunk" type channels, plus telephone and telegraphic channels. Optimum pulse-coding requirements for industrial color television operation must comply with the following conditions: (1) rational utilization of existing post-office networks—designed primarily for telephony transmission; (2) a maximum quantity of color information over a "color channel" of given bandwidth; (3) minimum risks of distortion in the reproduction of colors; and (4) minimum costs in the installation and operation of the terminal stations. Coding methods used in various color television systems (already in operation or under test) are examined with reference to the enumerated conditions. (*EEA*, 1958, #4953)

1,376. **HIGHLIGHT EQUALIZER SHARPENS TV PICTURES**
**Sullivan, M. V.**
***Electronics*, v. 31, no. 3, pp. 72–74, January 17, 1958**

Since most image orthicon noise is in a low light region, equalization of only the gray to the white highlight region in a video signal provides a better S/N ratio and improved definition over the conventional aperture equalizers covering full brightness range. The circuit was successfully tested in both monochrome and color television. (*EI*, 1958)

1,377. **ÜBER DAS VERHALTEN DER SYNCHRONISIERUNG IN FERNSEHRUNDFUNK-EMPFAENGERN BEI ANWESENHEIT VON STÖRUNGEN (BEHAVIOR OF SYNCHRONIZATION IN TV RECEIVERS IN PRESENCE OF NOISE)**
**Lüdicke, E.**
***Archiv der Elektrischen Übertragung*, v. 12, no. 1, pp. 8–14, January 1958**

Methods are presented by which susceptibility to noise of the horizontal and vertical sweep control system in simple TV receivers can be considerably reduced. (*EI*, 1958)

1,378. **RESOLUTION CHART AIDS TV CAMERA FOCUSING**
**Southworth, G.**
***Electronics*, v. 31, no. 7, pp. 100–101, February 14, 1958**

The optimum electronic focus of television cameras and film chains is effected by scanning a bar chart and adjusting

the focus controls for maximum response of peaks on a waveform monitor. The chart also permits the rapid determination of system resolution and relative resolving power of different camera lenses. (*EEA*, 1958, #2294)

**1,379. SYNCHRONOUS AND EXALTED-CARRIER DETECTION IN TELEVISION RECEIVERS**
**Avins, J., Brady, T., Smith, F.**
***IRE Transactions on Broadcast and Television Receivers*, v. BTR-4, no. 1, pp. 15–23, February 1958**

The fringe-signal picture performance that can be obtained by generating a noise-free carrier in a television receiver is described, and quantitative data are given on the improvement possible with ideal synchronous detection. This improvement is shown to vary significantly, depending upon whether the basis of reference chosen is: (1) the normal IF response curve with the carrier 6 db down from the flat top, or (2) a peaked response with the carrier at the peak. With synchronous and exalted-carrier detection, a further improvement in S/N ratio can be obtained by reducing the post-detection HF video response. Because of the difficulty of analytically weighting the unequal contribution of various parts of the noise spectrum to the subjective degradation of the picture, an experimental approach is followed. (*EEA*, 1958, #2295)

**1,380. THE INFLUENCE OF SCATTERING WITHIN PHOTOGRAPHIC EMULSIONS ON RESOLVING POWER [WITH SPECIAL REFERENCE TO LOW-CONTRAST IMAGES]**
**Giovanelli, R. G.**
***Optica Acta*, v. 5, no. 1–2, pp. 27–30, March–June 1958**
**(*PA*, 1959, #6433)**

**1,381. SUBJECTIVE SHARPNESS OF TELEVISION PICTURES**
**Sproson, W. N.**
***Electronic Radio Engineer*, v. 35, no. 4, pp. 124–132, April 1958**

The subjective sharpness of television pictures has been measured using a comparison technique and a multi-criterion scale for assessment. Two types of degrading network were used, and the subjective sensitivity to changes in equivalent rectangular bandwidth has been evaluated for both static and moving pictures. (*EEA*, 1958, #2743)

**1,382. THE IMPORTANCE OF THE PICTURE MONITOR IN TELEVISION TRANSMISSION**
**Grosskopf, H.**
***Rundfunktechnische Mitteilungen*, v. 2, no. 2, pp. 64–74, April 1958 (in German)**

The most important measures for controlling the black level in transmission are surveyed, and particular stress is placed on the fundamental importance of the picture monitor. Recommendations are made for standardizing the adjustment of the picture controls in the studio, with a view to otaining uniform gradation in the television picture. It is necessary to adjust the black level to a higher light intensity in order to avoid black compression in the picture. According to recent ideas, this lift has an effect on the reproduction of the black level. The picture is similar to that produced by incorrect black level in the receiver. This is due to certain properties of the sense of sight, which are thoroughly examined. (*EEA*, 1958, #4972)

**1,383. DESIGN OF LINEAR PHASE-SHIFT LOW-PASS FILTER**
**Weaver, L. E.**
**April 1958**
**British Broadcasting Corporation, London, Great Britain**
**Engineering Division Monograph 17**

The design of a filter to remove noise and other irrelevant information above approximately 3 Mc from the output of a television camera control unit is described. In this filter, the passband is flat within $\pm 0.1$ db to 3 Mc, and the group delay characteristic varies over a range of only $\pm 10$ m$\mu$sec throughout the passband and well into the attenuating region. (*EI*, 1958)

**1,384. AUTOMATA OF HIGH COMPLEXITY AND METHODS OF INCREASING THEIR RELIABILITY BY REDUNDANCY**
**Loefgren, L.**
***Information and Control*, v. 1, no. 2, pp. 127–147, May 1958**

Limitations of automation are described, with particular reference to the degree to which automation can imitate human beings in specific processes. The question of reliability becomes serious when the complexity of automation becomes large. An attempt is made toward formulating a theory of the manner in which redundancy should be applied on different levels for reducing the influence of temporary component errors in a universal computing machine. (*EI*, 1959)

**1,385. RESULTS OF INVESTIGATIONS OF THE RECOGNIZABILITY OF FINE DETAILS ON THE TELEVISION SCREEN**
**Below, F., Kroebel, W., Springer, H.**
***Zeitschrift für Angewandte Physik*, v. 10, no. 6, pp. 277–285, June 1958 (in German)**

The development of an objective test-scheme for measuring the recognizability of fine detail in television images is described. Transparencies of Landolt-Rings and a flying-spot scanner are used. Results of the effects of changes of bandwidth, viewing distance, and contrast are presented. (*EEA*, 1958, #6044)

**1,386. RELATION BETWEEN PICTURE SIZE, VIEWING DISTANCES AND PICTURE QUALITY WITH SPECIAL REFERENCE TO COLOUR TELEVISION AND SPOT-WOBBLE TECHNIQUES**
**Jesty, L. C**
***Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering,***
**v. 105, pp. 425–434, September 1958**
**(Also available in *Acta Electronica*, v. 2, no. 1–2, pp. 242–255, 1957–1958)**
***(AS&T*, 1960)**

**1,387. BEAM-LANDING IN IMAGE ORTHICON. REFLECTION AND VELOCITY DISTRIBUTION OF THE SLOW SCANNING ELECTRONS**
**Odagawa, K.**
***Institute of Electrical Communication Engineers of Japan, Journal of the*, v. 41, no. 9, pp. 850–856, September 1958**
**(in Japanese)**

Since noise in the image-orthicon TV camera tube is chiefly due to shot noise in the scanning beam, positive charges stored on the target glass should ideally be discharged by minimum beam current. Calculations show how the beam-incidence characteristics are affected by the reflection of the slow electrons in the beam, by the target, and by the axial velocity distribution of these electrons. To minimize the potential drift of the target glass due to the beam incidence, the beam current was reduced to a very small value ($1 \times 10^{-9}$ amp), and, by applying an additional blanking pulse to grid No. 1, the output signal current was line-selected and observed by a CRO, thus enabling the target-landing current and the beam current to be measured at the same time. The reflection ratio of the target glass itself was found to be about 0.7 at 1-v primary energy, and about 0.9 at 2–3 v, while for target glasses with an evaporated film of Ag, Au, Pt or Cu, the ratio is reduced to 0.3–0.5, the values changing very little in the 0- to 4-v range, Ag being the best for the image orthicon, taking account also of the effect on the resolving power. By using tubes with targets of Ag sheet, the axial velocity distribution of the slow electrons (0.1 v) under normal conditions was measured by the retarding method and found to be nearly equal to the theoretical Maxwell distribution. The electron gun used in the image orthicon is found to have very good beam-landing characteristics. (*EEA*, 1959, #1813)

**1,388. DETECTION OF ASYMMETRIC SIDEBAND SIGNALS IN PRESENCE OF NOISE**
**Murakami, T., Sonnenfeldt, R. W.**
***RCA Review*, v. 19, no. 3, pp. 388–417, September 1958**
**(Also available in *IRE Transactions on Broadcast and Television Receivers*, v. BTR-5, no. 1, pp. 18–21, January 1959)**

Three methods of detection of signals contaminated by fluctuation noise are analyzed. The use of detectors of linear envelope, product, and exalted carrier types are included. A new ratio, "video-to-noise error ratio," is proposed for a more adequate quantitative evaluation of detector performance. Studies indicate that improvement in output video-to-noise-error ratio is obtained by the substitution of a product detector for an envelope detector. The effects of impulse noise on the detection of asymmetric sideband signals are stated. (*EI*, 1959)

**1,389. A METHOD OF MEASURING THE OPTICAL SINE-WAVE SPATIAL SPECTRUM OF TELEVISION IMAGE DISPLAY DEVICES**
**Schade, O. H.**
***SMPTE, Journal of the*, v. 67, no. 9, pp. 561–566, September 1958**

The method of measuring the resolution characteristic (or "spatial spectrum") of kinescopes with electrically generated sine-wave patterns has proved to give consistently accurate data at all beam currents, varying from a few $\mu$a to several ma. It is independent of the phosphor decay time and can therefore be used for measurement of color kinescope performance, including the effects of misregistry. The ability to measure the response at very low "optical" (or spatial) frequencies gives numerical information on the haze and large diffusion disk surrounding the spot nucleus. (*EEA*, 1959, #1463)

**1,390. HIGH-FIDELITY VIDEO RECORDING USING ULTRASONIC LIGHT MODULATION**
**Levi, L.**
***SMPTE, Journal of the*, v. 67, no. 10, pp. 657–661, October 1958**

The method described makes it possible to record electronic signals at video frequencies on photographic materials. Employing the modulation of light intensity by ultrasonic waves, the system is capable of resolution and dynamic range performance well in excess of that obtained with conventional methods. Both black-and-white and color modulation of light are possible. Ultrasonic light modulation has been successfully used to obtain high-quality radar information, and is inherently capable of a similar function in video recording—either field-by-field or continuous. (*EEA*, 1959, #1219)

**1,391. QUANTITATIVE RELATION BETWEEN CHROMATICITY DIFFERENCES AND LUMINANCE DIFFERENCES**
**Lowry, E. M., DePalma, J. J.**
***Optical Society of America, Journal of the*, v. 48, no. 11, pp. 820–827, November 1958**

In general, when two or more stimuli are simultaneously presented to the eye, the phenomenon referred to as "contrast" results. This contrast will be produced by differences between the stimuli, in either luminance or chromaticity, or both. Making use of the fact that veiling luminance, commonly called "glare," destroys contrast, the use of veiling luminance as a means for specifying the equivalence between

chromaticity differences and luminance differences is proposed. The results of measurements on a large number of samples are presented, together with a practical application of the proposed method to the problem of determining how much chromaticity differences contribute to the judgment of graininess in photographic materials. (*PA*, 1959, #3021)

### 1,392. PREDICTIVE QUANTIZING OF TELEVISION SIGNALS

**Graham, R. E.**
***1958 IRE WESCON Convention Record*, pt. 4, v. 2, pp. 147–157, 1958**

A system is described for digital encoding of continuous information sources based on quantizing the difference between the original continuous signal and a predicted version thereof, as opposed to quantizing the original signal itself. The coding is tailored to the observer's perception by employing fine quantum steps for the small prediction errors, and coarse steps for the large errors, where the predictor, and possibly the observer, are surprised. With this tapering of the steps in the quantizing staircase, the total number of levels needed in the quantized error signal for high-quality reproduction may well be so small that a simple nonstatistical coding of the error signal will yield a substantially lowered bit rate compared with conventional systems. To extend the accuracy of digital representation obtained with this system, an additional operation is described in which the "idle times" —the blanking intervals in television—are commandeered to allow the introduction of extra samples in difficult regions of the signal. This requires "elastic" delay of a simple type in which the delay is varied step-by-step in one direction until reset to the starting point. A series of photographs is included showing processed pictures obtained by computer simulation of the various coding methods. (*EEA*, 1959, #3212)

### 1,393. RECEIVER SENSITIVITY

**Ammerman, C. R., Blair, W. L.**
***Electronics*, v. 32, no. 4, p. 52, January 23, 1959**

The chart given relates noise figure to video RF bandwidth assuming square-law detector. The chart, based on tangential signal level, shows tangential sensitivity when RF and video bandwidths and noise figure are known. (*EI*, 1959)

### 1,394. DIE STÖRWIRKUNG BEI UNGLEICHMAESSIGER SPEKTRALVERTEILUNG DER STÖRSCHWANKUNGEN (NOISE EFFECT CAUSED BY IRREGULAR SPECTRAL DISTRIBUTION OF NOISE FLUCTUATIONS)

**Sennhenn, E.**
***Elektronische Rundschau*, v. 13, no. 1, pp. 9–12, January 1959**

Measurements displaying the dependence of noise voltage on frequency for different pictures are discussed, as well as the rise and calculation of noise signal with irregular spectral distribution. Tests were made of the subjective noise sensitivity of the noise spectra of the most commonly used TV scanning tubes. (*EI*, 1959)

### 1,395. TELEVISION RECEIVER COLOR DECODER DESIGN

**Richman, D.**
***IRE Transactions on Broadcast and Television Receivers*, v. BTR-5, no. 1, pp. 27–45, January 1959**

Design principles and circuit details for a new color decoder intended to produce a high level of performance at a reasonable cost are discussed. Design principles internal to the decoder, and external or environmental factors such as IF shapes and burst gating, and measurements of performance characteristics are among the factors considered (*EI*, 1959)

### 1,396. ECHO PHENOMENA IN TELEVISION IMAGES

**Polonsky, J., Amster, L., Melchior, G.**
***Television Society, Journal of the*, v. 9, no. 1, pp. 2–14, January–March 1959**

The principal causes of echoes in the television transmission chain are reviewed. Threshold visibility of echoes as a function of picture content, and characteristics of echo itself with regard to amplitude, delay, and frequency spectrum are discussed. Devices for reducing echoes caused by transmitting antennas and feeders are described. (*EI*, 1959)

### 1,397. A NEW TECHNIQUE FOR EVALUATING THE RESOLUTION OF TELEVISION CAMERA TUBES

**Ryftin, Ya. A., Antipin, M. V.**
***Zhurnal Tekhnicheskoi Fiziki*, v. 29, no. 2, pp. 252–260, February 1959**
**(Translated from the Russian in *Soviet Physics—Technical Physics*, v. 4, no. 2, pp. 219–228, February 1959)**

The present method of using test cards with wedge-shaped lines is critically discussed. A proposal is made that the number of raster lines be adjusted until "fully valid" scanning occurs, i.e., the full scanning achieved by a Nipkow disk, for example. A test card including Fresnel patterns to measure this number is described and some results are given. (*EEA*, 1960, #4520)

### 1,398. A SYSTEM FOR THE AUTOMATIC RECOGNITION OF PATTERNS

**Grimsdale, R. L., Sumner, F. H., Tunis, C. J., Kilburn, T.**
***Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering*, v. 106, no. 26, pp. 210–221, March 1959**
**(Also available as Paper 2792M, Institution of Electrical Engineers, Great Britain, December 1958)**

A new method for the automatic recognition of patterns is described. This method may be applied to any form of spatial pattern, but in the present instance, patterns consisting of line figures are considered. The pattern is presented to a

flying-spot scanner connected to a digital computer. The shape of the pattern is analyzed and a statement is prepared describing the basic features of this pattern. The pattern is then recognized by comparing this statement with a number of others already stored in the computer which relate to named patterns. Patterns are recognized independently of the angle at which they are presented to the scanner, and may be of any size, provided that limits imposed by the resolution of the scanner are not exceeded. The average time to recognize a character is 60 sec with the system programmed on a medium-speed computer. Special-purpose equipment built to perform certain of the stages of the process, together with the use of higher-speed computers now envisaged, will reduce this time by at least a thousandfold. If a new pattern is presented to the machine it will indicate its inability to recognize the pattern, but by giving the machine the name of the pattern, it may become one of the standard patterns which it can subsequently recognize. All the patterns recognized by the machine are hand-drawn and consist of such symbols as the capital letters of the alphabet and numerals, although the system is in no way limited to any special set of characters. Using exactly the same method but with an increase in the degree of complexity, it will be possible for machines to read handwriting. Special allowances are made for imperfections in the patterns, including breaks and general ill-definition. Where there is some confusion and an unknown pattern resembles two or more of the standard patterns, the relative degrees of similarity of the unknown to each of these standard patterns is printed out by the machine. (*EEA*, 1959, #619)

**1,399. THE MEASUREMENT OF RANDOM NOISE IN THE PRESENCE OF A TELEVISION SIGNAL**
**March 1959**
**Weaver, L. E.**
**British Broadcasting Corporation, London, Great Britain**
**Engineering Division Monograph 24, pp. 5–14**

It is becoming increasingly important for authorities concerned with the generation, distribution, and radiation of television signals to have available an accurate method of measuring random noise in the presence of a signal. This monograph describes two realizations of a simple method which is based upon sampling the random noise in the known minimum-energy regions of the video spectrum. The first has been used quite extensively and has proved to give very consistent and reliable results, while the second and more sophisticated version is at the moment still in the course of development. The advantages of the method are: (1) the apparatus is simple and stable, and the measurements can be repeated to within 1 db. Also, no undue degree of skill is required on the part of the operator, (2) both the noise spectrum and the total noise power in the band of frequencies are measured simultaneously; (3) measurements can be made accurately in the presence of pilot control frequencies and relatively continuous interference, such as pickup from broadcast stations and mains hum. Furthermore, the accuracy is not impaired by relatively large amplitude nonlinearity such as is encountered in $\gamma$ correction amplifiers, (4) one is not restricted to a particular test signal of an artificial type, but, within limits, measurements can be made during the transmission of a wide range of picture signals. Also, it is simple to measure the noise level at various amplitudes of the picture signal. The disadvantage is that there is a minimum noise level, depending upon the type of signal present and the frequency of measurement, which can be measured to a given degree of accuracy. This limitation, however, has not been found restrictive in practice and, in general, an overall accuracy of approximately $\pm 1$ db can be expected. (*EEA*, 1959, #4021)

**1,400. ERMITTLUNG EINES RAUSCHBEWERTUNGS-FILTERS FÜR DAS FERNSEHEN (DATA FOR CALCULATION OF NOISE EVALUATION FILTER)**
**Müller, J., Demus, E.**
***N.T.Z. Nachrichtentechnische Zeitschrift*, v. 12, no. 4, pp. 181–186, April 1959**

The visual acuity curve for the 625-line TV system, derived from human measurements, is discussed. Data for the simple practical filter, an attenuation response of which remains within $\pm 1$ db of the measured visual acuity curve, are also described. (*EI*, 1959)

**1,401. REDUCTION OF RESOLUTION OF IMAGE-ORTHICONS BY CROSSTALK OF THE SCANNING FIELDS INTO THE PICTURE CONVERSION SECTION**
**Fix, H., Habermann, W.**
***Rundfunktechnische Mitteilungen*, v. 3, no. 2, pp. 76–80, April 1959 (in German)**

An arrangement by means of which the magnitude of the interfering effect may be assessed is discussed, as well as the results obtained. The variation in time and space of the interfering fields in the picture conversion section is measured, and an experiment is carried out to compensate for crosstalk with an opposing field. Improvement of resolution is shown by means of photographs and oscillograms. (*EEA*, 1960, #3790)

**1,402. TWO-DIMENSIONAL PREDICTIVE REDUNDANCY IN A TELEVISION DISPLAY**
**Martin, A. V. J.**
***IRE Transactions on Communication Systems*, v. CS-7, no. 1, pp. 57–61, May 1959**

The two-dimensional predictive redundancy of a television picture element is calculated as a function of the preceding point correlation for both interlaced and noninterlaced scanning. The resulting curves level off rapidly when the number of previous points taken into account is increased. This seems to indicate that while appreciable improvement would accrue if the preceding point redundancy were used, there would be little more to earn by including the redundancies due to more distant points, especially in view of the necessarily increased complexity of circuitry. An analysis of three-dimensional re-

dundancy would probably result in similar conclusions. (*EEA*, 1959, #5593)

**1,403. SUBJECTIVE IMPAIRMENT OF TELEVISION PICTURES**
**Weaver, L. E.**
***Electronic and Radio Engineer*, v. 36, no. 5, pp. 170–179, May 1959**

A series of tests were undertaken by the BBC in order to determine the statistical spread of opinion among viewers on the degree of impairment introduced into a television picture by known levels of wideband random fluctuation noise. It has for some time been recognized that present methods of specifying random-noise limits for television apparatus and circuits are inadequate, and it is hoped that the results presented will go an appreciable way toward supplying the deficiency. The tests were planned to simulate, as far as possible, home viewing of a picture under optimum conditions. They were made with flat and triangular noise waveforms on both 405- and 625-line pictures. The observers were presented with an accurately standardized television picture on which a series of known levels of random noise could be superimposed, and they were asked to record their opinion of each such display on a six-point scale of picture impairment. The results were smoothed by a method described in detail and, finally, a set of curves was obtained relating the S/N ratio in each case with the mean observer opinion of the degree of impairment caused to the picture. A simple application of the Binomial Distribution Law then allows one to predict from every such value of the mean score what percentage of observers is likely to correspond to each step of the rating scale. A table of this distribution is provided. An opinion limen is defined in a manner analogous to the well-known stimulus limen, and the interesting result is obtained that the opinion limen is equivalent to the value of 3 db in S/N ratio, irrespective of whether the noise is flat or triangular, or whether the picture is to 405- or 625-line standards. (*EEA*, 1959, #3854)

**1,404. LE BROUILLAGE DES IMAGES DE TÉLÉVISION PAR LES SIGNAUX PARASITES (THE DEGRADATION OF TELEVISION IMAGES BY PARASITIC SIGNALS)**
**Goussot, L.**
***Onde Électrique*, v. 39, no. 386, pp. 352–361, May 1959 (in French)**

The various types of interfering signal, ranging from continuous mains ripple to random motor car ignition, are described and classified. The objective S/N ratio is established in each case. The parameters to be taken into consideration when assessing the subjective nuisance value of any particular type of interference are then studied. One approach to quantitative assessment is the comparison of the natural interference against artificial interference derived from a standard source. Finally, the importance of the frequency of the noise, when repetitive, and the form of pattern it produces on the screen are investigated. (*EEA*, 1960, #1037) (See also Entry #1412)

**1,405. THEORETICAL AND EXPERIMENTAL CHARACTERISTICS OF RANDOM NOISE IN TELEVISION**
**Fatehchand, R.**
***British Institution of Radio Engineers, Journal of the*, v. 19, no. 6, pp. 335–344, June 1959**

Consideration is given to certain aspects of random noise which may be important in television, particularly noise due to electron current fluctuations in valves or thermal agitation of electrons in resistances. The relationship between frequency spectrum and the time variation of random noise is shown. In particular, a fluctuating LF envelope is associated with "quasi-triangular" noise, i.e., noise peaked at the HF end of the passband. A nonlinear transfer characteristic is next considered. LF components are then produced from quasi-triangular noise, these terms arising from the fluctuating envelope. Phase distortion after the nonlinearity has appreciable influence on noise properties. The relevance of these effects to noise visibility on a picture tube is examined, and oscilloscope photographs are given. For random noise, plus a sinusoidal signal, nonlinearity gives rise to intermodulation products of the noise and signal. This is of special significance if the signal is near the top of the passband and the noise is quasi-triangular, since in this case the presence of the LF intermodulation products drastically increases the noise visibility on a picture tube. It is shown that this intermodulation effect may be produced by the nonlinear characteristic of the picture tube. (*EEA*, 1959, #6151)

**1,406. THE OPTICAL OBJECTIVE SYSTEM IN TELEVISION AND ITS TRANSMISSION CHARACTERISTICS, BASED ON ITS AMPLITUDE AND PHASE RESPONSE**
**Grabre, H., Below, F.**
***Rundfunktechnische Mitteilungen*, v. 3, no. 3, pp. 145–152, June 1959 (in German)**

The relationship between optical (lines/mm) and electronic resolution on the surface of a photocathode is explained and discussed, followed by consideration of contrast transmission problems, and of practical methods of measuring the contrast transmission coefficient with the aid of a micro-slit, a number of various test systems being described in some detail. The spatial frequency band of an optically resolved test chart or pattern is converted into a sequentially scanned signal with certain transient response, thus, it is possible to apply amplitude and phase-response appraisal methods to the evaluation of the optical part alone. Once the "slit-function" (mainly a function of the scanning aperture shape) is known, the responses can be calculated by means of Fourier analysis or established empirically. The author's equipment, developed in the Hamburg Rundfunktechnik Institute and employing a rotating multi-slit drum, is shown to yield directly the required response data. (*EEA*, 1960, #8335)

**1,407. ON THE DETECTIVE QUANTUM EFFICIENCY OF TELEVISION CAMERA TUBES**
**Jones, R. C.**
***SMPTE, Journal of the*, v. 68, no. 7, pp. 462–466, July 1959**

The detective quantum efficiency of two RCA image orthicons (5820 and 6849) and one RCA vidicon (6326) is computed from unpublished signal, noise, and resolution data supplied by the manufacturer. The concept of detective quantum efficiency used here is identical with the concept of quantum efficiency introduced by Rose, and is defined as the square of the ratio of the measured S/N ratio to the maximum possible S/N ratio under the same external conditions, where the maximum possible S/N ratio is set by the statistical fluctuations in the number of the photons in the background. The detective quantum efficiency $Q$ is presented as a function of the wavelength of the photocathode radiation, of the irradiation of the cathode, and of the line-number of the target. The maximum value of $Q$ with respect to variation of the wavelength, irradiation, and line-number is 2.65 percent for the 5820 and 4.35 percent for the 6849 image orthicons and only 0.084 percent for the 6326 vidicon. (*EEA*, 1959, #6798)

**1,408. A STUDY OF FACTORS INFLUENCING THE LEGIBILITY OF TELEVISED CHARACTERS**
**Seibert, W. F., Kasten, D. F., Potter, J. R.**
***SMPTE, Journal of the*, v. 68, no. 7, pp. 467–471, July 1959**

Thirty-six volunteer subjects, screened for normal visual acuity, viewed televised displays during a one-hour testing session. There were 252 displays; each consisted of four characters (letters and numbers) of a given size and contrast condition. The study design made it possible to compare visibility across: (1) six viewing distances; (2) three viewing angles; (3) three figure-background contrasts; (4) four character sizes; and (5) three time-segments within the testing session. Results indicate that no visual fatigue occurred, that black-on-white and white-on-black contrasts produced about equal visibility, and that characters subtending 10 min of vertical visual angle could be perceived with almost complete accuracy. (*EEA*, 1959, #6819)

**1,409. MICROSTRUCTURE INVESTIGATION OF COLOUR TV IMAGES**
**Bornemann, I.**
***Nachrichtentechnik*, v. 9, no. 7, pp. 313–317, July 1959 (in German)**

An analysis of raster composition and resolution of the NTSC system transmission with shadow-mask picture-tube is presented, based on an evaluation of information entropy, undertaken previously by the author and P. Neidhardt, and extended to color television. Three items are considered in detail: (1) information reduction due to relationship between spot size and spot brightness, (2) reduction due to the eye's insensitivity to color in fine detail; and (3) resolution of a three-color tube in terms of color dot geometry (triplets). Results show that a genuine increase in picture information is achieved. The paper is illustrated by excellent photoenlargements of the parts of color screen images. (*EEA*, 1960, #5857)

**1,410. A METHOD OF CODING TELEVISION SIGNALS BASED ON EDGE DETECTION**
**Julesz, B.**
***Bell System Technical Journal*, v. 38, no. 4, pp. 1001–1020, July 1959**

A method is described for transmitting digitalized video signals to reduce channel capacity from that needed for standard pulse code modulation. This method takes advantage of the inability of the human eye to notice the exact amplitude and shape of short brightness transients. The transmitted information consists of the amplitudes and times of occurrence of the "edge" points of video signals. These selected samples are coarsely quantized, if they belong to HF regions, and the receiver then interpolates straight lines between the samples. The system was simulated on the IBM 704 computer. The processed pictures and channel-capacity savings are presented. (*EEA*, 1959, #7635)

**1,411. NOTE SUR LA RÉDUCTION DE LA QUANTITÉ D'INFORMATION CONTENUE DANS UNE IMAGE DE TÉLÉVISION (REDUCTION OF QUANTITY OF INFORMATION CONTAINED IN A TELEVISION PICTURE)**
**Martin, A. V. J.**
***Onde Électrique*, v. 39, no. 388–389, pp. 686–689, July–August 1959**

Two simple means of reducing the information content contained in a television picture are discussed. Quantization of brilliance levels of the picture are described. A method based on a high degree of correlation existing between neighboring points is outlined, and practical calculations are applied to the 819-line French TV standard.(*EI*, 1960)

**1,412. LE BROUILLAGE DES IMAGES DE TÉLÉVISION PAR LES SIGNAUX PARASITES (THE DEGRADATION OF TELEVISION IMAGES BY PARASITIC SIGNALS)**
**Goussot, L.**
***Onde Électrique*, v. 39, no. 388–389, pp. 690–700, July–August 1959 (in French)**

Random background noise alone is studied. The factors to be considered when assessing the subjective effect are briefly discussed. The relationships between the effective value of the noise, peak value, quasi-peak value and the probability of the peak value exceeding the quasi-peak value are analyzed. Methods of measurement for determining these values are considered and figures obtained by various authorities quoted. Subjective comparisons between random noise and artificial interfering signals of a specific constant frequency, e.g., 1 Mc, are established, and as a result the design of a weighing filter is worked out. (*EEA*, 1960, #1038) (See also Entry #1404)

**1,413. OPTIMIZATION OF THE APERTURE CORRECTIVE SYSTEMS**
**Otterman, J.**
***IRE Transactions on Instrumentation*, v. I-8, no. 2, pp. 55–62, September 1959**

The systematic distortions in an aperture system both with and without a corrective network are compared. Optimization of aperture size is discussed under different conditions of noise and signal, and under different optimization criteria; i.e., criteria for minimization of both the random and the systematic errors. It is shown that the optimization will generally result in aperture length ranging from $0.75\ \pi/\omega_s$ where $\omega_s$ is the limiting frequency of the signal. (*EEA*, 1960, #1904)

**1,414. IMPROVEMENT ON TV PICTURE QUALITY WITH RECTANGULAR APERTURES OF CRT GRIDS**
**Kogo, H., Kawase, T., Noguchi, F.**
***Institute of Electrical Engineers of Japan, Journal of the*, v. 79, no. 853, pp. 1341–1345, October 1959 (in Japanese)**

A new design of a TV monochrome kinescope is discussed. Rectangular apertures of the first and second grid cause an electron beam to project a stretched spot on a fluorescent screen. This stretched point is claimed, by removing the dark line between each scanning line on the TV picture, to improve the picture quality so much that many observers can appreciate the picture at a shorter distance. (*EI*, 1960)

**1,415. EXPERIENCE WITH LONG-DISTANCE TELEVISION FIELDS USED FOR RETRANSMISSION**
***AIEE Transactions, Part I—Communication and Electronics*, v. 78, no. 45, pp. 594–596, November 1959**

A brief engineering report is given on the use of long-distance "diffraction" fields (over 90 mi) for a community TV aerial system for re-transmission, to receive channel 2- to 13-VHF signals in a difficult terrain between two mountain ranges. The signal increases with height to a maximum, then to a minimum, and then to a lower maximum again. General conclusions are that the signal by night was 6- to 10-db higher than by day, that occasionally the propagation will suffer from very rapid deep fades similar to aircraft flutter, and that aerial gain should take place in the smallest possible physical volume, and with minimum height array. (*PA*, 1960, #2543)

**1,416. A PROBABILISTIC MODEL FOR RUN-LENGTH CODING OF PICTURES**
**Capon, J.**
***IRE Transactions on Information Theory*, v. IT-5, no. 4, pp. 157–163, December 1959**

A first-order Markoff process representation for pictures is proposed to study the picture coding system known as "run-length coding" (differential-coordinate encoding). A lower bound for the saving in channel capacity is calculated on the basis of this model, and is compared with the results obtained by previous investigators. In addition, this representation is shown to yield an insight into the run-length coding system which might not otherwise be obtained. The application of this probabilistic model to an "elastic" system of run-length coding is discussed. (*EEA*, 1960, #4508)

**1,417. NOISE-CANCELLED SYNCHRONISING-PULSE SEPARATOR CIRCUIT FOR 525- AND 625-LINE TELEVISION RECEIVERS**
**Mothersole, P. L.**
***Mullard Technical Communications*, v. 5, no. 41, pp. 13–16, December 1959**

The effect of noise pulses on a separator is discussed. To obtain stable time base synchronization with negative vision modulation, noise-protection must be provided. A simple noise-inverting circuit is described. (*EI*, 1960)

**1,418. TRANSISTORS IN VIDEO EQUIPMENT**
**Helsdon, P. B.**
***British Institution of Radio Engineers, Journal of the*, v. 19, no. 12, pp. 753–768, December 1959**

The design of video current amplifiers for a television using transistors is discussed in terms of hybrid-$\pi$ equivalent circuit. The importance of a current gain-bandwidth factor is stressed. Investigation of noise with regard to camera head design gives the transistor parameters and the circuit conditions necessary for maximum S/N ratio. (*EI*, 1960)

**1,419. TIME-BASE SYNCHRONIZATION AND ASSOCIATED PROBLEMS**
**Mothersole, P. L.**
***British Institution of Radio Engineers, Journal of the*, v. 20, no. 1, pp. 57–72, January 1960**

The definition and quality of a television picture are determined by the effectiveness of time-base synchronization when the receiver is used in a noisy situation. The requirements of synchronizing and time base oscillator circuits for use with both positive and negative modulation systems are described. (*EI*, 1960)

**1,420. DIE RESTEITENBANDENTZERRUNG DES FARBSIGNALS BEIM NTSC-SYSTEM (ELIMINATION OF VESTIGIAL SIDE BAND DISTORTION OF COLOR SIGNAL IN NTSC SYSTEM)**
**Schönfelder, H.**
***Archiv der Elektrischen Übertragung*, v. 14, no. 1, pp. 37–46, January 1960**

The elimination of transmission errors related to color cross-talk into $Q$-channel and frequency-response error of $I$-signal by suitable circuit arrangements in a color receiver is discussed. Circuits allowing pre-equalization of the $I$-signal in a color modulator are described. (*EI*, 1960)

**1,421. PICTORIAL DATA TRANSMISSION FROM A SPACE VEHICLE**
**Baumunk, J. F., Roth, S. H.**
*Electrical Engineering*, v. 79, no. 2, pp. 134–138, February 1960

The problems of radio communication are discussed in general terms. System parameters are deduced for a television link between the Moon and Earth capable of transmitting a 500-line frame in 1 min, with a 20-db S/N ratio. The working frequency chosen is 1000 Mc with FM/FM modulation. Given a 60-ft dish aerial feeding a 2-db noise-factor receiver, a transmitter power of 300 w would be required. (*EEA*, 1960, #5830)

**1,422. THE SIGNAL-NOISE RATIO IN THE N.T.S.C. COLOUR TELEVISION SYSTEM**
**Mayer, N.**
*Rundfunktechnische Mitteilungen*, v. 4, no. 3, pp. 130–139, March 1960 (in German)

Because additional interference arises due to transmission of the color signal, the sensitivity to sinusoidal interference above 1 Mc is greater than that obtaining in black-and-white television, but the results of previous investigations on the subject are widely conflicting. S/N ratios were determined for a number of interfering frequencies in the video-frequency range and from one RF measurement. The values obtained were used to calculate those obtaining for RF conditions. Comparison between measured and calculated values of S/N ratios showed satisfactory agreement. (*EEA*, 1960, #8347)

**1,423. THEORETICAL INVESTIGATIONS ON THE IMPULSE-SEPARATING STAGE IN TELEVISION RECEIVERS**
**Reker, H.**
*N.T.Z. Nachrichtentechnische Zeitschrift*, v. 13, no. 3, pp. 147–154, March 1960 (in German)

The time-constant requirements of the networks preceding this stage, in order to achieve precise synchronization and at the same time freedom from disturbance due to strong interfering pulses, are to a degree mutually exclusive. As the result of a detailed analysis of the network, it is shown that the opposing requirements are best met by the use of a network embodying two time constants, the second being derived from a paralleled resistance and capacitance connected in series with the feed to the grid of the sync separator valve, and providing rapid recovery following interference pulses. (*EEA*, 1961, #447)

**1,424. NEW TV CAMERA TUBE IMPROVES RESOLUTION**
*Electronics*, v. 33, pp. 84–85, April 8, 1960

A brief description is given of a 4½-in. image orthicon with greater S/N ratio than in 3-in. tubes.

**1,425. ELECTRONIC SWITCH SPLICES TWO INPUTS FOR SIDE-BY-SIDE COMPARISON OF IMAGE QUALITY**
*Machine Design*, v. 32, no. 8, p. 175, April 14, 1960 (*AS&T*, 1960)

**1,426. PREAMPLIFIERS WITH DRIFT TRANSISTORS FOR VIDICON CAMERAS**
**Anders, H.**
*Rundfunktechnische Mitteilungen*, v. 4, no. 2, pp. 66–73, April 1960

The choice of the input circuit and the effect of the working point on the S/N ratio are discussed. This is followed by results of noise measurements made on a fairly large number of transistors of different makes. The best samples attained a S/N ratio of 26 db (peak-to-peak) for a signal current of 0.3 $\mu a_{pp}$. The spectral distribution of the fluctuations of noise occurring in the transistor preamplifier was analyzed by means of a method of measurement based on the principle of search-tone analysis, and a comparison was made with that of a valve amplifier. In this connection, an appropriate accentuation of the high frequencies for aperture correction was also taken into account. The measured curves were evaluated by the CCIR method, in order to embrace the visual interference effect. The relatively great dependence on temperature of the input impedance and the possibility of compensation of the transmission faults resulting from it are discussed. (*EEA*, 1960, #5862)

**1,427. FERNSTEUERUNG VON INDUSTRIELLEN FERNSEHANLAGEN MITTELS FREQUENZ-CODE-VERFAHRENS (REMOTE CONTROL OF INDUSTRIAL TV USING FREQUENCY CODE TECHNIQUES)**
**Goehl, M.**
*F. und G. Rundschau*, no. 45, pp. 256–259, May 1960

The transistorized installation described uses mechanical resonators of resonance relays for frequency generation and selection. (*EI*, 1961)

**1,428. SOME ASPECTS OF VIDICON PERFORMANCE**
**Lubszynski, H. G., Taylor, S., Wardley, J.**
*British Institution of Radio Engineers, Journal of the*, v. 20, no. 5, pp. 323–334, May 1960

The performance of the 1-in. vidicon is discussed, particularly the effect of various operating conditions on transfer characteristics, lag, resolution, and geometry. When target voltage and dark current are high, maximum sensitivity is obtained, but this is at the expense of the other parameters. In the E.M.I. vidicon, the optimum performance as regards $\gamma$ and lag is obtained for signal currents of 0.2 to 0.3 $\mu a$ and dark currents of 0.01 to 0.03 $\mu a$. Methods of measuring

sensitivity, $\gamma$, and lag are described and possible sources of error indicated. The effect of bias illumination on $\gamma$, lag, and resolution is analyzed. Improvements in geometry are described together with a method of improving resolution. Infrared and ultraviolet sensitive tubes are mentioned. (*EEA*, 1960, #6464)

**1,429. NOISE LIMITATIONS TO RESOLVING POWER IN ELECTRONIC IMAGING**
**Coltman, J. W., Anderson, A. E.**
***IRE, Proceedings of the*, v. 48, no. 5, pp. 858–865, May 1960**

A theoretical derivation, verified by experiment, shows that the maximum visible line number of a displayed bar pattern is directly proportional to the signal-to-white-noise ratio. The constant of proportionality and the effect of finite screen boundaries were experimentally determined. It is found both theoretically and experimentally that the masking effect of white noise depends only on the noise power per unit bandwidth, and is independent of the upper frequency limit of the noise spectrum provided that this exceeds the frequency limit set by the eye. These results can be used together with the aperture response of any imaging system to predict, in quantitative terms, the resolution limit as a function of the signal and noise levels. As an example, the theorems postulated are used together with the measured amplitude response function of the 5820-image orthicon to obtain a universal resolution versus S/N ratio curve for beam-noise-limited tubes of the image orthicon type. The predicted performance is in good agreement with experimental results. A similar set of curves for quantum-noise-limited image tubes is also given. The effects of object contrast variation, signal integration in time, and the presence of spurious background are presented. (*EEA*, 1960, #5243)

**1,430. NOISE LEVEL MEASUREMENT IN TELEVISION**
**Weaver, L. E.**
***Wireless World*, v. 66, no. 6, pp. 264–266, June 1960**

A method particularly applicable to noise measurement of camera tubes is presented. It is based on the fact that the energy of a television signal is almost entirely concentrated in the immediate neighborhood of each line-frequency harmonic in the form of a rapidly decreasing series of sidebands originating from sync and picture signals. The video signal under investigation is applied via an attenuator to the input of a communications receiver covering the video band down to 60 kc and feeding into an output meter. The receiver bandwidth is set to 6 kc, for example, and the tuning is then adjusted until the setting is midway between two output maxima (corresponding to two line-frequency harmonics). The noise power for the 6-kc bandwidth is then determined by calibrating the receiver and its meter with a white-noise source of known output power. (*EEA*, 1960, #5497)

**1,431. PICTURE QUALITY—PROCEDURES FOR EVALUATING SUBJECTIVE EFFECTS OF INTERFERENCE**
**Fredendall, G. L., Behrend, W. L.**
***IRE, Proceedings of the*, v. 48, no. 6(I), pp. 1030–1034, June 1960**

A comprehensive study, conducted by the Television Allocations Study Organization, of the subjective effects on picture quality of a number of types of interfering signals and noise, as functions of levels of interference, is presented. The design of the tests and the laboratory facilities used are described. (*EI*, 1960)

**1,432. MEASUREMENTS OF THE SUBJECTIVE EFFECTS OF INTERFERENCE IN TELEVISION RECEPTION**
**Dean, C. E.**
***IRE, Proceedings of the*, v. 48, no. 6(I), pp. 1035–1049, June 1960**

A measurement program was conducted in which almost 200 observers made about 38,000 rating observations on color and monochrome stationary television pictures impaired by various known amounts of interference. Separate tests were made for the following types of interference: upper adjacent channel, lower adjacent channel, random noise, co-channel with each of six carrier-frequency separations, and simultaneous random noise and co-channel. The following rating grades were used: (1) excellent; (2) fine; (3) passable; (4) marginal; (5) interior; and (6) unstable. The observations were handled on a statistical cumulative frequency basis and plotted on probability paper. Commercial monochrome and color receivers were used, and the tests were made with laboratory signal-generating equipment on the lower VHF television channels. As representative results, a picture impaired by upper-adjacent-channel interference (with 6-Mc channels) was rated by 50 percent of the observers as passable or better for $-27$ db ratio of signal to interference. For the lower adjacent case a similar value was found, this result being explained as due to better traps in the medium-high-grade receivers of the test than in many receivers in use by the public. For random-noise interference the requirement for passable or better rating by 50 percent of the observers was $+27$ db on the basis of rms sync amplitude to rms noise of the 6-Mc channel. The co-channel tests gave the following requirements for the passable or better rating by 50 percent of the observers: 22 db for 360-cps offset, 41 db for 604, 24 db for 9985, 17 db for 10,010, 29 db for 19,995 and 17 db for 20,020. Data for simultaneous co-channel and random-noise interference were taken for 14 combinations of test conditions. (*EEA*, 1960, #6487)

**1,433. STUDIES OF CORRELATION BETWEEN PICTURE QUALITY AND FIELD STRENGTH IN THE UNITED STATES**
**Braum, C. M., Hughes, W. L.**
***IRE, Proceedings of the*, v. 48, no. 6, pp. 1050–1058, June 1960**

Data which correlate a given level of picture quality with some corresponding level of measured field strength are presented. The data were gathered by actual house-to-house surveys in conjunction with field strength measurements. This procedure was followed rather than making laboratory tests on new receivers because it was desired to evaluate coverage as it actually was, not as it ought to be. Particular attention was paid to differences between UHF and VHF channels, with respect to receiver and aerial performance in given field strengths. The ranges of field strengths required for a passable picture quality are fairly well established for each band of television channels. (*PA*, 1960, #6488)

**1,434. SOUND-TO-PICTURE POWER RATIO**
McIlwain, K.
*IRE, Proceedings of the*, v. 48, no. 6, pp. 1097–1102, June 1960
(*AS&T*, 1960)

**1,435. TRANSISTORS IN VIDEO EQUIPMENT**
Helsdon, P. B.
*SMPTE, Journal of the*, v. 69, no. 6, pp. 404–405, June 1960

The principles involved in the design of video current amplifiers for television using transistors are discussed in terms of the hybrid-$\pi$ equivalent circuit. The design philosophy which exploits the unconventional concept of gain-bandwidth is presented. An investigation of noise with regard to the camera head amplifier design gives transistor parameters and circuit conditions for maximum S/N ratio. (*EI*, 1960)

**1,436. A TRANSISTOR TV TUNER WITH A 4.5 db NOISE FIGURE**
Simmons, C. D., Specialny, J., Sfreddo, A.
*IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 2, pp. 67–71, July 1960

Characteristics of the particular transistor employed in the grounded-emitter RF stage are discussed. The noise figure is dependent upon the emitter-base diode capacitance, and this has been minimized by making the emitter area very small and by careful design of the base grading. The gain and the noise figure have a maximum and a minimum value respectively at about the same operating point, i.e., at about 1.5 ma collector current. The forward AGC characteristic is reasonably linear over a 27-db range, and the variation in the resistive component of the input and output impedance over the frequency range 50–200 Mc is not embarrassingly high. (*EEA*, 1961, #2014)

**1,437. CORRECTION DE PHASE EN TÉLÉVISION (PHASE CORRECTION IN TV)**
Melchior, G.
*Annales de Radioélectricité*, v. 15, no. 61, pp. 243–252, 278–279, July 1960

Features of a variable corrector which can be used in conjunction with transient examination for accurate determination of phase correction at video frequency are described, as well as phase correction in VHF transmitters and receivers. (*EI*, 1961)

**1,438. OPTICAL LINE ELIMINATOR—DISPERSIVE SCREEN UNDER DEVELOPMENT BY THE GERMAN FIRM SABA**
*Wireless World*, v. 66, p. 372, August 1960
(*AS&T*, 1960)

**1,439. PROBLEM OF THE UNRESTORED TELEVISION RECEIVER**
Nissen, R. J.
*SMPTE, Journal of the*, v. 69, no. 8, pp. 521–527, August 1960

It is maintained that correct gray-scale reproduction is the most important parameter of television picture fidelity. Under certain picture conditions, the absence of dc restoration in the modern home receiver will almost totally destroy proper gray-scale reproduction. Set manufacturers were queried as to their reasons for excluding this critical circuit. To compensate for the unrestored picture, until restoration circuits are again included in the home receiver, operating procedures and standards based on the use of the transmission waveform as a guide are proposed.

**1,440. PORTHOLING CURE**
*Electronic Industries*, v. 19, p. 88, September 1960
(*AS&T*, 1960)

**1,441. FUSION OF THE LINES OF A TELEVISION DISPLAY**
Fry, G. A.
September 1960
Ohio State University Research Foundation, Mapping and Charting Research Laboratory, Columbus
TP (696)-24, RADC-TN-60-217, AF 30(602)-1580
AD-251,460

This study is concerned with the use of pictures transmitted by television for stereoviewing and cover comparison. In both situations it is desirable to get rid of the line grain in the television display. This is a study of the feasibility of blurring the lines of the television display into each other. With a gaussian aperture and a pair of crossed cylinders, it is possible to create a blur in a direction perpendicular to the scan lines. A ground glass was also used to produce a blur in both directions. Both methods of blurring were tested using various kinds of test objects. Mathematically it can be shown that the ideal type of blur for this purpose is one with a blur function that conforms to the normal curve. Blur in a direction perpendicular to the scan lines is much better than blur in all directions. Less information is lost. A special technique for printing positives from negatives was proposed.

**1,442. VIDEO TRANSMISSION OVER TELEPHONE CABLE PAIRS BY PULSE CODE MODULATION**
**Carbrey, R. L.**
***IRE, Proceedings of the,* v. 48, no. 9, pp. 1546–1561, September 1960**

An experiment is described in which monochrome and color television signals were encoded into a seven-digit binary code and transmitted over seven pairs of regular telephone cable. The results indicate potential use of this method for transcontinental coaxial and microwave circuits as well as for short-haul television circuits in metropolitan area. (*EI*, 1960)

**1,443. GENERATION OF, AND COMPENSATION METHODS FOR, RETRACE INTERFERENCE SIGNALS IN VIDICON CAMERA SYSTEMS**
**Schneider, H. D.**
***Elektronische Rundschau,* v. 14, no. 9, pp. 367–368, 371, September 1960 (in German)**

The fast line-time-base retrace generates an interference pulse, which, picked up outside and inside the camera tube, causes incorrect black level clamping. The outside pickup can be avoided by wiring symmetry and care in connecting to the yoke terminals, and by improved screening. The internal pickup mechanism in vidicons with single enclosed or partitioned anode systems is explained, and compensating circuits to cancel stray capacitances from the yoke to the signal electrode are described, and their use in head-amplifier input circuits is indicated. Typical oscillograms of the original stray pulses and of their almost complete suppression after compensation are shown. (*EEA*, 1961, #1665)

**1,444. THE USE OF PHASE EQUALIZERS TO IMPROVE THE TRANSIENT RESPONSE OF A TELEVISION TRANSMITTING SYSTEM**
**MacDonald, J. K.**
***IRE Transactions on Broadcasting,* v. BC-6, no. 3, pp. 12–20, September 1960**

A condensed account of video-transmission improvement achieved by use of fixed and variable phase equalizers, tested by pulse input signals, and illustrated by photographs and 0.125 $\mu$sec pulse-reproduction is presented. (*EEA*, 1960, #2061)

**1,445. TELEVISION NOISE LIMITING**
**Kitchin, H. D.**
***Electronic Technology,* v. 37, no. 11, pp. 406–414, November; no. 12, pp. 455–459, December 1960**

The ultimate performance possible from various types of noise limiter has been studied theoretically by Weighton, who concludes that under certain conditions the S/N ratio of an AM receiver with a suitable noise limiter can be better than that of an equivalent FM receiver. Unfortunately, the performance of simple noise-limiting circuits often falls far short of that theoretically possible. It can be shown that with impulsive interference, the frequency spectrum of a pulse of given shape is inversely proportional to pulse width, hence a narrow pulse spectrum extends to very high frequencies, e.g., motor car ignition extends to 600 Mc. Hence, over the relatively narrow band accepted by a receiver the amplitude and phase spectrums can be considered constant and the pulse shape produced by the receiver depends solely on the receiver characteristics. Two main types of noise limiter have been derived in the past, namely, the series-diode peak-limiter and the rate-of-change limiter. Curves are given enabling the two systems to be compared. These both have shortcomings, an examination of which has led to the design of an improved limiter. This is considered in detail. Two important points in its design are the preservation of the narrowest interference pulses and the correct operation of the AGC. Circuit diagrams are given and the mathematical analysis of the whole subject is contained in seven appendices. (*EEA*, 1961, #2071)

**1,446. COLOUR TELEVISION STANDARDS. CO-CHANNEL INTERFERENCE AND THE COLOUR SUB-CARRIER**
**Maurice, R. D. A.**
***Wireless World,* v. 66, no. 11, pp. 536–537, November 1960**

Calculations and experimental work are summarized to show that for precision-offset working between television transmissions there would be an advantage in using ⅓ line-frequency precision best offset, rather than the ½ line-frequency value in use, to minimize interference from the color subcarrier (NTSC type) in receiver luminance channels. Proposed figures on this basis for several types of television systems are tabulated, and it is suggested that international European agreement be obtained to change the subcarrier frequency from 4,429,687.5 to 4,435,800 cps (an increase of 1,112.5 cps) and to increase the number of lines per picture from 625 to 627. Experiment has shown that the improvement of the ⅓ line-frequency condition over the ½ line-frequency condition for extinction viewing distances is 12 percent for dot-pattern interference and 65 percent for flickering cross-color interference. (*EEA*, 1961, #2060)

**1,447. LIMITS OF RESOLUTION OBTAINABLE WITH ELECTRONIC IMAGE ENHANCEMENT TECHNIQUES AND LONG FOCAL LENGTH OPTICS**
**Manning, W. H., Jr.**
**November 1960**
**Air Force Missile Test Center, Patrick Air Force Base, Fla.**
**AFMTC TR 60-26**
**AD-289,174 (ASTIA does not furnish copies.)**

**1,448. BENEFITS OF A NEW ASPECT RATIO FOR TELEVISION**
**Schuster, W. D., Torsch, C. E.**
***IRE Transactions on Broadcast and Television Receivers,* v. BTR-6, no. 3, pp. 13–17, November 1960**

The proposal is to change the aspect ratio from 4.3 to 5.4. Such a change, supported by a square frame, will, it is

claimed, meet with the approval of the oculist, the photographer, and the insurance companies as well as the set owner. The advantages include a substantial increase in the area of picture received on the screen and a reduction of horizontal scanning power required. (*EEA*, 1961, #5872)

**1,449. NOISE AND RADIATION PROBLEMS WITH TELEVISION RECEIVERS**
**Falk-Pederson, K.**
***Teknisk Ukeblad*, v. 107, no. 45, pp. 1013–1019, December 8, 1960 (in Norwegian)**

The interference of television reception caused by the mountainous terrain of Norway is discussed. Even though pictures may possess good quality, sound reception may be hampered by intercarrier noise. During winter at low temperatures the field strength of received signals may be much lower than in summer where there is no direct line-of-sight between transmitter and receiver. The field strength at 80 km from a 93.8-Mc transmitter rose from 100 to 300 $\mu$v with a temperature rise from −10 to +3°C. The main sources of noise disturbing television reception and Norwegian limiting specifications for radio interference as affecting television receivers are considered. The results of measurements of radio noise from the line deflection oscillators of 51 television receivers are shown. (*EEA*, 1961, #2074)

**1,450. SOME COMPARATIVE INVESTIGATIONS INTO THE MODIFIED N.T.S.C. COLOUR-TELEVISION SYSTEM WITH PRE- OR POST-CORRECTION OF GRADATION**
**Bernath, K.**
***Rundfunktechnische Mitteilungen*, v. 4, no. 6, pp. 232–237, December 1960 (in German)**

A comparison is made of two alternative methods of gradation correction (at the transmitting end, pre-correction, and at the receiving end, post-correction) of the three basic color signals as regards sensitivity to interference and picture sharpness. It is apparent, compared with the simple post-correction method, that the method of pre-correction now used in the U.S.A. has advantages relating not only to the equipment but also to transmission, since, for practically the same picture sharpness, the sensitivity to interference is on the average lower by 2 to 2.5 db. (*EEA*, 1961, #5851)

**1,451. THE ENERGY SPECTRA OF RANDOM SEQUENCES OF OVERLAPPING PULSES**
**Dorman, M. I.**
***Radiotekhnika*, v. 15, no. 12, pp. 50–52, December 1960 (in Russian)**

Levin's expression for non-overlapping pulses ("The Theory of Random Processes and Its Radio Applications," *Sovetskoe Radio*, 1957) is discussed, and it is shown how it can be modified for the case of a sequence of overlapping exponential video pulses of random amplitude. (*EEA*, 1962, #3089)

**1,452. U.H.F. TUNER FOR TELEVISION BANDS IV AND V**
**Hein, H.**
***S.E.L. Nachrichten*, v. 8, no. 1, pp. 7–11, 1960 (in German)**

In the near future, bands IV and V (of 470–790 Mc) will be used widely in Germany for a second television program. To date, these bands have been used only for radio links. The construction of a tuner suitable for television receivers operating in these frequency bands is described that will be inexpensive in mass production. To avoid radiation of the oscillator frequency by the aerial, an HF preamplifier is introduced. Details are given of the circuit of the tuner. The gain and noise-factor of the tuner are calculated. (*EEA*, 1961, #2015)

**1,453. KRITISCHE BETRACHTUNG DES NTSC-FARBFERNSEHSYSTEMS VOM STANDPUNKT DER INFORMATIONSTHEORIE (CRITICAL EXAMINATION OF NTSC COLOR TV SYSTEM FROM POINT OF VIEW OF INFORMATION THEORY)**
**Neidhardt, P.**
***Wissenschaftliche Zeitschrift der Hochschule für Elektrotechnik, Ilmenau*, v. 6, no. 1, pp. 55–60, 1960**

A discussion is presented of the application of theories relating to: transmission to continuous case, information entropy of continuous signal function in presence of noise, and transmission of color information across a frequency band that was formerly used by black and white TV only. Twenty-five references are included. (*EI*, 1960).

**1,454. A TELEVISION IMAGERY SIMULATOR**
**Smith, J. P., Baumunk, J. F.**
***SMPTE, Journal of the*, v. 70, no. 1, pp. 27–32, January 1961**

For evaluating TV systems and for studying image enhancement techniques, there is a need for simulator equipment with adjustable and measurable parameters. Because results must be duplicated from day to day and from month to month, reliability is of importance in designing the equipment. Also, when evaluating systems of high resolution, the resolution capabilities of the evaluating means must be better than the system under evaluation. The mechanical and electrical design must be flexible so that, when new ideas present themselves, they may be developed and added to the existing equipment. A TV imagery simulator which fulfills these requirements is described. (*EEA*, 1961, #2723)

**1,455. A FURTHER ANALYSIS OF TASO PANEL 6 DATA ON SIGNAL TO INTERFERENCE RATIOS AND THEIR APPLICATION TO DESCRIPTION OF TELEVISION SERVICE**
**Fine, H.**
***IRE Transactions on Broadcasting*, v. BC-7, no. 1, pp. 22–38, January 1961**

In Part I a more precise interpretation of the TASO Panel 6 signal-to-interference ratio data is developed. By transformation to a new quality index $M$, the viewer reaction to any given type of interference can be described as a continuous variable having a basic normal distribution. Further, a simple linear relationship has been developed between the average quality index $M$ and the signal-to-interference ratio $R$. The above relationships are combined in Part II with the known variability of TV signals, both with time and from location to location, to provide useful analytic relationships which permit a fairly complete prediction of TV service. Twelve references are included. (*EEA*, 1961, #5844)

**1,456. DIFFRACTION LIMIT: THE MAXIMUM POSSIBLE RESOLVING POWER OF A LENS AND HOW ENGINEERS ARE ATTAINING IT**
**Sherman, B.**
***Modern Photography*, v. 25, pp. 26–27, February 1961**
**(*AS&T*, 1961)**

**1,457. VIDEO-TAPE ANALYZER**
**Goldberg, A. A., Hannah, M. R.**
***SMPTE, Journal of the*, v. 70, no. 2, pp. 85–89, February 1961**

The video-tape analyzer is used to measure the following tape parameters: (1) number and characteristics of dropouts; (2) comparative frequency response; (3) comparative noise figure; (4) comparative sensitivity and output level; and (5) ability of tape to resist mechanical abrasion. Since the analyzer neither records nor stores picture information, analysis is accomplished during one run-through of the tape; therefore, tape handling is reduced, analysis time is decreased, and no synchronizing circuitry is necessary. The analyzer's operation is described. (*EEA*, 1961, #2717)

**1,458. SOME NEW VIDEO MEASUREMENT TECHNIQUES AND APPARATUS**
**Weaver, L. E.**
***Rundfunktechnische Mitteilungen*, v. 5, no. 1, pp. 8–14, February 1961**

Attempts to give a representative idea of the work which has been carried out recently by the BBC in the field of video measurement techniques and apparatus are described. Brief descriptions are given of a new sine-squared pulse and bar generator, and of a new source of test-signals for the measurement of non-linear distortion. In each instance examples are included of the use of the instrument. In addition, two new techniques for the measurement of random noise in the presence of a television signal are described. The first separates the noise from the signal by utilizing a fundamental difference between the spectra of the two signals. It was designed specifically for the measurement of camera tubes and channels, and has been standardized for that purpose. The second method is intended particularly for operational conditions where simplicity of handling is important, but is nevertheless very versatile. It makes use of a time-selection process to eliminate signal components, and appears to be capable of measuring S/N ratios on 405- or 625-line standards to at least 55 db with an accuracy of the order of 0.5 db. (*EEA*, 1961, #6470)

**1,459. OPTICAL FREQUENCY RESPONSE IN RELATION TO OTHER METHODS OF IMAGE ASSESSMENT**
**Dixon, F. A.**
**March 1961**
**Weapons Research Establishment, Supply Department, Australia**
**TN-OID-19**

The optical frequency response function is used to obtain the intensity distribution in the image of a step function of intensity, and from this the image intensity distributions for strips and Cobb test units are obtained. It is shown, for example, that if two systems are assessed by two different test methods, the order of the figure of merit for the two systems can be different, and, furthermore, the order of merit in which the two systems are placed depends strongly on the response function of the detector employed. The differences are large enough to be of real significance in practice.

**1,460. IRE STANDARDS ON VIDEO TECHNIQUES: MEASUREMENT OF RESOLUTION OF CAMERA SYSTEMS, 1961**
***IRE, Proceedings of the*, v. 49, no. 3, pp. 599–602, March 1961**
**Standard 60 IRE 2352**

Definitions, test and measuring equipment, and procedure are described for measurement of resolution of camera systems. (*EI*, 1961)

**1,461. ONE FRAME DELTA ENCODER**
**Salaman, R. G., Hackett, K. R., Southworth, G.**
**April 28, 1961**
**Ball Brothers Research Corporation, Boulder, Colo.**
**Final Report**

A highly efficient encoding system enhances the transmission of television signals from space probes by more economically overcoming the extreme signal attenuation imposed by a long signal path, particularly when only limited transmitter power is available.

**1,462. PRECISION-OFFSET OF THE COLOUR SUB-CARRIER IN THE NTSC SYSTEM**
**Müller, J., Jaeschke, F.**
***Electronische Rundschau*, v. 15, no. 6, pp. 249–252, June 1961 (in German)**

Experimental investigations of the advantages of precision-offset subcarrier operation in reception of color and black-and-white NTSC transmissions are described, based on R.D.A. Maurice's proposal. Starting with his recommendation

for ⅓ offset, other relationships −⅕, ⅖, and ⅙ are checked, and the results are described in a table and also illustrated by photographs of interfering moiré patterns. Of particular interest are diagrams plotting statistics of observer preferences for the ⅕ and ⅓ offset against half-line offset for varying viewing distance. Methods of operating various offset combinations are dealt with in some detail, supported by block diagrams of frequency divider and mixer stages. (*EEA*, 1961, #7067)

**1,463. MEASUREMENT OF PHASE DELAY IN COLOUR TELEVISION**
**Drescher, F.**
***Technische Mitteilungen BRF*, v. 5, no. 2, pp. 76–80, June 1961 (in German)**

The standard CCIR test signal based on the chrominance subcarrier of 4.43 Mc is used, consisting of sawteeth of 4-line duration, with added stair-step (meander) signals of adjustable amplitude. The subcarrier is maintained at 10 percent level. The chosen method of measurement uses a comparative phase observation on an oscilloscope. A detailed analysis is given of the design problems of the measuring and comparator amplifiers (time constants, phase linear response, and effects of a 20°C temperature rise), of the passband of the crystal filter for the re-insertion of the subcarrier, and of the continuously adjustable phase equalizers. To achieve a good indicator sensitivity, use is made of the high redundancy of the test signal by scanning the black-white interval at the field rate, so that the phase delay is displayed at a repetition rate of 50 cps rather than at ½ of line frequency, with a corresponding improvement of about 25 db in S/N. Brief information on simple phase equalizers is included, using variable capacitance junction diodes. (*EEA*, 1962, #3805)

**1,464. THE PROBLEM OF THE MEASUREMENT OF THE SIGNAL/NOISE RATIO OF A TELEVISION SYSTEM, INTRODUCED BY THE TRANSMITTING TUBES**
**Gurevich, S. B.**
***Radiotekhnika i Elektronika*, v. 6, no. 6, pp. 982–992, June 1961 (in Russian)**

Consideration is given the dependence of the sensitivity of television transmitters on (1) the minimal energy radiated from the subject, which suffices for the transmission of a given amount of information about the subject (determined by a number of distinct energy gradations, a number of distinct elements of the subject, and a number of states of the subject), and also on (2) the variation of S/N ratio between input and output, which depends on the properties of the television transmitting tubes. The possibility of re-establishing the S/N ratio which has been decreased in a stage with gain less than unity by a later stage with gain considerably greater than unity is discussed. The improvement of superorthicons to a level limited only by fluctuations in the photocurrent by the use of electron-optical amplifiers is studied. (*EEA*, 1962, #6145)

**1,465. RELATIONSHIP BETWEEN VIDICON QUALITY PARAMETERS AND SIZE OF SCANNED AREA OF SEMICONDUCTOR LAYER WITH EQUAL LIGHT FLUX**
**Theile, R., Pilz, F.**
***Rundfunktechnische Mitteilungen*, v. 5, no. 3, pp. 108–111, June 1961 (in German)**

Television camera tubes of the vidicon type have been widely used as 1-in. models. A quantitative summary of the way in which various properties of tubes of this type change with the size of the scanned area is given. For example, a reduction of the scanned surface, with equal light flux, brings about improvements in relation to the effect of lag, as a consequence of the greater intensity of illumination of the layer, whereas an increase of the scanned area leads to a considerable improvement of the resolution. (*EEA*, 1961, #5857)

**1,466. ANALYSIS OF NOISE IN THE IMAGE ORTHICON**
**Vine, B. H.**
***SMPTE, Journal of the*, v. 70, no. 6, pp. 432–435, June 1961**

Processes occurring within this camera tube and the noise contributed by each process are examined. It is shown that any increase in photocathode sensitivity or mesh transmission allows a corresponding reduction in light required for equal performance. Increases in the secondary-emission ratio of the target or first dynode, however, even if indefinitely large, can only produce moderate improvements. The S/N ratio at the tube output is obtained and expressed in several ways. (*EEA*, 1962, #510)

**1,467. AN INSTRUMENT FOR MEASURING TELEVISION SIGNAL-TO-NOISE RATIO**
**Edwardson, S. M.**
**June 1961**
**British Broadcasting Corporation, London, Great Britain Engineering Division Monograph 37**

An instrument is described which has been specially developed for the measurement of S/N ratios in television. It utilizes an input picture signal corresponding to a scene of uniform gray or white, and selects the central portion of the picture area by means of an internal gating circuit. Separation of the noise from the signal is effected by subtraction of a "noiseless" replica of the gated picture signal, and a locally generated sine wave is used in evaluating the ratio between the picture signal and rms noise levels. A range of S/N ratios from 9 to 51 db can be measured, at any gray level, with an accuracy of ±0.5 db. (*EEA*, 1961, #6756)

**1,468. COMPUTER SIMULATION OF A TELEVISION CODING SCHEME**
**Kitsopoulos, S. C., Kretzmer, E. R.**
***IRE, Proceedings of the*, v. 49, no. 6, pp. 1076–1077, June 1961**

A dual mode transmission scheme is described which uses coarse quantization of fine detail using time-division. The

system uses four bits per sample instead of the usual seven, and uses a computer to make a running decision as to whether or not any sample can be classified as fine detail. Fine detail samples are then quantized more coarsely than the others. Two pictures transmitted by this, and a normal seven-bit process, are included and compared. (*EEA*, 1962, #3237)

**1,469. THE SENSITIVITY OF TELEVISION SYSTEMS WITH VARIOUS DECAY PARAMETERS**
**Gurevich, S. B.**
***Radiotekhnika i Elektronika*, v. 6, no. 7, pp. 1165–1169, July 1961 (in Russian)**

Formulae are given for the specific and total sensitivities of television systems, and the connection is considered between the sensitivity and the quantity of information transmitted. The specific sensitivity is inversely proportional to the energy required to be radiated by an element of the object for it to be possible for a system with equal input and output S/N ratios to distinguish one gradation of radiated energy at the output. It is shown to be inversely proportional to the energy per unit of information. Modifications of the formulae to permit the comparison of the sensitivities of black-and-white and color television systems are discussed. (*EEA*, 1962, #4652)

**1,470. AN EFFICIENT NOISE IMMUNE SYNC. AND A.G.C. CIRCUIT FOR TELEVISION RECEIVERS**
**Rhodes, R. N., Dietz, W. F.**
***IRE Transactions on Broadcast and Television Receivers*, v. BTR-7, no. 2, pp. 35–38, July 1961**

Impulse noise interference, such as may be caused by sparking electric motors or automobile ignition systems, can interfere with the performance of a television receiver in the following principal ways: first, the impulses appear directly in the picture; second, the synchronization separator input circuit may charge up to such an extent that the picture loses synchronization; third, the impulses may provide false information to the AGC system, thereby causing a sharp reduction in receiver gain. Of the three, the latter two effects are by far the more serious. Consequently, noise "suicide" or noise inverter circuits, for the protection of the sync separator and AGC circuits, have been widely used. An economical high-performance circuit has been developed which performs the noise suicide function for the full gamut of usable received signals. It does not require the use of any active components in addition to those presently found in receivers employing keyed AGC, and it can be used without a separate "noise threshold" control. (*EEA*, 1962, #2257)

**1,471. THE PERCEPTIBILITY OF NON-LINEAR DISTORTIONS IN COLOUR-TV PICTURES IN THE NTSC-SYSTEM**
**Müller, J., Wengenroth, G.**
***N.T.Z. Nachrichtentechnische Zeitschrift*, v. 14, no. 8, pp. 388–395, August 1961 (in German)**

The object of this paper is an investigation of the limits for the perceptibility of differential phase- and amplitude-fluctuations in NTSC color-TV pictures in order to obtain a guide for specifications for TV links in respect of these distortions. Two main problems had to be solved independently: (1) the magnitude of the actual phase- and amplitude-fluctuations of the chrominance-carrier for one color in relation to the chrominance-sync signal when the characteristics for differential phase-response and gain are given, and (2) the threshold of perceptibility for phase- and amplitude-fluctuations of the chrominance-carrier for the various colors. The required limits of perceptibility are derived from the results of (1) and (2). (*EEA*, 1962, #1237)

**1,472. MEASUREMENTS ON S/N PERFORMANCE OF TV CAMERAS**
**Dillenburger, W.**
***Radio Mentor*, v. 27, no. 8, pp. 665–671, August 1961 (in German)**

An oscillographic method is proposed which permits accurate determination of the effective S/N performance figure. Using electronic switching, the noise from the picture signal is compared with that from a calibrated noise source. The apparatus and relevant circuits for these measurements are described. Properties of various types of camera tubes are discussed. (*EEA*, 1962, #3243)

**1,473. CALCULATION OF THE EFFECT OF INTERFERENCE ON THE METHOD OF SILHOUETTE GENERATION BY ELECTRONIC REAR-PROJECTION**
**Kataev, S. I., Khromoi, B. P.**
***Radiotekhnika*, v. 16, no. 10, pp. 38–43, October 1961 (in Russian)**

Dealing with the method of rear projection using standard cameras, as described by Spooner and Worswick, the problem of optimal S/N performance is discussed in detail. This is aggravated by the limitation of available amplitude excursion due to the division of signals and the fact that with a white background the whitest part of the front figure must be darker than the background and vice versa in the case of a black background (restricted black level). A simple analysis indicates how optimal performance is related to the percentages of "front" and "rear" signals, the parasitic dark signal of the camera, and the probability ratio of peak-to-average interference. (*EEA*, 1962, #10,177)

**1,474. MEASUREMENT TECHNIQUES FOR TELEVISION BROADCASTING**
**Weaver, L. E., Shelley, I. J.**
***Television Society, Journal of the*, v. 9, no. 12, pp. 468–483, October–December 1961**

For measurement of linear waveform distortion, the sine-squared pulse and bar technique are closely linked with the subjective impression of distortion, occurring when a very fine

dot and an area of uniform tone with a sudden transition are reproduced. Relation between frequency spectrum and the $2T$ pulse is explained. For measurement of nonlinearity distortion, incremental gain at various signal levels should be obtained. Standard test by staircase waveform is interpreted by feeding output from network under test to a differentiating device to produce pulses of approximately $\sin^2$ form of which the amplitudes are proportional to the staircase raisers. A refinement provides superimposed sine waves of 600 kc and 5 Mc. Standard combined BBC test waveform is transmitted during the frame blanking period, usually along line 11, consisting of the $2T$ $\sin^2$ pulse, bar and 5-step staircase. Random noise measurement of white noise and triangular noise (which rises with $f^2$) is treated next; weighting network to aim at the equivalent of subjective assessment is used. It is difficult to establish $p$-$p$ to rms ratio, generally accepted as 14–18 db. Two methods of objective noise measurement are described briefly: (1) the time sampling method, equivalent to video signal cancellation, and (2) the frequency discrimination method, based on the fact of energy "bunching" around line frequency harmonics and relying on comparison of the output of a very narrow band special receiver tuned to minimum reading between two harmonics, with a calibrated noise source. Other measurements and acceptance tests covered are: (1) amplitude versus frequency characteristics; (2) waveform distortion; (3) measurement of low-frequency dynamic response by a 50-cps square wave; and (4) scale of K-ratings and their use. A number of diagrams and waveform oscillograms are reproduced, and 10 references are quoted. (*EEA*, 1962, #10,720)

**1,475. THE RESOLUTION OF TELEVISION SYSTEMS**
**Khalfin, A. M.**
***Radiotekhnika*, v. 16, no. 11, pp. 45–58, November 1961 (in Russian)**

The application of Rayleigh's resolution criterion to television is considered, and it is shown that not only the aperture or bandwidth characteristics of the system but also the distribution and level of noise in it must be taken into account. In the absence of noise, aperture correction to compensate for system distortions can theoretically be used to increase the resolution to the limit of the information presented. An expression is developed for the limiting resolution of a system in the presence of white noise, and it is shown that a television microscope working in the visible or ultraviolet region can have a higher resolution than considered possible in classical optics. (*EEA*, 1962, #10,174)

**1,476. APPRAISAL OF THE BANANA-TUBE COLOUR-TELEVISION DISPLAY SYSTEM**
**Freeman, K. G., Overton, B. R.**
***Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering*, v. 108, no. 42, pp. 624–630, November 1961 (Also available as Paper 3563E, Institution of Electrical Engineers, Great Britain, May 1961)**

The many factors which determine the potentialities and limitations of the Banana tube as a possible solution to the color display problem are considered in some detail. Limitations imposed by tolerances set by the requirements of the system are stated and an appraisal of the picture quality is made. Some indication of possible cost compared with other displays and an overall appraisal and indication of future possibilities are given. (*EEA*, 1961, #3513)

**1,477. NOISE AND INTERMODULATION PROBLEMS IN MULTICHANNEL CLOSED-CIRCUIT TELEVISION SYSTEMS**
**Collins, C. A., Williams, A. D.**
***AIEE Transactions, Part I—Communications and Electronics*, v. 80, no. 57, pp. 486–491, November 1961**

Thermal noise in closed-circuit television systems containing a number of line amplifiers is considered, and design objectives are discussed in terms of video S/N ratio requirements. The use of a signal level diagram to describe the system in terms of frequency and temperature is explained. Intermodulation products in multichannel systems are then discussed; their elimination has been optimized by use of a computer. It is confirmed that some third-order products add on a voltage basis rather than a power basis. Tolerable single-frequency interference levels are stated, and formulae for the cross-modulation margin of a system are derived. System design considerations lead to a method of calculating the maximum length of a system as a function of the number of line amplifiers, and an optimum figure (8.7 db) for the gain of each amplifier. (*EEA*, 1962, #10,168)

**1,478. THE PHASE TOLERANCES FOR A COMPATIBLE COLOUR TELEVISION SIGNAL TAKING INTO ACCOUNT THE ABILITY TO REMEMBER COLOUR**
**Wobst, J.**
***Technische Mitteilungen BRF*, v. 5, no. 4, pp. 155–165, December 1961 (in German)**

Side-by-side comparison of reproduced color with the original is considered to be less significant than a sequential comparison, since the viewer normally judges the quality of a picture from his memory of the color of the objects seen. Tests were carried out with a number of viewers to determine the limits of phase error at which faulty reproduction could be detected. The equipment used comprised a color burst generator and a flying spot scanner for diapositives. The output of either of these was applied to a color coder. The phase of the color carrier could be altered either by the experimenter or by any of the viewers. Phase was shown on a vectorscope and the color signal was applied, after passing through a decoder, to a receiver.

For the single hue tests the correct hue was first shown to the viewers alongside a standard white reference field on the left half of the CRT. The viewer had two minutes in which to familiarize himself with the test color, and he could observe the effect of positive and negative changes of phase.

For each hue, this preliminary was followed by five tests in which the experimenter first adjusted the hue using the vectorscope and displayed it on the screen. He then made a large change of carrier phase before again switching on the receiver. The viewer then had to readjust the phase to bring the hue back to what he remembered of the test color. The time between the disappearance of the test color and the appearance of the wrong hue was 5 sec. The experimenter read the adjusted phase from the vectorscope. The recognizability limit was taken as that value of $\Delta\phi$ at which 75 percent of the judgments had the correct sign and none had the wrong sign.

For diapositives, two kinds of test were made. In the first, the picture was shown only with a phase error and the viewer was asked to adjust the phase so as to match the colors with his knowledge and memory of the objects depicted. In the second tests the picture was first shown correctly and after 5 sec with a phase error introduced by the experimenter. The viewer was asked to score the second picture "good," "still usable," or "bad." The field tests were carried out with twelve unsaturated and twelve saturated hues, each at three levels of luminosity. The average limit of recognizability was 2.5 deg, with a variation between 2 deg for orange and 3.5 deg for green. The tolerance for good reproduction of diapositives was found to be ±5 deg. (*EEA*, 1962, #14,904)

**1,479. SNOW IN THE INTERMEDIATE FREQUENCY**
**Wayne, M.**
***Radio-Electronics*, v. 32, no. 12, p. 51, December 1961**
**(*AS&T*, 1962)**

**1,480. A METHOD OF PLANARY PREDICTION FOR ENCODING PHOTOGRAPHS**
**Corradetti, M.**
**Rendiconti della 1961 Riunione Annuale dell' Associazione Elettrotecnica Italiana, Fasc. III, Paper 247 (in Italian) Associazione Elettrotecnica Italiana, Milan, Italy, 1961**

A method, based on the correlation in intensity between adjacent picture elements, enables photographs to be transmitted, using a facsimile technique, with a greatly reduced bandwidth and without undue degradation in quality. At the transmitting end is a decorrelator and a coder; at the receiver, a decoder and a correlator. A quantizing technique using, for example, 64 levels, positive and negative, is employed. Decorrelation and quantizing are effected in a computer which accepts regular samples of picture elements and feeds into the coder data corresponding to the difference between the actual and the predicted picture intensity. Procedure at the receiver is the reverse of that at the transmitter. (*EEA*, 1962, #10,188)

**1,481. CODED FEEDBACK COMMUNICATION SYSTEMS**
**Metzner, J. J., Morgan, K. C.**
***AIEE, Transactions of the, Part I—Communication and Electronics*, v. 80, no. 58, pp. 643–647, January 1962**

The conventional approach to coding for error correction is often impractical because of the required equipment complexity and the system vulnerability to changes in channel conditions, such as fading or burst-type noise. These problems can be solved by employing long codes with feedback, correcting only small numbers of errors, and utilizing appropriate feedback techniques. The resulting system yields essentially error-free performance under all conditions, is relatively efficient, and compares very favorably in cost. (*EEA*, 1962, #7159)

**1,482. BLACK LEVEL IN TELEVISION**
**Sims, H. V.**
***Wireless World*, v. 68, no. 1, pp. 2–11, January 1962**

Following a review of the importance of the black level as a reference, the design and operation of dc restorers and clamps are described. The clamping voltage is analyzed and the advantages of efficient clamping in the reduction of hum, etc., are discussed. (*EEA*, 1962, #8293)

**1,483. EFFECT OF THE EARTH'S MAGNETIC FIELD ON TELEVISION DISTORTION**
**Phillips, P. H.**
***Electronic Engineering*, v. 34, pp. 41–42, January 1962**

As television picture quality has improved, the effect of the Earth's magnetic field has assumed greater importance. This has been accentuated by the adoption of larger scanning angles for CRTs, and it is now a factor which must be considered by the deflection coil designer. (*EEA*, 1962, #3247)

**1,484. DEEP FRINGE TELEVISION RECEPTION PROBLEMS**
**Morphett, I. R.**
***Institution of Radio Engineers, Australia, Proceedings of the*, v. 23, no. 1, pp. 22–31, January 1962**

The required sensitivity of signal amplifiers is discussed, and means of protecting the last stage from overload are presented. An AGC amplifier which operates with a constant dc potential derived from the horizontal output stage and which relies on noise-gating for noise immunity is described. A comparison is made with the performance of the more usual time-gated AGC amplifier. Next the problem of protecting the sync circuits from impulsive noise is considered, and the circuit which selects noise pulses virtually free from video content from the IF amplifier is described. The use of such a source of noise pulses enables the design of noise-protected sync pulse separators and AGC amplifiers without any provision being necessary for production or field adjustments. Two sync pulse separators, one using a pentagrid valve, and the other a triode noise inverter, are described utilizing this source of gating pulses. Finally, some consideration is given to the requirements of the horizontal and vertical oscillators for adequate performance in fringe areas. (*EEA*, 1962, #7293)

**1,485. TRANSPORT PHOSPHOR SCREENS**
King, D. E. N.
*Television Society, Journal of the*, v. 10, no. 1, pp. 2–9, January–March 1962

Properties and preparation of thin transparent films of more conventional CRT phosphors are described. It is shown that such transparent screens offer possible resolutions of a few microns and exhibit freedom from noise, halo, and reflected ambient light. Several applications of this type of screen are briefly considered. (*EI*, 1963)

**1,486. ÜBER DIE BEZIEHUNGEN ZWISCHEN RAUSCH-BANDBREITE UND EINSCHWINGVERHALTEN VON NACHLAUFSYNCHRONISIERSCHALTUNGEN IM FERNSEHEMPFAENGER (RELATIONSHIP BETWEEN NOISE BANDWIDTH AND TRANSIENT RESPONSE OF SYNCHRONIZATION CONTROL CIRCUITS IN TV RECEIVERS)**
Grosskopf, H., Gruenewald, A.
*N.T.Z. Nachrichtentechnische Zeitschrift*, v. 15, no. 2, pp. 66–69, February 1962

It is shown that picture shift after line frequency shift fundamentally causes a strong overshoot, which increases when noise bandwidth is decreased. For this reason, the noise bandwidth of the synchronization control circuit should not be made smaller than is absolutely necessary, to make the receiver insensitive to additive interference. (*EI*, 1963)

**1,487. ESTIMATION OF THE SUBJECTIVE EFFECTS OF NOISE IN LOW-RESOLUTION TELEVISION SYSTEMS**
Brainard, R. C., Kammerer, F. W., Kimme, E. G.
*IRE Transactions on Information Theory*, v. IT-8, no. 2, pp. 99–106, February 1962

A model for the subjective effects of noise on television picture quality is described. Experimental and data-processing procedures are developed from this model, which yield a subjective noise sensitivity function of noise frequency for monochrome low resolution video pictures. The results obtained apply to high levels of noise power. Two noise sensitivity functions are obtained using these experimental methods, one for still pictures and one for live pictures. (*EEA*, 1962, #7153)

**1,488. SNOW REMOVAL—A NOISE-STRIPPING PROCESS FOR PICTURE SIGNALS**
Graham, R. E.
*IRE Transactions on Information Theory*, v. IT-8, no. 2, pp. 129–144, February 1962

A nonstationary, nonlinear operation has been found which selectively removes moderate amounts of additive gaussian noise from a received picture signal. Running tests are performed upon the signal to detect the presence of perceptually significant picture detail in a number of different categories. Depending upon the test results, a selection is made from a number of available smoothing filter modes to maximize the suppression of noise without picture blurring. No preparatory operation is required at the transmitter, so that the technique is compatible with existing picture transmission systems. The process is applicable to conventional broadcast television, and could in principle be incorporated in home receivers to improve reception in fringe areas. (*EEA*, 1962, #7158)

**1,489. A RESEARCH STUDY OF IMPROVED CODING FOR MILITARY DIGITAL TELEVISION**
Van Blerkom, R., Freeman, D. G., Land, W. H., Roehr, K. M.
March 1, 1962
International Business Machines Corporation, Federal Systems Division, Rockville, Md.
Interim Report for August 1, 1961–March 1, 1962, DA 36-039-sc-87338
AD-277,020

This is a research study and engineering investigation of the eventual design of a digital television system which will provide images of sufficiently good quality to be transmitted at the minimum bit rate. This end is to be achieved by using a computer to simulate new concepts for television transmission. The applications for which these processes are to be designed are intercommunications, briefing, and observation of hazardous operations. Investigations indicated that it is desirable to remove information in the picture which is either not necessary for the observer to identify its information content or so detailed that it tends to confuse the observer. It is clear that the significant structure (information which is necessary for the observer to identify the information content of the picture) must be identified before employing an information destroying process. Furthermore, the amount of information which may be removed depends strongly on the class (video phone, briefing material, or observation of hazardous experiments) of pictures and how the pictures are used.

**1,490. LINEAR CODING OF IMAGES**
Tsybakov, B. S.
*Radiotekhnika i Electronika*, v. 7, no. 3, pp. 375–385, March 1962 (in Russian)

The possibilities of the use of two-dimensional spacial filtering in coding and decoding images are examined. An idealized two-dimensional communication channel, applicable to the transmission of still images, is worked out. The optimum characteristics of filters for two-dimensional coding and decoding and the corresponding mean-square error are calculated. The case of isotropic images with exponential density correlation function is considered in detail. The method of analysis extends to images of arbitrary numbers. (*EEA*, 1962, #10,179)

**1,491. CONSTANT LUMINANCE COLOUR TELEVISION SYSTEM**
**James, I. J. P., Karwowski, W. A.**
***British Institution of Radio Engineers, Journal of the,* v. 23, no. 4, pp. 297–306, April 1962**

The system proposed modifies the coding of the NTSC system to improve quantity and quality of transmitted information. Methods of receiving this signal are described. (*EI*, 1962)

**1,492. RELATIVE VISIBILITY OF RANDOM NOISE OVER THE GREY-SCALE**
**Hacking, K.**
***British Institution of Radio Engineers, Journal of the,* v. 23, no. 4, pp. 307–310, April 1962**

The main factors which influence the relative visibility of random fluctuation noise over the grey-scale of a television display are examined. By applying existing data relating to the perception of small differences in luminance, theoretical relative visibility curves are deduced for three elementary types of noise source encountered in television systems. (*PA*, 1962, #8262)

**1,493. FLUCTUATION NOISE IN TWO FORMS OF THE N.T.S.C. COLOUR TELEVISION SYSTEM**
**Lord, A. V.**
***British Institution of Radio Engineers, Journal of the,* v. 23, no. 4, pp. 322–328, April 1962**

A recently proposed modification to the coding of NTSC-type color television claims to offer some improvements in the picture displayed by both color and black-and-white receivers. The effects of fluctuation noise in color receivers are investigated for both the modified system and the normal form of NTSC system. The analysis assumes that "flat-spectrum" noise is added to the signal at a point prior to decoding in the receiver, and the visibility of this noise is calculated for a series of test colors; the results given include allowance for the reduction of receiver ratio by ambient light falling upon the screen. It is shown that both systems have a substantially similar sensitivity to fluctuation noise. These findings are discussed in the light of experiments carried out in the U.S.A. and Great Britain. (*PA*, 1962, #8264)

**1,494. LIMITATIONS OF COMBINED IMAGE AMPLIFIER-TELEVISION SYSTEMS FOR MEDICAL FLUOROSCOPY**
**Webster, E. W., Wipfelder, R.**
***IRE Transactions on Bio-Medical Electronics*, v. BME-9, no. 2, pp. 150–155, April 1962**

Tests were carried out to compare the sensitivities and resolutions of vidicon and image orthicon tubes at various dose rates. To avoid the variations in images with different patients, metal slides with holes of various sizes arranged in patterns were used, and the number of errors made in recognition by the observers were counted. The slides were viewed through a wax phantom and further tests were carried out with moving slides. In the stationary tests at 4.7 mr/min on the screen of the intensifier, one vidicon and both of the image orthicons used gave results equal to those with direct viewing of the screen, with the advantage that the image was viewable by more than one observer. As the dose rate was decreased, the ultrasensitive image orthicon became superior. With moving slides the image orthicons were superior at all dose rates because of the "stickiness" of the vidicon. Theoretical work on the limits of resolution due to fluctuation "noise" in the photon flow is reviewed, and it is shown that the best vidicon and the image orthicons were performing to these limits. (*EEA*, 1963, #2305)

**1,495. TOTAL PICTURE CONTROL: DISTORTION TRUE VS PSEUDO**
**Feininger, A.**
***Modern Photography*, v. 26, p. 70, April 1962**
**(*AS&T*, 1962)**

**1,496. REVIEW OF SOME RECENT DEVELOPMENTS IN COLOR TV**
**Loughlin, B. D.**
***IRE Transactions on Broadcast and Television Receivers*, v. BTR-8, no. 1, pp. 55–59, April 1962**

A survey of receiver decoding for three-gun and one-gun displays, picture tube, related circuit developments, and European color system studies is described. (*EI*, 1962)

**1,497. COMMON-CHANNEL INTERFERENCE BETWEEN TELEVISION SIGNALS OF THE SAME OR DIFFERENT STANDARDS**
**Newell, G. F., Taylor, E. W.**
***EBU Review, Part A*, no. 72, pp. 56–67, April 1962**

Measurements of the ratios of the amplitudes of wanted and interfering signals are described which produce a particular subjective grade of interference. The measurements were made in order to ascertain the required protection ratios for all the possible conditions of mutual interference between stations operating on any of the three television standards presently in use in Western Europe: 405, 625, and 819 lines with 50 fields/sec. The results show that if the frequency difference between the wanted and interfering carriers can be maintained with a stability of better than 2 cps (precision offset), each of the three wanted signal standards requires the same protection. In these conditions there is an advantage of up to 6 db in having negative modulation for the wanted signal. If the offset frequency cannot be kept constant to within a few cycles per second, the required protection is smaller for the systems with the greater number of lines per field. A comparison between 525 lines, 60 fields/sec and 625 lines, 50 fields/sec is included. (*EEA*, 1962, #10,713)

**1,498. HIGH RESOLUTION DISPLAY MEDIA**
**Sachtleben, L. T.**
**May 7, 1962**
**RCA Defense Electronic Products, Camden, N.J.**
**Final Report, RADC-TDR-62-233, AF 30(602)-2238**
**AD-277,746**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

An extensive nonmathematical introductory discussion is given of factors involved in image quality, including aperture response and transfer characteristics. A study follows of the properties of commercial translucent projection screen materials and specialized techniques, with a study of experimental screen materials made of optical fibers. Commercial screen brightness distribution is improved for a 90-deg audience by combining with a Fresnel lens. One of the fiber optics experimental materials approaches the performance of such a combination. If the Fresnel lens is not used with commercial materials, fiber optics materials may give substantially equal or better performance than the best commercial screens. Studies are reported of electroluminescent image intensifier panels and photochromic materials as display media. The present state of the art in fiber optics magnifiers is reviewed. A study is presented of other possible magnifiers of this type, and the problems that may be expected. Results are given of a research into the problems of providing a large viewing angle and maintaining high resolution in a fiber optics display structure, by terminating each individual cladded fiber in an optically isolated diffusing element. Ninety-two references are included.

**1,499. PICTURE QUALITY ASSESSMENT AND WAVEFORM DISTORTION CORRECTION ON WIRED TELEVISION SYSTEMS**
**Osborne, B. W.**
***British Institution of Radio Engineers, Journal of the,* v. 23, no. 5, p. 399, May 1962**

Factors affecting the application of the *K*-rating as an assessment of picture quality on vestigial sideband television systems are mentioned, and the use of echoes for the correction of waveform distortion is briefly discussed. Description of the design and use of a compact, low-cost video frequency transversal equalizer is followed by consideration of an equalizer capable of correcting video waveform distortion on a modulated carrier. Using the latter, it was found possible to eliminate a long delay echo introduced at band I by the introduction of an echo at a lower "system" frequency. (*EEA*, 1962, #10,122)

**1,500. NOISE MEASUREMENTS AS A TOOL IN ELECTRON DEVICE RESEARCH**
**van der Ziel, A.**
**June 30, 1962**
**Minnesota, University of, Electron Tube Research Laboratory, Minneapolis**
**Quarterly Report 10 for April 1–June 30, 1962,**
**DA 36-039-sc-85289**
**AD-284,693**

Work on noise in image orthicons was completed. The current leaving the photocathode shows full shot noise. The readout beam shows full shot noise for the frequency region of interest. The noise in the first dynode is larger than would be anticipated from a Poisson distribution of the electron emission. Low-noise amplifiers were developed that have 25- to 50-ohm equivalent noise resistance at the input of the first stage. Additional data were obtained on the noise in Al-$Al_2O_3$-Al sandwiches. The results agree with earlier observations. The noise measurements on indium-doped CdS crystals were extended to different samples. Additional measurements have been performed on noise in the light emission of MgO cold cathodes. Noise in the electron emission has been determined. Twenty-five references are included.

**1,501. ECHOENTSTÖRUNG VON FERNSEHLEITUNGEN MIT DAEMPFUNGSARMEN PASSIVEN VIERPOLEN (ECHO SUPPRESSION ON TV LINKS BY MEANS OF LOW LOSS PASSIVE QUADRIPOLES)**
**Rasch, R.**
***N.T.Z. Nachrichtentechnische Zeitschrift,* v. 15, no. 6, pp. 267–278, June 1962**

Low intensity echo interference on TV links can be compensated in a simple manner by the insertion of passive echo equalizers with negligible insertion loss and mismatch. Construction and design of echo equalizers and practical applications are discussed. (*EI*, 1963)

**1,502. A CARRIER-OPERATED ECHO SUPPRESSOR AND CONTROL DEVICE**
**Benewicz, T. F.**
***IRE Transactions on Communication Systems,* v. CS-10, no. 2, pp. 208–214, June 1962**

Of the numerous distortions affecting high quality facsimile reception, noise and echo represent the most troublesome offenders. This paper describes a device which fills the critical need for suppression of noise and echo currents on two-way multipoint facsimile networks. Laboratory test data as well as operational performance results, gathered during field trials of two prototype units, are presented. Additional applications for the device, including TONLOC, disabling of compandors during picture transmission, and possible application to data transmission systems are discussed. (*EEA*, 1963, #2273)

**1,503. THE CODING OF VISUAL SIGNALS TO REDUCE CHANNEL-CAPACITY REQUIREMENTS**
**Seyler, A. J.**
***Institution of Electrical Engineers, Proceedings of the, Part C—Institution Monographs,* v. 109, pp. 676–684, July 1962**
**(Also available as Monograph 535E, Institution of Electrical Engineers, Great Britain, July 1962)**

Present-day communication channel requirements for the transmission of visual information are based on fixed and independent threshold criteria for spatial, motion, and contrast resolution. If, in accordance with the dynamic characteristics of the human sense of vision, time-variant and interdependent thresholds are introduced for these parameters, the required channel capacity may be reduced, provided that it is adaptively assigned to the three parameters as demanded. This concept is developed into an integrated coding system for visual signals, making use also of intraframe and interframe correlations existing in television signals. Although it was possible to establish a formal system design, certain psycho-physical data as well as signal statistics have still to be measured to enable a reliable numerical evaluation of the attainable reduction in channel-capacity requirements. (*EEA*, 1962, #13,611)

**1,504. IZMENENIE OTNOSHENIYA SIGNALA K SHUMU V IZOBRAZHENII PRI ELEKTRONNOM MASKIROVANII KINOFILMOV V TSVETNOM TELEVIDENII (VARIATION OF SIGNAL-TO-NOISE RATIO IN IMAGE IN COLOR TELEVISION USING ELECTRONIC MASKING FOR MOTION PICTURE FILM)**
**Deryugin, N. G.**
***Elektrosvyaz*, no. 9, pp. 42–52, September 1962**
**(Translated from the Russian in *Telecommunications*, pt. 1, no. 9, pp. 41–53, September 1962)**

Changes in the S/N ratio are evaluated in terms of intrinsic brilliance of noise. (*EI*, 1963)

**1,505. RESEARCH AND DEVELOPMENT TO IMPROVE THE RESOLUTION OF IATRON DIRECT VIEW STORAGE TUBES**
**Clayton, R. H., Lilie, P. A.**
**October 4, 1962**
**ITT Industrial Laboratories, Fort Wayne, Ind.**
**Interim Development Report for March 23–August 22, 1962, NObsr-87264**
**AD-285,256**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

A magnetically focused and deflected Iatron tube was built. The tube was designed around a write gun whose beam velocity was chosen to match the peak secondary emission potential of magnesium fluoride, 800 v. Scan section length was chosen at 10 in. Focus coil flux density was chosen to provide four or five loops of focus in the scan section. Image section length is 4 in. Equipment for the operation of the magnetic Iatron was assembled and preliminary testing was performed.

**1,506. RECENT IMPROVEMENTS IN THE SECAM COLOUR TELEVISION SYSTEM**
**Cassagne, P.**
***Radio Mentor*, v. 28, no. 10, pp. 833–834, October 1962**
**(in German)**

To maintain the S/N ratio in spite of a necessary reduction of the modulation index for low frequencies, pre-emphasis with a time constant of 1.1 $\mu$sec is used in the color channel of the transmitter. After FM, the carrier-frequency color difference signal is applied to a resonant circuit so that the color subcarrier is attenuated by 6 db relative to sidebands at $\pm\Delta f$, this process being analogous to the classic pre-emphasis of the modulation signal. To improve the suppression of intermodulation with the luminosity component, the color carrier is then amplitude-modulated. In the band from 3 to 5 Mc the carrier amplitude is increased in proportion to the amplitude of the luminosity component. In the receiver the attenuation around the color subcarrier is compensated by a resonant circuit at the input to the color channel. De-emphasis is applied to the demodulated color difference signals. (*EEA*, 1963, #3391)

**1,507. RESTORATION OF QUENCHING AND SYNCHRONIZING PULSE IN THE VIDEO SIGNAL AFTER MAGNETIC RECORDING**
**(Translated from *Tekhnika Kino i Televideniia*, no. 10, pp. 38–41, 1961)**
**Deryugin, N. G., Voronetskiy, G. V.**
**November 7, 1962**
**Air Force Systems Command, Foreign Technical Division, Wright-Patterson AFB, Ohio**
**FTD-TT-62-1342**
**AD-292,231**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

A method is presented of restoring quenching and synchronizing pulses in the full video signal after reading from magnetic tape. The block diagram and basic technical characteristics of the shaping device are presented.

**1,508. DEMONSTRATION OF THE FEASIBILITY OF USING DELTA MODULATION FOR PICTORIAL TRANSMISSION**
**Cotton, R. V., Strohmeyer, G. R., Tillman, A. F.**
**November 1962**
**Philco Corporation, Blue Bell, Pa.**
**R-9040-TN, Report for April 15–November 15, 1962 on Phase 1, ASD TDR 62-1037, AF 33(657)-8478**
**AD-294,689**

An extensive investigation of delta modulation techniques for encoding pictorial data was made. The objective was to determine the parameters of delta modulation systems for various image communication applications by (1) system analysis, (2) computer simulation, and (3) experimentation. The analysis of delta modulation techniques includes one-bit and two-bit systems with both linear and exponential integration. Computer simulations of delta modulation logics conducted were (1) one-bit with linear and exponential integration, (2) two-bit with linear and exponential integration, and (3) most important, data-link noise with mentioned systems and also PCM. Images of these simulations are presented for evaluation. An experimental two-bit delta modulation encoder with a sampling rate of 50 Mc was constructed and tested.

A table of the key parameters of PCM and delta modulation systems is presented. Using this table and the images, the image communication system designer can readily choose the best technique and combination of parameters to fulfill his particular application.

**1,509. RESEARCH AND DEVELOPMENT TO IMPROVE THE RESOLUTION OF IATRON DIRECT VIEW STORAGE TUBES**
**Clayton, R. H.**
**December 15, 1962**
**ITT Industrial Laboratories, Fort Wayne, Ind.**
**Interim Development Report for August–November 1962, NObsr-87264**
**AD-291,852**
**This report includes: CONSIDERATIONS ON THE USE OF A DIGITAL COMPUTER FOR IATRON RESOLUTION STUDIES; RELATIVE MERITS OF THE DIGITAL COMPUTER VERSUS ELECTRON-OPTICAL BENCH, Papp, G., RM 368**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

The electrostatic microlens approach to resolution improvement appears to hold promise. Analytical work including digital computer studies as well as electron optical bench analog work was continued. Practical techniques for fabrication of complex meshes were developed, and some measure of improvement has already been demonstrated in thick mesh tubes.

**1,510. DIGITAL SPACECRAFT TV CAN BEAT BIT-RATE AND WEIGHT PROBLEMS**
**Gicca, F. A.**
***Space/Aeronautics*, v. 38, no. 7, pp. 73–78, December 1962**

Four basic methods have been applied in attempts to solve the main problem of digital TV for spacecraft—the excessive bit rates required by the typical encoding level of six bits. These methods are reviewed in some detail, with particular emphasis on delta modulation and Roberts pseudo-noise modulation. It is pointed out that, of all the bit-reduction techniques, elastic encoding appears most promising. The design and operation of a "synthetic-highs" version of an elastic encoder are described. In this system, the output frame rate and therefore the transmitter power depend on the average information content of the transmitted pictures and not on that of the picture with the highest detail. (*AI/A*, 1963, #70,586)

**1,511. PERFORMANCE CHARACTERISTICS OF A SYSTEM FOR TELEVISION BROADCASTING BY SATELLITES. APPENDIX—EXTRATERRESTRIAL NOISE (Presented at the ARS Seventeenth Annual Meeting and Space Flight Exposition, Los Angeles, Calif., November 13–18, 1962)**
**Bond, D. S., Fredendall, G. L. (Radio Corporation of America, Princeton, N.J.)**
**1962**
**American Rocket Society, New York, N.Y.**
**Paper 2722B-62**

An examination was made, from the system viewpoint, of the electrical characteristics of the ground transmitter, the receiver and transmitter located in the satellite, and the community or home receiver. The characteristics of both the picture or video channel and the sound channel are discussed. It is concluded that television broadcasting from satellites will be technically feasible in the near future. The transmission means for relaying a program from a ground source, through the satellite, and back to home or community receivers are now possible. The required receiving systems are not substantially more costly than present-day home television receivers. Reasonable areas of coverage by a single satellite transmitter are at least 2,000,000 mi². (*IAA*, 1963, A63-12605)

**1,512. ANALOGY OF CHARACTERISTICS OF REPRODUCTION IN TELEVISION AND PHOTOGRAPHY**
**(Translated from *Tekhnika Kino i Televideniia*, no. 11, pp. 5–15, October 30, 1962)**
**Gurevich, S. B.**
**January 2, 1963**
**Joint Publications Research Service, Washington, D.C.**
**JPRS-16930**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

The following characteristics of TV and photographic systems are compared: S/N ratio; contrast and gradation transmission; resolving power and light-versus-signal characteristics. The possibility of an informational evaluation of reproduction quality and sensitivity is discussed. Formulas are deduced for information capacity, as well as for sensitivity of ideal and real systems. Fifteen references are included. (*STAR*, 1963, N63-11464)

**1,513. CONDITIONS FOR OPTIMUM TV PICTURE REPRODUCTION**
**Grosskopf, H.**
***Elektronische Rundschau*, v. 17, no. 1, pp. 21–23, January 1963 (in German)**

Starting from a comparison between a TV screen picture and a photo of the same scene, the importance of room illumination for viewing TV pictures is stressed. Ambient light objectively affects the reproduction characteristic of the TV receiver and has an influence on the subjective perception of pictures having large dark areas, apart from its control of the spectator's convenience. Optimum viewing conditions are obtained with a receiver equipped with a sufficiently dark contrast screen that is so illuminated from its front side that spectators and all objects that might be reflected by the picture tube are interposed to form a cone shadow. (*EEA*, 1963, #7831)

**1,514. A METHOD FOR REGENERATING VIDEO SIGNALS**
**Legler, E.**
***Rundfunktechnische Mitteilungen*, v. 7, no. 1, pp. 21–24, February 1963 (in German)**

This article deals with the problem of eliminating (as far as possible) the buzz and noise, or their disturbing effect, that are superposed on a television signal. Although it is not possible to separate the noise component from the video signal, it is possible to considerably reduce the disturbing effect by removing the noise superposed on the blanking intervals. The reason therefore lies in the disturbing effect known as line buzz, which is produced in the blanking circuits. The article goes on to describe a fully transistorized regeneration unit which consists of a separator and a sync regenerator. The functions of the separator are the elimination of buzz, blanking with adjustable pedestal by a regenerated blanking signal, limitation of the white level, and the addition of a regenerated synchronization waveform. The blanking and synchronization regenerator produces, from the television (picture, blanking, and sync) signal marred by interference signals, the blanking and sync signals required in the separator, by applying numerous measures for the purpose of attaining a high degree of insensitivity to interference. (*EEA*, 1963, #9205)

**1,515. CHROMATICITY CHANNEL PROTECTION IN THE SECAM COLOUR TELEVISION SYSTEM**
**Melchior, G.**
***Electronic Engineering*, v. 35, pp. 358–365, June 1963**

In order to compare the influence of noise and interference on the reception of colors, a protection factor for the chromaticity channels is defined and its values are calculated for each chrominance and both SECAM and NTSC systems. Then the action of differential phase is similarly compared by defining and calculating in each case the sensitivity factor relating to this fault. Finally, comparison is made of the effect of echoes and slow or fast variations of time delay. (*EEA*, 1963, #9207)

**(See also *Entries* #2, 145, 357, 737, 740, 787, 825, 836, 844, 847, 854, 861, 881, 888, 895, 913, 922, 933, 945, 946, 984, 986, 991, 1023, 1028, 1048, 1070, 1071, 1079, 1088, 1092, 1102, 1143, 1146, 1184, 1191, 1193, 1197, 1201, 1216, 1228, 1234, 1286, 1327, 1583, 2014.)**

# COLORIMETRY AND ILLUMINATION

**1,516. PHOTOELECTRIC TRISTIMULUS COLORIMETRY WITH THREE FILTERS**
**Hunter, R. S.**
**July 30, 1942**
**National Bureau of Standards, Washington, D.C.**
**NBS Circular-C429**

The photoelectric cell is finding ever-widening usage in scientific apparatus. This circular describes the development and use of an "artificial eye for color measurement," which consists of a barrier-layer photocell and three selected spectral filters. The distinguishing feature of a photoelectric tristimulus colorimeter is the approximate spectral equivalence of the filter-photocell combinations of the apparatus and the tristimulus specifications of the spectrum which characterize the color vision of the average normal observer.

**1,517. A METHOD OF MEASURING THE CONTRAST TRANSMISSION FUNCTION OF PHOTOGRAPHIC OBJECTIVES**
**Rosenhauer, K., Rosenbruch, K. J.**
***Optica Acta*, v. 4, no. 1, pp. 21–30, March 1957**
**(in German)**

The contrast $K$ of a self-luminous or incoherently illuminated object is defined by $K = (J_{max} - J_{min})/(J_{max} + J_{min})$ where $J$ is the intensity of illumination. When an optical system forms an image of the object, the contrast is reduced, due to diffraction, aberrations, and veiling glare. The reduction of contrast is a function of the size of the object (or of the spatial frequency), the relative aperture of the imaging system, and its state of correction. An apparatus is described for measuring this contrast transmission function for miniature camera lenses. The objective to be tested projects onto a narrow slit the image of a rotating grating having varying frequencies, and $K = 1$. A photomultiplier gives an output proportional to the intensity of transmitted light, and a cathode ray oscillograph, synchronized with the rotation of the grating, gives a stationary representation of the light distribution in the image. Results are given and discussed for radial and tangential lines at various relative apertures and field angles and at different axial planes of focus. (*PA*, 1959, #6694)

**1,518. DIE VERFAELSCHUNG DER GRADATION DES FERNSCHBILDES DURCH AUFHELLUNG DES BILDSCHIRMES (GRADATION ERRORS IN TELEVISION PICTURES THROUGH BRIGHTENING OF PICTURE SCREEN)**
**Suhrmann, R.**
***Elektronische Rundschau*, v. 11, no. 3, pp. 75–77, March 1957**

The change in gradation caused by a change of mean brightness or by incident light is described. The expression for this distortion, and a graphical method for calculating distortion and the required correcting signal are presented. (*EI*, 1958)

**1,519. THE CHROMATIC DISPERSION OF A FRESNEL LENS**
**Blaise, P.**
***Revue d'Optique*, v. 36, no. 8–9, pp. 423–429, August–September 1957 (in French)**

The intensity distribution and color variation are calculated in the beam produced by a Fresnel lens used in a lighthouse. It is shown that there is a slight spreading of the beam and that the intensity at the edge is about a quarter of the central intensity. The color of the beam as a function of the distance from the center is also calculated. (*PA*, 1959, #6687)

**1,520. THE TELEVISION COLOR TRANSLATING MICROSCOPE**
**Zworykin, V. K.**
***1957 IRE WESCON Convention Record*, pt. 7, v. 1, pp. 87–91, 1957**

The television color translating microscope permits the continuous observation of specimens under intermittent ultraviolet illumination, translating differences in absorption in different ultraviolet spectral ranges into color differences in the observed picture. Thus, the presence of some chemical constituents of organic cell and tissue specimens which are completely transparent in the visible and hence undifferentiable in the ordinary microscope can be readily recognized by their distinctive color. The principles of construction of the microscope are discussed, with special reference to an instrument built at the Rockefeller Institute for Medical Research. (*EEA*, 1958, #6035)

**1,521. FUNDAMENTALS OF COLOUR TELEVISION**
**de Vrijer, F. W.**
***Philips Technical Review*, v. 19, no. 3, pp. 86–97, 1957–1958**

Basic colorimetric concepts are reviewed, and the problem of limitation of bandwidth in transmission is considered. A discussion is presented of a system with two subcarriers and of the NTSC system used in America. Gamma correction is needed in view of the nonlinear relation between luminous flux and control voltage in picture tubes. (*EI*, 1958)

**1,522. PHYSIOLOGICAL OPTICS AND COLOUR TELEVISION: A SURVEY (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Wright, W. D.**
***Acta Electronica*, v. 2, no. 1–2, pp. 26–32, 1957–1958**

Color reproduction by television can be regarded as a point-by-point process of trichromatic color matching at very high speed, and, as such, the laws and data of colorimetry enter directly into any first analysis of a color television system. The present status of these laws and data for medium, large, and very small field sizes is therefore reviewed. However, the appearance of a reproduction is determined not merely by the particular red-green-blue mixture focused on the retina, but also by the viewing situation under which the picture is seen, and especially its size, luminance, and surrounding illumination. The problems posed by subjective color reproduction are accordingly summarized, and consideration is given to possible ways of describing them in numerical terms. In addition, a system has to be judged by its ability to reproduce detail, surface texture, gradations of light and color, etc.; the contribution of these items to the total perceptual pattern is discussed. Other features of a reproduction, such as flicker, graininess, scintillations, moiré patterns, color fringing, and instability of color and shape, may perhaps most aptly be described as visual irritants. Some viewers are more sensitive to these irritants than others, so that tolerance limits are not easy to specify. (*PA*, 1959, #6408)

**1,523. SUBJECTIVE VISUAL EFFECTS OF A.N.T.S.C. COLOUR TELEVISION RECEIVER TOLERANCES (Presented at the International Symposium on Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Carnt, P. S., Townsend, G. B.**
***Acta Electronica*, v. 2, no. 1–2, pp. 77–86, 1957–1958**

The variations in receiver performance which viewers will accept in color television have been investigated for the more important parameters which color adds to the domestic receiver, i.e., effects due to reference oscillator phase, chrominance, signal gain, and the background controls of the three-gun color tube. These tolerances are expressed in engineering and colorimetric terms, and the correspondence with viewers' reaction is given on a subjective scale. The experiments were devised to simulate domestic viewing, and the variations which typical audiences will accept are compared with those which the trained observer can distinguish under critical conditions. The influence of receiver performance on the choice of normalizing illuminant is discussed. (*PA*, 1959, #6411)

**1,524. THE CHOICE OF CHROMINANCE AXES FOR COLOUR TELEVISION (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Hacking, K.**
***Acta Electronica*, v. 2, no. 1–2, pp. 87–94, 1957–1958**

A subjective determination of the just permissible degradation in the sharpness of the color component at a boundary between two colors is described. The way in which this sharpness varies with the luminance contrast ratio has been determined. The luminance component of the transition was given the full 3-Mc bandwidth of the U.K. 405 lines television system. Optical projection was used for producing the color transitions, and a comparison was shown between a sharp transition and a variable one; nine color pairs were investigated. The luminance contrast ratio was found to have a greater influence on the permissible reduction in the chrominance bandwidth than did the choice of color pair. The chrominance bandwidth (averaged for all the luminance contrast ratios investigated) varied from 1.11 Mc for an orange-cyan transition to 0.62 Mc for a green-white transition, and the results support the choice of $I$ and $Q$ axes in the NTSC color television system. The chromaticity locus for the optically produced transition is compared with that produced by a color television channel. A second experiment shows that if the chrominance component of the transition is given the full 3-Mc bandwidth, the luminance component can be somewhat degraded before any perceptible loss of sharpness is visible, although in this case, the saving in bandwidth is usually not as great as for the first experiment. (*EEA*, 1958, #4959)

**1,525. AN INVESTIGATION INTO THE SUBJECTIVE EFFECTS OF SOME DIFFERENCES BETWEEN THE RED, GREEN AND BLUE TRANSFER CHARACTERISTICS OF A COLOUR TELEVISION SYSTEM (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Jacobs, T., Jackson, R. N.**
***Acta Electronica*, v. 2, no. 1–2, pp. 95–102, 1957–1958**

In systems employing three primaries, one condition for correct reproduction of colored and monochrome (grey) pictures is that the overall transfer characteristics of the three primary signals shall be identical. The present experiment has been designed to discover to what extent these transfer characteristics may differ from each other while maintaining satisfactory picture reproduction. Pictures from a film scanner are reproduced by a laboratory color television monitor, the apparatus being adjusted to give the best possible reproduction. Known errors of transfer are then introduced into one primary channel in a random manner, and observers are asked to assess the effect of these errors on the pictures according to a numbered scale of predetermined comments. So far the experiment has been conducted using monochrome pictures since the most visible errors have been found to occur in the grey scale. The technique will be extended to include color pictures. The statistical results obtained are expected to be of value in deciding design and production tolerances for color television equipment. (*PA*, 1959, #6412)

**1,526. THE CHOICE OF CHROMINANCE SIGNALS IN THE N.T.S.C. SYSTEM WITH A VIEW TO THE DIFFERENTIAL SENSITIVITY OF THE HUMAN EYE TO COLOUR (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**de Vrijer, F. W.**
***Acta Electronica*, v. 2, no. 1–2, pp. 103–109, 1957–1958**

In a NTSC-type color television system the phase of the subcarrier determines, to a first approximation, the hue, and the amplitude of the subcarrier relative to the value of the luminance signal determines the saturation of the reproduced color in a color receiver. Color deviations will occur in case of noise in the chrominance channel and in case of phase errors of the receiver subcarrier reference oscillator. These phase errors may be caused by noise or otherwise. The sensitivity of the signal to these effects is influenced by the particular choice of chrominance signals transmitted. In order to make an optimum choice, the differential sensitivity of the human eye to color has to be taken into account. In this paper known data on hue tolerances are used to calculate the sensitivity to phase errors in the NTSC system. Experiments were performed with an actual color television system to get more exact numerical data. These data are used to calculate the optimum choice of chrominance signals with respect to subcarrier phase errors. This optimum choice turns out to be not very much different from the actual NTSC system. Some remarks are made on the sensitivity to noise in the chrominance channel of the NTSC signal. (*PA*, 1959, #6413)

**1,527. MEASUREMENT AND EVALUATION OF COLOUR PURITY IN COLOUR TUBES (Presented at the International Symposium on the Physical Problems of Colour Television, Paris France, July 2–6, 1957)**
**Francken, J. C., Bathelt, R. R.**
***Acta Electronica*, v. 2, no. 1–2, pp. 153–158, 1957–1958**

Purity of the separate color fields in color tubes is one of the requirements of achieving good color reproduction. After a short survey of possible causes of deterioration of the primary color and of the known methods for measuring chromaticity, a colorimeter is described which is especially designed for use with color tubes. The instrument is based on the principle of visual additive mixing of three light sources. As such, three special CRT are used, fitted with the same phosphors as are used in color tubes. A rapid evaluation of color purity is thus possible, as well as a quantitative computation of chromaticity coordinates. The accuracy of the method is greatest in the vicinity of the primaries, a property that suits the purpose. Examples of measurements on actual tubes are given. For routine testing of tubes, in cases where reject limits have already been established, an objective method using colored filters in combination with a photomultiplier is easier and faster. A short description is given of the combinations used for color tube testing. (*PA*, 1959, #5596)

**1,528. THE COLORIMETRY OF SEQUENTIAL DISPLAYS (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Clapp, R. G.**
***Acta Electronica*, v. 2, no. 1–2, pp. 181–188, 1957–1958**

The term "sequential display" means a picture tube in which small areas of three primary colors are illuminated in rapid sequence by a single beam, whose intensity varies in a regular manner as it moves, so that it produces any desired color. The Apple system is an example. The relationship between the signal and the reproduced color is influenced by the sizes of the colored areas, the manner in which the spot size changes with beam current, the waveform applied to grid, and other factors. Thus, sequential displays have characteristics different from any other form of color display. A recent series of computations has given complete information on the colors produced by the Apple tube under a variety of signal conditions. It is presented in the form of transfer characteristics of hue, saturation, and brightness, each for various values of the others. Desirable and undesirable shapes of these curves are shown. Changes in these characteristics which can be achieved by variations in signal processing and screen design are discussed. The conclusion is that the Apple system has acceptable accuracy and also makes possible some variations from complete accuracy which may be desirable. (*EEA*, 1958, #4961)

**1,529. A LENS-TESTING APPARATUS (Presented at the International Symposium on the Physical Problems of Colour Television, Paris, France, July 2–6, 1957)**
**Birch, K. G.**
***Acta Electronica*, v. 2, no. 1–2, pp. 271–273, 1957–1958**

The intensity profile of the image of an incoherently illuminated slit can either be measured directly, or its Fourier transform determined by means of a scanning filter. In the first case, the frequency response is obtained by calculation, using Whittaker's interpolation theorem; in the second, a variable-velocity drum carrying equally spaced slits scans the images, the output from a photomultiplier then being detected using a narrow band electrical filter of fixed frequency. Varying the speed of rotation of the drum then corresponds to filtering different spatial frequencies from the slit-image. (*PA*, 1959, #5487)

**1,530. TELEVISION EN COULEURS (COLOR TELEVISION): COLOR AND ANALYSIS OF COLORED IMAGES and RECONSTRUCTION AND TRANSMISSION OF COLORED IMAGES**
**Angel, Y., Lequeux, J.**
***La Nature*, no. 3277, pp. 170–178, May 1958; no. 3278, pp. 208–217, June 1958**

Principles of colorimetry and a tricolor system are discussed, in addition to additive tricolor technique, color television cameras, three-tube cameras, and sequential analyzer systems. (*EI*, 1958)

**1,531. AN INSTANTANEOUS ELECTRONIC COLOUR FILM ANALYZER**
Loughlin, B. D., Page, C. E., Bailey, W. F., Hirsch, C. J., Miller, A. J., Giarraputo, L., Smith, K. R.
*British Kinematography*, v. 33, no. 1, pp. 3–18, July 1958 (*EEA*, 1959, #225)

**1,532. TRANSISTOR PHOTOFLASH POWER CONVERTERS**
Manoogian, H. A.
*Electronics*, v. 31, no. 35, pp. 29–31, August 29, 1958

One or two power transistors fed from an l.t. battery operate as a blocking oscillator or a multivibrator and drive a step-up transformer. The rectified output from the transformer secondary provides a 300- to 450-v supply for charging the storage capacitor of the photoflash. Novel features include: (1) the provision of two transformers for the blocking oscillator, one for the oscillator itself and the other for output-power conversion; (2) an RC network which reduces the idling current and permits a higher working current; and (3) the use of the transistors as rectifiers for charging the battery via the transformer. Items (2) and (3) apply only in the case of the multivibrator circuit employing two transistors. (*EEA*, 1958, #6108)

**1,533. COLOUR SCIENCE AND LIGHTING PRACTICE**
Einhorn, H. D.
*Light and Lighting*, v. 51, no. 9, pp. 303–308, September 1958

After a simple description of the underlying facts of color vision, color mixture and the color of illuminants are considered with special reference to the fluorescent lamp. Also described are the CIE and UCS (uniform chromaticity scale) color diagrams, the Munsell system for the description of surface colors, methods of specifying the color of an illuminant, and the psychological factors which affect the appreciation of color. (*EEA*, 1958, #6426)

**1,534. A COLOR "ELECTROFAX" PROCESS**
Rydz, J. S., Johnson, S. W.
*RCA Review*, v. 19, no. 3, pp. 465–486, September 1958

Electrofax color prints, while similar in appearance to photographic results, do not follow the subtractive color mixture laws which describe dye images. The basic principles of pigment mixtures and the application of the Kubelka analysis to the Electrofax color process are discussed. Colorimetric data for the printing of Electrofax particles are presented. A method of separating color for producing line work is discussed. The method differs from the conventional techniques of using tricolor filters in that the separation of color is achieved by controlling the amount of exposure on a scene. The mixing of colors, which occurs due to the fusing operation in the Electrofax process, provides the potential means for a color print system based on particle mixing rather than overlaying dyes as in a halftone printing ink process. (*PA*, 1959, #1994)

**1,535. GRADATIONSENTZERRUNG IM FARBFERNSEHEN (GRADATION CORRECTION IN COLOR TELEVISION)**
Kaashoek, J.
*N.T.Z. Nachrichtentechnische Zeitschrift*, v. 11, no. 10, pp. 515–518, October 1958

A new circuit is described for obtaining variable gamma corrections which depend on luminance and are free from color distortion. Any gamma value between 1 and 0.4 can be chosen for overall system transfer characteristic. Correction can be chosen to be also dependent on color, thus producing greater relative increase in brightness for picture areas of a chosen color, without any color change. (*EI*, 1959)

**1,536. ON THE QUALITY OF COLOR-TELEVISION IMAGES AND THE PERCEPTION OF COLOR DETAIL**
Schade, O. H., Sr.
*RCA Review*, v. 19, no. 4, pp. 495–535, December 1958 (Also available in *Journal of the SMPTE*, v. 67, no. 12, pp. 801–819, December 1958)

A theoretical and experimental study of the NTSC color system, supported by color photographs, shows that contrast range and color saturation obtained with commercial tricolor kinescopes provide a larger color space than provided by color motion pictures. In fine detail more than 60 percent of full color information is transmitted and reproduced by the NTSC system because the bandwidth restrictions of the electrical color signals ($I$,$Q$) do not affect definition in the vertical dimension and have a smaller effect on the reproduction of horizontal color detail than indicated by earlier evaluations which disregarded the two-dimensional nature of the image. The detail color reproduction appears adequate to the eye because the color errors remaining, although perceptible, are small. This fact is significant because the spatial sine-wave response functions of the color discriminators of the visual system are found to be substantially independent of the color of light and similar to the spatial sine-wave luminance response function of the eye. (*EEA*, 1959, #2539)

**1,537. MEASUREMENT OF THE EXPOSURE GUIDE NUMBER IN FLASH PHOTOGRAPHY**
Lang, W., Kocher, G.
*Technisch-Wissenschaftliche Abhandlungen der Osram-Gesellschaft*, v. 7, pp. 337–344, 1958 (in German)

The exposure guide number for a given light source is defined as the product of the $f$-number and the distance between the light source and the object photographed. It can be calculated from the light output of the source and the minimum permissible exposure. An alternative, empirical method of determining it is proposed, the film used being exposed to the light source through a neutral wedge. The numbers found in this way are tabulated for four different types of film and six lamps—three photoflash and three electronic flash. (*PA*, 1959, #10,488)

**1,538. TELEVISION STUDIO LIGHTING EQUIPMENT**
**Ackerman, K. R.**
***Illuminating Engineering Society, Transactions of the,* v. 23, no. 1, pp. 28–43, 1958**

The present state of development of lighting equipment for television studios in Great Britain, with particular reference to the studios of the BBC, is summarized. This development has included improvements in mechanical handling of luminaires, the introduction of remote-controlled dimming and switching systems, and improvements in studio luminaires themselves. The difficulties in lighting a television production effectively are outlined, and this paper shows how these difficulties can be minimized. The equipment used is shown to have developed logically from that designed for filming and for the stage, but modified to meet the special requirements of television. Light sources are discussed, and it is shown that the tungsten lamp remains the most suitable for this application, though fluorescent lamps and carbon arcs are used for special purposes. (*EEA*, 1958, #2756)

**1,539. ELECTRIC CONTROL OF STAGE AND TELEVISION LIGHTING**
**Bentham, F. P.**
***Institution of Electrical Engineers, Proceedings of the, Part A—Power Engineering*, v. 105, pp. 128–140, 1958**
**(Also available as Paper 2424U, Institution of Electrical Engineers, Great Britain, November 1957)**

Progress in the switchboard control of stage and television lighting which has been made in the past 25 years is surveyed. The various types of dimmer which form the basis are outlined, with particular reference to their remote control. The methods of coordinating control, using particular forms of levers and grouping aids, such as master selection and presetting, are described. Details of the application of organ-console techniques to the "playing" of light are given, together with reasons for a preference for electromechanical dimmer systems rather than the American all-electric dimmer or the Continental electromechanical desk. All three systems are described. (*EEA*, 1958, #159)

**1,540. A VERSATILE METHOD OF CALCULATING ILLUMINATION AND BRIGHTNESS**
**Jones, B. F., Jones, J. R.**
***Illuminating Engineering*, v. 54, no. 2, pp. 113–121, February 1959**

A modification of the lumen method of calculating illumination values in interiors is described. The room is divided into three portions by the working plane and a horizontal plane through the lighting fittings, and the effective reflection factors of the top and bottom sections are found from appropriate diagrams. The central portion of the room is divided into a number of horizontal sections, and the luminance distribution on the boundaries of these sections can now be calculated. It is suggested that three sections should be sufficient in practice. (*EEA*, 1959, #4403)

**1,541. A FLEXIBLE LIGHTING SYSTEM FOR A TELEVISION STUDIO**
**Needs, W. R., Gill, G.**
***SMPTE, Journal of the*, v. 68, no. 3, pp. 124–126, March 1959**

A flexible lighting system has been designed to meet the needs of an active television studio. Two groups of rails provide flexibility in locating lights. Lighting is controlled from a production control console. Although the system was designed to meet the needs of a particular studio, in principle it can be adapted to a studio of any size. (*EEA*, 1959, #4404)

**1,542. EXPERIMENTS IN COLOR VISION**
**Land, E. H.**
***Scientific American*, v. 200, no. 5, pp. 84–99, May 1959**

A description is given of previous experiments which showed that if the two transparencies, obtained by photographing a scene first through one filter then through another, are projected in register by beams of the color corresponding to the respective filters, then the eye interprets the field of view as being in the same full color as the original (although color saturation is determined by the spectral closeness of the beams). Details of further experiments using such transparencies with pairs of monochromatic beams or with a white light and a monochromatic beam are given, yielding a "color map" predicting the limitations in faithfulness of color experienced by the eye. It is further shown (color photographs included) that with white light as one of the sources, normal color photography of the projected scene is possible. The importance of the work to color photography and color television technology is apparent. (*EEA*, 1960 #1886)

**1,543. SENSITIVITY AND MOTION CAPTURING ABILITY OF TELEVISION CAMERA TUBES**
**Neuhauser, R. G.**
***SMPTE, Journal of the*, v. 68, no. 7, pp. 455–461, July 1959**

The sensitivities of various camera tubes are determined in terms of the illumination levels required for both standard and non-standard television scanning rates. For convenience, these values are given in terms of equivalent ASA film exposure index values to facilitate the use of a common exposure meter to determine scene light or iris settings. The effective rapidities of response of various camera tubes are also evaluated in terms of the ability to stop motion. This factor is evaluated both from the standpoint of deriving intelligence from the signal and from the standpoint of the esthetics of the picture, i.e., absence of negative image or "long-tail" carry-over of signal. The effects of overexposure or of underexposure on the speed of response of different camera tubes are also illustrated. (*EEA*, 1959, #6797)

**1,544. THE SYNTHESIS OF BLACK AND WHITE TELEVISION IMAGES FROM COLOURED PICTURE TUBE PHOSPHORS**

Laurence, C. H.
*Institution of Radio Engineers, Australia, Proceedings of the*, v. 20, no. 8, pp. 463–471, August 1959

The CIE colorimetric system is explained with reference to the mixture of yellow and blue phosphors on CRT screens to produce a subjective white luminescence (~7000–11,000°K). The effects of phosphor body color, current density, and some details of manufacture and color control are briefly discussed. (*EEA*, 1960, #1898)

1,545. A PRECISION COLOUR TELEVISION SIGNAL SOURCE FOR RESEARCH PURPOSES
Benson, J. E.
*Institution of Radio Engineers, Australia, Proceedings of the*, v. 20, no. 8, pp. 472–486, August 1959

After an introductory statement on the present status of color television in America and England, some of the problems of producing a precise color television signal for research purposes are discussed in relation to a new color slide scanner and monitor. This equipment, which is capable of producing color video signals with sufficient precision and stability to serve as a reference standard for research and test purposes, is described in the concluding section. (*EEA*, 1960, #520)

1,546. COLOUR SUBCARRIER ATTENUATION IN THE N.T.S.C. COLOUR TELEVISION SYSTEM
Schönfelder, H.
*Archiv der Elektrischen Übertragung*, v. 13, no. 9, pp. 383–392, September 1959 (in German)

For the compatible NTSC system, luminance and chrominance signals share part of the same frequency band, and some deleterious secondary effects are unavoidable. The main effects are the so-called "string of pearls" disturbance and the desaturation of some hues due to unwanted rectification at the grids of the CRT. This necessitates the use of a selective wave trap (notch-filter) tuned to the chrominance subcarrier frequency. The paper deals with the design problems of such a filter, describing various wave-trap circuits and their performance in terms of attenuation, bandwidth, and transient response; illustrations include diagrams, oscillograms of color bar waveforms, and frequency response curves. A recommended practicable filter has an attenuation of 85 percent, a bandwidth of 550 kc, and an overscoring of 3 percent. (*EEA*, 1960, #1890)

1,547. THE SILICON CONTROLLED RECTIFIER DIMMER
More, H. R., Malang, A. W.
*SMPTE, Journal of the*, v. 68, no. 10, pp. 678–683, October 1959

This article describes 4- and 10-kw dimmers and explains the advantages of using two silicon controlled rectifiers connected back-to-back, in preference to one rectifier controlling the current in a saturable reactor. Besides offering reduced weight, bulk, heat dissipation, and noise when compared with three other types, they give immediate response, infinite loading, an excellent dimming curve, and higher efficiency. Some of the many possible lighting combinations are outlined, and the use of these dimmers in a television studio installation is described in detail. (*EEA*, 1960, #2069)

1,548. MEASUREMENT OF COLOR RENDERING TOLERANCES
Crawford, B. H.
*Optical Society of America, Journal of the*, v. 49, no. 12, pp. 1147–1156, December 1959

The color rendering tolerances in different bands of the spectrum of an illuminant have been measured by direct experiment using several levels of illumination and a variety of test objects, including pictures, foodstuffs, and the human complexion. The spectral bands were contiguous, covering the whole visible spectrum, and their widths were chosen so that they had approximately equal weight from a color rendering point of view. All tolerances were measured in relation to a full radiator reference illuminant, for single bands and also for combinations of bands. With these results it is possible to predict the color rendering performance of an illuminant, knowing only the relative energy distribution in its spectrum. Examples are given. In general, the computed performance agrees with practical judgments derived from ordinary use. (*PA*, 1960, #186)

1,549. DOES DR. EDWIN H. LAND'S THEORY OF COLOUR VISION FORM THE BASIS FOR A NEW COLOUR TV SYSTEM?
Neidhardt, P.
*Elektronische Rundschau*, v. 13, no. 12, pp. 451–452, 454, 456, 457, December 1959 (in German)

An examination reveals that Land's method is explained by the combination of simultaneous color contrast and the color adaptation of the human eye. Because of the relatively small saturation values of the resultant colors and the resulting dependence of color valence on time and statistics of the picture contents, its significance for color television may not be so important, although it deals with a real two-component theory in the sense of information theory. (*EEA*, 1960, #3785)

1,550. TELEVISION COLORIMETRY IN A COLOUR TELEVISION SYSTEM WITH A QUADRATURE MODULATION OF COLOUR-CARRYING COMPONENTS
Ptáček, M., Pazderák, J.
*Slaboproudý Obzor*, v. 20, no. 6, pp. 342–349, 1959 (in Czechoslovakian)

This survey gives a derivation of the basic colorimetric equations which are necessary in the study of color television. The basic television receiver colors are defined and the M.K.O. color diagram is introduced. The general colorimetric transformation of the basic color systems is defined and the trans-

formation equations are given. The colorimetric transformation of colored light from the M.K.O. system to the system of the basic receiver colors (*R, G, B*) is discussed, and the choice of the color transmission signals is investigated. Maps of the colorimetric differences *R-Y* and *B-Y* are given and their use is discussed. Diagrams of the constant amplitude and constant phase of a color-carrying signal are shown and the *I, Q* system is explained. The article contains 24 references. (*EEA*, 1959, #6128)

**1,551. REPRODUCTION OF COLOUR**
**Hunt, R. W.**
**The Macmillan Company, New York, N.Y., 1959**

**1,552. THE COMPATIBILITY PROBLEM IN MODIFIED N.T.S.C. COLOUR TELEVISION SYSTEMS WITH DIFFERING CHROMINANCE BANDWIDTHS**
**Bernath, K.**
***Technische Mitteilungen PTT*, v. 37, no. 11, pp. 496–503, 1959 (in German)**

The problems considered deal with reversible compatibility of color television program exchanges between CCIR and OIR transmitters with 7- and 8-Mc bandwidth respectively. While both systems agree on a chrominance subcarrier frequency of 4.4296875 Mc, in the CCIR transmission *I* and *Q* channels are 1.5-Mc single sideband and 0.5-Mc double sideband (SB), whereas in the OIR transmission both are 1.5-Mc double SB. The theoretical investigation considers the transient response of: (1) a unit function of the *I* signal, (2) the *Q* signal (CCIR), (3) the crossmodulation from *Q* to *I* channel in the case of a translation from the 8- to the 7-Mc system, and (4) the luminance signal reproduction. The color triangle diagram is used to plot the above transient responses, three particular typical cases being selected: reversible transmission along green–magenta, blue–yellow, and red–green lines. Analytical methods are indicated for assessment of generated unwanted components; this is illustrated by the construction of vector diagrams, both for the symmetrical and single-band signals. Finally, it is shown that, compared with the chrominance transmission problems, the different transmission characteristics of the luminance signal are of secondary importance. (*EEA*, 1960, #7893)

**1,553. INDUSTRIAL TELEVISION LENS AND LIGHTING SYSTEMS**
**Noll, E. M.**
***Radio-Electronics*, v. 31, pp. 51–53, February 1960 (*AS&T*, 1960)**

**1,554. NEW COLORTRAN LIGHTING UNITS**
**Cavazzuti, P.**
***British Kinematography*, v. 36, no. 3, pp. 73–77, March 1960**

The principle on which the design is based consists in giving the screen lighting group excess voltage for a short period while the shot is being taken. Units are intended for use where easily transportable equipment is required in small studios and television studios. The principal features of PAR bulbs, made by General Electric, Westinghouse, etc., for use with Colortran units, are discussed as well as the internal reflector bulb, Colortran booster transformers, and types of lightweight lamps available. Tests were carried out by NBC engineers, and the results obtained are described. (*EI*, 1960)

**1,555. SOME COLOUR SLIDE AND COLOUR TELEVISION EXPERIMENTS USING THE LAND TECHNIQUE**
**Hughes, W. L.**
***IRE Transactions on Broadcasting*, v. BC-6, no. 1, pp. 29–33, March 1960**

A series of experiments is described in detail, verifying some of Dr. Land's experiments and showing that although they are not always explainable by classical additive colorimetric theory, certain results are predictable from the standard CIE chart. The color slide experiments were repeated with a color television setup, using a flying-spot scanner and photomultipliers; still observations were confirmed, the difference being in obtaining saturated colors on television, and not reproduction of motion as might be expected. The general conclusions are: (1) Color television will probably remain a three-dimensional medium; although a two-dimensional system could produce a blue, black, or yellow, they would not faithfully reproduce the original colors. (2) Land's findings go beyond the classical theory. Complementary colors are simulated by the eye and the mind with no difficulty or even hesitancy. Intensity variations shift observed colors above or below the complement axis, not only along the axis. (3) The CIE chart, derived from classical colorimetry, is useful in predicting Land colors. (4) Land's theory has discovered second-order terms which, in many cases, are as important as the first-order classical terms. (5) Color vision can be regarded as operating with three perceptors with automatic gain controls of finite transient characteristics; such a model is consistent with most Land phenomena. (*EEA*, 1960, #5856)

**1,556. A METHOD OF TESTING TELEVISION CAMERA TUBE COLOUR RESPONSE**
**Warren, A. G.**
***Electronic Engineering*, v. 32, pp. 144–147, March 1960**

A method is described, using fairly simple equipment, of obtaining the complete color response of a monochrome television camera. A display of effective camera color response to any chosen illuminant can be obtained, but tests so far have been confined mostly to studio tungsten-type lighting. (*EEA*, 1960, #2545)

**1,557. EVALUATION AND CONTROL OF BRIGHTNESS LEVELS FOR TELEVISION STUDIO LIGHTING**
**Williams, R. G.**
***SMPTE, Journal of the*, v. 69, no. 7, pp. 470–474, July 1960**

The relationships between illumination, reflection factor,

luminance, and apparent brightness, and their importance in television studio lighting are discussed. The spectral sensitivity curve of a typical camera tube is compared with that of the eye. (*EEA*, 1960, #7589)

**1,558. SOME COLOR SLIDE AND COLOR TELEVISION EXPERIMENTS USING THE LAND TECHNIQUE**
***IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 2, pp. 62–66, July 1960**

Some interesting results which came of repeating and expanding one small section of Land's experiments are discussed, in particular with color pictures produced in the following manner. Two original negatives were taken with relatively narrow-band color filters (red and green); these pictures were then displayed, both by optical projection and through the use of an intermediate color television system. When optical projection was used, one light source was white (3200°K) and the other was either red, green, or blue. When a color television system was used, one of the picture negatives was used to apply identical signals to all three guns of a tricolor display, and the system was balanced at Illuminant C. The other picture negative was used to obtain a signal that was added to only one of the color guns. These experiments lead to the conclusion that for this small part of the Land experiments, at least, the Land phenomenon follows a rule of complements which fall in approximately the same order as they do on a CIE color chart. This means that even though the Land phenomenon is not in any sense explainable from classical additive colorimetric theory, certain aspects of it are nevertheless predictable through the use of a standard color chart. (*EEA*, 1961, #977)

**1,559. REAPPRAISAL OF ADDITIVE COLOR PHOTOGRAPHY**
**Wheeler, L. H.**
***Photographic Science and Engineering*, v. 4, no. 5, pp. 302–304, September–October 1960**

Additive systems for motion picture photography, and projection for color television are discussed. Beamsplitting optical systems are explained. Dichroic mirrors, parallax, relay systems, film shrinkage, and projection are considered. It is suggested that no new invention is required to arrive at an integrated unit consisting of taking system, high-speed reversal processing equipment, and motion picture projector. (*EI*, 1960)

**1,560. REMARKS ON THE THREE-DIMENSIONAL GEOMETRY OF COLOUR REPRESENTATION**
**Kowaliski, P.**
***Revue d'Optique*, v. 39, no. 10, pp. 458–466, October 1960 (in French)**

Disadvantages of several published color coordinate systems for making clear general properties of color space and for correlating with color atlases are pointed out. A system in which a certain trio of spectral colors is represented by tri-rectangular axes is proposed for these purposes. (*PA*, 1961, #18,627)

**1,561. ELECTRONIC REVERSAL OF PHOTOGRAPHIC COLOUR NEGATIVES**
**Welland, K.**
***Archiv der Elektrischen Übertragung*, v. 14, no. 10, pp. 441–451, October 1960 (in German)**

To investigate the possibilities of an electronic reversal of color negatives, a flying spot scanner with three input channels and a reproducing device were developed. The spectral sensitivities of the three channels were selective and adapted to the absorption curves of the negative pigments. The distortion of brightness and color as introduced by the film and the system is reduced by gamma-correcting and masking stages. The coefficients of the masking matrix are found from well-known test colors on the one hand and their photographic negative rendition on the other. The usefulness of the system is determined by a comparison of original colors and their rendition. With nine test colors distributed over the spectrum, the mean RUCS spacing is $d = 9.8 \times 10^{-3}$, with the maximum deviation found in the blue region. Upon suitable calibration of the correcting elements, the system can be used as a simple film analyzer. (*EEA*, 1961, #978)

**1,562. ON RELATION BETWEEN COLOR CORRECTION AND FREQUENCY RESPONSE IN CENTRAL PART OF IMAGE OF GROUP OF PHOTOGRAPHIC SYSTEMS**
**Malinowski, T., Mandler, W.**
***Photographic Science and Engineering*, v. 4, no. 6, pp. 317–323, November–December 1960**

The variation of the sine wave response function of a system with varying color correction of the lens is investigated, and the influence of spherical aberration and sphero-chromatism is treated. Findings were used in the design of a telephoto lens; sine wave response curve and photographic results for the lens are shown. (*EI*, 1961)

**1,563. AUTOMATIC CONTRAST AND BRIGHTNESS CONTROL CIRCUITS FOR TELEVISION RECEIVERS**
***Mullard Technical Communications*, v. 5, pp. 227–230, January 1961**

A photoconductive cell can be used to control automatically the contrast and brightness of a television picture with changes in the ambient illumination. The cell can be used as a coupling device between the video amplifier and the CRT, or it can be incorporated into the AGC system of the receiver. Circuits are described for both methods of control in receivers designed for positive and negative modulation, and the relative advantages are discussed. (*EEA*, 1961, #4294)

**1,564. LIGHT SOURCES FOR OPTICAL COMMUNICATION**
**Beese, N. C.**
***Infrared Physics*, v. 1, no. 1, pp. 5–16, March 1961**

Several modulated light sources of historical nature are described which were used in transmitting intelligence to distant points. Some of the characteristics of cesium vapor lamps and high-intensity short-arc xenon lamps are described. The phenomenon of acoustical resonance in enclosed arcs is discussed. (*PA*, 1962, #7347)

**1,565. FLASH-TUBE LIGHTING IN SCIENTIFIC CINEMATOGRAPHY**
**Rieck, J.**
***Lichttechnik*, v. 13, no. 4, pp. 173–176, April 1961**
**(in German)**

A description is given of the characteristics of the lamps and circuits used for scientific cinematography at normal speeds (24 frames/sec) and high speeds (8000 frames/sec) and for such work as the study of plant behavior. At normal speeds it is possible to trigger any desired number of tubes practically simultaneously to obtain a higher illumination. (*PA*, 1961, #9495)

**1,566. THE CONTRAST FACTOR; ITS VISUAL DETERMINATION AND ITS APPLICATION IN METROLOGY**
**Simon, J.**
***Revue d'Optique*, v. 40, no. 5, pp. 213–230, May 1961**
**(in French)**

Conventional devices suitable for measuring the contrast factor of optical instruments are based on a photoelectric determination of the image contrast. As was suggested by Arnulf (1937), the ability of the eye to detect slight contrast differences between two adjacent fields may be used, and it results in a simple, accurate apparatus. It is essential, however, to continuously vary the contrast of one field. To this end, two methods are presented, making it possible to get a known change in the contrast of an image in which the mean illumination is not altered. The advantages of various arrangements are shown. Some modulation curves of ordinary lenses illustrate the effect of a stop or a focus shift on the image quality. The latter study leads to a new technique of optical settings. The accuracy of longitudinal settings is generally limited by the fact that one looks for a maximum in sharpness which exhibits a stationary variation with respect to focus shift. The method presented is based on a first-order effect using the equal contrast of images given by two periodical test objects shifted in depth. (*PA*, 1962, #5158)

**1,567. LAND'S SYSTEM OF TWO-COLOUR PROJECTION**
**Wilson, M. H., Brocklebank, R. W.**
***British Institution of Radio Engineers, Journal of the*, v. 21, no. 6, pp. 535–536, 546–548, June 1961**

A brief introduction is given of the physical principles involved in two-color reproduction. The limitations in reproduction of various colors are described. (*EEA*, 1961; #5849)

**1,568. THE RANGE OF COLOURS EXCITED BY A TWO-COLOUR REPRODUCTION SYSTEM**
**Sproson, W. N.**
***British Institution of Radio Engineers, Journal of the*, v. 21, no. 6, pp. 537–545, 546–548, June 1961**

Some experiments are described in which two-color and three-color reproductions of the same scene are compared. Optical projection of the separation positives was used primarily, but a description of a color television demonstration is also given. The accuracy of a two-color process is assessed on the basis of the color names given to specified areas of the color reproductions in the two-color and three-color versions. (*EEA*, 1961, #5850)

**1,569. LIGHT LEVEL INDICATOR**
**Reed, H.**
***Radio-Electronics*, v. 32, p. 78, June 1961**
**(*AS&T*, 1961)**

**1,570. ADDITIVE COLOR PHOTOGRAPHY AND PROJECTION FOR MILITARY PHOTO INTERPRETATION**
**Winterberg, R. P., Wulfeck, J. W.**
***Photogrammetric Engineering*, v. 27, no. 3, pp. 450–460, June 1961**

The color-vision system was analyzed, for naval research, in terms of its inherent capability for projecting black and white, full color, and color separation records. Detection and visual resolution data were obtained on artificial matrices. More targets were detected and more detail resolved in three separated images than in either full color or simulated panchromatic. (*EI*, 1961)

**1,571. CONSIDERATION OF SOME ESSENTIAL PROBLEMS OF COLOUR TELEVISION**
**Spătaru, A.**
***Buletinul Institutului Politechnic Bucureşti*, v. 23, no. 3, pp. 197–213, July–September 1961**
**(*EEA*, 1963, #1088)**

**1,572. ZAMETNOST OKRASHIVANIYA SEROI SHKALY V TSVETNOM TELEVIDENII (VISIBILITY OF GRAY SCALE COLORING IN COLOR TV)**
**Deryugin, N. G.**
***Electrosvyaz*, v. 15, no. 18, pp. 26–34, August 1961**
**(Translated from the Russian in *Telecommunications*, no. 8, pp. 25–36, August 1961)**

On the basis of experimental investigations, a determination is made of the tolerances for the amplification factor and the transmission characteristics of red, green, and blue channels in accordance with the visibility of gray scale coloring in color

television receivers. These tolerances are evaluated within the range of the McAdam chromaticity scale. (*EEA*, 1962, #14,905)

**1,573. THE ASSESSMENT OF THE COLOUR REPRODUCTION OF TELEVISION EQUIPMENT BY PHOTOGRAPHIC PROCESSES**
**Bergauer, H.**
***Elektronik*, v. 10, no. 9, pp. 279–283, September 1961 (in German)**

The spectral energy distribution of modern xenon high pressure lamps is practically constant from 0.4 to 0.7 $\mu$, hence their preference for color television studios. Rapid and accurate methods are required to assess other light sources and also the color sensitivity of various camera tubes. One method is to observe with a single pick-up tube two identical color stripe test boards placed side-by-side but separated by a masking partition, one board being illuminated by a standard xenon source, the other by the lamp under investigation. The physical relation $B = E.r$, where $B$ = illumination density in ASB, $E$ = illumination intensity in lux, and $r$ = reflection coefficient, can be checked by a densometer or photographically, by measuring the blackening of the film; blackening is given by $\log \tau^{-1}$; then $M = E.t^p$, where $M$ = total illumination, $\tau$ = transmission factor, $t$ = exposure time, and $p$ = Schwarzschild exponent. The technique of the photographic measurement is described first, including the choice of film, the investigation of its gradation, and the objective calibration, followed by a detailed account of a typical measurement, illustrated by diagrams, calibration characteristics of objectives, and photographs of color test stripes illuminated by various light sources. (*EEA*, 1963, #2300)

**1,574. THE USE OF FLASHBULBS FOR TRACKING ROCKETS**
**Spindler, G. B.**
**October 1961**
**Canadian Armament Research and Development Establishment, Valcartier, Quebec**
**CARDE TM 655/61, PCC-D48-95-10-24**

This memo discusses briefly the application of flashbulbs to rockets for the purpose of visual tracking and trajectory determination. Topics discussed are: the visibility of the flashes, the method of photographing them for trajectory determination, and the engineering of the flashbulb unit. The unit described was flown successfully last fall aboard a *Black Brant*.

**1,575. THE BANANA-TUBE DISPLAY SYSTEM. A NEW APPROACH TO THE DISPLAY OF COLOUR-TELEVISION PICTURES**
**Schagen, P.**
***Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering*, v. 108, no. 42, pp. 577–586, November 1961**
**(Also available as Paper 3564E, Institution of Electrical Engineers, Great Britain, May 1961)**

An introduction is given to the concept of color-display systems with mechanical field scan. The optical elements are of fundamental importance to this kind of display, and various optical aspects are discussed, including the advantages of direct-viewing systems over projection, the application of cylindrical optical elements, and the size of moving optical elements in relation to the required picture size. This discussion leads to the basic concept of a rotating mirror—or a lens drum with a magnifying cylindrical mirror. The fundamental properties of these two solutions are compared and the favored system with the Banana tube is described in detail. The basic requirements of this system with respect to the design of the tube, the optical elements, and the mechanical components are dealt with. Finally, some inherent advantages of the present system are discussed and possible further improvements are mentioned. (*EEA*, 1961, #3514)

**1,576. ELECTROLUMINESCENT DEVICES**
**Henisch, H. K.**
***British Journal of Applied Physics*, v. 12, no. 12, pp. 660–667, December 1961**

A survey is made of recent progress in the applications of electroluminescence, dealing with panels for illuminating purposes, with alpha-numerical indicators, with light and picture amplifiers of various kinds, and scanned picture displays. (*EEA*, 1962, #2610)

**1,577. ON THE HUES SEEN IN FOX-COLOR IMAGES**
**Burckhardt, C., Strutt, M. J. O.**
***IRE, Proceedings of the*, v. 49, no. 12, p. 1946, December 1961**

Referring to an article with the same title by Kallman, on two-color projection, the authors draw attention to the importance of using unequal developing times for the green and red separation slides, since the contrast of black-and-white film generally depends on color. The effects of incorrect gamma are discussed briefly. (*EEA*, 1962, #7297)

**1,578. CONCERNING THE MEASUREMENT OF PHASE DEPENDENCE ON BRIGHTNESS LEVEL IN COLOUR TELEVISION**
**Drescher, F.**
***Wissenschaftliche Zeitschrift der Technischen Hochschule Dresden*, v. 10, no. 4, pp. 813–815, 1961 (in German)**

In the NTSC method of color television, variations in phase of the two 90-deg phase-displaced carriers which carry the color information should be less than 5 deg. A method of measuring undesirable phase shifts which are dependent upon picture brightness is described. A saw-tooth voltage-modulated test signal, which corresponds to picture brightness passing through all levels from black to white, is compared after transmission with a direct signal, and the phase difference is applied to a CRT used as a null detector. The test signal is

passed through switched and variable phase shifters, and measurements of 0.1 deg are obtained. Some performance details of the test equipment are given. (*EEA*, 1963, #1658)

**1,579. COLORIMETRY OF THE BANANA-TUBE COLOUR-TELEVISION DISPLAY SYSTEM**
**Jackson, R. N.**
***Institution of Electrical Engineers, Proceedings of the, Part B—Radio and Communication Engineering,***
**v. 108, pp. 613–623, 630–632, 1961**
**(Also available as Paper 3565E, Institution of Electrical Engineers, Great Britain, May 1961)**

The principal sources of errors in color reproduction of the Banana tube are the color phosphors employed, the finite spot size of the tube, and the self-decoding color circuits. The errors due to these causes are analyzed, particular attention being given to the use of an incorrect green primary phosphor and to methods of evaluating the importance of random errors in the chromaticity and luminance of the phosphors. Methods of alleviating errors due to the incorrect green primary by special correction circuits are discussed. (*EEA*, 1961, #3515)

**1,580. THREE-CO-ORDINATE COLORIMETER FOR COLOUR TELEVISION**
**Kamler, J.**
***Prace Instytutu Tele- i Radiotechnicznego,* v. 5, no. 3 (16), pp. 89–108, 1961 (in Polish)**

The instrument measures directly the red, green, and blue light intensity. The transformation of the results to the usual $x$ and $y$ coordinates can be carried out conveniently on a suitable analog computer. Simplicity and speed of operation are the chief merits of the method, but the accuracy is limited by the characteristics of the chromatic filters. The instrument can measure the $x$ and $y$ coordinates to the accuracy of about 0.01. (*EEA*, 1962, #10,811)

**1,581. AN EXPERIMENTAL FLUORESCENT SCREEN IN DIRECT-VIEWING TUBES FOR COLOUR TELEVISION**
**Bathelt, R. R., Vermeulen, G. A. W.**
***Philips Technical Review,* v. 23, no. 5, pp. 133–141, 1961–1962**

Direct-viewing color picture tubes usually apply $Zn_3(PO_4)$-Mn for red, $Zn_2SiO_4$-Mn for green, and ZnS-Ag for blue color. The red and green phosphor persistence is too high, which causes loss in definition in moving images. The sulfide (ZnCd)S cannot be applied to the faceplate of the picture tube by the conventional process of using a solution of polyvinyl alcohol in water sensitized with a dichromate and polymerized and hardened under ultraviolet radiation. A new method giving good adhesion is described in which the green and blue phosphors are temporarily coated with an ultraviolet-absorbent dye before the application of the red sulfide which is hardened by ultraviolet irradiation through the glass instead of from the electron-gun side. The new process as applied to a shadow-mask-type tube is described in detail. The result is a screen on which moving images are much sharper and which has a 40 to 50 percent higher luminance. (*EEA*, 1962, #7304)

**1,582. AUTOMATIC SENSITIVITY CONTROL FOR VIDICON TV CAMERA**
**Kidd, P. C.**
***Electronics,* v. 35, p. 52, February 9, 1962**
**(*AS&T*, 1962)**

**1,583. COLOUR TELEVISION RECEPTION WITH THE BANANA TUBE**
**Neidhardt, P.**
***Elektronische Rundschau,* v. 16, no. 3, pp. 118, 120, 123–124, March 1962 (in German)**

The aberrations associated with the spot-wobbulation, whereby the three color strips are scanned, are discussed, and the effect, in this connection, of the Earth's magnetic field emphasized. The construction of the cylindrical lenses and the method of compensating for the different coefficients of expansion of the glass and the liquid filling are studied. The development of noise-free bearings for the drum, terminating in the choice of plastic sleeve bearings with a metallic powder lubricant, is described at length. Because of the low saturation level of the green luminescence, the color triangle of the Banana tube is smaller than that of the NTSC system. (*EEA*, 1962, #7303)

**1,584. A SPECTROPHOTOMETRIC INVESTIGATION OF DYE-SENSITIZED PHOTOCONDUCTIVE ZINC-OXIDE-RESIN LAYERS USED IN THE ELECTROFAX PROCESS**
**Giaimo, E. C.**
***RCA Review,* v. 23, no. 1, pp. 96–111, March 1962**

Spectral characteristics are presented for several of the dyes currently being used as Electrofax sensitizers, namely, rose bengal, fluorescein, brilliant green, thioflavin, and acridine orange. Several dyed layers were studied; spectral characteristics were revealed which have not been previously observed. These include ultraviolet sensitization at low dye concentrations, a shift of the visible response maxima with increasing dye concentration, and modification of "effective dye concentration" with exposure. Irreversible effects due to past light history are also described. These effects strongly influence the spectral response and processing techniques for Electrofax color reproduction. This paper also describes an apparatus and a method for obtaining the spectral characteristics of zinc-oxide-resin layers. The method provides a means for rapidly determining the photoconductivity of dye-sensitized layers as a function of light wavelength. (*EEA*, 1962, #8956)

**1,585. SISTEMA TSVETNOGO TELEVIDENIYA S VYNESENNYMI PODNESUSHCHIMI (COLOR TV SYSTEM WITH REMOTE SUBCARRIERS)**
**Sevalnev, L. A.**
***Elektrosvyaz*, no. 3, pp. 13–18, March 1962**
**(Translated from the Russian in *Telecommunications and Radio Engineering*, pt. 1, no. 3, pp. 12–18, March 1962)**

A system is discussed in which color information is transmitted over two subcarriers removed beyond limits of the brightness signal bandwidth. The bases for the selection of the number of parameters of the system and results of experimental investigations are given. (*EI*, 1963)

**1,586. ÜBER EIN DIREKT ANZEIGENDES LICHTELEKTRISCHES FARBMESSGERAET (ON A DIRECTLY INDICATING COLOR MEASURING INSTRUMENT)**
**Geutler, O.**
***Lichttechnik*, v. 14, no. 3, pp. 102–105, March 1962**

A directly indicating photoelectric color-measuring instrument is described which has three photoelectric multipliers and serves for direct reading of standard color value proportions of light sources and body colors. (*EI*, 1963)

**1,587. A COLORIMETRIC STUDY OF A CONSTANT LUMINANCE SYSTEM**
**Sproson, W. N.**
***British Institution of Radio Engineers, Journal of the*, v. 23, no. 4, pp. 311–314, April 1962**

The assessment of any system of color television depends to some extent on the colors chosen for the test. Electronically generated color bars may show faults which are non-existent in the transmission of ordinary pictures. A set of standard colors, which is typical of modern pigments and printing inks, is proposed for the purpose of assessing the color and luminance fidelity of a color television system. The method is illustrated for a constant-luminance color television system (proposed by James and Karwowski) under two conditions: (1) ideal analysis, and (2) analysis by an existing color scanner. The use of a uniform chromaticity diagram gives a convenient means of assessing the color errors in subjective terms. (*EEA*, 1962, #8296)

**1,588. SOME ASPECTS OF V.S.B. TRANSMISSION OF COLOUR TELEVISION WITH ENVELOPE DETECTION**
**Newell, G. F.**
***British Institution of Radio Engineers, Journal of the*, v. 23, no. 4, pp. 316–319, April 1962**

Reference is made to vestigial sideband transmission. Comparison of a constant-luminance color television system with the standard NTSC system indicates that the latter will give superior reproduction of large areas of color. (*EI*, 1962)

**1,589. A REVIEW OF SOME OF THE RECENT DEVELOPMENTS IN COLOUR T.V.**
**Loughlin, B. D.**
***IRE Transactions on Broadcast and Television Receivers*, v. BTR-8, no. 1, pp. 55–69, April 1962**

A survey of the present day state of color television is presented, illustrated by many vector, circuit block, and tube outline diagrams. The NTSC system is fully described, with particular emphasis on receiver circuitry, covering also decoding systems for one-gun displays, the two general modes being the continuous and the reversing color sequence methods. Display tubes are considered next: e.g., the latest shadow mask tubes; the new Apple tube, distinguished by (1) an ultraviolet photo-indexing servo,. (2) one beam electron gun only, and (3) a larger number of indexing stripes; and the latest 90° 22″ Chromatron with 1000 red, 500 green, and 500 blue stripes, and greatly reduced switching power demands (now 30 w despite higher EHT of 25 kv), due to placement of air core toroids of the resonating inductor inside the device; and, briefly, the Banana tube. New circuit requirements and developments relevant to the above display improvements are discussed, including a short account of the French SECAM system. Forty-two references are quoted. (*EEA*, 1962, #13,617)

**1,590. CALCULATION OF COLOR DIFFERENCE EQUATIONS**
**Meyer, S.**
***Optical Society of America, Journal of the*, v. 52, no. 4, p. 475, April 1962**

A computer program was produced to calculate small color differences on the basis of well-known formulae. The program and tables are available on request. (*PA*, 1962, #9360)

**1,591. F-M SEQUENTIAL SIGNALS KILL MULTICOLORED GHOSTS**
**Cassagne, P., Sauvanet, M.**
***Electronics*, v. 35, no. 21, pp. 50–52, May 25, 1962**

Experimental transmissions of a SECAM color TV system indicate that FM chrominance signals improve performance by reducing FM interaction with AM luminance signal. Also, FM makes chrominance signals largely independent of transmission distortion, especially phase distortion and differential gain of microwave relay links and TV tape recording equipment. (*EI*, 1962)

**1,592. PROGRESS COMMITTEE REPORT FOR 1961: COLOR TELEVISION**
***SMPTE, Journal of the*, v. 71, pp. 335–336, May 1962**
**(*AS&T*, 1962)**

**1,593. DIE EINHEIT DER LICHTSTAERKE (UNITS OF LIGHT INTENSITY)**
**Korte, H.**
***Zeitschrift für Instrumentenkunde*, v. 70, no. 6, pp. 139–143, June 1962**

Results obtained with a primary standard of light to show that luminance values are not yet reproducible with sufficient accuracy are presented. Several possible reasons for this fact are discussed, and some propositions for other primary standards are given. (*EI*, 1963)

**1,594. ASSESSMENT OF VISUAL PERFORMANCE**
**Fry, G. A.**
***Illuminating Engineering*, v. 57, no. 6, pp. 426–437, June 1962**

The roles of accuracy and rate of inspection in Weston's assessment of visual performance based on sorting Landolt ring arrays are discussed. An extension of this task to samples of different size and contrast is discussed. Eye movements during scanning of rings were investigated by means of an ophthalmograph, and it was shown that peripheral vision plays an important part in facilitating identification of rings adjacent to the point of fixation. The effectiveness of this vision is diminished where contrast is reduced. Vasa, Fry, and Enoch methods of study using successive exposure of single rings at a predetermined rate are reviewed. Difficulties concerning the rate of inspection in the Weston work are thus eliminated, but the effects of scanning and peripheral vision are not taken into account. The Blackwell technique of tests using disks displayed momentarily against a background of different luminance is also discussed. In part of this work some resemblance to Weston's work was introduced by moving the target. The dependence of threshold and suprathreshold performance on contrast and luminance is discussed, and it is shown that the various investigations tend to establish a fixed relationship between these performance levels. This supports methods of determining practical illumination levels by means of studies of threshold performance of the task. Suggestions are made for future research. (*EEA*, 1963, #510)

**1,595. AN ANALYTICAL AND EXPERIMENTAL STUDY CONCERNING AN INFRARED IMAGE CONVERTER SYSTEM FOR OBSERVATION BY MEANS OF THE SEQUENTIAL LIGHT AMPLIFICATION SYSTEM**
**Hall, F. F., Jr., Orthuber, R. K. (Aeronautical Research Laboratories, Wright-Patterson AFB, Ohio)**
**August 1962**
**ITT Federal Laboratories, San Fernando, Calif.**
**Report for April 16, 1958–January 31, 1960, ARL-62-411 (supersedes WADD-TR-60-152), AF 33(616)-5626**

The sensitivity of edgegraph image converters used in conjunction with a contrast enhancing sequential light amplifier is derived and compared with observation using the unaided eye. Both transmission and low reflectance type edgegraph films are considered. It is shown that the use of electronic contrast enhancement substantially improves the minimum detectable temperature difference for such devices. The ultimate sensitivity using available films and light sources is equivalent to temperature contrasts of well less than 1°C in the object scene. Experimental data on the optical constants of selenium, lead chloride, and lead bromide in the region of their absorption edges are given. Low reflectance films with $R = 0.002$ are described and the methods for production detailed. Various attempts to obtain intense, highly stable light sources, and associated filters are reported. Tests made at ARL with a transmission edgegraph converter and an available "Cat-Eye" light amplifier are described. The minimum detectable temperature difference of several hundred degrees is shown to be due to excessive bandwidth and lack of dynamic response in the chain. (*STAR*, 1963, N63-10129)

**1,596. APPLICATIONS OF MODIFIED ZERNIKE POLYNOMIALS TO THE ANALYSIS OF FRESNEL REGION FIELDS OF CIRCULAR APERTURES WITH NON-UNIFORM AND NON-SYMMETRIC ILLUMINATION**
**Hu, M.**
**September 15, 1962**
**Syracuse University Research Institute, N.Y.**
**EE 957-6209T2, Task Report 2, RADC-TDR-62-469, AF 30(602)-2646**
**AD-287,829**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

A modified form of Zernike polynomials and a set of generalized functions are introduced. These polynomials and functions are applied to the analysis of the Fresnel-region field of circular apertures with nonuniform and nonsymmetric illumination. With $m = 0$, the general result reduces to that for nonuniform but circularly symmetric illumination obtained previously. A general expression for the far field (Fraunhofer field) of circular apertures with general illumination is also derived. Finally, a simple example is given as an illustration.

**1,597. COLOR TV BASED ON LAND THEORY USES TWO SINGLE-GUN TUBES**
**Hashimoto, K.**
***Electronics*, v. 35, no. 38, pp. 54–55, September 21, 1962**

A description is given of the features of a Japanese receiver for NTSC color designed to operate on Land's two-color principle. It uses a pair of 14-in. monochrome picture tubes and a half-silvered mirror. One tube has a red plastic cap; the other has a green-blue one. (*EI*, 1963)

**1,598. THE 14-INCH RECTANGULAR COLOR PICTURE TUBE**
**Fujii, H., Tsuneta, A.**
***Toshiba Review, International Edition*, no. 11, pp. 5–11, Autumn 1962**

The development of a small color picture tube, 360FB22, which is expected to popularize color TV, is discussed. (*EEA*, 1963, #3158)

**1,599. RADIANCE**
**Nicodemus, F. E.**
**October 19, 1962**
**Electronic Defense Laboratory, Mountain View, Calif.**
**TM EDL-M494, DA 36-039-sc-87499**
**AD-298,971**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

**1,600. TROUBLESHOOTING WITH A COLOR BAR GENERATOR**
**Middleton, R. G.**
*Radio-Electronics*, v. 33, no. 10, pp. 50–55, October 1962

Methods of chasing faults in color TV reproduction with the help of a "color bar generator" are described. (*EEA*, 1963, #3729)

**1,601. SUNFLOWER OPTICS: A NEW CONCEPT IN COLOR TV DISPLAY**
**Harries, J. H. O. (Harries Electronics Corporation, Ltd., Bermuda)**
*Electronics*, v. 35, no. 50, pp. 33–38, December 14, 1962

A projection-type receiver, using from three to five 2½-in. color picture tubes, which has a sunflower-shaped plastic disk that corrects geometrical distortion is described. (*EEA*, 1963, #6461)

**1,602. ON THE QUALITY OF TYPE Yu-16 LUXMETERS**
**Khazanov, V. S., Fomina, A. M.**
**1962**
**Scripta Technica, Inc., Washington, D.C.**
**T-1659**
**AD-290,554**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

The Type Yu-16 luxmeter consists of a rectangular selenium photo-element, with a working area of 25 $cm^2$ and a meter of 1.0 accuracy. The luxmeter has three basic measurement ranges of 25, 100, and 500 lux, and three supplementary ranges of 2,500, 10,000, and 50,000 lux, obtained by means of an absorber mounted on the photo-element. The absorber consists of a metal frame holding two plates of frosted damped lucite. Between the two layers of lucite, there is an insert of opaque material with small openings. In accordance with technical specifications, the basic error of the luxmeter, with respect to its primary ranges, is ±10 percent and, in its supplementary ranges, ±15 percent of the magnitude measured. To improve the quality of luxmeters of Type Yu-16, the following must be accomplished: (1) the quality of the selenium photo-elements must be greatly improved, and only photo-elements that have naturally aged over a period of 6–12 months should be installed in the luxmeters; (2) the absorber design must be changed (a smooth-surface plastic should be substituted for the matte plastic so that its surface can be kept clean); and (3) to insure stability of the photo-element's sensitivity, the sensitive layer must be better protected against moisture.

**1,603. THE PROBLEM OF GENERATION OF COLOUR BAR SIGNALS**
**Mierzejewski, J., Sucharzewska, E.**
*Prace Instytutu Tele- i Radiotechnicznego*, v. 6, no. 2 (19), pp. 75–96, 1962 (in Polish)

Color bar signals are indispensable for investigation, alignment, and control of TV transmitting and receiving equipment circuits. This paper deals with the basic generation problems of these signals and presents characteristics of RGB waveforms of the color bar images. Circuit arrangements used in USSR and German designs and one designed at the Radio Research Institute, based on the interworking principle of delay lines and trigger circuits, are described. The test results of the Polish generator are compared with those of other designs. (*EEA*, 1963, #3390)

**1,604. G.E.C. COLOUR TELEVISION RECEIVERS AND MONITORS**
**Biggs, A. J.**
*G.E.C. Journal of Science and Technology*, v. 29, no. 1, pp. 32–40, 1962

The basic principles of color television are stated. The color screen with the shadow mask and over a million individual dots of red, green, and blue is described. Convergence and "tracking" difficulties of three color amplifiers and their remedies are mentioned. Two systems—the American NTSC and French SECAM—are described. They both use a luminance signal, which transmits the ordinary black-and-white picture in the absence of color signals, and two color signals: *R-Y* and *B-Y* (*Y* being the symbol for luminance). These three signals after demodulation reconstitute the three basic colors. The transmission is carried out on the main carrier for luminescence signal and on a color subcarrier for color information. The whole information is accommodated within the normal bandwidth of the existing black-and-white system. The American system transmits all color information simultaneously, the French transmits the *R-Y* signal on one line, and the *B-Y* on the subsequent. Block diagrams of both types of receivers are reproduced and circuits described. Photographs and a description of an experimental GEC receiver-type TTV are presented, as well as two color photographs of a television screen, one for 405 and another for 625 lines. It is claimed that color reproduction by television sets is superior to that of color photography. (*EEA*, 1963, #5437)

**1,605. COLOUR EQUALIZATION ON THE COMPLETE COLOUR TV LINK**
**Neidhardt, P.**
*Wissenschaftliche Zeitschrift der Hochschule für Elektrotechnik, Ilmenau*, v. 8, no. 1, pp. 95–103, 1962 **(in German)**

One of the major problems, here described, is in the development and testing of complete color TV links, as part of the general considerations in the transmission of picture information; as a result, a practical insight is given into color TV

techniques, covering equipment details and arrangements, and then concentrating on methods of color equalization both for individual stages in the link as well as overall checking and setting-up routines. (*EEA*, 1962, #14,903)

### 1,606. FLUCTUATION THEORY OF LUMINANCE AND CHROMATICITY DISCRIMINATION

**Bouman, M. A., Vos, J. J., Walraven, P. L.**
***Optical Society of America, Journal of the*, v. 53, no. 1, pp. 121–128, January 1963**

An attempt was made to describe brightness and color discrimination in the framework of a fluctuation theory. The fluctuation theory states that a difference between two stimuli will be just noticeable if it exceeds, by some factor, the average of the fluctuations in the stimuli. If the statistical fluctuations in the number of quanta absorbed are considered as the determining factor, the de Vries-Rose law ($\Delta B/B \sim 1/B^{1/2}$) is unforcedly explained. The deflection from this law into Weber's law ($\Delta B/B$ = constant) becomes understood in the same framework, provided the statistics are applied on the neural coding rather than on the quantum incidence, considering a refractory period in the nervous transmission. Overfilling of the nervous channels, adaptation of the receptors, and fluctuations in the refractory period are indicated as possible causes of the fall in contrast sensitivity at high levels of brightness. Adaptative effects, like shrinking of the information-collecting time and area, or changes in coincidence mechanisms with increasing luminance, may be reasons of deviations from the basic laws when large areas or exposure times are involved. The application of the fluctuation theory to chromaticity discrimination is elaborated for the case of tritanopia and illustrated for the general case of trichromasy. The agreement between theory and experiment is satisfactory. (*PA*, 1963, #5303)

### 1,607. CONTRIBUTIONS OF THRESHOLD MEASUREMENTS TO COLOR-DISCRIMINATION THEORY

**Boynton, R. M.**
***Optical Society of America, Journal of the*, v. 53, no. 1, pp. 165–179, January 1963**

Perhaps the most fundamental questions in color discrimination theory are: (1) how many different classes of photopic mechanisms mediate color discrimination, and (2) what are their spectral sensitivities? Studies of photopic visual thresholds—obtained by using small foveal stimuli—have provided evidence related to these questions. The radiance required for threshold probability of seeing is a function of many variables of a physical and methodological sort. Where color discrimination is concerned, wavelength has been the physical variable of prime interest. Visual sensitivity (reciprocal radiance required for some criterion response) is not a smooth function of wavelength, but exhibits interesting inflections, particularly when threshold radiance is the response criterion. These inflections can be significantly enhanced under suitable conditions of chromatic adaptation, and have been thought by many workers to suggest that separate underlying mechanisms contribute differentially to threshold response as a function of test-flash wavelength and adapting conditions. In order to attempt quantitative inferences about these presumed underlying mechanisms from threshold data, another difficult question must be examined: What is the nature of the interactions among the photopic mechanisms as they cooperate, fail to cooperate, or inhibit one another in the determination of a threshold probability of response? Various theoretical ideas and recent experimental evidence related to these three questions are also reviewed. (*PA*, 1963, #5304)

### 1,608. FURTHER STUDIES ON ACQUIRED DEFICIENCY OF COLOR DISCRIMINATION

**Verriest, G.**
***Optical Society of America, Journal of the*, v. 53, no. 1, pp. 183–195, January 1963**

The relationship between color discrimination, sex, and age is studied by giving the 100-Hue Test to 480 unselected subjects between the ages of 10 and 64. The mean total score of the 20- to 24-yr group is significantly lower than that of all other groups; the mean partial scores are always highest in the blue-green and red sections of the test, and this tendency is accentuated in the age groups with a higher mean total score.

A reproduction of the senile decrease of color discrimination was then attempted by fitting young subjects with filters, which absorb more or less selectively the rays of shorter wavelengths and which have several total optical densities; the effect of these filters is studied by means of the AO H-R-R and Farnsworth pseudoisochromatic plates, the Panel D-15, the 100-Hue, the Tritan-Plate Tests, and the anomaloscope.

Some 500 eyes affected by different diseases were examined by means of a diagnostic set including the Ishihara, AO H-R-R, and Farnsworth pseudoisochromatic plates, the Panel D-15 Test, the 100-Hue Test (the interpretation of which was subjected to some modifications), and the anomaloscope. Occasionally a complementary set was used to get further information about the photopic spectral curve of relative luminous efficiency and about the spectral mixture functions.

Accordingly, the acquired deficiencies of color discrimination are classified into four types: (1) a type in which a prominent axis of deterioration of color discrimination cannot be determined; this type is ill-defined and occurs principally in some cases of macular cysts and of toxic amblyopia; (2) a Type I of acquired red-green deficiency, which is characterized by a progressive shift of the photopic spectral curve of relative luminous efficiency toward the shorter wavelengths, till it becomes identical to the normal scotopic function; it occurs chiefly in juvenile macular degeneration and in some other chorio-retinal degenerations; (3) a Type II of acquired red-green deficiency, in which the photopic spectral curve of relative luminous efficiency remains normal; it

occurs in nearly all diseases of the optic pathways; (4) an acquired blue-yellow deficiency, which can be associated with a shift of the photopic spectral curve of relative luminous efficiency toward the shorter wavelength and which occurs in most chorio-retinal diseases. Nevertheless, the acquired deficiencies of color discrimination are only seldom as well outlined as the congenital ones. (*PA*, 1963, #5305)

**1,609. CONTRIBUTIONS TO COLOR-DISCRIMINATION THEORY: REVIEW, SUMMARY, AND DISCUSSION**
**Hurvich, L. M.**
***Optical Society of America, Journal of the*, v. 53, no. 1, p. 196, January 1963**

Verriest's valuable addition to the empirical data on age and color discrimination raises questions about sample selection and suggests the desirability of longitudinal follow-up work on the younger age groups. The advisability of treating the discrimination losses produced by selective short-wave absorption as a tritan type of color vision deficiency is questioned (1) on theoretical grounds, and (2) because selective filtering never completely imitates congenital color vision defects. An explanation is suggested for Verriest's report that color equations made through selective filters are not those expected on the basis of computed stimulus transmittances. Generalities are sought in his large body of data on diseased eyes and color vision, and the puzzling fact that no color vision defects are found in about 25 percent of the diseased cases tested is pointed out. In contrast to Boynton's views concerning color adaptation limits, the linkage between stable color perceptions and extremely labile chromatic adaptation is emphasized. Arguments are presented against his suggestion that the experimental parameters in research on visual thresholds be standardized. The importance of the time variable in visual research is agreed upon. Because of the discrepancies between the spectral sensitivity curves inferred from Stiles' increment-threshold technique and those derived from the "overall spectral sensitivity method," it is suggested that the increment threshold data might more fruitfully be analyzed in terms of the three-variable opponent color response systems which have been shown to cope satisfactorily with a wide variety of other psychophysical data. Helson's systematic research on the Bezold spreading effect stimulates further questions requiring experimental answers. There is a possibility that asymmetrical effects, i.e., contrast and assimilation, occur on the two different sides of his test fields, and that differential rates of the two processes may favor one or the other net effect. The use of a matching technique might expose the presence of such asymmetries, and the relevance of retinal light distribution and image spread functions to the limiting conditions for the two effects is suggested. (*PA*, 1963, #5306)

**1,610. ORTHO-CONTOUR PHOTOGRAPHY**
**Toishi, K., Kureya, M.**
***Photogrammetric Engineering*, v. 29, no. 1, pp. 206–210, January 1963**

A method of photographing ortho-contours which involves no great technical difficulties in constructing equipment is described. A small camera lens, provided it is free of distortion, will permit photographing the ortho-image of a large object such as a building. Whole illuminating-photographing equipment must be shifted in the direction of the lens axis instead of the object, and operation may be carried out at night. A working model is described. (*EI*, 1963)

**1,611. INSTRUMENTATION STUDIES: A STUDY OF PHOTOELECTRIC INSTRUMENTS FOR THE MEASUREMENT OF COLOR: REFLECTANCE AND TRANSMITTANCE: PART 14—THE STANDARD BRIGHTNESS TESTER AS A FOUR-FILTER COLORIMETER**
**Dearth, L. R., Shillcox, W. M., Van Den Akker, J. A.**
***Tappi*, v. 46, Supplement, pp. 179A–188A, January 1963 (*AS&T*, 1963)**

**1,612. IOWA CHROMA SEQUENCE SYSTEM OF COLOR TELEVISION**
**Morris, R., Hughes, W. L.**
***IEEE Transactions on Broadcasting*, v. BC-9, no. 1, pp. 55–64, February 1963**

A survey and discussion are presented of the system in which luminance information is obtained in the standard manner, but color information is provided sequentially in alternate red and blue fields. This color information is delayed by one field (262 lines) in a special torsional mode wire delay line, then combined with the undelayed signal in an electronic switch, to give two fully simultaneous outputs, one red and the other blue. A matrix combines red and blue and luminance signals to give red, green, and blue signals which can be NTSC encoded. Various coding and decoding schemes which have been experimented with in conjunction with the system are outlined with the aid of block diagrams. It is suggested that features of the Iowa, NTSC, and SECAM systems could be combined to give certain advantages, such as easier transmission over degraded microwave circuits and simpler studio equipment. Against this, home receivers would be somewhat more costly. (*EEA*, 1963, #7823)

**(See also *Entries* #816, 821, 936, 943, 980, 1033, 1068, 1212, 1257, 1286, 1302, 1328, 1506, 1833, 2014.)**

# PHOTOMETRY AND RADIOMETRY

## *General — 1933–1957*

**1,613. PHOTOMETRIC THEORY OF LUNAR ECLIPSES**
Funk, P. M. F.
1933
*Bulletin of Astronomique*, v. 8, no. 2, pp. 77–108, 1933

**1,614. PHOTOMETRIC ATLAS OF THE NEAR INFRA-RED SOLAR SPECTRUM, λ8465 TO λ25,242**
Mohler, O. C., Pierce, A. K., McMath, R. R., Goldberg, L. (University of Michigan, McMath-Hulbert Observatory, Pontiac)
University of Michigan Press, Ann Arbor, 1950

The reproductions of the infrared spectrum included in this volume were made from original records secured at the Mount Wilson Observatory under an arrangement between the Mount Wilson and Palomar Observatories and the McMath-Hulbert Observatory. The Snow telescope and infrared spectrometer, the detecting and recording system, and the spectrometer grating are described, as well as the observation procedures. Each page of the atlas consists of a direct reproduction of two original tracings. (*AI/A*, 1962, #5308)

**1,615. THE PRESENT STATE OF SPECTROPHOTOMETRY IN THE VISIBLE AND ULTRAVIOLET**
Ritschl, R.
*Experimentalle Technik der Physik*, v. 1, no. 4–5, pp. 145–157, November–December 1953 (in German)

This is a general article describing instruments used in visible and ultraviolet spectroscopy. A short note on continuous light sources and discontinuous sources with sharp lines is followed by a section on spectrographs. Descriptions are given of a number of Soviet and German models of quartz and glass prism spectrographs. Monochromators discussed include several Soviet and German models. (*PA*, 1959, #2204)

**1,616. THE STATE OF SPECTRAL PHOTOMETRY IN THE INFRARED REGION**
Jancke, H.
*Experimentalle Technik der Physik*, v. 1, no. 4–5, pp 157–173, November–December 1953 (in German)

Instruments used in Germany dealing with radiating sources, receivers, electronics, and recording are reviewed. A final section deals with the construction of some characteristic instruments with spectral resolution and nondispersive devices. Twenty-seven references are included. (*PA*, 1959, #2205)

**1,617. A PORTABLE LOW-LEVEL LIGHTMETER. SUPPLEMENT I: LOW-LEVEL LIGHTMETER FOR THE NEAR INFRARED**
Gebel, R. K. H.
March 31, 1955
Wright Air Development Center, Aeronautical Research Laboratory, Wright-Patterson AFB, Ohio
Supplement 1 to WCRR TN 54-5 (AD-58,440)
AD-233,442

Results of former attempts to establish a value for visible radiation in the region between 7000 and 11,000 Å in the near infrared of the night sky have been unreliable due to lack of precision instruments. In this modification for the low-level lightmeter, an infrared image-converter tube for converting the infrared into visible radiation has been employed. Further, better stabilization in the transformer and change of voltage in the photomultiplier are made to achieve a higher sensitivity of the meter. Calibrations were made similarly to the method explained in "Portable Low-Level Lightmeter." Improvement in registering the brightness of the night sky in the near infrared (6300 to 11,000 Å) was noted in the test made on the night of March 8, 1955.

**1,618. A MIDDLE ULTRAVIOLET TRANSMISSION FILTER**
Dunkelman, L., Field, D. E.
November 16, 1955
Office of Naval Research, Naval Research Laboratory, Washington, D.C.
NRL R-4647
(Also available at OTS: PB-111,733, U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Various techniques are used in radiometric measurements restricted to the middle ultraviolet (2000 to 3000 Å) when it is not practicable to employ dispersive optical systems. For an experiment to be performed in an *Aerobee* rocket on the detection of middle ultraviolet light of the night airglow, it was determined that an ideal middle ultraviolet photometer should consist of a chemical filter with a 1P28 multiplier phototube. Complete descriptions of materials and assembly are given for the chemical filter. Tests indicate that the filter is stable to a temperature variation of from −50 to +150°F, age, and shock.

**1,619. STRAY-LIGHT MEASUREMENTS ON A ZEISS SPECTROPHOTOMETER**
Fröhlich, F.
*Experimentalle Technik der Physik*, v. 4, no. 5, pp. 231–240, 1956 (in German)

A method is described for measuring the stray light passing through a spectrophotometer and for determining its wavelength. The practical results are given in detail. (*PA*, 1959, #1259)

**1,620. ON PHOTOMETRY IN THE EXTREME ULTRAVIOLET WITH FLUORESCENCE SENSITIZED PHOTOGRAPHIC MATERIAL**

Greiner, H.
*Zeitschrift für Naturforschung*, v. 12a, no. 9, pp. 735–738, 1957 (in German)

Agf. X-ray film is sensitized with sodium salicylate, and its sensitivity and resolving power are compared with Kodak SWR film for the short ultraviolet region. The sensitivity is effectively independent of wavelength over the short ultraviolet region and improves on the Kodak film in the example given of spectra photographed at 760 Å. (*PA*, 1959, #5476)

## *Mars — 1957*

### 1,621. NEAR INFRARED SPECTRUM OF MARS

Shaw, J. H., Burch, D. C., and Cummins, H. Z.
November 1957
Ohio State University Research Foundation, Columbus
Scientific Report 8, AFCRC-TN-58-203
AD-146,791

Infrared spectra of Mars were obtained in the autumn of 1956. From the intensity of the $CO_2$ bands near 1.6, it has been estimated that the amount of $CO_2$ in the atmosphere of Mars is about four times greater than in the Earth's atmosphere if the surface pressure is 100 mb and the atmosphere is composed mostly of nitrogen. This is compared with a Martian $CO_2$ abundance of 13 ± 4 times that of the Earth's atmosphere. No evidence of bands of CO (2.35) or $N_2O$ (2.11, 2.26, and 3.9) was found, and upper limits of 50 atm-cm have been placed on these gases. On one spectrum indications of an absorption at 3.5 were obtained. (*AI/A*, 1960, #2477)

## *General — 1958*

### 1,622. EFFECTIVE LINE WIDTHS IN PHOTOGRAPHIC SPECTRAL PHOTOMETRY

Junkes, J., Salpeter, E. W.
*Ricerche Spettroscopiche, Laboratorio Astrofisico della Specola Vaticana*, v. 2, no. 5, pp. 205–220, January 1958

The width ($w$) of a photographic image increases with increasing intensity ($I$). Measurement of $w$ with a suitable microphotometer may be used to determine $I$; the measurement is not so convenient as the usual determination of density of blackening, but is more sensitive at high intensities. (*PA*, 1960, #6930)

### 1,623. A PHOTOMETRIC-WEDGE EXPOSURE METER

*Revue d'Optique*, v. 37, no. 2, pp. 104–105, February 1958 (in French)

This visual brightness meter is designed for use in micro- and macro-photography over a wide range of luminance values (100,000/1). The variable comparison field is provided by a tungsten filament light-source modulated by a sliding neutral optical wedge. (*PA*, 1959, #4193)

### 1,624. THE THEORY OF THE RADIOMETER

Kelly, E. J., Lyons, D. H., Root, W. L.
May 2, 1958 (Reissued September 19, 1960)
Massachusetts Institute of Technology, Lincoln Laboratory, Lexington
Group Report 47.16, AF 19(122)-458
AD-257,332
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The sensitivities of various types of radiometers in current use are computed. The formulation of the problem is kept flexible enough to permit finding the optimum radiometer design. This optimum depends on the definition of sensitivity, and this definition is one of the details in which the procedures used differ from most of the previous English literature on the subject. Another such detail is the model used for the gain fluctuations as a random process. The problem of radiometer analysis is related to the general statistical problem of the estimation of the variance of a stationary random process. The definition of sensitivity and the model for the gain fluctuations permit the evaluation of the sensitivity of a conventional dc radiometer. The sensitivity of a general type radiometer (which includes dc radiometers and conventional modulated radiometers as special cases) is evaluated, and the performance is optimized over the design parameters which are available. The question of optimum detector law is appended.

### 1,625. SURVEY OF THERMAL IMAGING METHODS

Schadt, C., Kelly, R. L.
September 1, 1958
Stanford Research Institute, Menlo Park, Calif.
Final Report 16, DA 44-009-eng-2380
AD-287,748
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Methods of detection of thermal images by non-scanning devices were studied with the ultimate goal a portable device which registers an image produced by small differences in temperature of an object. Radiant energy from an object must produce a latent image on a receiver, in terms of optical inhomogeneity, which can be made visible by direct optical methods. The basic requirements for a thermal imaging device are the following: (1) temperature resolution sufficient to show differences of 1°C in a black object; (2) sufficient linear and angular resolution to show these temperature differences at a separation of 0.1 mm on a film as large as 4 × 4; and (3) a characteristic response time which allows formation of the image for an infrared exposure of 1 sec or less. Project studies consisted mainly of theoretical investigations of the capabilities and limitations of various non-scanning systems. Those under consideration have been steady-state, triggered, and isothermal systems. Eleven references are included.

**1,626. CONTINUOUSLY RECORDING SPECTRO-RADIOMETER**
MacAdam, D. L.
*Optical Society of America, Journal of the*, v. 48, no. 11, pp. 832–840, November 1958

A spectroradiometer is described for recording the spectral distribution of daylight or of any artificial light source that radiates steadily for 3.5 min. Beams from the external source and from an internal standard lamp are deviated alternately through a monochromator to a multiplier phototube. The collimator consists of parallel baffles instead of a mirror or lenses. The amplified signal activates a motor which moves a mirror to attenuate the energy from the internal standard until the beams are equal. The necessary degree of attenuation is then recorded while the wavelength is being changed. The logarithm of the spectral distribution of the internal standard may be added electrically to the logarithm of the measured attenuation to record directly the logarithm of the absolute energy radiated by the sample. The spectral distribution of sources with luminances as low as 1 ft L have been measured with a half-maximum bandwidth of 10 m$\mu$. The spectral emittance of a variety of phases of daylight and sunlight, at different times of the year and under various weather conditions, as well as of fluorescent lamps, electroluminescent panels, and ultraviolet-excited fluorescent coatings, have been recorded and are summarized. (*PA*, 1959, #2189)

**1,627. SOME PROBLEMS ASSOCIATED WITH THE APPLICATION OF ELECTRON-OPTICAL CONVERTERS IN ASTRONOMY**
Shcheglov, P. V.
*Astronomicheskii Zhurnal*, v. 35, no. 4, pp. 651–655, 1958 (in Russian)

A brief report is given on work carried out in 1954–1957 at the Shternberg State Astronomical Institute (GAISh), involving application of image converters in photometry and spectroscopy in the infrared region. Methods of cooling the photocathode and of introducing the high voltage supply are described. (*PA*, 1959, #3030)

**1,628. A RECORDING SPECTROPHOTOMETER FOR THE ULTRAVIOLET, VISIBLE AND NEAR INFRARED REGION**
Geppert, G.
*Experimentalle Technik der Physik*, v. 6, no. 2, pp. 79–84, 1958 (in German)

Radiation from a quartz prism monochromator, chopped at 1000 cps, is alternated at 12.5 cps through the specimen and comparison cells to a photomultiplier or PbS cell. The amplified output from the comparison beam is used to control the entrance slit to constant energy. Records showing performance are given. (*PA*, 1959 #192)

**1,629. PHOTOMETRY**
Walsh, J. W. T.
The Macmillan Company, New York, N.Y., 3rd Revised Edition, 1958

## *Mars — 1958*

**1,630. MARTIAN ATMOSPHERE RESTUDIED**
*National Bureau of Standards, Technical News Bulletin*, v. 42, no. 3, pp. 48–52, March 1958

Information is given on the properties of the atmosphere of Mars, obtained from analysis of spectroscopic observations of its light. Results confirm that there is little oxygen or water vapor on Mars. (*AI/S*, 1960, #21,284)

**1,631. SPECTROPHOTOMETRY OF MARS NEAR THE OPPOSITION OF 1956**
Yeserskaya, V. A., Yeremenko, N. F.
*Kharkov Universitet, Astronomicheskaia Observatoriia, Tsirkuliar*, no. 19, pp. 27–28, 1958 (in Russian)

From spectrograms obtained on September 4 and 27, 1956, the spectral energy distribution of the planet between 382 and 588 m$\mu$ was determined, with reference to $\alpha$ Aql, and compared with results from the other side. The color indexes on the two days were 1.43 and 1.68 mag, respectively. (*AJ*, 1959, #8433)

## *Moon — 1958*

**1,632. VISUAL PHOTOMETER FOR STUDYING THE EARTHLIGHT ON THE MOON**
Rösch, J.
*Revue d'Optique*, v. 37, no. 9, pp. 458–466, September 1958 (in French)

The design incorporates a novel beam-splitting device which, in conjunction with adjustable neutral wedge and rotating prism, enables the shadow area of the Moon's image to be placed in juxtaposition with an image of the bright portion of the lunar disk whose brightness may be varied. From the position of the neutral wedge when these two images are matched, the difference of magnitude, read on a calibrated scale, between the bright and dark portions of the lunar image may be determined to an accuracy of ~0.01 magnitude. (*PA*, 1959, #3033)

**1,633. LA LUMIÈRE CENDRÉE DE LA LUNE ET CE QU'ELLE NOUS PERMET DE CONNAÎTRE TOUCHANT L'ATMOSPHÈRE ET L'ASPECT PLANÉTAIRE DE LA TERRE (THE ASH-GREY LIGHT OF THE MOON AND WHAT IT TELLS US ABOUT THE ATMOSPHERE AND THE PLANETARY ASPECT OF THE EARTH)**
Dubois, J.
*Observatoire de l' Université de Bordeaux, Série A*, no. 10, 1958

A report is presented on integral and four-color (483, 540, 583, 615 mμ) observations of ash-grey moonlight (1940–1957) made with the cat-eye photometer. The corresponding values of the mean albedos for the entire Earth are 0.49, 0.41, 0.35, and 0.38. The phase laws of the albedos thus determined have mean standard deviations of 0.236, 0.234, 0.270, 0.214, and 0.162 (integral), in which the yellow absorption of chlorophyll in the continent regions is expressed. The daily variation shows that the oceans of the Earth appear brighter than the continents. The yearly variations follow the same course as the atmospheric clouds. The effect of solar activity is identical to Danjon's for the total lunar eclipses. The blue-yellow color index $I$ was between 0.1 and 0.9 mag for the yearly mean. In general, the ash-grey light became blue as the intensity increased, more so since 1950 than before. The discoloration of $\sim\lambda^{-0.26}$ is indicative of scattering particles with diameters of around 0.5 $\mu$, which may possibly be due to nuclear explosions, whereas the earlier, lesser discoloration corresponds to a particle diameter of about 0.3 $\mu$. The color anomalies, which have appeared with increasing frequency in the past few years, can be explained if, in addition to the scattering layer of the larger particles, one assumes the existence of a cloud of them circulating in the atmosphere, contributing an additional red coloration. According to the observations, the earthlight is composed somewhat as follows: floor vegetation (strongly discolored)—15 percent, clouds and oceans at oblique incidence angles ($I \approx 0.04$ mag)—20 percent, air ($I = 0.81$ mag, corresponding to $\lambda^{-4}$)—50–60 percent. Finally, the aspect of the Earth to be expected by an extraterrestrial observer is described. (*AJ*, 1960, #8320)

## *Venus — 1958*

**1,634. ABSOLUTE PHOTOMETRY OF VENUS IN THE ULTRAVIOLET AND INFRARED**
**Koval, I. K.**
***Astronomicheskii Zhurnal*, v. 35, no. 5, pp. 792–796, 1958**
**(Translated from the Russian in *Soviet Astronomy—AJ*, v. 2, no. 5, pp. 739–743, September–October 1958)**

During the period from August 23–26, 1956, about 60 photographs were obtained in the neighborhood of the quadrature, using the 270-mm reflector of the Kharkov Astronomical Observatory. The methods are detailed and the results tabulated. (*PA*, 1959, #8490)

## *General — 1959*

**1,635. INSTRUMENT FOR THERMAL PHOTOGRAPHY**
**Astheimer, R. W., Wormser, E. M.**
***Optical Society of America, Journal of the*, v. 49, no. 2, pp. 184–187, February 1959**

This paper describes an instrument for taking thermal photographs utilizing infrared radiation passively emitted by objects at ambient temperature. The instrument consists of an 8-in. radiometer utilizing thermistor infrared detectors and an imaging attachment. A glow modulator forms a thermal photograph on Polaroid or conventional film. Quantitative analysis of thermal photographs is described, and several examples of thermal photographs are given. (*PA*, 1959, #5473)

**1,636. HETEROCHROMATIC PHOTOMETRY BY MEANS OF COLORIMETRIC COMPENSATION**
**Einhorn, H. D.**
***Optical Society of America, Journal of the*, v. 49, no. 3, pp. 263–267, March 1959**

A method of heterochromatic photometry is described whereby the difference in color is eliminated by the admixture of saturated blue and red lights. Test results indicating observer variations are reported. The merits, problems, and potentialities of the method are discussed. (*PA*, 1959, #3247)

**1,637. TEMPERATURE VARIATION AND SENSITIVITY IN TWO-PHASE THERMAL IMAGE DETECTORS**
**Schadt, C.**
**April 1, 1959**
**Stanford Research Institute, Menlo Park, Calif.**
**R17, Technical Report 5 for September 1–March 13, 1959 (Supplement to Final Report), DA 44-009-eng-2380**
**AD-287,746**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

The feasibility of using an isothermal two-phase system for thermal imaging was examined. This supplement to the final report comprises a mathematical analysis of the operation of such a system, taking into account a temperature difference between the two phases. Through the analysis it is finally shown that the sensitivity and the temperature difference have opposite signs for all imaging films of practical thickness, where the temperature difference is defined as positive when the liquid state is warmer than the solid state; the sensitivity is defined as positive when the ratio of liquid to solid increases when the received radiation increases. This means that there is no steady-state or stable configuration of the film, under the assumptions of one substance in two phases, subjected to the radiant fluxes assumed in this report, except for films so thick that heat conductance is negligible compared with radiative transfer. Five references are included.

**1,638. STUDY AND RESEARCH ON A THERMAL IMAGING TRANSDUCER**
**Heil, H., Nolan, W. J.**
**January 15–April 15, 1959**
**General Electric Company, Syracuse, N.Y.**
**Quarterly Progress Report 1, AF 33(616)-6088**
**AD-227,726**

A search is underway for an efficient transducer, sensitive to the 8- to 15-$\mu$ region of wavelengths of electromagnetic radiation. Only transducers which reproduce a full image are considered, not single-cell detectors. The sensing process utilizes the change brought about in the magnetic properties

of a superconducting element by absorption of radiation. Related theoretical aspects are presented with respect to. (1) the problem of effective radiation absorption in the film, (2) calculation of the heat necessary to effect a transition, and (3) spatial and temporal resolution in the thin films. The construction of the magnetic reading heads, the magnetizer, and the transport and moving mechanism is described. Twenty-eight references are included.

**1,639. ABSOLUTE LIGHT-SCATTERING PHOTOMETER. I. DESIGN AND OPERATION**
**McIntyre, D., Doderer, G. C.**
***Journal of Research of the National Bureau of Standards*, v. 62, pp. 153–159, April 1959**

Designed and built for determining the absolute scattering from polymer solutions, this instrument is also capable of performing as a research instrument for making measurements at very low and very high angles, and at very low and very high intensities of scattered light. The instrument scans the angular scattering either manually or automatically while measuring continuously the ratio of the scattered light to the incident light. (*PA*, 1959, #6797)

**1,640. THE SENSITIVITY OF A LOW-NOISE RADIOMETER (IN THE QUANTUM REGION)**
**Karlov, N. V., Chikhachev, B. M.**
***Radiotekhnika i Elektronika*, v. 4, no. 6, pp. 1047–1051, June 1959 (in Russian)**

The limiting accuracy of measurement of the internal noise level of a radiometer, when the noise temperature is of the order of magnitude of $\hbar\omega/k$ and the noise power is determined by the quantum Nyquist formula, is investigated. Expressions are obtained for the radiometer sensitivity under these conditions. The optimum internal noise temperature is found for which the sensitivity is a maximum. The calculation shows that for values of $\hbar\omega/kT > 1.5$ the quantum formula differs appreciably from the classical formula. The result is of importance in the field of molecular amplifiers operating at liquid-helium temperatures in the centimeter waveband. (*PA*, 1961, #4215)

**1,641. PHOTOMETRIC OBSERVATIONS OF SUBVISUAL RED AURORAL ARCS AT MIDDLE LATITUDES**
**Duncan, R. A.**
***Australian Journal of Physics*, v. 12, no. 2, pp. 197–198, June 1959**
**(*AI/S*, 1960, #20,065)**

**1,642. PHOTOGRAPHIC PYROMETRY WITH A COLOR-SEPARATION CAMERA**
**Simmons, F. S., DeBell, A. G.**
***Optical Society of America, Journal of the*, v. 49, no. 7, pp. 735–736, July 1959**

In research on rocket flames, there is a need to study emissivity at a number of wavelengths. A color-separation camera has been adapted for use with a photographic pyrometer. The performance was found to be satisfactory by measurement of the temperature of a black body. Each color photograph gave a temperature within a few degrees of that indicated by an optical pyrometer. (*PA*, 1959, #9561)

**1,643. STUDY AND RESEARCH ON A THERMAL IMAGING TRANSDUCER**
**Heil, H., Nolan, W. J.**
**August 1, 1959**
**General Electric Company, Syracuse, N.Y.**
**R 59ELS-70, Quarterly Progress Report 2 for April 15–July 15, 1959 on Infrared Camera Tubes, AF 33(616)-6088**
**AD-227,599**

Assembly of the magnetizer and the mount for the superconducting film is described, as well as the construction of the bearings for the long drive shaft. In order to understand the relationship between the field distribution and the signal derived from the moving head as displayed on the oscilloscope screen, experiments were made with specific field distributions. Investigations were made into the fringe field of a straight solenoid, a homogeneous alternating field formed by a small permanent magnet, and the field between the pole pieces of our magnetizer. Experiments with a short shaft design were conducted whereby a vacuum was pumped and the lower portion of the apparatus immersed in liquid nitrogen. The full-sized apparatus was assembled and tested both at room temperature and liquid nitrogen temperature.

**1,644. DESCRIPTION OF A MIRROR SYSTEM WITH 120° OF FIELD, FOR THE PHOTOGRAPHIC PHOTOMETRY OF EXTENDED CELESTIAL SOURCES**
**Dumont, R.**
***Revue d'Optique*, v. 38, no. 8, pp. 395–400, August 1959 (in French)**

The image formed by a concave spherical mirror is photographed by a conventional short focus camera. There is only a very small change of illumination over the entire field so that photographic photometry is possible. Practical details are given together with typical results. (*PA*, 1961, #5122)

**1,645. THE USE OF A PHOTOMETRIC SPHERE IN DIFFERENTIAL SPECTROPHOTOMETRIC MEASUREMENTS**
**Broun, Zh. L.**
***Optika i Spektroskopiya*, v. 7, no. 3, pp. 421–425, September 1959 (in Russian)**

The use of Ulbricht's photometric sphere in studies of chemical sensitization of photographic emulsions is described. The sphere was of 200-mm D, covered inside with a layer of magnesium oxide. It was used to obtain the impurity absorption spectrum of a photochemically colored silver bromide emulsion, with allowance for scattering of light. It was found that the absorption curves obtained with the sphere did not differ greatly from those obtained spectrophotometrically.

Scattering resulted in a displacement of the spectrophotometric curves compared with those obtained by means of the photometric sphere. The use of the sphere may be justified in cases where it is necessary to separate out absorption effects, particularly when scattering alters considerably during measurements. (*PA*, 1960, #8793)

**1,646. PHOTOMETRE POUR L'OBSERVATIONE DES SATELLITES ARTIFICIELS (PHOTOMETER FOR OBSERVING ARTIFICIAL SATELLITES)**
*La Nature*, no. 3295, p. 499, November 1959 (in French)
(*AI/S*, 1960, #20,432)

**1,647. MULTIPLE EXPOSURE PHOTOGRAPHIC PHOTOMETRY**
Hoag, A. A.
*Astronomical Journal*, v. 64, no. 9, pp. 410–414, November 1959

A multiple-exposure technique, employing separated photographic and photovisual exposures on the same plate, has been tested for use in galactic cluster photometry. Results, to a given accuracy in *B-V*, are achieved with less work than that required for conventional single exposures. A special emulsion is recommended, and photometric properties of the Naval Observatory's 40-in. reflector are discussed. (*AI/S*, 1960, #20,036)

**1,648. PHOTOGRAPHIC PHOTOMETRY OF A FLASH TUBE USING A HIGH-SPEED STREAK CAMERA**
Milne, G. G., Miller, N. D.
*Optical Society of America, Journal of the*, v. 49, no. 12, pp. 1213–1217, December 1959

The General Radio Strobolux unit triggered by a Strobotac has been used for visual threshold determinations. This photometric study was undertaken to provide information on the duration of the flash and the constancy of the total energy for successive flashes. By using a standardized ribbon filament lamp for a comparison source and four narrow-pass filters, the total energy per flash in absolute units was found for four spectral regions. A high-speed camera developed by O'Brien was used for the photographic record. A narrow slit illuminated by the Strobolux was imaged on a strip of 16-mm Super-XX film carried on the inner circumference of a drum mounted on the shaft of a vertical motor. When the drum was driven at 10,800 rpm, the exposure time on the film was 0.236 $\mu$sec. The film was calibrated by exposing a standard lamp through a stepped slit on the same record. The peak luminance through a 550-m$\mu$ interference filter is 7660 c/cm$^2$ of tube area. The duration of the flash is about 100 $\mu$sec, with 90 percent of the energy delivered in 41 $\mu$sec. (*PA*, 1960, #169)

**1,649. NEW CONSTANT-BRIGHTNESS PHOSPHORS FOR SPECTROPHOTOMETRY OF FAINT [CELESTIAL] OBJECTS. ENERGY DISTRIBUTION IN THE SPECTRUM OF THESE PHOSPHORS**
Pariiskii, N. N., Gindilis, L. M.
*Astronomicheskii Zhurnal*, v. 36, no. 3, pp. 539–543, 1959
(Translated from the Russian in *Soviet Astronomy—AJ*, v. 3, no. 3, pp. 524–528, December 1959)

Constant-brightness phosphors, with $\beta$-active activators and a continuous spectrum in a broad band of wavelengths (developed at the Luminescence Laboratory of the P. N. Lebedev Physical Institute of the USSR Academy of Sciences), should be useful in the absolute spectrophotometry of faint celestial objects. This paper reports a study of the energy distribution in the spectrum of such phosphors, activated with $Sr^{90}$ which has a half-life of 20 years. The visual brightness of the phosphors was 0.015 apostilb. The energy distribution in absolute units was investigated in the wavelength interval 4400 to 6400 Å, by comparison with the energy distribution in the spectrum of $\alpha$ Lyr and reference to the Sun through the stellar magnitudes of $\alpha$ Lyr and the Sun. The results were given in erg and quanta/cm$^2$/sterad/sec for the interval $\Delta\lambda$ = 1 cm. The brightness was of the order of 600 quanta/cm$^2$/sec for a solid angle of 1 deg$^2$ and an interval $\Delta\lambda$ = 1Å. (*PA*, 1960, #18,589)

**1,650. PHOTOMETRY OF IMAGE CONVERTORS (Presented at the Colloquium on Image Convertors and Image Storage Tubes, Heidelberg, Germany, April 28–29, 1958)**
Hansen, G.
*Sitzungsberichte der Heidelberger Akademie der Wissenschaften, Mathematisch—Naturwissenschaftliche Klasse*, no. 5, pp. 17–28. 1959 (in German)

By means of an image converter the luminance of an optical image can be increased in a calculable ratio. This principle may be applied to the photometry of optical instruments or to reduce the exposure needed to make a photograph. A description of the basic theory is given. The use of picture feedback is also described. An historical survey of the optical principle that no increase in the luminance of an object can be obtained by purely optical means is also given. (*PA*, 1961, #6947)

**1,651. INSTRUMENT PROFILE AND RESOLVING POWER OF THE 9 METRE SPECTROGRAPH**
Michard, R.
*Annales d'Astrophysique*, v. 22, no. 2, pp. 185–187, 1959 (in French)

The instrumental profile of the 9-m spectrograph has been found for usual working conditions by the spectrophotometry of iodine vapor absorption lines. The corresponding resolving power in the sense Abbe is $\lambda/\Delta\lambda$ = 445,000 (5th order), or 90 percent of the theoretical power. (*PA*, 1960, #18,587)

**1,652. THE VISUAL STELLAR MAGNITUDE OF THE SUN, MOON AND LUX**
Martynov, D. Ya.
*Astronomicheskii Zhurnal*, v. 36, pp. 648–661, 1959
(in Russian with English reference)

As a result of the exact photoelectric and spectrophotometric work done since 1938, a review of the apparent integral brightness of the Sun ($m_\odot$), the Moon ($m_\mathbb{C}$), and the international lux ($m_0$) is not only recommended but is actually a necessity in view of the great uncertainty of the international photovisual system (IPv) being used to date. The integral brightnesses were determined for three photometric systems: (1) the Zinner system, (2) the quasi-IPv system, on the basis of Kuiper's relation IPv − PD = $0.22^{mag}$ + 0.11C, and (3) the photoelectric V-system. The results appear in the sequence $m_\odot$, $m_\mathbb{C}$, $m_0$: (1) $-26.59^{mag}$, $-12.54^{mag}$, $-13.75^{mag}$; (2) $-26.76^{mag}$, $-12.68^{mag}$; (3) $-26.80^{mag}$, $-12.71^{mag}$, $-13.78^{mag}$. (*AJ*, 1959, #6883)

**1,653. INCREASE OF THE SENSITIVITY AND DIRECTIVITY OF RADIO INTERFEROMETERS**
**Sanamian, V. A., Tovmasian, H. M.**
**In "Paris Symposium on Radio Astronomy, July–August 1958," pp. 496–497**
**Bracewell, R. N., Editor**
**Stanford University Press, Calif., 1959**

Two techniques are described for increasing the effective time constant of an interferometer. One uses photographic integration and the other a resonant system with a natural frequency equal to that of the interference pattern. High resolution in declination is possible with the latter system. (*PA*, 1961, #18,140)

## *Jupiter — 1959*

**1,654. ANOMALOUS CONTINUUM RADIATION FROM JUPITER**
**Epstein, E. E.**
***Nature*, v. 184, no. 4679, p. 52, July 4, 1959**

Observations of Jupiter were made with the 60-ft Harvard radio telescope from May 16 to June 2, 1959. Continuum radiation in the 21-cm wavelength was found to vary with time by as much as a factor of 2 in a period of a few hours. Antenna temperatures seem to rule out thermal origin for this radiation.

**1,655. SPECTRUM OF JUPITER**
***Sky and Telescope*, v. 18, no. 10, p. 558, August 1959**

It was found that molecular hydrogen ($H_2$) is a constituent of Jupiter's atmosphere. (*AJ*, 1959, #8647)

**1,656. OBSERVATIONS OF JUPITER AND MARS AT 3-CM WAVE LENGTH**
**Giordmaine, J. A., Alsop, L. E., Townes, C. H., Mayer, C. H.**
***Astronomical Journal*, v. 64, no. 8, pp. 332–333, October 1959**
**(*AJ*, 1959, #8616)**

**1,657. JUPITER PHOTOGRAPHY WITH EYEPIECE ENLARGEMENT**
**Vlassov, J. P., Sotkin, I. T.**
***Vsesoiuznoe Astronomo-Geodezicheskoe Obshchestvo Biulleten*, Moscow, no. 24, pp. 45–52, 1959 (in Russian)**

A mirror reflex camera was mounted behind an intermediate eyepiece on an 8-in. Zeiss refractor and used to take a number of photographs of Jupiter. From these, the jovigraphic widths of various bands were determined in 1956, and a photometric section along the central meridian was obtained on May 4, 1956. (*AJ*, 1959, #8640)

**1,658. THE INTENSITY DISTRIBUTION IN THE METHANE ABSORPTION BANDS OF THE JUPITER DISC**
**Teifel, V. G.**
***Astronomicheskii Tsirkuliar*, no. 201, pp. 3–4, 1959 (in Russian)**

From spectrograms of the year 1958, the differences in intensity of the methane absorption bands at 5430 and 6190 Å for the equator, the northern equatorial band, and the central meridian of Jupiter were determined with reference to the neighboring centinuum (table). Within the measuring accuracy, the intensity distribution is independent of the disk position. Presumably, this is caused by the compensation of absorption processes in the cloud layers and the gas in the Jupiter atmosphere above it. The optical depths of the CN bands are estimated to be 0.05 (*AJ*, 1959, #8638)

**1,659. THE INTENSITY DISTRIBUTION ON THE JUPITER DISC IN THE METHANE ABSORPTION BANDS**
**Teifel, V. G.**
***Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia*, no. 1, pp. 93–104, 1959 (in Russian)**

From Jupiter spectra obtained in 1958, the intensity distributions are determined along the equator, the northern tropical band, and the central meridian in the 6190 and 5430 Å bands of $CH_4$. The distribution in these bands agrees with the continuous spectrum. (*AJ*, 1959, #8639)

## *Mars — 1959*

**1,660. MULTICOLOR PHOTOMETRY OF MARS IN 1958**
**de Vaucouleurs, G. H.**
***Planetary and Space Science*, v. 2, no. 1, pp. 26–32, October 1959**

Photoelectric observations of Mars in October and November 1958 at the Lowell Observatory give values of the stellar magnitude and integral albedo at five wavelengths from λ 3300 to λ 6900. In the near ultraviolet $3000 < \lambda < 4000$ Mars is "grey" and very dark, with a nearly constant albedo A = 0.046. Earlier Mount Stromlo and Flagstaff data are also discussed. (*PA*, 1961, #6700)

**1,661. FURTHER EVIDENCE OF VEGETATION ON MARS**
Öpik, E. J.
*Irish Astronomical Journal*, v. 5, p. 137, 1959
(*AJ*, 1959, #8445)

**1,662. THE COMPOSITION OF THE MARTIAN ATMOSPHERE**
Öpik, E. J.
*Irish Astronomical Journal*, v. 5, pp. 137–139, 1959
(*AJ*, 1959, #8446)

**1,663. LES TACHES SOMBRES DE MARS ET LES PREUVES SPECTRALES DE L'EXISTENCE DE COMPOSÉS ORGANIQUES. (THE DARK SPOTS OF MARS AND SPECTRAL EVIDENCE OF THE EXISTENCE OF ORGANIC COMPOUNDS)**
Guérin, P.
*La Nature*, v. 87, pp. 528–531, 1959
(*AJ*, 1959, #8425)

**1,664. RESULTS OF SPECTROPHOTOMETRIC MARS OBSERVATIONS MADE IN 1956 ON THE ASP-9 SPECTROGRAPH**
Koslova, K. I.
*Akademiia Nauk Kazakhskoi SSR, Trudy, Sektor Astrobotaniki*, v. 7, pp. 3–7, 1959 (in Russian)
(Abstracted in *Referationyi Zhurnal, Astronomiia i Geodeziia*, no. 8, pp. 78–79, 1959)
(*AJ*, 1959, #8435)

**1,665. PHOTOGRAPHIC PHOTOMETRY OF THE PLANET MARS WITH COLOR FILTERS DURING THE 1956 OPPOSITION**
Barabashov, N. P., Koval, I. K.
Kharkov Universitet, USSR, 1959 (in Russian)
(*AJ*, 1960, #8401)

**1,666. LES CALOTTES POLAIRES DE MARS (THE POLAR CAPS OF MARS)**
Geneslay, E., Dollfus, A.
*l'Astronomie*, v. 73, pp. 265–276, 1959

Geneslay computes the thermal radiation in the Martian south-polar region and compares a few observations of three perihelion oppositions with the computed melting and with data on the melting of snow in Northern Sweden. He concludes that the polar caps are snow, from a few centimeters to over 1 m in depth; the small remnant of the cap which survives the summer is glacier-like. Dollfuss notes that the low polarization of the caps is not produced by snow but rather by very fine ice crystals or, more probably, by crystals formed under low pressure and strong radiation; i.e., the surface of the polar caps does not correspond to any of the terrestrial frost and ice formations but can be explained in terms of Martian conditions. Here, sublimation of ice replaces melting. Mars has no liquid water; even the dark rim is not due to water (moisture saturation). The winter clouds of the poles consist of ice crystals, which are scattered up to the middle latitudes. Further Lyot polarimeter measurements are recommended. (*AJ*, 1959, #8423)

**1,667. FURTHER EVIDENCE OF VEGETATION ON MARS**
Sinton, W. M.
*Lowell Observatory Bulletin*, v. 4, pp. 252–258, 1959

Observations made during the 1958 opposition established the reality and distribution of strong absorption bands at 3.5. These bands are most probably produced by organic molecules. An analysis of the observations is presented.

**1,668. THE COLOR CHANGES OF MARS ACCORDING TO PHOTOELECTRIC OBSERVATIONS, 1958**
Koslova, K. I., Glagolevskii, J. V.
*Astronomicheskii Tsirkuliar*, no. 201, pp. 4–6, 1959
(in Russian)

From October 14–November 27, 1958, Mars was measured photoelectrically, with reference to $\alpha$ Aur, at effective wavelengths of 4200 and 5350 Å. The color index of the planet increased with increasing phase angle; the color excess reached a minimum at the time of opposition. (*AJ*, 1959, #8434)

**1,669. COLOUR INDEX OF MARS DURING THE 1958 OPPOSITION**
Teifel, V. G.
*Astronomicheskii Tsirkuliar*, no. 204, pp. 10–11, 1959
(in Russian)
(*AJ*, 1959, #8457)

**1,670. MARS FLARE REPORT**
McClelland, C. C.
*Strolling Astronomer*, v. 13, pp. 29–30, 1959
(*AJ*, 1959, #844)

**1,671. ÉTUDE PHOTOMÉTRIQUE DE LA VARIATION SAISONNIÈRE DE LA BRILLANCE DES RÉGIONS SOMBRES DE LA PLANÈTE MARS (PHOTOMETRIC STUDY OF THE SEASONAL VARIATION IN BRIGHTNESS OF THE DARK REGIONS OF THE PLANET MARS)**
Focas, J. H.
*Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, pp. 924–926, 1959

After the start of winter, the dark regions of the Mars floor become darker, in the direction from the poles to the equator, with a velocity of about 35 km/Mars-day. After crossing the equator, this process diminishes, and ceases by the end of summer at a latitude of about 22 deg in the other hemisphere. In all probability, this darkening is closely related to the overall diffusion of water vapor in the Mars atmosphere. (*AJ*, 1959, #8422)

## *Moon — 1959*

1,672. THE THERMAL RADIATION OF THE MOON AT 1420 Mc/s
Mezger, P. G., Strassl, H.
*Planetary and Space Sciences*, v. 1, no. 3, pp. 213–226, August 1959

Measurements of the thermal radiation of the Moon at 1420 Mc have been made with the continuum receiver of the 25-m radio telescope of Bonn University. The measurements cover about three lunations (April 30 to July 22, 1958). The observations and their reduction are described in detail. It is found that—within the working accuracy of about ±2 percent relatively—the radiation temperature of the Moon at 1420 Mc shows no variation with the phase of the Moon. This may be explained by the fact that the observed radiation has its origin at some depth underneath the Moon's surface where the periodic variations of heating from the Sun have become insignificant. The mean value of the radiation temperature at 1420 Mc is found to be 250.2 deg with an estimated absolute uncertainty of about ±12 percent. (*PA*, 1961, #6697)

1,673. LIUMINESTSENTSIIA LUNNOI POVERKHNOSTI I INTENSIVNOST KORPUSHULIER NOGO IZLUCHENIIA SOINTSA (LUMINESCENCE OF THE LUNAR SURFACE AND THE INTENSITY OF THE SOLAR CORPUSCULAR RADIATION 1956)
(Translated from *Akademiia Nauk SSSR, Krymskaia Astrofizicheskaia Observatoria, Izvestiia*, v. 16, pp. 148–158, 1956)
Kozyrev, N. A.
Miller, J., Translator
August 1959
American Meteorological Society, Boston, Mass.
T-R-222, AF 19(604)-1936
AD-252,312
(Also available as AI/Translation 18, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, January 15, 1961)

Luminescence of the Aristarchus-Herodotus was established and measured; however, other investigations of details of the lunar surface have not disclosed any luminescence. These and other measurements indicate the existence of two belts: 3000 Å maximum ultraviolet and 4300 Å maximum blue. A luminescence of Aristarchus which exceeded normal by four times was observed on October 4, 1955. This increased luminescence was explained by the activity of a corpuscular flux from the Sun on the surface of the crater. From this, the concentration of protons in the flux near the Moon was determined as $5 \times 10$ particles cm$^2$. These observations, in the absence of luminescence on the dark side of the lunar surface, indicate that the Moon has no magnetic field. Assumptions on the nature of the lunar system are described. (*AI/A*, 1961, #3283)

1,674. THE LUNAR BRIGHTNESS DISTRIBUTIONS AT 4.3-MM WAVE LENGTH
*Astronomical Journal*, v. 64, no. 8, p. 326, October 1959
(*AJ*, 1959, #8306)

1,675. POLARIZATION OF LIGHT OF MOON AND PLANETS
*Sky and Telescope*, v. 19, no. 1, pp. 17–18, November; (corrections) no. 2, p. 94, December 1959
(*AJ*, 1959, #8125)

1,676. DISTINCTIVE FEATURES OF SPECTROPHOTOMETRIC STUDIES OF THE LUNAR SURFACE
Lipskii, Yu. N.
*Astronomicheskii Zhurnal*, v. 36, no. 2, pp. 322–326, 1959
(Translated from the Russian in *Soviet Astronomy—AJ*, v. 3, no. 2, March–April 1959)

In most cases of spectrophotometric investigations of the lunar surface, one has to deal with partially polarized light. It is important to note that not only the degree of polarization but also the orientation of the polarization plane can vary from one region of the lunar surface to another. Formulae for the spectrophotometric comparison of two areas of the lunar surface (each area considered as a source of light characterized by intensity, degree of polarization, and position angle of the polarization plane) are derived. (*AJ*, 1959, #8395)

1,677. COLOR CONTRASTS OF THE LUNAR SURFACE
Barabashov, N. P., Yeserskii, V. I., Fedorets, V. A.
*Astronomicheskii Zhurnal*, v. 36, no. 3, pp. 496–502, 1959
(Translated from the Russian in *Soviet Astronomy—AJ*, v. 3, no. 3, pp. 484–489, December 1959)

The photographic spectrophotometric method was employed for investigating the spectral reflecting properties of details of the lunar surface. The color contrasts in the usual system of color indexes are $0.^m2-0.^m3$. In the majority of cases, the relation between $\Delta CI$ and $\Delta \log I_{550}$ is close to linear, $(\Delta CI/\Delta \log I_{550})$ being $\cong 0.6$. (*PA*, 1960, #18,695)

1,678. PHOTOMETRIC PROPERTIES OF LUNAR CRATER FLOORS
*Recherches Astronomiques de l'Observatoire d'Utrecht*, v. 14, pt. 2, 1959

Photographic integral photometry of 38 crater floors at different phases of the Moon is presented. The phase law with its typical maximum at or near full Moon (for bright, irradiated craters), which is in good agreement with earlier observations, cannot be represented by simple scattering laws of the lunar surface. It is, however, reproduced well by a porous structure of the Moon's surface if one agrees with Bennet's assumption that ⅔ of the surface, scattering according to Lambert's law, is occupied by semi-ellipsoidal holes with depth three times greater than radius. A slight improvement can be

made by taking into consideration a similar scattering of the inner wall. In confirmation of illumination experiments on profilated model surfaces, but in contrast to volcanic ash and glass beads, a loose layer of the Cladonia Rangiferina range scatters in a manner similar to the lunar surface. Accordingly, the great depth of the Bennet holes does not contra-indicate the assumption of Sytinskaya and Scharonov according to which the lunar surface has an overall slag-like, porous structure produced by micrometeorite impacts which may possibly be covered by a layer of ash. An increase of the porous area to 75 percent of the surface results in a satisfactory representation of the crater rays. The profile of the pores, which disagrees with Baldwin's law, causes the author to seek its dimensions in the centimeter or millimeter region. However, even a spongy covering of the lunar surface, with photoelectrically charged dust particles, appears possible. (*AJ*, 1959, #8381)

### 1,679. ON THE SPECTRAL-POLARIZATION CHARACTERISTICS OF THE LUNAR SURFACE

**Teifel, V. G.**
***Astronomicheskii Tsirkuliar*, no. 205, pp. 7–8, 1959 (in Russian)**

One hundred and eight spectrograms of 12 lunar regions, obtained in June–July 1959 with the use of a polarization filter, indicated a decrease in degree of polarization of 5–7 percent in the interval $\lambda = 400$ to 6200 Å with increasing wavelength. If the wavelength degree of polarization is integrated with the mean albedo values for 4300 and 5600 Å (per L. N. Radlova), using the formula $\Delta P\lambda = P_{5600} - P_{4300} = -1.95\ (\bar{A}_{5600} - \bar{A}_{4300})$ then the observations yield $\Delta P\lambda = -0.01$ to $-0.05$, which is compatible with the values of $-0.03$ for maria and $-0.07$ for continents. (*AJ*, 1959, #83, 102)

### 1,680. COMPARISON OF THE CATALOGUES OF LUNAR SURFACE REFLECTIVITY

**Yeserskaya, V. A., Yeserskii, V. I.**
***Astronomicheskii Tsirkuliar*, no. 205, pp. 10–11, 1959 (in Russian)**

The comparison is based on the catalogs of Sytinskaya-Sharonov and Fedorez, whose photometric systems contain slight differences. (*AJ*, 1959, #8390)

### 1,681. ROCK FORMATIONS WHICH MOST CLOSELY CORRESPOND TO THOSE OCCURRING ON THE LUNAR SURFACE

**Barabashov, N. P., Chekirda, A. T.**
***Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia*, no. 1, pp. 5–39, 1959 (in Russian)**

The investigation described is based on the authors' photometric and spectrophotometric measurements of lunar and terrestrial rocks, and other features. The results of numerous and diverse methods of investigation indicate that the lunar surface does not resemble a fusion crust. It can best be compared with a covering of crushed volcanic calcareous tufa or, in some places, with coarse-grained volcanic ash. (*AJ*, 1959, #8374)

### 1,682. AN EXPERIMENT IN PHOTOGRAPHIC POLARIMETRY OF THE MOON WITH LIGHT FILTERS

**Barabashov, N. P., Koval, I. K.**
***Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia*, no. 1, pp. 55–58, 1959**

According to photographic polarization measurements, the majority of the lunar formations have the greatest degree of polarization in the blue; only a few have it in the red. (*AJ*, 1959, #8375)

### 1,683. SPECTROPHOTOMETRY OF LUNAR FORMATIONS

**Sergeva, A. N.**
***Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia*, no. 1, pp. 59–66, 1959 (in Russian)**

The tentative results reported here indicate that color contrasts are lacking in most cases and only rarely reach 20 percent. In comparison with the maria, craters and mountainous regions are reddish; only in two instances did maria appear reddish. (*AJ*, 1959, #83,101)

### 1,684. THE PHOTOMETRIC HOMOGENEITY OF THE LUNAR SURFACE

**Barabashov, N. P., Yeserskaya, V. A., Yeserskii, V. I., Ishutina, T. I.**
***Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia*, no. 1, pp. 67–69, 1959 (in Russian)**

On the basis of data on the reflectivity of lunar formations given in Fedorez' catalog and lunar photographs measured specifically for this purpose, the lunar surface is shown to be photometrically homogeneous to a high degree; i.e., that on the average, it possesses a uniform degree of polarization. (*AJ*, 1959, #8376)

### 1,685. THE PROBABLE EXTENT OF THE UNEVENNESS OF THE MICRORELIEF OF THE LUNAR SURFACE

**Sytinskaya, N. N.**
***Akademiia Nauk USSR, Komissii po Fizike Planetnii, Izvestiia*, no. 1, pp. 81–84, 1959**
**(Translation available as Translation Series 65, R-9990-6037-NU-000, Space Technology Laboratories, Inc., Los Angeles, Calif.; AID 62-141 (supplement to AID 62-4), AD-285,340, Library of Congress, Aerospace Information Division, Washington, D.C.; and through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

An evaluation is made of the dimensions of microfeatures of the lunar surface by comparing the characteristics of radiation reflected by the lunar surface in the optical range

(considerable roughness) with that in the decimeter range (specular reflection). Mean dimensions of roughness appear to be on the order of several millimeters or centimeters.

1,686. SPEKTRALAUFNAHMEN WÄHREND DER TOTALEN MONDFINSTERNIS 1957 MAI 13/14 (SPECTROPHOTOGRAPHS TAKEN DURING THE TOTAL LUNAR ECLIPSE OF MAY 13–14, 1957)
Haage, D. H.
*Mitteilungen der Archenhold-Sternwarte*, Berlin-Treptow, no. 51, pp. 5–7, 1959
(*AJ*, 1959, #8357)

1,687. SILBERKUGELPHOTOMETRIE DER TOTALEN MONDFINSTERNIS 1957 MAI 13/14 (SILVER-SPHERE PHOTOMETRY OF THE TOTAL LUNAR ECLIPSE OF MAY 13–14, 1957)
Herrmann, D.
*Mitteilungen der Archenhold-Sternwarte*, Berlin-Treptow, no. 51, pp. 7–9, 1959
(*AJ*, 1959, #8357)

1,688. PHOTOMETRIE DER TOTALEN MONDFINSTERNIS 1957 MAI 13/14 IN DREI SPEKTRALBEREICHEN (PHOTOMETRY OF THE TOTAL LUNAR ECLIPSE OF MAY 13–14, 1957 IN THREE SPECTRAL REGIONS)
Libuda, G.
*Mitteilungen der Archenhold-Sternwarte*, Berlin-Treptow, no. 51, pp. 9–11, 1959
(*AJ*, 1959, #8357)

1,689. DAS ASCHGRAUE MONDLICHT (THE ASH-GRAY MOONLIGHT)
Schröder-Rönneback, W.
*Mitteilungen für Planetenbeobachter*, v. 12, pp. 10–11, 1959
(*AJ*, 1959, #8329)

1,690. POURQUOI LA LUNE NOUS PARAÎTELLE PLUS GROSSE À SON LEVER QU'A SON POINT CULMINANT? (WHY DOES THE MOON APPEAR LARGER TO US AT ITS RISING THAN AT ITS CULMINATING POINT?)
*Orion Schaffhausen*, v. 5, p. 723, 1959
(*AJ*, 1959, #8344)

## *Saturn—1959*

1,691. PHOTOMETRIC MEASUREMENTS OF SATURN AND OF ITS RING
Camichel, H.
*Annales d'Astrophysique*, v. 21, no. 5, pp. 231–242, September–October 1959 (in French)

The results of photometric measurements made on photographs of Saturn obtained at the Pic du Midi Observatory since 1943 are presented. They give the brightness of the three rings and of the Saturn belts, the brightness of the equatorial zone being taken as unity. It is found that the brightness of $B$ decreases with its aperture; there are also brightness variations along the rings. (*PA*, 1960, #4880)

1,692. ATTEMPT AT SPECTROPHOTOMETRY OF SATURN
Teifel, V. G., Teifel, J. A.
*Akademiia Nauk Kazakhskoi SSR, Trudy, Sektor Astrobotaniki*, v. 7, pp. 64–68, 1959 (in Russian)
(Abstracted in *Referativnyi Zhurnal, Astronomiia i Geodeziia*, no. 2, pp. 59–60, 1961)
(*AJ*, 1960, #8722)

## *Uranus—1959*

1,693. THE ALBEDOS AND PHASE VARIATIONS OF URANUS AND NEPTUNE
Sinton, W. M.
THE STUDY OF THE VARIABILITY OF SOLAR ENERGY OUTPUT
Johnson, H. L., Sinton, W. M., Iriarte, B.
April 1959
Lowell Observatory, Flagstaff, Ariz.
Scientific Report 1, AFCRC-TN-59-273
AD-213,854

The photoelectric observations of Uranus and Neptune made over a number of years at the Lowell Observatory have been used to test the phase variation of these planets calculated by R. L. Talley and H. G. Horak. It is supposed that Rayleigh scattering is of prime importance, and that the albedo is very high. However, for ease of calculation isotropic scattering is assumed. In the range of phase angles observable on Uranus and Neptune (0 to 3.1 and 0 to 1.9 deg, respectively), their computations exhibit a quadratic dependence on angle. The relation $\phi\ (\alpha) = 0.00020\ \alpha^2$ agrees with the calculated values within 0.0001 mag for the phase angles from 0 to 8 deg. Thus, the expected total variation of Uranus is 0.002 mag and that of Neptune is only 0.0007 mag.

A comprehensive analysis of the complete data that have been collected by the Lowell Observatory's Solar-Variations Project during the last six years is presented. An increase of about two percent in the solar constant has been found to have occurred during the last six years. (*AI/A*, 1962 #5091)

## *Venus—1959*

1,694. THE AIRGLOW OF VENUS
Newkirk, G., Jr.
*Planetary and Space Science*, v. 1, no. 1, pp. 32–36, January 1959

Low dispersion, high-speed spectra of the unilluminated portion of Venus show emission features at 4415 and 4435 Å which agree in position with those found by Kozyrev (*Izvestiia Krymskoi Astrofizicheskoi Observatori*, USSR, v. 12, p. 169, 1954). Kozyrev's other emission bands are not corroborated by these spectra. A previously unreported emission

band may be present at 4505Å. The radiance of the emission bands centered at 4420 Å is about eighty times that of the 5577 Å line of the terrestrial airglow. It is unknown whether the emission from the dark side of Venus is of airglow or auroral character. (*PA*, 1961, #6699)

1,695. SPECTRUM OF VENUS IN THE VIOLET AND NEAR-ULTRAVIOLET
Heyden, F. J., Kiess, C. C., Kiess, H. K.
*Science*, v. 130, no. 3383, p. 1195, October 30, 1959

Recent observations, at the Georgetown College Observatory, of the spectrum of the planet Venus, with spectrographs of low and high dispersion, show that a wide, continuous absorption band is present in the violet and near-ultraviolet. The band begins near wavelength 4500 Å and extends to the short-wavelength limit of the spectrograms near 3800 Å. It is similar in structure to the strong absorption, reported by others, for gaseous nitrogen tetroxide. (*AJ*, 1959, #8213)

1,696. RADIO ECHO OBSERVATIONS OF VENUS
Evans, J. V., Taylor, G. N.
*Nature*, v. 184, no. 4696, pp. 1358–1359, October 31, 1959
(*AI/S*, 1960, #20,664)

1,697. THE CLOUDS OF VENUS
Briggs, M. H.
*Observatory*, v. 79, pp. 20–22, 1959

A theory of the chemical nature of the clouds of Venus is reported, based on the analysis of results of radiometric, ultraviolet, and spectral observations.

1,698. IPOTESI SULLA FORMAZIONE DELL'ATMOSFERA DI VENERE (THEORY OF THE FORMATION OF THE ATMOSPHERE OF VENUS)
Guerrini, D.
*Astronautica*, v. 8, pp. 251–253, 1959
(*AJ*, 1959, #8212)

1,699. THE ATMOSPHERE OF VENUS
*Astronomical Society of Victoria, Journal of the*, v. 12, p. 104, 1959
(*AJ*, 1959, #8234)

1,700. SPECIAL VENUS STUDY
*Strolling Astronomer*, v. 13, p. 46, 1959
(*AJ*, 1959, #8240)

1,701. VENUS IN THE ULTRAVIOLET
Smith, B. A.
*Strolling Astronomer*, v. 13, pp. 91–94, 1959
(*AJ*, 1959, #8226)

1,702. THE "ASHEN LIGHT" OF VENUS
*Strolling Astronomer*, v. 13, p. 96, 1959
(*AJ*, 1959, #8241)

1,703. VENUS—DICHOTOMIE (VENUS—DICHOTOMY)
*Monatsschrift für Österreichs Amateurastronomen—Der Sternenbote*, v. 2, p. 88, 1959
(*AJ*, 1959, #8239)

1,704. AIRGLOW OF VENUS
*Sky and Telescope*, v. 18, p. 368, 1959
(*AJ*, 1959, #8236)

1,705. LA ROTATION DE VÉNUS (THE ROTATION OF VENUS)
*Gazette Astronomique*, v. 41, p. 24, 1959
(*AJ*, 1959, #8233)

## *General—1960*

1,706. A NEW WIDE-BAND RECORDING SPECTRORADIOMETER
Wiland, J. N.
February 1960
Frankford Arsenal, Philadelphia, Pa.
Memorandum Report N60-20-1
AD-259,011 (ASTIA does not furnish copies.)

The simulation of solar radiation requires the accurate measurement of the spectral distribution and intensity of the radiation source. In order to determine that a test specimen receives radiant energy comprised of the proper percentages of ultraviolet, visible, and infrared radiation as found in natural sunlight, an instrument is required which will accurately measure the spectral distribution and intensity of radiation from less than 2900 Å units to at least 25,000 Å units. The described recording spectroradiometer measures and records the energy intensity for every band of 100 Å width between 2200 Å units and 25,000 Å units and draws a continuous curve of the intensity versus wavelength with uniform sensitivity response throughout the entire wavelength range of the instrument. An integrating counter converts the area under the curve into total watts/ft$^2$ for any wavelength band selected. The measurement of any source of radiation within the range of the instrument is discussed, and several sample curves are presented.

1,707. ON THE FOUNDATIONS OF GONIOPHOTOMETRY
Spencer, D. E., Gray, S. M.
*Illuminating Engineering*, v. 55, no. 4, pp. 228–234, April 1960

A method is described for extending the concepts of reflectance and transmittance to surfaces that cover the entire range from perfectly specular to perfectly diffusing. Whereas present goniophotometric measurements depend on both the characteristics of the sample and the characteristics of goniophotometer, the proposed system is believed to measure reflecting and transmitting characteristics of the sample, irrespective of details of construction of the goniophotometer. (*EEA*, 1960, #4902)

**1,708. A WOLLASTON PHOTOMETER**
Gehrels, T., Teska, T. M.
*Astronomical Society of the Pacific, Publications of the,* v. 72, pp. 115–122, April 1960

A description, with constructional details, is given of a new photoelectric polarization-photometer designed for use with the 82-in. telescope of the McDonald Observatory, Texas. The instrument was designed to operate at a series of wavelengths in the range 3500–9900 Å. A quartz depolarizer is employed giving substantially 100 percent performance at all wavelengths. The Wollaston prism, 1.05-in. D, is made of calcite cemented with butyl methacrylate to give full transmission down to 2900 Å. Divergences of ordinary and extraordinary rays are, respectively, 12.9 and 11.2 deg at 3500 Å, and 10.4 and 9.3 deg at 10,000 Å. The polarization measurements are not affected by the presence of thin clouds. (*PA*, 1960, #16,515)

**1,709. WIDE-BAND RADIOMETER**
Basov, N. G., Karlov, N. V.
*Radiotekhnika i Elektronika,* v. 5, no. 4, pp. 676–677, April 1960 (in Russian)

A molecular system having three discrete energy levels, such as the system of energy levels of electron spins of a paramagnetic crystal placed in a magnetic field, is proposed for radiometric purposes. A practical system with typical numerical values is considered. (*PA*, 1962, #7459)

**1,710. RADAR TECHNIQUES STUDY SEMIANNUAL TECHNICAL SUMMARY REPORT TO THE ADVANCED RESEARCH PROJECTS AGENCY**
January 1–June 30, 1960
Massachusetts Institute of Technology, Lincoln Laboratory, Lexington
Semiannual Report, AF 19(604)-5960
AD-246,910

The work reported can be divided into the following categories: radiometry, detection of signals in nongaussian noise, sequential detection, decision theory and multiple sensors, radar measurement of range, velocity and acceleration, delay-line analog-signal-processing techniques, pulse coding, and scattering from rotating bodies.

**1,711. A NEW DESIGN OF A DIFFERENTIAL PHOTOMETER FOR A SOLAR MAGNETOGRAPH**
Kotlyar, L. M.
*Astronomicheskii Zhurnal,* v. 37, no. 3, pp. 469–475, May–June 1960
(Translated from the Russian in *Soviet Astronomy—AJ,* v. 4, no. 3, pp. 445–450, November–December 1960)

This instrument differs from the existing types in that one photomultiplier is used instead of two, and that there is auxiliary modulation of the light beam by means of an electro-optical crystal modulator. Analytical expressions describing the process of transformation of the light beam in the instrument are given. (*PA*, 1961, #17,989)

**1,712. THE INFRARED REFLECTIVITY OF A PLANETARY ATMOSPHERE**
Goldstein, J. S.
*Astrophysical Journal,* v. 132, no. 2, pp. 473–481, September 1960

The reflectivity equation for a non-homogeneous stratified atmosphere is solved by an iteration procedure. This method of solution permits averaging over frequency in a straightforward manner suitable for use in the infrared absorption bands, where the exponential law of attenuation does not hold for detectors of finite bandwidth. The emission of such an atmosphere is also shown to be expressible in terms of the measured attenuation function. The separate consideration of emission and scattering will be valid only in a limited spectral region.

**1,713. PHOTOELECTRIC PHOTOMETRY IN ASTRONOMICAL STUDIES**
Wood, F. B.
*Science,* v. 132, pp. 1123–1127, October 21, 1960

This is a review article. (*PA*, 1960, #18,595).

**1,714. RESEARCH, DESIGN, AND CONSTRUCTION OF A MISSILE-BORNE RADIOMETER**
Dana, E. K., Zernike, F., Jr.
October 31, 1960
Block Associates, Inc., Cambridge, Mass.
Scientific Report 2, AFCRL-TN-60-681, AF 19(604)-5738
AD-263,416
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

A rocket-borne filter radiometer is described which was designed and constructed to study the infrared spectra of various extended sources. The theory of operation, some specific design considerations, and the problem of making the instrument small, lightweight, and rugged are discussed.

**1,715. THE NEW SCIENCE OF ASTRO-BOTANY**
Bazykine, V.
*South African Journal of Science,* v. 56, no. 10, pp. 229–231, October 1960

Observations of the optical properties of surface areas of the planet Mars have led to new theories concerning planetary vegetation, climate, and atmosphere. (*AI/S*, 1961, #40,024)

**1,716. AN INVESTIGATION INTO THE SEASONAL CHANGES OF ALBEDO AS DERIVED FROM EARTHSHINE OBSERVATIONS (Presented at the 106th Meeting of the American Astronomical Society, Mexico City, August 22–25, 1960)**
Bakos, G. A. (Smithsonian Astrophysical Observatory, Cambridge, Mass.)
*Astronomical Journal,* v. 65, no. 9, p. 482, November 1960 (Abstract)

A double-image photometer is designed in such a way that the Earth's albedo may be found through the ratios of the illuminations of the Moon by the Sun and by the Earth. (*AI/S*, 1961, #30,031)

**1,717. A RADIOMETER FOR HYDROGEN-LINE EXTRA-GALACTIC STUDIES AND FOR CONTINUUM OBSERVATIONS**
**Davies, R. D., Jennison, R. C.**
***Jodrell Bank Annals*, v. 1, no. 6, pp. 351–362, November 1960**

A hydrogen line spectrometer used on the Jodrell Bank 250-ft radio telescope for the investigation of the extragalactic and intergalactic absorption spectra of Cygnus-A is described. This spectrometer was designed to scan a wide range of frequencies and used a switched reference channel spaced 6 Mc from the signal channel. The instrument was also used as a narrow-band spectrometer for galactic absorption measurements and as a straight radiometer for total power investigations of selected objects. The aerial beam pattern is analyzed to provide estimates of the brightness temperature and the flux density of continuum sources. (*PA*, 1961, #2664)

**1,718. RESEARCH ON THE DETECTION OF FAR INFRARED RADIATION**
**Curtis, B. R.**
**December 1, 1960**
**Thompson Ramo Wooldridge, Inc., Canoga Park, Calif.**
**Final Report, AFCRL-TR-60-4351, AF 19(604)-5222**
**AD-250,112**

Research is presented on the study, design, and construction of equipment for the measurement of thermal radiation in the 3-mm (3000 $\mu$) region of the electromagnetic spectrum. The radiometer constructed is described. The design incorporates techniques for the measurement of both the absolute intensity and the polarization of radiation received from various objects. Experimental tests and investigations of the feasibility of the design are also presented.

**1,719. PROGRESS OF RADIOMETRIC OBSERVATION OF INFRARED ATOMIC EMISSION SPECTRA**
**Humphreys, C. J. (Naval Ordnance Laboratory, Corona, Calif.)**
***Optical Society of America, Journal of the*, v. 50, no. 12, pp. 1171–1175, December 1960**

This article calls attention to new investigations that have been completed since the last summary report in 1956 or are now in progress, and provides a systematic presentation of the status of all atomic spectra with reference to the availability of experimental data obtained by radiometric methods in the extraphotographic infrared region.

**1,720. MEASUREMENTS WITH A SPECTRAL RADIOMETER**
**Ginsburg, N., Fredrickson, W. R., Paulson, R.**
***Optical Society of America, Journal of the*, v. 50, no. 12, pp. 1176–1186, December 1960**

An $f/2.5$ spectral radiometer, consisting of telescope and monochromator mounted on a movable head, is described. By comparison with a blackbody standard and appropriate calibration, spectral radiances can be obtained in watts/cm$^2$-$\mu$-sterad. Observation on many targets indicates a nearly identical radiance for all. Space scans at a given wavelength do give target distinguishability, however, and a discussion of possible cause is given. Rapid variations in radiance have been observed, and are still being investigated. (*PA*, 1961, #1840)

**1,721. AN AIRBORNE SPECTRORADIOMETER**
**Mundie, L. G., Brown, D. E., Hasell, P. G., Jr., Lowe, D. S.**
***Optical Society of America, Journal of the*, v. 50, no. 12, pp. 1187–1192, December 1960**

A system is described for acquiring spectroradiometric data concerning objects in space from an airborne platform. The system operates in the 0.25- to 15-$\mu$ spectral region; large collecting optics, precise optical tracking, and background discrimination in the entrance optics permit the acquisition of high resolution and sensitivity. Through the use of reflective choppers, dichroic filters, and multiple exit slits, five types of data are acquired simultaneously; these include spectral data in the regions 0.25 to 0.6 $\mu$, 0.6 to 5 $\mu$, and 5 to 15 $\mu$, and radiometric data in the regions of 0.25 to 0.6 $\mu$, and 0.6 to 15 $\mu$. Calibration techniques are described. (*PA*, 1961, #1841)

**1,722. WIDE-ANGLE PHOTOELECTRIC INTEGRATING FLASHMETER**
**Edwards, J., Lane, W. R., Stone, B. R. D.**
***Journal of Scientific Instruments*, v. 37, no. 12, pp. 452–454, December 1960**

The design, construction, and calibration of a compact, portable, battery-operated photoelectric integrating photometer, for measuring very low levels of luminous energy incident on a surface from a distant light flash at night, are discussed. The instrument has linear response and on its most sensitive range gives full-scale deflection for an exposure of 0.004 lux-sec. (*EI*, 1961)

**1,723. THERMAL RADIATION MEASUREMENTS FROM AN AEROBEE-HI RESEARCH ROCKET**
**Hunter, R. E., Walker, R. G.**
**December 1960**
**Air Force Cambridge Research Center, Geophysics Research Directorate, Bedford, Mass.**
**GRD Research Note 34, AFCRL-TN-60-403**

A series of small rocket-borne radiometers and spectometers were installed for one static firing and two launchings aboard *Aerobee-Hi* research rockets. Performance characteristics were

determined and are discussed, plus design requirements for advanced instrumentation. The radiating characteristics of the plume were measured as a function of altitude, and the plume spectral radiance and modulation spectra are presented.

**1,724. THEORY OF THE ACCURACY OF WEDGE DENSITY MATCHING OF LOGARITHMICALLY SECTORED SPECTRA**
Green, M. (Army Signal Research and Development Laboratory, Fort Monmouth, N.J.)
*Applied Spectroscopy*, v. 14, pp. 91–94, 1960

An elementary theory on the accuracy of wedge-density matching for logarithmically sectored spectra is given. The results of the theory show that, other things being equal, the fractional error, as a result of wedge-density matching, in the measurement of intensity ratios of line pairs varies inversely as the intensity scale gamma of the emulsion employed, and within limits, is independent of both the magnification of the spectrum and the sector constant.

**1,725. PHOTOGRAPHIC PHOTOMETRY OF LARGE AREAS**
Lau, E., Hess, G.
*Monatsberichte der Deutschen Akademie der Wissenschaften su Berlin*, v. 2, no. 11, pp. 678–679, 1960 (in German)

A method is described in which the photograph is taken through a raster. Typical applications to astronomy are shown. (*PA*, 1961, #18,560)

**1,726. THE PHOTOELECTRIC PHOTOMETER OF THE TURIN ASTRONOMICAL OBSERVATORY**
Cocito, G., Masani, A.
*Memoire della Società Astronomica Italiana*, v. 31, no. 1, pp. 135–145, 1960 (in Italian)

The photoelectric photometer attached to the 30-cm Merz refractor of the Observatory of Turin is described. The spectral response curve for the 19-dynodes Lallemand multiplier phototube is plotted with the spectral transmission curve for the filters. A subsidiary apparatus for achieving the photon counting is also described. (*PA*, 1960, #18,586)

**1,727. CLASSICAL FORMULA FOR COLOUR TEMPERATURE**
Romano, G.
*Memoire della Società Astronomica Italiana*, v. 31, no. 2–3, pp. 369–370, 1960 (in Italian)

The expression $T = 7200/(0.64 + I)$ for the color temperature ($T$) of a star in terms of its color index ($I$) can be derived from the Wien expression connecting spectral intensities at two effective wavelengths, 0.425 and 0.529 mμ, taking the color index and the color temperature of the Sun as 0.57 and 6000°K, respectively. (*PA*, 1961, #2635)

**1,728. PHOTOELECTRIC PHOTOMETRY**
Braddick, H. J. J.
*Reports on Progress in Physics*, v. 23, pp. 154–175, 1960

Recent developments in photoelectric devices and their uses are described. Examples of special applications as well as forty-four references are included. (*EI*, 1961)

**1,729. RECTIFICATION OF PHOTOELECTRIC SPECTROMETER**
Ostrowski, K. W.
*Acta Physica Polonica*, v. 19, no. 3, pp. 319–327, 1960

Formulae are derived for the tolerances in focusing and slit inclination. A practical method of adjusting slit inclination using a Hartmann diaphragm is described. The permissible height of the exit slit is calculated for both linear and curved slits. For photoelectric photometry, these results show that high slits and high 45-deg prisms have an advantage. (*PA*, 1961, #12,989)

**1,730. A LIMIT ON THE ACCURACY OF PHOTOGRAPHIC RADIOMETRY**
Eyer, J. A.
*Applied Spectroscopy*, v. 14, no. 1, pp. 4–7, 1960

The granular nature of the photographic emulsion places a limit on the accuracy with which the density of a small area on the film can be defined. This in turn limits the accuracy with which incident exposures can be calculated when, for example, a spectrograph is employed for radiometric measurements. The quantity of information conveyed by a single density measurement is estimated for a particular emulsion and microdensitometer scanning aperture. (*PA*, 1960, #6931)

**1,731. A NOTE ON THE "EFFECTIVE GREY-SPHERE TEMPERATURE" AND "EFFECTIVE BOLOMETRIC ALBEDO" OF PLANETARY BODIES**
Firsoff, V. A.
*British Astronomical Association, Journal of the*, v. 70, pp. 131–134, 1960

It is stated that the surface temperature of an atmosphered body cannot be deduced directly from radiometric data unless the thermal properties of its atmosphere are known and properly understood. In the case of the Earth, the effective grey-sphere temperature is 38°C below the mean temperature of the surface. The method described is applied to the Martian atmosphere.

### *Jupiter — 1960*

**1,732. SPECTRUM OF JUPITER**
*Science*, v. 132, p. 885, 1960
(*AJ*, 1960, #8652)

**1,733. INTENSITY OF ABSORPTION BAND $CH_4$ 6190 A IN JUPITER'S SPECTRUM IN 1959**
Teifel, V. G.
*Astronomicheskii Tsirkuliar*, no. 210, pp. 11–14, 1960 (in Russian)
(*AJ*, 1960, #8637)

1,734. SPECTROPHOTOMETRY OF THE EQUATORIAL REGION OF JUPITER IN 1959
Teifel, V. G.
*Astronomicheskii Tsirkuliar*, no. 215, pp. 7–9, 1960
(in Russian)
(*AJ*, 1960, #8638)

1,735. LA FORMATION DES BANDES DE JUPITER (THE FORMATION OF THE BANDS OF JUPITER)
Cortesi, S.
*l'Astronomie*, v. 74, pp. 63–70, 1960
(*AJ*, 1960, #8612)

## Mars — 1960

1,736. RADIOMETRIC OBSERVATIONS OF MARS
Sinton, W. M., Strong, J.
*Astrophysical Journal*, v. 131, no. 2, pp. 459–469, March 1960

Radiometric temperature measurements of Mars were made with the 200-in. reflector in 1954. The radiometry utilized filters that isolate bands of radiation within the 8- to 13-$\mu$ "window." This broadband radiometry was augumented with spectra obtained with moderately good resolution with a grating spectrometer. The temperature of Mars at the center of the disk was found to be 15°C. Scans across the planet providing good S/N ratios were made with an aperture as small as 1.5-sec D. Several interesting phenomena were found and correlated with their appearance on photographs. The temperature of a yellow cloud, which appears on photographs taken by others, was −25°C. Dark areas were a few degrees warmer than adjacent bright regions. From several of the scans the diurnal temperature variation was determined, and this has been compared with that derived from the theory of surface heat conduction. It is found that no choice of the thermal constants will give agreement in both phase lag and amplitude simultaneously. The reason appears to be the presence of the Martian atmosphere, which is ignored in the theory. The bands of carbon dioxide at 9.4, 10.4, and 12.6 $\mu$ have been found in the Martian spectrum. From the spectrum it may be said that silicates are not present on the surface in large proportions. (*PA*, 1960, #6572)

1,737. RESULTS OF STUDIES OF CONTRAST ON MARS
Barabashov, N. P., Koval, I. K.
*Astronomicheskii Zhurnal*, v. 37, no. 2, pp. 301–305, March–April 1960
(Translated from the Russian in *Soviet Astronomy—AJ*, v. 4, no. 2, pp. 283–287, September–October 1960)

An attempt at critical evaluation of the possibility of explaining contrast variations in terms of variations in the transparency of the Martian atmosphere is based on a study of contrasts on Mars, in red, green, and blue light. The conclusion is that observational data on contrasts on Mars in red, green, and blue light ($\lambda > 420$ m$\mu$) are primarily attributable to the energy distribution in the surface of the planet proper. (*PA*, 1962, #944)

1,738. OBSERVATIONS OF THE INFRARED EMISSION OF PLANETS AND DETERMINATION OF THEIR TEMPERATURES
Sinton, W. M., Strong, J.
April 15, 1960
Johns Hopkins University, Baltimore, Md.
Progress Report

Modern infrared techniques were applied to the measurement of the spectrum of thermal radiation received from the planets, and to determination of their temperatures. Observations were made in the transparent region, 8 to 13 $\mu$, where the planets have maximum thermal emission. A number of interesting temperature situations on the planets were found and correlated with photographic appearances. The diurnal temperature variations of both Mars and Venus were determined. Spectra of Venus and Mars were obtained with both prism and grating spectrometers. (*AI/A*, 1962, #61,565)

1,739. SOME REMARKS ON THE DUST AND HAZE FORMATIONS ON MARS
Barabashov, N. P., Garazha, V. I.
*Astronomicheskii Zhurnal*, v. 37, no. 3, pp. 501–507, May–June 1960
(Translated from the Russian in *Soviet Astronomy—AJ*, v. 4, no. 3, pp. 473–479, November–December 1960)

Inferences based on an examination of the brightness distribution curves during the 1956 opposition and the rearward portions of indicatrices are drawn as to the structure of the Martian solid surface, and as to the properties of the yellow clouds and mist which often appear in the Martian atmosphere. (*PA*, 1961, #18,039)

1,740. A NEW INTERPRETATION OF MARTIAN PHENOMENA
Kiess, C. C., Karrer, S., Kiess, H. K.
*Astronomical Society of the Pacific, Publications of the*, v. 72, pp. 256–267, August 1960

All the available spectroscopic features of the Martian atmosphere can be simply explained by assuming it contains oxides of nitrogen. It is shown how the presence of these compounds can also explain such features as the Martian polar caps and their colors, the seasonal color changes in the dark areas, and the various cloud and haze formations. (*PA*, 1961, #1632)

1,741. THE ATMOSPHERE AND HAZE OF MARS
Öpik, E. J.
*Journal of Geophysical Research*, v. 65, no. 10, pp. 3057–3064, October 1960

The "blue haze" is an absorbing smoke, dark as soot in reflection, red in transmission. Its currently accepted explanation by pure scattering (omnidirectional or forward) is un-

tenable, as it would either increase the surface brightness or fail to obscure the surface details. The limb darkening of Mars is mainly the result of absorption by the smoke. The opacity of the Martian atmosphere increases from the red toward the violet. The extinction by the Martian atmosphere is greater than that by the terrestrial at all wavelengths, but only about 20 percent of the Martian extinction is due to scattering. Dollfus' polarimetric estimate (*Publications of the Astronomical Society of the Pacific*, v. 70, pp. 56–64, 1958), corrected for self-absorption, corresponds to a Martian atmospheric pressure of 87 mm Hg. The photochemical breakup of carbon dioxide and the escape of oxygen must lead to considerable concentrations of carbon monoxide in the Martian atmosphere. (*PA*, 1961, #15,428)

**1,742. NEW EVIDENCE OF MARTIAN LIFE**
**Briggs, M. H.**
***Spaceflight*, v. 2, no. 8, pp. 237–238, 259, October 1960**
**(*AI/S*, 1960, #23,178)**

**1,743. ON THE INFLUENCE OF ATMOSPHERIC DUST ON THE DISTRIBUTION OF BRIGHTNESS OVER THE MARTIAN DISK IN VARIOUS PARTS OF THE SPECTRUM**
**Orlova, N. S.**
***Astronomicheskii Tsirkuliar*, no. 209, pp. 6–8, 1960**
**(in Russian)**

The brightness distribution on Mars, as determined photographically in five spectral regions at the time of maximum development of the yellow veil (September 15–16, 1956), as a function of the distance from the center of the disk, is reported in tabular form and compared with N. U. Sytinskaya's observations of 1939. According to these data, the darkening at the edge is weakest in the yellow and strongest in the red, somewhat weaker in the ultrared, and considerably weaker in the green. In general, the edge darkening is noticeably greater in the presence of the veil than under normal conditions of the Martian atmosphere. These results agree with visual observations. (*AJ*, 1960, #8441)

**1,744. SPECTROPHOTOMETRY OF MARS DURING THE 1958 OPPOSITION**
**Kostiakova, E. B., Karimova, D. K.**
***Astronomicheskii Tsirkuliar*, no. 209, pp. 8–10, 1960**
**(in Russian)**

From photographs taken on November 19–20, 1958, and by reference to $\alpha$ Aur, using an explicitly described methodology, the mean absolute spectrophotometric gradient of Mars was determined to be 3.77, and its color index 1.44 mag. (*AJ*, 1960, #8428)

**1,745. ON THE OPTICAL PROPERTIES OF THE ATMOSPHERE AND THE SURFACE OF MARS**
**Kurtshakov, A. V.**
***Leningrad Universitet, Vestnik, Seriia Matematiki, Mekhaniki i Astronomii*, v. 15, no. 7, pp. 154–163, 1960**
**(in Russian with English reference)**
**(Abstracted in *Referativnyi Zhurnal, Astronomiia.i Geodeziia*, v. 89, no. 5A443, ZfMG, p. 240, 1960)**
**(*AJ*, 1960, #8429)**

**1,746. THE ATMOSPHERE AND SURFACE OF MARS**
**Barabashov, N. P.**
***Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia*, no. 2, pp. 3–23, 1960 (in Russian)**

An analysis is made of the data on the photographic photometry of the Martian disk obtained from the 1939, 1954, and 1956 observations. The values of the optical parameters of the Martian atmosphere are derived, confirming the fact that, in the visible part of the spectrum, its properties are principally scattering and its optical density is low. (*AJ*, 1960, #8404)

**1,747. SOME RESULTS OF THE MARS OBSERVATIONS MADE DURING THE OPPOSITION OF THE YEAR 1958**
**Sharonov, V. V.**
***Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia*, no. 2, pp. 24–29, 1960 (in Russian)**

The different variables employed in determining the optical features of the atmosphere and the surface of Mars are considered briefly. It is noted that, in interpreting data obtained by spectrophotometry of Mars, it is not necessary to apply the hypothesis of great optical density of the planetary atmosphere—at least, not in the visual portion of the spectrum. (*AJ*, 1960, #8453)

**1,748. PHOTOMETRIC AND COLORIMETRIC COMPARISONS OF THE MARTIAN SURFACE WITH REDDISH LIMONITE AND ROCK-MATERIAL SAMPLES**
**Sharonov, V. V.**
***Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia*, no. 2, pp. 30–35, 1960 (in Russian)**

With the aid of a visual Rosenberg photometer, equipped with a blue wedge, the brightness and yellow factors of 300 samples were determined in order to discover the rocks having these features which might occur on the surface of Mars. A very close agreement between the Martian soil and the ochre-colored forms of limonite was found, giving rise to the hypothesis that the surface of the Martian territories is entirely covered with a homogeneous layer of ochre-colored shifting sand. (*AJ*, 1960, #8454)

**1,749. SOME RESULTS OF THE PHOTOMETRY OF CLOUD FORMATIONS ON MARS**
**Barabashov, N. P., Koval, I. K., Chekirda, A. T.**
***Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia*, no. 2, pp. 36–40, 1960 (in Russian)**
**(*AJ*, 1960, #8405)**

## Moon — 1960

**1,750. MEASUREMENTS OF LUNAR REFLECTIVITY USING THE MILLSTONE RADAR**
Pettengill, G. H. (Massachusetts Institute of Technology, Lincoln Laboratory, Lexington)
February 8, 1960
*IRE, Proceedings of the*, v. 48, no. 5, pp. 933–934, May 1960

**1,751. PHOTOMETRIC PECULIARITIES OF THE MOON**
Fesenkov, V. G.
*Astronomicheskii Zhurnal*, v. 37, no. 3, pp. 496–500, May–June 1960
(Translated from the Russian in *Soviet Astronomy—AJ*, v. 4, no. 3, pp. 468–472, November–December 1960)

It is shown that all of the fundamental properties of the Moon may be accounted for by a rather simple formula (originally due to Lommel-Seeliger), which includes a unique function derived from observational data, i.e., a function of the brightness of the positive edge of the lunar crescent at various phases. This formula lends itself to interpretation under the assumption that the surface layer of the Moon is a combination of comparatively large grains, loosely bound together, and capable of scattering light predominantly in a backward direction, partially shadowing each other. (*PA*, 1962, #942)

**1,752. DENSITY OF THE LUNAR ATMOSPHERE**
Firsoff, V. A., Brandt, J. C.
*Science*, v. 131, no. 3414, pp. 1669–1671, June 3, 1960

Comments are made on a paper by Brandt, with an explanation of the presence of gas on the Moon, and mechanisms by which the lunar atmosphere is formed and gravitationally retained.

**1,753. THE DOLLFUS WHITE SPOT: A PRELIMINARY REPORT**
Cragg, T. A.
*Strolling Astronomer*, v. 14, no. 7–8, p. 121, July–August 1960
(*AI/S*, 1960, #22,817)

**1,754. FOTOMETRIA FOTOELETTRICA NELLA PENOMBRA DURANTE L'ECLISSE PARZIALE DI LUNA DEL 24 MARZO 1959 (PHOTOELECTRIC PHOTOMETRY IN THE PENUMBRA DURING THE PARTIAL LUNAR ECLIPSE OF MARCH 24, 1959)**
Fresa, A.
*Atti della Accademia Nazionale dei Lincei Rendiconti, Classe di Scienze Fisichi, Mathematiche e Naturali*, v. 29, no. 1–2, pp. 46–51, July–August 1960 (in Italian)
(Also available in *Osservatorio Astronomico di Capodimonte-Napoli, Osservazioni*, v. 1, no. 10, 1960)

Experimental data are compared with the theory of Link and are found to be in reasonable agreement. (*PA*, 1961, #5137)

**1,755. SPECTROPOLARIMETRY OF SOME REGIONS OF THE LUNAR SURFACE**
Teifel, V. G.
*Astronomicheskii Zhurnal*, v. 37, no. 4, pp. 703–708, July–August 1960
(Translated from the Russian in *Soviet Astronomy—AJ*, v. 4, no. 4, pp. 669–673, January–February 1961)

Spectropolarimetric observations of the Moon at near quadrature reveal that the degree of polarization of lunar features falls off with wavelength in the spectral interval 400 to 620 mμ, by an average of 0.04–0.06. The variation of polarization with wavelength is determined chiefly by the dependence of polarization on the monochromatic albedo values of lunar formations, which is similar to the dependence of polarization on albedo in white light. The polarization values obtained from observations over different intervals of the spectrum give some indication of being affected by the luminescence of lunar rocks. (*PA*, 1961, #18,028)

**1,756. RADC TRINIDAD TEST SITE QUARTERLY TECHNICAL NOTE, VOLUME IV: A STUDY OF IONOSPHERIC AND LUNAR CHARACTERISTICS BY RADAR TECHNIQUES**
October 31, 1960
Rome Air Development Center, Griffiss AFB, N.Y.
RADC-TN-61-140

Radar reflections from the Moon afford a method for investigating the characteristics of the ionosphere.

The polarization ambiguity problem of radar lunar reflections prevails when only one frequency is employed on transmission. This problem can be resolved by comparing the experimental measurements of the angular rotation of the plane of polarization, introduced by the ionospheric faraday effect, with theoretical estimates.

Apparently the electron density distribution above the peak of the F layer can be represented, to a first approximation, by a Chapman model with a constant scale height of less than 80 km for the neutral particles during the daytime, and more than 80 km during the nighttime. This assumption is based on the high degree of correlation between the total ionospheric electron content deduced from radar-lunar observations and that predicted from ionosonde data and the theoretical model. (*AI/A*, 1962, #60,197)

**1,757. A LUNAR AND PLANETARY ECHO THEORY**
Brown, W. E., Jr.
*Journal of Geophysical Research*, v. 65, no. 10, pp. 3087–3095, October 1960

The lunar radar echo is divided into specular and Lambert scatter components, the specular component being derived from a statistical model of the lunar surface. The theoretical impulse response is compared with experimental data from Trexler, and the theoretical frequency response is compared with some preliminary Goldstone moonbounce experimental

data. The theory indicates the Lambert component will be visible at high power levels and would probably become apparent about 1000 μsec after the leading edge of the echo. A value for reflectivity of 0.01 found from the level of the scatter component is used to derive an estimate of some of the average properties of the lunar surface. (*PA*, 1961, #15,559)

1,758. LUNAR DAILY VARIATION OF THE MAGNETIC DECLINATION AT IBADAN, NIGERIA
Onwumechilli, A.
*Journal of Geophysical Research*, v. 65, no. 10, pp. 3433–3435, October 1960

The data taken for 52 months at Ibadan are analyzed for lunar variation in geomagnetic declination. (*AI/S*, 1960, #23,421)

1,759. SURFACE CONDITIONS ON THE NEAREST PLANETS
Öpik, E. J.
*American Journal of Physics*, v. 28, no. 7, pp. 618–622, October 1960

This article reviews the more controversial problems relating to the surface structure of the Moon, Mars, and Venus. (*PA*, 1960, #16,533)

1,760. ENHANCED LUNAR THERMAL RADIATION DURING A LUNAR ECLIPSE
Shorthill, R. W., Borough, H. C., Conley, J. M.
*Astronomical Society of the Pacific, Publications of the*, v. 72, pp. 481–485, December 1960.

Bolometric measurements of infrared lunar radiation were made at the Newtonian focus of the Dominion Astrophysical Observatory's 72-in. reflector during the total eclipse of March 12–13, 1960, in an attempt to discover regions of anomalous thermal characteristics—in particular, zones undergoing less rapid cooling than that of the general lunar surface. Three lunar features (Tycho, Aristarchus, and Copernicus—all rayed craters) showed enhanced thermal radiation during the eclipse. The mean rise of temperature in each instance was 50°K. The effect is interpreted as being due to the thinner dust cover in the crater areas. (*PA*, 1961, #10,377)

1,761. MULTICOLOR PHOTOELECTRIC PHOTOMETRY OF THE MOON, VENUS, MARS, AND OTHER PLANETS
December 1960
Harvard College Observatory, Cambridge, Mass.
Semiannual Status Report 1 for July 1–December 31, 1960

Time has been chiefly devoted to equipment problems, such as selection of filters and photocells and design of the photometer heads.

1,762. LUNAR PHOTOMETRIC AND TOPOGRAPHIC ANALYSIS
Kopal, Z.
December 1960
Manchester University, Department of Astronomy, Great Britain
Final Technical Report, AFCRL-858, AF 61(052)-380
AD-272,575

This is a letter report.

1,763. STUDY OF INFRARED INSTRUMENTATION FOR THERMAL PHOTOGRAPHY OF THE MOON
December 1960
Harvard College Observatory, Cambridge, Mass.
Semiannual Status Report 2 for July 1–December 31, 1960

1,764. THE FORMATION OF THE SURFACE LAYERS OF THE MOON AND MARS
Barabashov, N. P., Garazha, V. I.
*Kharkov Universitet, Astronomicheskaia Observatoriia, Tsirkuliar*, no. 21, pp. 3–18, 1960 (in Russian)

Photometric measurements of a series of sample surfaces of different materials and shapes are reported in the form of tables and diagrams. Tuff with a grain size of 2–5 mm best reproduces the phase curve of the Moon; volcanic ash and slack do so less well; a layer of very fine dust seems to be out of the question. For the surface of Mars (divided into dark and bright regions), very fine sand (grains of 0.1 mm and smaller) are represented, while hematite, limonite, and moss-covered surfaces are eliminated. (*AJ*, 1960, #8305)

1,765. THE TEMPERATURE OF ZONES OF THE LUNAR SURFACE AROUND FULL MOON
Markov, A. V., Chistiakov, J. N.
*Pulkovo, Astronomicheskaia Observatoriia, Izvestiia*, v. 21, no. 4 (163), pp. 166–179, 1960 (in Russian with English reference)

Using a radiometer originally developed for solar eclipses (instrument: M. S. Selzer and A. W. Markov; thermoelement: B. P. Kosyrev), 3-ft wide strips of the lunar disk were examined without (0.4–12 μ) and with (0.4–1.4 μ) water filters. Temperatures were determined from the results by taking into account operation of the equipment, influence of phase angle, and (per D. Menzel) water-vapor absorption of the Earth atmosphere. The values vary by ±4°K within one night and by ±18°K between different nights. The mean value of 358°K agrees so well with the theoretical one of E. Pettit (360°) that his value for the infrared albedo of 0.135 could be used for calibration. Accordingly, the albedo of the maria is 0.12 and that of the continents 0.15. The accuracy attained is adequate for comparison with temperature measurements in the radio-frequency radiation region, but will be increased by means of reconstruction of the thermal element and greater consideration of the water-vapor absorption. (AJ, 1960, #8354)

**1,766. RELATIVE SPECTROPHOTOMETRY OF LUNAR FEATURES**
Polozhenzeva, T. A.
*Pulkovo, Astronomicheskaia Observatoriia, Izvestiia,* v. 21, no. 4 (163), pp. 180–184, 1960 (in Russian with English reference)

Using a mirror-lens camera, spectra of the lunar surface in the 4000–6300 Å region were taken on Ilford HP3 plates at an equivalent focal length of 8.5 m and 215 Å/mm. M. Crisium and S. Iridium served as references. The evaluation confirmed the existence of color contrasts of 10–15 percent. "Continents" are redder than "maria." The phase angle has no effect on the color. (*AJ*, 1960, #83,154)

**1,767. WHAT WE KNOW ABOUT THE MOON**
Sharcnov, V. V.
Lenisdat, Leningrad, USSR, 1960
(*AJ*, 1960, #8373)

**1,768. AN ATTEMPT TO DETERMINE THE TEMPERATURE OF INDIVIDUAL PORTIONS OF THE LUNAR SURFACE**
Chistiakov, J. N.
*Akademiia Nauk USSR, Komissiia po Fizkie Planetnii, Izvestiia,* no. 2, pp. 46–54, 1960
(Translation available in FTD-TT-62-1514, Air Force Systems Command, Foreign Technical Division, Wright-Patterson AFB, Ohio, December 13, 1962; and through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Lunar surface areas 1.5 × 1.5 ft were examined with a thermoelement in the Newton focus of the 13-in. Abastumani mirror. The tentative results are: (1) The temperature of the subsolar point at a phase angle of +17.2 deg is 400± 30°K. (2) The temperature of the maria is higher than that of the land adjacent to them. (3) The ratio of the radiometric and visual albedos for individual regions is equal to the ratio averaged over the entire disk. (*AJ*, 1960, #8384)

**1,769. PHOTOMETRIC AND COLORIMETRIC COMPARISON OF SOME POROUS AND DENSE ROCKS OF VOLCANIC ORIGIN WITH THE LUNAR SURFACE**
Sytinskaya, N. N.
*Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia,* no. 2, pp. 59–64, 1960 (in Russian)
(*AJ*, 1960, #83,157)

**1,770. THE REFLECTION DISTRIBUTION FUNCTIONS OF INDIVIDUAL PORTIONS OF THE LUNAR SURFACE**
Barabashov, N. P., Yeserskii, V. I.
*Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia,* no. 2, pp. 65–72, 1960
(Translation available in FTD-TT-62-1514, Air Force Systems Command, Foreign Technical Division, Wright-Patterson AFB, Ohio, December 13, 1962; and through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)
(*AJ*, 1960, #83,118)

**1,771. LA DEMI-LUNE A-T-ELLE LA MOITIÉ DE L'ÉCLAT DE LA PLEINE LUNE? (DOES THE HALF-MOON HAVE LESS BRIGHTNESS THAN THE FULL MOON?)**
Schindler, G.
*Gazette Astronomique,* v. 42, pp. 1–3, 1960
(*AJ*, 1960, #8375)

**1,772. RECENT STUDIES OF THE KNOWN PHYSICAL CHARACTERISTICS OF THE MOON AND THE PLANETS**
Kiess, C. C., Birney, D. S.
1960
Georgetown University, Georgetown College Observatory, Washington, D.C.
Monograph 15
(*AJ*, 1960, #8345)

**1,773. ELECTROPHOTOMETRIC COLOUR EXCESSES AND COLOUR INDEXES OF 14 LUNAR CRATERS NEAR THE EPOCH OF FULL MOON**
Koslova, K. I., Glagolevskii, J. V.
*Astronomicheskii Tsirkuliar,* no. 209, pp. 13–14, 1960 (in Russian)

The bottoms of 14 craters were examined at effective wavelengths of 4200 and 5350 Å. No major differences among the individual objects appear. The mean color index is + 0.830 mag; extreme values are + 0.717 and + 0.890 mag. (*AJ*, 1960, #83,144)

**1,774. FOTOMETRIA FOTOGRAFICA DELLA PENOMBRA DURANTE L'ECLISSE DI LUNA DEL 13–14 MAGGIO 1957 (PHOTOGRAPHIC PHOTOMETRY OF THE PENUMBRA DURING THE LUNAR ECLIPSE OF MAY 13–14, 1957)**
Torelli, M.
*Atti della Accademia Nazionale dei Lincei Rendiconti, Classe di Scienze Fisichi, Mathematiche e Naturali,* v. 28, pp. 50–56, 1960
(Also available in *Osservatorio Astronomico di Roma, Contributi Scientifici Series* 3, no. 6, 1960)

The changes in brightness of 24 lunar regions are measured on 18 photographs taken during the eclipse of May 13–14, 1957 at the Steinheil refractor in Rome, and the results are compared with Link's simplified theory. A brightness excess is shown for the major portion of the regions selected. (*AJ*, 1960, #83,106)

1,775. DENSITÉ DE L'OMBRE PENDANT LES ÉCLIPSES DE LUNE (DENSITY OF THE UMBRA DURING THE LUNAR ECLIPSES)
Link, F.
*Ceskaslovenska Akademie Ved., Biulletin' Astronomicheskikh Institutov Chekhoslovakii*, v. 11, pp. 13–22, 1960

A detailed discussion is presented of the results of umbra photometry during 17 lunar eclipses from 1921 to 1957, leading to the following conclusions: (1) The relationship between the type of eclipse and phase of solar activity discovered by Danjon is confirmed, although less so for umbral density than for color. (2) The radial course of umbral density close to the inner edge of the umbra appears to have several breaks, if the latter is produced by portions of the Earth near the equator. This leads to the conclusion that the absorbing layer above the equator is of the greater height. (3) The umbral densities observed during the given time period show a distinct variation with time in all wavelengths, and are located in part considerably below the minimum value computed from the extinction by Rayleigh scattering and $0_3$ absorption. The scattered light alone is not a sufficient explanation of this illumination of the umbra. (4) The correlation discovered by Dubois between umbral density and ash-gray light is reaffirmed. The relationship between the amplitudes of the two variations in the 11-year cycle, however, cannot be reconciled with Vassy's explanation of variable aerosol formation through the solar corpuscular radiation. (5) The two discrepancies can be explained by assuming a varying luminescence of the lunar floor, caused by the solar corpuscular radiation. (6) Since the corpuscular umbra precedes the optical one, this explanation would demand an E-W asymmetry of the density of the outer umbra, which can actually be demonstrated in the few available cases. (*AJ*, 1960, #83,100)

1,776. SPECTROCOLORIMETRIC PECULIARITIES OF THE LUNAR CRATER ARISTARCHUS
Teifel, V. G.
*Astronomicheskii Tsirkuliar*, no. 215, pp. 9–11, 1960
(in Russian)
(*AJ*, 1960, #83,203)

1,777. STUDIEN ÜBER DAS ASCHGRAUE MONDLICHT (STUDIES ON THE ASH-GRAY MOONLIGHT)
Schröder, W.
*Mitteilungen für Planetenbeobachter*, v. 13, pp. 12–13, 1960
(Also available in *Monatsschrift für Österreichs Amateur-astronomen—Der Sternenbote*, v. 3, pp. 59–60, 1960)
(*AJ*, 1960, #8376, 8377)

1,778. PHOTOMETRY OF THE MOON
Struve, O.
*Sky and Telescope*, v. 20, pp. 70–73, 1960
(*AJ*, 1960, #8382)

1,779. ISOTHERMAL CONTOURS OF THE MOON
Geoffrion, A. R., Korner, M., Sinton, W. M.
*Lowell Observatory Bulletin*, v. 5, pp. 1–15, 1960

A temperature survey was made of the illuminated part of the Moon at a representative sampling of phases. The lunar surface was scanned with a television-like raster using the rotation of the Earth and Moon's motion in declination, respectively, for the horizontal and vertical scanning motions. Isothermal contours have been constructed from these scans.

1,780. THE MOON AND ITS CONSTITUTION
Sharonov, V. V.
*Priroda*, v. 49, no. 1, pp. 9–19, 1960 (in Russian)
(*AJ*, 1960, #8374)

## *Saturn — 1960*

1,781. THEORETICAL PHASE CURVES OF THE SHADOW EFFECT ON SATURN'S RINGS. I. DERIVATION OF PERTINENT FORMULAE
Bobrov, M. S.
*Astronomicheskii Zhurnal*, v. 37, no. 2, pp. 306–316, March–April 1960
(Translated from the Russian in *Soviet Astronomy—AJ*, v. 4, no. 2, pp. 288–297, September–October 1960)

This article contains a detailed derivation of the dependence of the quantity $b_{1\alpha}/b_{10}$ on phase angle $\alpha$, where $b$ is the brightness of a plane layer of macroscopic particles illuminated by a distant source with an angular radius $\phi$; subscript 1 means that only first-order scattering effects are taken into account, while subscripts $\alpha$ and zero denote brightness at phase angle $\alpha$ and at the moment of exact opposition, respectively. Equations are given for approximate solutions to the problem, with a deficiency, in that pneumbral effects are completely disregarded, while other equations yield approximate solutions with an excess (the penumbra being assumed to be a full umbra). The reduction for higher-order scattering constitutes a small correction applied to the results derived from these equations. (*PA*, 1962, #945)

## *Venus — 1960*

1,782. THE SPECTRUM OF VENUS (Presented at the 104th Meeting of the American Astronomical Society, Cleveland, Ohio, December 27–30, 1959)
Richardson, E. H. (Dominion Astrophysical Observatory)
*Astronomical Journal*, v. 65, no. 2, p. 56, March 1960
(Abstract)

Spectra of Venus and the Moon have been compared from 3150 to 4500 Å and from 4850 to 6400 Å. The spectrograph used was a Littrow grating instrument with a dispersion of 16 Å/mm. The absorption bands reported by Kozyrev at 4120 Å and at 4372 Å are not present on the Victoria plates.

1,783. RADIOMETRIC OBSERVATIONS OF VENUS
Sinton, W. M., Strong, J.
*Astrophysical Journal*, v. 131, no. 2, pp. 470–490, March 1960

Modern infrared techniques were applied to the measurement of thermal radiation and temperatures of planets. The two nearest planets have the maximum of their thermal emission within the 8- to 13-$\mu$ band that is transmitted by our atmosphere with relatively little absorption. The transmission of the atmosphere was determined by extrapolation of observed planetary emission to outside the atmosphere, using the square-root law. Calibration of the equipment was made with blackbodies. The method of determining atmospheric transmission was tested in the laboratory with an ammonia cell, to simulate a planetary atmosphere, and a rock, to simulate a planet. Radiation temperatures for the rock within a few degrees of the thermometer temperature were obtained in these tests. Extensive measurements were made of Venus with the 200-in. telescope in 1953, and further measurements were made in 1954. The temperature at the center of the disk was found to be −39°C. Scans near dichotomy show that the dark side of the disk is nearly as hot as the bright side. There is also substantial limb darkening. A cold region found at the north cusp in 1953 appears to be related to a bright cloud found in ultraviolet photographs taken on the same date. Spectra of Venus between 8 and 13 $\mu$ were obtained with prism and grating spectrometers. A diffuse band at 11.2 $\mu$ was found in the spectrum of Venus in addition to a carbon dioxide band at 10.4 $\mu$. The 10.4-$\mu$ band was found to be much weaker than expected. (*PA*, 1960, #6573)

**1,784. THE EMISSION SPECTRUM OF THE NIGHT SIDE OF VENUS**
**Warner, B.**
***Royal Astronomical Society, Monthly Notices of the,***
**v. 121, no. 3, pp. 279–283, March 1960**

The measurements given by Kozyrev of features in the spectrum of the night side of Venus are examined. The existence of nitrogen bands is confirmed and evidence is presented identifying emission lines of neutral and ionized oxygen. (*AJ*, 1960, #8241)

**1,785. VENUS EN PLEIN JOUR ET LUMIÈRE CENDRÉE DE VENUS (VENUS IN BROAD DAYLIGHT AND THE GRAY LIGHT OF VENUS)**
**d'Hallwin, H.**
***l'Astronomie,* v. 74, p. 255, June 1960**
**(*AI/S*, 1960, #22,665)**

**1,786. THE SURFACE TEMPERATURE OF VENUS**
**Sagan, C. (Yerkes Observatory)**
***Astronomical Journal,* v. 65, no. 6, pp. 352–353, August 1960**
**(*AJ*, 1960, #8238)**

**1,787. OBSERVATIONS OF VENUS AT 10.2-CM WAVELENGTH (Presented at the 105th Meeting of the American Astronomical Society, Pittsburgh, Pa., April 18–21, 1960)**
**Mayer, C. H., McCullough, T. P., Sloanaker, R. M. (Office of Naval Research, Naval Research Laboratory, Radio Astronomy Branch, Washington, D. C.)**
***Astronomical Journal,* v. 65, no. 6, pp. 349–350, August 1960 (Abstract)**

The 10.2-cm emission of Venus was measured on 11 days near the inferior conjunction of September 11, 1959, using the 84-ft reflector at the Maryland Point Observatory of the U.S. Naval Research Laboratory. The apparent blackbody disk temperature for Venus which was derived from the measurements changed from 535 ± 65°K(p.e.) on September 17 to 675 ± 85°K(p.e.) on October 10. The average over the whole interval was 600 ± 65°K(p.e.). These measurements support the blackbody spectrum of the centimeter wavelength radiation from Venus which was suggested by the earlier observations at 3.15 and 9.4 cm (Mayer, McCullough, and Sloanaker) and at 3.37 cm (Alsop, Giordmaine, Mayer, and Townes).

**1,788. A MICROWAVE RADIOMETER EXPERIMENT FOR THE PLANET VENUS**
**Jones, D. E.**
**August 30, 1960**
**Jet Propulsion Laboratory, California Institute of Technology, Pasadena**
**TR 34-112**

Since the initial measurements of the brightness temperature of Venus by Mayer, et al., the planetary astronomer has shown considerable interest in this planet. The high brightness temperature of nearly 600°K measured in the centimeter region is generally considered to be that of the surface of the planet, although the assumption of an optically dense ionosphere with $\int n_e^2 dz \sim 4 \times 10^{25}/\text{cm}^5$ also fits the data.

It should be possible to determine the source of the centimeter radiation, and to scan the planet geographically at several wavelengths to study the surface and atmosphere of the planet by sending a microwave radiometer to Venus on a space probe. (*AI/A*, 1960, #2851)

**1,789. THE RADIATION BALANCE OF VENUS**
**Sagan, C.**
**September 15, 1960**
**Jet Propulsion Laboratory, California Institute of Technology, Pasadena**
**TR 32-34**
**AD-248,907**

Recent microwave observations of Venus give brightness temperature near 600°K. The spectrum precludes an origin as synchrotron or cyclotron radiation from a Cytherean Van Allen belt, the emission must be thermal and probably arises from just beneath the surface of Venus. The radiation temperature of an airless planet with Venus' color-corrected albedo and solar distance is ~250°K if the period of rotation is much less than the period of revolution, or if there is appreciable interhemispheric circulation, it is ~350°K if the

two periods are comparable. It is evident that a surface temperature of 600°K demands a very efficient greenhouse effect. From the radiation balance, the effective absorptivity of the atmosphere, integrated over all wavelengths, is $\alpha \simeq 0.995$ for nonsynchronous rotation, the equivalent atmosphere is opaque between 1.5 and 40 $\mu$. Water is the only molecule which is likely to be abundant on Venus and which absorbs in the region longward of 20 $\mu$.

If there is 1 km-atm of carbon dioxide above the effective reflecting layer for the $\lambda$ 8000 bands, the total carbon dioxide abundance in a convective Cytherean atmosphere is 18 km-atm, the total surface pressure is $\sim$ 4 atm. Extrapolation to long paths of $CO_2$ and $H_2O$ emissivities at elevated temperatures shows that $\sim$ 10 g cm$^{-2}$ of water vapor is required for a nonsynchronously rotating Venus and $\sim$ 1 g cm$^{-2}$ for a synchronously rotating Venus in order that the required greenhouse effect be achieved. As a check, the method was applied to Earth; the correct terrestrial water-vapor abundance was predicted. The Venus model atmosphere has an ice-crystal cloud layer about 36 km above the surface. For nonsynchronous rotation, the predicted cloud layer is at the thermocouple temperature but at saturation has five times more water vapor above it than observed by Strong; for synchronous rotation, the cloud layer is 14-K degrees cooler than the thermocouple temperature, but has $2 \times 10^{-3}$ g cm$^{-2}$ of water vapor above it, as observed by Strong. More precise agreement with the observed thermocouple temperature and water-vapor abundance cannot be expected because of $CO_2$ band emission from warmer regions above the cloud layer, and because of the possibility that ultraviolet photodissociation reduces the water-vapor abundance below saturation values. If the mean cloud albedo is $> 0.75$, the overcast is $< 0.90$. At gaps in the clouds, there are windows near 8.7 $\mu$ and also at many wavelengths in the near infrared and visible regions.

The absence of surface liquid water inhibits the establishment of the Urey equilibrium, and, incidentally, greatly reduces tidal friction. If the Earth had been placed in the orbit of Venus soon after its formation, roughly the same atmospheric carbon dioxide content as on Venus would have resulted, but the surface temperature and water-vapor abundance would have been much greater; thus, Earth must have been formed with $> 10^4$ times more water than was Venus. Because of the high temperature and the absence of liquid water, it is very unlikely that contemporary indigenous organisms exist on the surface of Venus. (*AI/A*, 1961, #3175)

## *General — 1961*

**1,790. PHOTOMETRY AT LOW LEVELS OF INTENSITY**
**Dawson, L. H., DuPre, E. F.**
**January 12, 1961**
**Office of Naval Research, Naval Research Laboratory, Washington, D.C.**
**NRL R-5530**
**AD-251,379**

The peculiar characteristics of vision in the scotopic and mesopic regions and their effects on photometric measurements are discussed. Consideration is given to the methods and techniques evolving from extended studies of light measurements, which had as their object the production of aids to military activities under the cover of darkness. A description of the physiology of the eye points out the important phenomena of the increase in eye sensitivity with a decrease of illumination and the shift of the luminosity curve toward the shorter wavelength region of the spectrum. The fundamentals of photometry are discussed, and the significant part that the level of illumination plays at low levels of intensity is stressed. The concluding sections are devoted to the physical photometry at low light intensities.

**1,791. SEMI-ANNUAL REPORT ON A SPACE BACKGROUND STUDY**
**January 16, 1961**
**Eastman Kodak Company, Apparatus and Optical Division, Rochester, N.Y.**
**EK/ARD-ED-575, DA-30-069-ORD-2803**

Irradiances of approximately 30 stars have been measured in two separate infrared bands located in the atmospheric windows at 2.0–2.4 and 3.2–4.2 $\mu$. Apparent infrared magnitude scales have been established for each band, and color indices have been computed and compared with theoretical values derived from the stellar model. Results of the present measurement program are shown to be in agreement with results of two other recent stellar measurement programs. The infrared star table has been revised and expanded and is included as an appendix to this report. Design considerations for the new infrared stellar photometer are discussed and a tentative optical layout is presented.

**1,792. RADIOMETER TO IMPROVE FORECASTING**
***Missiles and Rockets*, v. 8, no. 4, p. 35, January 23, 1961**

A radiometer aboard *Tiros* 2, which will improve the reliability of future weather forecasts, is made almost entirely of plastic. The fabrication of this instrument, built by Barnes Engineering Company, is briefly discussed. (*AI/S*, 1961, #30,336)

**1,793. GERAETE ZUR MESSUNG DER BELEUCHTUNGSSTAERKE (INSTRUMENTS FOR ILLUMINATION MEASUREMENT)**
**Wiechowski, W.**
***Archiv für Technisches Messen*, no. 294, pp. 143–144, July 1960; no. 300, pp. 11–14, January 1961**

Requirements and visual methods are discussed in the July issue, and objective methods and apparatus are discussed in the January issue. The description of an illumination photometer and precautions to be taken in using it are presented. A generalized discussion of visual instruments is given, as well

as a discussion of color difference. Calibration is also described. Twenty-one references are included. (*EI*, 1961)

**1,794. A HIGH PRECISION PHOTOELECTRIC PHOTOMETER**
**Jones, O. C., Sanders, C. L.**
***Optical Society of America, Journal of the*, v. 51, no. 1, pp. 105–108, January 1961**

During work on the primary standard of light, a photometer was developed which possesses desirable qualities. The detector used is a Gillod-Boutry vacuum photocell with cesium–bismuth cathode surface having a basic sensitivity of 25 $\mu$a/lu. The photocurrent is measured by a simple circuit, using balanced electrometer tubes, similar to circuits which have been described frequently over a long period of time in the literature, except in one rather important respect which is described fully. The photometer is compact and portable. Battery replacement is only necessary every three months. Differences between successive readings and zeros repeat to $\pm 2/10^4$ when measuring a steady incidence of $10^{-4}$ lu. Zero drift is small, necessitating readings only every 15 min. Circuit stability is good, so that the simple balance adjustment need not be used more than twice daily, provided that the triodes are suitably matched. Due to undetermined causes, day-to-day variations in sensitivity of 0.5 percent sometimes occur. (*PA*, 1961, #2836)

**1,795. PROPOSED PROGRAMS OF HIGH ALTITUDE INFRARED ASTROPHYSICS**
**Strong, J.**
**February 15, 1961**
**Johns Hopkins University, Laboratory of Astrophysics and Physical Meteorology, Baltimore, Md.**
**Report**

Proposed programs of high-altitude daytime astronomical observations are listed. New opportunities for study of planetary atmospheres are considered which have been made possible by recent developments in heavy load carrying high-altitude balloons and by availability of high-altitude aircraft such as the Lockheed U-2. New experimental developments that will help take advantage of these opportunities, such as improved startrackers, electronically controlled servomechanisms, new radiation sensors, etc., are also covered. Telescopes (present and planned), gondolas, and spectroscopic instrumentation including balloon grating and solar prism spectrometers, three-channel interferometers, bolometric receptors, and a sky-brightness and gradient photometer are described. (*AI/A*, 1963, #71,257)

**1,796. OPTIMUM VIDEO FILTER DESIGN FOR A SCANNING RADIOMETER**
**Stewart, R. M.**
**February 22, 1961**
**Space-General Corporation, El Monte, Calif.**
**RM-3**

**1,797. AN OPERATIONAL RUBY MASER FOR OBSERVATIONS AT 21 CENTIMETERS WITH A 60-FOOT RADIO TELESCOPE**
**Jelley, J. V., Cooper, B. F. C.**
***Review of Scientific Instruments*, v. 32, no. 2, pp. 166–175, February 1961**

A maser preamplifier designed for radiometry at a wavelength of 21 cm is described. The maser is mounted at the focus of the 60-ft reflector of the Harvard College Observatory and is being used principally for observations of hydrogen-line radiation from extra-galactic nebulae. An automatic gain stabilization system for the maser using a modulated-noise reference signal is described, and an example of an observation made with this stabilization scheme is included. The total input noise temperature of the radiometer is 85°K, without the gain stabilization, and 148°K with the stabilization. (*PA*, 1961, #4214)

**1,798. HISTORY OF THE PHOTOMETRIC QUANTITIES AND SOME PROBLEMS CONNECTED WITH THEM**
**Hahn, D., Schley, U.**
***Lichttechnik*, v. 13, no. 2, pp. 58–63, February 1961**
**(in German)**

The development of the system of photometric quantities and units is traced, with particular reference to the standard of luminous intensity. The evolution of the present standard, side by side with the development of radiation theory, is shown in a full-page table, with dates. The effects on the standard of uncertainties in the radiation constants and in the values of the relative luminous efficiency of radiation are discussed. The advantages of a standard operating at the Ir point (2716°K) instead of the Pt point are great, and work on such a standard is in progress in Germany. (PA, 1961, #8212)

**1,799. A NEW PHOTOELECTRIC PHOTOMETER WITH ELECTRONIC REFRIGERATOR**
**Huruhata, M., Kitamura, M.**
***Tokyo Astronomical Bulletin*, (Ser. 2), no. 144, pp. 1917–1922, February 1961**

A description is given of a photoelectric photometer used on a telescope at the Okoyama astrophysical station. The photometer is attached to the reflector at the cassegrain focus. In order to reduce the dark current of the photomultiplier (to $< 1/20$ of its normal intensity), a cooling system consisting of 160 thermo-elements has been mounted inside the apparatus. (*PA*, 1962, #11,098)

**1,800. 1ST ANNUAL ENGINEERING REPORT**
**March 1, 1961**
**Ohio State University Research Foundation, Antenna Laboratory, Columbus**
**R-1093-2 for March 1, 1960–February 28, 1961**

The purpose of this research program is to investigate various detection techniques pertinent to millimeter-wave and

submillimeter-wave radio astronomy. A detailed investigation of detectors and millimeter-wave masers, and a preliminary study of the radiometer techniques as well as the outlook for various detection techniques were made during the first year. No effort has been made to develop any particular receiver or radiometer.

1,801. NEW FRONTIERS IN ASTRONOMICAL INSTRUMENTATION
Meinel, A. B.
March 2, 1961
Kitt Peak National Observatory, Tuscon, Ariz.
Contribution 11
(Also available in *Science*, v. 134, no. 3486, October 20, 1961)

Very little astronomical work is done today by looking through the telescope, except as this is incidental to the setting of the telescope on the desired region of the sky. In recent decades the astronomer has worked principally with the photographic process to determine the positions, motions, and brightnesses of celestial objects. The principal auxiliary instruments currently used by astronomers are the direct photography plateholder, the photoelectric photometer, and the spectrograph. A spectrograph can reveal many interesting properties of a star, such as temperature, mass, chemical composition, atmospheric structure, multiplicity, motion toward or away from the observer, and, indirectly but effectively, the absolute luminosity and hence the distance and even the age of the star. Other kinds of special equipment have been devised from time to time to measure special properties such as polarization of starlight and magnetic fields of stars.

1,802. INFRARED PHOTOGRAPHY USING PERSISTENT INTERNAL POLARIZATION IN PHOSPHOR PLATES
Kallmann, H., Rennert, J., Sidran, M.
*Infrared Physics*, v. 1, no. 1, pp. 58–66, March 1961

The feasibility of recording infrared radiation using the persistent internal polarization effect is demonstrated. The electronic processes in a radiation stimulated phosphor and three methods of photography using de-excitation, polarization, or de-polarization are described. The image may be made visible either by scanning with an electron beam, or by applying dyed, charged, resin particles; in the latter case a permanent record may be made by heat fusion. Polarization effects in the phosphors for near and middle infrared were determined and methods of increasing the slow speed of the process outlined. (*PA*, 1962, #9414)

1,803. STUDY OF THERMAL MICROWAVE AND RADAR RECONNAISSANCE PROBLEMS AND APPLICATIONS
Peake, W. H., Taylor, R. C.
April 1, 1961
Ohio State University Research Foundation, Antenna Laboratory, Columbus
R-898-13, Interim Engineering Report for January 1–March 31, 1961, AF 33(616)-6158

Preliminary measurements of background temperatures (in this case the ground) were made at 3 cm. The results illustrated two important points that should be taken into consideration when radiometer systems are to be used to perform surveillance missions. It is important that the background temperatures should be kept low if one requires the radiometer system to detect such objects as satellites, missile launches, etc. It is also important when predicting the performance of the radiometer that the anticipated environment of the target be considered very carefully. An experimental program was set up using a sphere as a target and measuring the apparent temperature of the sphere at two different skin temperatures.

1,804. ENGINEERING
April 15, 1961
Massachusetts Institute of Technology, Lincoln Laboratory, Cambridge
Quarterly Progress Report D-7, AFESD-TN-61-1010, AF 19(604)-7400

Progress in the development of a radiometer is described.

1,805. FOURTH QUARTERLY STATUS REPORT ON NASA CONTRACT NASw-140
Bartman, F. L.
April 17, 1961
Michigan, University of, Office of Research Administration, Ann Arbor
R-03615-4-P, Quarterly Summary Report 4 for November 1, 1960–January 31, 1961

The project effort was primarily concerned with the high altitude testing of the five-channel *Tiros* radiometer.

1,806. FRESNEL ZONE PLATE FOR OPTICAL IMAGE FORMATION USING EXTREME ULTRAVIOLET AND SOFT X RADIATION
Baez, A. V.
*Optical Society of America, Journal of the*, v. 51, no. 4, pp. 405–412, April 1961

A new type of Fresnel zone plate was constructed which can focus ultraviolet radiation of any wavelength down to the soft X-ray region. It consists of a set of thin circular gold bands made self-supporting by radial struts, leaving the transparent zones empty. Experimental tests at 6700, 4358, and 2537 Å showed that the theoretical minimum angular resolution obeys the Rayleigh criterion, $\sin \theta_{min} = 1.22\lambda/D$. The diameter of the zone plate is D = 0.26 cm and it contains 19 opaque zones, the narrowest of which measured about 20 $\mu$ across. The zone plate was better than the optimum pinhole in resolution by a factor of about 6 and in speed by a factor of 40. The zone plate produced pictures that compared favorably with those made with a lens of similar focal length and aperture. The lens was about 20 times faster than the zone plate at 4358 Å, but at 1000 Å the zone plate would have been far faster than

the lens. Focusing tests are contemplated at 1000 Å and at 100 Å where lenses and mirrors, the conventional image-forming devices, may fail. The angular resolution at 2537 Å was close to the theoretical value of $1.2 \times 10^{-4}$ rad and held over a field of at least $1.75 \times 10^{-2}$ rad, which is 2.0 times the angle subtended by the Sun's disk at the Earth. A zone-plate telescope, operating in the soft X-ray or extreme ultraviolet region, far above the Earth's atmosphere in an orbiting satellite, now seems possible. (*PA*, 1961, #4448)

1,807. **BROAD-BAND ULTRAVIOLET FILTERS**
**Childs, C. B.**
**April 1961**
**National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.**
**TN D-697**
**AD-253,406**

A brief survey is made of the materials used in three filters, developed for ultraviolet nondispersive photometers, with effective wavelengths of 2700, 2600, and 2210 Å. The materials used were 2200 Å interference filters, $NiSO_4$ $(H_2O)_6$ crystals, KCl:KBr:Pb crystals, cation-X, and Corning filters 9-54 and 7-54. The filters have transmittances of 0.16, 0.23, and 0.10 at the respective effective wavelengths with corresponding bandwidths of 320, 200, and 330 Å.

1,808. **PROJECT LOOKOUT. PHASE I. CALIBRATION OF PbS SCANNING RADIOMETER**
**Hewitt, D. S., Cumming, C.**
**April 1961**
**Canadian Armament Research and Development Establishment, Valcartier, Quebec**
**CARDE TM 601/61**
**AD-257,400**

The effect of temperature on the calibration of the multichannel scanning lead sulfide radiometer is studied. A calibration is prepared which is valid for the temperatures prevailing in its airborne environment. The calibration is normalized to 2.3 $\mu$, the wavelength of peak response of the radiometer.

1,809. **A PORTABLE LOW LEVEL LIGHTMETER**
**Gebel, R. K. H.**
**April 1961**
**Wright Air Development Division, Aeronautical Research Laboratory, Wright-Patterson AFB, Ohio**
**ARL-13, Report on Research on Quantum Nature of Light**
**AD-260,500 (supersedes AD-58,440)**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

An explanation is given of the operation and calibration of a portable low level lightmeter designed in connection with work on the problem of light amplification. This light meter can be used to determine the light levels from as low as $10^{-8}$ foot-Lambert (ft-L).

1,810. **PHOTOMÉTRIE PHOTOÉLECTRIQUE DE L'EXTRÊME BORD SOLAIRE (PHOTOELECTRIC PHOTOMETRY OF THE EXTREME SOLAR RIM)**
**Florsch, M. G.**
*l'Astronomie*, v. 75, pp. 198–199, May 1961
(*AI/S*, 1961, #40,657)

1,811. **FILTER PHOTOMETRY USING CADMIUM SULFIDE DETECTORS**
**Post, G. A.**
*Analytical Chemistry*, v. 33, pp. 736–738, May 1961
(*AS&T*, 1961)

1,812. **PRELIMINARY RADIOMETER CALIBRATION STUDY**
**Hoch, F. W.**
**June 1, 1961**
**Aerospace Corporation, Los Angeles, Calif.**
**TDR-594(A1242-01)TR-1, AF 04(647)-594**
**AD-261,134**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

Infrared radiometers are discussed. After an introductory description of radiometer system components, the effects of several factors on calibration are discussed. These include analysis of tracking error, effect of variation in sensitivity over the surface of a detector, atmospheric attenuation, nonlinear response, and narrow band filtering. It is concluded that the individual contributions to calibration error of these factors are small, but collectively they might be quite significant.

1,813. **ARGMA—RANGE INSTRUMENTATION ANNUAL REPORT**
**Paige, W., Brown, E., Fahy, T. P.**
**June 26, 1961**
**Perkin-Elmer Corporation, Norwalk, Conn.**
**ER 5957**
**AD-261,947**

A description is given of the equipment for the optical instrumentation for Range 4 at CARDE. Range 4 is designed to test 2- to 14-in. projectiles at velocities up to 20,000 ft/sec and pressures down to 1 $\mu$. The present instrumentation includes: 12 photomultiplier radiometers operating in the 0.25- to 0.7-$\mu$ band; 12 infrared radiometers operating in the 0.6- to 10-$\mu$ band; two trigger generators to synchronize the recording system; and a high resolution multichromator with six channels capable of comparing 1-Å line spectra with two 20-Å channels located 10 Å away on both sides of the line spectra throughout the 0.3- to 0.8-$\mu$ band. Most of the video amplifiers have a logarithmic gain characteristic and a bandwidth from 6 c to 1.2 Mc. The trigger generators are unique in that they provide synchronization within 1 $\mu$sec for projectile velocity variations from 4000 to 20,000 ft/sec, without operator adjustment. The multichromator has extremely fine resolution.

1,814. PHOTOMETRY OF ASTEROIDS, THE MOON, PLANETS, AND REFLECTION NEBULAE
Gehrels, T.
June 30, 1961
Indiana University, Bloomington
Final Report for September 1, 1958–June 30, 1961, Nonr-253600
AD-259,482
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

A photometer is described which enables UBV transfers, asteroid lightcurve photometry, polarimetry, and color photometry. The effective wavelengths for the polarimetry range between 3250 and 9900 A. Through the use of this instrument and powerful telescopes it was found that the polarization on most objects is strongly wavelength dependent. A steep increase toward the ultraviolet was found for lunar regions, for Mars, for Mercury, and for Venus. A maximum in the amount of plane polarization near the visual, with a sharp decrease toward longer and a slow decrease toward shorter wavelengths, was found for the interstellar polarization. A steep increase of the polarization toward the infrared was found on reflection nebulae.

1,815. INFRARED SPECTROPHOTOMETERS
Leon Ch., B.
*Scientia*, Chile, v. 28, pp. 22–26, April–June 1961
(in Spanish)
(*PA*, 1962, #5167)

1,816. INTERPLANETARY NAVIGATION STUDIES: LIGHT CENTERS OF TERRESTRIAL PLANETS
de Vaucouleurs, G. H.
June 1961
Geophysics Corporation of America, Bedford, Mass.
GCA TR-61-25-A, AF 33(616)-7413
AD-258,902
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The center of light (barycenter of light distribution) in the image of a planet is one of the elements which has been considered for midcourse guidance of a space probe. If a planet had a uniform surface and were observed at full phase (opposition or superior conjunction, Sun-planet-probe phase angle $\alpha = 0$), the direction from the observer to the light center $C$ would coincide with the direction to the center of mass $O$. In practice, the two directions differ by a variable angle because, generally, (1) the phase angle is not zero, the disk of the planet appears either gibbous ($0 < \alpha < 90$ deg) or in crescent (90 deg $< \alpha <$ 180 deg); and (2) the surface of most planets, except perhaps Venus at wavelengths $\lambda > 0.45\ \mu$, is conspicuously nonuniform and shows both fixed surface markings (Moon, Mercury, Mars) and/or variable atmospheric formations (Earth, Venus).

The first effect causes a phase shift $OC$, which, in principle, can be estimated from theoretical or semi-theoretical calculations from assumed or observed phase laws. The second effect can be evaluated only empirically by direct observations of the center of light.

Very few data are available on this subject. In this paper, a simple theoretical estimate of the first effect is made. Some empirical data on the phases of Mercury and Venus are reviewed. The observational evidence on the departures between the center of light and the center of mass of Mercury is analyzed. (*AI/A*, 1961, #4159)

1,817. PHASE CURVES AND ALBEDOS OF TERRESTRIAL PLANETS
de Vaucouleurs, G. H.
June 1961
Geophysics Corporation of America, Bedford, Mass.
GCA TR-61-26-A, AF 33(616)-7413
AD-261,165

The reported study was undertaken as part of an investigation of navigation within the solar system by optical means. The objective of the investigation is to evaluate the suitability of various physical phenomena as sources of navigational information and to estimate the accuracy of navigational information obtained by various techniques.

1,818. DIGITAL RADIOMETER
Weinreb, S. (Massachusetts Institute of Technology, Research Laboratory of Electronics, Cambridge)
*IRE, Proceedings of the*, v. 49, no. 6, p. 1099, June 1961

One of the practical limitations on the sensitivity of present radio astronomical receiving apparatus is the gain fluctuation or drift of the radiometer. This stability problem also limits most radiometers to being single-channel instruments; that is, during one interval of time an estimate of the average power in a single band of frequencies is obtained. In many cases it would be more desirable to have a multichannel instrument which would be capable of analyzing the power in many frequency bands at one time, and thus make more efficient use of valuable antenna time. A system is described that combines the Dicke radiometer, digital data processing, and two concepts from statistical communication theory to form a multichannel radiometer that shows promise of achieving very high stability.

1,819. FIFTH OF A SERIES OF QUARTERLY STATUS REPORTS ON CONTRACT NASw-140
July 14, 1961
Michigan, University of, Office of Research Administration, Ann Arbor
R-03615-5-P, Quarterly Summary Report 5 for February 1–April 31, 1961

The project effort of this report period was primarily concerned with the evaluation of the data obtained on the November 23, 1960 balloon flight test of the 5-channel radiometer, and with preparations for the next balloon flight test of

the modified radiometer. The details of the work done on all phases of the contract are outlined.

1,820. A SWEEP-FREQUENCY RADIOMETER FOR TERRESTRIAL AND PLANETARY ATMOSPHERES
Barrett, A. H.
July 17, 1961
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TM 33-67

The feasibility and desirability of using microwave spectral lines of molecules to study the properties of planetary atmospheres will increase as the payload and power capabilities for deep space exploration increase. Some of the scientific justifications for developing special microwave equipment and the requirements and/or specifications of this equipment are presented. The fundamental approaches to receiver development which must be explored are also discussed. (*AI/A*, 1962, #5304)

1,821. SPACE BACKGROUND STUDY
Haynie, W., Gramm, C., Trasil, A., Schliff, J.
July 17, 1961
Eastman Kodak Company, Rochester, N.Y.
EK/ARD-ED-692, Semiannual Report for January 1–July 1, 1961, DA-30-069-ORD-2803
AD-260,263
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Research was continued on the development of the space background problem as faced by optical space defense systems operating in the infrared spectral region. Optical sensors for space applications must work in a background consisting of a multitude of point sources on the celestial sphere. This has presented a serious challenge to the designer to develop discrimination techniques for detecting essentially point targets against a stellar background. Further, the targets are relatively cold bodies (300°K) with most of their emitted energy concentrated in the far infrared. The aim is to locate and identify by theory and direct observation all thermal sources in space, stellar or otherwise, which will produce irradiances comparable to the irradiance from a relatively cold body at long range. For a preliminary measurement program, a new and improved stellar photometer was designed. The design of the optical-mechanical and electronic elements of the photometer system is described in detail. Ten references are included.

1,822. IÉS GUIDE FOR MEASUREMENT OF PHOTOMETRIC BRIGHTNESS (LUMINANCE)
*Illuminating Engineering*, v. 56, pp. 457–462, July 1961
(*AS&T*, 1961)

1,823. MEASURING LIGHT'S VARIOUS PROPERTIES
Parker, H.
*Industrial Photography*, v. 10, pp. 86–88, July 1961
(*AS&T*, 1961)

1,824. TIROS II RADIATION DATA—USERS' MANUAL
Conrath, B. J., Bandeen, W. R., Hanel, R. A., Persano, F., Hite, R. T., Bristor, C. L., Martin, G. E., Wark, D. Q.
August 15, 1961
National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
Manual

The NASA *Tiros 2* meteorological satellite contains a five-channel medium resolution scanning radiometer. After launch, the radiometer displayed characteristics which had not been previously suspected. Before serious work with the *Tiros 2* radiation data is attempted, an understanding of the radiometer, its calibration, and the problems encountered in the experiment is essential. This manual attempts to foster this understanding.

1,825. NEW PHOTOMETER FOR VISUAL HETEROCHROMATIC PHOTOMETRY
Boardman, L. J.
*Optical Society of America, Journal of the*, v. 51, no. 8, pp. 905–908, August 1961

A new heterochromatic photometer combining the features of direct comparison and flicker methods is presented. A comparison of red/white and of red/blue fields using field luminances from 32.50 to 0.0011 c/ft² is included. A comparison with the Ives flicker method and with the direct comparison method is also given. Improvements shown for the precision of setting for equality are discussed. (*EI*, 1962)

1,826. A NEW PHOTOMETRIC TECHNIQUE USING A VARIABLE SHUTTER DEVICE
Jones, O. C., Clarke, F. J. J.
*Nature*, v. 191, p. 1290, September 23, 1961

A technique is described for measuring optical transmission by balancing the photocell output from two beams, one that has passed through the sample under examination and the other through a rotating shutter, the "open-to-shut" time ratio of which can be varied. The latter time ratio is a measure of transmission. (*PA*, 1961, #18,561)

1,827. NEW AIRGLOW PHOTOMETER
Purdy, C. M., Megill, L. R., Roach, T. E.
*Journal of Research of the National Bureau of Standards, Section C—Engineering and Instrumentation*, v. 65, pp. 213–216, October 1961

A simple, yet rugged and reliable photometer, designed to monitor airglow intensities in one direction only, is described.

1,828. COLOR TEMPERATURE DIAGRAM
Canty, B. R., Kirkpatrick, G. P.
*Optical Society of America, Journal of the*, v. 51, no. 10, pp. 1130–1132, October 1961
(*PA*, 1961, #13,014)

**1,829. PLANETARY ATMOSPHERES AND RELATED INFORMATION: A BIBLIOGRAPHY**
**Colabrese, E.**
**October 1961**
**General Electric Company, Space Sciences Laboratory, Philadelphia, Pa.**
**R61SD126**
**AD-266,458**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

Although the composition of the planetary atmospheres is the prime concern of this bibliography, articles and reports on other aspects of the planets, such as surface features, temperature properties, and radiation measurements were included. Section I contains 169 references on the Planetary System in general; Section II, 159 references on Mars; Section III, 90 references on Venus; Section IV, 49 references on Jupiter; Section V, 15 references on Saturn; and Section VI, 23 references on Interplanetary Space and Exploration. Approximately one fourth of the references were abstracted. Abstracts were obtained from the sources consulted in compiling the bibliography. Within each of the six sections, references are arranged alphabetically by author. There is a total of 508 references.

**1,830. INFRARED AND REFLECTED SOLAR RADIATION MEASUREMENTS FROM THE TIROS 2 METEOROLOGICAL SATELLITE**
**Bandeen, W. R., Hanel, R. A., Licht, J., Stampfl, R. A., Stroud, W. G.**
***Journal of Geophysical Research*, v. 66, no. 10, pp. 3169–3185, October 1961**

The *Tiros* meteorological satellite contains detectors, storage, and telemetry for the measurement of infrared and reflected solar radiation from the Earth and its atmosphere. Two separate detector designs are employed: a medium-resolution scanning radiometer and a low-resolution non-scanning radiometer. The spin of the satellite provides the scan line of the medium-resolution radiometer, which is then advanced by the orbital motion of the satellite. Five channels using bolometer detectors and filters to limit the spectral response from 6 to 6.5 $\mu$, 8 to 12 $\mu$, 0.25 to 6 $\mu$, 8 to 30 $\mu$, and 0.55 to 0.75 $\mu$ are mounted in a single housing with choppers and pre-amplifiers. The spatial resolution is about 40 $mi^2$ when viewing the Earth directly beneath the satellite. The parameters studied by these spectral regions are, in the same order: radiation emerging in the water vapor absorption band, day and night time cloud cover, albedo, thermal radiation, and visual maps for comparison with television pictures from the vidicon camera also carried in the satellite. The low-resolution non-scanning radiometer, utilizing a simple unchopped design, measures the black-body temperature and the albedo of the Earth. The field of view of the detector when viewing the Earth directly beneath the satellite is a circle of 450-mi D and covers part of the area of each picture frame of the wide-field television camera. The detector consists of two thermistors, each mounted in the apex of a reflective mylar cone which provides optical gain. One thermistor, coated black, responds to both reflected solar radiation and the thermal radiation from the Earth, the second reflects solar radiation and responds only to the thermal radiation. The design, calibration, performance, and data reduction of both systems are discussed. (*PA*, 1962, #2574)

**1,831. ANALYSIS OF THE OPERATION OF OPTICAL RADIATION DETECTORS**
**Desvignes, F.**
***Acta Electronica*, v. 5, no. 4, pp. 517–592, October 1961**
**(in French)**

A comprehensive study of physical phenomena involved in optical radiation detectors leads to the establishment of the relations between geometrical and chemical structure, the main ambient parameters, and the optical and electrical properties of these detectors. A survey of the fundamental propagation laws of optical radiations, and some essential ideas on the metrology of detectors are given. The limits of detection of "perfect detectors" are examined, taking into account the influence of problems such as matching of detector area and beam structure, optical coupling, spectral range, ambient temperature, and stray light; this is followed by a comparison of real properties of thermal detectors (bolometer, thermopile) and photoelectric detectors (photoemissive, photoconductive, photovoltaic, photomagnetoelectric), giving the main values of active and reactive components of the equivalent circuit parameters. A few comments on compared performances, general rules of use, and on expected new devices and improvements of present detectors are given. (*EEA*, 1963, #6205)

**1,832. THE NYSTAGMIC RADIOMETER**
**Stewart, R. M.**
**November 3, 1961**
**Space-General Corporation, Applied Research Laboratory, El Monte, Calif.**
**RM-16**

The nystagmic microwave radiometer is a modification of a conventional fast-scanning microwave radiometer so designed as to enhance the direction and display of reproducible and invariant terrain features.

**1,833. PHOTOMETRY AND COLORIMETRY AT THE NATIONAL PHYSICAL LABORATORY**
**Lambert, G. E. V., Preston, J. S.**
***Light and Lighting*, v. 54, no. 11, pp. 327–330, November 1961**

Standard lamps used for the photometry of light sources and for the international comparisons carried out from time to time are described. The research in progress with the object of replacing the primary standard by absolute radiometery is also referred to briefly. An integrating sphere of 7-ft D has recently been installed, primarily for research work. A new templet colorimeter has been built for precise color measure-

ments, and the work on the visual matching functions is being continued along with other work on vision, particularly the relation between spectral distribution and color rendering. (*EEA*, 1962, #4026)

1,834. THE TIROS 2 RADIATION EXPERIMENT
Hønel, R. A., Stroud, W. G.
*Tellus*, v. 13, no. 4, pp. 486–488, November 1961

The *Tiros 2* meteorological satellite, containing two television cameras and a family of electromagnetic radiation experiments, was placed into orbit on November 23, 1960. The medium resolution radiometer is a cluster of five sensors, their optical axes inclined at 45 deg to the spin axis of the satellite. The spin of *Tiros* provides the scanning motion. Channels are sensitive to the following spectral bands: (1) 6 to 6.5, (2) 8 to 12, (3) 0.2 to 6, (4) 8 to 30, and 0.55 to 0.75 $\mu$. (*PA*, 1962, #8950)

1,835. LICHTMESSTECHNIK (PHOTOMETRY)
Wiechowski, W.
*Archiv für Technisches Messen*, no. 310, pp. 263–264, November 1961

A progress review of color measurement, vision, luminescent materials, light distribution, density measurement, and related instruments is presented. Sixty-eight references are included. (*EI*, 1962)

1,836. DISTRIBUTION OF THE INTENSITY AND POLARIZATION OF THE DIFFUSELY REFLECTED LIGHT OVER A PLANETARY DISK
Sekera, Z., Viezee, W.
November 1961
Rand Corporation, Santa Monica, Calif.
R-389-PR
AD-267,299

Much could be learned of a planet and its atmosphere if a fly-by probe could relay data on the patterns of light diffusely reflected by the planetary disk. These light patterns, as affected by various combinations of atmospheric parameters, are illustrated. The figures show the calculated distribution of intensity of light, degree of polarization, and the plane of polarization for various values of optical thickness, planetary phase angle, and surface albedo.

By comparing the distinctive patterns shown in the figures with data from as few as two preselected linear scans of the disk, much could be inferred about the depth and content of a planet's atmosphere and surface (or cloud-top) reflectivity. The distributions of intensity and degree of polarization are most sensitive to changes in atmospheric and surface characteristics. Previous results based on single scattering must be modified to take multiple scattering into account .(*AI/A*, 1961, #4610)

1,837. A SPACE BACKGROUND STUDY
December 6, 1961
Eastman Kodak Company, Apparatus and Optical Division, Rochester, N.Y.
EK/ARD-ED-735, Final Report for October 1960–September 1961, DA-30-069-ORD-2803

This is a summary report of a two-year effort to obtain and present astronomical data designed to show the nature and extent of the infrared space background. Emphasis in the first phase was placed on historical and theoretical considerations of the problem. A summary table of the computed infrared magnitudes of 235 stars in three infrared wavebands is presented, based on the assumption that stars radiate as blackbodies over their entire spectral range. The second phase was designed to test the foregoing assumption by observing and measuring in the infrared a number of selected astronomical sources. To this end two infrared photometer systems were designed and constructed and employed on the Perkins and Mount Wilson Observatories' telescopes.

1,838. A MEMORANDUM ON AN X-BAND RADIOMETER STUDY
Wortendyke, D.
December 15, 1961
Ohio State University Research Foundation, Antenna Laboratory, Columbus
R-1041-3, AFCRL-62-74, AF 19(604)-6134

This paper describes the principles of a dc and ac (switching) radiometer, and includes a discussion and demonstration of a rather novel calibration of a switching (Dicke) radiometer. The advantages of a nulling system are shown in a radiometer which was built to perform low noise temperature antenna studies. This instrument was used in experiments for: comparison of aluminum and metalized fiber glass 4-ft-D parabolic reflectors, measurement of the noise temperature of microwave lenses, and measurements of power reflection coefficients of wire mesh screens.

1,839. PHYSICAL SIGNIFICANCE OF THE TIROS 2 RADIATION EXPERIMENT (Presented at the Optical Society of America Meeting, Pittsburgh, Pa., March 1961)
Hanel, R. A., Wark, D. Q.
December 1961
National Aeronautics and Space Administration, Washington, D.C. (in cooperation with U.S. Department of Commerce, Weather Bureau, Washington, D.C.)
TN D-701
AD-268,135
(Also available in *Journal of the Optical Society of America*, v. 51, no. 12, pp. 1394–1399, December 1961; and through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The meteorological satellite *Tiros 2* carries a five-channel radiometer which scans the Earth as the satellite rotates. Two channels are sensitive to sunlight reflected from the Earth;

three are responsive to terrestrial infrared emission. The effect of the optical properties upon the measurements is discussed. Calculations based on model atmospheres show the sources of outgoing terrestrial radiation and limb-darkening effects for two of the channels. A map of the radiation received by the channel sensitive in the window region (8 to 12 $\mu$) is compared with a conventional weather chart.

**1,840. INFRARED RADIOMETRIC INSTRUMENTS ON TIROS 2**
**Astheimer, R. W., DeWaard, R., Jackson, E. A.**
***Optical Society of America, Journal of the*, v. 51, no. 12, pp. 1386–1393, December 1961**

A five-channel ac radiometer is mounted at 45 deg to the satellite spin axis. In order to obtain radiation measurements independent of satellite temperature, an optical chopping system is used which utilizes the near-zero radiation from space as a reference. These five radiometers have coincident 5 × 5-deg instantaneous fields of view which scan arcs over the Earth's surface as the satellite spins at 10 rpm. The five channels are filtered to respond to different spectral regions in the visual and infrared which are of meteorological significance. A two-channel, wide-angle, unchopped radiometer is mounted parallel to the spin axis and sees a 50-deg circular field of view which progresses slowly over the Earth's surface with the orbital motion of the satellite. This radiometer uses two thin thermistor disks mounted at the apex of two reflecting cones and coated "black" and "white," respectively. These radiometers measure solar reflection and total emission of the Earth. A third infrared device having a small angular field of view normal to the satellite spin axis produces reference pulses as it crosses the Earth's horizon. This sensor provides information to determine the inclination of the spin axis and the spin rotation rate. (*PA*, 1962, #1028)

**1,841. RADIOMETRIC STANDARDS AND MEASUREMENTS**
**Gillham, E. J.**
**1961**
**National Physical Laboratory, Great Britain**
**Notes on Applied Science 23**

These notes are devoted to a description of the methods used at the National Physical Laboratory for the measurement of ultraviolet, visible, and infrared radiation. The topics covered are: the measurement of total radiation, the measurement of monochromatic radiation, and the absolute measurement of radiation.

**1,842. PHOTOMETRIC STANDARDS AND THE UNIT OF LIGHT**
**Preston, J. S.**
**1961**
**National Physical Laboratory, Great Britain**
**Notes on Applied Science 24**

**1,843. A COMPARISON OF PHOTOELECTRIC AND PHOTOGRAPHIC SPECTROPHOTOMETRY**
**Cayrel De Strobel, G.**
***Annales d'Astrophysique*, v. 24, no. 6, pp. 509–515, 1961**

The absolute gradients $\phi_b$ and $\phi_{uv}$, and the relative gradients $\Delta\phi_b$, $\Delta\phi_{uv}$, with respect to $\alpha$ Lyr and the Balmer discontinuities of stars measured with a photoelectric spectrum scanner by Code, Whitford, Oke and Melbourne (1960), were compared with spectrophotographic gradients and discontinuities obtained by Chalonge, et al. The relative gradients in the blue region determined in these independent ways agree with only small errors, but there is disagreement concerning the structure of the continuum near $H_\beta$. The difference in the zero point of the absolute scale of gradients, and therefore of color temperatures, is significant. (*PA*, 1962, #6967)

**1,844. CIRCULAR OPTICAL ABSORPTION WEDGES**
**van der Wal, J.**
***Philips Technical Review*, v. 22, no. 12, pp. 402–403, 1960–1961**

The level of illumination in nature increases from about 0.5 lux at dusk to 50,000 lux in bright sunlight, i.e., by a factor of $10^5$. A continuously variable attenuating element has been made by designing an absorption filter in the form of a movable density wedge. The results obtained are given. (*EI*, 1961)

**1,845. FEASIBILITY STUDY OF SPECTROPHOTOMETRIC TECHNIQUES APPLICABLE TO SATELLITE OBSERVATION OF THE SUN IN THE WAVELENGTH INTERVAL 10A–200A**
**Givens, M. P., Evans, J. C.**
**1961**
**Rochester, University of, Institute of Optics, N.Y.**
**Final Technical Report**

**1,846. AN ELECTROMECHANICAL SYSTEM OF PROGRAM CONTROL OF A TELESCOPE**
**Sabinin, Yu. A., Mamedova, Z. N.**
***Visshikh Uchebnikh Zavedenii, Electromekhanika, Izvestiia*, no. 7, pp. 103–108, 1961**
**(Translation available as FTD-TT-62-476, AD-286,115, Air Force Systems Command, Foreign Technical Division, Wright-Patterson AFB, Ohio, May 18, 1962; and through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

**1,847. ELECTRONIC ULTRAVIOLET IMAGING TECHNIQUES (Presented at the National IAS/ARS Joint Meeting, Los Angeles, Calif., June 13–16, 1961)**
**Gray, S. (Radio Corporation of America, Princeton, N.J.)**
**1961**
**American Rocket Society, New York, N.Y.**
**61-112-1806**

Astrophysical studies in the vacuum ultraviolet can be pursued from extra-atmospheric platforms. The possibilities of

obtaining solar and stellar images in the far ultraviolet in a form suitable for transmission by television techniques are surveyed. It is proposed that this be done by modifying the structure of existing television-camera tubes and developing new ones specifically designed to handle the problems of imaging in this energy range.

The development of imaging systems for the vacuum ultraviolet is basically inhibited by the increasing scarcity of window materials for the pickup device at shorter wavelengths. Through the use of lithium fluoride, operation is possible in principle for any standard type of television-camera tube with a suitable transducer, down to about 1050 Å. To record images in the next higher energy range, windowless and effectively windowless imaging systems have been devised. (*AI/A*, 1961, #4180)

**1,848. A RAPID METHOD OF DETERMINING THE INTEGRAL BRIGHTNESS OF AN EXTENDED OBJECT**
**Rozhkovskii, D. A.**
***Astronomicheskii Zhurnal*, v. 38, no. 2, pp. 278–283, 1961**
**(Translated from the Russian in *Soviet Astronomy—AJ*, v. 5, no. 2, pp. 206–210, September–October 1961)**

A new microphotometric method for the measurement of photographs is proposed. With this method it is possible to rapidly obtain data for the determination of the integral brightness of an extended object. (*PA*, 1962, #924)

**1,849. THE LIMITS OF APPLICABILITY OF BOUGUER'S METHOD FOR DETERMINING THE BRIGHTNESS OF A CELESTIAL SOURCE**
**Kozhevnikov, N. I., Makarova, E. A.**
***Astronomicheskii Zhurnal*, v. 38, no. 3, pp. 536–540, 1961**
**(Translated from the Russian in *Soviet Astronomy—AJ*, v. 5, no. 3, pp. 399–401, November–December 1961)**

The limits of applicability of Bouguer's method are investigated using the general radiative transfer equation. Previous considerations are applied to the case of an atmosphere with absorption, which has layers with discontinuous properties. (*PA*, 1962, #923)

**1,850. A HIGH-SPEED SOLAR PHOTOELECTRIC SPECTROPHOTOMETER**
**P. P. Kozak**
***Astronomicheskii Zhurnal*, v. 38, no. 3, pp. 549–552, 1961**
**(Translated from the Russian in *Soviet Astronomy—AJ*, v. 5, no. 3, pp. 409–411, November–December 1961)**

A photoelectric spectrophotometer for rapid registration of line intensities in the solar spectrum is described. The spectrum is moved across the electrophotometer slit by the deflection of a twice-diffracted beam of light. (*PA*, 1962, #925)

## *Jupiter — 1961*

**1,851. OBSERVATIONS OF JUPITER AT A WAVELENGTH OF 10 CM**
**Sloanaker, R. M., Boland, J. W.**
***Astrophysical Journal*, v. 133, no. 2, pp. 649–656, March 1961**

Two series of measurements of the radiation from the planet Jupiter were made at wavelengths of 10.3 and 10.2 cm, using the same radiometer and the 84-ft reflector at the U.S. Naval Research Laboratory. Measurements were made from June to August, 1958, and in October, 1959. The mean apparent blackbody temperatures derived from the measurements are 640° ± 85°K standard error for the 1958 measurements and 315° ± 65°K standard error for the 1959 measurements. It is concluded that the observed change in intensity of about 2 to 1 between 1958 and 1959 is real and may be related to polarization of the radiation or to a correlation with solar activity. In addition, the 1958 measurements show some evidence of short-time variability, possibly correlated with the rotation of the planet. (*PA*, 1961, #5168)

**1,852. A PRELIMINARY SEARCH FOR $H\alpha$ ACTIVITY ON THE PLANET JUPITER**
**Jelley, J. V., Petford, A. D.**
***Observatory*, v. 81, no. 922, pp. 104–106, June 1961**
**(*AI/S*, 1961, #40,547)**

## *Mars — 1961*

**1,853. A LITHOLOGICAL INTERPRETATION OF THE PHOTOMETRIC AND COLORIMETRIC STUDIES OF MARS**
**Sharonov, V. V.**
***Astronomicheskii Zhurnal*, v. 38, no. 2, pp. 267–272, 1961**
**(Translated from the Russian in *Soviet Astronomy—AJ*, v. 5, no. 2, pp. 199–202, September–October 1961)**

The results of visual photometric and colorimetric observations of the surface of Mars, made during 1956 and 1958, were compared with data of a similar study of a large number of samples of terrestrial rocks. It was found that, according to the mean values of the albedo $r$ and the color excess $D$, sand and other materials covering deserts on the Earth, the red rocks of the Permian system, and the dense varieties of limonite are not similar to the continents of Mars, as the red color of the latter is considerably more saturated. Only the ochres, i.e., earthy varieties of limonite, are approximately similar in color to the disk of Mars. Therefore, the hypothesis is proposed that the surface of the Martian continents is everywhere covered with silt consisting of very fine particles of limonite. The latter, ascending into the atmosphere, produce the orange haze, the development of which was characteristic of the opposition of 1956. (*PA*, 1961, #18,040)

1,854. ÉTUDE PHOTOMETRIQUE ET POLARIMETRIQUE DES PHENOMENES SAISONNIERS DE LA PLANETE MARS (PHOTOMETRIC AND POLARIMETRIC STUDY OF THE SEASONAL PHENOMENA OF THE PLANET MARS)
Focas, J. H.
*Annales d'Astrophysique*, v. 24, no. 4, pp. 309–325, 1961
(*AI/S*, 1962, #50,524)

## *Mercury — 1961*

1,855. THE PHASE OF MERCURY
Vetterlein, J. C.
*British Astronomical Association, Journal of the*, v. 71, no. 4, pp. 156–157, 1961

The question of a phase anomaly is raised. (*AI/S*, 1961, #50,297)

## *Moon — 1961*

1,856. LUNAR INFRARED TEMPERATURE MEASUREMENTS DURING SEPTEMBER 4, 5, AND 6, 1960
Shorthill, R. W., Saari, J. M.
January 30, 1961
Boeing Airplane Company, Seattle, Wash.
D7-2550-1

Infrared temperature measurements were made on certain lunar crater areas during the full Moon and during the total lunar eclipse of September 5, 1960. The experimental apparatus, experimental program, method of calculation, and results are described. The variations in temperature found both on the full Moon and during the eclipse are discussed in terms of possible localized variations in surface properties. In particular, it was found that certain rayed craters cooled less rapidly than their surroundings during the eclipse. If caused by variations in dust thickness, this may offer a means for dating these areas. (*AI/A*, 1961, #3467)

1,857. LABORATORY SIMULATION OF LUNAR LUMINESCENCE
Kopal, Z.
March 1961
Manchester College of Science and Technology, Great Britain
Annual Summary Report 1, AFCRL-820, AF 61(052)-379
AD-272,119
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The luminescence of mineral samples, of the type which might exist on the Moon, is being investigated under conditions of temperature and radiation intended to simulate those on the lunar surface. The test apparatus is to consist of three parts: a small evacuated chamber in which dust or rock samples may be placed, equipment for exciting luminescence, and a recording photoelectric spectrophotometer for investigating the luminescent spectrum.

1,858. PHOTOMETRICAL RELIEF OF THE LUNAR SURFACE
(Translated from *Astronomicheskii Zhurnal*, v. 33, no. 1, 1956)
Orlova, N. S.
Trirogoff, K. N., Jakubski, Z., Translators
March 1961
Space Technology Laboratories, Inc., Los Angeles, Calif.
STL-TR 61-5110-13
AD-264,169
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Measurements of the brightness of the lunar surface and the absolute measurements of brightness were reduced. Supposing the surface of the continents and the surface of the seas as similar in all points of the lunar disk, average coefficients of brightness (brightness factor, albedo) were reduced for various combinations of the angles of incidence and reflection. Results related with the plane of incidence of the solar rays for seas and for continents are given. If the results are represented in the form of a polar diagram of reflectivity (diffusion function), then a group of curves is obtained, extremely extended in the direction to the Sun at any angles of incidence of solar rays. Curves for the seas are similar to those for the continents. The similarity of the character of curves shows that the unevenness of the lunar surface is extreme and is the same for the seas and the continents. A diffusion diagram of the Moon exceeds considerably the investigated terrestrial samples according to their extension. This relation shows that the surface of the Moon is covered with extremely porous matter, similar to slags of a spongy structure.

1,859. SPECTROPHOTOMETRIC STUDY OF THE LUNAR SURFACE
Kopal, Z.
March 1961
Manchester University, Great Britain
Annual Summary Report 1, AFCRL-860, AF 61(052)-378
AD-272,573
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

It is proposed to study the luminescence of the lunar surface more extensively and with greater photometric accuracy than was achieved previously, and to measure the variation of polarization of moonlight as a function of wavelength. A design study was made for a luminescence spectrometer, and a description is given of the completed instrument based on this design. A prototype polarimeter was used with a 15-in. telescope to gain experience in this field; the final instrument is now nearing completion. Experiments are in progress to find the most suitable electronic system for these instruments. It is expected that extensive astronomical observations will be carried out in the near future.

1,860. LUNAR BRIGHTNESS VARIATIONS WITH PHASE AT 4.3-mm WAVE LENGTH
Coates, R. J.
*Astrophysical Journal*, v. 133, no. 2, pp. 723–725, March 1961
(*PA*, 1961, #5169)

1,861. PHYSICAL CONDITION ON THE MOON AND PLANETS
(Translated from "Astronomiia V SSSR Za Sorok Let. 1917–1957," pp. 135–156, 1960)
Barabashov, N. P.
April 21, 1961
Joint Publications Research Service, Washington, D.C.
JPRS-4549, CSO: 1971-S/a
(Also available as OTS: PB 61-23,022, U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

1,862. STUDY OF INFRARED INSTRUMENTATION FOR THERMAL PHOTOGRAPHY OF THE MOON
Ingrao, H. C., Menzel, D. H., Burke, J. A.
May 15, 1961
Harvard College Observatory, Cambridge, Mass.
Scientific Report 1

Thermal detectors and available single-quantum detectors, with responses at wavelength of approximately 5 $\mu$ and longer, are intercompared in terms of figures of merit. Infrared-sensitive image-forming systems are surveyed and discussed for lunar thermal photography. Lateral heat conduction in the target plate of a simultaneous read-in image-forming system is analyzed to determine the size of the minimum resolvable element. On the basis of this analysis, the possible use of new thermal detectors as target plates for image-forming systems of simultaneous read-in is investigated.

The potentialities of ferroelectric materials for a target plate (thin film) of an image-forming system depend on the change in dielectric constant as a function of temperature close to the Curie point. Nonlinear phosphors, especially zinc cadmium sulfide, are considered for thermal image conversion. This phosphor fluoresces in the yellow and has a brightness change of approximately 28% C for a given ultraviolet excitation and phosphor temperature. (*AI/A*, 1961, #4030)

1,863. STUDY OF THE REFLECTING POWER OF THE MOON'S SURFACE
(Translated from *Uchenye Zapiski LGU*, Leningrad, no. 153, 1952)
Sytinskaya, N. N., Sharonov, V. V.
May 1961
Space Technology Laboratories, Inc., Los Angeles, Calif.
STL-TR 61-5110-23
AD-264,070

The reflecting power of the various formations on the Moon is studied. Absolute values of the reflecting power of a number of celestial bodies are derived by photometric observations based on the constancy of atmospheric attenuation. Final results of the data reduction of the observations are presented in tables, subtables, and in graphic form. (*AI/A*, 1962, #5547)

1,864. SUMMARY CATALOG OF THE ABSOLUTE VALUES OF THE VISUAL REFLECTING POWER AT FULL MOON OF 104 LUNAR OBJECTS
(Translated from *Astronomicheskii Zhurnal*, v. 30, no. 3, 1953)
Sytinskaya, N. N.
Lesgaft, P. F., Translator
May 1961
Space Technology Laboratories, Inc., Los Angeles, Calif.
STL-TR 61-5110-24
AD-264,167
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Absolute values of the reflecting power of various details of the lunar disk, obtained by different observations and expressed in the form of the brightness factor, are reduced to a single standard system and presented as average values. The catalog of these values is used for some statistical comparisons.

1,865. LUNAR ATMOSPHERE AND SURFACE CONDITIONS. AN ANNOTATED BIBLIOGRAPHY
Evans, G. R., Compiler
May 1961
Lockheed Aircraft Corporation, Missiles and Space Division, Sunnyvale, Calif.
LMSD 3-10-61-1, SB-61-22
AD-258,377
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The primary concern of this search was to collect information on the theory of the atmosphere and surface of the Moon; also, emphasis was placed on data derived from experiments and investigations. This search and a companion one, Lunar Probes and Landings, LMSD-5-10-61-3/SB-61-24 were undertaken to support studies of an eventual lunar landing. The period covered is from January 1959 to the present.

1,866. LUNAR SURFACE CHARACTERISTICS INDICATED BY THE MARCH, 1960, ECLIPSE AND OTHER OBSERVATIONS
Gibson, J. E.
*Astrophysical Journal*, v. 133, no. 3, pp. 1072–1080, May 1961

The variation in lunar brightness temperature during the total eclipse of March 13, 1960 was found to be about 1 deg or less at 8.6-mm wavelength. This result, when combined with prior data for this and other wavelengths, indicates that the average, or typical, lunar surface structure is stratified in at least two, and possibly three, layers. The topmost layer is about 0.5 cm in depth and seems to resemble ordinary sand *in vacuo*, the intermediate layer may be several centimeters

or more in depth and is most notably characterized by a high electric conductivity, while the lowermost stratum of indefinite depth is more like rock. (*PA*, 1961, #7979)

1,867. DISCUSSION OF UMBRAL CONTACT CRATER TIMINGS AT THE LUNAR ECLIPSE OF MARCH 2, 1961
Ashbrook, J.
*Strolling Astronomer*, v. 15, no. 5–6, pp. 94–96, May–June 1961
(*AI/S*, 1961, #40,330)

1,868. MULTICOLOR PHOTOELECTRIC PHOTOMETRY OF THE MOON, VENUS, MARS, AND OTHER PLANETS
Menzel, D. H.
July 15, 1961
Harvard College Observatory, Cambridge, Mass.
Semiannual Status Report 2 for January 1–June 30, 1961

1,869. STUDY OF INFRARED INSTRUMENTATION FOR THERMAL PHOTOGRAPHY OF THE MOON
July 25, 1961
Harvard College Observatory, Cambridge, Mass.
Semiannual Status Report 3 for January 1–June 30, 1961

1,870. HORIZON SENSOR PERFORMANCE IN MEASURING ALTITUDE ABOVE THE MOON
de Fries, P. J.
July 1961
National Aeronautics and Space Administration, Washington, D.C.
TN D-609

A space vehicle approaching the Moon can determine its altitude above the surface by measuring the diameter of the apparent lunar disk with a horizon sensor and computing the distance with the knowledge of the lunar radius. Two basic errors are involved in this process: an error introduced by measuring the chord of the lunar sphere, and an error introduced by computing with an inaccurately known lunar radius. The error in measuring breaks up into two: one is purely instrumental (electronic gear), the other one stems from the properties of the target, the Moon, which is not an ideal sphere but has elevations and depressions referenced to the ideal "sea level." An error analysis is carried out considering these factors. The accuracy with which the altitude can be determined is resolved as a function of altitude. (*AI/A*, 1961, #4274)

1,871. OPTICAL RADAR COULD MAP MOON FROM EARTH BASE
*Electrical Engineering*, v. 80, no. 7, pp. 559–560, July 1961
(*AI/S*, 1961, #40,549)

1,872. LUNAR TEMPERATURE MEASUREMENTS AT 3200 Mc/S
Medd, W. J., Broten, N. W.
*Planetary and Space Science*, v. 5, no. 4, pp. 307–313, August 1961

The measured effective blackbody temperature at the lunar equator is 220°K, with an estimated probable error of 5 percent. No variation with lunar phase was detected. If a variation is present, and obscured by the random scatter of the observations, it is less than 5 percent at this frequency. (*AI/S*, 1961, #40,861)

1,873. FINAL REPORT OF THE ELECTRICAL ENGINEERING RESEARCH LABORATORY
September 30, 1961
Texas, University of, Electrical Engineering Research Laboratory, Austin
R 5-51, AF 33(616)-6257
AD-267,863

Research and development studies in a variety of areas including microwave bistatic lunar reflection, solar emission and atmospheric absorption at millimeter wavelengths, radio phase variations from a balloon-borne transmitter, and the utilization of radio refractometer techniques in plasma measurements are considered. This research program, which became effective on March 1, 1959, was initially concerned solely with the instrumentation and operation of a Moon reflection communication receiving system. The plasma studies were effected as a result of a mutual agreement between representatives of this Laboratory and the Aeronautical Systems Division. Research in this area eventually superseded the millimeter propagation and balloon-borne phase variation efforts. Brief summaries of the pertinent research areas are given with references to the appropriate publications.

1,874. AN INVESTIGATION OF POSSIBLE VARIATIONS IN THE BRIGHTNESS TEMPERATURE OF THE MOON AT 21 CM (Presented at the 108th Meeting of the American Astronomical Society, Nantucket, Mass., June 18–21, 1961)
Waak, J. A.
*Astronomical Journal*, v. 66, no. 7, p. 298, September 1961 (Abstract)
(*AI/S*, 1961, #40,862)

1,875. THE APPARENT TEMPERATURE OF ISOLATED OBJECTS
Peake, W. H.
October 1, 1961
Ohio State University Research Foundation, Antenna Laboratory, Columbus
R-1388-2, Report on Theoretical and Experimental Analysis of the Electromagnetic Scattering and Radiative Properties of Terrain, With Emphasis on Lunar-Like Surfaces, AF 33(616)-6158

The emission and absorption cross sections of an arbitrary object are defined in terms of its scattering cross section, and the principle of detailed balance is then used to derive Kirchhoff's radiation law for the object, taking into account both the polarization of the emitted and absorbed radiation

and the orientation of the object. The result is used to calculate the apparent brightness temperature of an object in an arbitrary radiation field. Finally, a simple formula for the change in antenna temperature caused by introducing the object into the beam of a high-gain microwave radiometer antenna is found. Eight references are included.

**1,876. LUNAR ECLIPSE ROUNDUP**
*Sky and Telescope*, v. 22, no. 4, pp. 200–202, October 1961
(*AI/S*, 1961, #41,362)

**1,877. NOUVELLES RECHERCHES SUR LA LUNE (NEW RESEARCH ON THE MOON)**
Dollfus, A.
*l'Astronomie*, v. 75, pp. 375–392, October 1961
(*AI/S*, 1962, #50,367)

**1,878. THE NATURE OF THE SURFACES OF THE LUNAR MARIA**
Warner, B.
*Astronomical Society of the Pacific, Publications of the*, v. 73, pp. 349–351, October 1961

Some evidence is presented suggesting that the low albedo of the maria results from the accumulation of only a thin layer of dark dust; it is proposed that the maria may really be composed of continental material. (*PA*, 1962, #11,108)

**1,879. LUNAR RADIATION AT 4.3 MM DURING THE 25 AUGUST 1961 ECLIPSE AND THE LUNAR MODEL**
Tolbert, C. W., Krause, L. C., Dickinson, R. M.
November 15, 1961
Texas, University of, Electrical Engineering Research Laboratory, Austin
R-125, Nonr-37514
AD-267,862
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

This analysis describes the 4.3-mm-wavelength measurement of lunar emissions during a lunation and during the August 25, 1961 eclipse, the results of the measurements, and the relationship of the results to measurement at other wavelengths. The maximum and minimum temperatures observed with a 0.2-deg beamwidth antenna during a lunation were 260 and 145°K, respectively. The temperature change associated with the lunar occultation during the eclipse was approximately 10°C. The temperature change during the eclipse is hypothesized as being associated with the change in temperature of the dust layer.

**1,880. MICROPHOTOMETRIC ANALYSIS OF THE SPECTROGRAM OF THE EMISSION FLARE NEAR THE CENTRAL PEAK OF ALPHONSUS OBSERVED ON NOVEMBER 3, 1958**
Kalinyak, A. A., Kamionko, L. A.
*Astronomicheskii Zhurnal*, v. 38, no. 6, pp. 1085–1098, 1961
(Translated from the Russian in *Soviet Astronomy—AJ*, v. 5, no. 6, pp. 831–840, May–June 1962)

A microphotometric analysis was made of the spectrogram obtained when an emission flare was observed on the Moon near the central peak of the crater of Alphonsus. The results provide evidence that the emission was due to fluorescence of gas escaping from the depths of the Moon. Several maxima on the intensity curve may be identified with the Swan $C_2$ molecular bands. Radiation of thermal origin with a continuous spectrum was not detected. (*AI/A*, 1962, #60,556)

**1,881. ATTEMPT AT A PHOTOMETRIC STUDY OF THE NATURE OF SURFACE DETAILS ON THE REVERSE SIDE OF THE MOON**
Markov, A. V., Shchegolev, D. E.
*Iskusstvennye Sputniki Zemli*, no. 9, pp. 48–51, 1961
(Translation available as AID 62-38, supplement to AID 62-4, Library of Congress, Aerospace Information Division, Washington, D.C., March 29, 1962; and OTS: 62-24,486, U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Microphotometric studies were carried out on three frames obtained in the photography of the reverse side of the Moon. Analysis of the results leads the authors to the conclusion that the nature of the surface of the reverse side of the Moon does not differ appreciably from the visible side. (*PA*, 1962, #17,248)

**1,882. THERMAL RADIATION FROM THE MOON AND THE HEAT FLOW THROUGH THE LUNAR SURFACE**
Baldwin, J. E.
*Royal Astronomical Society, Monthly Notices of the*, v. 122, no. 6, pp. 513–522, 1961

Observations of thermal radiation from the Moon at a frequency of 178 Mc are described, giving a value for the mean disk temperature of 233 ± 8°K, which is the same to within 25°K as various estimates of the mean disk temperature at the surface. The absence of any detectable steady temperature gradient through the surface leads to upper limits on the study heat flow from the Moon for a range of possible properties of the surface materials. The observations at shorter radio wavelengths favor a model in which a gravelly material extends to depths of at least several meters. For this model the upper limit to the heat flow is very close to that expected from radioactive decay in a moon of chondritic composition. (*PA*, 1961, #15,423)

**1,883. X-RAY ANALYSIS OF LUNAR SURFACE (Presented at the National IAS/ARS Joint Meeting, Los Angeles, Calif., June 13–16, 1961)**
Miller, D. C., Hendee, C. F. (Philips Electronics, Inc., Mt. Vernon, N.Y.)
1961

American Rocket Society, New York, N.Y.
61-109-1803

Analytical techniques based on X-ray instrumentation have been studied for possible applications to analysis of the lunar surface. These studies have resulted in two programs, both sponsored and directed by JPL, aimed at the development of a lunar diffractometer and a lunar spectrometer. This paper describes the work which has been done on the lunar spectrometer. (*AI/A*, 1961, #4177)

1,884. SUMMARY OF METHODS AND RESULTS OF ESTIMATION OF THE PHYSICAL CONSTANTS OF THE LUNAR SURFACE
Siegel, K. M.
*1961 IRE International Convention Record*, pt. 5, v. 9, pp. 87–102, 1961

The electromagnetic constants of the lunar surface, its thermal conductivity, and volumetric specific heat have been deduced from terrestrial measurements. Laboratory tests have determined the properties of various likely lunar rocks, both in massive and powdered states. The samples tested include those forms of meteorite which are thought to be of lunar origin. Tables and graphs record the measured data. (*PA*, 1962, #4733)

## *Saturn — 1961*

1,885. RECENT DEVELOPMENTS AND OBSERVATIONS WITH A RUBY MASER RADIOMETER
Bair, M. E., Cook, J. J., Cross, L. G., Arnold, C. B.
*IRE Transactions on Antennas and Propagation*, v. AP-9, no. 1, pp. 43–49, January 1961

Recent developments in equipment design are detailed. Observations of radio sources are discussed, and response curves with and without the maser preamplifier are given. The detection of 3.45-cm radiation from the planet Saturn is reported, and the equivalent blackbody disk temperature calculated. The future of the maser amplifier in radio astronomy is considered. (*PA*, 1961, #8018)

## *Venus — 1961*

1,886. MICROWAVE ABSORPTION AND EMISSION IN THE ATMOSPHERE OF VENUS
Barrett, A. H.
*Astrophysical Journal*, v. 133, no. 1, pp. 281–293, January 1961

The radio-astronomical observations of Venus are analyzed in terms of a model atmosphere and the known microwave absorbing properties of $CO_2$ and $H_2O$. The model atmosphere is taken to consist of an adiabatic region with a temperature gradient of 9.0°K/km and an isothermal region with a scale height of 6.86 km and a temperature of 285°K. The surface temperature is assumed to be 580°K. The centimeter and millimeter radio data require surface pressures between 10 and 30 terrestrial atmospheres on the basis of the assumed model, and atmospheric compositions of 75 percent $CO_2$, 22–25 percent $N_2$, and 0–3 percent $H_2O$. (*PA*, 1961, #2659)

1,887. ATMOSPHERE OF VENUS. REVIEW OF SOVIET LITERATURE (Chapter II of a Study of Soviet Research on the Atmosphere of Venus, Mars, and the Moon)
March 21, 1961
Library of Congress, Air Information Division, Washington, D.C.
AID 61-30
AD-254,403

Contents:

I. Dimensions, orbit, detection of atmosphere, and distance from the Sun
  A. Dimensions and orbit
  B. Venus in space
  C. Venus transits
II. Photometric and spectroscopic investigations of the Venusian surface
  A. General statement
  B. Photometric observations
  C. Physical properties of the Venusian atmosphere
    1. Refraction
    2. Dispersion
    3. Absorption
  D. Atmospheric compounds and temperature
    1. Radio emission from Venus

1,888. RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM: THE OBSERVATION OF THREE CENTIMETER RADIATION FROM ASTRONOMICAL OBJECTS WITH A RUBY MASER
Novick, R.
June 1, 1961
Columbia University, Columbia Radiation Laboratory, New York, N.Y.
Special Technical Report, DA-36-039-sc-78330

Radiation at 3-cm wavelength associated with the planets Venus, Mars, and Jupiter has been measured with the use of a maser-type radiometer in conjunction with the U.S. Naval Research Laboratory 50-ft reflector. The maser radiometer was also used to measure the flux densities of five radio sources observed for the first time at 3 cm. In addition, an attempt was made to observe three planetary nebulae. The radiometer used is described and its operation discussed.

1,889. TEMPERATURE AND CIRCULATION OF THE VENUS ATMOSPHERE
Mintz, Y.
*Planetary and Space Science*, v. 5, no. 2, pp. 141–152, June 1961

The approximate radiative equilibrium temperature is computed for the atmosphere above the visible surface of Venus,

taking carbon dioxide as the only strongly absorbing gas on the planet. It is found that with radiative equilibrium the atmosphere is convectively stable, and that the mean temperature of the visible surface is 237°K. The small difference in observed intensity of infrared radiation from the day and night sides of the planet is attributed to a large heat capacity of the emitting body, and from this it is inferred that the visible surface is only a thin layer of smog covering a universal (but non-aqueous) ocean. The appearance of the clouds of Venus in visible and ultraviolet light suggests a form of the general circulation in which there are large low-level horizontal cells that transport heat from low to high latitudes and from the day to the night side of the planet, surmounted by a circumpolar vortex. (*PA*, 1962, #4745)

**1,890. AIRGLOW OF VENUS: A RE-EXAMINATION**
**Weinberg, J. L., Newkirk, G., Jr.**
***Planetary and Space Science*, v. 5, no. 2, p. 163, June 1961**

In an attempt to obtain the spectrum of the night sky of Venus, a comparison has been made of spectra of the bright crescent and of the unilluminated portion of Venus in the region of 4300 A. (*AI/S*, 1961, #40,443)

**1,891. SOVIET SCIENTIST CLAIMS NEW VENUS FINDINGS**
***Aviation Week and Space Technology*, v. 75, no. 5, p. 61, July 31, 1961**

The discovery of a constant luminescence of the lower Venusian atmosphere is claimed by Soviet astronomer N. A. Kozyrev. (*AI/S*, 1961, #40,445)

**1,892. PHOTOGRAPHIC PHOTOMETRY OF VENUS**
**(Translated from *Transactions of A. M. Gorki Astronomical Observatory, Kharkov State University*, v. 12, pp. 73–165, 1957)**
**Yeserskii, V. I.**
**Jakubski, Z., Translator**
**July 1961**
**Space Technology Laboratories, Inc., Los Angeles, Calif.**
**STL-TR 61-5110-40**
**AD-264,160**

This paper includes a review of the work on the photometry of Venus, studies of brightness distribution on the disk of Venus, and a discussion of the results.

**1,893. OBJECTIVES OF THE MARINER VENUS MICROWAVE RADIOMETER EXPERIMENT**
**Barrett, A. H., Copeland, J., Jones, D. E., Lilley, A. E.**
**August 22, 1961**
**Jet Propulsion Laboratory, California Institute of Technology, Pasadena**
**TR 32-156**
**AD-273,821**

At present, there are several models involving the surface, atmosphere (and ionosphere), and cloud conditions of the planet Venus which attempt to account for the observed high brightness temperature of 600°K in the microwave temperature region. None of these models can be definitely accepted or rejected on the basis of presently available data, and it is the goal of the microwave radiometer experiment planned for the *Mariner* Venus missiles to determine which of the proposed models most nearly approximate Venusian conditions. The disk of the planet will be scanned at four wavelengths—4, 8, 13.5, and 19 mm— to measure the temperature distribution across the planet. Measurement accuracy is expected to be within 2 percent. In addition to the study of gross thermal characteristics of surface and atmosphere (or ionosphere), some information regarding the fine-scale thermal variations will be obtained. Thirty-two references are included.

**1,894. RADAR OBSERVATION OF VENUS**
**Maron, I., Luchak, G., Blitzstein, W.**
***Science*, v. 134, pp. 1419–1421, November 3, 1961**

Observations during the last close approach have resulted in a value of solar parallax of 8.79460 sec of arc, corresponding to a value for the astronomical unit of 149,596,000 km. This is in satisfactory agreement with the determinations made during the same close approach of Venus at the Millstone Hill Radar Observatory and at Jodrell Bank, which are 149,597,700 and 149,601,000 km, respectively. The size of the astronomical unit, heretofore generally accepted as most authoritative, is based upon a 1950 determination by Rabe, and is 149,532,200 km. (*PA*, 1962, #4842)

**1,895. NOTE ON PHOTOMETRIC ANALYSIS OF THE STRUCTURE OF VENUS' ATMOSPHERE**
**Martynov, D. Ya., Pospergelis, M. M.**
***Astronomicheskii Zhurnal*, v. 38, no. 3, pp. 558–561, 1961**
**(Translated from the Russian in *Soviet Astronomy—AJ*, v. 5, no. 3, pp. 419–420, November–December 1961)**

The light-curve of Regulus during its occultation by Venus was analyzed. The conclusion is reached that the scale height $H$ of the atmosphere on Venus averages 6 km, but that $H$ falls off significantly at a 30- to 50-km level above the Venus cloud cover, which might possibly be related to a local temperature drop of large proportions. (*PA*, 1962, #946)

## *General — 1962*

**1,896. THE INFORMATION CONTENT OF ASTRONOMICAL MULTICOLOUR PHOTOMETRY**
**Hameen-Anttila, K. A.**
***Astrophysical Journal*, v. 135, no. 1, pp. 85–93, January 1962**

The formula for the information obtained by means of multicolor photometric measurements is derived for an instrument which uses the photon-counting method. As an application of the general formula, the best choice of bandpasses for three-color photometry is studied, and the results are compared with some combinations of bandpasses that actually have been used in astronomical measurements. (*PA*, 1962, #4710)

**1,897. A SEPARATION OF THE LIGHT FROM THE NIGHT SKY INTO ITS COMPONENTS**
Chuvaev, K. K.
*Soviet Astronomy—AJ*, v. 5, no. 4, pp. 526–535, January–February 1962

A method is proposed for determining the intensity of the components of light from the night sky for separate regions with given equatorial coordinates. Observational data were obtained with the night-sky photometer at the Crimean Astrophysical Observatory during the IGY and IGC. (*AI/S*, 1962, #50,823)

**1,898. ORBITING ULTRAVIOLET SYSTEM WILL MAP STARS AND THE SKY'S RADIANT INTENSITY**
*Electronics*, v. 35, no. 8, pp. 22–23, February 23, 1962

Project *Celescope* will map the sky's radiant intensity and obtain UV spectra of 100,000 stars. This project, which is part of the *OAO*, is intended to provide practical space tests of UV-sensitive cameras and digital television transmission. (*AI/S*, 1962, #50,560)

**1,899. INTERPRETING LIGHT DISTRIBUTION CURVES**
Allphin, W.
*Electrical Construction and Maintenance*, v. 61, pp. 88–90, February 1962

The control and distribution of light by a luminaire are revealed by its photometric light distribution curve. Correct reading and interpretation of these curves are described.

**1,900. OBSERVATIONS IN THE SOUTHERN HEMISPHERE OF ULTRA-VIOLET LIGHT FROM CELESTIAL OBJECTS**
Heddle, D. W. O.
*Nature*, v. 193, no. 4818, p. 861, March 3, 1962

An account is given of the first observations of ultraviolet radiation made by rockets launched from the Southern Hemisphere. The first reported measurements of lunar ultraviolet irradiance made from rockets are discussed. (*AI/S*, 1962, #51,261)

**1,901. PHOTOMETRY OF FLUORESCENT LUMINAIRES—ROTATING PHOTOCELL METHOD**
Dunlop, D., Finch, D. M.
*Illuminating Engineering*, v. 57, no. 3, Sec. I, pp. 159–165, March 1962

Development of the method of photometry to solve problems involved in rotating fluorescent luminaires during a test is explained. Details of luminaires selected for evaluation are discussed. Photometric measurements, calibration, and test descriptions are included. Test results show that the "rotating photocell method" of photometry for large and highly loaded fluorescent lamp luminaires is comparable in accuracy to existing present day methods of photometry. (*EI*, 1962)

**1,902. ZERO-LENGTH SEARCHLIGHT PHOTOMETRY SYSTEM (Presented at the National Technical Conference of the Illuminating Engineering Society, St. Louis, Mo., September 24–29, 1961)**
Johnson, J.
*Illuminating Engineering*, v. 57, no. 3, Sec. I, pp. 187–194, March 1962

A new type of photometric method which allows measurements of the candlepower distributions of large searchlights indoors at very short test distances is described. This method is based upon the use of a large mirror or lens to accept and reimage the projected searchlight beam. The results of laboratory and field measurements are presented and the practical and theoretical sources of error indicated. Finally, it is shown that the maximum theoretical error in the method may be reduced to less than one percent if the optical quality of the collimator exceeds that of the searchlight reflector by a factor of 5 to 10 times.

**1,903. A PHOTOMETER FOR MAPPING GALAXIES**
Miller, R. H.
*Astrophysical Journal*, v. 135, no. 1, pp. 638–643, March 1962

A special-purpose photometer was constructed to map the light-intensity distribution of elliptical galaxies with the 82-in. McDonald telescope. It uses a single photometer arm which moves over the galaxy image to map it in a point-by-point scan, while two other photometer arms remain in fixed locations to monitor the sky and a comparison star. The telescope axis is kept on the galaxy center, and the galaxy photometer arm makes measurements off the optic axis to simplify the mounting of an offset guider and of the sky and comparison-star photometer arms, because these should operate in positions fixed relative to the center of the galaxy. The photometer arms include changeable color filters, and the galaxy arm diaphragm is changeable. The sky monitor permits measurements to a few percent of sky intensity, while the comparison-star monitor facilitates extinction corrections. The field over which these photometer arms can work extends to about 10 min of arc from the optic axis. (*PA*, 1962, #15,290)

**1,904. INFRARED SPECTROSCOPY OF PLANETS AND STARS**
Sinton, W. M.
*Applied Optics*, v. 1, no. 2, pp. 105–110, March 1962

Infrared spectroscopy of the brighter planets and stars was performed, and sample spectra of some objects are presented. The sensitivity limit of scanning spectrometers for this purpose is discussed. The spectrometer which was used for three years is described. Advantages of a two-beam interferometer and its sensitivity increase are also presented. (*PA*, 1962, #9060)

**1,905. ROCKET-BORNE IR SCANNING RADIOMETER FOR HIGH ALTITUDE RADIATION MEASUREMENTS**
Smiley, V. N.
April 10, 1962

General Dynamics/Astronautics, San Diego, Calif.
AE 62-0216, Scientific Report 1, AFCRL-62-431,
AF 19(604)-7417
AD-276,647
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

A transistorized, scanning, filter radiometer designed for use in an *Atlas* piggyback pod is described. The instrument is designed for moderately narrow-band measurements at 2.7, 3.5, 4.3, 4.7, and 6.3 $\mu$ of the irradiance arriving at the radiometer from the Earth's atmosphere within a small field of view as a function of height above the true horizon. The measurements will be made while the vehicle is in the altitude range $3 \times 100{,}000$ to $10^6$ ft. A fairly complete description of the optics, electronics, and mechanical parts is given, including a description of calibration techniques.

## 1,906. SPECTRAL, ELECTROPHOTOMETRICAL AND RADAR RESEARCHES OF AURORAE AND AIRGLOW

Krasovskii, V. I., Editor
April 1962
National Aeronautics and Space Administration, Washington, D.C.
TT-F-76

The following articles are presented: "Hydrogen Emission and Two Types of Auroral Spectra"; "Observation of the Aurora on February 10–11, 1958 Near Moscow"; "Intensity of Some Emissions of the Twilight and Night Sky"; "Electrophotometric Measurements in the Auroral Zone"; "An Attempt at Interferometrical Study of Auroral Emission Lines"; "On the Observations of the Line $\lambda$ 6562 Å in the Spectrum of the Night Sky"; and "Some Results of Spectroscopic Investigations of Auroral and Night-Glow Spectra".

## 1,907. INFORMAL INFRARED ASTRONOMY SYMPOSIUM, NOVEMBER 11, 1961

April 1962
Johns Hopkins University, Laboratory of Astrophysics and Physical Meteorology, Baltimore, Md.
Meeting

## 1,908. PHOTOELECTRIC SCREENING OF BODIES IN INTERPLANETARY SPACE

Singer, S. F., Walker, E. H.
*Icarus*, v. 1, no. 1, pp. 7–12, May 1962

Bodies in space which are subject to the solar ultraviolet flux will emit photoelectrons. A certain number of these escape and are balanced by the accretion of thermal electrons from the surrounding plasma. However, for a positively charged body, a much larger number of photoelectrons will be released from the surface, but will not escape because their energy is insufficient to do so. Their effect will produce an inner screening of the body's electric charge. This screening is calculated for spherical bodies as a function of size. For large bodies the space-charge density of photoelectrons becomes quite large; in the case of the Moon it reaches a value of the order of $10^3$ to $10^4$ electrons/cm$^3$ just above the lunar surface. For small dust particles, however, the photoelectric cloud becomes negligible. (*AI/A*, 1962, #60,412)

## 1,909. FLUORESCENT SCATTERING IN PLANETARY ATMOSPHERES. I. BASIC THEORETICAL CONSIDERATIONS

Chamberlain, J. W., Sobouti, Y.
*Astrophysical Journal*, v. 135, no. 3, pp. 925–937, May 1962

Resonance scattering, fluorescence, and pure absorption are considered as mechanisms governing the daytime ultraviolet spectrum of a planet observed from above. It is assumed throughout that continuous absorption prevents any sunlight from being reflected by the ground (or cloud surface), and that the scattering continuum is weak compared with scattering in spectral lines. These considerations are appropriate to the ultraviolet when ozone (or some other substance) is strongly absorbing in the high atmosphere. Such a spectrum is qualitatively different from a reflected Fraunhofer spectrum; this scattering light constitutes a daytime airglow of emission lines. To aid interpretation of such spectra, in terms of atomic and molecular relative abundances, several alternative models of line formation are investigated. (*PA*, 1962, #15,310)

## 1,910. FLUORESCENT SCATTERING IN PLANETARY ATMOSPHERES. II. COUPLING AMONG TRANSITIONS

Sobouti, Y.
*Astrophysical Journal*, v. 135, no. 3, pp. 938–954, May 1962

The ground energy level of an atmospheric constituent absorbs the solar radiation in those frequencies which arise from this level. Re-emission may take place to the original level (resonant transition) or some other levels (fluorescent transitions). When more than one lower level is populated, an upper level may become populated through any one of several absorption transitions. Scattered radiation in one line may be absorbed again and then re-emitted in another line. The radiative-transfer equation for each line must therefore involve all transitions capable of populating the same upper level; the intensities of different emissions having a common upper level will be "coupled" to one another. In Part A the coupled transfer equations appropriate to a planetary atmosphere are developed and solved for diffusely reflected and transmitted radiations. In both optically finite and semi-infinite atmospheres the zeroth and first iterates of the integral equations are obtained in terms of Chandrasekhar's *X*-, *Y*-, and *H*-functions. These iterates are sufficient for analytic solutions in the case of nearly symmetric coupling between every pair of transitions. Part B treats the problem of coupling when continuous absorption exists across the line profiles. The principle of reciprocity is extended to the problem of coupled fluorescent scattering. (*PA*, 1962, #15,311)

1,911. IR HORIZON SENSOR AND RADIOMETERS FOR TIROS IV
*Space/Aeronautics*, v. 37, p. 215, May 1962
(*AS&T*, 1962)

1,912. STUDY OF INVESTIGATION OF MILLIMETER AND SUBMILLIMETER RECEIVER TECHNIQUES
June 1, 1962
Illinois, University of, Electrical Engineering Research Laboratory, Urbana
Technical Documentary Report 1 for March 1, 1961–February 28, 1962, RADC-TDR-62-313, AF 30(602)-2456
AD-284,905
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Efforts were made to develop video electromagnetic detection schemes which are usable in the millimeter-infrared region. The analysis and evaluation of pyroelectric effect detectors and antiferromagnetic detectors are presented. Antiferromagnetic detectors appear feasible if their low temperature requirement is acceptable. Other detection schemes which are discussed but which have not been fully investigated include Hall effect devices, photodetection schemes, electron heating in intrinsic semiconductors, and superconducting devices. A Goubau beam-type waveguide with a design frequency of 75 kMc was constructed for use in evaluating detection schemes. The design data for this transmission line are presented along with loss measurements. To aid in making measurements on the line, a resonator and a Michelson interferometer were constructed. The problems associated with efficient launching of the beam modes and with focusing the beam waveguide distributions for detection purposes were also investigated. A total of 32 references is included.

1,913. POLARIMETRIC OBSERVATIONS OF PLANETS AND SATELLITES
Dollfus, A.
June 30, 1962
Observatoire de Paris-Meudon, France
Annual Summary Report 1, AFCRL-62-1035,
AF 61(052)-508
AD-288,065

The design and construction of suitable equipment for polarimetric measurements of planets and satellites by photoelectric technique are described. Measurements in the infrared will permit not only collection of more data about the physical structure of the surface, but probably also production of information about the nature and composition of the superficial layers of these bodies. The first part of the work, achieved during the past 12 months, was only instrumental and can be divided into the design and testing of the infrared photoelectric polarimeter; the study of appropriate filters for selection of the infrared spectral ranges; the modification and improvement of the 40-in. reflector of the Meudon Observatory for adaptation to the photoelectric technique; and the design of techniques for removing by compensation the instrumental polarization.

1,914. REFLEXE AN FILTERGLAESERN BEIM PHOTOMETRIEREN (REFLEXES ON OPTICAL FILTERS IN PHOTOMETRY)
Foerste, D.
*Lichttechnik*, v. 14, no. 6, pp. 304–305, June 1962

A method of estimating errors is determined. It is shown that errors result in photometric measurements when optical filters are set close in front of the photometer. The order of magnitude of relative error comes up to $10^{-2}$. Exemplary error is computed. (*EI*, 1962)

1,915. ULTRAVIOLET ASTRONOMICAL PHOTOMETRY FROM ROCKETS
Boggess, A., III
June 1962
National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
TN D-673

Astronomical photometry in the ultraviolet from rockets may be divided into two spectral regions: above and below 2000 Å. Commercially available photomultipliers may be used as detectors in the upper region. Until recently, however, detectors have been available for only two bands in the lower region: 1350–1040 Å and 1350–1225 Å. Gas ionization techniques are used in the latter region; usually nitric acid is the fill gas and calcium fluoride the window. The data obtained in a rocket firing on March 28, 1957, in the 1225–1350 Å spectral band are presented and interpreted for Orion and $\alpha$ Virginis.

1,916. PHOTOMETRY OF THE PLANETS
Gehrels, T.
July 31, 1962
Arizona, University of, Tucson
Final Report for July 1, 1961–July 31, 1962,
Nonr (G) 00021-61
AD-285,999
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

1,917. SPECTRAL IRRADIANCE FROM STARS AND PLANETS, ABOVE THE ATMOSPHERE, FROM 0.1 TO 100.0 MICRONS
Ramsey, R. C.
*Applied Optics*, v. 1, no. 4, pp. 465–471, July 1962

Using published data concerning star irradiances in the visible region, and assuming a blackbody distribution of energy, irradiances from stars and planets are calculated over the spectral region of 0.1 to 100 $\mu$. Results are presented in chart form for ready application in the design of viewing systems operating in space. (*PA*, 1962, #19,270)

1,918. RADIOMETRIC MEASUREMENTS FROM SATELLITES
Hanel, R. A.
*Aerospace Engineering*, v. 21, pp. 34–39, July 1962
(*AS&T*, 1962)

1,919. INFRARED HORIZON MEASUREMENTS FROM NEAR-ORBITING ALTITUDES
Anthony, R., Smiley, V. N.
August 15, 1962
General Dynamics/Astronautics, San Diego, Calif.
AE 62-0794, Scientific Report 2, AFCRL-62-1001,
AF 19(604)-7417
AD-288,648
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The infrared horizon was scanned from an *Atlas* missile during a portion of the trajectory up to an 800,000-ft altitude. Data were collected with a ¼-deg field resolution in 3.5- , 4.3- , 4.7- , and 6.3-$\mu$ spectral regions to determine radiance gradients. The window regions of the spectrum appear full of gradients which can interfere with the definition of an infrared horizon. Both the water vapor band (6.3 $\mu$) and the carbon dioxide band (4.3 $\mu$) have broader gradients than the atmosphere windows. Of these, the carbon dioxide band may prove most useful, as it appears to also have a smoother gradient.

1,920. PROBLEMS OF PHOTOGRAPHIC SPECTROPHOTOMETRY OF SHORT DURATION LIGHT PULSES: GRANULARITY, RECIPROCITY FAILURE, AND LATENT IMAGE STABILITY
Milne, G. G., Eyer, J. A.
August 31, 1962
Rochester University, Institute of Optics, N.Y.
Final Report, DASA-1332, DA-49-146-XZ-008
AD-292,164
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Refinements in the technique of measuring granularity and data on the granularity of specific film-developer combinations are presented. A question concerning the shape of the granularity curve appears to have been definitively answered. A rotating mirror optical system has been developed with precise photometric controls for determination of photographic reciprocity failure at high intensity, covering exposure times to $10^8$ sec. A special underwater arc light source developed for use in this system is described. The experimental requirements for observing latent image stability, and data on the characteristics of three panchromatic emulsions are presented. Thirteen references are included.

1,921. RESEARCH ON MILLIMETER WAVE PROPAGATION AT HIGH ALTITUDES
August 31, 1962
Texas, University of, Electrical Engineering Research Laboratory, Austin
Semiannual Engineering Report for March 1–August 31, 1962, AF 33(657)-7333
AD-285,111

Research activities continued in the field of millimeter radiowave propagation at high altitudes. Summaries are given of the accomplishments and present status of research activities involving (1) laboratory microwave spectroscopy measurements of the shape and intensity of oxygen absorption lines at simulated pressure altitudes to 100,000 ft in the 58- to 62-kMc frequency interval, (2) total atmospheric absorption measurements at various frequencies in the 64- to 69-kMc interval using solar radiometric techniques, and (3) instrumentation for radiometric observations between 58 and 62 kMc at an altitude of 100,000 ft using a balloon-borne radiometer.

1,922. TELEMETERING INFRARED DATA FROM THE TIROS METEOROLOGICAL SATELLITES
Davis, J. F., Hanel, R. A., Stampfl, R. A., Strange, M. G., Townsend, M. R.
August 1962
National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
TN D-1293

All the *Tiros* satellites contain television cameras which acquire cloud cover information. *Tiros* 2 and 3 also have scanning and fixed radiometers to measure infrared and reflected solar radiation from the Earth and its atmosphere. The scanning radiometer is mounted so that the satellite's optical axis is inclined 45 deg to its spin axis. The spin motion provides a scan of individual lines of the Earth's surface, and the orbital motion provides line advance. Spin and optical resolution are such that the information bandwidth is eight cycles. This paper discusses the system design, circuits, test parameters, and performance of the *Tiros* infrared radiation experiment.

1,923. A PORTABLE LOW-LEVEL LIGHTMETER. I. LOW-LEVEL LIGHTMETER FOR THE NEAR INFRARED
Gebel, R. K. H.
August 1962
Wright Air Development Division, Office of Aerospace Research, Aeronautical Research Laboratory, Wright-Patterson AFB, Ohio
Supplement 1 to ARL-62-415
AD-287,877
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Results of former attempts to establish a value for visible radiation in the region between 7000 and 11,000 A in the near infrared of the night sky were unreliable due to lack of precision instruments. In this modification for the low-level lightmeter, an infrared image-converter tube for converting the infrared into visible radiation is employed. Further, better stabilization in the transformer and change of voltage in the

photomultiplier are made to achieve a higher sensitivity of the meter. Improvement in registering the brightness of the night sky in the near infrared (6300 to 11,000 Å) was noted.

1,924. A PORTABLE LOW-LEVEL LIGHTMETER. II. MODIFIED LOW-LEVEL LIGHTMETER FOR THE NEAR INFRARED
Gebel, R. K. H.
August 1962
Wright Air Development Division, Office of Aerospace Research, Aeronautical Research Laboratory, Wright-Patterson AFB, Ohio
Supplement 2 to ARL-62-415
AD-287,880
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Experiments to achieve a higher sensitivity in the low-level lightmeter for operation with a narrow bandwidth monochromator in near infrared observations were advanced by an experimental photomultiplier tube. This tube produces a sensitivity approximately five times greater than was possible with previous lightmeters. Recommendations are made for further increasing effectiveness in use of the low-level lightmeter by incorporating a new 16-stage near infrared photo-multiplier tube with a very large aperture and short-focal-length lens.

1,925. INFRARED FLUX AND SURFACE TEMPERATURE DETERMINATIONS FROM TIROS RADIOMETER MEASUREMENTS
Wark, D. Q., Yamamoto, G., Lienesch, J.
August 1962
U.S. Department of Commerce, Weather Bureau, Meteorological Satellite Laboratory, Washington, D.C.
MSL-R-10

The *Tiros 2* meteorological satellite carried a multiple channel radiometer of medium resolution (about 5 deg). Two of the channels were designed to measure the upward radiation in the "window" at 8 to 12 $\mu$, and over the broad spectral region of 7 to 30 $\mu$. To deduce surface temperatures and total upward flux values from the measurements in these two channels, additional operations must be carried out on the data. As a basis for these transformations, the specific spectral intensity over the entire infrared region was calculated at five zenith angles for each of 106 atmospheric models. In the 7- to 30-$\mu$ channel, an empirical relation was found to transform measured values to total intensity; and, from the limb-darkening exhibited by the 106 individual models, a method of calculating flux was formulated; in this case, the results contain inaccuracies of only about 2 percent attributable to the method used. In the 8- to 12-$\mu$ channel, the influence of ozone and water vapor was determined for the model atmospheres, and curves were developed for the direct transformation from measured values to surface temperature; however, if a knowledge of the water vapor content of the viewed column is lacking, errors in the inferred surface temperature can range from near 0 to 10 deg or more. A series of radiative flux maps over Europe, calculated from the 7- to 30-$\mu$ data, have values whose magnitudes are in accord with other estimates and measurements. Corrected satellite 8- to 12-$\mu$ data are compared with shelter temperatures for several stations in a cloudless area; the range of the satellite data from 3.5 deg higher to 5.0 deg lower than the shelter data is discussed. Thirty-two references are included. (*STAR*, 1963, N63-11881)

1,926. METHODS OF ESTIMATING INFRARED FLUX AND SURFACE TEMPERATURE FROM METEOROLOGICAL SATELLITES
Wark, D. Q., Yamamoto, G., Lienesch, J.
*Journal of the Atmospheric Sciences*, v. 19, no. 5, pp. 369–384, September 1962

Radiometers of relatively high angular resolution and low spectral resolution have been designed to measure from satellites the radiation emanating from the Earth and atmosphere. They are to provide measurements of temperature and of heat balance. Desired quantities are not immediately derivable, but require consideration of spectral response of instruments and of processes giving rise to radiation. *Tiros 2* radiometers and the measurements obtained are cited, but the principles are applicable to any similar instrument. Twenty-six references are included. (*EI*, 1963)

1,927. INVESTIGATIONS INTO THE QUANTITATIVE INTERPRETATIONS OF BRIGHTNESS ON TIROS-I FILMS
Giraytys, J.
September 1962
Pennsylvania, University of, Philadelphia
Master's Thesis
AD-294,690
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

An attempt has been made to draw quantitative conclusions from *Tiros 1* cloud pictures. Photometry made possible the construction of isopleths of brightness, and the computation of spectra of brightness variance. The spectra led to objective definitions of structure parameters, on the basis of which clouds can be classified into structured and nonstructured types. So far, the objective classification system does not agree entirely with subjective classification. Furthermore, sampling variations appear troublesome. Structured clouds are definitely of the cumulus type. Nonstructured clouds do not permit a clear-cut identification from *Tiros 1* pictures alone.

1,928. SIMPLE AUTOMATIC REFLECTION COLOR DENSITOMETER
Pinney, J. E., Kinard, J. C.
*Photographic Science and Engineering*, v. 6, no. 5, pp. 252–254, September–October 1962

This instrument incorporates a commercially available light photometer and an X-Y recorder. A constant time-interval

control unit determines the sequence of operations. The use of commercial units and other readily available components allowed rapid construction; 11-step sensitometric strips are read in about 50 sec. (*EI*, 1963)

**1,929. K VOPROSU OB UCHETE CHASTOTNYKH FOTOMETRICHESKIKH KHARAKTERISTIK AEROLANDSHAFTA (ON THE EVALUATION OF THE PHOTOMETRIC FREQUENCY CHARACTERISTICS OF THE AERIAL IMAGE)**
Vishniakov, A. N.
*Zhurnal Nauchnoi i Prikladnoi Fotografii i Kinematografii*, v. 7, pp. 359–368, September–October 1962 (in Russian)

The problem of accurate photometry, in terms of the evaluation of the probable frequency of the input signal, and the selection of measuring-system parameters required for this purpose are described. Specifically discussed are the photometric frequency characteristics of an aerial image and their qualitative relationship to the flight conditions and measuring system parameters. A quantitative analysis of the photometric frequency characteristics is included. (*IAA*, 1963, A63-16456)

**1,930. STUDY AND INVESTIGATION OF MILLIMETER AND SUBMILLIMETER WAVE RECEIVER TECHNIQUES**
October 15, 1962
Illinois, University of, Electrical Engineering Research Laboratory, Urbana
Quarterly Report 2 for June 1–September 1, 1962, RADC-TDR-62-250, AF 30(602)-2456
AD-289,809
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The pyroelectric effect detector was tested experimentally. The sensitivity of the experimental model varies between $2 \times 10^{-11}$ and $4 \times 10^{-11}$ amp/mw depending on the temperature of the sample. The use of a shunt inductor to increase the output of the detector was investigated. By choosing the inductor so that the crystal capacitance and the inductor form a resonant circuit at the modulation frequency, the output was increased. The possibility of using metal reflectors rather than dielectric lenses for the phase correctors was investigated. Also being studied is the problem of energy focusing on a beam waveguide for efficient detection. One proposed scheme of doing this consists of using a series of lenses of decreasing focal length to decrease the energy spot size. A tapered dielectric rod was used to focus the energy onto the detector.

**1,931. AN ALL-SKY PHOTOMETER**
Kulkarni, P. V.
*Nature*, v. 196, no. 4852, pp. 363–364, October 27, 1962

An all-sky photometer designed to measure the intensities of the night airglow radiations emitted from the whole dome of the sky is described. (*AI/A*, 1963, #70,797)

**1,932. SIMPLE PHOTOELECTRIC PROCESS-STREAM ANALYZER**
Glasser, L. G., Kanzler, R. J., Troy, D. J.
*Review of Scientific Instruments*, v. 33, no. 10, pp. 1062–1066, October 1962

This instrument for measuring spectral absorption of ultraviolet or visible radiation is described. Measurement at two selected wavelengths, logarithmic response to radiation, and attention to spectral purity of light sources simplify use of the instrument and compensate effectively for the number of potential measurement errors. (*EI*, 1963)

**1,933. TRUE-INTENSITY ATTACHMENT FOR A MÖLL MICROPHOTOMETER**
Petford, A. D.
*Journal of Scientific Instruments*, v. 39, pp. 526–527, October 1962
(*AS&T*, 1963)

**1,934. APPARATUS FOR AN EXPERIMENT IN PHOTOMETRY**
Warren, K. L.
*American Journal of Physics*, v. 30, pp. 768–769, October 1962
(*AS&T*, 1963)

**1,935. METHODS OF RADIOMETRIC CALIBRATION**
Nicodemus, F. E., Zissis, G. J.
October 1962
Michigan, University of, Institute of Science and Technology, Ann Arbor
Report of BAMIRAC, 4613-20-R, SD-91
AD-289,375

A general treatment is presented of the calibration of optical instruments which are to be used to measure electromagnetic radiation from sources of interest to the military services. The infrared spectral region is emphasized although the ultraviolet and visible wavelengths are also treated. A total of 32 references is included.

**1,936. PLANET ILLUMINANCE**
Meisenholder, G. W.
November 10, 1962
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TR 32-361
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The theoretical value of planet illuminance vs. range and phase angle is summarized. Solutions are obtained by digital computer and are based on the assumption of a diffuse (Lambert), spherical planet receiving radiation from the Sun at the respective planet's mean solar distance. Planet albedo is assumed invariant with wavelength, and values used for computations of planet illuminance are given. (*AI/A*, 1963, #70,495)

1,937. INVESTIGATION OF CORRELATION TECHNIQUES FOR MICROWAVE RADIOMETRIC SENSORS
Budd, W. E., Fawcett, R. G.
November 15, 1962
Melaboratories, Palo Alto, Calif.
Quarterly Engineering Report 2 for August 15–November 15, 1962, AF 33(657)-9183
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

An analysis of the dynamics of a correlating radiometric sensor is given which includes the interdependence of target detectability, time-on-target, and target penetration into the surveillance volume. The use of practical components and their effects on the system performance were investigated. Several design charts are presented which permit graphic evaluation of various system concepts in terms of target and operational characteristics.

1,938. ULTRAVIOLET SPACE TELESCOPE WILL SCAN THE STARS
Riggs, R. N. (Aircraft Armaments, Inc., Cockeysville, Md.)
*Electronics*, v. 35, no. 46, pp. 37–43, November 16, 1962

A UV telescope and television system (Project *Celescope*) designed to study stellar radiations from a high-altitude rocket is described. The system incorporates an off-axis parabolic mirror and a new UV camera tube activated by a high-resolution transistor TV camera. The entire payload weighs 142.7 lb. Some of the key circuits are diagrammed. (*IAA*, 1963, A63-11114)

1,939. SIMPLE RATIO PHOTOMETER
Hefele, J. R., Lundberg, J. L., Saloney, R. (Bell Telephone Laboratories, Inc., Murray Hill, N.J.)
*Review of Scientific Instruments*, v. 33, no. 11, pp. 1256–1258, November 1962
(*AS&T*, 1963)

1,940. NOTES ON MODIFICATION AND IMPROVEMENT OF THE BAUSCH AND LOMB 505 SPECTRONIC SPECTROPHOTOMETER
Josephs, J. J.
November 1962
Mitre Corporation, Bedford, Mass.
ESD-TDR-62-319, AF 33(600)-39852
AD-298,948

1,941. RADIOMETRIC VERTICAL SENSING STUDY
November 1962
Collins Radio Company, Cedar Rapids, Iowa
RR 263, ASD TDR 62-905, AF 33(616)-8109
AD-292,982

A study was made of a radiometric technique for sensing true vertical. The airborne test program is outlined in detail, and the requirements for this program are given. A summary of present progress and an evaluation of future prospects for the feasibility of the radiometric technique are presented. Twelve references are included.

1,942. MODIFICATION OF A JARRELL-ASH ULTRAVIOLET-MONOCHROMATOR TO AN INFRARED-DUOCHROMATOR
Sulzmann, G. P.
November 1962
General Dynamics/Astronautics, San Diego, Calif.
AE 62-0875, DA-04-495-ORD-3383
AD-292,681

The modification of an Ebert mounting Jarrell-Ash, ultraviolet monochromator, Model 82-000, to an infrared duochromator is described. This modification proved to be useful for shock tube studies and may supply a basis for the modification of other spectrographs or monochromators for different specific applications.

1,943. SPACE SPECTROSCOPY AT THE U.S. NAVAL RESEARCH LABORATORY—PHOTOELECTRIC PHOTOMETRY
Friedman, H.
*Journal of Quantitative Spectroscopy & Radiative Transfer*, v. 2, pp. 547–553, October–December 1962

X-ray photometry from rockets, which has been carried on since 1949, and X-ray photometry from satellites, which began with the June 1960 launching of *Solar Radiation 1*, are reviewed. Observations of X-ray emissions from solar flares, ultraviolet emission and Lyman-$\alpha$ glow from the night sky, and stellar ultraviolet fluxes are described and their results are reported. (*AI/A*, 1963, #71,106)

1,944. SPACE SPECTROSCOPY AT U.S. NAVAL RESEARCH LABORATORY—PHOTOGRAPHIC TECHNIQUE
Tousey, R.
*Journal of Quantitative Spectroscopy & Radiative Transfer*, v. 2, pp. 571–576, October–December 1962

Problems peculiar to space spectroscopy are described, and the relative advantages of the photoelectric and photographic methods are noted. Developments in normal-incidence grating spectrographs, grazing-incidence spectrographs, high-resolution spectroscopy, and spectro-heliography are discussed, as well as the place of satellites in solar spectroscopy. (*AI/A*, 1963, #71,193)

1,945. GENERAL EXPRESSION FOR THE OUTPUT OF A DICKE-TYPE RADIOMETER
Knight, J.
*IRE, Proceedings of the*, v. 50, pp. 2497–2498, December 1962
(*AS&T*, 1963)

1,946. A NEW DOUBLE-BEAM RECORDING INFRARED SPECTROPHOTOMETER WITH DOUBLE-PASSED OPTICS
Geppert, G.
In "Optics and Spectroscopy of All Wavelengths," Proceedings of the Meeting of the Physikalische Gesellschaft of the German Democratic Republic, Jena, October 27–31, 1960, pp. 599–604
Görlich, P., Editor
Akademie-Verlag, Berlin, Germany, 1962

The monochromator has interchangeable 60-deg prisms of different materials. The system is double-beam in time (three interchanges per sec) and the photometric comparison is made electrically, not by means of an optical wedge, etc. The double-passed energy is distinguished by an 18-cycle modulation. (*PA*, 1963, #252)

## *Jupiter — 1962*

1,947. THE JOVIAN ENVIRONMENT
Trafton, L. M.
March 8, 1962
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TM 33-77

Quantitative knowledge of the Jovian atmosphere and the environment above the atmosphere is summarized. Topics covered include composition and structure of the atmosphere, photometric properties of the atmosphere, period of rotation, magnetic field, and the Jovian radio-frequency spectrum. (*AI/A*, 1962, #5541)

1,948. ON THE INFRARED SPECTRA OF JUPITER AND SATURN (0.9–2.5$\mu$)
Moroz, V. I.
*Soviet Astronomy—AJ*, v. 5, no. 6, pp. 827–830, May–June 1962

Spectra of Jupiter and Saturn in the region $\lambda$ 0.9 to 2.5 $\mu$ have been obtained by means of a photoelectric grating spectrometer with a lead-sulfide photoresistive cell. The spectrum of Jupiter is in good agreement with the data of previous work of Kuiper, but the spectrum of Saturn does not resemble Kuiper's classical registograms—apparently because the spectrum of the rings is superimposed on that of the planetary disk. Evidence favors Kuiper's hypothesis that the rings are covered with hoarfrost if they are not actually composed of ice. (*AI/A*, 1962, #60,555)

1,949. SEARCH FOR OPTICAL EMISSIONS FROM JUPITER, AND STUDY OF FLARE ACTIVITY OF NEARBY STARS
Smith, H. J., Rodman, J. P.
June 23, 1962
Yale University, New Haven, Conn.
Final Technical Report, Nonr-(G)-0002-60, SAR/Nonr-(G)-00011, Nonr-(G)-00043-62
AD-283,355
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Apparatus has been constructed to make possible the detection of small variations in output of H$\alpha$ and CaK light from celestial objects. One application is the search for optical emissions from Jupiter correlated with its nonthermal radio storms. Considerably more of the program will be devoted to flare activity on stars other than the Sun, partly as a question of astrophysical interest, and partly in cooperation with efforts of radio astronomers to detect radio flare activity from nearby stars.

## *Mars — 1962*

1,950. SPECTROPHOTOMETRIC STUDY OF THE REFLECTIVITY OF THE CENTRE OF THE MARTIAN DISK AT OPPOSITION, AND THE NATURE OF THE VIOLET LAYER
Guérin, P.
*Planetary and Space Science*, v. 9, pp. 81–87, March 1962

Spectra of the center of the Martian disk (Arabia region) were compared, wavelength by wavelength, with those of a G0 V star. The Martian reflectivity curve was obtained by taking account of the visible and ultraviolet gradients of this star relative to the Sun. Mars is red from 6100 to 3850 Å, and "grey" on the average from 3850 to 3100 Å, but in this region of the spectrum, the reflectivity curve presents undulations which, if real, may perhaps be due to packets of absorption bands produced by some organic compound ejected by Martian "vegetation." (*PA*, 1962, #15,316)

1,951. DEVIATION OF THE FORMULAE FOR THE REDUCTION OF PLANETOGRAPHIC OBSERVATIONS WITH SPECIAL REFERENCE TO THE PLANET MARS
Graff, K.
Michelis, C. H., Translator
June 1962
Rand Corporation, Santa Monica, Calif.
RM-3138-NASA

The basic astronomical formulas and equations appropriate to the study of the planet Mars are given. (*AI/A*, 1962, #60,436)

1,952. PHOTOMETRY OF MARS
(Translation from "Photometric Observation of Mars in 1958," *Akademiia Nauk USSR, Komissiia po Fizike Planetii, Izvestiia*, no. 3, pp. 3–15, 1961)
Barabashov, N. P., Koval, I. K., Chekirda, A. T.
September 21, 1962
Library of Congress, Aerospace Information Division, Washington, D.C.
AID 62-148 (supplement to AID 61-138, AD-266,481)
AD-285,346
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

**1,953. COURBE CORRIGÉE DE RÉFLECTIVITÉ D'UNE RÉGION CLAIRE DE MARS AU CENTRE DU DISQUE A L'OPPOSITION (CORRECTED REFLECTIVITY CURVE IN THE LIGHT REGION OF MARS AT THE CENTER OF THE DISK AT OPPOSITION)**
**Guérin, P.**
***Annales d'Astrophysique*, v. 25, no. 6, pp. 429–433, November–December 1962**

New spectrophotometric observations have been carried out to compare a nonluminescent region of the Moon and $\eta$ Cas A. These observations have shown that the wavelike variations present on the apparent reflectivity curve of Mars in the ultraviolet, brought into evidence by comparison of the spectra of Mars and the same star, have their origin in the differences of spectral type between $\eta$ Cas A and the Sun and are not real features of Mars. When used in the visible, the results corrected for this effect could give information concerning the nature of the Martian surface; in the ultraviolet, the results are an indication of atmospheric scattering by small particles. (*AI/A*, 1963, #71,435)

**1,954. RESULTS OF OBSERVATIONS OF MARS IN THE USSR DURING THE GREAT OPPOSITION OF 1956**
**(Translated from *Izdatelstvo Akademiia Nauk SSSR*, 1959)**
**December 1962**
**National Aeronautics and Space Administration, Washington, D.C.**
**TT F-93**

Nine articles are presented, covering photographic, photometric, colorimetric, and visual observation of the changes on the surface and in the atmosphere of Mars. Papers covered include the following:

"Observations of Mars in the USSR in 1956," pp. 1–3

"Summary Results of the Observation of Mars by the Sector of Astrobotany During the Period of the Great Opposition in 1956," by G. A. Tikhov, pp. 4–6

"Photographic Photometry of Mars With Filters," by N. P. Barabashov, I. K. Koval, pp. 7–110

"Photometric Studies of Optical Properties of the Atmosphere of the Planet Mars," by N. N. Sytinskaya, pp. 111–121

"The Surface and Atmosphere of Mars According to Photographic, Photometric, and Colorimetric Observations Conducted in 1956 at Tashkent," by V. V. Sharonov, pp. 122–154

"An Experiment To Determine Contrasts on the Disc of Mars by the Method of Visibility," by V. V. Sharonov, pp. 155–166

"Some Thoughts on the State of the Atmosphere of Mars," by N. N. Sytinskaya, pp. 167–174

"Visual Observations of Mars During the Great Opposition in 1956," by V. A. Bronshten, pp. 175–193

"Photographic Photometry of the Light Region of Argyre on Mars Late in August 1956," by V. A. Bronshten, O. V. Dluzhnevskaya, pp. 194–201. (*AI/A*, 1963, #70,759)

**1,955. HEAT BALANCE ON THE SURFACE OF MARS**
**Hattore, A.**
**1962**
**Kyoto, University of, Institute of Astrophysics and Kwasan Observatory, Japan**
**Contribution 115**

The insolation for ($\tau$ = 0, 0.1, 0.2, and 0.3) and the heat loss on the Martian surface are calculated for various seasons. The heat balance on the surface and the effects of Martian clouds are discussed. The theoretical results are shown to be in fairly good agreement with observations. (*AI/A*, 1963, #71,824)

**1,956. SPECTROPHOTOMETRIC STUDY OF THE REFLECTIVITY OF THE CENTRE OF THE MARTIAN DISK IN OPPOSITION**
**Guérin, P.**
***Annales d'Astrophysique*, v. 25, no. 1, pp. 42–48, 1962**
**(in French)**

Spectra of the center of the Martian disk (bright area of Arabia), and of a star whose spectral type is nearly the same as that of the Sun, were obtained during the 1960 opposition by means of a small oscillating chalonge spectrograph at the cassegrain focus of the 32-in. reflecting telescope of the Haute-Provence Observatory, covering the spectral interval 6113–3176 Å. The spectrophotometric comparison of these spectra, wavelength by wavelength, gave the Arabian reflectivity curve. It is well known that the observed ultraviolet reflectivity is that of the Martian atmospheric "blue haze." The reflectivity curve decreases with wavelength to 3800 Å and then remains constant with several undulations up to the terrestrial ozone absorption limit. These undulations cannot be explained by diffusion by small ice crystals, and if real, they may be diffuse absorption bands produced by some chemical compound in the Martian atmosphere, perhaps of organic origin. (*PA*, 1962, #9061)

## *Mercury — 1962*

**1,957. THE 1961 A.L.P.O. SIMULTANEOUS OBSERVATION PROGRAM—FIRST REPORT**
**Chapman, C. R.**
***Strolling Astronomer*, v. 16, no. 3–4, pp. 56–69, March–April 1962**

Data obtained on phases of Mercury and Venus are presented. Latitudes, longitudes, and intensities of features on Jupiter and Saturn are discussed, and satellite phenomena

and central meridian transit timings for Jupiter are summarized. (*AI/S*, 1962, #51,392)

1,958. MEASUREMENT OF THE DIAMETER OF MERCURY DURING ITS TRANSIT IN FRONT OF THE SUN ON 7 NOVEMBER 1960
Camichel, H., Rösch, J.
*Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 255, no. 1, pp. 53–55, July 2, 1962
(in French)

Two techniques were employed: use of a double image micrometer, and the photometric method of Hertzsprung. Reasons are given for believing that the slightly higher results obtained by the latter method are the most probable. These give the apparent diameter of Mercury as 6″.75 ± 0″.01, reduced to a distance of 1 AU. This gives a density of 5.30 ± 0.04. (*PA*, 1962, #21,702)

## *Moon—1962*

1,959. REVISION OF HARTWIG'S OBSERVATIONS OF THE MOON (1890–1915) TAKING INTO ACCOUNT THE LIBRATION EFFECT
(Translated from *Astronomicheskii Tsirkular*, no. 211, 1960)
Gorynya, A. A.
January 17, 1962
Air Force Systems Command, Foreign Technical Division, Wright-Patterson AFB, Ohio
FTD-TT-61-13/1
AD-270,776

Hartwig's observations with the heliometer at the Bamberg Observatory to determine the constants of the physical libration of the Moon (1890–1915) were treated by Naumann by the classical method. In this paper, it is implicitly assumed that the most probable circumferences representing the visible limb of the Moon in the presence of different librations belong to one and the same sphere of constant radius and that the center of this sphere coincides with the center of mass. (*AI/A*, 1962, #5682)

1,960. SPACE PHYSICS PROGRAM. NEUTRON-GAMMA RAY INSTRUMENTATION EXPERIMENT FOR LUNAR SURFACE COMPOSITION ANALYSIS
Martina, E. F.
February 28, 1962
Aerospace Corporation, El Segundo, Calif.
TDR-930(2260-31)TR-1, Semiannual Technical Report for July 1–December 31, 1961, DCAS TDR 62-76, AF 04(647)-930
AD-277,697
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

An analysis technique capable of determining the nature and relative abundance of constituent elements at remote places, such as the lunar and planetary surfaces, is described. Details on accomplishments to date in developing a prototype instrument for analysis of the lunar surface are given.

1,961. CONSIDERATIONS ON THE COLOR VARIATIONS OF LUNAR FEATURES
Wegner, G.
*Strolling Astronomer*, v. 16, no. 1–2, pp. 7–9, January–February 1962

Spectral and colorimetric measurements of the composition and variations in color of various lunar features were examined. Results of these observations are discussed. (*AI/S*, 1962, #51,117)

1,962. LUNAR PHOTOMETRY FOR NAVIGATION
Levy, R. J.
February 1962
Geophysics Corporation of America, Bedford, Mass.
GCA TR-62-10-A, AF 33(616)-7013
AD-273,310
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

Available information on aspects of the Moon's photometric behavior is reviewed and discussed as it applies to anticipated navigational measurements. The variations with changing phase of total moonlight, surface brightness of specific areas, the limb, and the earthlit portions are considered. Other topics include the spectral energy distribution of moonlight, the size and shape of the Moon, and the risk of error in determining direction of the Moon's center from measurements on its irregular limb. A total of 32 references is included.

1,963. SURFACE AND ATMOSPHERE OF THE MOON. REVIEW OF SOVIET LITERATURE
March 20, 1962
Library of Congress, Aerospace Information Division, Washington, D.C.
AID 62-4
AD-275,255
(Also available as OTS: 62-24,481, U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The surface conditions and atmosphere of the Moon are described. The Moon will, without doubt, be the first extraterrestrial body to be reached in space flight. The Soviet *Lunik* series and the United States *Ranger* program have already recorded considerable success. It is the purpose of this report to review Soviet works dealing with the Moon as an objective of space flight. The Earth-Moon system, the lunar surface, the lunar atmosphere, the tektite question, astronautical problems, and other matters are discussed. Fifty-two references are included.

1,964. SPECTROPHOTOMETRIC STUDY OF THE LUNAR SURFACE
Kopal, Z.
March 1962
Manchester University, Great Britain
Annual Summary Report 2, AFCRL-62-1096, AF 61(052)-378
AD-292,763
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The instruments designed for the study of lunar luminescence as well as for the measurement of the polarization of moonlight were built in the laboratories at the University of Manchester, and their field use commenced both at the 50-in. reflector of Asiago Observatory of the University of Padua and the 15-in. refractor of the Wilfred Hall Observatory at Preston, Lancashire. Preliminary results of the reduction of observations do disclose the presence of an appreciable luminescent component in moonlight, amounting to a few percent of the total. There is, moreover, evidence on hand (though not yet definitive) that the amount of luminescence fluctuates both with the time and in frequency.

1,965. LABORATORY SIMULATION OF LUNAR LUMINESCENCE
**Geake, J. E., Lumb, M. D., Derham, J.**
**March 1962**
**Manchester College of Science and Technology, Great Britain**
**Annual Summary Report 2, AFCRL-62-1099, AF-EOAR 61(052)-379**

Instrumentation for laboratory simulation of lunar luminescence is practically completed, and the luminescence of some tektite and meteoric samples has been investigated. The grating monochromator has been completed and calibrated, and the equipment for ultraviolet and proton excitation has been designed so that the luminescence excited by UV and protons can be investigated one after the other with the sample in the same place. A few tektite and meteoric samples have been scanned with this equipment; also, arrangements have been made to use the large collection of meteoric material in the British Museum. (*STAR*, 1963, N63-11017)

1,966. THE COLOR OF THE MOON
**van den Bergh, S.**
***Astronomical Journal*, v. 67, no. 2, pp. 147–150, March 1962**

Colors of 14 regions on the Moon were determined on the *B–V* system. Small but significant color differences are found between some regions of the lunar surface. The maria exhibit a moderate range of colors, Mare Tranquillitatis being the bluest. Compared with Mare Serenitatis, the highlands of the southern hemisphere appear to be slightly reddish. The rayed craters Tycho and Copernicus do not show any color anomaly. Attention is drawn to a very dark blue region north of Schröter. The color index of Mare Serenitatis is found to be $B-V = +0.876 \pm 0.022$. (*PA*, 1962, #9054)

1,967. HOW BAD IS THE MOON ENVIRONMENT?
**Boner, M. A., Lander, G. A., Jr.**
***Space/Aeronautics*, v. 37, no. 4, pp. 92–96, April 1962**

Major hazards of the lunar environment are reviewed and the effects of lunar gravity are analyzed. The physical features of the Moon's surface, particularly the topmost dust layer, are described. Selection of landing sites which can afford some protection against the environmental hazards is discussed, and a list of such sites is given. (*AI/A*, 1962, #60,133)

1,968. INFRARED WORK AT HARVARD COLLEGE OBSERVATORY
**Ingrao, H. C., Menzel, D. H. (Harvard College Observatory, Cambridge, Mass.)**
**In "Informal Infrared Astronomy Symposium, Baltimore, Md., November 11, 1961," pp. 16–19**
**Johns Hopkins University, Laboratory of Astrophysics and Physical Meteorology, Baltimore, Md., April 1962**

Since 1958 attention has been given to problems requiring the use of infrared techniques in wavelength ranges of 8–14, and longer. The objective was to obtain thermal pictures of the Moon. Measurements taken, records made, and equipment developed are described, including a radiation pyrometer having a Golay cell as a detector with a blackbody temperature control for calibration purposes. Accumulated experience gained from the use of this equipment serves as a basis for construction of a new pyrometer with two channels—one in the visual and the other in the infrared. The visual channel will record the precise location of the area under investigation. The infrared channel will use either an immersed thermistor bolometer, 0.1 × 0.1 mm in size, or a Golay cell. (*AI/A*, 1963, #71,258)

1,969. SPOTLIGHT ON THE MOON
***Sky and Telescope*, v. 23, no. 5, p. 243, May 1962**

A brief description is given of a University of Michigan experiment to illuminate a small area of the Moon by a powerful ruby laser. (*AI/A*, 1962, #60,463)

1,970. THE MOON
**Cameron, A. G. W.**
***International Science and Technology*, no. 5, pp. 24–32, May 1962**

Lunar composition and formation are discussed in general, and theories are presented regarding surface features and temperatures. Preliminary investigations of the lunar magnetic field are cited. (*AI/A*, 1962, #60,465)

1,971. OPTICAL ECHOES FROM THE MOON
**Smullin, L. D., Fiocco, G.**
***Nature*, v. 194, p. 1267, June 30, 1962**

Using a ruby optical maser radiating 50 joule pulses, each of 0.5-msec duration, identifiable echoes were received from four different lunar regions on three successive nights, May 9–11, 1962. The optical system of the transmitter incorporated a 12-in.-D cassegrain reflector; the reflected radiation was

collected by a 48-in. cassegrain reflector. The incoming echo signals were first passed through a 7-amp bandpass interference filter, and then detected by a photomultiplier unit cooled in liquid $N_2$. (*PA*, 1962, #21,699)

**1,972. LUNAR COMPOSITION BY SCINTILLATION SPECTROSCOPY (Presented at the Eighth Scintillation Counter Symposium, Washington, D.C., March 1962)**
**Van Dilla, M. A., Anderson, E. C., Metzger, A. E., Schuch, R. L.**
***IRE Transactions on Nuclear Science*, v. NS-9, no. 3, pp. 405–412, June 1962**

Information on the composition of the Moon and its past history is being sought through measurements of the spectrum of the gamma rays emerging from the lunar surface. The detector is a 3 × 3-in. CsI-plastic scintillator phoswich feeding a 32-channel analyzer weighing 5 lb. Energy range is to 3 Mev; in-flight calibration is provided by a small $Co^{27}$ and $Hg^{203}$ source fixed to the detector. Energy resolution is 12 ± 2 percent at 0.66 Mev. The spectrometer, and indeed the entire spacecraft, are biologically sterile. The spectrometer aboard *Ranger 3* (launch January 26, 1962, misdistance 20,000 mi) transmitted back spectra currently being studied; *Rangers 4* and *5* were repeats scheduled for later in 1962. (*PA*, 1962, #19,279)

**1,973. PRELIMINARY REPORT ON EXPERIMENTS RELATING TO THE LUNAR SURFACE 1. PHOTOMETRIC STUDIES 2. PROTON BOMBARDMENT OF MINERALS**
**Hapke, B. W.**
**July 1, 1962**
**Cornell University, Radiophysics and Space Research Center, Ithaca, N.Y.**
**CRSR 127**

Preliminary results of two experiments relating to the nature of the lunar surface are described. These experiments are photometric studies of surfaces and proton bombardment of minerals. To scatter light in the same manner as the Moon a surface must be extremely intricate. Surfaces of solid rocks, slag or coarsely ground rock powders are not sufficiently complex. The effects of proton bombardment depend on the chemical constitution of the irradiated mineral. Metallic Fe and Ag were reduced from $Fe_2O_3$ and $Ag_2S$, respectively, while $Al_2O_3$, MgO, and $SiO_2$ were largely unaffected by 10-kev protons. No welding or sintering of the mineral powders was observed.

**1,974. INFRARED MAPPING OF LUNAR CRATERS DURING THE FULL MOON AND THE TOTAL ECLIPSE OF SEPTEMBER 5, 1960**
**Saari, J. M., Shorthill, R. W.**
**July 1962**
**Boeing Scientific Research Laboratories, Seattle, Wash.**
**AF 18(600)-1824**
**AD-288,263**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

Infrared measurements were made over certain lunar crater regions during the eclipse of September 5, 1960 and the full Moon. Five rayed craters were observed to cool less rapidly than their environs during the eclipse, the anomaly being greatest for Tycho and progressively less for Aristarchus, Copernicus, Proclus, and Kepler. The findings are discussed in terms of the thermal properties of the surface, including thickness of insulating layer and age of the craters. Localized variations were found during illumination, evidently attributable to variations in albedo and geometry. Twenty references are included.

**1,975. STUDIES OF THE PHYSICAL PROPERTIES OF THE MOON AND PLANETS**
**July 1962**
**Rand Corporation, Santa Monica, Calif.**
**AR-26-JPL, Quarterly Technical Progress Report 8 for April 1–June 30, 1962**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

Studies of the physical properties of the Moon and planets are reported. These include the following: planetary atmospheres, radiative transfer, atmospheric scattering, an isostatic model of the Moon, cosmogonic studies, optical tracking of deep-space probes, and planetary orbiters. Four references are included. (*STAR*, 1963, N63-11407)

**1,976. LUNAR LIGHT POLARIZATION**
**(Translation from "Investigations Conducted in Three Regions of the Spectrum, of the Degree of Polarization and of the Angle of the Plane of Polarization of Light Reflected From Lunar Details," *Akademiia Nauk USSR, Komissiia po Fizike Planetnii, Izvestiia*, no. 1, pp. 41–53, 1959)**
**Kokhan, Ye. K.**
**September 19, 1962**
**Library of Congress, Aerospace Information Division, Washington, D.C.**
**AID 62-142 (supplement to AID 62-4, AD-275,255)**
**AD-285,341**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**
**(See also Entry #339)**

**1,977. SELECTED ARTICLES OF LIGHT SCATTERING AND PHOTOMETRIC RELIEF OF THE LUNAR SURFACE**
**(Translated from *Astronomicheskii Tsirkular*, no. 156, pp. 19–21, 1955, and *Astronomicheskii Zhurnal*, v. 33, no. 1, pp. 93–100, 1956)**
**Orlova, N. S.**
**September 1962**
**National Aeronautics and Space Administration, Washington, D.C.**
**TT F-75**

Tables are given for the reflectances of the lunar maria and continents for solar radiation as functions of the angles of incidence and reflection, both measured in the same plane. The data are based on the photographic studies of V. A. Fedorets and on the visual studies of V. V. Sharonov.

1,978. LUNAR THERMAL EMISSION MEASUREMENTS
**Castelli, J. P., Ferioli, C. P.**
**September 1962**
**Air Force Cambridge Research Laboratories, Office of Aerospace Research, Bedford, Mass.**
**AFCRL-62-882**

During two lunar eclipses, March 15, 1960 and August 25, 1961, simultaneous records of the lunar thermal emissions at 1200 and 3100 Mc were obtained with the 84-ft radio telescope of the USAF Sagamore Hill Radio Observatory. No change in lunar temperature was measured at either frequency during the eclipse. A simple straightforward method is described to convert antenna temperatures to average disk temperatures of the Moon; the latter were found to be 230°K at 1200 Mc and 223°K at 3100 Mc. (*AI/A*, 1963, #71,853)

1,979. THE MOON'S FIRST DECIMETER
**Buettner, K. J. K. (University of Washington, Seattle)**
**September 1962**
**Rand Corporation, Santa Monica, Calif.**
**RM-3263-JPL**

If measured at various infrared and radio wavelengths, the reflectivity and polarization of the Moon's electromagnetic emission can yield valuable data on the lunar surface, e.g., heat and electrical conductivity. From these data, mechanical data such as the texture, density, and strength of the surface material may be inferred. In order to interpret these data, a number of assumptions are ordinarily made which constitute a potential pitfall for the lunar researcher. An attempt is made to evaluate the effect of each of these pitfalls. (*AI/A*, 1962, #61,440)

1,980. THE MICROSTRUCTURE OF THE LUNAR SURFACE
**Barabashov, N. P., Garazha, V. I.**
***Soviet Astronomy—AJ*, v. 6, no. 2, pp. 237–243, September–October 1962**

It is shown that a model of fragmented tuff honeycombed by square shaped cells can satisfactorily predict all the observed features of light reflection from the lunar surface. Graphs and tables of brightness variation vs. angle of incidence are given for various models as well as for the lunar surface. An examination shows that, with regard to photometric properties, the lunar surface is best described by crushed tuff whose surface irregularities have dimensions lying within limits of one and several millimeters. (*AI/A*, 1963, #70,840)

1,981. ERRORS IN THE MEASUREMENT OF THE TEMPERATURE OF THE MOON
**Burns, E. A., Lyon, R. J. P. (Stanford Research Institute, Menlo Park, Calif.)**
***Nature*, v. 196, pp. 463, 464, November 3, 1962**

Errors in temperature measurements of the Moon arising from the blackbody concept of lunar emissivity of Pettit and Nicholson, and from the calculation of temperature using Stefan's law are suggested. Inductive errors caused by use of relatively imprecise equipment in the 1930 experiments are pointed out, and more contemporary information is applied in discussing the nature and amount of error. (*IAA*, 1963, A63-10902)

1,982. HEAT WAVES REVEAL MOON IS COLDER THAN SUPPOSED
***Electronics*, v. 35, p. 112, November 30, 1962**
**(*AS&T*, 1963)**

1,983. THE DEVELOPMENT AND DESIGN OF A POLARIMETER FOR LUNAR STUDIES
**Clarke, D.**
**November 1962**
**Manchester University, Great Britain**
**Technical Note 1, AFCRL-63-405, AF 61(052)-378**

Some of the difficulties of measuring the usually small degree of polarization of astronomical objects are described. The equations necessary for the evaluation of the degree of polarization by certain methods have been formulated, and accuracies of these methods have been compared. In order to gain experience in photometric and polarization experiments, a single-beamed device was designed and tested. A description of this instrument is given along with a description of the double-beam polarimeter that is currently in use. The astronomical results that have been obtained at the telescope are listed. Observations were made on several stars, Uranus, and the Moon, including measurements of the degree of polarization at different wavelengths. Eleven references are included. (*STAR*, 1963, N63-14448)

1,984. PETROLOGY OF THE LUNAR CRUST
**Wegner, G.**
***Strolling Astronomer*, v. 16, no. 11–12, pp. 277–279, November–December 1962**

The results of colorimetric and spectroscopic observations of the Moon are given. The color reflectivities of the materials in the lunar maria resemble terrestrial basalts, and those of the bright continental regions resemble terrestrial granites. This could indicate that the basic mineral composition of the Earth and of the Moon differ little when effects of erosion and of living organisms are neglected in the case of the Earth. The results are only relative since no direct chemical analysis of the Moon has yet been made. A chart and a sketch are included. (*AI/A*, 1963, #70,842)

**1,985. OPTICAL EVIDENCE OF THE LUNAR ATMOSPHERIC TIDE**
**Barber, D. R.**
***Journal of Atmospheric and Terrestrial Physics*, v. 24, pp. 1065–1071, December 1962**

The results of photometric observations of twilight sky radiance made in Halsingborg, Sweden and Sidmouth, England reveal a systematic fluctuation of twilight intensity with lunar age, at constant solar depression. To explain this dependence, an influence of the lunar atmospheric tide on the optical scattering properties of the high atmosphere is postulated.

Harmonic analysis of the Halsingborg data reveals major periodicities of 14.75 and 29.5 days, respectively, the former resulting from a lunar semidiurnal tidal component. From these analytical data, amplitudes and phases of both tidal oscillations are computed for a series of optical sounding heights lying between 14.5 and 138 km. Both components have zero amplitudes at 32 ± 4 km.

Since the tidal oscillations can cause cyclic changes in sky brightness of up to ~30 percent of the mean brightness level, the necessity of recognizing and correcting for the lunar effect in certain types of photometric and spectrophotometric work is emphasized. (*AI/A*, 1963, #70,779)

**1,986. INFRARED SPECTRAL ANALYSIS OF THE LUNAR SURFACE FROM AN ORBITING SPACECRAFT**
**Lyon, R. J. P., Burns, E. A. (Stanford Research Institute, Menlo Park, Calif.)**
**In "Proceedings of the Second Symposium on Remote Sensing of Environment, University of Michigan, Ann Arbor, October 16, 1962," pp. 309–327**
**Michigan, University of, Institute of Science and Technology, Ann Arbor, 1962**

Absorption and specular reflection analyses have been used to test the feasibility of infrared compositional analysis of lunar materials in the wavelength range 2 to 25 $\mu$. In a NASA-sponsored study, over 300 minerals and rocks have been examined and the applicability of the techniques clearly established. By applying Kirchhoff's law to the spectral reflectance data, under thermal equilibrium conditions one can obtain the spectral-emittance curves at any given temperature. Major rock types may be readily differentiated from one another at lunar ambient temperatures. Twenty-one references are included. (*STAR*, 1963, N63-14668)

**1,987. COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, VOLUME I, NUMBERS 14–16**
**Middlehurst, B., Kuiper, G. P., Editors**
**Arizona, University of, Lunar and Planetary Laboratory, Tucson, 1962**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

The following chapters are included:

"A Completely Digitized Multi-Color Photometer," by H. L. Johnson and R. I. Mitchell, pp. 73–81

"Infrared Spectra of Stars and Planets, I: Photometry of the Infrared Spectrum of Venus, 1–2.5 Microns," by G. P. Kuiper, pp. 83–117 (See Entry #1996)

"An Infrared Stellar Spectrometer," by G. P. Kuiper, R. Goranson, A. Binder and H. L. Johnson, pp. 119–127. (*STAR*, 1963, N63-14008)

**1,988. COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, VOLUME I, NUMBERS 17–23**
**Kuiper, G. P., Herring, A. K., Editors**
**Arizona, University of, Lunar and Planetary Laboratory, Tucson, 1962**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

The following chapters are included:

"Photometric Studies of Asteroids. IX. Additional Light-Curves," by D. Owings (Indiana University) and T. Gehrels, pp. 129–146

"Photometric Studies of Asteroids. X.," by H. J. Wood (Indiana University) and G. P. Kuiper, pp. 147–153

"Preliminary Drawings of Lunar Areas. III.," by A. K. Herring, p. 154

"The Composition Anomalies of 3 Centauri," by A. S. Bashkin and B. Middlehurst, pp. 155–159

"Surface Photometry of Extended Images," by B. Middlehurst, pp. 161–165

"The Wavelength Dependence of Polarization," by T. Gehrels and T. M. Teska, pp. 167–177

"Infrared Spectra of Stars and Planets. II. Water Vapor in Omicron Ceti," by G. P. Kuiper, pp. 179–188. (*STAR*, 1963, N63-15077)

**1,989. A VISUAL-COLORIMETRIC STUDY OF THE LUNAR SURFACE**
**Sharonov, V. V.**
***Astronomicheskii Zhurnal*, v. 39, no. 1, pp. 87–92, 1962**
**(Translated from the Russian in *Soviet Astronomy—AJ*, v. 6, no. 1, pp. 62–66, July–August 1962)**

The colors of 115 details of the lunar surface have been found, using the blue wedge of the Rozenberg photometer, which was mounted on the visual tube of the Tashkent normal astrograph. A white scattering screen, illuminated by direct solar rays, was used for absolute standardization. This

permitted the color of each measured object to be expressed in the form $D = C_\supset - C_\odot$, where $C_\supset$ is the color index of the lunar formation and $C_\odot$ that of solar radiation. The mean for all the objects is $D = +0.344$, the extreme values being $+0.290$ and $+400$. Therefore, the extreme difference of color on the Moon, including the errors of measurement, is $\pm 0.005$ units of the color index. This only slightly exceeds the mean error of determination of $D$ which is $\pm 0.^m038$. A comparison of $D$ with the albedo $\rho$ shows that $D$ increases somewhat in the mean for brighter objects and the dispersion decreases. In general the difference in color on the lunar surface is very inconsiderable; it can be detected visually with difficulty on the maria and is almost indiscernible on the continents. (*PA*, 1962, #21,693)

### *Venus — 1962*

**1,990. THE ASTRONOMICAL UNIT DETERMINED BY RADAR REFLECTIONS FROM VENUS**
**Muhleman, D. O., Holdridge, D. B., Block, N.**
**March 8, 1962**
**Jet Propulsion Laboratory, California Institute of Technology, Pasadena**
**TR 32-221**

Radar reflections from the surface of Venus at a wavelength of 12.5 cm yielded an AU value of 149,598,845 ± 250 (p.e.) km, or a solar parallax of 8".7940976 ± 147 based on an Earth radius of 6,378,145 m. The computations were accomplished utilizing doppler-frequency-shift and time-of-flight observations (range measurements) in conjunction with the "best" available planetary ephemerides of the Earth and Venus. The investigations yielded proof of the transparency of the Venus atmosphere at 12.5 cm and some information on the radius of Venus. Systematic errors in the published ephemerides are also discussed. (*AI/A*, 1962, #5440)

**1,991. A NEW $CO_2$-BAND IN VENUS**
**Spinrad, H.**
***Astrophysical Journal*, v. 135, no. 2, p. 651, March 1962**

A new band with head at 7158 A, previously found by Herzberg and Herzberg (1953) as a very weak feature in ultralong path laboratory spectra, was discovered on a Venus spectrogram obtained at the Mount Wilson Observatory on May 17, 1943. The band is just visible on a few other spectrograms also. Its optical depth is probably quite large. (*PA*, 1962, #17,254)

**1,992. ON THE CONTINUOUS SPECTRUM OF VENUS AND JUPITER**
**Spinrad, H.**
***Astronomical Society of the Pacific, Publications of the*, v. 74, no. 437, pp. 156–158, April 1962**

Some empirical data on the intensity distribution in the spectra of Venus and Jupiter are given. (*AI/A*, 1962, #60,302)

**1,993. PHYSICAL PROPERTIES OF THE PLANET VENUS**
**Evans, D. C.**
**July 1962**
**Douglas Aircraft Company, Inc., Missile and Space Systems Division, Space Systems Engineering, El Segundo, Calif.**
**SM-41506**

The purpose of this report is to present a compilation of the orbital and physical properties of the planet Venus, for use as engineering design criteria. The topics discussed are: the orbital elements, mass, radius, gravity, density, rotation, atmospheric circulation, solar constant, albedo, color, temperature distribution, electromagnetic and particle fields, clouds, water, and the possible surface conditions on Venus. The latest information available in published journals was reviewed for evaluation of these physical properties. The information presented is a compilation of existing data—not of new theories or new experimental data.

**1,994. ON THE SPECTRUM OF LIGHTNING IN THE VENUS ATMOSPHERE**
**Meinel, A. B., Hoxie, D. T.**
***Astronomical Society of the Pacific, Publications of the*, v. 74, no. 439, pp. 329–330, August 1962**
**(*AI/A*, 1962 #61, 596)**

**1,995. INFRARED SPECTRA OF STARS AND PLANETS, I: PHOTOMETRY OF THE INFRARED SPECTRUM OF VENUS, 1–2.5 MICRONS**
**Kuiper, G. P.**
**In "Communications of the Lunar and Planetary Laboratory," v. 1, no. 15, pp. 83–117**
**Middlehurst, B., Kuiper, G. P., Editors**
**Arizona, University of, Lunar and Planetary Laboratory, Tucson, 1962**

Spectrographs of Venus for the 1.0- to 2.5-$\mu$ region are given and compared to the spectra of $CO_2$ obtained in the laboratory. The Venus observations were made with the 36-in. telescope of the Kitt Peak Observatory in June 1962 and with the 82-in. telescope of the McDonald Observatory in August 1962. Ten references are included. (*STAR*, 1963, N63-14010)

**1,996. MARINER II INSTRUMENTATION: WHAT WILL IT SEE ON VENUS?**
**Chase, S. C. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena), Schwarz, F. (Barnes Engineering Co., Stamford, Conn.)**
***Electronics*, v. 35, no. 50, pp. 42–45, December 14, 1962**

The *Mariner 2 (1962 αρ 1)* microwave- and IR-radiation detectors, designed to investigate the cloud cover and surface radiation of Venus, are discussed. By mapping the temperature pattern of the Venus cloud tops, and measuring the extent of cloud breaks, the IR radiometer will help to establish a correct model for the planet's atmosphere. It is shown how, by receiving radiation alternately through two lenses that

view regions 45 deg apart, the thermistor detector will measure the absolute radiation from the planet, from which its temperature can be determined. A low-frequency preamplifier with a high input-impedance, and a logarithmic amplifier are described, as is the synchronous rectification used to improve the S/N ratio. (*IAA*, 1963, A63-10756)

1,997. MICROWAVE RADIOMETER INSTRUMENTATION FOR VENUS STUDIES (Presented at the Eighth National Aero-Space Instrumentation Symposium, Washington, D.C., May 21–23, 1962)
Barath, T., Johnston, J. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena)
In "ISA Proceedings of the National Aerospace Instrumentation Symposium," v. 8, pp. 25–32
Instrument Society of America, Pittsburgh, Pa., 1962

Microwave radiometer instrumentation, in the framework of radio and optical astronomy, is surveyed. The advantages and limitations of space-borne radiometers for planetary exploration are analyzed from a scientific and engineering point of view. A two-channel (19 and 13.5 mm), crystal, video radiometer designed for the study of Venus is described in detail. (*IAA*, 1963, A63-12212)

1,998. THE NATURE OF THE VENUS CLOUD SYSTEM (Presented at the IAS National Summer Meeting, Los Angeles, Calif., June 18–22, 1962)
Anderson, C. E., Evans, D. C. (Douglas Aircraft Company, Santa Monica, Calif.)
1962
Institute of the Aerospace Sciences, Inc., New York, N.Y.
Paper

Photometric observations of Venus have been compared to a theoretical model. The approximating model consists of a spherical planet with a lambert reflecting surface of high albedo (0.80). The atmosphere of the model is corrected for multiple Rayleigh scattering for various wavelengths of light. The conclusions of the investigation are that (1) the high albedo of Venus is due to scattering from a high albedo surface, not from an infinite atmosphere; (2) there is no specular reflection; (3) multiple Rayleigh scattering is important and must be considered when interpreting absorption lines in the Venus spectrum; and (4) the pressure at the visible surface is of the order of 1.0 atm, rather than the previously stated order of 0.1 atm. (*AI/A*, 1962, #61,245)

## *General — 1963*

1,999. RADIATION MEASUREMENTS WITH AN AIRBORNE RADIOMETER OVER THE OCEAN EAST OF TRINIDAD
Clarke, D. B. (Woods Hole Oceanographic Institution, Woods Hole, Mass.)
*Journal of Geophysical Research*, v. 68, pp. 235–244, January 1, 1963

Direct observations of the long-wave radiative flux, using an aircraft-mounted radiometer, are discussed. The response of the radiometer is such that the measurements are running averages of the flux received over four miles. The measurements are made at selected levels in the lower troposphere during sky conditions ranging from clear to overcast. From these data, values of the means and extremes are selected and the radiative cooling is calculated. A heat budget of the subcloud layer is constructed from which it is determined that the air in this region is warming about 1°C per day. A description of the construction and performance of the radiometer is given. Eleven references are included. (*IAA*, 1963, A63-11385)

2,000. TEMPERATURE EFFECTS IN PHOTOMULTIPLIERS AND ASTRONOMICAL PHOTOMETRY
Young, T. (Harvard College Observatory, Cambridge, Mass.)
*Applied Optics*, v. 2, pp. 51–60, January 1963

Determination of the degree of temperature regulation actually achieved by various telescope-cooling methods is discussed. The importance of temperature effects in astronomical photoelectric photometry is assessed. Temperature coefficients are reported for photomultiplier-tube types used in astronomy. For 1-percent stability of gain and color response, a temperature regulation of 1°C or better is generally required. This is nearly an order of magnitude better than what is usually achieved at the telescope, but careful use of a well-designed cold box should make 1°C temperature stability possible. For maximum stability and reproducibility, ordinary blue-sensitive tubes should be avoided at wavelengths longer than 5000 A. Trialkali cathodes should not be used beyond 6500 A. Twenty-one references are included. (*IAA*, 1963, A63-11393)

2,001. STUDY OF PHOTOCHEMISTRY, PHYSICAL STATE AND MOTION OF THE UPPER ATMOSPHERE
Edwards, H. D.
January 1963
Georgia Institute of Technology, Engineering Experiment Station, Atlanta
Semiannual Technical Report on Project A-434, AF 19(604)-5467
AD-297,266

A technical paper is summarized on the design, fabrication, and operation of a field photometer with a 500-mm parabolic mirror as collector and employing a nine-element filter wheel. Preliminary data have been analyzed from the *Firefly 3* series. Control samples of the thousands of feet of film which were obtained were processed in the field and the following information was obtained. The location in space of the beginning of each chemical release was computed within a few hours after the rocket firing and enabled the *Firefly* director to plan the next firing and set timers. The location of a few additional points along the length of the cloud was determined. The

equipment operation was monitored and necessary adjustments were made. The results of the field observations and calculations are tabulated. In most cases, altitude is correct to within ±1 km.

2,002. INFRA-RED RADIOMETER
Adhav, R. S., Kemp, J. G.
*Journal of Scientific Instruments*, v. 40, pp. 26–27, January 1963
(*AS&T*, 1963)

2,003. RADIOMETRIC METHOD OF PERPETUATING UNIT OF LIGHT
Preston, J. S.
*Royal Society of London, Proceedings of the, Series A—Mathematical and Physical Sciences*, v. 272, no. 1348, pp. 133–145, February 19, 1963

In reproducing the basic unit of light, candela, it has proved both difficult and time-consuming to achieve the required accuracy. The principles of a new method for the radiometric calibration of tungsten filament photometric standard lamps are discussed, which consist mainly of passing radiation through a filter whose spectral curve is proportional to the relative spectral response of a standard eye. Practical considerations are included, as well as trial experiments and results and their implications. (*EI*, 1963)

2,004. WIDE-RANGE PHOTOGRAPHIC PHOTOMETRY
Dobbins, R. A., Crocco, L., Glassman, I.
*Review of Scientific Instruments*, v. 34, no. 2, pp. 162–167, February 1963

Methods of developing a photosensitive film to a high degree of uniformity are demonstrated to be dependent upon the effectiveness of the mixing of the developing solution and the disruption of the formation of a concentration boundary layer during the developing process. Adaptation of the hydraulic brush developing technique and use of film and microphotometer calibration procedures based on a primary standard of measurement made possible the extension of the useful range of commercial films for photometric purposes to a density of over 2.5. These methods permit the use of photographic photometry to make measurements of irradiance varying over a range of 100 to 1, with an accuracy of better than 10 percent over the entire range. (*PA*, 1963, #9575)

2,005. TESTS OF PHOTOMULTIPLIERS FOR ASTRONOMICAL PULSE-COUNTING APPLICATIONS
Rodman, J. P., Smith, H. J.
*Applied Optics*, v. 2, no. 2, pp. 181–186, February 1963

An apparatus is described for testing photomultiplier tubes to be used in an astronomical spectrophotometer. The wide differences in residual nonthermal dark current (after refrigeration) found among photomultiplier tubes with very similar rated characteristics require that each cell intended for faint-light astronomical applications be individually selected. The better CsSb and trialkali tubes tested have residual dark currents extrapolated to zero bias respectively in the range 2–6 and 15–30 counts/sec; unfortunately, this residual component is usually also somewhat nonstatistical in character. Further general conclusions from the tests are presented, together with specific data for cells, including relative-sensitivity scans of photosurfaces. (*PA*, 1963, #9146)

2,006. GEP TO ALTER ALL ASTRONOMY
Beller, W.
*Missiles and Rockets*, v. 12, pp. 22, 23, March 4, 1963

The Goddard Experiment Package (GEP) telescope and optical system to be installed in the second *Orbiting Astronomical Observatory* is briefly described. The telescope will be able to obtain spectra of about 14,000 stars a year in the UV. It is shown that the system can be upgraded to resolutions of 0.04 Å. The primary and spectrometer mirrors, made of beryllium, are the most critical parts of the system design. The concept of the telescope is briefly stated. Six photon-scintillation detectors are used, and the pulse outputs are fed to six data-accumulator channels. For pointing accuracy, a fine-guidance pickoff mirror is installed on the spectrometer mirror. Error signals are passed to the spacecraft stabilization and control system for orientation correction. (*IAA*, 1963, A63-13025)

2,007. STRAY LIGHT IN ULTRAVIOLET, VISIBLE, AND NEAR-INFRARED SPECTROPHOTOMETRY
Slavin, W. (Perkin-Elmer Corporation, Norwalk, Conn.)
*Analytical Chemistry*, v. 35, pp. 561–566, April 1963

The effect of stray light—which has a detrimental effect on the photometric accuracy of spectrophotometers—upon an analytical situation is investigated. The case in which the stray light is absorbed by the sample is considered as well as the case in which it is not. A nomograph quantitatively relates the percentage of stray light, the sample absorbance, and the photometric error introduced by unabsorbed stray light. A number of materials and methods are described which aid in the quantitative determination of stray light. Procedures are described for reducing the stray light level. Nineteen references are included. (*IAA*, 1963, A63-14273)

2,008. RESEARCH WITH TIROS RADIATION MEASUREMENTS
Nordberg, W.
*Astronautics and Aerospace Engineering*, v. 1, no. 3, pp. 76–83, April 1963

Radiometric experiments performed by meteorological satellites are described. The importance of supplementing TV photographs with radiometric observations is emphasized. Measurements discussed resulted from rather simple instruments reflecting the state of satellite radiometry of several years ago. (*AI/A*, 1963, #71,839)

2,009. A RADIATION VIEW OF HURRICANE ANNA FROM THE TIROS III METEOROLOGICAL SATELLITE
(Presented at the International Symposium on Rocket and Satellite Meteorology, Washington, D.C., April 23–25, 1962)
Bandeen, W. R., Conrath, B. J., Nordberg, W., Thompson, H. P. (National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.)
April 1963
National Aeronautics and Space Administration, Washington, D.C.
TN D-1713
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

The *Tiros 3* meteorological satellite, containing two television cameras and a family of electromagnetic radiation experiments, was launched on July 12, 1961. Nine days later, the satellite passed directly over Hurricane Anna, the first hurricane of the 1961 Atlantic season. Data gathered by a five-channel medium resolution radiometer during one pass over the hurricane are presented in the form of maps, and certain implications of the data are discussed. Supporting television pictures are also given. The design and calibration of the medium resolution radiometer are briefly described. Seven references are included. (*STAR*, 1963, N63-14586)

2,010. AN INTENSITY-RECORDING MICROPHOTOMETER
Kalinenkov, N. D., Stolov, A. L.
*Astronomicheskii Zhurnal*, v. 40, no. 1, pp. 171–175, 1963
(Translated from the Russian in *Soviet Astronomy—AJ*, 1963)

A simple device for a recording microphotometer is proposed which allows microphotometer tracings in passbands of densities, intensities, and logarithms of intensities to be obtained. The main part of the device is an optical template of the transformation curve. (*PA*, 1963, #11,485)

2,011. A PHOTOELECTRIC GRATING SPECTROMETER
Grainger, J. F., Ring, J.
*Royal Astronomical Society, Monthly Notices of the*, v. 125, no. 2, pp. 93–104, 1963

The astronomical advantages of a photoelectric grating spectrometer are outlined, and the theoretical and practical design considerations are given for an instrument of this type recently constructed at the University of Manchester. It has a relative aperture of $f/5$ and a spectral resolving power of 20 to 25 thousand over the near ultraviolet and visible regions of the spectrum. Its angular resolution is of the order of the "seeing" disk when used with the 50-in. reflector at Asiago. Tests of the instrument are described, including its optical performance and its ability to compensate to a high degree for fluctuations in entrance slit illumination. A description is given of observations of the 3727 Å O II radiation from the North America Nebula and luminescent radiation from the Moon. The accuracy with which this latter was measured is considerably higher than that achieved by earlier observers, and the implications of its existence are briefly discussed in the light of present day estimates of the lunar environment. (*PA*, 1963, #9148)

2,012. THERMAL-ELECTRIC TYPE INSTRUMENTATION FOR THE DETECTION AND RELATIVE MEASUREMENT OF INFRARED RADIATION IN A SELECTED WAVELENGTH BAND OF ESSENTIALLY BLACK BODY RADIATION
Zopf, W. D., Jr.
1963
Arkansas, University of, Fayetteville
Master's Thesis
AD-298,162

## *Moon — 1963*

2,013. DETERMINATION OF RELATIVE AGES OF LUNAR CRATERS BY ALBEDO AND POLARIZATION MEASUREMENTS
Fielder, G.
*Nature*, v. 197, p. 69, January 5, 1963

Consideration is given to the effects of ultraviolet radiation and fragmentation of the lunar crust by meteoritic impact on the albedo ($\rho$) and optical polarizing ($P$) properties of the lunar surface. From a study of crater floors, statistical equations are found which permit a calculation of the above parameters, i.e., $2 \log \rho + \log \Delta = 0$, and $3 \log (P_{max} - 7) = 4 \log (\Delta \sim 170) - 6$, where $\Delta$ is the crater diameter in kilometers. Both of the above relationships infer a longer lifetime for the larger craters. Thus, the rocks of the maria must now be considered the oldest surface features, contrary to the evidence from relative frequency data for continental and postmare craters. The discrepancy may be resolved by postulating differences in the chemical composition of the materials from which the maria and continents were formed. (*PA*, 1963, #11,513)

2,014. RANGER PREFLIGHT SCIENCE ANALYSIS AND THE LUNAR PHOTOMETRIC MODEL
Herriman, A. G., Washburn, H. W., Willingham, D. E.
January 7, 1963 (Revised March 11, 1963)
Jet Propulsion Laboratory, California Institute of Technology, Pasadena
TR 32-384, Revision
(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)

A photometric model of the lunar mare surface is presented. The lighting parameters for the *Ranger 3*, *4*, and *5* TV system are developed using the photometric model, and are related to the system parameters. The interactions of the TV constraints with those imposed by the other experiments and by trajectory characteristics are discussed in detail, and the use of plastic spheres to show graphically the interrelationships among the parameters is described. Eleven references are included. (*STAR*, 1963, N63-15244)

**2,015. PHOTOGRAPHY OF THE MOON FROM SPACE PROBES**
**Eimer, M.**
**January 15, 1963**
**Jet Propulsion Laboratory, California Institute of Technology, Pasadena**
**TR 32-347**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

Aspects of the photometric properties of the Moon that are important to an understanding of photographic problems are briefly examined. Geometric problems relating to impacters, orbiters, and landers are reviewed. The selection of system components is discussed, and examples of designs and their properties are given. (*AI/A*, 1963, #71,104)

**2,016. RADAR AND INFRARED LUNAR OBSERVATIONS**
***Sky and Telescope*, v. 25, no. 1, pp. 3, 24, January 1963**

Radar and infrared lunar observations indicating areas where the surface layer of dust is absent or very thin, or where bare rock is exposed, are discussed. Indications are also given of "thermal inertia" of the lunar surface. (*AI/A*, 1963, #71,557)

**2,017. COMPARATIVE SPECTROPHOTOMETRY OF SELECTED AREAS ON THE LUNAR SURFACE**
**Coyne, G. V.**
***Astronomical Journal*, v. 68, no. 1, pp. 49–56, February 1963**

A color-contrast function is defined in the following manner: $CE_{a,b}(\lambda) = (m_\lambda - m_{5500})_a - (m_\lambda - m_{5500})_b$, where $a$ and $b$ refer to two different areas of the lunar surface. Values of this function were determined for 16 paired areas on the lunar surface at approximately every 100 Å in the spectral range 4380 to 6835 Å from densitometer tracings of spectrograms having a dispersion of 4.9 Å/mm. The results show that there are significant color contrasts, even within the maria. The maximum values of $CE(\lambda)$ lie between 0′.15 and 0′.20. The lunar maria seem to be more homogeneous in blue light (below 5500 Å) than in red light (above 5500 Å). Some of the curves of $CE(\lambda)$ versus $\lambda$ shows humps about 500 Å wide which resemble luminescence bands found by Dubois for various regions of the Moon. (*PA*, 1963, #11,511)

**2,018. A THEORETICAL PHOTOMETRIC FUNCTION FOR THE LUNAR SURFACE**
**Hapke, B. W.**
**February 1963**
**Cornell University, Center for Radiophysics and Space Research, Ithaca, N.Y.**
**CRSR 138**

A formula describing the observed photometric properties of the lunar surface is derived theoretically. Functions for both the differential and integral brightness are obtained. The model surface on which the derivation is based consists of a semi-infinite, porous layer of randomly placed, obscuring objects. These objects are suspended in depth in such a manner that the interstices which separate them are interconnected. A layer of fine, loosely compacted dust is in the category of surfaces described by this model; volcanic foam is not. The shape of the photometric curve depends on the fractional void volume. Bulk densities of the order of one-tenth that of solid rock are implied for the upper layers of the lunar surface. (*AI/A*, 1963, #71,556)

**2,019. PHOTOMETRIC STUDIES OF COMPLEX SURFACES, WITH APPLICATIONS TO THE MOON**
**Hapke, B. W., Van Horn, H.**
**February 1963**
**Cornell University, Center for Radiophysics and Space Research, Ithaca, N.Y.**
**CRSR 139**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

The reflection laws of a wide variety of surfaces have been measured. The factors which govern the optical scattering characteristics of complex surfaces are discussed, and the properties of surfaces which scatter light in the same manner as the Moon are specified. Surfaces of solid rocks, volcanic slags, or coarsely ground rock powders do not possess the intricate structure necessary for back-scattering light strongly. However, finely pulverized dielectric particles are able to build extremely complex surfaces which can reproduce the lunar scattering law. It is concluded that the surface of the Moon is covered with a layer of fine rock dust composed of particles of the order of 10 $\mu$ average diameter, and that 90 percent of the volume of the surface layer is voids. Twenty-four references are included. (*STAR*, 1963, N63-14087)

**2,020. THE MOON'S FIRST DECIMETER**
**Buettner, K. J. K. (University of Washington, Seattle)**
***Planetary and Space Science*, v. 11, pp. 135–148, February 1963**

The possible composition of the surface layer of the Moon is discussed, and possible lunar conditions which could affect the interpretation of thermal and electromagnetic radiation measurements are pointed out. These possibilities are considered: that the top layers may be partially permeable to infrared emission; that the white surface areas, such as the crater Aristarchus, permit solar radiation to penetrate below the surface; that, based on laboratory measurements, the heat conductivity of dust decreases with air pressure, and at low pressures with temperature; that, also from laboratory measurements, the specific heat of rocks depends on the cube root of the temperature rather than on the temperature itself; and that ionizing rays could have liberated metals atoms in the lunar surface material, thus raising the electrical conductivity. Twenty-six references are included. (*IAA*, 1963, A63-14576)

**2,021. EVALUATION OF INFRARED SPECTRO-PHOTOMETRY FOR COMPOSITIONAL ANALYSIS OF LUNAR AND PLANETARY SOILS**
**Lyon, R. J. P. (Stanford Research Institute, Menlo Park, Calif.)**
**April 1963**
**National Aeronautics and Space Administration, Washington, D. C.**
**TN D-1871**
**(Also available through U.S. Dept. of Commerce, Office of Technical Services, Washington, D.C.)**

A preliminary feasibility study of infrared analytical techniques for the study of the lunar surface has been made, including absorption studies of 370 rock and mineral samples, and reflection studies of 80 rocks. Spectral information was collected in the wavelength range 2.5 to 25 $\mu$ (4000 to 400 $cm^{-1}$). Emittance spectra have been calculated from the reflectance data for several of the most important rock types. (*AI/A*, 1963, #71,585)

## *Venus — 1963*

**2,022. VENUS YIELDS SOME SECRETS TO MARINER**
***Engineering*, v. 195, no. 5058, pp. 93–94, January 18, 1963**

The first results obtained by analysis of transmissions from *Mariner 2* while it was in the vicinity of Venus are reported. A description of the spacecraft's science experiments and their functions is included. Special attention is given to the infrared radiometer and to information concerning atmospheric and possible surface temperatures derived from its use. Future U.S. plans for planetary exploration are outlined. (*AI/A*, 1963, #70,753)

**2,023. APPROACH TO VENUS**
***Spaceflight*, v. 5, pp. 2–7, January 1963**

The objectives of the spacecraft *Mariner 2 (1962 $\alpha\rho$ 1)* for the Venus fly-by mission are outlined. The six scientific experiments carried by it are discussed. The microwave and IR radiometers, the magnetometer, the ion chamber and particle-flux detector, the cosmic-dust detector, and the solar plasma spectrometer, and their applications are described and listed in tabular form. The spacecraft and launch-vehicle specifications are also provided. (*IAA*, 1963, A63-11809)

**2,024. MARINER II MICROWAVE AND INFRARED RADIOMETER RESULTS**
**February 26, 1963**
**National Aeronautics and Space Administration, Washington, D.C.**
**News Release 63-36-1**

The microwave and infrared radiometer observations of Venus by *Mariner 2* are described, and the results of a preliminary analysis of the data and their implications are discussed. The microwave radiometer scanned the surface of Venus at wavelengths of 13.5 and 19 mm. The data obtained from the microwave radiometer will be compared to infrared emission data at 8.4- and 10.4-$\mu$ wavelengths. Preliminary results indicate a surface temperature of near 800°F, a cloud layer temperature of about −30°F, and a cold spot in the cloud layer over the Southern Hemisphere. (*STAR*, 1963, N63-13151)

**2,025. MARINER II: PRELIMINARY REPORTS ON MEASUREMENTS OF VENUS, INFRARED RADIOMETER**
**Chase, S. C., Neugebauer, G. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena), Kaplan, L. D. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, and University of Nevada, Reno)**
***Science*, v. 139, pp. 907–908, March 8, 1963**
**(Also available as TR 32-429, Jet Propulsion Laboratory, California Institute of Technology, Pasadena)**

The IR radiometer carried by *Mariner 2 (1962 $\alpha\rho$ 1)* is described. Preliminary evaluations of data obtained by the radiometer during the pass near Venus on December 14, 1962, indicate that there is little $CO_2$ absorption in the light path. The measured temperatures appear to be cloud temperatures. The clouds are probably quite thick, and essentially no radiation is transmitted from the surface. A definite limb-darkening is observed in both spectral channels. The radiation temperatures show a monotonic decrease of approximately 20°K between the central portion and the limbs. Central radiation temperatures are estimated to be 240°K. The light- and dark-side temperatures are qualitatively the same. (*IAA*, 1963, A63-13083)

**2,026. THE INFRARED SPECTRUM OF VENUS (1–2.5 $\mu$)**
**Moroz, V. I.**
***Astronomicheskii Zhurnal*, v. 40, no. 1, pp. 144–153, 1963**
**(Translated from the Russian in *Soviet Astronomy—AJ*, 1963)**

The observations were made with a diffraction spectrograph and a lead-sulfide photoconductive cell attached to the 122- and 125-cm reflectors during 1961–1962. Numerous recordings of the planet were made at different velocities of scanning, slit widths, and time constants. Spectra of the Sun and Moon were recorded under similar conditions to exclude errors and incorrect identifications, which could be due to telluric bands. The spectrum is given with a list of new details, some of which are identified with $C^{12}O_2^{16}$ and $C^{13}O_2^{16}$. A general list of unidentified details is also presented. The abundance or its upper limit of a number of compounds is estimated by means of laboratory recordings and published data. Present-day data on the chemical composition of the atmosphere of Venus are summarized. The abundance ratio $C^{12}O_2^{16}/C^{13}O_2^{16}$ is estimated and found to be, within the limits of errors, the same as that in the Earth's atmosphere. A monochromatic albedo curve for Venus in the region

1–2.5 $\mu$ is obtained, and the integral albedo is estimated as 0.66. No features characteristic of reflection from ice crystals are seen in the monochromatic albedo curve. Evidently the clouds consist of neither ice nor water but of dust. The mean radius of a dust particle is about 1 $\mu$. The form of the monochromatic albedo curve in the region 2–2.5 $\mu$ contradicts the representation of the greenhouse effect due to water vapor. (*PA*, 1963, #11,517)

**(See also Entries #27, 94, 137, 159, 205, 233, 265, 306, 358, 382, 442, 556, 594, 599, 606, 628, 685, 785, 1061, 1271, 1516, 1584, 1599.)**

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| Boehmer, A. M. | 562 |
| | 662 |
| | 666 |
| | 673 |
| Boerio, A. H. | 1,345 |
| Boggess, A., III | 1,915 |
| Bogomolov, K. S. | 587 |
| Boland, J. W. | 1,851 |
| Bolle, G. | 989 |
| | 1,046 |
| Bollhagen, H. | 545 |
| Bond, D. S. | 1,511 |
| Boner, M. A. | 1,967 |
| Bonner, W. A. | 857 |
| Bonney, L. G. | 1,265 |
| Bordewijk, J. L. | 746 |
| Borgman, J. | 225 |
| Borkan, H. | 987 |
| | 1,077 |
| | 1,114 |
| | 1,319 |
| Born, C. J. | 188 |
| Borne, J. | 1,093 |
| Bornemann, I. | 738 |
| | 850 |
| | 975 |
| | 1,409 |
| Borough, H. C. | 1,760 |
| Both, E. E. | 454 |
| | 630 |
| | 638 |
| Botham, J. H. | 394 |
| Bouman, M. A. | 1,606 |
| Bouška, J. | 311 |
| | 473 |
| | 476 |
| Bousky, S. | 30 |
| Boutry, G. A. | 738 |
| | 909 |
| Bouwers, A. | 1,245 |
| Bowen, E. T. | 38 |
| Bowen, I. S. | 516 |
| Boxberger, M. | 744 |
| Boyer, C. | 500 |
| | 599 |
| Boynton, R. M. | 1,607 |
| Brace, J. E. H. | 774 |
| Bracewell, R. N. | 1,653 |
| Braddick, H. J. J. | 1,728 |
| Brady, T. | 1,379 |
| Brainard, R. C. | 1,487 |
| Brand, H. | 738 |
| Brandenberger, A. J. | 96 |
| Brandt, J. C. | 1,752 |
| Brasch, K. R. | 598 |
| Braum, C. M. | 1,433 |
| Bréan, C. | 278 |
| Breido, I. I. | 580 |
| Brewer, R. K. | 179 |
| Brickett, I. R. H. | 286 |
| Briggs, M. H. | 1,697 |
| | 1,742 |
| Brinton, H. | 700 |
| Bristor, C. L. | 1,824 |
| Broadbent, G. A. | 1,306 |
| Brock, G. C. | 182 |
| Brocklebank, R. W. | 1,567 |
| Brolin, S. | 896 |
| Bronshten, V. A. | 1,954 |
| Broten, N. W. | 1,872 |
| Brothers, D. C. | 1,047 |
| | 1,153 |
| Broun, Zh. L. | 1,645 |
| Brouwer, D. | 362 |
| Brown, D. C. | 67 |
| Brown, D. E. | 1,721 |
| Brown, E. | 1,813 |
| Brown, H. | 25 |
| | 655 |
| Brown, J. L. | 178 |
| Brown, R. P. | 1,303 |
| Brown, W. E., Jr. | 1,757 |
| Brown, W. M. | 917 |
| Brownless, S. F. | 1,084 |
| Bruk, Yu. M. | 880 |
| Brustat, J. | 508 |
| Bruun, G. | 1,027 |
| Bryan, J. S. | 172 |
| | 808 |
| Buchar, E. | 308 |
| Buchar, J. | 970 |
| Buck, A. L. | 939 |
| Budd, W. E. | 1,937 |
| Buddenhagen, T. F. | 1,183 |
| Budine, P. W. | 261 |
| | 391 |
| | 392 |
| | 592 |
| Buettner, K. J. K. | 1,979 |
| | 2,020 |
| Burch, D. C. | 1,621 |
| Burckhardt, C. | 1,577 |
| Burdecki, F. | 542 |
| Burgess, R. G. | 1,316 |
| Burke, B. F. | 556 |
| Burke, J. A. | 1,862 |
| Burke, J. J. | 83 |
| Burnett, D. I. | 80 |
| Burns, E. A. | 1,981 |
| | 1,986 |
| Burrell, B. | 275 |
| Burton, C. J. | 229 |
| Butterwick, G. N. | 120 |
| | 1,320 |
| Bykov, R. E. | 882 |
| | 1,033 |
| Bystrov, N. F. | 589 |
| | 683 |
| | 685 |
| Cade, C. M. | 115 |
| Cahen, R. | 1,030 |
| Callahan, L. G. | 917 |
| Cameron, A. G. W. | 1,970 |
| Camichel, H. | 273 |
| | 276 |
| | 500 |
| | 599 |
| | 1,691 |
| | 1,958 |
| Campen, C. F. | 653 |
| Cannell, W. D. | 176 |
| Canty, B. R. | 1,828 |
| Capon, J. | 1,416 |
| Carbrey, R. L. | 1,442 |
| Carder, R. W. | 567 |
| | 688 |
| Cardoso Tavares, O. | 262 |
| Carman, P. D. | 25 |
| Carnt, P. S. | 738 |
| | 1,372 |
| | 1,523 |
| Carnuth, W. | 292 |
| Carr, T. D. | 545 |
| Carreon, D. | 1,120 |
| Case, B. | 162 |
| Cassagne, P. | 767 |
| | 770 |
| | 783 |
| | 787 |
| | 793 |
| | 1,228 |
| | 1,506 |
| | 1,591 |
| Castelli, E. | 1,204 |
| | 1,978 |
| Castelli, J. P. | 464 |
| Castleberry, J. | 1,019 |
| Cavazzuti, P. | 1,554 |
| Cave, T. R. | 233 |
| | 274 |
| Cayrel De Strobel, G. | 1,843 |
| Cazalas, A. | 1,097 |
| Cazeneuve, B. | 863 |
| Cervenka, A. J. | 708 |
| Chabłowski, J. | 1,337 |
| Chamberlain, J. W. | 556 |
| | 1,909 |
| Chandler, J. S. | 1,069 |
| Chang, K. K. N. | 962 |
| Chapman, C. R. | 549 |
| | 636 |
| | 1,957 |
| Chapman, S. | 222 |
| Chase, S. C. | 1,996 |
| | 2,025 |
| Chaste, R. | 767 |
| | 770 |
| | 783 |
| | 787 |
| Chatterton, N. E. | 545 |
| Chekalov, D. N. | 192 |
| Chekirda, A. T. | 1,681 |
| | 1,749 |
| | 1,952 |
| Cherry, C. | 940 |
| Cherry, E. M. | 1,139 |
| Chikhachev, B. M. | 1,640 |
| Childs, C. B. | 1,807 |
| Chistiakov, J. N. | 1,765 |
| | 1,768 |
| Chistiakov, V. F. | 449 |
| Choi, O. | 1,103 |
| | 1,319 |
| | 1,325 |
| Cholet, P. H. | 860 |
| Church, E. | 1 |
| Church, R. | 54 |
| Chuvaev, K. K. | 1,897 |
| Chwalow, M. L. K. | 1,118 |
| Ciuciura, A. | 1,167 |
| Clapp, R. G. | 738 |
| | 1,528 |
| Clark, E. | 240 |
| Clark, R. J. | 1,112 |
| Clarke, D. | 300 |
| | 1,983 |
| Clarke, D. B. | 1,999 |
| Clarke, F. J. J. | 1,826 |
| Clarke, H. | 914 |
| Claveloux, B. A. | 73 |
| Clay, B. R. | 1,289 |
| Claypool, H. W. | 901 |
| Clayton, R. H. | 1,290 |
| | 1,505 |
| | 1,509 |
| Clow, R. G. | 910 |
| Coates, G. P. | 102 |
| Coates, R. J. | 1,860 |
| Cocito, G. | 1,726 |
| Coenning, F. | 1,197 |
| Cohen, A. E. | 1,064 |
| Cohlan, B. F. | 615 |
| Colabrese, E. | 1,829 |
| Colas, M. | 770 |
| Coldewey, G. | 1,123 |
| Colledge, C. H. | 1,198 |
| Collins, C. A. | 789 |
| | 1,477 |
| Coltman, J. W. | 1,429 |
| Colwell, R. N. | 94 |
| Comeau, C. P. | 808 |
| Compte Porta, R. | 243 |
| Conley, J. M. | 1,760 |
| Conrath, B. J. | 159 |
| | 1,824 |
| | 2,009 |
| Cook, G. H. | 996 |
| | 1,012 |
| | 1,021 |
| | 1,105 |
| | 1,151 |
| Cook, J. J. | 1,885 |

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|---|---|
| Cook, J. S. | 961 |
| Cook, R. W. | 1,223 |
| | 1,256 |
| Cooley, H. J. | 76 |
| Cooper, B. F. C. | 1,797 |
| Copeland, J. | 1,893 |
| Corliss, C. H. | 387 |
| Corradetti, M. | 1,480 |
| Cortesi, S. | 1,735 |
| Costanza, J. L. | 906 |
| Cotton, R. V. | 1,508 |
| Coughlin, F., Jr. | 1,071 |
| Coulson, K. L. | 635 |
| Courtney-Pratt, J. S. | 559 |
| Coyne, G. V. | 2,017 |
| Cragg, T. A. | 593 |
| | 1,753 |
| Crawford, B. H. | 1,548 |
| Crawford, C. J. | 38 |
| Crews, R. W. | 1,230 |
| Crocco, L. | 2,004 |
| Croce, P. | 738 |
| Croome, A. | 597 |
| Cross, L. G. | 1,885 |
| Crouch, L. W. | 10 |
| Cruickshank, F. D. | 769 |
| Cruikshank, D. P. | 233 |
| | 295 |
| | 493 |
| | 727 |
| Csorba, I. P. | 884 |
| Cumming, C. | 1,808 |
| Cummins, H. Z. | 1,621 |
| Curie, C. | 863 |
| Curtis, B. R. | 1,718 |
| Dachs, J. | 251 |
| dall'Olmo, U. | 257 |
| Dana, E. K. | 1,714 |
| D'Atri, M. L. | 738 |
| Dauvillier, A. | 1,231 |
| Davidse, J. | 750 |
| | 752 |
| | 918 |
| | 1,057 |
| | 1,122 |
| | 1,242 |
| Davidson, R. A. | 993 |
| Davies, M. E. | 436 |
| | 490 |
| Davies, R. D. | 1,717 |
| Davies, R. W. | 556 |
| Davis, J. | 242 |
| Davis, J. F. | 1,922 |
| Davis, R. J. | 606 |
| Davne, L. | 895 |
| Dawson, L. H. | 1,790 |
| Day, B. E. | 1,312 |
| | 1,329 |
| Day, R. | 897 |
| | 910 |
| Dean, C. E. | 1,432 |
| Dearth, L. R. | 1,611 |
| DeBell, A. G. | 1,642 |
| Decker, R. W. | 971 |
| de France, H. | 738 |
| | 978 |
| de Freitas Mourão, R. R. | 262 |
| | 296 |
| | 390 |
| | 418 |
| | 494 |
| | 495 |
| de Fries, P. J. | 1,870 |
| de Haan, E. F. | 738 |
| Deitzel, K. | 738 |
| de Jager, C. | 284 |
| Delbord, Y. L. | 738 |
| | 919 |
| de Mottoni, G. | 287 |
| Demus, E. | 1,400 |
| DePalma, J. J. | 1,391 |
| Derham, J. | 1,965 |
| Deryugin, N. G. | 923 |
| | 1,504 |
| | 1,507 |
| | 1,572 |
| de Saussure, M. | 422 |
| Desvignes, F. | 909 |
| | 1,831 |
| Deutsch, S. | 904 |
| Devadas, P. | 729 |
| de Vaucouleurs, G. H. | 265 |
| | 358 |
| | 415 |
| | 497 |
| | 522 |
| | 543 |
| | 546 |
| | 547 |
| | 550 |
| | 553 |
| | 594 |
| | 1,660 |
| | 1,816 |
| | 1,817 |
| Devol, L. | 359 |
| | 373 |
| | 517 |
| Deverall, G. V. | 851 |
| de Vrijer, F. W. | 738 |
| | 1,521 |
| | 1,526 |
| DeWaard, R. | 1,840 |
| d'Hallwin, H. | 1,785 |
| Dickinson, R. M. | 1,879 |
| Diehl, M. H. | 1,136 |
| Dietz, W. F. | 1,470 |
| DiIanni, E. J. | 76 |
| Dillenburger, W. | 846 |
| | 951 |
| | 954 |
| Dillenburger, W. (Cont'd) | 991 |
| | 1,014 |
| | 1,287 |
| | 1,364 |
| | 1,472 |
| Dixon, F. A. | 1,459 |
| Djurle, E. | 121 |
| Dluzhnevskaya, O. B. | 412 |
| | 1,954 |
| Dobbins, R. A. | 2,004 |
| Dobrichovsky, Z. | 613 |
| Doderer, G. C. | 1,639 |
| Dodge, H. F. | 29 |
| Doin, J. | 741 |
| Doland, G. | 979 |
| Dollfus, A. | 500 |
| | 1,666 |
| | 1,877 |
| | 1,913 |
| Dolon, P. J. | 871 |
| | 878 |
| Dommanget, J. | 316 |
| | 317 |
| | 318 |
| | 319 |
| Donovan, P. F. | 1,138 |
| Dorman, M. I. | 1,451 |
| Doyle, F. J. | 199 |
| Doyle, R. J. | 908 |
| | 1,340 |
| Drake, S. | 479 |
| Drescher, F. | 1,463 |
| | 1,578 |
| Dresner, J. | 1,209 |
| Drobyshev, Yu. P. | 1,165 |
| Drofa, V. K. | 484 |
| Dubner, H. | 379 |
| | 1,026 |
| Dubois, J. | 1,633 |
| Duchesne, M. | 224 |
| | 369 |
| | 384 |
| | 527 |
| | 595 |
| Dudley, L. P. | 573 |
| Duflo, J. | 224 |
| Duggan, R. S., Jr. | 565 |
| Dumont, R. | 1,644 |
| Duncan, R. A. | 1,641 |
| Dunkelman, L. | 1,618 |
| Dunlop, D. | 1,901 |
| Dunn, G. L. | 132 |
| | 575 |
| DuPre, E. F. | 1,790 |
| Dupre, M. F. | 384 |
| Dutton, J. A. | 27 |
| Dvořak, M. | 970 |
| Eastman, F. J., Jr. | 233 |
| | 302 |
| | 663 |
| Eastwell, B. A. | 1,252 |
| Ebisawa, S. | 423 |
| Eckart, F. | 1,254 |
| Eden, J. A. | 131 |
| Edwards, D. J. | 1,186 |
| Edwards, H. D. | 178 |
| | 2,001 |
| Edwards, J. | 1,722 |
| Edwardson, S. M. | 1,467 |
| Eichwald, W. F. | 924 |
| Eimer, M. | 2,015 |
| Einhorn, H. D. | 1,533 |
| | 1,636 |
| Ellis, T. R. | 163 |
| Ellman, C. | 22 |
| Emberson, D. L. | 1,296 |
| Emmons, R. B. | 860 |
| Endacott, K. A. | 1,139 |
| Engel, K. H. | 233 |
| Enselme, L. | 1,092 |
| | 1,094 |
| | 1,096 |
| Epifanov, M. V. | 1,059 |
| Epstein, E. E. | 1,654 |
| Eremin, V. I. | 1,141 |
| Eshleman, V. R. | 556 |
| Evans, C. H. | 738 |
| Evans, D. C. | 1,993 |
| | 1,998 |
| Evans, G. R. | 1,865 |
| Evans, J. C. | 1,845 |
| Evans, J. V. | 1,696 |
| Evnevichchekan, O. V. | 1,141 |
| Eyer, J. A. | 1,730 |
| | 1,920 |
| Fagot, J. | 1,348 |
| Fahy, T. P. | 1,813 |
| Fairchild, S. M. | 153 |
| Falk-Pederson, K. | 1,449 |
| Fanchenko, S. D. | 1,034 |
| Farrand, W. B. | 1,037 |
| Fatechand, R. | 1,405 |
| Fatuzzo, E. | 1,293 |
| Fawcett, R. G. | 1,937 |
| Fedorets, V. A. | 1,677 |
| Fehrenbach, C. | 385 |
| Feininger, A. | 1,285 |
| | 1,495 |
| Fenn, L. A. | 815 |
| Ferioli, C. P. | 464 |
| | 1,978 |
| Fesenkov, V. G. | 1,751 |
| Field, D. E. | 1,618 |
| Fielder, G. | 297 |
| | 298 |
| | 330 |
| | 333 |
| | 590 |
| | 649 |

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|---|---|
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| | 690 |
| | 712 |
| | 716 |
| | 2,013 |
| Finch, D. M. | 1,901 |
| Fine, H. | 1,455 |
| Finlay, E. B. | 563 |
| Fiocco, G. | 1,971 |
| Fiorentini, A. | 738 |
| Firsoff, V. A. | 400 |
| | 498 |
| | 524 |
| | 723 |
| | 1,731 |
| | 1,752 |
| Fischer, W. A. | 50 |
| Fisher, E. P. L. | 1,195 |
| Fisher-Colbrie, E. | 1,149 |
| Fix, H. | 1,401 |
| Fleishman, B. S. | 1,215 |
| Florsch, M. G. | 1,810 |
| Flory, L. E. | 364 |
| | 366 |
| | 521 |
| | 742 |
| Focas, J. H. | 477 |
| | 628 |
| | 634 |
| | 1,671 |
| | 1,854 |
| Foerste, D. | 1,914 |
| Fomina, A. M. | 1,602 |
| Fontenit, R. | 1,030 |
| Forlini, J. B. | 654 |
| Fournol, J. M. | 1,094 |
| | 1,096 |
| Fowler, A. D. | 1,056 |
| Fox, W. E. | 627 |
| Francken, J. C. | 738 |
| | 1,527 |
| Frank, K. | 1,175 |
| Franks, J. | 1,330 |
| Fredendall, G. L. | 738 |
| | 920 |
| | 1,431 |
| | 1,511 |
| Fredrickson, W. R. | 1,720 |
| Freeman, D. G. | 1,489 |
| Freeman, K. G. | 1,042 |
| | 1,045 |
| | 1,253 |
| | 1,476 |
| Freilich, A. | 1,352 |
| Freitag, W. | 1,164 |
| French, H. | 398 |
| Frenzel, D. | 859 |
| | 927 |
| | 931 |
| | 981 |
| Fresa, A. | 1,754 |
| Fridkin, V. M. | 803 |
| | 1,009 |
| Friedman, H. | 367 |
| | 1,943 |
| Frihart, H. N. | 884 |
| Frisch, R. | 425 |
| Fröhlich, F. | 1,619 |
| Fry, G. A. | 1,441 |
| | 1,594 |
| Fryszman, A. | 1,053 |
| | 1,156 |
| | 1,158 |
| | 1,161 |
| | 1,162 |
| | 1,163 |
| Fujii, H. | 1,598 |
| Fujimura, Y. | 1,115 |
| Fujinami, S. | 303 |
| | 680 |
| Fulford-Jones, R. | 620 |
| Funch, O. | 1,027 |
| Funk, L. L. | 38 |
| Funk, P. M. F. | 1,613 |
| Furuta, K. | 680 |
| Fyler, G. W. | 869 |
| Gabor, D. | 816 |
| | 934 |
| | 990 |
| Gadźuk, B. | 968 |
| Gaedke, W. | 1,304 |
| Gagliardi, R. M. | 541 |
| Gagnon, G. E. | 1,037 |
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| | 558 |
| Gaj, M. | 63 |
| Galbraith, D. S. | 1,240 |
| Gallagher, J. | 562 |
| | 673 |
| Gallouet, L. | 595 |
| Gapcynski, J. P. | 658 |
| Garazha, V. I. | 684 |
| | 1,739 |
| | 1,764 |
| | 1,980 |
| Gardiner, R. A. | 186 |
| Gardner, A. L. | 898 |
| Gardner, F. M. | 1,082 |
| Gardner, I. C. | 1,362 |
| Gargini, E. J. | 735 |
| Garthwaite, A. | 1,039 |
| Gaskins, F. J. | 756 |
| Gates, D. M. | 246 |
| Gavrilov, I. V. | 715 |
| Geake, J. E. | 1,965 |
| Gear, A. E. | 677 |
| Gebel, R. K. H. | 223 |
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| | 984 |
| | 1,142 |
| | 1,305 |
| | 1,328 |
| | 1,617 |
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| Geddes, W. K. E. | 942 |
| Geduldig, D. | 1,260 |
| Gehrels, T. | 1,708 |
| | 1,814 |
| | 1,916 |
| | 1,988 |
| Geneslay, E. | 1,666 |
| Geneve, R. | 768 |
| | 783 |
| | 909 |
| Geoffrion, A. R. | 1,779 |
| Geppert, G. | 1,628 |
| | 1,946 |
| Gerber, W. | 784 |
| | 949 |
| Gernsback, H. | 534 |
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| Gethmann, R. B. | 1,326 |
| Gettys, R. F. | 156 |
| Geutler, O. | 1,586 |
| Ghosh, S. K. | 61 |
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| Giaimo, E. C. | 1,584 |
| Giarraputo, L. | 1,531 |
| Gibbs, J. | 1,159 |
| Gibson, J. E. | 1,866 |
| Gibson, W. G. | 868 |
| Gicca, F. A. | 1,510 |
| Gildebrandt, N. T. | 192 |
| Gill, G. | 1,541 |
| Gillette, W. | 1,258 |
| Gillham, E. J. | 1,841 |
| Gindilis, L. M. | 1,649 |
| Giordmaine, J. A. | 1,656 |
| Giovanelli, R. G. | 1,380 |
| Giraytys, J. | 1,927 |
| Givens, M. P. | 1,845 |
| Glagolevskii, J. V. | 1,668 |
| | 1,773 |
| Glaser, A. H. | 4 |
| Glaser, P. R. | 626 |
| Glasser, L. G. | 1,932 |
| Glassman, I. | 2,004 |
| Gleghorn, G. E. | 708 |
| Gleichauf, P. H. | 994 |
| Glenn, W. H. | 726 |
| Glicken, M. | 77 |
| Goehl, M. | 1,427 |
| Goetz, R. A. | 1,182 |
| Goetze, G. W. | 1,345 |
| Goldberg, A. A. | 1,457 |
| Goldberg, L. | 1,614 |
| Goldfarh, L. | 118 |
| Goldstein, J. S. | 1,712 |
| Goldzahl, L. | 224 |
| Gomer, G. I. | 780 |
| Gomolka, B. | 507 |
| Gonin, G. B. | 205 |
| González Solís, A. | 482 |
| Goodbody, A. M. | 738 |
| | 977 |
| Goodman, J. W. | 695 |
| Goranson, R. | 1,987 |
| Görlich, P. | 36 |
| | 37 |
| | 1,061 |
| | 1,946 |
| Görling, H. | 1,216 |
| Goron, I. E. | 1,165 |
| Gorynya, A. A. | 484 |
| | 489 |
| | 1,959 |
| Goss, W. C. | 1,148 |
| Gould, R. G. | 1,342 |
| Gouriet, G. G. | 1,098 |
| Goussot, L. | 1,404 |
| | 1,412 |
| Grabre, H. | 1,406 |
| Graff, K. | 1,951 |
| Graham, R. | 1,251 |
| Graham, R. E. | 738 |
| | 1,373 |
| | 1,392 |
| | 1,488 |
| Grainger, J. F. | 2,011 |
| Gramm, C. | 1,821 |
| Granath, J. A. | 85 |
| Grant, C. R. | 1,316 |
| Gray, G. W. | 364 |
| | 366 |
| Gray, S. | 1,103 |
| | 1,114 |
| | 1,203 |
| | 1,319 |
| | 1,325 |
| | 1,847 |
| Gray, S. M. | 1,707 |
| Graziano, E. E. | 604 |
| Green, M. | 1,724 |
| Greenhow, J. S. | 242 |
| Greiner, H. | 1,620 |
| Greybo, G. A. | 780 |
| Griffin, E. P. | 48 |
| Grimm, F. | 687 |
| Grimsdale, R. L. | 1,398 |
| Grosskopf, H. | 1,382 |
| | 1,486 |
| | 1,513 |
| Gruenewald, A. | 1,486 |

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| Guérin, P. | 551 |
| | 1,663 |
| | 1,950 |
| | 1,953 |
| | 1,956 |
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| Guinot, B. | 595 |
| Gula, A. | 1,355 |
| Gundert, E. | 903 |
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| Gunn, T. A. | 1,323 |
| Guntzel-Lingner, U. | 381 |
| Gurevich, S. B. | 882 |
| | 889 |
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| | 1,464 |
| | 1,469 |
| | 1,512 |
| Gurtin, M. E. | 17 |
| Haack, P. M. | 177 |
| Haage, D. H. | 1,686 |
| Haantjes, M. J. | 738 |
| Haas, W. H. | 469 |
| Habermann, W. | 1,028 |
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| Hackett, K. R. | 1,461 |
| Hacking, K. | 738 |
| | 1,190 |
| | 1,492 |
| | 1,524 |
| Hackman, R. J. | 566 |
| | 586 |
| Haffner, H. | 209 |
| Hahn, D. | 1,798 |
| Halberstam, M. | 187 |
| Haley, D. C. | 1,039 |
| Hall, F. F., Jr. | 1,595 |
| Hall, J. A. | 899 |
| | 1,265 |
| Hall, J. E. | 242 |
| Hallermeier, W. D. | 1,140 |
| Hallert, K. B. P. | 8 |
| | 41 |
| | 86 |
| | 125 |
| | 155 |
| | 167 |
| | 168 |
| | 169 |
| | 170 |
| | 171 |
| | 200 |
| Hallock, H. B. | 605 |
| Hallows, R. L. | 1,168 |
| Hambálek, V. | 258 |
| Hameen-Anttila, K. A. | 1,896 |
| Hamilton, C. E. | 759 |
| Hamilton, D. H., Jr. | 612 |
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| Hanson, A. G. | 230 |
| Hapke, B. W. | 1,973 |
| | 2,018 |
| | 2,019 |
| Haq, K. E. | 1,321 |
| Harley, T. J., Jr. | 147 |
| | 172 |
| Harper, M. H., Jr. | 149 |
| Harries, J. H. O. | 1,601 |
| Harris, A. | 1,113 |
| Harris, F. H. | 1,013 |
| Hart, G. G. | 222 |
| Hartmann, W. K. | 698 |
| | 699 |
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| Harty, W. E. | 1,194 |
| Harvell, J. F. | 161 |
| Hasell, P. G., Jr. | 1,721 |
| Hashimoto, K. | 1,597 |
| Hattore, A. | 1,955 |
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| Hayes, J. D. | 995 |
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| Haywood, W. J., Jr. | 90 |
| Heath, A. W. | 400 |
| | 704 |
| Heath, M. B. B. | 491 |
| Hecht, F. | 248 |
| | 490 |
| Heck, L. | 890 |
| Heddle, D. W. O. | 1,900 |
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| Heijne, L. | 738 |
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| Heil, H. | 1,103 |
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| Hein, H. | 1,452 |
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| Hell, W. H. | 162 |
| Hellman, B. | 896 |
| Helsdon, P. B. | 862 |
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| Hémeret, J.-L. | 388 |
| Hémez, B. | 328 |
| Hempel, H. P. | 164 |
| Hendee, C. F. | 1,883 |
| Hendry, E. D. | 1,067 |
| Henisch, H. K. | 1,576 |
| Henny, G. C. | 1,314 |
| Herold, T. | 1,325 |
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| Herring, A. K. | 433 |
| | 568 |
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| Hibbs, A. R. | 556 |
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| Hicks, G. T. | 1,135 |
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| Hoffman, H., Jr. | 18 |
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| Holmes, L. H. | 804 |
| Holý, B. | 969 |
| Hoover, H. H., Jr. | 612 |
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| Hopmann, J. | 331 |
| Howard, A. D. | 57 |
| Howard, J. A. | 162 |
| Howden, H. | 809 |
| Howorth, D. | 1,360 |
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| Hoxie, D. T. | 1,994 |
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| Hubert, L. F. | 65 |
| | 103 |
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| Hudson, M. J. | 1,316 |
| Hughes, J. | 529 |
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| Humphreys, C. J. | 1,719 |
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| Huruhata, M. | 1,799 |
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| Hurvich, L. M. | 1,609 |
| Hurwitt, S. | 1,222 |
| Husbands, C. W. | 514 |
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| Hutter, E. C. | 44 |
| Hyde, F. W. | 620 |
| Hynek, J. A. | 571 |
| Iglehart, J. D. | 1,056 |
| Ignatev, N. K. | 1,011 |
| Inatsu, M. | 1,212 |
| Ingrao, H. C. | 1,862 |
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| Intrater, J. | 1,222 |
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| Iriarte, B. | 1,693 |
| Ishutina, T. I. | 1,684 |
| Issacs, J. D. | 365 |
| Ives, G. M. | 798 |
| Jablonski, A., Jr. | 166 |
| Jackson, E. A. | 1,840 |
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| Jacobs, S. J. | 1,137 |
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| Jansen, A. G. | 283 |
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| Jareš, V. | 1,338 |
| Jaschek, C. O. R. | 457 |
| Jaschek, W. J. | 248 |
| Jaskolski, T. M. J. | 1,171 |
| Jastrow, R. | 415 |
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| Jedlička, M. | 1,050 |
| Jelley, J. V. | 1,797 |
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| Jesty, L. C. | 738 |
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| Jetten, G. | 1,274 |
| Jetter, A. | 1,206 |
| Johnson, D. S. | 38 |
| | 42 |
| Johnson, H. L. | 1,693 |
| | 1,987 |
| Johnson, J. | 1,902 |
| Johnson, O. S. | 143 |
| Johnson, S. W. | 1,534 |
| Johnston, J. | 1,997 |
| Jones, B. F. | 1,540 |
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| Julesz, B. | 1,410 |
| Jung, L. | 790 |
| Junkes, J. | 1,622 |
| Justice, J. W. H. | 1,251 |
| Kaashoek, J. | 1,535 |
| Kaláb, D. | 258 |
| Kalafut, J. | 1,292 |
| Kalashnikov, N. I. | 101 |
| Kalinenkov, N. D. | 2,010 |
| Kalinyak, A. A. | 1,880 |
| Kallman, H. | 478 |
| | 1,802 |
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| Kamionko, L. A. | 1,880 |
| Kamler, J. | 848 |
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| Kanzler, R. J. | 1,932 |
| Kapany, N. S. | 83 |
| Kaplan, L. D. | 556 |
| | 2,025 |
| Karara, H. M. | 124 |
| | 198 |
| Karimova, D. K. | 1,744 |
| Karlov, N. V. | 1,640 |
| | 1,709 |
| Karrer, S. | 1,740 |
| Kartashev, A. I. | 371 |
| Karwowski, W. A. | 1,282 |
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| Kaseman, P. W. | 1,005 |
| Kasten, D. F. | 1,408 |
| Kataev, S. I. | 1,473 |
| Katz, A. H. | 62 |
| | 460 |
| Kaufmann, A. | 1,176 |
| Kaus, P. E. | 1,000 |
| Kavanagh, B. | 49 |
| Kawase, T. | 1,414 |
| Kawashima, M. | 1,273 |
| Kay, N. D. | 926 |
| Keating, P. N. | 1,330 |
| Kelley, R. A. | 70 |
| Kellogg, W. W. | 556 |
| Kelly, E. J. | 1,624 |
| Kelly, R. L. | 1,625 |
| Kelsall, D. | 738 |
| Kelso, J. M. | 227 |
| Kemp, J. B. | 38 |
| Kemp, J. G. | 2,002 |
| Kennedy, R. | 1,107 |
| Kennedy, R. C. | 756 |
| | 1,078 |
| Kerl, R. R. | 164 |
| Keyes, R. J. | 1,109 |
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| Khabakov, A. V. | 581 |
| Khalfin, A. M. | 1,475 |
| Khanzhin, A. G. | 456 |
| Khazanov, V. S. | 1,602 |
| Khromoi, B. P. | 1,473 |
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| Kiang, T. | 649 |
| Kidd, P. C. | 1,263 |
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| Kidd, M. C. | 1,289 |
| Kielkiewicz, A. | 814 |
| Kiess, C. C. | 387 |
| | 443 |
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| Kiess, H. K. | 387 |
| | 1,695 |
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| Kilburn, T. | 1,398 |
| Kimme, E. G. | 1,487 |
| Kimura, E. | 1,202 |
| Kinard, J. C. | 1,923 |
| King, D. E. N. | 1,485 |
| King, R. W. | 1,189 |
| Kinoshita, K. | 1,101 |
| Kirby, R. S. | 157 |
| Kirillov, N. I. | 587 |
| Kirkpatrick, G. P. | 1,828 |
| Kirschner, U. | 734 |
| Kitamura, M. | 1,799 |
| Kitchin, H. D. | 1,445 |
| Kitsopoulos, S. C. | 1,468 |
| Kitsuregawa, T. | 915 |
| Klasens, H. A. | 738 |
| Klepešta, J. | 320 |
| | 337 |
| | 488 |
| Klopf, P. | 1,187 |
| Klotzbaugh, G. | 1,143 |
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| | 1,311 |
| Knapp, C. F. | 922 |
| | 926 |
| Knight, J. | 1,945 |
| Kobayashi, K. | 886 |
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| Kocher, G. | 1,537 |
| Koepsel, W. W. | 672 |
| Kogo, H. | 1,414 |
| Kohlmeyer, R. B. | 933 |
| Kokhan, Ye. K. | 339 |
| | 1,976 |
| Kolessov, A. K. | 309 |
| Koltsov, V. V. | 34 |
| Kompfner, R. | 961 |
| Kondo, T. | 915 |
| Kopal, Z. | 297 |
| | 307 |
| | 442 |
| | 447 |
| | 563 |
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| Koprovich, N. F. | 375 |
| Korner, M. | 1,779 |
| Kornhauser, M. | 646 |
| Korte, H. | 1,593 |
| Kosche, E. | 1,108 |
| Koslova, K. I. | 1,664 |
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| Kostiakova, E. B. | 1,744 |
| Kotlyar, L. M. | 1,711 |
| Koustarev, A. K. | 738 |
| Koval, I. K. | 266 |
| | 269 |
| | 271 |
| | 293 |
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| | 1,682 |
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| | 1,749 |
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| Kovit, B. | 66 |
| Kowalczyk, C. E. | 47 |
| Kowaliski, P. | 1,560 |
| Kozak, P. P. | 1,850 |
| Kozanowski, H. N. | 1,353 |
| Kozhevnikov, N. I. | 1,849 |
| Kozyrev, N. A. | 1,673 |
| Kramer, C. | 1,280 |
| Krasikov, V. I. | 192 |
| Krasovskii, V. I. | 1,906 |
| Kratochvil, F. | 1,244 |
| Krause, L. C. | 1,879 |
| Krauss, D. M. | 897 |
| Krebs, R. G. F. P. | 1,245 |
| Kretzmer, E. R. | 1,468 |
| Kreuzer, B. | 539 |
| Kroebel, W. | 1,385 |
| Krolak, L. J. | 785 |
| Kruse, J. R. | 1,041 |
| Kubota, K. | 886 |
| | 1,170 |
| Kuehne, J. E. | 1,324 |
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| Kuiper, G. P. | 236 |
| | 1,987 |
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| | 1,995 |
| Kuklin, G. V. | 456 |
| | 474 |
| Kulkarni, P. V. | 1,931 |
| Kuntze, R. | 1,269 |
| Kunze, C. | 963 |
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| Kupperian, J. E., Jr. | 708 |
| Kuprevich, N. F. | 686 |
| Kurchakov, A. V. | 631 |
| Kureya, M. | 1,610 |
| Kurtshakov, A. V. | 1,745 |
| Kutyreva, A. P. | 270 |
| Lacomme, P. | 738 |
| La Fond, C. D. | 561 |

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| | 369 |
| | 384 |
| Lambe, J. | 912 |
| Lambert, G. E. V. | 1,833 |
| Lance, T. M. C. | 1,066 |
| Land, E. H. | 1,542 |
| Land, W. H. | 1,489 |
| Landau, H. J. | 1,081 |
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| Lane, W. R. | 1,722 |
| Lang, W. | 1,537 |
| Langenbeck, U. | 334 |
| | 509 |
| Langford, M. J. | 107 |
| | 602 |
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| LaRocca, A. J. | 150 |
| Lasser, M. E. | 860 |
| Lau, E. | 1,725 |
| Laurence, C. H. | 1,544 |
| Law, H. B. | 895 |
| Lawrence, C. H. | 126 |
| Lawrence, L. G. | 1,261 |
| Lebedev-Karmanov, A. I. | 1,357 |
| Leeds, L. M. | 999 |
| Leereek, H. J. | 738 |
| Legler, E. | 757 |
| | 1,514 |
| Leistner, K. G. | 129 |
| Lempert, J. | 1,143 |
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| Lenham, A. P. | 255 |
| | 692 |
| Lenhert, D. H. | 672 |
| Leon Ch., B. | 1,815 |
| Leonardo, E. S. | 74 |
| Lequeux, J. | 1,530 |
| Le Resche, J. | 14 |
| Lesgaft, P. F. | 1,864 |
| Lester, H. L. | 1,149 |
| Levi, L. | 745 |
| | 1,390 |
| Levine, S. R. | 11 |
| Levine, S. W. | 15 |
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| Levy, M. | 106 |
| Levy, R. J. | 511 |
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| Lewin, G. | 510 |
| Lewis, J. D. | 998 |
| Lewis, N. W. | 937 |
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| Link, F. | 1,775 |
| Lipskii, Yu. N. | 335 |
| | 336 |
| | 437 |
| | 444 |
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| | 585 |
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| Lisk, K. G. | 988 |
| Litvinenko, V. | 781 |
| Ljubić, M. | 221 |
| Löbering, W. | 256 |
| Locke, R. V., Jr. | 612 |
| Lodén, K. | 505 |
| Loefgren, L. | 1,384 |
| Lohmann, A. | 738 |
| Long, J. F. | 1,186 |
| Loomis, A. A. | 713 |
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| | 482 |
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| | 662 |
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| Lubszynski, H. G. | 1,428 |
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| Lüdicke, E. | 1,377 |
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| Lyubarskii, K. A. | 215 |
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| Macek, O. | 805 |
| Mach, R. E. | 158 |
| MacLellan, D. C. | 612 |
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| Maillard, J. | 1,095 |
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| Makarova, E. A. | 1,849 |
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| Manring, E. R. | 511 |
| Mansfield, W. O. | 1,292 |
| Marchant, M. Q. | 439 |
| Mardsen, B. | 763 |
| Maréchal, A. | 738 |
| Marin, M. | 624 |
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| Markelova, A. A. | 580 |
| Markov, A. V. | 588 |
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| Martin, A. V. J. | 1,402 |
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| Martin, D. J. | 619 |
| Martin, F. F. | 1,199 |
| Martin, G. E. | 1,824 |
| Martin, H. J. | 1,164 |
| Martin, K. E. | 832 |
| | 845 |
| Martina, E. F. | 1,960 |
| Martinez Garcia, D. | 482 |
| Martone, M. | 1,277 |
| | 1,343 |
| Martynov, D. Ya. | 506 |
| | 1,652 |
| | 1,895 |
| Martz, E. P., Jr. | 718 |
| Maruyasu, T. | 51 |
| Masani, A. | 1,726 |
| Masek, F. W. | 189 |
| Mason, A. C. | 586 |
| Mason, J. F. | 648 |
| Matsui, M. | 423 |
| | 481 |
| Matthews, W. E. | 845 |
| | 1,144 |
| Matveyeva, M. A. | 192 |
| Matzkin, M. A. | 1,177 |
| | 1,233 |
| | 1,276 |
| Maurice, D. | 1,266 |
| Maurice, R. D. A. | 813 |
| | 1,076 |
| | 1,446 |
| Mayer, C. H. | 1,656 |
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| | 854 |
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| | 1,422 |
| McAllister, J. F. | 1,073 |
| McClelland, C. C. | 1,670 |
| McCullough, T. P. | 1,787 |
| McGee, J. D. | 621 |
| | 622 |
| McHail, R. R. | 1,229 |
| McIlwain, K. | 1,434 |
| McIntosh, P. S. | 675 |
| McIntosh, R. A. | 254 |
| McIntyre, D. | 1,639 |
| McKenzie, M. L. | 188 |
| McLanahan, J. D. | 1,138 |
| McLeod, J. H. | 357 |
| McLucas, J. M. | 56 |
| McMann, R. H., Jr. | 144 |
| McMath, R. R. | 1,614 |
| McNeil, G. T. | 108 |
| McQuate, P. L. | 157 |
| Medd, W. J. | 1,872 |
| Medhurst, R. G. | 1,080 |
| Medina Vela, G. | 24 |
| Meeus, J. | 696 |
| Megill, L. R. | 1,827 |
| Meier, H. K. | 133 |
| Meinel, A. B. | 532 |
| | 1,801 |
| | 1,994 |
| Meisenholder, G. W. | 1,936 |
| Melchior, G. | 1,396 |
| | 1,437 |
| | 1,515 |
| Menne, D. F. | 174 |

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| | 528 |
| | 594 |
| | 623 |
| | 1,862 |
| | 1,868 |
| | 1,968 |
| Merchant, D. C. | 183 |
| Mergler, H. W. | 906 |
| Merlen, M. M. | 90 |
| Merritt, E. L. | 5 |
| | 201 |
| Mesner, M. H. | 361 |
| Metzger, A. E. | 1,972 |
| Metzler, A. R. | 1,235 |
| Metzner, J. J. | 1,481 |
| Meyer, G. L. | 35 |
| Meyer, M. P. | 127 |
| Meyer, S. | 1,352 |
| | 1,590 |
| Mezger, P. G. | 1,672 |
| Michael, W. | 1,157 |
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| Michard, R. | 1,651 |
| Michelis, C. H. | 1,951 |
| Miczaika, G. R. | 540 |
| Middlehurst, B. | 1,987 |
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| Middleton, R. G. | 1,600 |
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| Mietelski, J. | 310 |
| Mii, N. | 1,115 |
| Mikhailov, A. A. | 585 |
| Milkhiker, M. A. | 475 |
| Miller, A. J. | 1,531 |
| Miller, B. | 625 |
| | 661 |
| Miller, C. I. | 16 |
| Miller, D. C. | 1,883 |
| Miller, J. | 1,673 |
| Miller, J. S. | 233 |
| Miller, L. D. | 1,004 |
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| Miller, T. | 541 |
| Milne, G. G. | 1,648 |
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| Mitchell, R. I. | 1,987 |
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| | 557 |
| Miyashiro, S. | 1,129 |
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| Moffitt, F. | 19 |
| Mohler, O. C. | 1,614 |
| Mollberg, B. M. | 79 |
| Möller, R. | 779 |
| Monro, C. R. | 758 |
| Monteath, G. D. | 813 |
| | 913 |
| Montgomery, P. O'B. | 857 |
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| Moore, P. | 345 |
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| | 702 |
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| | 730 |
| Moore,T. H. | 44 |
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| Moreton, G. | 623 |
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| Morgan, J. M. | 364 |
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| Morrow, W. E., Jr. | 612 |
| Morton, G. A. | 733 |
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| Moses, H. | 98 |
| Mothersole, P. L. | 1,144 |
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| Murray, B. C. | 655 |
| Murray, P. | 1,325 |
| Myhre, D. W. | 127 |
| Myskowski, E. P. | 18 |
| Nagel, M. R. | 116 |
| Nagy, F. | 660 |
| Nakahara, S. | 915 |
| Nakai, Y. | 557 |
| Nanbo, S. | 886 |
| Narayana, J. V. | 280 |
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| Niklas, W. F. | 871 |
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| Ninomiya, T. | 1,125 |
| Nishio, M. | 51 |
| Nissen, R. J. | 1,439 |
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| Nolan, W. J. | 1,638 |
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| Nymoen, H. | 822 |
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| Oberndorfer, H. | 485 |
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| Ochs, S. A. | 985 |
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| Ockert, D. L. | 71 |
| Odagawa, K. | 1,387 |
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| Onwumechilli, A. | 1,758 |
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| Orthuber, R. K. | 1,595 |
| Ortusi, J. | 737 |
| Orville, H. D. | 142 |
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| Otterman, J. | 1,413 |
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| Overton, B. R. | 837 |
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| Paris, D. P. | 129 |
| Park, F. R. | 533 |
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| Parker, W. E. | 1,309 |
| Partington, G. E. | 1,068 |

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| Paulson, R. | 1,720 |
| Pawley, E. I. E. | 800 |
| Pazderák, J. | 1,550 |
| Peake, W. H. | 1,803 |
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| Pemberton, M. E. | 1,015 |
| Perevertun, M. P. | 272 |
| Perevezentsev, L. T. | 865 |
| Perevodchikov, V. I. | 1,010 |
| Perilhou, J. | 738 |
| Perkins, G. S. | 924 |
| Persano, F. | 1,824 |
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| Phillips, P. H. | 1,483 |
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| Piepereit, P. | 212 |
| Pierce, A. K. | 1,614 |
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| Pike, W. S. | 364 |
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| Pilz, F. | 834 |
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| Pinney, J. E. | 1,928 |
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| Pither, C. M. | 701 |
| Plattner, C. M. | 617 |
| Pohn, H. | 655 |
| Polonnikov, R. I. | 705 |
| Polonskii, A. B. | 1,370 |
| Polonsky, J. | 764 |
| | 1,396 |
| Polozhenzeva, T. A. | 1,766 |
| Popham, R. W. | 151 |
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| Pospergelis, M. M. | 1,895 |
| Post, G. A. | 1,811 |
| Potter, H. I. | 324 |
| Potter, Kh. I. | 589 |
| Potter, J. B. | 1,085 |
| Potter, J. R. | 1,408 |
| Pouleau, J. | 738 |
| | 976 |
| Poulsen, A. S. | 378 |
| Pourciau, L. L. | 1,070 |
| Powers, K. H. | 738 |
| | 920 |
| Powers, W. T. | 571 |
| | 707 |
| Prchlik, J. | 968 |
| | 970 |
| Preston, J. S. | 1,833 |
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| | 2,003 |
| Preuss, L. E. | 1,065 |
| Příhoda, P. | 259 |
| Protitch, M. B. | 313 |
| Pryor, W. T. | 38 |
| Ptáček, M. | 1,051 |
| | 1,550 |
| Pullan, B. R. | 1,344 |
| Pulling, B. S. | 382 |
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| Purvis, M. B. | 851 |
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| Quinlan, E. J. | 870 |
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| Quinn, S. F. | 738 |
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| | 305 |
| | 656 |
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| Rainger, P. | 935 |
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| Ramberg, E. G. | 742 |
| | 847 |
| | 895 |
| | 1,150 |
| | 1,288 |
| Ramsey, R. C. | 1,917 |
| Rasch, R. | 1,501 |
| Rasool, S. I. | 711 |
| Ray, R. G. | 50 |
| | 87 |
| Redden, R. C. | 910 |
| Rediker, R. H. | 1,316 |
| Redington, R. W. | 831 |
| | 982 |
| Reed, H. | 1,569 |
| Reinhold, J. G. | 1,003 |
| Reininger, W. G. | 185 |
| Reker, H. | 1,423 |
| Rennert, J. | 1,802 |
| Rennilson, J. J. | 570 |
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| Reukauf, D. C. | 85 |
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| Reynolds, M. L. | 164 |
| Rhodes, R. N. | 1,470 |
| Rice, P. | 1,230 |
| Richards, T. J. | 322 |
| Richards, T. W. | 175 |
| Richardson, E. H. | 1,782 |
| Richardson, R. S. | 217 |
| | 264 |
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| Ridgeway, D. V. | 738 |
| Rieck, J. | 1,565 |
| Riehs, A. | 402 |
| Riggs, R. N. | 1,938 |
| Ring, J. | 2,011 |
| Rinner, K. | 88 |
| Riordon, J. S. | 1,048 |
| Risvanov, N. G. | 448 |
| Ritchie, D. J. | 89 |
| Ritschl, R. | 1,615 |
| Rizkin, A. A. | 1,179 |
| Roach, T. E. | 1,827 |
| Roberts, A. | 12 |
| Robertson, D. A. | 1,074 |
| Robey, D. H. | 277 |
| Robinson, G. A. | 1,188 |
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| Robinson, J. H. | 400 |
| Robson, W. M. | 204 |
| Rodman, J. P. | 1,949 |
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| Rodman, R. B. | 585 |
| Roehr, K. M. | 1,489 |
| Rogers, E. E. | 162 |
| Rogers, T. F. | 612 |
| Roizen, J. | 747 |
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| Roman, N. G. | 354 |
| Romano, G. | 1,727 |
| Rome, M. | 1,259 |
| Ronchi, V. | 738 |
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| Root, W. L. | 1,624 |
| Roques, P. E. | 264 |
| Rorive, A. L. | 738 |
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| Rosberry, F. W. | 100 |
| Rösch, J. | 1,632 |
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| Rose, A. | 738 |
| Roselek, E. | 1,274 |
| Rosen, B. H. | 993 |
| Rosenau, M. D., Jr. | 109 |
| | 181 |
| | 207 |
| Rosenberg, P. | 6 |
| Rosenbruch, K. J. | 1,517 |
| Rosenfeld, A. | 180 |
| | 194 |
| | 380 |
| Rosenfield, G. H. | 28 |
| | 97 |
| | 160 |
| | 188 |
| Rosenhauer, K. | 1,517 |
| Rosenzweig, S. | 222 |
| Rosin, S. | 512 |
| Rosner, I. S. | 1,354 |
| Ross, L. E., Jr. | 15 |
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| Roth, S. H. | 1,421 |
| Rouman, M. A. | 738 |
| Rout, E. R. | 1,266 |
| Rowley, C. D. | 1,194 |
| Rozhkovskii, D. A. | 1,848 |
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| | 410 |
| Rükl, A. | 320 |
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| Ruston, J. | 1,008 |
| Rutherford, N. S. | 1,356 |
| Rutkovskaya, M. J. | 396 |
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| Ryftin, Ya. A. | 967 |
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| Saari, J. M. | 1,856 |
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| Sabinin, Yu. A. | 1,846 |
| Sachtleben, L. T. | 1,498 |
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| | 406 |
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| Sadashige, K. | 985 |
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| Sadowsky, M. | 1,180 |
| Sagan, C. | 556 |
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| Sager, R. L. | 889 |
| Saheki, T. | 416 |
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| Salaman, R. G. | 1,461 |
| Salisbury, J. | 461 |
| Saloney, R. | 1,939 |
| Salpeter, E. W. | 1,622 |
| Sanamian, V. A. | 1,653 |
| Sandefur, K. L. | 377 |
| Sanders, C. L. | 1,794 |
| Sanders, R. G. | 154 |
| Sandford, B. P. | 525 |
| Sandner, W. | 294 |
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| Sarson, A. E. | 960 |
| Sato, M. | 738 |
| Sato, T. | 554 |
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| Sauvanet, M. | 793 |
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| Schade, O. H. | 1,389 |
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| Schadt, C. | 1,625 |
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| Schimpf, L. G. | 1,025 |
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| | 188 |
| Schmidt, I. | 417 |
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| Shoemaker, E. M. | 462 |
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| Siegel, K. M. | 1,884 |
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| Simmons, C. D. | 1,436 |
| Simmons, F. S. | 1,642 |
| Simon, J. | 1,566 |
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| | AD-245,973 | 1,118 |
| | AD-246,199 | 1,132 |
| | AD-246,910 | 1,710 |
| | AD-247,440 | 434 |
| | AD-248,511 | 1,135 |
| | AD-248,907 | 1,789 |
| | AD-249,415 | 373 |
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| | AD-251,664 | 594 |
| | AD-252,312 | 1,673 |
| | AD-252,827 | 1,140 |
| | AD-253,162 | 84 |
| | AD-253,165 | 81 |
| | AD-253,186 | 546 |
| | AD-253,406 | 1,807 |
| | AD-253,534 | 1,119 |
| | AD-254,238 | 1,173 |
| | AD-254,403 | 1,887 |
| | AD-254,977 | 76 |
| | AD-255,238 | 1,134 |
| | AD-255,991 | 1,186 |
| | AD-257,332 | 1,624 |
| | AD-257,400 | 1,808 |
| | AD-257,754 | 544 |
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| | AD-258,902 | 1,816 |
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| | AD-259,482 | 1,814 |
| | AD-259,864 | 1,184 |
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| | AD-260,051 | 1,194 |
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| | AD-260,219 | 517 |
| | AD-260,263 | 1,821 |
| | AD-260,500 | 1,809 |
| | AD-261,134 | 1,812 |
| | AD-261,165 | 522 |
| | AD-261,165 | 1,817 |
| | AD-261,170 | 528 |
| | AD-261,445 | 1,210 |
| | AD-261,529 | 550 |
| | AD-261,947 | 1,813 |
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| | AD-263,416 | 1,714 |
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| | AD-264,160 | 1,892 |
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| | AD-264,352 | 569 |
| | AD-265,049 | 572 |
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| | AD-265,402 | 518 |
| | AD-265,432 | 1,241 |
| | AD-265,898 | 892 |
| | AD-266,458 | 1,829 |
| | AD-266,481 | 552 |
| | AD-266,919 | 118 |
| | AD-267,299 | 1,836 |
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| | AD-267,862 | 1,879 |
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| | AD-267,981 | 438 |
| | AD-268,126 | 442 |
| | AD-268,135 | 1,839 |
| | AD-268,523 | 1,238 |
| | AD-269,134 | 1,143 |
| | AD-269,878 | 576 |
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| | AD-270,776 | 1,959 |
| | AD-271,415 | 1,240 |
| | AD-272,119 | 1,857 |
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| | AD-272,575 | 1,762 |
| | AD-273,310 | 1,962 |
| | AD-273,614 | 132 |
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| | AD-273,821 | 1,893 |
| | AD-274,663 | 628 |
| | AD-275,135 | 577 |
| | AD-275,255 | 1,963 |
| | AD-275,764 | 1,278 |
| | AD-276,417 | 538 |
| | AD-276,647 | 1,905 |
| | AD-276,746 | 147 |
| | AD-276,879 | 660 |
| | AD-276,897 | 1,290 |
| | AD-276,964 | 1,292 |
| | AD-277,020 | 1,489 |
| | AD-277,125 | 654 |
| | AD-277,697 | 1,960 |
| | AD-277,724 | 563 |
| | AD-277,746 | 1,498 |
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| | AD-281,846 | 1,291 |
| | AD-282,460 | 157 |
| | AD-282,473 | 608 |
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| | AD-282,643 | 1,294 |
| | AD-283,055 | 635 |
| | AD-283,248 | 114 |
| | AD-283,355 | 1,949 |
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| | AD-284,767 | 665 |
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| | AD-285,258 | 164 |
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| | AD-285,342 | 293 |
| | AD-285,344 | 637 |
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| | AD-288,158 | 613 |
| | AD-288,263 | 1,974 |
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| | AD-288,873 | 1,323 |
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| | AD-292,741 | 651 |
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