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EUROPEAN SCIENTIFIC NOTES

Edited by J.E. Rasmussen and Victoria S. Hewitson

30 September 1966 Vol. 20 No. 9

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C. T. FROSCHER
Captain, U.S. Navy
Commanding Officer

AND NOT A DROP TO DRINK!

It would seem that one of the best ways of obtaining an index of the interest which ESN holds for our 7000 or so readers is to insert a request for obscure information. This fact came to light recently when one of our liaison scientists, Prof. S.Y. Tyree, included such a passing request for information in an article he wrote on Water Chemistry in Italy (ESN 20-6, 15 June 1966).

In presenting the chemical analysis of a commercially bottled mineral water in Italy, he included "Radioactivity ... 3.01 Mache units." This was followed by the parenthetic statement, "The scientific staff of ONRL will be grateful to anyone who can tell us what a Mache is." While the editors of ESN guarantee that this statement was not slipped in as a subtle technique for sampling reader response, they were at the same time delighted with the results which the statement elicited.

No attempt will be made to quote each of the letters received in response to Tyree's query. We were deeply impressed by the fact that at least two of our readers, having come across the Mache unit of measurement in the past, devoted considerable time and effort to running down forty- to fifty-year old publications in the archives of university and city libraries. Moreover, one was gracious enough to translate a portion of an early and somewhat obscure reference which was published in German. We were also very pleased to learn that each of our correspondents, while quoting from a number of different sources, sent us essentially the same if not identical definitions of the Mache unit. The definition, forwarded to us by the following correspondents: Prof. T.D. Brock, Dept. of Microbiology, Indiana Univ.; Dr. D.F. Gasbarri and E-8 D. Richard, U.S. Army Chemical Corps, Information and Liaison Office - Europe; Dr. P. Morrison, Dept. of Physics, Massachusetts Institute of Technology; Dr. E. Segrè, Dept. of Physics, Univ. of California, Berkeley; and Dr. P.F. Winternitz, Dept. of Chemical Engineering, New York Univ., is as follows: (Heinrich Mache, Austrian physicist) M.E. A unit of radioactive emanation. The quantity of emanation which produces a saturation current of one-thousandth of an electro-static unit. 1 curie = 2.8×10^{9} mache; 1 mache = 3.64×10^{-10} curie/liter = 3.64 eman. For those with an interest in pursuing the matter, the following references may be consulted:

Lehrbuch der praktischen Physik by Fr. Kohlrausch, Verlag Teuliner, Leipsig, 1913.

Zeitschrift für Balneologie, 6, 1, 1913.

Handbuch der Radiologie, ed. by Marx, pp 425-426, 1920.

Review of Modern Physics, 3, p 432, 1931.

Die Thermen von Baden, Eine Balneologische Monographie, by Munzel and Ulrich, Baden, Switzerland, 1947.

Hackh's Chemical Dictionary, third ed., ed. by Julius Grant, 1953.

In addition to contributing to one of ONR London's primary missions -- that of scientific information exchange -- Tyree's article also had a rather unexpected and quite positive pay-off. One of our correspondents indicates that the article on Water Chemistry in Italy has had a direct impact on his attitude toward and response to the newly-introduced New York City income tax. Thus, this correspondent reports having become reconciled to paying the first installment of this tax after visiting the annex of the New York City public library in search of a 1913 reference which would answer Tyree's inquiry. In reading this letter carefully, it would appear two factors contributed to our correspondent's change of heart. Even though the relative importance of these two factors may be reversed: (1) He was, in fact, able to find the journal for which he was searching, and (2) the volume was handed to him by a "smiling, pretty girl."

For the record it should be noted that another of our correspondents does not agree with Tyree's highly subjective ranking of Italian waters in terms of gustatory appeal. In this connection the following information is quoted directly:

> "Finally, I cannot at all agree with Mr. Tyree. Italian tap waters can be delicious, and they are far pleasanter than Cambridge dilute chlorine solution, but surely they cannot compare with the tart, tingling sparkle of San Pelligrino (the brand of water which is responsible for this correspondence). And the physical chemistry and dynamics of the bubbles add more pleasure yet. Evviva San Pelligrino è Professore Bonino!"

AEROSPACE SCIENCES

The Exhibition of the British Aerospace Industry

One might consider the keynotes of this year's display of the British Aerospace Industry as international cooperation and export. The joint British-French supersonic transport Concorde is, of course, the primary example of cooperation; while the importance of the BAC 1-11 as the largest dollar earner laid emphasis on the export potential of the industry.

If one saw only the flying display, these factors would be quite evident. From the export standpoint, the potential of the short-haul, light transport was exemplified by such aircraft as the Short "Skyvan" (shortly off to Australia) and the Britten-Norman Islander. The latter was also an example of the elusive incentive that is thought lacking in this country by the press. The announcer noted that the workers at the factory had postponed their vacation in order that both the prototype and the first production model be at the display. Another outstanding example of an aircraft with export potential was the Hawker-Siddeley "125" 6-passenger executive transport. The flying capability of this aircraft was proven in a convincing way.

The joint-cooperative aspect of the display often showed the cooperation between countries other than Britain as in the Brequet "Atlantic" joint German-French reconnaissance aircraft, and the "Transall" C.160 passenger/freighter that is built by a consortium of continental aircraft engineers. One should add that these and other cooperative aircraft in the display were all powered by British engines - a further aspect of the export potential of the industry.

To the casual observer, the most remarkable performer in the flying display was the Hawker-Siddeley P.1127 V/STOL close-support reconnaissance aircraft. After showing its short takeoff capability and maneuverability at high subsonic speeds, the aircraft performed the transition from forward to vertical (and then to sideways and reverse) flight. The "Kestral" version of the aircraft was also displayed.

One was again reminded of the Concorde with the flyover of the BAC 221 delta-wing jet aircraft. This is currently fitted with the "ogee" wing of the Concorde design and is undergoing tests at the Royal Aircraft establishment at Bedford.

In the display pavilion, the structure of the Aerospace Industry was revealed in the floor plan. The booths of manufacturers of auxiliary equipment were arranged in a symmetrical pattern so as to enclose the central display of the major air frame companies - British Aircraft Corp. and Hawker-Siddeley. Also adjacent were the two major engine manufacturers - Bristol Siddeley and Rolls-Royce. Westland, Short Bros., Handley-Page, Scottish Aviation and Beagle were given a prominent position near the entrance.

The central display of BAC was the Concorde - a large transparent plastic model about 20 ft in length. It was left for the Queen to see the full-size Concorde fuselage when she visited the Filton, Bristol, works during the display after opening the Severn Bridge.

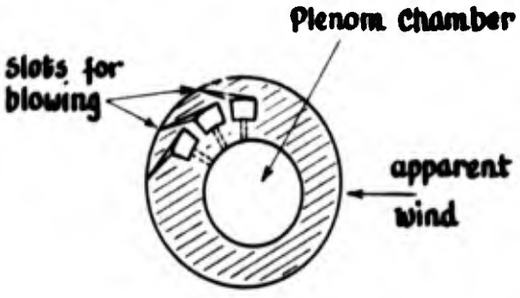
Bristol-Siddeley had a full-size model of the "Olympus" which will power the Concorde. There was also a very elaborate visual demonstration on a screen of the various configurations of the inlet and outlet to the engine during the many phases of flight. Among many other engines on display was a full-size model of the "Pegasus" ducted-fan turbo-jet that powers the P.1127. This was very helpful in attempting to understand how the P.1127 is maneuvered.

The Rolls-Royce display was of comparable interest. Most of the engines currently in use were on display, including a number of lift-jets in use here and abroad. Of particular importance to the casual observer was the demonstration model of the gas turbine in which the blades were of fiber-reinforced plastic. There was also an interesting display of air-cooled turbine blades from many of the current Rolls-Royce models.

The Ministry of Aviation had several very interesting displays. One that was attracting considerable attention was a rigid lifting rotor. This had the appearance of a helicopter which had a 12-ft section of about a 3-in diameter pipe in place of its aerofoil-shaped rotor. It was suggested by means of models and in print that this type of rotor might enable current jet aircraft to acquire VTOL characteristics. (This takes on some significance after one reads the article by Basil Arkell in the recent "Times" Survey of British Aviation entitled "High-Speed Helicopters."

In this article he challenges the industry to reassemble those engineers who worked on the abandoned "Rotodyne" project and in turn challenged Lockheed which is currently developing a high-speed helicopter.)

Lift is produced by blowing air tangentially on the upper surface of the rotor from span-wise slots (see Figure). The rotation of the rotor is accomplished by air flowing through inclined vanes at the rotor tips. A jet-powered vehicle acting as a test bed for the rotor was also on display. Apparently this is used to augment wind tunnel tests. This work is being undertaken at the National Gas Turbine Establishment.



Cross-Section of Rigid Rotor

The Royal Aircraft Establishment, Farnborough, had a display of "Carbon Fiber Reinforcement of Structural Plastics." By embedding fibers of graphite about 6 μ in diameter in a plastic, one is able to develop a Young's modulus of 60 X 10^6 psi. A display of tip-loaded cantilevers showed that the flexural rigidity of a beam of reinforced plastic was greater than that of a comparable beam of aluminum.

The Royal Aircraft Establishment, Bedford, exhibited the results of their design and evaluation of the Concorde air intake. Graphs were available showing (1) the effect of changes in the shape of the wall which divides the two ducts (in a given nacelle) on pressure recovery and amplitude of oscillatory pressures, (2) the relative insensitivity of both inboard and outboard ducts to throttling, in turn, of its neighbor, and (3) the effect of immersing the intake into the wing boundary layer.

Suffice it to say that these were but a few of the many interesting exhibits, and represent only the highlights for a particular viewer. (H.E. Williams)

MATERIALS SCIENCES

Fuel Cell Development at ASEA

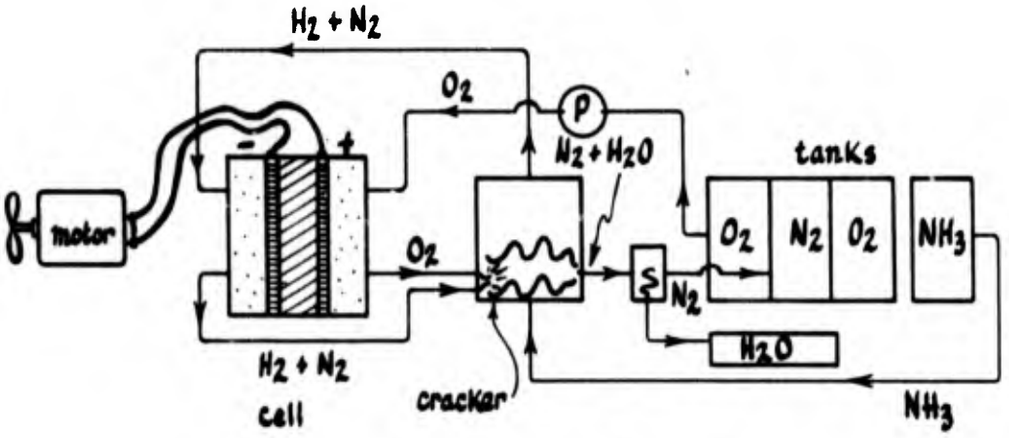
Allmanna Svenska Electrinska Actiabolaget (ASEA) of Sweden - the "General Electric" of Scandinavia - is capitalized at about $75 million with 34,000 employees. Organized in 1883, ASEA is now the largest manufacturer of heavy electrical equipment in northern Europe. It consists of mechanical, electrical, and chemical divisions. The company has main manufacturing plants in Vasteras, Ludvika, and Halsingborg, and smaller plants in other Swedish towns and in Australia, Brazil, France, Mexico, Norway, South Africa, and West Germany. The organization is considered progressive for a heavy industry. It has in the past established itself as a world leader in several new fields of electrical conversion and transmission by developing unique capabilities brought about by exploiting its rather large research investment for a European firm.

The ASEA Central Research Laboratory located in Vasteras near the group's main headquarters employs 400 engineers and scientists. Fuel cell research is conducted through the laboratory's Physics and Chemistry Division, although Dr. Olle Lindstrom, who acts as the fuel cell project leader, is also the Director of the entire Central Laboratory. Research on fuel cells started at ASEA in 1960 and now represents the largest fuel cell effort in Europe: 70 full-time employees (including 20 in thermal engineering, 15 in electrode development, 15 in manufacturing, and 10 in component testing).

The principal fuel cell effort at ASEA is exerted toward developing, manufacturing, assembling, and testing components for the 200-kW prototype power plant. Research on high temperature electrodes and electrode thermodynamics is being conducted by several individual researchers at a lower level of effort.

200-kW Power Plant - The system: ASEA Central Laboratory is constructing the largest fuel cell power plant ever built -- a 200 kW unit -- larger by a factor of ten than any known competitor. Liquid ammonia and liquid oxygen are the reactants for the prototype. The ammonia is cracked into its gaseous components, hydrogen and nitrogen, prior to reaching the cell. The nitrogen is later used as a pressurizing agent. Water is removed while

processing the electrodyte. The schematic diagram indicates the flow of reactants.



Schematic ASEA Fuel Cell Power Plant

The Cell - The cells employ dual-porosity nickel electrodes and a 35%-KOH electrolyte, operating at about 70 psi and 80°C. The electrodes are 200 mm in diameter with current density expected to be about 170 mA/cm^2 at 700 mV. This gives an output of over 35W per cell. Cells will be built into submodules of about 1 kW each, submodules then built into larger modules each of 25 kW, and eight of these modules compose the 200 kW plant. The electrolyte is circulated and reconditioned. The anodic catalyst is nickel-boride; the cathodic catalyst, silver. There is a cutoff in the current density at about 170 mA/cm^2 at which an increase in surface area does not bring about a further increase in current density. This is due to mass transfer problems on the surface of the electrodes. The chosen current density constitues an operational compromise, as cell characteristics of 280 mA/cm^2 at -0.66V have been reached in the research laboratory. Current leakage within a cell is about 0.5 mA/cm^2.

The Cracker - Liquid ammonia is pumped through a cracker in which it is broken down into hydrogen and nitrogen gas at an elevated temperature. The reaction starts at 600°C and operates best at 800°C with hot spots as high as 900°C. 600°C is the minimum cracking temperature for NH_3. For a reasonable yield 800°C is chosen as the operating temperature. At this temperature, only 0.012% NH_3 is left uncracked. The output mixture is then passed through the anode plenum in which most of the hydrogen is removed to flow through the cell. The diluted mixture is returned to the cracker. There the residual hydrogen is burned with oxygen surplus from the cathodic plenum. Of the hydrogen formed, about 20% is used for fuel heating and cracking and about 80% is utilized for producing electrity. To start the cracker, pure ammonia is burned. A catalyst to inhibit the formation of nitrogen oxides is present. The initial start-up requires three hours. The ammonia cracker is a modified standard model made for the chemical industry by Mahlert, Stuttgart.

ASEA personnel claim a bulk purchase price for NH_3 at 6-7¢/kg to be attainable. They further claim that the present utilization rate for ammonia is 0.35-0.40 kg of NH_3/kWh in their system.

Assembly and Test - Electrodes are pressed, sintered under cracked-ammonia atmosphere, tested, sealed in a plastic frame which contains passages for gases and electrolytes, and given a final tightness test. The processes are proprietary. The production rate is several hundred cells per day. The rejection rate, as in many powder metallurgical processes, is reasonably high.

After assembly and checkout, an

extensive test period of several months is planned. It is anticipated that tests will be completed sometime during 1967.

Several published articles on fuel cell development by Dr. Lindstrom of ASEA have appeared, i.e., (a) "Fuel Cells," ASEA Journal, 37 (1964): 1, pp 3-8; (b) "Fuel Cells," FOA Orienterar Om, 5 (April 1966) pp 24-29 (original in Swedish, English translation available ONRL). (B.I.Edelson and B. Bartocha)

Fuel Cell Research at Siemens

The research laboratory of Siemens-Schuckert Werke A.G. near Erlangen, Germany, would certainly place a Southern-Californian at his ease. With its alternate and separate low and high-rise, glass, steel and concrete structures surrounding grassy parks and landscaped pools in an appropriate rural atmosphere, an architectural entity is created sufficient to fool a visitor. One half expects to see the "US-101" route signs nearby.

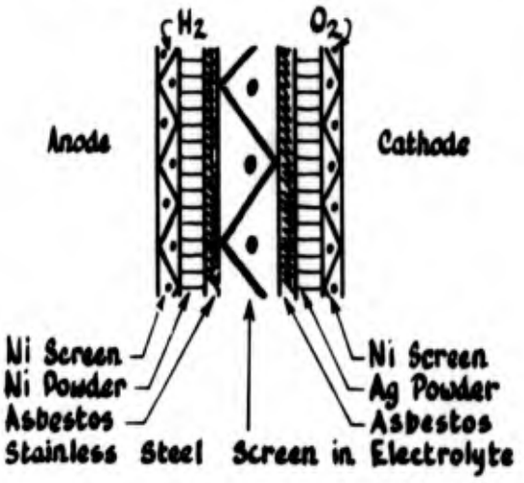
The laboratory is modern in every respect, and its research policy appears to have a reasonable mixture of unfettered research and applied development. Its fuel cell research program runs this gamut. Dr.Ferdinand von Sturm, heads the Fuel Cell Division, which appears to number over a dozen full-time researchers. The division operates with the Chemistry Department under Herr Evencheck.

Fuel cell development work at Siemens has been entirely a company-sponsored effort. Von Sturm started the research about four years ago. They have done basic research on fuel cell chemistry, materials and thermodynamics, and have developed some fuel cell components. They have subjected a number of components to long life-time tests.

Siemens' effort has been concentrated on low-temperature (less than 100°C) and medium-temperature (up to 250°C) systems, using both porous and non-porous electrodes. Several new and interesting electrodes and cells have been developed and tested:

(a) Raney nickel and carbonyl nickel electrodes of the DSK type. These have been made 3 to 4 mm thick, with some successful electrodes 1 mm thick. Great difficulty has been encountered with homogeneity in the thinner electrodes.

(b) Gestutze (supported) electrodes. These represent what is believed to be a unique development. The electrodes consist of a thin mechanically unstable porous sheet supported by metal screens. The sheets are unsintered powder, nickel on the anode side, silver on the cathode side. Asbestos sheets provide porosity and support between the powder and the circulated alkaline electrolyte. (Fiberglass replaces asbestos in acid electrolyte systems.) Electrodes have been made of areas 10, 30, and 2500 cm^2. These cells operated at about 5 atm, 50° to 60°C, obtaining about 30-50 mA/cm^2. One 500-watt battery, using the medium size cells, was built and used to power a small boat for demonstration purposes. The largest size cell has been under test for over a year. It has attained a current density of as high as 200 mA/cm^2, but normally maintains about 50 mA/cm^2. (This is about 100-watts constant output per cell.)



Gestützte Electroden

(c) Palladium foil electrodes in both sheet and tube form. These non-porous electrodes pass hydrogen by diffusion rather than by seepage. Using either hydrogen or methanol at 275°C, they have obtained current densities of several hundred mA/cm^2. The foil can be manufactured 0.15 mm thick, and an attempt is being made to produce it 0.05 mm thick. Some trouble has been encountered in embrittlement and cracking by formation of a palladium hydride.

(d) For small cells (less than 1 kW) Siemens has developed some power storage devices which contain an alcohol fuel dissolved in an alkaline electrolyte. Atmospheric air is the oxidant. These cells are reliable

over many years. Some four-year old cells can be recharged and reused.

Siemens has only recently given thought to applications of very large fuel cell systems. They are prepared to build a plant of 100 kW or so, and have, in fact, written proposals for US and foreign contractors for several such plants. No awards, though.

Studies and preliminary designs have been prepared for even larger plants. In such plants they would employ liquid hydrogen and liquid oxygen as reactants with their gestützte electrodes. They might consider using sulphur-free diesel oil, gasoline, or methanol if the customer preferred. Siemens prefers the cryogenic liquid reactants for simplicity's and efficiency's sake. They also brought out the interesting point that reformers require the handling of gaseous hydrogen at high temperatures in many small tubes and this may be more dangerous than handling cryogenic liquids. They added also that reformers cannot handle power surges very well.

An excellent review of the Siemens work is available: F.v. Sturm: "Electrodes in Fuel Cells," Siemens Review, March 1966, pp 118-124. (B.I.Edelson)

The International Union of Crystallography Meetings, Moscow, July 1966

The International Union of Crystallography was founded twenty years ago to re-establish the lines of communication among the world's crystallographers following World War II. Among its founders were Sir Lawrence Bragg, Max Von Laue and Paul Ewald: the name "Acta Crystallographica" was suggested by the Russians for its journal. Beginning in the US in 1948, its triennial General Assembly, International Congress and Symposium has been held in Sweden, France, Canada, United Kingdom, Italy and this year in Russia at the invitation of the Academy of Sciences of the USSR; the 1969 meetings are rumored to be scheduled for Stony Brook, Long Island. In addition, topical conferences, such as the one celebrating the 50th Anniversary of X-ray Diffraction held in Munich in 1962, have been sponsored wholly or in part by the IUC.

Of all the fields of science, one of the ones which needs no justification, explanation or apology for having its most important meeting in Moscow is that of crystallography, crystal physics, and crystal chemistry. Indeed, many of the works and articles of Zhdanov, Belov, Shubnikov, Vainshtein, Pinsker, and Chernov on crystal physics, symmetry groups, electron diffraction, and crystal growth have been translated into English and are considered to be authoritative accounts in their areas. Not only is the quality of the Russian work recognized as being high, but the size of the effort and number of people involved in the many institutes is staggering.

The Russian contribution was a major factor in the more than 50% increase in the number of pages of abstracts from 204 at the 1963 Rome meeting to 321 at this one, and swamped the normal monotonic increase in scientific activity and participation in international meetings. Fifteen hundred of the delegates -- one-half of the total -- were from institutes within the USSR. In addition, the Deutsche Demokratische Republik (East German) contingent of 115 was only exceeded in size by that from the UK (200) and the USA (175), and was almost twice the number from the West German Bundesrepublic and West Berlin (listed separately). There were substantial numbers of scientists from Czechoslovakia (65), Hungary (55), Poland (30), as well as France and Italy; in all, there were 3,000 active delegates from 34 countries.

The inaugural session on Tuesday, 12 July, was held in the 6000-seat auditorium of the beautiful modern, air-conditioned Kremlin Palace of Congresses, where "Swan Lake" was presented by the Bolshoi Ballet Company for all participants that evening and where the Congress banquet was held toward the end of the meeting. All scientific sessions were conducted in the enormous Moscow State University Main Building and the nearby Physics Building. The more than 950 papers were divided into 21 divisions - 17 during the five days designated as the "Congress of Crystallography" and four during the two days immediately following, set aside as the "Symposium on Crystal Growth." A listing of these divisions will emphasize that in many European countries, and especially in Russia, crystallography includes what we would call crystal and solid state physics, crystal chemistry and parts of related fields such as geology, mineralogy, metallurgy and ceramics: theory of structure analysis (28); theory of diffraction of X-rays, neutrons and electrons (48); symmetry in

its relation to crystalline structure (17); dynamics of crystalline structure, force-field theory (17); structure of inorganic compounds, including minerals (112); structure of metals and alloys (57); magnetic structures (33); structure of organic compounds (108); structure of coordination compounds (71); structure of proteins (44); types of breakdown of ideal structure of crystals, dislocations (78); structure and properties of crystals in the field of phase transitions (68); apparatus and techniques for crystallography (49); computing (12); partly ordered structures (46); thermal motion of atoms and molecules (19); miscellaneous topics (24); external and internal morphology and mechanism of crystal growth in their relation to crystallization conditions (30); the effect of impurities on crystal growth, adsorption, impurity capture, connection between crystal and impurity structures (30); epitaxy, structural and crystal-chemical correspondence of growing surfaces, auto-epitaxio overgrowth (films) (37); miscellaneous topics (34). The divisions were arbitrary and there was considerable overlap; many of the papers could have equally well been in more than one division or category. Thus, the numbers following each topic which refer to the number of papers in each division only give a rough idea of the relative amount of effort in each of these areas reported at the meeting.

A 50-minute invited general lecture proceded each of the five Congress morning sessions. The first of these was called The Congress Discourse and was on "Antisymmetry" by A.V.Shubnikov (Inst. of Crystallography, Academy of Sciences of the USSR, Moscow). The others were "Electron-deficient Valences in Crystal Structures" by W.N.Lipscomb (Harvard University), "Problems in Organic Crystal Physics" by A.I. Kitajgorodskij (Inst. of Elementoorganic Compounds, Academy of Sciences of the USSR), "New Ideas on Isomorphous Replacements" by N.V.Belov (Inst. of Crystallography, Academy of Sciences of the USSR), and "Investigations of Biological Systems by X-ray Diffraction and Electron Microscopy" by H.E.Huxley (Medical Research Council, Laboratory of Molecular Biology, Hills Road, Cambridge, England). An additional general lecture on "Anomalous Dispersion as a Tool in Structure Determination" was delivered by G.N.Ramachandran (Centre of Advanced Study in Biophysics and Crystallography, University of Madras, India).

All of these lectures were presented in the Assembly Hall of the Moscow State University and were simultaneously translated into the official languages of the Congress: English, French, German, Russian. The eight or nine short (15 minute) contributions in each of the nine half-day sessions of the Congress were not simultaneously translated; authors were requested to have legends and captions on slides in Russian and one of the Congress languages and to prepare slides of the explanatory text (which were projected by a second projector) in Russian if the paper was to be read in English, French, or German; the Russian authors were instructed to prepare accompanying text slides in English. This worked out satisfactorily in most cases though there were some annoying exceptions. Interpreters were present at each session and in general were very helpful during the discussions.

This meeting suffered as all large meetings do from the necessity of having simultaneous sessions... on most days there were as many as 13 sets of papers being presented at once! Since session chairmen did not always adhere strictly to the published time schedule, it was almost impossible to hear papers in more than one session. In this particular case, the very conditions contributing to this discouraging situation also provided the more than compensating factor, viz., the unique occasion to meet and discuss work with investigators most of whom one would have had a vanishingly small chance of meeting anywhere else, and the opportunity to visit laboratories and see facilities and research in progress. Thus, I feel that this meeting, in spite of its obvious limitations, was a success, and suspect the experience of many visitors will parallel my own described briefly below.

The sessions of Division 12 on Phase Transitions included papers on the theory of phase transitions; martensitic transformations; defects and lattice distortions during transformations; ferroelectric, piezoelectric, and antiferromagnetic transformations; order-disorder transformations, kinetics of precipitation; radiation damage and other influences on transformations; and the many techniques of studying transformations. The sessions which included predominantly Russian papers were very well attended by the Russians.

Many of the papers were by women, and half of the audience in these sessions were women who participated actively in the discussions; M.I. Zakharova (Moscow State University Physics Department) chaired one of the transformation sessions, for example. I found the discussions out in the corridors and at lunch with L.A. Shuvalov (Inst. of Crystallography, Moscow), K.Aleksandrov (Dept. of Physics, Siberian Dept. Aca. of Sci., Krasnjarsk), A.Khandras (Inst. of Metal Physics, Kiev) and A. Roitburd and V.J. Izotov (Inst. of Metal Physics, Moscow) on the relationship between martensitic transformations and ferroelectricity, transformations in Cu-Al-Ni alloys, the theory of martensitic transformations, and electron microscopic evidence of partially twinned martensite, professionally and personally more stimulating and rewarding than the discussions in the sessions where I was chairman, author or participant.

The opportunity to see laboratories and work in progress was a very important phase of the Moscow meeting, and some Congress participants did make such visits in response to invitations from Russian colleagues. In addition, excursions to physics, X-ray, crystallogenesis, semiconductor, ferro electric, and plasticity laboratories at the Kiev Institute of Physics of the Ukranian SSR Academy of Science and at the Plekhanov Mining Inst., the Leningrad State University, the Inst. of Semiconductors and the Ioffe Inst. of Physical Engineering in Leningrad were arranged by Intourist before and after the Congress. During the Congress arrangements could be made for visits to any of the 40 laboratories in nine of the numerous institutes in Moscow, including 14 laboratories in the famous USSR Academy of Science Institute of Crystallography which is so well known for its research in X-ray and electron structure analysis of minerals and proteins, studies of ferrites and dielectrics, work on mechanical properties of single crystals and dislocations, and its extensive program in crystal growth and synthesis.

On the Monday preceding the opening of the Congress, I had been invited by Academician Kurdjumov to visit his institute, and I spent a most profitable and enjoyable time with him and his co-workers discussing martensitic transformations and other research areas. Kurdjumov, who is still very active, presides over the Institute of Metal Physics of Moscow which includes among its staff of 200, 50 with PhD's, five of professorial status and others working toward the "Candidate" qualification, as well as technicians. While this Institute is an order of magnitude smaller than the three other constituent institutes of the Central Scientific Research Institute of Ferrous Metallurgy in Moscow, its activities are much more oriented toward fundamental speculative research than its sister institutes, The Institute of Steels & Ferrous Alloys, The Institute of Precision (Special) Alloys, and the Institute of New Technical Processes for Metals and Alloys. Here, as well as at the Department of Physics laboratories at the Moscow State University which I visited on Saturday on a group tour, I was impressed with the high quality of some of the transmission electron micrographs obtained with the Russian 100-kV instrument which showed, for example, dislocation interactions in metal and non-metallic systems and partially twinned martensite plates. Among the standard (Russian) X-ray apparati was a Japanese Lang camera; many kinds of crystal growing equipment for the production of ferroelectric crystals, etc., could be seen. Again, a substantial fraction of the scientists (not just technicians) in the laboratories were women.

The exhibit of crystallographic apparati, other research equipment, and synthetic crystals was held in the Sun Pavillion of the Central Stadium Luzhniki across the Moscow River from the University; exhibitions of books and photographs of crystals were displayed during the conference period. Frequent bus service to the University and Stadium from the several large Intourist Hotels in which the participants were comfortably housed was provided by the local Organizing Committee, which also drew up an extensive excursion program to the many attractions of Moscow and environs, as well as a Ladies Program. American delegates had an additional opportunity to meet Soviet scientists socially at a reception given by US Ambassador Kohler and his wife at their residence. I hope that we can make the 1969 meeting as stimulating and interesting an experience for our foreign guests as this one was in spite of its large size, and that we can provide the opportunity for our younger scientists to participate in such international meetings as the British do -- a substantial number of the UK delegates in

Moscow were young, enthusiastic men and women who were close to completing their doctoral research or who had just received their PhD's.
(D.S. Lieberman)

Metal Physics at Battersea College of Technology

The group involved in "metal physics" at Battersea is perhaps misnamed. Although a part of the Physics Dept., it is clearly developing as a "materials research center." The nucleus of a polymer section has been started, and this group is concerned primarily with the mechanical behavior of polymers. Dr. J.G. Rider (Senior Lecturer) worked last year with Dr. A. Keller at the University of Bristol, and is now continuing his studies on deformation of polyethylene at Battersea. Dr. T. Hinton (Senior Research Fellow) is now involved in a research program with Keller, after which he will join Rider.

Dr. A. Crocker (Reader) has been calculating the energies of small dislocation loops. His results indicate considerable sensitivity to the orientation and shape of the loop. He is, of course, continuing his work on the application of matrix theory to phase transformations. Recently he has developed a procedure for predicting twinning elements. The basic physical argument consists of calculating the shear associated with all possible twinning reactions, the only requisite being that the new unit cell be one that was possible in the original structure; but there are not necessarily any mirror relationships involved.

In connection with these theoretical studies, some quite interesting experimental work was done with Hg. One of the predicted twinning systems for this material was found to be present and predominant, and indeed this was a Type-II twin. This is the first time that such a twin (with an irrational twin plane) has been found to be the predominant mode. Although Crocker had predicted this possibility, it is not the mode with the smallest shear. Such a twinning system presents a number of problems. First, what is the nature of the interface with an irrational plane? Second, the dislocation reactions for glide on this plane must be unusual as they obviously cannot involve dislocations on the slip plane. Crocker is thinking about both of these problems. Serious problems for dislocation theory are not only caused by this twinning mode but also by the atomic shuffles involved in some crystals. (In fact, there have been no observations in any crystals of any of the proposed dislocation configurations for producing a twin. Is it possible that this is a mode of deformation without these defects -- a nasty bit of heresy, some of you readers will say, I imagine!)

Crocker and co-workers have also found that the predominant slip in Hg occurs on the close-packed plane -- not on [100] as previously reported, but in the second most close-packed direction $[1\bar{1}0]$. Near the melting point there is also some wavy slip involving the close-packed direction [110]. In a recent analysis of stacking faults in Hg (Phys. Stat. Sol. 10, 141 (1965)), it was shown that there was a large reduction in the line energy when partials form from dislocations with $[1\bar{1}0]$ Burger's vectors, but the partials for the [110] dislocation are almost perpendicular. As a result their interaction is quite small and cross-slip likely. This explains the waviness with the [110] slip direction and the straight slip with the $[1\bar{1}0]$ slip direction.

The question remained as to why the second most close-packed direction is the slip direction, and why the unusual Type-II twinning system occured. Calculations of the shear moduli in various directions have just been completed. By use of a criterion of either fixed stress for twinning or a fixed strain, it turns out that this constant is lowest for the observed twinning and slip systems!

Under Rider, theoretical calculations have begun on the resistivity due to dislocations. Departing from previous models, which have considered either the long-range stress field only or a core of "bad" material, they are calculating the effect due to the displacement of planes on either side of the dislocation. Bicrystals involving simple twist and tilt boundaries are being prepared, and the resistivity tensor will be measured. The new model suggests, for example, that conduction along the plane containing an edge dislocation will not be affected.

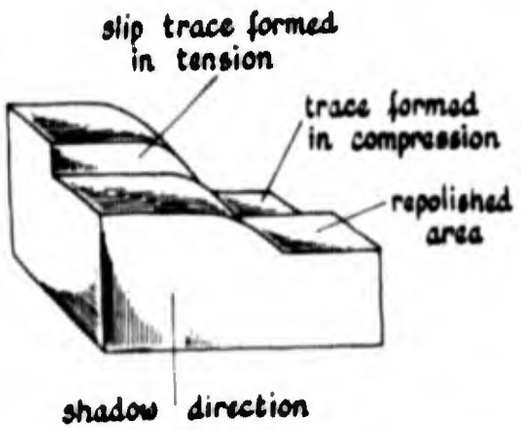
Dr. Keith Puttick (Reader) has been working on his unusual discovery of kinking of Cd in tension. The two kink walls consist of cells and arrays of dislocations of opposite sign.

Unusual regions have been discovered within the kink, misoriented by as much as 90°.

Other work in the group includes studies of lattice thermal conductivities, magnetoresistivity, Type II superconductors, cyclotron resonance, magneto-optic effects, and thermodynamics of solid-rare gases.

Under Dr. P. Charsley, some interesting studies have been made of the deformation of Cu-Al alloys. Previous work by Koppenaal and Koppenaal and Fine (Trans. Met. Soc. AIME, 1963, 227, p. 257; ibid, 1961, 221, p. 1178) indicated that all the strain in a single crystal did not seem to be accounted for by the displacements of the slip traces that were observable optically. Charsley's group, using replication techniques, have found that the additional strain is on slip planes in the region behind the Lüder's band, and not ahead of it. Further, the strain increases in this region as the band moves beyond it. They have also obtained striking evidence that during reverse loading, most of the initial strain is on the same slip planes (in reverse shear) until the stress exceeds that applied in tension. Above this load, nearby planes become active. The technique used is illustrated in the figure below. After tensile deformation, and replication, one region is repolished, deformed in compression, and replicated again. By shadowing the two replicas in the same direction, the traces formed in tension will be, say, light, and those formed in compression will be dark. By comparing how these regions join, the active traces can be pinpointed.

Comparison of the two replicas gives information on the amount of reverse shear as well.



(J.B. Cohen)

Materials Science at General Electric Co., Ltd., Hirst Research Centre

Although there is no connection whatsoever between this company and its namesake in the US, the interests of the two firms are quite similar. (In fact, the lawyers of the two firms are getting to know each other quite well in a trademark action now under way!) The Hirst Centre, at Wembley, Middlesex, consists of a large central laboratory and several smaller laboratories "owned" and controlled by certain producing divisions. In this way, each division retains its own research group, and yet, through being in the vicinity of a large research complex, derives all benefits from exchanges, equipment, and so on.

The total staff is about 1000, of whom 400 are professionals. This is about one-third the level obtained in the early 1950's, but the reduction has really only elimated most of the pilot plant operations that were in full swing then. Groups within the laboratory are encouraged to seek outside support from the government and from other companies as well.

Dr. D.S. Evans has been studying ways of making tungsten or its alloys by powder metallurgy techniques. It has been found that small additions of palladium sharply increase the sintering rate, at temperatures well below those at which any liquid phase would be present. On alloying with about 10% Cr, and as soon as the composition of Pd exceeds about 0.03%, a Pd-rich phase appears and oxidation resistance is markedly improved. Life is 1000 hours at 1200°C, or 50 hours at 1400°C! The exact role of the Pd in sintering, or of its second phase in preventing oxidation, is not at all clear yet. It is felt that both coat the W powder particles, but no evidence for this has been obtained.

Mr. D.R. Evans has been obtaining high purity refractory metals (<1 ppm O_2) with electron-beam melting and zone refining techniques. He has also been comparing coatings of W and Mo on Ti, using electrodeposition from carbonyls, and spraying techniques. He finds that the electrodeposits are far more satisfactory as they are less brittle, contain less oxide inclusion, and give better coverage around corners than the sprayed coatings.

Dr. N.S. Corney has been examining the reaction of graphite with CO_2 for the Atomic Energy Establishment. Tracer techniques have been used to examine

the amount of oxygen exchanged between the gas and the surface of a fine powder. At the moment, there seem to be some indications that impurities in the graphite are a major factor.

Dr. C.D.A. Elvin has made some interesting findings on W-Re alloys, with the field emission microscope. On evaporating layers, certain groups of atoms seem to require a higher field than the rest of the layer and stay behind on the tip. The number of atoms in these groups increases with Re content, suggesting that these groups are locally ordered regions, or clusters. However, he has not yet been able to find anything specific about the nature of the neighbors of these Re atoms.

Dr. T.B. Copestake's group is concerned primarily with the growth of garnet and ruby crystals and the sintering of ceramic powders. The flame fusion process is generally employed for crystal growing, but there is some experimental work going on pulling crystals from a melt, and precipitating from supersaturated (lead) salt solutions. The last process has produced large crystals, but they are not very perfect and often contain large glassy inclusions.

In trying to obtain highly dense ceramics, Copestake's group is concerned with the reasons behind discontinuous grain growth. (The grain boundaries move so quickly that they leave pores behind rather than absorbing them.) The facets on such grains have suggested to others that there may be a thin liquid layer at the boundaries, but so far they have not been able to detect it. Inclusions may hold up the grains, as in steel, but when discontinuous growth starts, the impurity concentration may build up to produce a liquid layer and hence the facets. Interest is also high on the application of the latest theories of sintering, especially as they apply to the later stages in which grain growth is occurring; the theories to date do not include this.

They are much aware of Dr.D.Lewis' work at Battersea College (ESN 20-8), who has detected very high lattice strains -- what we have normally thought to be brittle ceramics. The stored energy per particle is comparable to the surface energy. Some of his X-ray studies have been duplicated in the X-ray group at GEC, and now this group is interested in determining whether the strain is in the bulk or just in the surface layers. If the latter is true, it would explain the observation of increased interdiffusion with decreasing particle size. They are planning to examine this by X-ray line broadening, using long and short wavelengths to vary the depth of penetration of the beam. Experiments will start soon on the effect of this stored energy on sintering. (Lewis had found that with Al_2O_3, sintering took place at temperatures about 200°C lower than on sintering without prior grinding.) There is also some interest in colloidal ceramics.

The interaction with the diffractions group is largely the result of the general interest of Mr. H.P.Rooksby. There is a long tradition of diffraction and crystallography in the UK, and they still seem to be blossoming here. Since he joined GEC in 1924, Rooksby has been one of the pioneers in their industrial applications. His "chemical services" group provides routine powder diffraction, fluorescent and spectroscopic analysis. In addition, a number of research projects are undertaken for the other laboratories, or independently. He has helped train a number of well-known figures in diffraction in this country, such as B.T.M. Willis.

For a number of years E.H. Kellett and Rooksby have been studying graphitization using X-ray line positions, breadths, and intensities under contract to AERE. Their work has been published in the literature, so I will only briefly summarize their findings. Surprisingly, the expansion along the c-axis <u>is independent</u> of the state of graphitization (even though the basal plane spacing varies with perfection) except at perhaps near 4.2°K. Measurements in this vicinity are just beginning to be made with a new cryostat. The minimum in the coefficient of expansion in the "a" direction has been confirmed and more accurately measured. The rms amplitude of vibration along the c-axis increases with temperature (more slowly for more imperfect graphite) and the "free space" - the spacing of based planes minus twice the rms vibrational amplitude - <u>decreases</u> with increasing temperature. Because of the weak interplanar bonding, this fact helps to explain the increase in strength and elastic modulii with increasing temperature

Bromination reduces the crystallinity, but no compounds could be detected: Slight heating eliminates the

bromine, and the structure can be returned to its original state. Unfortunately, the effect of bromine saturates; therefore, it probably cannot be used to simulate the effects of radiation in a reactor, except qualitatively.

C.A. Wallace and B.J. Isherwood have developed a particular competence in X-ray diffraction topography. A new Lang camera with many additional motions (such as for film placement and translation) is being built. Some interesting applications of the technique have been made. For example, in one topograph, the location of each of the several polymorphs of SiC in a polycrystalline deposit was obtained from the images of a reflection from each polymorph. Using the spacing between two doubly-diffracted beams involving the 133 or 313, and the 222 reflections, they have determined the lattice parameter of Si with a precision of $\pm$ 3 x 10^{-5} Å. (The value differs from that of other investigations by 1 x 10^{-4} Å.) (J.B. Cohen)

MECHANICS

Some Activities of the Cement and Concrete Association

The Cement and Concrete Association in Great Britain is a non-profit body, financed by a number of cement manufacturers through a levy. It offers to users of cement and concrete a free service of technical information and impartial advice. Further activities are research, technical education, the promotion of better and more economical concreting practice, the study of new uses of concrete, and the publication of both popular and scientific booklets and reports. The Association does not engage in the manufacture or sale of cement.

Two aspects of work promoted by the Association are represented by the Concrete Structures and Technology Group of the Civil Engineering Department of Imperial College, London, and the Research and Development Division of the Research Station at Slough, Bucks.

In about 1946, the Association established the Chair of Concrete Structures and Technology which is presently held by Professor A.L.L.Baker. A one-year program leading to a Diploma of Imperial College (D.I.C.) was established to train prospective engineers. As the D.I.C. is not awarded by the University of London, the entrance standards are set by the College. As a result, it is possible for one with more professional than academic qualifications to be admitted. About 35 students per year enter.

The first term of the program includes basic courses in analyses, plates and shells, intermediate structures and concrete technology. In the beginning of the second term, the students elect a major and a miror course which are continued the third term. Using the major course as a basis, the student is expected to write a dissertation which is either a review paper or a completely worked-out problem. Some examples of dissertations presented in May 1966 are (1) Earthquake effects in structures, P.J.Taylor; (2) Membrane stresses in hyperboloidal shells of revolution for cooling towers, T.J. Tipler; and (3) Methods of arrangement and tabulation to facilitate computation of the solution of linear equations for shallow cylindrical shells, S.C. Chong. An important aspect of the program is the Design Project. This is started at the beginning of the Second term, and a prize is awarded for the best design at the end of the year.

Though not properly considered an activity of the Association, one might mention the research activity underway by members of the College staff and graduate students in Baker's group. One of the staff, Dr. J. Munro, is active in the field of reinforced concrete shells. Some of his past work has been reported at the World Conference on Shell Structures in San Francisco in 1962 ("Some Tests on Thin Shells of Reinforced Mortar") and at the Symposium on Shell Research in Delft in 1961 ("An Investigation of the Strain Distribution in Reinforced Concrete Shallow Thin Shells of Negative Gaussian Curvature"). One of his present students, K.C. Michael, is currently investigating the properties of various assumed forms for the deflection in a Rayleigh-Ritz formulation of the solution for the bending of a shallow, hyperbolic paraboloidal shell with a rectilinear planform. Some assumed forms can be chosen which satisfy certain realistic boundary conditions for the deflection but which lead to rather unrealistic behavior of the transverse shear stress. Michael is attempting to find a set of functions which will yield realistic boundary values for both deflections and stresses.

Some recent theses have included

a very large amount of computational work performed on the "Altas" at the Institute of Computer Sciences which is located near University College. For example, P.J. Moss considered the non-linear behavior of a circular cylindrical shell under axial load in "The Stability of Thin Shells" (1965); and S.Z. Uzsoy worked up a finite difference scheme for linear, elastic shells in "Certain Aspects of the Stress Analysis of Shells of Revolution" (1966). This latter thesis includes an analysis of the Ferrybridge Cooling Tower as an example. Such computer work is likely to increase as IBM made a gift of a Model 7090 to the College two years ago; this has since been augumented by the installation of a Ferranti High Speed Data Link with the "Altas."

In Baker's Structures Laboratory there are several tests in progress. The effect of oscillating transverse forces on reinforced beams is being observed; and rectangular slabs in biaxial stress are being loaded to test various failure theories. There is a prestressed concrete nuclear pressure vessel that was heated and loaded to failure. Some of the experimental work is industry funded.

The Research Station is set on a country estate in a strictly rural atmosphere a few miles from the center of Slough. The original house is still in use, but has been augmented by the addition of a number of attractive two-story concrete buildings. The original gardens are still maintained, and are available for the recreation of the staff. There is also a demonstration area where precast panels are displayed as well as prize-winning park benches and trash bins.

In addition to the printing facility for the many publications and technical reports of the Association, the principal activities at Slough can be considered to be either in education or research and development.

At present, about 40 students are housed on the estate at any given time, taking a variety of courses of a week's duration. These courses range from those designed for manual laborers to those for architects. A nearby estate has recently been acquired. With this additional space, it is expected that the number of students that can be housed will be increased. It will also allow several courses to be conducted concurrently, and it is planned to extend the duration of some up to a month.

The research and development activities can be broadly divided into Chemistry and Physics, Materials and Structures. The activities and scope of the Station are directed by a board which includes a number of university professors; hence, work is not duplicated and information can be shared.

The activities of the Structures Department are largely in testing and development, and a great deal of work is done for consulting firms at below-cost prices. However, on the analytical side, Dr. W.B. Cranston is developing computer methods for the analysis of elastic-plastic plates, shells and frames.

There is a variety of projects in progress in the Testing Laboratory. The feasibility of using a single dowel pin to join a reinforced column to a beam is being studied (Fig. 1). The T-shaped structure is loaded vertically in a testing machine while transverse loads are applied.

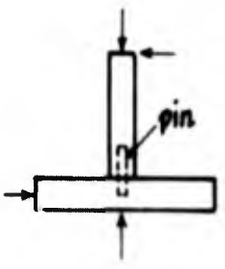


FIG.1

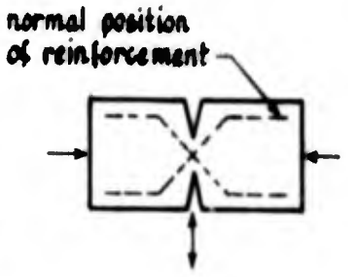


FIG.2

The design of a hinge without reinforcement is being developed (Fig. 2). The actual hinge is tested in compression while an oscillating transverse load is applied. It is found that the complex stress distribution in the contact region of the hinge is such that the concrete develops appreciably more strength than heretofore expected.

A very elaborate model of a flyover (overpass) was in the final phases of being tested. Dead load was simulated by hanging weights through "Christmas Trees" that were tied to the bridge deck. Lines of vehicles and an exceptional vehicle could be simulated. The entire assembly was also loaded by load cells to simulate the action of an adjacent section of the flyover. All readings of strain gauges were measured and recorded on digital voltmeters so that a large amount of data could be conveniently

taken.

A very impressive experiment is the model of a cooling tower which stands about 20 ft high. It is a true hyperboloid as compared to the Ferrybridge tower which was largely conical. The shell wall is made in segments of a few inches in height (several segments needed to complete a level) and mortared together. A ring is attached at the top, and the wall near the bottom is thickened. The aggregate in the concrete is very small in order to conform to the geometric modeling of the actual tower.

It was originally thought that the mode of failure in buckling due to the wind-load would be largely confined to the upper region, and hence no provision for dead loading was included. However, an observer at the scene at Ferrybridge took a photograph which shows large deflections in the lower region. Hence, as an afterthought in order to simulate this load effect, cables which could be tightened were attached at about 80 positions between the shell wall and the base.

The actual wind-load profile is shown in Fig. 3, and the load will be applied by cables tied through pads to the tower wall and a vertical post attached to the floor. The resultant pressure on the lee side of the tower is zero, as a significant contribution to the pressure is made by the internal flow. The electronic digital voltmeters will be moved from the site of the flyover in order to facilitate the taking of data when testing gets under way.

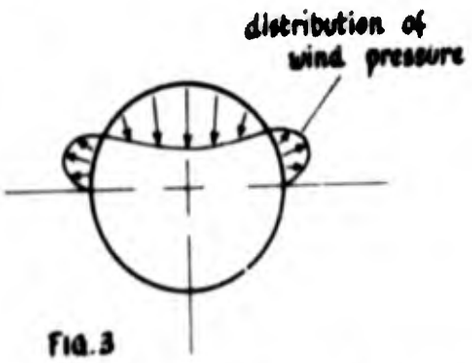


FIG.3

Other examples of work in progress were (1) a study of shear failure in transversely loaded beams, (2) a correlation with Yield-Line theory for a transversely loaded plate and, (3) the progression and development of cracks in a beam with transverse reinforcement loaded by a constant moment. (H.E. Williams)

MISCELLANEOUS

The Shifting Educational Scene

For a period, new universities seemed to appear almost weekly in Britain. Battersea, Brunel and Cranfield have achieved such status this summer. There is considerable discussion of the possibility of starting junior college systems. And the Universities of Manchester, Leeds, Liverpool, Sheffield and Birmingham have joined together in setting up more common entrance requirements. While the vast majority of Englishmen still leave school before age 16, it is clear that this will not be the case in five or ten years.

The University of Manchester has started an honours course in "Liberal Studies of Science," aimed at giving students a broad picture of science, its application, structure, management, and its interaction with society. Students from the Sixth Form in humanities will soon be accepted, as will those with backgrounds in science. The object is to provide a program suitable for those interested in industrial management and government, rather than science and engineering *per se*. (The University of London has been experimenting with such a course for a few years.) (J.B. Cohen)

BBC on Oceanography

The British Broadcasting Company is now editing film for a series of seven programs on oceanography to be broadcast on television BBC-2 on Friday evenings at 7:30. Present schedule calls for the first program in the series on 18 November 1966.

Although no details about this series are available, it is known that three days of filming and recording were carried out in the US at Woods Hole and Scripps. It is also known that Dr. John Swallow of NIO will be interviewed in one of the programs.

Visitors to the UK during the period November-December may be interested in viewing what promises to be an interesting and informative series. (J.E. Bennett)

Mini Mini TV for Britain

Clive Sinclair, British electronics engineer and President of Sinclair Radionics, Cambridge, demonstrated 405 line microvision TV (coat pocket size: 4"X2.5"X2", 10.5 ounces) at the Television and Radio show. The key factor

in the "mini" TV is a new type of simple 30-transistor circuit which can be produced at low cost. The firm maintains that "microvision will do for TV what the transistor did for radio." That is, move it from the corner in the living room into everyone's pocket. It also is claimed that the set makes possible the much discussed "look and talk" telephone system. Production plans of 1000/month starting in January were disclosed. Initial price will be £50. (P.D. Maycock)

PHYSICAL SCIENCES

Far Infrared Spectroscopy at Freiburg

Prof. L. Genzel has long been known for his contributions to far infrared spectroscopy. He left the Physical Institute of the University of Frankfurt in 1960 to become the professor in charge of the infrared program at the Physical Institute in the University at Freiburg, Germany. According to Genzel, the Freiburg Institute was the first in Germany for which all areas of physics are under one institute. There are approximately 10 professors of physics at Freiburg and the principal assistants (comparable to associate professors) of Genzel are Drs.H.Happ, K.F.Renk and R.Weber.

There are 20-25 research students active in far infrared spectroscopy. The programs are directed toward obtaining a better understanding of the physics of solids; one of Genzel's principal goals seems to be that of obtaining a material from which a bulk detector and/or bulk harmonic generator can be developed. The far infrared laboratory is well equipped and includes about 10 grating spectrometers, several Fabry-Perot interferometers (FP), at least one interference spectrometer, and a Collins liquid helium generator.

Although most of the experiments are performed with the classical mercury arc generator (incoherent), Happ is now completing the development work for a system that employs a coherent source and a crystal-diode frequency multiplier. The equipment is being developed for studying solids at wavelengths of $\frac{1}{3}$ mm and shorter. Although Happ is aware of the merits of detection with crystal diodes (von H. Happ, W. Eckhardt, L. Genzel, G. Sperling and R. Weber, Z. Naturforsch., 12a, No. 6, 1957), he uses a Golay cell detector, thereby eliminating one set of critical diode adjustments necessary to obtain a signal initially. An FP, operated with 20:1 resolution, is used as a harmonic selector. In this arrangement a high resolution is not needed because the interferometer is required only to pass the desired harmonic and to reject the unwanted ones.

Originally Happ used an 8-mm klystron to drive a conventional cross-guide frequency multiplier-detector, but he is now using a 2-mm CSF carcinotron for which the frequency can be easily changed. Available output power is 1 W but only 100 mW is used, because more than this will burn out the whisker of the harmonic generator. Oversized (4-mm) waveguide is used to minimize attenuation, and samples will be placed between two dielectric lenses. Most of Happ's recent effort has been consumed in developing his new system, and it appears that it will soon be completely debugged.

The low burn-out levels of about a 100 mW for the whisker in a diode harmonic generator limits over-all system sensitivity. On the other hand, a driving power of several tens of watts can be used with a Froome-type plasma harmonic generator (K.D. Froome, Quantum Electronics III, Columbia University Press, edited by P. Grivet and N. Bloemberger, 1964), but a plasma generator is to some extent plagued by fluctuations in output power. In principle, generator stability can be improved by increasing gas pressure. Genzel feels that an output sufficiently stable for general spectroscopic use would result only for pressures so great that attenuation due to window thickness would be too excessive for practical use.

In an effort to obtain a source of millimeter-wave power, Genzel recently generated Cerenkov radiation by accelerating electrons with a 200-kV potential. To obtain an interaction that satisfies the conditions for producing the radiation, an electron beam of several milliamperes was directed along a small-diameter crystalline rod. According to Genzel, the device will not provide a useful amount of output power unless electron bunching is somehow accomplished. The program has now been abandoned, except for the completion of a paper, because Genzel feels that the bunching instrumentation required would be too large and expensive for the generator to be of practical importance.

The only current laboratory research on generators, per se, is directed toward an effort to find a

material from which a bulk (semiconductor) harmonic generator can be developed. However, Genzel has initiated an effort on the application of lasers to spectroscopy. Equipment is now being assembled and built for research on the application of a 300-μ laser (H.A. Gebbie, N.W.B. Stone, and F.D. Finlay, Nature, 202, No. 4933, 685, May 16, 1964). An FP will be used in an effort to reject the numerous extraneous lines which characterize the output of such a laser. Genzel expressed concern over the small amount of power available, and he is searching for a method of increasing the output level.

The FP offers the advantage of possibly having the highest transmission efficiency for a given resolution of any far infrared instrument. Genzel's group has constructed several FP's for wavelengths between 100-600 μ that have Q-values of 5-30, and peak transmissions up to 90% have been obtained (R. Ulrich, K.F. Renk, and L. Genzel, IEEE Transactions on Microwave Theory and Techniques, Vol. MTT-11 p. 363, September 1963). Metal meshes are used as reflectors. The mesh is made for sorting particles, and is manufactured by Buckbee Mears Company, 245 East 6th Street, St. Paul, Minn. As previously mentioned, Happ uses an FP as a separator of harmonics, but a tunable FP can serve as a useful general-purpose band-pass filter. Application of the FP as a dispersion element has also been considered (R.Ulrich, K.F. Renk, and L. Genzel, IEEE Transactions on Microwave Theory and Techniques, Vol. MTT-11, p. 363, Sept 1963).

Because some of the new low-temperature detectors have a fast response, there is need for a good high-speed chopper for the far infrared. A thin plate of germanium to which is applied a static magnetic field and the modulating voltage has been used for a chopper. The percentage modulation decreases with increased modulation frequency, but modulations in excess of 50% have been obtained for frequencies up to 100 kc. Transmission and reflection measurements have been made on metallic meshes in an effort to find an efficient and broadband partially-reflecting plate for a Michelson interferometer. Measurements have been made for normal and 45° incidence, and Genzel finds that the losses of the meshes studied are not larger than 1%. The transmission properties are a complicated function of polarization. Measurement results for the chopper and the meshes have been published (L. Genzel, Japan. J. Appl. Phys. 4, Supplement I, 353-357, 1965).

Genzel has been a major contributor (L.Genzel and R.Weber, Z.Angew. Phys. 10(4), p. 195, 1958, Translation: DDC AD 252 310) to the concepts of Fourier-type interference spectrometers. These highly successful instruments cannot be used in his studies of non-linear phenomena in solids, however, because a Fourier instrument simply marks spectral elements by means of different modulation frequencies without selecting them out of the beam. Therefore, for non-linear phenomena one might use a grating monochromator (L. Genzel, H. Happ and R. Weber, Z. Physik 154, 1-12, 1959), an FP instrument or a prism. Genzel feels that a prism spectrometer may now be possible below 250 cm^{-1} by using crystalline prism materials normally used in the near and medium infrared. This seems possible because it is now known that at low temperatures (4°-80°K) the prism materials become transparent in the far infrared without losing their dispersion (H.Bilz and L. Genzel, Z. Physik 169, 53, 1962; H. Hadni, Spectrochim. Acta. 19, 793, 1963). A remarkable exception is fused silica which does not change its absorption between 4° and 300°K and which is therefore an excellent window material for low temperatures. (M.W. Long)

Sector-Shaped Antenna Patterns

At the German Post Office and at Siemens and Halske AG, much effort is being directed toward developing so-called sector-shaped patterns, the objective being to minimize sidelobes while retaining efficient aperture illumination. The ideal sector-shaped pattern is constant over the beam and has no sidelobes. Patterns actually considered are "cone-shaped" because the apertures being used have circular symmetry.

The German Post Office seems to be a combination of the Post Office Department as we know it in the States, the Federal Communications Commission, and the American Telephone and Telegraph Company. Dr. G.F. Koch is Head of the Antenna Group of the Bureau of Telecommunications, German Federal Post Office, Darmstadt, Germany. A wide variety of microwave antenna research and development tasks are pursued under Koch's direction,

including antennas for relay links and for satellite communications systems. The group was involved with preliminary designs for the German earth satellite at Raisting, but detailed design and construction was handled at the Central Laboratory of Siemens and Halske in Munich. Antennas for relay links and for satellites are also investigated at the Central Laboratory.

At microwave stations a conventional parabolic-reflector antenna of relatively large focal length (shallow reflector) often cannot be employed because its sidelobe attenuation is too poor. Horn-reflector antennas can sometimes be used, but they are bulky and expensive. However, a high-gain factor with high-sidelobe attenuation (at large angles) can be obtained by illuminating a deep reflector with a primary radiator having a pattern which is approximately sector-shaped.

It is well known that in the case of the two dimensional problem, a sector-shaped pattern is produced by a sin x/x aperture distribution which requires an infinite aperture and an infinite number of oscillations in the amplitude distribution. Koch has investigated the case of an axially symmetric aperture to produce a "cone-shaped" pattern, and as expected, found that the required illumination function is also oscillatory and requires an infinitely large aperture. However, the desired patterns can be approximated with a finite aperture and a number of oscillations in the distribution function. The calculated far-zone patterns are nearly constant in amplitude across the main lobe, but the finite aperture width causes some waviness in that lobe and the appearance of sidelobes.

Koch has studied analytically the detailed requirements for obtaining a sector-shaped pattern from a finite aperture, and he has developed some feeds for the task (G.F. Koch, NTZ 18 No. 6, 324-330, 1965; NTZ 18, No. 7, 374-379, 1965); the papers have been translated into English for publication soon in NTZ-Communications Journal. One of the feeds consists of a central waveguide and five conductors with circular cross sections arranged coaxially. In this way an aperture is obtained which consists of a central circular zone and five ring-shaped sections. In order to permit adjusting the amplitude and phase of the individual sections of the feed, the various outputs are connected to a power divider via phase shifters and attenuators.

Feed diameter is 24 cm, and the feed is so dimensioned that at 10 Gc the pattern closely approximates the desired sector shape. The calculated main-lobe width between 20-dB points is 120°, and the calculated sidelobes are smaller than 20 dB below the main lobe. Measured patterns show reasonably good agreement with the calculated main lobe, but the near-in sidelobes are only 17 dB below the main lobe. It was planned that the TE_{11} mode would be used in the various parts of the composite feed, but it has been difficult to suppress the TEM and higher order modes in the coaxial sections. A mode filter, consisting of radially arranged strips, has been used to short circuit the radial (TEM) field components. This arrangement has provided a 10-dB reduction in antenna spillover, as compared with a conventional horn feed that gives equal antenna gain (G.F. Koch, Institution of Electrical Engineers Conference Publication No. 21, London, 6-8 June 1966).

Additional improvements in the wide-angle radiation patterns will result from further reduction in the feed side-lobes which are caused by cross-polarized components from the feed. Koch believes that he can suppress these cross-polarized components, and he is therefore now trying to reduce overall feed size in order to minimize aperture blocking.

Peter Thust of Siemens and Halske has developed a horn feed, based on sector-shaping techniques, that has been successfully used to illuminate a parabolic reflector (P. Thust, Proc. IEEE, 53, 1239-1240, Sept 1965; Frequenz, 20, No. 5, 148-155, 1966). TE_{11}-modes are propagated in the waveguide which is circular, and the feed can be used for two perpendicular polarizations over a broad frequency band. The feed has a large flange in the aperture plane, and on the flange there are mushroom-shaped elements. Antenna gain with a 3-m diameter reflector is 43 dB over the frequency range of 5.9-6.4 Gc. With edge shields, sidelobe level is more than 60 dB below the main beam for angles greater than 76°.

Mr. W. Rebhan of Siemens and Halske has been investigating modified sector-shaped patterns for use with attitude-controlled satellite-borne antennas. For an ordinary pencil-

beam antenna, a considerable part of the radiated energy is wasted by bypassing the earth; on the other hand, if a highly directive beam is used, only the central area of the earth's surface is well illuminated. To effect constant illumination over the earth's surface, a cone-shaped radiation pattern with a spherical depression is needed to compensate for the higher path-losses in the directions far removed from the beam center. Rebhan has recently published (W. Rebhan, Frequenz, 20, No. 5, 156-165, 1966) a theoretical analysis and some experimental data on the illumination of a circular aperture for producing a uniform signal over the earth. (M.W. Long)

NATO Advanced Study Institute on the Optical Properties of Solids

NATO supports research in essentially three different ways. Similar to the system of research contracts in the US, research grants are given to institutions for certain projects; fellowships, particularly at the postdoctoral stage, are granted to scientists in the NATO countries; and last, but not least, advanced study institutes are sponsored on topics of current interest.

Since the optical properties of solids are presently in the focal point of research, NATO together with ONR and ARPA sponsored such an Advanced Study Institute in Freiburg, Germany, 7-20 August 1966, on this subject. The Institute can best be compared with a summer school. A staff of lecturers present a review of their specialty to an audience of mostly the post-graduate level. Panel discussions unite audience and staff in an evaluation of the present status and the future development of the field in general. Out of these discussions, it is expected that the participants will gain some feeling of research accomplished, in progress, and directions to go in pursuit of new research activities within their own countries.

Twenty-four lecturers presented the different aspects of solid-state optics to one hundred registered participants. Neither staff nor audience was restricted to countries of the NATO community. The excellent and indispensable lectures on the spectra of amorphous materials by J. Tauc, from NATO-opposed Czechoslovakia, and on excitons by S. Nikitine of France proved the internationality of this effort beyond the boundaries of NATO.

Lattice dynamics and optical features induced by impurity and defect states were well represented at the Institute through lectures by H. Bilz (Frankfurt), L. Genzel (Freiburg), C.W. McCombie (Univ. of Reading), S.S. Mitra (U. of Rhode Island), and R.H. Silsbee (Cornell Univ.). S. Marshall (Argonne National Lab.) lectured on the EPR of ions in crystals. D.L. Wood (Bell Labs) and D.S. McClure (U. of Chicago) presented the electronic spectra of ions and molecules, respectively. Excitons were the subjects of lectures by S. Nikitine (Strasbourg) and D.Reynolds (Wright-Patterson AFB). F. Matossi (Freiburg) and J.J. Markham (U. of Chicago) talked on luminescence and the configurational model. The pressure dependence of optical spectra and magneto-optics were dealt with in lectures by D. Langer (Wright-Patterson AFB) and S.D.Smith (U. of Reading).

The close and indispensable relation between the band structure of a solid and its optical properties was the central theme of a number of lectures. L. Pincherle (Kings College, London) presented the fundamentals of the band model and H. Jones (Imperial College of Science & Technology, London) developed the related group theory. M. Cardona (Brown University) went in detail into the intricacies of dispersion relations. B.O.Seraphin (Michelson Laboratory) reported on the more recent differential reflectance techniques, in particular electroreflectance. R. Potter (NOL Corona) and J. Dixon (NOL White Oak) gave excellent surveys of the fundamental experimental techniques in optical studies.

The organizers of this Advanced Study Institute, S. Nudelman and S.S. Mitra (both of the U. of Rhode Island) and F. Matossi (Freiburg) deserve credit for a smooth and efficient organization. They managed to extract manuscripts from the lecturers in time to distribute the lectures ahead of time, and they taperecorded the lively and informal panel discussions. Both will be published as Proceedings of the NATO Advanced Study Institute by Plenum Press before the end of the year. In addition, a detailed report will shortly be available from this office. (B.O. Seraphin)

PSYCHOLOGICAL SCIENCES

It Isn't What You Have -- It's What You Want That Counts

The Danish concept of "trivsel" is related to satisfaction, but it has not a precise English equivalent. Broadly speaking, trivsel implies, in addition to satisfaction, a certain general state of individual self-fulfillment, congruence of expected and achieved goals, etc. Eggert Peterson, Director of the Danish Mental Health Association in Copenhagen, has been interested in the concept for some years, and currently is completing an extensive study of trivsel in Danish industry. Data analysis has not yet been completed, and Petersen is not ready to commit himself with regard to his findings or their significance. There are, however, certain trends emerging from the data which give rise to rather intriguing speculations about the ideal society. Because of the interest on the contemporary American scene in philosophical issues related to utopian societies, it is considered both timely and appropriate to engage in a bit of speculation on the basis of imcomplete data.

Within the past seven years Denmark reportedly has experienced a 40% rise in national income over the cost of living. There is no significant unemployment, university education is free to all, medical care is provided from the cradle to the grave, and there are old-age benefits for all. At the same time there is reported to be a belief in some circles that the Danes are more generally dissatisfied with their present life situation than they were seven years ago. The possibility that progress toward a utopian society was hindering individuals in their search for trivsel led Petersen to embark on a rather extensive series of studies.

Subjects for the present study were obtained from 15 factories which were considered to constitute a representative sampling of Danish industry. A 59-item satisfaction scale provided the primary data for the study. This scale, based on a mathematical model developed by George Rasch, Professor of Statistics at Copenhagen University, provides for analysis of trivsel in terms of two parameters. One parameter characterizes the individual and the second characterizes the factory. (An extensive discussion of this model may be found in a recent paper by Rasch -- An Item Analysis Which Takes Individual Differences Into Account, Brit. J. Math. and Stat. Psych., 19, 49-57, 1966.) Considerable biographical information was available on the subjects, and information also was available on a number of variables characterizing the factories. Petersen's theoretical position is basically quite straightforward: satisfaction or trivsel is considered to be a function both of an individual's expectations and the degree to which these expectations are fulfilled by his milieu -- in this case the factory.

His results to date indicate that satisfaction appears to be inversely related to expectation. That is, the lower one's expectations, the more likely they are to be fulfilled and the higher the degree of satisfaction. Generally speaking, individuals with a history of broken homes, low social-economic status, etc., in fact, characteristics directly opposite to those usually associated with healthy adjustment, demonstrated a higher degree of satisfaction. Again, the expectations of individuals with disturbed or impoverished backgrounds did not appear to reach the same magnitude levels as their more fortunate colleagues.

A number of variables pertaining to characteristics of factories were found to be significantly related to satisfaction. For example, group size was inversely related to satisfaction, and area of working space was found to be directly related. Greater satisfaction was found in those factories where foremen were imported from other departments rather than being promoted from within the department which they supervise. Moreover, trivsel was found to hold a direct and positive relationship to the percentage of the people in the work group who held leadership roles. Thus, trivsel appeared lower in those factories where the nature of the work was sufficiently routine or uncomplicated as not to require a multiple leadership hierarchy.

As indicated at the beginning of this article, Petersen is not yet ready to claim that the increase of well-being among the Danish people has led to a commensurate decrease in trivsel or satisfaction. In fact, his present research really isn't designed to provide a direct test of such a hypothesis. On the other hand, he is beginning to think in terms of

a formulation whereby expectation accelerates at a greater rate than the standard of living in the prosperous or utopian society. This increases the discrepancy between expectation and realization of expectation which in turn leads to a consequent decrease in trivsel. (J.E. Rasmussen)

Notes on Danish Military Psychology Service

The Danish Armed Forces Psychological Service (Militaerpsykologisk Tjeneste or MPT) was described in some detail about 18 months ago in Technical Report ONRL-18-65. Since that time the organization has continued to grow, and it recently has been assigned a responsibility that will make this group one of the more significant military psychology organizations in Europe.

The structure of MPT has not changed markedly from that described in the 1965 report. The staff has been increased by two military psychologists, and it is hoped to add four more fully-trained civilian psychologists and an unspecified number of supporting personnel in the near future. When this comes about, there will be some reorganization, mostly to accommodate the programs upon which MPT will embark in the immediate future.

The pronounced lack of interest in selection which has been present for some time at MPT remains unchanged. This is not surprising, as there is compulsory military service for all male Danes, and the primary need for selection programs comes in the appointment of officer candidates and aviation cadets. Likewise, classification is not a major problem, as relatively few men from the total available population go to specialized service schools. These individuals are picked from the small but relatively easy-to-identify group of superior conscripts. The previously reported trend towards an increasing emphasis in training has continued. However, this coming fall will see an expansion of research both in the areas of small group interaction and in training.

While the Danish MPT has been engaged for some years in giving lectures or courses to various categories of personnel, this function is assuming such magnitude that a special section is being established to handle the teaching program. The Danes probably emphasize the role of teaching as much, if not more, than any other military psychology program in Europe. As might be expected, lectures are given to cadets and midshipmen at the service academies, and for some time a three-month course has been offered for junior officers who are scheduled to serve as instructors in military schools. This year a program has been established whereby all Danish Army officers at the Major level will receive two weeks of sensitivity training. It is interesting to note that the more rigid and tradition-bound Danish Navy is not participating in the program; however, those sensitivity training courses held to date have been both very well received and judged to be quite successful.

Probably the most significant recent development in Danish military psychology is the decision to establish a 1½-year program in the principles of military psychology and education at the level of the Command and General Staff Course. At present, senior officers being groomed for major command positions and/or promotion to general officer rank have two options for specialized training in this course: a two-to three-year tactical course or a 1½-year technical curriculum. The third option, which will be under the direction of the MPT is intended to prepare officers for command of service schools and senior billets concerned with military manpower utilization.

The history of this development is quite intriguing, and it probably would not have occurred exactly in this manner in any country other than Denmark. At this point, it might be added that the factual statements, as far as can be determined, are correct; the interpretation of the events and cultural influences leading up to establishment of this course is that of the present writer and should be accepted as such.

The Danish people are far more concerned with butter and eggs, drinking beer, education, housing, medical advances, and "trivsel" (satisfaction, fulfillment of personal life goals and enjoyment of living) than they are with national defense and the military. It might be safe to say that the Danish people as a whole are mildly anti-

military. The German occupation of World War II is vividly and unpleasantly remembered. Moreover, one occasionally receives the impression that Danish history plays some part in the genius of present-day attitudes. If one or two of the better-known Danish kings of the 17th and 18th centuries had spent more time at home in the pursuit of trivsel and drinking beer instead of attempting to conquer his neighbors, Denmark well might be a much larger and influential country today.

Coupled with a less than enthusiastic attitude toward the military is a deeply ingrained pride in and defense of intellectual and personal freedom. A democratic expression of individual opinion on any issue about which one might become exercised is a highly prized "right" or prerogative of all Scandinavians -- and there are few countries in the Western World where the citizens make greater use of this right than do the Danes. While it is recognized that the Scandinavians do not have a monopoly in this regard, the mass communication media does have a tremendous influence in conveying their current attitudes, especially of the Danish population. Moreover, the responsiblity for expressing these attitudes is not vested solely in professional commentators and correspondents. The Danish newspapers serve as a forum in which current problems are aired by individual citizens. Letters to the editor and interviews with individuals on controversial subjects in the daily papers would appear to be on a par with national and international news in terms of importance. Of more than passing significance here is the fact that both elected and appointed officials in the Danish government are strongly influenced by and responsive to public opinion.

The combination of generally anti-military attitudes among the citizens of Denmark and a government which traditionally is heavily influenced by attitudes of the people it represents might well be enough to make one wonder how any type of organized and effective armed force can be maintained. Continuing with the subjective and sweeping generalizations which have characterized the last two paragraphs, it would appear that the answer to this question lies in the fact that the Danes tend to be "realists." They know that Denmark cannot maintain an armed force which could cope singlehandedly with all possible threats to their sovereignty; however, from bitter experience they are aware of the necessity for maintaining a sound defensive posture and thus are members of NATO. While the military is considered to be of sufficient importance that all physically fit Danish males are conscripted for military duty, the armed forces (particularly the army) also constitute one of the favorite topics of public discussion and newspaper criticism. The attacks tend to be quite broad in scope, ranging from strategy and tactics of military defense to manpower utilization.

It would appear that the new option at the Command and General Staff Course level has evolved from a period of intense political and newspaper criticism of the armed forces which occurred about two years ago. At that time, there was concern that the services were too military and too "Prussian" in their attitude toward and handling of the young men entering the forces through conscription. In some respects this wave of public sentiment for increased military "democracy" is analogous to that which occurred in the US following World War II.

In February 1965 the Minister of Defense established a "Military Climate Committee" to study ways in which more "psychologically sound" attitudes could be introduced into the armed forces. The Committee was chaired by the Director of the Danish Office of University and Technical College Education, and consisted of 40 members, half of whom were military and half civilian. LCOL Finn Agersted, Director of the Military Psychology Service, acted as secretary. The group took a rather broad approach to their task, and started by collecting and categorizing specific examples of problems which might have any conceivable bearing on the issues at hand. Next, an effort was made to conceptualize the fundamental difficulties or causal factors which characterized the various categories. On the basis of this exercise, it was concluded that difficulties associated with interpersonal communication and other dimensional small group interaction constituted the most important single factor underlying the problems to which the Committee had been exposed. In a report summarizing their findings

three courses of action were recommended to the Minister of Defense: (1) the military psychology research program should be expanded, (2) military officers should be given advanced education in the areas of personnel management, leadership, and education; and (3) a program should be introduced which would enhance military management effectiveness, intra-service cooperation, and communication through a systematic reshaping or changing of officers' attitudes. Because of this latter recommendation, the programs outlined by the Committee have occasionally been referred to under the rather misleading heading of "military democracy." In fact, nothing in the Committee's report or recommendations would lead to changes either in military structure or delegation of authority. The emphasis is solely on changing the broad management approach to carrying out presently existing tasks or functions within the armed forces.

The 40-man Military Climate Committee has completed its task and will be dissolved this month. At the same time a seven-man executive has been formed to serve as a continuing advisory group to the Minister of Defense for implementing the major Committee recommendations. In addition to the Director of the Military Psychology Service, the Executive Committee will be composed of one representative from each service, two civilian educators, and a representative of the Welfare Ministry.

Concrete and meaningful steps already have been taken to carry out the major recommendations of the Military Climate Committee. The six new professional staff members of the MPT will constitute an increase of approximately one-third in the size of the organization and should materially enhance its research capacity. The sensitivity training, commented upon earlier, is aimed at carrying out the recommendation concerned with attitude change. The establishment of the new 1½-year program at the level of the Command and General Staff Course will be the means of carrying out the recommendations for advanced education in personnel management.

It will be at least one year, if not a year and a half, before any officers actually are assigned to the new course, and the full curriculum has yet to be determined. At present it is planned that the first six months will be spent at Copenhagen University attending formal courses which will be developed and taught by members of the Psychological Institute. The next year will be spent at the MPT, where academic work will be combined with an exposure to research. Thus, during the second six-month period, a formal course will be given in statistics and the officers will work as assistants in an ongoing research program. During the final six months, the students will be expected to carry out an independent research project.

There are few countries anywhere in the world where a military psychology program has been given as great a degree of responsibility and latitude within the armed forces essentially to influence the basic structure of the services. In some respects this situation may provide a test of whether psychological theory and the state of the art in the behavioral sciences are sufficiently advanced to have a significant impact in changing the character of an institution as old, large, and well established as the Danish Army. Unfortunately, social psychology is not particularly strong in Denmark. On the positive side, the MPT is generally well accepted by the military. About half of the professional staff are service-academy graduates who have considerable experience as line officers, as well as formal training in psychology to a level roughly equivalent to the US doctorate. Moreover, Agersted, who is directing the program, has the reputation of being a highly skilled military administrator and an excellent applied psychologist. He also has quite strong support from and is well respected by civilian psychologists and the Danish academic community; in fact, he is president of the Danish Psychological Association. Thus, it should be extremely interesting to follow the developments in Danish military psychology over the next few years. (J.E. Rasmussen)

NEWS AND NOTES

The Council of the Scottish Marine Biological Association has announced the appointment of Mr. Ronald I.Currie, BSc, as Director of the Marine Station, Millport, Isle of Cumbrae, Scotland. Currie has been Head of the Biological Section of the National Institute of Oceanography, Wormley, Surrey, for a number of years and brings to the

Millport Station experience and a background of considerable breadth and depth.

In European circles, Currie has been active in the Intergovernmental Oceanographic Commission, the Scientific Committee on Oceanic Research and, more recently, was appointed Secretary of the Oceanographic Section, International Union of Biological Sciences. He is also well known in the Americas, both from visits to oceanographic centers within the US and from participation in the First International Oceanographic Congress, New York, 1959, and the Symposium on Oceanography of the Western South Atlantic, Rio de Janeiro, 1964. Currie, with an active interest in plankton and organic production in the sea, has been concerned for several years with the coordination of the International Indian Ocean Expedition and participated as Principal Scientist on a number of cruises of the RRS 'Discovery.' His publications have covered a variety of topics, including the environmental features in the ecology of Antarctic seas, the Indian Ocean standard net, and oceanography in Brazil.

Currie assumes the responsibilities of Director of the Millport laboratory at an especially important point in the long development of this major Scottish laboratory. The National Environment Research Council has recently approved, for 1967-68, the first installment of the capital sum required to construct the new mainland laboratory near Oban. The laboratory can thus take the first step towards implementation of the plans for expansion of research on the Scottish West Coast which have been under consideration for a number of years. (J.D. Costlow)

The Challenger Society, organized in 1903 to promote the exchange of ideas in the area of marine biology and oceanography in the United Kingdom, offers a unique opportunity for American scientists visiting the UK to meet informally with British scientists and actually participate in the meetings. There are normally four meetings each year, usually lasting two days and, with the exception of the January meeting, marine laboratories and universities with programs in marine biology and oceanography serve as the host organization. They are attended by established workers in these fields as well as by students and recent graduates. The host institution is open to visitors during the meetings and, in addition to providing for an inspection of the research and teaching facilities, it gives an excellent opportunity to discuss research at a level of detail which is rarely possible in the larger symposia.

At the two most recent meetings of the Society, held at the Department of Oceanography, Univ. of Southampton and the Marine Biological Station, Port Erin, Isle of Man, papers were presented which included the following topics: ecology of rocky shores; populations of Laminaria Hyperborea from various latitudes; identification of marine sediments by echo-sounders; distribution of pelagic polychaetes in the Pacific and Atlantic Oceans; studies of the structure of the floor of the Atlantic Ocean; and recent changes in the Manx scallop fishery.

The next annual meeting is scheduled to be held in London, January 26-27, 1967, in the British Museum of Natural History. The Convener, Mr. R.S.Glover, has indicated that he would especially welcome as speakers American scientists who are visiting or working in the UK at that time. Marine biologists or oceanographers who would be interested in attending and presenting a paper should write: Mr. R.S. Glover, Convener, Oceanographic Laboratory, 78 Craighall Road, Edinburgh 6, Scotland. (J.D. Costlow)

A new space project consortium has been set up by agreement between leading aerospace firms in Western Europe. The firms involved are Engins Matra (France), Hawker-Siddeley (UK), Entwicklungsring Nord (W. Germany), and SAAB (Sweden), and they will submit joint tenders for future satellite or space probe projects within Europe and elsewhere.

The National Computing Centre, now under construction at Manchester, will be equipped with its first machine -- a KDF-9 built by the English Electric Leo Marconi group -- early next year. The Centre's Director, Prof. Gordon Black, stated at a recent press conference that he hoped the Centre would become the focal point of a first computer grid system serving the UK. By 1972 it would be possible to link the installation at Manchester by post office telephone lines with approximately 12 computers in other parts of the country, so that

universities, research organizations, and industrial firms could have immediate access to computer facilities at any time.

University College, London's, Electrical Engineering Dept., under Prof. H.E.M. Barlow, is to carry out a research contract on the use of waveguides with low power loss for the transmission of microwave messages. The work will include the installation and testing of a one-mile length of circular waveguide at the Post Office Engineering Department's new research center at Martlesham, Ipswich, to which the Dollis Hill establishment is scheduled to move in the near future.

The Royal Society is to send a two-man team to Aldabra, a long-isolated coral atoll north of Madagascar where flora and fauna have been allowed to breed unhindered by man. Dr. D.R. Stoddard, Dept. of Geography, Cambridge Univ., will study the vegetation and general composition of the land, and Dr. C.A. Wright, Dept. of Zoology, British Museum of Natural History will study the animal life.

Sir Willis Jackson, Professor of Electrical Engineering at Imperial College, London, has been elected next year's President of the British Association for the Advancement of Science.

J.A. Ratcliffe, formerly Director of the Radio and Space Research Station at Ditton Park, Slough, will be President of the Institution of Electrical Engineers for 1966-1967.

Dr. F.S. Dainton has been appointed Chairman of the Advisory Committee for Scientific and Technical Information, succeeding Sir James Cook.

Dr. C.C. Spicer, at present Chief Statistician (Medical) at the General Register Office for England and Wales, is to be Director of the Medical Research Council's new Computer Unit, to be set up in London early in 1967.

Members of the Computer Board for Universities and Research Councils have been appointed as follows: Prof. B.H.Flowers (Chairman), Prof. Gordon Black, Prof. C.E.H. Bawn, Lord Halsbury, Prof. D.J. Finney and J.K. Steward.

Prof. E.A. Guggenheim, Professor of Physical and Inorganic Chemistry at the Univ. of Reading, retires Sept. 30 to become Professor Emeritus. He will be succeeded as Head of the Dept. of Chemistry by Prof. G.W.A. Fowles. Professor of Inorganic Chemistry at Reading.

Dr. C.H. Mortimer, resigning Director, will join the University of Wisconsin at Milwaukee, to continue his research on the Great Lakes.

Technical Reports of ONRL

The following reports have recently been issued by ONRL. Copies may be obtained gratis by Defense Dept. and other US Government personnel, ONR contractors, and other American scientists who have a legitimate interest. However, because of the frequent content of proprietary and prepublication information, the reports cannot be sent to libraries or to citizens of foreign countries. Requests for ONRL reports should be addressed to: Commanding Officer, Office of Naval Research Branch Office, Box 39, Fleet Post Office, New York 09510.

ONRL-39-66	Some Electromagnetics in W. Germany by M.W. Long
ONRL-40-66	Medical Education and Research in Spain by C.N. Peiss
ONRL-41-66	Some Programs on Millimeter and Submillimeter Wave Spectroscopy in Europe by M.W. Long

The following conference reports are releasable to European scientists:

ONRL-C-15-66	International Symposium on Reaction Mechanisms of Inorganic Solids by S.Y. Tyree
ONRL-C-16-66	Seminar on Strength of Materials, Cavendish Lab, Cambridge by J.B. Cohen
ONRL-C-17-66	Conference on the Physics of Semiconducting Compounds, Univ. of Swansea, Wales, by B.O. Seraphin

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13. ABSTRACT

This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to both American and European scientists by disclosing interesting information well in advance of the usual scientific publications.

The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist.

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