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LR-1029

Prepared For
Naval Training Equipment Center
Orlando, Florida 32813

Under

Contract No. N61339-74-C-0039 *N*

By

Singer/Link Division

Binghamton, New York 13902

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER (14) LR-1029-REV-A	2. GOVT ACCESSION NO. AD-A204	3. RECIPIENT'S CATALOG NUMBER 239
4. TITLE (and Subtitle) RELIABILITY AND MAINTAINABILITY ASSESSMENT REPORT FOR LASER SCANNER IMAGE GENERATION SYSTEM Key: 12, 13, 14, 15, 16, 17, 18, 19, 20	5. TYPE OF REPORT & PERIOD COVERED Final Repts Jan 81	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) 11. Edmondson M. / Edmondson	8. CONTRACT OR GRANT NUMBER(s) 15 N61339-74-C-0039	
9. PERFORMING ORGANIZATION NAME AND ADDRESS The Singer Company Link Division Binghamton, NY 13902 313370	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 6.42.04.A 1F464204027503 1703	
11. CONTROLLING OFFICE NAME AND ADDRESS PM TRADE ATTN: DRCPM-TND-AV, Naval Training Center Orlando, FL 32813	12. REPORT DATE 15 Jan 81	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	13. NUMBER OF PAGES 142 12 244	
	15. SECURITY CLASS. (of this report) Unclassified	
	16. DECLASSIFICATION/DOWNGRADING SCHEDULE	
16. DISTRIBUTION STATEMENT (of this Report) DOD Distribution Statement "A" DISTRIBUTION STATEMENT A Approved for public release; Distribution Unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) SEP 1 5 1981		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Reliability Visual Systems Maintainability Training Devices Laser Simulation		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The data presented herein constitutes a complete and accurate account of the procedures, criteria and conclusions associated with the Reliability and Maintainability Assessment performed on the Laser Scanner Image Generation System.		

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Abstract

The data presented herein constitutes a complete and accurate account of the procedures, criteria and conclusions associated with the Reliability and Maintainability Assessment performed on the Laser Scanner Image Generation System.

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Table of Contents

		<u>Page</u>
1.0	INTRODUCTION	1
1.1	Scope	1
1.2	Application	1
1.3	Associated Documents	1
1.3.1	Specifications	1
1.3.2	Standards	1
1.3.3	Other	1
1.4	Definitions	2
1.5	Abbreviations/Symbols	2
2.0	TEST OBJECTIVES	2
3.0	DESCRIPTION OF TEST ITEM	2
4.0	TEST CONDITIONS	3
4.1	Assessment Location and Schedule	3
4.2	Procedures	3
4.3	Environmental Conditions	3
4.4	Equipment Operation	6
4.5	Maintenance	6
4.6	Support Equipment	6
5.0	TEST RESULTS	7
5.1	System Stability	7
5.2	Critical Failure Modes	21
5.2.1	Spinner Electronics Intermittent	21
5.2.2	Spinner Air Supply	22
5.2.3	Argon Laser	23
5.3	Parametric Estimate	25
6.0	CONCLUSIONS	27
	Appendix A - Reliability and Maintainability Assessment Procedure	
	Appendix B - Assessment Log Sheets	

LSIG

List of Illustrations

		<u>Page</u>
Figure 1	Breadboard LSIG Diagram	4
Figure 2	Laser Table Diagram	5
Figure 3	Graph - Ambient Temperature vs Time	9
Figure 4	Graph - Humidity vs Time	10
Figure 5	Graph - Argon Laser Power and Current vs Time	11
Figure 6	Graph - Krypton Laser Power and Current vs Time	12
Figure 7	Graph - Dye Laser Power vs Time	13
Figure 8	Graph - Video Level, Red	14
Figure 9	Graph - Video Level, Green	15
Figure 10	Graph - Video Level, Blue	16
Figure 11	Graph - Vertical Resolution	17
Figure 12	Graph - Horizontal Resolution	18
Figure 13	Proposed Laser Table Configuration	29
Figure 14	Beam Correction Servo	31
Figure 15	Laser Life Expectancy	33
Figure 16	Image Correlation System Block Diagram	36

LSIG

1.0 INTRODUCTION

1.1 Scope

This document sets forth the procedures, criteria and conclusions associated with the Reliability and Maintainability Assessment for the Laser Scanner Image Generation System.

1.2 Application

This document is applicable to Contract N61339-74-C-0039, Item 0026, Reliability Demonstration. The equipment subject to evaluation is defined as Item 0003, Laser Scanner Image Generation System.

1.3 Associated Documents

The following documents were utilized to develop this report:

1.3.1 Specifications

NTEC Specification 222-1183
dated 5 November 1979

Specification for AH-IS
(Cobra) Flight Simulator,
Device 2838

1.3.2 Standards

MIL-STD-757

Reliability Evaluation from
Demonstration Data

MIL-STD-785A

Reliability Program for
Systems and Equipment

MIL-STD-721B

Definitions of Terms for
Reliability, Maintainability,
Human Factors and Safety

1.3.3 Other

Singer-Link Document

Procedure for 12 day Re-
liability and Maintainability
(RAM) Assessment, Laser Scanner
Image Generator Product De-
velopment Program
Rev. A, 11-26-80

Other (cont'd)

LR-979

Laser Scanner Image
Generator System Study
Final Report 28 November 1979

1.4 Definitions

Definitions of terms used throughout this document are those of MIL-STD-721B.

1.5 Abbreviations/Symbols

SPD	Simulation Products Division of Singer
NTEC	Naval Training Equipment Center
MTBF	Mean-Time-Between-Failure
MTTR	Mean-Time-To-Repair
LSIG	Laser Scanner Image Generation

2.0 TEST OBJECTIVES

The objective of the 12 day assessment was to evaluate the reliability/maintainability potential of the LSIG, specifically with regard to operational availability. Data accrued on the breadboard system concerning those design characteristics influencing operational availability - reliability, stability, and maintainability - was to be combined with data from operation during the development period and vendor data to accomplish this objective.

To the extent possible, parametric estimates were to be developed and compared to the design goals established in para. 3.1.2(3) of the Link S.O.W.

3.0 DESCRIPTION OF TEST ITEM

The LSIG has been described in detail in section 1.3 of the LSIG system study final report LR-979. The breadboard system used in

LSIG

the development program was the test item evaluated during the 12 day period. Block diagrams of the breadboard LSIG and Laser table are provided in Figure 1 and Figure 2.

The laser table as designed is an optical bench used for producing and mixing the outputs of three lasers to provide a "white light" beam consisting of four major laser lines. In addition to the conventional red, green, and blue laser lines, it was found that a fourth, "yellow" line is necessary for high-fidelity color reproduction. The red is obtained from a krypton laser, the green and blue from an argon laser, and the yellow from a dye laser pumped with the excess green light emanating from the argon laser.

4.0 ASSESSMENT CONDITIONS

4.1 Assessment Location and Schedule

The assessment was conducted at Librascope, Glendale, California. It commenced on 1 December 1980 and was completed on 12 December 1980.

4.2 Procedures

The assessment was conducted in accordance with the Reliability and Maintainability Test Procedures. The procedure is included as Appendix A of this report.

4.3 Environmental Conditions

The assessment was conducted under normal operating conditions of the test facility. These conditions are as follows:

Lab ambient air: Temp 70 ± 2 typical
Humidity $55 \pm 15\%$ typical

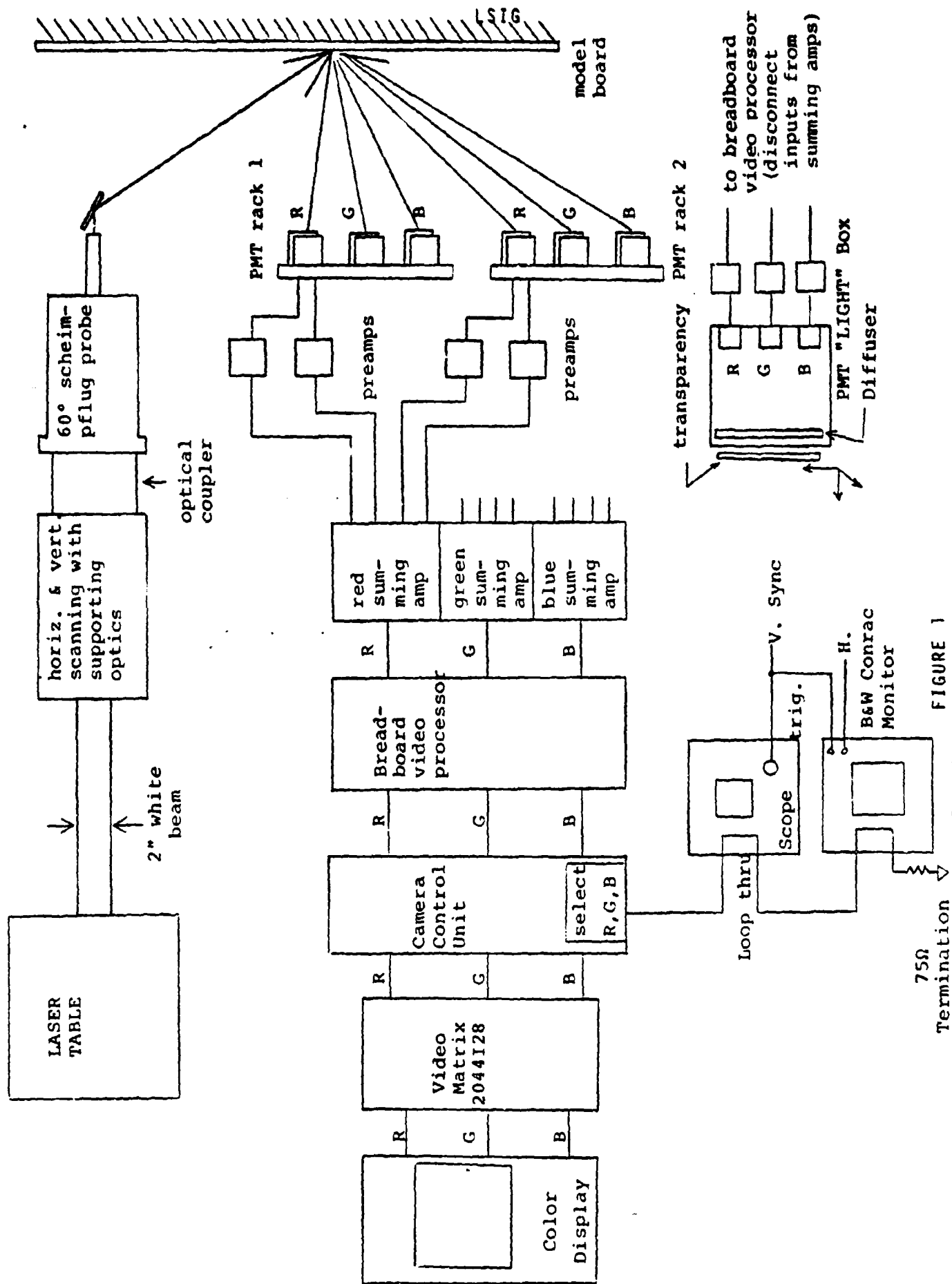


FIGURE 1
Breadboard LSIG System Block Diagram

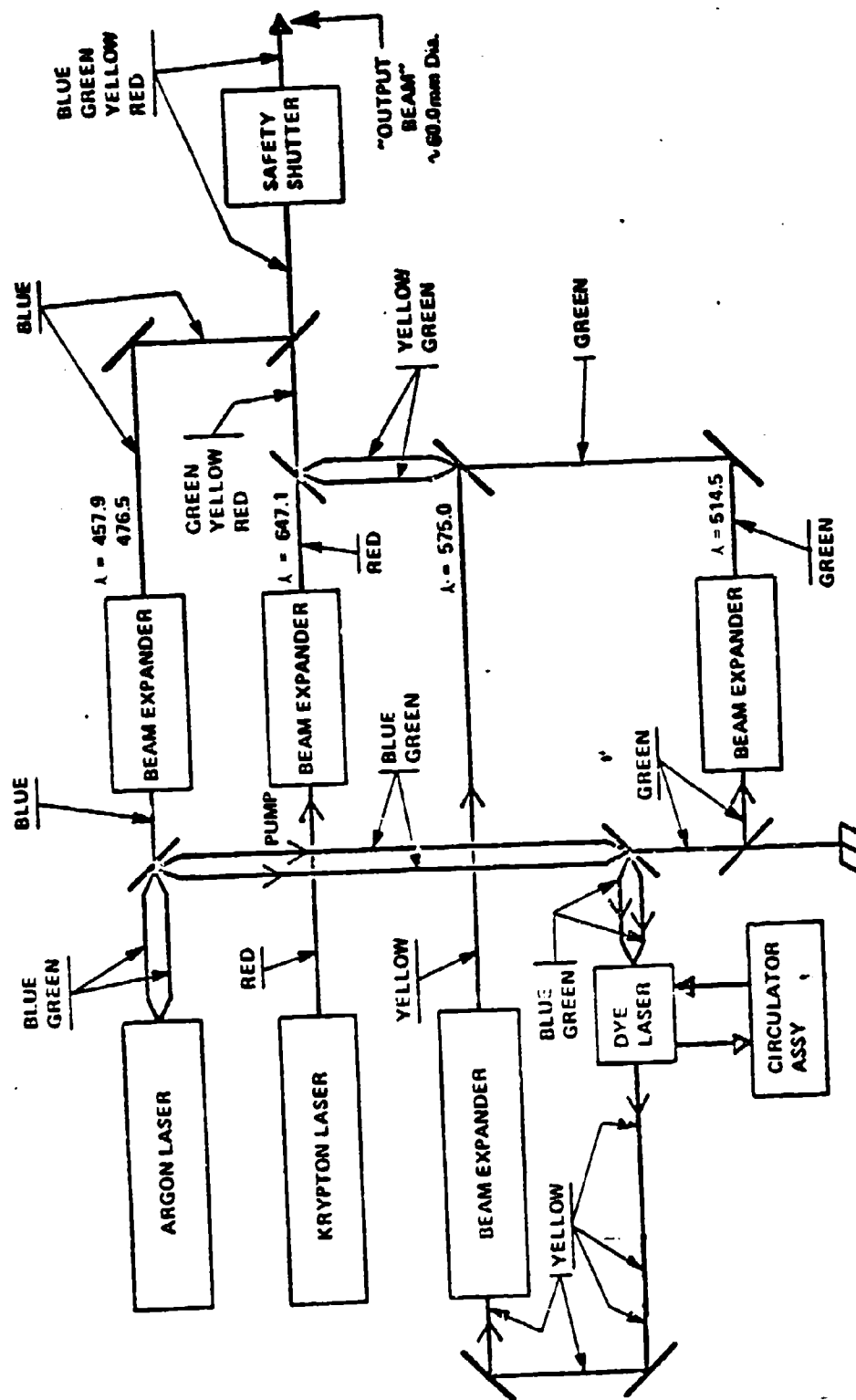


FIGURE 2
Breadboard Laser Table

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Laser table air:	Laboratory Ambient Filtered (95% atmospheric Particles Removed) 235 CFM Flow Rate
Laser cooling : (Plasma tube and power supply)	Water, closed loop system 60°F @ 45 PSIG (Argon) 60°F @ 30 PSIG (Krypton)
Electrical: Power	Commercial, unconditioned

4.4 Equipment Operation

Equipment operation was scheduled for a period of 12 days with a 2 day break after the first 5 days of testing. The daily test cycle consisted of a 16-hour period with the system at full power and a 8-hour period with the system off. System performance parameters, including power output levels of the lasers, video levels of the red, green and blue channels, field of view centering, color registration of the system, and system resolution were measured and recorded periodically during the 16 hour period.

4.5 Maintenance

The Laser Scanner system was routinely operated and maintained by Librascope Engineering personnel. Spectra-Physics and Loxel personnel provided technical assistance on an as needed basis, including a visit to the test facility by Spectra-Physics and via telephone (see results discussion).

All maintenance actions, including adjustments, were documented.

4.6 Support Equipment

No support equipment, other than that utilized to perform normal maintenance and test of the system was required during the assessment. This equipment consisted of the following:

LSIG

5 Channel Probe Servo Director	Singer Test Fixture C4154
Photo Multiplier Test Box	Singer Test Fixture
Test Transparency	Singer Test Fixture
50 MHZ Oscilloscope (2)	Tektronix Model 454
Volt-Ohm-Milliammeter	Triplet Model 630-T-APLK #30152
Power Meter, 0-10 Watts	Coherent Radiation Model 210 #2929

5.0 TEST RESULTS

The breadboard LSIG system accrued a total of 115.5 operational hours over 10 operational days (12 calendar days).

Appendix B of this report contains the official log of the assessment. The data from the assessment has been organized into three broad categories as follows:

- 1) System stability
- 2) Critical failure modes
- 3) Parametric estimates

5.1 System Stability

System stability was, for assessment purposes, evaluated with respect to the capability of the system to commence operation on schedule and to operate within tolerances without frequent maintenance.

The system was able to commence operation at the desired time (generally 0700) 40% percent of the time. Argon laser problems and the unavailability of a replacement laser during the first week of test were significant factors inhibiting system readiness.

LSIG

The impact of the 8 hour power-off period produced alignment problems, which on several occasions caused delays in commencing operation. The exact cause of the change in alignment has not been determined but it is believed to be related to thermal stability of the laser table, since the breadboard table is extremely sensitive to temperature change. The typical temperature differences between the end of the day and turn-on was $2-3^{\circ}$. Limitations in the ease of alignment of the breadboard system also contributed significantly to delays in the morning. In general, however, delays were 90 minutes or less.

Stability on the whole, after operation commenced, was good. The ability of the breadboard to operate within tolerance is portrayed in Figure 5 through 12. These graphs were developed from the measurement data on the logs. The ambient temperature and humidity graphs, Figures 3 and 4 respectively, are included for reference because of the previously defined interaction with the breadboard alignment.

Color registration (no graph developed) was typically less than 2 arc minutes, and worst case was 8 arc minutes. Note that the implied specification at turn-on was ± 8.4 arc minutes in the central circle (.8 picture height diameter) with degradation during operation to ± 21.2 arc minutes permissible.

Field of view centering (no graph developed) was rated fair. Although some drifting was observed, drift was usually less than 7 arc minutes vertically and 10 arc minutes horizontally with a worst case drift of 20 and 50 arc minutes respectively. The auto image correlation feature of final design and the beam angle servo will correct this problem.

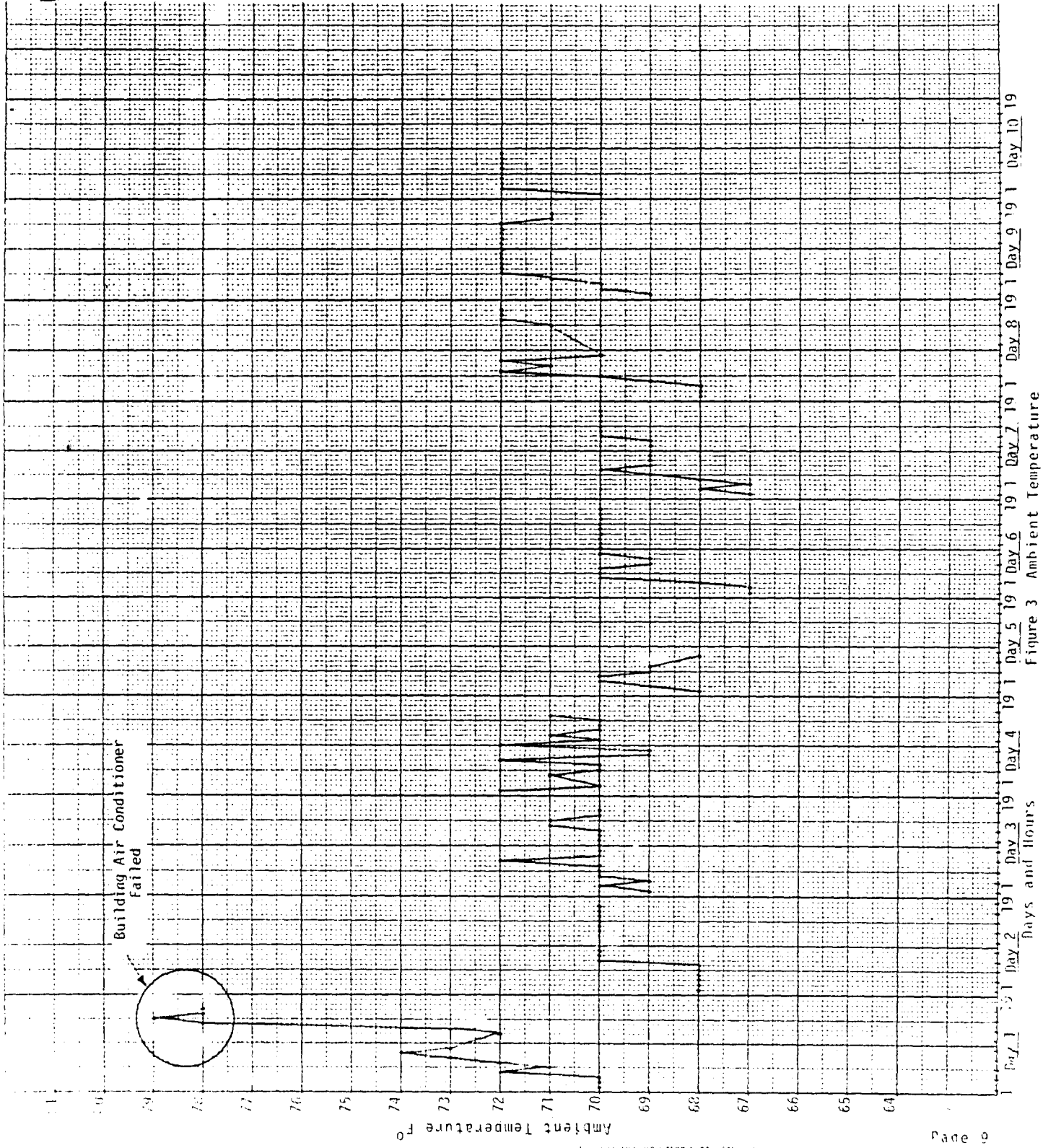


Figure 3 Ambient Temperature

Days and Hours

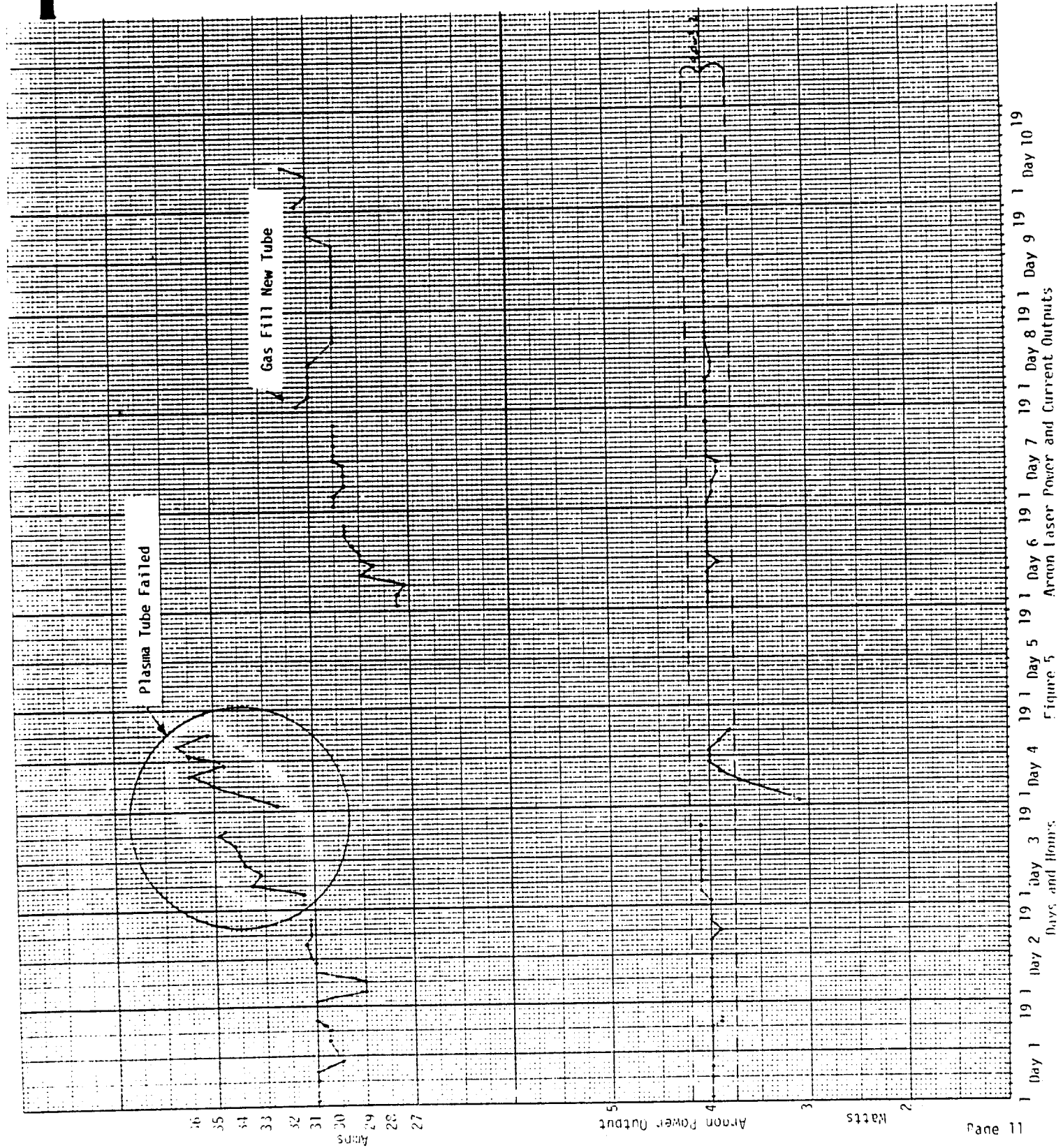
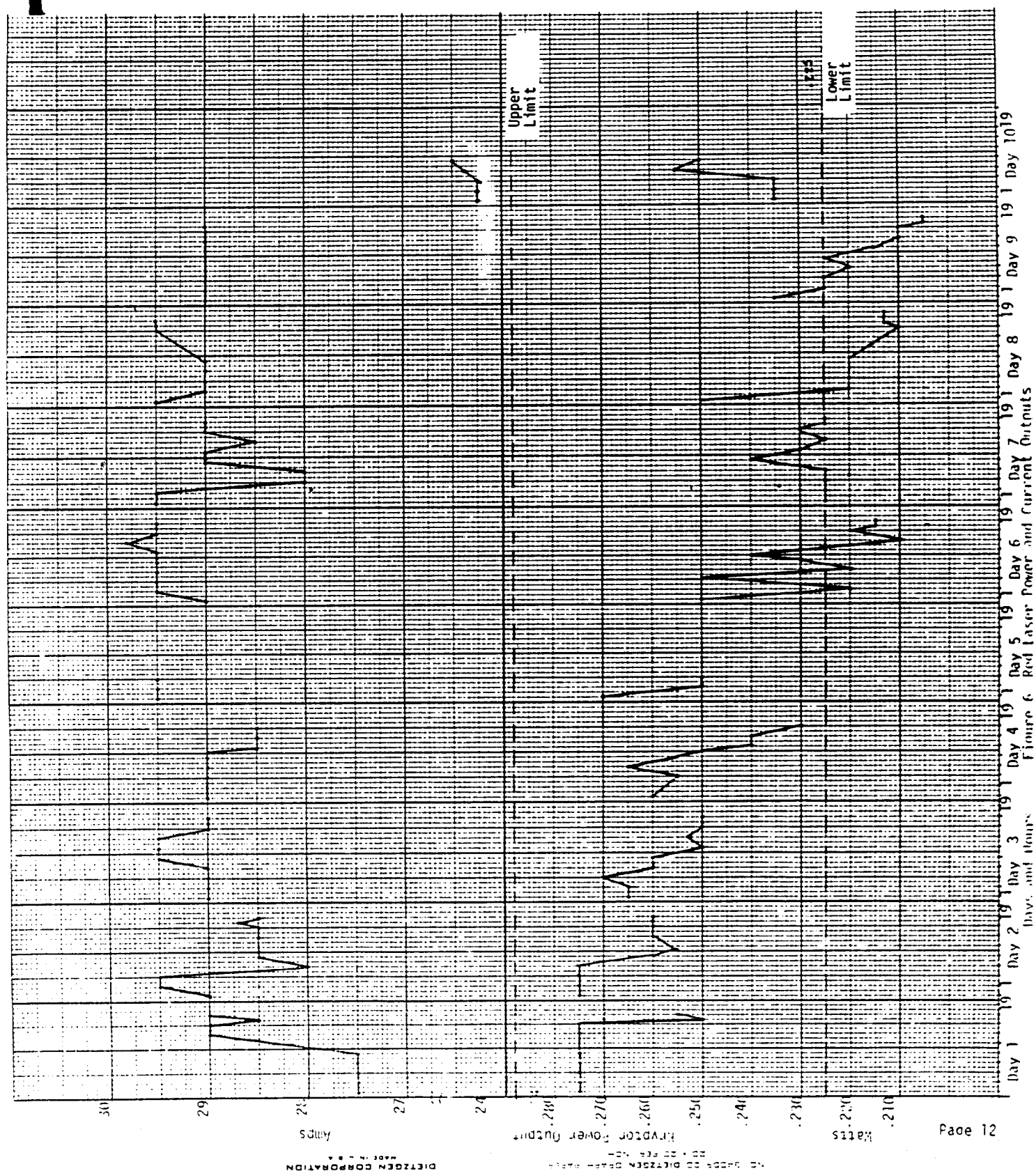


Figure 5 Armon Laser Power and Current Outputs



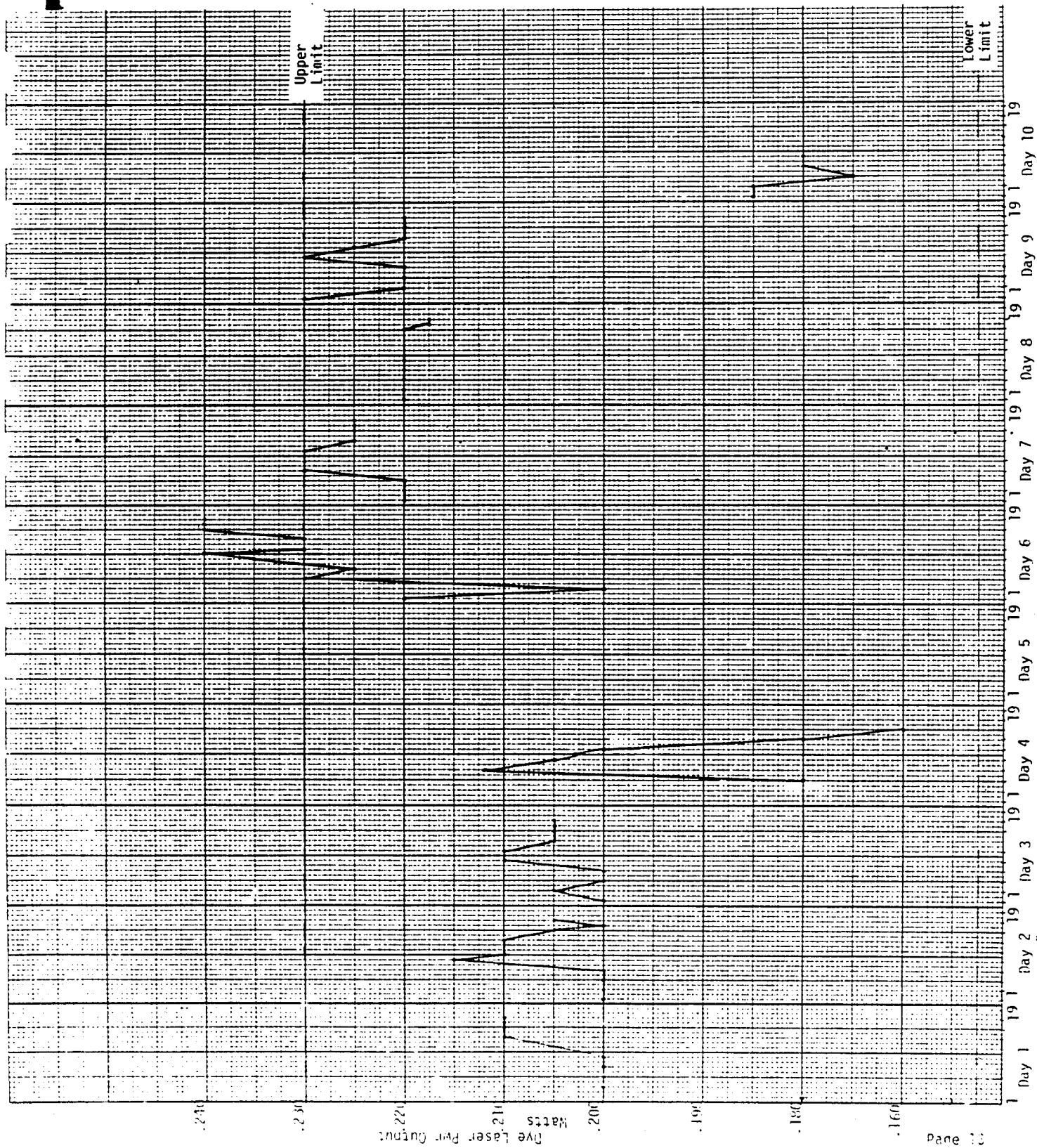


Figure 7 Dye Laser Power Outputs

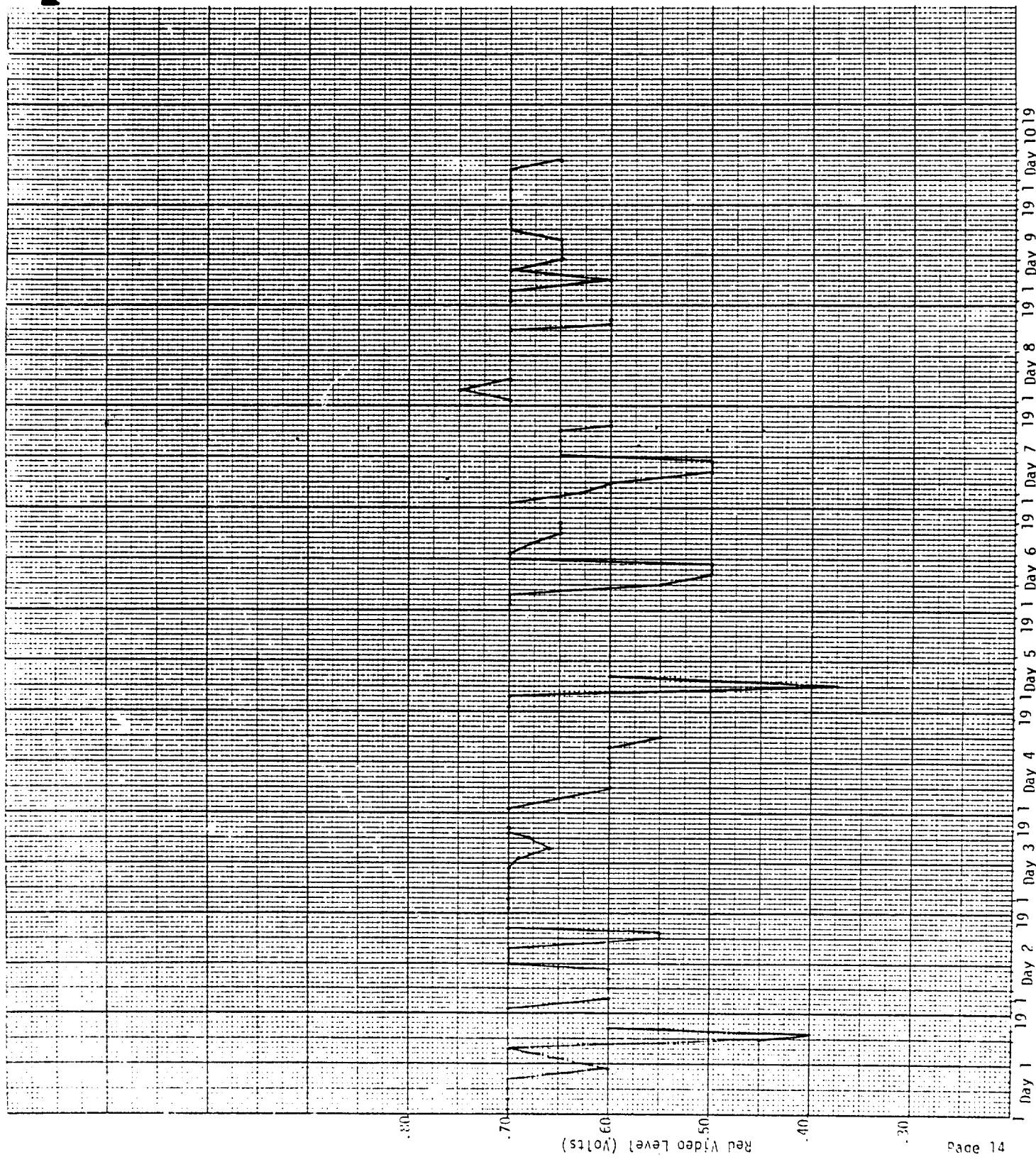


Figure 8 Red Video Levels

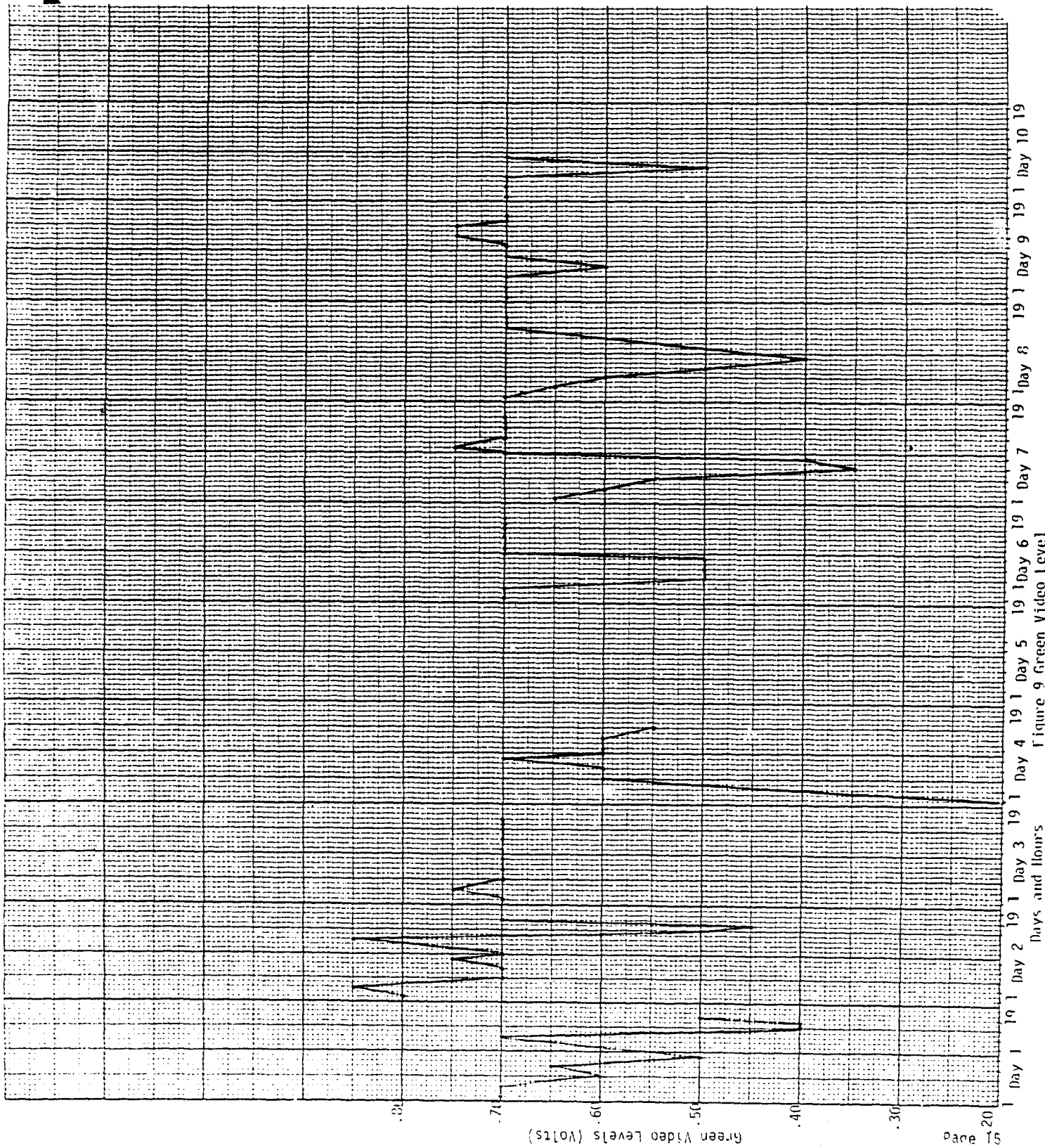
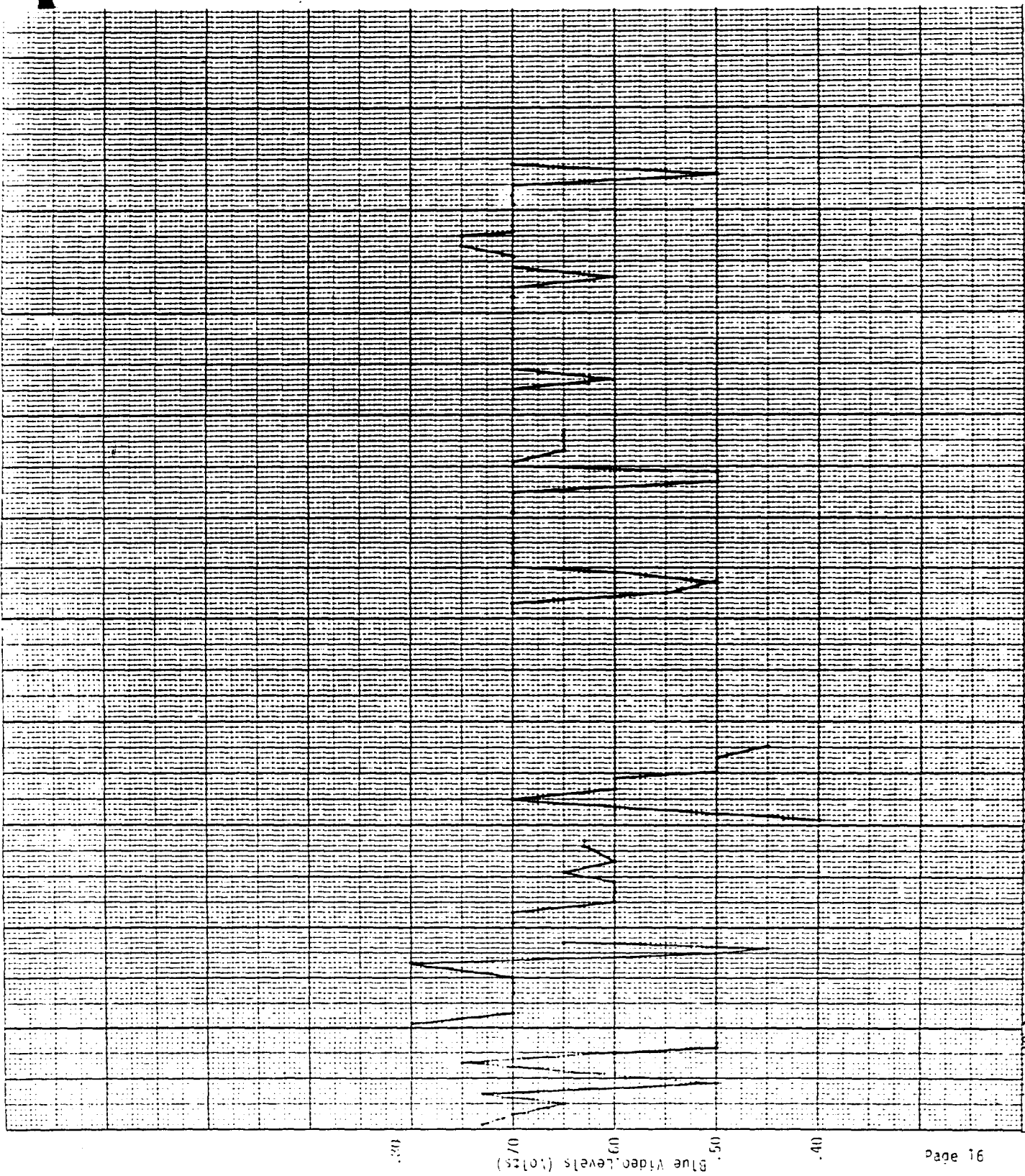


Figure 9 Green Video Level

Days and Hours



Days and Hours

Figure 10 Blue Video Levels

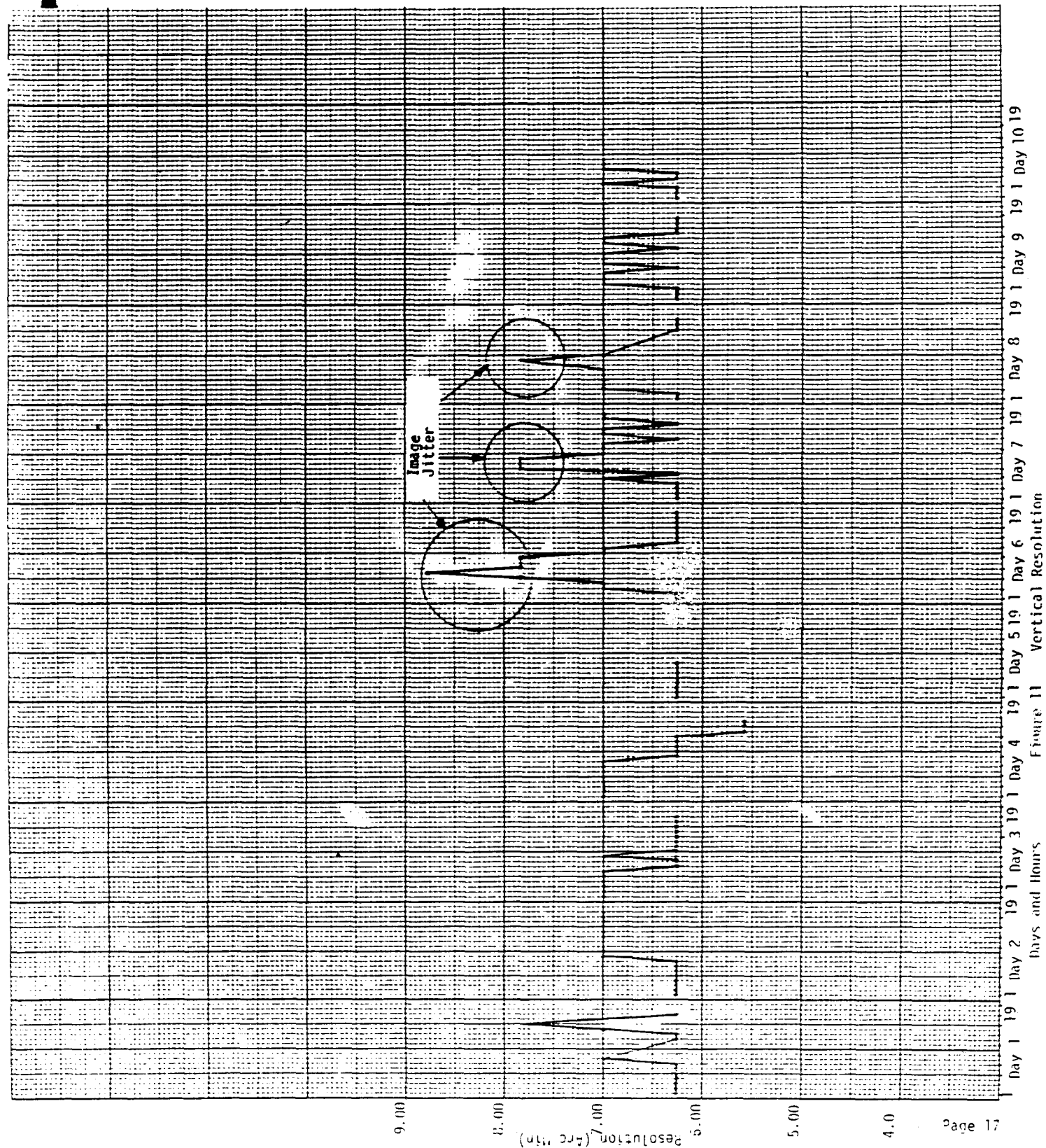
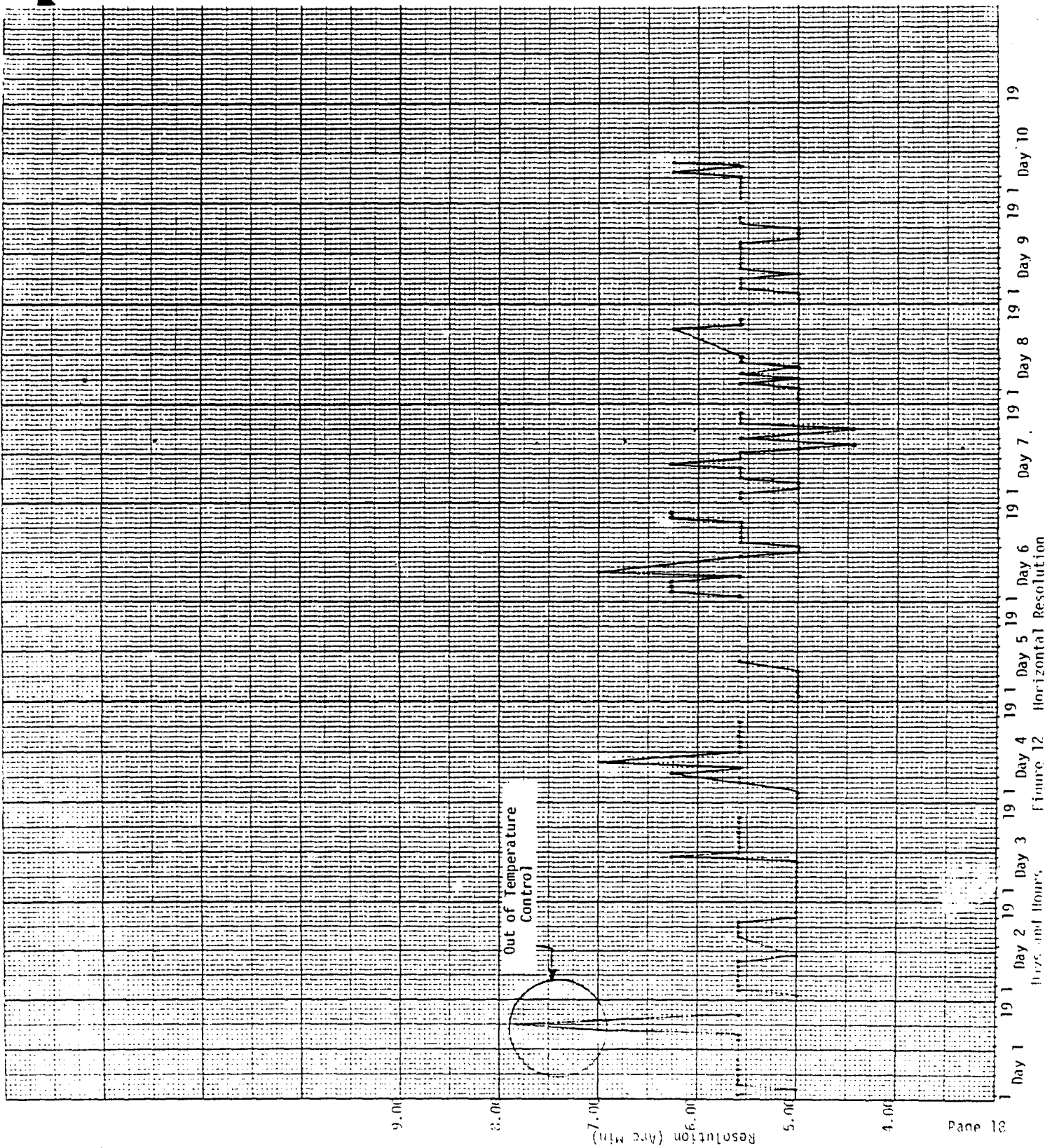


Figure 11 Vertical Resolution

Days and Hours



Laser power output (see Figures 3, 4, and 5) was very good except when attributable to equipment failure. The Lexel Krypton laser, which was last aligned in June of 1980 during factory refurbishment, exhibited some graceful degradation in output. Re-alignment of the laser, on the final day of test, was the only laser power adjustment of the entire assessment other than during the fault isolation and replacement of the Spectra-Physics Argon laser.

Note that the yellow dye laser is "pumped" by a portion of the Argon laser output and is therefore dependant. The dye laser output, Figure 7, is influenced by table alignment and the power outputs of the Argon laser, Figure 5. The dye laser output correlates with the output levels of the Argon laser as can be seen in the Figures.

Video levels, Figures 8, 9, and 10, were also generally good, but exhibited more drift than any of the other parameters monitored. In reviewing this data, it should be noted that the electronics were not gain stabilized, a deficiency corrected in the proposed final design.

The nominal video output is 0.7 ± 0.1 volts. The green video level fell within the desired range approximately 80% of the time. Red video level was within the desired range approximately 90% of the time, and the blue was within limits 85% of the time.

Video level is impacted by laser output, optical path alignment (in particular the top periscope mirror, and PMT pre-amplifier gain). The catastrophic failure of the Argon laser is apparent in the graphs. Routine restoration of video levels was accomplished by adjustment/alignment of the following:

- PMT Pre-amplifier gain

- Blue-Green-Yellow Dichroic mirrors (laser table)

- Top Periscope mirror (optical input to scanner)

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The top periscope mirror was the most critical, both in terms of the frequency of adjustment and the impact upon video output. Beam displacements attributable to alignment shifts of this mirror, through vibration or temperature effects, was addressed in the breadboard design. A beam angle servo design exists in the scanner support optics. Mechanical design deficiencies and dead zone characteristics of the photo sensor utilized limit the effectiveness of the system to low frequency, large amplitude alignment shifts. A candidate photo sensor with significantly better resolution is under study for application in the final design. The improved sensor and improvements in mechanical design are expected to provide a much improved beam angle servo system and improved video level stability.

Resolution throughout the assessment was good. Horizontal resolution in particular was consistently 7.0 arc minutes or better. Vertical resolution was less stable, but was generally 7.0 arc minutes. Resolution of less than 7.0 arc minutes was experienced for 11 hours of operation, with a worst case of 8.77 arc minute resolution.

The performance described above was accomplished primarily in a "hands-off" mode. The plan was to make adjustments as needed after 8 operational hours (even days) or 16 operational (odd days). This procedure was adhered to except when unscheduled maintenance due to equipment failure or serious performance degradation made continued operation impractical. Such unscheduled maintenance was discouraged to provide as much information as possible on the stability of the system. It is significant, however, in assessing the impact of the

LSIG

data upon the availability potential of the final design, to consider that most adjustments to improve performance could have been accomplished on-line, without interrupting operation.

Specific maintenance actions and frequency of maintenance are discussed in Section 5.3 Parametric Estimates of this report.

5.2 Critical Failure Modes

Five hardware problems were experienced during the assessment. These problems are summarized below:

- Spinner electronics (intermittent)
- Spinner air supply (facility)
- Argon laser power supply relay
- Argon laser rear cavity mirror
- Argon laser plasma tube

5.2.1 Spinner Electronics Intermittent

An intermittent associated with circuit card 220 caused a loss of spinner synchronization and resulting automatic shut down of the spinner. Attempts to resolve this problem during the assessment, including replacement of the connector, were not completely successful and a spare card was not available. Subsequently, a poor solder joint at a potentiometer was located and corrected. Although a total of 16 such dropouts occurred, all occurred within the first 4 days of test, including 4 in a 15 minute period. This problem is believed to be caused by the poor solder joint on the circuitry of the breadboard Speedring 220 card. This particular problem is a classical electronic equipment problem, and is not unique to the LSIG design concept. It is believed that the production version of these electronics, will effectively minimize such occurrences. (It should also be noted that the spinner protective circuitry operated as intended - it consistently sensed the problem and shut the spinner down).

5.2.2 Spinner Air Supply

During the final day of test, the external air compressor which supplies air to the spinner assembly failed. The loss of pressure was sensed and the system safely shut itself down.

The pump is an oil-less design, and it is suspected that the teflon rings in the pump wore out. The system has been in service for approximately three years. Failure analysis of the pump has not been completed, but the failure is not uncharacteristic of teflon rings. The failure is within the compressor and is of the type expected of this class of electro-mechanical equipment. The mode of failure is absolutely unrelated to its application on the LSIG.

Repair of the pump in a brief period was not feasible, so the spinner was operated using Nitrogen gas as the bearing instead of air. System operation is not degraded using Nitrogen, indeed Nitrogen offers superior dryness and cleanliness with respect to air. Operation of the system using Nitrogen is constrained only by the supply and spinner consumption rate of 125 cubic feet per hour at 165 PSI.

5.2.3 Argon Laser

The Argon laser proved to be the most troublesome component of the entire system. After operating for approximately 1200 hours (including two days of the assessment period) the laser output fell below the 4 watts required. Inspection of the rear cavity mirror revealed a small spot, believed to be a burn at the beam impact area. Cleaning the mirror and rotating the burn spot out of the beam impact area was not successful. Laser alignment and increasing plasma tube current from 30.5 to 33.5 amperes produced 4 watts maximum (laser rated at 5 watts). The laser operated for approximately 15 hours without further incident. The following mornings, laser power at turn-on was 3.1 watts. The rear cavity mirror was replaced, a capacitor in the power supply replaced (at the suggestion of Spectra-Physics) and the laser realigned. Maximum power output attainable was 3.9 watts at a current of 36 amperes. Operation commenced at that level and continued for approximately 12 hours at which time the laser failed completely. Unavailability of a replacement precluded operation the following day, Friday December 5, 1980.

Spectra-Physics personnel replaced the plasma tube Saturday afternoon. A relay in the power supply, which had not failed, but which was considered marginal, was also replaced and the system was powered up and aligned to specification and shut down for the weekend.

The system operated very well for the following two days of test. On Wednesday, video levels degraded and could not be restored through optical path alignment or video amplifier gain adjustment.

It was observed that low gas pressure alarm in the Argon laser supply was activated. The gas pressure in the plasma tube was increased to the proper level via the key operated pressurization system in the supply. An automatic tube pressure monitor prevents overfilling. Operation of the laser at rated power was immediately restored.

Investigation of these events yielded the following:

- (1) Because of the deterioration of the plasma tube and the ineffectiveness of the rear cavity mirror replacement upon the laser output, it is uncertain that the original mirror failed. A minute spot, suspected as caused by a dust particle incinerated by the laser beam on the mirror surface was observed, but not confirmed as adversely effecting operation.
- (2) Preliminary analysis by Spectra Physics indicates the pressure of the argon gas in the plasma tube was too high. The increased pressure requires a supply voltage in excess of that attainable with the breadboard system. Cause of the increased pressure has not been confirmed, but the failure investigation is centering upon the solenoid operated gas fill valve. Spectra-Physics has recorded previous fill valve failures but such failures are infrequent (less than 1% of field returns) and are not considered to be a problem with this design.
- (3) The need to raise the internal pressure of the noble gas within the plasma tube is a result of entrapment of some of the gas in the walls of the bore in operation. This phenomenon is well understood and the gas reservoir and filling provisions of the laser supply are incorporated to ensure an adequate supply of gas for 5000 to 10,000 hours of operation.

5.3 Parametric Estimates

The breadboard LSIG is essentially a development system, intended to prove viability of the design concept.

Significant design differences exist between the breadboard and the proposed production system. Such differences as a single gas laser instead of the two in use on the breadboard, improvements in the laser table configuration with improved thermal stability error detection and improved alignment capabilities, beam angle servo compensation, etc., are discussed in detail in the Engineering Report prepared by Link. These differences, and the comparatively short duration of the assessment, precludes drawing any strong conclusions regarding either the quantitative reliability and maintainability characteristics of key components (such as the plasma tube) or the production configuration of the LSIG itself. Despite such differences, sufficient conceptual and hardware similarities exist to generate considerable interest in those parameters impacting operational readiness and logistic resources. Accordingly, estimates of several parameters have been developed.

<u>Parameter</u>	<u>Estimated Value</u>
Power-on hours ¹	
Breadboard LSIG System	283
Spinner Assembly	320
Argon Laser	297
Krypton Laser	316
Dye Laser	318
Operational Availability ²	72%
Scheduled Hours	160
Operational Hours	115.5
Unscheduled Maintenance Actions ³	27 (9)

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<u>Parameter</u>	<u>Estimated Value</u>
Mean-Time-Between-Maintenance ⁴	4.25 (10.5) hours
Mean-Time-Between-Failure ⁵	
Breadboard LSIG System	14 (94) hours
Spinner Assembly	18.8 (160) hours
Argon Laser	99 (297) hours
Krypton Laser	316 hours
Dye Laser	318 hours
Mean-Time-To-Repair	2 - 4 hours typical
Frequent Adjustments/Alignments	
Top Periscope Mirror	
Laser Table Dichroic Mirror	
PMT Pre-amplifier Gain	
Laser Table Beam Pointing Mirror	
Typical Alignment Time (System)	60 minutes

1. Includes 172 hours on the lasers and 165.45 hours on the spinner assembly during the period October 9th through November 11th. No failures occurred.
2. Assumes a hypothetical schedule of 16 hours/day commencing at 0700. Delays in commencing operation were treated as lost time. Computed as the ratio of achieved operation to scheduled operation. Includes logistic delay time (no spares available at Librascope).
3. Parenthetic figure excludes spinner dropouts to illustrate significant impact this one problem had on calculations.
4. Includes scheduled adjustments and alignments. Parenthetic figure excludes spinner dropouts.
5. Parenthetical figures consider the spinner electronics intermittent as one equipment problem, and exclude the argon laser power supply relay and rear cavity mirror replacements on the premise that the cause of failure was the plasma tube fill valve, not these items.

6.0 Conclusions

During the assessment period, there were numerous maintenance actions. The nature and frequency of these actions produced an initial disappointment in the system's performance. It soon became apparent, however, that the majority of these maintenance actions were associated with design limitations of the breadboard and its support facilities. In this regard, the lessons learned from the breadboard have been very beneficial and will continue to influence the design of the production system. Specific design areas which require improvement follow:

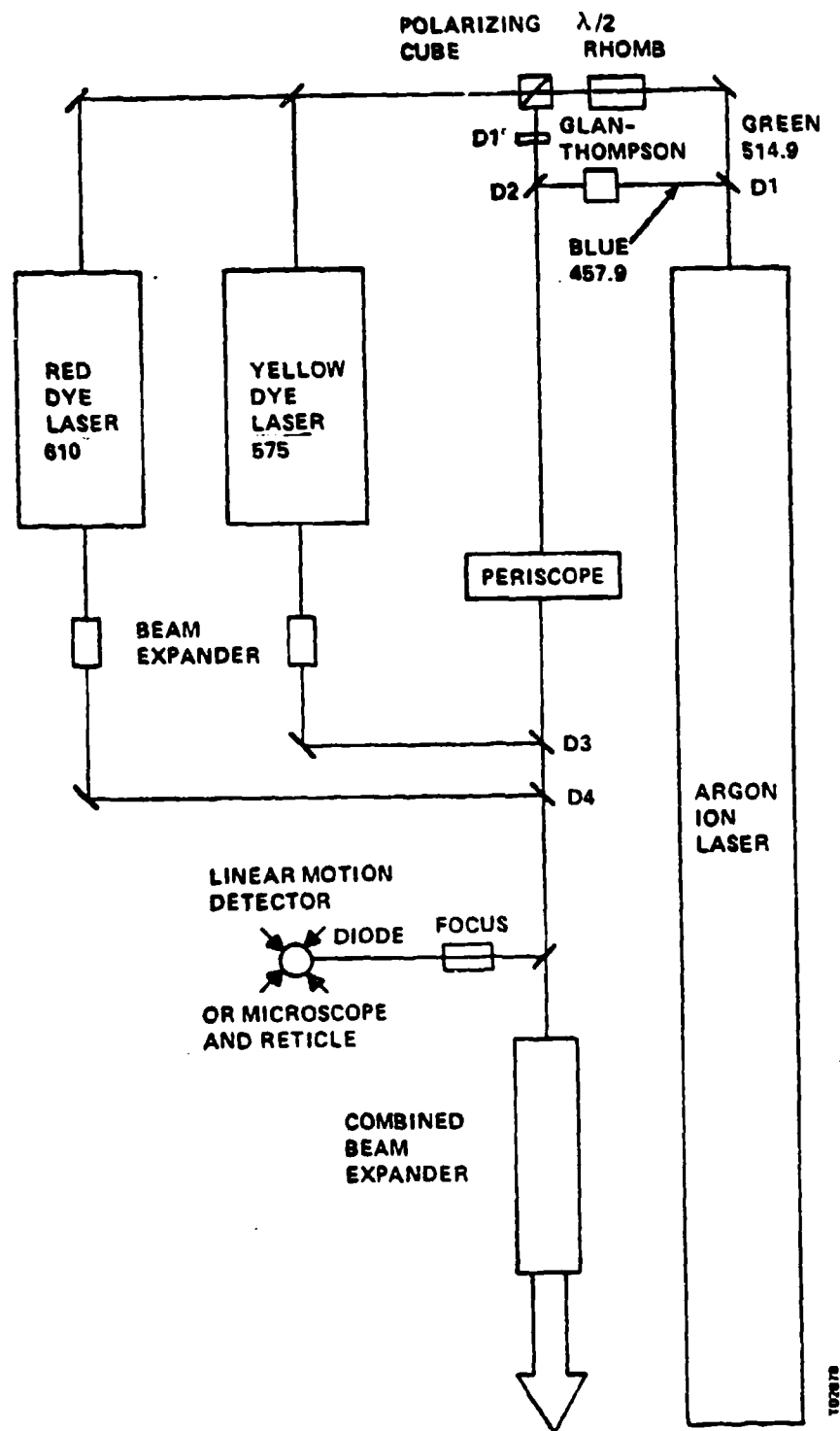
- (1) Beam stability. The laser table, and optical path stability, should be improved through better matching of thermal coefficients. An improved beam angle servo is needed to provide automatic error correction.
- (2) PMT pre-amplifier gain. Automatic gain control is necessary. This feature has been incorporated in the production design.
- (3) Fault Isolation/alignment. The existing breadboard table has rudimentary alignment provisions and reference points. Extended maintenance times resulted from the inadequate provisions for alignment. Additional delays were frequently introduced because of the absence of reference points to aid fault isolation. Corrective action was based upon technician experience and trial and error. Improvements must be incorporated to facilitate maintenance by less highly skilled personnel and to reduce alignment times.
- (4) System Dependability. A better understanding of the effect of power-off periods on the optical path alignment is required. Cause of morning start-up problems

must be identified and incorporated in the design.

- (5) Supporting facilities. It is very apparent that control of the laser table environment cannot be treated lightly. The production design must carefully address temperature control, air cleanliness and water temperature, cleanliness and flow rate.
- (6) Spinner Electronics. The breadboard electronics packaging should be ruggedized. The card bin support structure does not provide sufficient card support, and is not acceptable for installation on the Y tower.

The preceding design concerns are solvable and are not in conflict with the basic design approach. Indeed, the proposed production design has addressed these concerns. Figure 13 depicts the production laser table configuration. The table provides the following advantages with respect to the breadboard:

- (1) Improved reliability - one gas laser and two dye lasers offer inherent advantages with respect to the breadboard configuration of two gas lasers and one dye laser. The more efficient optical design also permits operation of the laser at power levels well below those of the breadboard. The derating permitted by these low power requirements provide a potential for extended laser life.
- (2) Fault Isolation/alignment - provisions to monitor the beam alignment have been incorporated (re: Figure 13 - linear motion detector or microscope and reticle). Alignment of each color beam is individually adjustable via



PROPOSED LASER TABLE CONFIGURATION

FIGURE 13

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beam splitter (Green via D1, Blue via D2, Yellow via D3, and Red via D4).

Other production system improvements include improved beam stability. The laser table itself is designed to be more thermally stable, and the beams are combined before expansion. This latter technique significantly reduces performance degradation resulting from beam drift. Additionally, a beam angle servo has been included at the spinner input, and is an improved version of the breadboard design. Figure 14 illustrates the proposed servo design. (A lateral servo is also under consideration, and will be added, if necessary, at the laser table output).

PMT pre-amplifiers will provide automatic gain control circuitry. The drift experienced on the breadboard system from this source will therefore be eliminated. The PMT banks will also include built-in test circuitry which will permit rapid monitoring of each individual PMT on a daily basis via switches and LED displays.

These improvements are indicative of how the design concerns of the breadboard LSIG have been addressed in the production design.

It is significant that the breadboard, despite its deficiencies, confirmed that 16 hour per day operation with good visual performance is feasible. With its improvements, the production design has the potential for excellent operational readiness.

No conclusion relative to laser life is possible. Previous projections of laser life can neither be confirmed nor refuted. Further evaluation of life data and failure mechanisms is necessary. However, data from the manufacturer, including failure mode information,

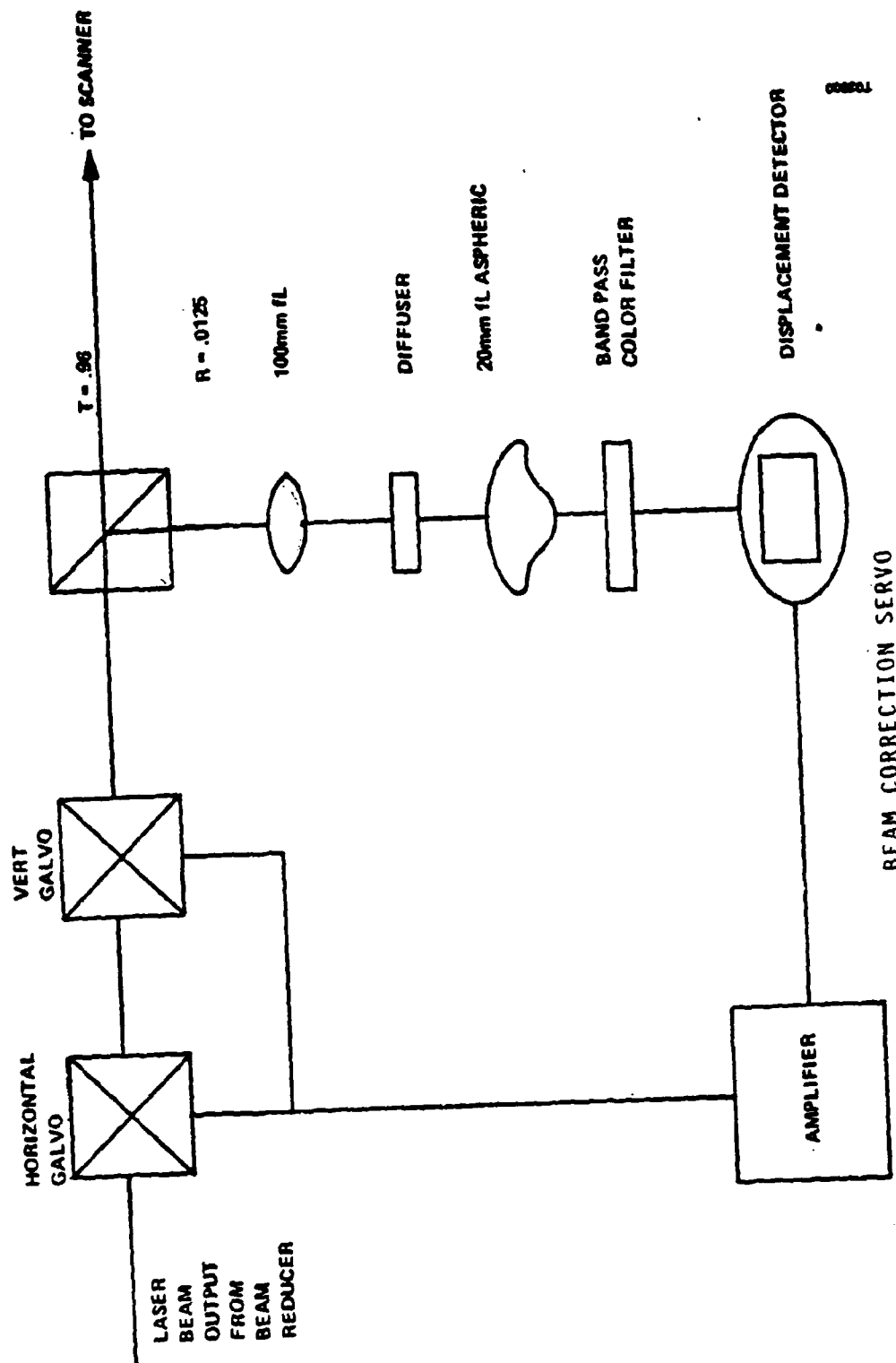


FIGURE 14

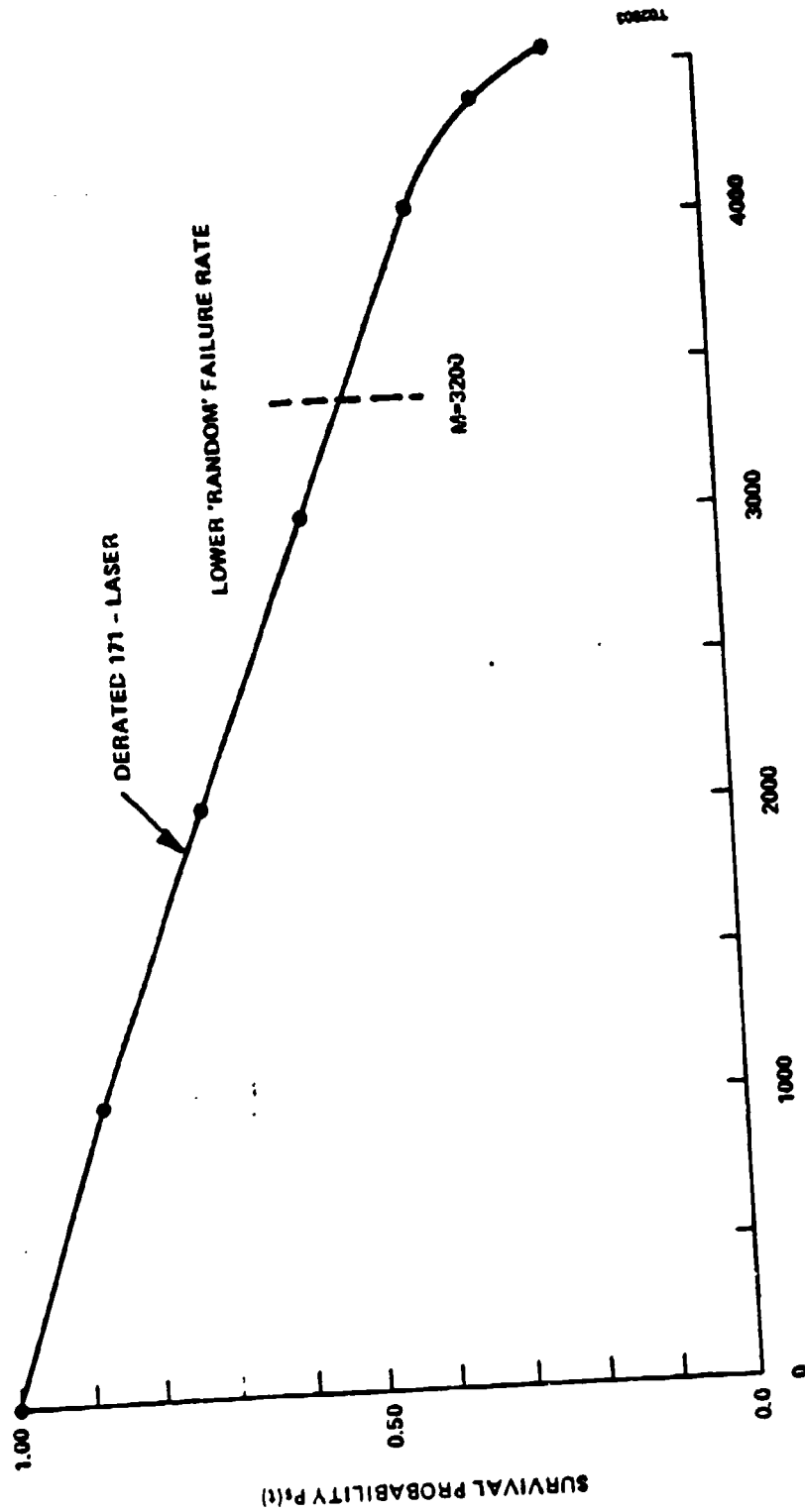
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indicates a life of 3000-4000 hours in the LSIG application environment to be a realistic expectation. The manufacturer of the laser, Spectra-Physics, has, after reviewing the LSIG application, extended the warranty to 2000 hours. the price of the unit, including extended warranty, is therefore based upon a single plasma tube with an expected mean life of greater than 2000 hours. Figure 15 depicts survival probability (life) as a function of operating time. Laser life is addressed in more detail in the engineering report.

The impact of the LSIG upon the overall 2B33 visual system reliability and maintainability cannot be quantified on the basis of this assessment data. The design differences between the breadboard and production design and the brief evaluation period prevent direct extrapolation of assessment data to the 2B33 LSIG. Predicted data using classical reliability procedures are considered a best estimate, particularly for comparison purposes. The prediction for the 2B33 CMS visual system* was updated to reflect the LSIG configuration as defined in the engineering report. This analysis has been completed and the following table summarizes the reliability and maintainability parameters obtained in addition to comparing corresponding subsystems of each configuration from a reliability/maintainability viewpoint:

* Reference Maintainability Status Report 2B33-3.19, 20 July 1979.

REASONABLE EXPECTATION - NEAR TERM



HOURS OF OPERATION,
LASER LIFE EXPECTANCY

FIGURE 15

LSIG

	CMS System		LSIG System	
	$\lambda/10^6$ hrs	MTTR	$\lambda/10^6$ hrs	MTTR
Probe Installation	382	(45)	382	(46)
Image Generation	2942	(46)	1894	(50)
Model Installation	2455	(40)	2105	(40)
Switching/Weapons Effects	1217	(40)	1217	(40)
Display Installation	2264	(42)	2264	(42)
Cables/Miscellaneous	235	(45)	235	(45)
Linkage	745	(40)	745	(40)
λ	10240		8842	
MTBF	97.6		113.1	
MTTR	42.5		43	

These updated classical predictions reflect a 15.8 percent improvement in reliability using the LSIG in lieu of the Camera Image Generator Hardware. It should be noted that in both CMS and LSIG analyses, light bank and PMT bank reliability and maintainability parameters were excluded from the calculations. In the case of the LSIG system, Link Reliability Engineering chose to exclude the associated failure rate λ for the following reasons:

- The probability of having no PMT site failures during a 16 hour training day is 97.8%.
- The shadowing effect of failure of a single PMT site does not significantly degrade the system. (Re: discussion of this topic in the engineering report). The probability of having less than two PMT site failures is 99.954%.
- The probability of having two adjacent PMT site failures (which would cause objectionable degradation) is 4.839×10^{-8} .

LSIG

Since the probability of having two adjacent complete site failures (thus affecting a training mission) is so minute, the R/M values associated with the PMT bank were excluded from the classical analyses. Failed PMT hardware would be replaced on an "as needed" basis during the daily preventive maintenance period. All previous R/M analyses of the CMS system treated the light bank in the same manner.

The LSIG system also incorporates an Automatic Image Correlation System which has no counterpart in the CMS system. This system is described in detail in the engineering report, and is illustrated conceptually in Figure 16. Fiber optics with PIN diode sensors imbedded in the model board provide inputs to electronics which give active feedback for probe heading, pitch, and roll angles near airfields, target ranges and other designated areas. The system utilizes approximately 200 diode amplifier cards and associated electronics. The system has an MTBF of approximately 9000 hours, and when integrated into the 2B33 visual system with LSIG, results in a system MTBF of 100.3 hours. The overall MTBF, including the image correlation hardware, is 2.7% better than the CMS system without image correlation. In this instance, reliability was traded-off for improved maintainability and system performance. The image correlation system, in addition to improving visual performance in such areas as weapons effects, significantly reduces probe alignments, a frequent and time consuming task on the existing CMS design.

It is important to note that classical reliability analyses address catastrophic part failures only, and that other events such as wear out, drift, secondary failures, and maintenance induced errors result in a frequency of maintenance actions much higher than suggested by MTBF figures. The CMS for example, because of drift, requires

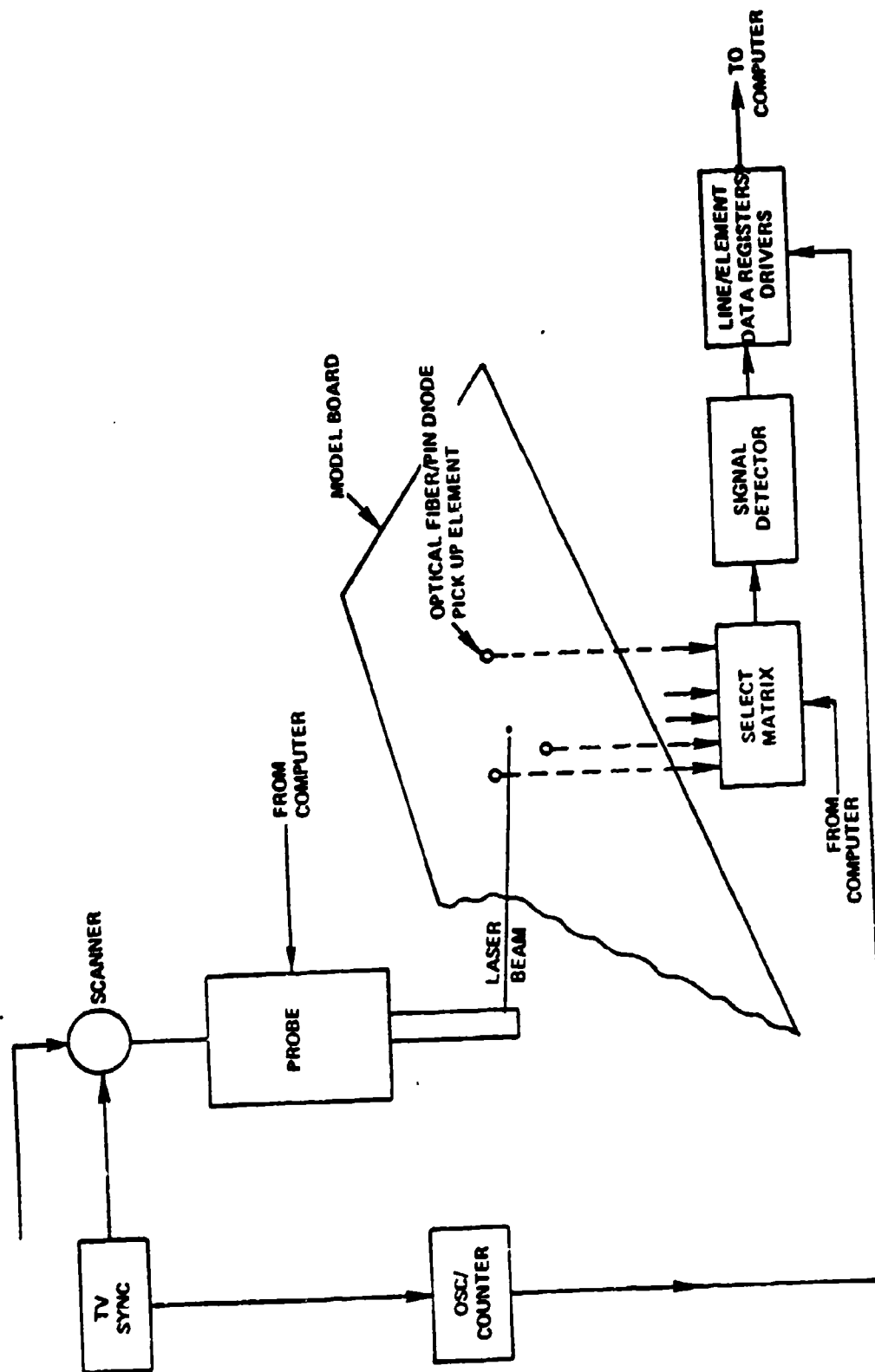


IMAGE CORRELATION SYSTEM BLOCK DIAGRAM

Figure 16

LSIG

frequent adjustment and is, per OT&E data, exhibiting a mean time between maintenance actions of 3-4 hours. In this regard, the LSIG offers significant potential for improvement. The breadboard, despite its maintenance liabilities, exhibited a MTBM greater than 4 hours, and the improvements of the production design suggest a MTBM of 10 hours is feasible. Factors contributing to the reduced requirement for maintenance include:

- a) Elimination of the hostile thermal environment including gradients over the model board, by eliminating the light bank.
- b) Elimination of the camera and camera electronics. This equipment exhibits an inherent sensitivity to thermal effects significantly higher than that of the scanner electronics.
- c) Provisions for automatic drift compensation via PMT amplifier AGC, beam position servo(s), and probe-image correlation. The latter feature eliminates one of the more frequent and time consuming probe alignment tasks of the CMS design.

The LSIG design is superior from a maintainability viewpoint to the CMS. Although statistical estimates of MTTR indicate no drastic difference between the two competing designs, the limitations of the analysis procedure (catastrophic failure only) understate the true maintainability advantages of the LSIG design. MTTR may in fact, not change significantly because of the much greater influence on that parameter of the non-image generator equipment, i.e., the image generator comprises approximately 20% of the total system hardware.

LSIG

Maintenance manhours per operational hour and MTBM will be lower with the LSIG design than the CMS design.

Quantitative goals of 300 hours MTBF and 30 minutes MTTR were established for the LSIG. The proceeding discussion confirms that significant improvements in these parameters compared to the CMS have been attained, although the established goals were not. It should be noted, in assessing these parameters, that the image generation portion of the visual system represents approximately 20% of the total system, and that even if it were perfect, i.e., never failed, the total system MTBF and MTTR would not attain the design goals established.

The proposed LSIG design does offer the following:

- a) improved visual performance
- b) lower cost of ownership
- c) increased reliability
- d) lower frequency of maintenance
- e) reduced alignment time

The transition from breadboard to production LSIG is a significant one. The engineering report and this document have addressed the technical objectives which must be accomplished in the production design. From a reliability and maintainability point of view, the objectives appear attainable with the proposed design.

Appendix A

RELIABILITY AND MAINTAINABILITY
ASSESSMENT PROCEDURE

SINGER
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PROCEDURE FOR

12 DAY RELIABILITY & MAINTAINABILITY (RAM) TEST

LASER SCANNER IMAGE GENERATOR
PRODUCT DEVELOPMENT PROGRAM

[illegible]

DATE	SINGER LINK DIVISION BINGHAMTON, NEW YORK	PAGE NO. 1
REV.		REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

TABLE OF CONTENTS

	<u>PAGE NO.</u>
1. SCOPE AND PURPOSE	1
2. APPLICABLE DOCUMENTS	1
3. BREADBOARD SYSTEM CONFIGURATION	2
4. DAILY PROCEDURES	2
4.1 Turn-on and Warm-up	2
4.2 Morning Readiness Procedures	5
4.3 Odd Day Procedure	6
4.4 Even Day Procedure	8
4.5 Shut-Down	8
5. TESTS	10
5.1 "Light" Box Set-up	10
5.2 Power Output Level	14
5.3 Video and Pedestal Levels	19
5.4 Centering and Size	21
5.5 Color Registration	23
5.6 System Resolution	26
6. DAILY TEST RESULTS TABLES	28
6.1 Odd Day Table	29
6.2 Even Day Table	32

FIGURES

FIGURE 3.-1	Breadboard System Block Diagram	3
FIGURE 3.-2	Breadboard Laser Table	4
FIGURE 4.3-1	Odd Day Procedure	7
FIGURE 4.4-1	Even Day Procedure	9
FIGURE 5.1-1	Test Chart	11

DATE 11-26-80

SINGER
LINK DIVISION

PAGE NO. 11

REV. A

BINGHAMTON, NEW YORK

REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

REVISIONS

Revision A

Changed pages 5, 10, 14, 15, 16, 17, 18, 19, 20, 21, 22, 29, 30

31, 32, 33, and 34.

Added page 11.

DATE	SINGER LINK DIVISION BINGHAMTON, NEW YORK	PAGE NO. 1
REV.		REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

1. SCOPE AND PURPOSE

This document describes the test procedure to be followed in conducting the 12-Day Reliability and Maintainability (RAM) Test on the LSIG demonstration hardware as required under the LSIG Development contract. The purpose of the test is to collect the necessary RAM data on the laser breadboard hardware under controlled operational conditions such that a RAM assessment can be made on the proposed final LSIG system design. Data collected during the 12 day period will supplement the reliability statistics from vendors of critical components, as well as RAM data collected on the breadboard system throughout the LSIG Development Program. Reliability and Maintainability predictions on the full-scale LSIG visual system will be made in analyzing such data, in conjunction with engineering analysis on the RAM aspects of the final design. Existing RAM data on system components common to both the camera-model system (CMS) and the laser scanner image generator (LSIG) will be used as much as possible. Sections 4 through 6 in this document details the daily tests. In addition, a maintenance log will be kept to record all scheduled and unscheduled alignment and repair performed during the test period.

2. APPLICABLE DOCUMENTS

- a) Change Order No. P00023 to NAVTRAEQUIPCEN Contract N61339-74-C-0039.
- b) "Technical Proposal for Laser Scanner Image Generation System Development Program", No. 1168, by Link, 7 March 1980.
- c) "Specification for AH-IS (Cobra) Flight Simulator Device 2B33", 222-1183, by NTEC, 5 November 1979.
- d) "Laser Scanner Image Generation System Study Final Report", LR979 by Link, Revised 28 November 1979.
- e) "RAM Assessment Daily Test Procedures for Librascope - LSIG Product Development Program", by Link, 22 August 1980.

DATE	SINGER LINK DIVISION BINGHAMTON, NEW YORK	PAGE NO. 2
REV.		REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

3. BREADBOARD SYSTEM CONFIGURATION

The breadboard system configuration is shown by the Block Diagram (Figure 3.-1) and by the Laser Table Schematic (Figure 3.-2).

4. DAILY PROCEDURES

The daily procedures to be followed are described in the sequence below. There will be 5 days (16 hr/day) of testing followed by one or two days off and then another 5 days (16 hr/day) of testing. The first day of testing shall be numbered day number 1 and each of the remaining test days shall receive a number in sequence. On odd numbered days the procedure in section 4.3 shall be run after turn-on and the morning readiness procedure have been completed. On even numbered days the procedure in section 4.4 shall be run. These procedures may be modified, if necessary, on site (with both Government and Link concurrence) if the data generated at the beginning of the 12-day period indicated that a change to the procedures would generate more useful data to correlate with the actual operation of the intended simulator (production 2B33).

4.1 Turn-on and Warm-up

Turn the system on first thing in the morning and let it warm-up for 30 minutes. This warm-up time shall not count as part of the 16 hour day.

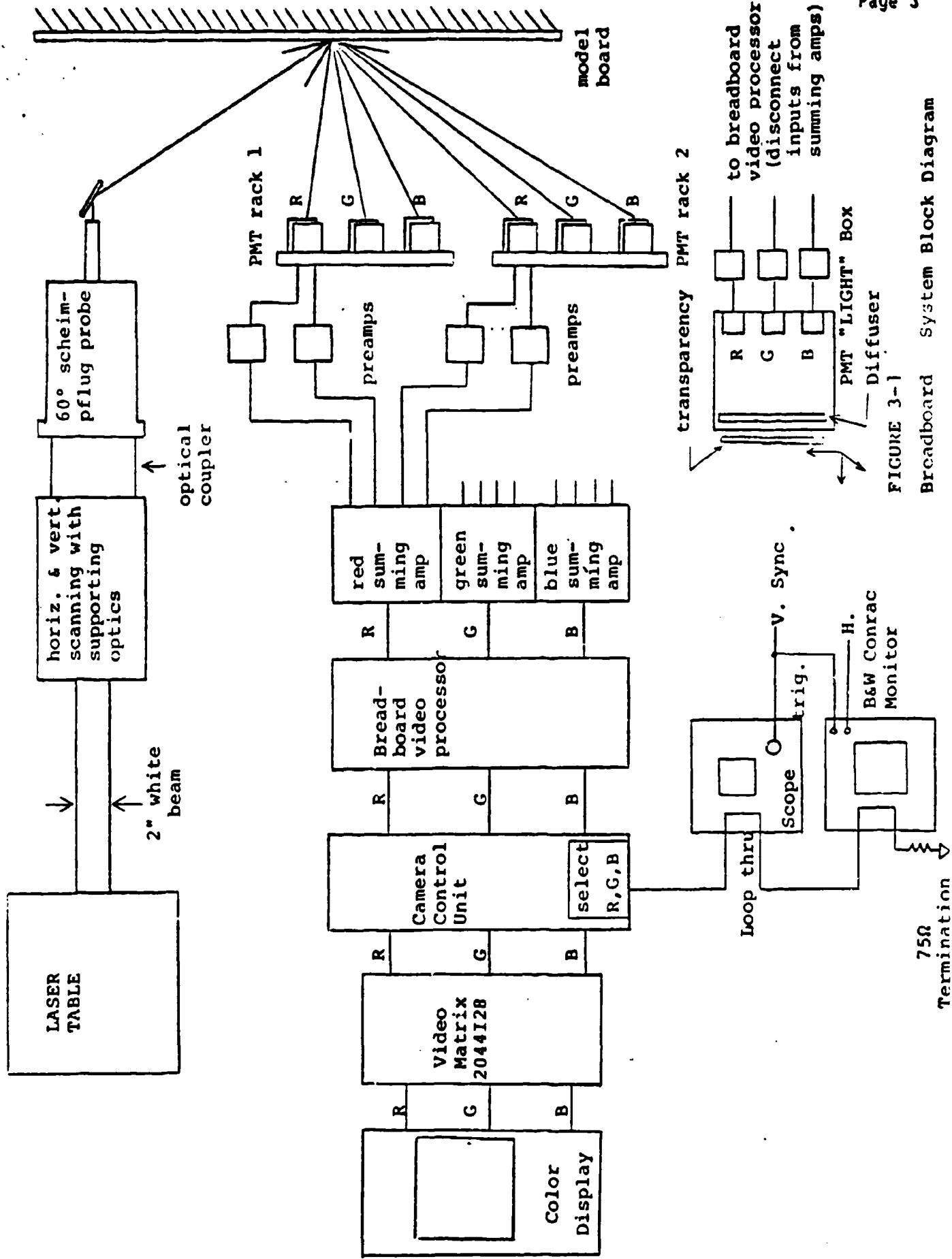
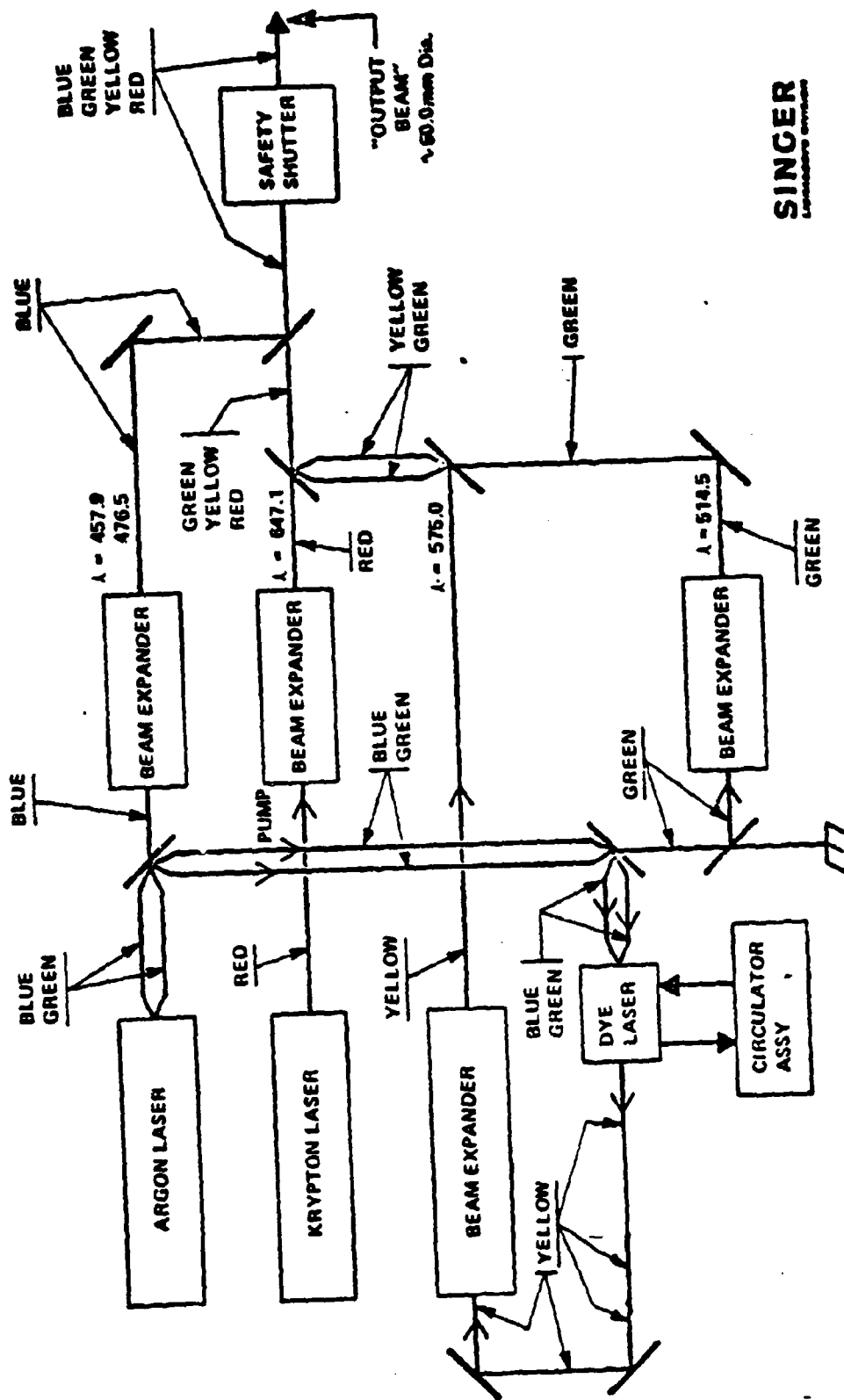


FIGURE 3-1

Breadboard System Block Diagram



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FIGURE 3.-2 BREADBOARD LASER TABLE

DATE 11-26-80

SINGER
LINK DIVISION

PAGE NO. 5

REV. A

BINGHAMTON, NEW YORK

REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

4.2 Morning Readiness Procedures

The following morning readiness procedures shall be performed sequentially after the 30 minute warm-up period and before the start of each day's tests:

- a) Adjust, if necessary, the Argon and Krypton laser controller currents to yield the rated power output, as read on the controller's internal optical wattmeters in the case of the Argon laser and on an external optical wattmeter placed at the laser output in the case of the Krypton laser. Then adjust, if necessary, the dye laser for the rated power level measured at the output of the dye laser using an external optical wattmeter placed on the laser table. All three lasers should be kept in the TEM₀₀ mode during these adjustments.
- b) Check the sizing, centering and convergence of the color monitor paying particular attention to the convergence in the center of the CRT. Adjust if necessary.
- c) Register the 4 laser beams together by adjusting the appropriate optical components on the laser table, if necessary.
- d) Focus the 4 laser beams together by adjusting the beam expanders on the laser table, if necessary. This may affect registration - alternately adjust registration and focus until both are correct.
- e) Adjust, if necessary, the PMT high voltage to yield a white signal level of 0.7 V in the red channel at the output of the bread-board video processor. Then adjust the blue and green gain of the Light Box preamps to yield a white signal level of 0.7 V in the blue and green outputs.
- f) Check the vertical galvo deflection angle and centering. Adjust if necessary.

The time to perform these morning readiness procedures shall be counted as part of the 16 hour day.

DATE	SINGER LINK DIVISION BINGHAMTON, NEW YORK	PAGE NO. 6
REV.		REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

4.3 Odd Day Procedure

Figure 4.3-1 shows the procedure to be followed on odd days. The intent of this procedure is to demonstrate reliability and maintainability over a 16 hour period and to determine the performance level of the system over a 16 hour period without any adjustments.

Therefore, do not make any adjustments to simply improve performance. The only adjustments allowed (other than probe servos) are those necessary to keep the system operational and these shall be recorded in Table 6-1 along with any failures that might occur. Adjusting of the probe in heading, pitch, roll and focus is allowed each time a test is run because the intent of this procedure is to determine performance of the laser system and not the performance of an existing piece of equipment (optical probe). Reliability data on the optical probe gathered on existing operational simulators will be used in the RAM analysis. The results of the hourly tests shall be recorded in Table 6-1. The tests referred to in Table 4.3-1 are described in section 5.

DATE	SINGER LINK DIVISION BINGHAMTON, NEW YORK	PAGE NO. 7
REV.		REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

HOURL NO.

30 minute warm-up

- 1- a. Perform morning readiness procedure
b. Perform tests 5.2 thru 5.6

- 2- Test 5.6
- 3- Tests 5.6, 5.2, 5.3
- 4- Test 5.6
- 5- Tests 5.6, 5.2, 5.3, 5.4, 5.5
- 6- Test 5.6
- 7- Tests 5.6, 5.2, 5.3
- 8- Test 5.6
- 9- Tests 5.6, 5.2, 5.3, 5.4, 5.5
- 10- Test 5.6
- 11- Tests 5.6, 5.2, 5.3
- 12- Test 5.6
- 13- Tests 5.6, 5.2, 5.3, 5.4, 5.5
- 14- Test 5.6
- 15- Tests 5.6, 5.2, 5.3

- 16- a. Perform Tests 5.6, 5.2, 5.3, 5.4, 5.5
b. Record any adjustments necessary to return system to max. performance using morning readiness procedure.
c. Repeat tests 5.6, 5.2, 5.3, 5.4, 5.5
d. Shut-down at end of Hour No. 16

17-

KEY:

5.2 Power Output
5.3 Video and Pedestal
5.4 Centering and Size
5.5 Color Registration
5.6 System Resolution

FIGURE 4.3-1 ODD DAY PROCEDURE

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

4.4 Even Day Procedure

Figure 4.4-1 shows the procedure to be followed on even days. The intent of this procedure is to demonstrate reliability and maintainability over a 16 hour period and to determine the performance level of the system over a 16 hour period with one adjustment period allowed after 8 hours - i.e., the end of the first 8 hour shift during a simulator's 16 hour training period.

Therefore, the adjustments allowed to simply improve performance are to be made only at the designated adjustment period. The only other adjustments allowed (besides probe servos) are those necessary to keep the system operational and these shall be recorded in Table 6-2 along with any failures that might occur. Adjusting of the probe in heading, pitch, roll and focus is allowed each time a test is run because the intent of this procedure is to determine performance of the laser system and not the performance of an existing piece of equipment (optical probe). Reliability data on the optical probe gathered on existing operational simulators will be used in the RAM analysis.

The results of the hourly tests shall be recorded in Table 6-2. The tests referred to in Table 4.4-1 are described in Section 5.

4.5 Shut-Down

Shut the system off during hours outside of the warm-up and operational test periods indicated above.

DATE

SINGER

LINK DIVISION

PAGE NO. 9

REV.

BINGHAMTON, NEW YORK

REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

HOUR NO.

30 minute warm-up

- 1- a. Perform morning readiness
b. Perform tests 5.2 thru 5.6

2- Test 5.6

3- Tests 5.6, 5.2, 5.3

4- Test 5.6

5- Tests 5.6, 5.2, 5.3, 5.4, 5.5

6- Test 5.6

7- Tests 5.6, 5.2, 5.3

8- Test 5.6

KEY:

5.2 Power Output
5.3 Video and Pedestal
5.4 Centering and Size
5.5 Color Registration
5.6 System Resolution

- 9- a. Perform tests 5.6, 5.2, 5.3, 5.4, 5.5
b. Then record any adjustments necessary to return system to maximum performance using morning readiness procedure.
c. Repeat tests 5.6, 5.2, 5.3, 5.4, 5.5

10- Test 5.6

11- Tests 5.6, 5.2, 5.3

12- Test 5.6

13- Tests 5.6, 5.2, 5.3, 5.4, 5.5

14- Test 5.6

15- Tests 5.6, 5.2, 5.3

- 16- a. Perform tests 5.6, 5.2, 5.3, 5.4, 5.5
b. Then record any adjustments necessary to return system to max. performance using morning readiness procedure.
c. Repeat tests 5.6, 5.2, 5.3, 5.4, 5.5
d. Shut down at end of Hour No. 16

17-

FIGURE 4.4-1 EVEN DAY PROCEDURE

DATE 11-26-80

SINGER
LINK DIVISION

PAGE NO. 10

REV. A

BINGHAMTON, NEW YORK

REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

5. TESTS

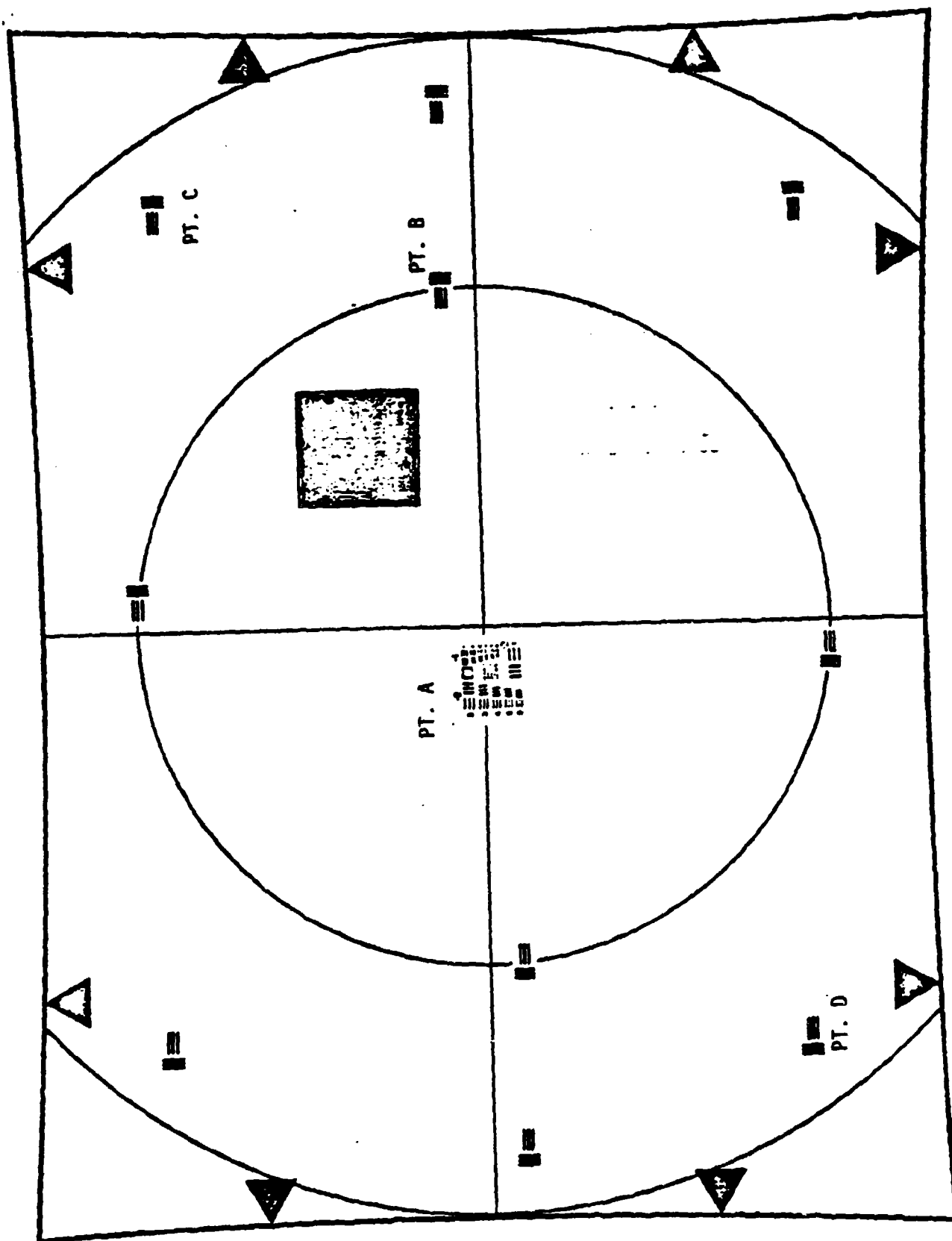
The following tests shall be run during the periods designated in Paragraphs 4.3, and 4.4. The specification referred to in the "Applicable Spec. Paragraphs" section of each test is item (c) of Paragraph 2. of this document

5.1 "Light" Box Set-Up

All of the following tests make use of the test chart shown in Figure 5.1-1 and the Photomultiplier Tube (PMT) "Light" Box shown schematically in the lower right hand corner of Figure 3-1. The PMT Light Box contains three PMT's with red, green and blue filters, three preamplifiers, diffuser screen(s) and a test chart transparency holder capable of being moved in X, Y, and Z.

The tests are such that once the Light Box and Test Chart are set-up, all of the tests can be run without any further set-up. The single test chart contains all the information necessary to perform the five tests.

Therefore, one general set-up procedure is given in the following table which is common to all five tests.



NOTE: Actual Chart is negative of chart shown above.

FIGURE 5.1-1 TEST CHART

TEST ITEM NO. 5.1	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1	LIGHT BOX SET-UP a) Insert the Test Chart of Figure 5.1-1 into the Light Box b) Position the Light Box so the probe views the Test Chart orthogonal to the line of sight with pitch set at approximately 10° down and heading set to produce a line of sight parallel to the floor. c) Position the Light Box so that the front of the glass transparency is 9.96 ± 1/32 inch from the probe entrance pupil (center of pitch mirror).	The pitch down angle of 10° is required to prevent vignetting at the top of the picture due to shadowing caused by the end of the snout. The film chart is designed for a 10-inch viewing distance. However, the 1/16 inch cover glass makes the chart appear 1/3 x 1/16 inch closer, due to refraction. Also, a measurement made to the front of the cover glass must take into account thickness of the cover glass. Distance = $10 + (1/3 \times 1/16) - 1/16$ inch The 1/32 inch tolerance allows a 0.3% error.

TEST ITEM NO. 5.1 Cont'd	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
d) e) f) g) h) i)	Adjust left/right tilt of the Light Box and probe heading to remove any keystoneing. Alternate procedures c) and d) until both conditions are met. Turn on motor drive for roll axis at the probe servo director. Adjust transparency translation slides until the center crosshair in the transparency is stationary. with roll, indicating the center of the test chart is on the probe's optical axis. Recheck the distance to the probe entrance pupil Adjust roll until the test chart vertical and horizontal in the color monitor as referenced to the color monitor's internal crosshatch pattern. Carefully adjust probe focus for the best compromise between horizontal and vertical resolution in the center of the picture with tilt set at zero (2000 on dial).	9.96± 1/32 inch

DATE 11-26-80

SINGER

LINK DIVISION

PAGE NO. 14

REV. A

BINGHAMTON, NEW YORK

REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

5.2 Power Output Level

5.2.1 Test Objective

To measure the laser power output from the three lasers - i.e., argon (blue and green), dye (yellow) and krypton (red).

5.2.2 Test Equipment Required

- a) 5 channel probe servo director
- b) Coherent Radiation model 210 optical wattmeter

5.2.3 Test Method

Read the output of the argon laser using the optical wattmeter built into its controller. Read the output of the dye and krypton lasers using an external optical wattmeter on the laser table at the output of each laser.

5.2.4 Initial Conditions

System warmed-up for 30 minutes.

5.2.5 Applicable Spec. Paragraphs

None

5.2.6 Detailed Procedure

The detailed procedure is given in the following table.

DATE, 11-26-80

SINGER
LINK DIVISION

PAGE NO. 15

REV. A

BINGHAMTON, NEW YORK

REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

DELETED

11-26-80

REV. A

Page 16

DELETED

11-26-80
REV. A

DELETED

TEST ITEM NO. 5.2	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1	<u>PERIODIC TEST-POWER OUTPUT LEVEL</u> a) Set-up the Light Box and Test Chart as described in paragraph 5.1. b) Record the current setting of the argon laser controller. c) Record the output power from the argon laser using its controller's internal optical wattmeter d) Record the output power from the yellow dye laser using the Model 210 optical wattmeter placed on the laser table at the output of the dye laser. e) Record the current setting of the krypton laser controller f) Record the output power from the krypton laser using the Model 210 optical wattmeter placed on the laser table at the output of the krypton laser.	

DATE 11-26-80

SINGER
LINK DIVISION

PAGE NO. 19

REV. A

BINGHAMTON, NEW YORK

REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

5.3 Video Levels

5.3.1 Test Objective

To measure and record the video levels in the red, green and blue channels.

5.3.2 Test Equipment Required

- a) 5 channel probe servo director
- b) PMT Light Box
- c) Test Chart (Figure 5.1-1)
- d) 50 MHz oscilloscope

5.3.3 Test Method

Using the oscilloscope and Camera Control Unit (CCU) measure the peak red, green and blue video levels.

5.3.4 Initial Condition

System warmed-up for 30 minutes.

5.3.5 Applicable Spec. Paragraphs

None

5.3.6 Detailed Procedure

The detailed procedure is given in the following table.

TEST ITEM NO. 5.3	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1	<u>VIDEO AND PEDESTAL LEVEL</u> a) Set-up the Light Box and Test Chart as described in paragraph 5.1. b) Record the PMT high voltage setting c) Using the oscilloscope and CCU, measure the peak-white video level from the reference square (clear) portion of the test chart in the red, green and blue channels.	$V_{red} = 0.7 \text{ volt}$ $V_{green} = 0.7 \text{ volt}$ $V_{blue} = 0.7 \text{ volt}$

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

5.4 Centering and Size

5.4.1 Test Objective

To verify that the centering and size of the image generation raster does not drift outside of the allowed field-of-view tolerance during a sustained operating period.

5.4.2 Test Equipment Required

- a) 5 channel probe servo director
- b) PMT Light Box
- c) Test Chart (Figure 5.1-1)

5.4.3 Test Method

The PMT Light Box is set up orthogonal to the probe's line-of-sight. The Test Chart is moved around on the light box face (using the three axis slides) until it is centered on the roll axis of the probe and a set distance away from the probe entrance pupil. A check is then made as to whether the centering and sizing of the raster remains constant during a sustained operating period.

5.4.4 Initial Conditions

System warmed up for 30 minutes.

5.4.5 Applicable Spec. Paragraphs

3.4.5.1 (b), (d), and (e)

5.4.6 Detailed Procedure

The detailed procedure is given in the following table:

TEST ITEM NO. 5.4	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1	<u>CENTERING AND SIZE</u> a) Set-up the Light Box and Test Chart as described in paragraph 5.1. b) For test run after the initial set-up, check that the center cross-hair of the test chart still is stationary when the roll servo is activated. If not, adjust the probe heading and pitch to compensate for any drifts in the probe's look angle. Only do this if the roll center has definitely drifted and not just for minor correction since the inability to minimize the roll center exactly the same each time will introduce more error than a minor drift. Make sure to return to the smaller inner loop of the probe roll pattern when runout of the cross-hair is checked. c) Observe the arrows or registration groups at the perimeter of the Test Chart on the color monitor and record any mis-match from the start of the day (the reference position of each arrow or registration group should be marked anew at the beginning of each day). Any mis-match should be recorded in terms of arc-minutes either by referencing to the size of the registration bars (each black bar is 5 arc-minutes and each white bar is 5 arc-minutes) or by measuring the mis-match on the face of the CRT with a flexible rule and then scaling to the 48° width of the color monitor face. The arrow tips and perimeter border of the test chart define a 36° vertical x 48° horizontal field-of-view. d) Observe the center of cross-hair of the test chart on the color monitor and record any mis-match to its position marked at the beginning of each day in terms of arc-minutes. The cross-hair line width can be used as a reference (it is 5 arc-minutes in width at the center) or the mis-match can be scaled with a flexible rule and then scaled to the 48° width of the color monitor face.	

DATE.	SINGER LINK DIVISION BINGHAMTON, NEW YORK	PAGE NO. 23
REV.		REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

5.5 Color Registration

5.5.1 Test Objective
 To measure the registration of the Laser Scanner Image Generator (LSIG).

5.5.2 Test Equipment Required

- a) 5 channel probe servo director
- b) PMT Light Box
- c) Test Chart (Figure 5.1-1)

5.5.3 Test Method
 The Test Chart contains groups of horizontal and vertical bars spread throughout the field-of-view of the LSIG. The spacing on these groups is 10 arc-minutes/line pair. Using the Camera Control Unit (CCU) any one color channel can be displayed on the B&W monitor. The three color channels are rapidly switched one at a time onto the B&W monitor and the jump of the three bar groups is estimated using the 10 arc-minutes spacing of the bars on a reference.

5.5.4 Initial Conditions
 System warmed up for 30 minutes.

5.5.5 Applicable Spec. Paragraphs

- 4.1.1.2
- 3.4.5.6.1 (i) - as amended by proposed spec. deviation
- 3.4.5.1 (m) - proposed spec. addition

5.5.6 Detailed Procedure
 The detailed procedure is given in the following table:

TEST ITEM NO. 5.5	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1	<u>REGISTRATION</u> a) Set-up the Light Box and Test Chart as described in paragraph 5.1 b) For tests run after the initial set-up, adjust the probe for best focus to compensate for any minor drifts in the probe focus and tilt servos that might have occurred. c) Refer to Figure 5.1-1 and locate Point A on the B&W monitor, lay a strip of masking tape along the outside edge of the most outside vertical bar of the resolution group (-2,4) at Point A. The red channel alone is to be selected by the CCU. Group (-2,4) corresponds to 10 arc-minute/lp in the center. d) On the B&W monitor, lay a strip of masking tape along the bottom edge of the bottom most horizontal bar of the resolution group (-2,4) at Point A. The red channel alone is to be selected by the CCU. e) Adjust your head position so both strips of tape lay exactly along their respective target edges. f) Without moving your head, quickly de-select the red channel and select the green channel with the buttons of the CCU. Record the estimated jump in arc-minutes in both horizontal position (horizontal registration using vertical bars) and vertical position (vertical registration using horizontal bars) of the bar group. Each white space is .5 arc-minutes and each black space is .5 arc-minutes.	$\leq \pm 8.4$ arc-min at start * $\leq \pm 21.2$ arc-min after 16 hr. *

TEST ITEM NO. 5.5 (cont'd)	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
	g) Reselect the red channel and re-establish your head position. h) Without moving your head, quickly de-select the red channel and select the blue channel with the buttons of the CCU. Record the estimated jump in arc-minutes in both horizontal and vertical position of the bar group. i) Repeat the above procedures (c) thru (h) for points B, C, and D of Figure 5.1-1. The spacing of each group has been adjusted to yield 10 arc-minutes/line pair when viewed by the probe centered over the center cross-hair and $9.96 \pm 1/32$ inch from the front of the glass transparency.	$\leq \pm 8.4$ arc-min at start * $\leq \pm 21.2$ arc-min after 16 hr * For points A & B (0.8 picture ht) $\leq \pm 8.4$ arc-min at start * $\leq \pm 21.2$ arc-min after 16 hr * For points C and D (elsewhere) $\leq \pm 21.2$ arc-min at start * $\leq \pm 42.3$ arc-min after 16 hr * * Based on a Root Sum Square (RSS) calculation of the image generator component of the system registration given the system and display specification - i.e., $\text{Error}_{IG} = \sqrt{\text{Error}_{\text{System}}^2 - \text{Error}_{\text{Display}}^2}$

TEST ITEM NO. 5.6	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1	<u>RESOLUTION</u> a) Set-up the Light Box and Test Chart as described in paragraph 5.1. b) For tests run after the initial set-up, check that tilt is zero (200° on dial) and then carefully adjust probe focus for the best compromise between horizontal and vertical resolution in the center of the picture. Record the horizontal (vertical bars) and vertical (horizontal bars) resolution on the color monitor in the center of the picture.	Group (-1,1) should be resolved both vertically and horizontally. This corresponds to 7 arc-minutes/line pair at a probe pupil to target distance of 10 inches ($9.96 \pm 1/32$ inch to front of glass) Note that the Air Force target on the Test Chart has been reduced to $1/3.867$ of normal scale.

DATE	SINGER LINK DIVISION BINGHAMTON, NEW YORK	PAGE NO. 26
REV.		REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

5.6 System Resolution

5.6.1 Test Objective

To verify that system resolution is in accordance with the specification

5.6.2 Test Equipment Required

- a) 5 channel probe servo director
- b) PMT Light Box
- c) Test Chart (Figure 5.1-1)

5.6.3 Test Method

The probe is focused for best resolution and the resolved group is read from the Air Force resolution target at the center of the Test Chart. No Scheimpflug tilt is used in the probe and the chart is located at a distance far enough away to be considered infinity.

5.6.4 Initial Conditions

System warmed-up for 30 minutes

5.6.5 Applicable Spec. Paragraphs

- 4.1.1.2
- 3.4.5.1

5.6.6 Detailed Procedure

The detailed procedure is given in the following table:

TEST ITEM NO. 5.6	CONTROL ACTION OR PROCEDURE	EXPECTED RESULTS
1	<u>RESOLUTION</u> a) Set-up the Light Box and Test Chart as described in paragraph 5.1. b) For tests run after the initial set-up, check that tilt is zero (2000 on dial) and then carefully adjust probe focus for the best compromise between horizontal and vertical resolution in the center of the picture. Record the horizontal (vertical bars) and vertical (horizontal bars) resolution on the color monitor in the center of the picture.	Group (-1.1) should be resolved both vertically and horizontally. This corresponds to 7 arc-minutes/line pair at a probe pupil to target distance of 10 inches ($9.96 \pm 1/32$ inch to front of glass) Note that the Air Force target on the Test Chart has been reduced to $1/3.867$ of normal scale.

DATE :

SINGER
LINK DIVISION

PAGE NO. 28

REV.

BINGHAMTON, NEW YORK

REP. NO.

THIS DATA IS SUBJECT TO THE RESTRICTIONS ON THE TITLE PAGE OF THIS DOCUMENT.

6.0 DAILY TEST RESULTS TABLES

Tables 6.-1 and 6.-2 are to be used to record the daily test results on odd and even days respectively.

LIBRASCOPE

HOUR NO.	LIFE (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PMR OUTPUT						TEST 5.3 VIDEO LEVEL			
					ARGON		KRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	III VOLTAGE (VOLTS)	
1					WATTS	AMPS	WATTS	AMPS	WATTS					
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
Before Adjust														
After Adjust														

TABLE 6.-1 ODD DAY TABLE

DATE _____ WITNESSED BY: GUY T
LINK _____
LIBRSCOPE _____

TAMIR No. (Cont'd)	TEST 5.4 CENTER & SIZE				TEST 5.5 REGISTRATION								
	CENTER ↑ (ARC-MIN)	LEFT ← (ARC-MIN)	RIGHT → (ARC-MIN)	TOP ↑ (ARC-MIN)	BOTTOM ↓ (ARC-MIN)	PT. A		PT. B		PT. C		PT. D	
						HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16 Before Adj After Adj													

SHEET 2 of 3

TABLE 6.-1 000 DAY TABLE (CONT'D)

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

LINK
LIBRASCOPE

HOUR NO. (CONT.)	TEST 5, 6 RESOLUTION*		ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIAL (DEG.)	VERT RES. (GROUP)		
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
Before Adj.				
After Adj.				

TABLE 6.-1 ODD DAY TABLE (CON'T)

*NOTE - Horiz Res → Vert Bars,
Vert Res → Horiz Bars

LINK
LIBRSCOPE

REV. A

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% REL. H ₂ O)	TEST 5.2 PMR OUTPUT				TEST 5.3 VIDEO LEVEL					
					ARGON		KRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)	
					WATTS	AMPS	WATTS	AMPS						
1														
2														
3														
4														
5														
6														
7														
8														
Before Adjust														
9 After Adjust														
10														
11														
12														
13														
14														
15														
Before Adjust														
16 After Adjust														

Sheet 1 of 3

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

LINK
LIBRSCOPE

TEST 5.4 CENTER & SIZE										TEST 5.5 REGISTRATION							
HOUR NO. Cont'd	CENTER ↑ (ARC-MIN)	LEFT ← (ARC-MIN)	RIGHT → (ARC-MIN)	TOP ↑ (ARC-MIN)	BOTTOM ↓ (ARC-MIN)	PT. A		PT. B		PT. C		PT. D					
						HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)				
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16 Before Adj																	
After Adj																	

* NOTE: HORIZ REG → VERT REGS

TABLE 6.-2 EVEN DAY TABLE

LINK
LIBRASCOPE

HOUR NO. (CONT)	TEST 5.6 RESOLUTION*		VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)				
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
Before Adj.						
After Adj.						

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

*NOTE - Horiz Res → Vert Bars
Vert Res → Horiz Bars

Appendix B

ASSESSMENT LOG SHEETS

DATE 12/1/80 WITNESSED BY: GOV'T

LINK

Mark Blum

LIBRSCOPE

John Borden

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PMR OUTPUT				TEST 5.3 VIDEO LEVEL				
					ARGON		CRYPTON		DYE WATTS	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS					
1	7:00	120	70	64	4.0	31	275mw	27.5	.180	.70	.70	.73	1200 V
2	8:00	120	70	64									
3	9:00	120	70	64	4.0	31	275mw	27.5	.200	.70	.70	.70	1200 V
4	10:00	120	72	57									
5	11:00	120	71	61	4.0	31	275mw	27.5	.200	.70	.60	.65	1200 V
6	12:00	120	72	65									
7	1:00	120	73	61	4.0	31	275mw	27.5	.200	.70	.65	.73	1200 V
8	2:00	120	74	58									
9	3:00	120	73	53	4.0	30	275mw	27.5	.200	.60	.50	.50	1200
10	4:00	SEE COMMENTS											
11	5:00												
12	6:00	120	72	50									
13	7:00	120	73	50	4.0	30.5	275mw	29.0	210mw	.70	.70	.75	1200
14	8:00	120	70	46									
15	9:00	120	79	35	4.0	30.5	275mw	29.0	210mw	.45	.40	.60	1200
Before Adjust	10:00	120	78	44	3.9	30.7	250mw	28.5	210mw	.40	.40	.50	1200
After Adjust	10:20	120	78	44	3.9	31.0	255mw	29.0	210mw	.60	.50	.50	1200

TABLE 6.-1 ODD DAY TABLE

SHEET 1 of 3

DATE 12/1/80 WITNESSED BY: Gov't
LINK Mark Elam
LIBRASCOPE of Am. Radio

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION							
	CENTER ↑ (ARC-MIN)	LEFT ← (ARC-MIN)	RIGHT → (ARC-MIN)	TOP ↑ (ARC-MIN)	BOTTOM ↓ (ARC-MIN)	PT. A		PT. B		PT. C		PT. D	
						HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)
1	—	START	—	—	—	0	0	0	0	0	0	0	0
2													
3													
4													
5	0	0	0	0	0	0	0	0	0	0	0	0	0
6													
7													
8													
9													
10													
11													
12													
13	—	32T 2UP	12T 1UP	2UP 2UP	NO MARKS	0	0	0	0	0	0	0	0
14													
15													
Before Adj	50T 5UP	50T 5UP	60T 5UP	3UP 5UP	NO MARKS	2IN	3IN	2UP	2UP	0	0	2UP	2UP
After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	0	0	0	0	0	0	0	0

* NOTE: HORIZ REG → VERT BARS VERT REG ⇒ HORIZ BARS

TABLE 6.-1 ODD DAY TABLE

(CONT'D)

SHEET 2 OF 2

WITNESSED BY: GOWT

DATE: 12/1/80

LINK

LIBRASCOPE

Link Shunk
LIBRASCOPE got in Borden

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION*			ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)		
1	201° 18'	- 1.3	- 1.2		AD. 1 ADDED TO GREEN
2	201° 3'	- 1.4	- 1.2		
3	201° 27'	- 1.3	- 1.2		
4	201° 12'	- 1.3	- 1.2		RESTART SPINNER (10:00)
5	201° 18'	- 1.3	- 1.2		RESTART SPINNER (11:10)
6	201° 15'	- 1.3	- 1.2		
7	201° 45'	- 1.3	- 1.2		RESTART SPINNER (1:45)
8	201° 33'	- 1.3	- 1.1		RESTART SPINNER (2:03) AND (2:40)
9					INTENSIFY FLUTTER ON WHITE BACKGROUND DUE TO TOP PERISCOPE MIRROR DEFECT
10					OFF AT 3:30 PM SPINNER BOUL OUT OF SYNC. PROBLEM TRACED TO BAD CAMMETER. APPROX 4 PM - BENDING PINS DAMAGED PIN 20. IDENTIFIED WHEEL. SUBMIT BETTER TO CARGO MOVEMENT. RESTART 5:15 PM
11					
12	200° 54'	- 1.3	- 1.2		6:18 SPINNER NOT DAMAGED: BAD CAMMETER W/ 200 200
13	200° 50'	- 1.3	- 1.2		RESTART 6:35
14	200° 45'	- 1.1	- 1.1		7:30 SPINNER NOT DAMAGED AT 8:00 APPROX AIRCRAFT RESTART 7:31
15	200° 35'	- 2.5 2.6 NE	- 2.5 2.6 NE		
Before Adj.	199° 24'	VERY BAD	VERY BAD		UNABLE TO OBSERVE ACCURATE RESOLUTION DUE TO LOUSY CONNECTION
After Adj.	200° 15'	- 1.3	- 1.2		END TEST 10:30 PM

TABLE 6.-1 ODD DAY TABLE (CON'T)

SHEET 3 of 3

NOTE - Horiz Res → Vert Bars
Vert Res → Horiz Bars

DATE 12-2-80

WITNESSED BY: GOV'T

LINK

LIBRASCOPE

Mark Almonder
John Gordon

DUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PHR OUTPUT				TEST 5.3 VIDEO LEVEL				
					ARGON		KRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS					
1	7:10	120	68°/64°	62%	4	31	.275	29	.200	.7	.8	.8	1200
2	8:10	120	68°/64°	58%									
3	9:14	120	68°/64°	54%	4	29	.275	29.5	.200	.6	.85	.7	1200
4	10:12	120	68°/64°	54%									
5	11:12	120	68°/64°	54%	4	29	.275	29.5	.200	.6	.7	.7	1200
6	12:12	120	68°/64°	54%									
7	1:11	120	70°/64°	55%	4	31	.275	28.0	.200	.6	.7	.7	1200
8	2:11	120	70°/64°	55%									
9	3:14	120	70°/64°	59%	4	31	.260	28.5	.215	.6	.75	.7	1200
10	6:20	122	70°/60°	58%	4.0	31.2	.255	28.5	.210	.7	.7	.7	1200
11													
12	6:20	122	70°/60	55%									
13	7:10	122	70°/62	64%	4.0	31.4	.260	28.5	.210	.7	.8	.8	1200
14	8:10	123	70°/62	64%									
15	9:10	122	70°/60	55%	3.9	31.2	.260	28.5	.205	.55	.50	.50	1200
16	10:00	122	70°/62	64%	4.0	31.2	.260	28.7	.200	.55	.45	.45	1200
17	10:13	122	70°/62	64%	4.0	31.2	.260	28.5	.205	.70	.70	.65	1200

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

DATE 12-2-60 WITNESSED BY: GOV'T
LINK Mark Chandler
LIBRASCOPE John Bondy

TEST 5.4 CENTER & SIZE										TEST 5.5 REGISTRATION									
OUR D. bnt'd	CENTER ↑ (ARC-MIN)	LEFT ← (ARC-MIN)	RIGHT → (ARC-MIN)	TOP ↑ (ARC-MIN)	BOTTOM ↓ (ARC-MIN)	PT. A		PT. B		PT. C		PT. D							
						HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)						
1	←	S	T	A	RT →	0	0	0	-1	-1	0	0	0	-1	+1	0	0		
2																			
3																			
4																			
5	+1, 0	+1	-1	+1	-1	0	0	0	-2	-1	0	1	0	-2	0	+1	0		
6																			
7																			
8																			
Before Adj	35, 0	-1	+20	0	0	0	-4	-1	0	0	-5	0	0	-1	0	-2	0		
After Adj	←	S T A	RT →			0	-1	0	0	-2	-2	0	0	-3	0	0	0		
9																			
10																			
11																			
12																			
13	0, 0	0	0	0	0	-1	-1	0	0	-2	-3	0	0	-4	-2	0	+2		
14																			
15																			
16	10, 0	+2	+2	-2	0	0	+3	0	0	0	0	+2	0	0	+2	0	+2		
17	←	S T A	RT →			0	0	0	0	-3	-3	0	0	-4	-2	0	0		

TABLE 6.-2 EVLN DAY TABLE

NOTE: HORIZ REG → VERT BARS

VERT REG → HORIZ BARS

DATE: 12-2-80
WITNESSED BY: GOVT
LINK Mark Churkin
LIBRASCOPE John B. Bards

OUR NO. (CONT.)	TEST 5.6 RESOLUTION*		ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIST. (DEG.)	VERT. RES. (GROUP)			
1	201° 12'	-1.4			
2	200° 45'	-1.3			
3	200° 55'	-1.3			
4	201° 15'	-1.3			
5	201° 18'	-1.3			
6	201° 12'	-1.3			
7	201° 0'	-1.3			
8	201° 0'	-1.3			
9	201° 03'	-1.4			
10	201° 15'	-1.3	ADJ. B.G.V. MIRRORS, TOP PERISCOPE MIRROR, & B DELAMP GAIN		643 SPINNER OFF REACTIVATE
11	{ SEE COMMENTS }				SPINNER PC BOARD 2.00 DETERMINED INTERMITTENT OFF-SPINNING CONNECTOR REPLACED.
12	201° 15'	-1.3			
13	201° 16'	-1.3			
14	200° 12'	-1.3			LIGHT LEVELS DROPPED R-55 G-5 B-5
15	200° 6'	-1.3			
fore Adj.	200° 22'	-1.4			VERT. ADJ. TOP PERISCOPE MIRROR ADJ. B.G.V. MIRRORS
ter Adj.	200° 48'	-1.5			ADJ. HEADING, ROLL, PITCH TOP PERISCOPE MIRROR ADJ. BROUGHT ALL VIBET LEVELS UP.

END TEST
10:26
SHEET 3 of 3

TABLE 6-2 EVEN DAY TABLE (CONT'D)

ITE - Horiz Res → Vert Bars
Vert Res → Horiz Bars

WITNESSED BY:

DATE 12/3/80

✓

GON'T *Put Temp (units only)*LINK *M. M. M. M.*LIBRASCOPE *M. M. M. M.*

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PHR OUTPUT				TEST 5.3 VIDEO LEVEL				
					ARGON		KRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HT VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS					
1	9:30	120	69/62	68%	4.0	31.5	265	29	.060/.200	.70	.70	.70	1200
2	10:30	120	70/62	64%	4.1	31.5	265	29	.205	.70	.75	.70	1200
3	11:30	120	70/63	59%	4.1	33.5	270	29	.300	.70	.70	.6	1200
4	12:30	120	70/64	59%	4.1	33.2	260	29	.200	.70	.70	.6	1200
5	1:30	120	70/63	55%	4.1	33.2	250	29	.200	.70	.70	.6	1200
6	2:30	120	70/62	64%	4.1	33.8	210	29.5	.210	.7	.7	.6	1200
7	3:30	120	70/60	55%	4.1	34	250	29.5	.210	.69	.7	.65	1200
8	4:30	120	70/63	55%	4.1	34.2	255	29.5	.205	.66	.7	.60	1200
9	5:30	120	70/64	64%	4.1	34.7	250	29	.205	.68	.7	.62	1200
10	6:30	120	71/64	55%	4.1	34.5	250	29	.205	.70	.7	.63	1200
11	7:30	120	71/63	64%	4.1	34.5	250	29	.205	.70	.7	.63	1200
12	8:30	120	71/63	64%	4.1	34.5	250	29	.205	.70	.7	.63	1200
13	9:30	120	71/63	64%	4.1	34.5	250	29	.205	.70	.7	.63	1200
14	10:30	120	71/63	64%	4.1	34.5	250	29	.205	.70	.7	.63	1200
15	11:30	120	71/63	64%	4.1	34.5	250	29	.205	.70	.7	.63	1200
Before Adjust After	12:30	120	70/63	55%	4.1	34.5	250	29	.205	.70	.7	.63	1200

DATE 12/3/80 WITNESSED BY: GOV'T *Robert J. [Signature]* (Master Only)
 LINK *R. [Signature]*
 LIBRASCOPE *Ki. [Signature]*

11-26-80
REV. 1

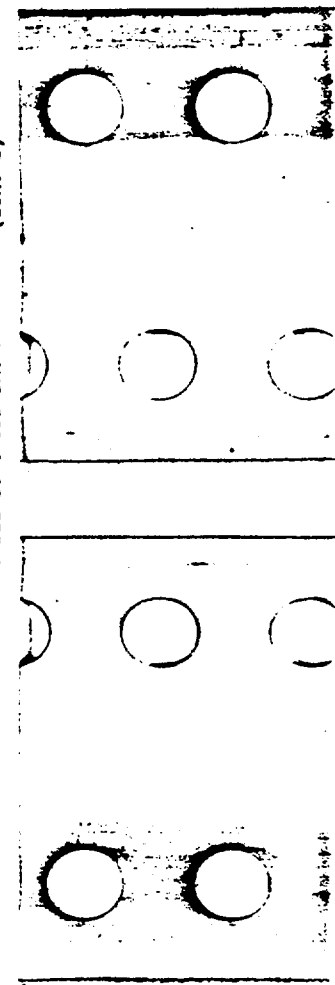
TEST 5.4 CENTER & SIZE										TEST 5.5 REGISTRATION							
HOUR NO. Cont'd	CENTER ↑+ (ARC-MIN)	LEFT ←+ (ARC-MIN)	RIGHT →+ (ARC-MIN)	TOP ↑+ (ARC-MIN)	BOTTOM ↓+ (ARC-MIN)	PT. A		PT. B		PT. C		PT. D					
						HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)				
1	←	START				0	0	0	0	-2	-2	0	0				
2																	
3																	
4																	
5	+5; 0	-2	-2	0	0	0	-1	0	0	-2	0	0	+1				
6																	
7																	
8																	
9	←	START				-1	-2	+1	0	-1	0	0	0				
10																	
11																	
12																	
13	+10	+7	-5	0	+10	0	+2	0	0	0	0	0	+2				
14																	
15																	
16 Before Adj	0	+7	0	+2	+10	0	+2	+2	-2	0	0	0	-2				
After Adj																	

SHEET 2 of 3

TABLE 6.-1 ODD DAY TABLE (CONT'D)

VERT REG → HORIZ BARS

* NOTE: HORIZ REG → VERT BARS



JESSL

120

E:

GO

LINK *Mark E. Lusk*LIBRASCOPES *W. H. H. H.*

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION*		VERY RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DISTAL (DEG.)	HORIZ RES. (GROUP)			
1	200° 57'	-1, 4	-1, 1		ADJUSTED PRISMIC BEAM INTO DYE LASER
2	200° 52'	-1, 4	-1, 1		BEAM BEING (-200) since late 5.6 not becoming a
3	200° 56'	-1, 4	-1, 1		damaged (mixed) near center, began to appear
4	200° 56'	-1, 4	-1, 1		was focused, mirror rotated to get beam
5	200° 56'	-1, 4	-1, 1		off of beam spot. Subsequent file
6	201° 17'	-1, 4	-1, 1		redemption.
7	200° 57'	-1, 4	-1, 2		
8	201° 0'	-1, 4	-1, 2		None, etc
9	200° 26'	-1, 2	-1, 1		None
10	200° 39'	-1, 3	-1, 2		None
11	200° 57'	-1, 3	-1, 2		None
12	200° 54'	-1, 3	-1, 2		None
13	200° 48'	-1, 3	-1, 2		None
14	200° 36'	-1, 3	-1, 2		None
15	200° 48'	-1, 3	-1, 2		None
Before Adj.	200° 36'	-1, 3	-1, 2		
After Adj.					Ready, instrument not needed - not used

*NOTE - Horiz Res → Vert Bars
Vert Res → Horiz Bars

TABLE 6.-1 ODD DAY TABLE (CON'T)

SHEET 3 of 3

HEADLINE - 3° 41'
 Pitch - 201° 41'
 Roll - 8° 36'
 Fuz - 201° 27'

DATE 12/4/80

WITNESSED BY: Gov't Robert Ferguson (Minted)
 LINK
 LIBRASCOP M. Hanc

11-26-80
 REV. A

TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PMR OUTPUT				TEST 5.3 VIDEO LEVEL				
				ARGON		KRYPTON		DYE WATTS	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
				WATTS	AMPS	WATTS	AMPS					
9:30	120V	72°/68°	69%	3.2	32.5	.260	29	.030	.7	.2	.4	1200
10:30	110V	70°/62°	64%									
11:30	SEE	COMMENTS										
12:30	120V	71°/68°	68%									
1:30	120V	70°/64°	64%	3.7	35	.255	29	.180	.6	.6	.7	1200
2:30	120V	70°/64°	64%									
3:30	121V	72°/64°	65%	3.9	34	.265	29	.212	.6	.6	.6	1200
4:30	123	73°/62°	63%									
5:30	120V	72°/62°	62%	4.0	34.5	.255	29	.205	.6	.7	.6	1200
6:05	121V	72°/63°	65%	4.0	35.0	.250	29	.205	.6	.6	.5	1200
6:30	120V	70°/63°	64%									
7:30	120V	71°/64°	64%	4.0	36	.240	28.5	.200	.6	.6	.5	1200
8:30	121	70°/64°	68%									
9:30	120	70°/64°	64%	3.9	36.5	.240	28.6	.182	.6	.6	.5	1200
10:30	120	70°/64°	64%									
11:30	120	71°/64°	64%	3.85	35.2	.230	28.5	.160	.6	.55	.45	1200
12:02	See	See	COM	men	75							
fore dust ter tust												

TABLE 6.2-2 EVEN DAY TABLE

DATE: 12/14/00

WITNESSED BY: GARY R. FRYMAN (Master)

LINK

LIBRSCOPE M. Manni

NO. T)	TEST 5.6 RESOLUTION*		VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIST (DEG.)	HORIZ RES. (GROUP)				
1	201° 34'	-1.4	-1.1			12.02.03 Spectra Physics shut down completely -
2	201° 30'	-1.4	-1.1	Physical Handling, lens		12.02.03 Spectra Physics shut down completely -
3	~~201° 30'~~	~~-1.4~~	~~-1.1~~	Roll, piled - new setup		12.02.03 Spectra Physics shut down completely -
4	201° 10'	-1.3	-1.1	For start - Resistant		12.02.03 Spectra Physics shut down completely -
5	201° 15'	-1.3	-1.1	align on table -		12.02.03 Spectra Physics shut down completely -
6	201° 20'	-1.2	-1.1	Lead focusing up.		12.02.03 Spectra Physics shut down completely -
7	201° 21'	-1.3	-1.1	Argon laser. Flow appears		12.02.03 Spectra Physics shut down completely -
8	201° 23'	-1.1	-1.1	to be a minimum		12.02.03 Spectra Physics shut down completely -
9	201° 20'	-1.2	-1.2	Align to table.		12.02.03 Spectra Physics shut down completely -
10	200° 58'	-1.3	-1.2	This reduced signal.		12.02.03 Spectra Physics shut down completely -
11	200° 49'	-1.3	-1.2	Lead and aligned		12.02.03 Spectra Physics shut down completely -
12	200° 57'	-1.3	-1.2	increase in laser output.		12.02.03 Spectra Physics shut down completely -
13	200° 39'	-1.3	-1.3	-backed off a read		12.02.03 Spectra Physics shut down completely -
14	200° 52'	-1.3	-1.3	is original -		12.02.03 Spectra Physics shut down completely -
15	200° 53'	-1.3	-1.3	*Power output 9.1.1.6		12.02.03 Spectra Physics shut down completely -
16				on Argon laser observed		12.02.03 Spectra Physics shut down completely -
17				vacuum is gone		12.02.03 Spectra Physics shut down completely -
18						
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E - Horiz Res → Vert Bars
Vert Res → Horiz Bars

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

SHEET 3 of 3

DATE 12-5-80 WITNESSED BY: GOV'T
LINK LIBRSCOPE

[illegible]

DATE: 12/5/80 WITNESSED BY: GOVT

LINK

LIBRASCOPE M. Name

NO. (T)	TEST 5.6 RESOLUTION*		ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	
1	201° 10'	-1.4	1.2	RED ONLY: The Spectro fluorimeter analog power supply is not functioning properly with the regulation The result of that a protect circuit shuts the laser down completely. A repairman will be here 12/7/80.
2	201° 15'	1.4	1.2	
3	201° 12'	1.4	1.2	
4	201° 30'	1.4	1.2	
5	201° 27'	1.4	1.2	
6	201° 35'	1.4	1.2	
7	~	1.3	1.2	Red. At Operator Senses operation or for online period. Equipment shut down - 12/2
8	201° 18'	1.3	1.2	
9				
10				
11				
12				
13				
14				
15				
Line Adj.				
IR Adj.				

E - Horiz Res → Vert Bars
Vert Res → Horiz Bars

TABLE 6.-1 000 DAY TABLE (CON'T)

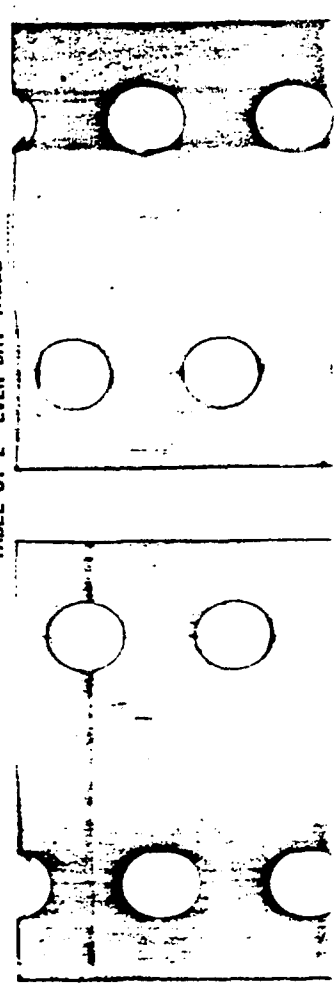
DATE 12/1/80 WITNESSED BY: Gov't Robert Ferguson (Motor Lab)
 LINK 16010000
 LIBRSCOPE M. Mass. v. J. Borden

11-26-80
REV. A

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PMR OUTPUT				TEST 5.3 VIDEO LEVEL				
					ARGON		CRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS					
1	7:00	120	67°/63°	58%	4	27.5	250	29	.220	.7	.7	.7	1200
2	8:00	120	67°/63°	50%									
3	9:00	120	68°/64°	58%	4	27.5	.220	29.5	.200	.7	.7	.7	1000
4	10:00	120	70°/63°	55%									
5	11:00	120	70°/62°	78%	4.0	27.2	.230	29.5	.230	.55	.5	.55	1200
6	12:00	120	70°/63°	50%									
7	12:30	120	69°/63°	50%	4	29	.220	29.5	.225	.5	.5	.5	1200
8	2:00	120	69°/63°	50%									
9	Before Adj	120	70°/62°	48%	3.9	28.5	.230	29.5	.235	.5	.5	.6	1200
10	After Adj	121	70°/62°	55%	4.0	29.0	.240	29.5	.240	.7	.7	.7	1200
11	4:00	120	70°/62°	55%									
12	5:00	121	70°/63°	46%	4.0	29.2	.280	29.5	.230	.7	.7	.7	1200
13	6:00	120	70°/64°	44%	4.0	29.3	.210	29.8	.230	.68	.7	.7	1200
14	7:00	120	70°/64°	48%									
15	8:00	121	70°/64°	44%	4.0	29.5	.220	29.5	.240	.65	.7	.7	1200
16	9:00	120	70°/60°	48%	4.0	29.5	.215	29.5	.240	.65	.7	.7	1200
Before Adj													
After Adj													

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3



DATE 12/8/00

WITNESSED BY:

GOV'T Arch. & Manus. (Master Only)
LINK Dr. Edwards
LIBRASCOPE W. Mann J. Barber
Spec.

TEST 5.5 REGISTRATION

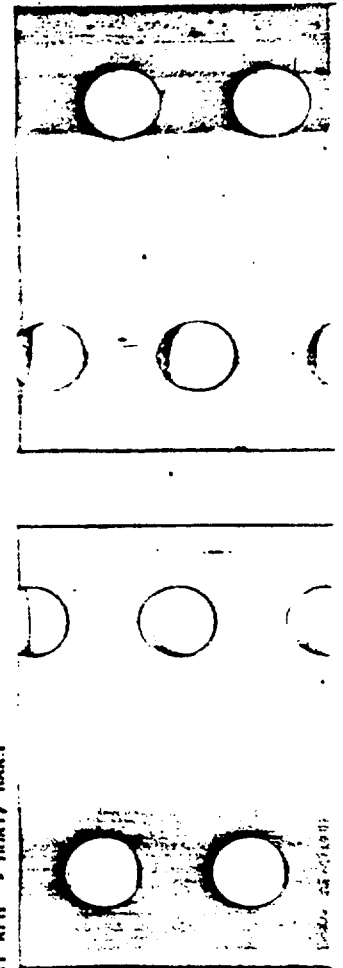
TEST 5.4 CENTER & SIZE										TEST 5.5 REGISTRATION							
HOUR NO. Cont'd	CENTER ↑ (ARC-MIN)	LEFT ← (ARC-MIN)	RIGHT → (ARC-MIN)	TOP ↑ (ARC-MIN)	BOTTOM ↓ (ARC-MIN)	PT. A		PT. B		PT. C		PT. D					
						HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)				
1	← ^H V ST	ART			→	0	0	2	0	0	0	2	0	0	2		
2																	
3																	
4																	
5	35 ¹ +15	-30	+25	-5	0	0	+2	5	8	0	+5	+6	0	+5	+2		
6																	
7																	
8																	
9	Before Adj +50 ¹ +20 After Adj	-40	+40	0	-10	0	+2	+5	+5	0	0	+6	+8	0	+2		
		STA 2T			→	0	-1	0	0	0	0	0	0	0	-1		
10																	
11																	
12																	
13	0 ¹ +15	-10	+10	0	-5	0	+5	0	0	-2	0	0	0	0	0		
14																	
15																	
16	Before Adj +25 ¹ +15 After Adj	-15	+15	0	0	0	+5	0	0	-5	0	0	0	0	+3		

TABLE 6.-2 EVEN DAY TABLE

VERT REF ⇒ HOR 17 RARS

* NOTE: HORIZ REG → VERT BARS

SHEET 2 of 3



DATE 12/9/80 WITNESSED BY: Gov't Robert Taylor (Monitor Only)
 LINK NEH
 LIBRASCOPE Harve

11-26-80
 REV. A

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PMR OUTPUT				TEST 5.3 VIDEO LEVEL				
					ARGON		CRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS	WATTS				
1	7:00/7:10	120	67°/62°	49%	4	30	.225	29.5	.220	.7	.65	.7	1200
2	8:00/8:10	120	68°/63°	50%									
3	9:00/9:10	120	67°/63°	50%	3.95	30	.225	29.5	.220	.63	.6	.7	1200
4	10:00/10:10	120	68°/62°	54%									
5	11:00/11:10	120	68°/62°	50%	3.95	29.5	.225	28	.220	.6	.55	.7	1200
6	12:00/12:10	120	70°/63°	48%									
7	1:00/1:10	120	64°/63°	47%	3.9	29.5	.225	28	.230	.5	.35	.85	1200
8	2:00/2:10	120	65°/63°	51%									
9	3:00/3:10	120	69°/63°	59%	3.9	29.5	.240	29	.230	.5	.4	.5	1200
10	4:00/4:10	120	69°/63°	58%	4.0	30.0	.235	29	.230	.65	.7	.7	1200
11	5:00/5:10	120	69°/63°	58%	4.0	30.0	.230	29	.230	.65	.75	.70	1200
12	6:00/6:10	120	70°/64°	48%									
13	7:00/7:10	121	70°/64°	45%	4.0	30.0	.225	28.5	.225	.65	.70	.65	1200
14	8:00/8:10	121	70°/63°	48%									
15	9:00/9:10	120	70°/63°	48%	4.0	30.0	.230	29	.225	.65	.7	.65	1200
Before Adjust													
After Adjust													
Adjust													

TABLE 6-1 PMR DAY TABLE

SHEET 1 of 3

DATE 12/9/80 WITNESSED BY: Gov't
LINK H. Chandra
LIBRSCOPE Hand

TEST 5.5 REGISTRATION

TEST 5.4 CENTER & SIZE

TEST 5.4 CENTER & SIZE						TEST 5.5 REGISTRATION								
HOUR NO. Cont'd	CENTER ↑ (ARC-MIN)		LEFT ← (ARC-MIN)	RIGHT → (ARC-MIN)	TOP ↑ (ARC-MIN)	BOTTOM ↓ (ARC-MIN)	PT. A		PT. B		PT. C		PT. D	
	↑	↓					HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)
1	←	→	STA	RT	→	→	0	0	0	0	0	0	0	0
2														
3														
4	→	←	→	→	→	→	0	0	0	0	0	0	0	0
5	→	←	→	→	→	→	0	0	0	0	0	0	0	0
6														
7														
8														
9	→	←	→	→	→	→	0	0	0	0	0	0	0	0
10	→	←	→	→	→	→	0	0	0	0	0	0	0	0
11														
12														
13														
14														
15														
16 Before Adj	→	←	→	→	→	→	0	0	0	0	0	0	0	0
After Adj	→	←	→	→	→	→	0	0	0	0	0	0	0	0

WITNESSED BY:

DATE: 11/17/80

GUY:

LINK

LIBRSCOPE Marie

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION*		ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERY RES. (GROUP)	
1	200° 34'	-1.3	-1.2	In attempt: Handing 1st pump for: heading same in factor pump for 1st cycle away
2	200° 19'	-1.3	-1.2	
3	200° 15'	-1.4	-1.2	
4	200° 19'	-1.4	-1.2	
5	199° 42'	-1.3	-1.1	REGISTRATION BAD IN VERTICAL GREEN Y. SIGNAL LOW
6	200° 6'	-1.3	-1.2	
7	200° 27'	-1.3	-2.6	
8	200° 15'	-1.2	-2.6	
9	200° 12'	-1.3	-2.6	ADJUST. PERISSCOPE MIRROR 1. 200° 12' 14' 15' 16' 17' 18' 19' 20' 21' 22' 23' 24' 25' 26' 27' 28' 29' 30' 31' 32' 33' 34' 35' 36' 37' 38' 39' 40' 41' 42' 43' 44' 45' 46' 47' 48' 49' 50' 51' 52' 53' 54' 55' 56' 57' 58' 59' 60' 61' 62' 63' 64' 65' 66' 67' 68' 69' 70' 71' 72' 73' 74' 75' 76' 77' 78' 79' 80' 81' 82' 83' 84' 85' 86' 87' 88' 89' 90' 91' 92' 93' 94' 95' 96' 97' 98' 99' 100' 101' 102' 103' 104' 105' 106' 107' 108' 109' 110' 111' 112' 113' 114' 115' 116' 117' 118' 119' 120' 121' 122' 123' 124' 125' 126' 127' 128' 129' 130' 131' 132' 133' 134' 135' 136' 137' 138' 139' 140' 141' 142' 143' 144' 145' 146' 147' 148' 149' 150' 151' 152' 153' 154' 155' 156' 157' 158' 159' 160' 161' 162' 163' 164' 165' 166' 167' 168' 169' 170' 171' 172' 173' 174' 175' 176' 177' 178' 179' 180' 181' 182' 183' 184' 185' 186' 187' 188' 189' 190' 191' 192' 193' 194' 195' 196' 197' 198' 199' 200' 201' 202' 203' 204' 205' 206' 207' 208' 209' 210' 211' 212' 213' 214' 215' 216' 217' 218' 219' 220' 221' 222' 223' 224' 225' 226' 227' 228' 229' 230' 231' 232' 233' 234' 235' 236' 237' 238' 239' 240' 241' 242' 243' 244' 245' 246' 247' 248' 249' 250' 251' 252' 253' 254' 255' 256' 257' 258' 259' 260' 261' 262' 263' 264' 265' 266' 267' 268' 269' 270' 271' 272' 273' 274' 275' 276' 277' 278' 279' 280' 281' 282' 283' 284' 285' 286' 287' 288' 289' 290' 291' 292' 293' 294' 295' 296' 297' 298' 299' 300' 301' 302' 303' 304' 305' 306' 307' 308' 309' 310' 311' 312' 313' 314' 315' 316' 317' 318' 319' 320' 321' 322' 323' 324' 325' 326' 327' 328' 329' 330' 331' 332' 333' 334' 335' 336' 337' 338' 339' 340' 341' 342' 343' 344' 345' 346' 347' 348' 349' 350' 351' 352' 353' 354' 355' 356' 357' 358' 359' 360' 361' 362' 363' 364' 365' 366' 367' 368' 369' 370' 371' 372' 373' 374' 375' 376' 377' 378' 379' 380' 381' 382' 383' 384' 385' 386' 387' 388' 389' 390' 391' 392' 393' 394' 395' 396' 397' 398' 399' 400' 401' 402' 403' 404' 405' 406' 407' 408' 409' 410' 411' 412' 413' 414' 415' 416' 417' 418' 419' 420' 421' 422' 423' 424' 425' 426' 427' 428' 429' 430' 431' 432' 433' 434' 435' 436' 437' 438' 439' 440' 441' 442' 443' 444' 445' 446' 447' 448' 449' 450' 451' 452' 453' 454' 455' 456' 457' 458' 459' 460' 461' 462' 463' 464' 465' 466' 467' 468' 469' 470' 471' 472' 473' 474' 475' 476' 477' 478' 479' 480' 481' 482' 483' 484' 485' 486' 487' 488' 489' 490' 491' 492' 493' 494' 495' 496' 497' 498' 499' 500' 501' 502' 503' 504' 505' 506' 507' 508' 509' 510' 511' 512' 513' 514' 515' 516' 517' 518' 519' 520' 521' 522' 523' 524' 525' 526' 527' 528' 529' 530' 531' 532' 533' 534' 535' 536' 537' 538' 539' 540' 541' 542' 543' 544' 545' 546' 547' 548' 549' 550' 551' 552' 553' 554' 555' 556' 557' 558' 559' 560' 561' 562' 563' 564' 565' 566' 567' 568' 569' 570' 571' 572' 573' 574' 575' 576' 577' 578' 579' 580' 581' 582' 583' 584' 585' 586' 587' 588' 589' 590' 591' 592' 593' 594' 595' 596' 597' 598' 599' 600' 601' 602' 603' 604' 605' 606' 607' 608' 609' 610' 611' 612' 613' 614' 615' 616' 617' 618' 619' 620' 621' 622' 623' 624' 625' 626' 627' 628' 629' 630' 631' 632' 633' 634' 635' 636' 637' 638' 639' 640' 641' 642' 643' 644' 645' 646' 647' 648' 649' 650' 651' 652' 653' 654' 655' 656' 657' 658' 659' 660' 661' 662' 663' 664' 665' 666' 667' 668' 669' 670' 671' 672' 673' 674' 675' 676' 677' 678' 679' 680' 681' 682' 683' 684' 685' 686' 687' 688' 689' 690' 691' 692' 693' 694' 695' 696' 697' 698' 699' 700' 701' 702' 703' 704' 705' 706' 707' 708' 709' 710' 711' 712' 713' 714' 715' 716' 717' 718' 719' 720' 721' 722' 723' 724' 725' 726' 727' 728' 729' 730' 731' 732' 733' 734' 735' 736' 737' 738' 739' 740' 741' 742' 743' 744' 745' 746' 747' 748' 749' 750' 751' 752' 753' 754' 755' 756' 757' 758' 759' 760' 761' 762' 763' 764' 765' 766' 767' 768' 769' 770' 771' 772' 773' 774' 775' 776' 777' 778' 779' 780' 781' 782' 783' 784' 785' 786' 787' 788' 789' 790' 791' 792' 793' 794' 795' 796' 797' 798' 799' 800' 801' 802' 803' 804' 805' 806' 807' 808' 809' 810' 811' 812' 813' 814' 815' 816' 817' 818' 819' 820' 821' 822' 823' 824' 825' 826' 827' 828' 829' 830' 831' 832' 833' 834' 835' 836' 837' 838' 839' 840' 841' 842' 843' 844' 845' 846' 847' 848' 849' 850' 851' 852' 853' 854' 855' 856' 857' 858' 859' 860' 861' 862' 863' 864' 865' 866' 867' 868' 869' 870' 871' 872' 873' 874' 875' 876' 877' 878' 879' 880' 881' 882' 883' 884' 885' 886' 887' 888' 889' 890' 891' 892' 893' 894' 895' 896' 897' 898' 899' 900' 901' 902' 903' 904' 905' 906' 907' 908' 909' 910' 911' 912' 913' 914' 915' 916' 917' 918' 919' 920' 921' 922' 923' 924' 925' 926' 927' 928' 929' 930' 931' 932' 933' 934' 935' 936' 937' 938' 939' 940' 941' 942' 943' 944' 945' 946' 947' 948' 949' 950' 951' 952' 953' 954' 955' 956' 957' 958' 959' 960' 961' 962' 963' 964' 965' 966' 967' 968' 969' 970' 971' 972' 973' 974' 975' 976' 977' 978' 979' 980' 981' 982' 983' 984' 985' 986' 987' 988' 989' 990' 991' 992' 993' 994' 995' 996' 997' 998' 999' 1000' 1001' 1002' 1003' 1004' 1005' 1006' 1007' 1008' 1009' 1010' 1011' 1012' 1013' 1014' 1015' 1016' 1017' 1018' 1019' 1020' 1021' 1022' 1023' 1024' 1025' 1026' 1027' 1028' 1029' 1030' 1031' 1032' 1033' 1034' 1035' 1036' 1037' 1038' 1039' 1040' 1041' 1042' 1043' 1044' 1045' 1046' 1047' 1048' 1049' 1050' 1051' 1052' 1053' 1054' 1055' 1056' 1057' 1058' 1059' 1060' 1061' 1062' 1063' 1064' 1065' 1066' 1067' 1068' 1069' 1070' 1071' 1072' 1073' 1074' 1075' 1076' 1077' 1078' 1079' 1080' 1081' 1082' 1083' 1084' 1085' 1086' 1087' 1088' 1089' 1090' 1091' 1092' 1093' 1094' 1095' 1096' 1097' 1098' 1099' 1100' 1101' 1102' 1103' 1104' 1105' 1106' 1107' 1108' 1109' 1110' 1111' 1112' 1113' 1114' 1115' 1116' 1117' 1118' 1119' 1120' 1121' 1122' 1123' 1124' 1125' 1126' 1127' 1128' 1129' 1130' 1131' 1132' 1133' 1134' 1135' 1136' 1137' 1138' 1139' 1140' 1141' 1142' 1143' 1144' 1145' 1146' 1147' 1148' 1149' 1150' 1151' 1152' 1153' 1154' 1155' 1156' 1157' 1158' 1159' 1160' 1161' 1162' 1163' 1164' 1165' 1166' 1167' 1168' 1169' 1170' 1171' 1172' 1173' 1174' 1175' 1176' 1177' 1178' 1179' 1180' 1181' 1182' 1183' 1184' 1185' 1186' 1187' 1188' 1189' 1190' 1191' 1192' 1193' 1194' 1195' 1196' 1197' 1198' 1199' 1200' 1201' 1202' 1203' 1204' 1205' 1206' 1207' 1208' 1209' 1210' 1211' 1212' 1213' 1214' 1215' 1216' 1217' 1218' 1219' 1220' 1221' 1222' 1223' 1224' 1225' 1226' 1227' 1228' 1229' 1230' 1231' 1232' 1233' 1234' 1235' 1236' 1237' 1238' 1239' 1240' 1241' 1242' 1243' 1244' 1245' 1246' 1247' 1248' 1249' 1250' 1251' 1252' 1253' 1254' 1255' 1256' 1257' 1258' 1259' 1260' 1261' 1262' 1263' 1264' 1265' 1266' 1267' 1268' 1269' 1270' 1271' 1272' 1273' 1274' 1275' 1276' 1277' 1278' 1279' 1280' 1281' 1282' 1283' 1284' 1285' 1286' 1287' 1288' 1289' 1290' 1291' 1292' 1293' 1294' 1295' 1296' 1297' 1298' 1299' 1300' 1301' 1302' 1303' 1304' 1305' 1306' 1307' 1308' 1309' 1310' 1311' 1312' 1313' 1314' 1315' 1316' 1317' 1318' 1319' 1320' 1321' 1322' 1323' 1324' 1325' 1326' 1327' 1328' 1329' 1330' 1331' 1332' 1333' 1334' 1335' 1336' 1337' 1338' 1339' 1340' 1341' 1342' 1343' 1344' 1345' 1346' 1347' 1348' 1349' 1350' 1351' 1352' 1353' 1354' 1355' 1356' 1357' 1358' 1359' 1360' 1361' 1362' 1363' 1364' 1365' 1366' 1367' 1368' 1369' 1370' 1371' 1372' 1373' 1374' 1375' 1376' 1377' 1378' 1379' 1380' 1381' 1382' 1383' 1384' 1385' 1386' 1387' 1388' 1389' 1390' 1391' 1392' 1393' 1394' 1395' 1396' 1397' 1398' 1399' 1400' 1401' 1402' 1403' 1404' 1405' 1406' 1407' 1408' 1409' 1410' 1411' 1412' 1413' 1414' 1415' 1416' 1417' 1418' 1419' 1420' 1421' 1422' 1423' 1424' 1425' 1426' 1427' 1428' 1429' 1430' 1431' 1432' 1433' 1434' 1435' 1436' 1437' 1438' 1439' 1440' 1441' 1442' 1443' 1444' 1445' 1446' 1447' 1448' 1449' 1450' 1451' 1452' 1453' 1454' 1455' 1456' 1457' 1458' 1459' 1460' 1461' 1462' 1463' 1464' 1465' 1466' 1467' 1468' 1469' 1470' 1471' 1472' 1473' 1474' 1475' 1476' 1477' 1478' 1479' 1480' 1481' 1482' 1483' 1484' 1485' 1486' 1487' 1488' 1489' 1490' 1491' 1492' 1493' 1494' 1495' 1496' 1497' 1498' 1499' 1500' 1501' 1502' 1503' 1504' 1505' 1506' 1507' 1508' 1509' 1510' 1511' 1512' 1513' 1514' 1515' 1516' 1517' 1518' 1519' 1520' 1521' 1522' 1523' 1524' 1525' 1526' 1527' 1528' 1529' 1530' 1531' 1532' 1533' 1534' 1535' 1536' 1537' 1538' 1539' 1540' 1541' 1542' 1543' 1544' 1545' 1546' 1547' 1548' 1549' 1550' 1551' 1552' 1553' 1554' 1555' 1556' 1557' 1558' 1559' 1560' 1561' 1562' 1563' 1564' 1565' 1566' 1567' 1568' 1569' 1570' 1571' 1572' 1573' 1574' 1575' 1576' 1577' 1578' 1579' 1580' 1581' 1582' 1583' 1584' 1585' 1586' 1587' 1588' 1589' 1590' 1591' 1592' 1593' 1594' 1595' 1596' 1597' 1598' 1599' 1600' 1601' 1602' 1603' 1604' 1605' 1606' 1607' 1608' 1609' 1610' 1611' 1612' 1613' 1614' 1615' 1616' 1617' 1618' 1619' 1620' 1621' 1622' 1623' 1624' 1625' 1626' 1627' 1628' 1629' 1630' 1631' 1632' 1633' 1634' 1635' 1636' 1637' 1638' 1639' 1640' 1641' 1642' 1643' 1644' 1645' 1646' 1647' 1648' 1649' 1650' 1651' 1652' 1653' 1654' 1655' 1656' 1657' 1658' 1659' 1660' 1661' 1662' 1663' 1664' 1665' 1666' 1667' 1668' 1669' 1670' 1671' 1672' 1673' 1674' 1675' 1676' 1677' 1678' 1679' 1680' 1681' 1682' 1683' 1684' 1685' 1686' 1687' 1688' 1689' 1690' 1691' 1692' 1693' 1694' 1695' 1696' 1697' 1698' 1699' 1700' 1701' 1702' 1703' 1704' 1705' 1706' 1707' 1708' 1709' 1710' 1711' 1712' 1713' 1714' 1715' 1716' 1717' 1718' 1719' 1720' 1721' 1722' 1723' 1724' 1725' 1726' 1727' 1728' 1729' 1730' 1731' 1732' 1733' 1734' 1735' 1736' 1737' 1738' 1739' 1740' 1741' 1742' 1743' 1744' 1745' 1746' 1747' 1748' 1749' 1750' 1751' 1752' 1753' 1754' 1755' 1756' 1757' 1758' 1759' 1760' 1761' 1762' 1763' 1764' 1765' 1766' 1767' 1768' 1769' 1770' 1771' 1772' 1773' 1774' 1775' 1776' 1777' 1778' 1779' 1780' 1781' 1782' 1783' 1784' 1785' 1786' 1787' 1788' 1789' 1790' 1791' 1792' 1793' 1794' 1795' 1796' 1797' 1798' 1799' 1800' 1801' 1802' 1803' 1804' 1805' 1806' 1807' 1808' 1809' 1810' 1811' 1812' 1813' 1814' 1815' 1816' 1817' 1818' 1819' 1820' 1821' 1822' 1823' 1824' 1825' 1826' 1827' 1828' 1829' 1830' 1831' 1832' 1833' 1834' 1835' 1836' 1837' 1838' 1839' 1840' 1841' 1842' 1843' 1844' 1845' 1846' 1847' 1848' 1849' 1850' 1851' 1852' 1853' 1854' 1855' 1856' 1857' 1858' 1859' 1860' 1861' 1862' 1863' 1864' 1865' 1866' 1867' 1868' 1869' 1870' 1871' 1872' 1873' 1874' 1875' 1876' 1877' 1878' 1879' 1880' 1881' 1882' 1883' 1884' 1885' 1886' 1887' 1888' 1889' 1890' 1891' 1892' 1893' 1894' 1895' 1896' 1897' 1898' 1899' 1900' 1901' 1902' 1903' 1904' 1905' 1906' 1907' 1908' 1909' 1910' 1911' 1912' 1913' 1914' 1915' 1916' 1917' 1918' 1919' 1920' 1921' 1922' 1923' 1924' 1925' 1926' 1927' 1928' 1929' 1930' 1931' 1932' 1933' 1934' 1935' 1936' 1937' 1938' 1939' 1940' 1941' 1942' 1943' 1944' 1945' 1946' 1947' 1948' 1949' 1950' 1951' 1952' 1953' 1954' 1955' 1956' 1957' 1958' 1959' 1960' 1961' 1962' 1963' 1964' 1965' 1966' 1967' 1968' 1969' 1970' 1971' 1972' 1973' 1974' 1975' 1976' 1977' 1978' 1979' 1980' 1981' 1982' 1983' 1984' 1985' 1986' 1987' 1988' 1989' 1990' 1991' 1992' 1993' 1994' 1995' 1996' 1997' 1998' 1999' 2000' 2001' 2002' 2003' 2004' 2005' 2006' 2007' 2008' 2009' 2010' 2011' 2012' 2013' 2014' 2015' 2016' 2017' 2018' 2019' 2020' 2021' 2022' 2023' 2024' 2025' 2026' 2027' 2028' 2029' 2030' 2031' 2032' 2033' 2034' 2035' 2036' 2037' 2038' 2039' 2040' 2041' 2042' 2043' 2044' 2045' 2046' 2047' 2048' 2049' 2050' 2051' 2052' 2053' 2054' 2055' 2056' 2057' 2058' 2059' 2060' 2061' 2062' 2063' 2064' 2065' 2066' 2067' 2068' 2069' 2070' 2071' 2072' 2073' 2074' 2075' 2076' 2077' 2078' 2079' 2080' 2081' 2082' 2083' 2084' 2085' 2086' 2087' 2088' 2089' 2090' 2091' 2092' 2093' 2094' 2095' 2096' 2097' 2098' 2099' 2100' 2101' 2102' 2103' 2104' 21

DATE

12-10-80

WITNESSED BY:

GOV'T Exhibit Tagman (Master Only)

LINK

LIBRSCOPE System

11-26-80
REV. A

Page 32

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PHR OUTPUT				TEST 5.3 VIDEO LEVEL				
					ARGON		KRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HT VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS					
1	8:00	120	68°	54%	4	31.5	.230	29.5	.220	.7	.7	.7	1200
2	9:00	120	68°	50%									
3	10:00	120	68°	50%	4	31	.220	29	.220	.75	.65	.7	1200
4	11:00	120	69°	48%									
5	2:00	120	70°	45%	4	31	.220	29	.220	.7	.6	.7	1200
6	1:00	120	72°	42%									
7	2:00	120	71°	45%	39.5	31	.220	29	.220	.7	.5	.6	1200
8	3:00	121	72°	44%									
9	Before Adj	122	73°	44%	39.5	31	.220	29	.220	.7	.4	.7	1200
10	After Adj												
11													
12													
13													
14	9:00	121	71°	45%	4.0	30.2	.215	29.5	.215	.7	.7	.7	1200
15	10:00	121	72°	42%	4.0	30.2	.210	29.5	.220	.7	.7	.7	1200
16	11:00	121	72°	43%	4.0	30.2	.215	29.5	.215	.6	.7	.7	1200
	Before Adjust												
	After Adjust												

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

DATE 12-10-90

WITNESSED BY: GOV'T

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LIBRASCOPE

11-26-80
REV. A

Page 33

TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION							
HOUR NO. Cont'd	CENTER (ARC-MIN)	LEFT (ARC-MIN)	RIGHT (ARC-MIN)	TOP (ARC-MIN)	BOTTOM (ARC-MIN)	PT. A		PT. B		PT. C		PT. D
						HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	
1	←	← STA	RT		→	0	0	0	0	0	0	0
2												
3												
4												
5	50, 0	-20	+20	-5	-50	0	0	0	0	0	0	0
6												
7												
8												
9	Before Adj	+10, +10	+10	+10	-10	0	0	0	0	0	0	0
10	After Adj											
11												
12												
13												
14												
15												
16	Before Adj	115	+5	Not calculated		0	0	0	0	0	0	0
After Adj												

TABLE 6.-2 EVLN DAY TABLE

VERT REG → HORIZ BARS

* NOTE: HORIZ REG → VERT BARS

SHEET 2 of 3

DATE: 12-10-80 WITNESSED BY: GOVT

LINK *Paul Smith*
LIBRASCOPES *John S. Sander*

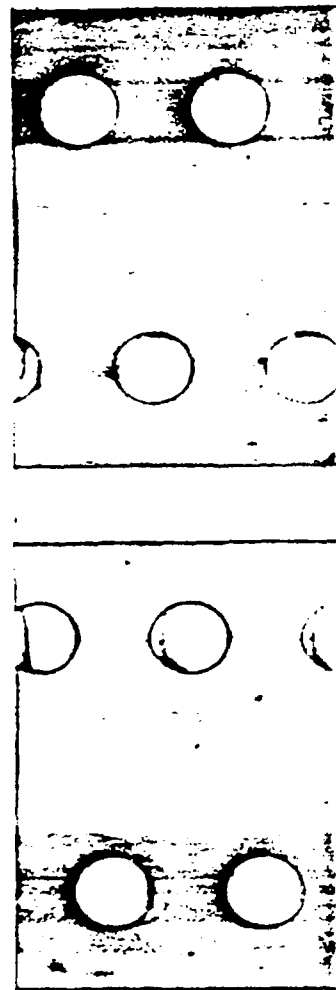
11-26-80
REV. A

Page 34

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION*		VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)				
1	200° 58'	-1,4	-1,2			Beam Angle servo and align. error fixed
2	200° 39'	-1,4	1,2			(VIEW LEVELS PROPER TO 3V ANGLE)
3	200° 28'	-1,4	-1,1			
4	200° 15'	-1,3	-1,1			
5	200° 42'	-1,4	-1,1			
6	200° 54'	-1,3	-1,1			
7	200° 42'	-1,4	-1,1			
8	200° 42'	-1,3	-2,6 m			
9	200° 30'	-1,3	-1,1	Adjust by 2 deg. gain		Typically after much fluctuation the problem was in install of in the beam line - checked beam line + 8:30 - 10:30
10				checked tube compass		
11				used floor wavy by attempting to average.		Expenditure removed on - defect beam inside of scope when inspecting field during time. The same was reproduced.
12				used signal improved to 10V. readjusted beam		
13				to 0.7 - readjust at compass		
14	200° 26'	-1,2	-1,2			Blue Resolving by 8:11 3:3 min up window
15	200° 0'	-1,3	-1,2			Small Blue misalignment do. it. v. d. I
Before Adj.	200° 21'	-1,3	-1,2			
After Adj.	Not	Performed.				

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

*NOTE - Horiz Res → Vert Bars
Vert Res → Horiz Bars



DATE 12-11-80 WITNESSED BY: GOV'T
LINK State Elmer
LIBRASCOPE John Conley

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PHR OUTPUT				TEST 5.3 VIDEO LEVEL				
					ARGON		CRYPTON		DYE	V SIGNAL (VOLTS)	GREEN (VOLTS)	BLUE (VOLTS)	HT VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS	WATTS				
1	8:19	120	69/65	55%	4	30	.235	29	.230	.7	.7	.7	1200
2	9:19	120	70/65	48%	4	30	.225	29	.220	.7	.7	.7	1200
3	10:19	120	70/66	44%	4	30	.225	29	.220	.7	.7	.7	1200
4	11:09	120	71/65	45%	4	30	.225	29	.220	.6	.65	.7	1200
5	12:09	120	72/66	42%	4	30	.225	29	.220	.7	.6	.6	1200
6	1:09	120	72/66	49%	4	30	.225	29	.220	.7	.6	.6	1200
7	2:09	120	73/66	49%	4	30	.225	29	.220	.7	.6	.6	1200
8	3:10	120	72/66	49%	4	30	.225	29	.220	.65	.6	.7	1200
9	4:10	120	72/65	49%	4	30	.225	29	.225	.65	.6	.7	1200
10	5:10	120	72/65	49%	4	30	.225	29	.225	.65	.6	.7	1200
11	6:10	120	72/66	49%	4	30	.225	29	.225	.65	.6	.7	1200
12	7:10	120	72/65	49%	4	30	.225	29	.225	.65	.6	.7	1200
13	8:10	121	72/66	49%	4	30	.225	29	.225	.65	.6	.7	1200
14	9:10	119	72/66	49%	4	31	.210	29	.220	.7	.7	.7	1200
15	10:09	126	72/66	49%	4	31	.210	29	.220	.7	.7	.7	1200
Before Adjust	10:55	120	71/66	49%	4	31	.205	29	.220	.7	.7	.7	1200
After Adjust													

TAB 5.3 AND NAV TAB 1

Sheet 1 of 1

DATE 12-11-80 WITNESSED BY: Gov't
LINK Nash
LIBRARIAN John Bond

TEST 5.4 CENTER & SIZE										TEST 5.5 REGISTRATION											
HOUR NO. Cont'd	CENTER ↑ (ARC-MIN)		LEFT ← (ARC-MIN)	RIGHT → (ARC-MIN)	TOP ↑ (ARC-MIN)	BOTTOM ↓ (ARC-MIN)	PT. A		PT. B		PT. C		PT. D								
	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)					HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)							
1	←	→	START			→	0	0	0	0	-2	1	0	1	-2	0	0	0	0	+2	0
2																					
3																					
4																					
5			+4, 0	+2	0	0	0	1	0	0	0	-1	-2	0	-2	0	-1	0	-1	+2	-2
6																					
7																					
8																					
9			+8, +4	-5	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	0	+2	0
10																					
11																					
12																					
13			+10, +5	-15	0	-5	-5	0	+4	0	0	0	0	+4	0	0	0	0	-2	0	0
14																					
15																					
16 Before Adj. After Adj.			+8, 0	-15	0	-5	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	-1

* NOTE: HOUR 17 DEC → VERT. DATE

DATE: 12-11-80 WITNESSED BY: GONT

LINK

LIBRSCOPE

John S. Gordon

COMMENTS

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION*			ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)		
1	200° 48'	-1.4	-1.2		
2	200° 51'	-1.4	-1.2		
3	200° 18'	-1.3	-1.2		
4	200° 45'	-1.3	-1.1		
5	200° 0'	-1.3	-1.1		
6	200° 9'	-1.4	-1.1		
7	200° 25'	-1.3	-1.2		
8	200° 10'	-1.3	-1.1		
9	200° 2'	-1.3	-1.1	~~After~~	
10	200° 25'	-1.3	-1.1		
11	200° 15'	-1.3	-1.2		
12	200° 0'	-1.3	-1.1		Re. adj top periscope mirror to front mirror level.
13	200° 28'	-1.4	-1.1		
14	200° 33'	-1.4	-1.2		
15	200° 36'	-1.4	-1.2		
Before Adj.	200° 30'	-1.3	-1.2	NOISE	SHUT DOWN 11:01
After Adj.					

Re. adj top periscope mirror to mount
water level.

SHUT DOWN 11:01

TABLE 6.-1 ODD DAY TABLE (CON'T)

SHEET 3 of 3

*NOTE - Horiz Res → Vert Bars
Vert Res → Horiz Bars

WITNESSED BY: GOV'T

LINK

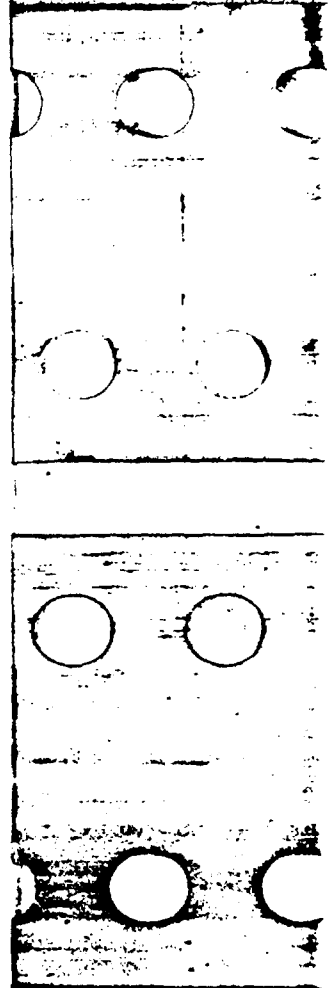
LIBRSCOPE Maure/Bowley

DATE 12/12/80

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT				TEST 5.3 VIDEO LEVEL				
					ARGON		CRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS					
1	11:30 / 9:15	120	70°/68°	40%	4	31.5	235	24	240, 185	.7	.7	.7	1200
2	10:00 / 10:00	120	72°/68°	48%									
3	11:30 / 11:10	120	72°/68°	48%	4	31	235	24	185	.7	.7	.8	1200
4	12:00 / 12:00	120	72°/68°	45%									
5	1:00 / 1:10	120	72°/68°	45%	4	31	235	24	170	.7	.7	.75	1200
6	2:00 / 2:10	120	72°/68°	42%									
7	3:00 / 3:00	120	72°/68°	42%	4	31	255	24.5	180	.7	.5	.6	1200
8	4:00 / 4:00	120	72°/68°	42%									
9	5:00 / 5:00	120	72°/68°	42%	4	32	250	25	180	.65	.7	.7	1200
10													
11													
12													
13													
14													
15													
Before Adj													
After Adj													

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3



DATE: 12/12/80

WITNESSED BY: GOVT

LINK

LIBRASCOPE Name / Number

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION*		VERY RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)				
1	200° 33'	-1,3	-1,2			
2	200° 24'	-1,3	-1,2			
3	200° 51'	-1,3	-1,2			
4	200° 24'	-1,3	-1,1			
5	200° 36'	-1,3	-1,2			
6	200° 59'	-1,2	-1,2			
7	200° 14'	-1,3	-1,1			Adjusted Resolution beam that was blurred during previous P & G video work see basket 17
8	200° 36'	-1,2	-1,1			Resolution poor -
Before Adj	200° 21'	-1,2	-1,1			First P & G die right compressor stopped - lost air - system stopped.
After Adj						Fixed problem to air pressure meter indicator. - Manual pressure rest. Restored air compressor pressure would only come to 180 PSI with system valve open (1/4) closed 1/2 pressure air valve - air compressor went to 200 PSI & shut off.
10						Ground valve - 10 min to 180 PSI.
11						Restored system and started.
12						shut out then about 5 min
13						and air pressure dropped to 180 PSI. Compressor would not bring up - Shut down all at 9:30
14						
15						
Before Adj.						
After Adj.						

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

*NOTE - Horiz Res → Vert Bars
Vert Res → Horiz Bars

DATE 12-12-90

WITNESSED BY:

LINK LIBRASCOPE

11-26-80
REV. A

Page 33

TEST 5.5 REGISTRATION

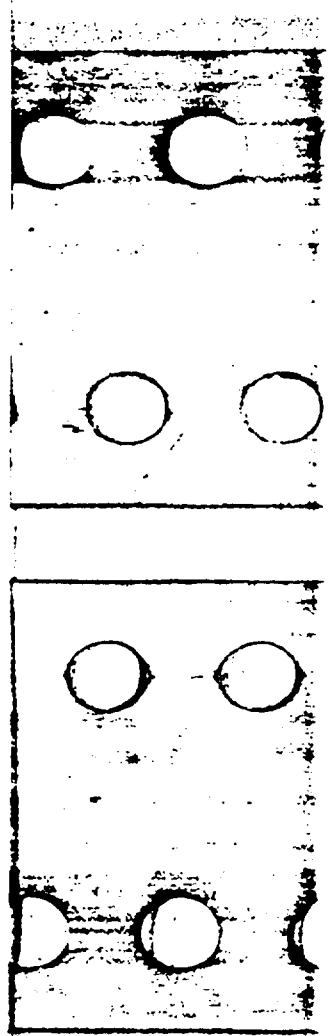
TEST 5.4 CENTER & SIZE

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE				TEST 5.5 REGISTRATION				PT. D			
	CENTER (ARC-MIN)	LEFT (ARC-MIN)	RIGHT (ARC-MIN)	TOP (ARC-MIN)	BOTTOM (ARC-MIN)	HORIZ* REG (ARC-MIN)	VERT* REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	VERT REG (ARC-MIN)
1		START				0	0	0	0	0	0	0
2												
3												
4												
5	-2.1	0	-2	0	0	0	1.0	0	0	0	0	0
6												
7												
8												
9 Before Adj	2.2	-1	+2	0	0	+1	+1	+0	+0	+1	+1	+1
10												
11												
12												
13												
14												
15												
16 Before Adj												
After Adj												

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-2 EVLN DAY TABLE

SHEET 2 of 3



WITNESSED BY: *Gov't. Robert J. ... (Monitor only)*
 LINK *Black ...*
 LIBRSCOPE *John Gordon*

DATE 12/1/80

TIME (START & END EACH SECURITY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT				TEST 5.3 VIDEO LEVEL			
				ARGON		KRYPTON		DYE	V SIGNAL		V SIGNAL VOLTAGE (VOLTS)
INHR NO.				WATTS	AMPS	WATTS	AMPS	WATTS	RED (VOLTS)	GREEN (VOLTS)	BLUE (VOLTS)
1	7:00	70	64	4.0	31	275mW	27.5	.180	.70	.70	.73
2	8:00	70	64	4.0	31	275mW	27.5	.200	.70	.70	.70
3	9:00	70	64	4.0	31	275mW	27.5	.200	.70	.60	.65
4	10:00	72	57	4.0	31	275mW	27.5	.200	.70	.65	.73
5	11:00	71	61	4.0	31	275mW	27.5	.200	.70	.65	.73
6	12:00	72	65	4.0	31	275mW	27.5	.200	.60	.50	.50
7	1:00	73	61	4.0	30	275mW	27.5	.200			
8	2:00	74	58	4.0	30	275mW	27.5	.200			
9	3:00	73	53								
10	4:00	SEE ANALYSIS									
11	5:00										
12	6:00	72	50	4.0	30.5	275mW	29.0	210mW	.70	.70	.75
13	7:00	73	50	4.0	30.5	275mW	29.0	210mW			
14	8:00	76	46	4.0	30.5	275mW	29.0	210mW	.45	.40	.60
15	9:00	79	35	3.9	30.7	250mW	28.5	210mW	.40	.40	.50
16	10:00	78	44	3.9	31.0	255mW	29.0	210mW	.60	.50	.50
17	11:00	78	44								

TABLE 6.-1 OOD DAY TABLE

DATE 12/1/80 WITNESSED BY: Gov. Robert F. Wagner (Municipal Only)
LINK Mark Blumstein
 LIBRSCOPE John G. Oakes

JUNK NO. Cont'd	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION					PT. D				
	CENTER (ARC-MIN)	LEFT (ARC-MIN)	RIGHT (ARC-MIN)	TOP (ARC-MIN)	BOTTOM (ARC-MIN)	PT. A		PT. B		PT. C		PT. D			
	(ARC-MIN)	(ARC-MIN)	(ARC-MIN)	(ARC-MIN)	(ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)
1		START				0	0	0	0	0	0	0	0	0	0
2															
3															
4															
5						0	0	0	0	0	0	0	0	0	0
6															
7															
8															
9															
10															
11															
12															
13		3RT SUP	1RT SUP	2UP 2UP	NO MARKS	0	0	0	0	0	0	0	0	0	0
14															
15															
16 Before Adj		5RT SUP	6RT SUP	3UP SUP	NO MARKS	2in	3in	2up	2up	0	0	0	0	2up	2up
After Adj		After Adj	After Adj	After Adj	After Adj	0	0	0	0	0	0	0	0	0	0

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

TABLE 6.-1 000 DAY TABLE (CONT'D)

DATE: 12-11-90 WITNESSED BY: CONT. Prof. Ferguson (M. B. J.)
 LINK: 1st Floor
 LIBRARY: 2nd Floor

INSTR. NO. (CONT.)	FOCUS DIST. (DEG.)	TEST 5.6 RESOLUTION*		ADJUSTMENTS MADE AT HOUR 16	COMMENTS
		HORIZ. RES. (GROUP)	VERT. RES. (GROUP)		
1	201° 10'	- 1.3	- 1.2		NO. 1 ADDED TO GROUP
2	201° 3'	- 1.4	- 1.2		
3	201° 27'	- 1.3	- 1.2		
4	201° 12'	- 1.3	- 1.2		RESTART SPINNER (10:00)
5	201° 18'	- 1.3	- 1.2		RESTART SPINNER (11:10)
6	201° 15'	- 1.3	- 1.2		
7	201° 45'	- 1.3	- 1.2		RESTART SPINNER (1:45)
8	201° 33'	- 1.3	- 1.1		RESTART SPINNER (2:03) and (2:40)
9					INTERMITTENT PLATTER ON WHITE BACKGROUND AND TO TOP PLATE OF MICROSCOPE
10					OFF AT 3:30 PM SPINNER STOPPED OUT OF SYNC. PROBLEM TRACED TO BAD CONNECTION. ADJUSTED IN - SPINNER STOPPED DURING PM 20. RESTARTED AND 5.6. RESTARTED WITHIN 10 MINUTES. RESTART 5:15 PM
11					6:18 SPINNER STOPPED DOWN: BAD CONNECTION AND RESTARTED
12	200° 54'	- 1.3	- 1.2		RESTART 6:35
13	200° 50'	- 1.3	- 1.2		7:30 SPINNER STOPPED DOWN: BAD CONNECTION AND RESTARTED
14	200° 45'	- 1.1	- 1.1		RESTART 7:31
15	200° 35'	- 2.5	- 2.5		
Before Adj.	199° 24'	VERY BAD	VERY BAD		TABLE TO OBSERVE AND ADJUST RESOLUTION
After Adj.	200° 35'	VERY BAD	VERY BAD		AND TO ADJUST CONNECTION
		- 1.3	- 1.2		END TEST 10:30 PM

NOTE - Horiz Res → Vert Bars
 Vert Res → Horiz Bars

TABLE 6.-1 000 DAY TABLE (CONT.)

DATE 12-2-80
 WITNESSED BY: Gov't [Signature] (Ment. Only)
 LINK Black [Signature]
 LINDASCOPE John [Signature]

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT				TEST 5.3 VIDEO LEVEL				
					AESON		CRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS					
1	7:10	120	68°/64°	62%	4	31	275	29	.200	.7	.8	.8	1200
2	8:10	120	68°/64°	58%	4	29	275	29.5	.200	.6	.85	.7	1200
3	9:14	120	68°/64°	54%	4	29	275	29.5	.200	.6	.7	.7	1200
4	10:12	120	68°/64°	54%	4	29	275	29.5	.200	.6	.7	.7	1200
5	11:12	120	68°/64°	54%	4	31	275	28.0	.200	.6	.7	.7	1200
6	12:12	120	70°/64°	55%	4	31	260	28.5	.215	.6	.75	.7	1200
7	1:11	120	70°/64°	55%	4	31	260	28.5	.215	.6	.75	.7	1200
8	2:11	120	70°/64°	59%	4	31	260	28.5	.215	.6	.75	.7	1200
9	3:14	120	70°/64°	59%	4	31	260	28.5	.215	.6	.75	.7	1200
10													
11													
12													
13													
14		123	70°/62°	64%									
15	9:10	122	70°/60°	55%	3.9	31.2	260	28.5	.205	.55	.50	.50	1200
16					4.0	31.2	260	28.7	.200	.55	.45	.45	1200
Before Adjust					4.0	31.2	260	28.5	.205	.70	.70	.65	1200
After Adjust		122	70°/62°	64%	4.0	31.2	260	28.5	.205	.70	.70	.65	1200

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

TABLE 6.-2 EVEN DAY TABLE

DATE 12-2-00 WITNESSED BY: CON'T *John J. Fagan (Master Chief)*
 LINK *John J. Fagan*
 LIDARSCOPE *John J. Fagan*

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION					PT. D		
	CENTER (ARC-MIN)	LEFT (ARC-MIN)	RIGHT (ARC-MIN)	TOP (ARC-MIN)	BOTTOM (ARC-MIN)	PT. A	PT. B	PT. C	PT. D	PT. E	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)
1	←	S	T	A	R T →	0 0	0 -1	-1 -1	0 0	0 -1	0 1	0 0	0 1
2													
3													
4													
5	+1, 0	+1	-1	+1	-1	0 0	0 -2	-1 -1	0 1	0 -2	0 1	0 1	0 1
6													
7													
8													
9 Before Adj.	35, 0	-1	+20	0	0	0 -4	-1 0	0 -5	0 0	-1 -1	0 0	0 -2	0 0
After Adj.													
10													
11													
12													
13													
14													
15													
16 Before Adj.													
After Adj.													

TABLE 6.-2 EVLN DAY TABLE

SHEET 2 of 3

* NOTE: HORIZ REG → VERT REG VERT REG → HORIZ REG

DATE: 12-2-80 WITNESSED BY: CONT *Robert Ferguson (Militia)*
 LINK *Mark Elliott*
 LIBRASCOP *John Browder*

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION*		VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIAL (DEG.)	HORTZ RES. (GROUP)				
1	201° 12'	- 1.4	- 1.2			
2	200° 45'	- 1.3	- 1.2			
3	200° 55'	- 1.3	- 1.2			
4	201° 15'	- 1.3	- 1.2			
5	201° 12'	- 1.3	- 1.2			
6	201° 12'	- 1.3	- 1.2			
7	201° 0'	- 1.3	- 1.2			
8	201° 0'	- 1.3	- 1.2			
9	201° 03'	- 1.4	- 1.1			
Before Adj.						
After Adj.						
10						
11						
12						
13						
14	200° 12'	- 1.3	- 1.1			ALIENT LEVELS PHOTOFED
15	200° 6'	- 1.3	- 1.1			RSS 6.5 B ₅
Before Adj.						
After Adj.						

*NOTE - Hortz Res → Vert Hars
 Vert Res → Hortz Bards

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

DATE 12/3/80 WITNESSED BY: Gov't Rep. (M. L. Moore)
 LINK at 11:00
 LIBRSCOPE M. L. Moore

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT				TEST 5.3 VIDEO LEVEL				
					ARGON		KRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS	WATTS				
1	9:30	120	69/62	68%	4.0	31.5 ^(31.3)	.265	29	.060/.200 ¹⁶	.70	.70	.70	1200 ¹²
2	10:30	120	70/62	64%									
3	11:30	120	69/63	59%	4.1	31.5	.265	29	.205	.70	.75	.70	1200
4	12:30	120	70/63	59%									
5	1:30	120	70/64	55%	4.1	33.5	.270	29	.200	.70	.70	.6	1200 ¹²
6	2:30	120	70/63	55%									
7	3:30	120	72/64	61%	4.1	33.2	.260	29	.210	.70	.70	.6	1200
8	4:30	120	72/62	55%	4.1	33.0	.250	29	.200	.7	.7	.6	1200
9	5:30	120	70/62	64%	4.1	33.8	.260	29	.210	.7	.7	.6	1200
10	6:30	120	74/61	55%									
11	7:30	120	72/63	55%	4.1	34	.250	29.5	.210	.69	.7	.65	1200
12	8:30	120	70/62	54%									
13	9:30	120	71/64	64%	4.1	34.2	.253	29.5	.205	.66	.7	.60	1200
14	10:30	120	71/64	64%									
15	11:30	120	71/64	64%	4.1	34.7	.251	29	.205	.65	.7	.62	1200
Before adjust	12:30	120	72/62	55%	4.1	34.5	.250	29	.205	.70	.7	.63	1200

[illegible]

* NOTE: IND012 REG → VERT BARS

DATE: 12/2/80 WITNESSED BY: CONT. P. L. Thompson (M. J. B. J.)
 LINK: Link
 TELESCOPE: for the same

HOUR NO. (CONT.)	TEST 5.6 RESOLUTION*		VERY RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIST. (FEET)	HORIZ. RES. (GROUP)			
1	200° 51'	-1, 4	-1, 1		ADJUSTED PIVOTING BEAR INTO PIVOT LATER
2	200° 52'	-1, 4	-1, 1		(200° 51' - 200° 52') and (200° 52' - 200° 53') became a
3	200° 56'	-1, 4	-1, 1		single (200° 52' - 200° 53') and (200° 53' - 200° 54') were
4	200° 56'	-1, 4	-1, 1		was measured. When noticed to get beam
5	200° 56'	-1, 4	-1, 1		of beam spot. Subsequent file
6	201° 17'	-1, 4	-1, 2		redesignated.
7	200° 51'	-1, 4	-1, 2		
8	201° 17'	-1, 4	-1, 2		Time, 4:50
9	200° 51'	-1, 2	-1, 1		Time
10	201° 54'	-1, 3	-1, 2		Time
11	200° 57'	-1, 3	-1, 2		Time
12	200° 54'	-1, 3	-1, 2		Time
13	200° 58'	-1, 3	-1, 2		Time
14	200° 51'	-1, 3	-1, 2		Time
15	200° 55'	-1, 3	-1, 2		Time
Before Adj.	200° 51'	-1, 3	-1, 2		Revised, but not needed - not visible
After Adj.					

*NOTE - Horiz Res → Vert Bars
 Vert Res → Horiz Bars

TABLE 6.-1 ODD DAY TABLE (CONT.)

DATE 10/4/80 WITNESSED BY: Gov't [Signature] (Military)
 LINK [Signature]
 LIMASCOPE M1 Main

44-40000-3747
 2-1-6-2-1-40
 1-1-1-2-1-20
 Form 20-27

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT				TEST 5.3 VIDEO LEVEL			
					AUSCH		CRYPTON		DYE	V SIGNAL		V SIGNAL
					WATTS	AMPS	WATTS	AMPS		RED (VOLTS)	GREEN (VOLTS)	BLUE (VOLTS)
1	9:30	120V	72°/64°	69%	3.8	32.5	.260	29	.030	.7	.2	.4
2	10:30	120V	70°/63°	64%								
3	1:30	SEE COMMENTS										
4	12:30	120V	71°/65°	68%								
5	1:30	120V	70°/64°	64%	3.7	35	.255	29	.180	.6	.6	.7
6	2:30	120V	70°/64°	64%								
7	3:30	121V	72°/64°	65%	3.9	34	.265	29	.212	.6	.6	.6
8	4:30	123	71°/64°	63%								
9	Before Adjust	120V	70°/64°	62%	4.0	34.5	.255	29	.205	.6	.7	.6
10	After Adjust	121V	72°/65°	65%	4.0	35.0	.250	29	.205	.6	.6	.5
11	7:30	120V	70°/64°	64%	4.0	36	.240	28.5	.200	.6	.6	.5
12	8:30	121	70°/64°	68%								
13	9:30	120	70°/64°	64%	3.4	36.5	.240	28.5	.180	.6	.6	.5
14	10:30	120	70°/64°	64%								
15	11:30	120	70°/64°	64%	3.85	35.2	.230	28.5	.160	.6	.55	.45
16	Before Adjust	120	70°/64°	60%	3.85	35.2	.230	28.5				
17	After Adjust	120	70°/64°	60%	3.85	35.2	.230	28.5				

TABLE 6.-2 EVEN DAY TABLE

DATE 12/1/80 WITNESSED BY: Gov't Link Librascope M. M. M. M. (Monitor Only)

TEST 5.5 REGISTRATION

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE					PT. A					PT. B					PT. C					PT. D				
	CENTER (ARC-MIN)	LEFT (ARC-MIN)	RIGHT (ARC-MIN)	TOP (ARC-MIN)	BOTTOM (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj
10	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj
11																									
12																									
13																									
14																									
15																									
16	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj	Before Adj
	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj	After Adj

TABLE 6.-2 EVEN DAY TABLE

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

DATE: 12/1/62
 WITNESSED BY: Govt. [Signature]
 LITHOGRAPH: M. K. [Signature]

HOUR NO. (CONT'D)	TEST 5.6 RESOLUTION*		VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)				
1	201° 30'	-1, 4	-1, 1			
2	201° 30'	-1, 4	-1, 1	Physical Handling, Lens		
3	~~201° 30'~~	~~-1, 4~~	~~-1, 1~~	set table - new setup		
4	201° 10'	-1, 3	-1, 1	Sp. Start - Residual		
5	201° 15'	-1, 3	-1, 1	center on table -		
6	201° 20'	-1, 2	-1, 1	level focusing up		
7	201° 21'	-1, 3	-1, 1	Phys. handle then adjust		
8	201° 23'	-1, 1	-1, 1	table - sandbagged		
9	201° 20'	-1, 2	-1, 2	flange to table.		
10	201° 58'	-1, 3	-1, 2	this residual signal.		
11	200° 57'	-1, 3	-1, 2	level and signal		
12	200° 57'	-1, 3	-1, 2	increase in beam spread		
13	200° 52'	-1, 3	-1, 3	-backed off a bit		
14	200° 52'	-1, 3	-1, 3	Physical -		
15	200° 53'	-1, 3	-1, 3	Physical -		
Before Adj.						
After Adj.						

*NOTE - Horiz Res → Vert Bars
 Vert Res → Horiz Bars

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

DATE 12-5-80 WITNESSED BY: Robert Ferguson (Monitor Only)
 LINK John Diller
 LIBRASCOPIC W. H. Moore

813

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT				TEST 5.3 VIDEO LEVEL				
					ARGON		CRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS					
1	8:30	120	68 1/4	71%	See comment		270	29.5	See comment	.7	See comment		1200
2	9:30	120	67 3/4	67%			250	29.5		.7			1200
3	10:30	120	70 1/4	68%									
4	11:30	120	70 1/4	69%			250	29.5		375			1200
5	12:30	120	69 1/4	67%									
6	1:30	120	69 1/4	67%									
7					See comment					0.4			1200
8	1:50	122	68 1/2	71%									
9													
10													
11													
12													
13													
14													
15													
Before Adjust													
After Adjust													

TABLE 6.-1 (NO DAY TIME)

SHEET 1 OF 3

TABLE 6.-1 (NO DAY TARE)

SHEET 1 OF 3

DATE 12-5-80 WITNESSED BY: GUY T. [Signature] (Master Only)
 LINK [Signature]
 LIBRSCOPE

TEST 5.4 CENTER & SIZE										TEST 5.5 REGISTRATION							
ROW NO. Cont'd	CENTER ↑ (ARC-MIN)	LEFT ← (ARC-MIN)	RIGHT → (ARC-MIN)	TOP ↑ (ARC-MIN)	BOTTOM ↓ (ARC-MIN)	PT. A		PT. B		PT. C		PT. D					
						HORIZ REG (ARC-MIN)	VERT* REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)				
1	←	ST	ART		→	ASEG		COMMENTS									
2																	
3																	
4																	
5	-4, +2	+2	-2	-2	+2												
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16	Before Adj																
	After Adj																

DATE: 12/5/80 WITNESSED BY: GONT Robert James Christie, Dof.
LINK John B. Link
LITHASCOPE Mr. Hance

LIBRASCOPE M. HANSEL

COMMENTS

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION*		ADJUSTMENTS MADE AT HOUR 16		COMMENTS
	FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)		
1	20° 10'	-1.4	1.2		RED ONLY: The Spectro Physics engineer from Denver worked together with the rest of the team to get a photo of the the rest of the team to get a photo of the the rest of the team to get a photo of the
2	20° 15'	1.4	1.2		
3	20° 12'	1.4	1.2		
4	20° 30'	1.4	1.2		
5	20° 27'	1.4	1.2		
6	20° 35'	1.4	1.2		
7	20° 18'	1.3	1.2		
8					
9					
10					
11					
12					
13					
14					
15					
16	Before Adj.				
	After Adj.				

SHEET 3 of 3

TABLE 6-1 OOD DAY TABLE (CON'T)

*NOTE - Horiz Res → Vert Bars,
Vert Res → Horiz Bars.

DATE 12/8/80 WITNESSED BY: Gov't Robert Ferguson (Photo adj)
 LINK Robert Ferguson
 LIDARSCOPE M. Mass 4/9/80

816

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT				TEST 5.3 VIDEO LEVEL				
					AREON		CRYPTON		DYE WATTS	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS					
1	7:00	120	61/64	58%	4	27.5	250	29	.220	.7	.7	.7	1200
2	8:00	120	61/63	50%									
3	9:00	120	68/64	58%	4	27.5	220	29.5	.200	.7	.7	.7	1200
4	10:00	120	70/63	55%									
5	11:00	120	70/62	48%	4.0	27.2	220	29.5	.230	.55	.5	.55	1200
6	12:00	120	70/63	50%									
7	12:30	120	68/63	50%	4	29	220	29.5	.225	.5	.5	.5	1200
8	2:00	120	69/63	50%									
9	3:00	120	70/62	48%	3.9	28.5	230	29.5	.235	.5	.5	.6	1200
10	3:30	121	70/62	55%	4.0	29.0	240	29.5	.240	.7	.7	.7	1200
11	4:00	120	70/62	55%									
12	5:00	121	70/62	48%	4.0	29.0	230	29.5	.230	.7	.7	.7	1200
13	7:00	120	70/64	44%	4.0	29.3	210	29.8	.230	.68	.7	.7	1200
14	8:00	121	70/64	45%									
15	1:00	120	70/60	40%	4.0	28.5	200	29.5	.240	.65	.7	.7	1200
16	10:00	120	70/61	48%	4.0	29.5	215	29.5	.240	.65	.7	.7	1200

TABLE 6.2 EVEN DAY TABLE

DATE: 12/2/80

WITNESSED BY:

CERTIFICATE OF FREQUENT (Mort-Coll)

[illegible]

NOTE - Horiz Res → Vert Bars
Vert Res → Horiz Bars

TABLE 6.-2 EVEN DAY TABLE (CONT'D)

SHEET 3 of 3

DATE 12/7/80 WITNESSED BY: Don't Phat T. Nguyen (Monitor Only)
 LINK NEEL
 LIBRARIAN Thomson

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT				TEST 5.3 VIDEO LEVEL				
					AREION		CRYPTON		DYE	V SIGNAL			
					WATTS	AMPS	WATTS	AMPS		RED (VOLTS)	GREEN (VOLTS)	BLUE (VOLTS)	HT VOLTAGE (VOLTS)
1	7:00-8:00	120	67°/62°	49%	4	30	.225	29.5	.220	.7	.65	.7	1200
2	8:00-9:00	120	69°/63°	50%									
3	9:00-10:00	120	67°/63°	50%	3.95	30	.225	29.5	.220	.63	.6	.7	1200
4	10:00-11:00	120	68°/63°	54%	3.95	29.5	.225	28	.220	.6	.55	.7	1200
5	11:00-12:00	120	64°/62°	50%									
6	12:00-1:00	120	70°/63°	48%									
7	1:00-2:00	120	64°/63°	47%	3.9	29.5	.225	28	.230	.5	.35	.85	1200
8	2:00-3:00	120	65°/63°	51%									
9	3:00-4:00	120	64°/65°	57%	3.9	29.5	.240	29	.230	.5	.4	.5	1200
10	4:00-5:00	120	64°/65°	58%	4.0	30.0	.235	29	.230	.65	.7	.7	1200
11	5:00-6:00	120	65°/65°	57%	4.0	30.0	.230	29	.230	.57	.75	.70	1200
12	6:00-7:00	120	65°/64°	48%									
13	7:00-8:00	121	66°/64°	45%	4.0	30.0	.225	28.5	.225	.65	.70	.65	1200
14	8:00-9:00	121	70°/65°	48%									
15	9:00-10:00	120	70°/63°	48%	4.0	30.0	.230	29	.225	.65	.7	.65	1200
Before Adjust					4.0	30.0	.225	29	.225	.60	.70	.65	1200
After Adjust													

DATE 10/9/80 WITNESSED BY: GOV'T
 LINK ASB
 LIBRSCOPE Manual

TEST 5.4 CENTER & SIZE										TEST 5.5 REGISTRATION								PT. D	
HOUR NO. Cont'd	CENTER ↑ (ARC-MIN)		LEFT ← (ARC-MIN)	RIGHT → (ARC-MIN)	TOP ↑ (ARC-MIN)	BOTTOM ↓ (ARC-MIN)	PT. A		PT. B		PT. C		PT. D						
	↑	↓	←	→	↑	↓	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)					
1	←	→	←	→	↑	↓	0	0	0	0	0	0	0	0					
2																			
3																			
4	←	→	←	→	↑	↓	0	0	0	0	0	0	0	0					
5	←	→	←	→	↑	↓	0	0	0	0	0	0	0	0					
6																			
7																			
8	←	→	←	→	↑	↓	0	0	0	0	0	0	0	0					
9	←	→	←	→	↑	↓	0	0	0	0	0	0	0	0					
10																			
11																			
12																			
13																			
14																			
15																			
16 Before Adj	←	→	←	→	↑	↓	0	0	0	0	0	0	0	0					
After Adj																			

TABLE 6.-1 000 DAY TABLE (CONT'D)

SHEET 2 of 3

TABLE 6.-1 000 DAY TABLE (CONT'D)

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

DATE: 12/9/70
 WITNESSED BY: GOVT. Phil Thompson (Contractor)
 LINK: H. E. [unclear]
 LIBRSCOPE: Marie

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION*		ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIST. (DEG.)	HORIZ RES. (GROUP)	VERT RES. (GROUP)	
1	200° 34'	-1.3	-1.2	
2	200° 19'	-1.3	-1.2	
3	200° 15'	-1.4	-1.2	
4	200° 19'	-1.4	-1.2	
5	199° 42'	-1.3	-1.1	
6	200° 6'	-1.3	-1.2	
7	200° 27'	-1.3	-2.6	
8	200° 15'	-1.2	-2.6	
9	200° 12'	-1.3	-2.6	
10	200° 14'	-1.3	-1.1	
11	200° 9'	-1.4	-1.1	
12	200° 6'	-1.3	-1.2	
13	199° 51'	-1.4	-1.1	
14	200° 13'	-1.5	-1.1	
15	200° 8'	-1.3	-1.2	
Before Adj.	199° 50'	-1.2	-1.1	
After Adj.				

*NOTE - Horiz Res → Vert Bars
 Vert Res → Horiz Bars

TABLE 6.-1 ONE DAY TABLE (CON'T)

DATE 12-10-90 WITNESSED BY: Gov't Robert Ferguson (Milit. Eng.)
LINK Link 1
LIBRARYSCOPE Sydney Borden

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT				TEST 5.3 VIDEO LEVEL				
					ARGON		CRYPTION		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HT VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS					
1	~~7:00~~	120	68°/65	54%	4	31.5	.230	29.5	.220	.7	.7	.7	1200
2	~~8:00~~	120	68°/65	50%	4	31	.220	29	.220	.75	.65	.7	1200
3	~~9:00~~	120	68°/65	50%	4	31	.220	29	.220	.7	.6	.7	1200
4	~~10:00~~	120	68°/65	48%	4	31	.220	29	.220	.7	.5	.6	1200
5	~~11:00~~	120	70°/65	45%	4	31	.220	29	.220	.7	.4	.7	1200
6	~~12:00~~	120	70°/65	45%	4	31	.220	29	.220	.7	.4	.7	1200
7	~~1:00~~	120	70°/65	45%	4	31	.220	29	.220	.7	.4	.7	1200
8	~~2:00~~	120	70°/65	45%	4	31	.220	29	.220	.7	.4	.7	1200
9	Before Adj	121	70°/65	45%	4	31	.220	29	.220	.7	.4	.7	1200
10	After Adj	121	70°/65	45%	4	31	.220	29	.220	.7	.4	.7	1200
11		121	70°/65	45%	4	31	.220	29	.220	.7	.4	.7	1200
12		121	70°/65	45%	4	31	.220	29	.220	.7	.4	.7	1200
13		121	70°/65	45%	4	31	.220	29	.220	.7	.4	.7	1200
14		121	70°/65	45%	4	31	.220	29	.220	.7	.4	.7	1200
15		121	70°/65	45%	4	31	.220	29	.220	.7	.4	.7	1200
16	Before Adj	121	70°/65	45%	4	31	.220	29	.220	.7	.4	.7	1200
17	After Adj	121	70°/65	45%	4	31	.220	29	.220	.7	.4	.7	1200

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

TABLE 6.-2 EVEN DAY TABLE

DATE 12-15-90 WITNESSED BY: CON'T
LINK John B. ...
LIBRSCOPE John B. ...

TEST 5.4 CENTER & SIZE										TEST 5.5 REGISTRATION									
HOUR NO. Cont'd	CENTER (ARC-MIN)		LEFT (ARC-MIN)	RIGHT (ARC-MIN)	TOP (ARC-MIN)	BOTTOM (ARC-MIN)	PT. A		PT. B		PT. C		PT. D						
	←	→					HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)					
1	←	→	STA	RT		→	0	0	0	0	0	+1	0	0	0	0			
2																			
3																			
4																			
5			90,0	-20	-5	-50	0	0	+5	0	0	+5	0	0	+1	+1			
6																			
7																			
8																			
9	Before Adj		-10	+10	+10	-10	0	0	+5	0	0	+5	0	0	+1	+1			
10	After Adj																		
11																			
12																			
13																			
14																			
15																			
16	Before Adj		15	77.6	20.6		0	0	+5	0	0	+3	0	0	0	+1			
17	After Adj																		

TABLE 6.-2 EVLN DAY TABLE

* NOTE: HORIZ REG → VERT MARK VERT REG → HORIZ MARK

DATE: 12-10-80 WITNESSED BY: GUNT
 LHM: [Signature]
 LIBRARY: [Signature]

ADJUSTMENTS MADE AT HOUR 9
 ADJUSTMENTS MADE AT HOUR 16
 COMMENTS

HOUR NO. (CONT.)	TEST 5.6 RESOLUTION*		VERY RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)				
1	200° 58'	-1.4	-1.2			Room Airflow sensor not working (ever since)
2	200° 39'	-1.4	1.2			
3	200° 28'	-1.4	-1.1			
4	200° 15'	-1.3	-1.1			
5	200° 42'	-1.4	-1.1			
6	54'	-1.4	1.1			
7	200° 42'	-1.4	-1.1			
8	200° 42'	-1.3	-2.5			
9	200° 30'	-1.3	-1.1			
Before Adj.						
After Adj.						
10						
11						
12						
13						
14	200° 20'	-1.2	-1.2			
15	200° 20'	-1.3	-1.2			
Before Adj.	200° 21'	-1.3	1.2			
After Adj.	200° 21'	-1.3	1.2			

*NOTE - Horiz Res → Vert Bars
 Vert Res → Horiz Bars

TABLE 6.2 EVEN DAY TABLE (CONT'D)

DATE 12-11-80 WITNESSED BY: _____

DATE 12-11-80

GEON'T. William Wentland
LINK Black Elder
LIBRSCOPE John Bondy

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PHR OUTPUT				TEST 5.3 WIND LEVEL				
					ZARSON		CRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS					
1	8:00	120	69/65	55%	4	30	.235	29	.230	.7	.7	.7	1200
2	9:00	120	70/65	48%	4	30	.225	29	.220	.7	.7	.7	1200
3	10:00	120	70/66	44%	4	30	.225	29	.220	.6	.65	.7	1200
4	11:00	120	71/65	45%	4	30	.225	29	.220	.7	.6	.7	1200
5	12:00	120	70/66	42%	4	30	.225	29	.220	.7	.6	.7	1200
6	1:00	120	70/66	41%	4	30	.225	29	.220	.7	.6	.7	1200
7	2:00	120	70/66	41%	4	30	.225	29	.220	.7	.6	.7	1200
8	3:00	120	71/66	41%	4	30	.225	29	.230	.65	.6	.7	1200
9	4:00	120	71/65	47%	4	30	.215	29	.225	.65	.6	.7	1200
10	5:00	120	72/65	49%	4	30	.215	29	.225	.65	.6	.7	1200
11	6:00	120	72/65	42%	4	30	.215	29	.225	.65	.6	.7	1200
12	7:00	120	72/65	44%	4	30	.215	29	.220	.65	.6	.7	1200
13	8:00	120	72/66	44%	4	30	.215	29	.220	.65	.6	.7	1200
14	9:00	120	72/66	44%	4	31	.215	29	.220	.65	.6	.7	1200
15	10:00	120	72/66	42%	4	31	.205	29	.220	.65	.6	.7	1200
Before Adjust After	11:00	120	71/	44%	4	31	.205	29	.220	.65	.6	.7	1200

DATE 12-11-80 WITNESSED BY: GOV'T John J. [Signature]
 LINK LIBRASCOPY John J. [Signature]

TEST 5.4 CENTER & SIZE										TEST 5.5 REGISTRATION								PT. D	
HOUR NO. Cont'd	CENTER		LEFT	RIGHT	TOP	BOTTOM	PT. A		PT. B		PT. C		HORIZ REG		VERT REG				
	(ARC-MIN)	(ARC-MIN)	(ARC-MIN)	(ARC-MIN)	(ARC-MIN)	(ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)	HORIZ REG (ARC-MIN)	VERT REG (ARC-MIN)			
1	START	START	START	START	START	START	0	0	0	0	0	0	0	0	0	0			
2																			
3																			
4							0	1	0	0	-1	-2	0	-1	0	-1			
5							0	1	0	0	-1	-2	0	-1	0	-1			
6																			
7																			
8							0	0	0	0	0	0	0	0	0	0			
9							0	0	0	0	0	0	0	0	0	0			
10																			
11																			
12							0	0	0	0	0	0	0	0	0	0			
13							0	0	0	0	0	0	0	0	0	0			
14																			
15							-2	0	0	0	0	0	0	0	0	0			
16 Before Adj																			
After Adj																			

9

TEST 5.5 REGISTRATION

TABLE 5-3 000 DAY TABLE (CONT'D)

SHEET 2 of 3

SHEET 2 of 3

TABLE 5.-1 ODD DAY TABLE (CONT'D)

* NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

DATE: 12-11-86 WITNESSED BY: GWT

LINK

LITHASCOPE

Handwritten signature

COMMENTS

ADJUSTMENTS
MADE AT HOUR 16

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION*		VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIST (DEG.)	HORIZ RES. (GROUP)			
1	200° 48'	-1.4	-1.2		
2	200° 51'	-1.4	-1.2		
3	200° 18'	-1.3	-1.2		
4	200° 43'	-1.3	-1.1		
5	200° 0'	-1.3	-1.1		
6		-1.3	-1.2		
7		-1.3	-1.1		
8		-1.3	-1.1		
9	200° 2'	-1.3	-1.1		
10	200° 25'	-1.3	-1.1		
11	200° 15'	-1.3	-1.2		
12	200° 6'	-1.3	-1.1		
13	200° 28'	-1.4	-1.1		
14	200° 33'	-1.4	-1.2		
15	200° 4'	-1.4	-1.1		
Before Adj.		-1.2	-1.2		
After Adj.					

Ready top periscope magnifier to front

SPLIT DOWN 11.01

SHEET 3 of 3

TABLE 6.-1 ODD DAY TABLE (CON'T)

*NOTE - Horiz Res → Vert Bars,
Vert Res → Horiz Bars

DATE 12/12/80 WITNESSED BY: GOWT
 LINK LIBRASCOPY Alance / Picard

HOUR NO.	TIME (START & END EACH HOURLY TEST)	LINE VOLTAGE (V)	TEMP (°F)	HUMIDITY (% RELATIVE)	TEST 5.2 PWR OUTPUT				TEST 5.3 VIDEO LEVEL				
					AREON		CRYPTON		DYE	V SIGNAL RED (VOLTS)	V SIGNAL GREEN (VOLTS)	V SIGNAL BLUE (VOLTS)	HI VOLTAGE (VOLTS)
					WATTS	AMPS	WATTS	AMPS	WATTS				
1		120	70°	45%	4	31.5	235	2.4	240, 185	.7	.7	.7	1200
2		120	70°	45%									
3		120	70°	45%		31	235	2.4	185	.7	.7	.7	1200
4		120	70°	45%									
5		120	70°	45%		31	235	2.4	170	.7	.7	.7	1200
6		120	70°	45%									
7		120	70°	45%	4	31	235	2.4	185	.7	.7	.7	1200
8		120	70°	45%	4	31	235	2.4	185	.7	.7	.7	1200
9	Before Adj												
10	After Adj												
11													
12													
13													
14													
15													
16	Before Adj												
17	After Adj												

TABLE 6.-2 EVEN DAY TABLE

Sheet 1 of 3

DATE 12-12-80 WITNESSED BY: Gov't Librarian
 LINK LIBRARIAN
 LIBRARIAN Gov't

HOUR NO. Cont'd	TEST 5.4 CENTER & SIZE					TEST 5.5 REGISTRATION					PT. D				
	CENTER 4" (ARC-MIN)	LEFT 4" (ARC-MIN)	RIGHT 4" (ARC-MIN)	TOP 4" (ARC-MIN)	BOTTOM 4" (ARC-MIN)	PT. A HORIZ REG (ARC-MIN)	PT. A VERT REG (ARC-MIN)	PT. B HORIZ REG (ARC-MIN)	PT. B VERT REG (ARC-MIN)	PT. C HORIZ REG (ARC-MIN)	PT. C VERT REG (ARC-MIN)	PT. D HORIZ REG (ARC-MIN)	PT. D VERT REG (ARC-MIN)	PT. D HORIZ REG (ARC-MIN)	PT. D VERT REG (ARC-MIN)
1															
2															
3															
4															
5															
6															
7															
8															
9	Before Adj	-1	+2	0	0	0	0	0	0	0	0	0	0	0	0
	After Adj														
10															
11															
12															
13															
14															
15															
16	Before Adj														
	After Adj														

TABLE 6.-2 EVEN DAY TABLE

NOTE: HORIZ REG → VERT BARS VERT REG → HORIZ BARS

DATE: 12/12/80 WITNESSED BY: GOVT
 LINK LIBRASCOPE Science / Physics

HOUR NO. (CON'T)	TEST 5.6 RESOLUTION*		VERT RES. (GROUP)	ADJUSTMENTS MADE AT HOUR 9	ADJUSTMENTS MADE AT HOUR 16	COMMENTS
	FOCUS DIAL (DEG.)	HORIZ RES. (GROUP)				
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
Before Adj.						
After Adj.						

*NOTE - Horiz Res ⇒ Vert Dars
 Vert Res ⇒ Horiz Bards

TABLE 6.-2 EVEN DAY TABLE (CONT'D)