SURVEYOR VII
TELEVISION DATA PACKAGE
1968

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

SURVEYOR VII TELEVISION DATA PACKAGE

Foreword

The enclosed image, tabular, and text information represent the record of Surveyor VII television data delivered to the scientific community to the present time. These contents are not a report on the scientific analysis of the Surveyor VII data, but provide only the most complete and accurate TV data available to date. Scientific analyses are reported through other mechanisms, including Project Reports, Public Information Releases, and Scientific Journal articles.

The Surveyor VII Mission Data Package was prepared by the staff of the Surveyor Project under contract NAS 7-100.

TELEVISION DATA PACKAGE DESCRIPTION

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

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INTRODUCTION

The information included in this document contains supporting material to assist scientific analysis of the Surveyor VII television data. The contents are arranged to provide the following:

a) The calibration section explains and contains the calibration data available for the image and TV Identification data. Included are the light transfer functions delineating the transfer characteristic from input lunar luminance to the film density of the duplicate negative. Additional calibration is provided to show the shading response of the camera and film recorder system and to show the extent and location of vidicon blemishes.

b) The operations information section includes a brief description of camera performance, the Surveyor VII landing location and spacecraft attitude, and the ephemeris of the stars and earth when viewed by the Surveyor VII television camera. Also, the mission sequence log, listing the type and period of science operations, is enclosed.

c) The image data description section describes the image format of the duplicate negative and the format of the mosaics included, in addition to listing these mosaics. A description of the digital computer processing used to prepare the digitally enhanced pictures contained in the mission data package is given.

Introduction (cont.)

d) The television identification data description section gives the human and machine readable portions of the duplicate negative and identifies the parameters on the film and summary listing. By providing a blank computer magnetic tape to the

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a user may obtain an IBM 7094 Fortran II or Fortran IV (user specified) compatible recording of the time sorted television identification data. The format of this recording is described in this section.

e) During lunar sunset, some of the pictures were taken in the integrate mode. These sunset time exposure frames with their iris settings, azimuths and elevations are listed.

Surveyor VII carried a single fixed mounted television camera using a movable mirror to scan the lunar surface. Two modes of vidicon or electronic scanning were included, 200 line and 600 line. The scanning raster used for both modes was 11 mm by 11 mm. The sequence of lunar operations included both, but the latter was emphasized. Of approximately 21,000 frames taken during the Surveyor VII mission, only 59 were in 200 line mode, 14 on the first lunar day and 45 on the second lunar day.

Introduction (cont. 2)

Accompanying each image transmission were 13 camera parameters, the television identification (TVID) data. A detailed engineering description of the Surveyor VII camera system can be found in the Surveyor VII Mission Report, Part III, by M. Smokler.

The television data transmitted by Surveyor VII was received by the world-wide Deep Space Stations (DSS) of the JPL managed and operated tracking network, the Deep Space Net (DSN). Control of the mission was exercised from the Space Flight Operations Facility (SFOF) at JPL in Pasadena. The primary recording facilities for television data were at Goldstone, California, and at the SFOF facilities connected to the Goldstone DSS via a 6 mc microwave link.

Image and TVID data were recorded on film and magnetic tape during Goldstone (Station 11) view periods both at Goldstone and the SFOF. Overseas data were recorded only on magnetic tape and then replayed through the SFOF film recorder. The source of the image data for each frame is identified by the process code which is described in Section 5. TVID data were validated and reconstructed by reference to the command logs, engineering assessments of camera response, and comparison with mosaics.

JPL PROJECT DOCUMENT 602-65

SURVEYOR VII SPACECRAFT
SURVEY CAMERA
SCIENCE CALIBRATION REPORT

1 January 1968

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INTRODUCTION

On 16-18 November 1967, the television camera system of the Surveyor VII Spacecraft (SC-7) was calibrated by a JPL team. The calibration was conducted according to JPL Test Procedure ETP-SUR-001-G and utilized JPL calibration equipment -- including a light source, slide transparencies, and a video tape recorder.

The test collected accurate data for verification of the Television Ground Data Handling System (TV-GDHS) for use by the Space Science Analysis and Command (SSAC) group during Surveyor Mission G operations, and in postflight data processing.

CALIBRATION CONTENT

Procedures for this scientific calibration were based on past Ranger calibration experience and experience gained from Surveyor SC-1 through SC-6 calibrations. The main parameters were light transfer characteristics, sine wave response, geometric linearity, polarimetric constants, and erasure characteristics.

Calibration was performed in both 200- and 600-line TV scan modes and in both normal-shutter and open-shutter exposure modes for the narrow-angle field of view. In the 600-line scan mode, the polarizing filter light transfer characteristics were taken and automatic-iris and commanded-iris position repeatability measurements were made.

All of the above calibrations were performed via spacecraft Transmitter A. Brief tests were made on Transmitter B and for the wide angle field of view.

Calibration data on the constants for reduction of video data were obtained. (Photometric charts on the spacecraft were calibrated at JPL previously.) Photogrammetry calibration was also performed.

Data were recorded on a modified Ampex VR 1560 portable video recorder, and selected single-line scans at the center (vertically) of the TV frame were recorded on Polaroid film by using an A-scan oscilloscope presentation.

EQUIPMENT AND DATA RECORDING

A special light source and calibration slides were developed by JPL to permit continuous luminance level changes and monitoring, coupled with rapid slide interchangeability. The light source utilizes xenon lamps in conjunction with an integrating hemisphere. Resulting performance includes a field uniformity of 3 percent with a luminance range of from 4 foot-lamberts to 2500 foot-lamberts, continuously adjustable by means of an iris control. Calibration slides are constructed of appropriate 8-inch-square film negatives mounted between glass plates, which in turn are mounted and retained in the light source. The slides individually consist of a 10-level grey wedge for erasure determination, low-contrast sine wave slides for sine wave response measurements, and accurately-measured grid pattern for geometric distortion calibration. A rotatable polarizing target is used to determine polarization constants. In addition, two scan slides are used to provide a visual indication of frequency response.

The recording/playback configuration and equipment are depicted by a block diagram (Figure 1). The predetection signal is recorded, providing calibration information free from unknown factors and nonlinearities associated with the normal video test equipment. The tape recorder consists of an Ampex VR 1560 rotating-head, helical-scan machine modified to a VR-660 configuration. Other modifications allow direct-level recording as well as recorder-servo control when applying non-standard (slow-scan) video information. Video information is obtained from the first IF stage of the receiver in the System Test Equipment Assembly (STEA), at which point the carrier frequency is 50 Mc. This 50-Mc signal is amplified in the JPL equipment and then converted to 4 megacycles. In the 600-line scan mode, this 4-Mc signal is hard limited and applied to the predetection input (direct record) of the recorder. In the 200-line scan mode, the 4-Mc signal is further converted to 500 kc and then applied FM-FM to the recording machine.

The 600-line scan mode playback is accomplished by demodulating the 4-Mc carrier through a carefully calibrated pulse-averaging type demodulator to obtain the baseband video signal. The 200-line scan mode playback required another frequency conversion to 70 kc for demodulation through an existing 70-kc demodulator.

Resultant calibration tapes were played into the GDHS system at Goldstone on 27 December, 1967. Consequent data at Station TV-11 (Goldstone) and Station TV-1 (Pasadena) is in the form of 35- and 70-mm film and tape recordings on Ampex FR 1400 and FR 800 recorders. These tapes represent an overall S/C camera-GDHS system calibration and are the principal calibrations which will be used in processing the Mission G lunar pictures. The analysis presented in this report is obtained principally from the examination of the single-line Polaroids obtained during the ETR calibration.

USE OF CALIBRATION DATA

Data from the calibration have several uses. Principally, the entire calibration tape will be utilized in digital data reduction of pictures received during the mission, as previously mentioned. Geometric distortions can be removed, vidicon shading corrected, camera frequency response fall-off restored, and possibly the transfer characteristic data can be used to convert video output to absolute luminance units. In addition to the recording heretofore mentioned, an abbreviated tape from selected portions of the prime calibration tape was made on 27 December at TV-1 and will be used to calibrate, for each operating day, the Goldstone-SFOF Ground Data Handling System -- thus providing a complete end-to-end calibration of the camera system.

Finally, the Polaroid data are used to make camera-characteristic plots for real-time mission operations. From this data, estimates of iris settings for a given Sun position and each camera viewing direction can be made. Recommendations as to nonstandard procedures and camera operations take into account such calibration data.

DATA REDUCTION

Luminance Corrections

Since the light source does not have exactly the same energy spectrum as Sun light, corrections must be made to the luminance levels of the source so that the data are valid for lunar operations. Surveyor spectral measurements have indicated that the lunar reflection spectrum is essentially identical to the solar spectrum. A correction factor is calculated to give the ratio of source luminance to lunar luminance for equal response from the camera. The light source for SC-7 utilized xenon lamps in special reflectors. The source emission spectrum simulates the solar spectrum rather closely. A comparison of the source with the solar distribution is given by Figures 2 and 3. The correction factor calculation involves the spectra of the camera, the standard eye, the measuring photometer, the light source, the Sun, and the calibration light standard.

During the SC-7 calibration, measurements were made on two light standards --namely, Gamma Scientific Working Standard Models 200 and 220. Luminance correction factors were calculated using the Model 200 readings. Detailed procedures for the calculation are outlined in JPL Technical Memorandum 32-665. Resultant factors were:

Source Luminance / Lunar Luminance	Type Filter
1.1662	vidicon + clear filter
1.1344	vidicon + P filter
1.1398	vidicon + N filter
1.1318	vidicon + S filter

Corrections were also made for photometer nonlinearities.

Polaroid Data Graphs

Data for the characteristic curves in this report were obtained by measurement on Polaroid prints, each representing one scan line of video signal. Figure 4 is an idealized drawing of a typical print. The amplitude is scaled by appropriate calibration to the frequency deviation of the spacecraft transmitter carrier. In each

of operation, with the iris set to f/4. This camera configuration assured maximum sensitivity for near-null measurements.

Automatic Iris

The operation of the automatic iris is shown in Figure 13. The curve reflects the operation in the clear filter position, and is also applicable to the polarizing filter positions since the attenuation characteristics are approximately the same. The iris appears to be functioning well and maintains the video level at about 60 percent of full black to white deviation for luminance inputs of up to 2000 foot-lamberts.

Photogrammetric Tests

The photogrammetric data require computer reduction, and are not presented in this document.

Deviations for TV-GDHS and SFO TV-GDHS Tape Playback

From the calibration data, settings denoting the characteristic deviations and timing rates were derived and supplied to the GDHS. These settings are:

Modulation* Characteristics (f)	XMTR A 600 line	XMTR B 600 line	XMTR A 200 line	XMTR B 200 line
Sync to porch	462 kc	457 kc	1.95 kc	1.94 kc
Porch to black	95 kc	82 kc	1.18 kc	1.20 kc
Porch to PCM '0'	1.842 Mc	1.802 Mc	7.69 kc	7.63 kc
Porch to PCM '1'	1.389 Mc	1.368 Mc	5.68 kc	5.66 kc
Porch to white**	1.540 Mc	1.486 Mc	8.37 kc	8.72 kc
Carrier to sync tip	1.159 Mc	1.130 Mc		
Carrier to porch	697 kc	673 kc		
Carrier to black	602 kc	591 kc		
Carrier to PCM "0"	1.145 Mc	1.129 Mc		
Carrier to PCM "1"	692 kc	695 kc		
Carrier to white**	0.843 Mc	0.813 Mc		

*The Survey Camera installed on SC-7 uses reversed vertical scan, i.e., the vertical scan direction is from bottom to top. The SC-7 Survey Camera does not employ horizontal overscan.

**Note: Average for full active TV frame.

Timing Characteristics	600-Line Scan Mode	200-Line Scan Mode
Sync pulse time	133.0 μs	8.21 ms
Porch time	126.8 μs	7.77 ms
Vertical blanking time	202.5 ms	602.0 ms
PCM	203.5 ms	604.0 ms
Active line time	1.394 ms	85.1 ms
Total line time	1.654 ms	101.1 ms
Total frame time	1.418 sec	21.8 sec

Foregoing deviation values are measured directly on the polaroid frames. Average white deviations are approximately 1.2 Mc lower than was measured for SC-5. This lower deviation is a result of a reduced camera gain adjustment intended to prevent possible adjacent channel interference.

The SC-7 VR-1560/660 Video Calibration Tape Playback was performed 27 December 1967. This activity was a part of the Mission G Video Certification Test.

The 70 mm film recorder (OSFR) at DSS-11 was not operative during this test and the station will play the FR-800 SC-7 Post-Pass-Cal-Tape into the system for recording on 70 mm film at DSS-11/TV-11 to verify mission configuration.

The 70 mm film recorded at SFOF/TV-1 has been checked for support of science requirement and is acceptable.

The FR-1400 data recorded at DSS-11 has been checked for digitization quality and is acceptable.

The TVID output was spot checked after conversion to decimal and appeared to be acceptable for mission support.

A complete 70 mm film record was produced by TV-1.

Table 1 shows a listing of the calibration items on each FR-1400 magnetic tape.

Table 2 shows the selected items recorded on the FR-800 magnetic tape for Post-Pass-Cal Playback and TV-11 certification.

curve, the scale is arbitrarily displaced so that sync tip deviation frequency falls on its nominal value of 5 kc and 1.25 Mc for 200- and 600-line scan modes, respectively.

The scan line photographed is selected at the approximate center of the frame, vertically. Response is measured on each print at the same point (the nominal center) on the time scale. Therefore, curves drawn from such data represent response at one point in the frame. Where significant shading exists (Figure 10), transfer characteristics will change accordingly. Variation of data due to incomplete erasure is avoided by recording the first frame after exposure and by allowing ample erasure time after completion of a series of exposures at one illumination level.

Telemetry data representing a readout of camera functional setting is recorded on the back of each print. The data are in numerical units termed BCD (binary coded decimal) and include the full-scale value and measured value for each frame. Figure 6 is a calibration curve for iris position, showing the luminance as a function of BCD reading.

The 600-line scan mode transfer characteristic data (i.e., camera response to flat scenes at various light levels) are shown in Figure 7. The procedure utilized in obtaining such data was changed somewhat from those used in SC-1 and SC-2 calibrations, where luminance levels were varied at a fixed iris position. The method used on SC-3 through SC-7 involved setting a light level and cycling through all iris positions, since this was faster and provided data for each iris position. The amount of data collected allows the construction of an accurate three-dimensional computer surface with axes of iris BCD, lunar luminance, and output video level -- thus permitting a more accurate computer reduction of the video data. This revised method was also used in the 200-line scan mode.

In the iris repeatability calibration, the iris was forced to several different conditions -- for example, by stepping the iris to f/22 and then to f/8; or by stepping the iris to f/16, then f/5.6 and f/8. In these two cases, the iris potentiometer may give different readings -- indicating that the lens iris varies around the nominal f/8 position. For iris positions around f/8, the luminance level of the source is known and the polaroid of the video level is obtained at the second frame of exposure. This procedure was conducted three times for the f/8 and f/11 iris positions. Resultant deviations were found to be small in terms of observed video levels (Figure 15), while no error at all was indicated in the iris BCD data. Exposure

reciprocity is evaluated by measuring the luminance level required to produce approximately the same video deviation for the several iris positions. These data are presented in Figure 16. By comparing Figures 15 and 16, it can be seen that the small data scatter shown in the reciprocity plot correlates with errors in video level adjustment, i.e., the video level was not exactly constant for all iris positions.

Figure 8 gives the light transfer curve in the 600-line scan mode. All data presented were obtained with the iris set for f/4.

Figure 9 shows the black level (or dark current) buildup for the 600-line scan mode as a result of integrating zero light intensity for various lengths of time. In this test, the camera is completely covered with a black cloth, the shutter is kept open, and no scanning is allowed for "x" minutes. After "x" minutes, the camera is allowed to read out and the dark current level is obtained. These data are useful in judging exposure levels for night operations or star sighting.

Figure 10 shows the shading which the camera exhibits near saturation in the 600-line scan mode. This figure is a depiction of composite frames taken from the A-scope display.

Figure 11 shows results of sine wave response tests. As the slides used have sine waves, not square waves, the data enable a true Fourier representation of the camera system. The 200-line scan mode light transfer, integrate exposure mode, and frequency response data are shown in Figures 22, 24, and 23, respectively. As in the other camera systems, the 200-line scan mode data shows a response well past 200 lines/pic width in the horizontal direction.

Geometric Distortion and Erasure

The geometric distortion and erasure data are principally used in computer reduction of the pictures and will not be analyzed in this report. Full frame and line scan polaroids are shown in Figure 21 for qualitative evaluation..

Polarization Filter Nulls

The polarization nulls for the N, P, and S filters are depicted in Figures 17, 18, and 19. The light transmission for near-null polarizer angles was determined by measuring the video output signal from the television camera, with a constant light source brightness. The measurements were made in the open shutter mode

Table 1

SC-7 Calibration Tape Playback

Test Step Number	DSS 11 FR-1400 Reel No.	SFOF/TV-1 FR-800 Reel No.	SFOF/TV-1 HW-7600 Reel No.
10.6 thru 10.22	1	1	1
10.20A thru 10.22A	1	1	1
10.23 thru 10.26 (f/8)	1	1	1
10.26 (f/11) thru 10.34	2	1	2
10.34A	2	1	2
10.44 thru 10.67	2	1	2
11.6 thru 11.19	2	1	2
11.24	3	2	3
12.2 thru 12.30	3	2	3
13.2 thru 13.3	3	2	3
13.7	3	2	3
13.12	3	2	3
13.17	3	2	3
13.22	3	2	3
13.27	3	2	3
14.4 thru 14.38	3	2	3
15.7 thru 15.18	3	2	3
16.5 thru 16.15	3	2	3
17.7 thru 17.16	4	2	4
17.20 thru 17.26	4	2	4
18.5 thru 18.13	4	2	4
19.3 thru 19.15	4	2	4
20A.9 thru 20A.23 (FIL P 345°)	4	2	4
20A.23 (FIL P, 342°) thru 20A.55	5	3	5
21.4 thru 21.11	5	3	5
22.15	5	3	5
22.6	5	3	5
2.9 thru 2.50	5	3	5
2.53 thru 2.209	6	3	6

Table 1 (contd)

Test Step Number	DSS-11 FR-1400 Reel No.	SFOF/TV-1	
		FR-800 Reel No.	HW-7600 Reel No.
HAC/JPL special tests Post cleaning and alignment photogrammetric, charts, all mirrors - GMT 344-1314 to 345-0102	7	4	7

Table 2

DSS-11 SC-7 Post Pass Calibration Playback

The following data is on an FR-800 tape at DSS-11

Test Step	GMT Start	Source Bright	Total Frames	Iris BCD Readings f/4	f/5.6	f/8	f/11	f/16	f/22
-	Light transfer	-	CAL BCD	972					
10.6	321-1223	0	4	-	Video black	-	-	-	929
10.20	321-1245	50	24	027	222	386	546	701	854
10.21	321-1252	70	24	027	222	386	546	702	857
10.22A	321-1324	100	24	027	223	386	547	703	859
10.24	321-1344	200	24	027	223	386	547	703	858
10.26	321-1359	400	16	-	-	387	547	703	859
10.27	321-1407	560	24	027	222	387	547	703	859
10.28	321-1414	800	24	027	222	387	547	704	859
10.30	321-1430	1100	12	(SAT.)	223	387	-	-	-
10.32	321-1445	1600	20	-	222	387	546	702	858
10.34	321-1453	2400	16	-	-	387	547	703	859
10.34A	321-1457	2400	4	-	222	-	-	-	-
-	Linearity	-	CAL BCD	974					
15.7	321-1951	200	6	027	-	-	-	-	-
15.15	321-1956	1400	6	-	-	387	-	-	-
15.18	321-2000	2500	6	-	-	-	-	-	933
-	Frequency response		CAL BCD	974					
17.7	321-2052	800	8	25 TVL Freq.		-	-	703	-
17.8	321-2054	800	8	50 TVL Freq.		-	-	703	-
17.9	321-2056	800	8	75 TVL Freq.		-	-	703	-
17.11	321-2057	800	8	100 TVL Freq.		-	-	703	-
17.12	321-2058	800	8	150 TVL Freq.		-	-	704	-
17.13	321-2059	800	8	225 TVL Freq.		-	-	704	-
17.14	321-2100	800	8	300 TVL Freq.		-	-	703	-
17.15	321-2101	800	8	450 TVL Freq.		-	-	703	-
17.16	321-2102	800	8	600 TVL Freq.		-	-	704	-

Approximately 2 min. of VDS grey bar were recorded to indicate end of normal Post Pass Cal Playback.
The following data is to be played for TV-11 certification.

17.20	321-2121	600	8	027	25 TVL Freq.		-	-	-
17.20	321-2122	600	8	027	50 TVL Freq.		-	-	-
17.20	321-2124	600	8	027	75 TVL Freq.		-	-	-
17.20	321-2125	600	8	027	100 TVL Freq.		-	-	-
17.20	321-2126	600	8	027	150 TVL Freq.		-	-	-
17.20	321-2127	600	8	027	225 TVL Freq.		-	-	-
17.20	321-2128	600	8	027	300 TVL Freq.		-	-	-
17.20	321-2129	600	8	027	450 TVL Freq.		-	-	-
17.20	321-2130	600	8	027	600 TVL Freq.		-	-	-
17.22	321-2148	2000	4	027	-	Footpad Scene Saturated			-
17.25	321-2153	1000	4	028	-	Footpad Scene Normal			-
17.26	321-2158	1500	4	028	-	Desert Scene		-	-
-	Transmitter B Levels		-	CAL BCD	973				
18.5	321-2219	0	4	-	-	Black	-	-	931
18.11	321-2223	1100	4	027	-	White	-	-	-
18.13	321-2231	-	Recording of Crystal Frequencies				-	-	-
-	Integrate Mode	-	CAL BCD	974					
19.3	321-2244	0	1	-	1 min Integration			-	931
19.11	321-2249	0	1	-	2 min Integration			-	932
19.12	321-2255	0	'	-	5 min Integration			-	932
19.13	321-1306	0	1	-	10 min Integration			-	932
19.15	321-1327	0	1	-	20 min Integration			-	932
-	Polarimetric Constants		-	CAL BCD	974				
20A.9	322-0014	2340	4	027	- N Filter - Polarizer 33°				-
20A.10	322-0016	2340	4	027	- N Filter - Polarizer 35°				-
20A.11	322-0018	2340	4	027	- N Filter - Polarizer 31°				-

CALIBRATION CONCLUSIONS

1) The 600-line scan mode frequency response (Figure 11) shows a gradual roll-off out to 600 TVL/PH width. The approximate response at 600 TVL/PH width is reduced by 70 percent over its low spatial-frequency value. The frequency response of the SC-7 camera appears to be slightly higher than the SC-6 camera, but the difference is not significant. In the 600 line scan mode, the half-response point[1] is approximately 470 TVL/PH width.

2) The 200-line scan mode frequency response (Figure 23) shows a gradual roll-off that extends well beyond 200 TVL/PH width. The 200-line frequency response is also higher than that measured in SC-6 but the difference does not appear to be significant. The half-response point[1] is located at approximately 300 TVL/PH width, creating a nearly symmetrical resolution picture in the 200-line scan mode.

3) Vidicon shading appears to be about the same as was experienced with the SC-6 camera. With the exception of the first 10 percent of scan lines, the frame shading is quite small (Figure 10). Also the horizontal line shading is about the same as was observed on the SC-6 camera system.

4) The SC-7 camera does not deviate beyond established nominal limits for saturated-white signal excursions. No adjacent-band interference should be experienced, and no special ground station configurations will be required. The SC-7 camera incorporates a lower gain video amplifier than earlier cameras.

5) The auto iris mode performs well over the full range of luminance inputs. Since the attenuation characteristics of the clear filter and polaroid filters are approximately the same, the auto iris mode should perform well in any filter position.

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[1] Relative Response equals 0.5.

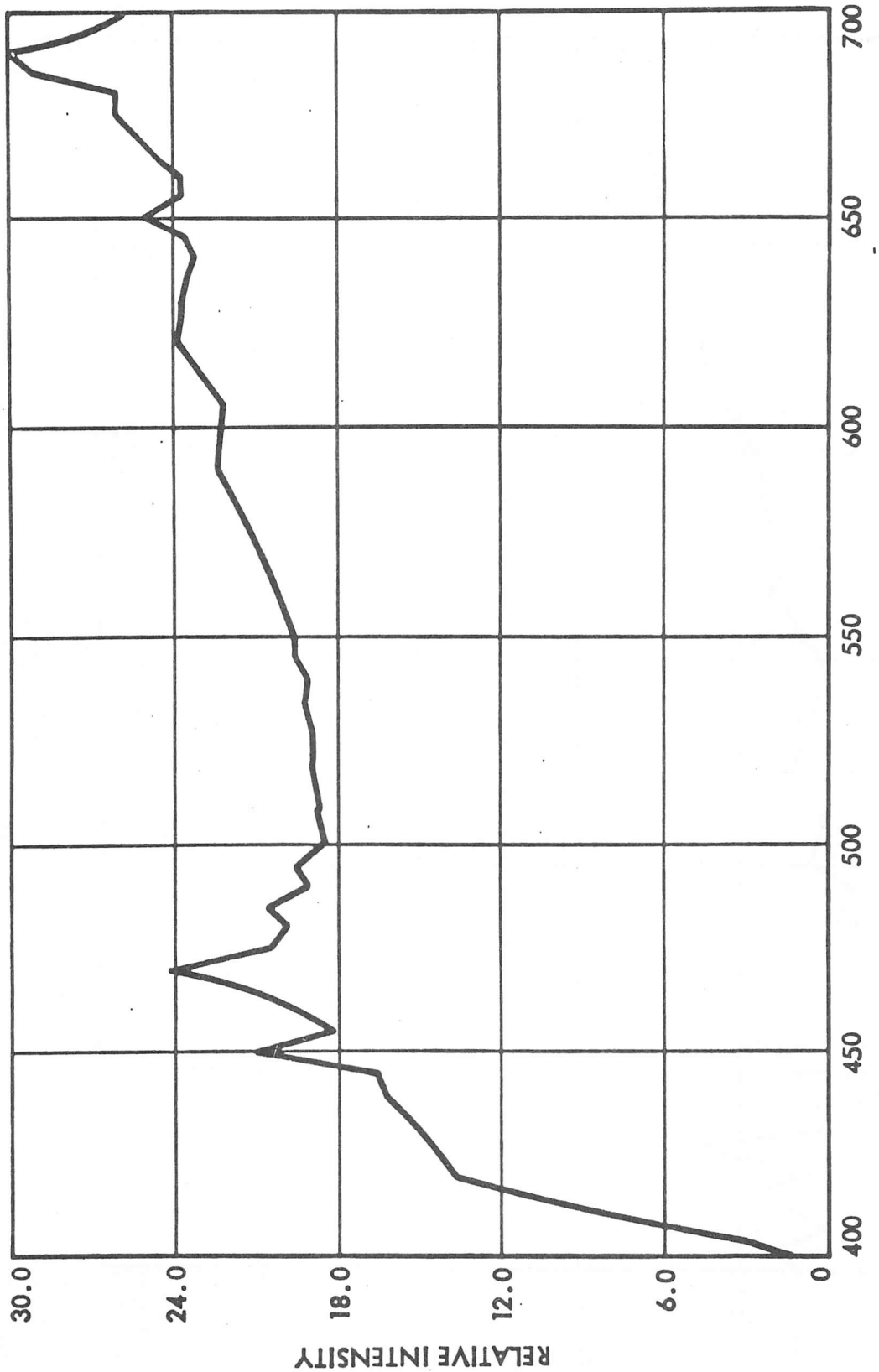


Figure 2. Spectrum of Surveyor TV Calibration Light Source

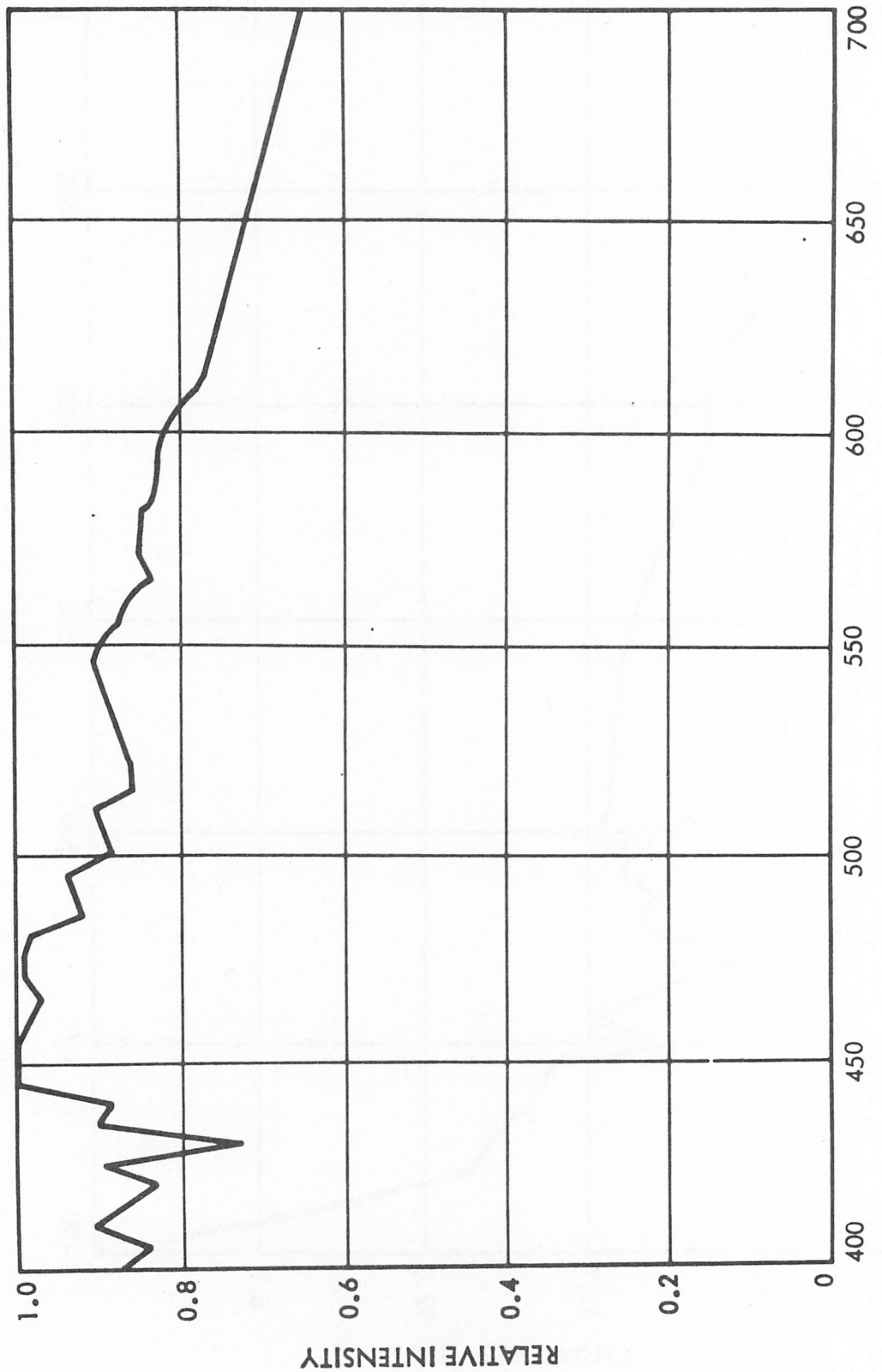


Figure 3. Solar Spectrum

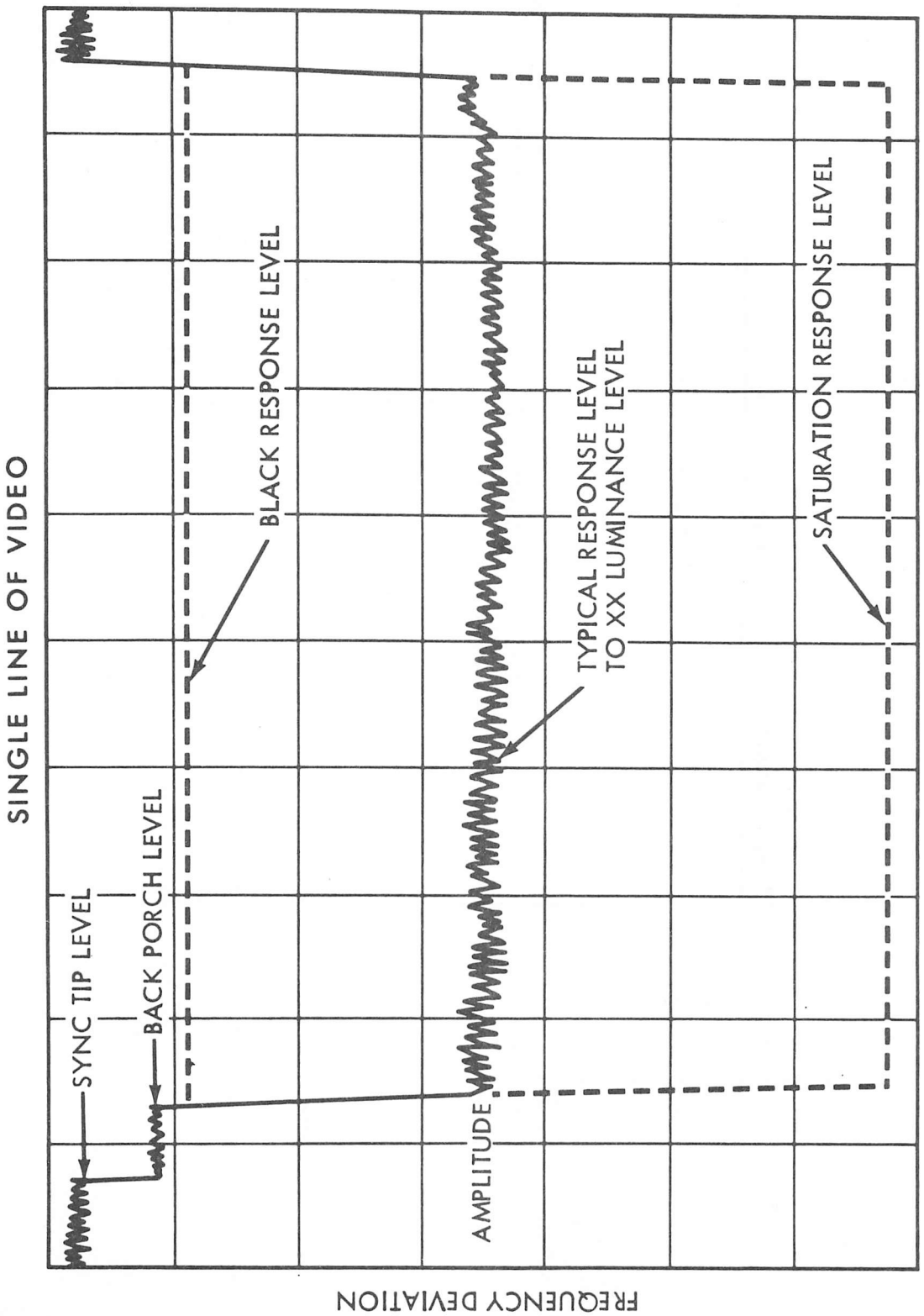


Figure 4. Drawing of Typical Polaroid Data

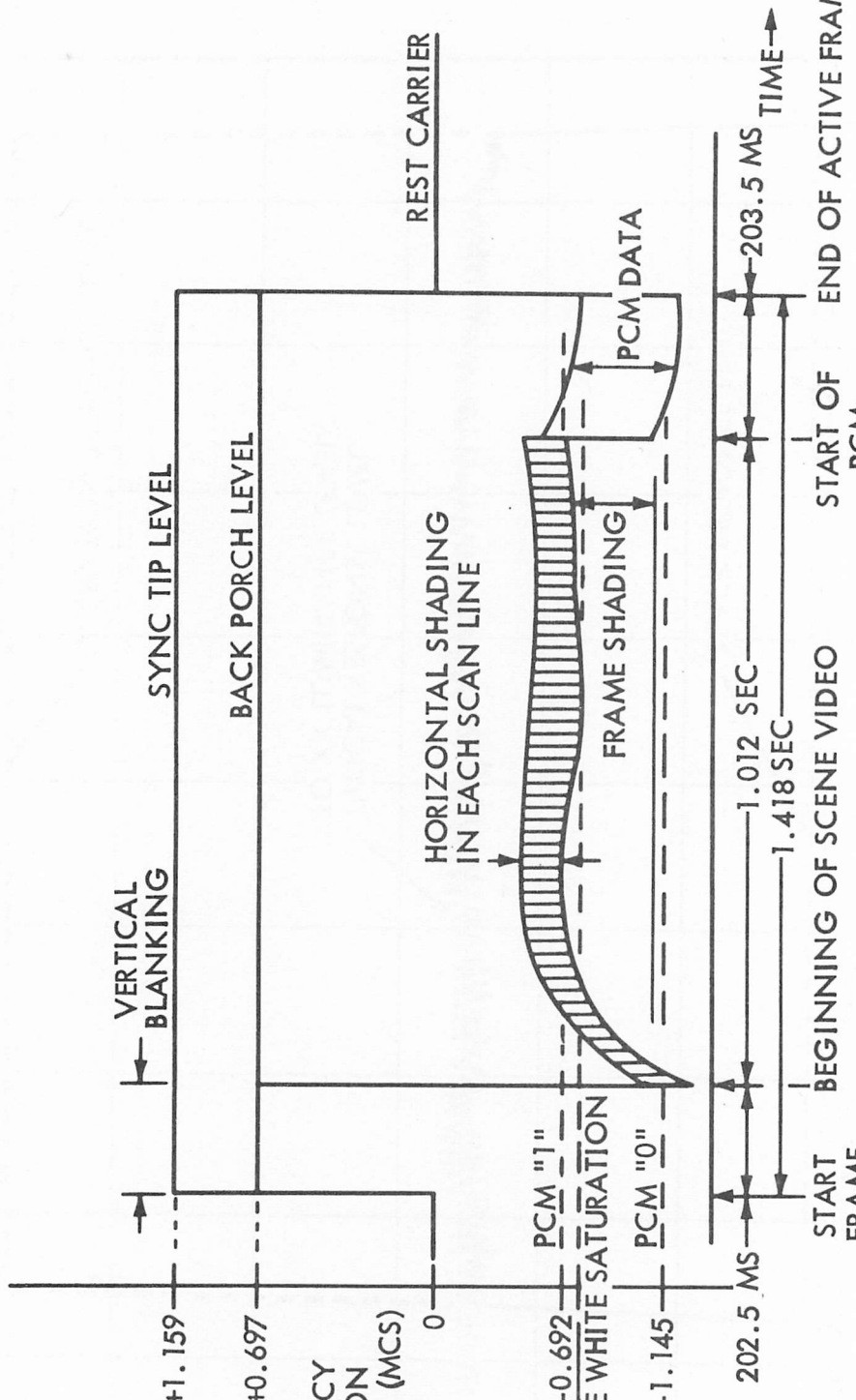


Figure 5. SC-7 Typical Full-Frame Video Output, 600-Line Scan Mode, Transmitter A

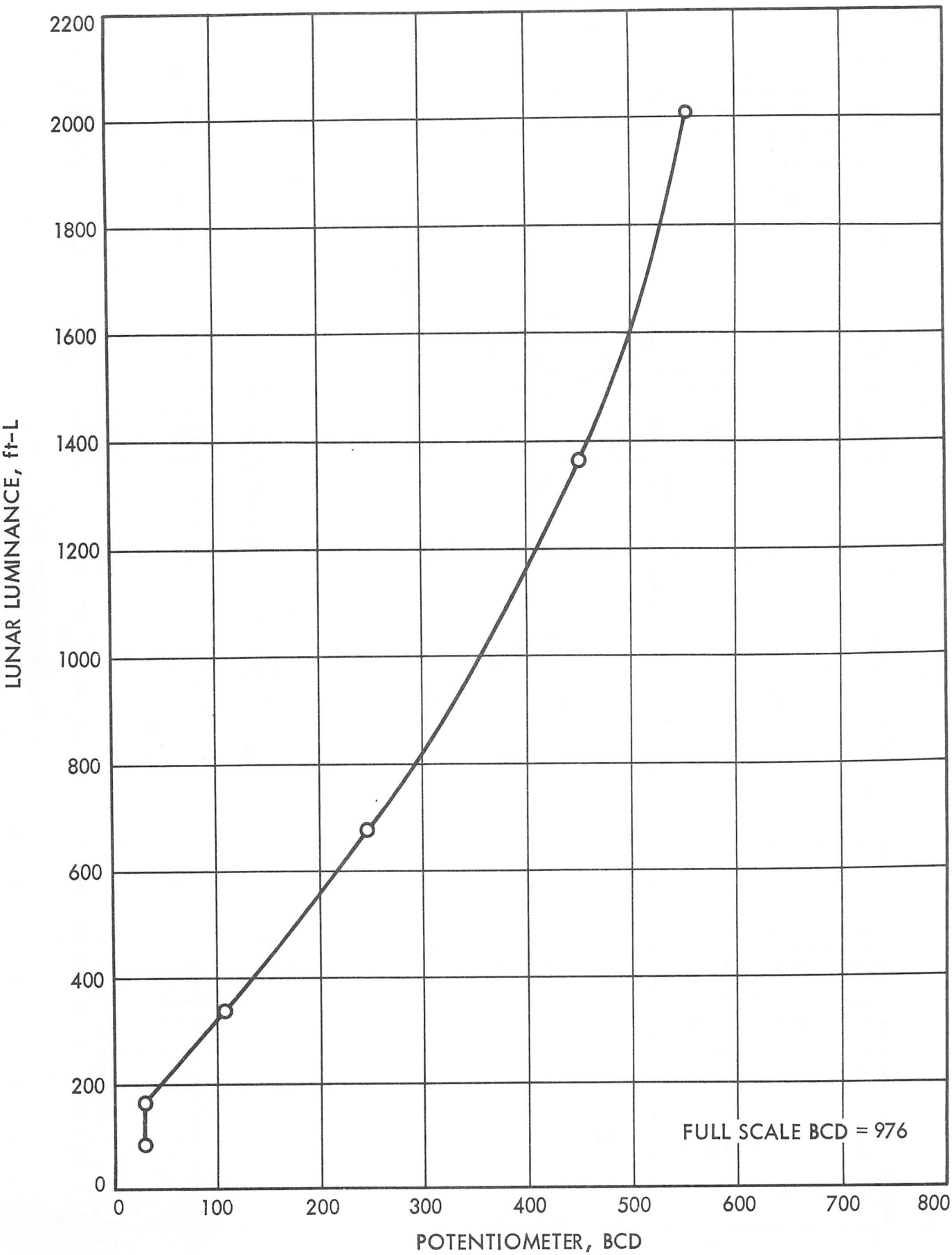


Figure 6. S/C-7 Luminance Versus Auto Iris BCD 600-Line Scan Mode, Transmitter A

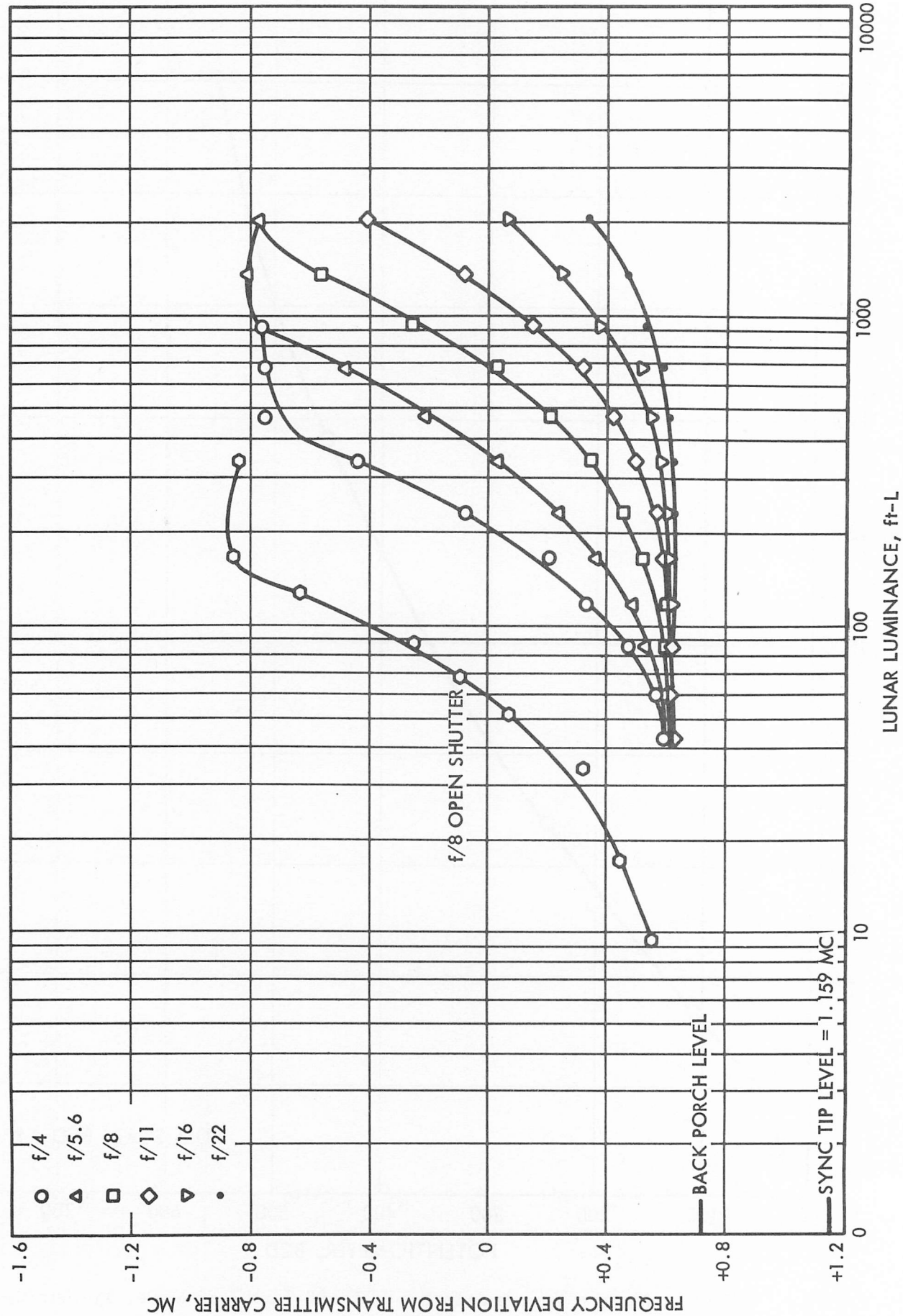


Figure 7. S/C-7 Light Transfer Characteristic, 600-Line Scan Mode, Transmitter A

6) The rate of dark current buildup in the 600 line scan mode is comparable to that measured for SC-6. Over a 20 minute integration, the recorded video level was 59 percent of full black to average white deviation. This may be compared to previous measured values of 95, 69, and 50 percent for SC-5, SC-6, and SC-4 respectively. In the 200 line scan mode, video deviation of 38 percent of full black to average white deviation was recorded. This compares with the 48 percent measured for SC-6.

7) The 600 line scan mode light transfer characteristic indicates a useful dynamic range of 11.1 which is somewhat less than that measured for SC-6 (15.5).

8) A usable black reference may not be available under expected worst case operating conditions. The black reference mark appears in the top-right of the picture format.

9) The SC-7 camera uses a reversed vertical scan, i.e., the vertical scan direction is from bottom to top. The camera does not employ horizontal overscan.

10) The SC-7 camera exhibits a much lower light sensitivity than the SC-6 camera with comparable filters installed. The SC-7 cameras requires about 600 ft lamberts for a saturated exposure at f/4, whereas the SC-6 camera required only 340 ft-lamberts under the same conditions. The lower sensitivity is apparent at all f-stops.

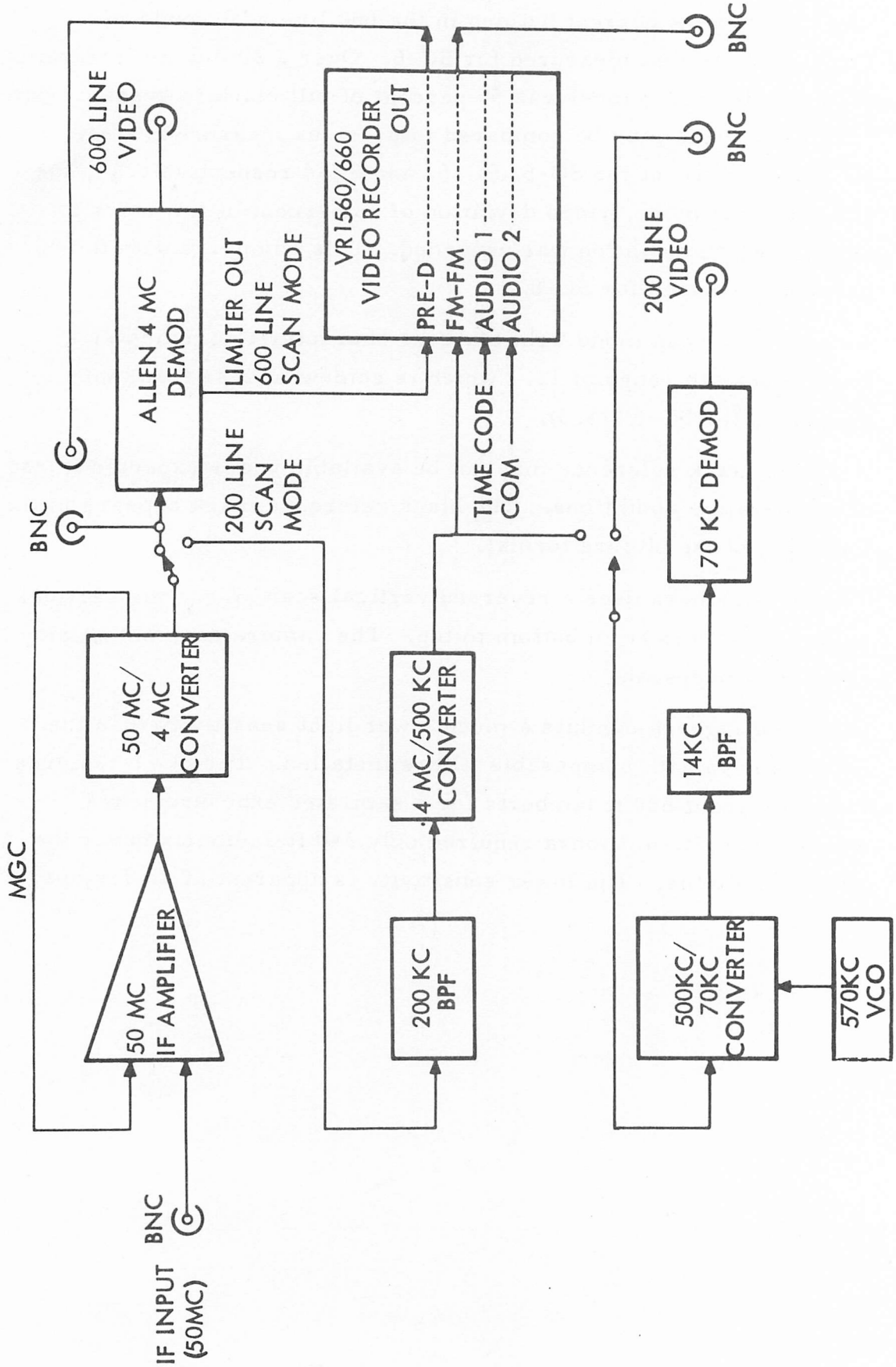


Figure 1. Video Recording System Block Diagram

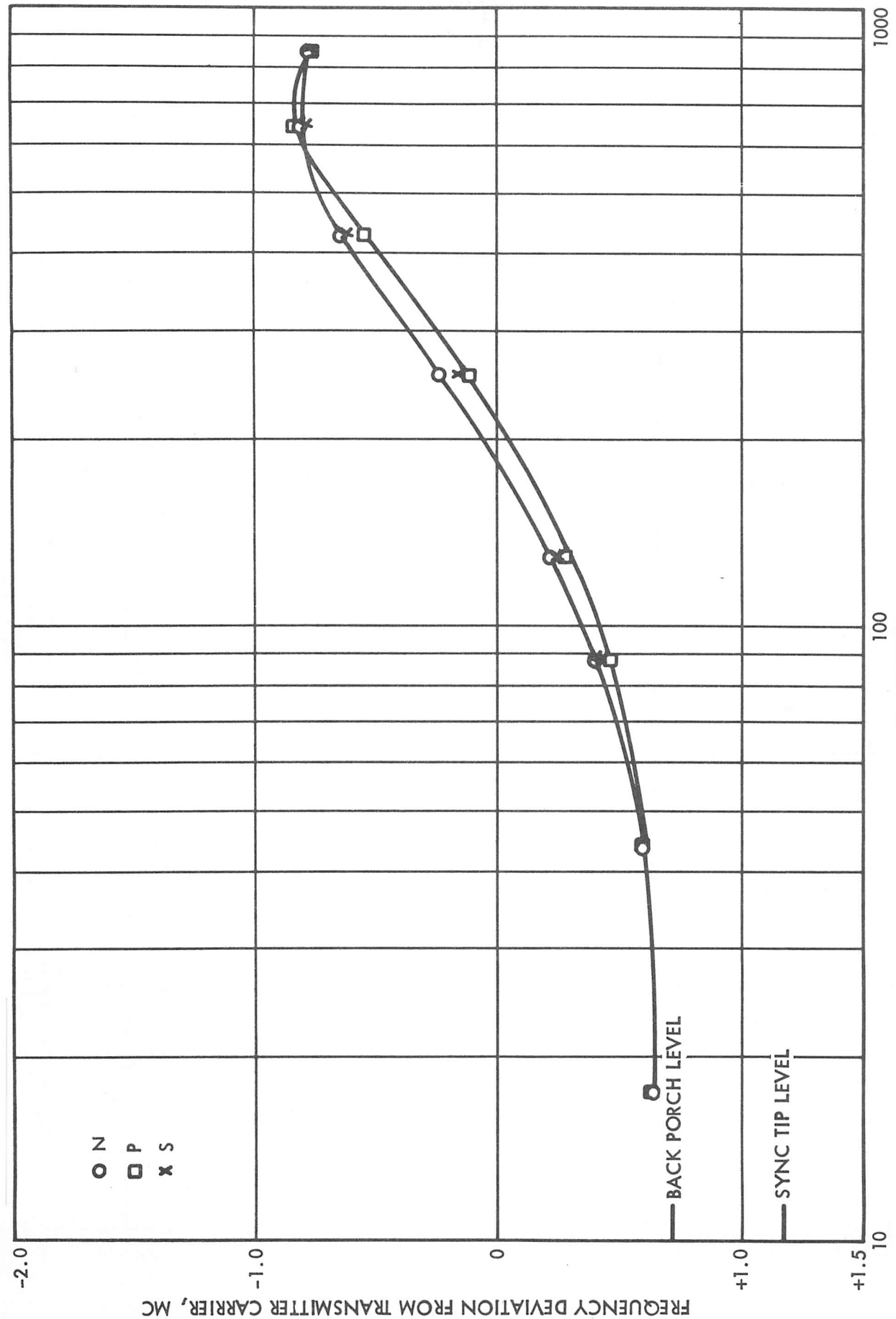


Figure 8. S/C-7 Light Transfer Characteristic, Polarizing Filters, 600-Line Mode, Transmitter A

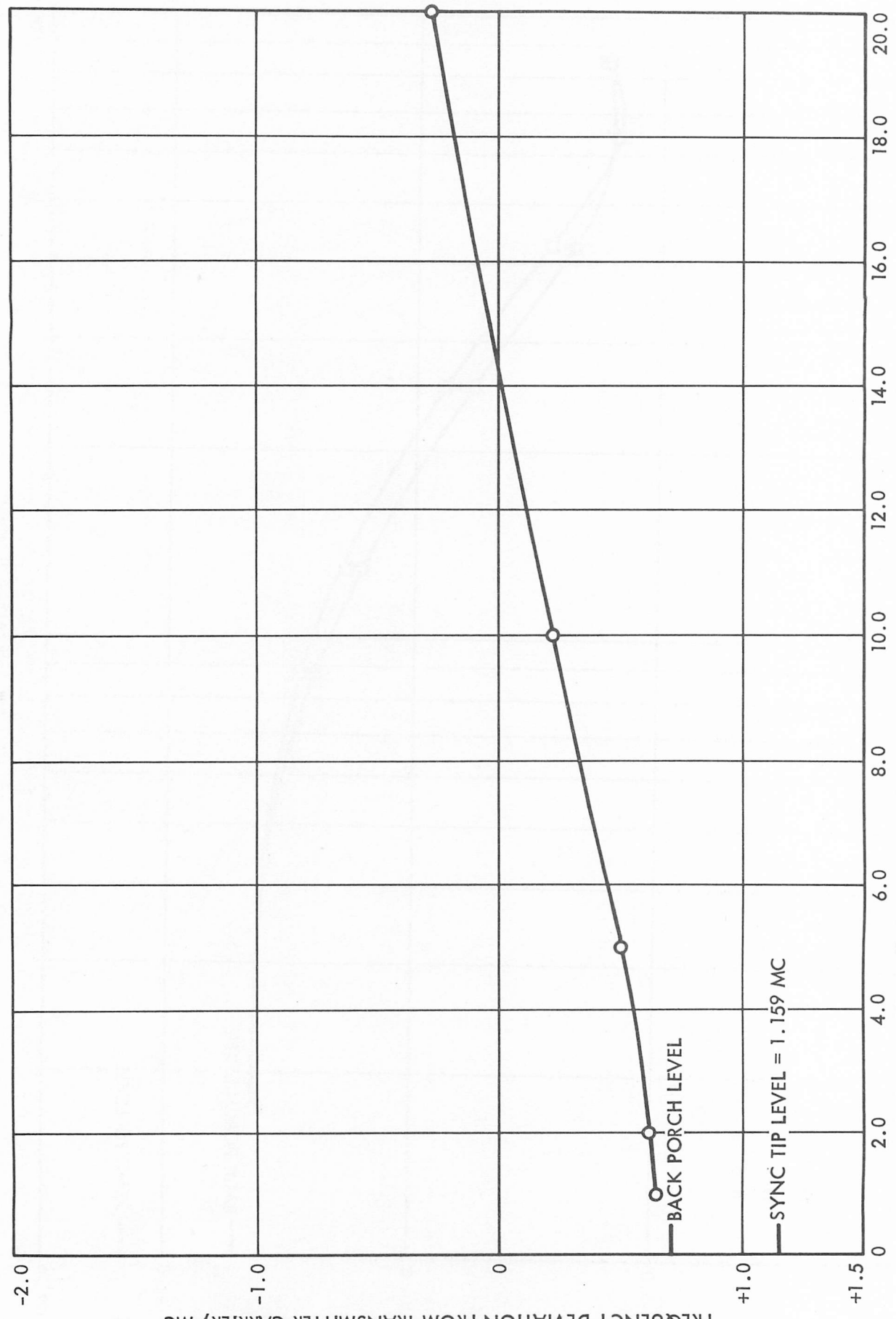


Figure 9. S/C-7 Integrate Mode, Dark Current Buildup, 600-Line Mode, Transmitter A

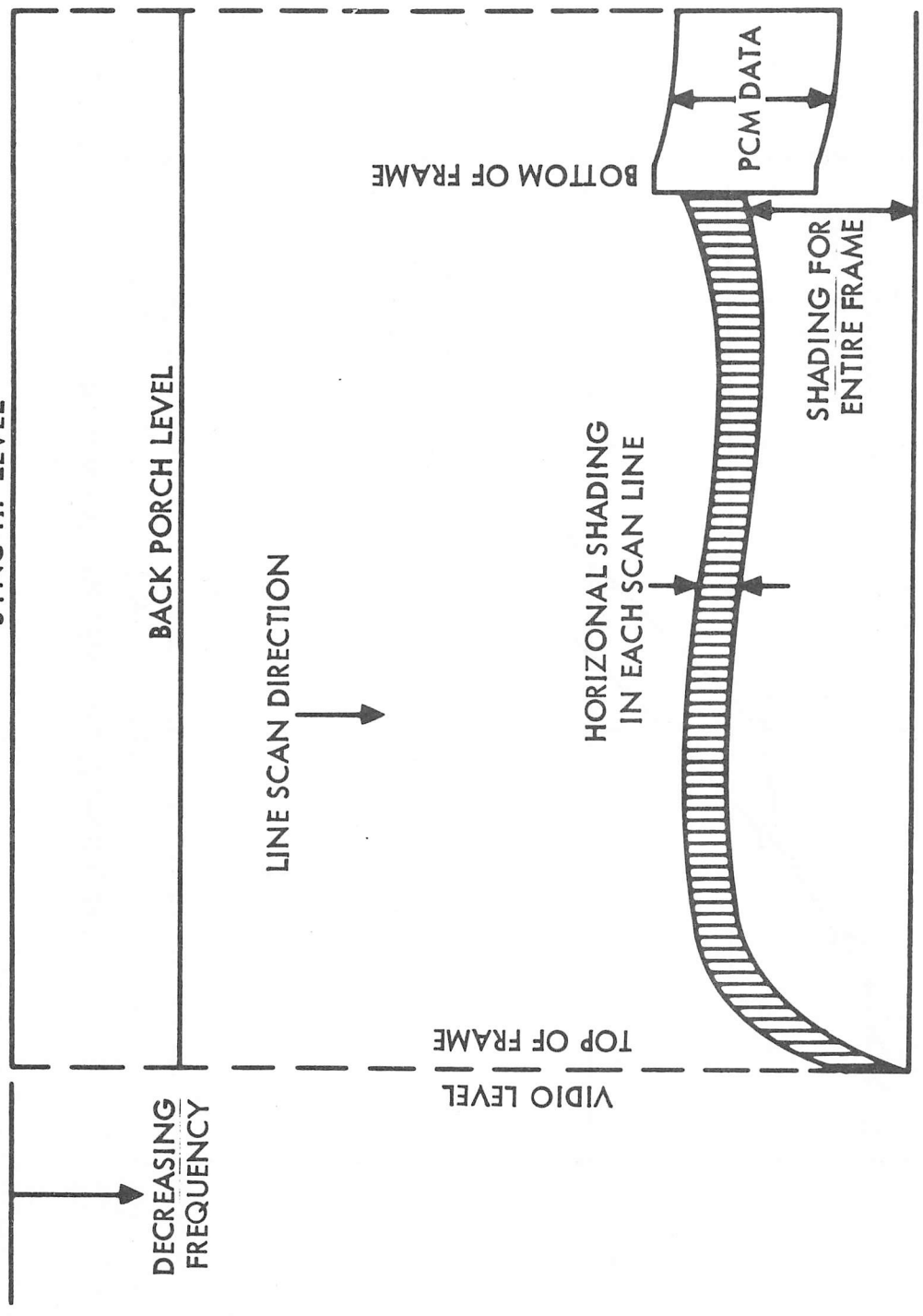


Figure 10. SC-7 Camera Shading Near Saturation
(Diagram Measured From Polaroid Of Composite Frame), 600-Line Scan Mode, Transmitter A.

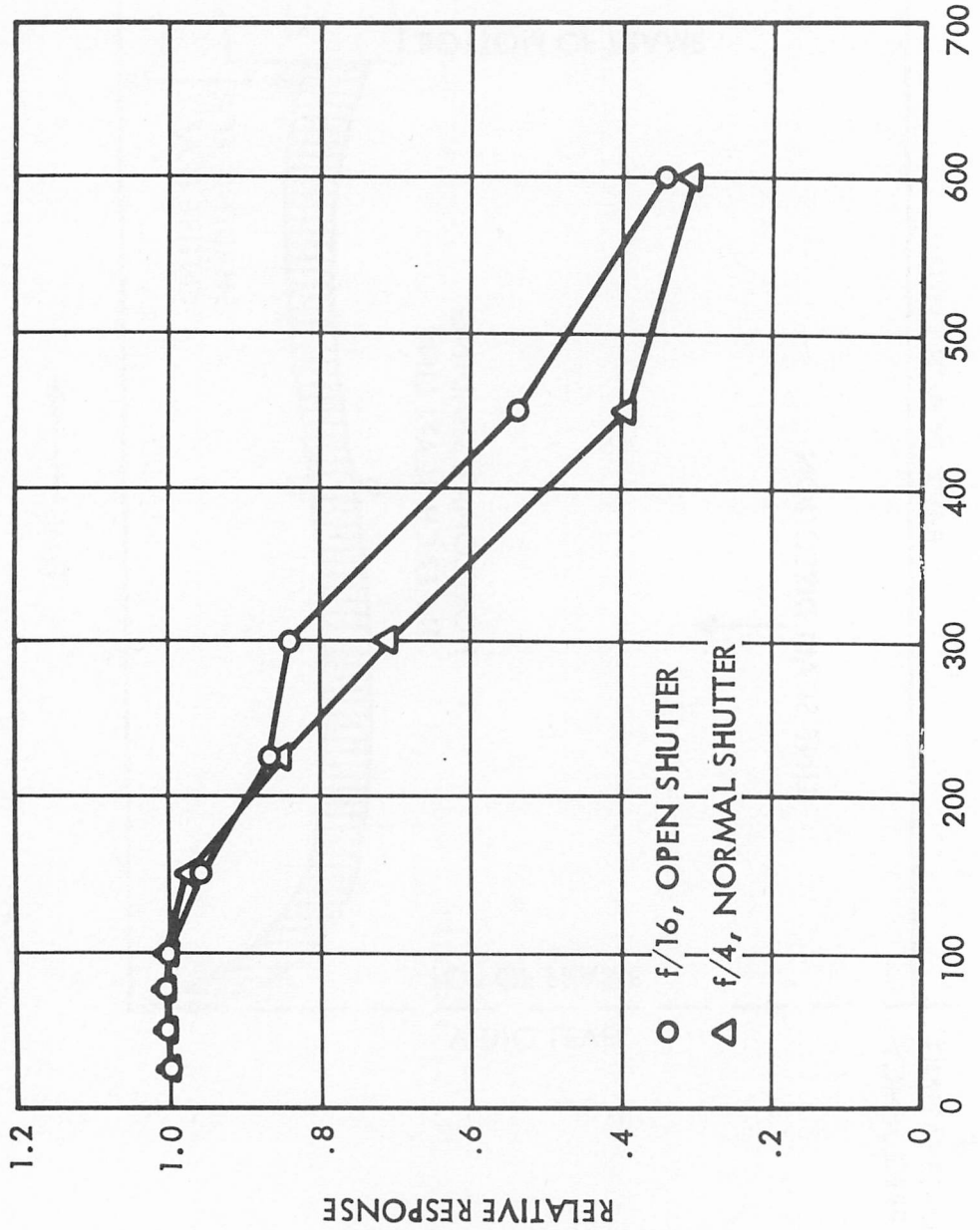
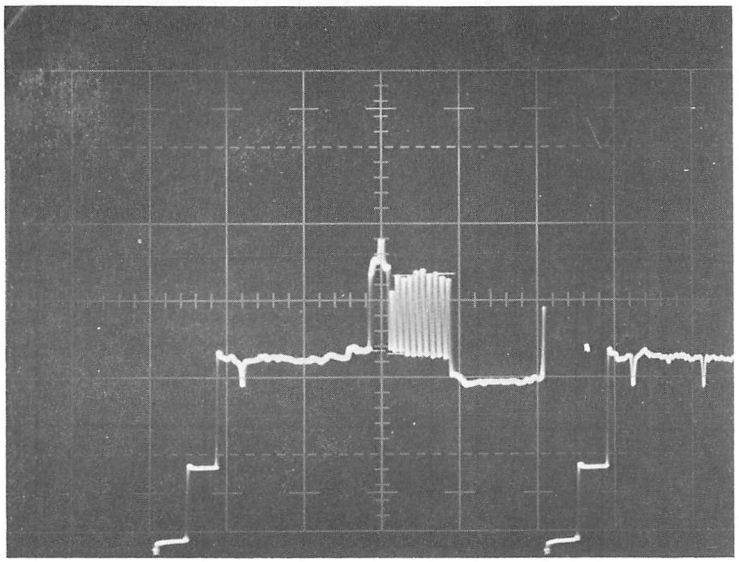
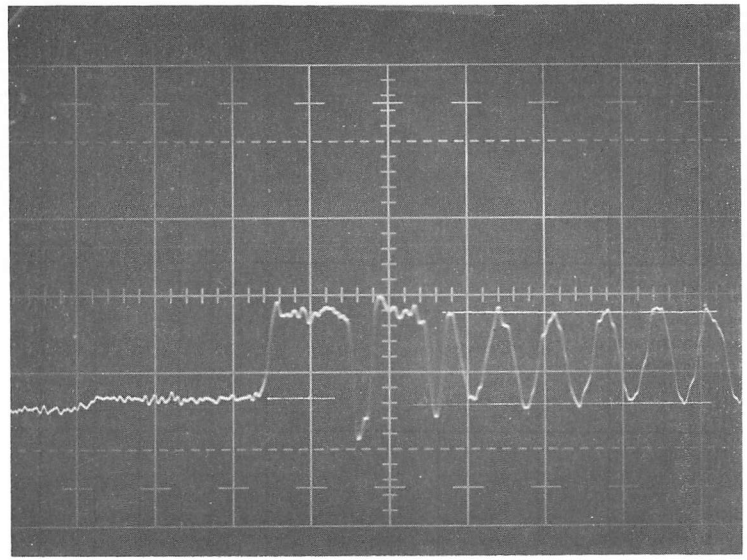


Figure 11. SC-7 Frequency Response, 600-Line Scan Mode, Transmitter A



200 LINE SCAN MODE



600 LINE SCAN MODE

Figure 12. Typical Line Scans Showing Horizontal Frequency Response at 100 TV Lines/PH Width

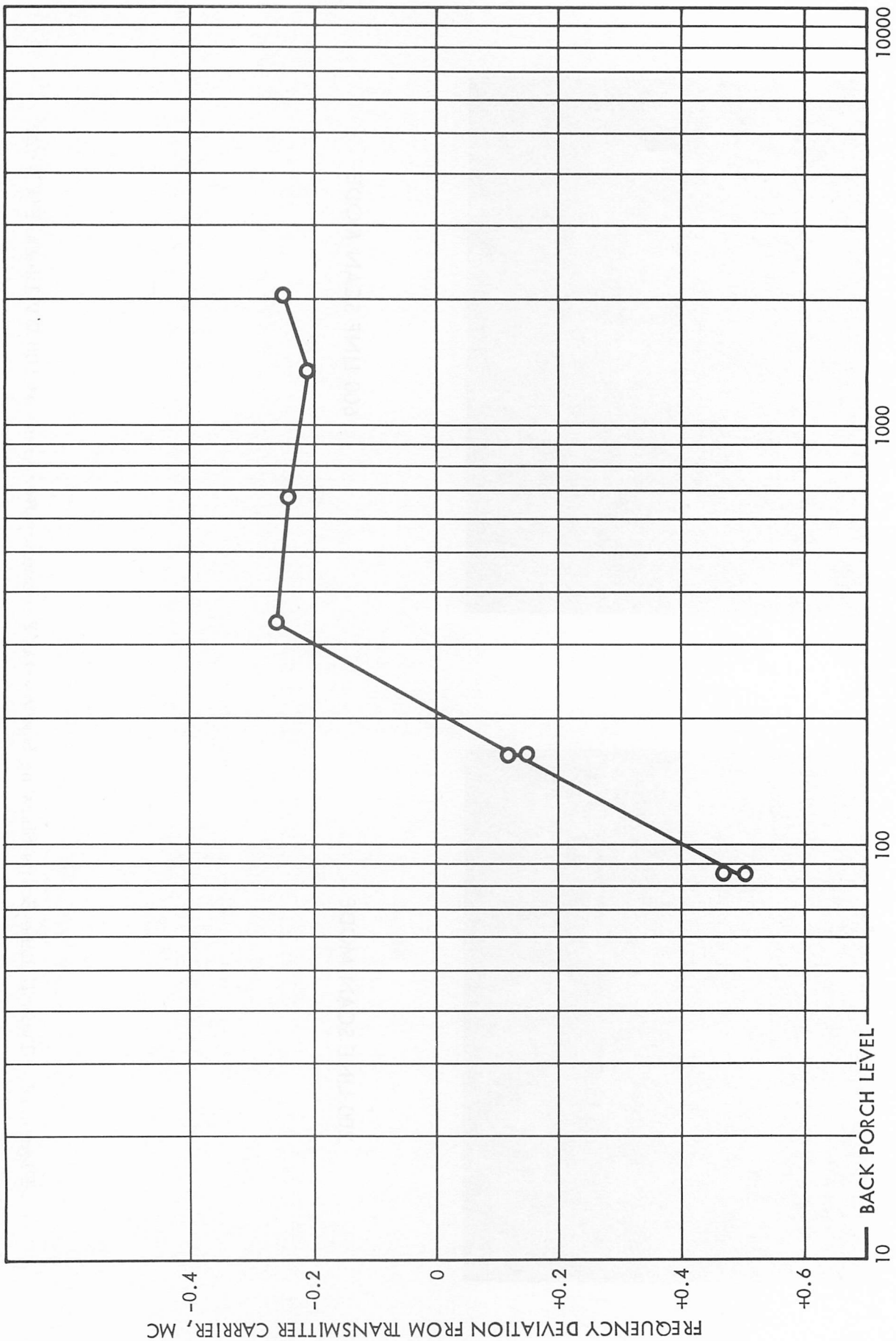


Figure 13. S/C-7 Auto Iris Tracking, 600-Line Mode, Transmitter A

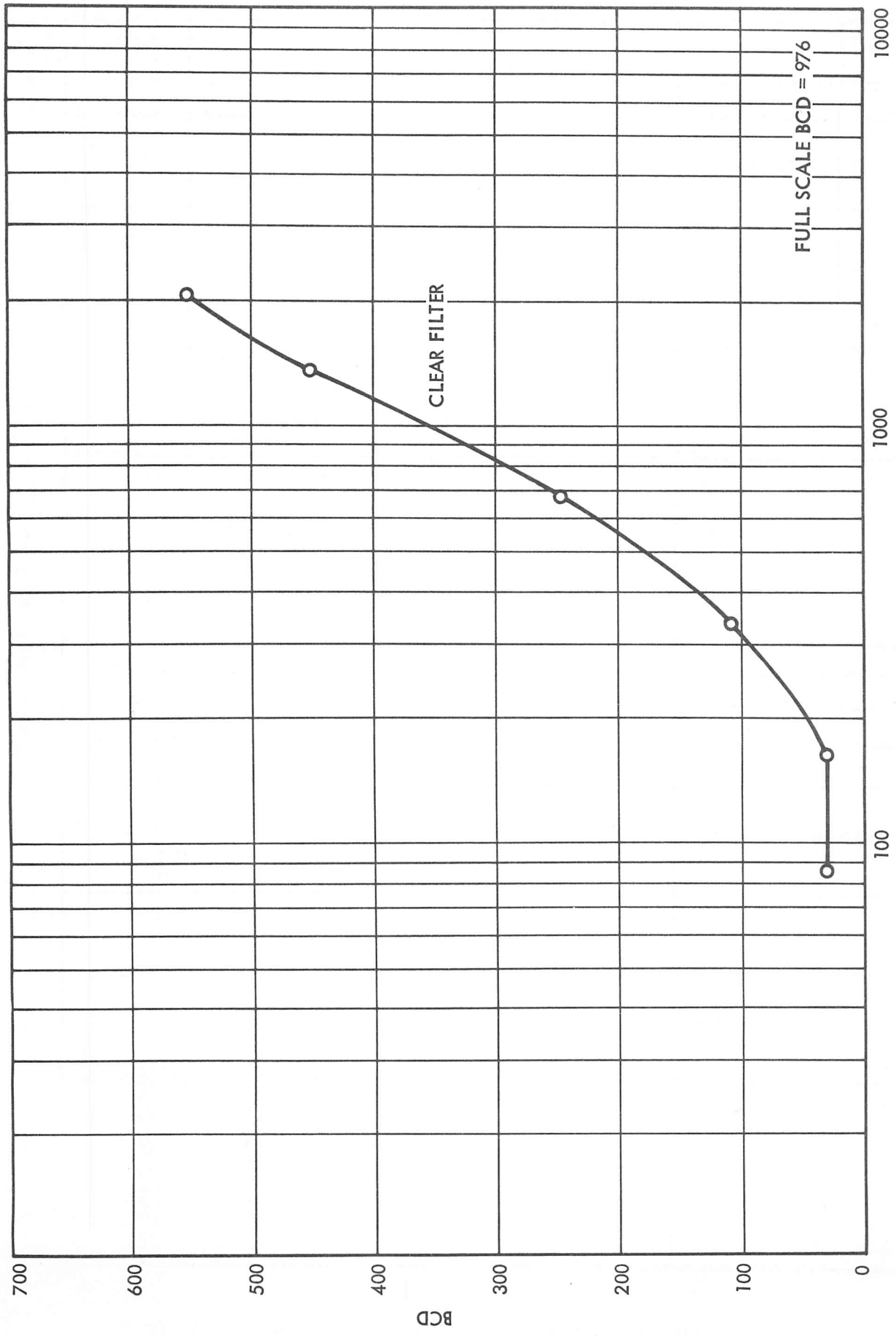


Figure 14. S/C-7 Auto Iris Tracking, 600-Line Mode, Transmitter A

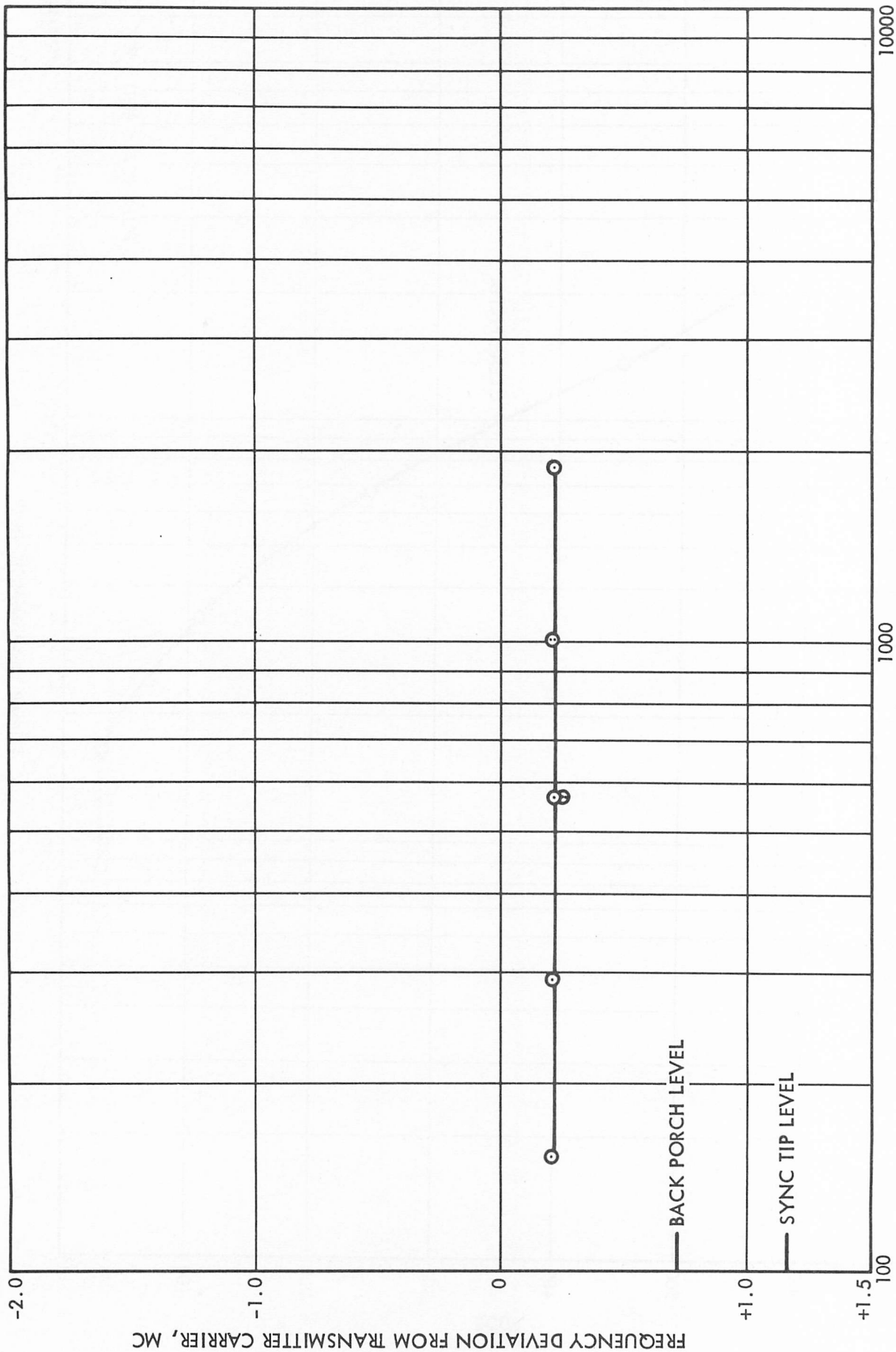


Figure 15. S/C-7 Iris Repeatability, 600-Line Mode, Transmitter A

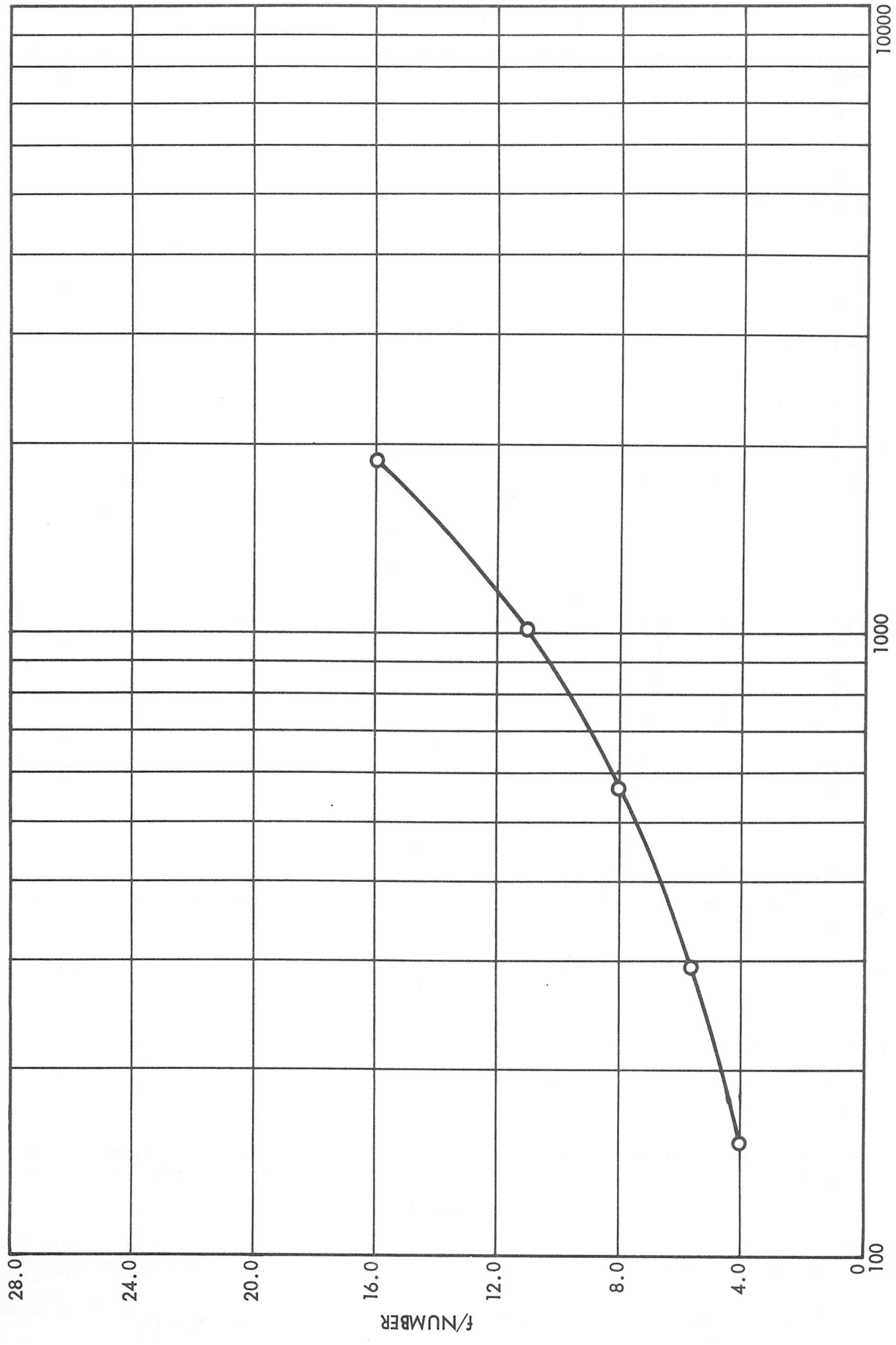


Figure 16. S/C-7 Exposure Reciprocity, 600-Line Mode, Transmitter A

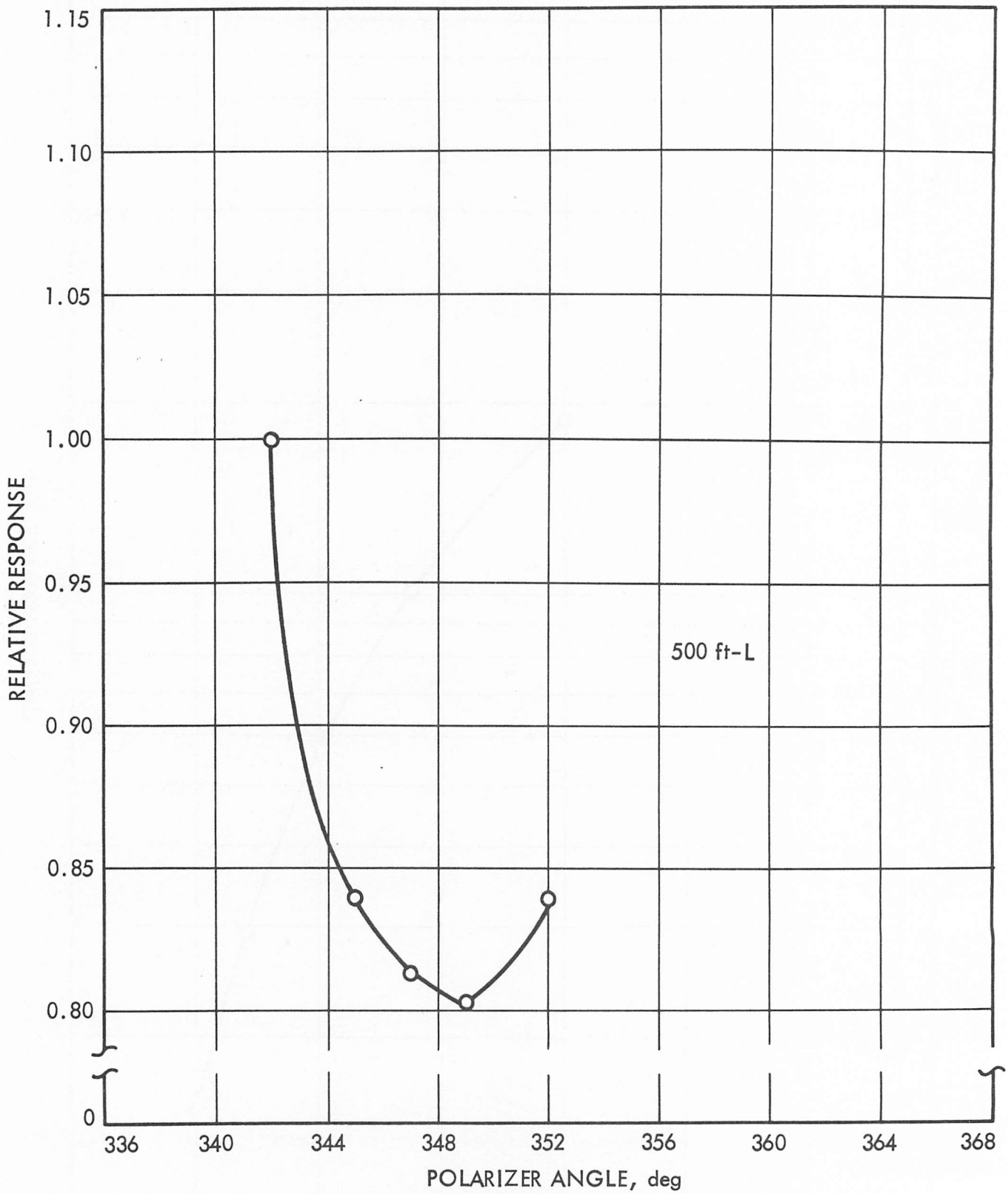


Figure 17. Polarization Null, P-Filter f/4, Open Shutter, 600-Line Scan Mode, Transmitter A

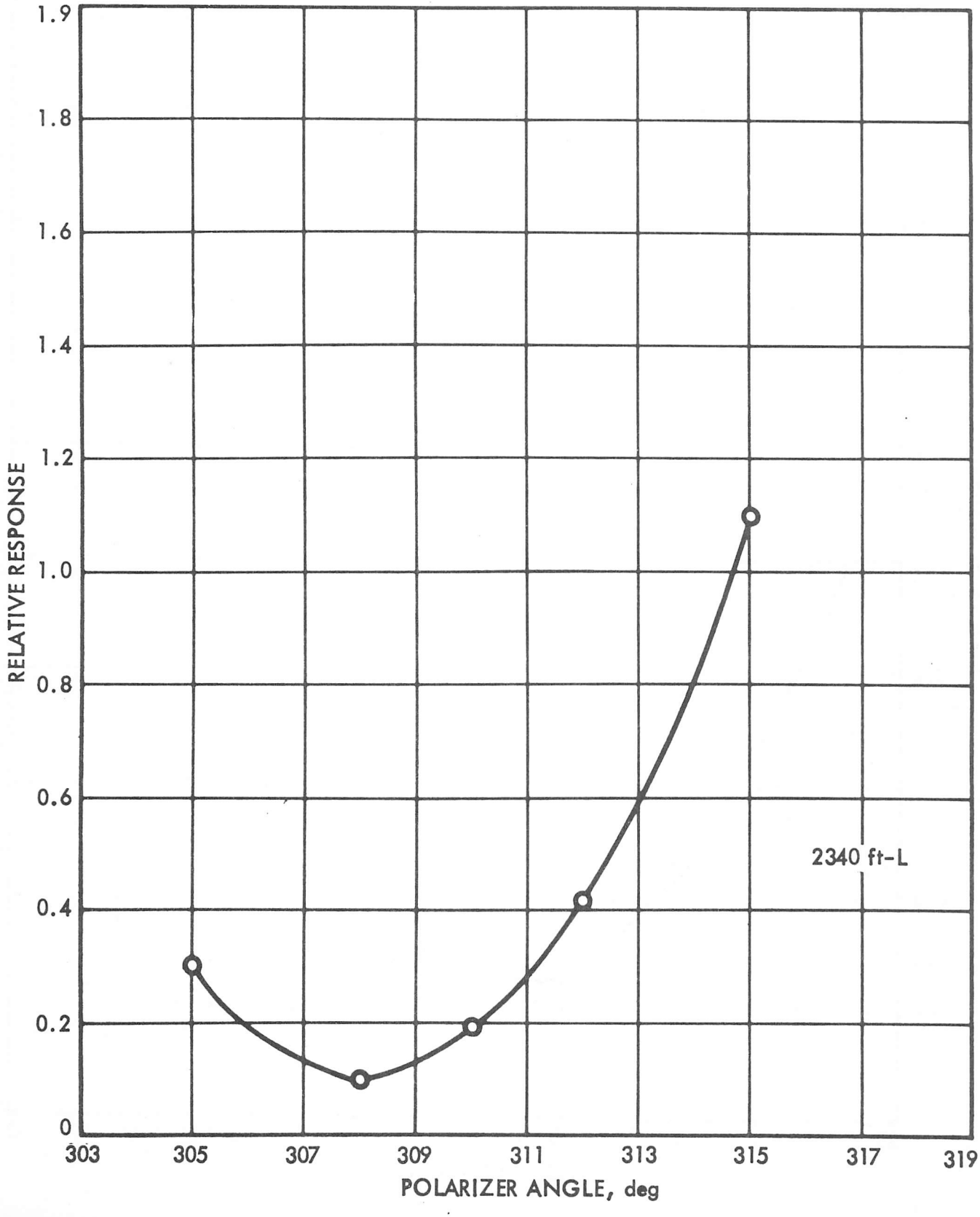


Figure 18. Polarization Null, S-Filter f/4, Open Shutter, 600-Line Scan Mode, Transmitter A

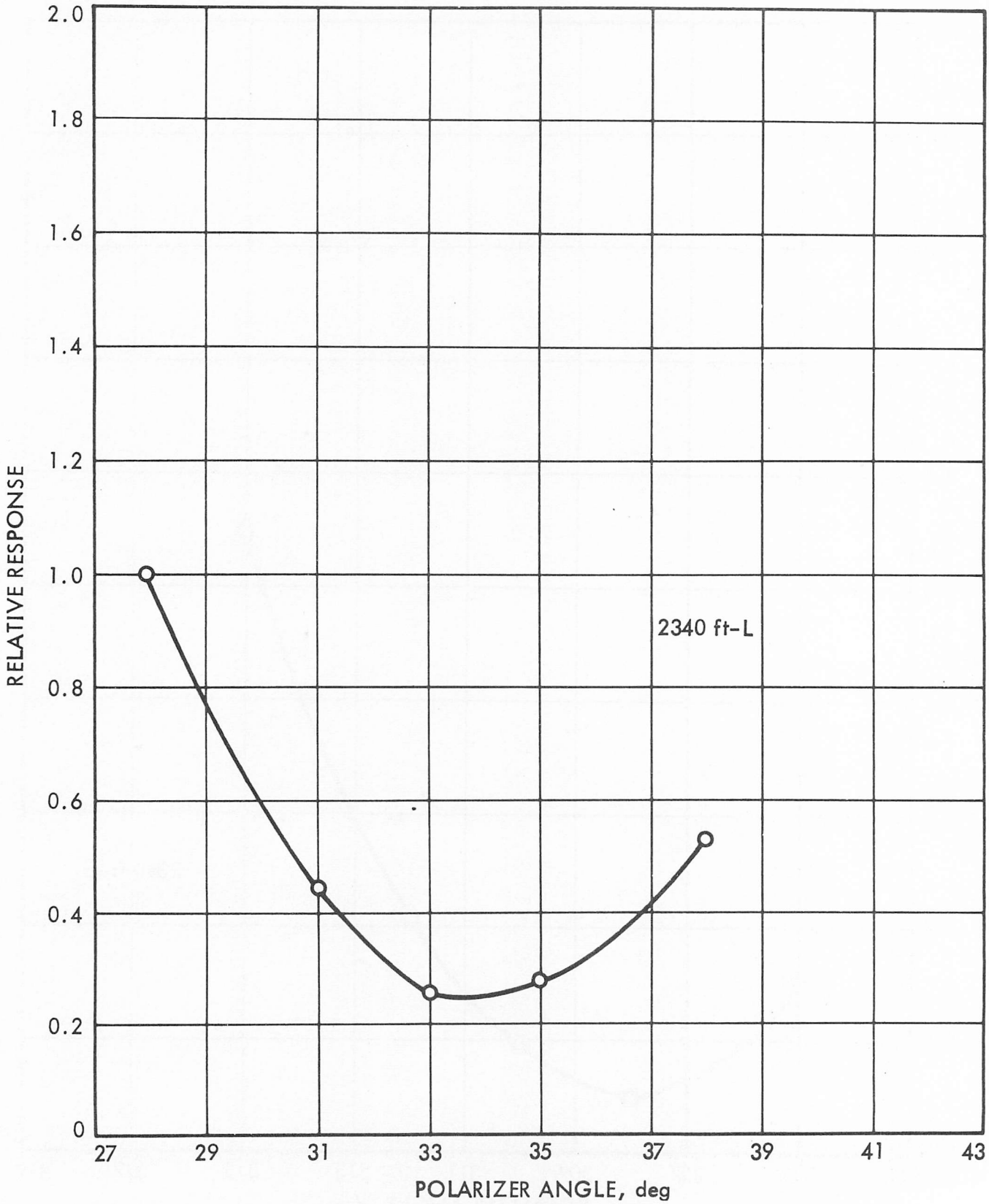
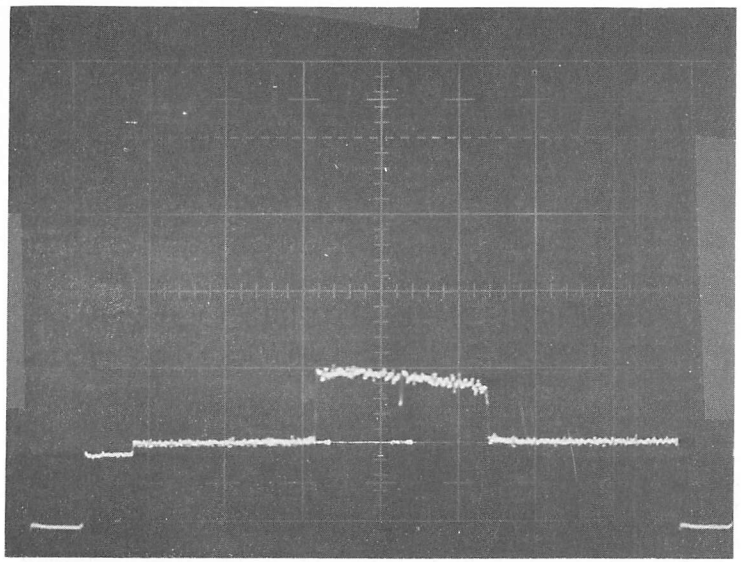
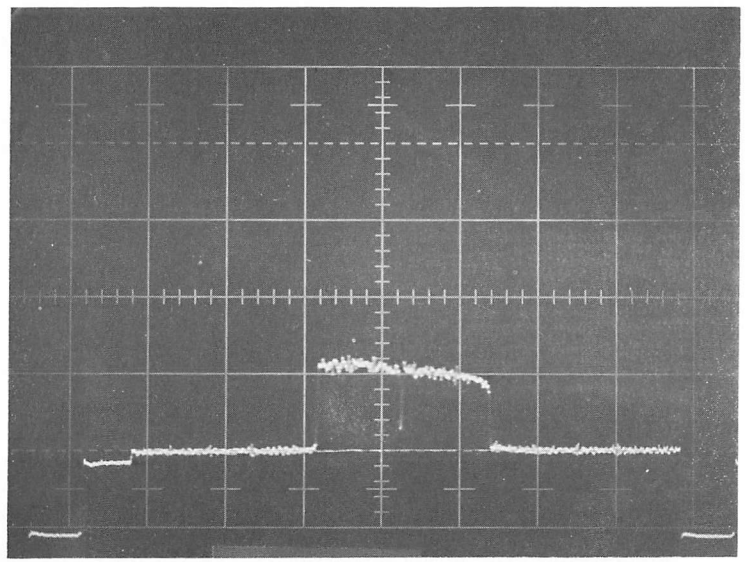


Figure 19. Polarization Null, N-Filter f/4, Open Shutter, 600-Line Scan Mode, Transmitter A

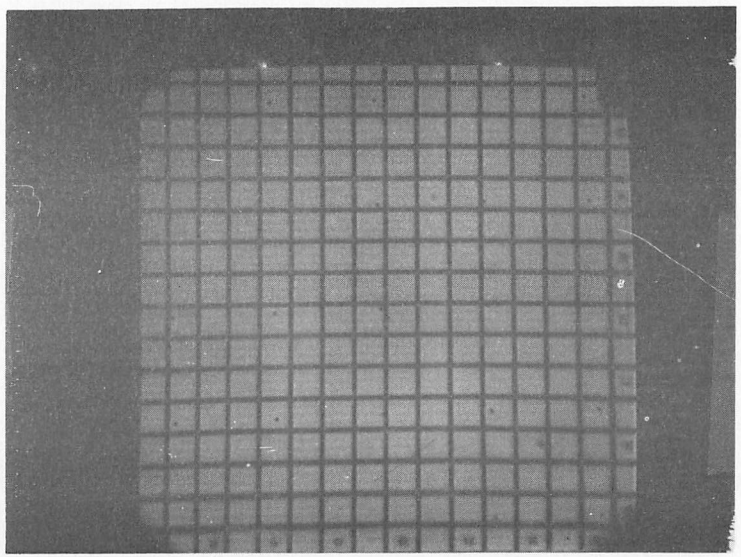


VIDEO OUTPUT AT 349 DEGREES (NULL)
WITH 500 ft-L AND f/4 IRIS.
(600-LINE SCAN MODE) TRANSMITTER A

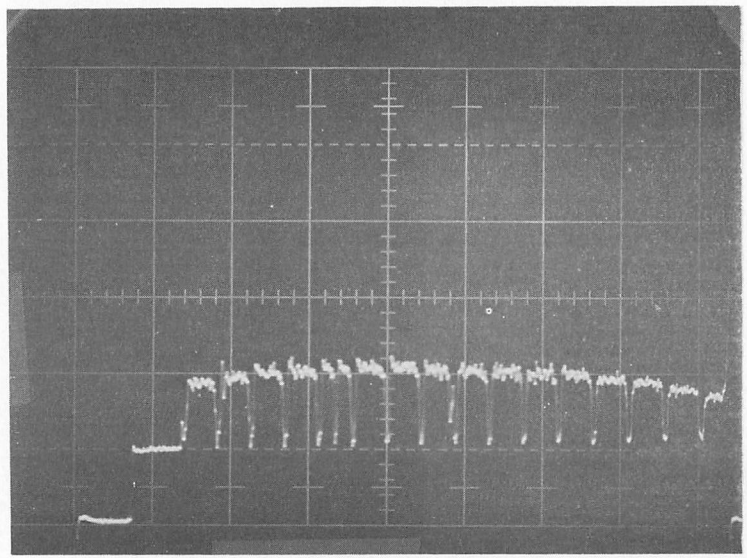


VIDEO OUTPUT AT 342 DEGREES
WITH 500 ft-L AND f/4 IRIS.
(600-LINE SCAN MODE) TRANSMITTER A

Figure 20. Typical Line Scan Showing P-Filter Video Output Level at Different Polarizer Angles.
Sharp Spike is Vidicon Reseau Mark.



FULL FRAME REPRODUCTION
(NOTE CORNER REFERENCE MARKS)



TYPICAL LINE SCAN

Figure 21. Geometric Linearity, 600-Line Scan Mode, f/11, 200 ft-L, Clear Filter

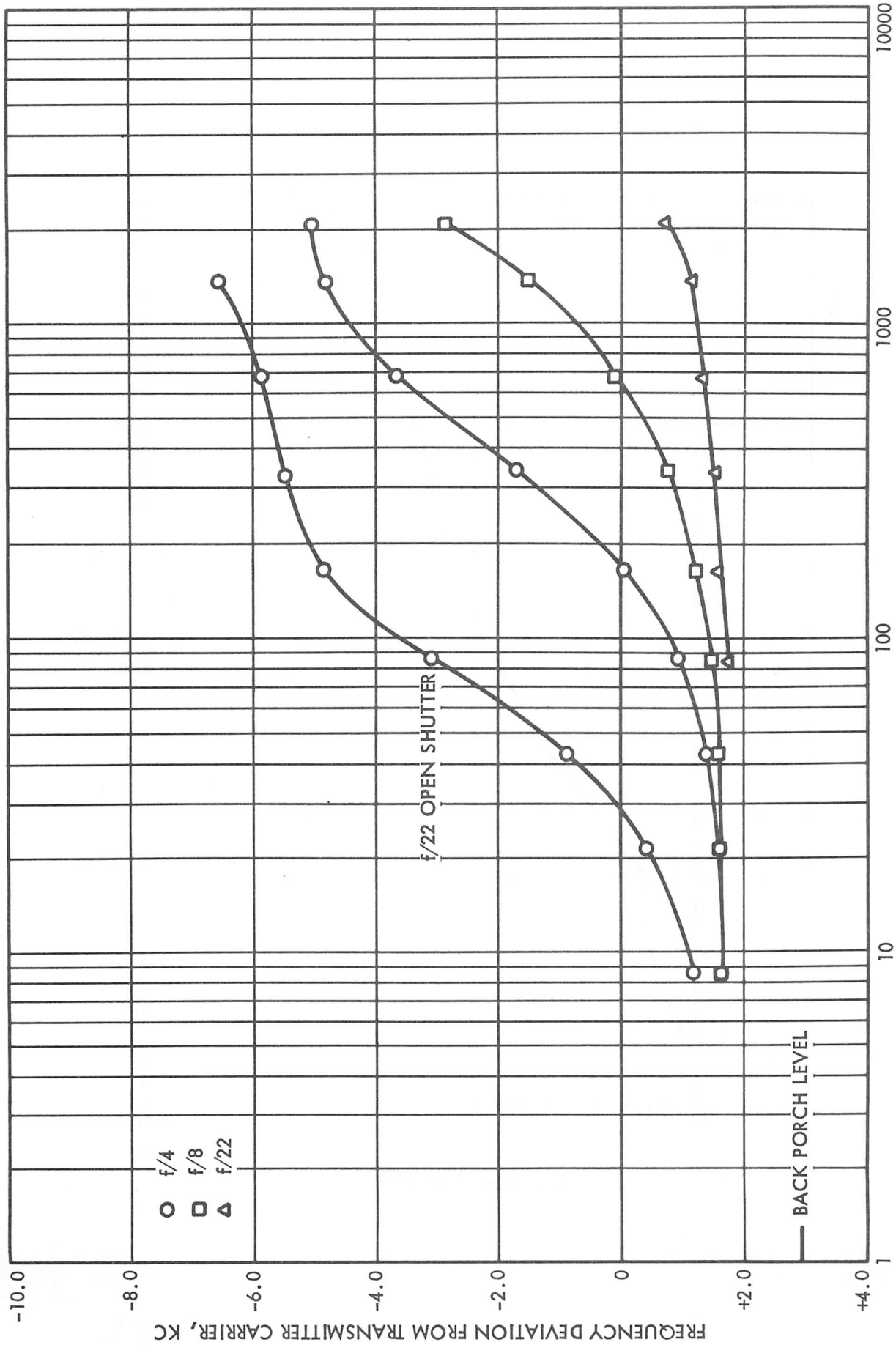


Figure 22. S/C-7 Light Transfer Characteristic, 200-Line Scan Mode, Transmitter A

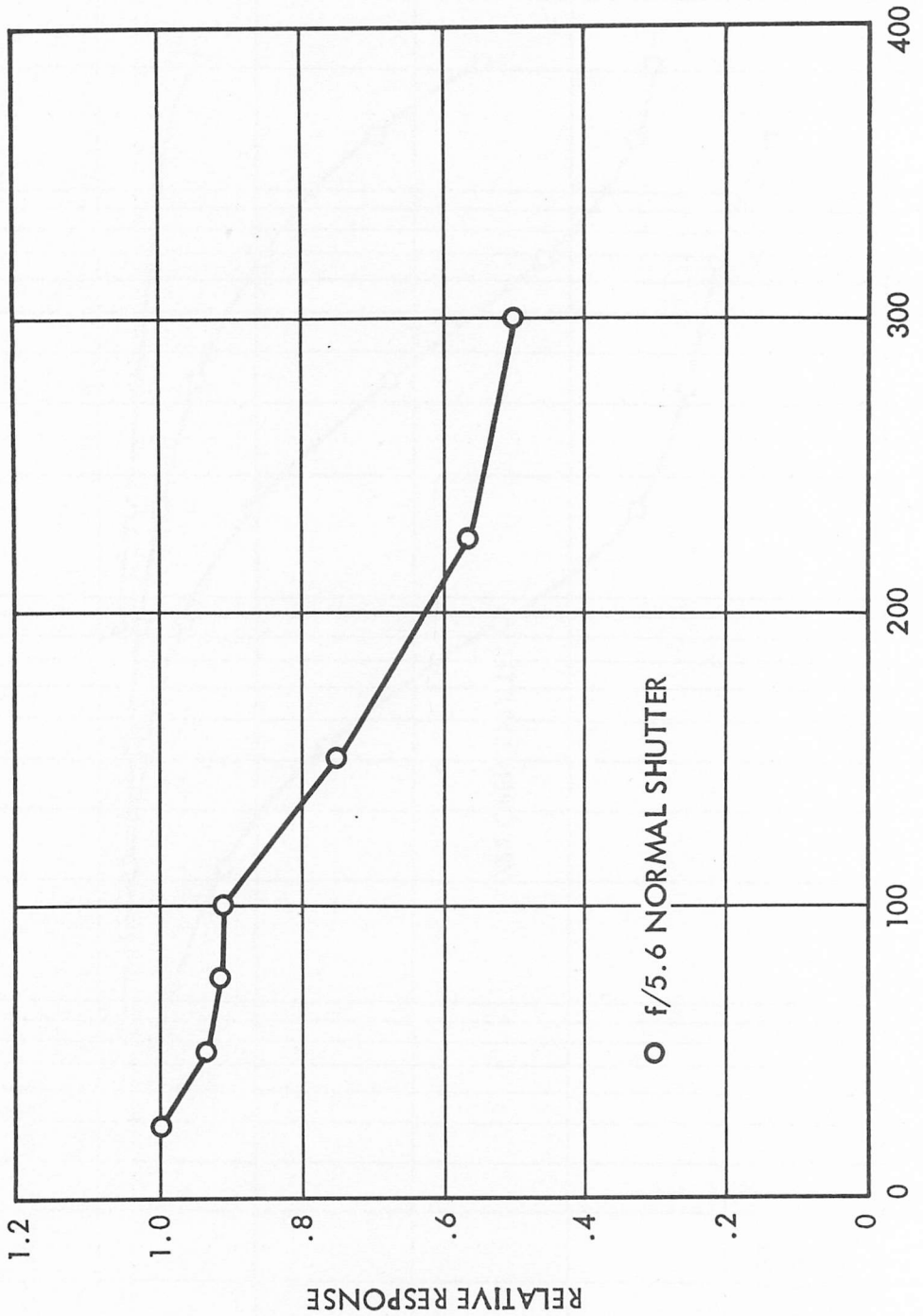


Figure 23. SC-7 Frequency Response, 200-Line Scan Mode, Transmitter A

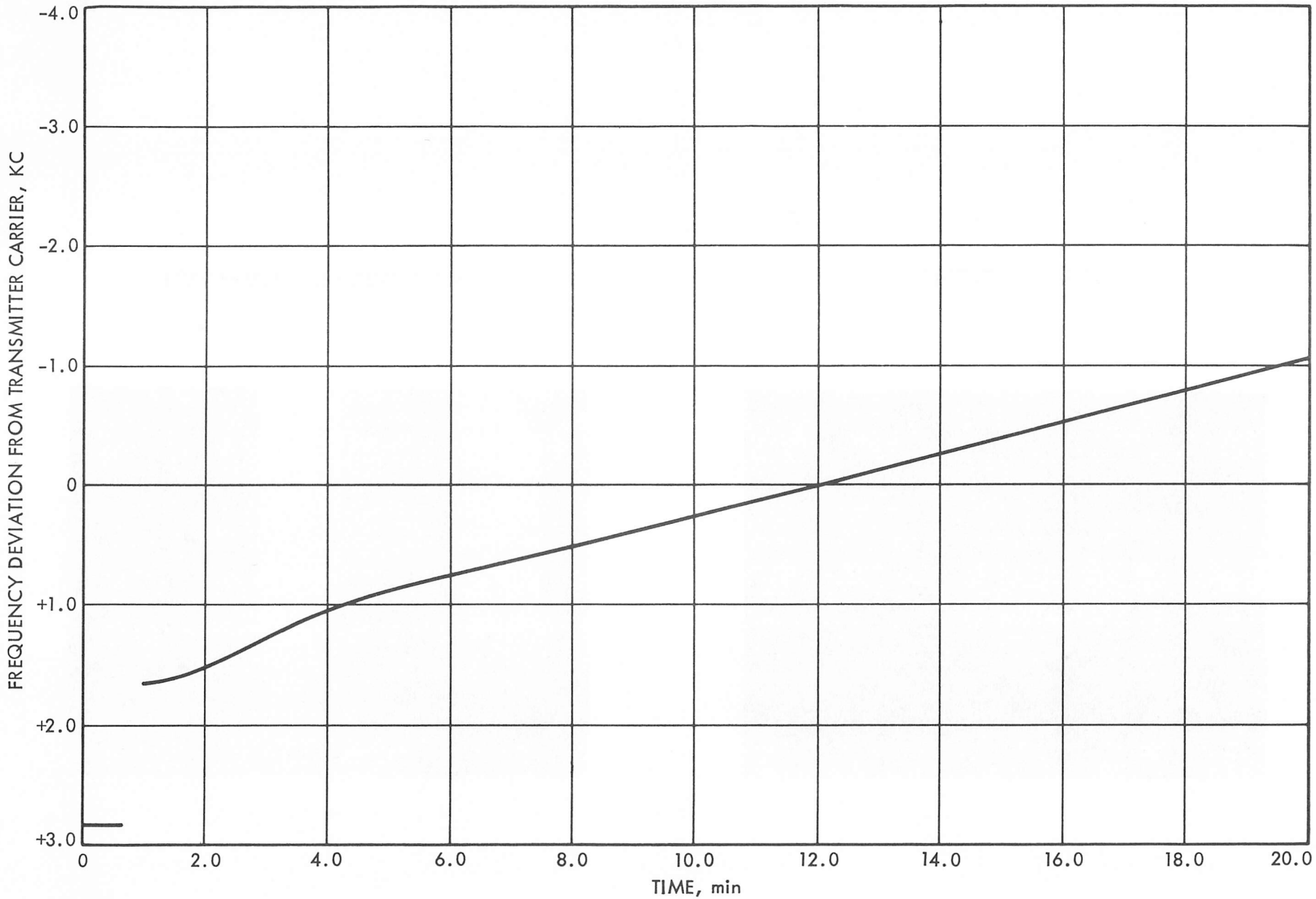


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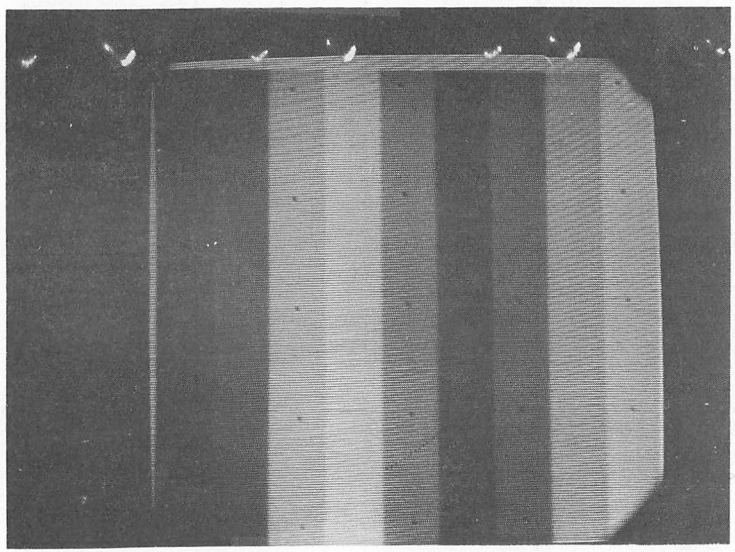
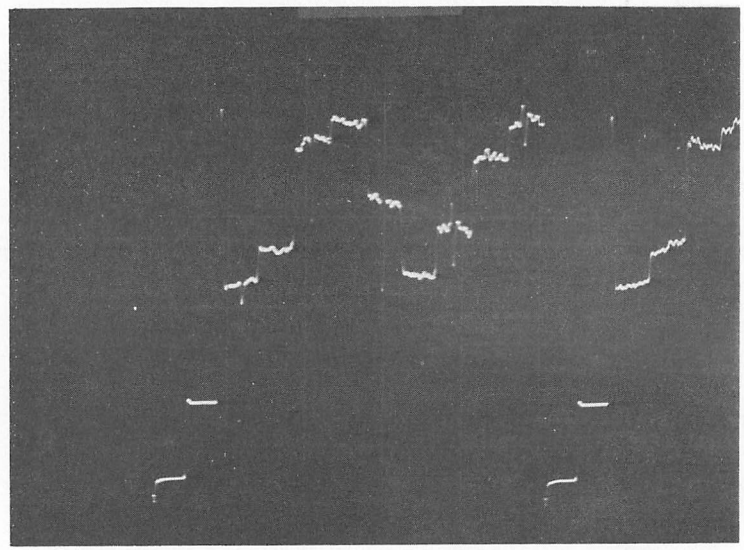
Figure 24. S/C-7 Integrate Mode, Dark Current Buildup 200-Line Mode, Transmitter A



FULL FRAME REPRODUCTION



TYPICAL LINE SCAN

Figure 25. Grey Scale Response, 200-Line Scan Mode, f/4, 2410 ft-L, Clear Filter

SURVEYOR MISSION G

TV-GDHS CALIBRATION DATA

DERIVING VIDEO CALIBRATION FROM DUPLICATE NEGATIVES

Photometric video calibration is directed to the objective of having the ability to determine Lunar Scene brightness from the recorded density of an image on film. Several aids have been designed into the film product to facilitate the meeting of this objective. These aids, the associated data, the restrictions and the tolerances for the use of these aids and data, are given below.

The Calibration Process and Data Flow

During the calibration of the TV-GDHS, the FM demodulator is set for a given voltage output at various discreet frequencies. The calibration results in a conversion ratio of a nominal 3 volts per 1.25 MHz. After demodulation, the video signal is processed by clamping the backporch to an adjustable reference voltage and normalizing the resultant video signal such that black level occurs at 0 volts and white level occurs at 1 volt. The black level and white level frequencies are determined from a calibration tape recording made at Cape Kennedy prior to launch. Only the delta frequencies, referenced to backporch, are required for the calibration of the ground equipment (absolute frequencies are required for operational reasons). See Reference (1).

An analog exposure computer operates on the normalized video signal to achieve the following functions.

1) To introduce a recording gamma to match the film processing gamma γ_A such that a desired system gamma γ_S may be achieved. The relationship between system gamma, film processing gamma, and recording gamma γ_R is:

$$\gamma_S = \gamma_R \gamma_A$$

Generally, the goal is a γ_S of 1.0 on the original archival negative.

2) To set a contrast ratio (CR) on the original negative independent of γ_S. The contrast ratio is generally set at 25:1 which results in a delta density of 1.4 between black and white when $\gamma_S = 1.0$.

3) To compensate for operational parameters such as CRT writing speeds, light filters, etc.

4) To supply a constant intensity signal which represents a flat white level field or a flat black level field for recording "calibrate" frames.

The Film Recorder then takes the video signal from the exposure computer and exposes the film with light from a CRT which is linearly related to its input signal. After a frame of video information is recorded, an electrically generated gray scale is exposed along the left side of the video frame. The Film Recorder also position modulates the recording electron beam, in the vertical direction, to fill in the gaps between recording lines. This is known as dither.

The film is wet processed to obtain an original negative. The negatives distributed in this data package are duplicates made from the original negative via a master positive.

During the mission, it is the practice to expose film during the countdown procedures with graybar and white line grid patterns generated by the Video Data Simulator, and the flat white and flat black levels generated by the exposure computer to provide standard reference frames. At the conclusion of the pass, a dub of portions of the Calibration Tape made at Cape Kennedy is played through the system, and likewise recorded on film.

Sources of Density Variation From Pass to Pass

It is obvious that there are many steps between the Spacecraft and

the final duplicate negative, each one of which can cause day to day density variation in the final product.

These sources of variation are listed here:

a) The output voltage versus input light intensity in the spacecraft camera itself.

b) The sensitivity of the modulator in the spacecraft.

c) The set up of the test equipment used to perform the countdown calibration.

d) The ground equipment demodulator and associated video amplifiers.

e) The video processor and the normalization process and calibration.

f) The exposure computer.

g) The day-to-day set up of the light versus input voltage to the Film Recorder.

h) The day-to-day processing of the original negative.

i) The exposure and processing of the master positive and duplicate negatives.

Calibration Aids

1) The Electrical Gray Scale (EGS)

An Electrical Gray Scale (EGS) is exposed along the left edge of every frame. The EGS is generated internally by the exposure computer independent of any input signal. The intent of this gray scale is to provide a series of gray steps, the black and white steps of which are equivalent to the normalized input voltages corresponding to the calibrated black and white levels of the input signal. The gray scale is a series of eight equal voltage steps

from 0 volts to 1 volt. 0 volts corresponds to black level, and 1 volt corresponds to white level. A ninth step is included which is a repeat step of white level.

For Surveyor Mission G, the voltage steps have the following correspondences for spacecraft transmitters XMTR-A and XMTR-B. See reference (1).

	Step	Voltage (Volts)	Representing Δ Frequency From Back Porch (MHz)	
			XMTR-A	XMTR-B
Black Level	8	0.000 ± .001	0.095	0.082
	7	0.143 ± .001	0.301	0.283
	6	0.286 ± .001	0.508	0.483
	5	0.429 ± .001	0.714	0.684
	4	0.571 ± .001	0.921	0.884
	3	0.714 ± .001	1.127	1.085
	2	0.857 ± .001	1.334	1.285
White Level	1	1.000 ± .001	1.540	1.486

2) The Video Gray Bar

The Video Gray Bar (VGB) is generated by the Video Data Simulator (VDS). During countdown, the VDS is set according to published S/C Video Calibration parameters. See Reference (1). The back porch is set to nominal frequency; sync tip, black level and white level are then set to produce the published difference frequencies, all relative to back porch. Eight equal step voltage levels are generated between the black level and the white level in two series of staircases. The first series starts at midscale and goes to black level. The second series starts at white level and goes to black level immediately after the black level of the first series.

The following table lists the correspondences for spacecraft transmitter XMTR-A.

	Step	Composite Video Output (Volts)	Representing Δ frequency (MHz)	Processed Video Output voltage (to film recorder exposure computer) (volts)
Black Level	8	-1.572 ± .03	0.095	0.000 ± .02
	7	-1.077 ± .03	0.301	0.143 ± .02
	6	-0.581 ± .03	0.508	0.286 ± .02
	5	-0.086 ± .03	0.714	0.429 ± .02
	4	+0.410 ± .03	0.921	0.571 ± .02
	3	+0.905 ± .03	1.127	0.714 ± .02
	2	+1.401 ± .03	1.334	0.857 ± .02
White Level	1	+1.896 ± .03	1.540	1.000 ± .02
Back Porch		-1.800 ± .03	0.000	-
Sync Tip		-2.909 ± .03	0.462	-

The following table lists the correspondences for spacecraft transmitter XMTR-B.

	Step	Composite Video Output (Volts)	Representing Δ frequency (MHz)	Processed Video Output voltage (to film recorder exposure computer) (volts)
Black Level	8	-1.603 ± .03	0.082	0.000 ± .02
	7	-1.122 ± .03	0.283	0.143 ± .02
	6	-0.640 ± .03	0.483	0.286 ± .02
	5	-0.159 ± .03	0.684	0.429 ± .02
	4	+0.322 ± .03	0.884	0.571 ± .02
	3	+0.804 ± .03	1.085	0.714 ± .02
	2	+1.285 ± .03	1.285	0.857 ± .02
White Level	1	+1.766 ± .03	1.486	1.000 ± .02
Back Porch		-1.800 ± .03	0.000	-
Sync Tip		-2.897 ± .03	0.457	-

3) White Level and Black Level Calibrate Frames

During countdown and at the conclusion of the Video operating pass, the Film Recorder is put into a calibrate mode in which the exposure computer puts out a signal corresponding to white level (1 volt input to the exposure computer), and a few frames are exposed on film. Similarly, a black level (0 volts input to the exposure computer) is recorded on film. Any shading introduced by the Film Recorder, or subsequent processing, can be measured from these frames.

4) The Optical Gray Wedge

The optical gray wedge is exposed onto the film by an independent light source. The film is exposed by this gray wedge during the countdown and subsequent to the video operating pass as well as automatically at 50 frame intervals during the pass. This provides a reference which will vary only because of film processing variation independent of changes in the Film Recorder.

5) Playback of the Dub of the S/C Calibration Tape

Subsequent to the end of a view period, a dub of selected frames from the S/C Calibration Tape is played back through the system. The tape playback originates at DSS-11. The entire system records the signal just as if it were a true real-time signal. See reference (2) for a description of the data content of this playback.

Additional Remarks

To the eye used to viewing negatives intended for rapid production printing, the negatives in the data package may well appear relatively dense. The reason is that the toe of the H & D Curve extends up to approximately .3 to .4 density units. It is highly desirable from a photometric standpoint to place the image on the most linear part of the H & D Curve, hence black level is set to the minimum density possible, but still on the linear portion of the curve.

The Recording Function

All functions in the exposure computer are normalized with respect to an input voltage V_{in} of 1.0 volts. The relationship of the exposure computer output V_{out} to its input is:

$$V_{out} \approx (K_1 V_{in} + K_2)^{\gamma_R}$$

Where K_1 and K_2 are constants, and

$0 \leq V_{in} \leq 1.0$.

By definition: $K_1 + K_2 = 1$

Also by definition: $CR = \frac{K_1 + K_2}{K_2}$

The density D on the film, as measured by an averaging densitometer, is:

$$D \approx \log (K_1 V_{in} + K_2)^{\gamma_R \gamma_A}$$

A further refinement is:

$$D \approx \log (K_1 V_{in} + K_2)^{\gamma_S} + f \text{ (Beam Current i.e., spot size and shape)}$$

$$+ f \text{ (Line Spacing)} + f \text{ (Dither)}$$

The last three terms have a small effect upon D and cannot be quantitatively expressed at this time.

By plotting D versus $\log (K_1 V_{in} + K_2)$ of the EGS or VGB, it is possible to derive V_{in} from density measurements in a video frame, and hence, spacecraft delta frequency which can then be related to the camera output voltage and Scene Brightness. The slope of the curve represents $-\gamma_S$.

For the EGS or VGB and a Contrast Ratio setting of 25, the following relationships hold:

$$\frac{K_1 + K_2}{K_2} = 25, \quad K_1 + K_2 = 1 \therefore K_1 = .96, \quad K_2 = .04$$

	Step	V_{in}	$K_1 V_{in} + K_2$
Black	8	0.000 ± .02 Volts	0.040 ± .023 Volts
	7	0.143 ± .02 Volts	0.177 ± .027 Volts
	6	0.286 ± .02 Volts	0.315 ± .031 Volts
	5	0.429 ± .02 Volts	0.452 ± .035 Volts
	4	0.571 ± .02 Volts	0.588 ± .039 Volts
	3	0.714 ± .02 Volts	0.725 ± .042 Volts
	2	0.857 ± .02 Volts	0.863 ± .046 Volts
White	1	1.000 ± .02 Volts	1.000 ± .050 Volts

If correctly adjusted, the error in the light intensity from the CRT in the Film Recorder is less than 1% compared to the output of the exposure computer. By measuring the densities over a white or black Calibrate frame the characteristic shading introduced by the film recorder can be measured.

References:

1) Surveyor VII Spacecraft Survey Camera Science Calibration Report 1 January 1968, Project Document No. 602-65, Page 9.

2) Ibid, Page 13.

TELEVISION IDENTIFICATION DATA CALIBRATION

The television identification parameters transmitted back from the spacecraft were calibrated prior to launch by Hughes Aircraft Company personnel. Essentially, tables of each parameter function in engineering units vs. the binary coded decimal equivalent were delivered for each parameter. Fifth-degree polynomials were fit to these by JPL personnel for operational use, with the calculated functions plotted and visually examined for goodness of fit to the calibration data. These polynomials were then used in the TVGDHS computing system to obtain the engineering units in the TVID contained in this data package.

Polynomials were fit to the vidicon faceplate and electronics temperatures, mirror azimuth and elevation, lens faces and iris positions, and the filter wheel positions. The lens iris servo, multistep focus, focal length and time exposure words are transmitted as full binary words, but actually can be in only one of two states, hence were handled merely by level detection.

MISSION DATA PACKAGE FILM GENERATION

Section 2-d gives measurements and plots using data obtained from the original negatives (recorded on Optics 1), master positives, and EDR duplicate negatives. Also included is the method of generating the transfer function for a duplicate negative film roll.

Measured Data, Plotting Methods and Examples

Shading Characteristics

The EDR and the Duplicate Negatives in this Data Package were produced from Optics I of the Film Recorder in the SFOF, Pasadena. Figure B-1 shows average density patterns of the shading characteristics of a white calibration frame of this optics. Figure B-2 shows a family of orthogonal microdensitometer traces at approximate equal spacing across and down a white calibration frame. The frame used to make these measurements was made as part of the calibrate frames exposed for the first video pass of the mission. Figures B-3 and B-4 show similar data for a black calibration frame.

An examination of the films show some mottling which appears to account at least partially for the apparent differences between the patterns. Generally, however, there is a negative density gradient from both the top edge and the bottom edge of the frame to the center of the frame.

System Gamma Plots

Figure B-5 shows typical System Gamma Plots for three film products. Figure B-5a shows the EGS and VGB step densities of an original negative film product. Also shown as a dashed line is the EGS curve which has been normalized to the average density of a white calibration frame and also corrected for left edge shading taken from Figure B-1. It is noted that the deviations of the VGB step densities from the EGS step densities are due to the relative differences in the respective shading curves. The left edge shading curve pertaining to the EGS has smaller density variations than that shading curve pertaining to the VGB as respectively evidenced by the left edge of Figure B-1 and the boxed-in area of Figure B-2.

Figure B-5b shows typical system gamma plots for the master positive film and the EDR duplicate negative film.

H & D Plots

From sensitometric data, and H & D plot can be constructed for any film product. Figure B-6 shows typical H & D plots for original negatives, master positives, and EDR duplicate negatives.

Demodulator Curve

Figure B-7 shows the output voltage of the FM Demodulator vs. input frequency at a point prior to final amplification.

Density vs. Delta Frequency

Figure B-8 shows the upper and lower limits of EGS density of original negatives recorded on Optics I, SFOF, Pasadena, vs. the delta frequency from back porch corresponding to spacecraft transmitter XMTR-A. Similar data is shown on Figure B-9 corresponding to spacecraft transmitter XMTR-B. These original negatives are the sources for the duplicate negatives in the data package and for the EDR.

In using Figures B-8 and B-9, it must be understood that the range of density vs. delta frequency describes the envelope for a family of curves, The slope of density vs. delta frequency curve for a film roll may differ from the average slope of the upper and lower limit curves. The resulting deviation of the density vs. delta frequency curve from the average slope of the upper and lower limit curves can be measured in density units. For all the film rolls measured, the maximum density deviation obtained is ± 0.06 density units, and the average deviation is about ± 0.04 density units. Since these are measured on the original negatives, a similar set of curves should be generated from measurements made on the duplicate negative.

Original Film Measurements

Tables B-1 to B-14 give the measurements of the output of the exposure computer, typical EGS and VGB step densities for three film products, OGW step number 2 density at the beginning, middle, and end of an original negative film roll, and a 25 density profile of white calibration frame. Also shown in these tables for all the film rolls received by all the stations per pass and exposed on Optics I are the maximum and minimum EGS density measurements pertaining to black level and white level of an original negative, and the system gamma values for the three film products. It is noted that XMTR-A was used throughout Mission G except for spacecraft transmitter periods GMT day 14 though GMT day 20 during which spacecraft transmitter XMTR-B was used.

The exposure computer output voltages listed in tables B-1 to B-14 correspond to those film rolls which have been received by receiving station DSS-11. Since the film rolls which have been received by receiving stations DSS 42 and DSS 61 have been exposed at different GMT periods than those film rolls received by station DSS 11, the exposure computer output voltages listed in tables B-1 to B-14 do not apply for film rolls received by stations DSS 42 and DSS 61. The exposure computer output voltages corresponding to these film rolls are listed in tables B-15 and B-16.

The relationship between the input to the exposure computer to its output is:

$$V_{out} = K_3 \ (K_1 \ V_{in} + K_2)^{\gamma_R}$$

For Mission G, the values for the parameters were:

$K_1 = 0.96$, $K_2 = 0.04$ (as discussed in Section A), $\gamma_R = 0.574$, and the average $K_3 = 21.8086$.

The light output of the film recorder optics is directly proportional to the exposure computer voltage except for any shading characteristics.

TABLE 1

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS
ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42	DSS-61
Visibility Period	10:00-10:09	10:06-10:15	10:14-11:03

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W0947					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.72	1.88					
2	20.06	1.66					
3	18.35	1.57					
4	16.42	1.45					
5	14.38	1.34					
6	11.98	1.22					
7	9.098	1.01					
8	4.405	.58					
9		1.88					
File/Frame No.		0026					

OGW Step No. 2
Original Negative Roll No. W0947

Location	Density	Adj. Frame No.
Start	1.93	0094
Middle		
End	2.01	0026

White Calibration Frame No. 0093
Original Negative Roll No. W0947

1.73	1.70	1.59	1.65	1.66
1.65	1.62	1.57	1.61	1.64
1.60	1.55	1.52	1.58	1.69
1.62	1.59	1.54	1.64	1.62
1.66	1.69	1.67	1.75	1.74

Average: 1.635

Film	Roll No.	W0947	W0948	W0951
Orig. Neg.	EGS D_{Max} Wht D_{Min}	1.88 1.84	1.87 1.85	1.98 1.82
	EGS D_{Max} Blk D_{Min}	.58 .53	.54 .52	.64 .54
	γ_{s_1}	.91	.99	.99
Pos	γ_{s_2}			
EDR	γ_{s_3}			
Receiving DSS		11	11	11

TABLE 2

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS
ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42	DSS-61 *
Visibility Period	10:22-11:10	11:08-11:15	11:14-12:04

* See Table 15

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W0960					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.79	2.01		.62		1.94	
2	20.12	1.78		.70		1.72	
3	18.40	1.65		.76		1.57	
4	16.46	1.50		.86		1.40	
5	14.43	1.37		.96		1.26	
6	12.01	1.21		1.10		1.10	
7	9.120	1.01		1.24		.90	
8	4.410	.57		1.62		.48	
9		2.14		.57		2.14	
File/Frame No.		3052		3011		3052	

OGW Step No. 2
Original Negative Roll No. W0958

Location	Density	Adj. Frame No.
Start	1.98	2314
Middle		
End	2.13	2763

White Calibration Frame No. 15
Original Negative Roll No. W0958

1.84	1.80	1.75	1.76	1.69
1.65	1.60	1.56	1.60	1.59
1.60	1.52	1.48	1.55	1.70
1.59	1.56	1.54	1.62	1.56
1.72	1.70	1.74	1.75	1.70

Average: 1.647

Film	Roll No.	W0958	W0960	W0962	W0965	W0967	W0969	W0986
Orig. Neg.	EGS D_{Max} Wht D_{Min}	2.06	2.01	2.01	2.04	2.04	2.04	1.79
		1.92	1.88	1.94	1.95	1.87	1.95	1.73
	EGS D_{Max} Blk D_{Min}	.68	.57	.60	.59	.61	.59	.48
		.60	.52	.53	.54	.51	.57	.40
	γ_{s_1}	1.11	1.15	1.08	1.00	1.15	1.19	1.12
Pos	γ_{s_2}		.74					.94
EDR	γ_{s_3}	.90	1.18	1.02	1.06	1.31	1.32	1.21
Receiving DSS		11	11	11	11	11	11	61

TABLE 3

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS

ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42 *	DSS-61 *
Visibility Period	11:23-12:11	12:08-12:16	12:15-13:05

* See Table 15

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W0976					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.82	1.87	1.65	.64		1.80	
2	20.16	1.79	1.62	.68		1.67	
3	18.42	1.67	1.53	.74		1.51	
4	16.49	1.51	1.38	.87		1.38	
5	14.43	1.35	1.26	.98		1.23	
6	12.03	1.19	1.18	1.10		1.09	
7	9.151	.98	.89	1.26		.99	
8	4.440	.52	.42	1.63		.47	
9		1.99		.57		1.95	
File/Frame No.		4361	21	4361		4361	

OGW Step No. 2

Original Negative Roll No. W0976

Location	Density	Adj. Frame No.
Start	1.96	7
Middle	2.01	4332
End	2.23	4551

White Calibration Frame No. 02

Original Negative Roll No. W0976

1.84	1.80	1.76	1.74	1.72
1.68	1.65	1.64	1.68	1.63
1.59	1.60	1.61	1.66	1.65
1.64	1.67	1.69	1.70	1.62
1.69	1.72	1.70	1.70	1.58

Average: 1.678

Film	Roll No.	W0976	W0978	W0981	W0983	W0985	W1005	W1008	W1021	W1089
Orig. Neg.	EGS D_{Max} / Wht D_{Min}	2.03 / 1.86	1.98 / 1.80	1.99 / 1.85	1.89 / 1.79		1.89 / 1.75	1.86 / 1.84	1.78 / 1.71	1.77 / 1.68
	EGS D_{Max} / Blk D_{Min}	.60 / .52	.57 / .49	.60 / .48	.50 / .46		.49 / .46	.51 / .49	.47 / .38	.48 / .44
	γ_{s_1}	1.19	1.16	1.18	1.07		1.20	1.18	1.10	1.11
Pos	γ_{s_2}	.90	.84	.92	.74		.86	.85	.68	.86
EDR	γ_{s_3}	1.12	1.16	1.23	1.03		1.18	1.05	.99	1.20
Receiving DSS		11	11	11	11		42	42	61	42

TABLE 4

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS
ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42 *	DSS-61 *
Visibility Period	12:24-13:12	13:09-13:17	13:16-14:06

*See Table 15

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W0990					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.78	1.88	1.54	.55			
2	20.11	1.68	1.40	.65			
3	18.38	1.54	1.27	.70			
4	16.45	1.40	1.18	.84			
5	14.40	1.29	1.14	.94			
6	12.02	1.12	1.01	1.06			
7	9.136	.93	.78	1.23			
8	4.433	.49	.33	1.60			
9		2.00		.51			
File/Frame No.		5570	5563	5570			

OGW Step No. 2
Original Negative Roll No. W0990

Location	Density	Adj. Frame No.
Start	1.94	4
Middle		
End	2.07	6202

White Calibration Frame No. 2
Original Negative Roll No. W0990

1.78	1.76	1.66	1.71	1.63
1.59	1.54	1.52	1.61	1.60
1.50	1.44	1.45	1.54	1.60
1.50	1.55	1.56	1.60	1.58
1.63	1.69	1.65	1.66	1.62

Average: 1.599

Film	Roll No.	W0990	W0992	W0999	W1001	W1003	W1007	W1056	W1091
Orig. Neg.	EGS D_{Max}	1.90	1.91	1.88	1.93	1.90		1.91	1.74
	Wht D_{Min}	1.82	1.84	1.71	1.82	1.79		1.89	1.69
	EGS D_{Max}	.50	.50	.53	.52	.53		.55	.51
	Blk D_{Min}	.48	.47	.44	.48	.49		.53	.45
	γ_{s_1}	1.22	1.23	1.28	1.26	1.25		1.23	1.04
Pos	γ_{s_2}	.97	.92	.92	.90	.92		.93	.86
EDR	γ_{s_3}		1.25		1.25	1.18		1.19	1.23
Receiving DSS		11	11	11	11	11		61	42

TABLE 5

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS

ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42 *	DSS-61
Visibility Period	14:01-14:13	14:08-14:17	14:17-15:07

* See Table 15

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W1012					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.78	1.71	1.35	.64		1.84	
2	20.11	1.57	1.26	.68		1.66	
3	18.40	1.45	1.18	.74		1.54	
4	16.45	1.32	1.08	.87		1.38	
5	14.42	1.19	1.01	1.00		1.22	
6	12.02	1.04	.90	1.12		1.02	
7	9.144	.88	.70	1.27		.80	
8	4.434	.48	.28	1.64		.41	
9		1.90		.61			
File/Frame No.		11373	17	11373		11373	

OGW Step No. 2

Original Negative Roll No. W1012

Location	Density	Adj. Frame No.
Start	1.82	4
Middle		
End	2.10	12146

White Calibration Frame No. 6
Original Negative Roll No. W1012

1.66	1.64	1.58	1.62	1.54
1.44	1.45	1.38	1.44	1.42
1.40	1.36	1.29	1.40	1.50
1.43	1.34	1.30	1.42	1.40
1.36	1.38	1.42	1.50	1.55

Average: 1.449

Film	Roll No.	W1012	W1014	W1018	W1123
Orig. Neg.	EGS D_{Max} Wht D_{Min}	1.79	1.81	1.72	1.90
		1.71	1.70	1.65	1.88
	EGS D_{Max} Blk D_{Min}	.49	.53	.44	.50
		.45	.43	.40	.47
	γ_{s_1}	1.10	1.17	1.15	1.28
Pos	γ_{s_2}	.85	.81	.89	.99
EDR	γ_{s_3}	1.15	1.25		1.32
Receiving DSS		11	11	11	42

TABLE 6

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS
ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42 *	DSS-61
Visibility Period	15:02-15:14	15:02-15:14	15:10-15:19

* See Table 16

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W1023					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.82	2.08	1.76	.59		1.90	
2	20.15	1.97	1.70	.63		1.80	
3	18.41	1.84	1.62	.68		1.67	
4	16.48	1.70	1.54	.80		1.50	
5	14.44	1.55	1.44	.92		1.37	
6	12.04	1.37	1.31	1.06		1.16	
7	9.158	1.14	1.04	1.21		.90	
8	4.443	.64	.54	1.62		.42	
9		2.23		.52		2.07	
File/Frame No.		13660	19	13763		13660	

OGW Step No. 2
Original Negative Roll No. W1023

Location	Density	Adj. Frame No.
Start	1.90	13660
Middle		
End	2.18	14057

White Calibration Frame No. 6
Original Negative Roll No. W1023

2.06	2.04	1.96	1.97	1.88
1.85	1.85	1.83	1.82	1.82
1.82	1.80	1.78	1.76	1.82
1.78	1.82	1.84	1.84	1.71
1.86	1.87	1.89	1.87	1.79

Average: 1.853

Film	Roll No.	W1023	W1025	W1027	W1028	W1029	W1031	W1033	W1171
Orig. Neg.	EGS D_{Max} Wht D_{Min}	2.22 / 2.08	2.21 / 2.04	2.21 / 2.04	2.07 / 1.99	2.12 / 2.02	2.08 / 2.04		1.77 / 1.75
	EGS D_{Max} Blk D_{Min}	.68 / .64	.66 / .62	.66 / .62	.67 / .58	.68 / .66	.66 / .62		.45 / .44
	γ_{s_1}	1.27	1.31	1.31	1.21	1.24	1.24		1.05
Pos	γ_{s_2}	.97	.88	.88	.77	.81	.94		.88
EDR	γ_{s_3}	1.29	1.42	1.42	1.26	1.29	1.30		1.14
Receiving DSS		11	11	11	11	11	11		42

TABLE 7

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS

ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42	DSS-61
Visibility Period	16:03-16:15	16:11-16:20	16:19-17:08

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W 1051					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.83	1.82	1.57	.59		1.74	
2	20.18	1.80	1.51	.68		1.73	
3	18.044	1.70	1.40	.76		1.62	
4	16.50	1.58	1.39	.84		1.51	
5	14.46	1.45	1.30	.92		1.39	
6	12.05	1.28	1.17	1.00		1.22	
7	9.166	1.02	.94	1.17		.96	
8	4.448	.56	.41	1.62		.46	
9		1.99		.42		2.02	
File/Frame No.		15621	18	16363		15621	

OGW Step No. 2

Original Negative Roll No. W1051

Location	Density	Adj. Frame No.
Start	1.88	15614
Middle	-	
End	2.09	16363

White Calibration Frame No. 5

Original Negative Roll No. W 1051

1.85	1.87	1.80	1.82	1.74
1.70	1.66	1.66	1.71	1.69
1.66	1.61	1.58	1.70	1.76
1.65	1.65	1.64	1.73	1.68
1.73	1.76	1.79	1.78	1.65

Average: 1.715

Film	Roll No.	W1051	W1054
Orig. Neg.	EGS D_{Max} Wht D_{Min}	2.09 1.82	1.92 1.90
	EGS D_{Max} Blk D_{Min}	.65 .56	.55 .51
	γ_{s_1}	1.15	1.21
Pos	γ_{s_2}	.71	
EDR	γ_{s_3}	1.19	
Receiving DSS		11	11

TABLE 8

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS

ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42	DSS-61
Visibility Period	17:03-17:16	17:12-17:22	17:20-18:09

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W 1062					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.80	1.72		.58		1.84	
2	20.13	1.60		.64		1.72	
3	18.42	1.49		.68		1.64	
4	16.48	1.36		.80		1.45	
5	14.44	1.22		.91		1.30	
6	12.04	1.08		1.06		1.12	
7	9.142	.86		1.25		.86	
8	4.409	.44		1.68		.42	
9		1.88		.52		2.07	
File/Frame No.		17435		17771		17435	

OGW Step No. 2		
Original Negative Roll No. W1062		
Location	Density	Adj. Frame No.
Start	1.86	17435
Middle	-	
End	2.04	17771

White Calibration Frame No. 311
Original Negative Roll No. W 1062

1.70	1.68	1.66	1.66	1.60
1.58	1.51	1.52	1.54	1.56
1.56	1.44	1.44	1.54	1.64
1.55	1.49	1.50	1.63	1.59
1.62	1.62	1.62	1.66	1.68

Average: 1.584

Film	Roll No.	W1062	W1064	W1067	W1069
Orig. Neg.	EGS D_{Max} Wht D_{Min}	1.85 1.72	1.86 1.71	1.87 1.78	1.86 1.82
	EGS D_{Max} Blk D_{Min}	.49 .44	.50 .39	.49 .46	.46 .44
	γ_{s_1}	1.20	1.05	1.08	1.17
Pos	γ_{s_2}	.90	.88	.86	
EDR	γ_{s_3}		1.23	1.19	
Receiving DSS		11	11	11	11

TABLE 9

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS

ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42	DSS-61
Visibility Period	18:04-18:16	18:12-18:22	18:21-19:09

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W1076					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.82	1.96	1.57	.52		2.34	
2	20.16	1.77	1.56	.61		2.09	
3	18.44	1.62	1.52	.69		1.90	
4	16.48	1.48	1.38	.78		1.76	
5	14.45	1.32	1.28	.90		1.58	
6	12.05	1.16	1.16	1.04		1.38	
7	9.152	.96	.90	1.20		1.11	
8	4.435	.50	.47	1.63		.58	
9		2.04		.45		2.46	
File/Frame No.		21735	23	21735		21735	

OGW Step No. 2

Original Negative Roll No. W1076

Location	Density	Adj. Frame No.
Start	1.94	21172
Middle	1.99	21410
End	1.98	21735

White Calibration Frame No. 2

Original Negative Roll No. W1076

1.86	1.90	1.84	1.82	1.80
1.68	1.73	1.75	1.70	1.68
1.64	1.68	1.63	1.66	1.72
1.64	1.70	1.67	1.72	1.61
1.81	1.83	1.79	1.79	1.76

Average: 1.736

Film	Roll No.	W1076	W1079	W1080	W1084	W1122
Orig. Neg.	EGS D_{Max}	1.96	1.99	2.21	1.77	1.94
	Wht D_{Min}	1.90	1.89	1.89	1.72	1.93
	EGS D_{Max}	.50	.50	.67	.51	.54
	Blk D_{Min}	.46	.47	.47	.46	.52
	γ_{s_1}	1.28	1.24	1.16	1.10	1.13
Pos	γ_{s_2}	.85	.86	.88	.78	.84
EDR	γ_{s_3}	1.41	1.28	1.33	1.41	1.29
Receiving DSS		11	11	11	11	11

TABLE 10

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS

ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42	DSS-61
Visibility Period	19:05-19:17	19:13-19:23	19:22-20:10

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W1097					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.82	1.96	1.56			2.02	
2	20.17	1.76	1.43			1.74	
3	18.44	1.64	1.32			1.61	
4	16.46	1.49	1.23			1.46	
5	14.42	1.36	1.18			1.34	
6	12.02	1.16	1.06			1.20	
7	9.118	.96	.83			.97	
8	4.401	.54	.42			.52	
9		2.06				2.18	
File/Frame No.		25475	19			25475	

OGW Step No. 2 Original Negative Roll No. W1097		
Location	Density	Adj. Frame No.
Start	2.02	25335
Middle		
End	2.02	25700

White Calibration Frame No. 6
Original Negative Roll No. W1097

1.76	1.79	1.78	1.74	1.75
1.64	1.59	1.58	1.59	1.71
1.60	1.48	1.45	1.56	1.76
1.58	1.51	1.53	1.58	1.65
1.68	1.79	1.80	1.76	1.82

Average: 1.724

Film	Roll No.	W1097	W1099	W1101	W1103	W1105
Orig. Neg.	EGS D_{Max} Wht D_{Min}	1.97	1.91	1.93	1.80	1.93
		1.88	1.83	1.83	1.75	1.90
	EGS D_{Max} Blk D_{Min}	.55	.56	.52	.50	.55
		.52	.48	.50	.49	.52
	γ_{s_1}	1.12	1.14	1.33	1.09	1.19
Pos	γ_{s_2}		.81	.82	.74	
EDR	γ_{s_3}	1.01	1.13	1.12	1.10	
Receiving DSS		11	11	11	11	11

TABLE 11

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS

ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42 *	DSS-61
Visibility Period	20:06-20:18	20:13-21:00	20:23-21:10

* See Table 16

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W 1112					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.79	1.89		.58		1.94	
2	20.13	1.70		.68		1.71	
3	18:41	1.57		.76		1.60	
4	16:48	1.45		.85		1.49	
5	14.43	1.30		.96		1.33	
6	12.04	1.13		1.08		1.14	
7	9.156	.92		1.25		.89	
8	4.405	.49		1.66		.42	
9		2.02		.54		2.06	
File/Frame No.		27337		27337		27337	

OGW Step No. 2 Original Negative Roll No. W1112		
Location	Density	Adj. Frame No.
Start	1.91	7
Middle		
End		

White Calibration Frame No. 2
Original Negative Roll No. W1112

1.81	1.80	1.75	1.72	1.65
1.63	1.65	1.61	1.60	1.61
1.55	1.52	1.49	1.54	1.65
1.56	1.59	1.54	1.57	1.59
1.69	1.74	1.72	1.71	1.68

Average: 1.619

Film	Roll No.	W1112	W1114	W1116	W1118	A1120	W1121	W1201
Orig. Neg.	EGS Wht D_{Max}	1.93	1.96	1.88	1.92	1.69	1.90	1.80
	EGS Wht D_{Min}	1.88	1.87	1.87	1.91	1.64	1.85	1.71
	EGS Blk D_{Max}	.54	.52	.50	.50	.38	.50	.51
	EGS Blk D_{Min}	.49	.47	.49	.50	.36	.46	.47
	γ_{s_1}	1.18	1.12	1.24	1.21	1.17	1.25	1.00
Pos	γ_{s_2}	.75	.87	.75	.67			.88
EDR	γ_{s_3}	1.16	1.42	1.30	1.28			1.34
Receiving DSS		11	11	11	11	11	11	42

TABLE 12

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS

ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42 *	DSS-61
Visibility Period	21:07-21:18	21:13-22:01	22:00-22:11

* See Table 16

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W1125					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.86	1.82	1.57	.58		2.00	
2	20.19	1.65	1.45	.66		1.79	
3	18.47	1.55	1.39	.73		1.68	
4	16.52	1.40	1.30	.86		1.52	
5	14.45	1.26	1.21	.96		1.37	
6	12.05	1.14	1.10	1.05		1.20	
7	9.160	.90	.85	1.25		.92	
8	4.447	.48	.39	1.63		.44	
9		1.94		.55		2.05	
File/Frame No.		32367	22	32367		32367	

OGW Step No. 2 Original Negative Roll No.		
Location	Density	Adj. Frame No.
Start		
Middle		
End		

White Calibration Frame No. 16
Original Negative Roll No. W 1125

1.76	1.76	1.72	1.71	1.71
1.65	1.60	1.58	1.61	1.68
1.63	1.53	1.54	1.59	1.66
1.64	1.57	1.54	1.61	1.69
1.63	1.64	1.62	1.68	1.69

Average: 1.642

Film	Roll No.	W1125	W1126	W1128	W1130	W1132	W1203	W1205	W1210	W1211
Orig. Neg.	EGS D_{Max} Wht D_{Min}	2.00	1.89	1.86	1.89	1.89	1.70	1.84	1.98	1.97
		1.77	1.74	1.82	1.81	1.79	1.63	1.69	1.86	1.90
	EGS D_{Max} Blk D_{Min}	.53	.53	.50	.49	.51	.50	.51	.60	.58
		.48	.49	.48	.47	.48	.44	.44	.55	.56
	γ_{s_1}	1.13	1.13	1.12	1.19	1.18	1.00	1.15	1.11	1.01
Pos	γ_{s_2}	.93	.81	.77	.85		.91	.94	.94	.79
EDR	γ_{s_3}	1.26	1.23	1.17	1.21		1.06	1.33	1.44	1.29
Receiving DSS		11	11	11	11	11	42	11	42	42

TABLE 13

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS

ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42 *	DSS-61
Visibility Period	22:08-22:19	22:14-23:02	23:01-23:11

* See Table 16

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W1135					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.87	1.79	1.54	.51		1.95	
2	20.20	1.69	1.44	.53		1.84	
3	18.47	1.59	1.37	.59		1.70	
4	16.52	1.49	1.29	.72		1.63	
5	14.45	1.38	1.24	.77		1.51	
6	12.07	1.17	1.10	.93		1.30	
7	9.169	.93	.82	1.13		.98	
8	4.452	.49	.32	1.52		.50	
9		2.01		.42		2.13	
File/Frame No.		34445		34445		34445	

OGW Step No. 2		
Original Negative Roll No. W1135		
Location	Density	Adj. Frame No.
Start		
Middle		
End	2.03	34667

White Calibration Frame No. 2
Original Negative Roll No. W 1135

1.81	1.82	1.77	1.75	1.69
1.68	1.61	1.56	1.63	1.66
1.60	1.55	1.50	1.61	1.73
1.60	1.56	1.56	1.67	1.58
1.68	1.73	1.74	1.76	1.66

Average: 1.660

Film	Roll No.	W1135	W1137	W1139	W1141	W1143	W1215	W1217	W1219
Orig. Neg.	EGS D_{Max} Wht D_{Min}	1.92	1.91	1.78	1.91	1.96	2.01	2.00	1.94
		1.71	1.81	1.74	1.71	1.82	1.83	1.90	1.91
	EGS D_{Max} Blk D_{Min}	.53	.55	.48	.51	.53	.61	.62	.63
		.47	.50	.45	.49	.48	.52	.53	.61
	γ_{s_1}	1.14	1.16	1.14	1.13	1.25	1.09	1.08	1.03
Pos	γ_{s_2}	.84	.88	.86	.71		.89	.85	.81
EDR	γ_{s_3}	1.25	.99	1.37	1.15		1.43	1.38	1.33
Receiving DSS		11	11	11	11	11	42	42	42

TABLE 14

MEASURED DATA ON ORIGINAL AND DUPLICATE FILMS

ORIGINAL NEGATIVE EXPOSED ON OPTICS I, SFOF, PASADENA

Receiving Station No.	DSS-11	DSS-42 *	DSS-61 *
Visibility Period	23:09-23:19	23:15-24:04	24:03-24:12

* See Table 16

Step	Pre-acquisition Exposure Computer Output (EGS Voltage)	Density Measurements for Roll No. W1157					
		Original Negative		Positive		EDR	
		EGS	VGB	EGS	VGB	EGS	VGB
1	21.82	2.00	1.76	.57		2.03	
2	20.26	1.92	1.68	.61		1.90	
3	18.38	1.86	1.60	.68		1.82	
4	16.42	1.73	1.51	.79		1.68	
5	14.38	1.58	1.38	.90		1.52	
6	11.99	1.40	1.22	1.02		1.32	
7	9.087	1.13	.95	1.20		1.05	
8	4.400	.58	.40	1.64		.48	
9		2.04		.52		2.08	
File/Frame No.		37132	9	34011		37132	

OGW Step No. 2

Original Negative Roll No. W1157

Location	Density	Adj. Frame No.
Start	1.86	503
Middle		
End	2.04	37243

White Calibration Frame No. 3

Original Negative Roll No. W1157

1.95	1.90	1.82	1.79	1.73
1.84	1.81	1.78	1.76	1.74
1.82	1.78	1.72	1.76	1.70
1.86	1.82	1.76	1.76	1.75
1.84	1.84	1.79	1.75	1.74

Average: 1.792

Film	Roll No.	W1157	W1159	W1165	W1167	W1189	W1191	W1193	W1213	W1225
Orig. Neg.	EGS D_{Max} Wht D_{Min}	2.02	1.76	1.97	1.95	1.83	1.80	1.88	2.00	1.85
		1.90	1.64	1.85	1.90	1.80	1.76	1.83	1.97	1.76
	EGS D_{Max} Blk D_{Min}	.66	.47	.66	.64	.56	.52	.52	.61	.56
		.58	.40	.61	.56	.48	.48	.48	.55	.47
	γ_{s_1}	1.12	1.06	1.07	1.07	1.09	.93	1.13	1.08	1.14
Pos	γ_{s_2}	.86	.87	.81		.82	.75	.88	.88	.90
EDR	γ_{s_3}	1.22	1.31	1.18		1.28	1.08	1.28	1.15	1.09
Receiving DSS		11	11	11	11	42	42	42	42	61

Table B-15

The exposure computer output voltages listed in Tables B-3 to B-10 corresponding to film rolls received by Stations DSS 42 and DSS 61.

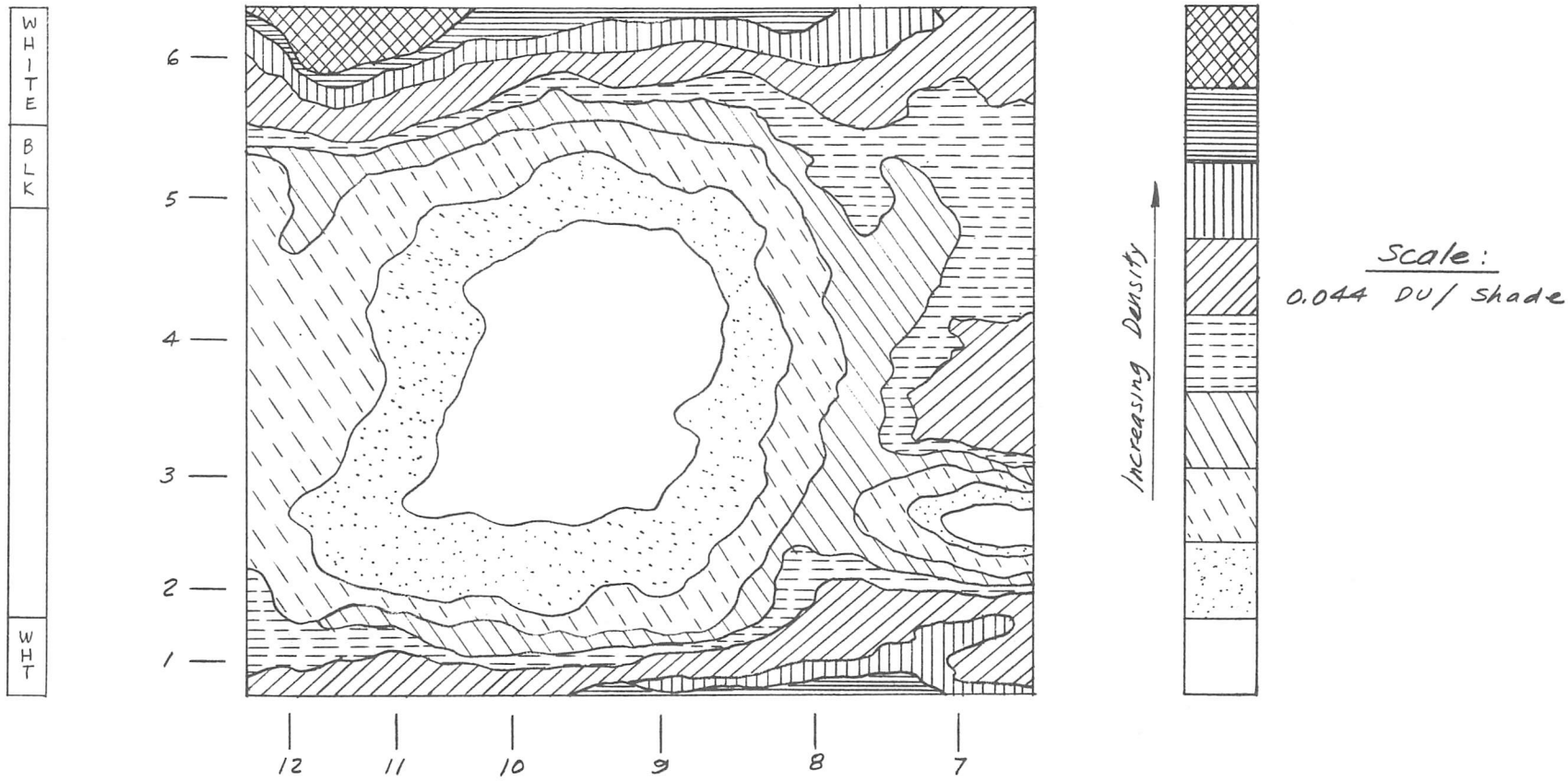
Film Roll No.	Corresponding Exposure Computer Output Voltages as listed in Table No.
W-0986	3
W-1005 W-1008	4
W-1021	5
W-1056	7
W-1089 W-1091	9
W-1123	11

Table B-16

The exposure computer output voltages corresponding to film rolls received by Stations DSS 42 and DSS 61 after mission day 23.

Mission GMT Day No.		24	26	29	30	36
Film Roll No.		W-1171	W-1191 W-1193	W-1201	W-1203 W-1210 W-1211 W-1213 W-1215 W-1217 W-1219	W-1225
Corresponding exposure computer output EGS voltage (Volts)	Step					
	1	21.88	21.71	21.50	21.14	21.34
	2	20.22	20.22	19.95	19.45	19.74
	3	18.52	18.51	18.27	17.90	18.16
	4	16.63	16.61	16.31	16.10	16.27
	5	14.55	14.68	14.40	14.16	14.31
	6	12.14	12.22	11.95	11.76	11.85
	7	9.115	8.940	8.780	8.660	8.840
	8	4.420	4.390	4.160	4.230	4.250

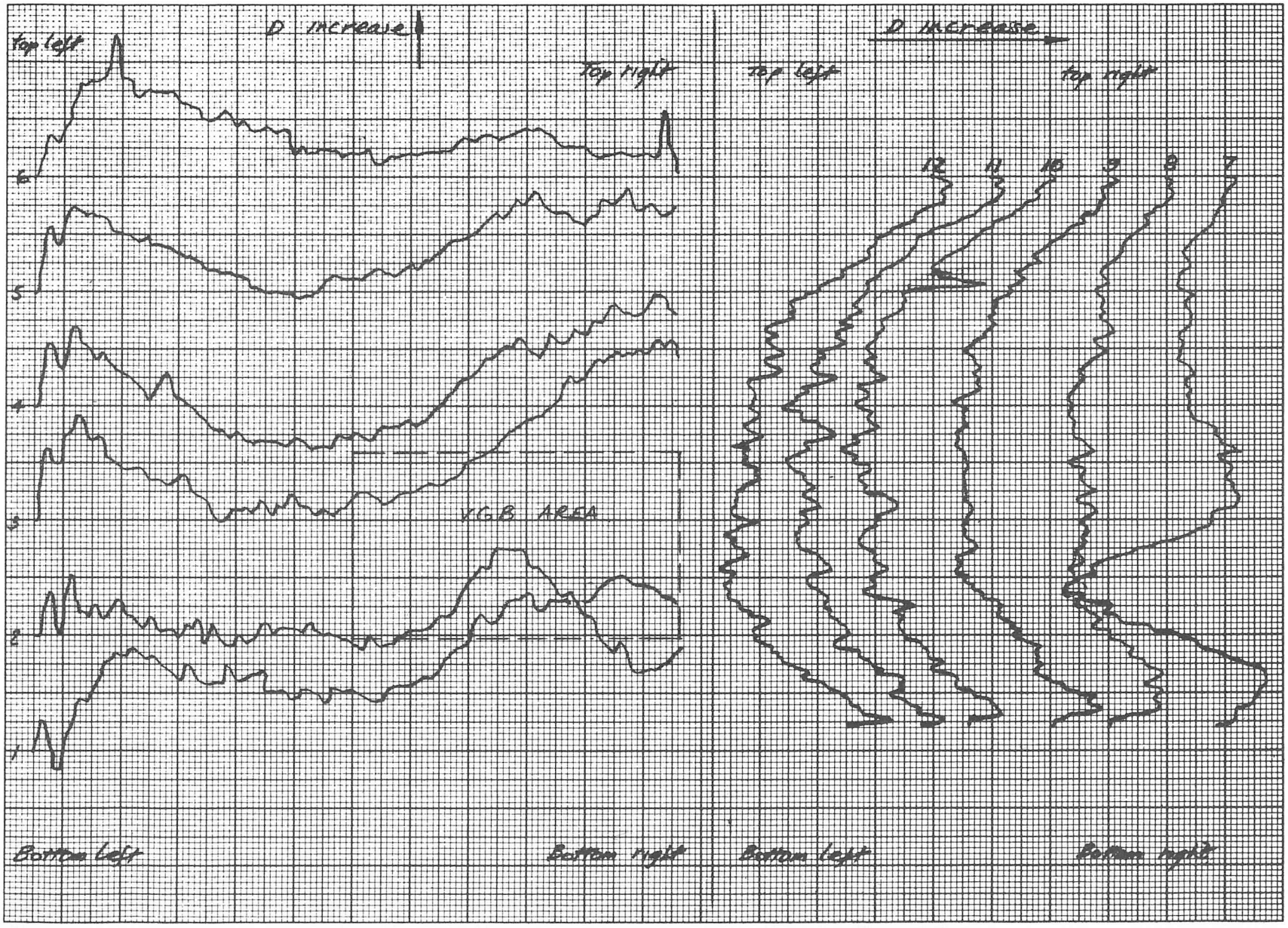
White Calibration Frame



TV-1 OPTICS 1

SHADING CHARACTERISTICS

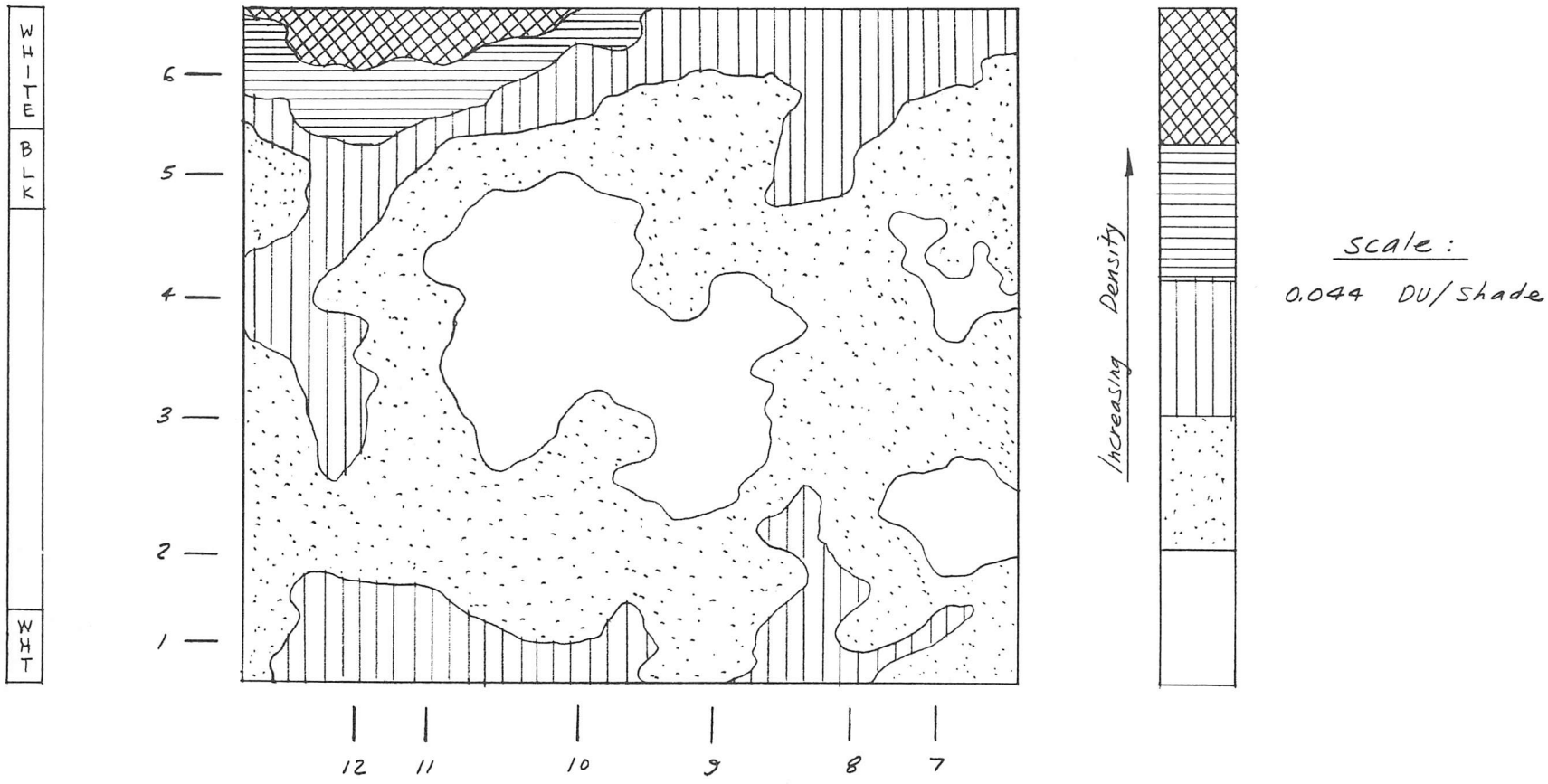
Figure B-1



MICRODENSITOMETER TRACES OF A WHITE CALIBRATION FRAME

Figure B-2

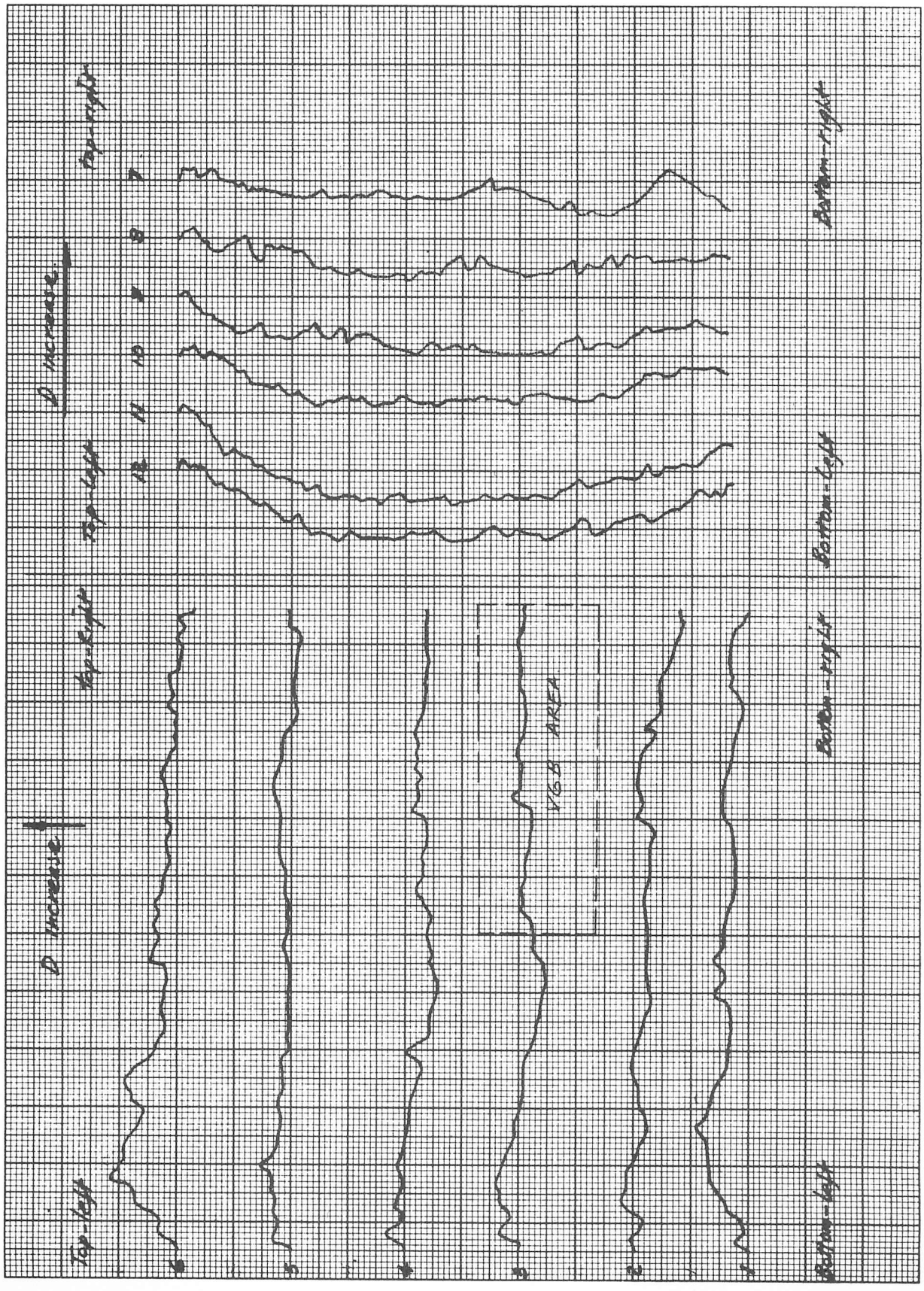
Black Calibration Frame



TV-1 OPTICS 1

SHADING CHARACTERISTICS

Figure B-3



MICRODENSITOMETER TRACES OF A BLACK CALIBRATION FRAME

Figure B-4

Original Negative

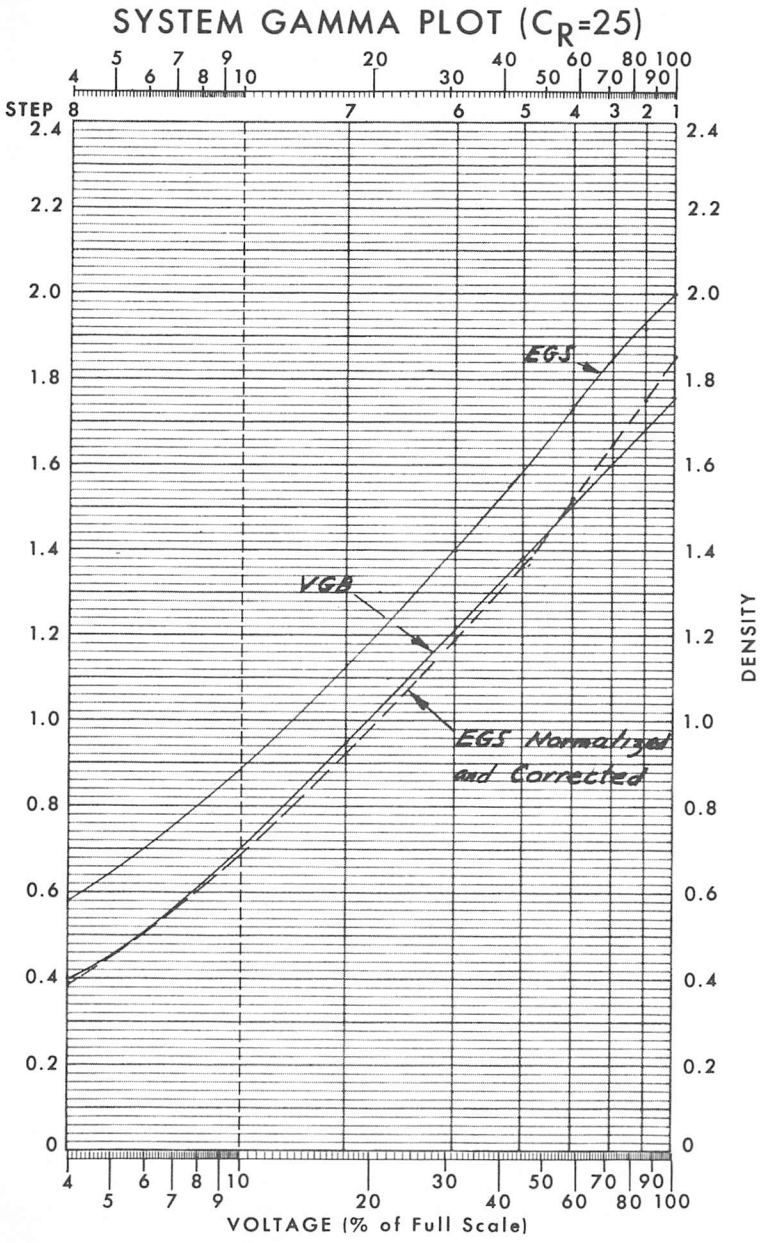


Fig. B-5a

Master Negative and EDR

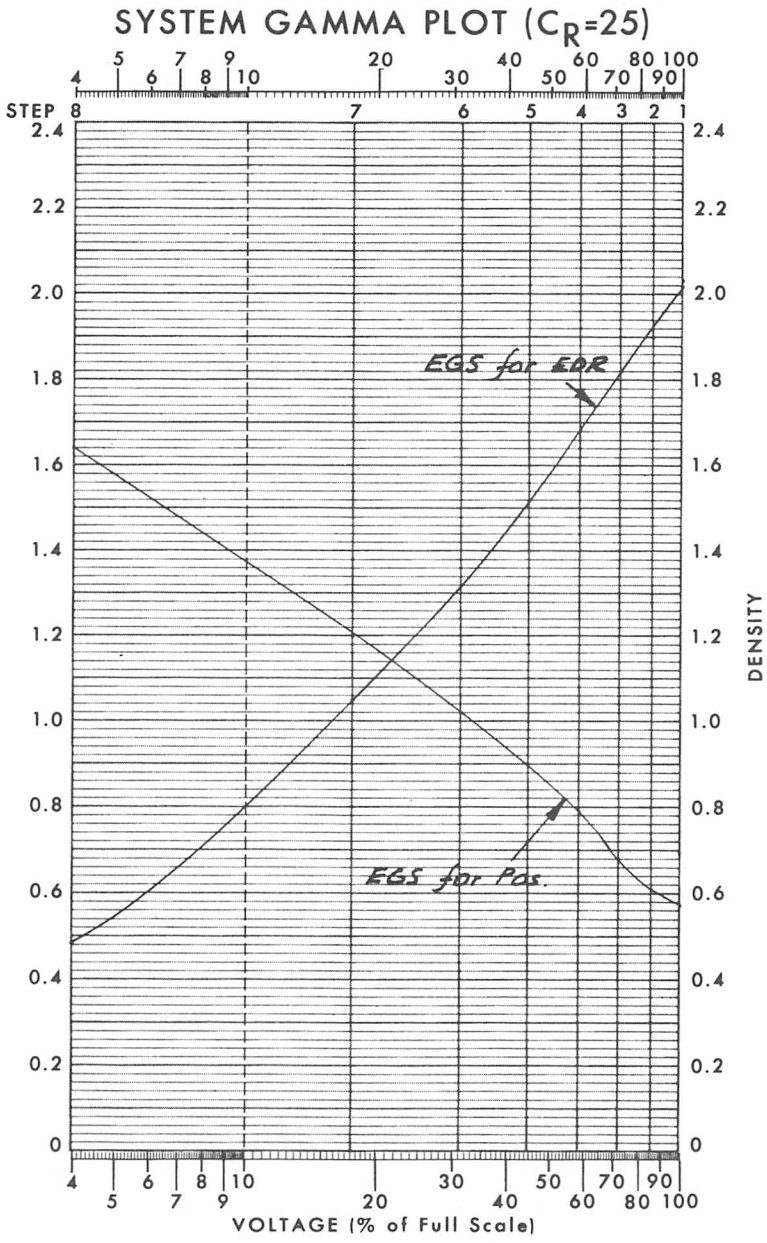


Fig. B-5b

Fig. B-5 Typical System Gamma Plot for Original Negative, Master Positive and EDR Duplicate Negative

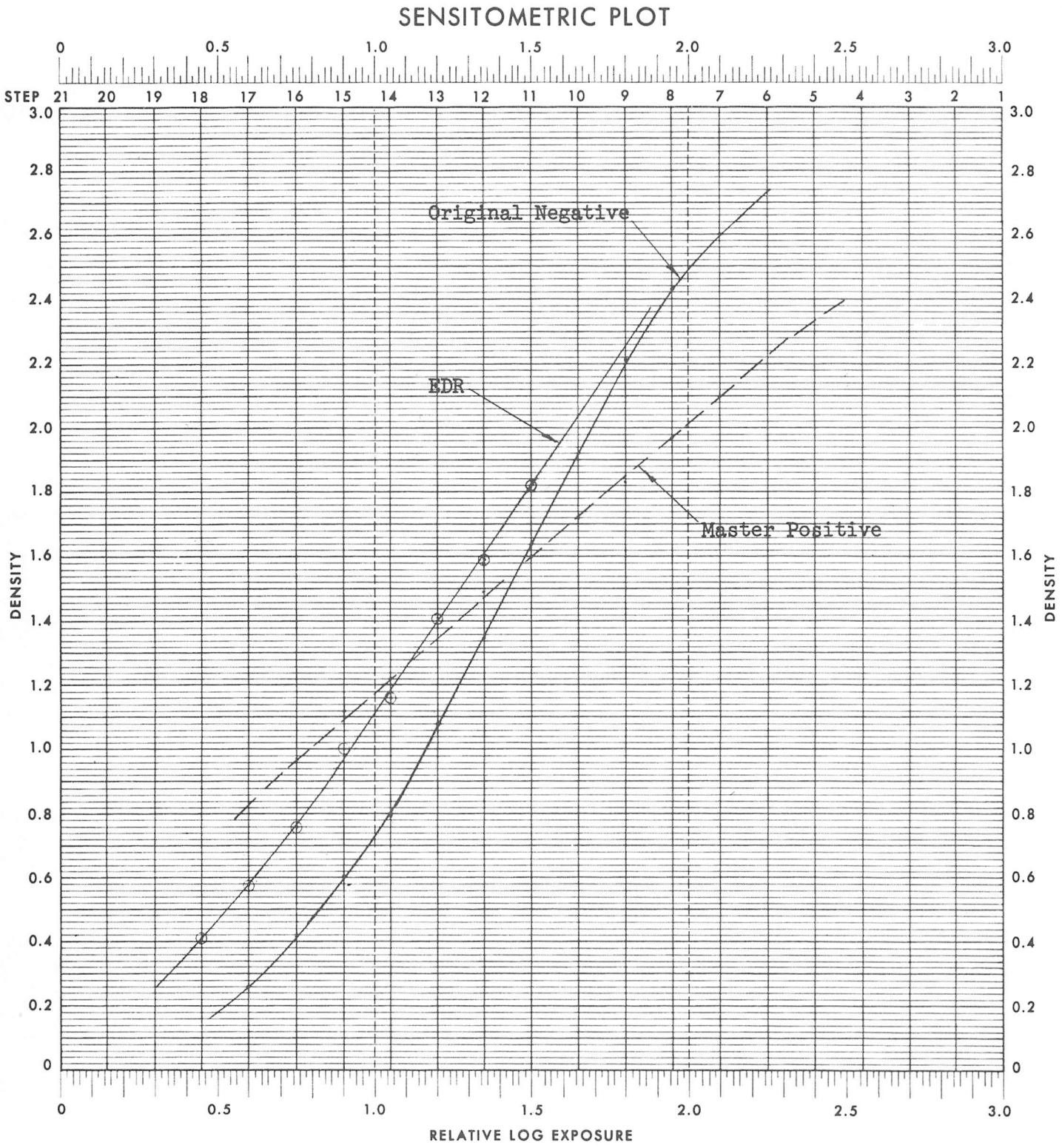


Fig. B-6 Typical H & D Plot for Original Negative, Master Positive and EDR Duplicate Negative

FIG. B-7 - OUTPUT VOLTAGE VS. INPUT FREQUENCY FOR THE MCDR ALLEN DEMODULATOR TV-1 MISSION G

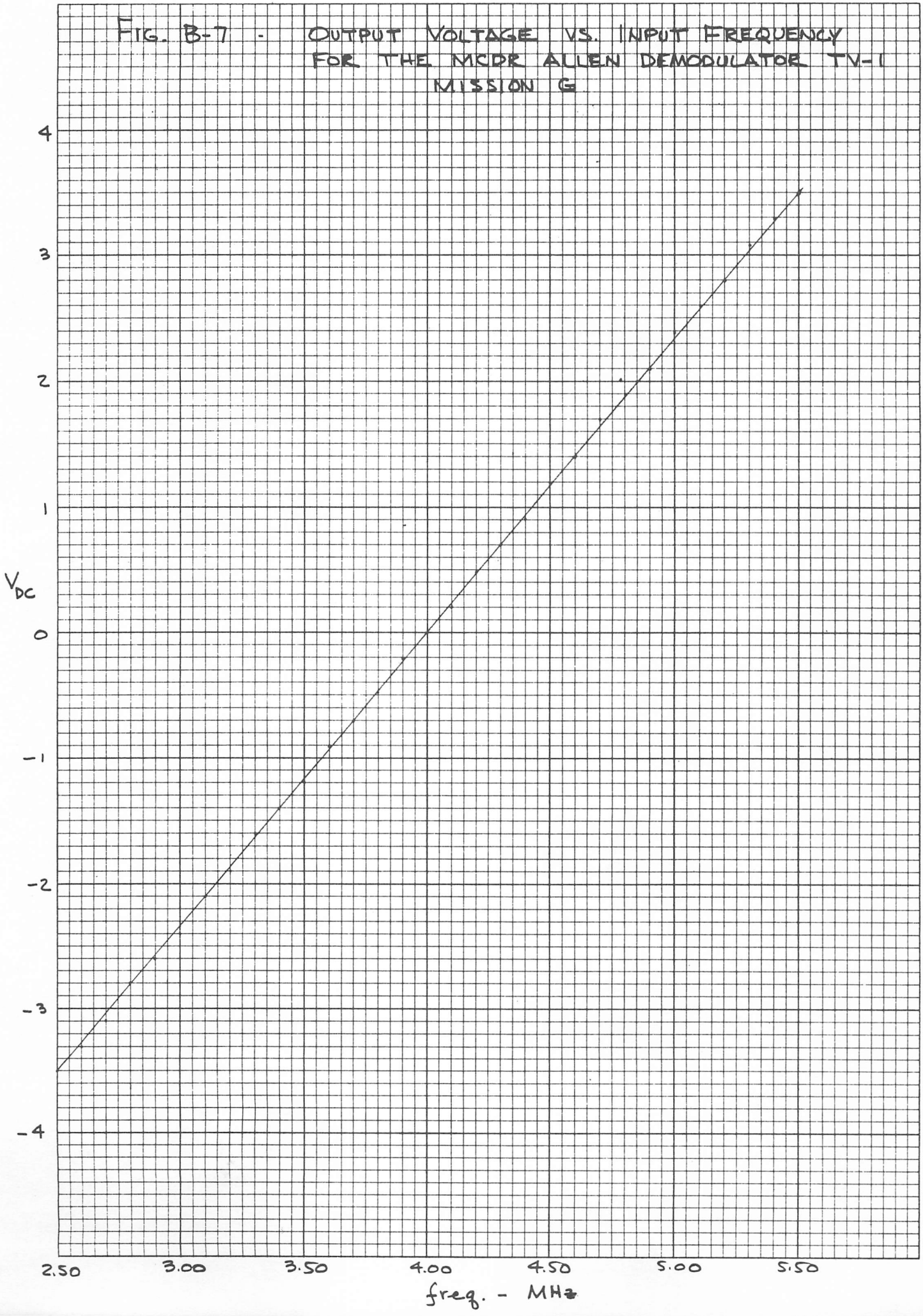


Fig. B-8

DENSITY RANGE OF ORIGINAL NEGATIVES
RECORDED ON OPTICS I

vs.

DELTA FREQUENCY FROM BACK PORCH
CORRESPONDING TO SPACECRAFT TRANSMITTER XMTR-A

FIRST LUNAR DAY OF MISSION G

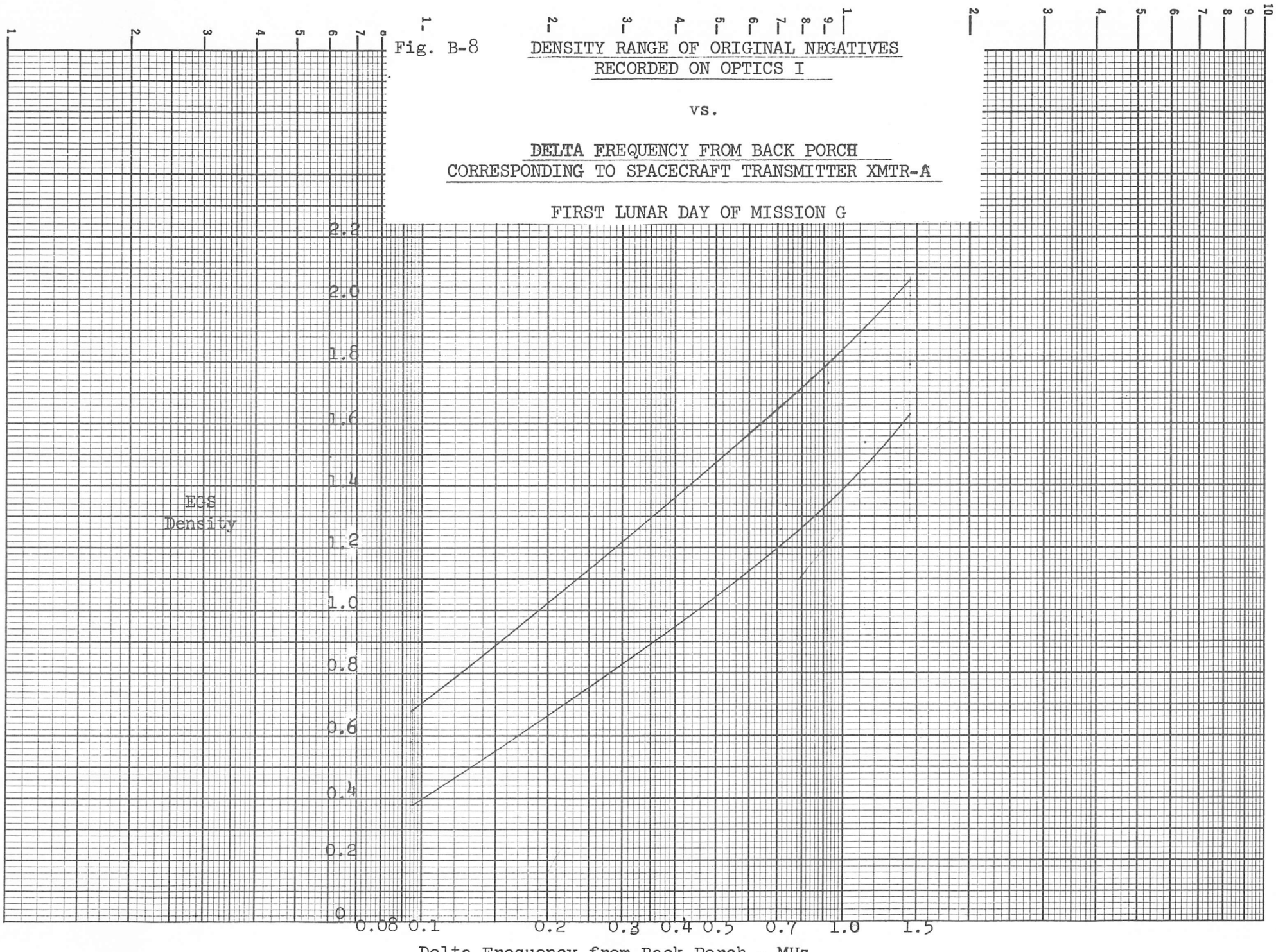


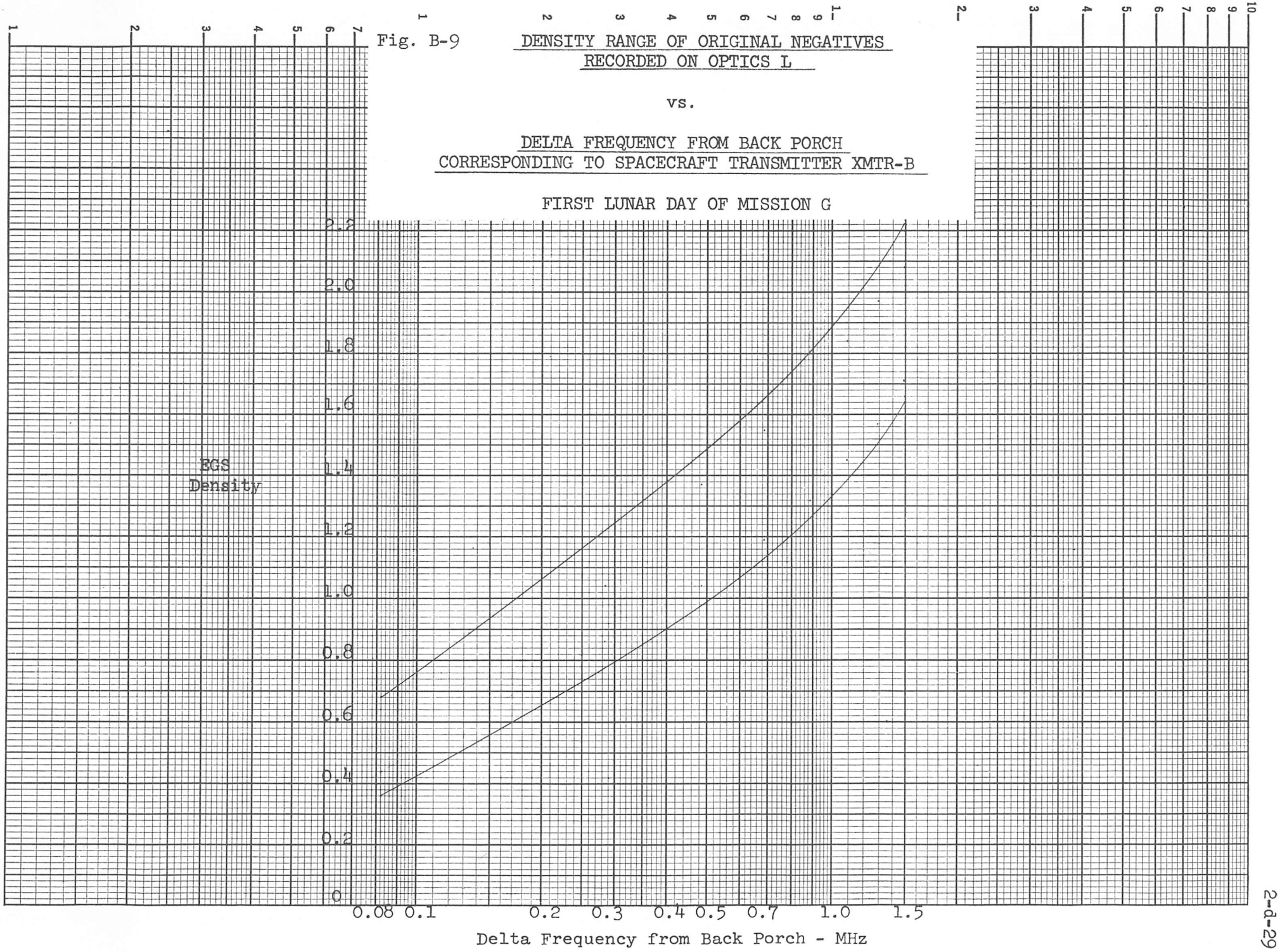
Fig. B-9

DENSITY RANGE OF ORIGINAL NEGATIVES
RECORDED ON OPTICS L

vs.

DELTA FREQUENCY FROM BACK PORCH
CORRESPONDING TO SPACECRAFT TRANSMITTER XMTR-B

FIRST LUNAR DAY OF MISSION G



2-d-29

CAMERA PERFORMANCE

The Surveyor VII spacecraft camera performed normally (except as indicated in the last paragraph) and took about 21,000 pictures on the first lunar day. The operationally significant differences among the last three Surveyors were:

Item	Surveyor V	Surveyors VI and VII
Filters	1 clear and 3 color	1 clear & 3 polarization
Scan	top to bottom	bottom to top
Overdeviation	Yes	None
Overscan	None	Yes
Nominal Elevation Angle Increments	4.96 degrees	5.00 degrees

The most significant change is the change from a color study to a polarization study. The other changes are not significant from a TV picture analysis point of view. The overscan results in a rectangular picture with black corners, but there is no stretching or distortion of the picture as a result of the overscan.

As shown in the above list, the frequency deviation of the transmitters used on SC-7 was within the tolerance of the design limits. It was therefore not required to detune the DSS receivers for the purpose of centering the video in the passband of the ground equipment. Figure 1 shows both the design and measured SC-7 video frequency deviations as well as the composite bandpass filter responses of the ground equipment.

There were about 45 TV pictures taken by Surveyor VII on the second lunar day. These were all 200-line pictures. The pictures on Surveyor VII give the appearance of being slightly out of focus in the lower right-hand area. This is an electronic defocusing which exists on all the SC-VII pictures.

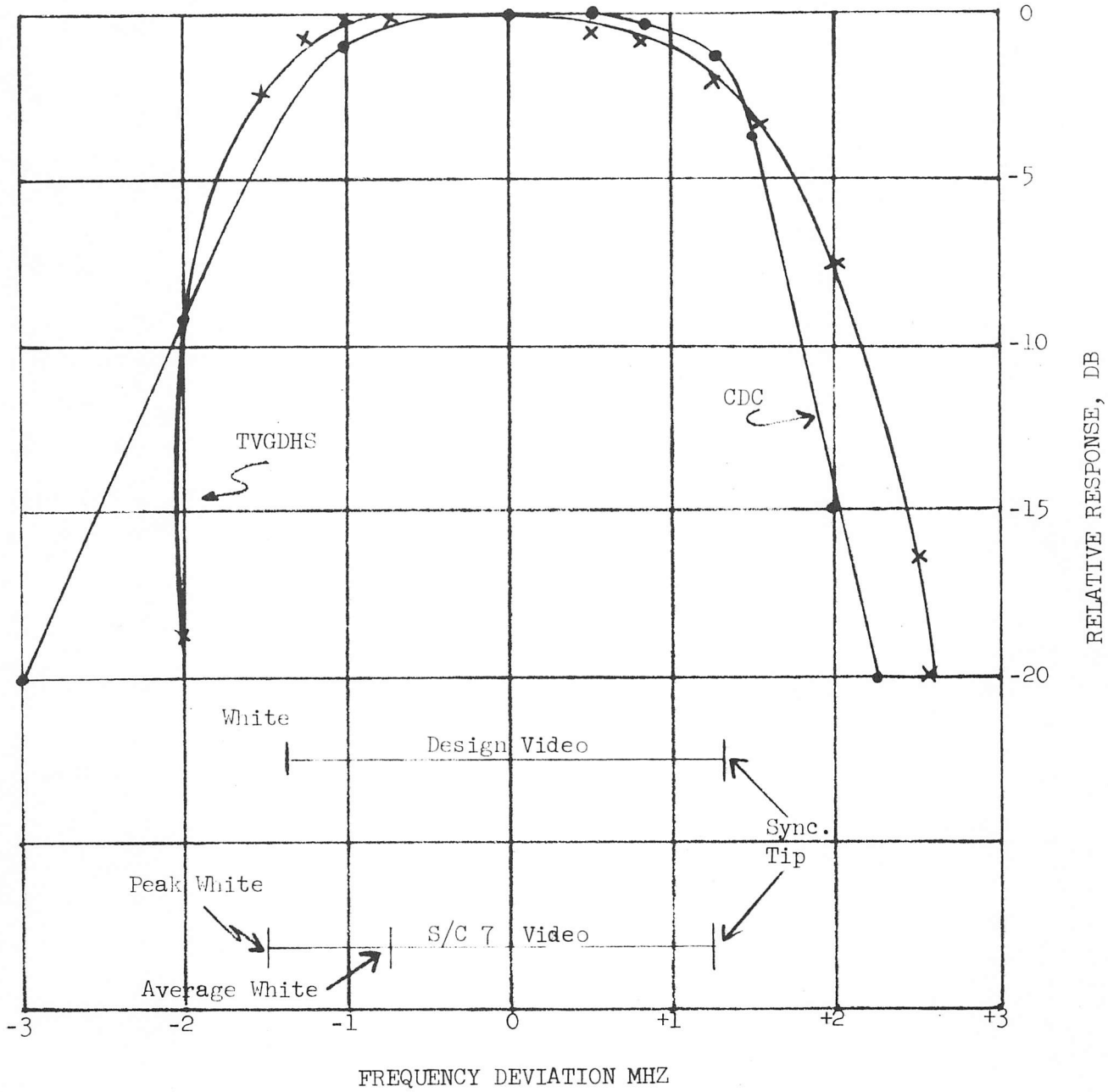


FIGURE I: Ground System Filter Response and Video Frequency Deviations

LANDING SITE LOCATION AND CAMERA ORIENTATION FOR SURVEYOR VII

The application of Lunar Orbiter V High Resolution Frame H-128 and correlation of surface features recorded by the Surveyor VII television camera provided the data for determination of the final landing site location for this mission. Careful association of the noted landmarks and relation to the Orthographic Atlas of the Moon resulted in the following coordinate locations for Surveyor VII: 40.95°S latitude and 11.41°W longitude. This is estimated to be less than one kilometer from the location indicated by tracking data and only about 3 kilometers south southwest of the original aiming point.

The orientation of the spacecraft on the lunar surface was determined from measurement in the television pictures of the positions at the earth, Jupiter and the star Rigel in Orion, from the angular settings of the solar panel sun sensor, from the positional tuning of the spacecraft's planar array antenna, and from gyro data at touchdown. Reduction of this data indicates the spacecraft was tilted 3.17 deg at an azimuth of 349 deg from lunar north during the first lunar day. The -Y axis of the spacecraft was found to be oriented 20.23 deg west of north. As there is a slight difference (0.92 deg) between the camera 0-deg azimuth and the spacecraft -Y axis, the 0-deg azimuth of the camera was oriented 19.3 deg west of north. These estimated angles may have errors on the order of 1 deg.

MAPS OF THE SURVEYOR VII LANDING SITE

A generalized topographic map of the area within 10 m of the spacecraft was prepared by focus ranging. This technique utilizes pictures taken at nine or more focus settings at each camera elevation position along a given azimuth. Small areas in best focus in each picture are located on a mosaic of pictures taken at specific focus settings; the azimuth and elevation of the centers of each small area in best focus are determined by graphical measurement. The location of a point on the lunar surface with respect to the intersection of the camera mirror rotation axes is computed from azimuth, elevation, and calibrated focus distance. Focus-ranging surveys, consisting of about 75 pictures each, were taken along fourteen camera azimuths during the Surveyor VII mission.

A preliminary geologic map of this landing site has also been prepared and is shown. A detailed explanation of the stratographic units and the related analysis may be found in Part II of the Surveyor VII Mission Report (JPL - TR 32 - 1264).

PRELIMINARY GEOLOGIC MAP OF THE SURVEYOR VII LANDING SITE

BY
E. M. SHOEMAKER AND E. C. MORRIS
1968

EXPLANATION

COPERNICAN SYSTEM

Cff — Steep-fronted flow

Characteristics
Rugged surface composed of ridges and irregular hills with 10 meters to several tens of meters relief. Rises about 100 meters above adjacent terrain. Slopes on flanks and at terminus about 10° to 15°. Coarse blocks up to tens of meters across common. Fissures 50 meters to several hundred meters long common. Crater density similar to that on ridged lobate flow.

Interpretation
Emplaced as highly viscous fluid flow of hot partially melted debris ejected from Tycho. Displacement of material is probably several kilometers at terminus of flow. Fissures formed by spreading of flow at late stage of emplacement.

Crf — Ridged lobate flow

Characteristics
Hummocky to bumpy or ridged surface bounded by scarp 3 to 10 meters high. Pattern of ridges 50 to 200 meters long locally parallel or subparallel with margin of flow. Abundant coarse blocks up to 50 meters across. Irregular fissures, about 100 meters long, common. Local flow channels parallel with long dimension of flow. Density of craters larger than 8 meters in diameter is 155/km².

Interpretation
Emplaced as relatively viscous fluid flow of hot partially melted debris ejected from Tycho. Displacement of material may be only a few tens of meters at terminus of flow. Fissures formed by spreading of flow at late stage of emplacement.

Cpd — Patterned debris

Characteristics
Smooth surface with pattern of gentle ridges and shallow grooves superposed on larger hillocks and swales, a few hundred meters to 1/2 km across, and on larger north trending ridges and valleys. Scattered blocks up to 20 meters across. Normal albedo about 0.13 to 0.14. Density of craters larger than 8 meters in diameter is 220/km². Larger craters have smooth raised rims.

Interpretation
Fragmental debris ejected from Tycho. Spacing between lineaments suggests debris is several tens of meters thick and is draped over subsurface fault scarps formed in underlying coherent material. Smooth raised rims of larger craters indicates surficial material is weakly cohesive and relatively fine grained.

Cdf — Divergent flow

Characteristics
Relatively smooth surface marked by numerous flow lineations with divergent pattern. Bounded by rounded scarp 15 to 20 meters high. Rough patches of blocky rubble occur locally. Short fissures and flow ridges are present but not abundant. Density of craters larger than 8 meters diameter is 110/km².

Interpretation
Emplaced as moderately viscous fluid flow of hot partially melted debris ejected from Tycho. Displacement of material may be several kilometers at terminus of flow. Flow lineations are probably stream lines and indicate spreading of flow near its terminus.

Cpf — Patterned flow

Characteristics
Surface composed of irregular low hills and depressions, ranging from 100 meters to several hundred meters across, studded with smaller bumps, blocks, and small craters. Surface is also marked with weakly defined pattern of northwest- and northeast-trending low ridges and grooves. Abundant fissures; two north-trending swarms of fissures occur on low broad ridges on crest of flow. Density of craters larger than 8 meters in diameter is about 185/km².

Interpretation
Emplaced as extremely viscous fluid flow of hot partially melted debris ejected from Tycho. Displacement of material probably does not exceed 200 meters at any place in flow. Fissures formed by spreading of flow.

Csf — Smooth flow

Characteristics
Smooth undulating surface with rimless flow channels and flow lineations. Blocks up to 10 meters across common near margin. Normal albedo low, like that of lunar playa material. Small flow ridges and fissures relatively sparse. Density of craters larger than 8 meters diameter is 80/km².

Interpretation
Emplaced as fluid flow of melted ejecta from Tycho. Similar in origin to lunar playa and smooth patch materials, but smooth flow material probably had slightly higher viscosity than lunar playa material at time of emplacement.

Clp — Lunar playa material

Characteristics
Smooth, flat, level surface on floor of closed depression. Low normal albedo. Branching systems of fine grooves and fissures common. Density of craters larger than 8 meters in diameter is about 80/km².

Interpretation
Emplaced as very low viscosity fluid flow of melted, probably gas-charged ejecta from Tycho. Grooves and fissures are probably contraction cracks formed during cooling of flow.

Csp — Smooth patch material

Characteristics
Relatively dark, smooth, flat, level surface. Occurs in small closed depressions and on benches. Similar to lunar playa material but somewhat rougher; lacks branching grooves.

Interpretation
Emplaced as low viscosity fluid flow of melted ejecta from Tycho. Similar in origin to lunar playa material but deposits are thinner than in lunar playas and are derived from smaller drainage basins.

Contact
Dashed where approximately located

Lineament
Trace of shallow groove on patterned debris

Flow lineation
Trace of shallow groove on smooth and divergent flows

Flow ridges
En echelon groups of minor ridges near margins of flows

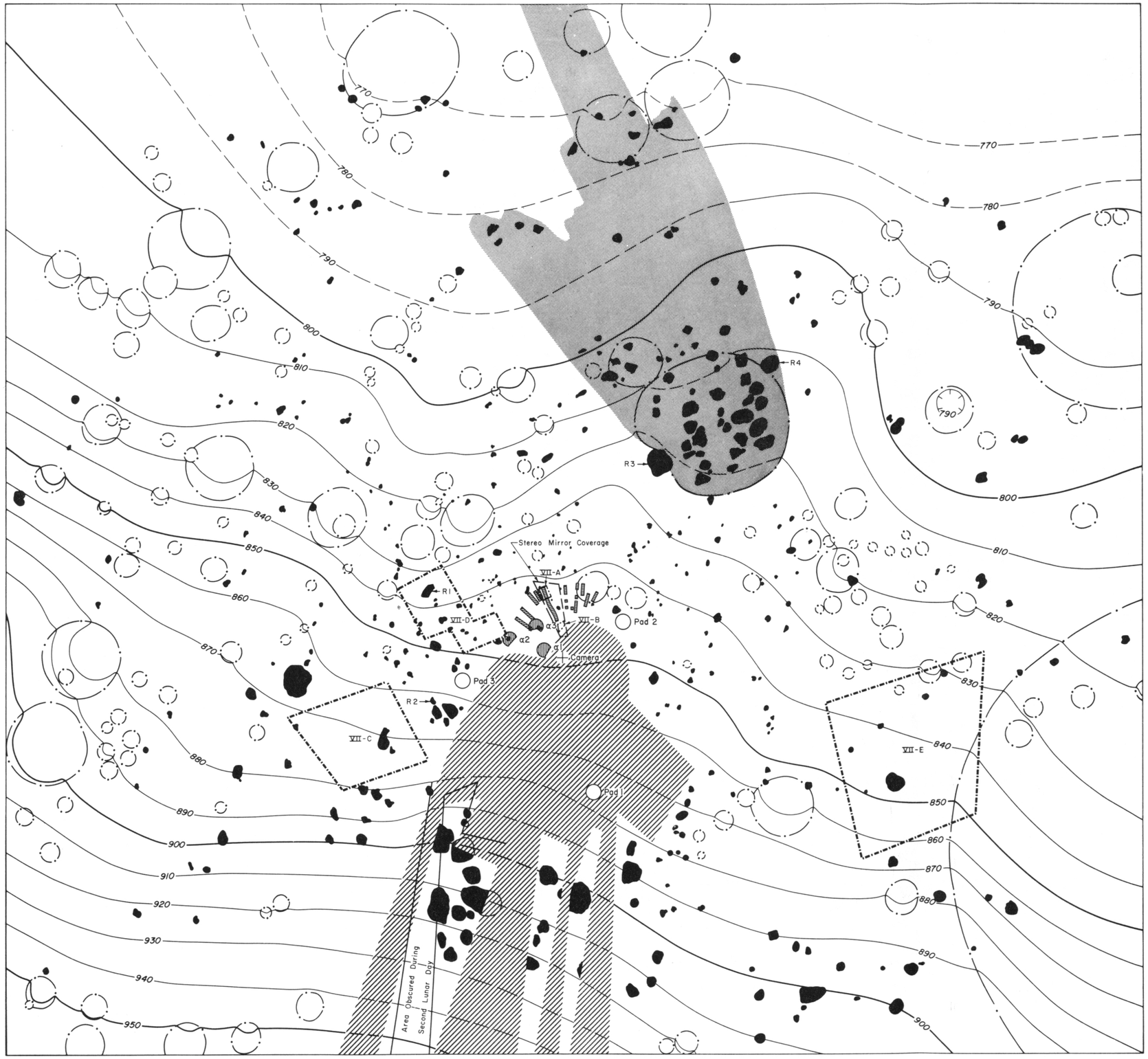
Fissures
Narrow linear depressions on surfaces of flows and lunar playas

Flow channels
Relatively smooth trenches on surfaces of flows

Flow scarp
Dashed where approximately located

DEPARTMENT OF INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION
WITH THE NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION



EXPLANATION

COARSE FRAGMENT
(FRAGMENTS R-1 TO R-4 STUDIED
FOR POLARIZATION PROPERTIES)

CRATER RIM

AREA USED FOR DETERMINATION OF SIZE-FREQUENCY DISTRIBUTION OF FRAGMENTS. SIZE-FREQUENCY DISTRIBUTION FUNCTION CORRESPONDING TO EACH NUMBERED AREA IS SHOWN IN FIG. III-42

AREA EXCAVATED BY SURFACE SAMPLER

α1

APPROXIMATE AREA COVERED BY SKIRT OF THE ALPHA-SCATTERING INSTRUMENT. NUMBERS INDICATE SEQUENCE OF DEPLOYMENT.

STREWN FIELD PATTERN OF FRAGMENTS
ASSOCIATED WITH 3 METER CRATER

AREA OBSCURED BY SPACECRAFT

HORIZONTAL AND VERTICAL CONTROL BY FOCUS RANGING

THIS MAP IS PRELIMINARY. A FUTURE EDITION WILL INCORPORATE ADDITIONAL OR REFINED TOPOGRAPHIC AND GEOLOGIC INTERPRETATIONS AND HORIZONTAL AND VERTICAL CONTROLS OBTAINED BY FOCUS RANGING, SHADOW MEASUREMENTS AND STEREOSCOPIC PHOTOGRAMMETRIC MEASUREMENTS.

ALL INFORMATION ON THIS MAP WAS PLOTTED FROM DATA CONTAINED IN PICTURES TAKEN BY THE SURVEYOR VII CAMERA, RECEIVED AT THE JET PROPULSION LABORATORY OF THE CALIFORNIA INSTITUTE OF TECHNOLOGY.

0 5 10 15 20 FEET

0 1 2 3 4 5 METERS

SCALE 1:50

CONTOUR INTERVAL 10 CENTIMETERS
DATUM IS 10 METERS BELOW CAMERA MIRROR ELEVATION AXIS

APRIL, 1968

N

TOPOGRAPHIC MAP OF NEAR FIELD AT THE SURVEYOR VII LANDING SITE

BY
RAYMOND JORDAN

CELESTIAL EPHEMERIS

The following pages contain the lunicentric positions of the following celestial bodies:

Sun

Earth

Jupiter

Mercury

BORI (Rigel)

ACMA (Sirius)

SURVEYOR 7 STELLAR PREDICTION
FIRST LUNAR DAY

SUN	DAY	LATITUDE	LONGITUDE	AZIMUTH	ZENITH
	9	-1.55	76.20	89.52	87.20
	10	-1.56	64.06	79.41	78.05
	11	-1.56	51.91	69.16	69.09
	12	-1.57	39.78	58.53	60.57
	13	-1.57	27.64	47.20	52.80
	14	-1.57	15.51	34.94	46.24
	15	-1.57	3.39	21.63	41.54
	16	-1.56	351.26	7.30	39.40
	17	-1.55	339.13	352.35	40.25
	18	-1.54	327.00	337.36	43.91
	19	-1.53	314.87	322.95	49.73
	20	-1.52	302.73	309.51	57.04
	21	-1.51	290.59	297.15	65.28
	22	-1.50	278.44	285.75	74.09
	23	-1.49	266.29	275.09	83.18
	24	-1.48	254.12	264.86	-87.61
	25	-1.47	241.95	254.80	-78.50

EARTH	DAY	LATITUDE	LONGITUDE	AZIMUTH	ZENITH
	9	-1.04	1.48	19.23	41.53
	10	-2.35	.06	18.06	39.91
	11	-3.57	358.71	16.88	38.42
	12	-4.64	357.52	15.78	37.13
	13	-5.51	356.54	14.83	36.09
	14	-6.15	355.82	14.10	35.34
	15	-6.49	355.37	13.62	34.93
	16	-6.51	355.17	13.36	34.88
	17	-6.19	355.21	13.31	35.20
	18	-5.53	355.45	13.43	35.89
	19	-4.55	355.84	13.64	36.92
	20	-3.29	356.35	13.90	38.24
	21	-1.83	356.96	14.21	39.79
	22	-.26	357.67	14.59	41.46
	23	1.35	358.48	15.05	43.19
	24	2.88	359.39	15.61	44.87
	25	4.24	.40	16.29	46.41

Surveyor 7 Stellar Prediction, First Lunar Day
(Continued)

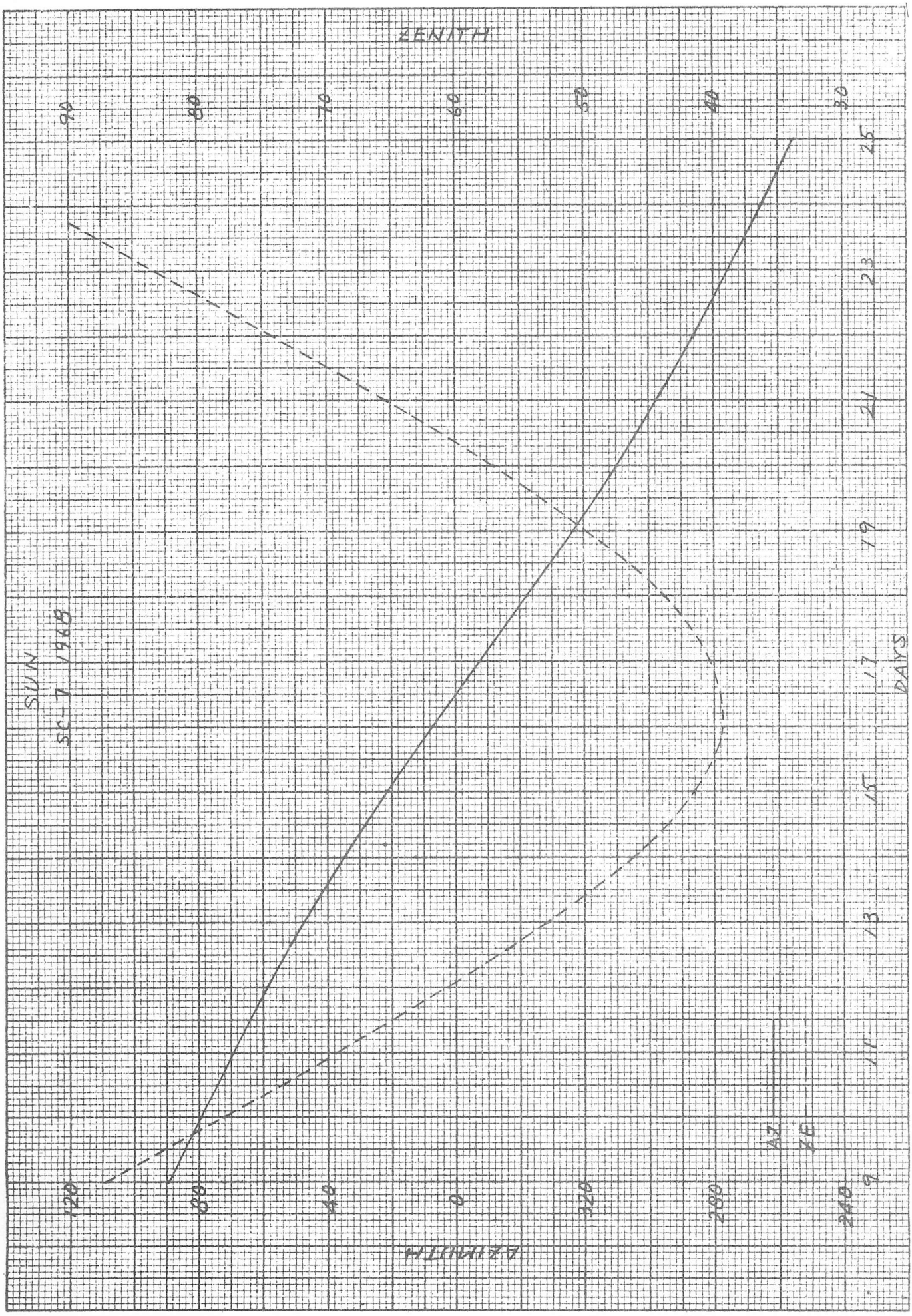
JUPITER	DAY	LATITUDE	LONGITUDE	AZIMUTH	ZENITH
	9	2.25	303.97	313.86	59.19
	10	2.26	290.74	300.73	67.88
	11	2.27	277.50	288.53	77.33
	12	2.28	264.26	277.02	87.19
	13	2.29	251.01	265.91	-82.80
	14	2.29	237.76	254.83	-72.87
	15	2.30	224.51	243.40	-63.30
	16	2.30	211.25	231.26	-54.44
	17	2.30	197.99	218.03	-46.82
	18	2.31	184.72	203.49	-41.24
	19	2.31	171.46	187.66	-38.66
	20	2.30	158.19	171.04	-39.70
	21	2.30	144.92	154.44	-44.08
	22	2.30	131.64	138.69	-50.92
	23	2.30	118.37	124.25	-59.33

MERCURY	DAY	LATITUDE	LONGITUDE	AZIMUTH	ZENITH
	9	-3.67	82.96	97.26	-89.08
	10	-3.68	71.44	87.62	82.21
	11	-3.67	59.94	77.98	73.57
	12	-3.66	48.45	68.12	65.14
	13	-3.63	36.96	57.76	57.15
	14	-3.60	25.47	46.66	49.88
	15	-3.55	13.99	34.59	43.78
	16	-3.49	2.51	21.44	39.45
	17	-3.42	351.03	7.31	37.53
	18	-3.33	339.54	352.59	38.42
	19	-3.23	328.05	337.89	41.93
	20	-3.12	316.54	323.80	47.49
	21	-2.99	305.02	310.72	54.44
	22	-2.85	293.47	298.74	62.30
	23	-2.70	281.89	287.74	70.72

Surveyor 7 Stellar Prediction, First Lunar Day
(Continued)

BORI	DAY	LATITUDE	LONGITUDE	AZIMUTH	ZENITH
	9	-29.88	225.48	220.58	-88.19
	10	-29.87	212.31	212.21	-81.52
	11	-29.87	199.13	203.56	-76.21
	12	-29.88	185.96	194.59	-72.58
	13	-29.88	172.78	185.35	-70.88
	14	-29.88	159.60	175.90	-71.26
	15	-29.89	146.43	166.35	-73.68
	16	-29.89	133.25	156.82	-77.96
	17	-29.90	120.07	147.43	-83.79
	18	-29.90	106.89	138.24	89.12
	19	-29.91	93.71	129.26	81.08
	20	-29.91	80.53	120.45	72.31
	21	-29.91	67.35	111.68	63.01
	22	-29.91	54.17	102.73	53.34
	23	-29.91	40.99	93.17	43.45

ACMA	DAY	LATITUDE	LONGITUDE	AZIMUTH	ZENITH
	9	-38.06	252.40	229.68	70.13
	10	-38.06	239.23	222.88	78.07
	11	-38.06	226.05	215.85	85.19
	12	-38.06	212.88	208.55	-88.72
	13	-38.06	199.70	200.97	-83.92
	14	-38.06	186.53	193.11	-80.64
	15	-38.07	173.35	185.03	-79.08
	16	-38.07	160.18	176.78	-79.33
	17	-38.08	147.00	168.45	-81.38
	18	-38.08	133.82	160.15	-85.11
	19	-38.09	120.65	151.96	89.71
	20	-38.09	107.47	143.95	83.32
	21	-38.10	94.28	136.18	75.95
	22	-38.10	81.10	128.65	67.82
	23	-38.10	67.92	121.34	59.08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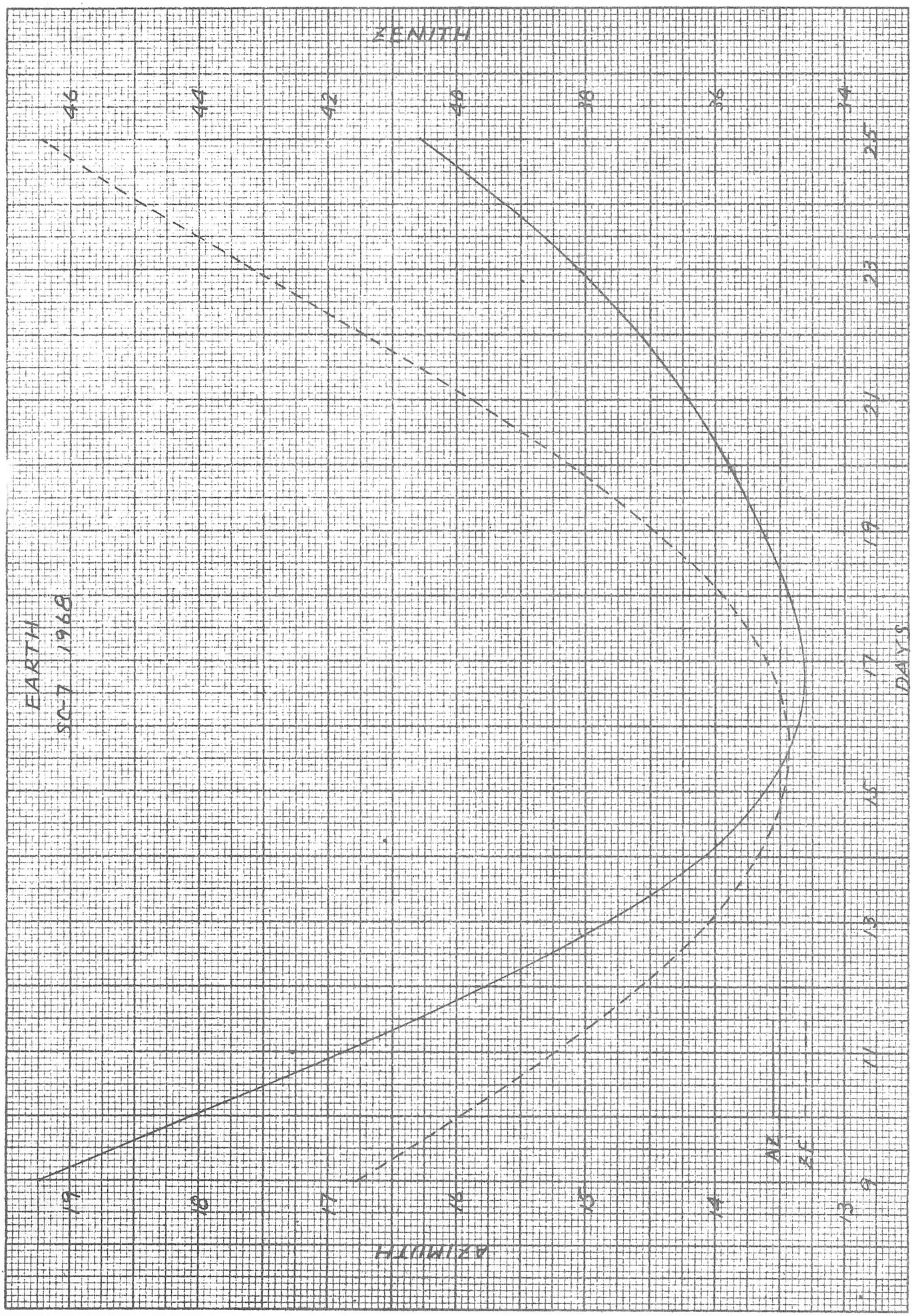
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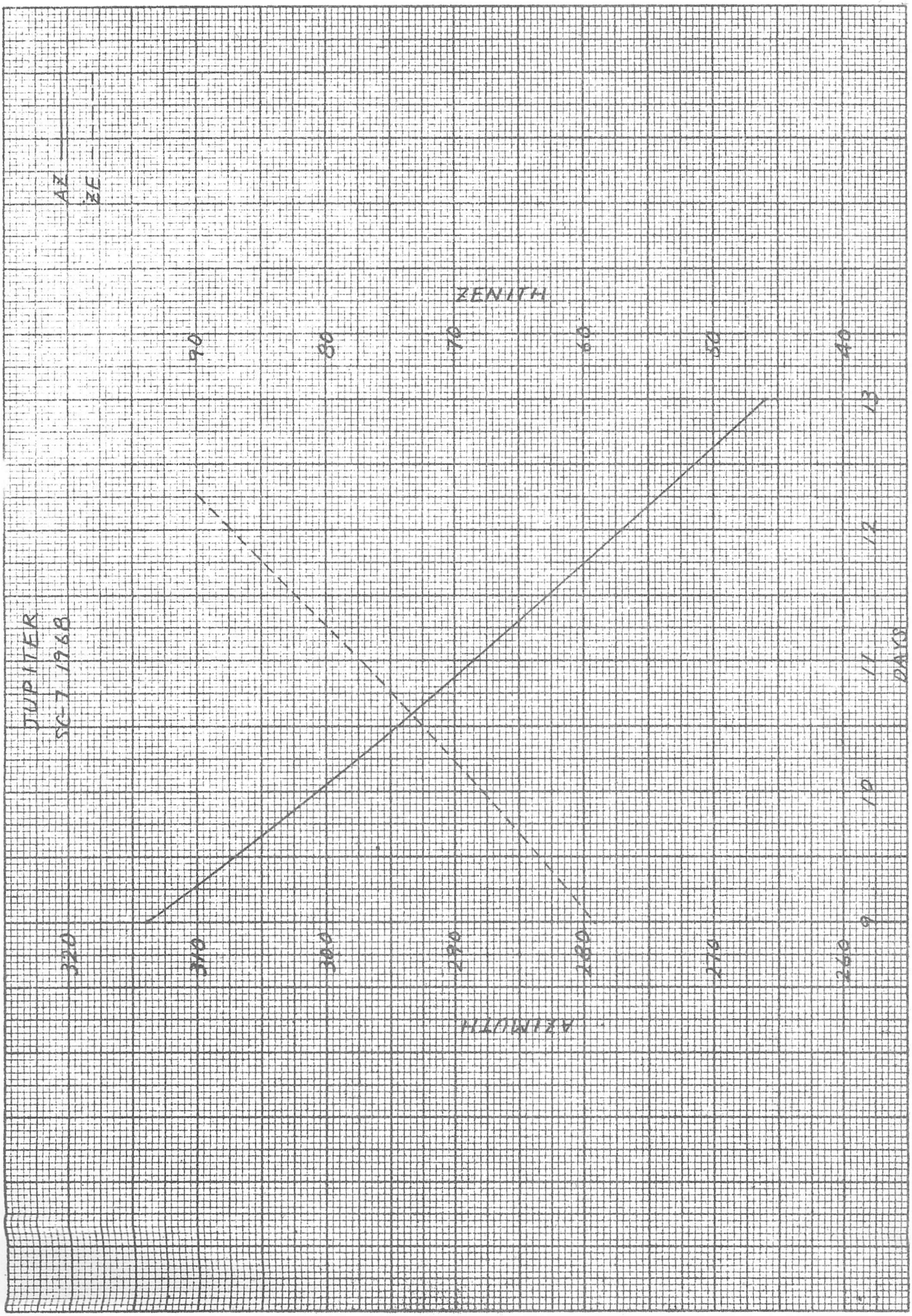
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SC-7 1968
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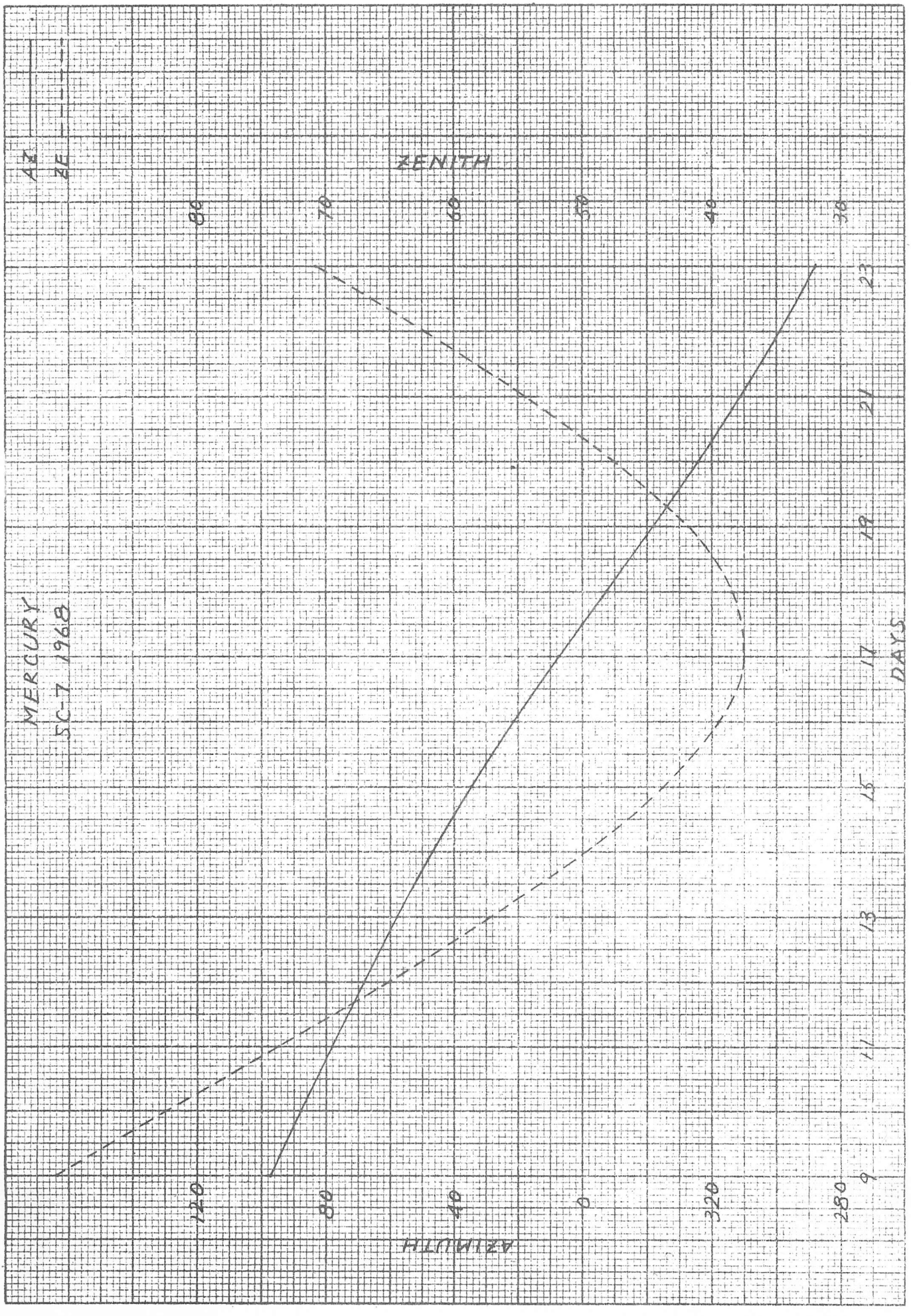
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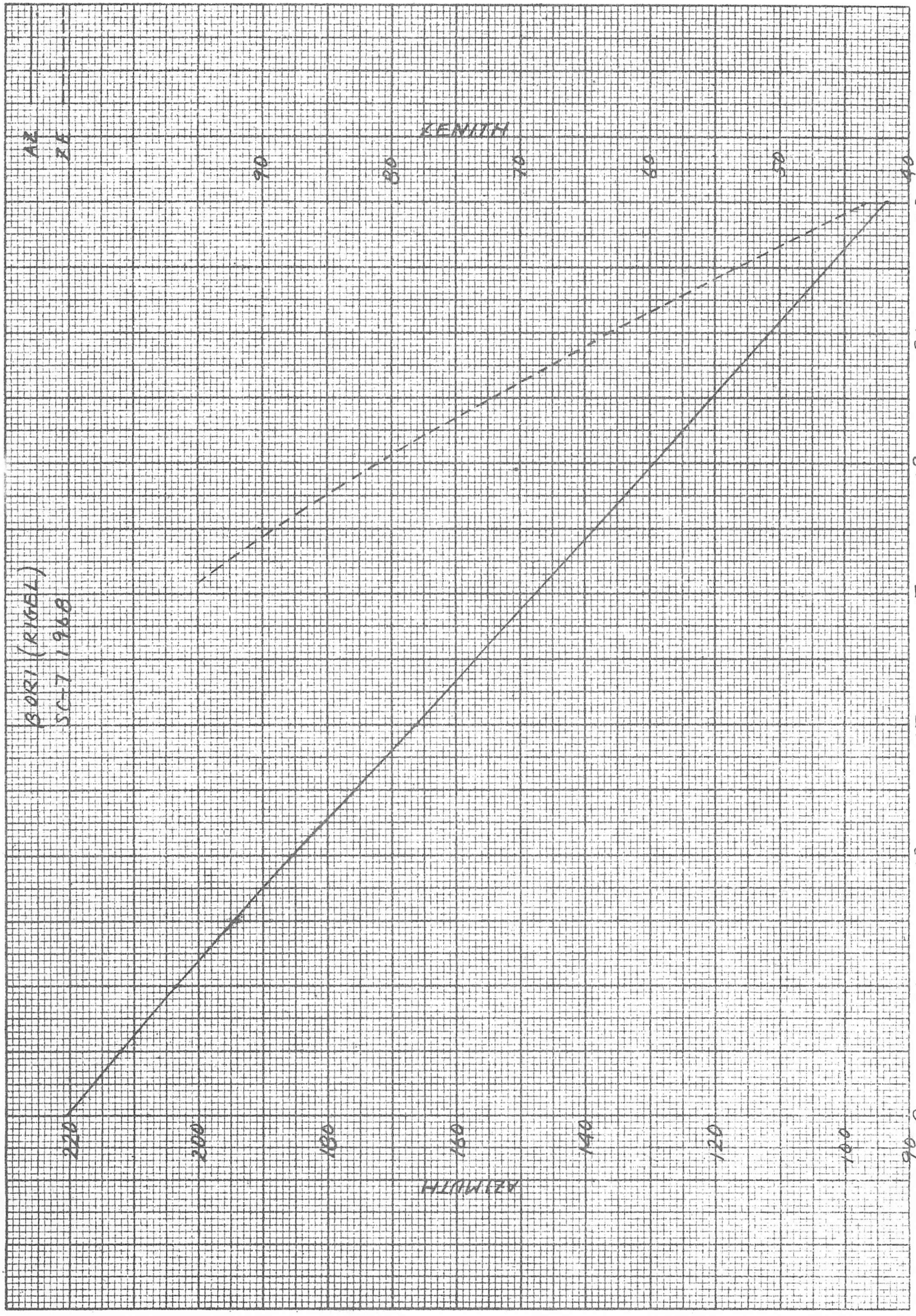
AZIMUTH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ZE
ZENITH
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DAYS
BORI (RIGEL)
SC-7 1968
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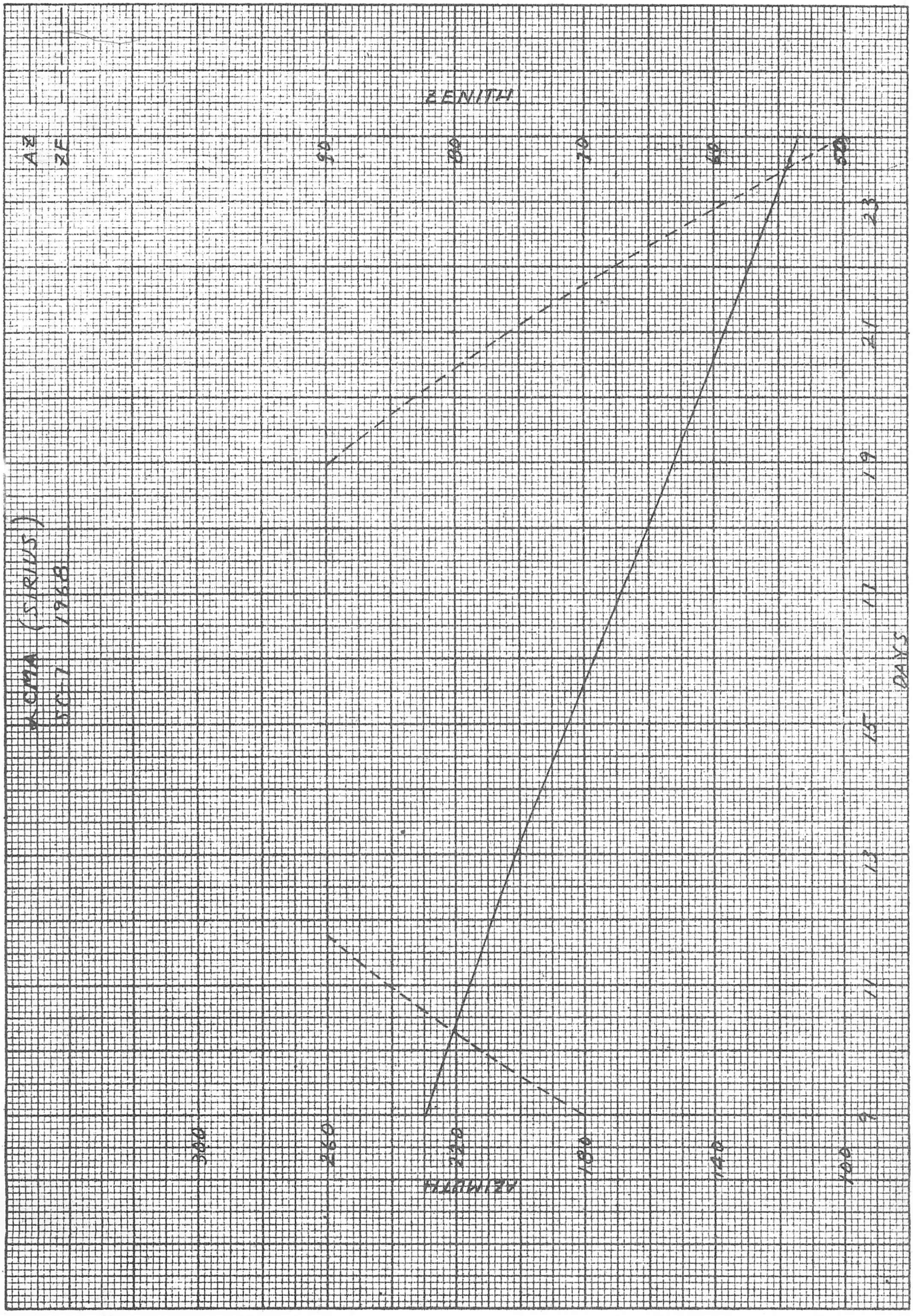
200
180
160
140
120
100
90
AZIMUTH


ZENITH
AZ
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ALPHA (SIRIUS)
DEC -1 1968
AZIMUTH
DAYS

SSAC OPERATIONS REPORT - SURVEYOR VII

I. General

1. The science payload operations for Mission G were those involving Television, Alpha Scattering and Surface Sampler. Since the instrument payload was a combination of instruments which were flown and operated successfully on prior missions, there were no significant changes in SSAC operations other than to combine previous types of efforts to meet daily objectives. Each instrument support group was manned by the same expereinced personnel who supported their respective instrument during prior missions. Procedures and interfaces remained the same as for prior missions with the exception that additional telemetry data displays were utilized as provided from a 1219 computer complex installed in the SFOF for this mission.

2. The performance of SSAC personnel was excellent in all respects in support of achieving mission objectives. Except for restrictions on instrument operation around lunar noon due to high instrument temperatures, operations were conducted on a round-the-clock basis. More TV was obtained by the overseas stations than for previous missions due to greater requirements for TV support of Surface Sampler during Goldstone visibility. All daily operationsal objectives were accomplished with a few minor exceptions. Interfaces with Mission Control, Project Scientist Representatives, SPAC, and DSIF were smooth and effective.

Total Data Acquisition

Television: 20,993 video frames

Alpha Scattering; 65 H 44 M

Surface Sampler: 36 H 21 M
(4,397 mechanism motions)

II. Instrument Performance

1. Television

The television camera performed in a flawless manner with none of the following mirror deviations in performance due to instrument failure.

(a) Due to vidicon characteristics which were known at launch, electronic focus was soft on the lower half of the image.

(b) At low electronic chassis temperatures (-20 to-30° F) vertical sweep time decreased by approximately 10%.

(c) Camera warm up time from turn on to first video increased from a 40 second wait to 60 seconds.

(d) On two occasions, camera commands were not received by the spacecraft and the camera did not respond as desired. It was the opinion, as the result of subsequent investigation, that this problem was due to spacecraft RF subsystem behavior.

2. Alpha Scattering

Technical performance of the Alpha Scattering Instrument (ASI) was excellent except for failure of the deployment mechanism which kept the instrument head from dropping to the surface when commanded to do so. This failure did not affect operating characteristics of the instrument and was eventually overcome by applying an external force to the instrument with the surface sampler scoop to pull the suspension cable free. Because deployment failure and excessive temperatures tended to restrict operations to periods less than desired, the instrument was operated at temperatures in excess of specifications. At high temperatures an increase in guard monitor voltage was noted and there was an excess number of events in the low energy region of the proton spectra. These high readings cleared up when the instrument returned to lower temperatures.

3. Surface Sampler

All commands to the Surface Sampler were correctly decoded and the mechanism operated perfectly in all respects.

III. SSAC SURVEYOR VII TELEVISION OPERATIONS SUMMARY

TRACK PASS	STATION CMDG	SURVEY NO.	ACTIVITY	GMT START	GMT END
03	DSS-11	010	Pad 3-2, 200 line	010-0145	010-0211
		020	W/A 360 Pan, 600 line	-0341	-0427
		030	Special Area	-0434	-0504
		040	Aux, Mirror	-0509	-0546
		050	N/A Segment 1	-0548	-0605
		051	N/A Segment 2	-0606	-0630
		052	N/A Segment 3	-0645	-0711
		053	N/A Segment 4	-0713	-0731
		054	N/A Segment 5, Seg 0251	-0732	-0739
04	DSS-42	054	N/A Segment 5, Seg. 0251	-0811	-0828
		060	Earth Polarimetric	-0829	-0904
	DSS-61	-	ASI Deployment Coverage	-1535	-1600
	DSS-11	070	ASI Coverage, Not Deployed	-2239	-2310
		080	SMSS Area Survey	-2315	-2346
		090	Stereo Mirror Coverage	-2348	011-0002
		070	ASI Coverage	011-0004	-0028
		014/017	SMSS Operation	-0110	-0215
		070	ASI Coverage	-0217	-0250
		014/017	SMSS Bearing Test	-0315	-0505
		020	Polarimetric Survey	-0527	-0604
		030	Special Area and Magnets	-0607	-0638
		031	Aux. Mirrors	-0644	-0658
		040	Omni B P.T.	-0659	-0701
		071	ASI Coverage	-0723	-0845
		050	Star Survey, Earth, Jupiter	-0855	-0917
05	DSS-42	060	Focus Ranging Az-108, -126 DSS-11 Set at 1016	-0952	-1057
		-	W/A 360 Pan	-1058	-1132
		-	N/A Segment 1	-1200	-1218
		-	N/A Segment 2	-1220	-1235
		-	N/A Segment 3	-1240	-1307
		-	N/A Segment 4	-1308	-1334
		-	N/A Segment 5	-1336	-1410
	DSS-11	070	ASI Coverage	-2312	-2342
		080	N/A Segment 4	-2345	012-0006
		010	Stereo Mirror Coverage	012-0008	-0032
		024/027	SMSS Operation	-0022	-0439
		030	Earth and One Star	-0508	-0541
		071	Attempt to Free ASI	-0544	-0813
		070	ASI Coverage	-0857	-0904
		071	Attempt to Free ASI	-0904	-1030

TRACK PASS	STATION CMDG	SURVEY NO.	ACTIVITY	GMT START	GMT END
06	DSS-42	040	End Stop Coverage	-1045	-1107
		-	Focus Ranging	-1146	-1327
		-	N/A Segment 1	-1358	-1421
		-	N/A Segment 2	-1424	-1444
		-	N/A Segment 3 to Seq 253	-1446	-1515
	DSS-61	-	N/A Segment 3, Completion	-1537	-
		-	N/A Segment 5	-	-1620
	DSS-11	010	Polarimetric Survey	013-0028	013-0135
		020	SMSS Area Survey	-0200	-0225
		030	Stereo Mirror Coverage	-0225	-0234
		040	ASI Deployment Mech.	-0231	-0241
		054/057	SMSS Operations	-0341	-0903
		060	Earth, Star, and Laser Exp.	-0913	-0937
		070	Special Area, and Magnets	-1011	-1051
07	DSS-42	071	Aux. Mirrors	-1147	-1157
		-	N/A Segment 2	-1157	-1216
		-	N/A Segment 3	-1217	-1332
		-	N/A Segment 4	-1333	-1353
		-	N/A Segment 5 and stop	-1354	-1502
		-	N/A Segment 1 and stop	-1517	-1533
	DSS-11	010	ASI Head Lunar Surface	014-0107	014-0113
		020	N/A Segment 2	-0116	-0133
		021	N/A Segment 3	-0133	-0155
		034/037	SMSS Operations	-0230	-0410
		040	Laser Experiment and Earth	-0430	-0444
		034/037	SMSS Operations	-0445	-0932
		050	Particle Viewing Mirrors	-1013	-1025
		060	Polarimetric Survey	-1026	-1218
08	DSS-42	-	ASI Mirror Coverage	-1315	-1328
		-	W/A 360 Pan.	-1328	-1432
		-	N/A Segment 1	-1534	-1632
	DSS-11	010	ASI Aux. Mirror, ASI W/A	015-0225	015-0247
		020	Polarimetric Survey	-0248	-0443
		030	Special Area	-0444	-0550
		031	Aux. Mirrors	-0627	-0631
		040	W/A 360 Pan.	-0633	-0823
		050	N/A Segment 1	-0856	-1100
		051	N/A Segment 4	-1100	-1148
		052	N/A Segment 5	-1148	-1223

TRACK PASS	STATION CMDG	SURVEY NO.	ACTIVITY	GMT START	GMT END
09	DSS-11	010	Polarimetric Survey	016-0816	016-0903
		020	Pad 2 Magnets	-0903	-0906
		030	N/A Segment 2	-0907	-1006
		040	Magnets and SMSS Rock	-1006	-1007
10	DSS-11	010	Polarimetric Survey	017-0510	017-0600
		020	Special Area, Segments 2 & 3	-0600	-0727
		030	SMSS Area Survey	-0727	-1047
		030	ASI Mirror, N/A	-1047	-1050
		040	N/A Segment 4	-1137	-1309
		041	N/A Segment 5	-1310	-1516
11	DSS-11	010	Polarimetric Survey, and,	018-0517	-
		020	Special Rocks, and	-	-
		030	ASI Head	-	018-0739
		040	Special Area	-0748	-0757
		041	Aux. Mirrors	-0757	-0902
		050	Earth Survey	-0903	-0908
		060	W/A 360 Pan.	-0912	-1040
		050	Earth - Polarimetric	-1040	-1045
		021	Special Rocks	-1045	-1053
		070	N/A Segment 1	-1054	-1211
		071	N/A Segment 2	-1211	-1224
		072	N/A Segment 3 and Az, El grid	-1224	-1351
		073	N/A Segment 5	-1351	-1510
		080	Particle Viewing Mirrors	-1511	-1536
12	DSS-11	014/017	SMSS Operations	019-0640	019-0810
		020	Earth Survey and Laser Exp.	-0815	-0845
		014/017	SMSS Operations	-0922	-1344
		030	SMSS Scoop Magnets	-1344	-1351
		040	Polarimetric Survey	-1351	-1546
		041	Rock Polarimetry	-1546	-1557
		040	Polarimetric Survey	-1557	-1605
		050	Stereo Mirror Coverage	-1605	-1620
13	DSS-42	060	SMSS Area Survey	-1638	-1701
		-	Special Area	-1723	-1747
		-	Aux. Mirrors	-1748	-1804
		-	N/A Segment 1	-1808	-1825
		-	N/A Segment 2	-1936	-1958
		-	N/A Segment 3	-1958	-2016
		-	N/A Segment 5	-2018	-2043
		-	W/A 360 Pan.	-2111	-2125
	DSS-11	014/017	SMSS Operations	020-0644	020-0842
		020	Earth Survey & Laser Exp.	-0857	-0918
		014/017	SMSS Operations	-0919	-1026
		021	Laser Exp.	-1054	-1103

TRACK PASS	STATION CMDG	SURVEY NO.	ACTIVITY	GMT START	GMT END
		022	Star Survey, Sirius	-1103	-1116
		014/017	SMSS Operations and Magnet	-1118	-1420
		030	Magnet Test with SMSS	-1420	-1502
		014/017	SMSS Operations	-1502	-1520
		040	SMSS N/A Segment	-1522	-1534
		014/017	SMSS Operations	-1534	-1541
		050	Star Survey Sirius	-1605	-1618
		060	Polarimetric Survey and	-1619	-
		061	Special Rocks	-	-1714
14	DSS-42	070	W/A 360 Pan.	-1737	-1752
		-	Stereo Mirror Coverage	-1755	-1806
		-	Special Area	-1808	-1838
		-	Aux. Mirrors	-1839	-1844
		-	N/A Segment 1 and stop	-1844	-1904
		-	N/A Segment 2	-1926	-1939
		-	N/A Segment 3	-1939	-1956
		-	N/A Segment 4	-2003	-2020
		-	N/A Segment 5 and stop	-2020	-2052
	DSS-11	010	Earth Polarimetry	021-0821	021-0826
		020	Laser Experiment	-0826	-0837
		034/037	SMSS and ASI Repositioning	-0839	-1520
		040	Star Survey, Sirius	-1540	-1556
		050	Polarimetric Survey	-1556	-1657
		060	SMSS Area, Partial for ASI	-1707	-1712
15	DSS-42	070	Focus Ranging	-1733	-1934
		-	Special Area	-1937	-1953
		-	Aux. Mirrors	-1955	-2002
		-	N/A Segment 1 and stop	-2004	-2023
		-	N/A Segment 2	-2024	-2104
		-	N/A Segment 3	-2123	-2140
		-	N/A Segment 4	-2141	-2205
		-	N/A Segment 5 and stop	-2205	-2236
		-	W/A 360 Pan.	-2238	-2254
	DSS-11	014/017	SMSS Operations, ASI Move.	022-1003	022-1436
		020	Polarimetric Survey	-1457	-1550
		030	Special Area	-1605	-1619
		040	Focus Ranging	-1621	-1709
16	DSS-42	050	Earth Polarimetry	-1747	-1750
		060	W/A 360 Pan.	-1751	-1815
		070	N/A Segment 3	-1816	-1841
		-	N/A Segment 1 and stop	-1844	-1902
		-	N/A Segment 2	-1904	-1919
		-	N/A Segment 4	-1920	-1946
		-	N/A Segment 5	-1948	-2007

TRACK PASS	STATION CMDG	SURVEY NO.	ACTIVITY	GMT START	GMT END
		-	Earth Polarimetry	-2010	-2011
		-	Shadow Progression	-2306	-2324
		-	Shadow Progression	-2325	-2333
		-	Shadow Progression	023-0101	023-0103
		-	Earth Polarimetry	-0105	-0108
	DSS-61	-	Shadow Progression and Earth	-0259	-0325
		-	Shadow Progression	-0500	-0606
		-	Sunset 023-060613		
		-	Solar Corona and W/A Horizon	-0606	-0930
	DSS-11	010	Horizon Scan, Segment 2	-0953	-0958
		011	Horizon Scan, Segment 3	-0959	-1006
		020	Earth Polarimetry	-1007	-1013
		030	Solar Corona	-1014	-1136
		040	SMSS and Pad 2 View	-1137	-1146
		012	Eastern Horizon, Segment 1	-1147	-1155
		010	Eastern Horizon, Segment 2	-1155	-1201
		011	Eastern Horizon, Segment 3	-1203	-1206
		020	Earth Polarimetry	-1207	-1214
		050	SMSS Operations	-1215	-1253
		012	Eastern Horizon, Segment 1	-1354	-1359
		010	Eastern Horizon, Segment 2	-1400	-1407
		011	Eastern Horizon, Segment 3	-1407	-1411
		020	Earth Polarimetry and Sirius	-1412	-1425
		030	Solar Corona - 30 min exp.	-1427	-1606
		012	Eastern Horizon Segment 1	-1608	-1611
		010	Eastern Horizon Segment 2	-1612	-1625
		020	Earth Polarimetry	-1626	-1632
		030	Solar Corona - series of 30 min exp	-1634	-1822
17	DSS-42	-	Solar Corona - 30 min. exp.	-1822	-1852
		-	Lunar Polarimetry - 10 min exp. - all Fil.	-1857	-1930
		-	Earth Polarimetry	-1936	-1945
		-	Solar Corona -2-30 min. exp.	-1945	-2046
		-	Lunar Polarimetry (repeat)	-2050	-2101

Camera Mirror Closed on Pad 2 azimuth (-60)
Camera turnoff at 023-210633 GMT

SC-7 TV-CAMERA FRAME SUMMARY

TRACK PASS NO.	DSS 42 FRAMES CMD & REC	DSS 42 FRAMES REC NOT CMD	DSS 61 FRAMES CMD & REC	DSS 61 FRAMES REC NOT CMD	DSS 11 FRAMES CMD & REC	DSS 11 FRAMES REC NOT CMD
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	15	1055	169
4	169	803	108	451	751	108
5	1261	121	0	367	601	31
6	799	202	294	597	846	33
7	984	0	0	365	842	0
8	382	138	0	0	995	0
9	0	300	0	0	356	0
10	0	0	0	338	860	0
11	0	233	0	416	1220	0
12	0	405	0	0	720	186
13	1053	93	0	65	846	120
14	1297	106	0	64	672	321
15	1838	71	0	0	966	391
16	1184	692	350	109	496	6
17	48	133	0	0	0	0
TOTALS	9015	3297	752	2787	11226	1365

20993 CMD & REC.

7449 REC NOT CMD.

28442 RECOVERED

IV. SSAC SURVEYOR VII ALPHA SCATTERING OPERATIONS SUMMARY

DAY	DSS	CALIBRATION TIME	ACCUMULATION TIME	POSITION
10	42	23M	4H 50M	Stowed
	61	14M	20M	
		27M Total	5H 10M Total	
		DEPLOYED TO BACKGROUND POSITION GMT 154852		
10	61	16M	4H 58M	Background
11	61	33M	7H 10M	
12	11	---	12M	
		49M Total	12H 20M Total	
		DEPLOYED TO LUNAR SURFACE GMT 111000*		
		SAMPLE #1		
12	42	---	12M	Surface
	61	30M	6H	
13	11	---	72M	
	42	---	65M	
	61	15M	4H 15M	
14	42	---	10M	
	61	28M	5H	
15	61	---	50M	
20	42	13M	2H 10M	
	61	---	40M	
21	61	17M	5H 50M	
		1H 43M Total	27H 24M Total	

* Approximate GMT

DAY	DSS	CALIBRATION TIME	ACCUMULATION TIME	POSITION
		SAMPLE #2		
21	11	---	50M	Surface
	42	13M	50M	
22	42	---	40M	
	61	14M	6H 38M	
	11	---	1H 20M	
		27M Total	10H 18M Total	
		SAMPLE #3		
22	42	13M	3H	Surface
23	42	---	40M	
	61	13M	2H 10M	
	11	---	50M	
		26M Total	6H 40M Total	
		ALL POSITIONS		
		3H 52M Total	61H 52M Total	

V. SSAC Surveyor VII Surface Sampler Operations Summary

The Soil Mechanics Surface Sampler (SMSS) operations during the Surveyor VII mission yielded many and varied results. Included in the operations were sixteen bearing tests, five done with the scoop door open, and one done near the wall of a deep trench. A total of seven trenches were dug, two of which were subjected to multiple trenching operations. Four rocks were moved or manipulated, one of which was weighed several times and photographed in stereo for volume determination. A second rock was broken.

Two impact tests were performed, both with scoop open. The SMSS scoop magnets were surveyed after all potentially worthwhile soil contacts. One such survey showed a magnetic fragment of approximately 3/8 inch diameter stuck to the magnet.

The SMSS successfully deployed the Alpha Scattering Instrument Sensor head to the lunar surface after the ASI deployemtn mechanism jammed. The ASI was also successfully deployed to a second and a third lunar surface sample by the SMSS.

TIME EXPOSURE FRAMES

Frames taken in the normal mode are exposed for 0.150 seconds. Frames taken in the open shutter, non-integrate mode, are exposed for 1.2 seconds. Frames taken in the open shutter, integrate mode can be exposed for long periods of time.

During lunar sunset, the pictures taken in the open shutter, integrate mode were:

GMT	Exposure	Azimuth	Elevation	Scene
023-1446-08	15 min	69	30	Solar Corona
023-1523-13	30 min	69	25	Solar Corona
023-1555-27	30 min	69	25	Solar Corona
023-1705-39	30 min	-111	35	Orion
023-1742-20	30 min	69	25	Solar Corona
023-1816-35	30 min	69	25	Solar Corona
023-1852-04	30 min	69	25	Solar Corona
023-2015-10	30 min	69	25	Solar Corona
023-2046-55	30 min	69	25	Solar Corona

FRAME IMAGES

The frames contain fairly complete identification data which appears from left to right on each frame. This data is described below:

1. The vertical electrical gray scale. For an explanation of this, and its use, see the section on TVGDHS calibration.
2. The 48 mm by 48 mm image.
3. Identification information, taken either from returned television identification or added on ground receipt. Here is provided only a decoding of the TVID abbreviations. For more information please refer to the section on television identification data.
   a. Octal file number
   b. Greenwich mean time of receipt
   c. Mission code and receiving station code
   d. Mission — the letter designating the mission
   e. STA — receiving station; DSS 11 is Goldstone, California; DSS 42 is Canberra, Australia; DSS 61 is Madrid, Spain
   f. CAM — camera number 3
   g. AZ — azimuth angle of the camera mirror
   h. EL — elevation angle of the camera mirror
   i. FOC — computed distance to the plane of principal focus, in meters
   j. FL — focal length of the camera in millimeters
   k. IRIS — f number of the iris
   l. FLTR — polarization filter wheel position
   m. SHTR — camera shutter mode
   n. IS — state of the iris servo

o. MSF — state of the camera multiple step focus

p. ELEC — electronics temperature in degrees centigrade

q. VID — vidicon faceplate temperature in degrees centigrade

r. CAL — calibration voltage

s. EREC — computed erection angle in degrees to bring the horizon to a horizontal position

t. ALARMS — alarms or errors detected in the transmitted TVID

u. WDS — number of transmitted TVID frames processed to provide the above data

4. A process code above the television identification data recorded as a machine readable dot pattern.

5. A frame of film roll number above a machine readable bar pattern containing the mission, receiving station, process and frame of roll number codes, and GMT.

br

MOSAICS

A number of USGS prepared mosaics have been included to aid in the interpretation of individual frames and to provide an integrated view of the Surveyor and the landing site. The following is a list of the mosaics which have been selected for the data package.

Day	Title	Catalog Number
10	W/A Panorama	7-2-SI
10	N/A Seg. 3	7-10-SI
10	N/A Seg. 3	7-11-SI
10	N/A Seg. 4	7-12-SI
10	N/A Seg. 4	7-13-SI
10	SMSS Area	7-16-SI
11	N/A Seg. 1	7-35-SI
11	N/A Seg. 1	7-36-SI
11	N/A Seg. 2	7-37-SI
11	N/A Seg. 2	7-38-SI
11	N/A Seg. 3	7-39-SI
11	N/A Seg. 4	7-41-SI
11	N/A Seg. 4	7-42-SI
15	N/A Seg. 5	7-50-SI
15	N/A Seg. 5	7-55-SI
18	N/A Seg. 1	7-77-SI
20	W/A Panorama	7-83-SI
13	N/A Seg. 4	7-91-SI
21	SMSS Area Survey (N/A Partial ASI Area #3)	7-97

N/A = Narrow Angle
W/A = Wide Angle

MECHANICAL PROPERTIES WORKING GROUP
SURVEYOR MISSION G MOSAIC PHOTOS

Catalog Number	JPL Photo Lab Negative Number	GMT Day	Description
7-SE-3	P-8510A	10	Crater and horizon
7-SE-4	P-8511	10	ASI and SMSS area N/A survey
7-SE-5	211-2533A	10	ASI and SMSS area W/A survey
7-SE-6	211-2533B	10	Pad 2 and rock
7-SE-7	211-2534A	11	Pad 2 and rock
7-SE-8	211-2534B	15	ASI and SMSS area W/A survey
7-SE-9	211-2539	13	ASI and SMSS area N/A survey
7-SE-10	211-2540	15	Pad 3
7-SE-11	211-2543A	13	SMSS area
7-SE-12	211-2932	15	Rock pile and horizon end-stop
7-SE-13	211-2543B	20	Close in panorama, W/A, 180°
7-SE-13A	211-2925A	20	Stereo mirror trench
7-SE-14	211-2612A	19	SMSS area
7-SE-15	211-2607A	15	Pads 2 & 3, W/A, +90° to -108°
7-SE-15*	211-2607B	15	Pad 2 and throw-out
7-SE-15*	211-2608	15	Pad 3 and throw-out
7-SE-16	211-2612B	21	SMSS area
7-SE-18	211-3141	14	Pad 2 throw-out area
7-SE-19	211-3142	13	Rock pile behind spacecraft
7-SE-20	211-2898A	10,11	Large mosaic
7-SE-20	211-2898B	10,17,18	Large mosaic
7-SE-20*	211-2912	10,17,18	Mirror reflected image, part of above
7-SE-20*	211-2923A	17,18	End-stop areas
7-SE-20B	211-2923B	10,11	Mosaic with compartment
7-SE-20C	211-2924	10,11,18	Mosaic
7-SE-20D	211-2610B	17	Close-in of rock
7-SE-20E	211-2609A	10,17	Pad 3 area

MECHANICAL PROPERTIES WORKING GROUP
SURVEYOR MISSION G MOSAIC PHOTOS

Catalog Number	JPL Photo Lab Negative Number	GMT Day	Description
7-SE-20F	211-2611	10,17	Pad 3, wider view
7-SE-20G	211-2610A	10,11	Pad 2 area
7-SE-20H	211-2609B	10,11	Pad 2 area
7-SE-21A	211-3143	10,11, 17,18	360° spherical mosaic
7-SE-22	211-3138	10,11, 17,18	360° flat horizon
7-SE-23	211-3145A	18	Pad 2 throw-out area
7-SE-24	211-3145B	13	Large rock over leg 3 shock
7-SE-25	211-3146A	22	Close up of rock, ASI
7-SE-26	211-3146B	21	Close up of rock, ASI position # 2
7-SE-27	211-3147A	20	Pad 2, dust on top
7-SE-28	211-3147B	15	Large rock over leg 3
7-SE-29	211-3148	17	Large rock (almost a duplicate of 7-SE-28)

*Close-up detail views

DIGITALLY PROCESSED DATA

The following pictures have been processed digitally in the JPL Image Processing Laboratory. After being digitized, the pictures were processed by the IBM 360-44 computer using the Sine Wave Response Filter (SWRF) program. This program restores high frequency data (fine details in the picture) in both the horizontal direction along the camera scan lines and in the vertical direction. The amount of enhancement necessary is obtained from pre-launch calibration where optical sine wave targets of known frequency are scanned by the spacecraft camera. Any noise present is also enhanced by the SWRF program; therefore pictures which have been SWRF processed will appear more noisy than the original but will be much sharper and will show more detail. The maximum amount of enhancement is controlled to minimize the increase in noise. Since the SWRF program uses a 15 x 15 element matrix to apply the filter to a picture, the processed pictures are labeled "FILTERED 15 x 15". Each frame is identified with the GMT and TVGDHS File Number.

DAY	HOUR	MINUTE	SECOND	FRAME NO.	PHOTO NO.	DESCRIPTION
10	05	45	23	444	211-3315A	Surface behind Mast Az, -213; El, -35
10	06	52	33	1230	211-2946A	Rock beyond Leg 2
10	06	52	38	1231	211-2946B	Rock beyond Leg 2
10	06	52	42	1233	211-2947A	Rock beyond Leg 2
10	06	52	46	1234	211-2947B	Rock beyond Leg 2
10	06	52	51	1235	211-2948A	Rock beyond Leg 2
10	06	52	56	1236	211-2948B	Rock beyond Leg 2
10	06	52	59	1237	211-2949A	Rock beyond Leg 2
10	06	54	02	1246	211-2949B	Rock beyond Leg 2
10	06	54	06	1247	211-2950A	Rock beyond Leg 2
10	06	54	11	1250	211-2950B	Rock beyond Leg 2
10	06	54	15	1251	211-2951A	Rock beyond Leg 2
10	06	54	20	1252	211-2951B	Rock Az, -36; El, -10
10	06	54	25	1253	211-2952A	Rocks Az, -42; El, -10
10	06	54	28	1254	211-2952B	Rock Az, -48; El, -10

DAY	HOUR	MINUTE	SECOND	FRAME NO.	PHOTO NO.	DESCRIPTION
10	06	58	25	1271	211-2953A	Rock Az, -39; El, -5
10	06	58	30	1272	211-2953B	Rocks Az, -33; El, -5
10	06	58	34	1273	211-2954A	Crater Az, -30; El, 0
10	06	58	38	1274	211-2954B	Valley Az, -36; El, 0
10	06	58	43	1275	211-2955A	Slopes Az, -42; El, 0
10	06	58	48	1276	211-2955B	Slopes Az, -48; El, 0
10	06	59	23	1306	211-2956A	Az, -45; El, 5
10	06	59	28	1307	211-2956B	Slopes Az, -39; El, 5
10	06	59	33	1310	211-2957A	Az, -33; El, 5
10	08	12	45	2044	211-2957B	Rocks Az, 66; El, -10
10	08	27	19	2232	211-2958A	Horizon Az, 126; El, 10
10	08	47	57	2273	211-2521	Earth
10	09	00	09	2311	211-2958B	Alpha Scat Hang-up
11	06	29	29	3434	211-2575A	Pad 3 and Rock
11	06	57	35	3530	211-3315B	Stereo Mirror
11	10	11	26	3767	211-2575B	Az, -108; El, -40
11	12	28	52	10142	211-3316A	Pad 2
11	12	55	16	10401	211-3152A	Az, -51; El, -5
11	12	55	20	10402	211-3152B	Az, -45; El, -5
12	00	04	46	4531	211-2576	Az, 33; El, 15
13	10	18	45	7124	211-3316B	Pad 2
14	01	34	57	11664	211-3358B	Throwout material to left of rock
18	07	52	24	21774	211-3317A	Pad 2 and Rock

DAY	HOUR	MINUTE	SECOND	FRAME NO.	PHOTO NO.	DESCRIPTION
19	07	45	25	25440	211-2600A	SMSS
19	07	49	14	25444	211-2600B	SMSS
19	07	51	00	25445	211-2601A	SMSS
19	07	54	21	25450	211-2601B	SMSS
19	17	36	27	42233	211-3359A	Pad 2 edge, Rock Throwout material
19	18	00	51	42267	211-3317B	Stereo Mirror
19	19	42	37	42545	211-3318A	Debris
20	19	33	56	44651	211-3318B	Debris
20	19	40	24	44761	211-3359B	Rock and Throwout material
22	11	21	12	34330	211-2577	Alpha Scat, #3 location

TELEVISION IDENTIFICATION DATA DESCRIPTION

Source of Frame Data

Television Identification (TVID) data is generated and transmitted between each television frame. On ground receipt, the TVID is decommutated, converted to engineering units, time tagged, assigned a file number, and stored in TVGDHS computer systems disc storage unit. The data thus accumulated in real time during the mission or by tape playback of overseas data has been manually examined and all observed anomalies corrected to their most likely value. This correction has been accomplished by comparison of the image data associated with each TVID theoretically to be expected in response to the command stream sent to the camera. Final production of the TVID catalog included with this data package has been by a computer program which selects and prints a subset of the corrected TVID as stored on the disc file. As such it represents out best estimate of correct TVID to be associated, through GMT correlation, with each image frame taken during the mission.

Summary Listing

The catalog presents a time sorted listing of the TVID. A list of abbreviations, their meaning, allowable ranges and least significant units (LSU) follows:

Abbreviations	Meaning	Range	LSU
DAY	Day of Year	0-366	1
HR	Hour of Day	0-23	1
MIN	Minute of Hour	0-59	1
SC	Second of Minute	0-59	1
FILE NO	Octal File Number	1-20000	1
AZ	Azimuth angle of camera mirror	-222 to +132	1 rounded, not truncated from ±0.1 values
EL	Elevation angle of camera mirror	-90.0 to +90.0	0.1
FCS ST	Focus Step	0-49	1
FCS DIST	Distance in meters to plane of principal focus	0.00 to 9.99	0.1
IRIS	Camera iris setting in f stop numbers	4.0 to 22.0	0.1
FILTER	Filter wheel position	CLR 1 VER 2 45 3 HOR 4 CLR 5	
F/L	Camera focal length	Wide or Narrow	

FORTRAN COMPATIBLE TAPE FORMAT DESCRIPTION

An ancillary output of the TVID processing programs is an IBM 7094 Fortran IV compatible magnetic tape record of all TVID. A copy of this tape is available from the National Space Science Data Center, Greenbelt, Maryland. The tape is written (and can be read) in Fortran IV binary mode, using the statement WRITE (i) List, where "i" and "List" are described in the Fortran IV manuals.

Following is the format of this tape:

BCD = A format

Floating = F format

Fixed = I format

Octal = O format

b = Hollerith blanks

* = Hollerith asterisk

RECORD	LOGICAL LENGTH	WORD	MODE	DESCRIPTION
1	1	1	BCD	Date the tape was generated, month, day, & year
2, 3 ..., Last-1	63	1	Floating	Azimuth corrected. (bbbbb* if no entry, "b" meaning "blank")
		2	Floating	Azimuth
		3	Fixed	Azimuth T/M Word Count
		4	BCD	Camera number alarm (ALARMb or OKbbbb)
		5	Fixed	Camera number
		6	BCD	Calibration voltage alarm (ALARMb or OKbbbb)
		7	Floating	Calibration voltage corrected (bbbbb* if no entry)
		8	Floating	Calibration voltage
		9	Fixed	Calibration voltage T/M word count
		10	Fixed	Days
		11	Fixed	DSIF Code
		12	Fixed	Erection angle
		13	Fixed	Erection angle option
		14	Floating	Elevation angle corrected (bbbbb* if no entry)
		15	Floating	Elevation
		16	Fixed	Elevation T/M word count
		17	Floating	Electronic tamperature corrected (bbbbb* if no entry)
		18	Floating	Electronic tamperature
		19	BCD	Focal length angle corrected. (bbWIDE or NARROW) (bbbbb* if no entry)
		20	BCD	Focal length angle. (bbWIDE or NARROW)

RECORD	LOGICAL LENGTH	WORD	MODE	DESCRIPTION
		21	Floating	Focus corrected (bbbbb* if no entry)
		22	Floating	Focus
		23	Fixed	Focus T/M word count
		24	BCD	Filter position alarm (ALARMb or OKbbbb)
		25	Fixed	Filter position corrected (bbbbb* if no entry)
		26	Fixed	Filter position
		27	Fixed	Filter position T/M word count
		28	BCD	Focal length alarm (ALARMb or OKbbbb)
		29	Floating	Focal length corrected (bbbbb* if no entry)
		30	Floating	Focal length
		31	Fixed	Format number
		32	Octal	File number
		33	Fixed	Frame number
		34	Fixed	Focus step corrected (bbbbb* if no entry)
		35	Fixed	Focus step
		36	Fixed	Hours
		37	Fixed	ID quality
		38	Floating	Iris setting corrected (bbbbb* if no entry)
		39	Floating	Iris setting
		40	Fixed	Iris T/M word count
		41	BCD	Iris servo corrected (bbONbb or bbOFFb) (bbbbb* if no entry)

RECORD	LOGICAL LENGTH	WORD	MODE	DESCRIPTION
		42	BCD	Iris servo (bbONbb or bbOFFb)
		43	BCD	Multiple step focus corrected (bbONbb or bbOFFb) (bbbbb* if no entry)
		44	BCD	Multiple step focus, (bbONbb or bbOFFb)
		45	Fixed	Milliseconds
		46	Fixed	Minutes
		47	Fixed	Mission number code
		48	Fixed	Process code
		49	Floating	Sun Azimuth (bbbbb* if no entry)
		50	Fixed	Seconds
		51	Floating	Sun elevation (bbbbb* if no entry)
		52	BCD	Shutter mode alarm (ALARMb or OKbbbb)
		53	BCD	Shutter mode corrected (NORMAL or bbOPEN) (bbbbb* if no entry)
		54	BCD	Shutter mode (NORMAL or bbOPEN)
		55	Fixed	Stereo mate's file number (bbbbb* if no entry)
		56	Fixed	Survey number
		57	Fixed	Camera axis tilt angle
		58	Floating	Camera axis tilt direction
		59	Floating	Vidicon temperature corrected (bbbbb* if no entry)
		60	Floating	Vidicon temperature
		61,62 & 63	BCD	Searchable subjective data
Last	63	1, 2,	BCD	ENDbOFbDATAb
		3-63	BCD	"blanks"

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