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79 Pages

June 1965

TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT

MISSION 1014-1
18-23 NOVEMBER 1964

MISSION 1014-2
23-27 NOVEMBER 1964

This document contains information referring to

Project Corona

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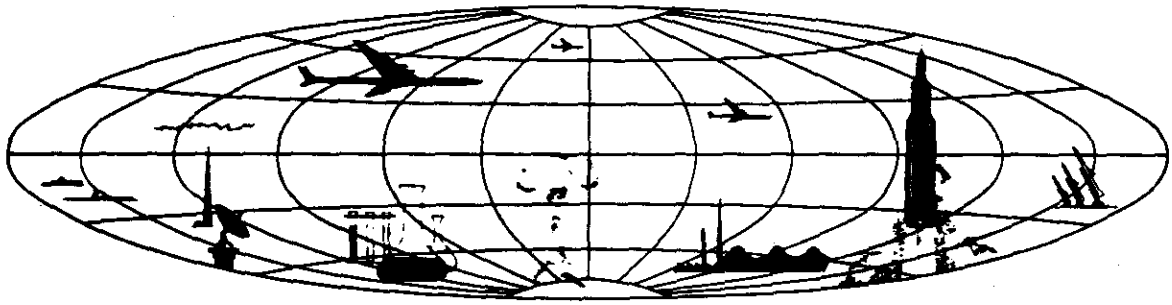
NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER



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SYNOPSIS

Mission 1014 was a two-part satellite reconnaissance mission. Photography was accomplished on 18-27 November 1964. The "A" bucket was recovered dry during orbital revolution 81, 23 November 1964, and the "B" bucket was recovered dry on revolution 145, 27 November 1964.

The satellite was launched at 2036Z. This is 4 hours earlier than the normal launch time and was intended to provide coverage of certain areas during times of more favorable solar elevations.

A filter experiment was conducted on this mission. The master (FWD) panoramic camera was equipped with a Wratten 25 filter, while the slave (AFT) panoramic camera had a Wratten 21 filter. The slit width of the master (FWD) panoramic camera was 0.250 inches; the slit width of the slave (AFT) panoramic camera was 0.175 inches. The resulting exposure was less than that which is normal this time of year.

The result of the earlier launch time and the filter and slit width differences has not been fully analyzed. The degree of complexity involved in the evaluation of the experiment is discussed in the text of this report.

The imagery of the panoramic cameras is good; however, it is not as good as that of recent missions (1004, 1006, 1009, 1010, etc.). The photography is sharp but lacks the fine edge acuity we have come to expect from photography obtained from this system.

The photography of the master (FWD) panoramic camera is degraded by an out-of-focus condition. The affected area is confined to a band approximately 0.2 inches wide at the binary edge and take-up end. It extends about 4 inches toward supply from the take-up end. The condition appears to exist on each frame from the beginning through pass 106D. It is not present thereafter.

In the area not affected by the out-of-focus condition, the image quality of the film from the two panoramic cameras is about equal and consistent throughout the mission.

The quality of the stellar and index photography of Mission 1014-1 is good, but a malfunction rendered most of the stellar and index photography of Mission 1014-2 unuseable for vehicle attitude determination.

[redacted]

GENERAL FLIGHT DATA

Date of Launch 18 November 1964, 2036Z

Actual Orbital Parameters

	Revolution 40	Revolution 110
Period	89.7 minutes	89.6 minutes
Perigee	102.3 nm	101.4 nm
Perigee Latitude	67.8°N	70°N
Apogee	198.4 nm	194.2 nm
Eccentricity	0.0134	0.0129
Inclination Angle	70.03°	70°

Recovery
Mission 1014-1: 23 November 1964, 2217Z
Mission 1014-2: 27 November 1964, 2151Z

[redacted]

PART I. CAMERA OPERATIONS

1. Master (FWD) Panoramic Camera Number 162

The operation of the Master Panoramic Camera was normal throughout the mission. The following paragraphs denote the nature, frequency, location, and severity of the degradations associated with camera operations.

a. There are small emulsion scratches just inside the format edges under the camera number and also at the take-up end of most frames. Only the first frame of a camera operation appears to be unaffected. The amount of degradation caused by these scratches is minor.

b. Rail scratches along both film edges are continuous throughout the photography. They are outside of the format and have no effect on the imagery.

c. Light entering the camera around the lens housing, during camera off periods, caused the first and last frames of most passes to be partially fogged. The density of the fog is commensurate with the duration of the camera off period and the prevailing solar elevation.

d. Minus density streaks, approximately parallel to the path of the field flattener, are intermittent throughout the mission. The resulting degradation is minor. An example of these streaks can be found on pass 7D, frame 2.

e. There are minus density dots every 6.25 inches along the major axis throughout passes 7D and 8D. Each dot is 0.75 inches from the frequency mark edge of the format. The associated degradation is minor. The distance between the dots is very nearly the same as the circumference of the metering roller, indicating that a burr or foreign matter on the metering roller probably caused the anomaly.

f. There is an out-of-focus area on each frame, from the beginning of the mission through pass 106D. Although the affected area is confined to a strip approximately 0.2 inches wide and 4 inches long at the binary edge and take-up end of the format, the degradation is severe within that area.

[redacted]

2. Slave (AFT) Panoramic Camera Number 139

Camera number 139 was a substitute for the camera which was originally scheduled for this mission. The change of cameras was made so near launch time that the engineers at the site did not have time to precisely calibrate the two panoramic cameras to each other. This adversely affected the mensuration process. The geometry on the photography of Mission 1014-1, Master (FWD) Panoramic Camera, was solved and the Slave (AFT) Panoramic Camera was assumed to be at the basic 30-degree angle from it. Poor stellar photography of Mission 1014-2 further complicated the mensuration process.

The camera operated well throughout the mission. Like the master camera, there are some degradations of image quality which are associated with camera operation. The following paragraphs make note of the most significant anomalies.

a. There are emulsion scratches just inside the format, under the camera number, and at the take-up end of each frame, except the first frame of each pass. Like the scratches described as being present on the master camera photography, they cause little or no degradation to image quality.

b. Rail scratches are continuous throughout the mission. They do not degrade the imagery.

c. Light, leaking around the lens housing during inactive camera periods, caused areas of fog on the first and last frame of most passes. The density of the fog is commensurate with the duration of the camera-off period and the prevailing solar elevation.

d. There are minus density streaks, approximately parallel to the path of the field flattener, intermittently throughout the mission. As in the Master (FWD) Panoramic Camera photography they present little degradation of imagery. For an example of the streaks refer to pass 116D, frames 52-76.

3. Master (FWD) Horizon Cameras

a. The port (supply) horizon camera was operational throughout the mission. The exposure was adequate except on those frames exposed at extreme northern latitudes.

b. The starboard (take-up) horizon camera was operational throughout the mission. Like the port horizon camera, the exposure was commensurate with the solar elevation.

[redacted]

4. Slave (AFT) Horizon Cameras

a. The port (take-up) horizon camera was operational throughout the mission. Approximately 10 percent of each frame is vignetted, in addition to the usual optical vignetting. The loss of imagery appears to have been caused by an obstruction rather than by failure of the optics to distribute the image evenly. The additional vignetting occurs at both ends of the horizon arc. The configuration of the shadowgraph that is formed is irregular at each end and suggests the presence of a wire or string in the focal path. The exposure was commensurate with the solar elevation.

b. The starboard (supply) horizon camera was operational throughout the mission. The imagery is vignetted in the usual manner by the optical system, and is additionally vignetted at the binary edge by an unknown obstruction. The loss of imagery associated with the unknown obstruction is about 5 percent of each frame. The shadowgraph that is formed is a wavering band at the binary edge. Like the other horizon cameras, the exposure was commensurate with the solar elevation.

[redacted]

5. Stellar Camera No 49 (1014-1)

The camera operated well throughout the mission and recorded 419 frames. There is in excess of 20 stellar images on most frames.

Flare degrades approximately 20 percent of each format; in addition, the mounting plates of the fiducial lamps are imaged on most frames. There is a series of plus density spots in the border, at the camera number edge, of the first 22 frames. The cause is unknown and because of their location, the spots have no effect on the stellar imagery. The last 8 feet of film contains various scratches, abrasions, emulsion cracks, and dendritic static traces. These degradations are associated with film exhaustion.

6. Stellar Camera No 46 (1014-2)

This camera produced 351 frames of photography during the mission. The first frame was double exposed, the following 118 frames were exposed as programmed, and the remainder of the film is severely degraded. Beginning at frame 120 the camera operation became very erratic. More than 50 frames were exposed more than once, and on many more frames the platen was not down when the exposure was made. Vehicle attitude has been determined solely from the horizon photography. The system manufacturers have concluded that the malfunction was the result of an electrical failure. In conjunction with the malfunction there are corona fog, emulsion cracks, bloomed fiducial lamps, and double reseau lines. The corona fog appears to have resulted from the tugging on the film by the take-up mechanism while the platen was down. At least some of the emulsion cracks probably resulted from the rather rough treatment the film received. The bloomed fiducials are those which were exposed more than once. The double reseau lines are associated with the double exposure of the imagery, since that is their source of illumination.

There is a dense band of fog which extends from edge to edge of frame 6. On the frames not double exposed, flare patterns degrade approximately 15 percent of the format. The fiducial lamp mounting plates are again imaged in most formats.

[redacted]

7. Index Camera No D59(1014-1)

The camera operated normally throughout the mission and 419 frames were recorded.

There are two fine, minus density lines between the fourth and fifth grid lines from the correlation lamp edge. They are continuous throughout the mission but cause little degradation to the imagery. The last few frames are abraded in conjunction with film exhaustion.

8. Index Camera No D44(1014-2)

The operation of this camera was exactly like the stellar camera (Number 46) of the mission. Because of the number of double exposures, the film from this camera is also considered to be of no value for vehicle attitude determination. There is no corona fog on the film, but fog due to dendritic static discharges is common along the camera number edge. The correlation of operation remained constant throughout the mission. A total of 351 frames of photography were exposed.

9. Associated Equipment (This equipment records information required for the correlation and mensuration of the primary cameras)

Beginning at pass 101D, in association with the malfunction that degraded the stellar and index camera photography, the mark which appears on the Forward Panoramic Camera film when the stellar and index cameras are tripped is excessively elongated. In some instances it parallels a frame or more. This condition is intermittent throughout the remainder of the mission.

The binary, binary index lamps, horizon fiducial lamps, camera number, and camera-off indicator functioned properly throughout the mission.

[redacted]

PART II. FILM

1. Film Footage/Frame Totals

The film footage and the frames processed from each camera used in Missions 1014-1 and 1014-2 are as follows:

CAMERA	FOOTAGE	FRAMES
Master Panoramic Camera No 162		
Mission 1014-1	7,774'	2,932
Mission 1014-2	7,814'	2,950
Slave Panoramic Camera No 139		
Mission 1014-1	7,567'	2,853
Mission 1014-2	7,654'	2,889
Stellar Camera No 49		
Mission 1014-1	50'	419
Stellar Camera No 46		
Mission 1014-2	54'	351
Index Camera No D59		
Mission 1014-1	90'	419
Index Camera No D44		
Mission 1014-2	91'	351

2. Film Processing

This section provides an evaluation of exposure, processing, and densities of the original negatives from the 10 cameras used in Missions 1014-1 and 1014-2.

[redacted]

a. The film of the Master and Slave Panoramic Cameras was underexposed at the beginning of most passes. Because of the time of year and the considerable film footage programmed for exposure at northern latitudes, the average solar elevation was low, resulting in thin negatives. The Master Panoramic Camera was equipped with a Wratten 25 filter and the slave with a Wratten 21. In order to compensate for the difference in filter factors, the slit width of the Master (FWD) Panoramic Camera was 0.25 inches, compared to 0.175 inches on the Slave (AFT) Panoramic Camera. There was no apparent difference in the density of the original negatives from the 2 cameras. Terrain partially covered by snow was recorded on the film of both cameras at solar elevations as low as 1 degree. Good-quality photography of snow covered terrain was acquired at solar elevations as low as 1 degree 26 minutes. Frame 12 AFT, pass 17D, is an example of good image quality at a low solar elevation (1 degree 26 minutes).

b. The density of the index camera photography is commensurate with the solar elevation at which it was exposed. Discounting the multiple exposures of Mission 1014-2 (Camera No D44), the film in general is less dense than the average index negatives of this system.

c. The exposure of the stellar camera of Mission 1014-1 was adequate throughout the mission. The exposure of the stellar camera on Mission 1014-2 was good, except on the frames degraded by the aforementioned malfunction.

d. The exposure of the horizon cameras was also commensurate with the solar elevation, i.e., when the film of the panoramic cameras was under-exposed, the horizons were also under-exposed.

e. The processing levels, which are determined by infrared densitometry, reflect the exposure level of the film.

[redacted]

The percentages processed at the three possible levels were as follows:

Levels of Development	Mission 1014-1 Master	Mission 1014-1 Slave	Mission 1014-2 Master	Mission 1014-2 Slave
Primary	0%	0%	0%	0%
Intermediate	13%	19%	16%	23%
Full	87%	81%	84%	77%

On Mission 1014-1 there were 55 changes of development level on the master (FWD) record and 6 on the slave (AFT) record.

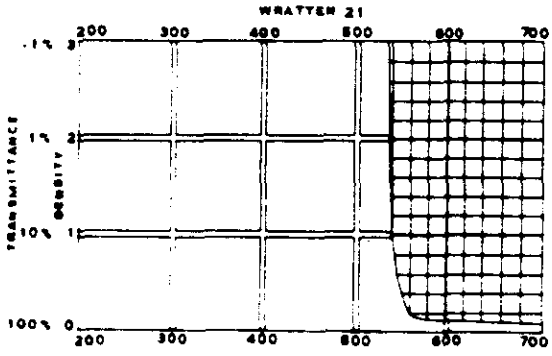
On Mission 1014-2 there were 29 development level changes on the master (FWD) record and 6 on the slave (AFT) record. The film of the stellar and index cameras was processed at 1 level.

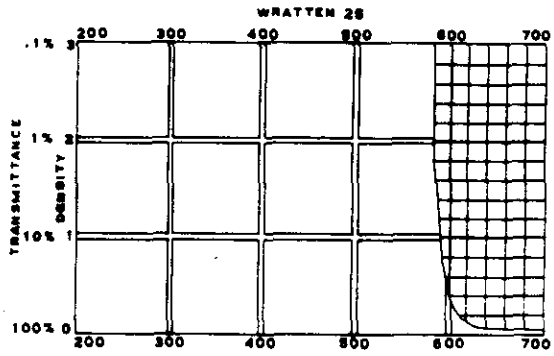
f. The following data provide information pertinent to the Wratten 21 filter used on the Slave (AFT) Panoramic camera and the Wratten 25 filter used on the Master (FWD) Panoramic camera.

[redacted]

3. Filter Transmission Data

Wave Length	Percent Transmittance Wratten 21	Wratten 25
540	2.50	
550	29.0	
560	65.0	
570	80.6	
580	85.4	
590	87.3	12.6
600	88.1	50.0
610	88.7	75.0
620	89.0	82.6
630	89.5	85.5
640	89.9	86.7
650	90.2	87.6
660	90.4	88.2
670	90.5	88.5
680	90.5	89.0
690	90.6	89.3
700	90.6	89.5
Dominant (A) Wave Length	593.7	617.2
Excitation (A) Purity	100.0	100.0
% Luminous Transmit (A)	57.4	22.5
Dominant (C) Wave Length	588.9	615.3
Excitation (C) Purity	99.9	100.0
% Luminous (C) Transmit	45.6	14.0





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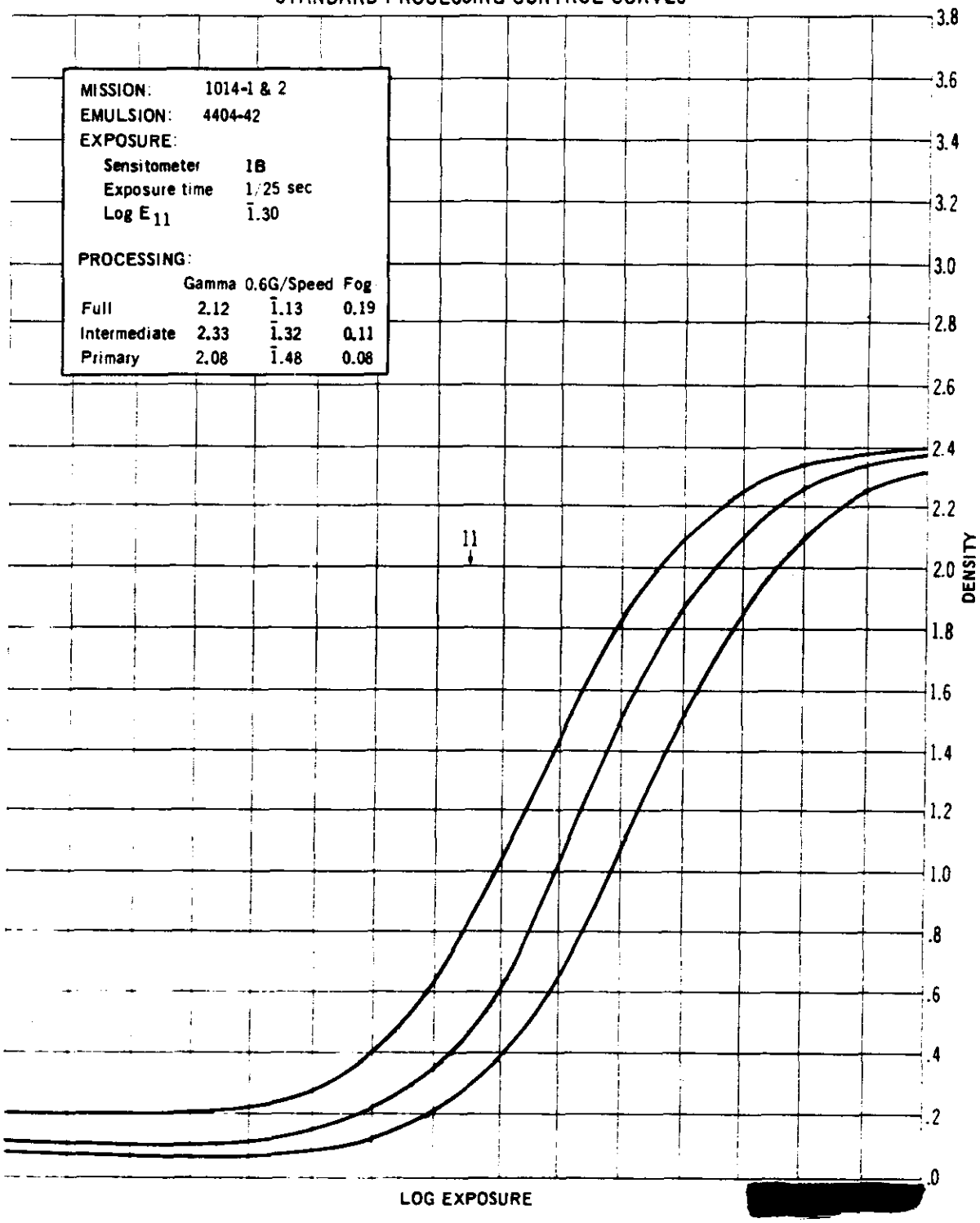
4. Film Processing Curves

The following processing curves are a product of the processing contractor and are presented here in the interest of exposure analyses and their relationship to processing.

[redacted]

STANDARD PROCESSING CONTROL CURVES



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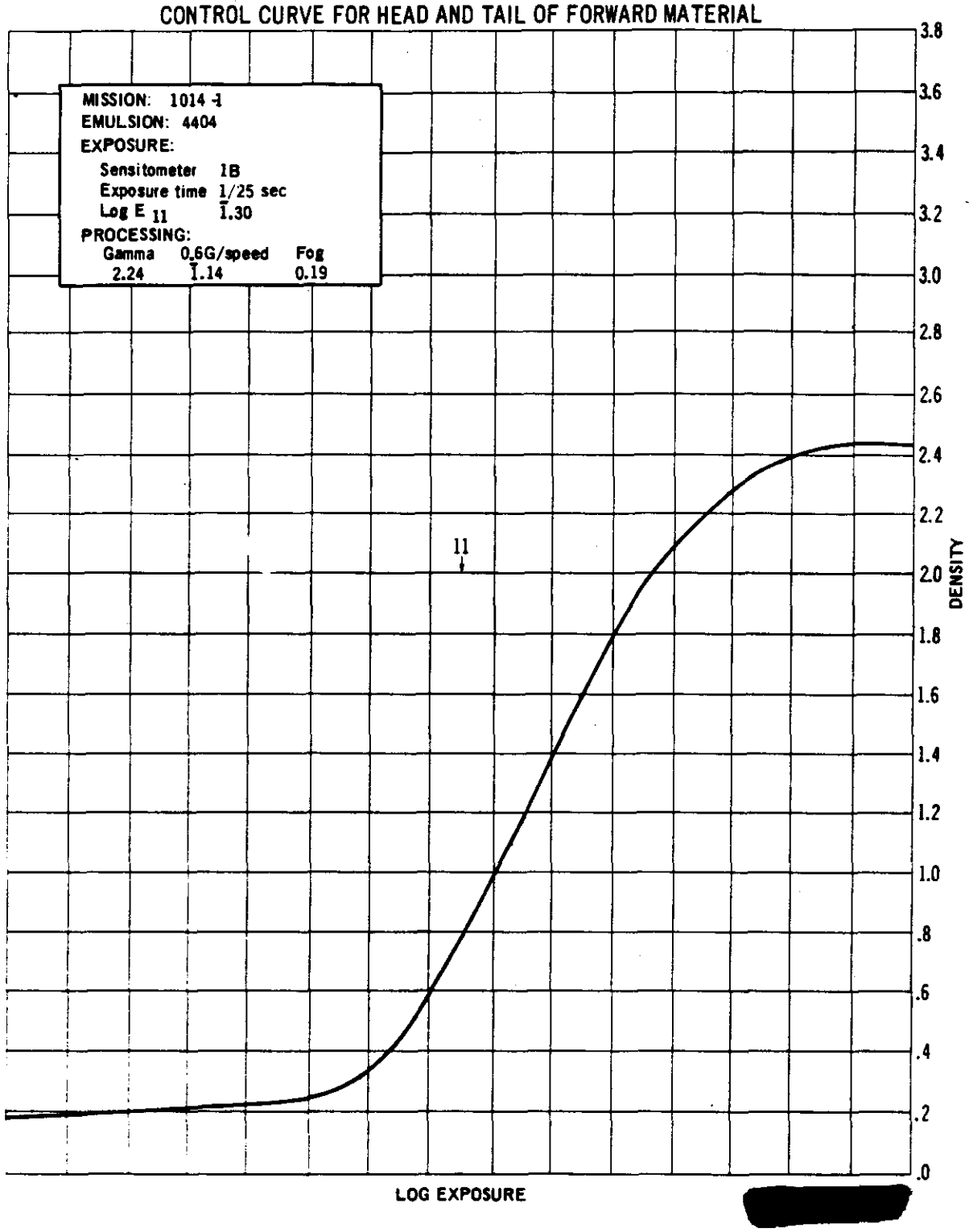
CONTROL CURVE FOR HEAD AND TAIL OF FORWARD MATERIAL



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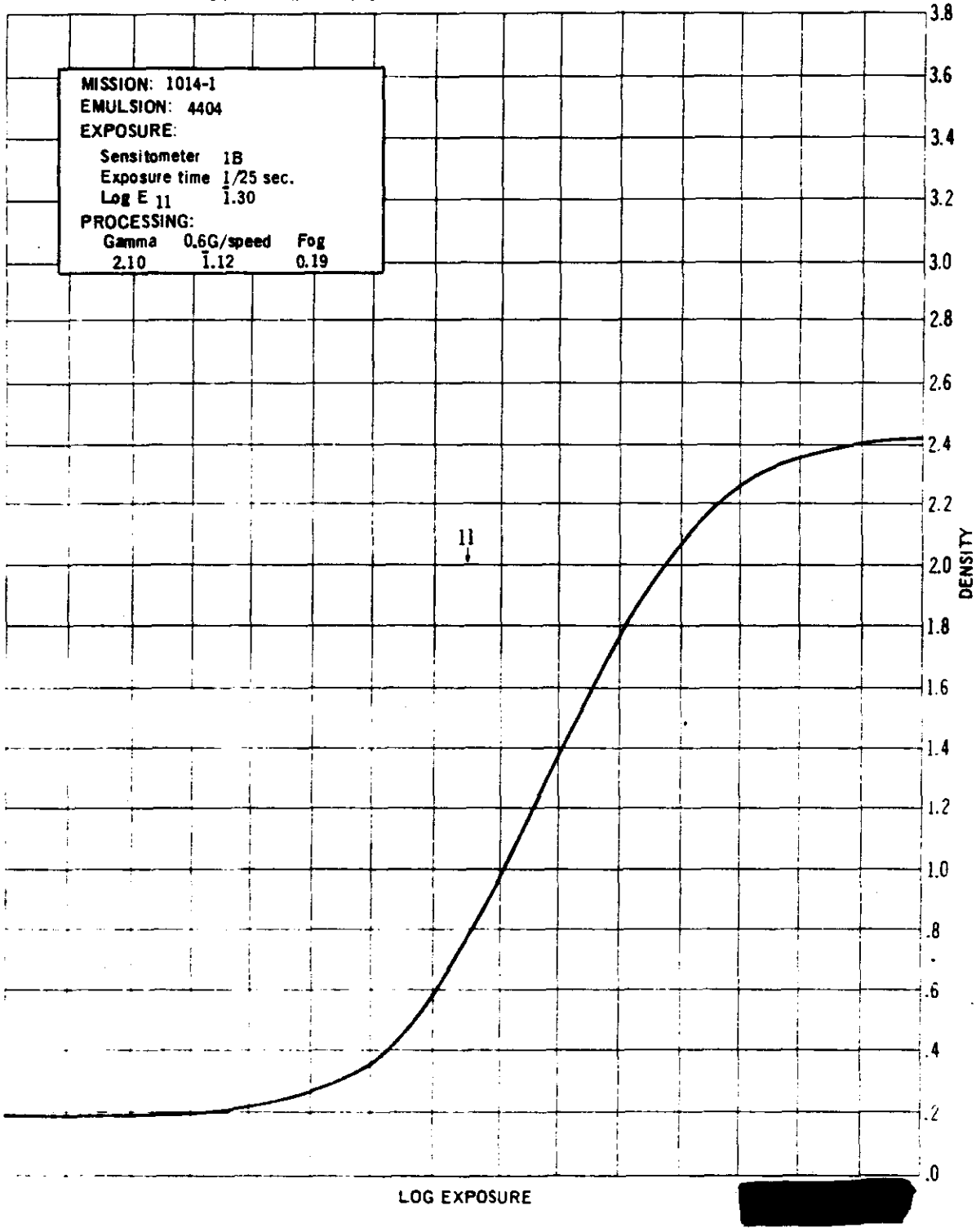
SENSITOMETRIC CURVE FROM AFT CAMERA MATERIAL



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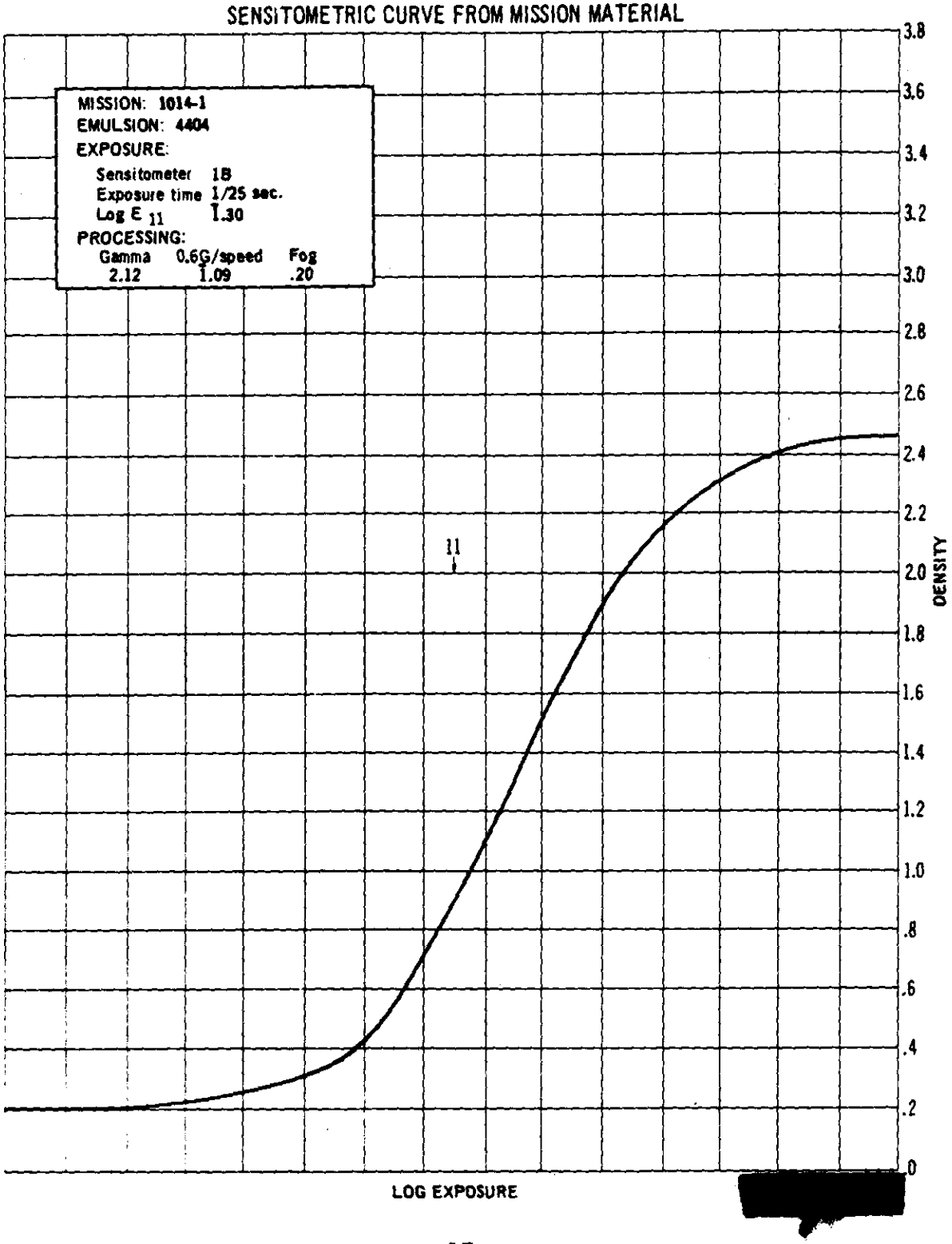
SENSITOMETRIC CURVE FROM MISSION MATERIAL



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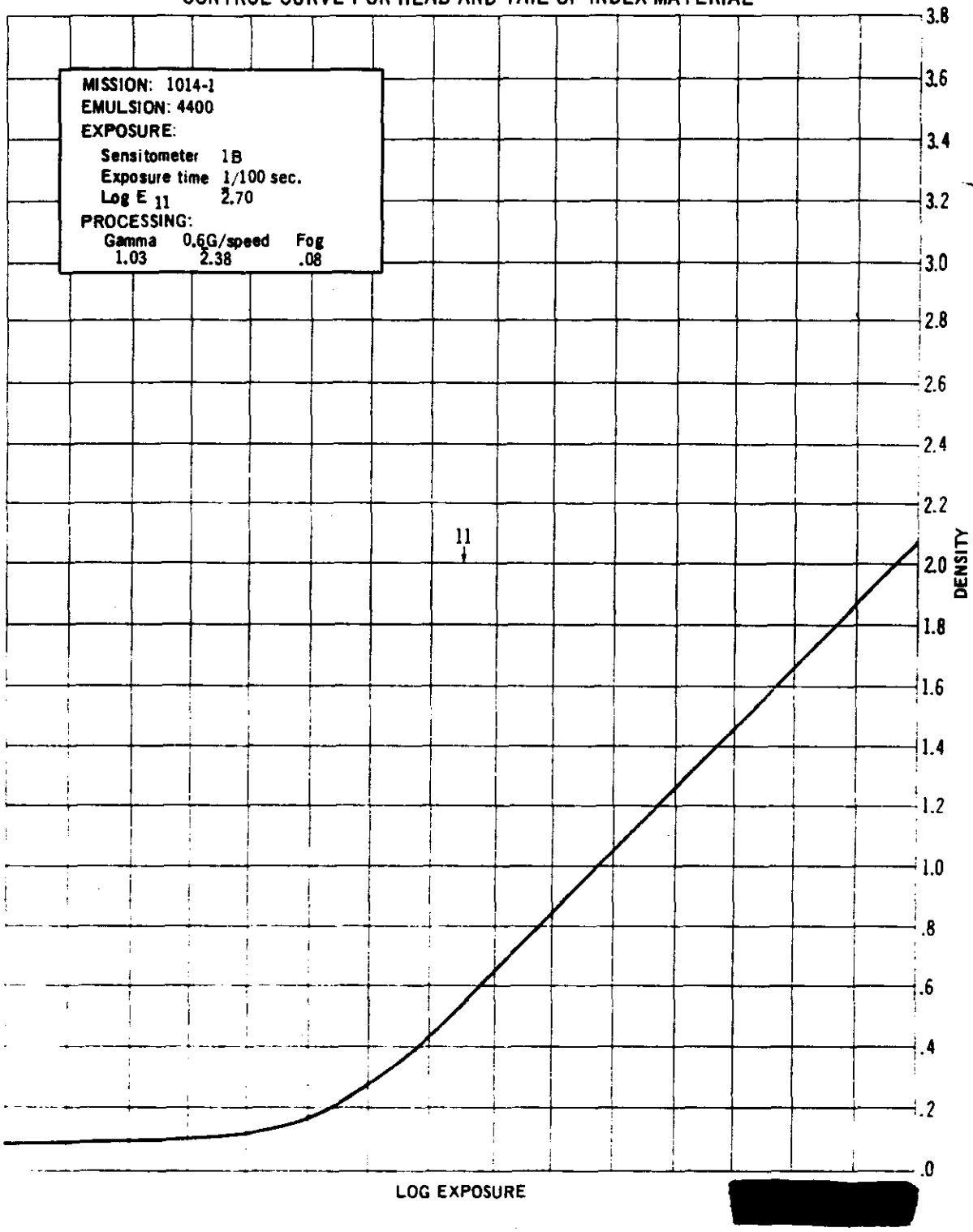
CONTROL CURVE FOR HEAD AND TAIL OF INDEX MATERIAL



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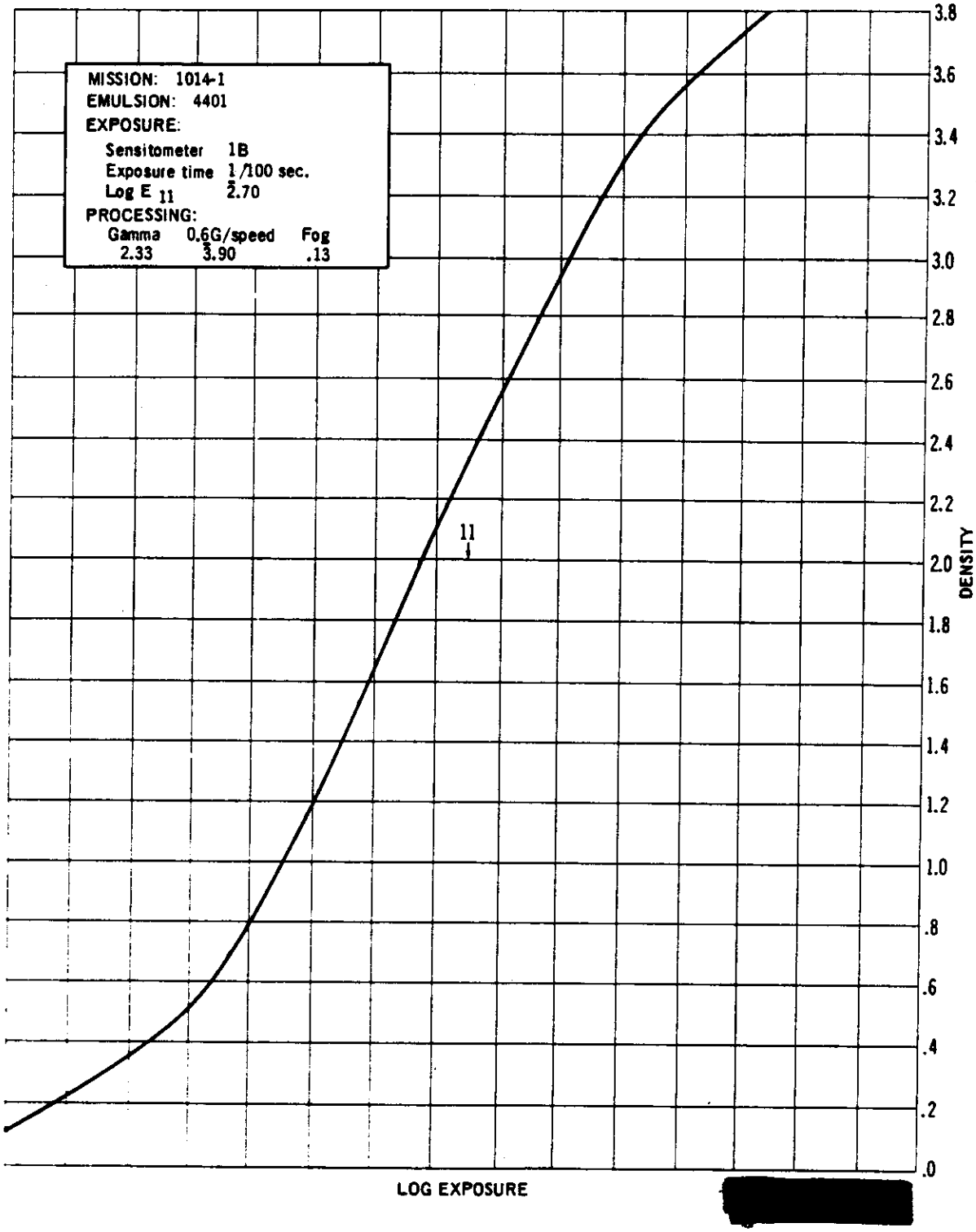
CONTROL CURVE FOR HEAD AND TAIL OF STELLAR MATERIAL



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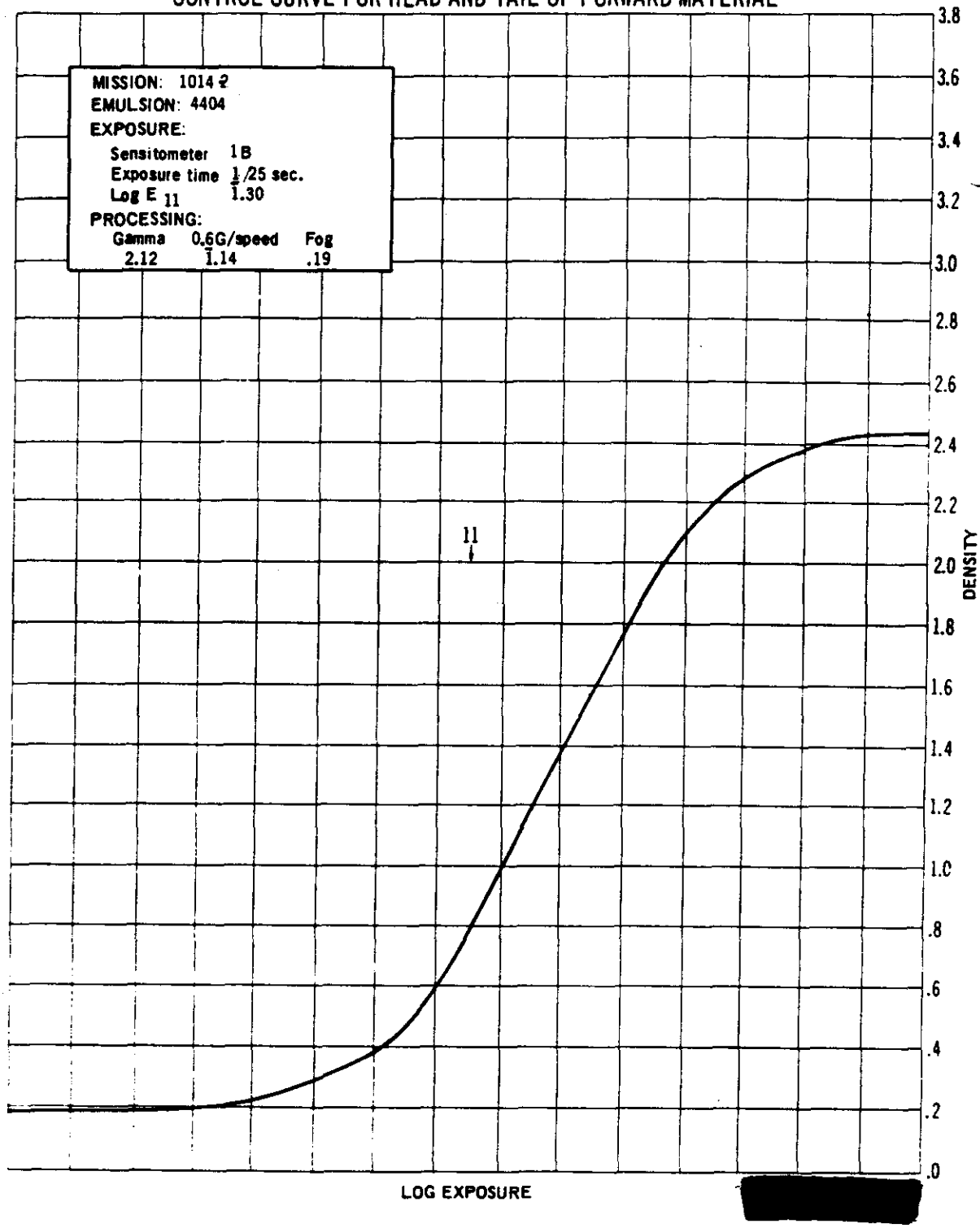

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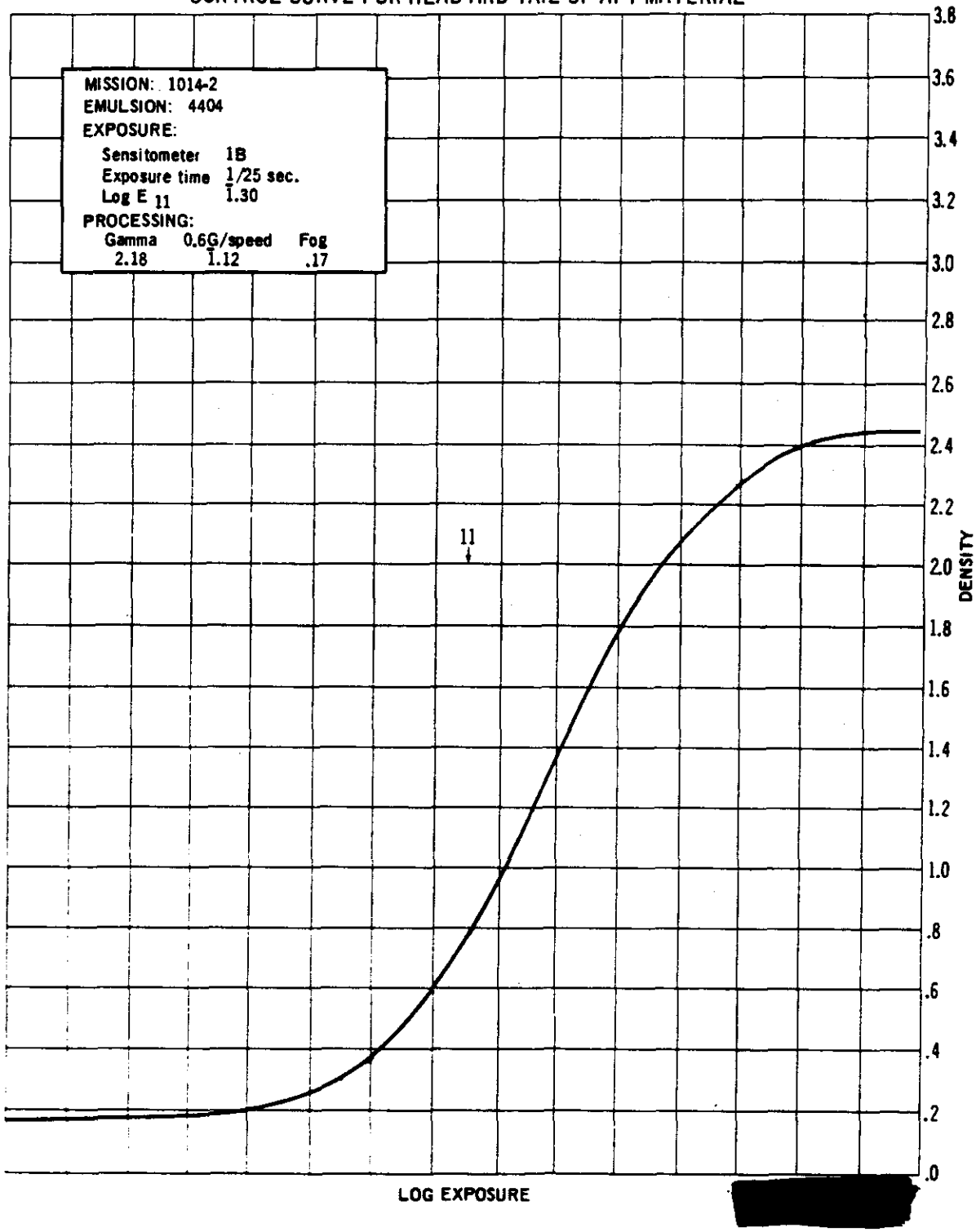

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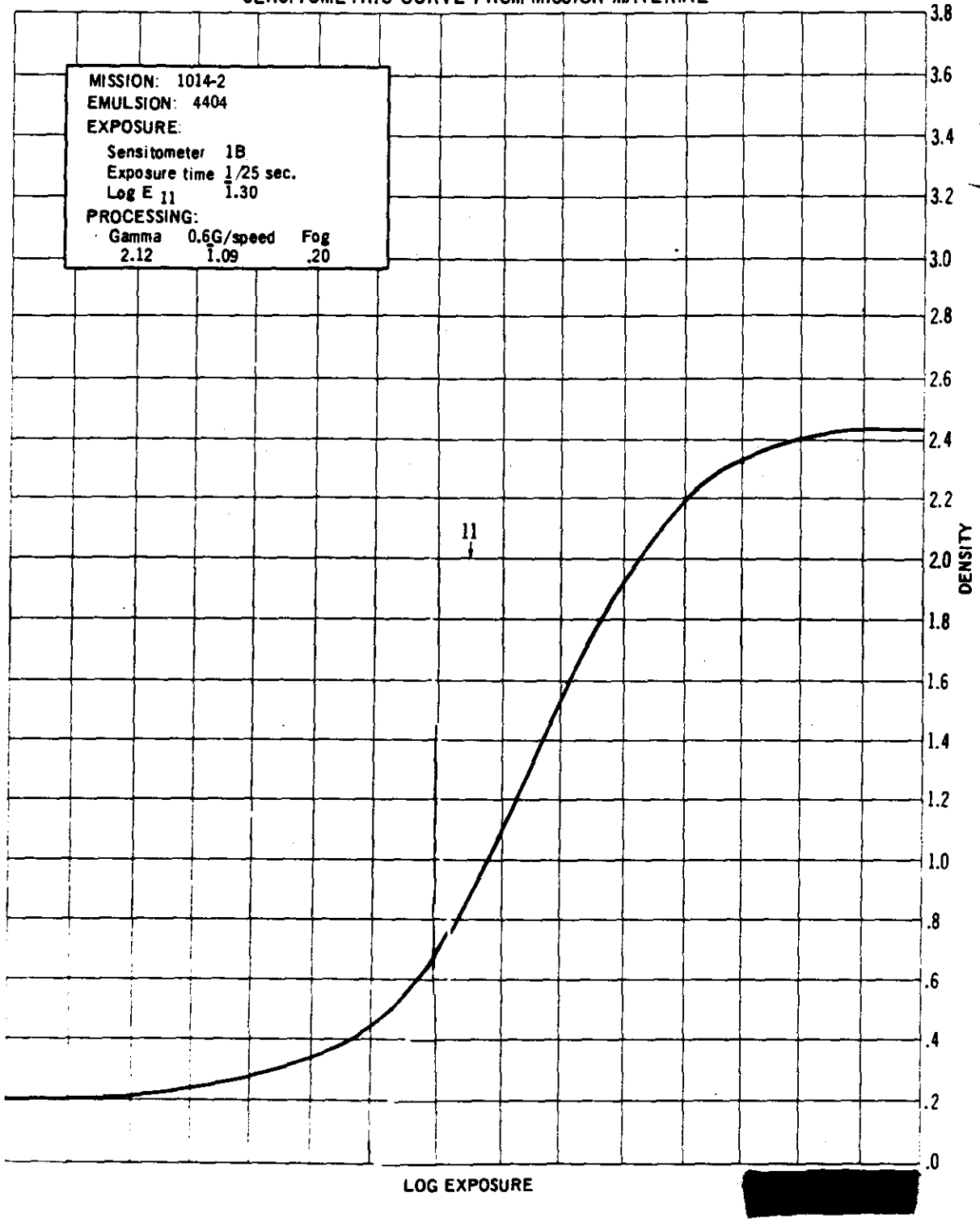
SENSITOMETRIC CURVE FROM MISSION MATERIAL



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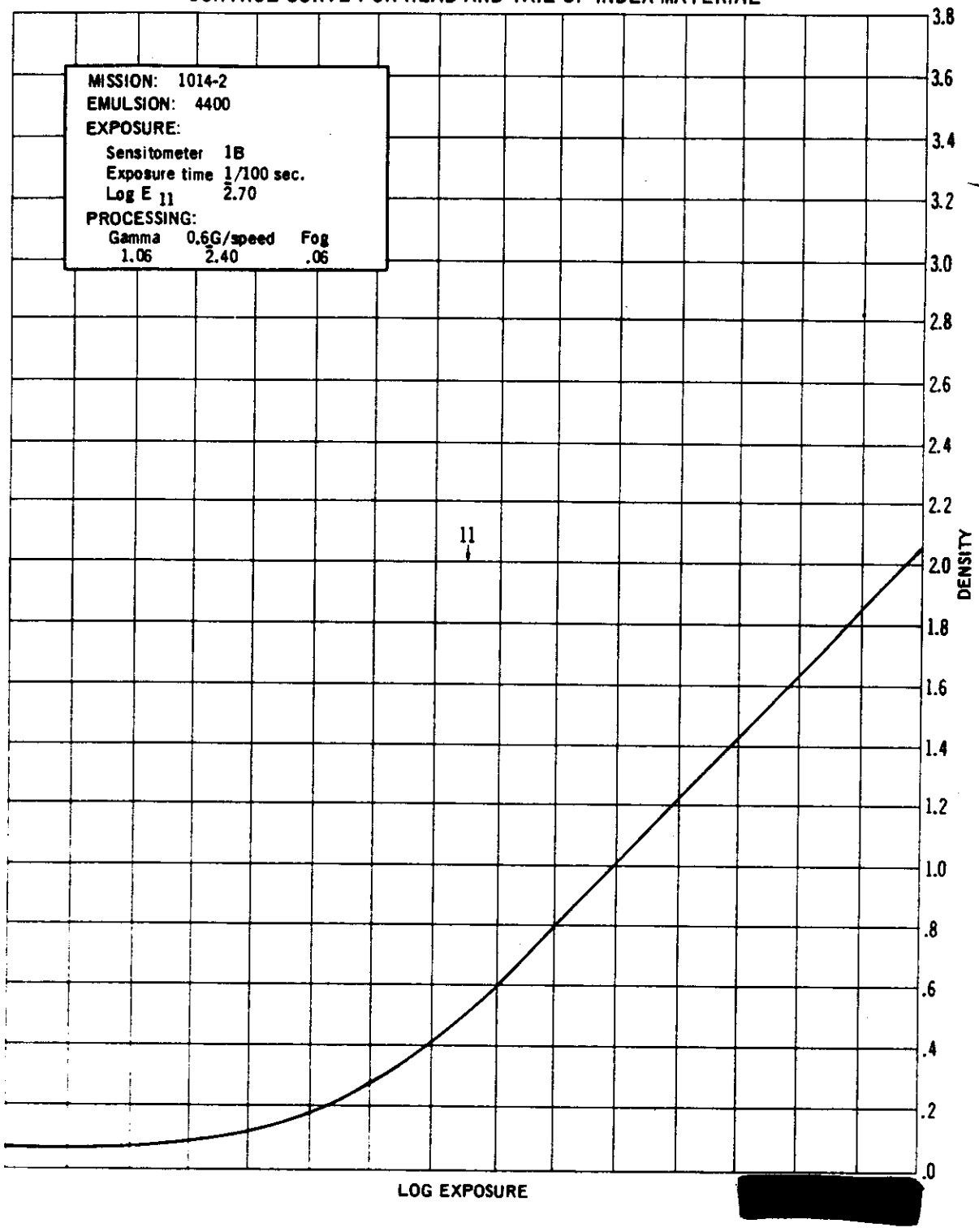

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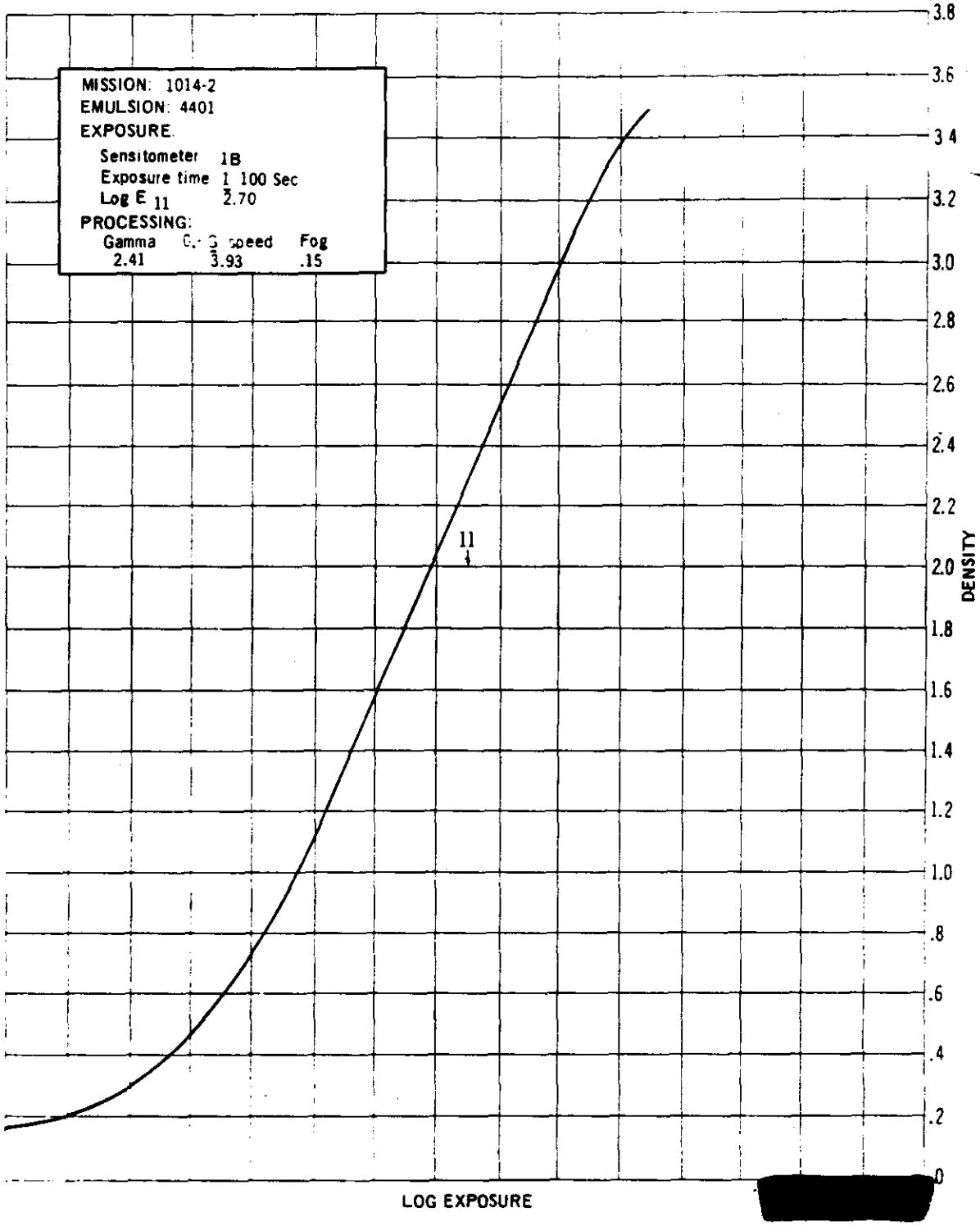

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5. Physical Film Degradations

This section provides data pertaining to the film degradations of this mission that are not attributed directly to camera operation.

a. Master (FWD) Panoramic Camera: There is an area of fog near the take-up end of the next-to-last frame of most passes. The configuration of the fog pattern is similar to that which results from a corona static discharge; however, the fog has been determined to be the result of a light leak rather than a corona discharge. Pass 16D, frame 15 is a good example of the fog pattern. Fog due to dendritic static discharges is present intermittently along both film edges on passes 133D, 134D, 135D, and 136D. The fog occasionally enters the format and degrades the imagery. Scratches, abrasions, pinholes, and handling marks are minor and intermittent throughout the mission.

b. Slave (AFT) Panoramic Camera: Areas of fog are present on the third and fifth frames of most passes, also on next-to-last, and third-from-last frames of most passes. The fog on the third frame is a diagonal streak near the take-up end; it originates at the frequency mark edge and extends across the entire width of the film. The fog affecting the fifth frame of a pass is also a diagonal streak and appears in or near the horizon format at the take-up end of the frame. The streak appears to originate at the binary data block edge and extends approximately 1 inch into the format. Another diagonal streak of fog appears near the binary data block of the next-to-last frame of most passes. It extends from edge to edge. Also on the next-to-last frame of most passes there is an area of fog which has been determined to be the result of a light leak, but has the same general configuration as corona static fog. This "corona-like" fog also appeared on the photography of Mission 1012. In association with the aforementioned fog there is a variety of equipment shadowgraphs. There is a similar pattern of fog on the fourth frame from the end of most passes. The cause of the aforementioned fog patterns has not been established, but they are believed to be the result of a vehicle light leak. The density of each fog pattern is commensurate with the duration of the associated camera-off period and the prevailing solar elevation.

[redacted]

Fog due to dendritic static discharges is intermittent at the frequency mark edge of passes 86D, 87D, 98D, 99D, 100D, and 120D. The fog occasionally intrudes into the format and degrades the imagery.

Pinholes, scratches, abrasions, and handling marks are minor and intermittent throughout the mission.

c. Index Camera Number D59 (1014-1): There is a continuous emulsion scratch 0.1 inches from and parallel to the correlation lamp edge of the film. There is a narrow plus-density streak on either side of the scratch, indicating that it occurred prior to development.

d. Index Camera Number D44 (1014-2): Fog due to dendritic static discharges is intermittent along the camera number edge throughout the mission. The fog often enters the format. This anomaly is not necessarily associated with camera operation, but it is mentioned in that section also because it is likely that it occurred in conjunction with the malfunction that degraded the stellar and index cameras of the mission.

e. Stellar Cameras Number 46 and 49: There were no physical degradations other than those mentioned in the Camera Operations section.

[redacted]

PART III. IMAGE QUALITY

1. Definition of Photographic Interpretation (PI) Suitability

PI suitability is an assessment of the information content of photographic reconnaissance material and its interpretability. A number of interrelated factors are involved, such as the quality of the photography, the extent of target coverage, scale, and weather limitations. However, the fundamental criteria for assigning a PI suitability rating may be reduced to (a) the scope of the photographic coverage and (b) the degree to which a photographic interpreter may extract useful and reliable information from the material.

PI suitability ratings are: Excellent, Good, Fair, Poor, and Unusable. These ratings refer to the overall interpretive value of the photography obtained from a particular reconnaissance mission. Individual targets may also be assigned PI suitability ratings. The standards that determine assignment of the various ratings are:

Excellent: The photography is free of degradations by camera malfunctions or processing faults and weather conditions are favorable throughout. The imagery contains sharp, well defined edges and corners with no unusual distortions. Contrast is optimum and shadow details, as well as details in the highlight areas, are readily detectable. Observation of small objects and a high order of mensuration are made possible by the consistently good quality of the photography.

Good: The photography is relatively free of degradations, or limiting atmospheric conditions. Edges and corners are well defined. No unusual distortions are present. Detection and accurate mensuration of small objects are feasible, but to a lesser degree than in material rated as Excellent.

Fair: Degradation is present and the acuity of the photography is less than optimum. Edges and corners are not crisply defined and there is loss of detail in shadow or highlight areas. Detection and identification of small objects are possible but accuracy of mensuration is limited by the fall-off in image quality and the less-than-optimum contrast.

Poor: Camera-induced degradations or weather limitations severely reduce the effectiveness of the photography. Definition of edges and corners are not well defined. Only gross terrain features and culture may be detected or identified and distortion of form may exist. Accurate mensuration of even large objects is doubtful.

Unusable: Degradation of photography completely precludes detection, identification, and mensuration of cultural details.

[redacted]

2. PI Suitability for Missions 1014-1 and 1014-2

The PI suitability of this mission is good. However, the general consensus of the subjective analysts is that the image quality is less than optimum. This opinion is borne out by objective analysis: RES and Edge Spread figures. The reason for the apparent degradation has not been determined, but the following paragraphs will deal with the factors of the mission that have a direct bearing on image quality and its interpretation suitability.

The initial PI report includes many derogatory statements about the photography accomplished in semidarkness; however, the interpreters are quick to express their preference for even poor photography rather than none at all.

The time of the launch and the inclination angle of the orbit were selected to produce the most favorable photographic conditions over the areas of particular interest. Because the prime areas of interest of this mission were different than those of most previous missions and because the solar elevation is not sufficient in the far northern latitudes to produce good imagery this time of year, the orbital parameters were considerably different than on most missions. The vehicle was launched at 2036Z, 1236 local. The inclination angle was 70.03 degrees. This combination resulted in the sun being nearly directly ahead of the vehicle throughout the mission. It was anticipated that the prevailing solar elevation and solar azimuth would be such that the angle of incidence between the principal ray of the Master (FWD) Panoramic camera and the rays of the sun would result in considerable flare; therefore, the Master (FWD) camera was equipped with a Wratten 25 filter instead of the normal Wratten 21.

A detailed study of the image quality reveals no consistent difference between the master (FWD) and the slave (AFT) camera image quality. Therefore, the conclusion is that the deeper filter (Wratten 25) did not degrade the imagery and in fact enhanced it. That is not to imply that it is better than the slave (AFT) camera photography, but rather that the quality was approximately equal where it would not have been if the Wratten 25 filter had not been used.

[redacted]

The Wratten 25 filter, being a deeper red than the Wratten 21 filter used on the slave camera, required an adjustment in the slit width to compensate for the loss of exposure. The slit width of the master camera was 0.25 inches, while the slit width of the slave camera was 0.175 inches. The filter factors are such that the resulting exposure is nearly identical.

Evaluation of the filter-exposure experiment is extremely complex because of the many variables. Among the considerations that must be taken into account on such a study are: terrain conditions (snow, green, wet, burned, dry, shadow, etc.), weather conditions, solar elevation, solar azimuth, azimuth of the principal ray, scan rate, slit width, emulsion speed, and processing level. In addition, the frames exposed before the camera system overcomes inertia and the frames processed during a transition period must be eliminated, together with any frames affected by an anomaly. It would therefore be impractical to attempt a detailed evaluation of the experiment in this report; however, certain observations were made which indicate, as previously mentioned, that the experiment was generally advantageous as far as the PI suitability is concerned.

The imagery of this mission does not generally display the acuity of most recent missions, but the image quality is consistent throughout and there appears to be little or no difference between the 2 panoramic cameras.

The lack of calibration between the panoramic cameras resulted in mensuration difficulties. If the stellar and index cameras had been functional, the difficulties would have been minimal, but because of the stellar and index camera malfunctions of Mission 1014-2, the mensuration on that portion of the mission was poor. Even on the photography of Mission 1014-1, the mensuration figures were not exact because of the lack of calibration. The analysts concerned with measurements could only assume an angle of convergence of 30 degrees.

[redacted]

Special prints or additional copies, designed to minimize the density difference of the original negative, were made on 24 parts of this mission; 17 from the Master (FWD) Panoramic Camera photography and 7 from the Slave (AFT) Panoramic Camera photography.

The density difference between the photography of the panoramic cameras does not appear to be significant, but it is interesting to note the difference in processing levels as indicated in the film processing section of this report.

The microdensitometric traces accomplished on each mission by the processing contractor and based on the A.I.M. 4404 curve indicate the following "average resolution": Mission 1014-1, 83.01 L/mm; Mission 1014-2, 74.2 L/mm. The validity of image evaluation through microdensitometery is a matter of conjecture. Such evaluations are considered to be a research and development effort and their results should be regarded as such. The best readings to date were on Mission 1010-1, where the "average resolution" was 89.4 L/mm. The poorest readings to date, 71.0 L/mm, were on Mission 1007-2.

Among the highlights of the mission, according to the photointerpreters, were:

a. A new rail spur entering a secured area.

b. Discovery of construction of two launch sites.

c. Discovery of construction suggesting preparation for a nuclear test.

d. Abandonment of an enemy launch site.

e. Eighty targets were reported in the preliminary readout on Mission 1014-1 and 46 on Mission 1014-2.

[redacted]

3. Stellar Reduction Study

a. Mission 1014-1: Various flares on the stellar camera photography made the process of stellar reduction difficult. Fiducial number 1 was excessively dense and was used for orientation on only the first 119 frames. The first 330 frames had good, clear star images. Tailing, streaking, double imaging, etc. became prevalent on the remaining frames. Following is a numerical summary of image conditions, listing the number of frames affected.

Double Images	Dumbell Shaped	Streaked	Comet Shaped	Flare	Weak
27	25	9	19	46	20

b. Mission 1014-2: The stellar film was not used to determine attitude. Attitude was determined from reduction of horizon images.

c. The mensuration process was less than optimum because the panoramic cameras were not calibrated to each other. Because of this, a basic convergence angle of 30 degrees was assumed.

[redacted]

4. Definition of Mission Information Potential (MIP)

The MIP is an arbitrary number, not limited by terminal values, which is subjectively assigned to the panoramic photography of a mission and which compares it to the other missions. It is meant to be a measure of the camera's maximum capability for recording information, discounting adverse atmospheric conditions, minimum solar elevations, camera malfunctions, or other factors which reduce the quality of the photography.

The MIP is based on the best photography found in a mission, even though the photography may be limited to a few frames. Since these frames are considered to be the best in the mission, they do not indicate the overall success, average quality, or general interpretability of the photography.

Criteria for selection of the MIP frame:

a. Eliminate all portions of the mission affected by system malfunctions.

b. Select frames which are free of clouds or atmospheric attenuation.

c. Eliminate the first 10 frames and last frame of a pass because these may be affected by incorrect scan speed.

d. Select frames that are in a continuous strip of approximately 10 cloud-free frames because cloud shadows from weather fronts are cast for great distances.

e. Determine from the horizon cameras that the panoramic photography is not affected by apparent vehicle perturbations.

f. Select targets that are near the center of the format and on frames as close as possible to perigee for scale purposes and to eliminate obliquity.

g. Select frames having near optimum solar elevation.

h. Select a high-contrast target (preferably an airfield) and compare the target to a previous mission which has been given an MIP rating.

[redacted]

5. MIP Rating for Mission 1014-1

Pass 79D, frame 8 FWD, is the frame which has been selected, according to the foregoing criteria, as the MIP frame. While the imagery of this frame is good, it fails to meet the standard accomplished by most recent missions; hence, the rating assigned to this frame is 80 whereas the rating assigned to most recent missions has been 85, and on 1006 was 90. This evaluation of image quality has been borne out by objective image evaluation methods. Microdensitometric traces and reciprocal edge spread readings yield lower values than we have come to expect from the photography of this system. The image quality of the Slave (AFT) Panoramic Camera is very similar to that of the Master (FWD) Panoramic Camera.

6. MIP Rating for Mission 1014-2

The MIP frame of Mission 1014-2 is pass 111D, frame 12 FWD. For the reasons explained in the preceding paragraph, the rating assigned to this frame is also 80. There is little or no difference in the quality of missions 1014-1 and 1014-2. There is also little difference in the image quality of the two panoramic cameras of this mission.

APPENDIX A. SYSTEM SPECIFICATIONS

1. CAMERAS

	Master Panoramic	Master Port Horizon	Master Stbd Horizon	Slave Panoramic	Slave Port Horizon	Slave Stbd Horizon	Mission 1014-1		Mission 1014-2	
							Stellar	Index	Stellar	Index
Camera No	162	NA	NA	139	NA	NA	49	53	46	50
Lens Serial No	137243	814016	812284	1122435	814024	812305	11205	813058	11166	813048
Slit Width	0.250"	NA	NA	0.175	NA	NA	NA	NA	NA	NA
Aperture	f/3.5	f/6.8	f/8.0	f/3.5	f/8.0	f/6.8	f/1.8	f/4.5	f/1.8	f/4.5
Exposure Time	NA	1/100 sec.	1/100 sec.	NA	1/100 sec.	1/100 sec.	2.0 sec.	1/500 sec.	2.0 sec.	1/500 sec.
Filter	Wratten 25	Wratten 25	Wratten 25	Wratten 21	Wratten 25	Wratten 25	None	Wratten 21	None	Wratten 21
Focal Length (mm)	609.577	54.42	54.5	609.602	55.10	55.02	*	38.08	*	38.41
Film Length	16,000	NA	NA	16,000	NA	NA	45'	90'	45'	90'
Splices	4	NA	NA	4	NA	NA	None	None	None	None
Emulsion	77-7-9-4	77-7-9-4	77-7-9-4	77-7-9-4	77-7-9-4	77-7-9-4	44-30-7-4	31-4-7-4	44-30-7-4	31-4-7-4
Film Type	4404	4404	4404	4404	4404	4404	4401	4400	4401	4400
Res. Data L/mm (A)	*	100.6	*	*	89.4	82.9	*	71.4	*	73.9
Static										
High Contrast	257	*	*	273	*	*	*	*	*	*
Low Contrast	154	*	*	143	*	*	*	*	*	*
Dynamic:										
I High Contrast	166	*	*	178	*	*	*	*	*	*
I Low Contrast	126	*	*	126	*	*	*	*	*	*
P High Contrast	189	*	*	190	*	*	*	*	*	*
P Low Contrast	116	*	*	116	*	*	*	*	*	*

NA = Not Applicable
* = Not Available
(A) = Awar

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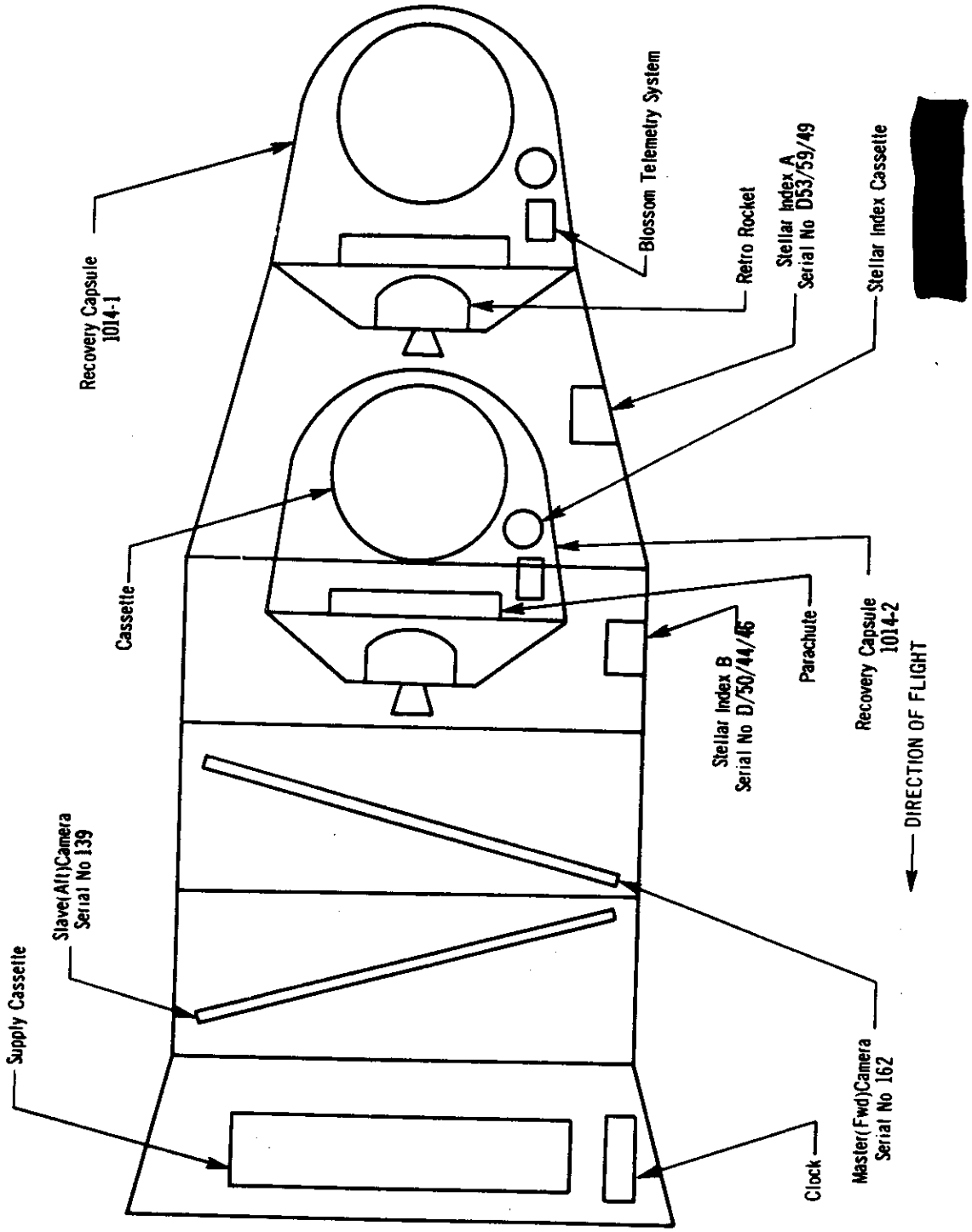
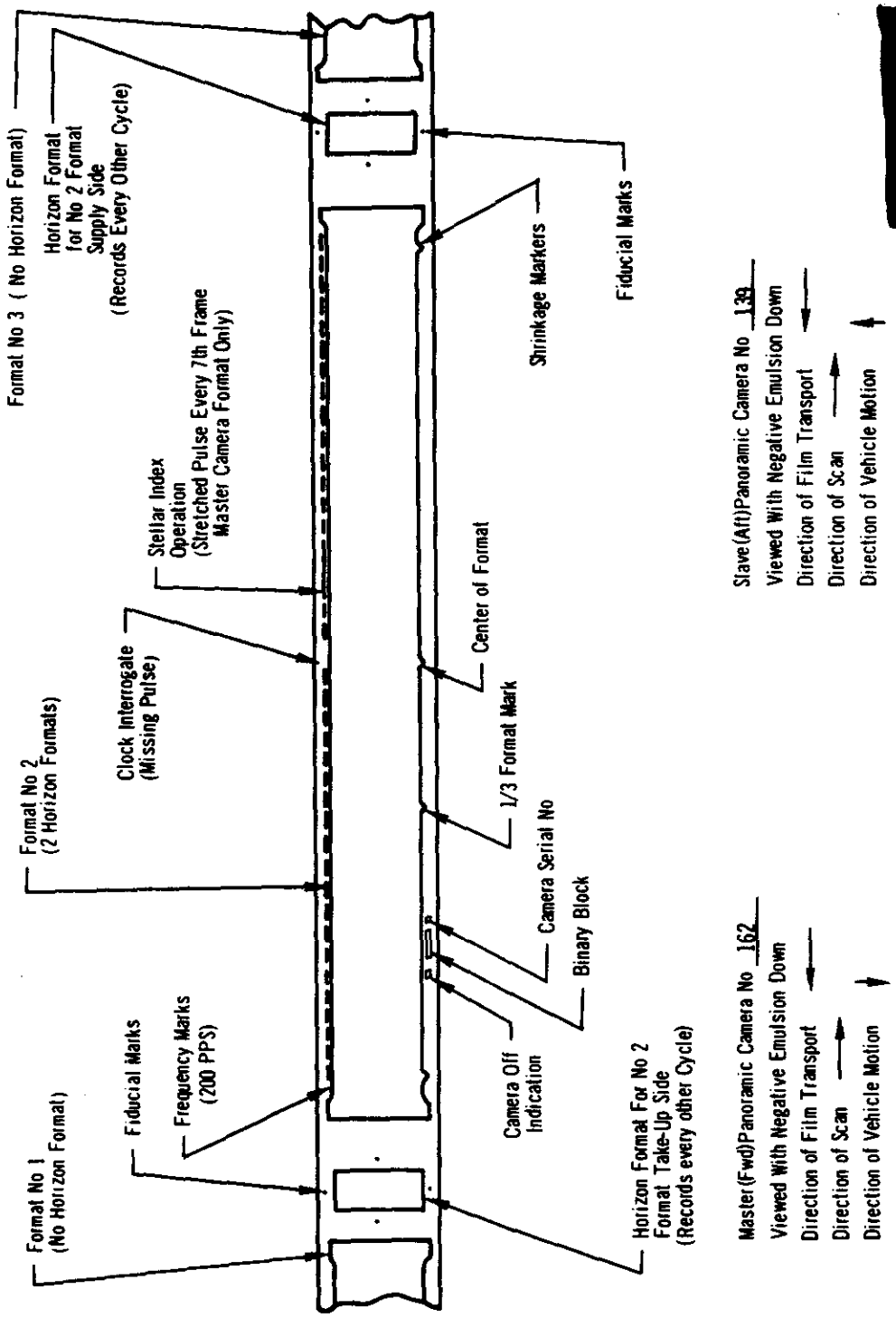
2. VEHICLE LAYOUT



3. FILM SPECIFICATIONS
FORMAT LAYOUT



[redacted]

DEFINITION OF PANORAMIC CAMERA FORMAT CALIBRATIONS:

Measurements are made with respect to collimator targets fixed with respect to the mechanical interface between the total payload assembly and the orbital vehicle.

Two sets, of 3 targets each, are aligned to be coplanar within ±5 seconds of arc so positioned as to form an angle of -15.00 degrees ±5 seconds to the mechanical interface for master camera calibrations and an angle of +15.00 degrees ±5 seconds to the mechanical interface for slave camera calibrations.

A. Target 1 of each set is imaged on the terrain format.

B. The second and third targets of each set are at angles of 75.00 degrees ±5 seconds from target 1 and are imaged on the horizon formats.

The indicated center of format for the panoramic cameras is given by the intersection of a line through the center of mass of the central shrinkage marker drawn normal to the edge of format containing the shrinkage marker and a line parallel to the same edge located at a position half-way between the format edges.

The indicated principal points of the horizon cameras are the points of intersection of lines joining opposite fiducials.

Xvo and Yvo are the offsets of target 1 from the indicated center of format of the panoramic cameras as defined in Paragraph 3.

Xs, Ys and Xt, Yt are the offsets of targets 2 and 3 from the indicated principal points of the supply and take-up horizon cameras respectively.

The indicated flight direction is the direction of vehicle travel during orbit. The forward edge of format is the edge opposite the shrinkage markers for the slave camera.

Dimensions A, B, and C are the spacings of the shrinkage markers, and dimensions D and E are the spacings of the Y axis fiducials. Techniques for exact measurement of these dimensions have not been developed. The figures quoted are measurements made on hand-processed film without control of shrinkage.

The format dimensions are measured to the best estimate of format edge.

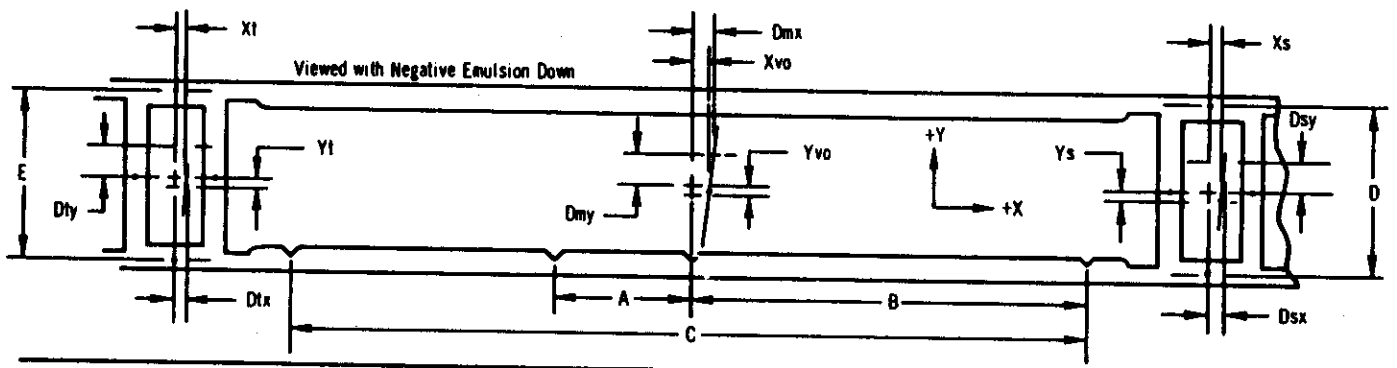
Measurement of the angle between the indicated axis of the panoramic cameras and the line of intersection of the plane defined in Paragraph 2

[redacted]

on the format is obtained from the offset dimensions Dmx and Dmy of target-1 for each camera.

Measurement of the angle between the indicated axis of the horizon cameras and the line of intersection of the plane defined in Paragraph 2 on the format is made by measuring the scan direction offset of the targets defined in Paragraph 2B at a fixed distance from the target center in the Y direction. Dimensions Dtx, Dty, Dsx, and Dsy are the offsets of these measurements.

5. FILM SPECIFICATIONS
FORMAT DIMENSIONS



Master (Fwd) Camera 162		Vehicle Motion		Scan Direction	
A	76.1	Xt	+0.231 •	Dtx	+0.227 •
B	355.1	Yt	-0.098 •	Dty	+2.854 •
C	709.9	Xs	-0.526 •	Dsx	-0.522 •
D	56.468	Ys	-0.050 •	Dsy	+2.910 •
E	56.436	Xvo	+1.375 •	Dmx	+1.382 •
		Yvo	+0.794 •	Dmy	+3.794 •

Format dimensions:

	Panoramic
Height	55.787
Width	754.0

Slave (Alt) Camera 139		Vehicle Motion		Scan Direction	
A	76.1	Xt	+0.102 •	Dtx	+0.098 •
B	355.1	Yt	-0.014 •	Dty	+2.149 •
C	710.2	Xs	+0.258 •	Dsx	+0.249 •
D	56.450	Ys	+0.100 •	Dsy	-2.519 •
E	56.483	Xvo	-0.731 •	Dmx	-0.738 •
		Yvo	+1.448 •	Dmy	+4.448 •

Format dimensions:

	Panoramic
Height	55.729
Width	756.2

NOTE: 1. All dimensions are in millimeters and are average dimensions of three formats
2. Height of main format is taken at center of format
3. Dt, Dm, Ds, X and Y dimensions are taken 10 mm above point defining target center
4. Format Sign Convention

-X+Y	+X+Y
-X-Y	+X-Y

*INSTRUMENTS 162 AND 139 WERE NOT CALIBRATED AS A SYSTEM

[redacted]

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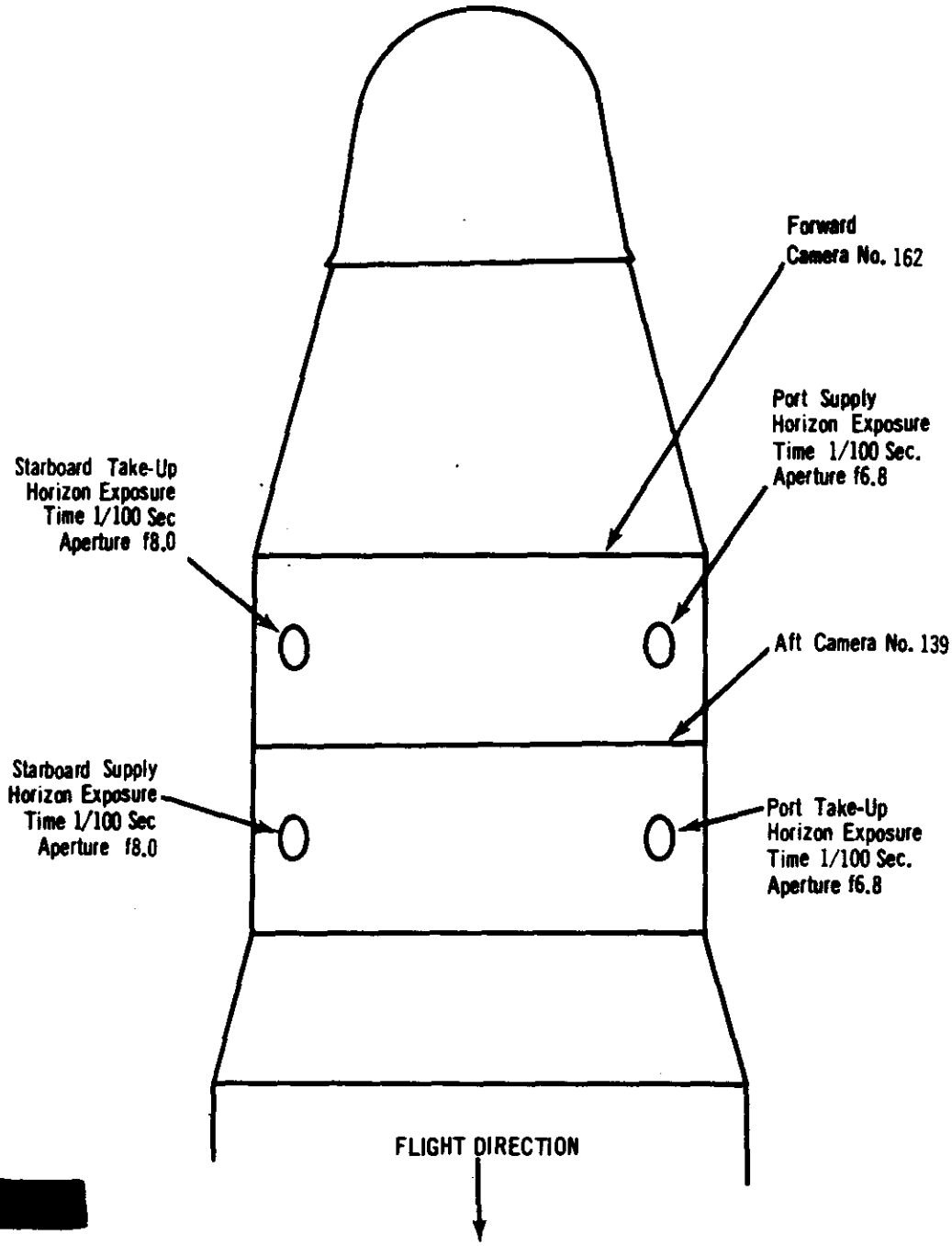
[redacted]

6. HORIZON LENS SETTINGS
(Viewed from top of vehicle in flight)



[redacted]

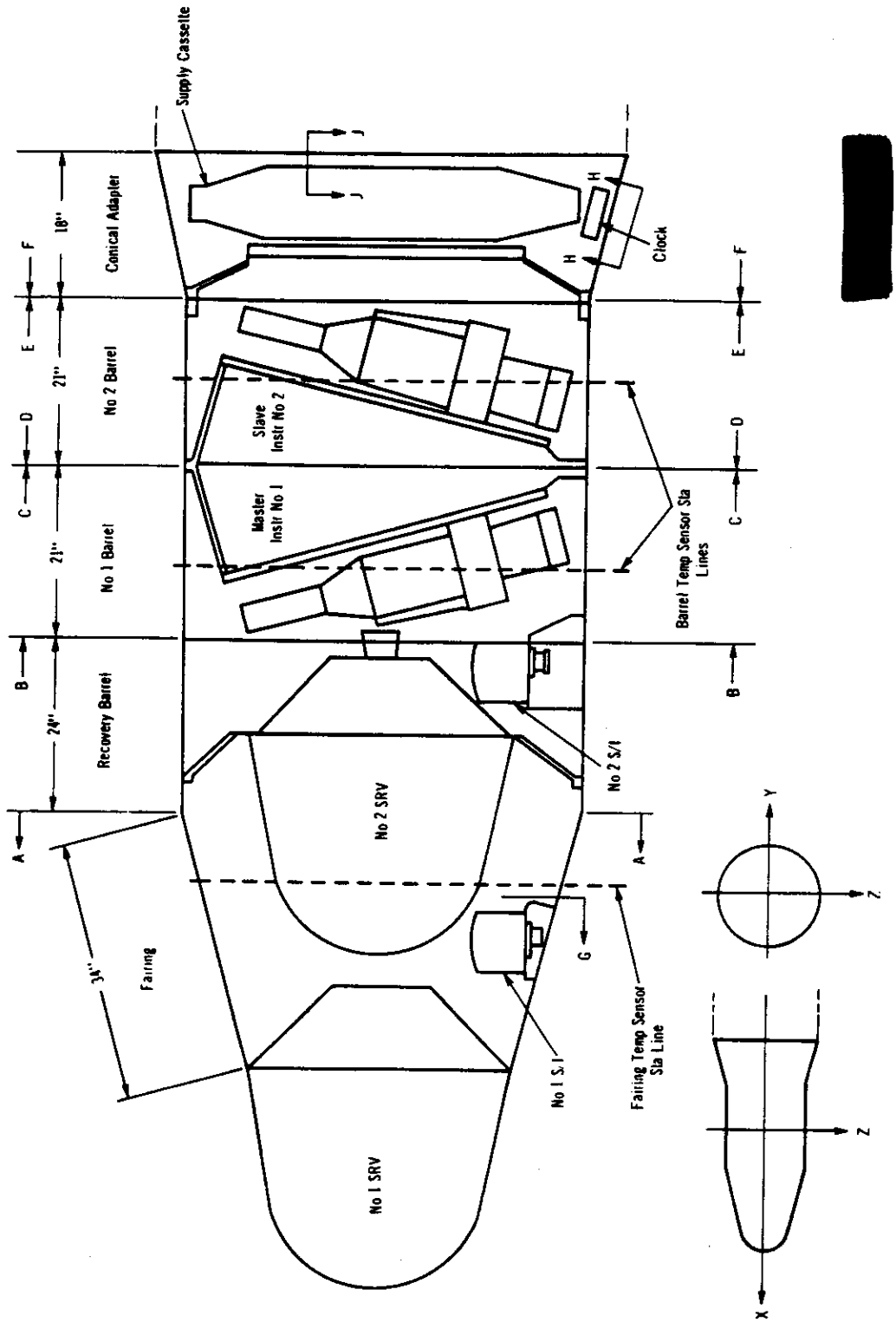
[redacted]

APPENDIX B. TEMPERATURE DATA

Temperatures of the various components of this system are not considered to have been detrimental to the image quality of the mission. However, the following data, as supplied by the vehicle manufacturer, is presented in the interest of comparative analysis.

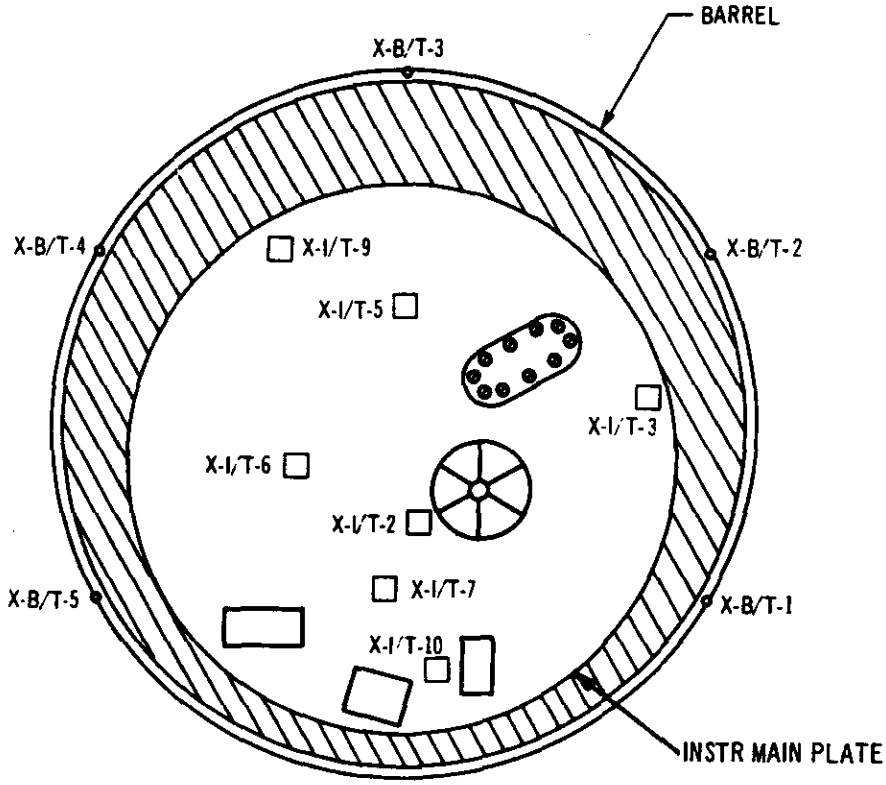
In analyzing the average temperatures recorded by the sensors during the mission, note the extreme temperatures at launch and the gradual cooling as the mission progresses. Also note the sudden change in temperature at recovery battery B SRV as the heaters were activated between orbits 79 and 89.

"J" PROFILE TO SHOW APPROXIMATE TEMP SENSOR LOCATIONS

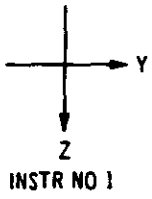


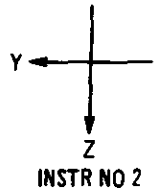
[redacted]

NO 1 & NO 2 INSTR TEMP SENSORS (BACKFACE)
NO 1 & NO 2 BARREL TEMP SENSORS (SKIN)



VIEW C-C & D-D
INSTR NO 2 LOOKING AFT
INSTR NO 1 LOOKING FWD



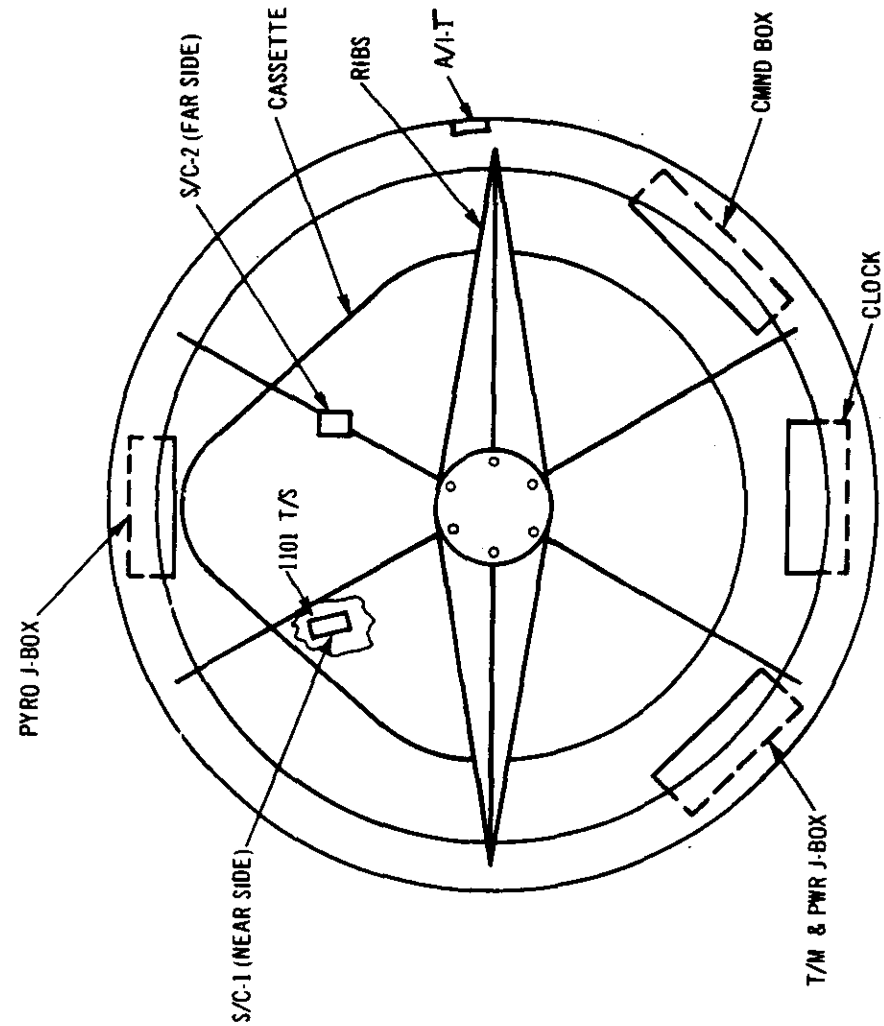


KEY.
X denotes No 1 or No 2 instr or barrel
e.g. X-I. T- 6 is No 1 or No 2 instr-
instr temp sensor No 6
X-B T-4 is No 1 or No 2 barrel temp
sensor No 4

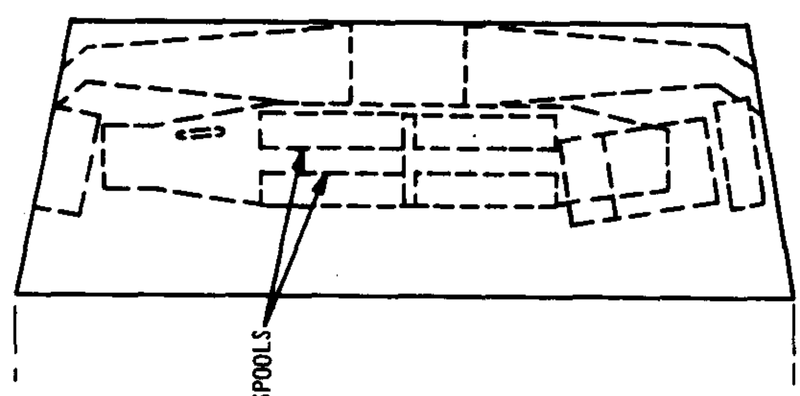
[redacted]

[redacted]

VIEW E-E SUPPLY CASSETTE LOOKING AFT



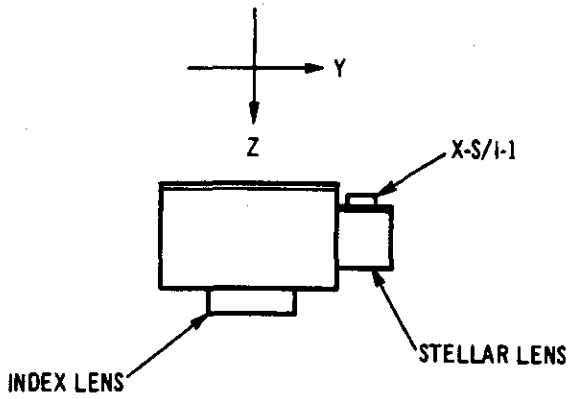
SIDE VIEW SHOWING SPOOLS



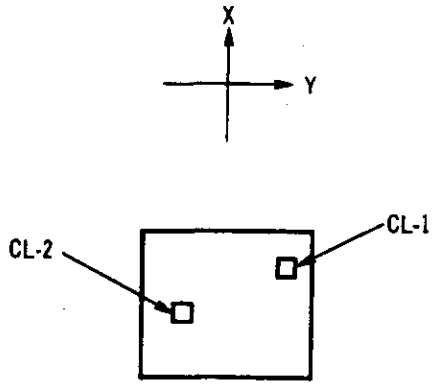
[redacted]

[redacted]

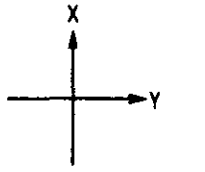
VIEW G-G
S/I TEMP SENSOR

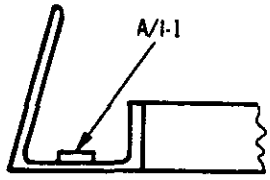


VIEW H-H
CLOCK TEMP SENSOR



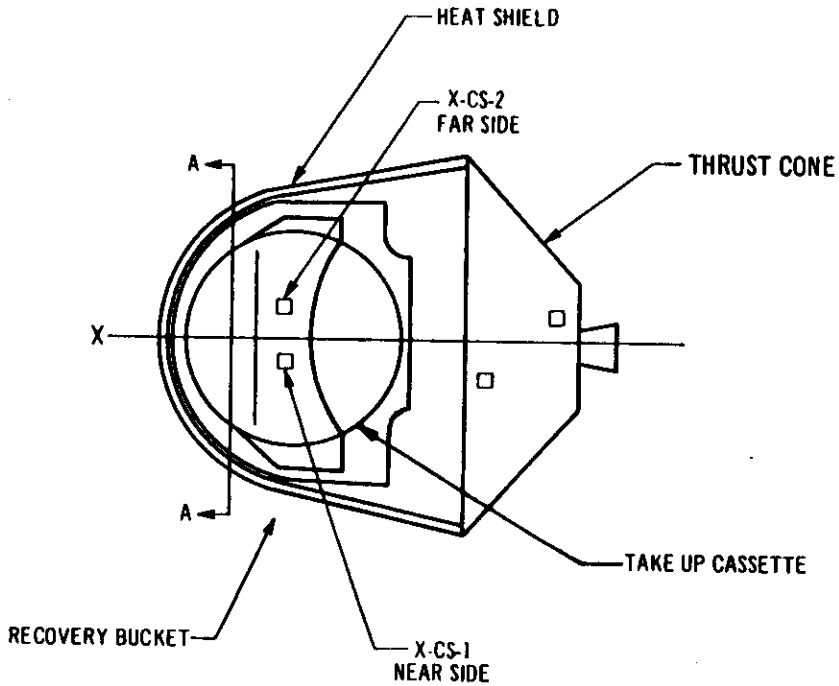
VIEW J-J
INTERFACE TEMP SENSOR
(SENSOR ON-Y AXIS)

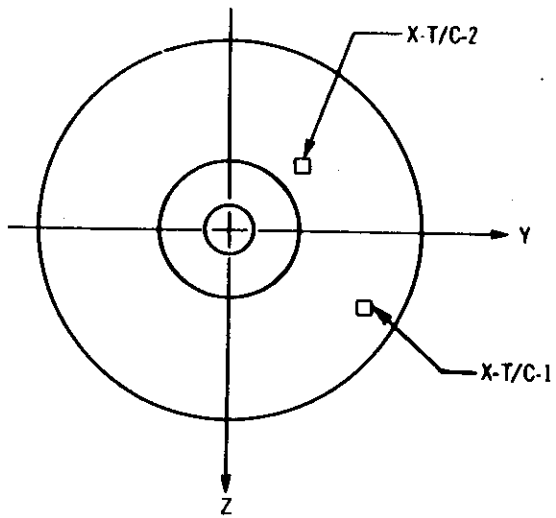


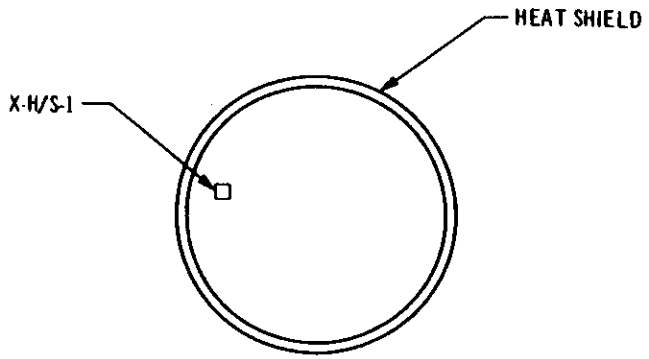


[redacted]

NO 1 AND NO 2 SRV TEMP SENSORS







SECTION A-A

KEY:

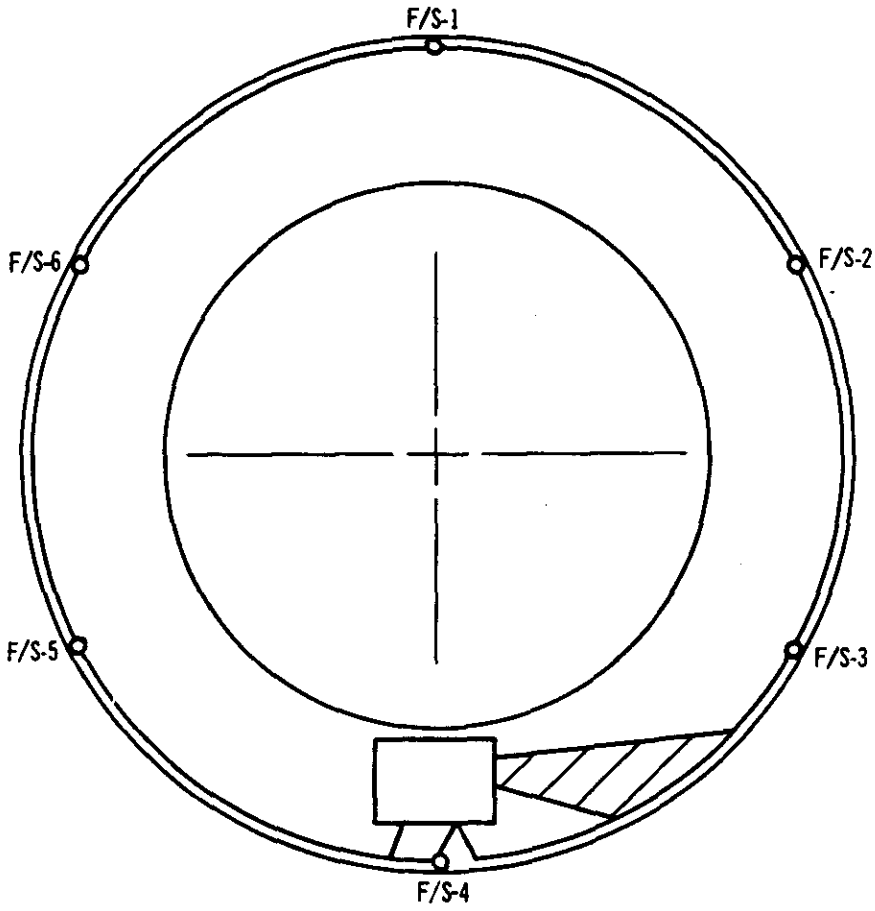
X denotes No 1 or No 2 SRV
e.g.
X-T/C-2 is
No 2 SRV-thrust
cone temp sensor-2

[redacted]

[redacted]

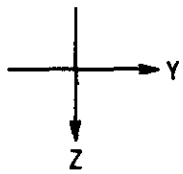
[redacted]

FAIRING TEMP SENSORS



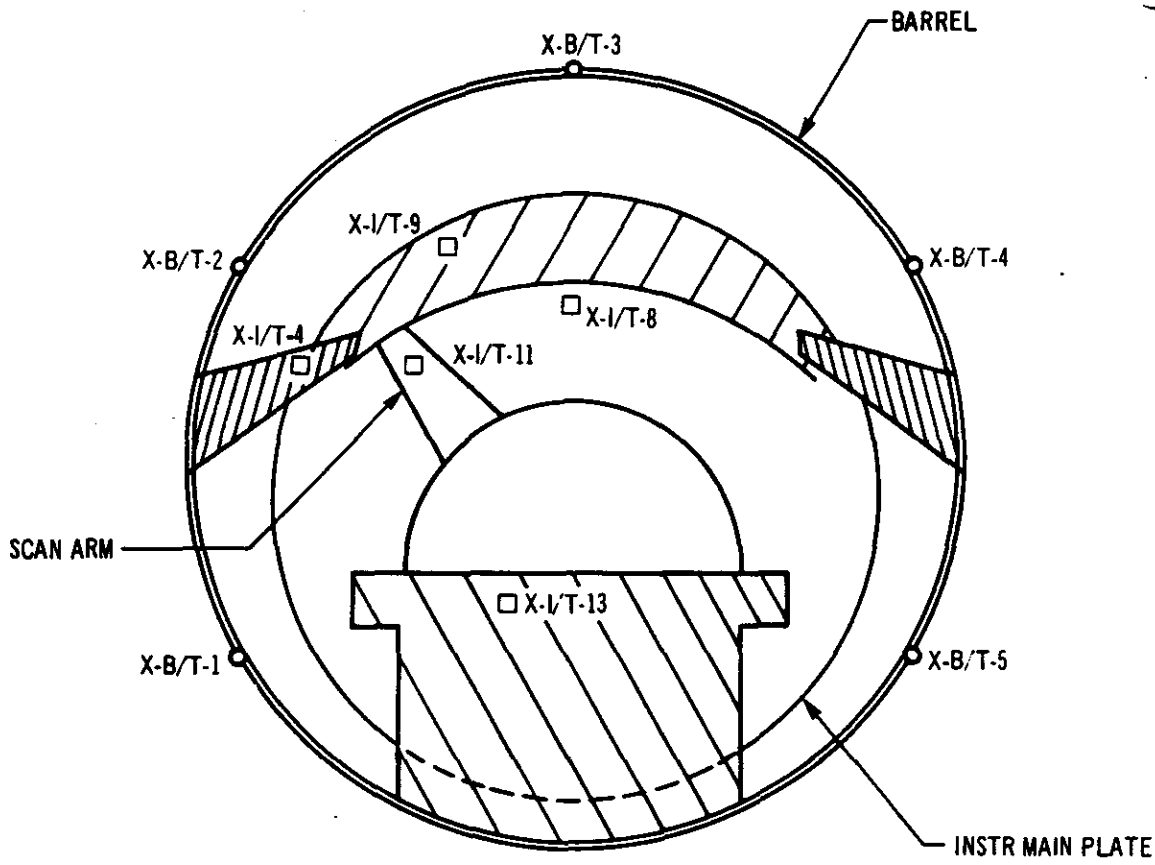
VIEW A-A
LOOKING FORWARD

[redacted]

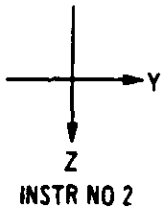


[redacted]

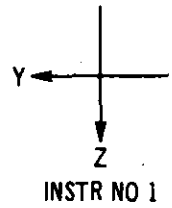
NO 1 & NO 2 TEMP SENSORS (FRONT FACE)
NO 1 & NO 2 BARREL TEMP SENSORS (SKIN)



VIEW B-B & F-F
INSTR NO 1 LOOKING AFT
INSTR NO 2 LOOKING FWD



INSTR NO 2



INSTR NO 1

[redacted]

2. Temperature Samplings

SENSOR	ORBITS ACQUIRED																		
Master	Launch	09	16	25	32	42	48	57	64	73	79	89	95	105	111	121	127	137	143
3	67	57	55	58	53	55	52	53	51	51	50	46	45	45	44	46	44	46	44
4	71	65	62	66	60	63	59	59	56	59	55	53	52	51	51	52	50	51	50
5	68	66	64	68	61	65	59	59	58	58	56	53	51	51	49	51	49	51	48
6	67	73	72	72	68	69	66	66	63	63	62	46	55	55	54	54	53	52	52
7	66	69	67	68	64	67	63	63	61	62	60	55	54	55	53	54	53	53	53
8	72	67	66	70	62	67	60	62	59	61	58	55	52	54	50	52	50	52	50
9	65	70	67	69	63	67	61	63	59	61	58	54	52	51	50	51	48	50	48
10	66	63	62	63	59	61	58	58	55	56	54	51	50	50	48	50	47	48	47
11	98	77	72	78	66	70	66	68	61	65	60	58	53	60	53	55	53	55	52
12	72	56	54	61	53	58	51	53	50	53	49	48	44	48	43	47	43	48	42
13	69	70	69	71	63	65	63	62	60	62	59	54	53	50	52	49	52	50	50
AVG. INSTR. TEMP.	68	65	64	67	61	64	59	61	57	59	56	51	51	51	49	50	49	50	48
Slave																			
3	66	72	66	69	62	66	60	60	56	56	53	51	46	49	43	45	41	43	42
4	67	69	63	69	59	64	58	59	52	57	52	51	45	49	43	46	41	44	41
5	66	64	60	65	57	61	56	56	51	54	51	49	45	49	44	46	42	44	43
6	68	62	60	62	58	59	57	57	52	56	53	50	48	49	47	48	45	47	47
7	72	61	62	67	60	62	59	61	56	59	55	53	50	55	50	51	48	50	48
8	66	65	58	63	55	60	55	56	52	54	51	49	45	48	43	45	43	45	43
9	67	59	53	58	51	55	51	52	50	51	47	46	43	45	42	44	42	45	42
10	67	59	58	60	56	57	54	56	51	53	51	48	46	50	44	44	44	45	43
11	90	61	61	61	58	58	56	56	55	54	53	49	47	47	46	47	45	46	45
12	67	71	63	69	60	66	58	60	55	58	52	53	46	51	43	46	42	45	42
13	67	60	62	62	59	59	58	57	56	55	56	49	49	45	47	44	47	45	47
AVG. INSTR. TEMP.	67	64	60	64	58	61	57	57	53	55	52	50	46	50	45	46	44	46	44
Supply Spool																			
1	69	53	56	58	56	55	52	53	52	52	50	48	44	48	42	43	41	43	41
2	67	62	60	63	58	61	57	58	56	56	53	49	46	49	42	44	43	43	42

NOTE: All data corrected for self-heating, except injection.
X - Indicates not included in average.

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NO FOREIGN DISSEM

SENSOR		ORBITS ACQUIRED										"A"							
Fairing ("A")	Barrel #1 ("B")	Launch	09	16	25	32	42	48	57	64	73	79	89	95	105	111	121	127	137	143
	1	OBH	43	27	43	24	40	21	40	80	40	24	-7	0	0	-3	0	0	3	0
	2	OBH	9	-4	9	-4	9	-4	9	-4	12	-4	0	-7	7	-3	10	3	13	3
	3	OBH	-1	2	2	2	-1	-1	-1	-4	2	2	22	18	28	19	22	18	22	18
	4	206	56	47	53	47	50	44	47	40	50	40	28	25	28	22	22	16	19	9
	5	220	79	72	79	66	72	60	69	53	66	50	28	28	28	21	24	21	21	18
	6	199	66	66	66	57	60	47	57	41	54	38	--	--	--	--	--	--	--	--
Barrel No. 2																				
	1	133	49	59	49	56	43	46	36	40	36	33	24	20	20	17	17	14	17	14
	2	127	49	71	49	62	43	53	36	46	33	43	27	27	27	21	21	17	14	11
	3	161	17	27	20	23	17	20	14	17	14	24	11	14	20	24	14	17	14	14
	4	194	0	-6	0	-10	0	-10	0	-6	3	-3	0	-10	3	-3	7	0	10	3
	5	174	13	13	13	13	13	13	13	13	16	13	0	6	6	6	10	6	16	6
Conic Adapter																				
	1	145	76	73	76	66	70	60	60	51	57	48	38	28	35	25	32	22	28	19
Clock																				
	1	95	75	71	75	71	73	69	71	69	71	67	60	56	58	56	58	54	60	54
	2	97	73	69	73	69	71	67	69	65	67	65	58	54	56	52	56	50	56	52
Thrust Cone "A" to "B" SRV																				
	1	116	47	42	44	39	41	39	42	36	41	37	56	55	54	54	54	54	55	54
	2	78	66	60	61	56	56	54	55	51	52	50	57	55	55	54	52	52	52	52
Stellar/Index "A" to "B"																				
	1	82	66	61	64	61	61	58	54	54	54	54	46	49	52	46	46	46	49	46
	2	75	63	60	60	57	60	57	57	54	54	54	47	47	43	43	47	47	43	43
Recovery Batt. "B" SRV																				
	1	72	74	73	72	71	71	71	69	69	66	67	92	88	81	85	92	94	83	81
Master Cassette "A" SRV																				
	2	89	38	31	32	25	29	25	30	26	28	26	--	--	--	--	--	--	--	--

NOTE: Only Thrust Cone and "A" Cassette Data corrected for Self-heating.

TOP SECRET
CORONA
NO FOREIGN DISSEM

[redacted]

APPENDIX C. DENSITY READINGS

Mission 1014-1

STELLAR						INDEX								
						LIMITING					TERRAIN			
Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta
1D	1	2.48	0.49	1.99	0.16	1D	1	0.89	0.14	0.71	0.08	NR	NR	--
	2	2.52	0.49	2.03	0.16		2	1.16	0.13	1.03	0.08	NR	NR	--
2D	3	1.42	0.20	1.22	0.16	2D	3	0.52	0.09	0.43	0.08	0.52	0.09	0.43
	10	1.81	0.26	1.56	0.15		10	0.98	0.11	0.87	0.08	0.73	0.20	0.53
3D	11	1.92	0.34	1.58	0.16	3D	11	1.38	0.16	1.22	0.08	1.22	0.32	0.90
	15	2.01	0.34	1.67	0.16		15	1.34	0.16	1.18	0.08	1.34	0.32	1.02
4D	16	1.57	0.21	1.36	0.16	4D	16	0.48	0.14	0.34	0.08	0.48	0.14	0.34
	25	2.35	0.46	1.89	0.15		25	1.18	0.17	1.01	0.08	1.18	0.26	0.92
6D	26	2.28	0.36	1.92	0.14	6D	26	1.02	0.24	0.78	0.08	NR	NR	--
	39	1.96	0.18	1.78	0.16		39	1.63	0.19	1.44	0.07	0.50	0.19	0.31
7D	40	2.42	0.40	2.02	0.15	7D	40	0.98	0.49	0.49	0.07	NR	NR	--
	50	2.06	0.43	1.63	0.16		50	0.98	0.32	0.66	0.07	0.71	0.38	0.33
8D	51	2.42	0.34	2.08	0.15	8D	51	1.09	0.38	0.71	0.07	NR	NR	--
	63	2.38	0.42	1.96	0.16		63	1.17	0.25	0.92	0.08	0.63	0.25	0.38
9AE	64	NR	NR	--	0.16	9AE	64	NR	NR	--	0.08	NR	NR	--
	66	NR	NR	--	0.16		66	NR	NR	--	0.08	NR	NR	--
10D	67	2.48	0.46	2.02	0.16	10D	67	1.64	0.38	1.26	0.08	0.62	0.38	0.24
	68	2.60	0.42	2.18	0.16		68	1.72	0.38	1.34	0.07	0.58	0.38	0.20
14D	69	2.19	0.44	1.75	0.16	14D	69	1.24	0.12	1.12	0.07	0.80	0.31	0.49
	71	2.20	0.42	1.78	0.15		71	1.60	0.18	1.42	0.07	0.56	0.24	0.32
16D	72	2.42	0.36	2.06	0.15	16D	72	1.02	0.14	0.88	0.07	NR	NR	--
	74	2.16	0.40	1.76	0.15		74	0.91	0.16	0.75	0.07	NR	NR	--
17D	75	1.42	0.19	1.23	0.15	17D	75	0.30	0.09	0.21	0.07	0.30	0.09	0.21
	77	1.70	0.22	1.48	0.14		77	0.35	0.13	0.22	0.07	0.22	0.13	0.09
21D	78	2.32	0.42	1.90	0.14	21D	78	1.10	0.24	0.86	0.07	1.10	0.24	0.86
	92	2.16	0.42	1.74	0.15		92	1.04	0.22	0.82	0.07	0.52	0.36	0.16
22D	93	2.19	0.44	1.75	0.15	22D	93	0.82	0.41	0.41	0.07	0.70	0.52	0.18
	119	2.52	0.43	2.09	0.15		119	1.61	0.19	1.42	0.07	0.56	0.19	0.37
23D	120	1.52	0.20	1.32	0.15	23D	120	0.20	0.09	0.11	0.07	0.20	0.09	0.11
	139	2.32	0.32	2.00	0.16		139	0.78	0.30	0.48	0.08	0.62	0.30	0.32
26D	140	2.18	0.32	1.86	0.16	26D	140	1.44	0.11	1.33	0.08	0.40	0.31	0.09
	143	2.54	0.42	2.12	0.16		143	1.42	0.40	1.02	0.08	0.76	0.40	0.36
30D	144	2.26	0.43	1.83	0.16	30D	144	1.18	0.27	0.91	0.08	0.60	0.24	0.36
	146	2.23	0.32	1.91	0.16		146	1.52	0.18	1.34	0.08	0.80	0.42	0.38
32D	147	2.53	0.46	2.07	0.16	32D	147	1.40	0.28	1.12	0.08	NR	NR	--
	148	2.31	0.39	1.92	0.16		148	1.23	0.34	0.89	0.08	NR	NR	--
33D	149	1.34	0.18	1.16	0.16	33D	149	NR	NR	--	0.08	NR	NR	--
	152	1.80	0.21	1.59	0.16		152	0.38	0.12	0.26	0.08	0.38	0.14	0.24
35D	153	1.38	0.18	1.20	0.16	35D	153	0.14	0.08	0.06	0.07	0.14	0.08	0.06
	158	2.28	0.26	2.02	0.16		158	0.50	0.12	0.38	0.08	0.50	0.14	0.36
37D	159	2.28	0.50	1.78	0.16	37D	159	0.80	0.28	0.52	0.08	0.60	0.28	0.32
	170	2.58	0.47	2.11	0.15		170	0.72	0.17	0.55	0.08	0.59	0.22	0.37
38D	171	2.68	0.42	2.26	0.14	38D	171	0.94	0.20	0.74	0.08	0.39	0.20	0.19
	187	2.80	0.75	2.05	0.15		187	1.58	0.26	1.32	0.08	NR	NR	--
39D	188	1.70	0.17	1.53	0.15	39D	188	0.13	0.08	0.05	0.08	0.13	0.08	0.05
	205	2.50	0.43	2.07	0.15		205	1.61	0.12	1.49	0.07	1.61	0.22	1.39
41AE	206	NR	NR	--	0.15	41AE	206	NR	NR	--	0.07	NR	NR	--
	207	NR	NR	--	0.15		207	NR	NR	--	0.07	NR	NR	--
41D	208	2.79	0.65	2.13	0.16	41D	208	1.24	0.58	0.66	0.08	NR	NR	--
	217	2.72	0.68	2.04	0.15		217	1.32	0.20	1.12	0.07	0.48	0.24	0.24

NR - Denotes No Reading Made

[redacted]

Mission 1014-1 (Continued)

STELLAR						INDEX								
						LIMITING						TERRAIN		
Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta
46D	218	2.30	0.31	1.99	0.16	46D	218	0.83	0.24	0.59	0.07	0.51	0.28	0.23
	221	2.09	0.46	1.63	0.15		221	1.26	0.22	1.04	0.08	NR	NR	--
47D	222	2.68	0.49	2.19	0.15	47D	222	1.24	0.22	1.02	0.08	1.02	0.22	0.80
	224	2.59	0.60	1.99	0.14		224	1.12	0.36	0.76	0.08	1.08	0.36	0.72
48D	225	2.58	0.49	2.09	0.15	48D	225	1.42	0.21	1.21	0.08	NR	NR	--
	227	2.72	0.51	2.21	0.15		227	1.82	0.12	1.70	0.08	NR	NR	--
51D	228	1.44	0.18	1.26	0.15	51D	228	NR	NR	--	0.08	NR	NR	--
	239	2.70	0.51	2.19	0.16		239	1.23	0.72	0.51	0.08	NR	NR	--
52D	240	1.42	0.18	1.24	0.16	52D	240	NR	NR	--	0.08	NR	NR	--
	259	2.68	0.51	2.17	0.16		259	0.75	0.20	0.55	0.08	0.38	0.32	0.06
53D	260	1.89	0.22	1.67	0.16	53D	260	0.27	0.12	0.15	0.08	0.27	0.12	0.15
	277	3.19	0.92	2.27	0.14		277	1.62	0.33	1.29	0.08	0.59	0.38	0.21
54D	278	1.81	0.20	1.61	0.15	54D	278	0.24	0.10	0.14	0.08	NR	NR	--
	303	2.86	0.55	2.31	0.14		303	1.68	0.25	1.43	0.08	0.71	0.44	0.27
55D	304	1.20	0.16	1.04	0.14	55D	304	NR	NR	--	0.08	NR	NR	--
	325	2.40	0.39	2.01	0.16		325	1.04	0.36	0.68	0.08	1.04	0.36	0.68
56D	326	2.71	0.54	2.17	0.16	56D	326	0.92	0.20	0.72	0.08	NR	NR	--
	339	2.89	0.58	2.31	0.15		339	1.58	0.24	1.34	0.08	0.58	0.36	0.22
57AE	340	NR	NR	--	0.16	57AE	340	NR	NR	--	0.07	NR	NR	--
	341	NR	NR	--	0.16		341	NR	NR	--	0.07	NR	NR	--
62D	342	2.38	0.40	1.98	0.15	62D	342	0.54	0.20	0.34	0.07	0.54	0.20	0.34
	347	2.28	0.32	1.96	0.16		347	1.08	0.32	0.76	0.07	0.87	0.42	0.45
64D	348	2.50	0.43	2.07	0.16	64D	348	1.42	0.18	1.24	0.07	NR	NR	--
	349	2.20	0.32	1.88	0.15		349	1.34	0.25	1.09	0.07	NR	NR	--
67D	350	1.98	0.19	1.79	0.15	67D	350	0.22	0.07	0.15	0.07	NR	NR	--
	356	2.45	0.32	2.13	0.15		356	0.78	0.16	0.62	0.07	0.78	0.16	0.62
68D	357	1.28	0.16	1.12	0.15	68D	357	NR	NR	--	0.07	NR	NR	--
	368	3.03	0.60	2.43	0.15		368	1.22	0.17	1.05	0.07	0.56	0.30	0.26
69D	369	2.79	0.47	2.32	0.16	69D	369	0.88	0.24	0.64	0.07	0.51	0.24	0.27
	380	3.04	0.67	2.37	0.14		380	1.44	0.22	1.22	0.07	0.79	0.22	0.57
70D	381	2.81	0.60	2.21	0.14	70D	381	1.23	0.24	0.99	0.07	NR	NR	--
	388	2.41	0.36	2.05	0.14		388	0.93	0.22	0.71	0.06	0.93	0.22	0.71
71D	389	1.42	0.18	1.24	0.14	71D	389	NR	NR	--	0.06	NR	NR	--
	399	2.59	0.55	2.04	0.16		399	1.22	0.22	1.00	0.06	0.68	0.35	0.33
72D	400	2.29	0.26	2.03	0.16	72D	400	0.51	0.16	0.35	0.06	NR	NR	--
	411	2.89	0.54	2.35	0.14		411	1.10	0.32	0.78	0.06	0.40	0.32	0.08
73AE	412	NR	NR	--	0.14	73AE	412	NR	NR	--	0.06	NR	NR	--
	413	NR	NR	--	0.14		413	NR	NR	--	0.06	NR	NR	--
78D	414	2.33	0.46	1.87	0.16	78D	414	1.82	0.19	1.63	0.06	NR	NR	--
	416	2.30	0.32	1.98	0.16		416	1.34	0.27	1.07	0.06	0.67	0.38	0.29
79D	417	2.09	0.30	1.79	0.16	79D	417	1.09	0.18	0.91	0.08	1.09	0.18	0.91
	419	2.24	0.34	1.90	0.16		419	0.87	0.28	0.59	0.09	0.87	0.28	0.59

Dmax Range 1.20-3.19 Average Dmax 2.26
Dmin Range 0.16-0.92 Average Dmin 0.39
Average Gross Fog 0.15

Average Terrain Dmax 0.66 Average Limiting Dmax 1.06
Average Terrain Dmin 0.26 Average Limiting Dmin 0.22
Terrain Dmax Range 0.14-1.61 Limiting Dmax Range 0.13-1.68
Terrain Dmin Range 0.08-0.52
Limiting Dmin Range 0.09-0.72
Average Gross Fog 0.07

[redacted]

Mission 1014-2

STELLAR						INDEX								
						LIMITING					TERRAIN			
Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta
83D	1	3.42	0.40	3.02	0.17	83D	1	NR	NR	--	0.05	NR	NR	--
	8	1.31	0.27	1.04	0.18		8	0.28	0.08	0.20	0.05	0.24	0.10	0.14
84D	9	2.35	0.50	1.85	0.18	84D	9	0.86	0.28	0.58	0.06	NR	NR	--
	20	2.19	0.62	1.57	0.16		20	1.29	0.20	1.09	0.05	1.29	0.29	1.00
85D	21	2.31	0.46	1.85	0.17	85D	21	1.04	0.19	0.85	0.05	0.56	0.19	0.37
	39	2.13	0.52	1.61	0.16		39	0.88	0.24	0.64	0.06	0.88	0.26	0.62
86D	40	2.36	0.48	1.88	0.17	86D	40	0.72	0.16	0.56	0.06	0.52	0.22	0.30
	52	2.92	0.89	2.03	0.17		52	1.74	0.22	1.52	0.05	1.26	0.56	0.70
87D	53	1.37	0.24	1.13	0.16	87D	53	0.30	0.08	0.22	0.05	0.30	0.08	0.22
	70	2.72	0.64	2.08	0.16		70	1.10	0.20	0.90	0.05	0.52	0.32	0.20
89AE	71	NR	NR	--	0.17	89AE	71	NR	NR	--	0.05	NR	NR	--
	72	NR	NR	--	0.17		72	NR	NR	--	0.05	NR	NR	--
95D	73	2.84	0.76	2.08	0.17	95D	73	1.40	0.61	0.79	0.05	NR	NR	--
	75	2.77	0.62	2.15	0.17		75	1.20	0.29	0.91	0.05	0.94	0.46	0.48
98D	76	1.21	0.24	0.97	0.16	98D	76	0.30	0.10	0.20	0.05	0.30	0.14	0.16
	82	2.10	0.42	1.68	0.16		82	1.40	0.16	1.24	0.06	NR	NR	--
99D	83	2.25	0.43	1.82	0.17	99D	83	0.84	0.11	0.73	0.06	NR	NR	--
	89	2.58	0.54	2.04	0.17		89	0.98	0.22	0.76	0.06	0.57	0.34	0.23
100D	90	2.12	0.38	1.74	0.17	100D	90	0.78	0.26	0.52	0.06	0.54	0.38	0.16
	102	2.79	0.57	2.22	0.16		102	1.02	0.18	0.84	0.06	1.02	0.18	0.84
101D	103	1.68	0.28	1.40	0.16	101D	103	0.69	0.12	0.57	0.06	0.69	0.12	0.57
	123	2.52	0.50	2.02	0.16		123	0.91	0.19	0.72	0.06	0.58	0.24	0.34
102D	124	1.55	0.34	1.21	0.21	102D	124	0.18	0.08	0.10	0.06	NR	NR	--
	143	2.70	0.58	2.12	0.17		143	1.38	0.20	1.18	0.06	1.38	0.66	0.72
104D	144	1.20	0.30	0.90	0.18	104D	144	0.34	0.08	0.26	0.06	NR	NR	--
	154	2.92	1.16	1.76	0.17		154	1.48	0.26	1.22	0.06	0.52	0.26	0.26
106D	155	2.46	0.51	1.95	0.17	106D	155	0.94	0.46	0.48	0.06	0.94	0.46	0.48
111D	156	2.84	1.18	1.66	0.22	111D	156	1.78	1.26	0.52	0.06	1.78	1.26	0.52
	158	2.76	0.48	2.28	0.18		158	1.09	0.11	0.98	0.06	1.09	0.32	0.77
114D	159	1.40	0.42	0.98	0.18	114D	159	0.42	0.10	0.32	0.06	NR	NR	--
	162	1.72	0.42	1.30	0.19		162	0.92	0.20	0.72	0.06	0.42	0.20	0.22
115D	163	0.78	0.30	0.48	0.20	115D	163	NR	NR	--	0.06	NR	NR	--
	173	1.86	0.58	1.28	0.30		173	0.83	0.16	0.67	0.06	0.83	0.22	0.61
116D	174	1.21	0.32	0.89	0.20	116D	174	0.16	0.08	0.08	0.06	0.16	0.08	0.08
	187	2.76	0.59	2.17	0.18		187	0.88	0.16	0.72	0.06	0.88	0.16	0.72
117D	188	2.91	0.87	2.04	0.30	117D	188	1.20	0.40	0.80	0.06	1.20	0.40	0.80
	205	2.42	0.61	1.81	0.16		205	1.32	0.17	1.15	0.06	NR	NR	--
118D	206	1.21	0.32	0.89	0.24	118D	206	0.22	0.17	0.05	0.06	NR	NR	--
	229	2.34	0.54	1.80	0.17		229	0.11	0.06	0.05	0.06	0.11	0.06	0.05
119D	230	1.12	0.20	0.92	0.17	119D	230	0.11	0.06	0.05	0.06	NR	NR	--
	240	2.68	0.94	1.74	0.17		240	1.34	0.36	0.98	0.06	0.76	0.52	0.24
120D	241	2.02	0.42	1.60	0.18	120D	241	0.60	0.07	0.53	0.06	NR	NR	--
	251	2.83	0.66	2.17	0.17		251	1.13	0.20	0.93	0.05	NR	NR	--
122D	252	2.62	0.50	2.12	0.17	122D	252	0.92	0.26	0.66	0.05	0.92	0.26	0.66
	253	3.00	0.95	2.05	0.18		253	1.42	0.72	0.70	0.06	1.32	0.72	0.60

NR - Denotes No Reading Made

[redacted]

Mission 1014-2 (Continued)

STELLAR						INDEX								
						LIMITING						TERRAIN		
Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta
125D	254	2.96	1.32	1.64	0.18	125D	254	1.56	0.48	1.08	0.06	0.70	0.48	0.22
	255	2.55	0.72	1.83	0.17		255	1.01	0.12	0.89	0.06	0.44	0.18	0.26
127D	256	3.06	1.02	2.04	0.22	127D	256	1.40	0.72	0.68	0.06	NR	NR	--
	257	2.88	0.62	2.26	0.20		257	1.25	0.59	0.66	0.06	NR	NR	--
130D	258	0.61	0.24	0.37	0.18	130D	258	NR	NR	--	0.06	NR	NR	--
	265	1.88	0.46	1.42	0.18		265	0.58	0.26	0.32	0.06	NR	NR	--
131D	266	1.99	0.42	1.57	0.20	131D	266	0.81	0.14	0.67	0.06	0.72	0.18	0.54
	271	2.63	0.78	1.85	0.18		271	0.97	0.22	0.75	0.06	0.92	0.22	0.70
132D	272	2.02	0.43	1.59	0.17	132D	272	0.84	0.10	0.74	0.06	0.43	0.10	0.33
	279	2.72	0.60	2.12	0.18		279	1.20	0.30	0.90	0.06	0.48	0.30	0.18
133D	280	0.49	0.27	0.22	0.20	133D	280	NR	NR	--	0.06	NR	NR	--
	296	2.90	0.80	2.10	0.18		296	1.21	0.36	0.85	0.06	1.12	0.74	0.38
134D	297	1.56	0.28	1.28	0.18	134D	297	0.31	0.08	0.23	0.06	NR	NR	--
	310	2.88	0.87	2.01	0.17		310	1.55	0.51	1.04	0.06	1.55	0.51	1.04
135D	311	0.90	0.20	0.70	0.17	135D	311	NR	NR	--	0.06	NR	NR	--
	321	2.99	1.12	1.87	0.20		321	1.32	0.75	0.57	0.06	NR	NR	--
136D	322	1.54	0.32	1.22	0.18	136D	322	0.70	0.14	0.56	0.06	NR	NR	--
	335	2.82	0.73	2.09	0.19		335	1.32	0.18	1.14	0.06	0.56	0.38	0.18
137AE	336	NP	NR	--	0.23	137AE	336	NR	NR	--	0.06	NR	NR	--
	337	NR	NR	--	0.25		337	NR	NR	--	0.06	NR	NR	--
137D	338	2.10	0.56	1.54	0.20	137D	338	1.56	0.31	1.25	0.05	NR	NR	--
	344	2.82	0.72	2.10	0.18		344	1.71	0.26	1.45	0.06	NR	NR	--
142D	345	2.84	0.90	1.94	0.18	142D	345	1.07	0.23	0.84	0.06	0.58	0.23	0.35
	347	2.68	0.90	1.78	0.18		347	1.50	0.30	1.20	0.06	0.52	0.30	0.22
143D	348	2.54	0.80	1.74	0.19	143D	348	1.18	0.14	1.04	0.06	0.48	0.16	0.32
	351	2.71	0.60	2.11	0.19		351	1.16	0.15	1.01	0.06	0.44	0.18	0.26

Dmax Range 0.49-3.42
Average Dmax 2.24
Dmin Range 0.20-1.32
Average Dmin 0.57
Average Gross Fog 0.18

NP - Denotes No Reading Made

Average Terrain Dmax 0.75 Average Limiting Dmax 0.97
Average Terrain Dmin 0.31 Average Limiting Dmin 0.25
Terrain Dmax Range 0.11-1.78
Limiting Dmax Range 0.11-1.78
Terrain Dmin Range 0.06-1.26
Limiting Dmin Range 0.06-1.26
Average Gross Fog 0.06

[redacted]

APPENDIX D. STELLAR-INDEX-MASTER CAMERA FRAME CORRELATION (1014-2)

FRAMING CAMERA FRAME NUMBER	MAIN CAMERA PASS	MAIN CAMERA FRAME	TOTAL FRAMES	FRAMING CAMERA FRAME NUMBER	MAIN CAMERA PASS	MAIN CAMERA FRAME	TOTAL FRAMES
				50		73	
1	83D	2-9	Double Ex.	51		80	
2		16		52		87	89
3		23		53	87D	5	
4		30		54		12	
5		37		55		19	
6		44		56		26	
7		51		57		33	
8		58	58	58		40	
9	84D	7		59		47	
10		14		60		54	
11		21		61		61	
12		28		62		68	
13		35		63		75	
14		42		64		82	
15		49		65		89	
16		56		66		96	
17		63		67		103	
18		70		68		110	
19		77		69		117	
20		84	88	70		124	126
21	85D	3		71	89AE	5	
22		10		72		12	16
23		17		73	95D	3	
24		24		74		10	
25		31		75		17	21
26		38		76	98D	3	
27		45		77		10	
28		52		78		17	
29		59		79		24	
30		66		80		31	
31		73		81		38	
32		80		82		45	49
33		87		83	99D	3	
34		94		84		10	
35		101		85		17	
36		108		86		24	
37		115		87		31	
38		122		88		38	
39		129	133	89		45	46
40	86D	3		90	100D	6	
41		10		91		13	
42		17		92		20	
43		24		93		27	
44		31		94		34	
45		38		95		41	
46		45		96		48	
47		52		97		55	
48		59		98		62	
49		66		99		69	

TDL - Indicates double exposure.
TDT - Indicates triple exposure.

[redacted]

FRAMING CAMERA FRAME NUMBER	MAIN CAMERA PASS	MAIN CAMERA FRAME	TOTAL FRAMES	FRAMING CAMERA FRAME NUMBER	MAIN CAMERA PASS	MAIN CAMERA FRAME	TOTAL FRAMES
100	100D	76		150		67	
101		83		151		74	
102		90	95	152		81	
103	101D	2		153		88	
104		9		154		95-102	(DBL) 103
105		16		155	106D	6	
106		23		156	106D & 111D	13-20-6	TRI
107		30		157	111D	13	
108		37		158		20	21
109		44		159	114D	6	
110		51		160		13	
111		58		161		20	
112		65		162		27	33
113		72		163	115D	1	
114		79		164		8	
115		86		165		15	
116		93		166		22	
117		100		167		29	
118		107		168		36	
119		114		169		43	
120		121-128	DBL	170		50	
121		135		171		57	
122		142-149	DBL	172		64	
123		156	159	173		71	71
124	102D	4		174	116D	7	
125		11-18	DBL	175		14	
126		25-32	DBL	176		21-28	DBL
127		39		177		35	
128		46		178		42	
129		53		179		49-56	DBL
130		60		180		63	
131		67-74-81	TRI	181		70	
132		88		182		77	
133		95-102-109	TRI	183		84	
134		116		184		91	
135		123		185		98	
136		130		186		105	
137		137		187		112	
138		144		188	116D & 117D	119-2-9	(TRI) 124
139		151		189	117D	16-23-30	TRI
140		158		190		37	
141		165		191		44	
142		172		192		51	
143		179	182	193		58-65-72	TRI
144	104D	4-11	DBL	194		79	
145		18		195		86	
146		25		196		93	
147		32-39	DBL	197		100	
148		46-53	DBL	198		107-114	DBL
149		60		199		121-128	DBL

DBL - Indicates double exposure.
TRI - Indicates triple exposure.

[redacted]

FRAMING CAMERA FRAME NUMBER	MAIN CAMERA PASS	MAIN CAMERA FRAME	TOTAL FRAMES
200	117D	135	
201		142	
202		149-156	DBL
203		163-170	DBL
204		177	
205		184	184
206	118D	7	
207		14	
208		21	
209		28	
210		35-42-49	TRI
211		56-63	DBL
212		70	
213		77	
214		84	
215		91-98	DBL
216		105	
217		112	
218		119	
219		126	
220		133	
221		140	
222		147	
223		154	
224		161	
225		168	
226		175	
227		187	
228		189	
229		196	201
230	119D	2-9	DBL
231		16-23	DBL
232		30	
233		37	
234		44-51	DBL
235		58	
236		65-72	DBL
237		79-86	DBL
238		93	
239		100-107	DBL
240	119D & 120D	114-3	(DBL)118
241	120D	10-17-24	TRI
242		31	
243		38	
244		45	
245		52	
246		59	
247		66-73	DBL
248		80-87	DBL
249		94-101	DBL

FRAMING CAMERA FRAME NUMBER	MAIN CAMERA PASS	MAIN CAMERA FRAME	TOTAL FRAMES
250		108	
251		115	119
252	122D	3	
253		10-17	(DBL) 21
254	125D	3-10	DBL
255		17	22
256	127D	2-9	DBL
257		16	21
258	130D	2	
259		9	
260		16	
261		23-30	DBL
262		37	
263		44	
264		51-58	DBL
265		65	65
266	131D	7	
267		14	
268		21	
269		28	
270		35	
271	131D & 132D	42-3	(DBL) 46
272	132D	10	
273		17	
274		24	
275		31	
276		38	
277		45	
278		52	
279		59	60
280	133D	6-13	DBL
281		20-27	DBL
282		34-41	DBL
283		48-55	DBL
284		62	
285		69	
286		76	
287		83	
288		90-97	DBL
289		104	
290		111-118	DBL
291		125	
292		132-139	DBL
293		146	
294		153	
295		160-167	DBL
296		174-181	(DBL) 182
297	134D	6	
298		13	
299		27	

DBL - Indicates double exposure.
TRI - Indicates triple exposure.

[redacted]

FRAMING CAMERA FRAME NUMBER	MAIN CAMERA PASS	MAIN CAMERA FRAME	TOTAL FRAMES	FRAMING CAMERA FRAME NUMBER	MAIN CAMERA PASS	MAIN CAMERA FRAME	TOTAL FRAMES
300	134D	34		326		38	
301		41		327		45-52	DBL
302		48-55	DBL	328		59	
303		62		329		66	
304		69		330		73-80	DBL
305		76		331		87-94	DBL
306		83-90	DBL	332		101	
307		97		333		108	
308		104		334		115	
309		111		335		122	124
310		118-125	(DBL) 126	336	137AE	5	
311	135D	6-13	DBL	337		12	16
312		20		338	137D	3	
313		27		339		10	
314		34		340		17	
315		41		341		24	
316		48		342		31	
317		55		343		38	
318		62		344		45	51
319		69-76-83	TRI	345	142D	1	
320		90-97	DBL	346		8	
321		104	108	347		15	21
322	136D	3-10	DBL	348	143D	1	
323		17		349		8	
324		24		350		15	
325		31		351		22	23

DBL - Indicates double exposure.
TRI - Indicates triple exposure.

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APPENDIX E. MICRODENSITOMETRY

1. Edge Spread Function:

The technique of obtaining the spread function from microdensitometer edge traces is used as an objective measure of the image quality in mission photography. The spread function curve represents a summation of the separate elements of the photographic system. By taking the Fourier Transform of the spread function the modulation transfer function (MTF) of the system may be obtained.

To satisfy the desire to express image quality in terms of a value, a single number is determined from the spread function curve by measuring its width at 50 percent amplitude. This width is expressed as a micron distance in image space and may be converted to a distance on the ground. On domestic passes, where 3-bar resolution targets have been available, the ground distance determined from edge trace analysis and from the targets has been found to be comparable.

The microdensitometric analysis of edges in the image requires that the object edge fulfill the conditions of a unit step function, i.e., exist for an appreciable distance at a fixed brightness level and change abruptly to a new level which exists for an appreciable distance. This requirement is usually achieved by rooftops of buildings in large-scale photography, and aircraft runways or taxiways in small-scale photography.

The mission is examined to determine the Mission Information Potential (MIP) frame, which is a subjective selection of the best photography. Straight edges in this imagery meeting the criteria of a step function for a length of at least 120 microns are selected for scanning with the microdensitometer.

The microdensitometer used is a Joyce-Lobel Double Beam Model III CS. It is used with an effective slit of 1 by 75 microns. The recording table and specimen table are directly linked with a 1000:1 ratio arm. The speed of the scan is proportional to the rate of pen deflection (as the pen deflection rate increases the speed is decreased giving the pen time to reach its maximum response). The trace thus produced represents a plot of deflection versus distance. The deflection of the pen is essentially linear with density.

Several computer programs that have as output both the spread function and MTF are currently being investigated. The best features of each will be incorporated into a program for the UNIVAC 490. In the interim the data reduction is done manually.

The microdensitometer plots, which exhibit the steeper density gradi-

[redacted]

ents and fall on the straight-line portion of the H & D curve for the material, are traced and smoothed. They are then digitized in a comparator into values of distance (X) and deflection (Y). Since the instrument response is linear with density, it is also linear with exposure on the straight-line portion of the applicable D Log E curve. The values of Y are converted to Log E and the antilog taken to obtain values of relative exposure. The difference between adjacent values of E is divided by the corresponding difference of the measured values of X to produce the slope values (dE/dX) of the original object reflectance distribution. Finally, 50 percent of the maximum slope is computed, and the distance between the 50 percent slope values is determined by interpolation. The Line Spread Function (LSF) may also be plotted (slope versus distance) and the 50 percent amplitude width measured for verification of the calculated value.

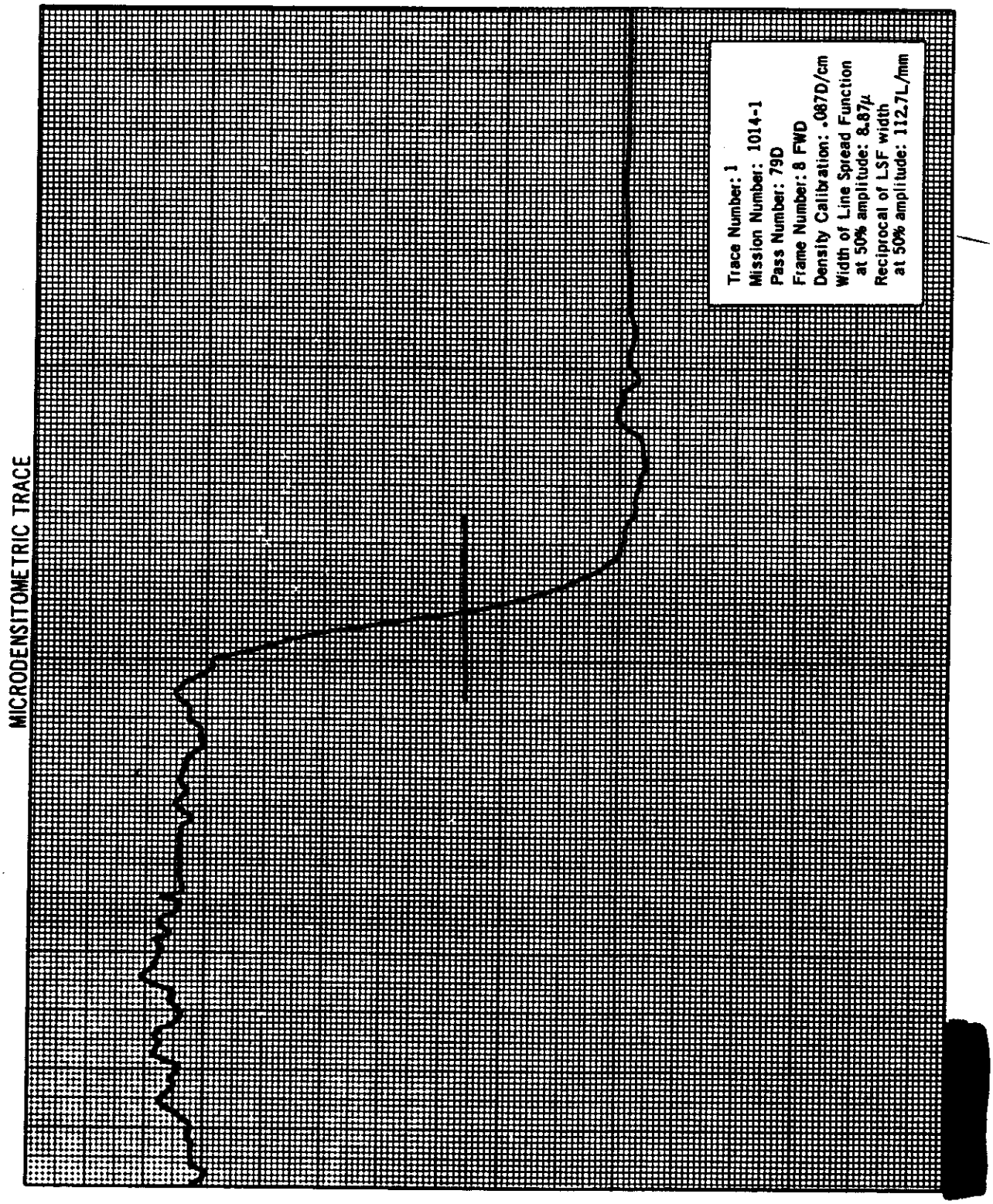
The following table shows the 50 percent amplitude width of the LSF determined from the enclosed microdensitometric edge traces made on the original negative. The lines per millimeter is determined by taking the reciprocal of the 50 percent amplitude width LSF and converting to millimeters.

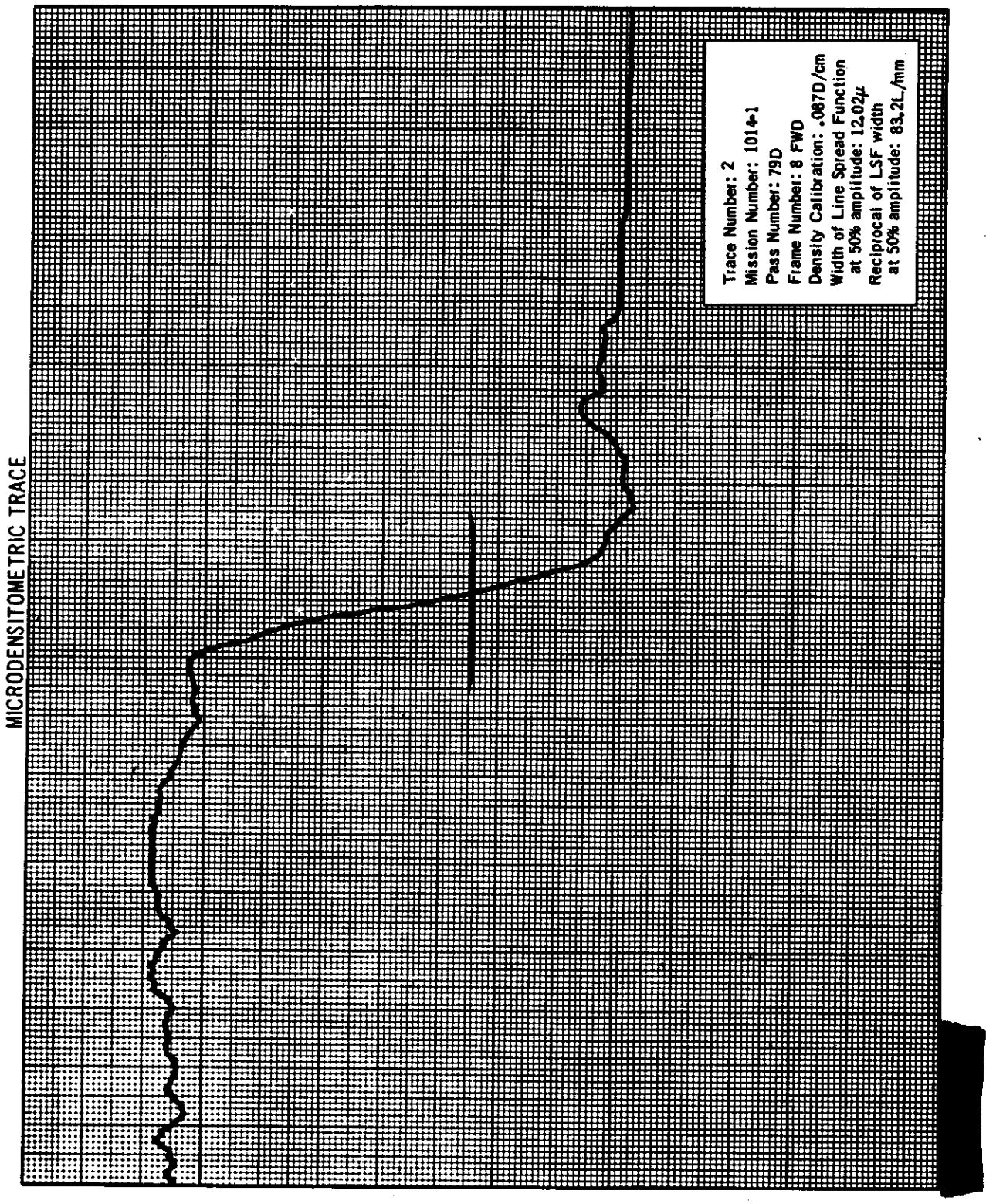
[redacted]

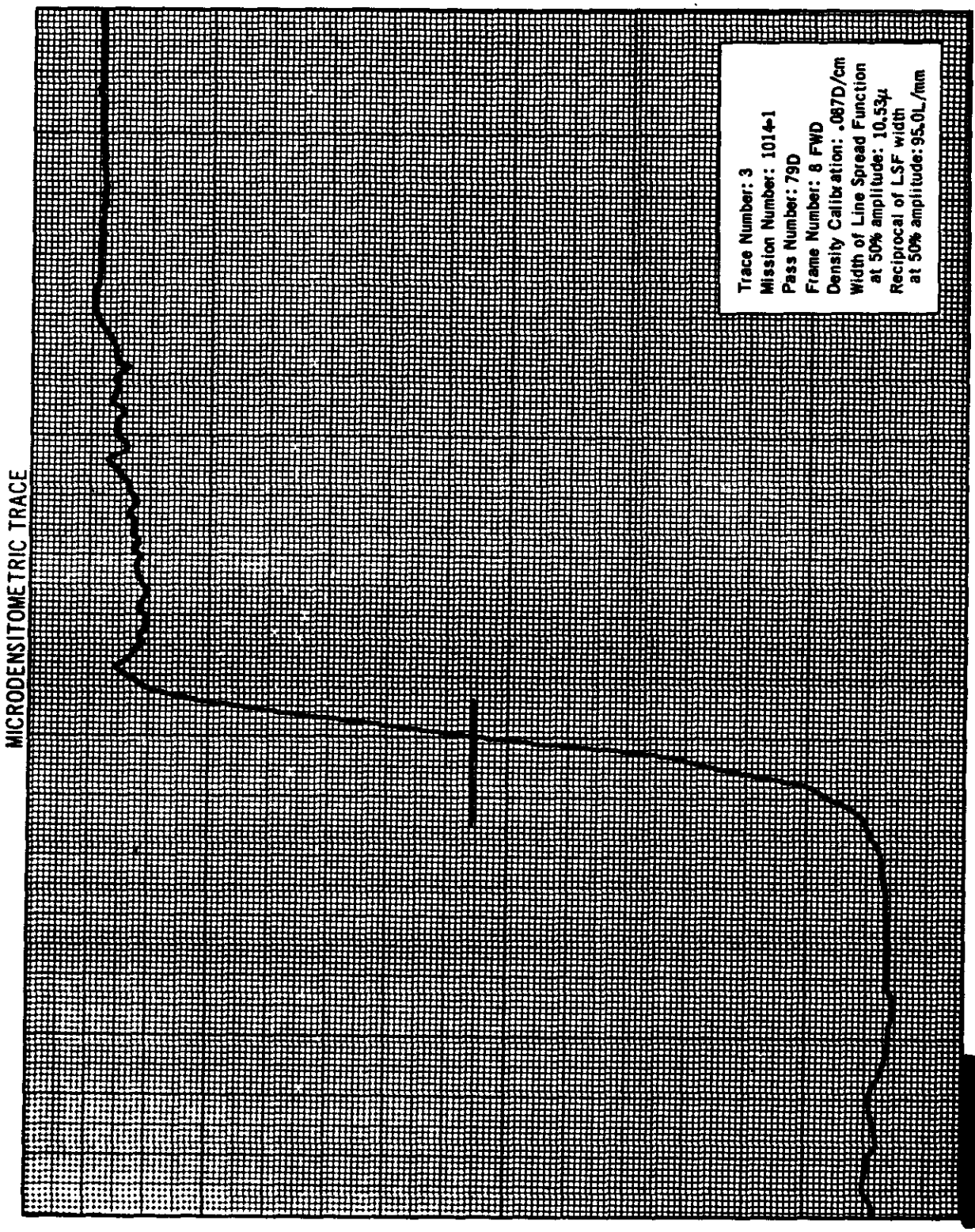
SUMMARY TABLE OF EDGE TRACES

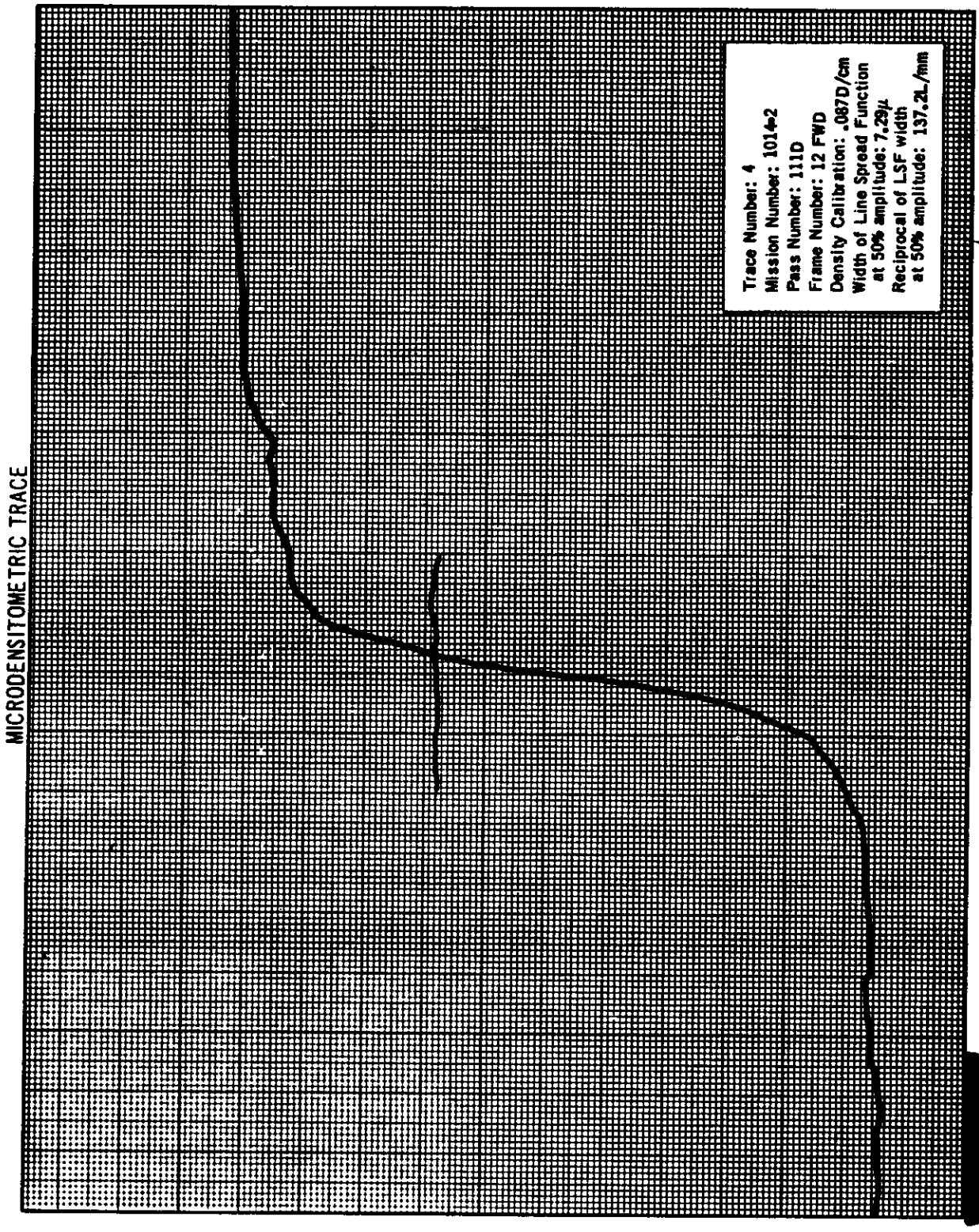
Trace Number	Line Spread Function Width at 50% Amplitude	Reciprocal of LSF Width at 50% Amplitude
1014-1		
1	8.87 microns	112.7 L/mm
2	12.02 microns	83.2 L/mm
3	10.53 microns	95.0 L/mm
1014-2		
4	7.29 microns	137.2 L/mm
5A	10.07 microns	99.3 L/mm
5B	10.92 microns	91.6 L/mm
6A	8.88 microns	112.6 L/mm
6B	11.96 microns	83.6 L/mm

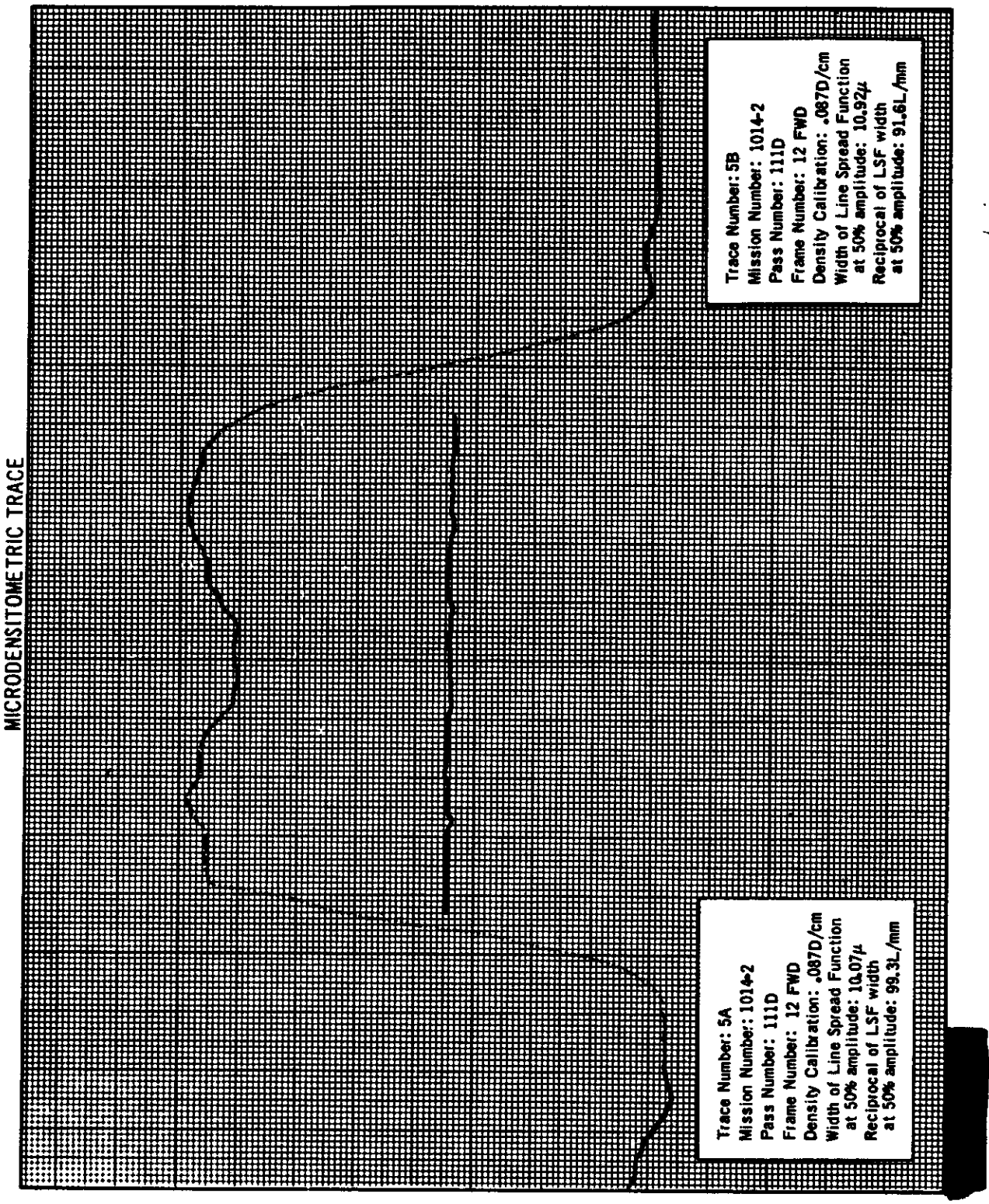
NOTE: The two frames used for edge traces on this mission were also the MIP frames.

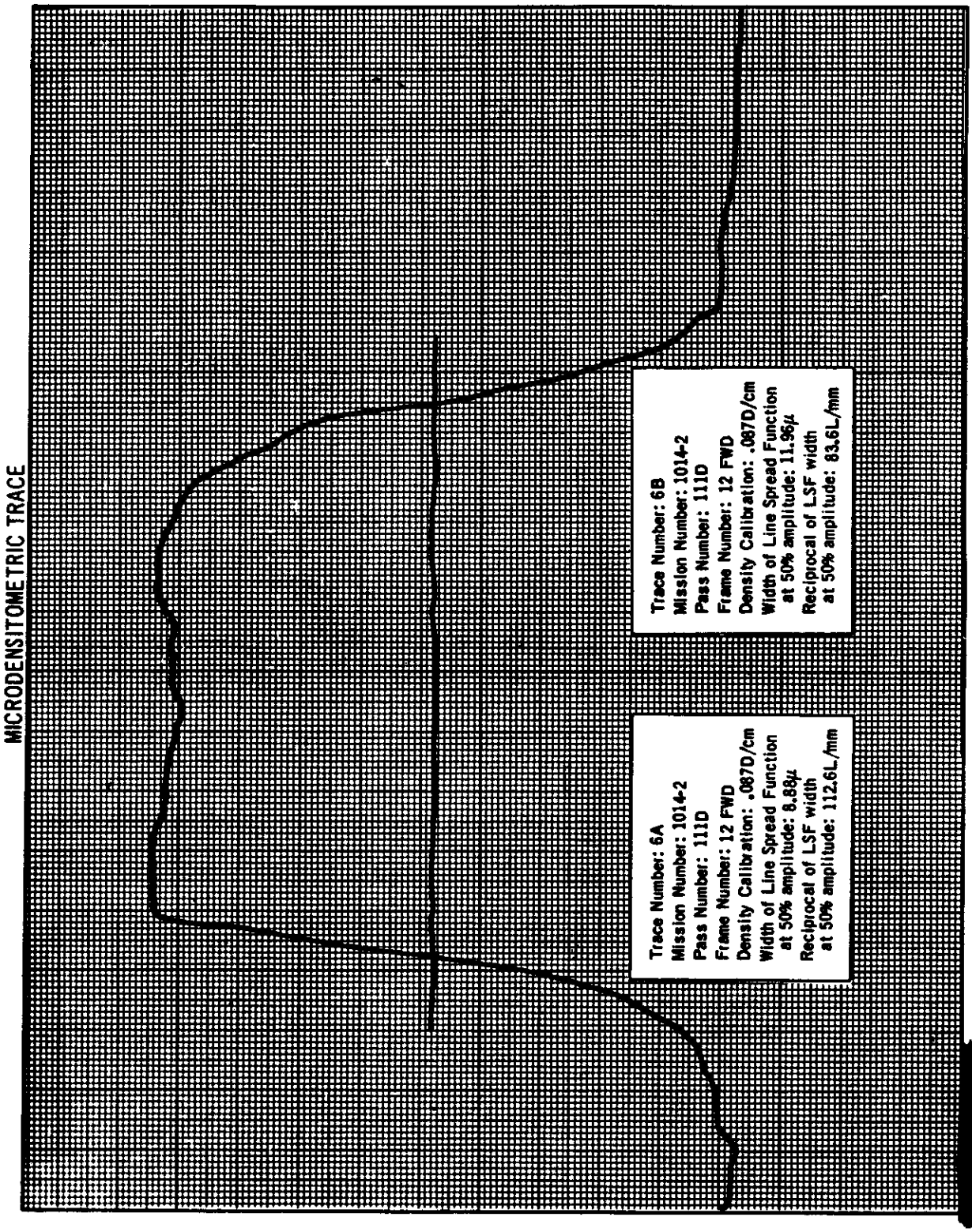

MICRODENSITOMETRIC TRACE
Trace Number: 1
Mission Number: 1014-1
Pass Number: 79D
Frame Number: 8 FWD
Density Calibration: .087D/cm
Width of Line Spread Function at 50% amplitude: 8.87μ
Reciprocal of LSF width at 50% amplitude: 112.7L/mm


MICRODENSITOMETRIC TRACE
Trace Number: 2
Mission Number: 1014-1
Pass Number: 79D
Frame Number: 8 FWD
Density Calibration: .087D/cm
Width of Line Spread Function
at 50% amplitude: 12.02μ
Reciprocal of LSF width
at 50% amplitude: 83.2L/mm


MICRODENSITOMETRIC TRACE
Trace Number: 3
Mission Number: 1014-1
Pass Number: 79D
Frame Number: 8 FWD
Density Calibration: .087D/cm
Width of Line Spread Function
at 50% amplitude: 10.53μ
Reciprocal of LSF width
at 50% amplitude: 95.0L./mm


MICRODENSITOMETRIC TRACE
Trace Number: 4
Mission Number: 1014-2
Pass Number: 111D
Frame Number: 12 FWD
Density Calibration: .087D/cm
Width of Line Spread Function
at 50% amplitude: 7.29μ
Reciprocal of LSF width
at 50% amplitude: 137.2L/mm


MICRODENSITOMETRIC TRACE
Trace Number: 5B
Mission Number: 1014-2
Pass Number: 111D
Frame Number: 12 FWD
Density Calibration: .087D/cm
Width of Line Spread Function
at 50% amplitude: 10.92μ
Reciprocal of LSF width
at 50% amplitude: 91.6L/mm
Trace Number: 5A
Mission Number: 1014-2
Pass Number: 111D
Frame Number: 12 FWD
Density Calibration: .087D/cm
Width of Line Spread Function
at 50% amplitude: 10.07μ
Reciprocal of LSF width
at 50% amplitude: 99.3L/mm


MICRODENSITOMETRIC TRACE
Trace Number: 6B
Mission Number: 1014-2
Pass Number: 111D
Frame Number: 12 FWD
Density Calibration: .087D/cm
Width of Line Spread Function at 50% amplitude: 11.96μ
Reciprocal of LSF width at 50% amplitude: 83.6L/mm
Trace Number: 6A
Mission Number: 1014-2
Pass Number: 111D
Frame Number: 12 FWD
Density Calibration: .087D/cm
Width of Line Spread Function at 50% amplitude: 8.88μ
Reciprocal of LSF width at 50% amplitude: 112.6L/mm

[redacted]

APPENDIX F. SUMMARY OF PHOTOGRAPHIC IMAGE EVALUATION PERFORMED BY THE PROCESSING CONTRACTOR

The following data, compiled by the processing contractor, is a summary of the microdensitrometric traces accomplished on each mission since mission 1007-2.

Mission Number	Number of Edges	Spread Function Width at 50% Amplitude in Microns Computer Calculations			Resolution in lines/mm from A.I.M. 4404 Curve, Computer Calculations		
		Arithmetic Mean	Standard Deviation	Coefficient of Dispersion	Arithmetic Mean	Standard Deviation	Coefficient of Dispersion
1007-2*	106	12.2	3.9	32%	71.0	18.0	25%
1008-1*	103	10.6	3.2	30%	83.0	21.1	25%
1008-2*	123	10.2	3.9	38%	84.3	21.0	25%
1009-1	80	11.7	4.2	36%	75.3	19.9	26%
1009-2	110	13.0	5.0	39%	74.1	21.7	29%
1010-1	119	9.8	3.3	33%	89.4	22.7	25%
1010-2	110	9.8	3.2	32%	84.3	21.4	25%
1011-1	115	10.9	3.8	35%	80.5	21.6	27%
1012-1	94	10.1	3.7	36%	86.1	20.4	24%
1012-2	100	10.2	3.1	31%	84.0	21.4	26%
1013-1	49	10.8	4.1	38%	83.3	27.3	33%
1014-1	92	10.8	4.5	41%	83.0	24.7	30%
1014-2	90	11.7	3.9	34%	74.2	20.1	27%

*A 1 x 320 micron slit was used

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APPENDIX G. CLOUD COVER ANALYSIS

1. INTRODUCTION

This study represents a statistical analysis of the cloud cover on the photography of Mission 1014. The basis of this study is the cloud cover data for each quarter segment of every individual frame of photography. The data is obtained by analysts specifically trained in estimating cloud cover by designated categories.

Five cloud categories have been formulated for use in this photography (See Table 1). These categories allow for the wide latitude of cloud cover conditions commonly found on a frame of this photography. Note in Table 1 that a mean cloud percentage value has been calculated for each category for use in determining a combined cloud cover percentage for all operational passes of the mission.

The occurrence of each cloud category within an operational pass is expressed as a percentage and appears in Table 2. Each percentage is a ratio of the number of occurrences of a given cloud cover category to the total number of cloud observations in a photography pass. For example: if the number of category 1 occurrences in a given pass is 200 out of a total of 1,000 (250 frames x 4 quarters), all categories combined, then 20 percent of the pass would be classed as category 1.

Also, a cloud cover percentage per pass is included in the last column of Table 2 under "Cloud Cover % Per Pass." This value is determined by the summation of the products of category percentage in each pass and the mean cloud percentage for that category as established in Table 1. For example: if it is determined that the following percentages exist in a given pass:

20% Category 1
15% Category 2
30% Category 3
25% Category 4
10% Category 5

Then, by using the mean cloud percentage established in Table 1, the following computations are made:

0.20 x 5.0	=	1.00%
0.15 x 17.5	=	2.63%
0.30 x 38.0	=	11.40%
0.25 x 75.0	=	18.75%
0.10 x 100.0	=	10.00%
		43.78%

Hence, 43.8 percent of this pass is cloud covered.

[redacted]

TABLE 1

CLOUD COVER CATEGORIES

CATEGORY NUMBER	PERCENT OF CLOUD COVER	DESCRIPTION	MEAN CLOUD PERCENTAGE
1	Less than 10%	Clear	5%
2	10% - 25%	Small scattered Clouds	17.5%
3	26% - 50%	Large scattered Clouds	38%
4	51% - 99%	Broken or Connected Clouds	75%
5	100%	Complete overcast	100%

2. CLOUD COVER DATA
MISSION 1014-1

Pass Number	1	2	3	4	5	Cloud Cover % Per Pass
2D	89.8	4.5	4.9	0.8	0.0	7.8
3D	40.3	37.5	13.1	9.1	0.0	20.4
4D	73.4	8.6	4.8	12.2	1.0	17.1
6D	22.8	4.2	6.4	48.0	18.6	58.9
7D	48.9	3.6	9.4	30.3	7.8	37.1
8D	30.3	9.3	9.4	33.3	17.7	49.4
10D	0.0	0.0	0.0	100.0	0.0	75.0
14D	32.7	35.6	29.8	1.9	0.0	20.6
17D	62.1	2.3	6.1	29.5	0.0	28.0
21D	50.7	14.2	13.0	22.1	0.0	26.5
22D	16.4	3.7	4.7	62.5	12.7	62.9
23D	54.5	3.9	7.6	31.1	2.9	32.5
26D	18.1	12.1	18.1	51.7	0.0	48.7
30D	19.8	10.3	19.0	50.0	0.9	48.4
33D	93.2	6.8	0.0	0.0	0.0	5.9
35D	95.1	2.9	2.0	0.0	0.0	6.9
37D	79.2	3.6	4.4	10.0	2.8	16.6
38D	29.6	4.8	3.5	39.0	23.1	56.0
39D	67.8	4.9	4.0	20.5	2.8	24.0
41D	4.0	3.7	11.7	50.3	30.3	73.4
46D	4.9	6.2	51.4	37.5	0.0	49.0
51D	57.8	3.0	4.7	25.5	9.0	33.3
52D	77.5	9.6	6.4	6.5	0.0	12.9
53D	52.7	5.8	8.1	26.8	6.6	33.5

[redacted]

2. CLOUD COVER DATA (Continued)
MISSION 1014-1

Pass Number	1	2	3	4	5	Cloud Cover % Per Pass
54D	49.8	5.3	18.4	20.3	6.2	31.9
55D	68.7	4.5	7.8	17.5	1.5	21.8
56D	0.0	0.0	8.4	70.3	21.3	77.2
62D	48.7	3.1	27.2	20.1	0.9	29.3
67D	86.7	11.7	1.6	0.0	0.0	7.0
68D	71.2	2.8	7.4	17.3	1.3	21.1
69D	65.3	2.6	10.8	18.4	2.9	24.5
70D	42.4	0.0	0.8	56.8	0.0	45.0
71D	64.0	0.0	0.8	15.8	20.2	35.3
72D	11.1	1.9	7.1	60.9	19.0	68.2
78D	8.6	4.3	24.1	55.2	7.8	59.5
	48.7*	5.6*	8.7*	29.5*	7.5*	36.4**

*Average percentage by category for mission.

**Overall mission cloud cover percentage.

[redacted]

MISSION 1014-2

Pass Number	1	2	3	4	5	Cloud Cover % Per Pass
83D	88.6	0.0	0.0	0.0	11.4	15.9
84D	57.7	0.5	4.5	22.4	14.9	36.3
85D	84.0	1.9	4.0	9.6	0.5	13.7
86D	32.0	0.5	4.2	36.2	27.1	57.5
87D	52.1	6.4	10.8	26.3	4.4	31.9
98D	8.3	3.2	16.2	64.4	7.9	63.3
99D	0.0	0.0	10.1	86.5	3.4	72.1
100D	54.7	3.2	14.9	20.0	7.2	31.2
101D	89.6	3.2	3.2	3.6	0.4	9.4
102D	76.5	4.2	7.7	10.6	1.0	16.4
104D	11.9	5.6	17.0	57.3	8.2	59.2
106D	100.0	0.0	0.0	0.0	0.0	5.0
114D	1.9	10.3	18.6	59.0	10.2	63.4
115D	55.2	14.0	13.3	16.2	1.3	23.7
116D	65.4	7.7	3.9	9.4	13.6	26.7
117D	75.5	5.3	11.5	6.4	1.3	15.2
118D	30.4	9.1	18.7	36.4	5.4	42.9
119D	26.4	5.4	8.3	42.8	17.1	54.6
120D	20.5	1.4	2.6	66.1	9.4	61.2
122D	68.5	5.6	18.5	7.4	0.0	17.0
130D	47.1	9.4	21.4	21.4	0.7	28.9
131D	57.8	9.0	13.8	19.4	0.0	24.3
132D	49.3	12.7	9.9	27.8	0.3	29.6
133D	61.2	2.5	2.3	16.9	17.1	34.1
134D	51.5	5.8	5.5	36.5	0.7	33.8
135D	15.7	3.3	5.5	75.5	0.0	60.0
136D	5.3	5.3	6.4	82.2	0.8	66.1
137D	0.0	0.0	6.6	88.6	4.8	73.8
	48.9*	4.9*	8.7*	31.2*	6.3*	36.3**

*Average percentage by category for mission.
**Overall mission cloud cover percentage.