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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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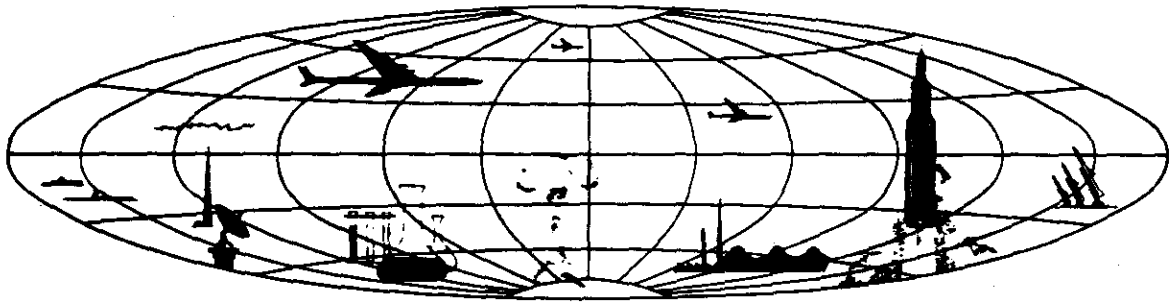
NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER



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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.

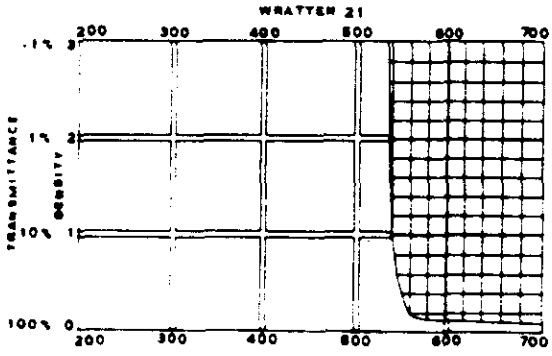
On Mission 1014-2 there were 29 development level changes on the master (FWD) record and 6 on the slave (AFT) record. The film of the stellar and index cameras was processed at 1 level.

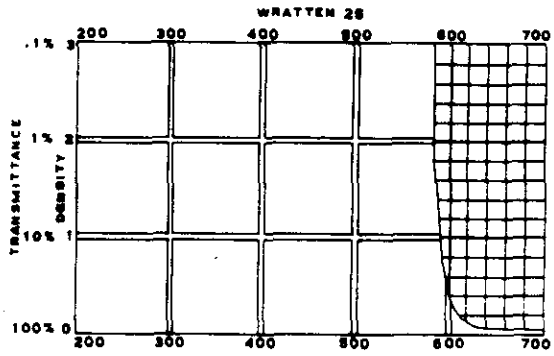
f. The following data provide information pertinent to the Wratten 21 filter used on the Slave (AFT) Panoramic camera and the Wratten 25 filter used on the Master (FWD) Panoramic camera.

[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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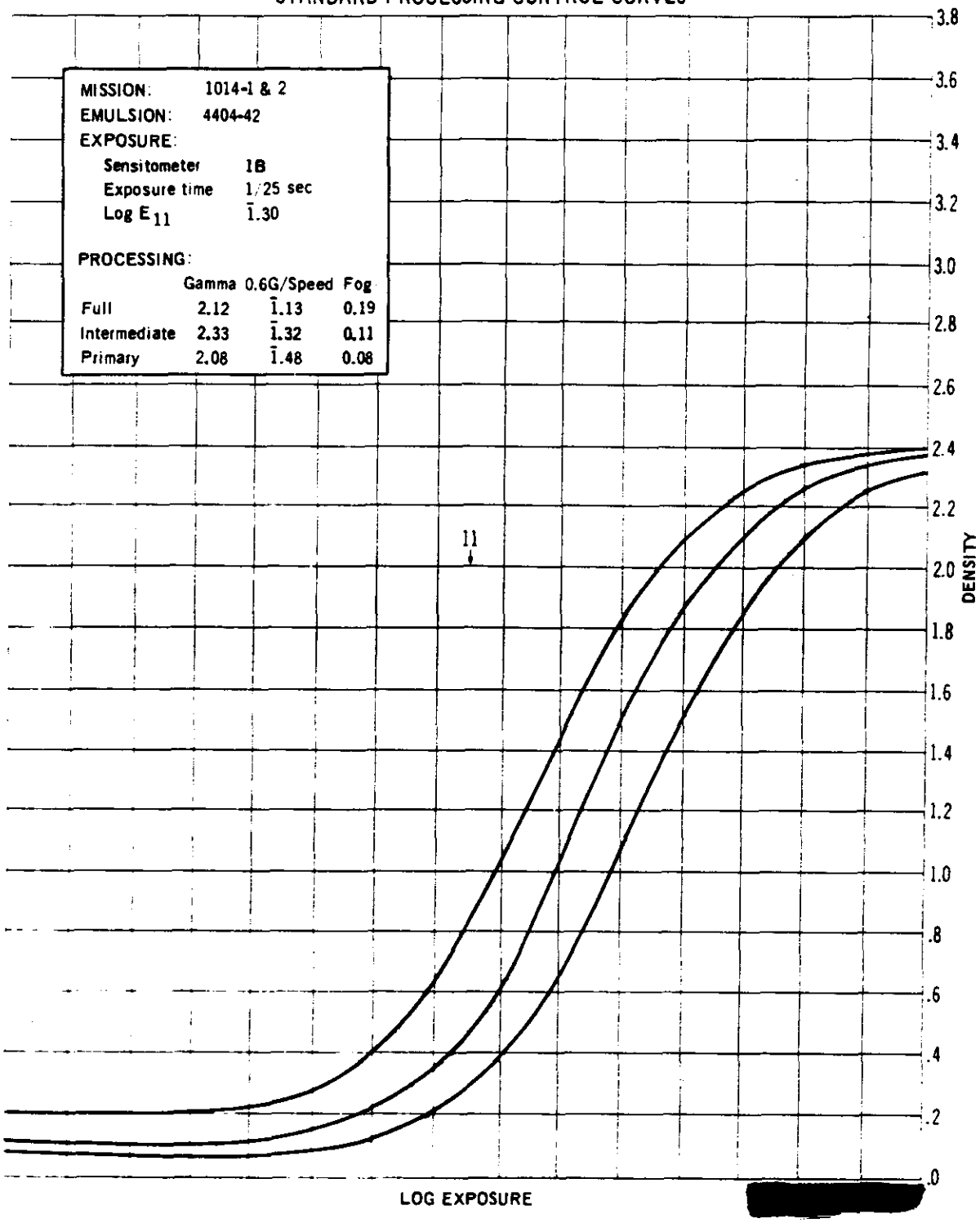
4. Film Processing Curves

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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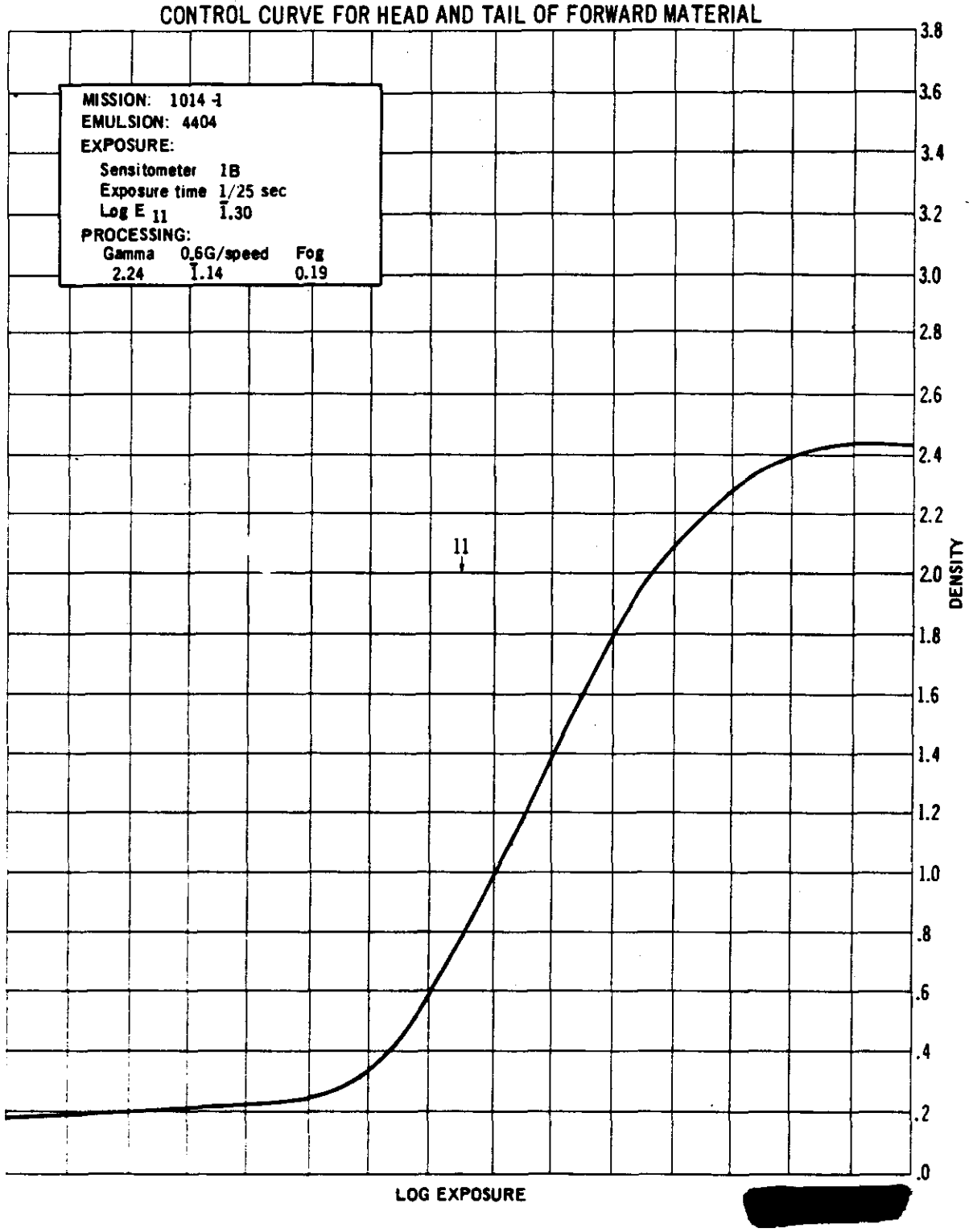
CONTROL CURVE FOR HEAD AND TAIL OF FORWARD MATERIAL



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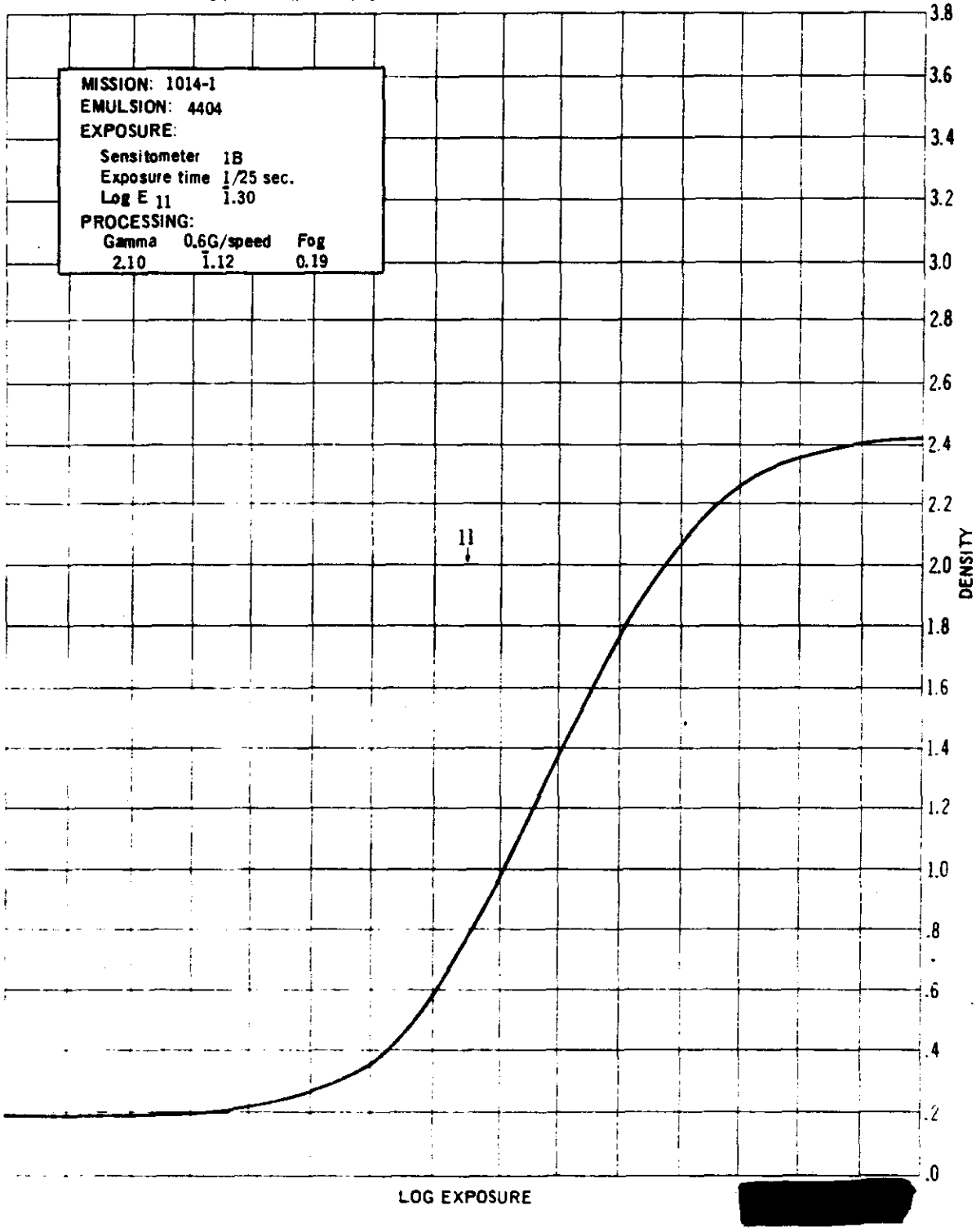
SENSITOMETRIC CURVE FROM AFT CAMERA MATERIAL



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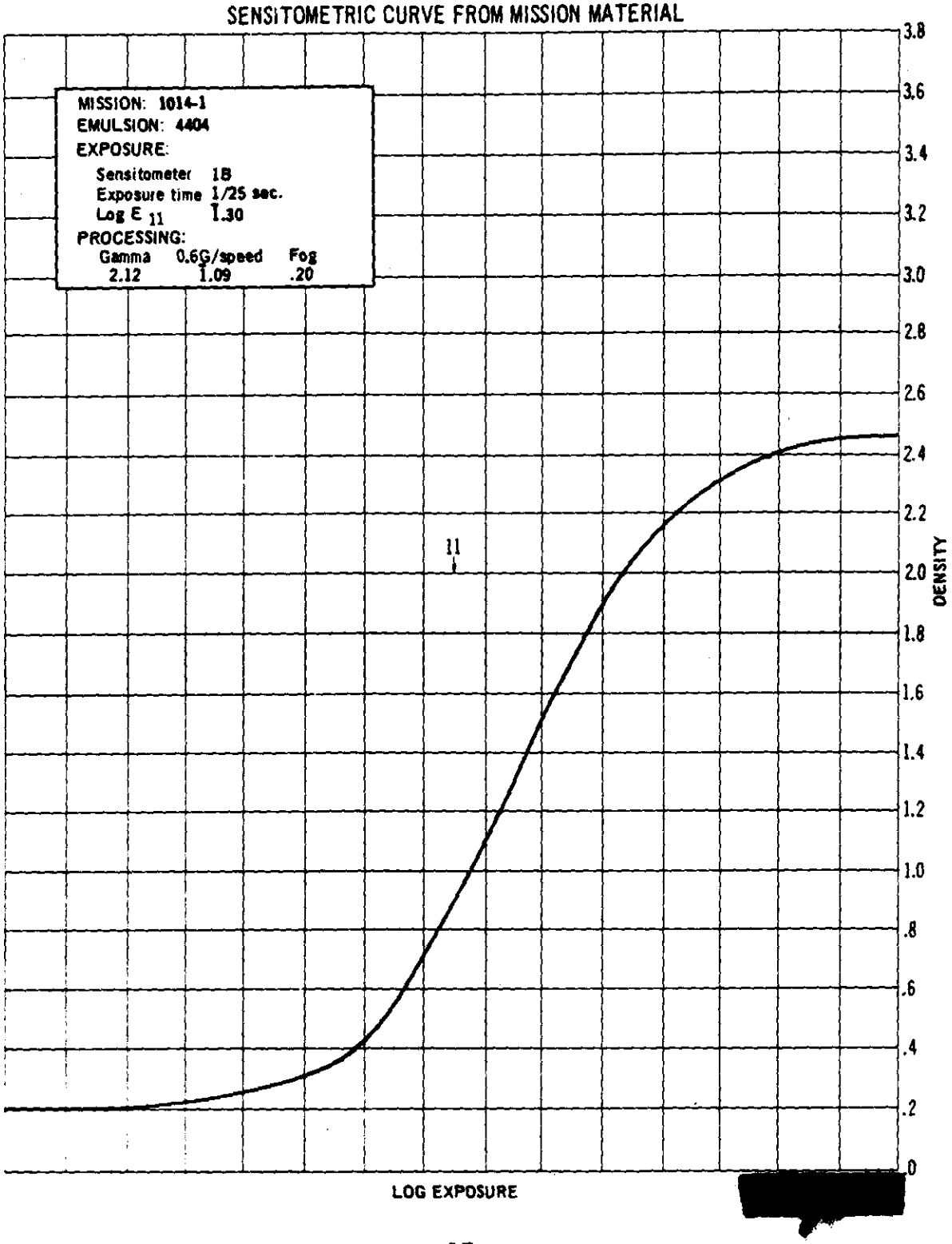
SENSITOMETRIC CURVE FROM MISSION MATERIAL



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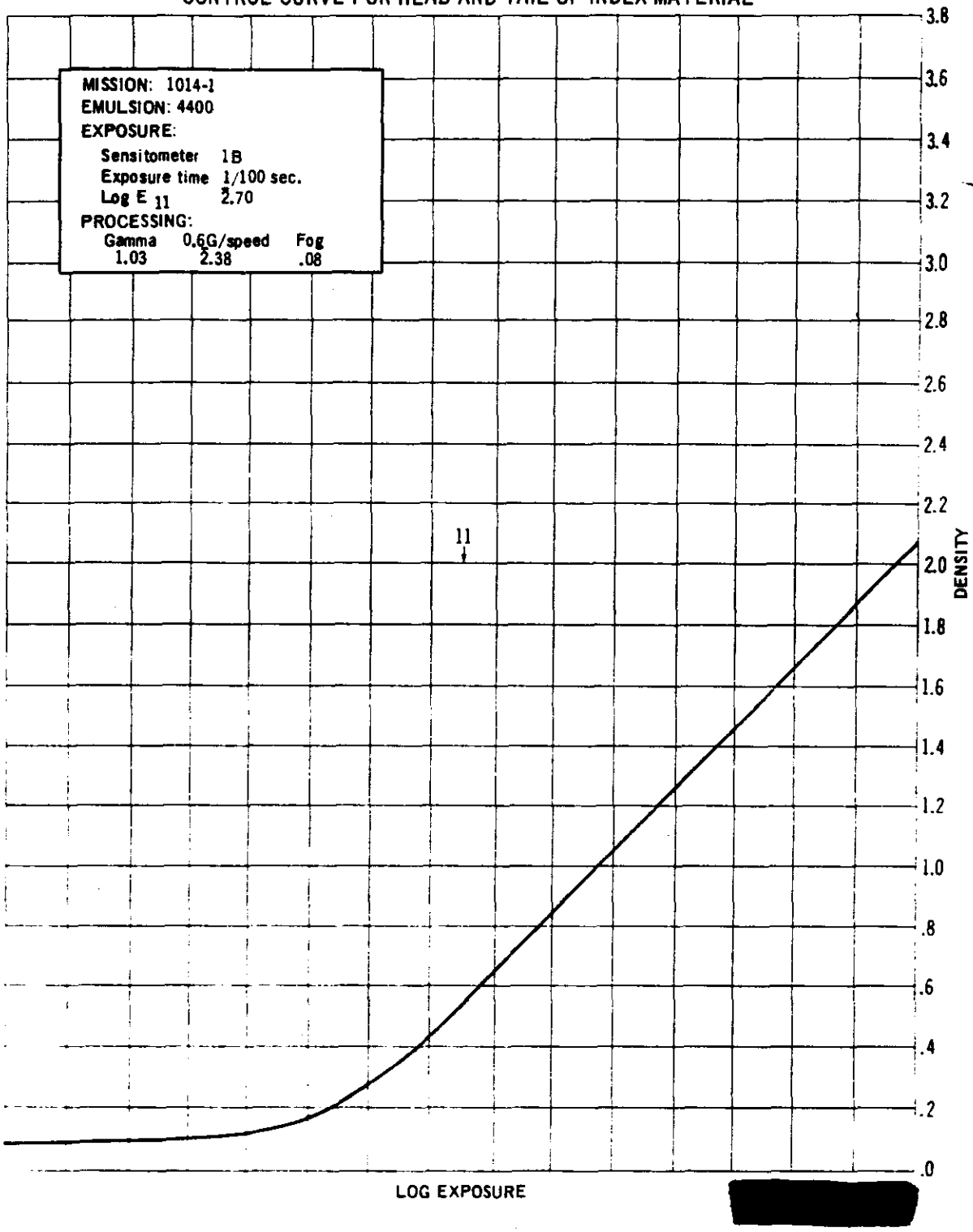
CONTROL CURVE FOR HEAD AND TAIL OF INDEX MATERIAL



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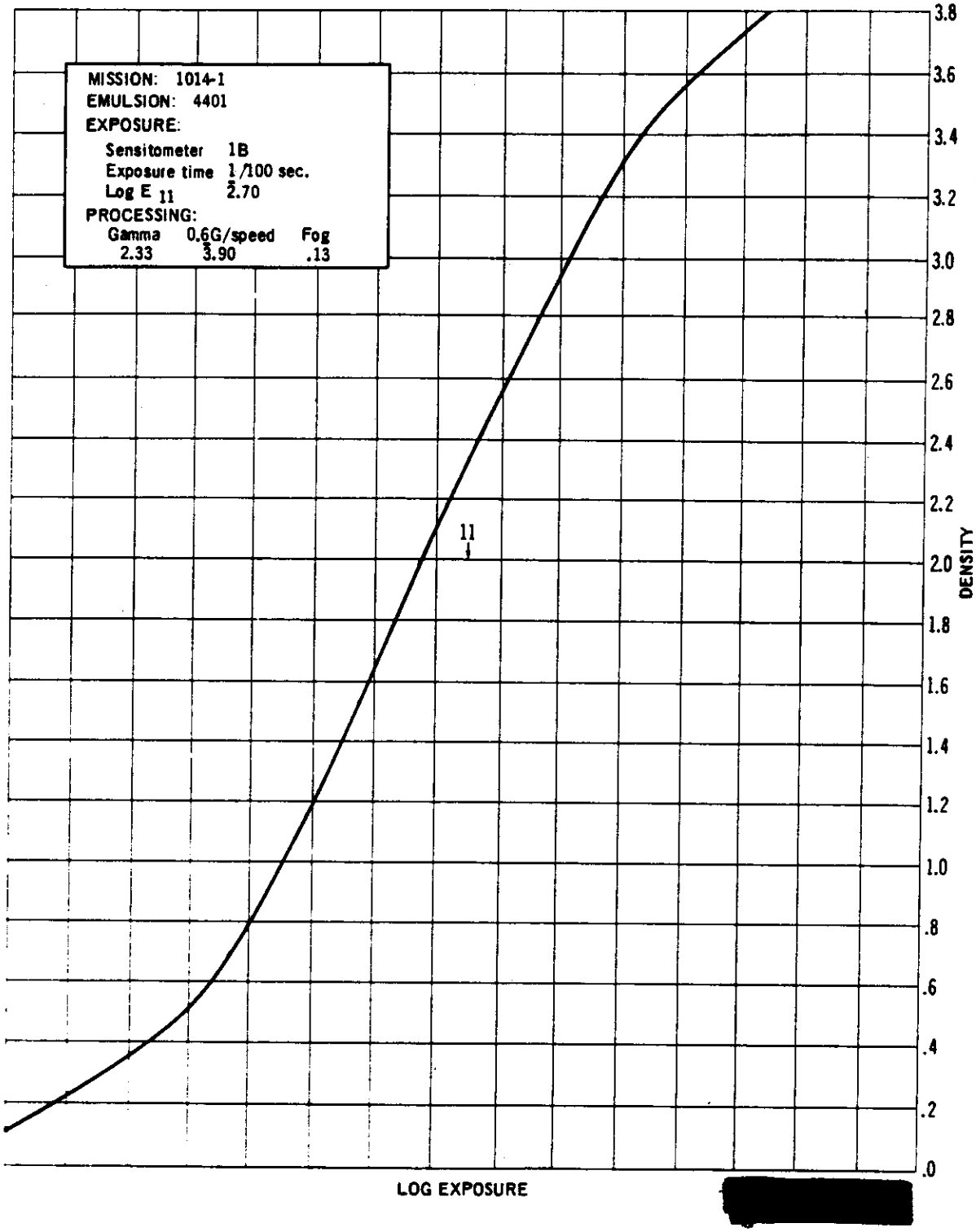
CONTROL CURVE FOR HEAD AND TAIL OF STELLAR MATERIAL



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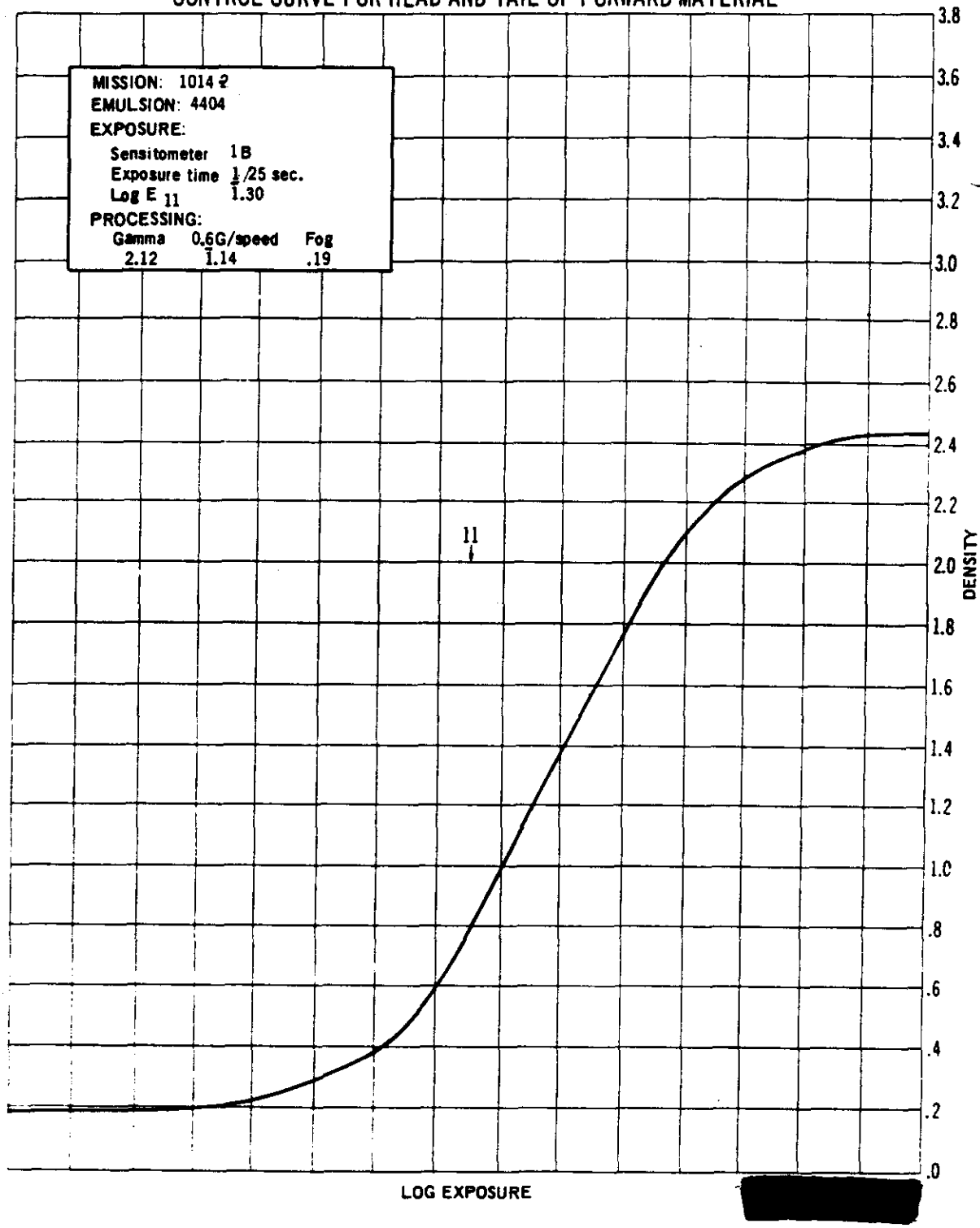

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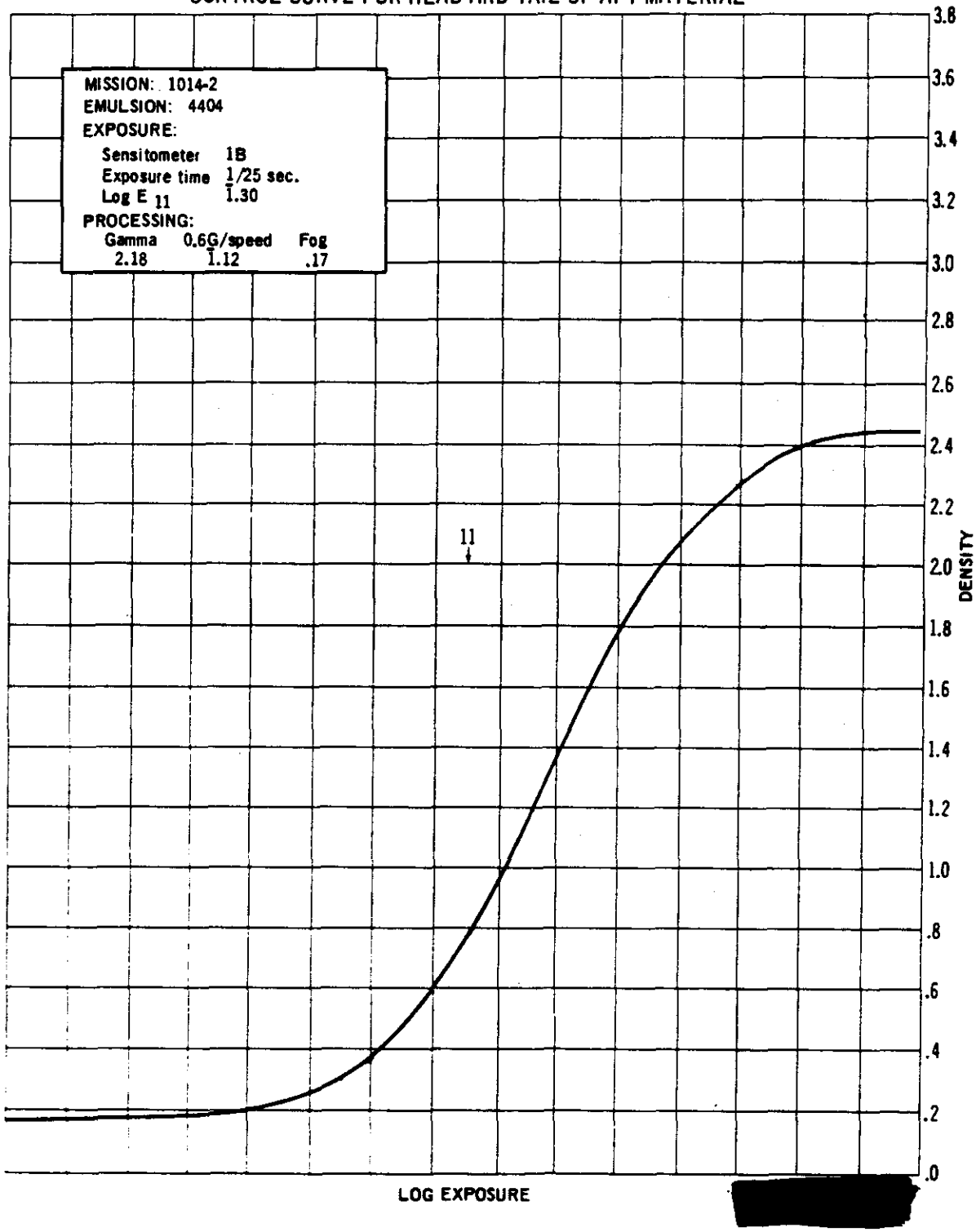

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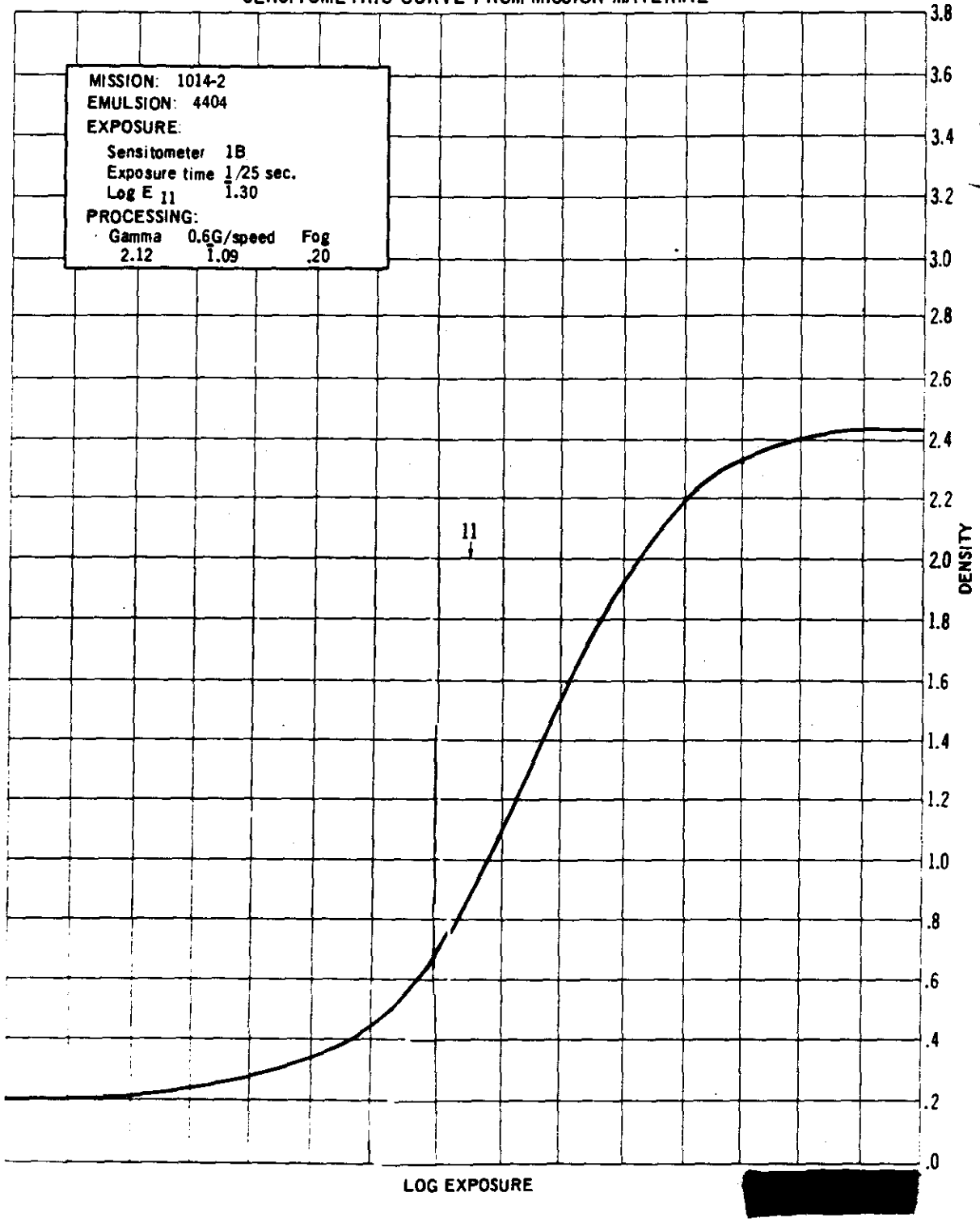

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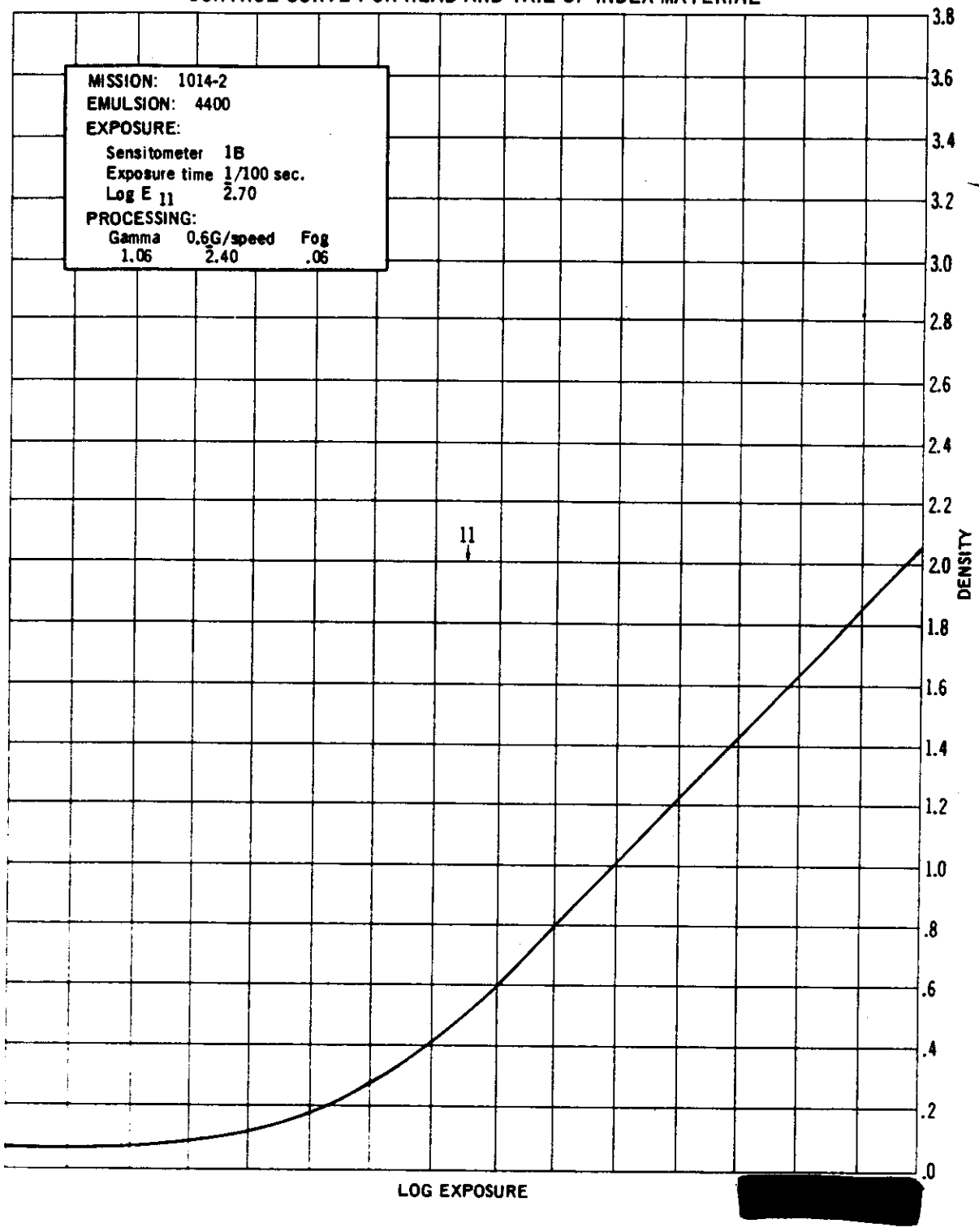

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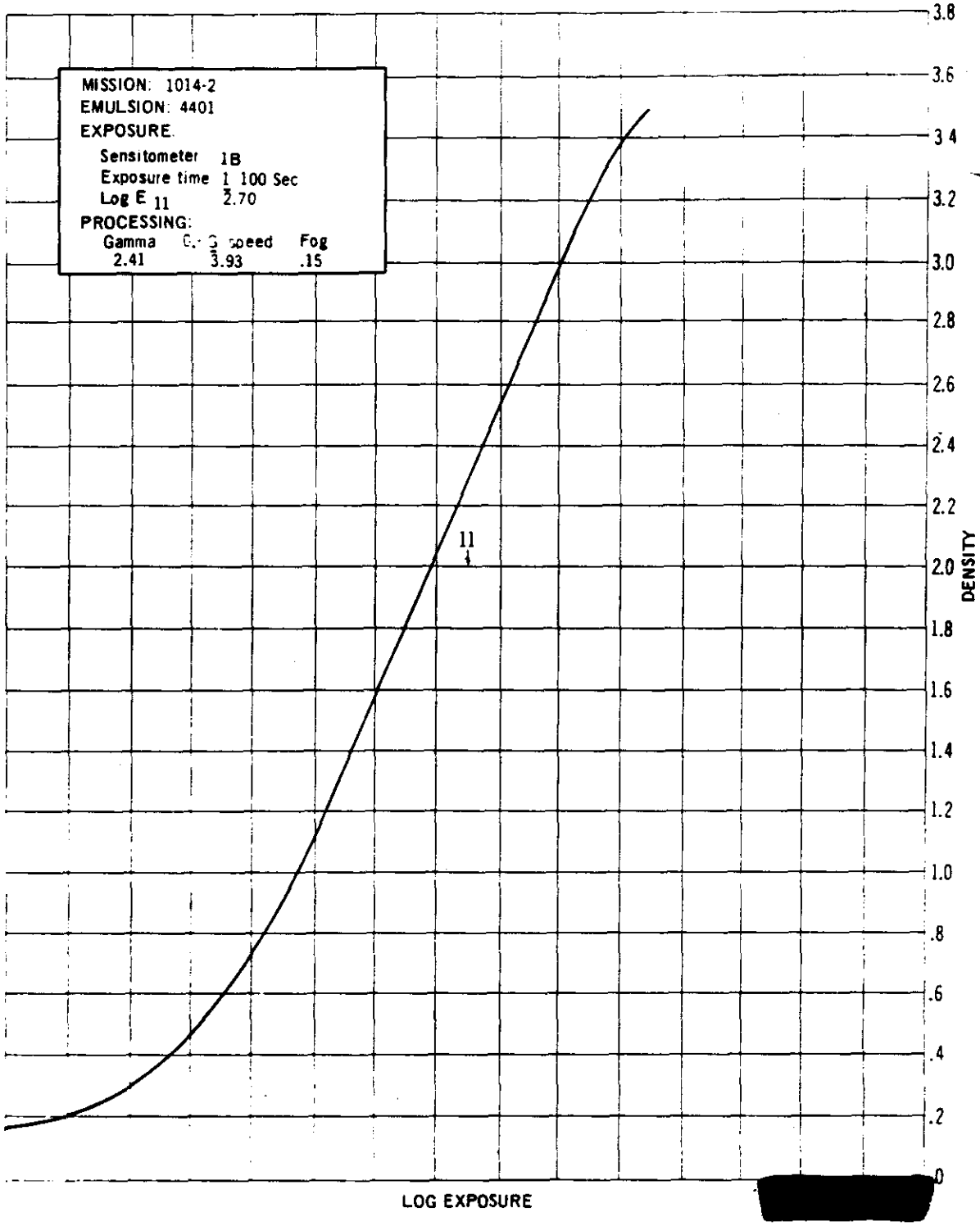

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5. Physical Film Degradations

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

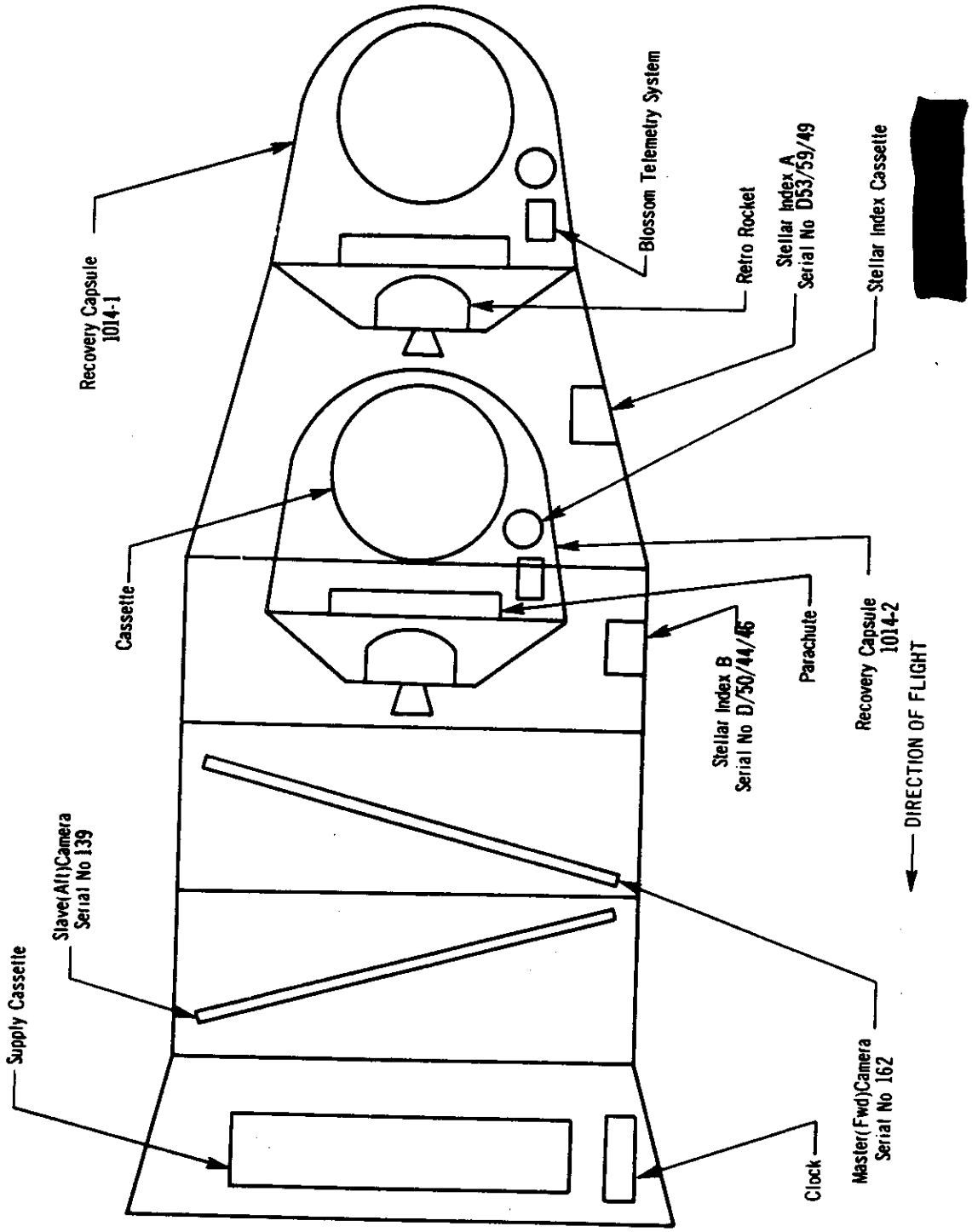
1. CAMERAS

	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	*	*	*	*	*	*

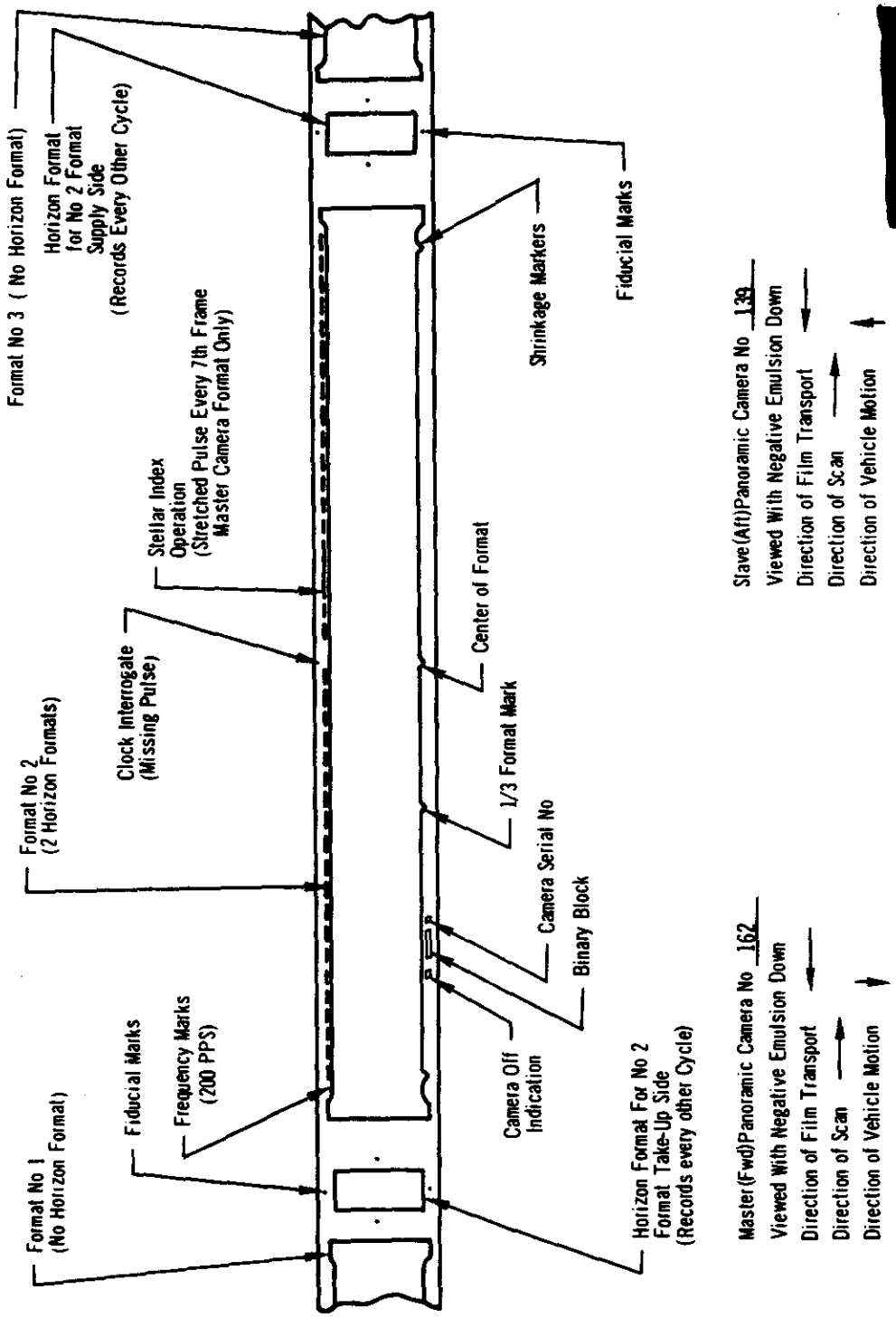
NA = Not Applicable
* = Not Available
(A) = Awar

TOP SECRET
CORONA
NO FOREIGN DISSEM

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.

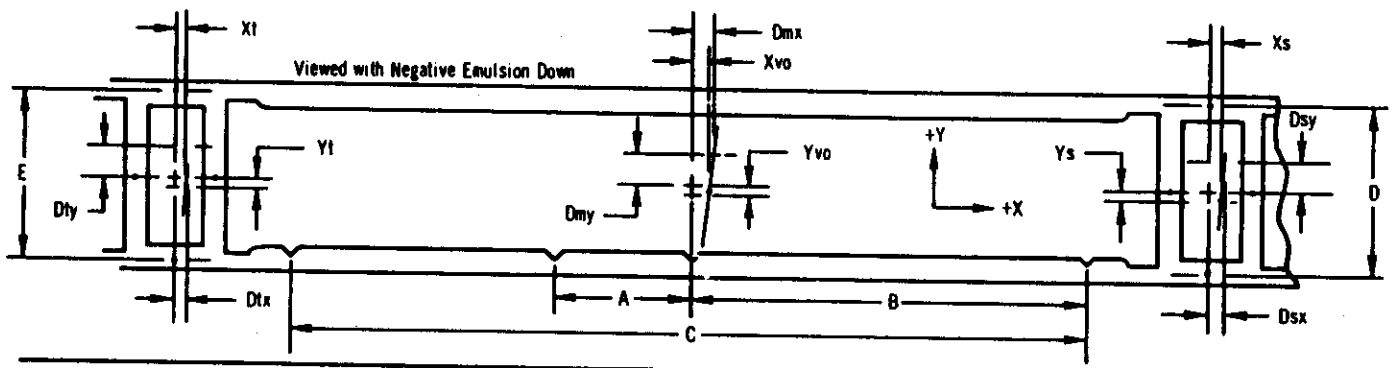
Measurement of the angle between the indicated axis of the panoramic cameras and the line of intersection of the plane defined in Paragraph 2

[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

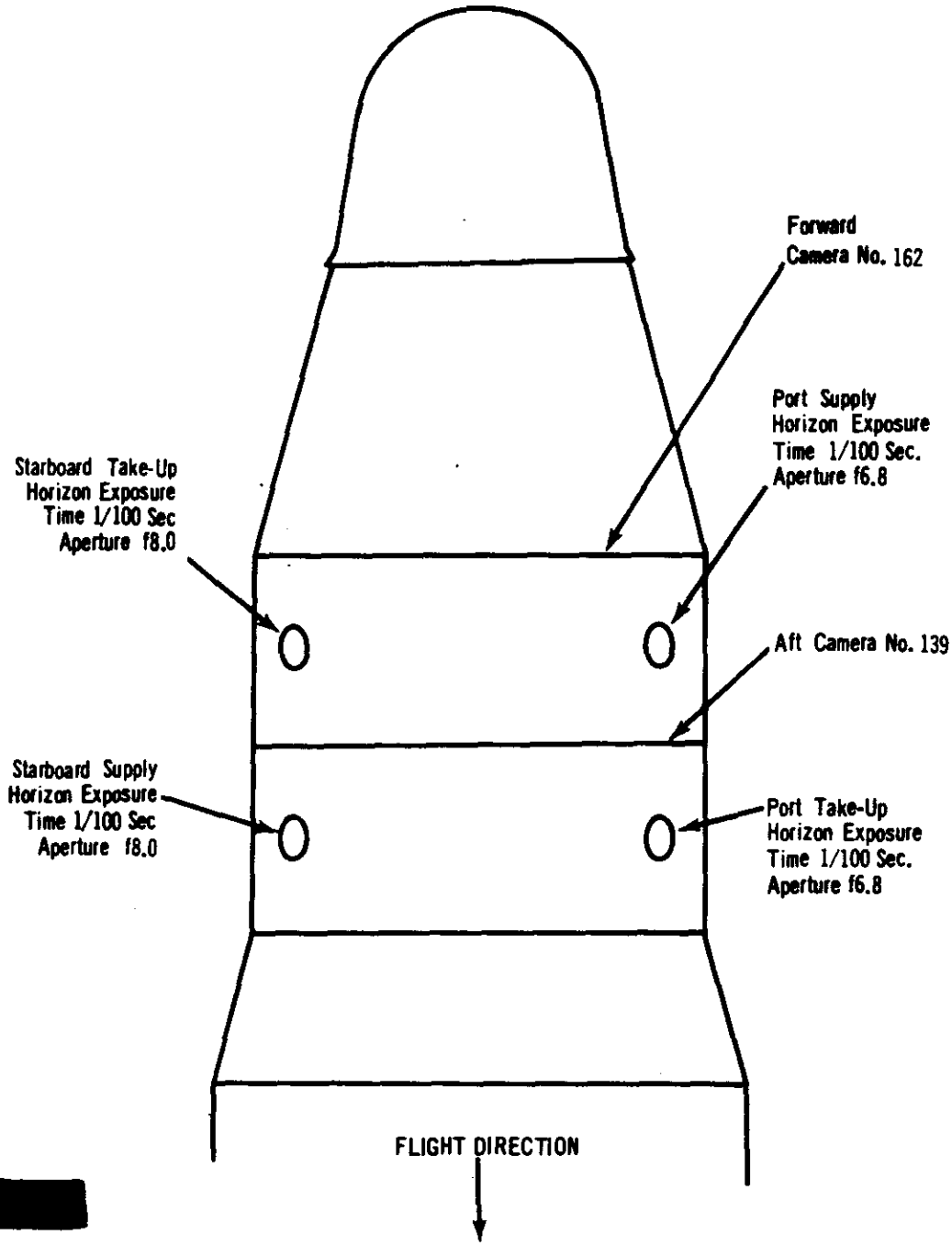
*INSTRUMENTS 162 AND 139 WERE NOT CALIBRATED AS A SYSTEM

[redacted]

TOP SECRET
CORONA
NO FOREIGN DISSEM

[redacted]

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



[redacted]

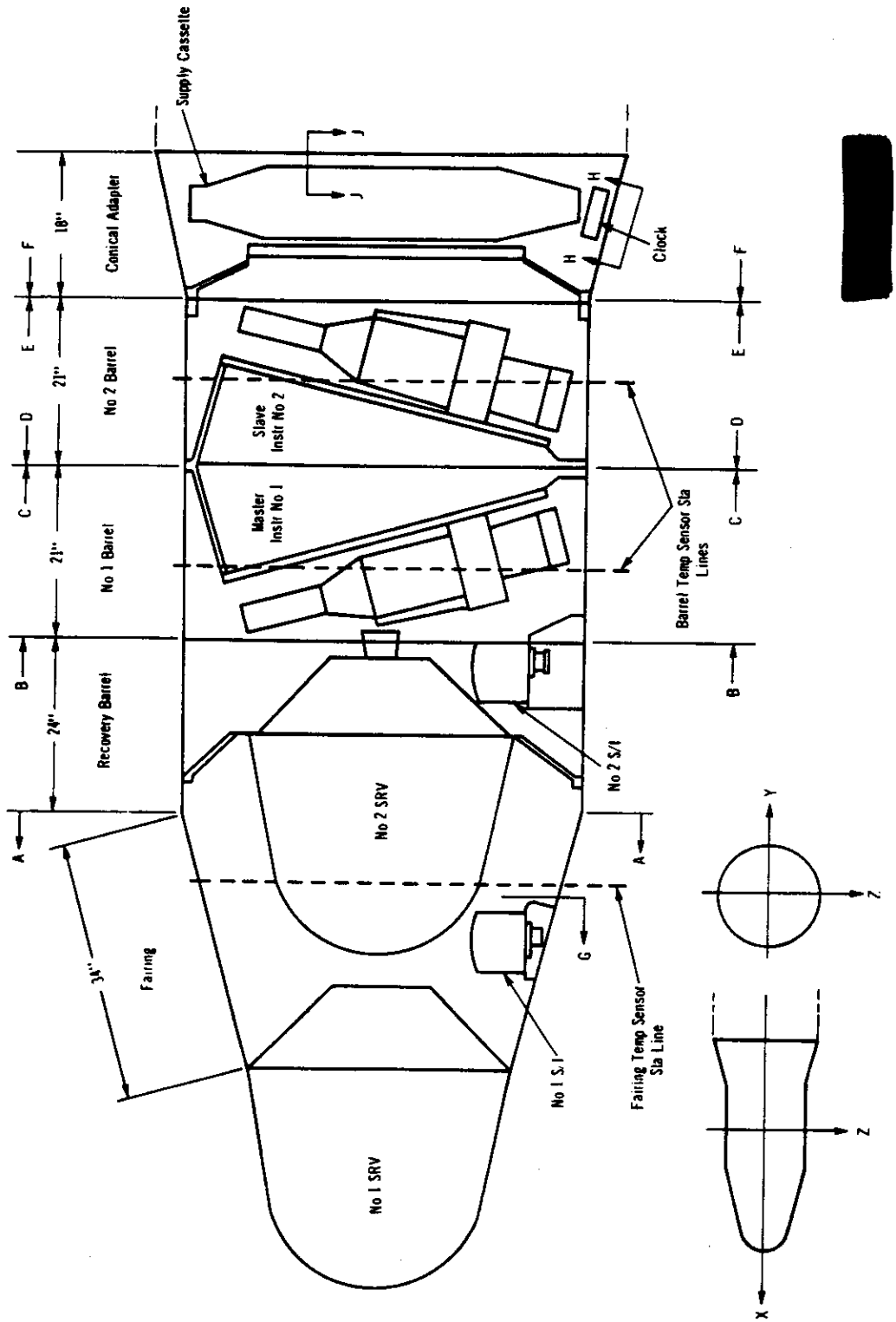
[redacted]

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.

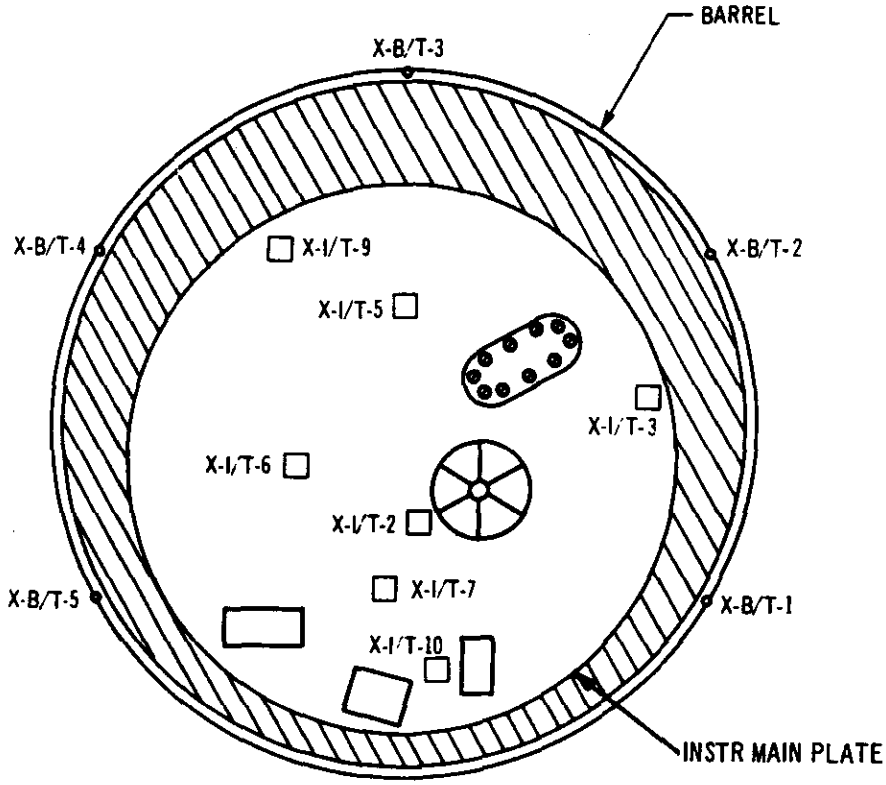
In analyzing the average temperatures recorded by the sensors during the mission, note the extreme temperatures at launch and the gradual cooling as the mission progresses. Also note the sudden change in temperature at recovery battery B SRV as the heaters were activated between orbits 79 and 89.

"J" PROFILE TO SHOW APPROXIMATE TEMP SENSOR LOCATIONS

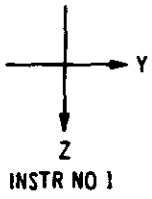


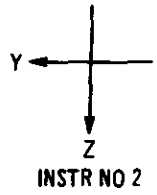
[redacted]

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



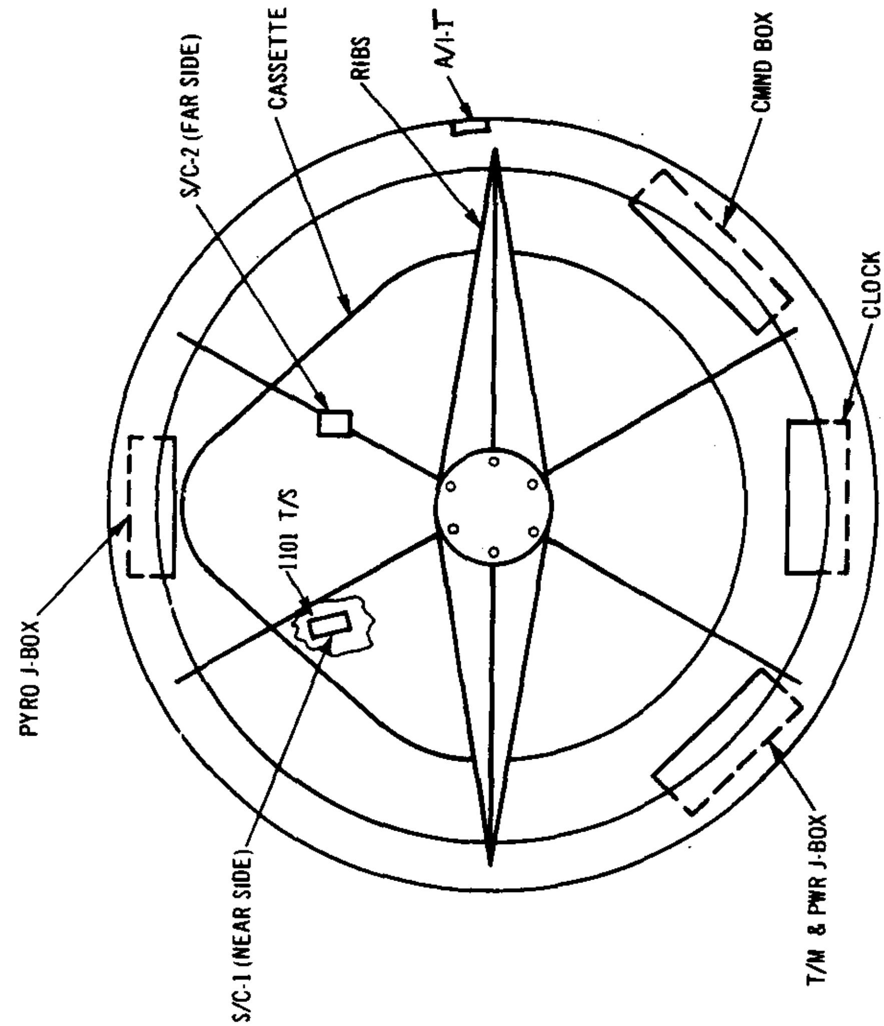


KEY.
X denotes No 1 or No 2 instr or barrel
e.g. X-I. T- 6 is No 1 or No 2 instr-
instr temp sensor No 6
X-B T-4 is No 1 or No 2 barrel temp
sensor No 4

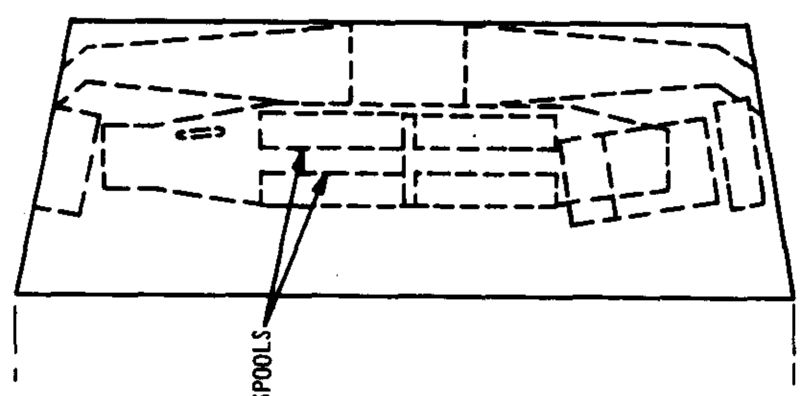
[redacted]

[redacted]

VIEW E-E SUPPLY CASSETTE LOOKING AFT



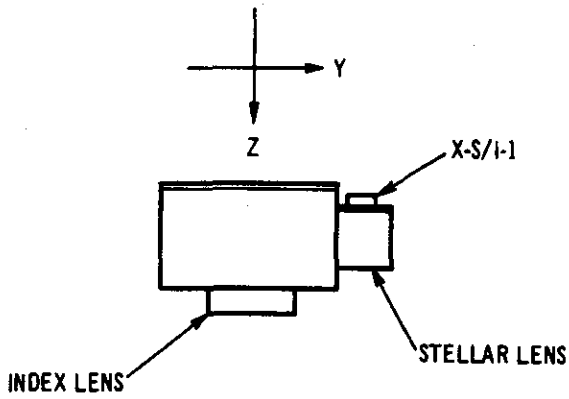
SIDE VIEW SHOWING SPOOLS



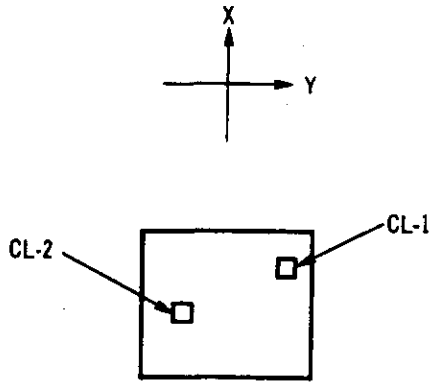
[redacted]

[redacted]

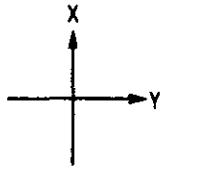
VIEW G-G
S/I TEMP SENSOR

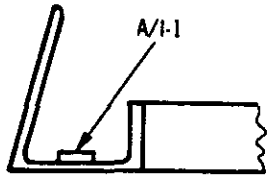


VIEW H-H
CLOCK TEMP SENSOR



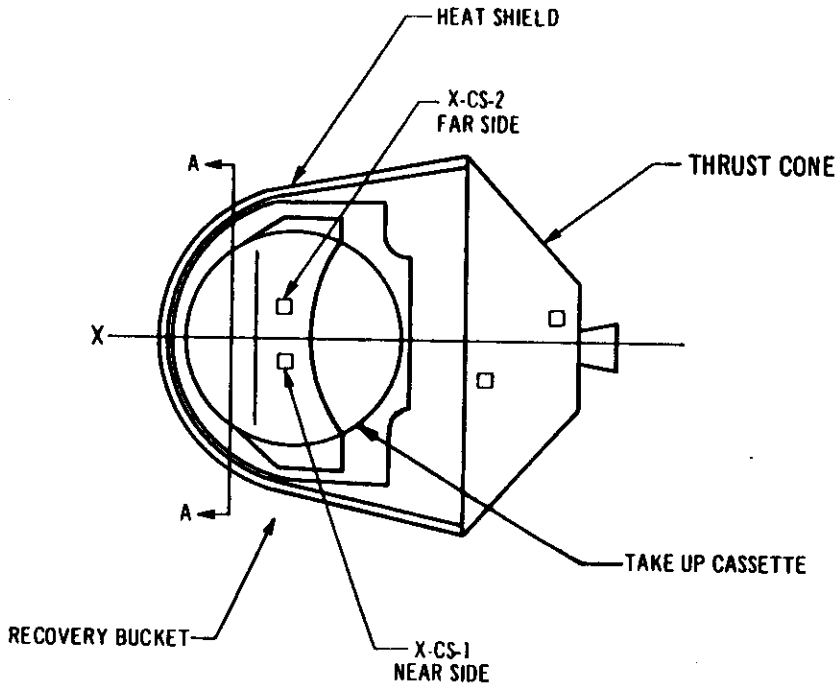
VIEW J-J
INTERFACE TEMP SENSOR
(SENSOR ON-Y AXIS)

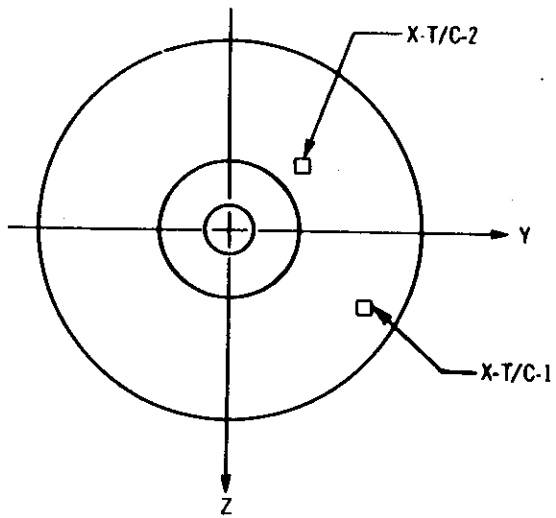


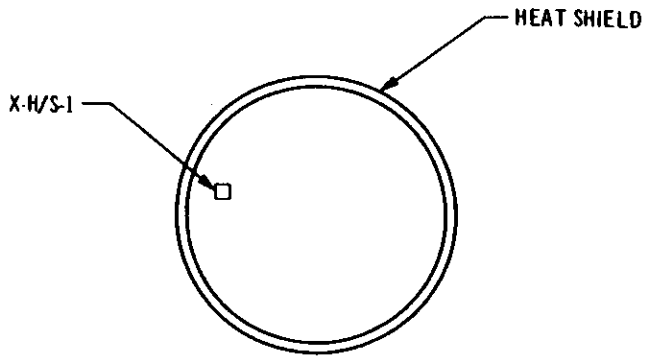


[redacted]

NO 1 AND NO 2 SRV TEMP SENSORS







SECTION A-A

KEY:

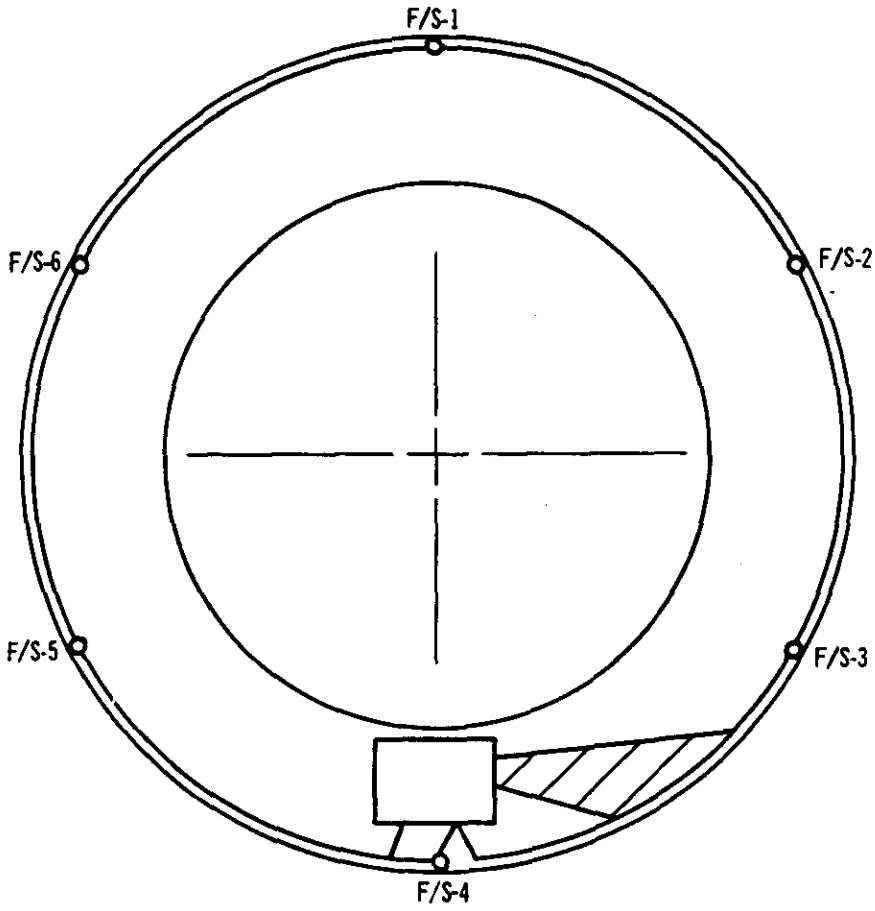
X denotes No 1 or No 2 SRV
e.g.
X-T/C-2 is
No 2 SRV-thrust
cone temp sensor-2

[redacted]

[redacted]

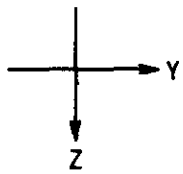
[redacted]

FAIRING TEMP SENSORS



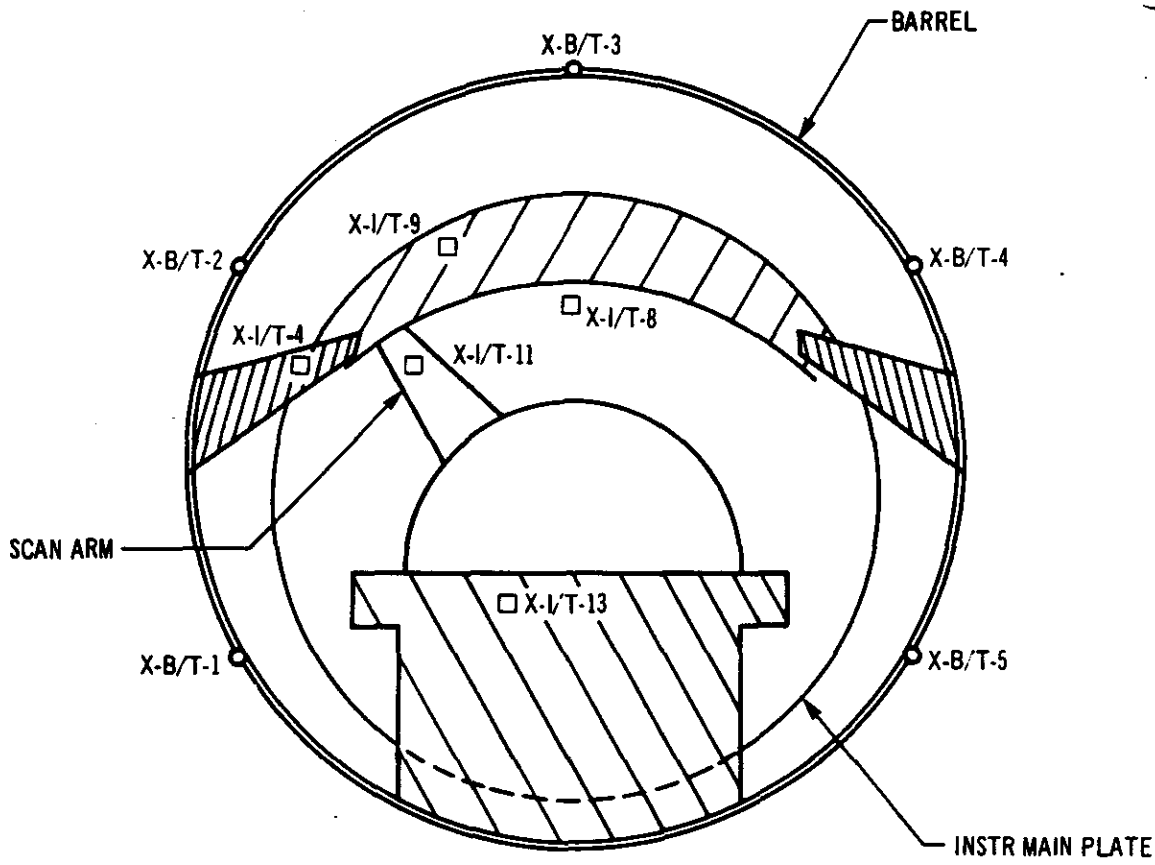
VIEW A-A
LOOKING FORWARD

[redacted]

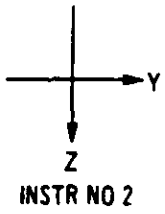


[redacted]

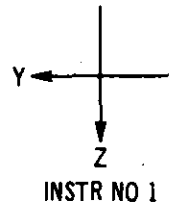
NO 1 & NO 2 TEMP SENSORS (FRONT FACE)
NO 1 & NO 2 BARREL TEMP SENSORS (SKIN)



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



INSTR NO 2



INSTR NO 1

[redacted]