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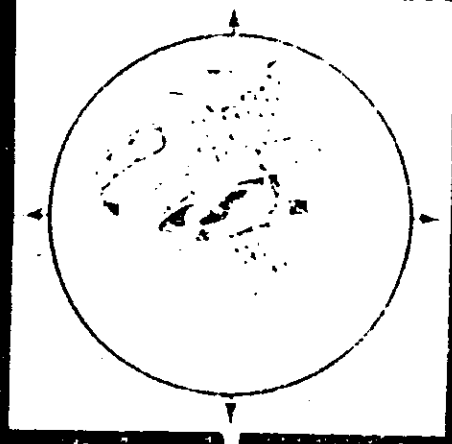

PHOTOGRAPHIC EVALUATION REPORT MISSION 1017-1 25 FEBRUARY - 2 MARCH 1965 MISSION 1017-2 2 - 6 MARCH 1965

AUGUST 1965
COPY
112 PAGES

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TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT
MISSION 1017-1
25 FEBRUARY - 2 MARCH 1965
MISSION 1017-2
2 - 6 MARCH 1965

AUGUST 1965

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

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SYNOPSIS

Mission 1017 (J-14) was launched 25 February 1965. The initial phase, designated Mission 1017-1, accomplished 39 photographic revolutions, including 3 domestic and 2 engineering passes. The payload was recovered in an air catch on 2 March 1965 and second-phase operations were initiated with no intervening deactivation period. Mission 1017-2 accomplished 33 photographic revolutions, including 3 domestic and 3 engineering passes. Recovery of the second payload in an air catch on 6 March 1965 terminated the mission.

The panoramic cameras were operational throughout the mission, but a capping shutter malfunction degraded the slave (AFT) camera photography in the last 5 passes (133D - 137D). The stellar/index cameras performed satisfactorily throughout Mission 1017-1. A possible solenoid malfunction in the second-phase S/I unit caused a film metering failure. Only 45 stellar formats and 29 index [illegible] recorded. Of these, approximately 70 percent of the stellar formats and most of the index formats contain multiple exposures.

The photography in Mission 1017 was acquired at solar elevations ranging between 0 and 79 degrees. Geographic latitudes ranged between 9 degrees south and 74 degrees north. Clouds obscured 20 percent of the panoramic photography in Mission 1017-1 and 30 percent in Mission 1017-2.

[redacted]

GENERAL FLIGHT DATA

Mission 1017-1

Launch Date	25 February 1965
Recovery Date	2 March 1965

Mission 1017-2

Starting Date	2 March 1965
Recovery Date	6 March 1965

Orbital Parameters

	Mission 1017-1 (Rev 40)	Mission 1017-2 (Rev 109)
Period	89.99 min	89.86 min
Perigee	92.29 nm	98.45 nm
Apogee	201.90 nm	198.32 nm
Eccentricity	0.0145	0.0139
Inclination Angle	75.07°	75.07°

Photographic Operations

	Mission 1017-1	Mission 1017-2
Operational Passes	34	27
Domestic Passes	3	3
Engineering Passes	2	3
Recovery Revolutions	81	145

PART I. CAMERA OPERATION

1. Master (FWD) Panoramic Camera No 140: The instrument was operational throughout the mission. Camera-induced degradations consist primarily of minor scratches, random minus-density streaks, light leak patterns at or near the at-rest positions, and a number of dendritic static discharges. The latter appear intermittently on both film edges in pass 94D and on the time track edge in passes 94D and 97D. Although some of the discharges intrude on the formats, degradation is minor. The major light-struck areas at or near the camera-rest positions contain the following patterns:

Mission 101-1: The 6th frame from the end of most passes is degraded by an edge-to-edge rectangle of uniform fog, approximately 0.7 inches wide, located in the take-up section of the frame. The last frame of some passes contains an equipment shadowgraph at the supply end of the format.

Mission 101-2: The 5th frame from the end of most passes contains a small light trace in the take-up end of the format. A similar pattern is present in the next-to-last frame. The last frame contains an equipment shadowgraph.

The degree of degradation in the frames affected by the uniform fog, light traces, and equipment shadowgraphs is dependent on the extent of time that the camera was at rest and on the solar elevation during the camera-off period. Degradation is not severe in the majority of cases in Mission 101-1 and is even less in Mission 101-2.

Faint banding is noted at the start of the scan in the thin-density areas, such as water imagery. Examples are found in passes 93D and 120D. Frames 57-61 of pass 137D (the terminal photographic revolution) are severely degraded by smeared images and intermittent fogging due to impending film exhaustion. In addition, static discharges and abrasions are present on both edges of the film.

2. Slave (AFT) Panoramic Camera No 165: The camera operated without malfunction until pass 133D, frame 24, when the capping shutter failed to close. It stayed open throughout the remainder of the mission. The horizon images and the extreme ends of the panoramic formats suffered the most degradation. The degree of degradation varied with solar elevation. Most of the affected horizon images were later salvaged by special printing of the duplicate positives. Similarly, special printing restored a significant amount of the degraded imagery in the panoramic format end sections. Dendritic static discharges are present intermittently on the fiducial edge of pass 55D and on the frequency marks edge of passes 83D-86D. A number of the discharges intrude on the formats, but image degradation is minor. Banding is detectable in thin-density areas at the scan start. Several passes contain intermittent minus-density streaks. As in the master (FWD) panoramic material, certain fog patterns and light traces appear recurrently at or near camera-off positions. Brief descriptions of these follow:

Mission 1017-1: The first frame of most passes contains a bar-type light trace, approximately 0.75 inches wide, extending from edge to edge within the format near frame-center. The 7th frame from the end is degraded by an edge-to-edge rectangle of uniform fog, approximately 6.5 inches wide, positioned in the take-up section of the frame. The third frame from the end of most passes contains an equipment shadowgraph at the take-up end. A small, irregular fog pattern is present in the next-to-last frame but is not readily detectable in all cases.

Mission 1017-2: The first frame of most passes contains the same bar-type light trace noted in Mission 1017-1. An equipment shadowgraph is present in the third frame from the end and a faint light trace is detectable in the last frame of some passes.

3. Master (FWD) Horizon Cameras: The port (supply) horizon camera was operational throughout the mission. The starboard (take-up) horizon camera shutter malfunctioned (failed to close) in pass 5D, frames 120 and 121, causing the loss of 2 horizon exposures and degrading the panoramic photography in those frames. The overall horizon image quality is good.

4. Slave (AFT) Horizon Cameras: The port (take-up) and starboard (supply) horizon cameras were operational throughout the mission. Image quality is good. However, the Panoramic camera capping shutter malfunction noted in Item 2 degraded all the horizon images from pass 133D, frame 24 to the end of the mission in Pass 137D. Special printing was required to restore the affected images to a useable condition.

5. Stellar Camera No 21 (Mission 1017-1): The instrument was operational throughout the mission. Approximately 30 percent of each format is degraded by flare. All frames contain a minimum of 10 readily identifiable stars which provide better-than-average geometry. However, numerous examples of distorted stellar images are also detectable in most frames. In general, mensuration and reduction of attitude values were enhanced by the above-average contrast and better-than-average geometry, but limited by the prevelance of distorted images. Some difficulty was encountered in resolving the reseau cross in the fiducial marks which were overexposed. The film is free of all but minor degradations.

6. Stellar Camera No 60 (Mission 1017-2): A possible solenoid malfunction is tentatively identified as the cause of a film metering failure, with consequent multiple exposures. The camera generated only 45 stellar formats, of which approximately 70 percent contain evidence of multiple exposures ranging from 2 to 5 exposures per format. The remaining, unaffected frames contain fair-to-good stellar images. The flare is noticeably less intense than in the film exposed during Mission 1017-1, and a considerable number of stellar images are detectable in the flared areas.

7. Index Camera No D21 (Mission 1017-1): The instrument performed without malfunction and produced good-quality terrestrial imagery.

8. Index Camera No D68 (Mission 1017-2): The possible stellar/index solenoid malfunction noted in Item 6 limited the acquired photography to 29 frames, most of which contain multiple exposures that have little or no information content value.

9. Associated Equipment: The old-type binary data block was employed in the master (FWD) panoramic camera and the lamp images are bloomed and distorted. Some read-out problems were encountered in the Slave (AFT) camera material. Specifically, the dimness of Lamp No 17 in passes 20D and 41D and Lamp No 29, in many passes, caused difficulties. In pass 136D, the top row of lamp images tracked

too close to the edge of the film and the time had to be hand-read. The frequency marks are flared, with reflected images, but are recorded outside the formats. The marks appear underexposed in the slave (AFT) camera material of Mission 1017-2 but are readable in all cases.

10. Special Note: Yaw Steering Experiments: Vehicle yaw was programmed in passes 9D-85D. The yaw increments ranged from 0.75 to 1.50 degrees, depending on the system lattitude. This is one of a continuing series of experiments intended to investigate the practical value of controlled yaw as compensation for possible image smear induced by the earth's rotational velocity. Approximately 0.5 degrees of residual (uncompensated) yaw angle remained after implementation of the yaw steering control. Identical terrain photography, acquired with and without yaw steering, was examined for comparison of image quality. The participants in the evaluation were unable to detect a difference between the samples.

[redacted]

FIGURE 1. DEFINITION OF PHOTOGRAPHIC DATA.

The data pertaining to photographs contained in this publication are defined as follows:

Pass: A pass is the operational portion of an orbital revolution. A suffix D indicates that the photography was acquired during the descending portion; a suffix A indicates that the photography was acquired during the ascending portion; and a suffix M indicates that the photography was acquired during a pass that included both ascending and descending portions. An additional suffix E indicates that the pass was an engineering operation or that a portion of the pass has been edited.

Date of Photography: The date of photography indicates the day, month, and year (GMT) that the photography was acquired.

Universal Grid Coordinates: These coordinates are included to locate the illustrated photography within the panoramic format.

Enlargement Factor: The enlargement factor is included to indicate the latitude and longitude of the panoramic format.

Geographic Coordinates: These coordinates are included to indicate the latitude and longitude of the panoramic format.

Altitude: This measurement is the vertical distance from the vehicle to the Hough Ellipsoid at the time of the acquisition of the photography.

Pitch: Rotation of the camera about its transverse axis. Using appropriate aeronautical terminology, positive readings indicate nose-up attitude and negative readings indicate nose-down attitude.

Roll: Rotation of the camera about its longitudinal axis. Using appropriate aeronautical terminology, positive readings indicate left wing-up attitude. Negative readings indicate right wing-up attitude.

Yaw: Rotation of the camera about its vertical axis. Positive readings indicate counterclockwise rotation when viewing the ground nadir from the vehicle-mounted camera in flight.

Local Sun Time: This time is included to present to the viewer a realistic time of the acquisition of the photography illustrated.

Solar Elevation: The solar elevation is the angular elevation of the sun above a plane tangent to the surface of the earth at the center of the panoramic format. A negative solar elevation indicates that the sun is below the plane.

Solar Azimuth: The solar azimuth is the angular measurement of the rays of the sun measured from true north in a clockwise direction.

Exposure: The exposure is the duration of the photographic exposure expressed in a fraction of a second and is computed from the scan rate and slit width.

[redacted]

FIGURE 2. EXAMPLE OF HORIZON CAMERA PHOTOGRAPHY.

NPIC K-2002 (8/68)

Camera	FWD
Pass	30D
Frame	8
Date of Photography	27 February 1965
Universal Grid Coordinates	Port Horizon
Enlargement Factor	3x
Geographic Coordinates	40°00'N, 83°57'W
Altitude (feet)	622,831
Pan Camera Attitude:	
Pitch	15°21'
Roll	00°18'
Yaw	02°02'
Local Sun Time	1258 Hrs
Solar Elevation	40°
Solar Azimuth	199°
Horizon Camera Exposure	1/100 sec

Approximate flight direction on photograph

Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.

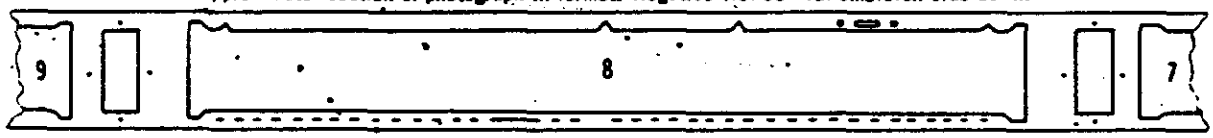
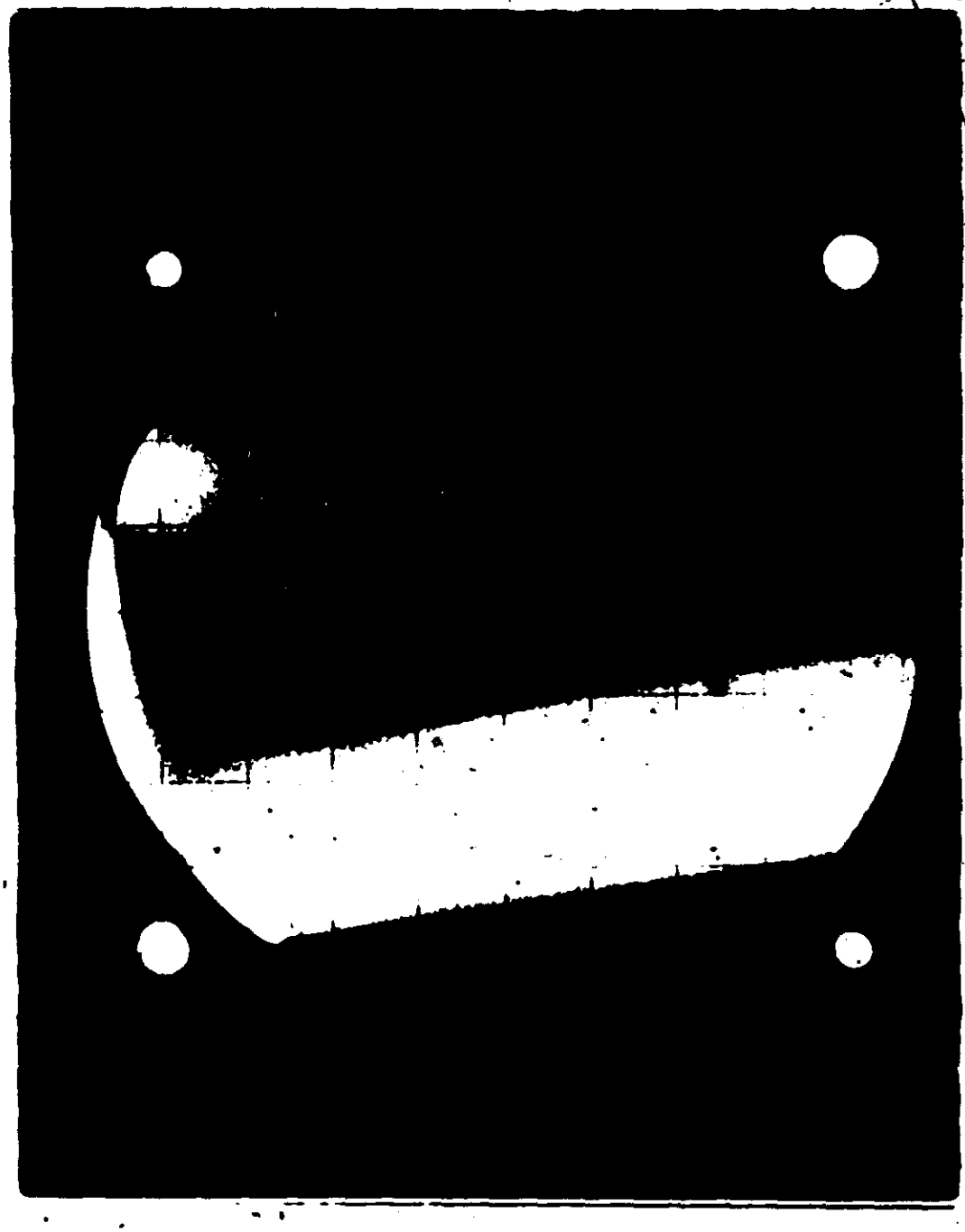


FIGURE 3. EXAMPLE OF STELLAR CAMERA PHOTOGRAPHY

[redacted]

Stellar Frame Number	66
Correlates with FWD Camera:	
Pass	60
Frame	144
Date of Photography	26 February 1965
Enlargement Factor	5x
Pan Camera Attitude:	
Pitch	15°21'
Roll	00°20'
Yaw	-00°18'
Stellar Camera Exposure Time	2 sec



[redacted]

FIGURE 4. EXAMPLE OF INDEX CAMERA PHOTOGRAPHY.

NPIC K-2684 (8/65)

[redacted]

Index Frame Number	23
Correlates with FWD Camera:	
Pass	4D
Frame	53
Date of Photography	26 February 1965
Enlargement Factor	2x
Pan Camera Attitude:	
Pitch	14°43'
Roll	00°11'
Yaw	-00°29'
Index Camera Exposure	1/500 sec


023
1017-1 26 FEB 65
TOP SECRET RUFF

PART II. FILM

1. Film Footage/Frame Totals:

	1017-1	1017-2
Master (FWD) Camera	8,252 ft/2,936 frames	7,725 ft/2,914 frames
Slave (AFT) Camera	8,214 ft/2,940 frames	7,672 ft/2,908 frames
Stellar Camera	66 ft/ 420 frames	5 ft/ 45 frames
Index Camera	94 ft/ 420 frames	6 ft/ 29 frames

Total Footage/Frames, Master (FWD) Camera: 15,977 ft/ 5,850 frames
Total Footage/Frames, Slave (AFT) Camera: 15,886 ft/ 5,848 frames
Total Footage/Frames, FWD & AFT Cameras: 31,863 ft/11,698 frames

The last 6 master panoramic frames and the last 7 slave panoramic frames of the terminal pass in Mission 1017-1 (pass 81D) were recovered with the second payload. In every mission employing the 2-phase concept, the last few frames of first-phase photography will be contained at the head of the second-phase payload. Monoscopic coverage, employing either panoramic camera, may be programmed into any part of a mission.

2. Film Processing Data: This section provides evaluations of processing, exposure, density, and physical condition of the original negatives. Processing data is abstracted from records provided by the processing contractor. Evaluation of exposure and determination of the film's physical condition are accomplished by on-site inspection of the negatives as they are made available for breakdown and titling. Densitometric readings and a final, more thorough examination of the original negatives are conducted by photographic analysts at a later date.

Most of the footage in this mission received adequate exposure. However, variations in terrain reflectivity and/or low solar elevations caused some departures from normal exposure results. In order to strike an acceptable minimum/maximum densities mean, infrared densitometry was utilized by the processing contractor to determine the optimum development levels required for the various portions of the panoramic records.

The following development levels were employed in processing the film:

	1017-1		1017-2	
	Master	Slave	Master	Slave
Primary	13%	24%	5%	18%
Intermediate	63%	58%	63%	62%
Full	24%	18%	32%	20%

Sixty-two processing level changes were required on the master record and 47 on the slave record on Mission 1017-1. On Mission 1017-2, 51 processing level changes were required on the master record and 46 changes on the slave material. As a whole, density of the mission record is good. Most of the density levels are in the medium category.

3. Physical Film Degradations: No major degradations are present on the panoramic film. Most of the degradations consist of intermittent and minor scratches, digs, pinholes, etc., except for the dendritic static discharges previously mentioned. The only other exceptions worth noting are an uncommonly high number of kinks in the material recovered from Mission 1017-1 and numerous fine, longitudinal emulsion scratches near the take-up end of many frames in the second-phase material. The stellar/index film records are also free of all but minor physical defects.

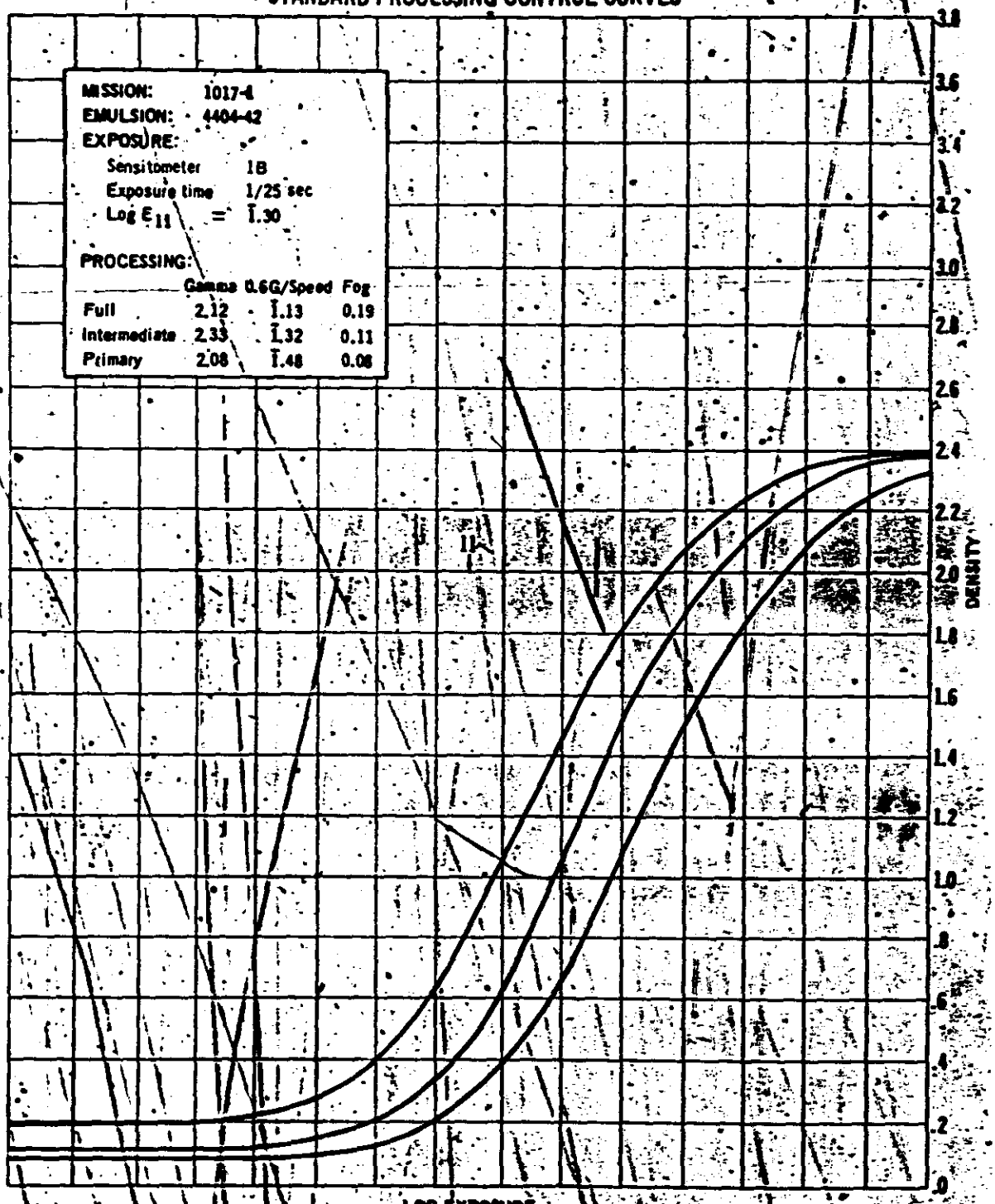
4. Film Processing Curves: The following pages contain reproductions of the film processing curves for Missions 1017-1 and 1017-2.

STANDARD PROCESSING CONTROL CURVES

MISSION: 1017-4
EMULSION: 4404-42
EXPOSURE:
Sensitometer 1B
Exposure time 1/25 sec
Log E_{11} = 1.30

PROCESSING:

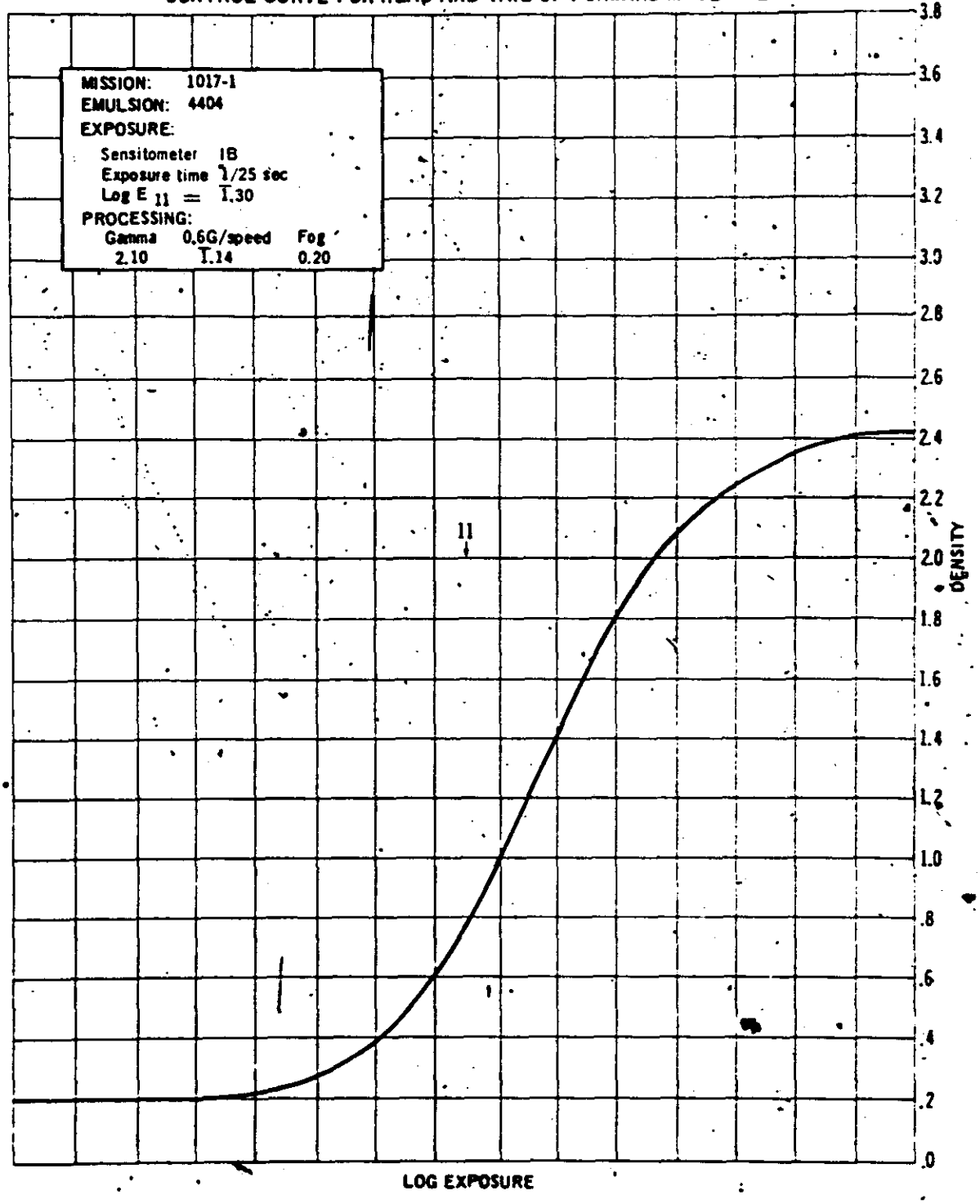
	Gamma	0.6G/Speed	Fog
Full	2.12	1.13	0.19
Intermediate	2.33	1.32	0.11
Primary	2.08	1.48	0.08



NPIC [illegible]

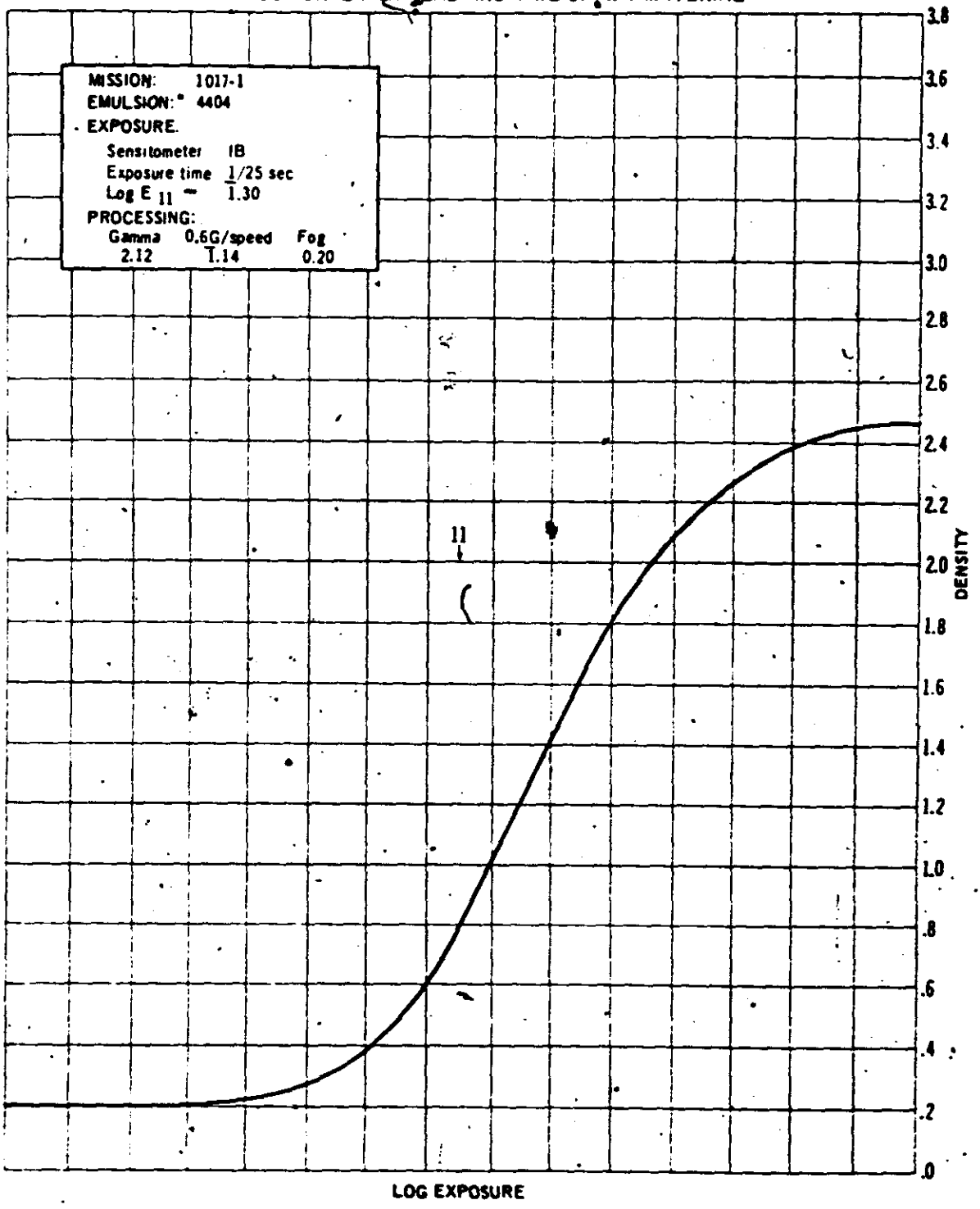
[redacted]

CONTROL CURVE FOR HEAD AND TAIL OF FORWARD MATERIAL



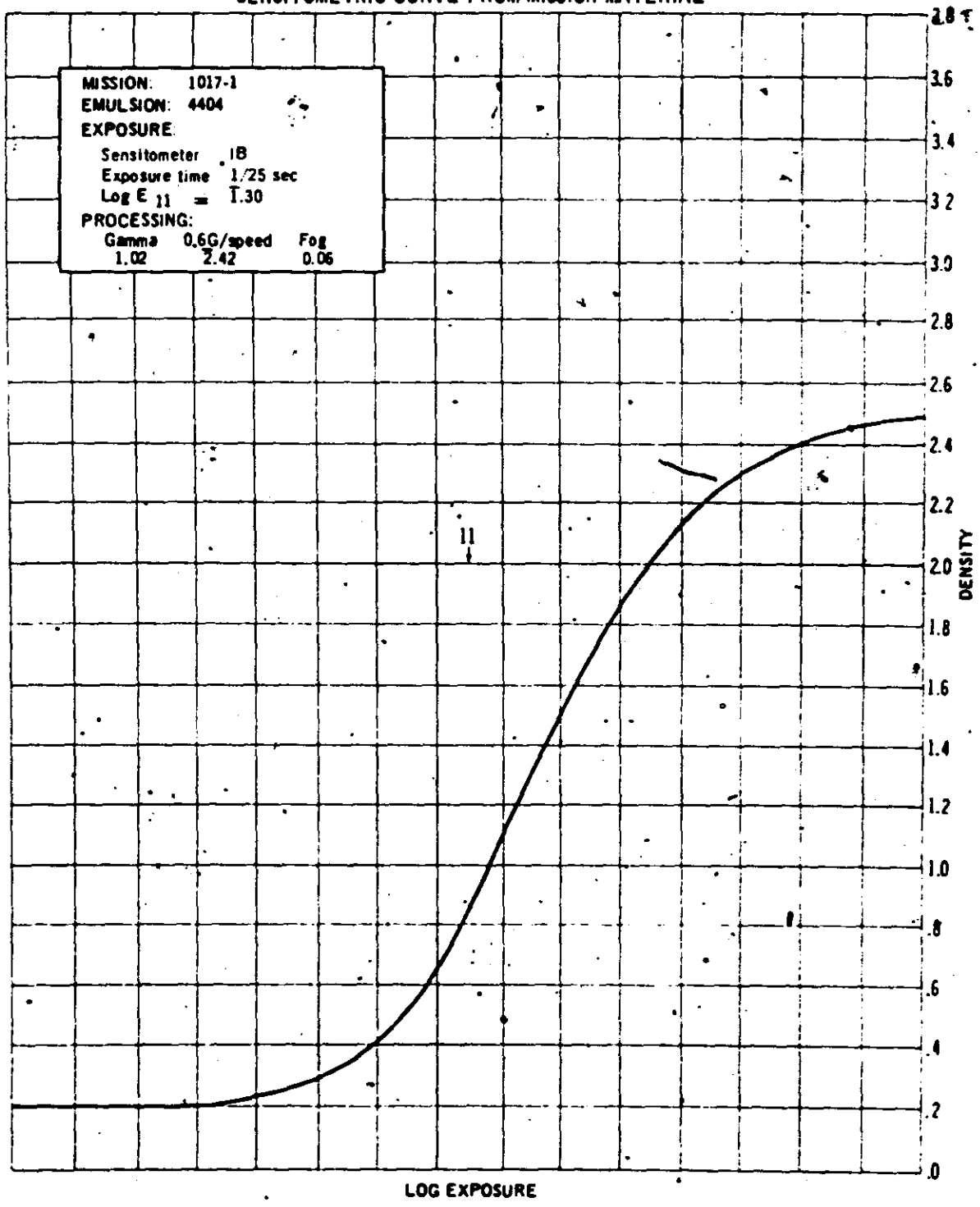
NPIC K-2890 (7/68)

CONTROL CURVE FOR HEAD AND TAIL OF AFT MATERIAL



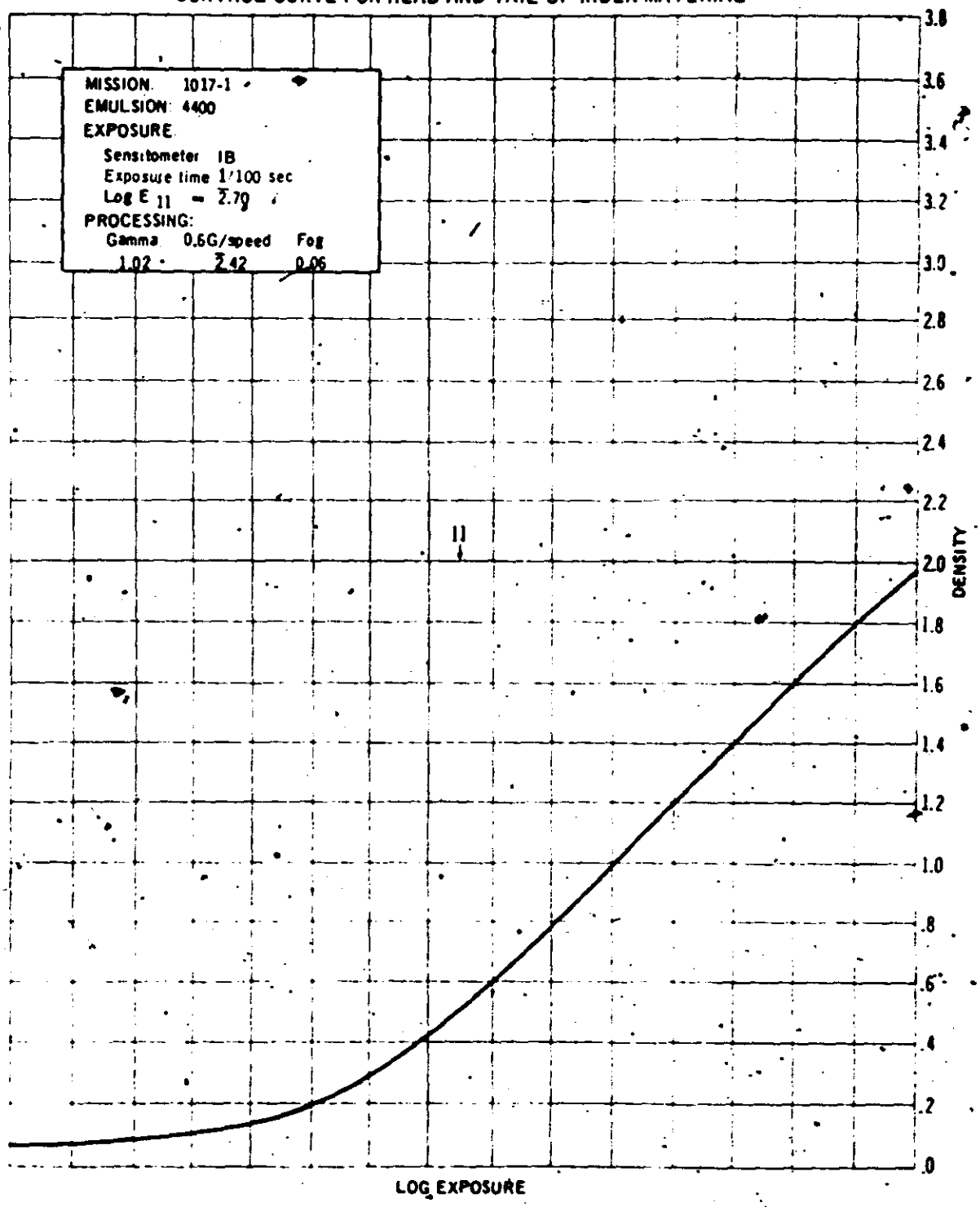
NPIC K-2091 (7/85)

SENSITOMETRIC CURVE FROM MISSION MATERIAL



NPIC K-2002 (7/68)

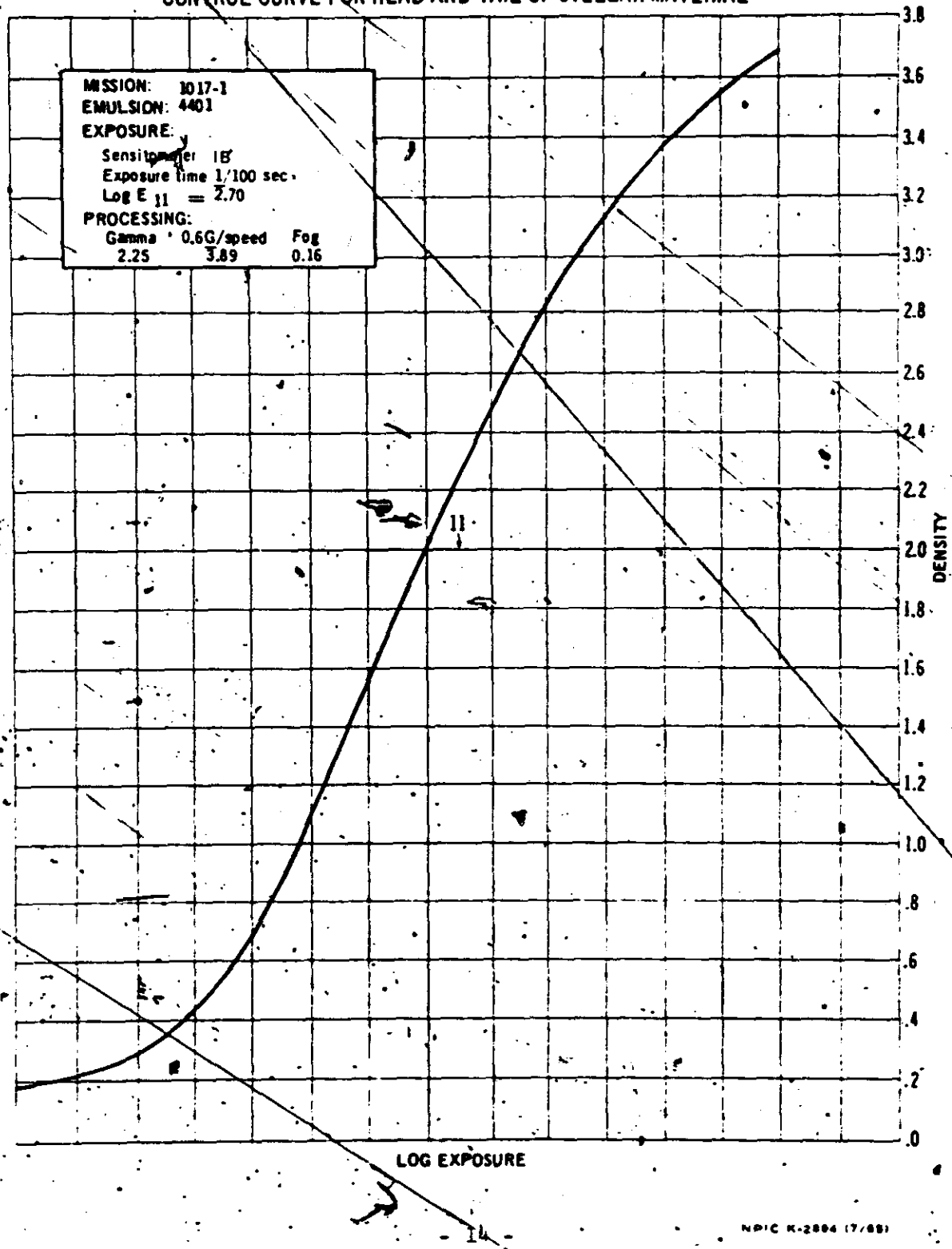
CONTROL CURVE FOR HEAD AND TAIL OF INDEX MATERIAL



NPIC K-2003 (7 69)

[redacted]

CONTROL CURVE FOR HEAD AND TAIL OF STELLAR MATERIAL



NPIC K-2804 (7/68)

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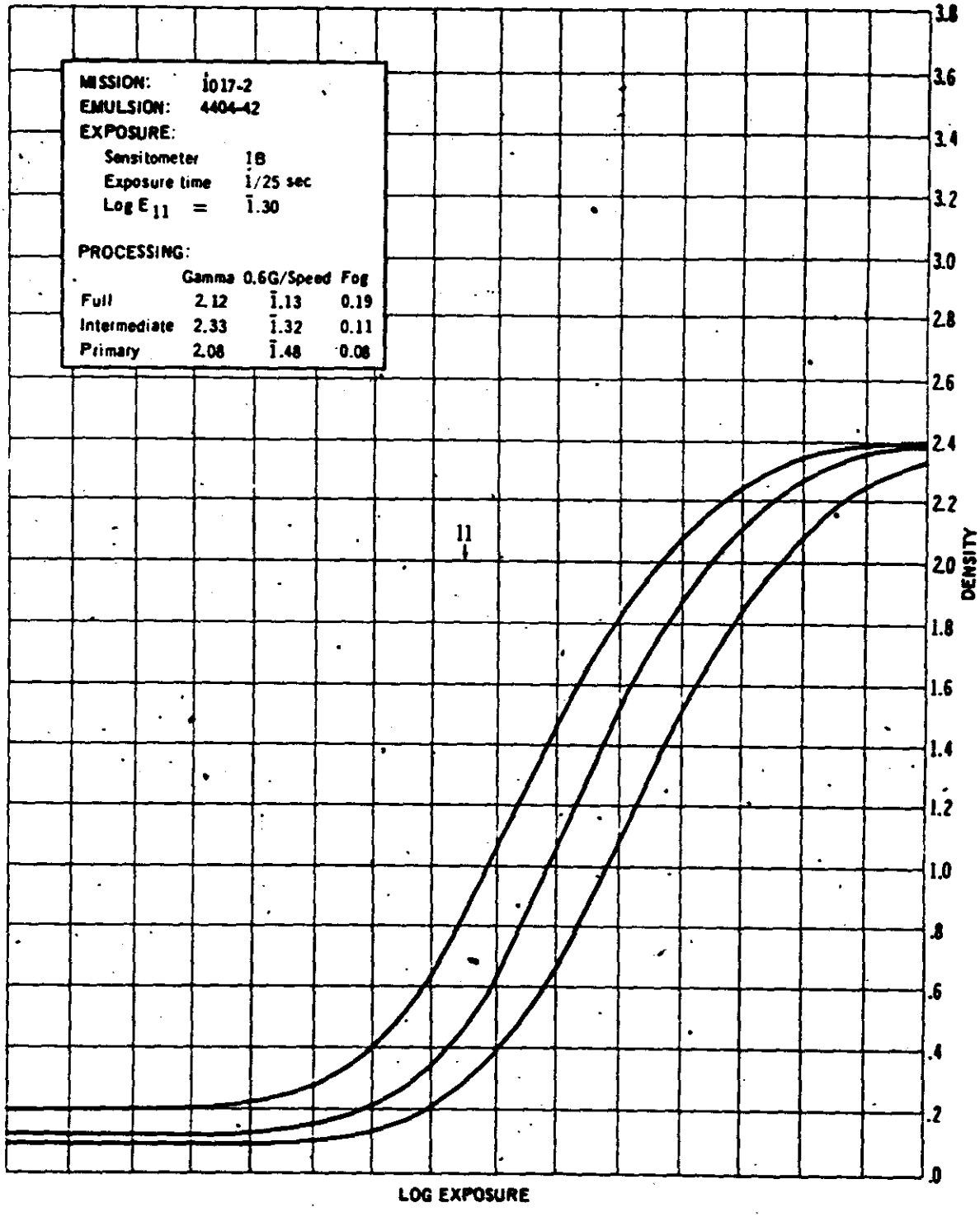
STANDARD PROCESSING CONTROL CURVES



NPIC K-2898 (7/69)

[redacted]

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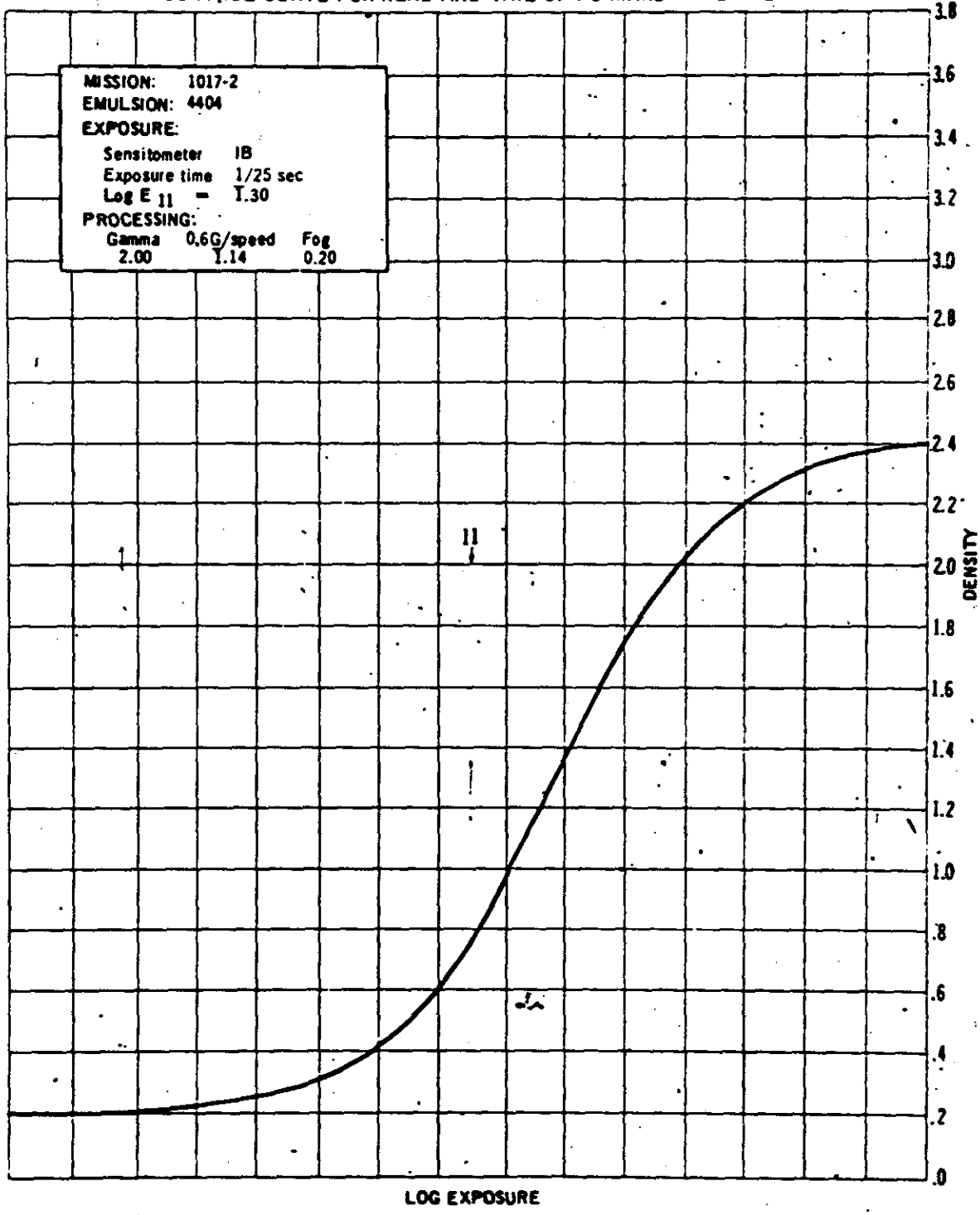
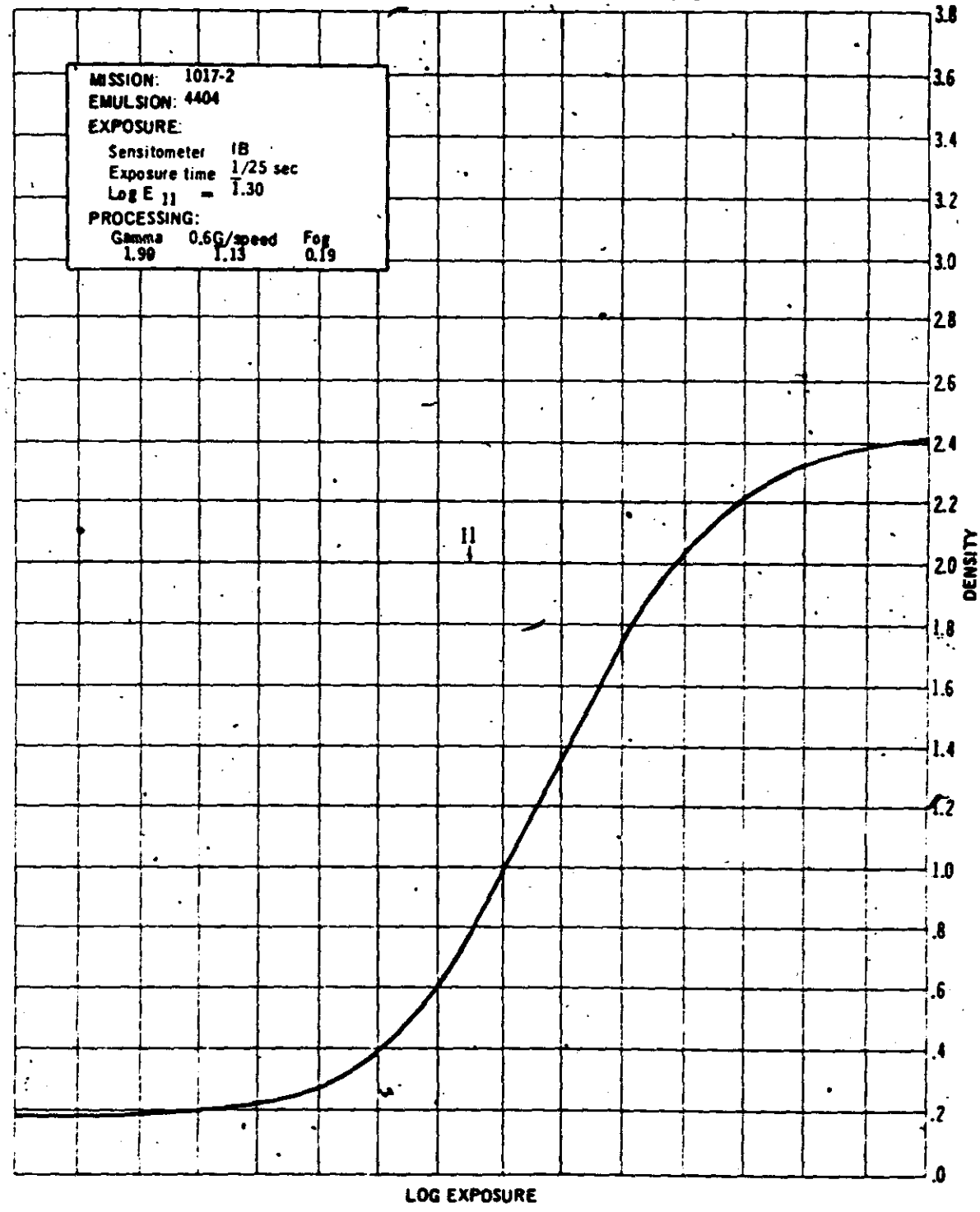


NPIC R-2800 (7/69)

[redacted]

CONTROL CURVE FOR HEAD AND TAIL OF AFT MATERIAL



NPIC K-2897 (7/68)

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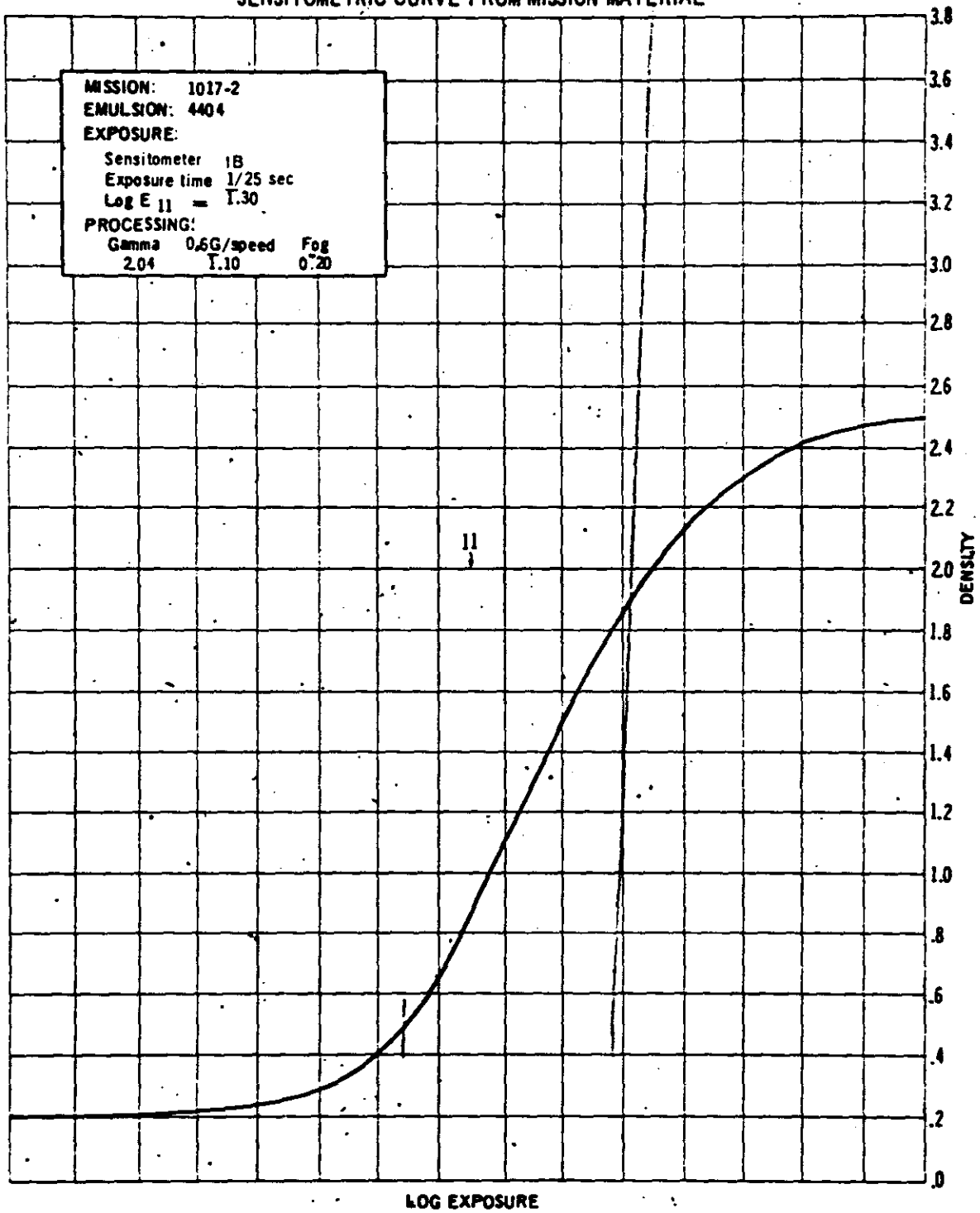
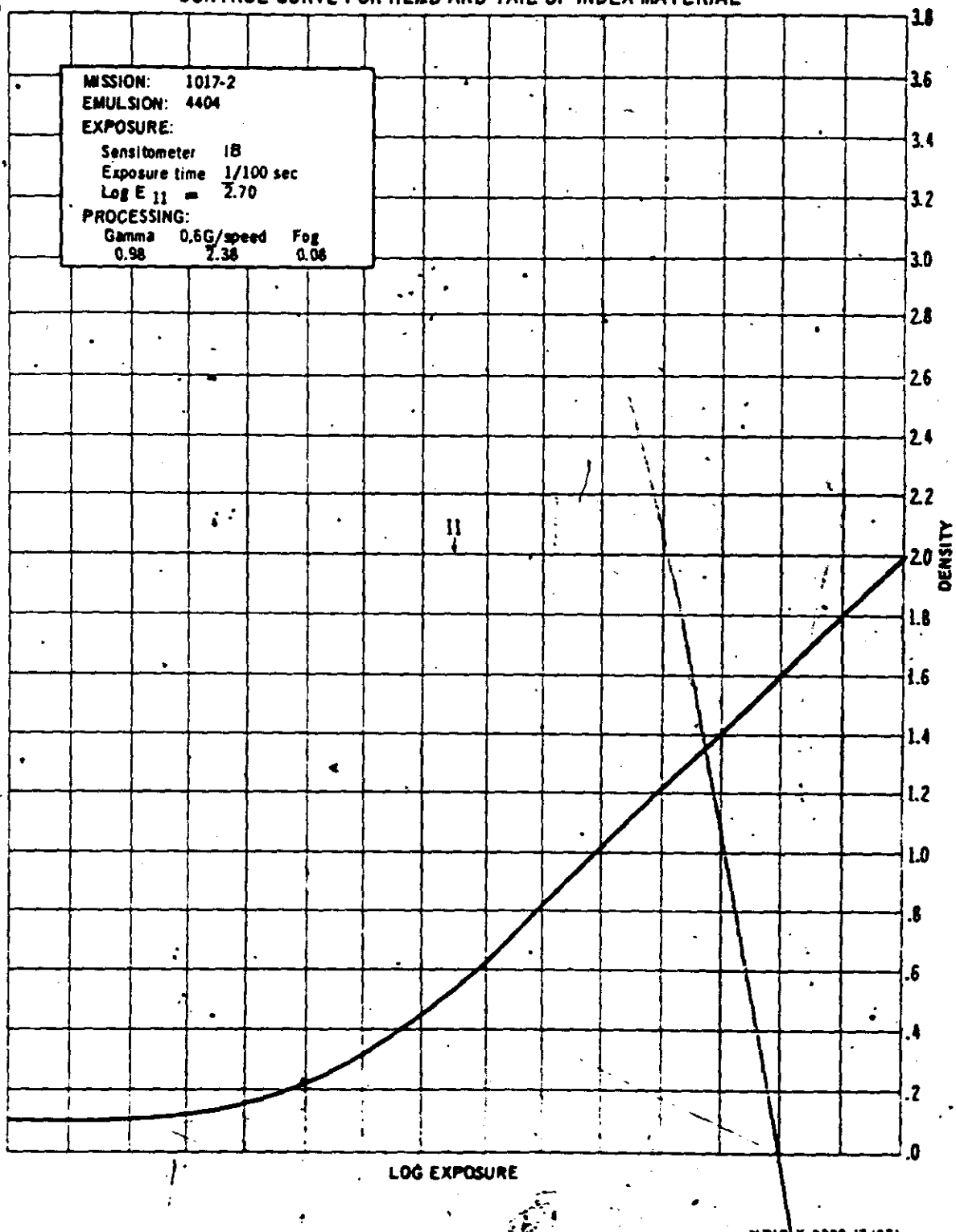
SENSITOMETRIC CURVE FROM MISSION MATERIAL



NPIC K-2898 (7/85)

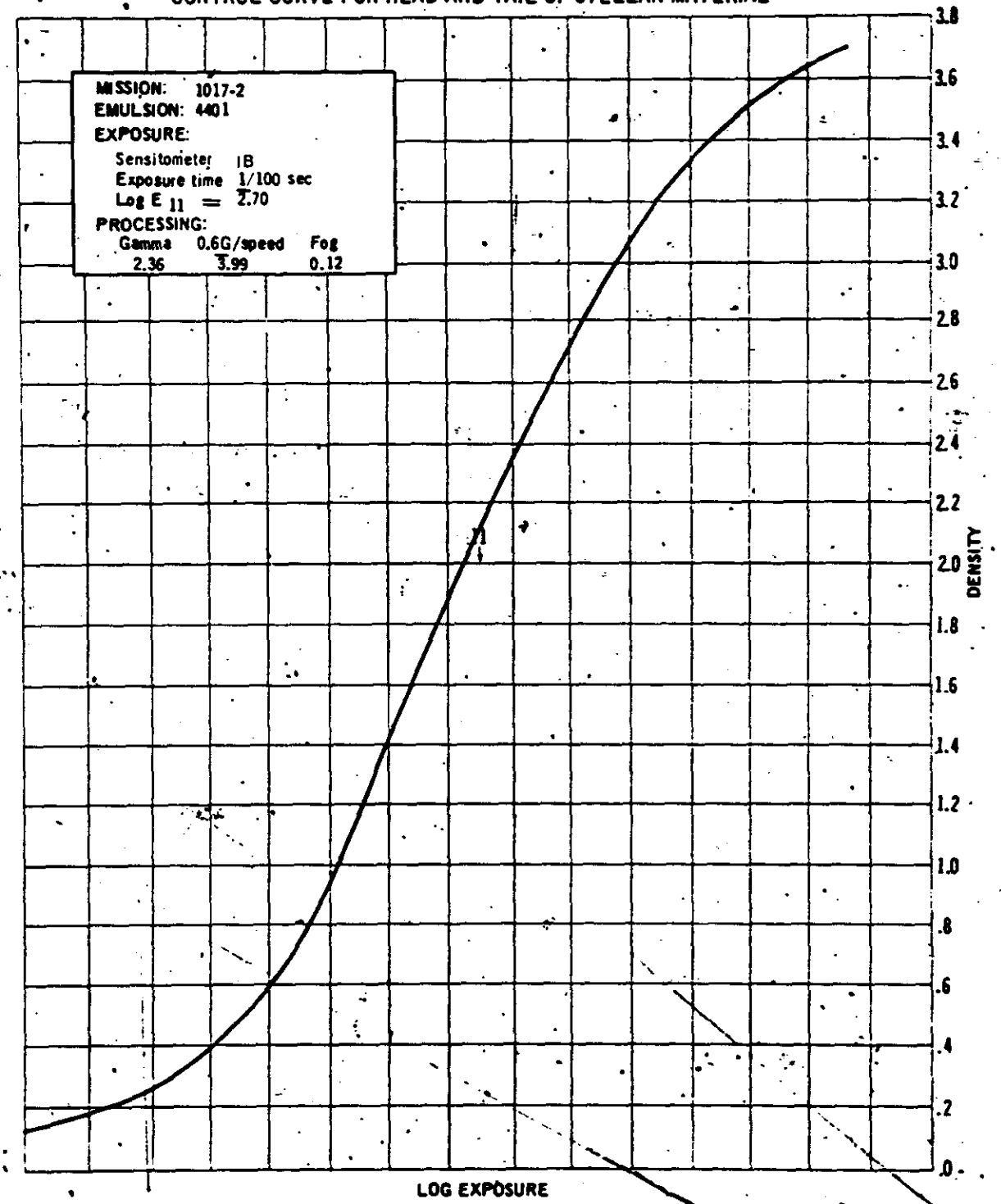
CONTROL CURVE FOR HEAD AND TAIL OF INDEX MATERIAL



NPIC K-2999 (7/69)

[redacted]

CONTROL CURVE FOR HEAD AND TAIL OF STELLAR MATERIAL



NRO R-2900 (7/68)

PART III. IMAGE QUALITY

1. Definition of Photographic Interpretation (PI) Suitability: This 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 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 photo interpreter may extract useful and reliable information from the material.

PI suitability ratings are categorized as 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 if that is necessary or desirable. The standards that determine the various ratings are as follows:

Excellent: The photography is free of degradation 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 optimal 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 superior quality of the photography.

Good: The photography is relatively free of degradations and limiting weather conditions. Edges and corners of objects 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 minimal but the acuity of the photography is less than optimum. Edges and corners of objects are not crisply defined and there is loss of detail in shadow and/or highlight areas. Detection and identification of small objects are possible but accuracy of mensuration is reduced by less-than-optimum contrast that prevails.

Poor: Camera-induced degradations and/or weather limitations severely reduce the quality of the photography. Definition of edges and corners is not sharp. 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 the photography completely precludes detection, identification, and mensuration of cultural details.

2. PI Suitability, Missions 1017-1 and 1017-2: The PI suitability of the photography obtained in Missions 1017-1 and 1017-2 is good. A total of 239 targets was reported in the preliminary PI reports (152 targets in Mission 1017-1 and 87 targets in Mission 1017-2). With regard to photographic quality of the specific targets covered, the notation PQ (Poor Quality) appears only 28 times. The majority of the PQ ratings refer to photography degraded by obliquity and low solar elevations and further degraded by atmospheric haze or blowing snow. The capping shutter malfunction reported in Part I, Item 2 did not seriously reduce PI suitability, since only the extreme ends of the panoramic formats were affected by the resultant fogging in passes 133D - 137D of the slave (AFT) camera. In addition, special printing was employed to salvage a significant amount of the degraded imagery in the panoramic format end sections. Cloud reflectance streaks were observed in a number of instances throughout the mission record but degradation is minimal, particularly in the photography acquired with slave (AFT) panoramic camera.

The comparatively extensive coverage in this mission permitted confirmation of numerous previous suspect activities, new identifications, and revision of information on a number of targets covered in past missions. However, the preliminary PI reports represent the initial scan results only, which are accomplished in a relatively short time without the aid of the precise analytical and mensural instruments normally employed in photographic interpretation. More detailed study of the material usually develops additional information and may uncover matters of interest not noted in the preliminary scan.

3. Definition of Mission Information Potential (MIP): The MIP rating assigned to a mission is an arbitrary figure intended to indicate the quality of the best photography obtained in the mission. It is representative of the camera system's maximum capability for recording information as demonstrated by the instruments employed in each mission.

In consideration of the information the MIP is intended to convey, photography containing adverse factors such as low solar elevation, poor atmospheric conditions, and similar degradations is eliminated in selection of the MIP example. The MIP rating assigned to a mission is indicative solely of the camera system's photographic capability exclusive of degradations which are not camera-derived. The selected photography may constitute a portion of a frame containing a particular target, an entire frame, or several frames. In any case the selections do not indicate the success, quality, or PI suitability of the mission as a whole but only the camera system's maximum effort. The criteria which govern selection of suitable MIP examples are as follows:

a. The photography must be comparatively free of cloud cover and/or atmospheric interference.

b. The selected targets should be at or near frame center in order to minimize the effects of obliquity and similar distortive factors.

c. No photography affected by system malfunctions or inherent degradations can be considered for MIP selection. This eliminates the first few and last few frames of a pass, since these may contain image motion. In addition, the photography must be free of effects induced by vehicle pitch, roll, or yaw deviations from normal.

d. Solar elevation must be near optimum. Overexposed or underexposed photography is not suitable for MIP selections.

e. Preferably, good-contrast targets such as airfields are chosen for comparison with similar targets covered in previous missions.

4. MIP, Missions 1017-1 and 1017-2: Based on the foregoing criteria, frame 9 of pass 30D, FWD, and frame 106 of pass 136D, AFT, are selected as the MIP examples for Missions 1017-1 and 1017-2, respectively. The targets within those frames that exemplify the MIP rating of 85 awarded to both phases of the mission are an airfield (Mission 1017-1) and a built-up culture area (Mission 1017-2). Examination of the overall quality of the photography acquired by both panoramic cameras indicates that the slave (AFT) camera produced slightly better imagery, on the whole.

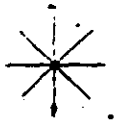
[redacted]

FIGURE 5. MIP SELECTION, MISSION 1017-1.

NPIC K-2901 (8/68)

[redacted]

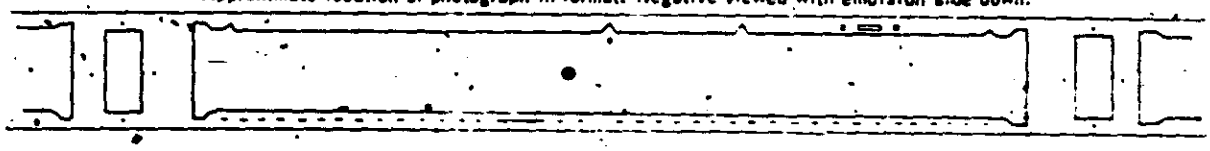
Camera	FWD
Pass	30D
Frame	9
Date of Photography	27 February 1965
Universal Grid Coordinates	41 x 13
Enlargement Factor	20x
Geographic Coordinates	39°51'N, 83°54'W
Altitude (feet)	622,419
Camera Attitude	
Pitch	15°21'
Roll	00°18'
Yaw	02°01'
Local Sun Time	1258 Hrs
Solar Elevation	40°
Solar Azimuth	199°
Exposure	1/255 sec



Approximate flight direction on photograph

Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.



Handle Via
TALENT KEYHOLE
Control System Only

[redacted]

FIGURE 6. MIP SELECTION, MISSION 1017-2.

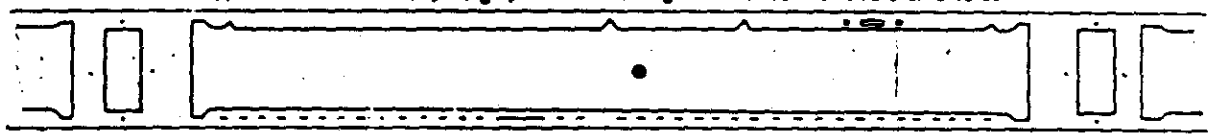
NPIC K-2902 (8/68)

Camera	AFT
Pass	1360
Frame	106
Date of Photography	6 March 1965
Universal Grid Coordinates	48 x 10
Enlargement Factor	20x
Geographic Coordinates	47°00'N, 28°56'E
Altitude (feet)	605,659
Camera Attitude:	
Pitch	Not Available
Roll	Not Available
Yaw	Not Available
Local Sun Time	1122 Hrs
Solar Elevation	36°
Solar Azimuth	167°
Exposure	1/384 sec

Approximate flight direction on photograph

Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.



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TALENT-KEYHOLE
Control System Only

TOP SECRET RUFF

[redacted]

[illegible] FOR GENERAL DISTRIBUTION [illegible]

[illegible] DISTRIBUTION [illegible]

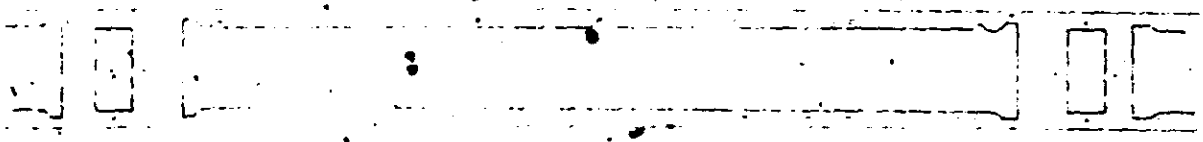
[redacted]

Camera	FWD
Pass	63D
Frame	4
Date of Photography	1 March 1965
Universal Grid Coordinates	24 x 12
Enlargement Factor	20x
Geographic Coordinates	32°25'N, 110°12'W
Altitude (feet)	598,694
Camera Attitude:	
Pitch	15°06'
Roll	00°09'
Yaw	02°49'
Local Sun Time	1245 Hrs
Solar Elevation	40°
Solar Azimuth	195°
Exposure	1/325 sec

Approximate flight direction on photograph

Approximate scan direction on photograph

Approximate position of photograph on format. Negative viewed with emulsion side down.



Handle Via
TALENT-KEYHOLE
Control System Only

Handle Via
TALENT-KEYHOLE
Control System Only

[redacted]

FIGURE 8. EXAMPLE OF GENERAL PHOTOGRAPHIC QUALITY, SLAVE (AFT) PANORAMIC CAMERA.

NPIC K-2804 (8/65)

Q

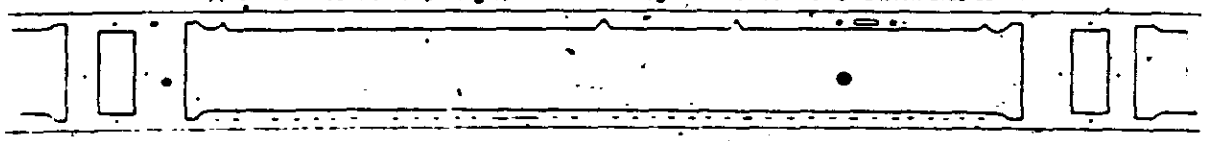
[redacted]

Camera	AFT
Pass	63D
Frame	10
Date of Photography	1 March 1965
Universal Grid Coordinates	65.5 x 11.5
Enlargement Factor	20x
Geoglaphic Coordinates	32°23'N, 110°14'W
Altitude (feet)	59[illegible]652.
Camera Attitude:	
Pitch	Not Available
Roll	Not Available
Yaw	Not Available
Local Sun Time	1245 Hrs
Solar Elevation	40°
Solar Azimuth	195°
Exposure	1 355 sec

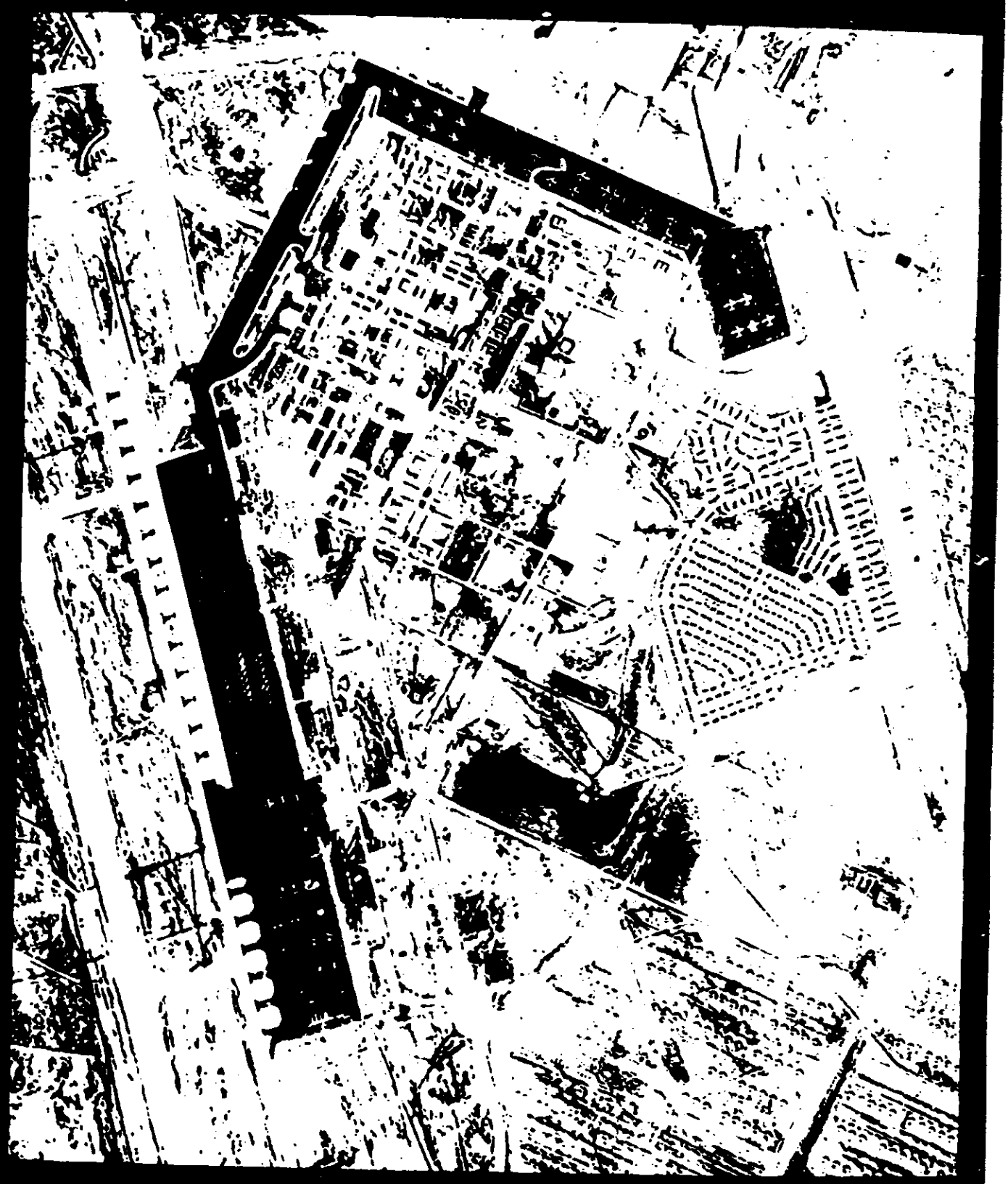
Approximate flight direction on photograph

Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.



Handle Via
TALENT-KEYHOLE
Control System Only



Handle Via
TALENT-KEYHOLE
Control System Only

FIGURE 9. FIXED RESOLUTION TARGET, INDIAN SPRINGS, NEVADA (MASTER PANORAMIC CAMERA).

NPIC K-2909 (8/68)

[redacted]

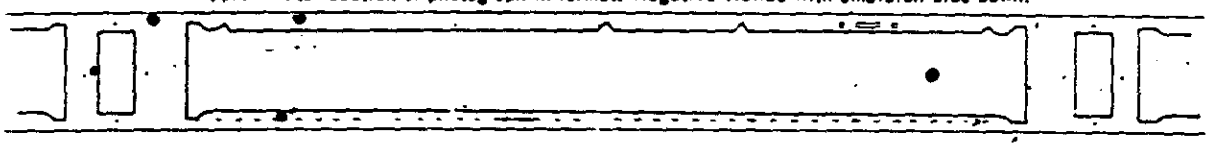
Camera	FWD
Pass	95D
Frame	14
Date of Photography	3 March 1965
Universal Grid Coordinates	77.4 x 12.8
Enlargement Factor	40x
Geographic Coordinates	35°59'N, 117°09'W
Altitude (feet)	599,405
Camera Attitude:	
Pitch	Not Available
Roll	Not Available
Yaw	Not Available
Local Sun Time	1216 Hrs
Solar Elevation	47°
Solar Azimuth	195°
Exposure	1 373 sec

The bar groups are detectable but individual bars within the groups cannot be resolved.

Approximate flight direction on photograph

Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.



Handle Via
TALENT-KEYHOLE
Control System Only

Handle Via
TALENT-KEYHOLE
Control System Only

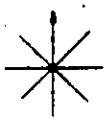
FIGURE 10. FIXED RESOLUTION TARGET, INDIAN SPRINGS, NEVADA (SLAVE PANORAMIC CAMERA).

NPIC K-2906 (8/68)

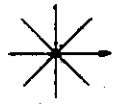
[redacted]

Camera	AFT
Pass	95D
Frame	20
Date of Photography	3 March 1965
Universal Grid Coordinates	13.5 x 10.3
Enlargement Factor	40x
Geographic Coordinates	35°56'N, 117°11'W
Altitude (feet)	598,508
Camera Attitude:	
Pitch	Not Available
Roll	Not Available
Yaw	Not Available
Local Sun Time	1216 Hrs
Solar Elevation	47°
Solar Azimuth	195°
Exposure	1 386 sec

The bar groups are detectable but individual bars cannot be resolved. However, the slave camera photography is slightly better than the master.

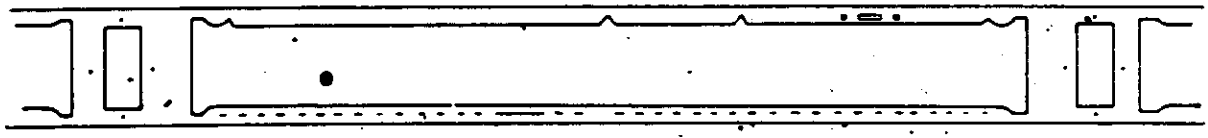


Approximate flight direction on photograph



Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.



Handle Via
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Control System Only

[redacted]

FIGURE 11. FIXED RESOLUTION TARGET, WRIGHT-PATTERSON AEB, DAYTON, OHIO (MASTER PANORAMIC CAMERA).

NPIC K-2007 (8/66)

[redacted]

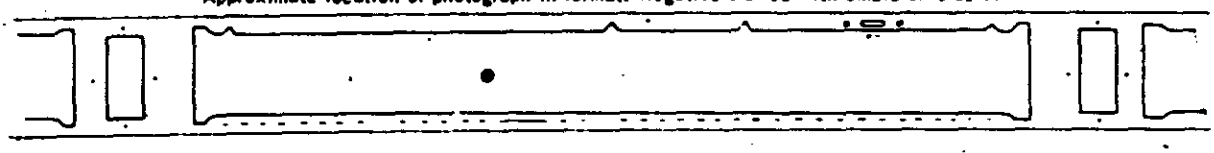
Camera	FWD
Pass	30D
Frame	9
Date of Photography	27 February 1965
Universal Grid Coordinates	38.5 x 11.8
Enlargement Factor	40x
Geographic Coordinates	39°51'N, 83°54'W
Altitude (feet)	622,419
Camera Attitude:	
Pitch	15°21'
Roll	00°18'
Yaw	02°01'
Local Sun Time	1258 Hrs
Solar Elevation	40°
Solar Azimuth	199°
Exposure	1.255 sec

The smallest bars that may be individually resolved in the Military Standard 3-Bar Photo Resolution Target Type "A-B" are 4 feet wide. In the adjacent target, 9 bars may be resolved in the X direction and 7 bars in the Y direction.

Approximate flight direction on photograph

Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.



Handle Via
TALENT KEYHOLE
Control System Only

FIGURE 12. FIXED RESOLUTION TARGET, WRIGHT-PATTERSON AFB, DAYTON, OHIO (SLAVE PANORAMIC CAMERA).

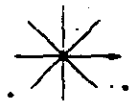
NPIC K-2908 (8/69)

[redacted]

Camera	AFT
Pass	300
Frame	15
Date of Photography	27 February 1965
Universal Grid Coordinates	51.2 x 12.3
Enlargement Factor	40x
Geographic Coordinates	39°52'N, 83°57'W
Altitude (feet)	620,134
Carrera Attitude:	
Pitch	Not Available
Roll	Not Available
Yaw	Not Available
Local Sun Time	1256 Hrs
Solar Elevation	40°
Solar Azimuth	199°
Exposure	1 400 sec

The resolution obtained in the slave camera material is the same as in the master camera record, although the photography is slightly better.

Approximate flight direction on photograph



Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.

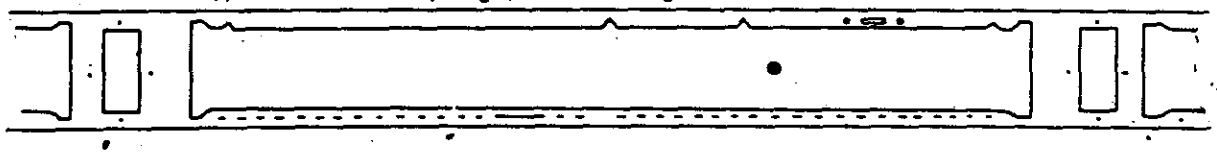


FIGURE 13. FIXED RESOLUTION TARGET, FORT HUACHUCA, ARIZONA (MASTER PANORAMIC CAMERA).

NPIC K-2900 (8/68)

[redacted]

Camera	FWD
Pass	63D
Frame	9
Date of Photography	1 March 1965
Universal Grid Coordinates	34.4 x 13.0
Enlargement Factor	40x
Geographic Coordinates	31°40'N; 109°59'
Altitude (feet)	597,799
Camera Attitude:	
Pitch	15°09'
Roll	00°08'
Yaw	02°46'
Local Sun Time	1246 Hrs
Solar Elevation	40°
Solar Azimuth	195°
Exposure	1/325 sec

The smallest bars that may be individually resolved are 4 feet, 11 inches wide (Group No 7, High Contrast; no bars or groups are definable in the low contrast leg).

Approximate flight direction on photograph

Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.

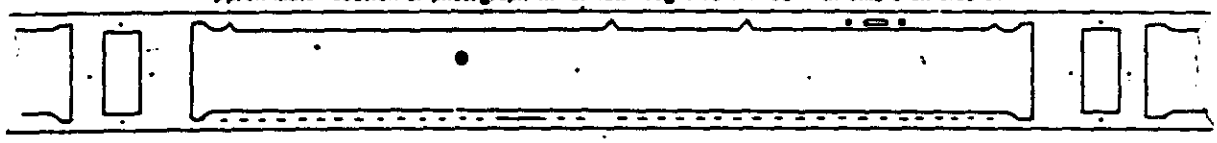
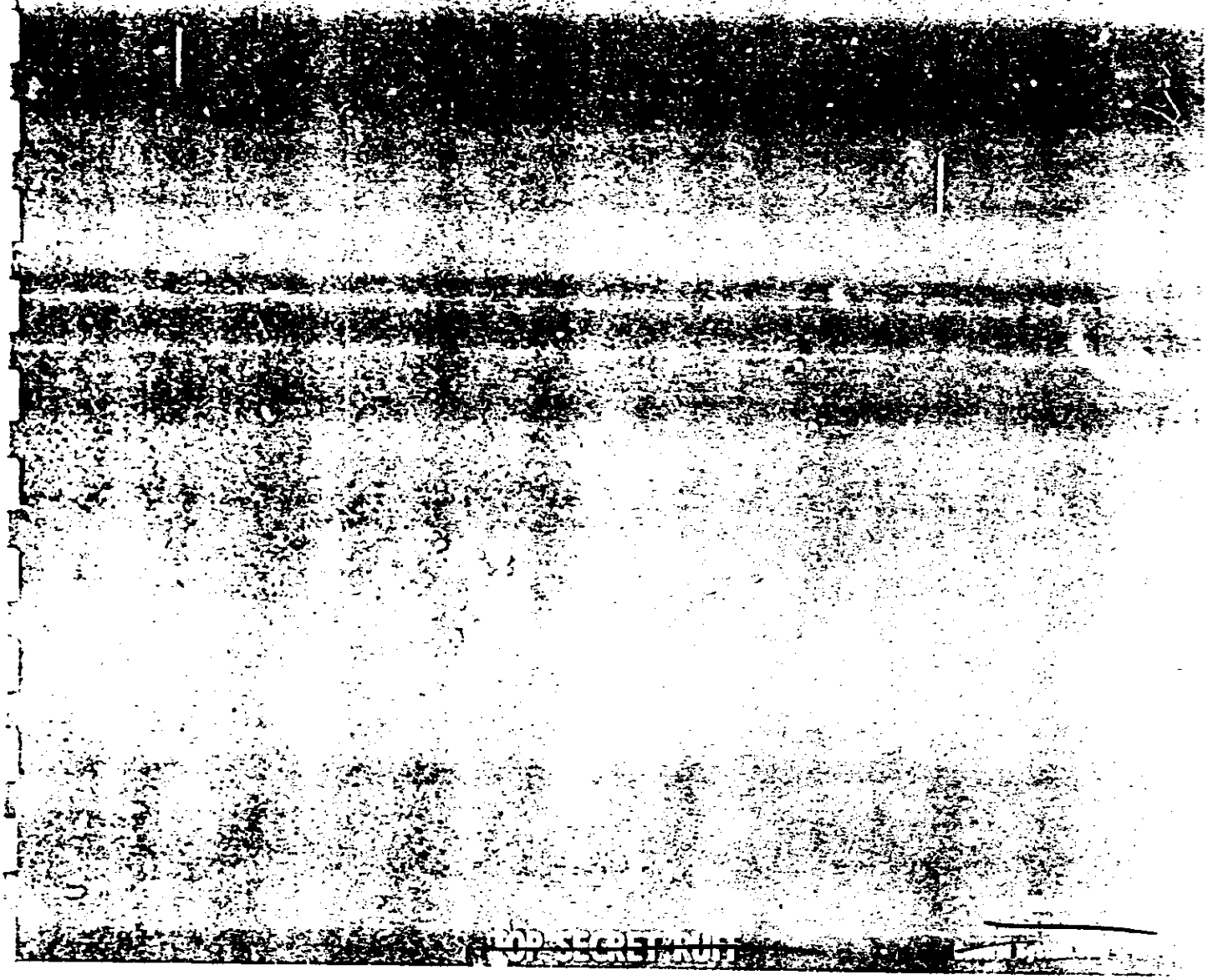


FIGURE 11 FIXED-RESOLUTION TARGET FOR [illegible]

[illegible] OVERNIGHT [illegible]

[illegible]



[redacted]

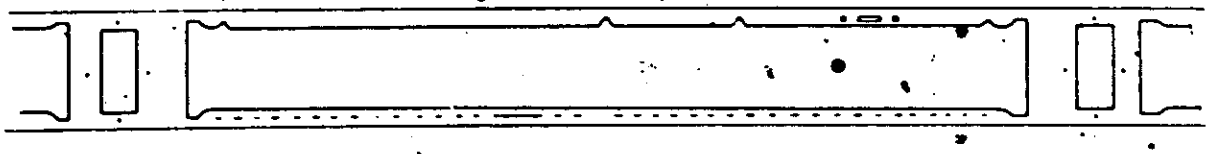
Camera	AFT
Pass	63D
Frame	15
Date of Photography	1 March 1965
Universal Grid Coordinates	54.5 x 10.5
Enlargement Factor	40x
Geographic Coordinates	31°39'N, 110°00'W
Altitude (feet)	596,841
Camera Attitude:	
Pitch	Not Available
Roll	Not Available
Yaw	Not Available
Local Sun Time	1246 Hrs
Solar Elevation	40°
Solar Azimuth	195°
Exposure	1 400 sec

The resolution is comparable to that obtained from the master camera material but the photography is slightly better.

Approximate flight direction on photograph

Approximate scan direction on photograph

Approximate location of photograph in format. Negative viewed with emulsion side down.

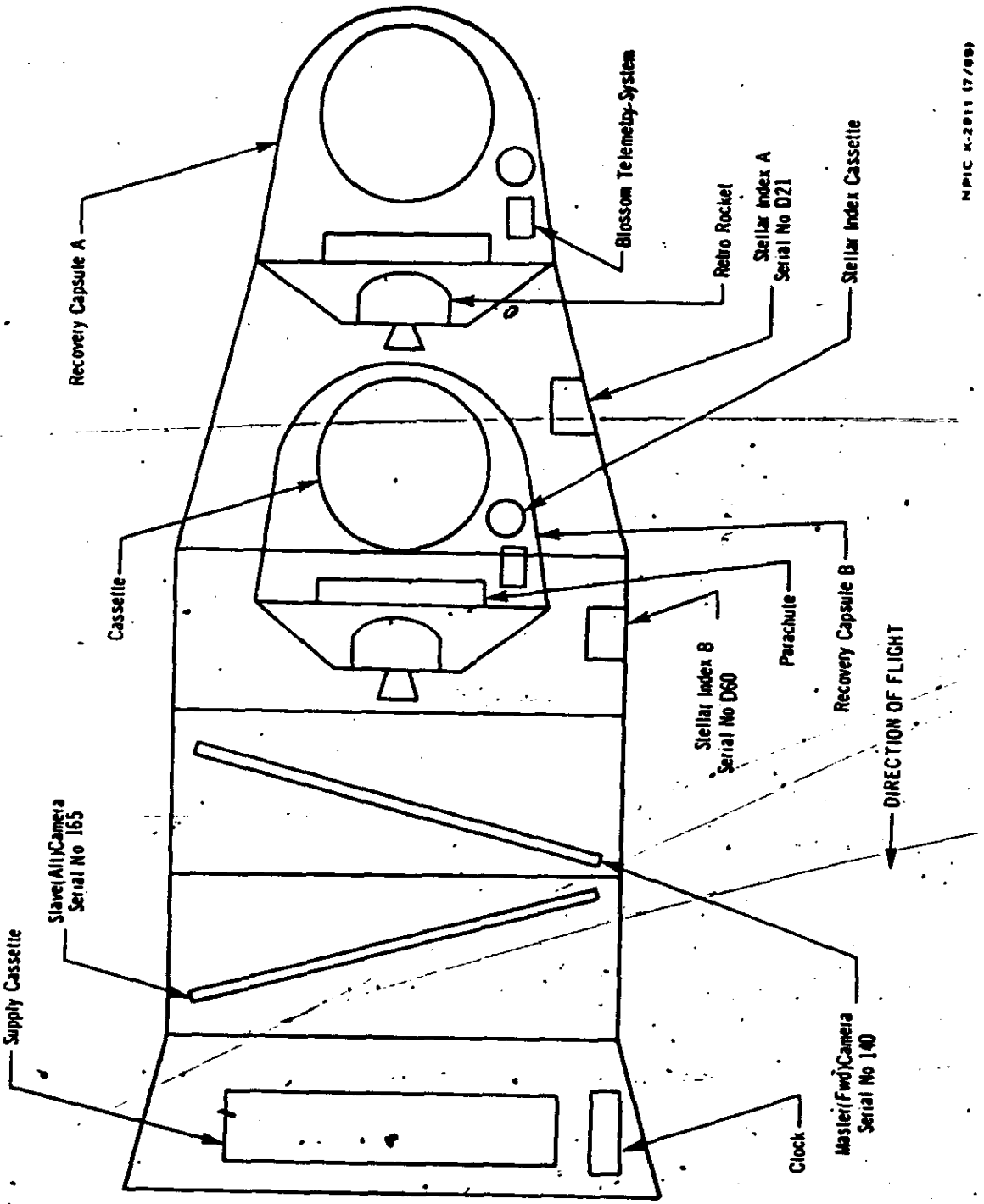


APPENDIX A. SYSTEM SPECIFICATIONS

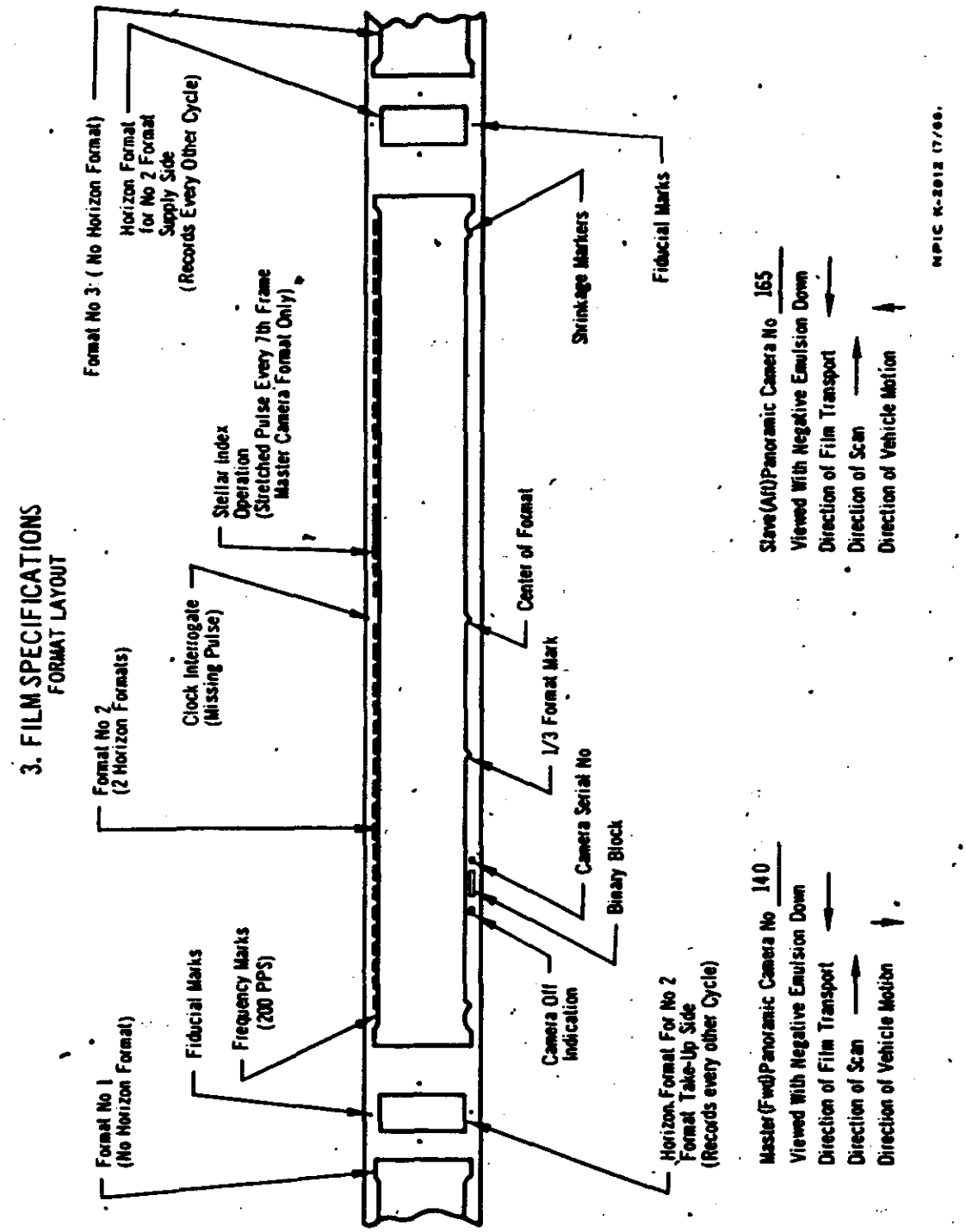
	Cameras									
	Master (FWD) Panoramic	Master Port Horizon	Master Stbd Horizon	Slave (FWD) Panoramic	Slave Port Horizon	Slave Stbd Horizon	Mission 1017-1		Mission 1017-2	
							Stellar	Index	Stellar	Index
Camera No	140	NA	NA	165	NA	NA	21	21D	60	68D
Lens Serial No	1132435	813524	812314	1432435	814026	813552	10485	811711	10554	817015
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/6.8	f/8.0	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	None	None	None
Focal Length (mm)	609.628	55.13	55.22	609.580	54.60	54.11	*	*	*	*
Film Length (ft)	16,000	NA	NA	16,000	NA	NA	*	*	*	*
Splices	5	NA	NA	4	NA	NA	None	None	None	None
Emulsion	85-51-12-4	85-51-12-4	85-51-12-4	85-51-12-4	85-51-12-4	85-51-12-4	44-30-9-4	31-4-9-4	44-30-9-4	31-4-9-4
Film Type	4404	4404	4404	4404	4404	4404	4401	4400	4401	4400
Res. Data L/mm (A)	*	12	79	*	88	104	*	*	*	*
Static										
High Contrast	237	*	*	239	*	*	*	*	*	*
Low Contrast	153	*	*	140	*	*	*	*	*	*
Dynamic										
I High Contrast	165	*	*	183	*	*	*	*	*	*
I Low Contrast	129	*	*	130	*	*	*	*	*	*
P High Contrast	171	*	*	182	*	*	*	*	*	*
P Low Contrast	120	*	*	113	*	*	*	*	*	*

NA - Not Applicable
* - Not Available
(A) - AWAR

2. VEHICLE LAYOUT



NPIC K-2811 (7/68)


3. FILM SPECIFICATIONS
FORMAT LAYOUT
Format No 3 (No Horizon Format)
Horizon Format for No 2 Format Supply Side (Records Every Other Cycle)
Stellar Index Operation (Stretched Pulse Every 7th Frame Master Camera Format Only)
Clock Interrogate (Missing Pulse)
Format No 2 (2 Horizon Formats)
Format No 1 (No Horizon Format)
Fiducial Marks
Frequency Marks (200 PPS)
Camera Off Indication
Binary Block
Camera Serial No
1/3 Format Mark
Center of Format
Shrinkage Markers
Fiducial Marks
Horizon Format For No 2 Format Take-Up Side (Records every other Cycle)
Master(Fwd)Panoramic Camera No 140
Viewed With Negative Emulsion Down
Direction of Film Transport
Direction of Scan
Direction of Vehicle Motion
Slave(Aft)Panoramic Camera No 165
Viewed With Negative Emulsion Down
Direction of Film Transport
Direction of Scan
Direction of Vehicle Motion
NPIC K-2012 (7/66)

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 $\pm$ 5 seconds of arc so positioned to form an angle of $-15.00^{\circ} \pm 5$ seconds to the mechanical interface for master camera calibrations and an angle of $+15.00^{\circ} \pm 5$ 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 $75.00^{\circ} \pm 5$ 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.

Svo 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 master camera and is the edge containing the shrinkage markers for the slave camera.

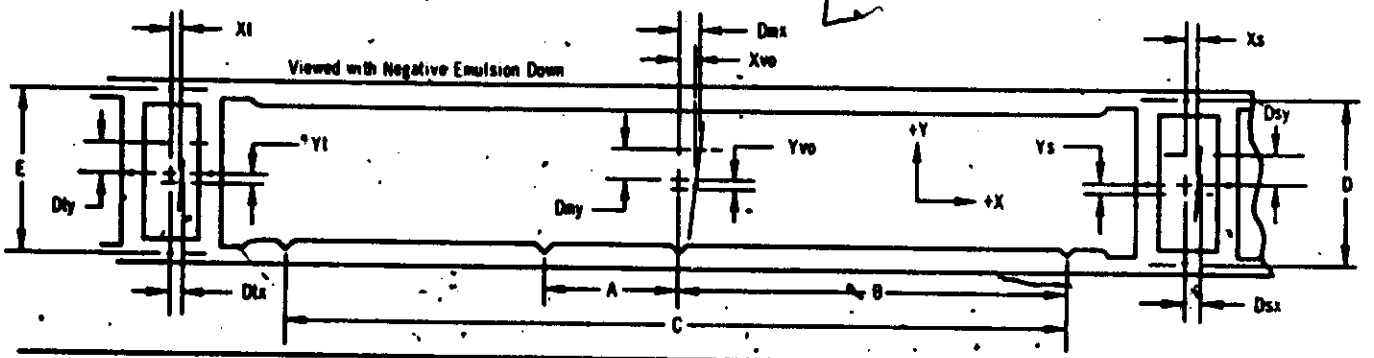
Dimensions A, B, and C are the spacings of the shrinkage markers and dimensions D and E are the spacing of the Y axis fiducials. Techniques for exact measurement of these dimensions have not been developed. The figures quoted are measurements made on hand-processed film without control of shrinkage.

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

Measurements of the angle between the indicated axis of the panoramic cameras and the line of intersection of the plane defined in Paragraph 2 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 of 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 140		Vehicle Motion		Scan Direction
A	76.1	Xl	-.200	Dlx -.203
B	354.5	Yl	+.082	Dly +2.601
C	709.4	Xs	+.144	Dsx +.141
D	56.475	Ys	-.126	Dsy +2.442
E	56.460	Xvo	+.740	Dmx +.733
		Yvo	+1.082	Dmy +4.082

Format dimensions:

	Panoramic
Height	55.968
Width	755.6

Slave(Aft)Camera 165		Vehicle Motion		Scan Direction
A	76.1	Xl	+.126	Dlx -.124
B	355.2	Yl	-.178	Dly +1.989
C	710.0	Xs	-.003	Dsx -.016
D	56.430	Ys	+.014	Dsy -2.205
E	56.489	Xvo	-.703	Dmx -.704
		Yvo	+.233	Dmy +3.233

Format dimensions:

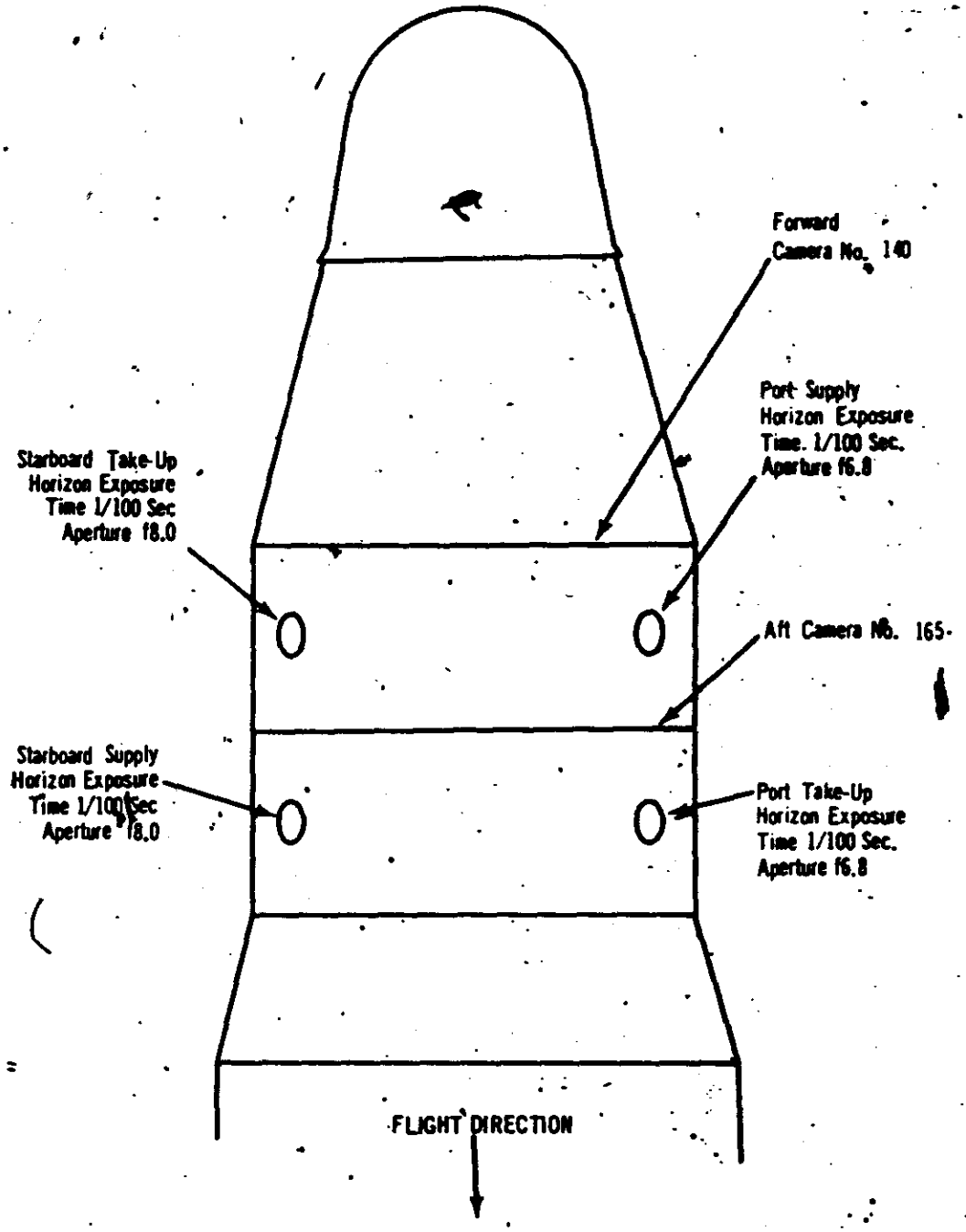
	Panormic
Height	56.004
Width	755.3

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. Dl, 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

NPIC K-2013 (7/68)

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



NPIC K-2914 (7/68)

APPENDIX B. DENSITY READINGS

The following pages contain a compilation of the stellar/index density values obtained with a Macbeth QuantaLog Densitometer, Model EP 1000, fitted with an ET 20 attachment and an 0.5mm aperture.

Mission 1017-1

STELLAR CAMERA						INDEX CAMERA						
						LIMITING			Gross Fog	TERRAIN		
Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta		Dmax	Dmin	Delta
1D	1	0.64	0.19	0.45	0.18	1.22	0.19	1.03	0.08	NR	NR	NR
2D	2	NR	NR	NR	0.18	0.21	0.10	0.11	0.08	NR	NR	NR
	15	0.62	0.22	0.40	0.70	1.04	0.54	0.50	0.09	0.92	0.54	0.38
4D	16	0.38	0.22	0.16	0.21	0.72	0.24	0.48	0.08	0.72	0.24	0.48
	26	0.76	0.19	0.57	0.17	1.24	0.22	1.02	0.08	1.24	0.22	1.02
5D	27	0.24	0.18	0.06	0.17	0.68	0.21	0.47	0.08	0.62	0.25	0.37
	45	1.55	0.20	1.35	0.15	1.00	0.16	0.84	0.08	0.92	0.40	0.52
6D	46	0.29	0.18	0.11	0.16	0.62	0.27	0.35	0.09	NR	NR	NR
	66	1.42	0.21	1.21	0.18	1.34	0.49	0.85	0.08	NR	NR	NR
7D	67	0.70	0.19	0.51	0.18	0.97	0.18	0.79	0.08	0.97	0.18	0.79
	80	1.36	0.19	1.17	0.16	1.42	0.16	1.26	0.09	1.42	0.16	1.26
8D	81	0.65	0.18	0.47	0.17	0.92	0.36	0.56	0.09	0.92	0.36	0.56
	85	0.59	0.18	0.41	0.17	0.91	0.29	0.62	0.08	0.91	0.29	0.62
9AE	86	NR	NR	NR	0.18	NR	NR	NR	0.08	NR	NR	NR
9D	87	0.75	0.20	0.55	0.18	1.18	0.39	0.79	0.08	1.18	0.39	0.79
	94	0.91	0.20	0.71	0.19	1.20	0.19	1.01	0.09	NR	NR	NR
10D	95	0.98	0.22	0.76	0.19	1.71	0.22	1.49	0.08	0.49	0.22	0.27
	104	0.90	0.20	0.70	0.18	1.42	0.20	1.22	0.08	NR	NR	NR
16D	105	0.94	0.22	0.72	0.18	1.48	0.55	0.93	0.08	NR	NR	NR
	107	1.09	0.21	0.88	0.18	1.34	0.48	0.86	0.08	NR	NR	NR
20D	108	0.38	0.19	0.19	0.17	0.78	0.21	0.57	0.08	0.78	0.21	0.57
	115	0.84	0.18	0.66	0.14	1.08	0.18	0.90	0.08	NR	NR	NR
21D	116	0.21	0.18	0.03	0.14	0.42	0.16	0.26	0.08	NR	NR	NR
	130	0.87	0.18	0.69	0.16	1.09	0.25	0.84	0.08	1.09	0.25	0.84
22D	131	0.34	0.18	0.16	0.16	0.62	0.20	0.42	0.08	0.62	0.20	0.42
	146	1.59	0.19	1.40	0.15	1.34	0.28	1.06	0.08	0.61	0.28	0.33
23D	147	0.74	0.19	0.55	0.16	1.08	0.42	0.66	0.08	NR	NR	NR
	162	1.85	0.21	1.64	0.17	1.34	0.30	1.04	0.08	1.34	0.30	1.04
24D	163	0.39	0.19	0.20	0.17	0.64	0.14	0.50	0.08	0.64	0.14	0.50
	182	1.14	0.19	0.95	0.17	0.74	0.21	0.53	0.08	0.74	0.39	0.35
A25E	183	NR	NR	NR	0.17	NR	NR	NR	0.08	NR	NR	NR
25D	188	0.74	0.20	0.54	0.17	1.12	0.48	0.64	0.08	NR	NR	NR
	199	1.24	0.19	1.05	0.17	1.10	0.19	0.91	0.08	1.10	0.36	0.74
26D	200	1.08	0.23	0.85	0.18	1.29	0.30	0.99	0.08	1.29	0.30	0.99
	202	1.10	0.21	0.89	0.18	0.70	0.21	0.49	0.08	0.70	0.21	0.49
27D	203	1.14	0.24	0.90	0.18	1.19	0.18	1.01	0.08	NR	NR	NR
	205	1.18	0.24	0.94	0.18	1.24	0.22	1.02	0.08	NR	NR	NR
28D	206	0.36	0.19	0.17	0.18	0.72	0.21	0.51	0.08	0.72	0.32	0.40
	208	0.32	0.18	0.14	0.17	0.80	0.27	0.53	0.08	0.74	0.24	0.50
29D	209	0.28	0.18	0.10	0.17	0.52	0.19	0.33	0.08	0.52	0.19	0.33
	215	0.48	0.19	0.29	0.16	0.94	0.22	0.72	0.08	0.94	0.22	0.72

Mission 1017-1

		STELLAR CAMERA				INDEX CAMERA							
						LIMITING			Gross Fog	TERRAIN			
Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta		Dmax	Dmin	Delta
36D	216	0.23	0.17	0.06	0.15	0.49	0.13	0.36	0.08	0.49	0.13	0.36
	224	0.63	0.18	0.45	0.15	1.06	0.32	0.74	0.08	1.06	0.32	0.74
37D	225	0.63	0.18	0.45	0.15	1.10	0.22	0.88	0.09	0.68	0.31	0.37
	239	1.20	0.27	0.93	0.18	1.30	0.48	0.82	0.08	1.30	0.48	0.82
41D	240	0.82	0.26	0.56	0.18	0.96	0.24	0.72	0.08	0.84	0.40	0.44
	247	2.85	0.22	2.63	0.18	1.29	0.32	0.97	0.08	1.29	0.32	0.97
48D	248	0.89	0.23	0.66	0.20	1.31	0.17	1.14	0.08	NR	NR	NR
	249	0.82	0.22	0.60	0.18	1.02	0.19	0.83	0.08	NR	NR	NR
50D	250	0.36	0.20	0.16	0.17	0.68	0.28	0.40	0.08	0.68	0.28	0.40
	257	0.68	0.21	0.47	0.18	0.80	0.38	0.42	0.08	0.80	0.38	0.42
52D	258	0.35	0.20	0.15	0.17	0.72	0.20	0.52	0.08	0.66	0.30	0.36
	276	1.05	0.19	0.86	0.15	1.02	0.24	0.78	0.08	1.02	0.32	0.70
54D	277	0.34	0.18	0.16	0.16	0.72	0.28	0.44	0.08	0.64	0.30	0.34
	300	1.39	0.23	1.16	0.16	1.43	0.29	1.14	0.08	0.82	0.29	0.53
55D	301	0.29	0.18	0.11	0.17	0.60	0.10	0.50	0.08	NR	NR	NR
	313	0.98	0.21	0.76	0.18	1.31	0.32	0.99	0.08	NR	NR	NR
56D	314	0.58	0.22	0.36	0.18	1.00	0.30	0.70	0.09	1.00	0.30	0.70
	324	1.01	0.25	0.76	0.18	1.13	0.56	0.57	0.09	0.90	0.68	0.22
63D	325	1.39	0.29	1.10	0.19	0.80	0.26	0.54	0.09	0.80	0.26	0.54
	327	1.22	0.21	1.01	0.16	0.72	0.22	0.50	0.09	0.72	0.22	0.50
67D	328	0.34	0.19	0.15	0.16	0.62	0.22	0.40	0.09	0.62	0.22	0.40
	332	0.50	0.18	0.32	0.16	0.83	0.26	0.57	0.09	0.63	0.26	0.37
68D	333	0.78	0.20	0.58	0.16	0.90	0.37	0.53	0.09	0.90	0.37	0.53
	334	0.85	0.21	0.64	0.17	1.10	0.28	0.82	0.09	1.10	0.28	0.82
70D	335	0.92	0.21	0.71	0.16	1.12	0.35	0.77	0.09	1.12	0.35	0.77
	366	0.88	0.19	0.69	0.18	1.08	0.35	0.73	0.09	0.84	0.53	0.31
71D	367	0.27	0.18	0.09	0.16	0.62	0.11	0.51	0.09	0.55	0.22	0.33
	386	0.81	0.20	0.61	0.16	1.22	0.40	0.82	0.09	1.22	0.40	0.82
72D	387	0.58	0.18	0.40	0.15	0.92	0.28	0.64	0.09	0.92	0.28	0.64
	405	1.08	0.22	0.86	0.16	1.32	0.18	1.14	0.09	1.01	0.66	0.35
78D	406	1.00	0.22	0.78	0.16	1.22	0.40	0.82	0.09	0.98	0.40	0.58
	408	1.02	0.21	0.81	0.16	1.28	0.38	0.90	0.09	NR	NR	NR
81D	409	NR	NR	NR	0.16	NR	NR	NR	0.09	NR	NR	NR
	420	0.71	0.19	0.52	0.16	0.93	0.40	0.53	0.09	0.70	0.54	0.16

NR - Denotes No Reading Made

Dmax Range 0.21-2.85
Dmin Range 0.17-0.27
Gross Fog Range 0.14-0.21

Average Dmax 0.81
Average Dmin 0.21
Average Gross Fog 0.17

NR - Denotes No Reading Made

Terrain Dmax Range 0.49-1.42
Terrain Dmin Range 0.13-0.68
Average Terrain Dmax 0.83
Average Terrain Dmin 0.31

Limiting Dmax Range 0.21-1.71
Limiting Dmin Range 0.10-0.56
Average Limiting Dmax 0.99
Average Limiting Dmin 0.27

Gross Fog Range 0.08-0.09
Average Gross Fog 0.08

STELLAR CAMERA

Frame	Dmax	Dmin	Delta	Gross Fog	Frame	Dmax	Dmin	Delta	Gross Fog
1	3.62	1.22	2.40	0.20	23	3.30	0.89	2.41	0.20
2	3.54	1.12	2.42	0.19	24	3.35	1.30	2.05	0.22
3	3.42	0.89	2.53	0.19	25	3.17	0.82	2.35	0.48
4	3.40	0.91	2.49	0.20	26	3.24	0.95	2.29	0.42
5	3.30	0.92	2.38	0.25	27	3.12	0.74	2.38	0.24
6	3.50	1.24	2.26	0.21	28	3.10	0.70	2.40	0.24
7	3.53	1.28	2.25	0.20	29	3.28	0.79	2.49	0.26
8	3.47	1.23	2.24	0.21	30	3.22	0.43	2.79	0.23
9	3.40	0.74	2.66	0.24	31	3.24	0.49	2.75	0.24
10	3.40	0.82	2.58	0.20	32	3.20	0.58	2.62	0.25
11	3.43	0.96	2.47	0.19	33	3.21	0.58	2.63	0.27
12	3.38	0.98	2.40	0.20	34	3.18	0.58	2.60	0.25
13	3.46	1.11	2.35	0.22	35	3.30	1.01	2.29	0.26
14	3.48	1.01	2.47	0.20	36	3.32	0.92	2.40	0.22
15	3.42	0.79	2.63	0.20	37	3.23	0.64	2.59	0.21
16	3.45	1.02	2.43	0.20	38	3.28	0.54	2.74	0.20
17	3.50	0.91	2.59	0.21	39	3.34	0.84	2.50	0.23
18	3.35	0.59	2.76	0.20	40	3.22	1.07	2.15	0.25
19	3.49	1.02	2.47	0.20	41	3.34	0.91	2.43	0.24
20	3.42	1.04	2.38	0.20	42	NR	NR.	NR	0.24
21	3.51	1.47	2.04	0.22	43	3.40	1.40	2.00	0.22
22	3.47	1.42	2.05	0.19	44	3.42	1.15	2.27	0.24

Dmax Range 3.10-3.62 Average Dmax 3.38 NR - Denotes No Reading Made
Dmin Range 0.43-1.30 Average Dmin 0.93
Gross Fog Range 0.19-0.48 Average Gross Fog 0.23

Note: The unusually high density values recorded in Item 3 are the result of multiple exposures caused by a possible solenoid malfunction in the Stellar/Index unit (refer to Part I, Item 6).

[redacted]

4. Index Camera No D68 (Mission 1017-2): Due to the possible solenoid malfunction in the Stellar/Index unit, no density readings were made. Of the 29 frames generated in Mission 1017-2, the majority are degraded by multiple exposures.

APPENDIX C. 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 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% 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 MIP frame (Mission Information Potential) 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-Loebel Double Beam Model III CS. It is used with an effective slit of 1 micron 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 gradients 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% of the maximum slope is computed, and the distance between the 50% slope values is determined by interpolation. The Line Spread Function (LSF) may also be plotted (slope versus distance) and the 50% amplitude width measured for verification of the calculated value.

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

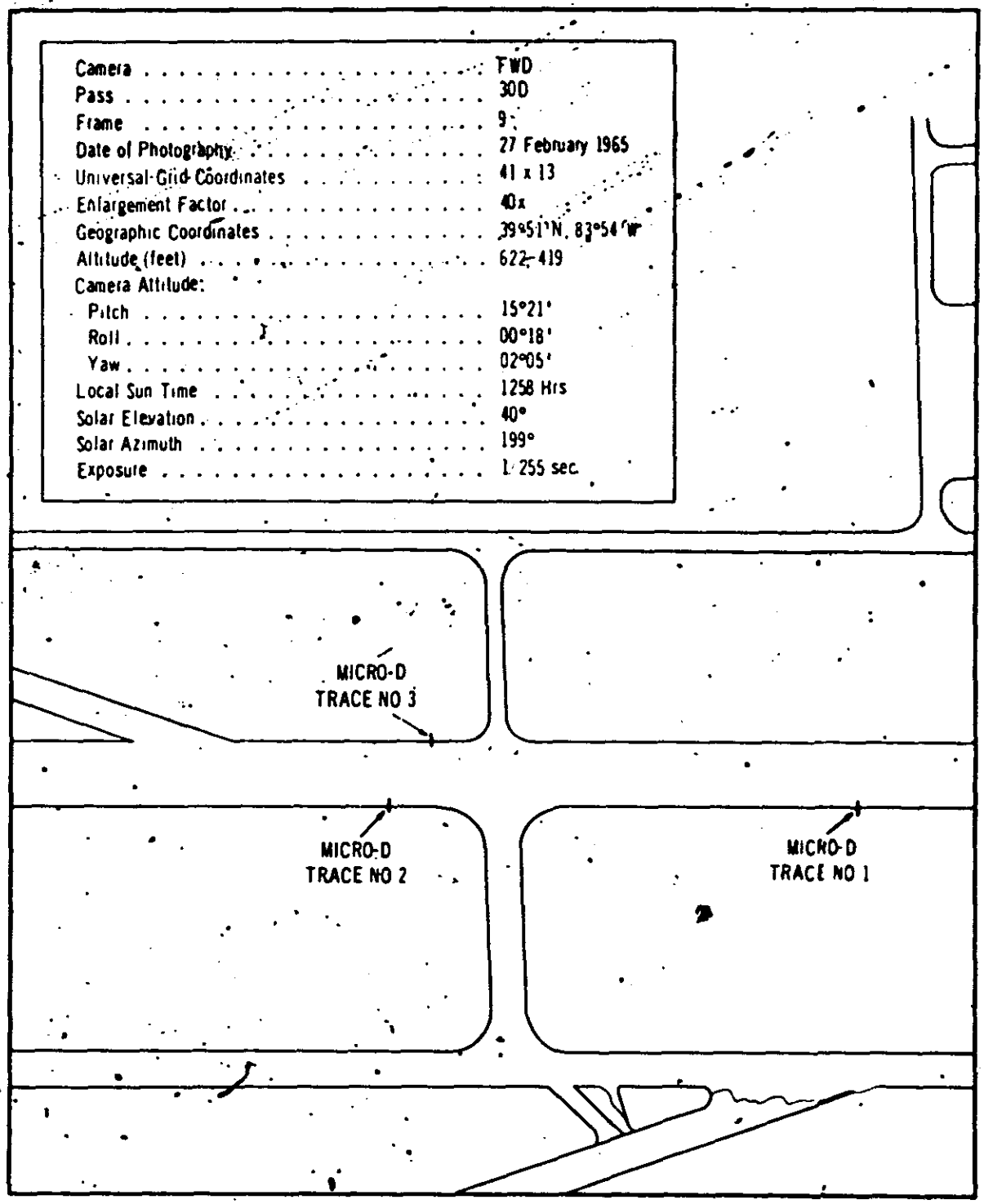
SUMMARY TABLE OF EDGE TRACES

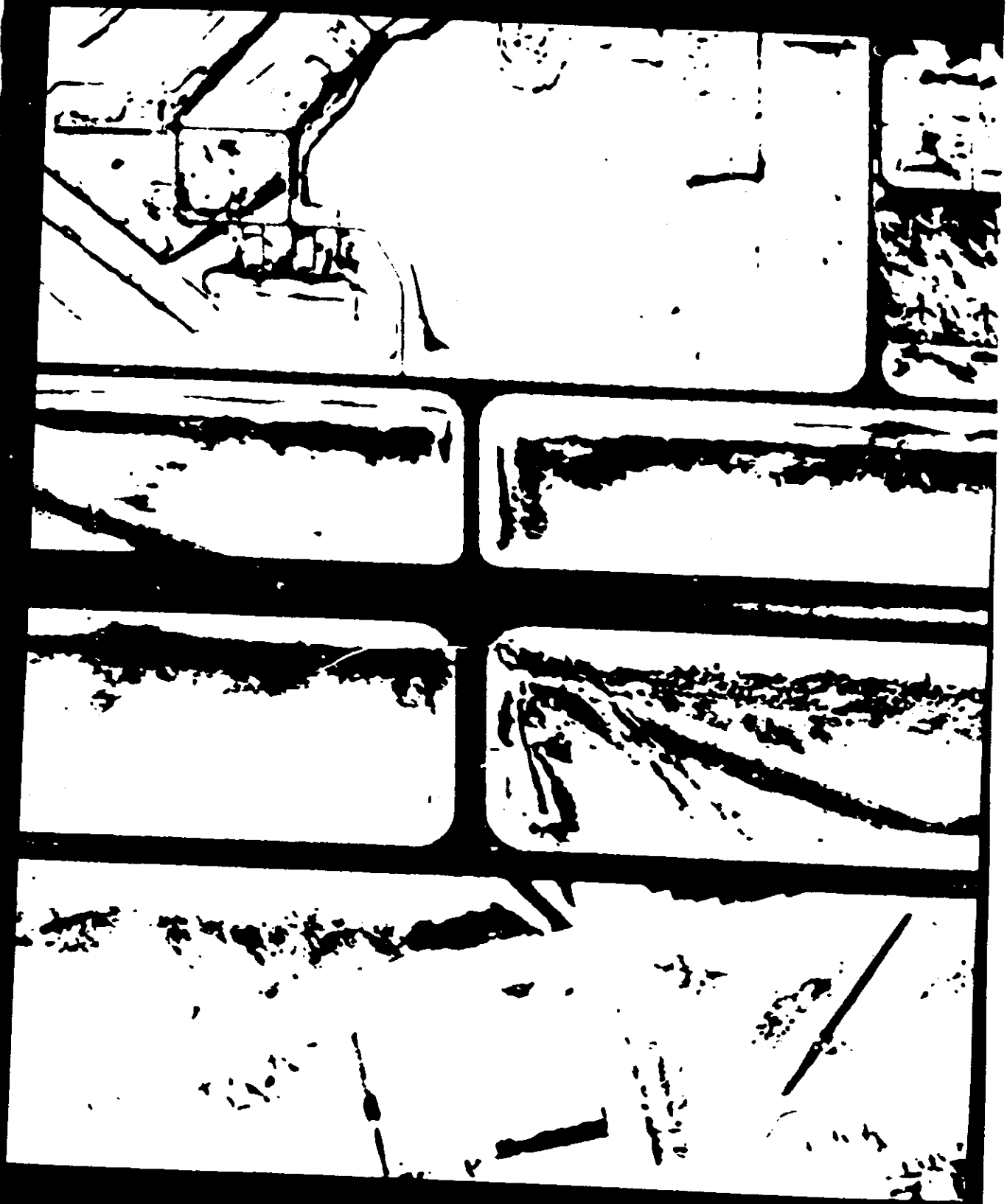
Trace Number	Line Spread Function width at 50% amplitude	Reciprocal of LSF width at 50% amplitude
1	14.5 microns	69 L/mm
2	15.3 microns	65 L/mm
3	14.2 microns	71 L/mm
4	11.5 microns	87 L/mm
5	19.6 microns	51 L/mm
6	13.1 microns	76 L/mm

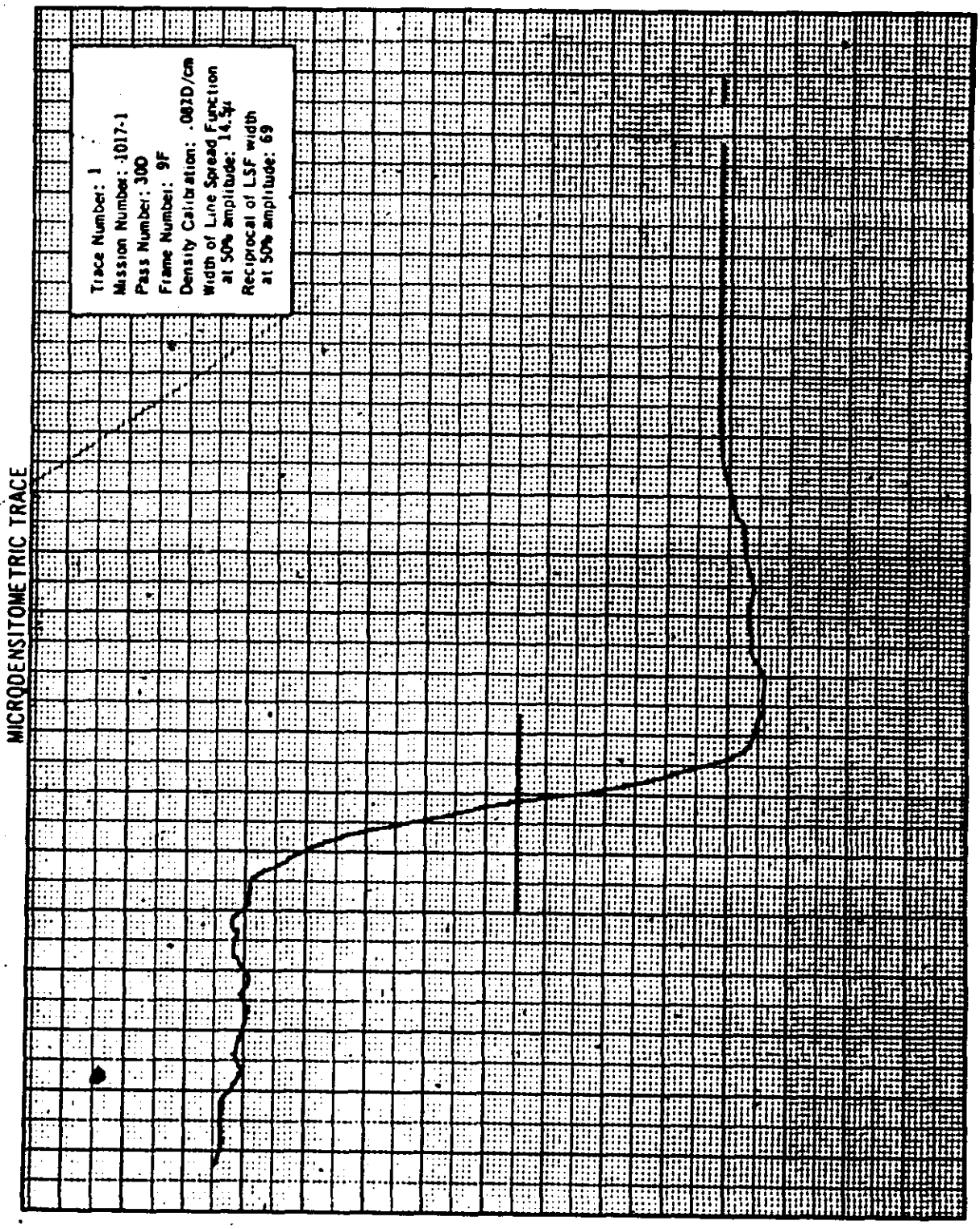
FIGURE 15. TARGET, MICRODENSITOMETRIC TRACES NOS 1, 2, AND 3 (MISSION 1017-1).

NPIC K-2918 (8/68)

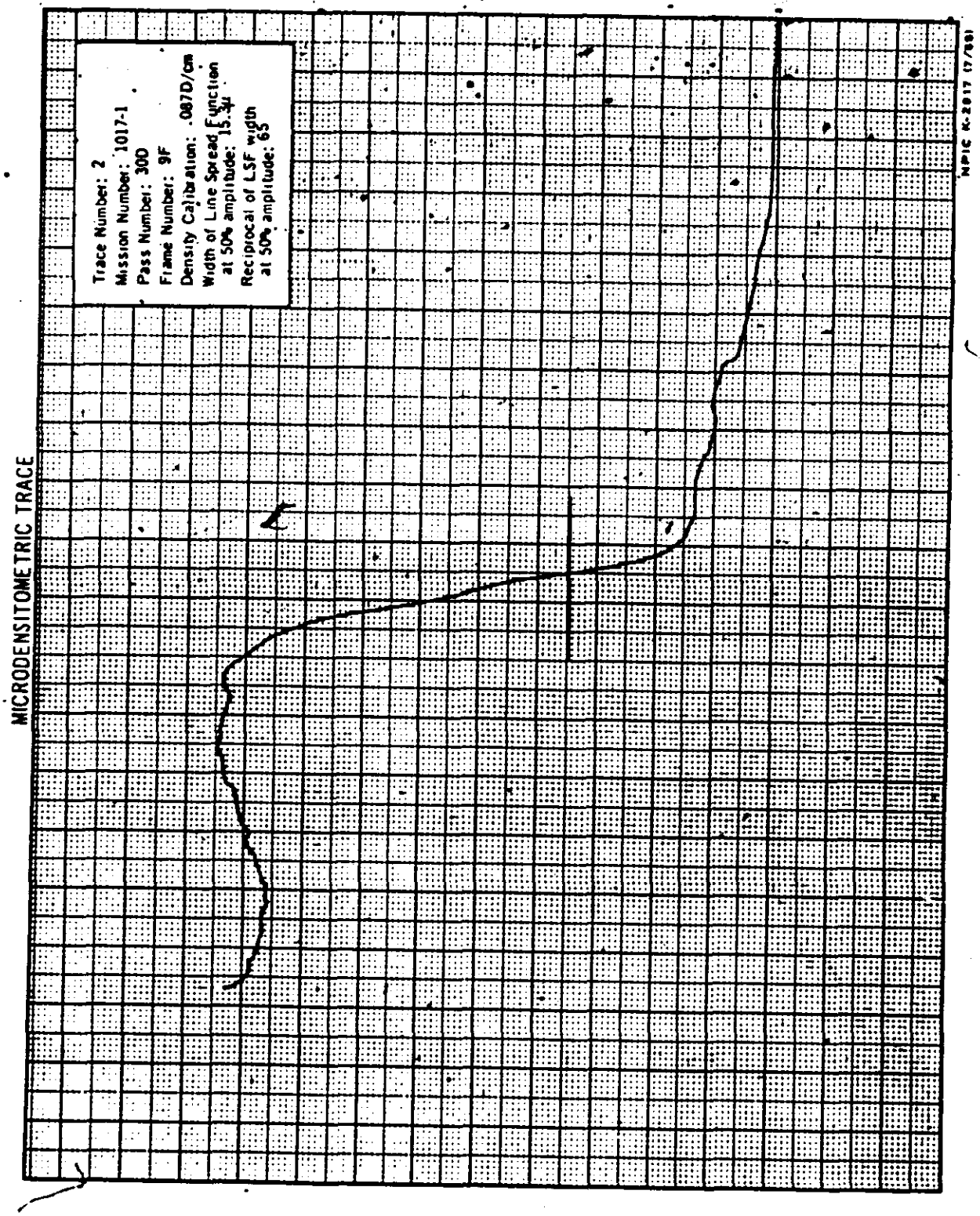
Camera	FWD
Pass	30D
Frame	9
Date of Photography	27 February 1965
Universal Grid Coordinates	41 x 13
Enlargement Factor	40x
Geographic Coordinates	39°51'N, 83°54'W
Altitude (feet)	622-419
Camera Attitude:	
Pitch	15°21'
Roll	00°18'
Yaw	02°05'
Local Sun Time	1258 Hrs
Solar Elevation	40°
Solar Azimuth	199°
Exposure	1/255 sec

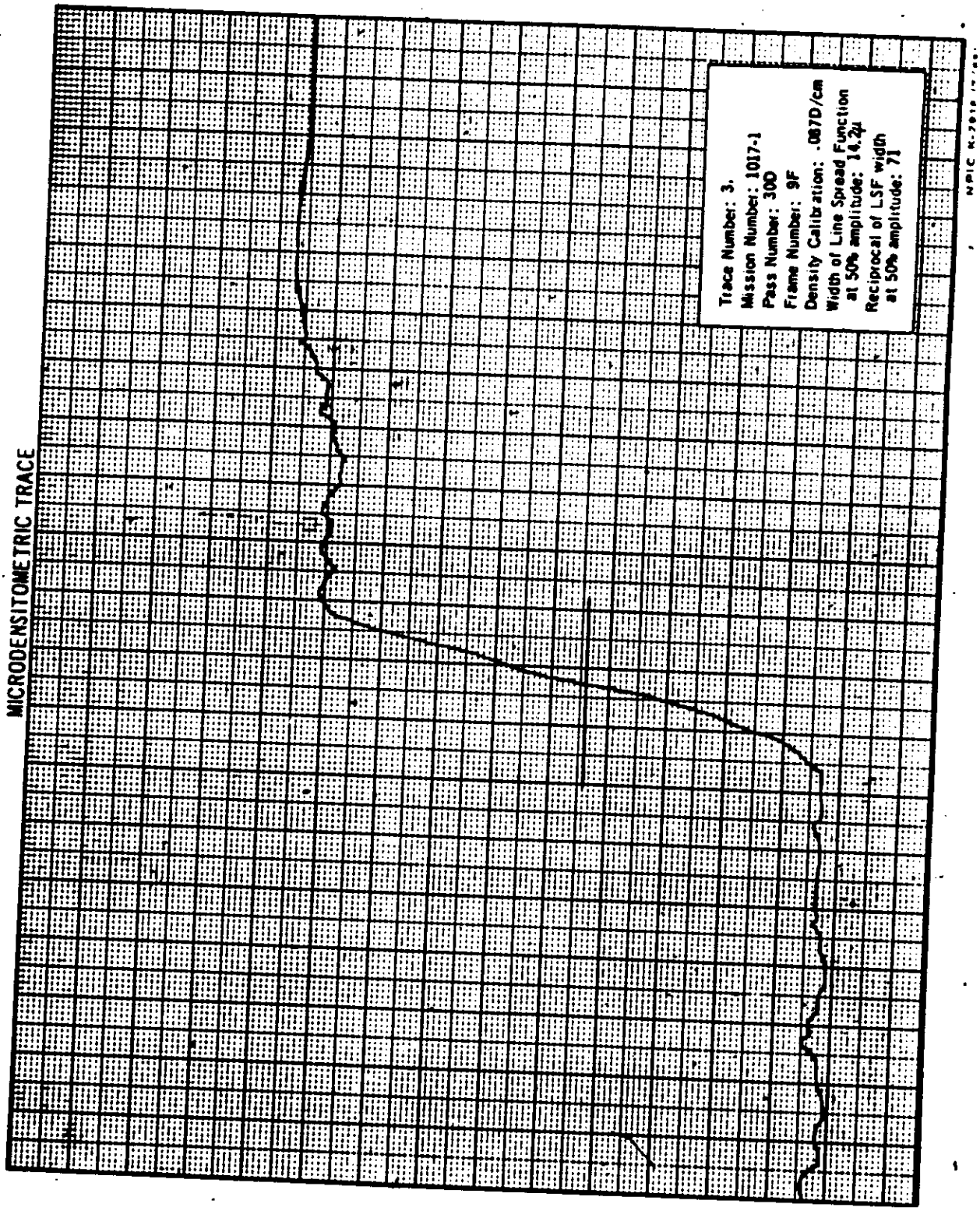





Trace Number: 1
Mission Number: 1017-1
Pass Number: 300
Frame Number: 9F
Density Calibration: .083D/cm
Width of Line Spread Function at 50% amplitude: 14.5μ
Reciprocal of LSF width at 50% amplitude: 69
MICRODENSITOMETRIC TRACE
NPIC R-2816 (7/68)

[redacted]


Trace Number: 2
Mission Number: 1017-1
Pass Number: 30D
Frame Number: 9F
Density Calibration: .087D/cm
Width of Line Spread Function at 50% amplitude: 15.4μ
Reciprocal of LSF width at 50% amplitude: 65
MICRODENSITOMETRIC TRACE
NPIC K-2017 (7/68)


MICRODENSITOMETRIC TRACE
Trace Number: 3.
Mission Number: 1017-1
Pass Number: 300
Frame Number: 9F
Density Calibration: .087D/cm
Width of Line Spread Function at 50% amplitude: 14.2μ
Reciprocal of LSF width at 50% amplitude: 71

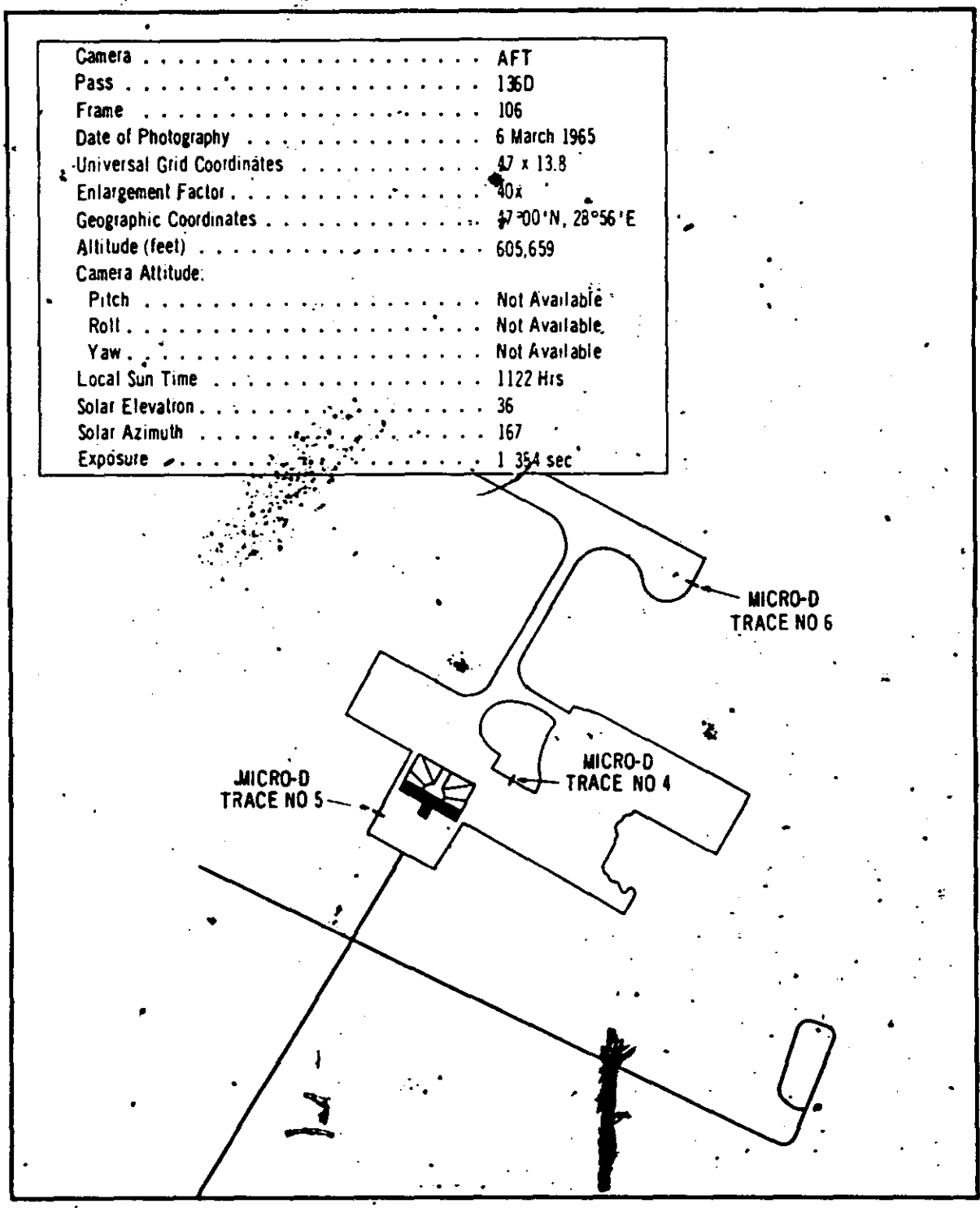
[redacted]

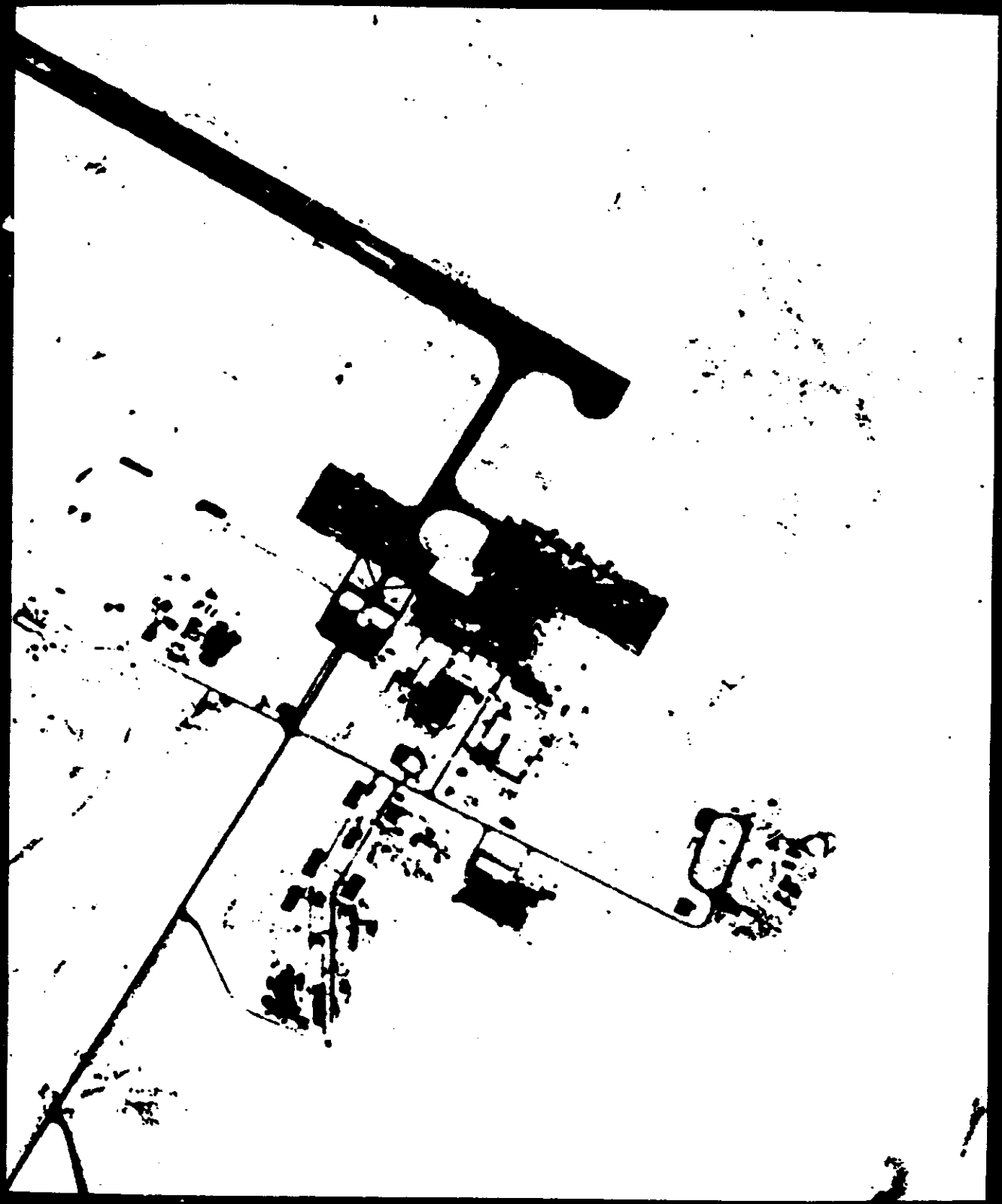
FIGURE 16. TARGET, MICRODENSITOMETRIC TRACES NOS 4, 5 and 6 (MISSION 1017-2).

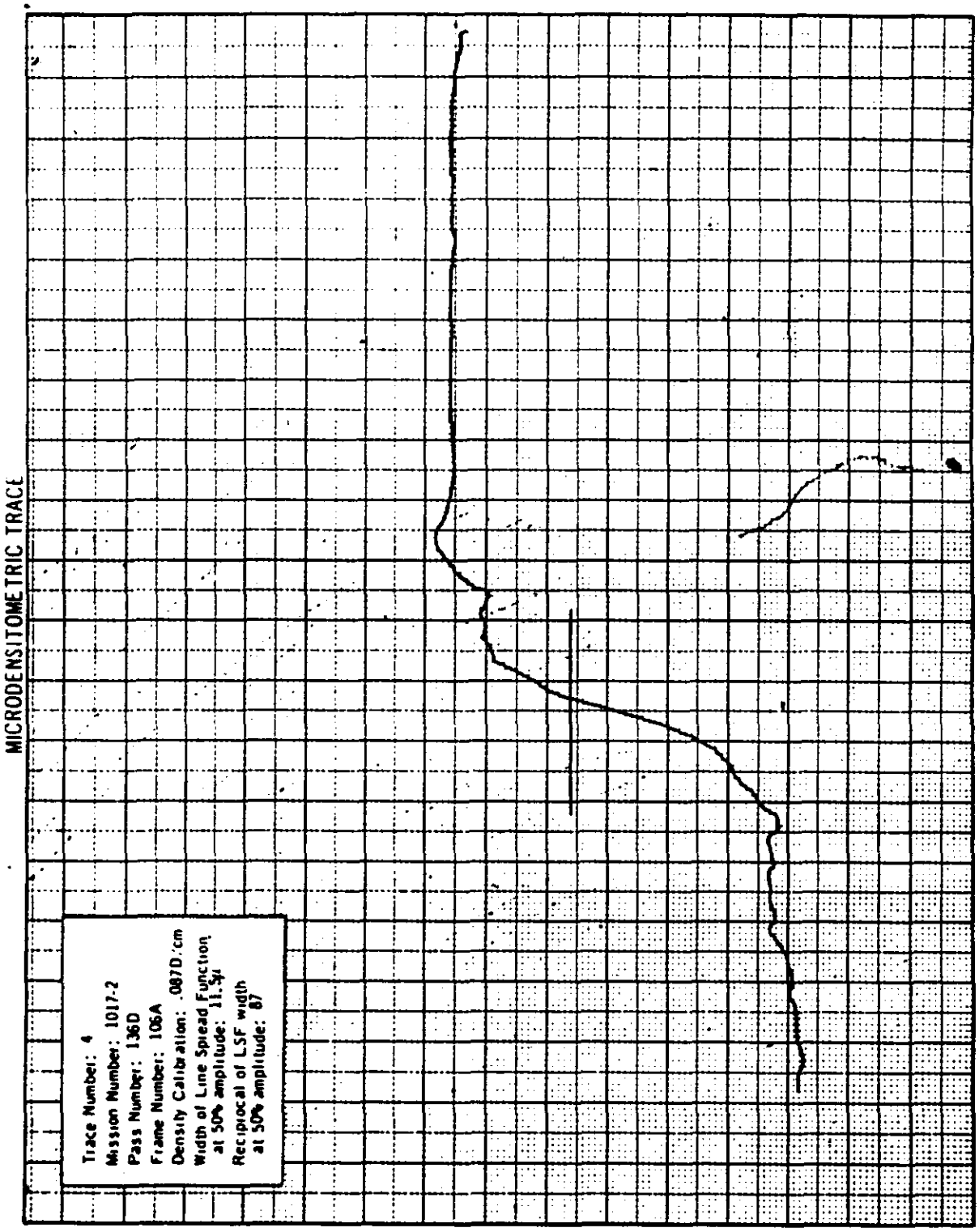
NPIC K-2919 (8/68)

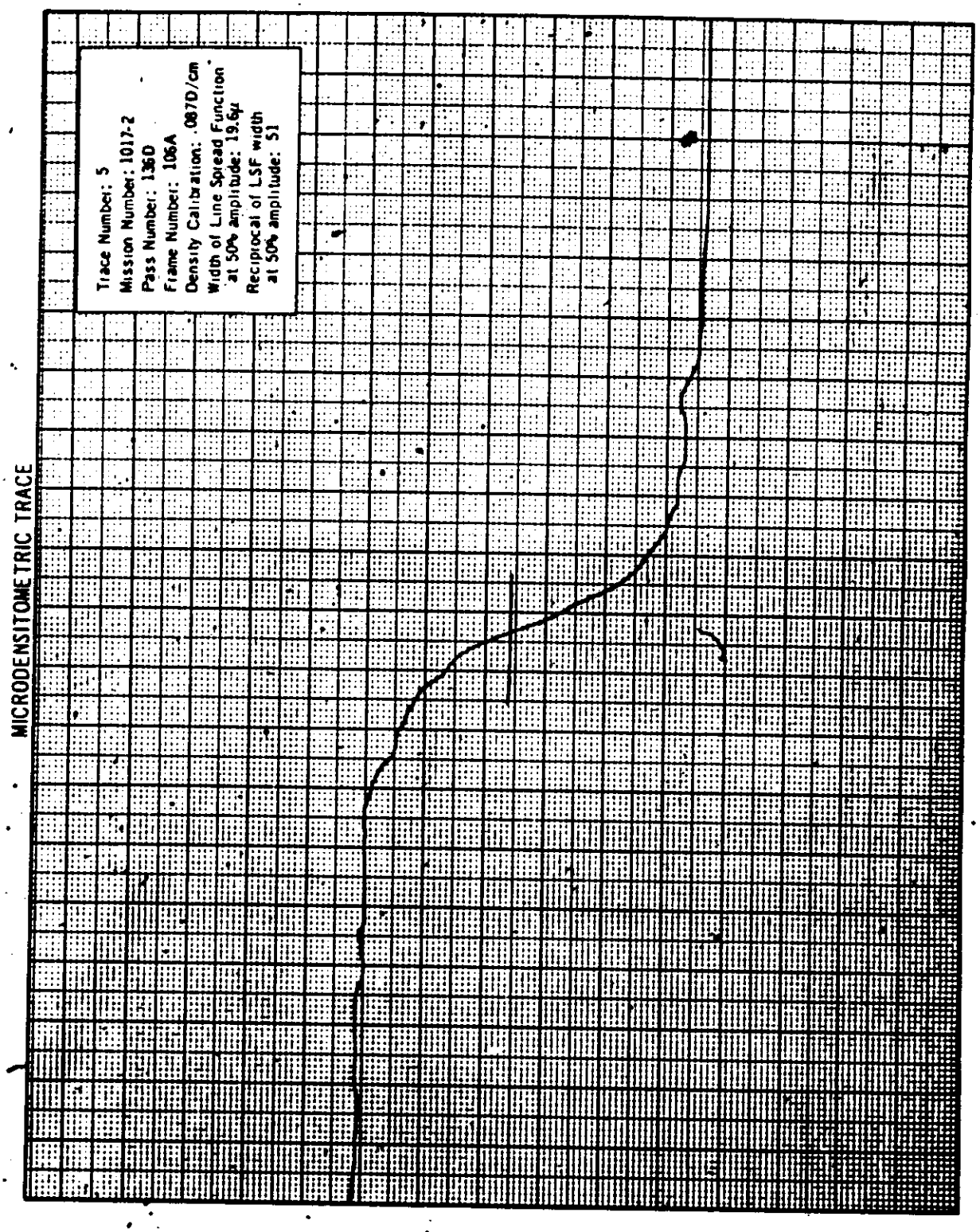
[redacted]

Camera	AFT
Pass	136D
Frame	106
Date of Photography	6 March 1965
Universal Grid Coordinates	47 x 13.8
Enlargement Factor	40x
Geographic Coordinates	47°00'N, 28°56'E
Altitude (feet)	605,659
Camera Attitude:	
Pitch	Not Available
Roll	Not Available
Yaw	Not Available
Local Sun Time	1122 Hrs
Solar Elevation	36
Solar Azimuth	167
Exposure	1 354 sec

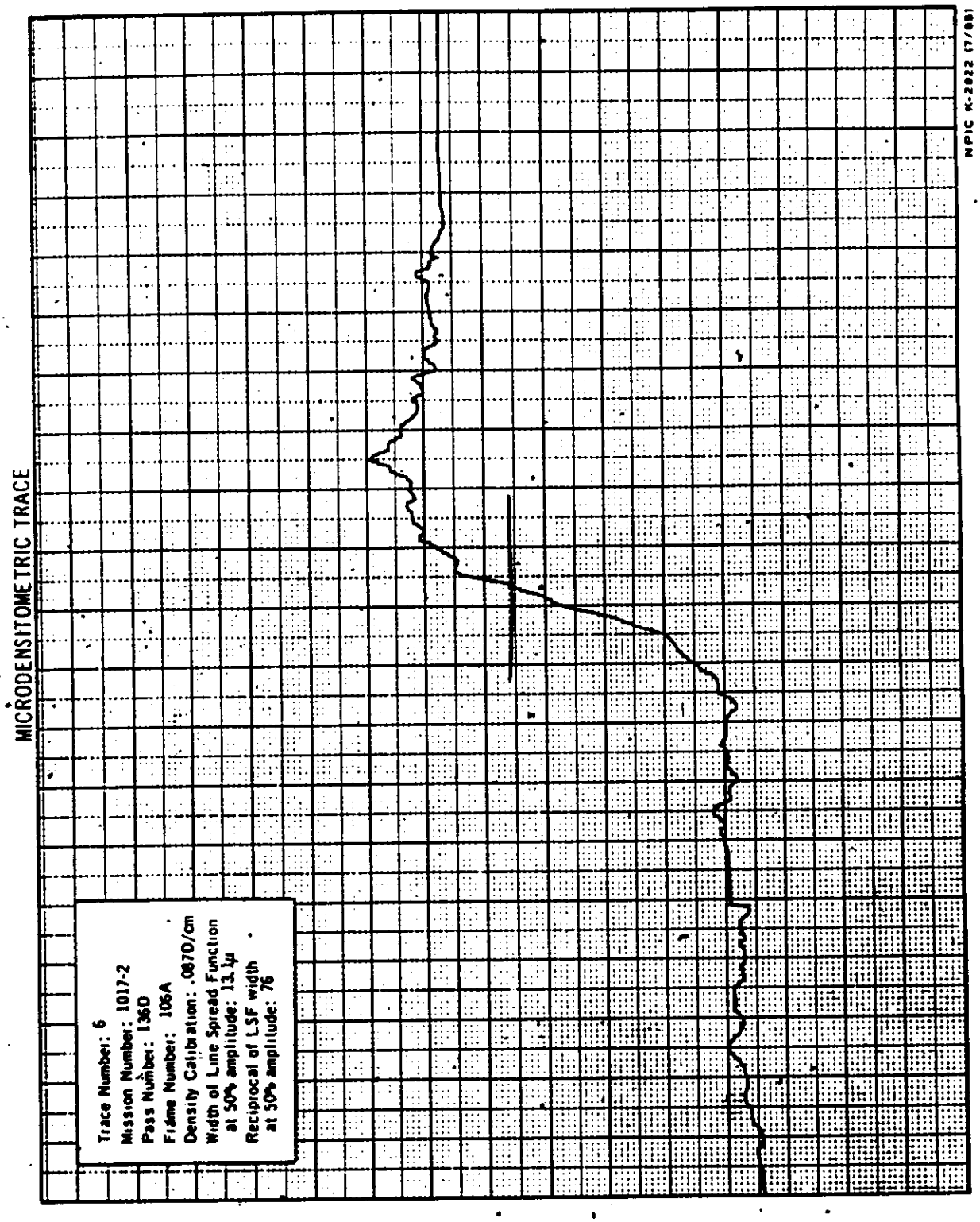





MICRODENSITOMETRIC TRACE
Trace Number: 4
Mission Number: 1017-2
Pass Number: 136D
Frame Number: 106A
Density Calibration: .087D/cm
Width of Line Spread Function at 50% amplitude: 11.5μ
Reciprocal of LSF width at 50% amplitude: 87
NPIC K-2920 (7-69)


Trace Number: 5
Mission Number: 1017-2
Pass Number: 136D
Frame Number: 106A
Density Calibration: .087D/cm
Width of Line Spread Function at 50% amplitude: 19.6μ
Reciprocal of LSF width at 50% amplitude: 51
MICRODENSITOMETRIC TRACE

[redacted]


MICRODENSITOMETRIC TRACE
Trace Number: 6
Mission Number: 1017-2
Pass Number: 136D
Frame Number: 106A
Density Calibration: .087D/cm
Width of Line Spread Function at 50% amplitude: 13.4μ
Reciprocal of LSF width at 50% amplitude: 76
NPIC K-2022 (7/68)

APPENDIX D. CLOUD COVER ANALYSIS

1. Introduction: This study represents a statistical analysis of the cloud cover on the photography of Mission 1017. 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 (Reference, 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 of 100 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 photo 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:

$$
\begin{aligned}
0.20 \times \quad 5.0 &= 1.00\% \\
0.15 \times \quad 17.5 &= 2.63\% \\
0.30 \times \quad 38.0 &= 11.40\% \\
0.25 \times \quad 75.0 &= 18.75\% \\
0.10 \times \quad 100.0 &= 10.00\% \\
&\overline{43.78\%}
\end{aligned}
$$

Hence, 43.8 percent of this pass is cloud covered.

TABLE 1

CLOUD COVER CATEGORIES

CATEGORY NUMBER	PERCENT OF CLOUD COVER	DESCRIPTION	MEAN CLOUD PERCENTAGE
1	Less then 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%

[illegible] Cloud Cover Data, Missions 1017-[illegible] and [illegible]

PERCENTAGE OF CLOUD COVER CATEGORIES BY PASS

Mission 1017-[illegible]

Pass Number	1	2	3	4	5	Cloud Cover % Per Pass
[illegible]	[illegible]	[illegible]	[illegible]	4.0	[illegible]	10.4
[illegible]	[illegible]	[illegible]	[illegible]	0.0	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	0.8	0.8	[illegible]	6.7
[illegible]	[illegible]	[illegible]	21.5	[illegible]	46.8	67.0
[illegible]	[illegible]	[illegible]	[illegible]	11.4	[illegible]	14.1
[illegible]	71.7	[illegible]	10.5	[illegible]	[illegible]	13.7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	32.3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	16.0
[illegible]	77.5	1.5	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0.0	[illegible]	0.0	[illegible]	5.0
[illegible]	[illegible]	0.0	[illegible]	[illegible]	[illegible]	5.0
[illegible]	[illegible]	[illegible]	[illegible]	0.0	[illegible]	6.5
[illegible]	[illegible]	[illegible]	10.6	6.0	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	2.1	[illegible]	15.6
50D	91.6	[illegible]	1.7	[illegible]	[illegible]	6.4
[illegible]	81.3	11.8	6.1	[illegible]	[illegible]	9.1
54D	[illegible]	8.1	[illegible]	13.4	1.3	18.4
55D	61.6	[illegible]	17.5	7.3	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	0.0	[illegible]	[illegible]
67D	[illegible]	3.5	[illegible]	[illegible]	0.0	7.5
68D	93.0	3.5	3.0	0.5	0.0	6.8
70D	[illegible]	[illegible]	2.3	6.1	[illegible]	[illegible]
71D	66.5	6.1	15.3	8.2	[illegible]	[illegible]
72D	[illegible]	8.0	7.3	14.0	11.5	[illegible]
81D	[illegible]	[illegible]	[illegible]	0.6	0.0	[illegible]
	67.0*	10.2*	[illegible]	9.1*	[illegible]	[illegible]

Mission [illegible]

Pass Number	1	[illegible]	[illegible]	[illegible]	[illegible]	Cloud Cover % Per Pass
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
84D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
85D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
86D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	61.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	71.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
131D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
132D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
133D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
134D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23.2
135D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	60.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
137D	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	53.2*	[illegible]	12.3*	[illegible]	[illegible]	[illegible]

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

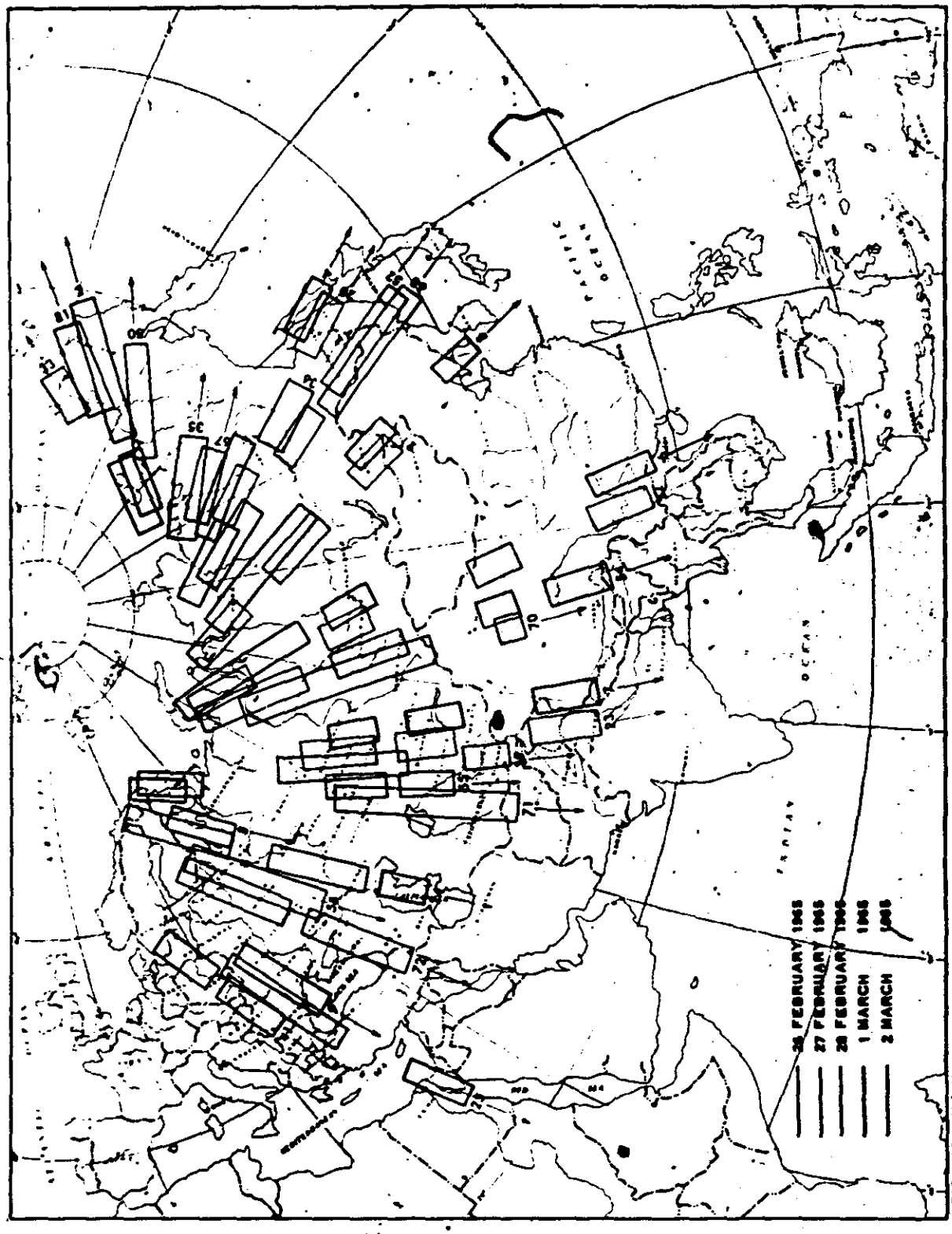
APPENDIX E. MISSION COVERAGE STATISTICS

Summary of Plottable Photographic Coverage Mission 1017-1

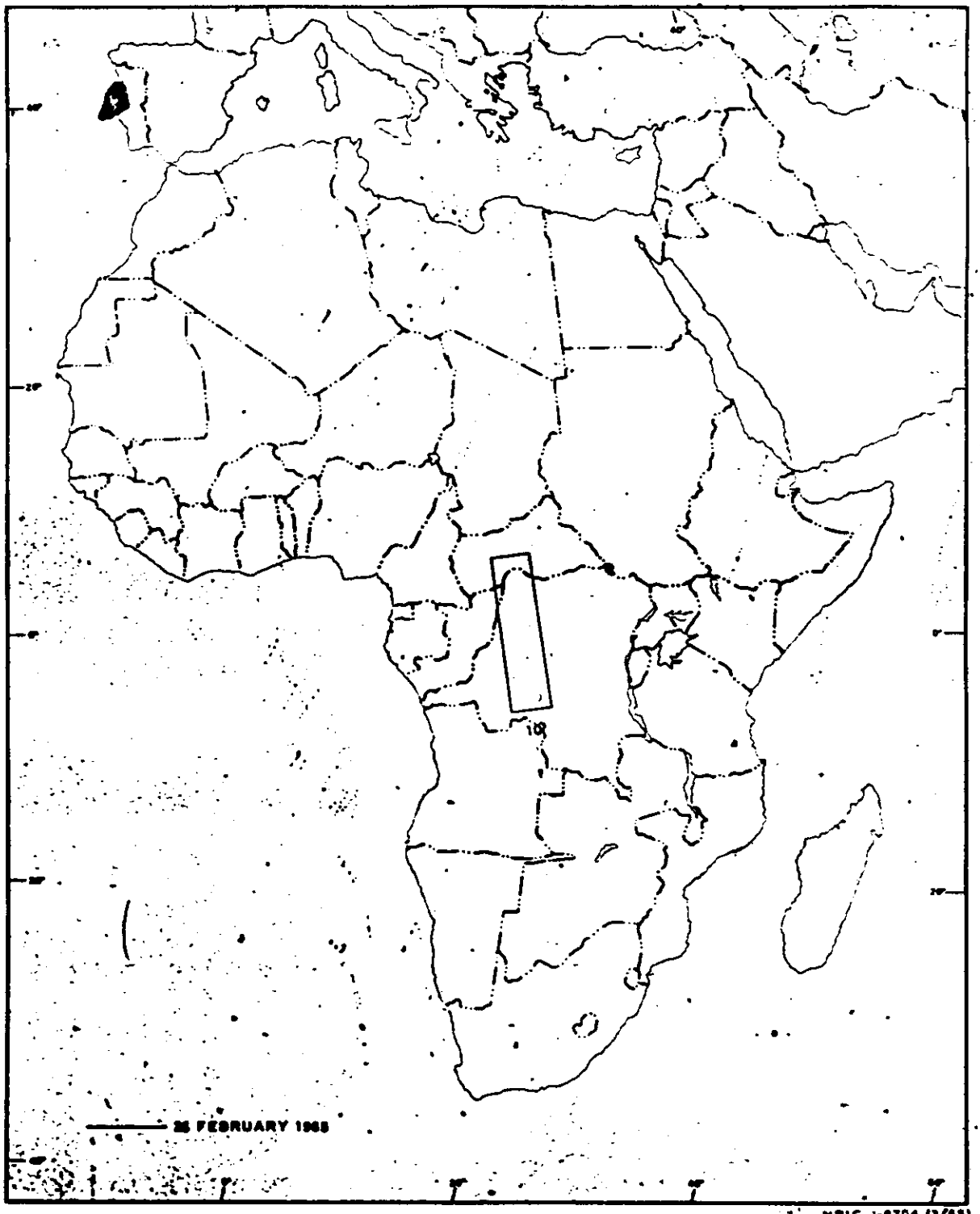
Country	FORWARD CAMERA		AFT CAMERA		TOTALS	
	Linear nm	Square nm	Linear nm	Square nm	Linear nm	Square nm
USSR	20,416	3,288,824	19,416	3,140,802	39,832	6,429,626
China	2,458	364,691	2,503	371,350	4,961	736,041
Congo	580	84,462	546	79,492	1,126	163,954
Rumania	474	69,916	365	52,490	839	122,406
Egypt	287	41,328	246	35,424	533	76,752
India	281	40,461	179	26,124	460	66,585
Poland	261	41,614	308	48,676	569	90,290
Finland	156	26,124	115	19,844	271	45,968
Kashmir	140	20,160	234	34,398	374	54,558
Turkey	138	18,696	81	8,622	219	27,318
Mexico	113	16,272	66	9,504	179	25,776
North Korea	111	3,300	------	------	111	3,300
Mongolia	98	15,484	78	12,156	176	27,640
Bulgaria	76	11,704	62	9,548	138	21,252
Canada	67	10,586	171	27,018	238	37,604
Nepal	62	8,928	------	------	62	8,928
Afghanistan	49	7,350	------	------	49	7,350
South Korea	41	600	------	------	41	600
Czechoslovakia	37	5,698	37	5,846	74	11,544
Hungary	37	5,698	37	5,846	74	11,544
Union of Central African Republic	27	3,888	74	10,656	101	14,544
North Vietnam	25	3,575	142	5,194	167	8,769
Sweden	12	2,112	109	15,552	121	17,664
Norway	6	1,056	132	14,630	138	15,686
TOTAL	25,952	4,092,588	24,901	3,933,111	50,853	8,025,699
Continental US	390	58,182	422	62,714	812	120,896
GRAND TOTAL	26,342	4,150,770	25,323	3,995,825	51,665	8,146,595

Summary of Plottable Photographic Coverage Mission 1017-2

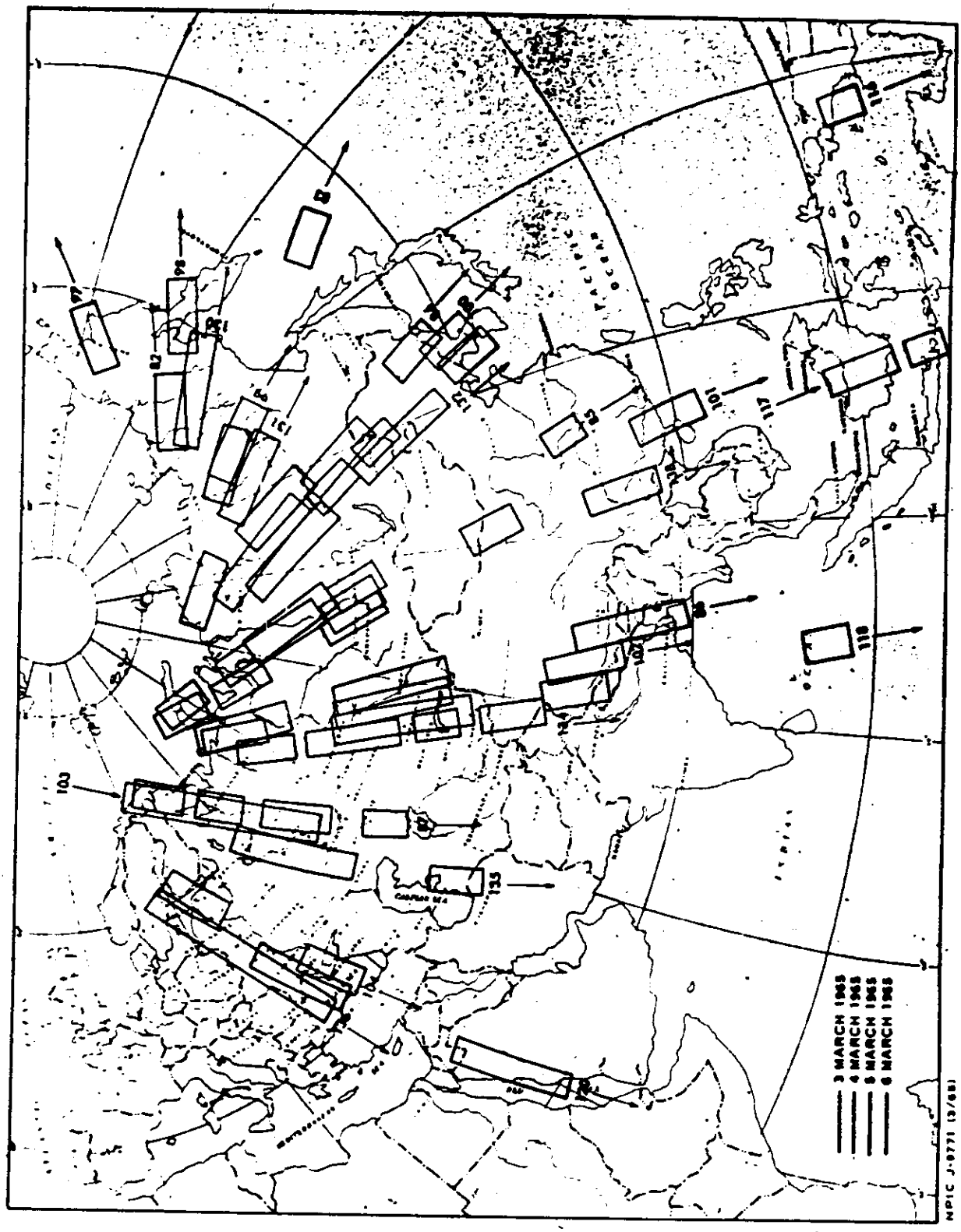
Country	FORWARD CAMERA		AFT CAMERA		TOTALS	
	Linear nm	Square nm	Linear nm	Square nm	Linear nm	Square nm
USSR	15,445	2,567,862	15,819	2,596,224	31,264	5,164,086
China	2,478	371,808	2,508	373,064	4,986	744,872
Saudi Arabia	643	84,513	130	18,590	773	103,103
North Korea	430	45,658	338	39,131	768	84,789
Congo	416	60,736	784	114,464	1,200	175,200
Indonesia	398	51,703	426	53,878	824	105,581
Sweden	226	17,854	115	14,536	341	32,390
Norway	220	26,428	283	26,995	503	53,423
Pakistan	160	20,736	175	22,594	335	43,330
Finland	142	22,820	211	34,649	353	57,469
Poland	113	17,854	115	18,170	228	36,024
Rumania	113	16,116	115	18,170	228	34,286
South Korea	109	9,804	33	4,891	142	14,695
India	107	15,408	105	15,015	212	30,423
Union of Central African Republic	104	15,184	98	14,308	202	29,492
Iran	90	13,500	31	4,650	121	18,150
Mongolia	85	13,230	141	21,504	226	34,734
Nepal	76	10,944	45	6,850	121	17,794
Netherlands	62	894	103	7,800	165	8,694
Bhutan	53	7,632	70	10,010	123	17,642
Kashmir	53	7,950	------	------	53	7,950
Malaysia	33	4,917	107	15,943	140	20,860
Puerto Rico	25	1,846	25	1,846	50	3,692
Burma	21	572	------	------	21	572
Jordan	14	2,002	56	8,008	70	10,010
Angola	------	------	98	14,308	98	14,308
North Vietnam	------	------	4	572	4	572
TOTAL	21,616	3,407,971	21,935	3,456,170	43,551	6,864,141
Continental US	568	65,709	529	62,769	1,097	128,478
GRAND TOTAL	22,184	3,473,680	22,464	3,518,939	44,648	6,992,619



APPROXIMATE TRACK OF MISSION 1017-1, 26 FEBRUARY - 2 MARCH 1965 OVER USSR, FAR AND MIDDLE EAST.



APPROXIMATE TRACK OF MISSION 1017-1, 26 FEBRUARY - 2 MARCH 1965 OVER AFRICA.


3 MARCH 1965
4 MARCH 1965
5 MARCH 1965
6 MARCH 1965
NPIC J-8771 (3/68)