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TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT
MISSION 1010-1, 14-19 SEPTEMBER
MISSION 1010-2, 19-23 SEPTEMBER

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TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT MISSION 1010-1, 14-19 SEPTEMBER 1964 MISSION 1010-2, 19-23 SEPTEMBER 1964

[redacted]

March 1965

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

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SYNOPSIS

Mission 1010, a two-part satellite reconnaissance mission, was launched 14 September 1964. The "A" bucket was recovered in an air catch on revolution 65, 19 September 1964, and the "B" bucket was recovered in an air catch on orbit 144, 23 September 1964.

There is an out-of-focus area on the photography of both panoramic cameras beginning at pass 9D. The soft area on the master panoramic camera photography is confined to a narrow band along the camera number edge near the take-up end of each frame. It appears only through pass 47DE. The area on the slave panoramic camera photography is at the frequency mark edge and take-up end. While it is present on most frames, there are frames which appear to be unaffected. The photography of pass 61D is the last to be degraded by the softness. The area is erratic in size and shape, but is generally 1.5 inches wide and extends 4 inches along the edge.

The quality of the panoramic photography not degraded by the out-of-focus condition is good throughout the mission.

The stellar imagery of both stellar cameras is intermittently smeared. While this does not make the process of stellar reduction impossible, it does make it difficult.

A light leak resulted in fogged areas on the photography of the stellar and index cameras of Mission 1010-2. The degradation is minor except on the frames affected during camera-off periods.

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GENERAL FLIGHT DATA

Date of Launch: 14 September 1963

Orbital Parameters
(Revolution 1)

Period	90.971 min	Eccentricity	0.02236
Perigee	97.45 nm	Perigee Latitude	42.567°N
Apogee	259.19 nm	Inclination Angle	84.96°N

(Revolution 107)

Period	90.81 min	Eccentricity	0.02181
Perigee	99.58 nm	Perigee Latitude	68.389°N
Apogee	257.09 nm	Inclination Angle	87.96°N

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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 includes 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 number of diameters the original material has been enlarged in the photographic illustration.

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: The pitch is the rotation of the vehicle about the transverse axis. Positive readings indicate nose-up attitude, negative readings indicate nose-down attitude.

ROLL: The roll is the rotation of the vehicle about the longitudinal axis. Positive readings indicate left wing-up attitude. Negative readings indicate right wing-up attitude.

YAW: The yaw is the rotation of the vehicle about the vertical axis. Positive readings indicate counterclockwise rotation when viewing the ground nadir from the vehicle.

LOCAL SUN TIME: This time is included to present to the viewer a realistic time of the acquisition of the photography illustrated.

[redacted]

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. GOOD IMAGE QUALITY NEAR THE BEGINNING OF THE MISSION.

NPIC J-[redacted] (3/68)

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Camera	153 (Aft)
Pass	09D
Frame	116
Date of Photography	15 September 1964
Universal Grid Coordinates	x56.2 y12.7
Enlargement Factor	20X
Geographic Coordinates	47°02'N 32°32'E
Altitude (feet)	593495
Vehicle:	
Pitch	-14°35'
Roll	-00°28'
Yaw	00°13'
Local Sun Time	1441
Solar Elevation	32°05'
Solar Azimuth	281°30'
Exposure	1/338 sec.
Dmax	1.05
Dmin	0.53
Delta	0.52
Gross Fog	0.17

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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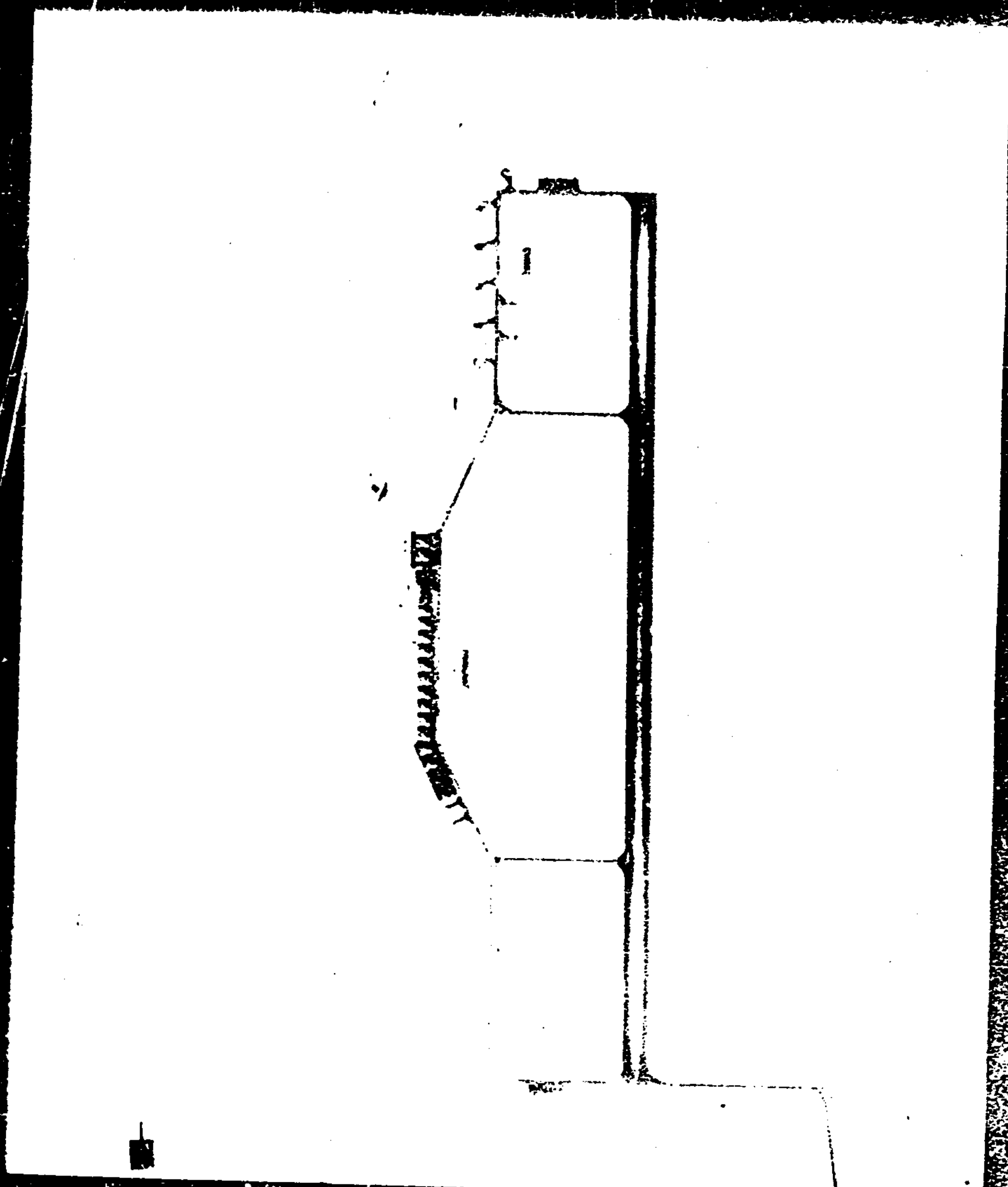

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PART I. CAMERA OPERATION

1. Master (FWD) Panoramic Camera No 152

a. Minus-density streaks, approximately parallel to the path of the field flattener, are minor and few throughout the first 75 percent of the mission. Although the resulting degradation is still minor, the streaks become more pronounced and frequent after pass 87D. Frames 90-129, pass 88D, are an extreme example of the minus density streaks.

b. Scratches just inside the format at each edge under the camera number and just inside the format at each edge at the take-up end, appear on each frame except on the first frame following a camera-off. These scratches have appeared on all of the "J" Missions to date. There is a multitude of longitudinal emulsion scratches throughout the mission. Most of them are very light and are not believed to be camera induced. One exception is a scratch approximately 0.1 inches inside the format at the camera number edge and supply end. It is about 4 inches long and parallel to the film edges. It is believed to be camera induced and is intermittent on pass 69D and thereafter throughout the remainder of the mission. Rail scratches are continuous.

c. Fog on the first and last frames of most passes is the result of light entering the chimney around the lens housing during camera-off periods.

d. Smearing of highly reflective images (clouds, beaches, etc.) results from reflections within the camera. The smearing is always parallel to the film edges and is believed to be caused by reflections from the field flattener. The resulting degradation is dependent upon the intensity of the light entering the camera, and the principal ray.

e. An out-of-focus area appears on each frame between pass 9D, frame 1, and the last frame of 47DR. The affected imagery is within a band approximately 4 inches long and 0.5 inches wide at the take-up end and camera number edge. It extends along the frequency mark edge in a rather irregular configuration that varies slightly from frame to frame. Due to cloud cover, areas of water, and desert areas, it is impossible to definitely establish the location of presence of the soft imagery on every frame. However, it is definite that the [illegible] on pass 9D and ended prior to pass 52D. The passes immediately preceding pass 9D were 8AR and 7D. Because pass 9AR was [illegible] there is no exposure and it is impossible to tell [illegible] soft area exists. The photography of 7D displayed [illegible] It is interesting to note that the out-of-focus [illegible] between camera rest periods. The [illegible] of each "J" Mission except [illegible] focus condition. [illegible] 90% (on the Missions [illegible]

[redacted]

2. Slave (AFT) Panoramic Camera No 153

a. Minus density streaks parallel to the path of the field flattener are intermittent throughout the mission. The degradation of imagery associated with the streaks is minor. The streaks are most pronounced on the first four operational passes.

b. An emulsion scratch parallel to the major axis of the film is just inside the format, at the camera number edge and take-up end on each frame. There are several longitudinal emulsion scratches, but they are light and of little consequence. Furthermore, their origin cannot be determined.

c. Light leaks caused fog on the first and last frames of most passes. The fog, like that of the master panoramic camera, is a result of light entering the chimney around the lens housing during camera-off periods.

d. Streaking of highly reflective images is present intermittently throughout the mission. Pass 65D, frame 5, is a good example of the smearing. This problem is discussed in Part I, paragraph e, of this report.

e. Out-of-focus areas are present on the film of this camera intermittently on pass 9D through 61D. Although every frame does not display this soft imagery, most frames do. Like the master panoramic camera the out-of-focus area first appears on the photography of Pass 9D. Unlike the photography of the master panoramic camera the area of soft imagery continues intermittently throughout the photography of Mission 1010-1. The out-of-focus area extends about 4 inches along the frequency mark edge at the take-up end of the frames. Unlike the affected area of the master camera photography it is not confined to a narrow band. It has irregular humps which extend up to 1.5 inches into the format. The size and shape are irregular and at times the imagery in the area normally affected is sharp and well defined. It is of interest that again the out-of-focus area disappears following a camera-off (rest) period. Pass 61D, the last pass displaying the soft imagery, is followed by pass 65D.

[redacted]

FIGURES 3 and 4. COMPARISON OF HORIZON IMAGE QUALITY.

NPIC J-6060 (S/SI) NPIC J-[illegible] (S/SI)

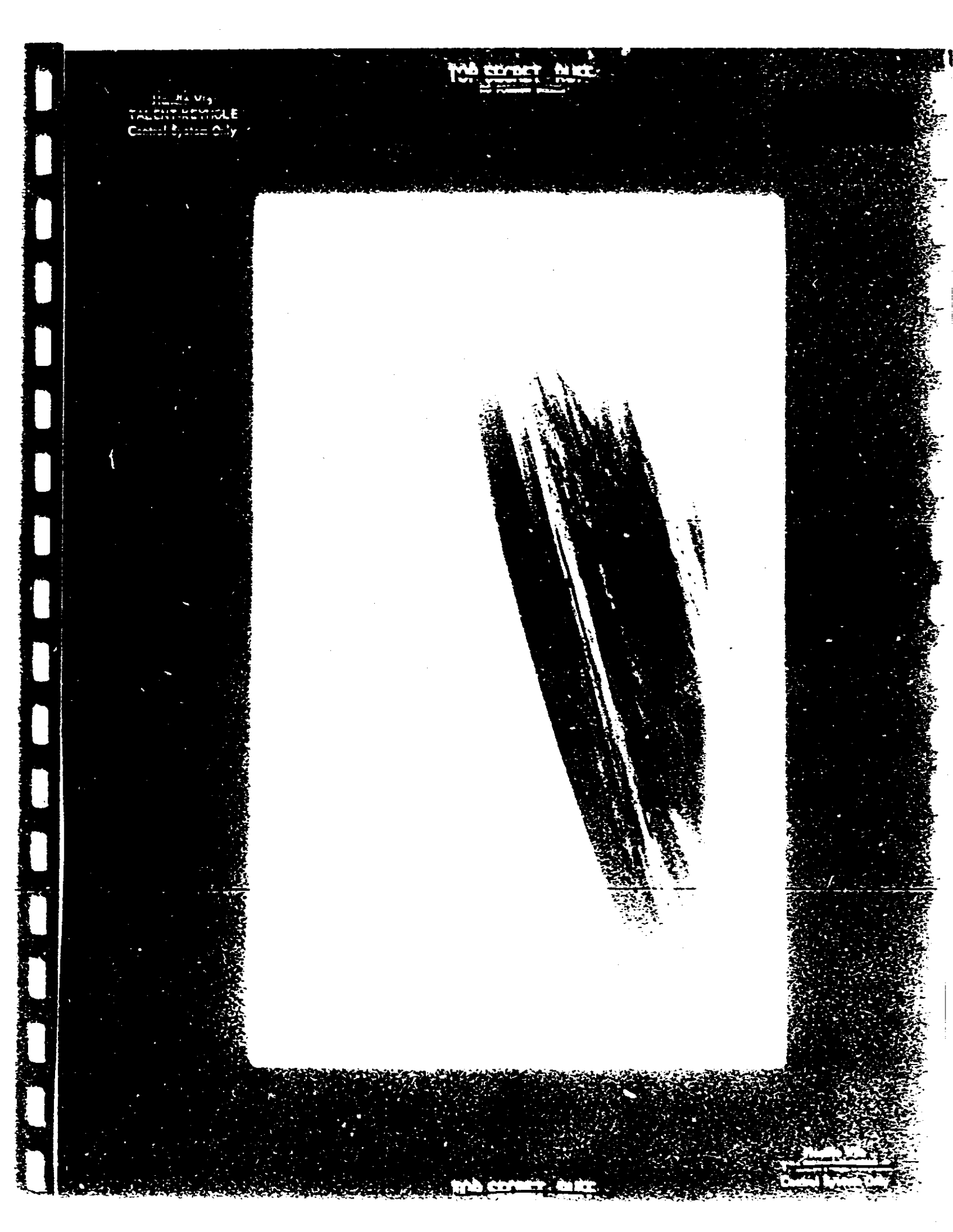
The first photograph is the imagery of the starboard looking horizon camera.

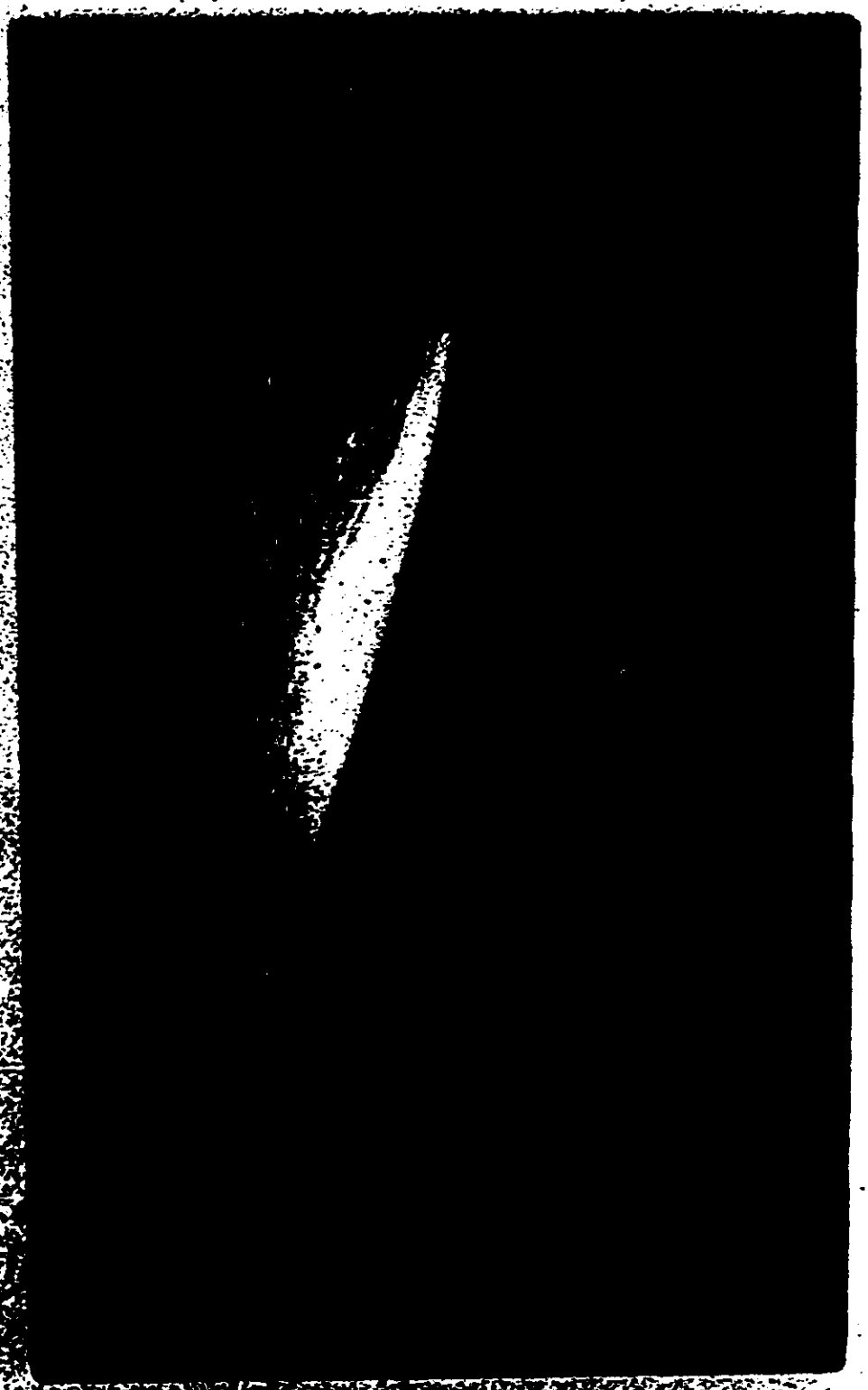
The second is imagery of the port looking horizon camera.

[redacted]

	STARBOARD	PORT
Camera	152 (Fwd)	152 (Fwd)
Pass	380	380
Frame	18	18
Date of Photography	17 September 1964	17 September 1964
Universal Grid Coordinates	Not Applicable	Not Applicable
Enlargement Factor	3X	3X
Geographic Coordinates	56°02'N 88°39'E	56°02'N 88°39'E
Altitude (feet)	601862	601862
Vehicle:		
Pitch	19°24'	19°24'
Roll	-00°25'	-00°25'
Yaw	-00°16'	-00°16'
Local Sun Time	1420	1420
Solar Elevation	27°48'	27°48'
Solar Azimuth	227°00'	227°00'
Exposure	1/100 sec.	1/100 sec.
Delta	1.87	1.56
Dens	0.27	0.24
Delta	1.60	1.32
Gray Fog	0.17	0.17

Approximate flight direction on photograph





3. Master (FWD) Horizon Cameras

a. Both horizon cameras operated well throughout the mission. The imagery is sharp and the arc of the horizon is well defined.

4. Slave (AFT) Horizon Cameras

a. Both horizon cameras of the slave panoramic camera operated well throughout the mission. The imagery is good and there is a good horizon arc.

5. Stellar Camera No 41 (Mission 1010-1)

The stellar imagery is smeared intermittently throughout the mission. The stars are imaged in a barbell configuration: a definite stellar image, a less dense smear, and another definite image. Although it has not been established as fact, it seems that the anomaly is the result of vehicle attitude deviations during exposure. Plus density streaks through the formats (unidentified objects going by the lens) like those noted on previous missions, appear intermittently throughout the mission. When these streaks appear in a straight line through the stellar format, there is no smearing of the stellar images. When the plus density streaks deviate from a straight line, (indicating vehicle instability) the stellar images invariably display smear. In addition, the vehicle manufacturer indicates that preliminary data show that there is a correlation between the smeared imagery and the synchronization of the camera chimneys: when the master and slave panoramic camera chimneys are scanning in the same direction simultaneously, forces are introduced that result in vehicle instability. While the degradation introduced by the smear in the stellar imagery complicates the stellar reduction process, it does not make it impossible.

Emulsion cracks parallel to the minor axis of the film are present throughout the last 50 percent of the mission.

The last 22 frames are fogged and abraded in conjunction with film exhaustion.

There is a continuous plus density streak parallel to the minor axis of the film and in line with the camera master chimney through the last 40 frames. Because of the position of the streak [illegible] degradation of the imagery.

Flare in the format accounted for some [illegible] 30 percent of each frame.

[redacted]

6. Stellar Camera No 44 (1010-2)

The stellar imagery of this camera is intermittently smeared like that of the stellar camera used in Mission 1010-1 (camera No 41).

A light leak caused a diagonal streak of fog, variable in length and intensity, on 23 frames of the mission. There is a definite correlation between the fog and camera-off periods. The fog is most intense at the camera number edge and appears to enter the frame from that direction. There is a band of fog 0.10 inches wide parallel to and in contact with the camera number edge intermittently throughout the mission. It does not enter the frame nor degrade the imagery.

A dendritic static discharge resulted in a small area of fog near the center of the film each 0.60 inches along the major axis of the film on the first 75 percent of the mission.

Approximately 30 percent of each frame is degraded by flare (earth flare and flare from the fiducial mounting plates).

7. Index Camera No D41 (Mission 1010-1)

The film of this camera was out of the film plane at the camera number edge during exposure. The result is a distortion of the reseau and out-of-focus imagery at the camera number edge. This also happened at the same relative location on the photography of the index camera of Mission 1007-2 (camera No D56).

There is minor fog at both film edges on the last 10 frames.

8. Index Camera No D46 (Mission 1010-2)

The imagery of this camera is also distorted and out-of-focus at the camera number edge of most frames. The reseau is distorted on the frames displaying out-of-focus and distorted imagery. This is identical to the degradation that affected the imagery of the index camera used in the first half of this mission (Mission 1010-1, index camera No. D41).

A streak of fog originates at the camera number edge of each frame and extends approximately 1 inch into the format. This streak of fog is about 0.4 inches wide and is faint except at camera-off periods. The density of the fog on the frame affected during camera-off is commensurate with the duration of the inactive camera period and the solar elevation. The frame affected is the fourth preceding the first frame of a new pass (toward take-up). This fog is apparently the result of a light leak.

There is another area of fog which is detectable only at camera off periods. It affects the two frames immediately preceding the first frame of a new pass (toward take-up). The fogged area is approximately 2 inches long, along the major axis, and covers nearly the entire width. The fog originates at the correlation mark edge and dissipates toward the other edge. The degradation induced by the fog is minor.

9. Associated Equipment

a. The frequency marks of the master panoramic camera are imaged inside the format with reflected images in the border. Because they are superimposed on the panoramic camera imagery, they are difficult and at times impossible to read.

b. All other collateral equipment operated well throughout the mission.

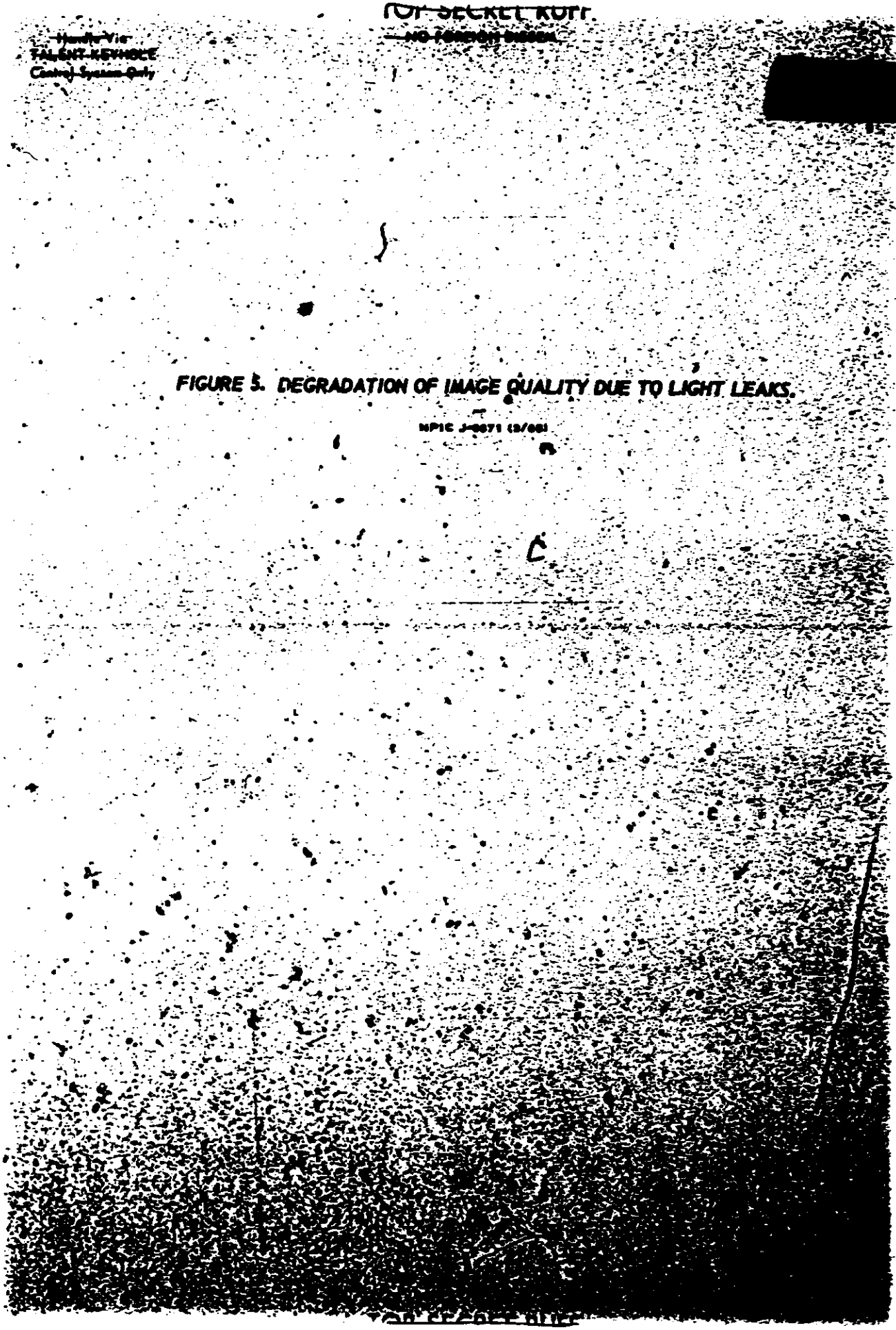


FIGURE 5. DEGRADATION OF IMAGE QUALITY DUE TO LIGHT LEAKS.

NPIC J-0071 (3/68)

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Camera	D-46 (Index)
Pass	1180
Frame	379 (Mission 1010-2)
Date of Photography	22 September 1964
Universal Grid Coordinates	Not applicable
Enlargement Factor	2.75X
Geographic Coordinates	46°11'N 64°31'E
Altitude (feet)	626163
Vehicle:	
Pitch	00°05'
Roll	00°08'
Yaw	00°01'
Local Sun Time	1356
Solar Elevation	39°15'
Solar Azimuth	220°00'
Exposure	1/500 sec.
Density of Fog in Border	2.77
Gross Fog	0.19

[redacted]

PART II. FILM

1. Film Processing

This section provides evaluation of processing, exposure, and density of the original negative.

The exposure/density of the panoramic cameras used in this mission was slightly less than that which has come to be considered normal. The slit width used in this mission was 0.175 inches compared to a slit width of 0.20 inches usually used at this time of year. While a lower than normal density of the panoramic photography is apparent, it was not a degrading factor. In some instances the lower densities were an aid to photo interpretation. Sixteen percent of the panoramic photography recovered in the "A" bucket was processed at the intermediate level of development, and 84 percent at the full level; 19.5 percent of the panoramic camera photography recovered in the "B" bucket was processed at intermediate, while 80.5 percent was processed at the full level. There was no panoramic photography processed at the primary level of development.

2. Film Footage Processed

Camera	Feet	Frames
41 (Stellar)	78	422
D41 (Index)	105	423
44 (Stellar)	92	432
D46 (Index)	87	432
152 (1010-1)	8,155	2970
153 (1010-1)	8,183	2973
152 (1010-2)	7,803	2961
153 (1010-2)	7,793	2946

3. Film Degradations

a. A severe processing streak caused some loss of imagery on pass 88D, frame 24 FWD.

b. There are manufacturing splices on passes 22D, frame 23 FWD; 53D, frame 60 FWD; 71D, frame 68 FWD; 7D, frame 36 AFT; [redacted] 69D, frame 132 AFT; 100D, frame 93 AFT.

c. Emulsion lifts, pinholes, and blisters are [redacted] mittent throughout the mission.

[redacted]

d. In addition to the areas of fog described in Part 1, paragraph c, the second, third, and next to last frames of master panoramic camera photography were also partially fogged on most passes. The fog affecting the second frame is confined to a narrow band in the border area of the camera number edge. Because of its location there is no degradation of imagery. Also on the second frame of most passes there is a faint equipment image at the supply end. On the third frame of a pass there is usually a diagonal streak of fog which extends from edge to edge. The fog that usually appears on the next to last frame is in the form of various equipment shadowgraphs.

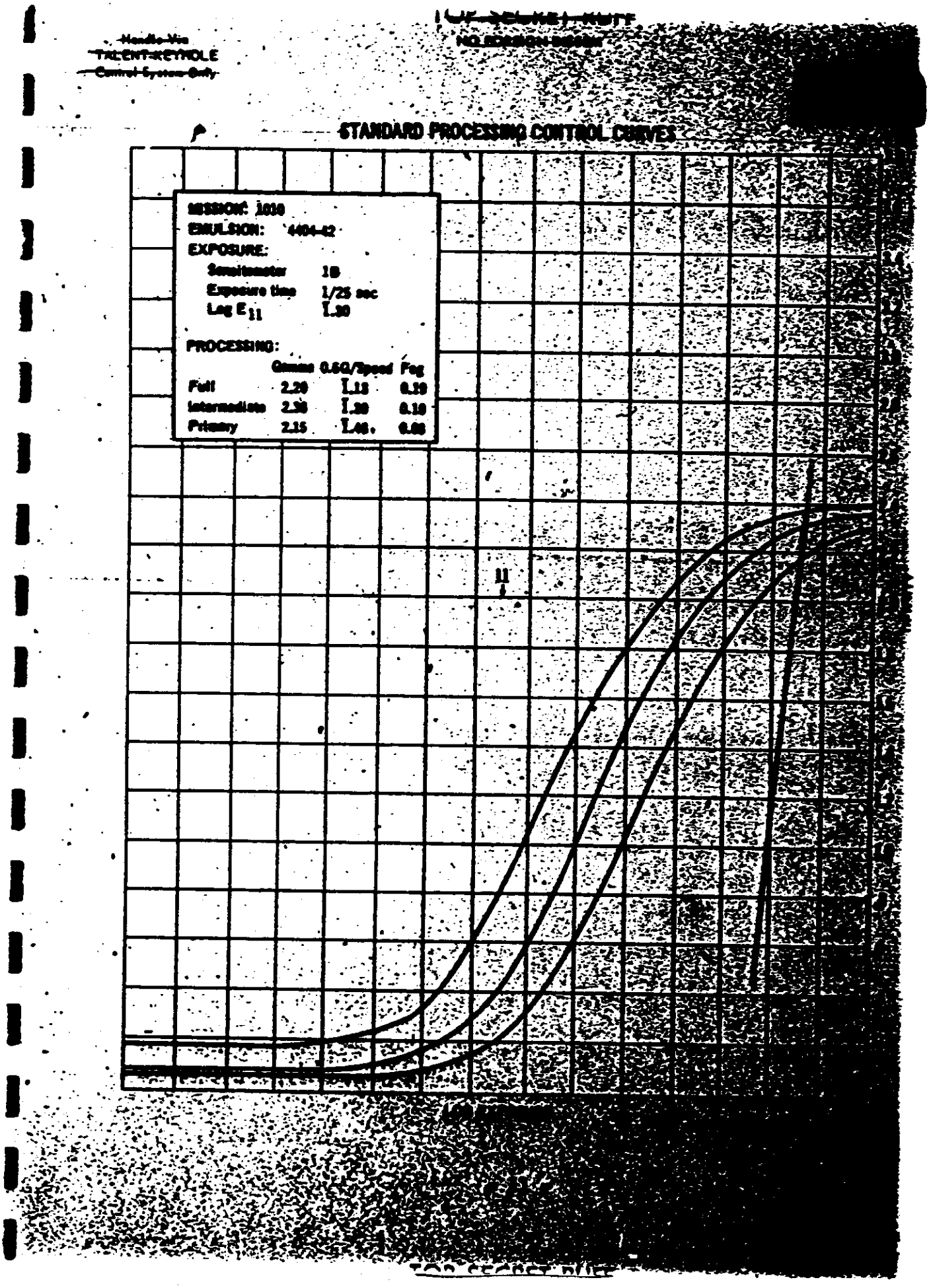
e. Fogged areas on the photography of the slave panoramic camera, in addition to that described in Part 2, paragraph c, is usually present on the second, third, and fifth frame of a pass, also on the second, third, and fifth from last frame of a pass. The fog on the third frame of a pass is a diagonal streak approximately 0.1 inches wide extending from edge to edge of the film. An equipment image is also present on the third frame of most passes. Fog on the third and fifth from last frame is also in the form of equipment shadowgraphs. The next to last frame of a pass usually contains a diagonal streak of fog similar to the fog on the third frame of a pass.

f. Dendritic static discharges result in fog along both edges of the film of the master panoramic camera intermittently throughout the mission. The fog is usually minor but on occasions does enter the format. Pass 84D, frames 112-115, are extreme examples of fog induced by dendritic static.

g. Passes 69D, 70D, and 71D of the slave panoramic camera are fogged intermittently along both edges due to dendritic static discharges. The fog occasionally projects into the format but the associated degradation is minor.

4. Film Processing Curves

The following processing curves, as supplied by the film processing contractor, are presented in the interest of comparative analysis:


STANDARD PROCESSING CONTROL CURVES
EMULSION: 4404-42
EXPOSURE:
Sensitometer 1B
Exposure time 1/25 sec
Log E_{11} 1.30
PROCESSING:
Gamma 0.60/Speed Fog
Full 2.20 1.18 0.19
Intermediate 2.30 1.30 0.10
Primary 2.15 1.46 0.08
11

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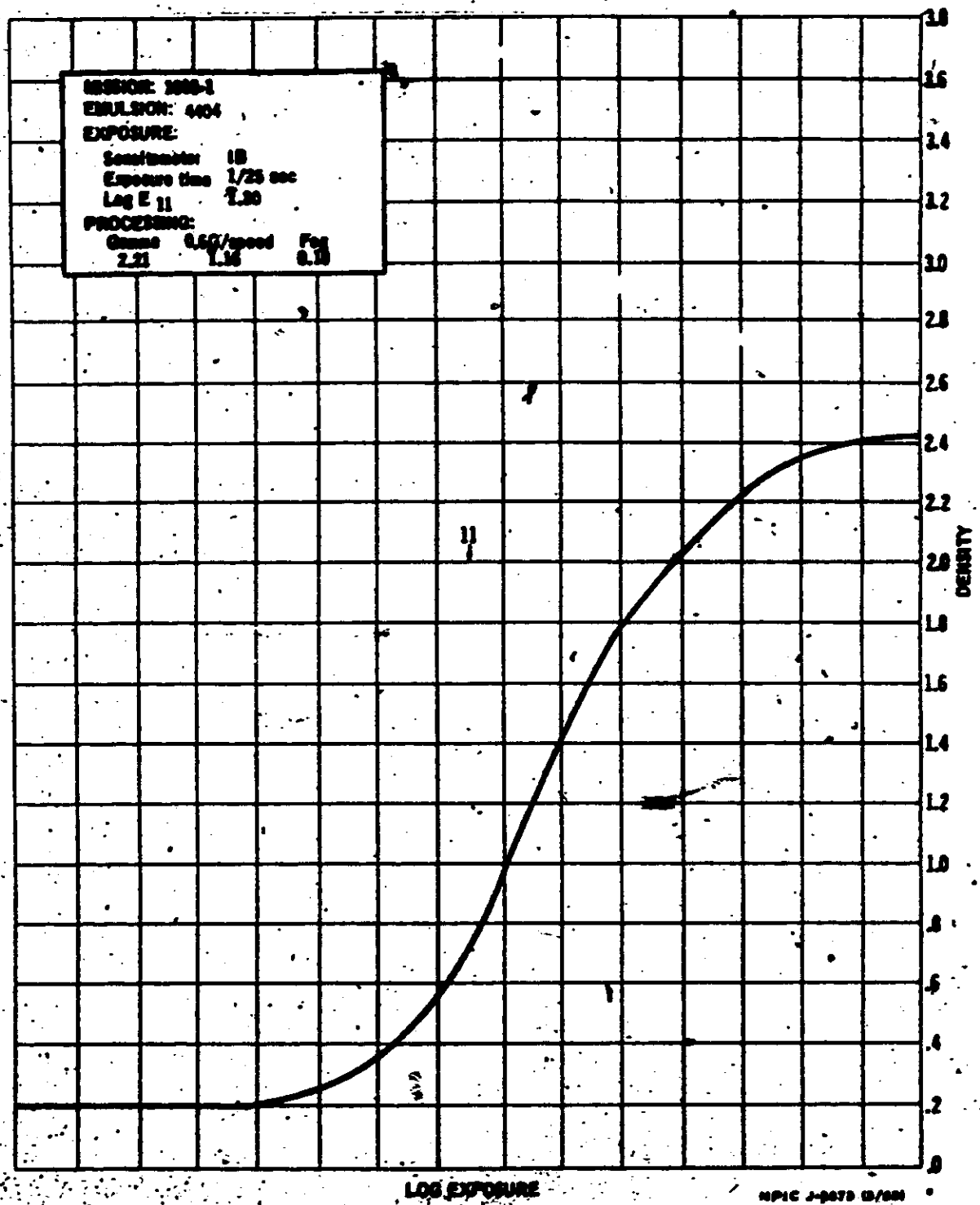
CONTROL CURVE FOR HEAD AND TAIL OF FORWARD MATERIAL



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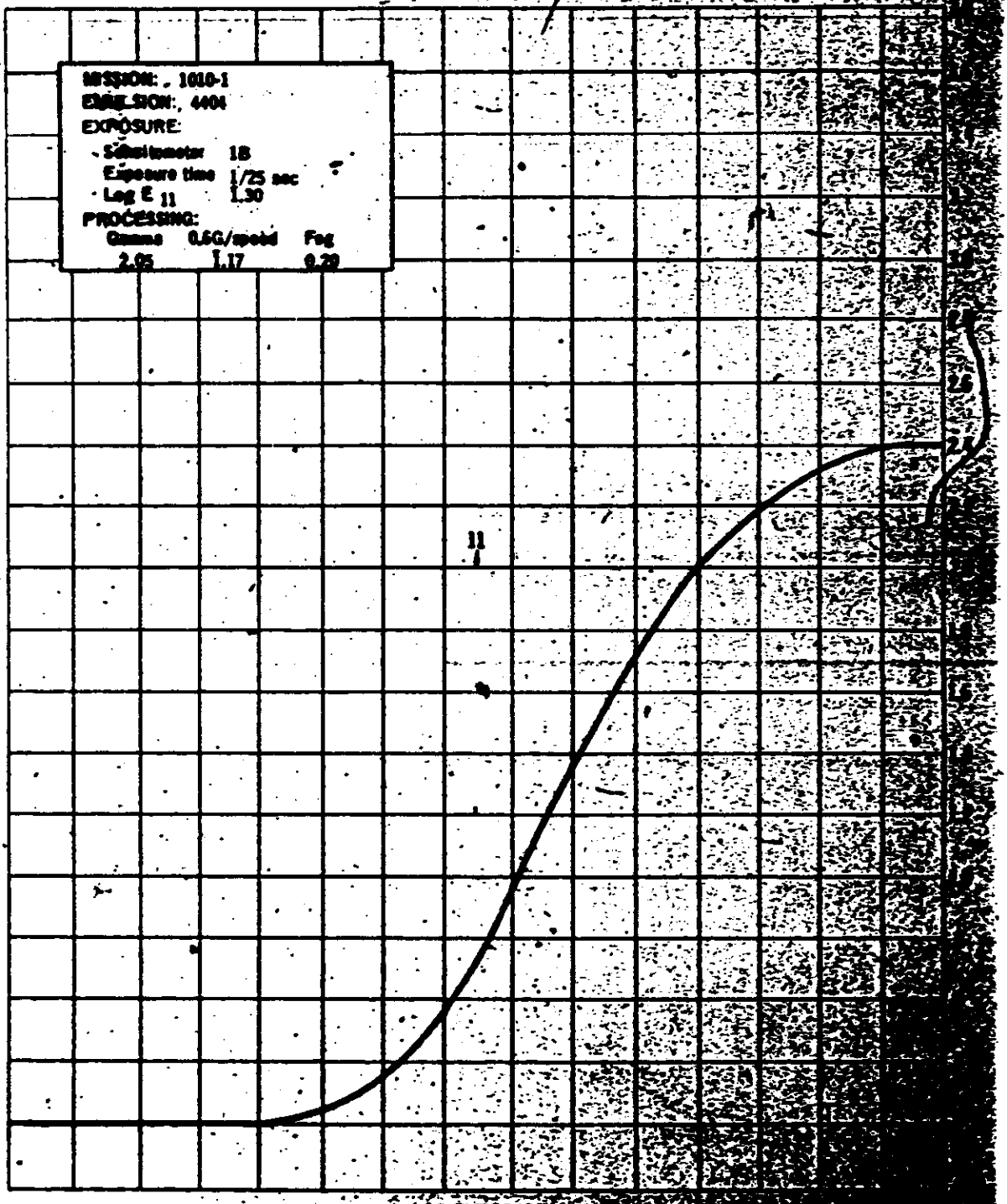
[redacted]
TALENT-KEYHOLE
[redacted]

CONTROL CURVE FOR HEAD AND TAIL OF AFT MATERIAL

MISSION: 1010-1
EMULSION: 4404
EXPOSURE:
- Sensitometer 1B
- Exposure time 1/25 sec
- Log E 11 1.30

PROCESSING:

Gamma	0.6G/speed	Fog
2.05	1.17	0.29



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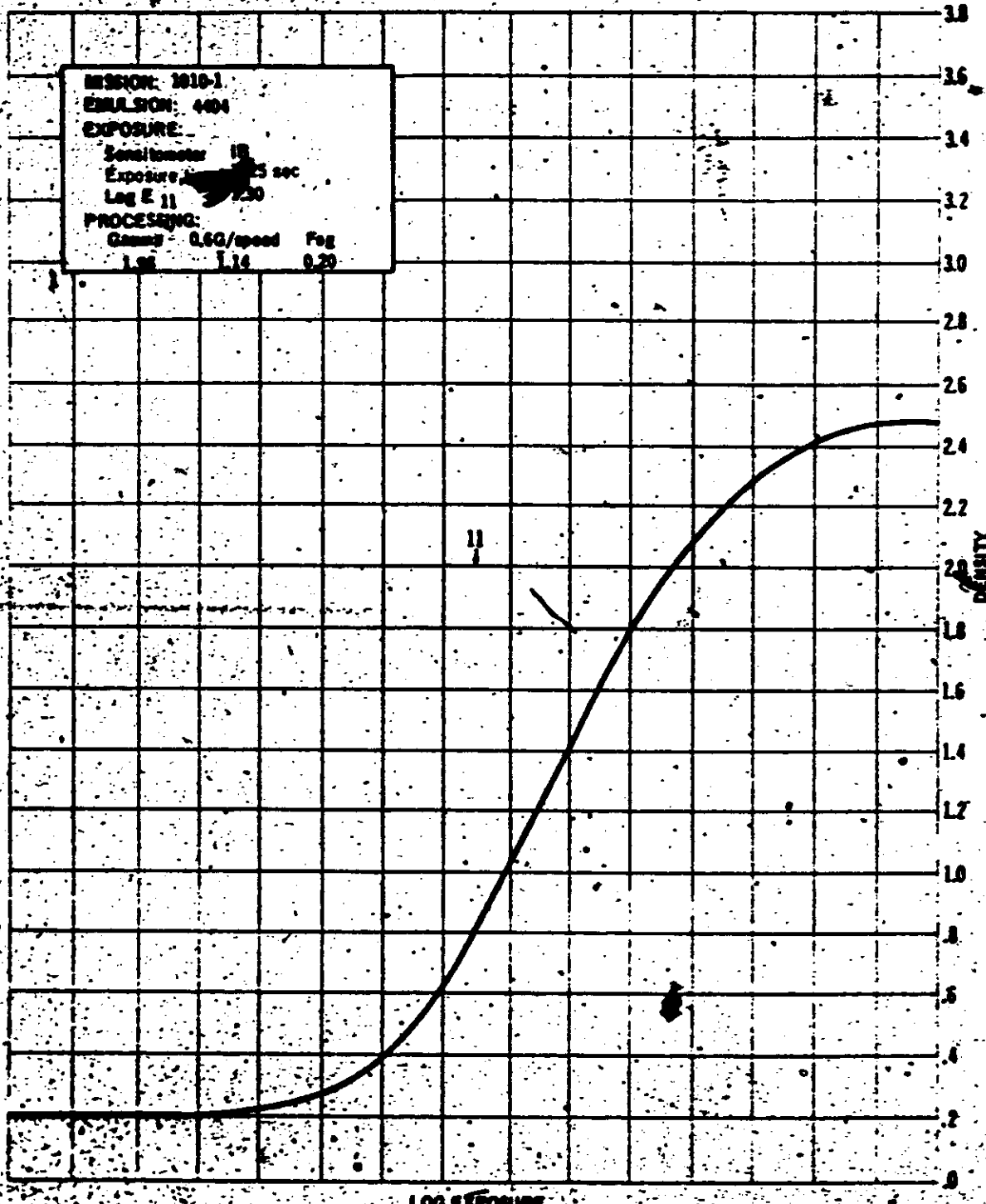
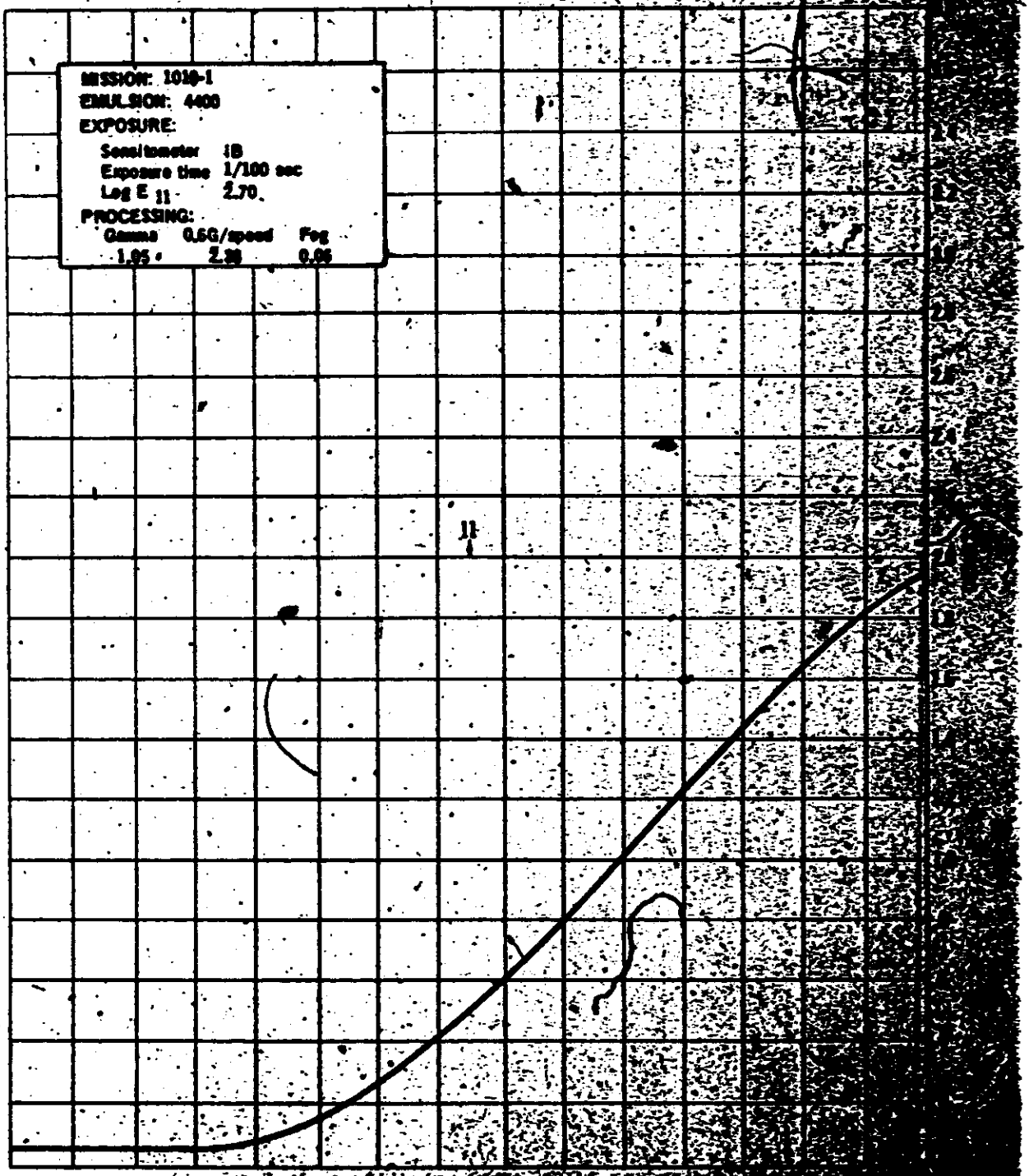
[redacted]

SENSITOMETRIC CURVE FROM MISSION MATERIAL



CONTROL CURVE FOR HEAD AND TAIL OF INDEX MATERIAL

MISSION: 1019-1
EMULSION: 4400
EXPOSURE:
Sensitometer IB
Exposure time 1/100 sec
Log E 11 2.70
PROCESSING:
Gamma 0.6G/speed Fog
1.95 2.28 0.06



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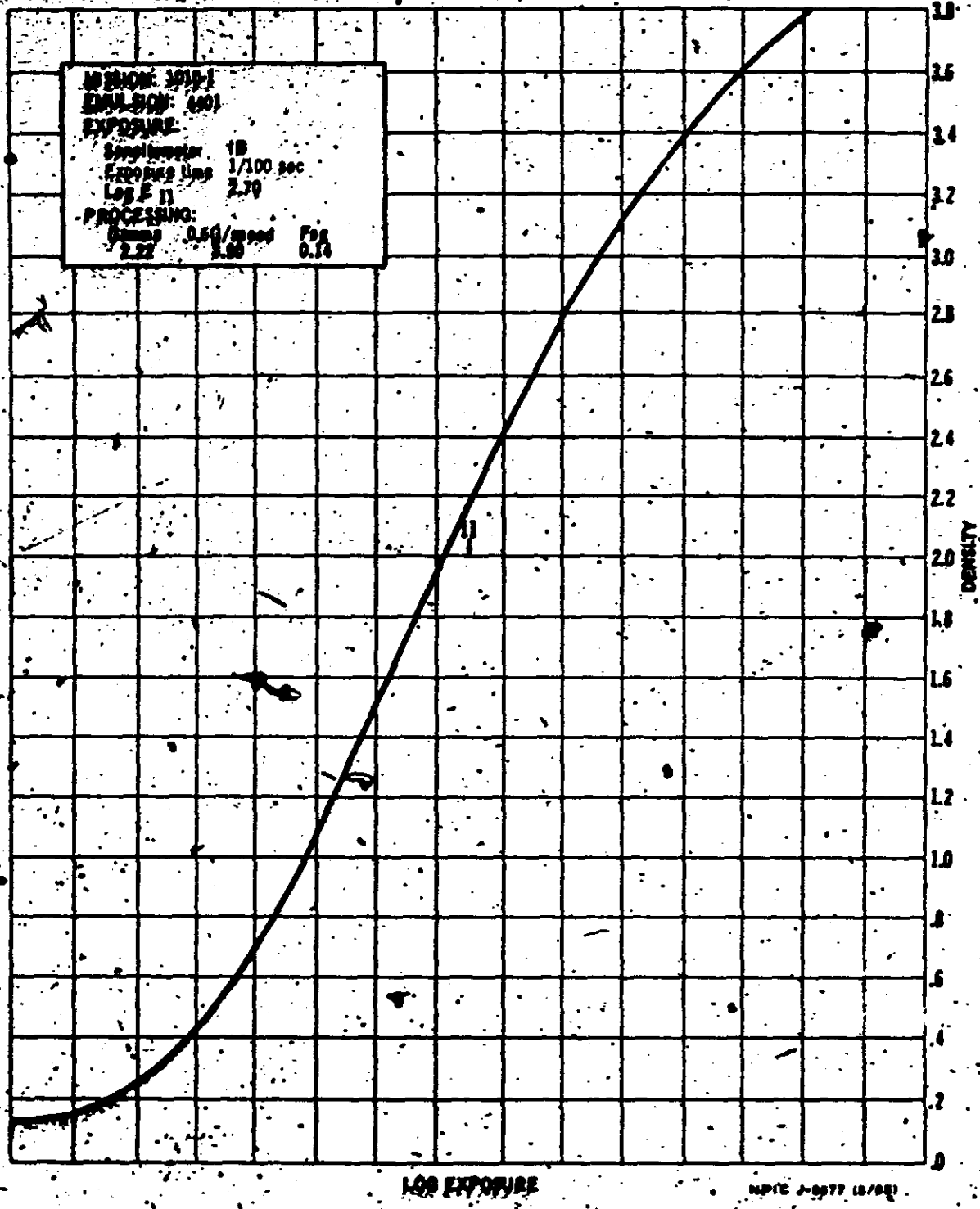
CONTROL CURVE FOR HEAD AND TAIL OF STELLAR MATERIAL



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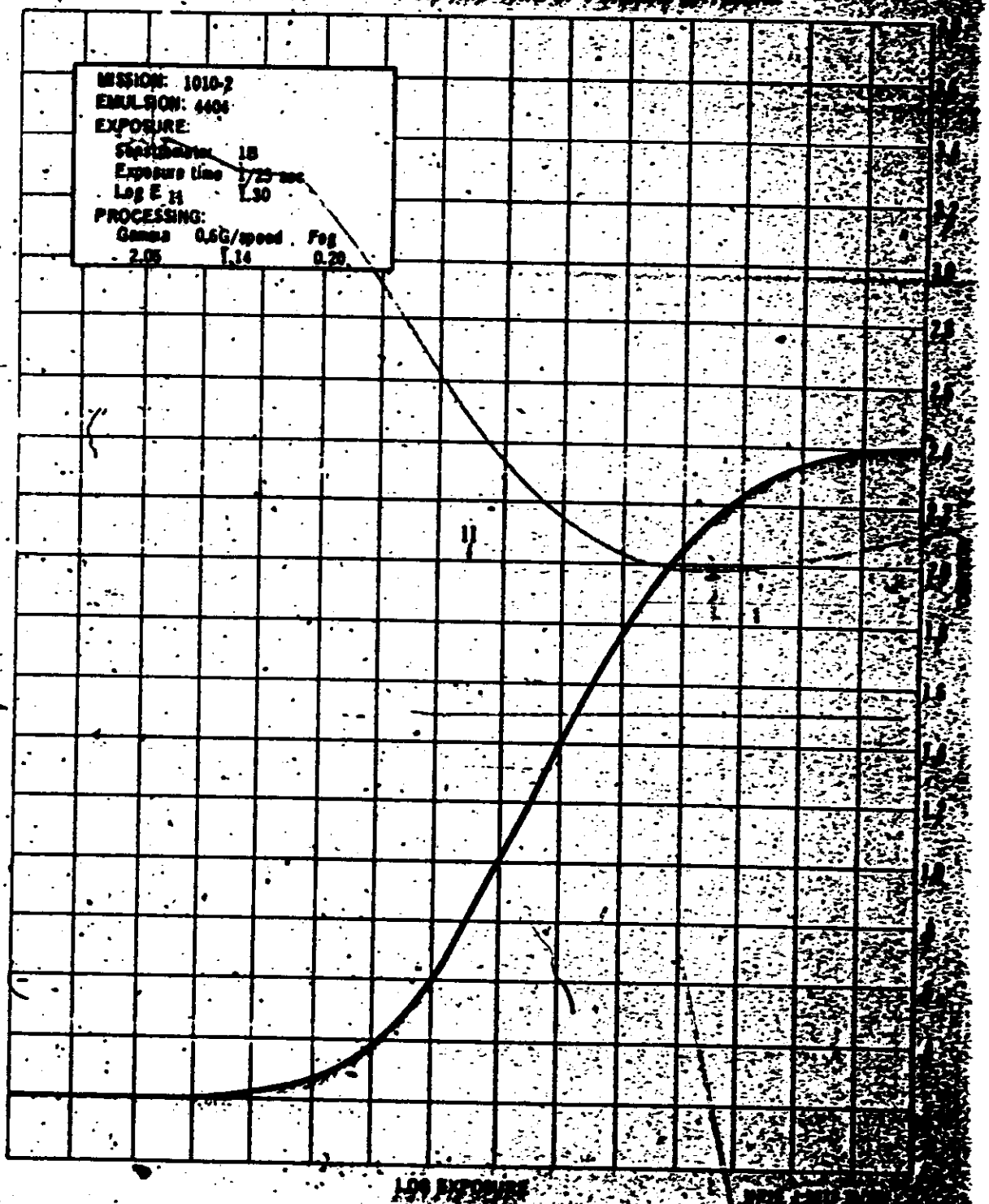
CONTROL CURVE FOR HEAD AND TAIL OF FORWARD MATERIAL



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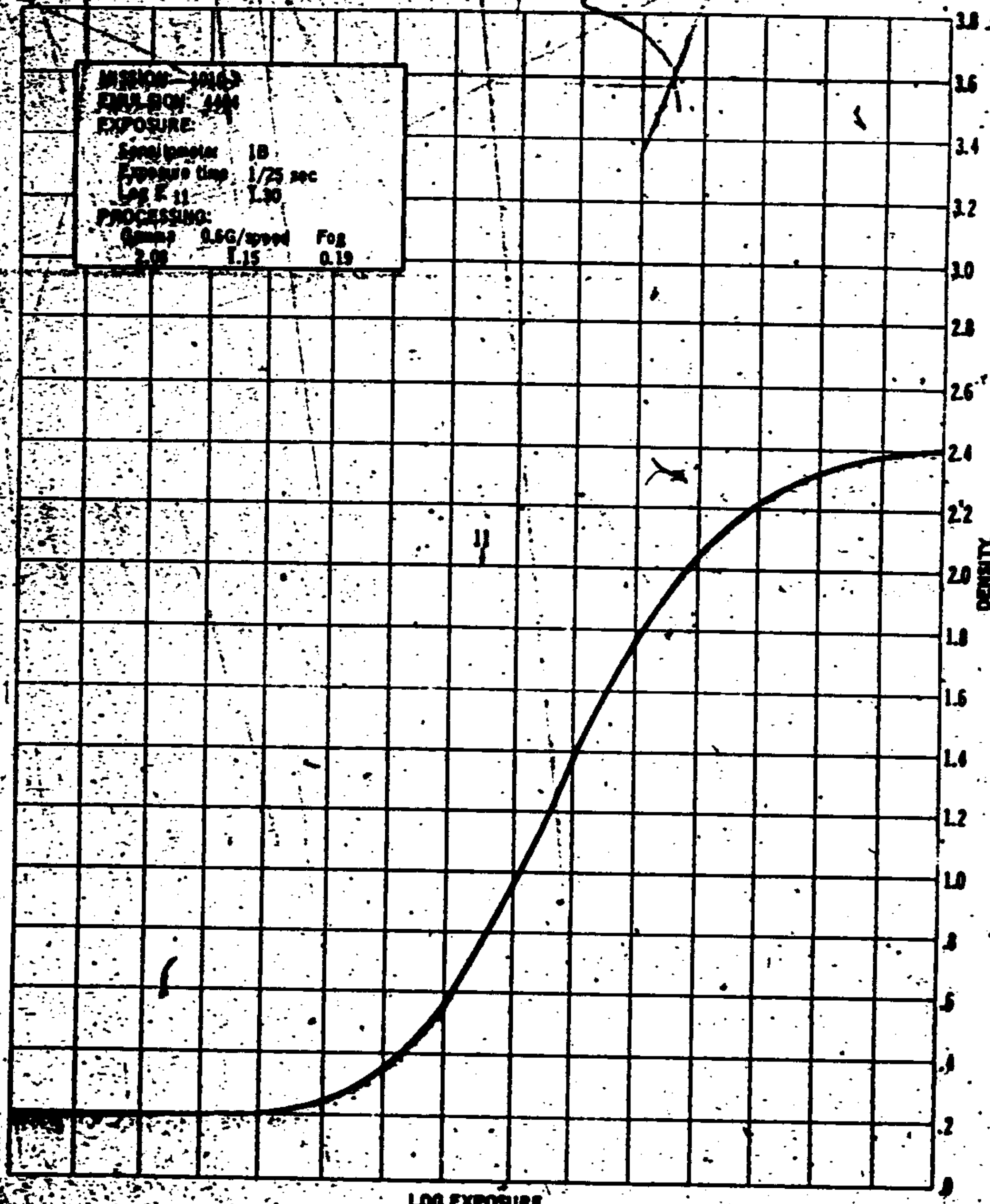

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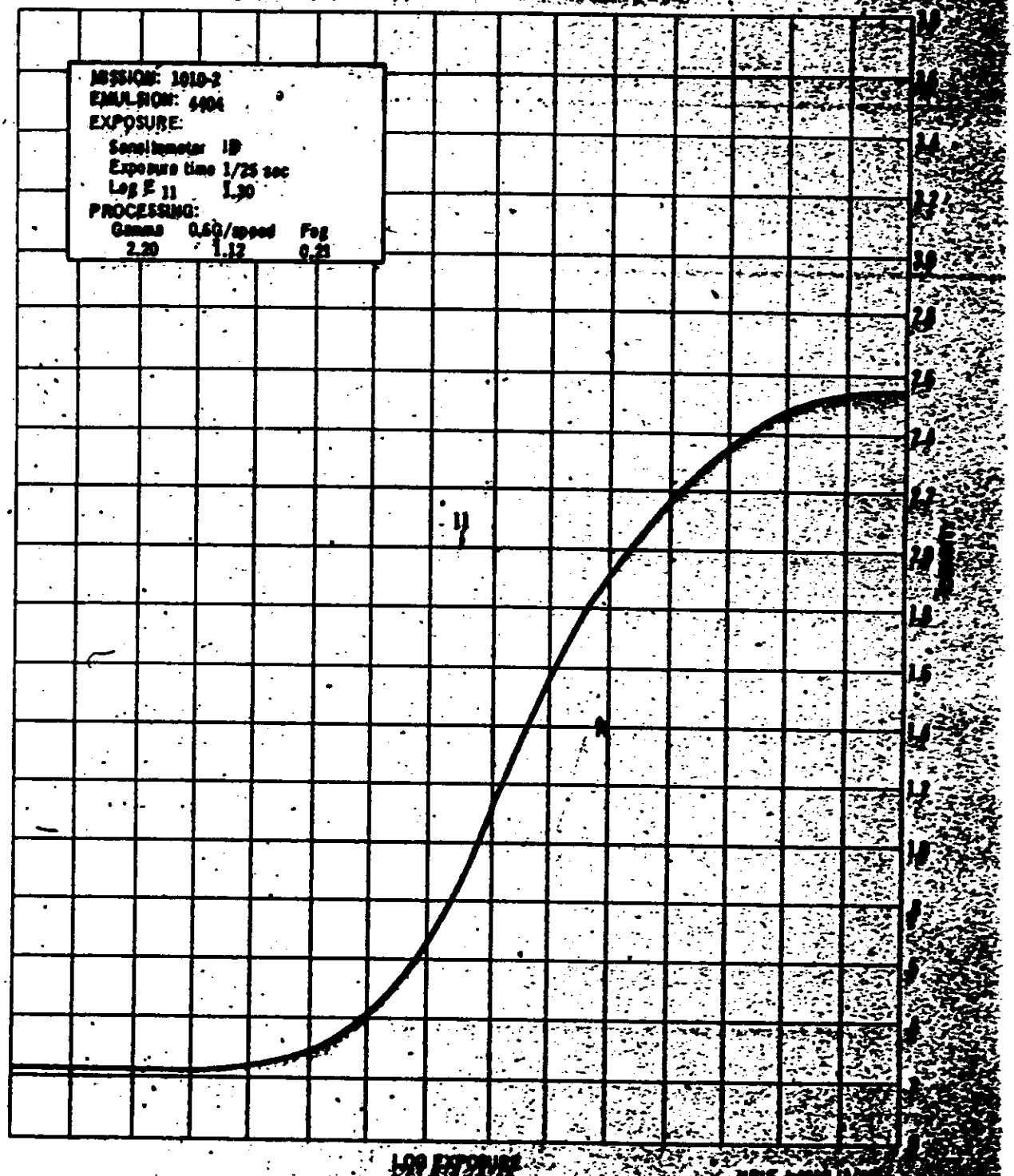
SENSITOMETRIC CURVE FROM MISSION MATERIAL



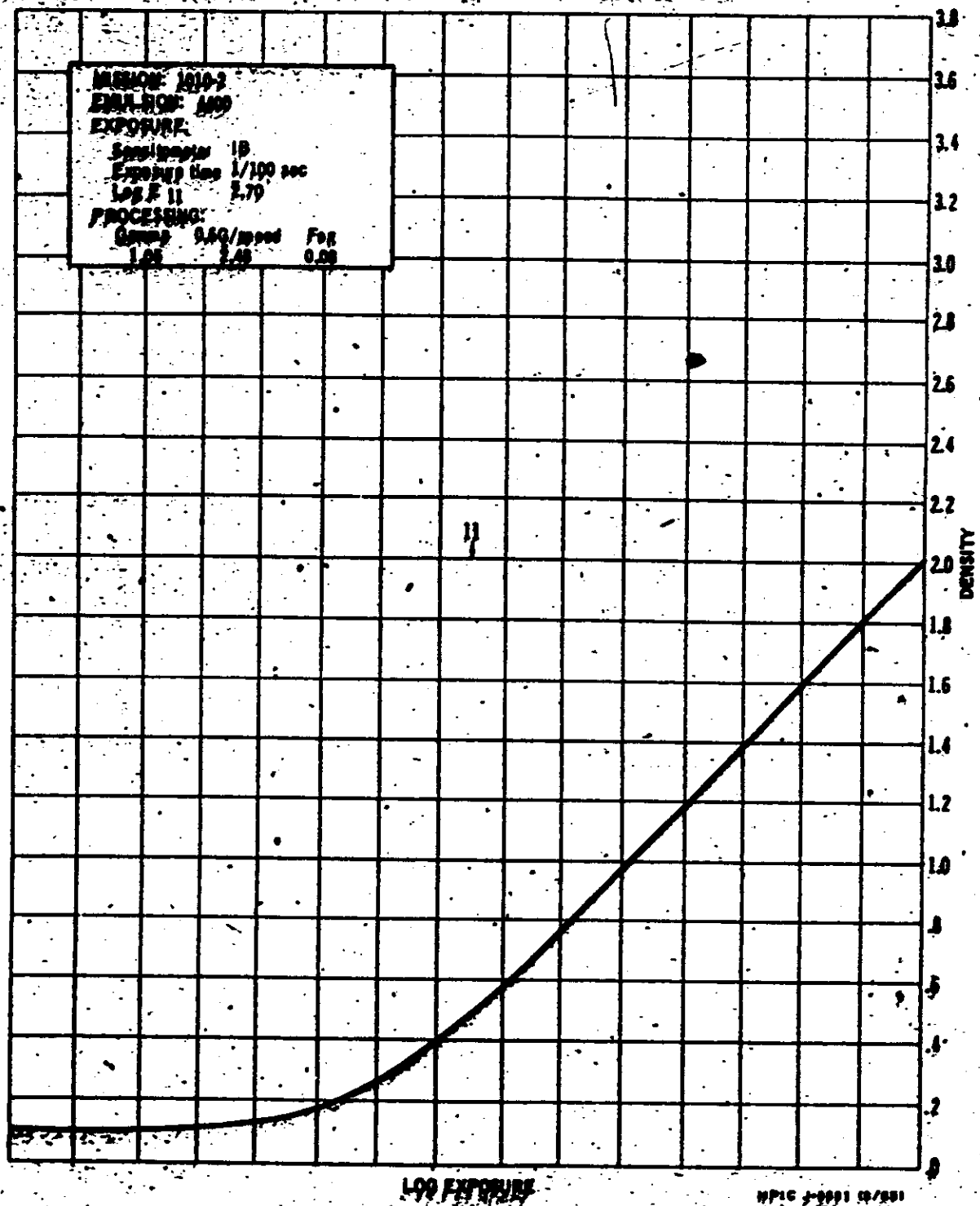
LOG EXPOSURE

[redacted]

TOP SECRET RUFF

[redacted]

CONTROL CURVE FOR READ AND TAIL OF INDEX MATERIAL



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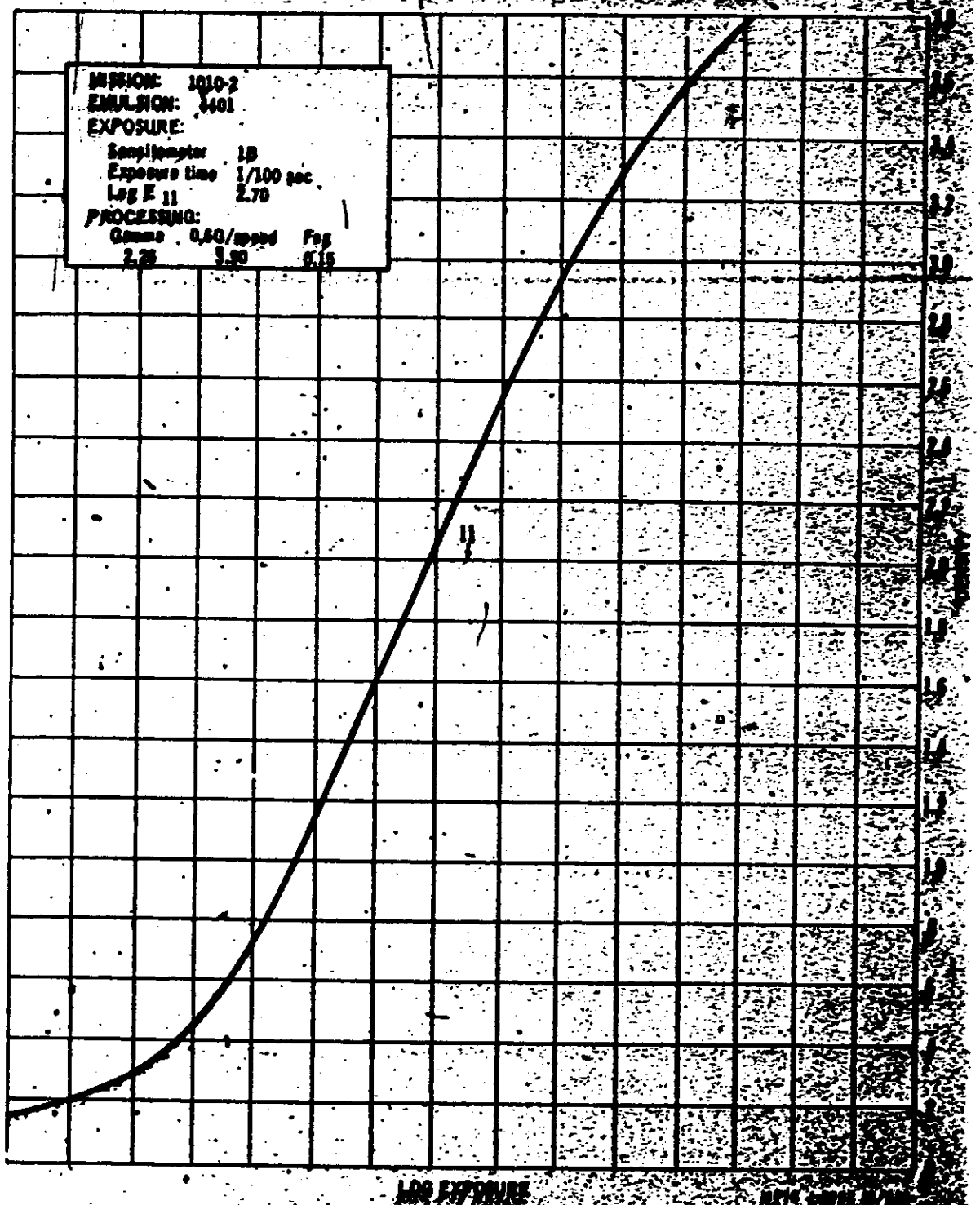
CONTROL CURVE FOR HEAD AND TAIL OF STELLAR MATERIAL



[redacted]

TOP SECRET RYBAT

[redacted]

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 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 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, although individual targets may also be assigned PI suitability ratings. The standards that determine assignment of 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 good quality of the photography.

Good: The photography is relatively free of degradation 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 minimal but the acuity of the photography is less than optimum. Edges and corners 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 the fall-off in image quality and the less-than-optimal contrast that prevails.

Poor: Camera-induced degradations and/or weather limitations severely reduce the effectiveness 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.

[redacted]

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

2. PI Suitability for Mission 1010

The PI suitability of Mission 1010 is good in the areas not degraded by the out-of-focus condition. The imagery within the out-of-focus area ranges from "unusable" to "fair" according to the criteria outlined on the preceding page.

a. The slit width of 0.175 inches used in the panoramic cameras of this mission resulted in slightly less exposure than is rendered with the usual slit width of 0.20 inches. However, image motion effects are less apparent with less effective exposure (a narrow slit) and many individuals in the intelligence community believe photography received from this system is usually overexposed; hence, the exposure experiment. No definite conclusion can be made on the basis of 1 mission, but it does not appear that the film of this mission is underexposed.

b. In relation to the exposure experiment, the photo interpreters report a definite improvement in the imagery displaying high reflectivity. On the other hand, there were a few isolated areas in which some photo interpreters feel there would have been more detail if there had been the usual exposure. The imagery not recorded due to a lack of exposure is an intangible and therefore is impossible to measure, while the gains due to less exposure are readily apparent.

c. Photo interpreters reported on 217 targets in the preliminary read-out of Mission 1010. Of the total, only 6 received a rating of poor. Obliquity, haze and clouds were the cause of degradation. Targets entirely obscured by clouds are not included in the totals.

d. Image streaking along the major axis of the film is present in association with areas of high reflectivity (clouds, beaches, etc.). As stated in prior Photographic Evaluation Reports, the streaking is believed to be reflections within the camera assembly. A design change involving the addition of more baffles in the "stack," which the manufacturer believes will eliminate the streaking, has been approved and will be implemented in the near future.

e. The PI suitability of this mission is affected very little by the minor degradations induced by pinholes, scratches, abrasions, etc. There are 7 manufacturing splices on the panoramic photography of this mission. Each is a definite degradation to PI suitability.

f. Approximately 47 percent of the mission is obscured or degraded by clouds. Cloud shadows are an additional degradation to PI suitability and are proportional to the cloud cover.

[redacted]

g. The first 4 to 6 frames following a camera-on display image motion. The motion (smear) occurs until the camera overcomes inertia and the proper scan rate is accomplished.

h. Samples of highlights of this mission are:

1. Identification of a vertical test stand previously reported as unidentified construction.
2. Detection of a camouflage attempt.
3. Identification of new fixed field launch sites.
4. Identification of a static test facility previously reported as an unidentified facility.
5. Observation and study of an earth satellite tracking facility.

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FIGURES 6 and 7, COMPARISON OF THE SAME TARGET ON MISSIONS 1010-1 AND 1010-2 PHOTOGRAPHY.

NPIC J-9069 (3/68)

NPIC J-9069 (3/68)

The first photo is from pass 23D, frame 106 AFT (Mission 1010-1).
The second is from pass 86D, frame 95 AFT (Mission 1010-2).

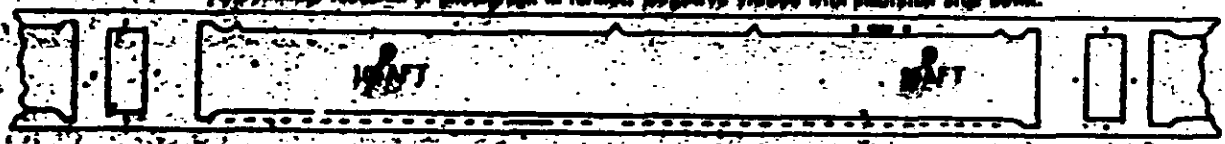
[redacted]

	FIGURE NO 6	FIGURE NO 7
Camera	153 (AR)	153 (AR)
Pass	230	860
Frame	106	95
Date of Photography	16 September 1964	20 September 1964
Universal Grid Coordinates	x29.4 y14.3	x71.0 y13.6
Enlargement Factor	20X	20X
Geographic Coordinates	69°04'N 72°50'E	69°12'N 74°32'E
Altitude (feet)	591250	607207
Vehicle:		
Pitch	-15°16'	-14°40'
Roll	-00°14'	-00°01'
Yaw	00°01'	-00°20'
Local Sun Time	1338	1411
Solar Elevation	33°04'	35°11'
Solar Azimuth	216°00'	224°00'
Exposure	Not Available	Not Available
Density	Not Available	1.36
Density	Not Available	0.67
Density	Not Available	0.69
Gross Fog	Not Available	0.17

Approximate flight direction on photograph

Approximate scan direction on photograph

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



[redacted]

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[redacted]

FIGURE 8. EXAMPLE OF GOOD PHOTOGRAPHIC QUALITY.

NPIC J-9000 (9/69)

[redacted]

Camera	153 (Aft)
Pass	560
Frame	72
Date of Photography	18 September 1964
Universal Grid Coordinates	x49.1 y10.9
Enlargement Factor	20X
Geographic Coordinates	55°44'N 37°42'E
Altitude (feet)	596862
Vehicle:	
Pitch	-14°30'
Roll	00°13'
Yaw	00°04'
Local Sun Time	1617
Solar Elevation	28°05'
Solar Azimuth	227°00'
Exposure	Not Available
Dmax	0.76
Dmin	0.50
Delta	0.26
Gross Fog	0.17

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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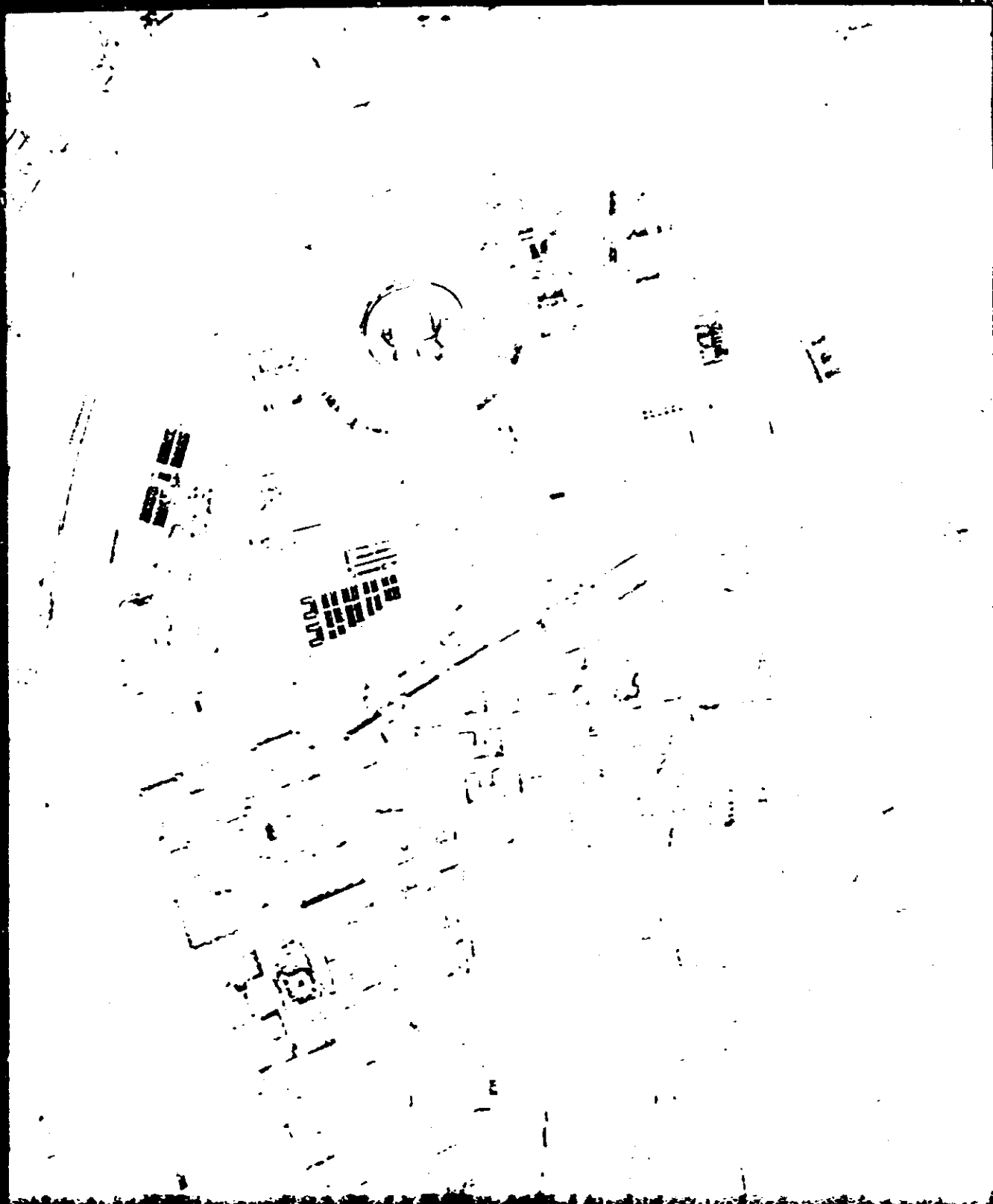

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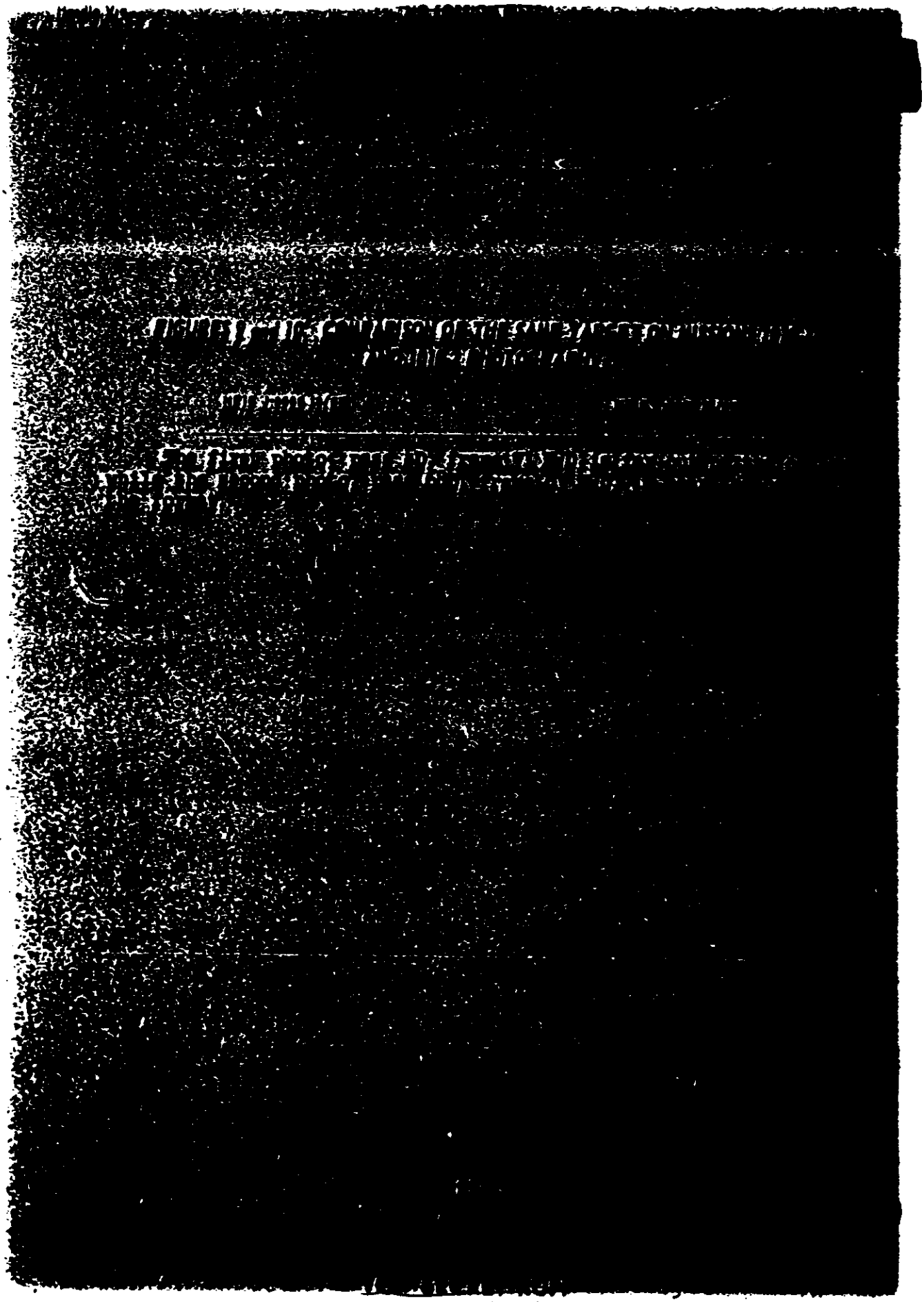


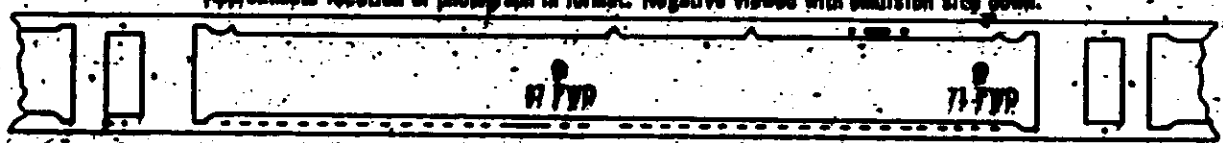
[redacted]

	FIGURE NO 9	FIGURE NO 10
Camera	152 (Fwd)	152 (Fwd)
Pass	050	580
Frame	71	83
Date of Photography	15 September 1964	19 September 1964
Universal Grid Coordinates	x75.6 y12.8	x42.9 y12.6
Enlargement Factor	20X	20X
Geographic Coordinates	42°08'N 126°31'E	42°16'N 125°51'E
Altitude (feet)	590528	602764
Vehicle:		
Pitch	15°22'	15°37'
Roll	00°10'	00°12'
Yaw	00°10'	00°52'
Local Sun Time	1448	1120
Solar Elevation	34°19'	37°00'
Solar Azimuth	237°00'	165°00'
Exposure	Not Available	Not Available
Dmax	1.15	0.88
Dmin	0.63	0.44
Delta	0.52	0.44
Gross Fog	0.17	0.17

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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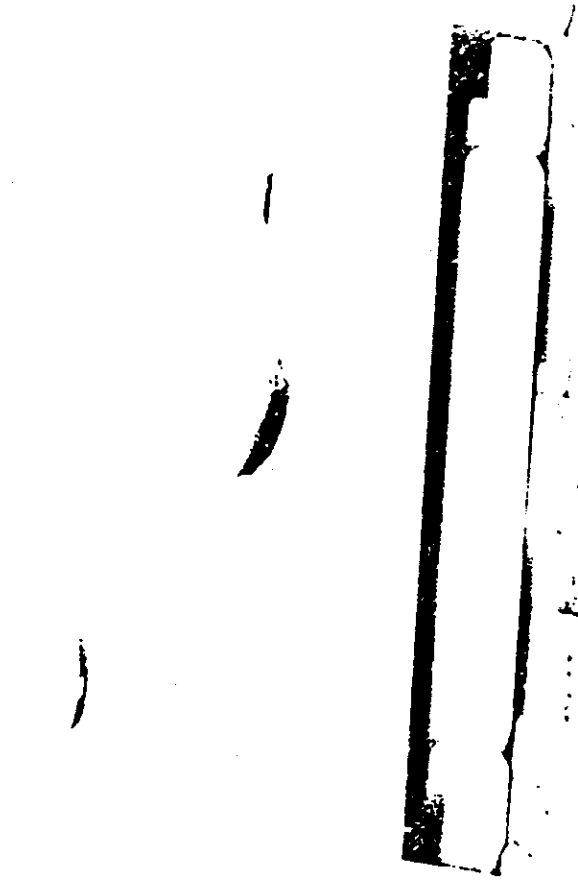

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[redacted]

3. Definition of Mission Information Potential (MIP)

The MIP is an arbitrary number not limited by [illegible] is subjectively [illegible] to the [illegible] photography [illegible] which [illegible] of the camera [illegible] capability for recording [illegible] adverse atmospheric conditions, [illegible] functions, or other factors [illegible]

The MIP is based on the best photography found in a mission, even though the photography may be limited to a few frames. [illegible] frames are considered to be the best in the mission, they do not [illegible] 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 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, thus eliminating frames having either overexposure or underexposure.
h. Select a [illegible] target [illegible] and compare the target to a previous mission which has been given an MIP rating.

4. MIP Rating for Mission 1010-1

Pass [illegible], frame [illegible] is the MIP frame. A value of 8[illegible] has been assigned. [illegible] mission.

[redacted]

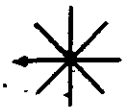
FIGURE 11. MIP FRAME OF MISSION 1010-1.

NPIC J-9668 (3/68)

[redacted]

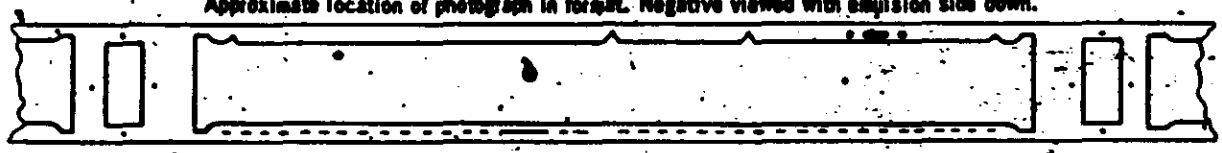
Camera	153 (Aft)
Pass	56D
Frame	73
Date of Photography	18 September 1964
Universal Grid Coordinates	x38.1 y12.2
Enlargement Factor	20X
Geographic Coordinates	55°35'N 37°44'E
Altitude (feet)	596734
Vehicle:	
Pitch	-14°30'
Roll	00°06'
Yaw	00°10'
Local Sun Time	1417
Solar Elevation	28°11'
Solar Azimuth	226°00'
Exposure	1/325 sec.
Dmax	1.10
Dmin	0.41
Delta	0.69
Gross Fog	0.17

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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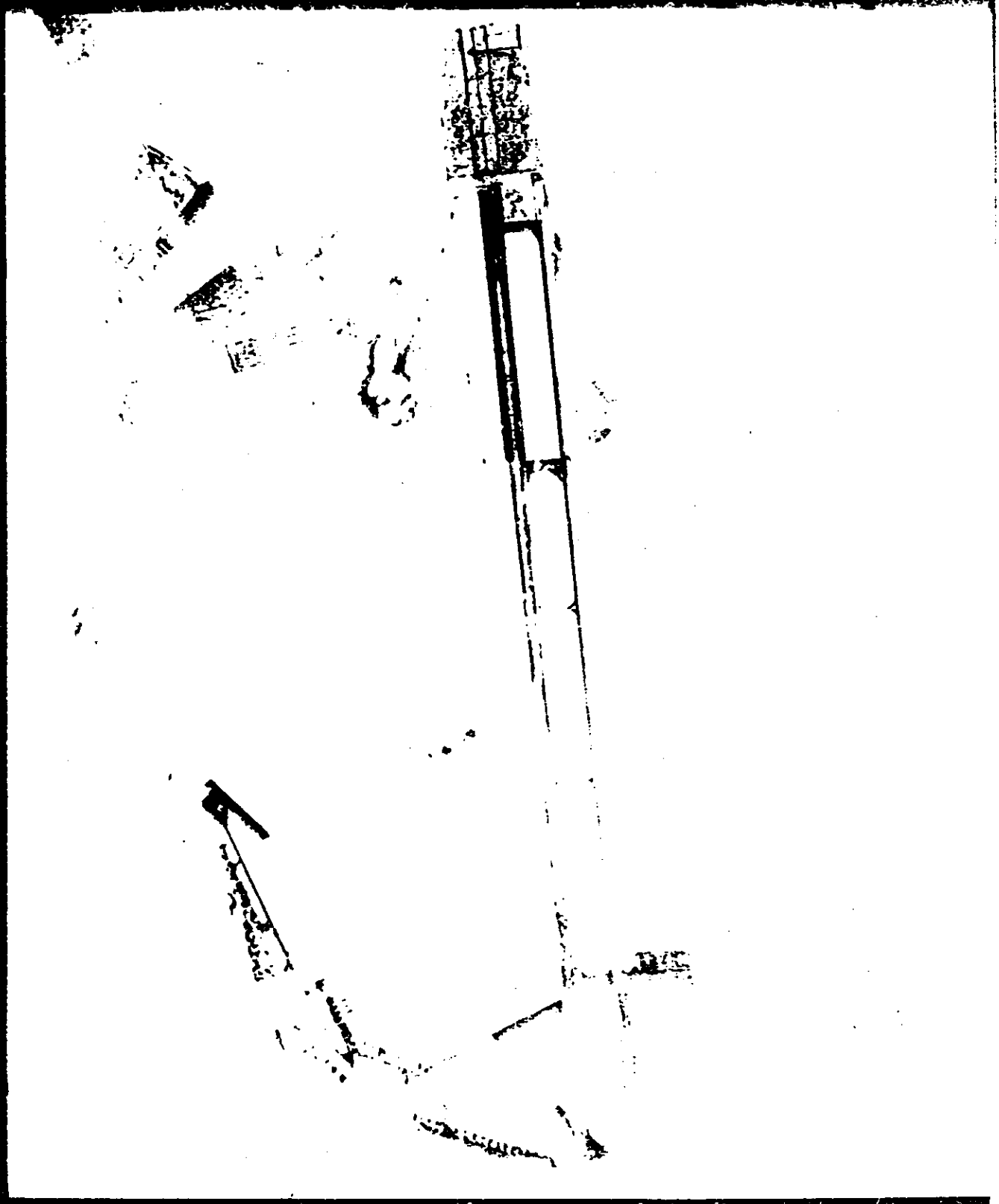

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FIGURE 12. MASTER CAMERA PHOTOGRAPHIC COVERAGE OF THE NIP TARGET.

NPIC J-6000 12/69

Note the subtle difference in image quality.

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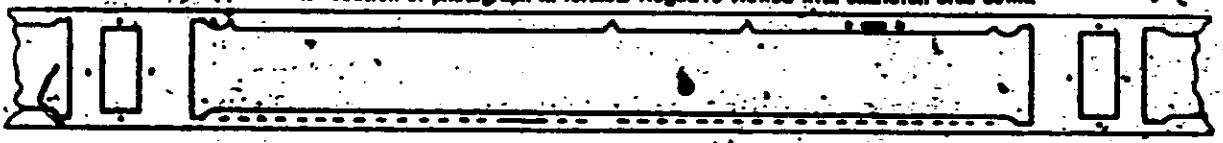
[redacted]

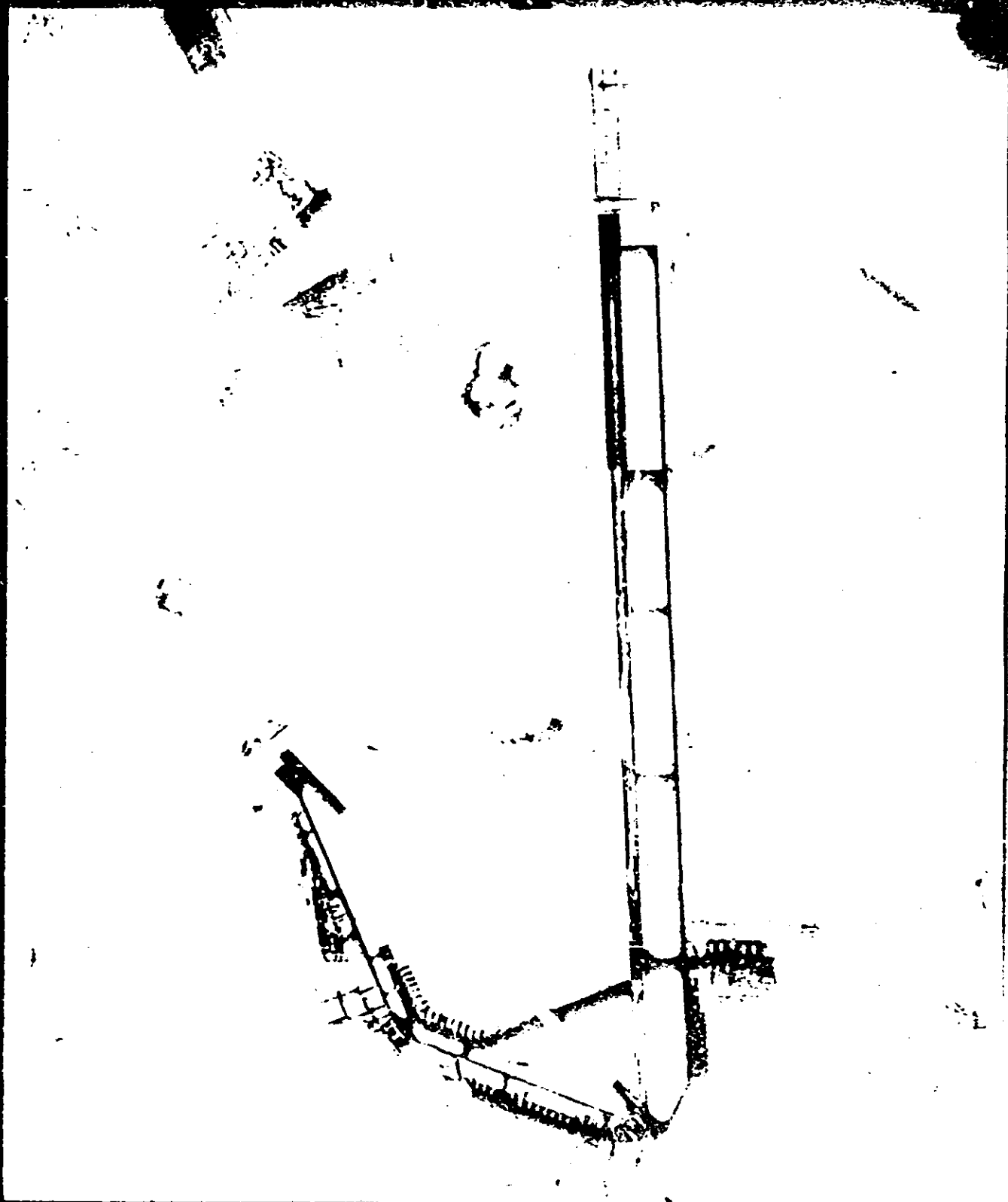
Camera	152 (Fwd)
Pass	56D
Frame	67
Date of Photography	18 September 1964
Universal Grid Coordinates	x52.7 y10.5
Enlargement Factor	20X
Geographic Coordinates	55°36'N 37°47'E
Altitude (feet)	597536
Vehicle:	
Pitch	15°28'
Roll	00°16'
Yaw	-00°15'
Local Sun Time	1416
Solar Elevation	28°26'
Solar Azimuth	226°00'
Exposure	1/322 sec.
Dmax	1.12
Dmin	0.35
Delta	0.77
Gross Fog	0.17

Approximate flight direction on photograph

Approximate scan direction on photograph

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





[redacted]

5. MIP Rating for Mission 1010-2

Pass 115D, Frame 59 AFT, is the MIP frame for photography on Mission 1010-2. The imagery is of approximately the same quality as that of Mission 1010-1. The MIP rating is 85.

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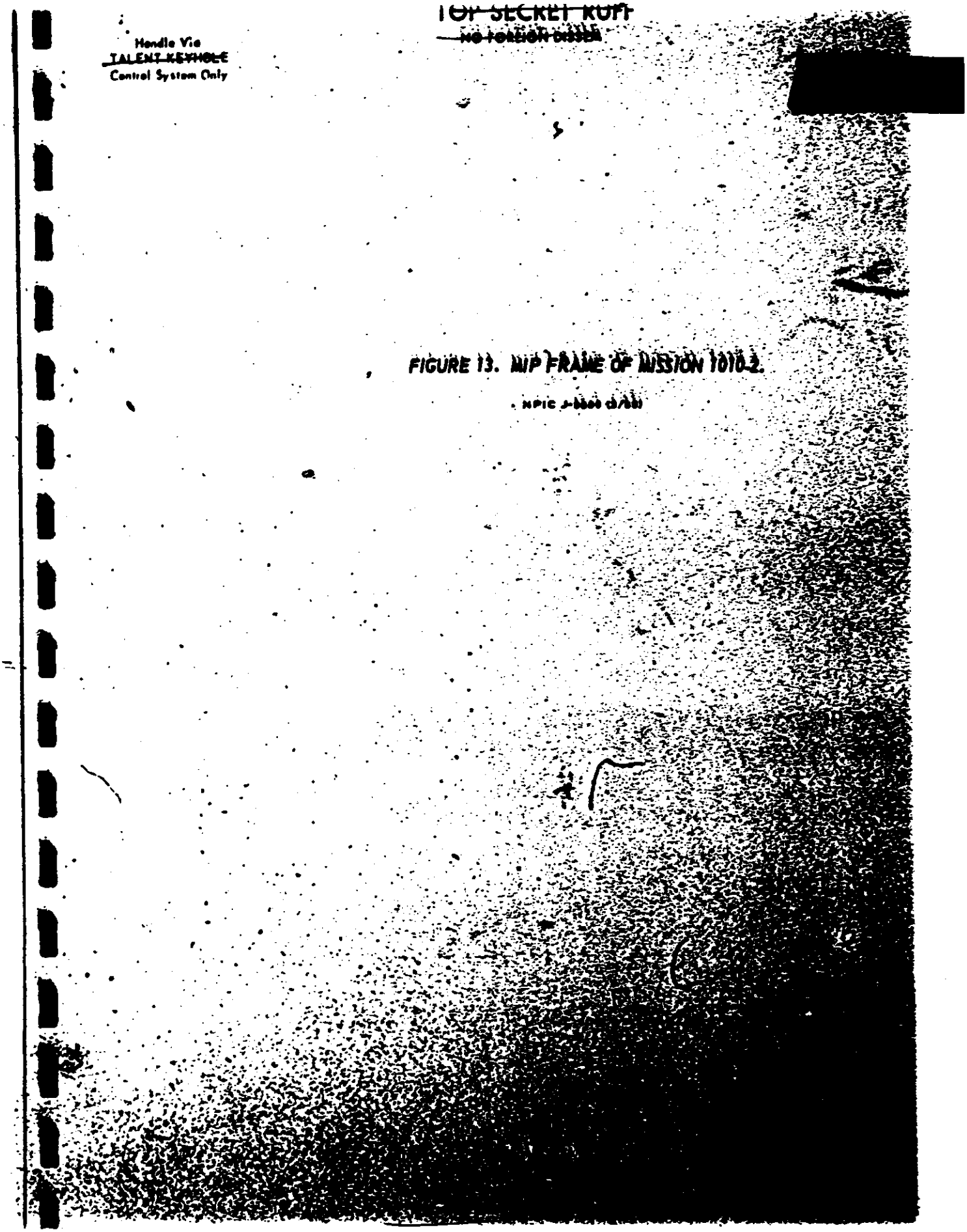

FIGURE 13. MIP FRAME OF MISSION 1010-2.

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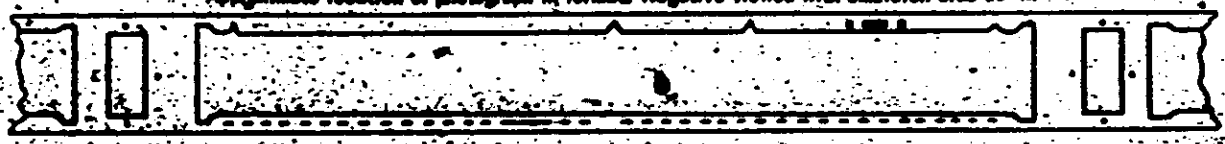
[redacted]

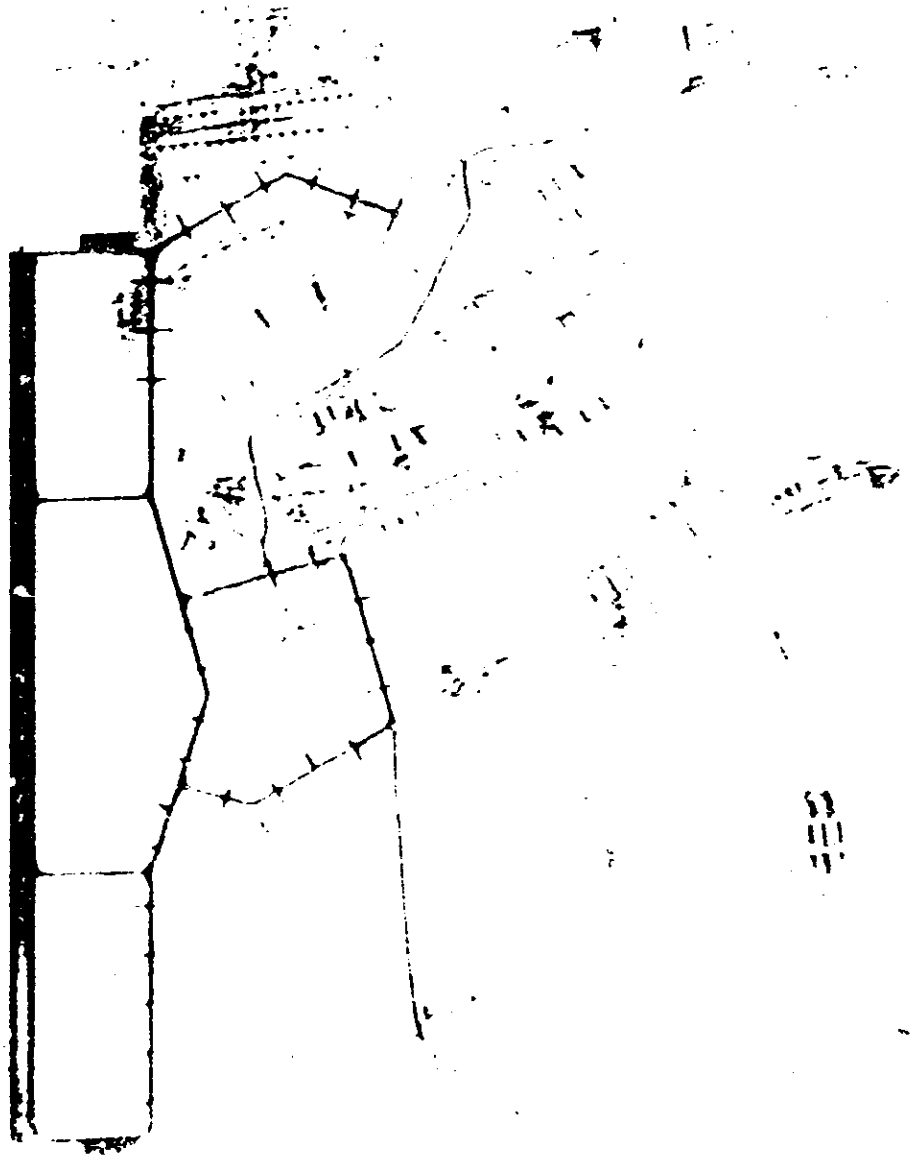
Camera	153 (Aft)
Pass	1150
Frame	59
Date of Photography	22 September 1964
Universal Grid Coordinates	x48.0 y10.6
Enlargement Factor	20X
Geographic Coordinates	43°03'N 133°17'E
Altitude (feet)	633224
Vehicle:	
Pitch	-15°04'
Roll	-00°09'
Yaw	-00°34'
Local Sun Time	1400
Solar Elevation	38°01'
Solar Azimuth	220°00'
Exposure	Not Available
Dmax	0.82
Dmin	0.45
Delta	0.37
Gross Fog	0.17

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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[redacted]

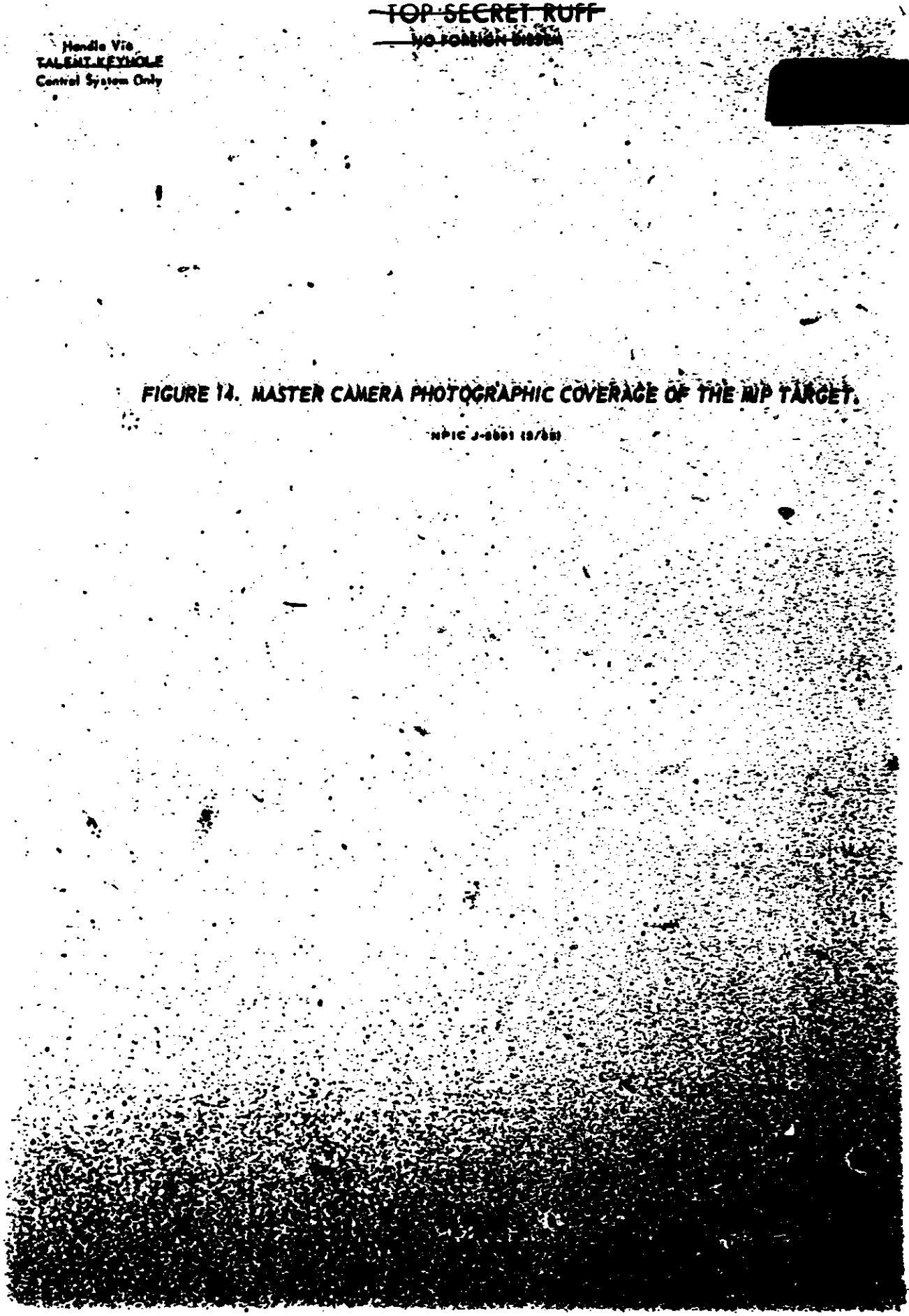


FIGURE 14. MASTER CAMERA PHOTOGRAPHIC COVERAGE OF THE NP TARGET.

NPIC J-8691 (8/68)

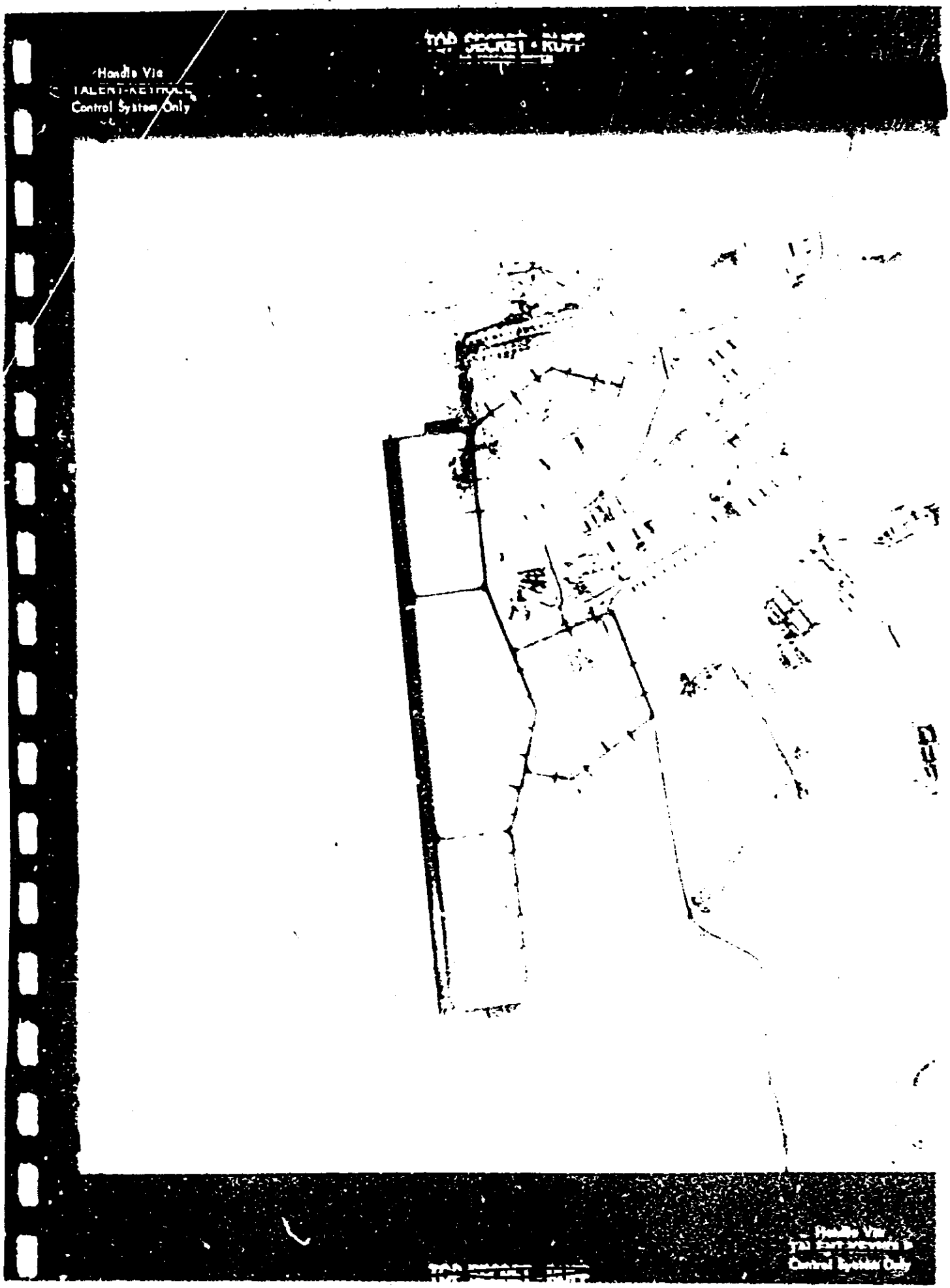
[redacted]

Camera	152 (Fwd)
Pass	115D
Frame	53
Date of Photography	22 September 1964
Universal Grid Coordinates	x42.8 y12.2
Enlargement Factor	20X
Geographic Coordinates	43°05'N 133°20'E
Altitude (feet)	630628
Vehicle:	
Pitch	15°06'
Roll	-00°08'
Yaw	-00°23'
Local Sun Time	1400
Solar Elevation	38°01'
Solar Azimuth	220°00'
Exposure	Not Available
Dmax	0.75
Dmin	0.32
Delta	0.43
Gross Fog	0.17

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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[redacted]

6. MIP Ratings of Past Missions

The following is a list of missions and their MIP.

Mission	MIP	Mission	MIP
9009	20	9050	85
9013	30	9051	80
9017	45	9053	90
9019	45	9054	80
9023	65	9056	85
9022	65	9057	85
9025	55	1001-1	80
9028	50	1002-1	80
9029	80	9062	85
9031	70	1004-1	85
9032	85	1004-2	85
9035	75	1006-1	90
9037	80	1006-2	90
9038	85	1007-1	85
9039	85	1007-2	85
9040	75	1008-1	85
9041	85	1008-2	85
9044	85	1009-1	85
9043	85	1009-2	85
9045	80	1010-1	85
9047	80	1010-2	85
9048	80		

[redacted]

APPENDIX A. SYSTEM SPECIFICATIONS

1. Panoramic Cameras

	Master (FWD)	Slave (AFT)
Camera Number	152	153
Lens Serial Number	1252435	1282435
Slit Width	0.175"	0.175"
Filter	Wratten 21	Wratten 21
Operational Focal Length	609.577 mm	609.585 mm
Film Type	4404	4404
Film Length	16,000'	16,000'
Splices	4	4
Emulsion	62-7-6-7-4	62-7-7-4
Static Bench Test		
High Contrast	268 L/mm	243 L/mm
Low Contrast	148 L/mm	139 L/mm
Dynamic Test		
I. High Contrast	159 L/mm	167 L/mm
I. Low Contrast	128 L/mm	128 L/mm
P. High Contrast	185 L/mm	171 L/mm
P. Low Contrast	127 L/mm	110 L/mm
Distortion - Positive (Pincushion)		

Angle Off Axis	3.0°	2.0°	1.0°	0.0°	359°	358°	357°	
Distortion Millimeters	.005	.002	.001	.000	.000	.001	.002	Camera 152
Distortion Millimeters	.006	.003	.002	.000	.001	.003	.006	Camera 153

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[redacted]

2. Horizon Cameras

Camera	Starboard (Take-Up)	Port (Supply)	Starboard (Supply)	Port (Take-Up)
Camera Number	152	152	153	153
Lens Serial Number	812267	812279	813527	814014
Exposure Time	1/100 sec	1/100 sec	1/100 sec	1/100 sec
Filter	Wratten 25	Wratten 25	Wratten 25	Wratten 25
Aperture	f/8.0	f/6.8	f/8.0	f/6.8
Operational Focal Length	54.54 mm	54.43 mm	55.06 mm	55.21 mm
Radial Distortion				
10° off axis	.015 mm	.010 mm	.001 mm	.007 mm
20° off axis	.022 mm	.017 mm	.004 mm	.015 mm
Tangential Distortion	Not available	.004 mm	.004 mm	.002 mm

Note:
1. Distortion and resolution are read at equivalent operational focal length.
2. Resolution in lines per mm on SO-132 film and a high contrast target.

3. Camera No D41/41/41 (Mission 1010-1)

	Stellar	Index
Lens Serial Number	11002	813054
Reseau Serial Number	41	41
Filter	None	Wratten 25
Aperture	f/1.8	f/4.5
Exposure Time	2.0 sec	1/100 sec
Equivalent Focal Length	Not Available	54.58 mm
Film Type	4404	4404
Film Length	70'	70'
Emulsion	7-3-64	7-3-64
Resolution		
Angle Off Axis	0 10 20 30 35	
Resolution L/mm	82 96 114 95 90	
High Contrast	92 92 96 93 95	

Index Axis: 77 L/mm read from 4404 film
Alignment: 0.003"/.937"
0.007"/2.25"

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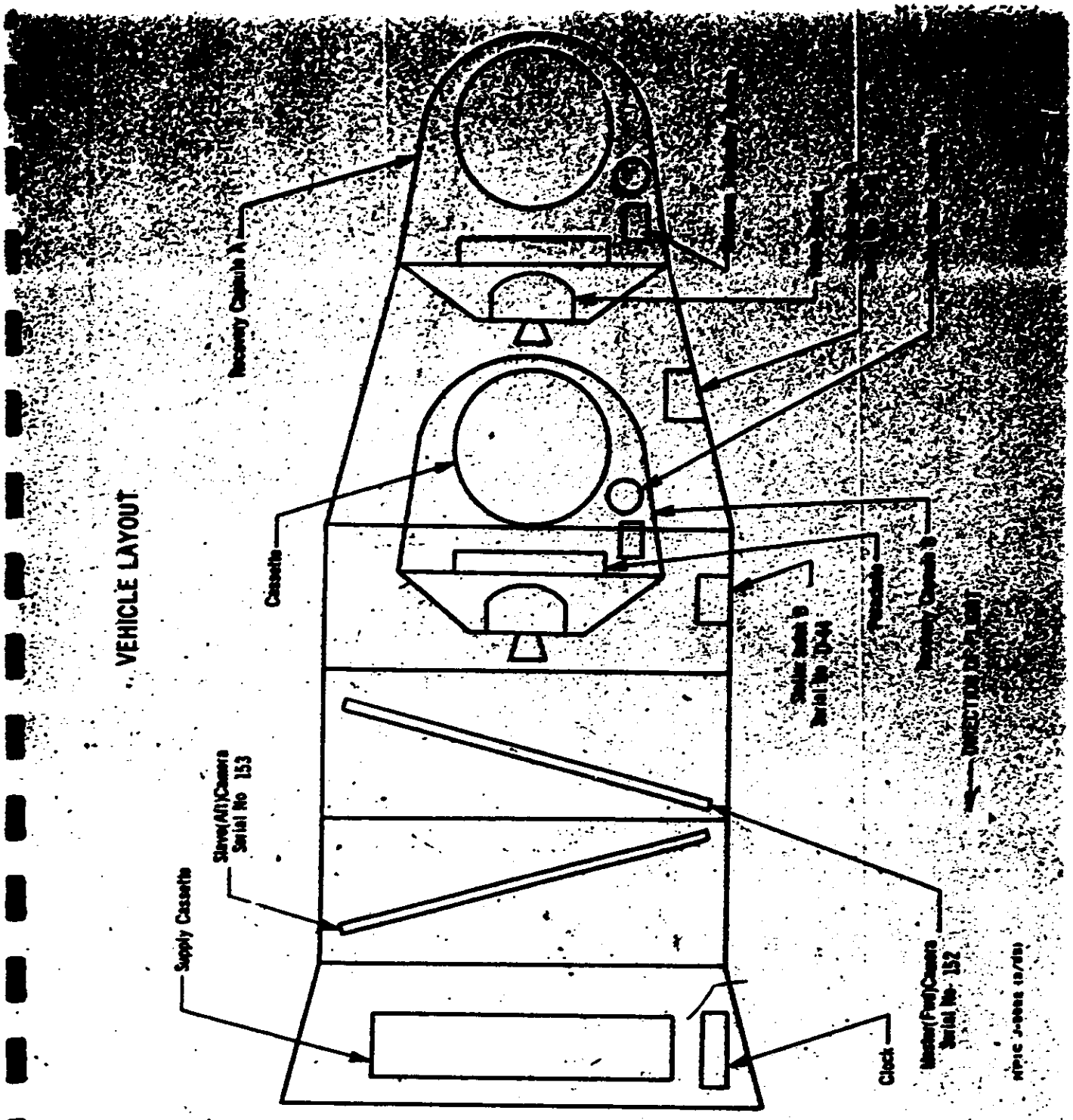
[redacted]

[redacted] 46/4) (1010-2)

	Stellar	Index
[redacted] Serial Number	10701	813059
Mission Serial Number	46	46
Filter	None	Wratten 21
Aperture	f/1.8	f/4.5
Exposure	2.0 sec	1/500 sec
Equivalent Focal Length	Not available	38.23 mm
Film Type	4401	4400
Film Length	Not reported	Not reported
Emulsion	7-3-6-4	28-4-5-4

Maximum Resolution:
MTF: 73.3 L/mm read from 4404 film.



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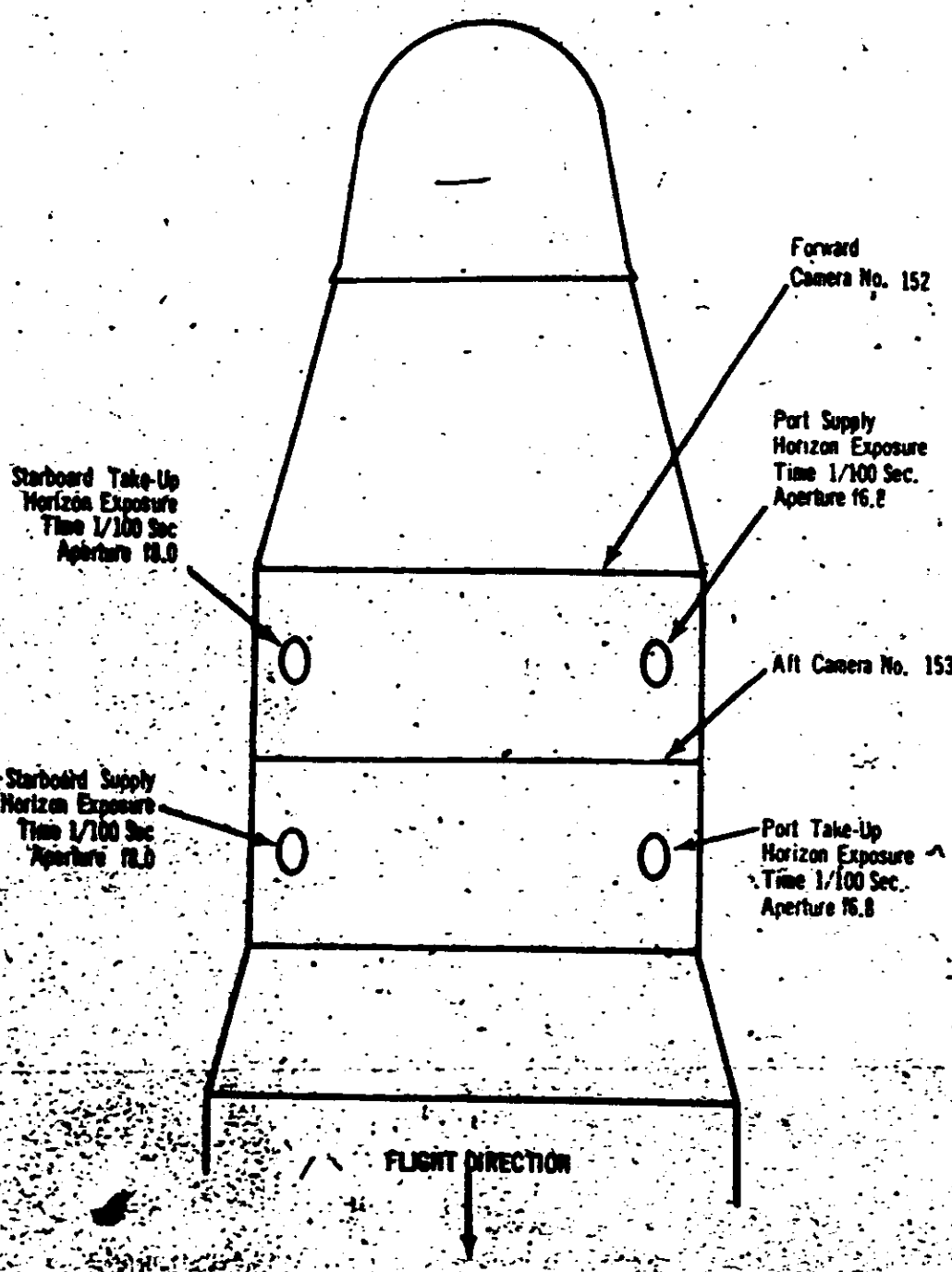
HORIZON LENS SETTINGS
(Viewed from top of vehicle in flight)



[redacted]

7. 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". of arc so positioned to form an angle of -15.00° ±5" to the mechanical interface for master camera calibrations and an angle of +15.00° ±5" to the mechanical interface for slave camera calibrations.

A. One target, 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° ±5" 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 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 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 correction of shrinkage.

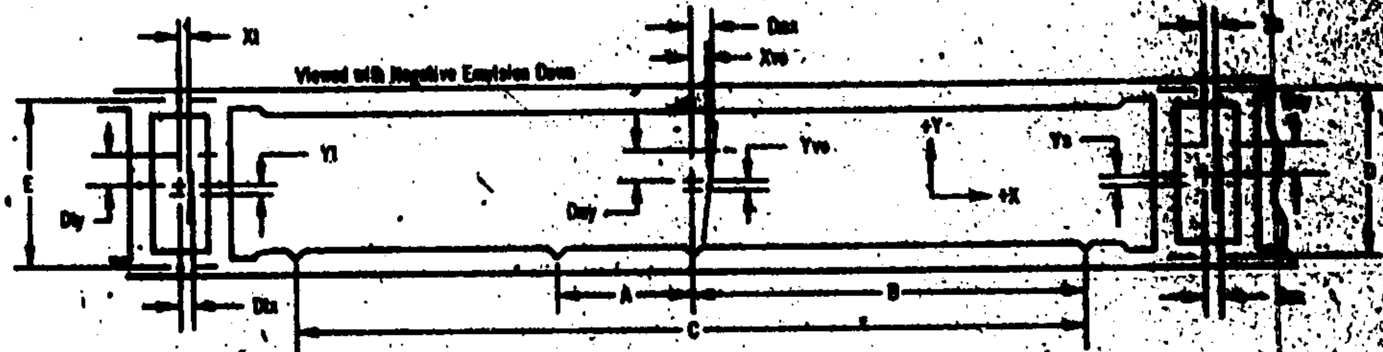
The format dimensions are measured to the best estimate of the edge.

[redacted]

Measurement 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 Dax and Day 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, Dax and Day are the offsets of these measurements.

FORMAT CALIBRATIONS



Master (Fwd) Camera	Vehicle Motion	Scan Direction
A 76.2	X1 +.217	Dx +.224
B 355.4	Y1 +.116	Dy -1.483
C 710.8	Xs +.355	Dxs +.365
D 56.842	Ys -.229	Dsy +2.525
E 56.538	Xvs +1.309	Dxs +1.305
	Yvs +.173	Dsy -1.[illegible]

Format dimensions:

	Panoramic
Height	55.[illegible]
Width	754.8

Slave (Aft) Camera	Vehicle Motion	Scan Direction
A 76.2	X1 +.497	Dx +.[illegible]
B 355.2	Y1 -.154	Dy +1.782
C 710.3	Xs -.377	Dxs -.377
D [illegible]	Ys -.[illegible]	Dsy -1.[illegible]
E [illegible]	Xvs -.212	Dxs -.[illegible]
	Yvs +.[illegible]	Dsy -[illegible]

Format dimensions:

	Panoramic
Height	[illegible]
Width	[illegible]

NOTE:
1. All dimensions are in millimeters and are average dimensions of three frames.
2. Height of main format is taken in center of format.
3. Dx, Dxs, Dy, X and Y dimensions are taken [illegible]
4. Format Sign Convention

$$\frac{-X+Y}{-X-Y} \Bigg| \frac{+X+Y}{+X-Y}$$

NPIC J-0084 (8/66)

[redacted]

Handle Via
TALENT-KEYHOLE
Control System Only

TOP SECRET RUFF
NO FOREIGN DISSEM

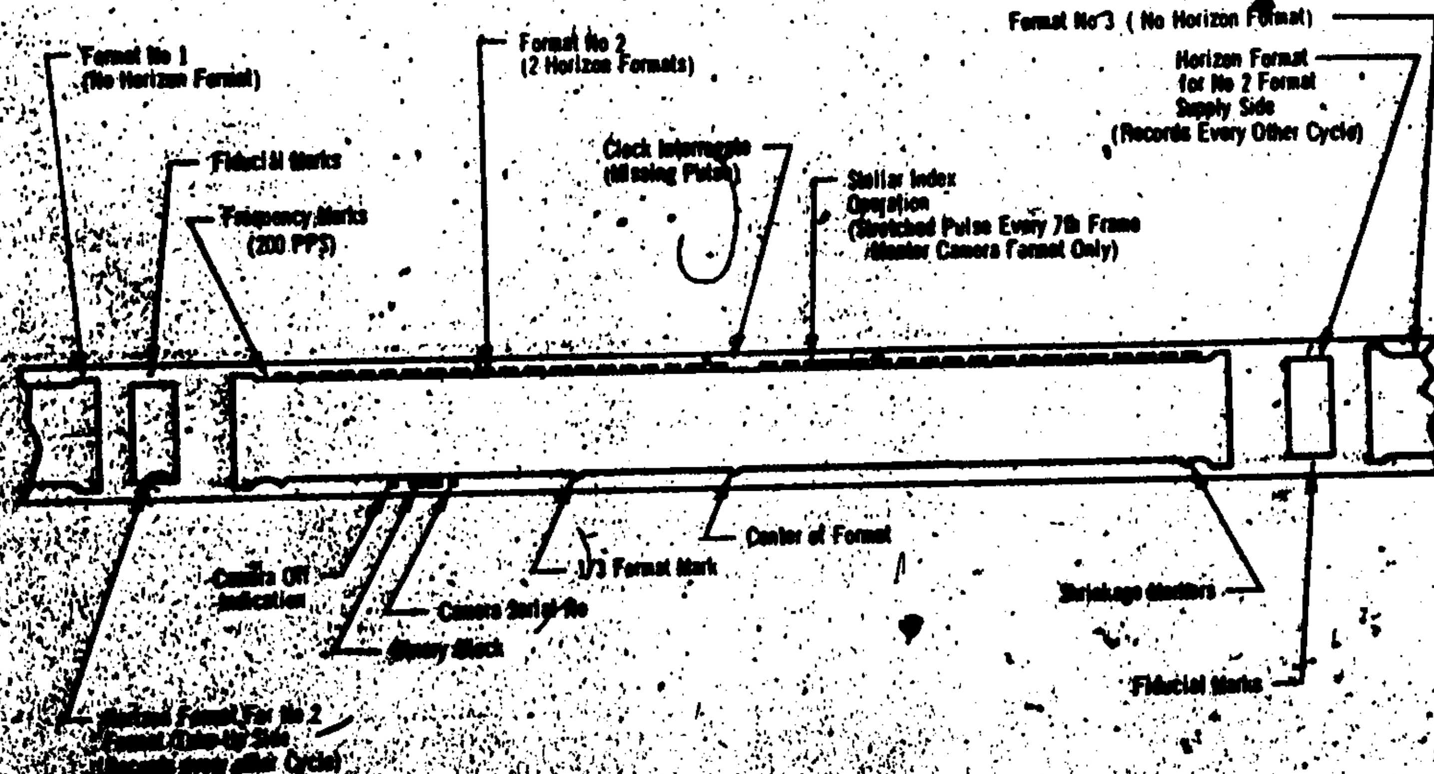
Handle Via
TALENT-KEYHOLE
Control System Only

TOP SECRET RUFF

NO FOREIGN DISSEM

[redacted]

FORMAT LAYOUT
(Panoramic Cameras)



Slave (Aft) Panoramic Camera No 153
Viewed thru Negative Emulsion Down
Direction of Film Transport
Direction of Scan
Direction of Vehicle Motion

APPENDIX B STELLAR/INDEX AND MASTER CAMERA FRAME CORRELATION

Following is a list of each stellar and index frame and the master panoramic frame each correlates with.

[redacted]

Mission 1010-1

Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames	Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames
0				43	6D	128	
1	1D	5	12	44	6D	135	
2	4D	1		45	6D	142	
3	4D	8		46	6D	149	
4	4D	15		47	6D	156	161
5	4D	22		48	7D	2	
6	4D	29		49	7D	9	
7	4D	36	40	50	7D	16	
8	5D	3		51	7D	23	
9	5D	10		52	7D	30	
10	5D	17		53	7D	37	
11	5D	24		54	7D	44	
12	5D	31		55	7D	51	
13	5D	38		56	7D	58	
14	5D	45		57	7D	65	
15	5D	52		58	7D	72	
16	5D	59		59	7D	79	
17	5D	66		60	7D	86	
18	5D	73		61	7D	93	
19	5D	80		62	7D	100	
20	5D	87		63	7D	107	
21	5D	94		64	7D	114	
22	5D	101		65	7D	121	
23	5D	108		66	7D	128	
24	5D	115	120	67	7D	135	
25	6D	2		68	7D	142	
26	6D	9		69	7D	149	
27	6D	16		70	7D	156	
28	6D	23		71	7D	163	
29	6D	30		72	7D	170	
30	6D	37		73	7D	177	
				74	7D	184	185
				75	8D	6	9
				76	9D	4	
				77	9D	11	
				78	9D	18	
				79	9D	25	
				80	9D	32	
				81	9D	39	
				82	9D	46	
				83	9D	53	
				84	9D	60	
				85	9D	67	

Mission 1010-1 (Continued)

Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames
86	9D	74	
87	9D	81	
88	9D	88	
89	9D	95	
90	9D	102	
91	9D	109	
92	9D	116	
93	9D	123	
94	9D	130	
95	9D	137	140
96	21D	4	
97	21D	11	
98	21D	18	
99	21D	25	
100	21D	32	
101	21D	39	
102	21D	46	
103	21D	53	
104	21D	60	
105	21D	67	
106	21D	74	
107	21D	81	
108	21D	88	
109	21D	95	
110	21D	102	
111	21D	109	
112	21D	116	
113	21D	123	
114	21D	130	
115	21D	137	
116	21D	144	
117	21D	151	
118	21D	158	
119	21D	165	
120	21D	172	
121	21D	179	184
122	22D	2	
123	22D	9	
124	22D	16	
125	22D	23	
126	22D	30	
127	22D	37	
128			

Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames
129	22D	51	
130	22D	58	
131	22D	65	
132	22D	72	
133	22D	79	
134	22D	86	
135	22D	93	
136	22D	100	
137	22D	107	
138	22D	114	
139	22D	121	
140	22D	128	
141	23D	3	
142	23D	10	
143	23D	17	
144	23D	24	
145	23D	31	
146	23D	38	
147	23D	45	
148	23D	52	
149	23D	59	
150	23D	66	
151	23D	73	
152	23D	80	
153	23D	87	
154	23D	94	
155	23D	101	
156	23D	108	
157	23D	115	
158	23D	122	
159	23D	129	
160	23D	136	
161	23D	143	
162	23D	150	
163	23D	157	
164	23D	164	
165	23D	171	
166	23D	178	
167	24D	5	
168	24D	12	
169	24D	19	
170	24D	26	
171	24D	33	
172	24D	40	
173	24D	47	
174	24D	54	
175	24D	61	
176	24D	68	
177	24D	75	
178	24D	82	
179	24D	89	
180	24D	96	
181	24D	103	
182	24D	110	
183	24D	117	
184	24D	124	

[redacted]

Mission 1010-1 (Continued)

Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames	Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames
171	25D	90		214	37D	144	
172	25D	97		215	37D	151	
173	25D	104		216	37D	158	158
174	25D	111		217	38D	7	
175	25D	118		218	38D	14	
176	25D	125	128	219	38D	21	
177	31D	4		220	38D	28	
178	31D	11		221	38D	35	
179	31D	18		222	38D	42	
180	31D	25		223	38D	49	
181	31D	32	36	224	38D	56	
182	36D	3		225	38D	63	
183	36D	10		226	38D	70	
184	36D	17		227	38D	77	
185	36D	24		228	38D	84	
186	36D	31		229	38D	91	
187	36D	38		230	38D	98	
188	36D	45		231	38D	105	
189	36D	52		232	38D	112	
190	36D	59		233	38D	119	
191	36D	66		234	38D	126	
192	36D	73		235	38D	133	
193	36D	80	83	236	38D	140	
194	37D	4		237	38D	147	
195	37D	11		238	38D	154	
196	37D	18		239	38D	161	
197	37D	25		240	38D	168	
198	37D	32		241	38D	175	
199	37D	39		242	38D	182	
200	37D	46		243	38D	189	191
201	37D	53		244	39D	5	
202	37D	60		245	39D	12	
203	37D	67		246	39D	19	
204	37D	74		247	39D	26	
205	37D	81		248	39D	33	
206	37D	88		249	39D	40	
207	37D	95		250	39D	47	
208	37D	102		251	39D	54	
209	37D	109		252	39D	61	
210	37D	116		253	39D	68	
	37D	123		254	39D	75	
	37D	130		255	39D	82	
	37D	137		256	39D	89	

Mission 1010-1 (Continued)

Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames	Framing Camera Frame Number	Main Camera Pass	Main Camera Frame
257	39D	96		300	41D	65
258	39D	103		301	41D	72
259	39D	110		302	41D	79
260	39D	117		303	41D	86
261	39D	124		304	41D	93
262	39D	131		305	41D	98
263	39D	138	142	306	52D	5
264	40D	3		307	52D	12
265	40D	10		308	52D	19
266	40D	17		309	52D	26
267	40D	24		310	52D	33
268	40D	31		311	52D	40
269	40D	38		312	52D	47
270	40D	45		313	52D	54
271	40D	52		314	52D	
272	40D	59		315	52D	
273	40D	66		316	52D	
274	40D	73		317	52D	
275	40D	80		318	52D	
276	40D	87		319	52D	
277	40D	94		320	52D	
278	40D	101		321	52D	
279	40D	108		322	52D	
280	40D	115		323	52D	
281	40D	122		324	52D	
282	40D	129		325	52D	
283	40D	136		326	52D	
284	40D	143		327	52D	
285	40D	150		328	52D	
286	40D	157		329	52D	
287	40D	164	170	330	52D	
288	41D	1		331	52D	
289	41D	8		332	52D	
290	41D	15		333	52D	
291	41D	22		334	52D	
292	41D	29		335	52D	
293	41D	36		336	52D	
294	41D	43		337	52D	
295	41D	50		338	52D	
296	41D	57		339	52D	
297	41D	64		340	52D	
298	41D	71		341	52D	
299	41D	78		342	52D	

[redacted]

Mission 1010-1 (Continued)

Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames	Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames
343	53D	162		383	55D	67	
344	53D	169		384	55D	74	
345	53D	176		385	55D	81	
346	53D	183		386	55D	88	
347	53D	190		387	55D	95	
348	53D	197		388	55D	102	
349	53D	204		389	55D	109	
350	53D	211		390	55D	116	
351	53D	218		391	55D	123	
352	53D	225	225	392	55D	130	
353	54D	7		393	55D	137	
354	54D	14		394	55D	144	
355	54D	21		395	55D	151	153
356	54D	28		396	56AE	5	10
357	54D	35		397	56D	2	
358	54D	42		398	56D	9	
359	54D	49		399	56D	16	
360	54D	56		400	56D	23	
361	54D	63		401	56D	30	
362	54D	70		402	56D	37	
363	54D	77		403	56D	44	
364	54D	84		404	56D	51	
365	54D	91		405	56D	58	
366	54D	98		406	56D	65	
367	54D	105		407	56D	72	
368	54D	112		408	56D	79	
369	54D	119		409	56D	86	
370	54D	126		410	56D	93	
371	54D	133		411	56D	100	
372	54D	140		412	56D	107	
373	54D	147	150	413	56D	114	
374	55D	4		414	56D	121	
375	55D	11		415	56D	128	
376	55D	18		416	56D	135	
377	55D	25		417	56D	142	
378	55D	32		418	56D	149	153
379	55D	39		419	61D	3	
380	55D	46		420	61D	10	
381	55D	53		421	61D	17	
382	55D	60		422	61D	24	
				423	61D	31	

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TALENT-KEYHOLE
Control System Only

Mission 1010-2

Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames	Framing Camera Frame Number	Main Camera Pass	Main Camera Frame
1	65D	9		44	69D	172
2	65D	16	17	45	69D	179
3	68D	6		46	69D	186
4	68D	13		47	69D	193
5	68D	20		48	69D	200
6	68D	27		49	69D	207
7	68D	34		50	69D	214
8	68D	41		51	69D	221
9	68D	48		52	70D	1
10	68D	55		53	70D	14
11	68D	62		54	70D	21
12	68D	69		55	70D	28
13	68D	76		56	70D	35
14	68D	83		57	70D	[illegible]
15	68D	90		58	70D	[illegible]
16	68D	97		59	70D	[illegible]
17	68D	104		60	70D	[illegible]
18	68D	111		61	70D	[illegible]
19	68D	118	121	62	70D	[illegible]
20	69D	4		63	70D	[illegible]
21	69D	11		64	70D	[illegible]
22	69D	18		65	70D	[illegible]
23	69D	25		66	70D	[illegible]
24	69D	32		67	70D	[illegible]
25	69D	39		68	70D	[illegible]
26	69D	46		69	70D	[illegible]
27	69D	53		70	70D	[illegible]
28	69D	60		71	70D	[illegible]
29	69D	67		72	70D	[illegible]
30	69D	74		73	70D	[illegible]
31	69D	81		74	70D	[illegible]
32	69D	88		75	70D	[illegible]
33	69D	95		76	70D	[illegible]
34	69D	102		77	70D	[illegible]
35	69D	109		78	70D	[illegible]
36	69D	116		79	70D	[illegible]
37	69D	123		80	70D	[illegible]
38	69D	130		81	70D	[illegible]
39	69D	137		82	70D	[illegible]
40	69D	144		83	70D	[illegible]
41	69D	151				
42	69D	158				
43	69D	165				

[redacted]

Mission 1010-2 (Continued)

Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames	Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames
87	71D	76		130	84D	209	
88	71D	83		131	84D	216	
89	71D	90		132	84D	223	224
90	71D	97		133	85D	6	
91	71D	104		134	85D	13	
92	71D	111		135	85D	20	
93	71D	118		136	85D	27	
94	71D	125		137	85D	34	
95	71D	132		138	85D	41	
96	71D	139		139	85D	48	
97	71D	146		140	85D	55	
98	71D	153		141	85D	62	
99	71D	160		142	85D	69	
100	71D	168	169	143	85D	76	
101	84D	6		144	85D	83	
102	84D	13		145	85D	90	
103	84D	20		146	85D	97	
104	84D	27		147	85D	104	
105	84D	34		148	85D	111	
106	84D	41		149	85D	118	
107	84D	48		150	85D	125	
108	84D	55		151	85D	132	
109	84D	62		152	85D	139	
110	84D	69		153	85D	146	
111	84D	76		154	85D	153	
112	84D	83		155	85D	160	
113	84D	90		156	85D	167	
114	84D	97		157	85D	174	
115	84D	104		158	85D	181	
116	84D	111		159	85D	188	
117	84D	118		160	85D	195	
118	84D	125		161	85D	202	
119	84D	132		162	85D	209	
120	84D	139		163	85D	216	
121	84D	146		164	85D	223	
122	84D	153		165	85D	230	232
123	84D	160		166	86D	5	
124	84D	167		167	86D	12	
125	84D	174		168	86D	19	
126	84D	181		169	86D	26	
127	84D	188		170	86D	33	
128	84D	195		171	86D	40	
	84D	202		172	86D	47	

Handle Via
[redacted]
Control System Only

Mission 1010-2 (Continued)

Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames	Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames
173	86D	54		216	88D	90	
174	86D	61		217	88D	97	
175	86D	68		218	88D	104	
176	86D	75		219	88D	111	
177	86D	82		220	88D	118	
178	86D	89		221	88D	125	129
179	86D	96		222	93D	3	
180	86D	103		223	93D	10	
181	86D	110		224	93D	17	
182	86D	117		225	93D	24	
183	86D	124		226	93D	31	
184	86D	131		227	93D	38	41
185	86D	138		228	96D	4	
186	86D	145		229	96D	11	
187	86D	152		230	96D	18	
188	86D	159	161	231	96D	25	
189	87D	5		232	96D	32	
190	87D	12		233	96D	39	
191	87D	19		234	96D	46	
192	87D	26		235	100D	4	
193	87D	33		236	100D	11	
194	87D	40		237	100D	18	
195	87D	47		238	100D	25	
196	87D	54		239	100D	32	
197	87D	61		240	100D	39	
198	87D	68		241	100D	46	
199	87D	75		242	100D	53	
200	87D	82		243	100D	60	
201	87D	89		244	100D	67	
202	87D	96		245	100D	[illegible]	
203	87D	103	104	246	100D	[illegible]	
204	88D	6		247	100D	88	
205	88D	13		248	100D	95	
206	88D	20		249	100D	[illegible]	
207	88D	27		250	100D	[illegible]	
208	88D	34		251	100D	[illegible]	
209	88D	41		252	100D	[illegible]	
210	88D	48		253	100D	[illegible]	
211	88D	55		254	100D	[illegible]	
212	88D	62		255	[illegible]		
213	88D	69		256	[illegible]		
214	88D	76		[illegible]			
215	88D	83		[illegible]			

[redacted]

Mission 1010-2 (Continued)

Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames	Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames
259	100D	172		302	115D	63	
260	100D	179		303	115D	70	74
261	100D	186		304	116D	3	
262	100D	193		305	116D	10	
263	100D	200		306	116D	17	
264	100D	207		307	116D	24	
265	100D	214		308	116D	31	
266	100D	221		309	116D	38	
267	100D	228	228	310	116D	45	
268	101D	7		311	116D	52	
269	101D	14		312	116D	59	
270	101D	21		313	116D	66	
271	101D	28		314	116D	73	
272	101D	35		315	116D	80	
273	101D	42		316	116D	87	
274	101D	49		317	116D	94	
275	101D	56		318	116D	101	
276	101D	63		319	116D	108	
277	101D	70		320	116D	115	
278	101D	77		321	116D	122	
279	101D	84		322	116D	129	
280	101D	91		323	116D	136	
281	101D	98		324	116D	143	
282	101D	105		325	116D	150	
283	101D	112		326	116D	157	
284	101D	119		327	116D	164	
285	101D	126		328	116D	171	
286	101D	133		329	116D	178	180
287	101D	140		330	117D	5	
288	101D	147		331	117D	12	
289	101D	154		332	117D	19	
290	101D	161		333	117D	26	
291	101D	168	171	334	117D	33	
292	103AE	4		335	117D	40	
293	103AE	11	11	336	117D	47	
294	115D	7		337	117D	54	
295	115D	14		338	117D	61	
296	115D	21		339	117D	68	
297	115D	28		340	117D	75	
298	115D	35		341	117D	82	
299	115D	42		342	117D	89	
300	115D	49		343	117D	96	
301	115D	56		344	117D	103	

Mission 1010-2 (Continued)

Framing Camera Frame Number	Main Camera Pass	Main Camera Frame	Total Frames	Framing Camera Frame Number	Main Camera Pass	Main Camera Frame
345	117D	110		388	130D	3
346	117D	117		389	130D	10
347	117D	124		390	130D	17
348	117D	131		391	130D	24
349	117D	138		392	130D	31
350	117D	145		393	130D	38
351	117D	152		394	130D	45
352	117D	159		395	130D	52
353	117D	166	169	396	130D	59
354	118D	4		397	130D	66
355	118D	11		398	130D	73
356	118D	18		399	130D	80
357	118D	25		400	130D	87
358	118D	32		401	130D	94
359	118D	39		402	130D	101
360	118D	46		403	130D	108
361	118D	53		404	130D	115
362	118D	60		405	130D	122
363	118D	67		406	130D	129
364	118D	74		407	130D	136
365	118D	81		408	130D	143
366	118D	88		409	130D	150
367	118D	95		410	130D	157
368	118D	102		411	130D	164
369	118D	109		412	130D	171
370	118D	116		413	130D	178
371	118D	123		414	130D	185
372	118D	130		415	130D	192
373	118D	137		416	130D	199
374	118D	144		417	131D	6
375	118D	151		418	131D	13
376	118D	158		419	131D	20
377	118D	165		420	131D	27
378	118D	172		421	131D	34
379	118D	179		422	131D	41
380	118D	186		423	131D	48
381	118D	193		424	131D	55
382	118D	200	203	425	131D	62
383	119D	4		426	131D	69
384	119D	11		427	131D	76
385	119D	18		428	131D	83
386	119D	25		429	131D	90
387	119D	32		430	131D	97

[redacted]

Mission 1010-2 (Continued)

Trailing Camera Frame Numbers	Main Camera		Total Frames
	Film	Frames	
431	142D		
432	142D		

APPENDIX C. IN-FLIGHT TEMPERATURE SAMPLINGS AND SENSOR LOCATIONS

Temperature is not considered to be a detrimental factor in the quality of this mission. However, the following data, supplied by the vehicle manufacturer, is presented in the interest of comparative analysis.

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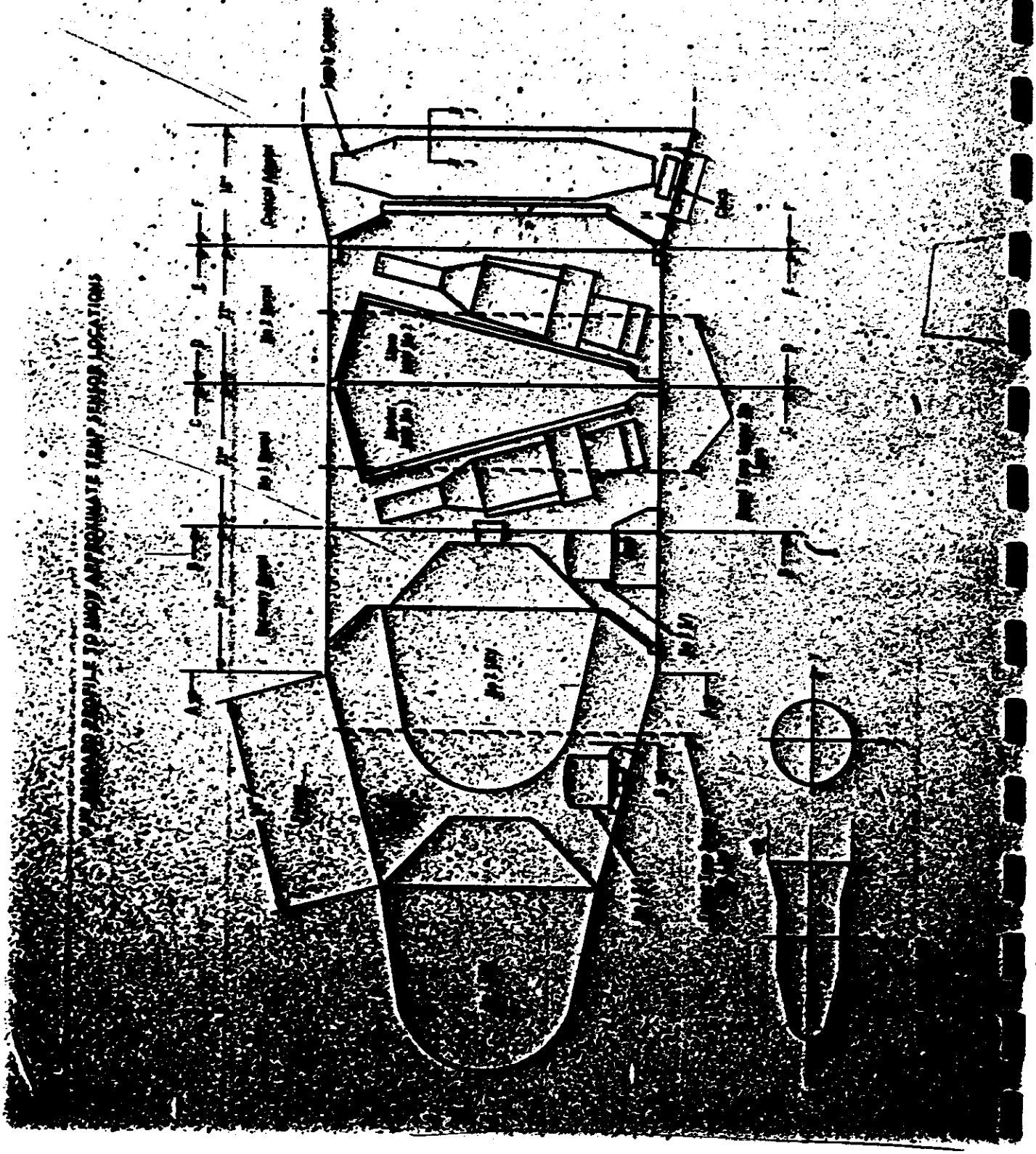
[redacted]



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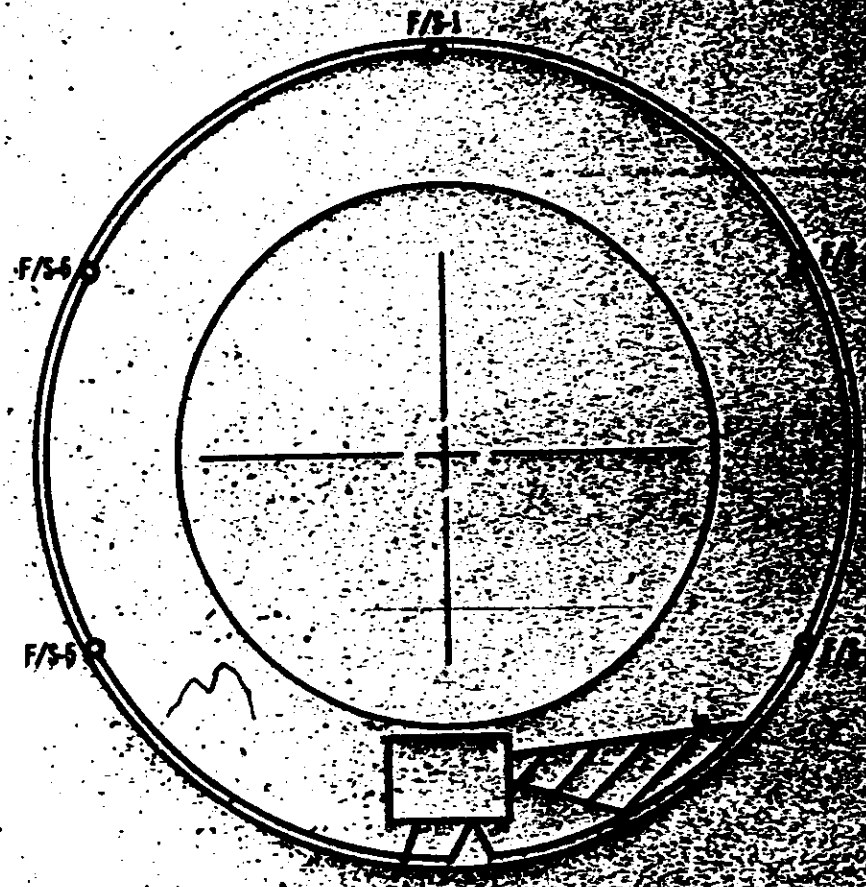
FAIRING TEMP SENSORS

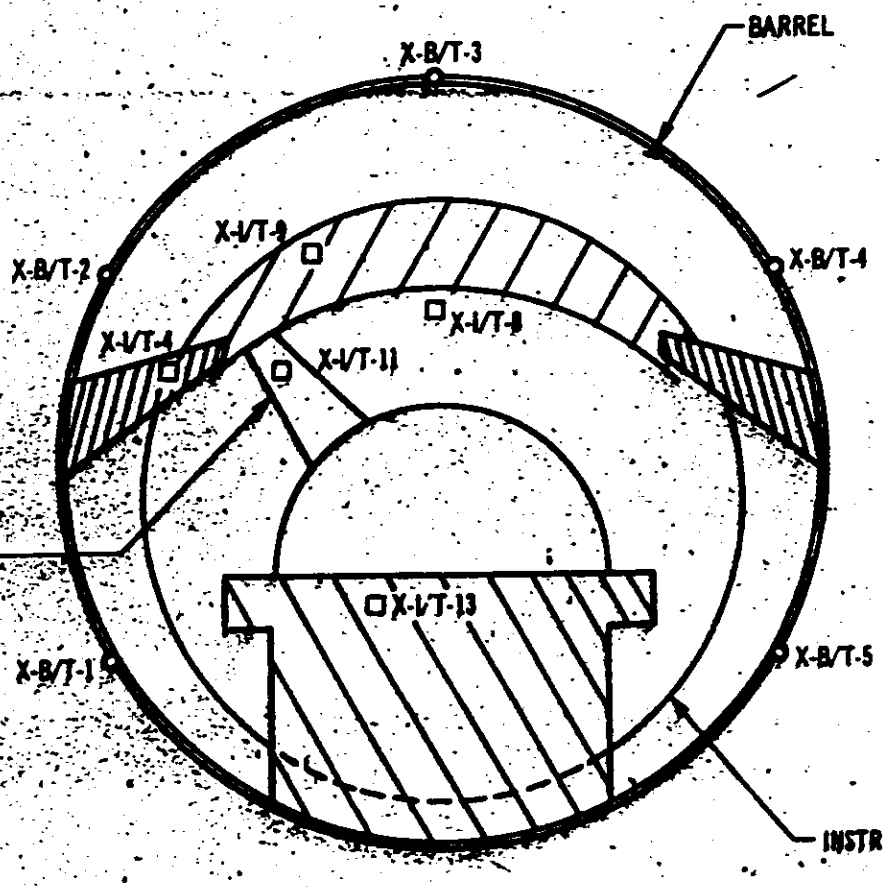


VIEW A-A
LOOKING FORWARD

NPIC-7999-8/89

[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

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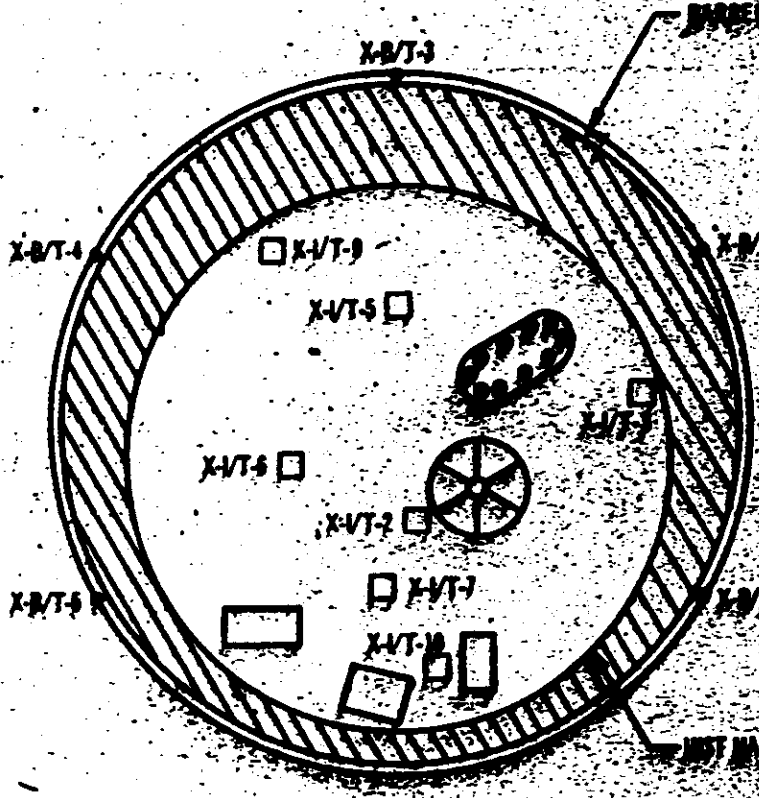
[redacted]

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



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

INSTR NO 1

KEY:

[redacted]

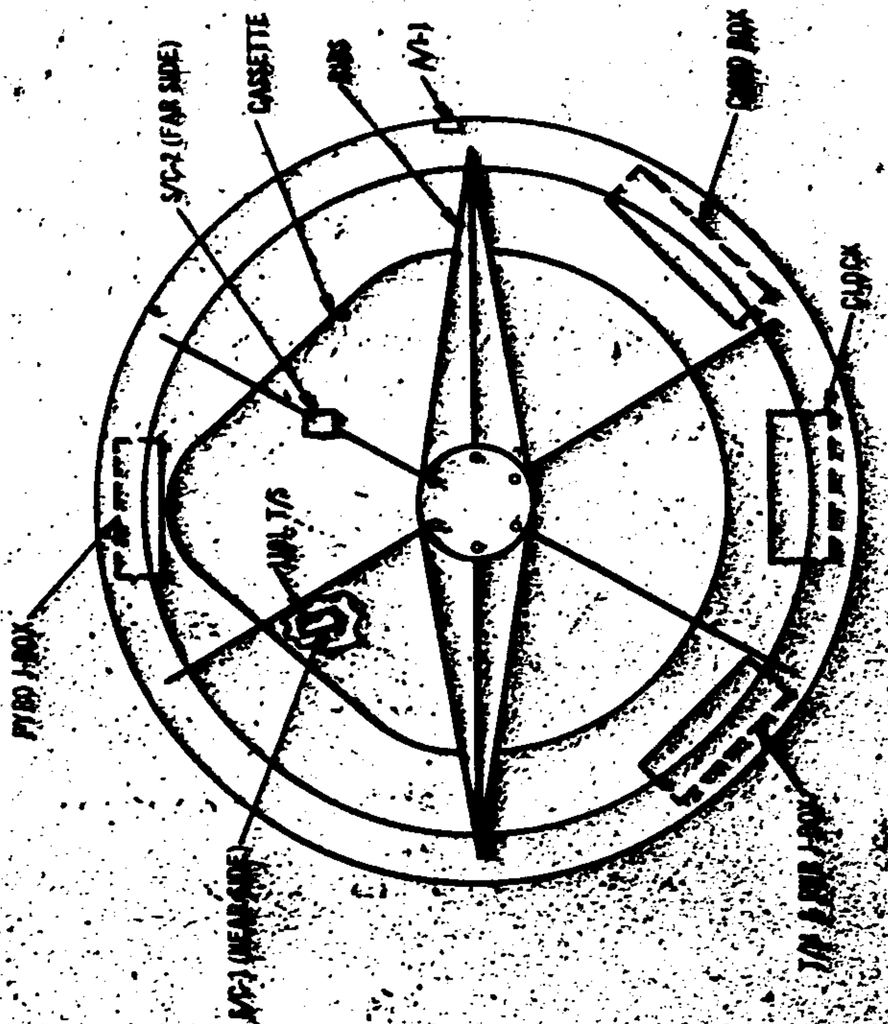
[redacted]

TOP SECRET RUFF

Handle Via
TALENT-KEYHOLE
Control System Only

[redacted]

VIEW E-E SUPPLY CASSETTE LOOKING AFT



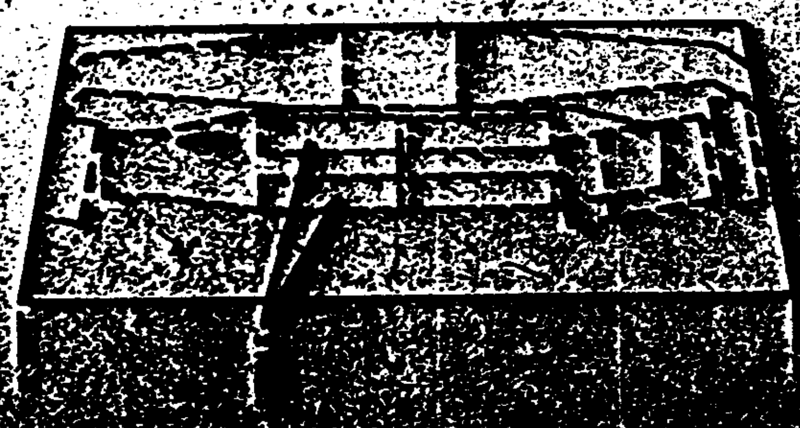
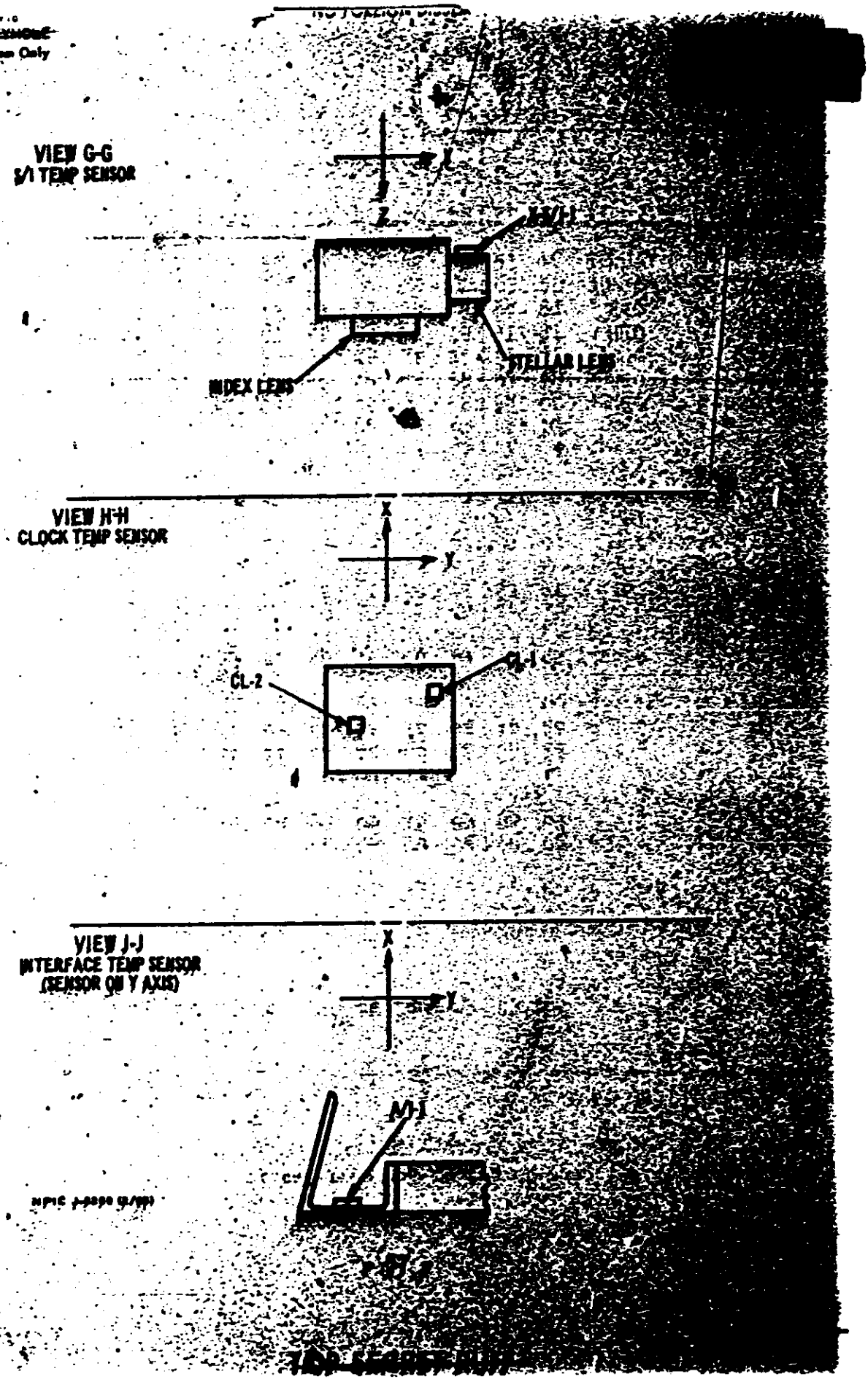


FIGURE 7-10
~~CALENDAR/CLOCK~~
Control System Only



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Control System Only

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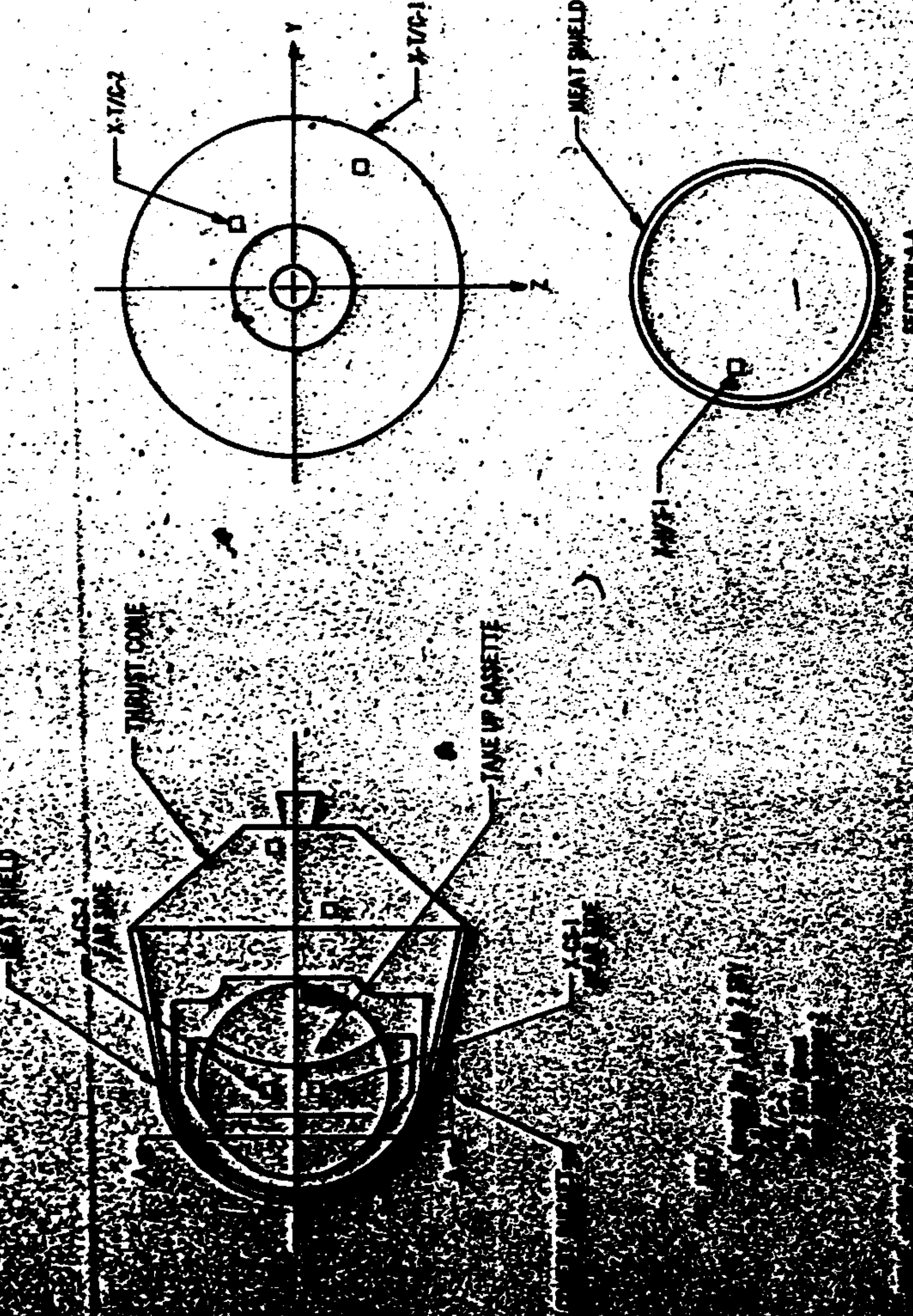
NO 1 AND NO 2 SRV TEMP SENSORS



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2. Temperature Summary

SENSOR		ORBITS ACQUIRED								"A"				"B"	
Master	Launch	9	16	24	31	40	47	56	63	71	79	87	95	103	
3	66	60	57	63	56	59	54	62	52	53	48	50	47	48	
4	72	69	66	72	65	68	64	72	61	62	56	59	53	56	
5	68	75	70	77	69	74	67	76	67	68	61	66	60	63	
6	65	85	80	85	80	82	78	85	74	77	71	74	67	70	
7	66	78	73	78	73	74	72	79	69	69	65	67	64	63	
8	71	76	71	77	71	73	68	78	66	67	60	64	59	60	
9	69	84	78	84	77	79	63	82	72	72	68	78	65	70	
10	66	71	69	71	67	66	65	72	63	59	59	59	58	54	
11*	100	86	91	94	86	90	83	88	86	75	79	80	78	69	
12	73	65	60	67	60	63	58	68	57	57	51	55	50	53	
13	68	80	78	82	76	76	73	81	73	67	67	63	65	60	
Avg Instr Temp	68	74	70	76	69	71	66	77	65	65	61	63	59	60	
Slave															
3	62	80	77	81	76	78	73	81	72	74	70	73	68	69	
4	63	74	69	77	70	74	66	77	66	74	64	69	64	67	
5	64	71	67	73	66	69	66	76	64	67	62	67	62	64	
6	60	66	61	66	63	64	62	68	59	60	56	58	54	56	
7	62	69	66	71	56	66	63	71	63	61	60	59	58	57	
8	64	70	63	71	64	69	69	72	62	66	59	63	57	61	
9	67	63	58	65	57	62	57	66	57	59	55	57	52	54	
10	65	70	68	71	68	65	64	71	64	62	61	59	59	56	
11*	94	63	57	63	60	62	60	68	58	62	56	58	57	60	
12	66	75	69	77	69	73	68	78	65	69	64	68	64	65	
13	67	72	69	74	70	69	68	74	68	66	66	63	63	62	
Avg Instr Temp	64	70	67	73	66	68	65	73	63	65	61	63	59	60	
Supply Spool															
1	60	58	57	61	61	62	61	64	59	61	58	58	56	56	
2	60	66	63	67	64	68	64	68	63	65	62	64	62	62	

NOTE: All data corrected for self-heating, except injection.

Instrument averages do not include T/S #11.

[redacted]

Temperature Summary (Continued)

SENSOR — ORBITS ACQUIRED

			"A"						"B"					
Fairing/ Barrel #1 ("A")	("B")	Launch	9	16	24	31	40	47	56	63	71	79	87	95	103	110
1		OBH	48	76	51	70	48	67	51	70	4	78	1	14	1	14
2		OBH	18	15	21	15	18	12	18	12	3	-4	-1	-7	-1	-4
3		OBH	2	15	5	15	2	12	5	12	19	58	19	61	19	64
4		OBH	83	88	88	86	83	86	86	83	67	122	67	122	63	119
5		OBH	120	153	126	142	120	139	120	134	62	98	65	92	62	86
6		OBH	91	154	94	143	88	138	91	135						
Barrel No 2																
1		163	67	111	67	106	64	103	64	100	58	97	61	92	54	86
2		158	62	139	65	131	62	126	62	126	62	120	62	120	55	118
3		186	22	66	22	60	19	57	22	60	22	57	22	63	19	63
4		194	4	4	7	4	7	0	7	0	4	0	4	0	4	-3
5		191	16	26	16	22	19	22	19	22	12	19	9	16	9	19
Conic Adapter																
1		162	64	94	67	89	61	86	64	83	55	83	58	80	55	77
Clock																
1		91	75	71	75	71	77	71	75	71	69	64	66	64	69	62
2		95	75	73	77	73	77	73	77	71	71	64	69	64	69	62
Thrust Cone "A" to "B" SRV																
1		119	62	58	62	57	60	56	60	56	68	64	65	63	64	62
2		76	86	81	86	80	84	79	84	77	79	74	74	72	72	71
Stellar/Index "A" to "B"																
1		86	92	89	92	89	92	86	92	83	76	70	70	67	67	64
2		64	79	76	79	73	79	73	79	70	69	62	65	59	62	59
Recovery Batt "B" SRV																
1		68	79	81	84	84	84	82	84	82	81	81	81	79	80	82
Master Cassette "A" SRV																
2		90	55	48	52	48	53	50	53	50						

NOTE: Only thrust cone corrected for self-heating.

[redacted]

Temperature Summary (Continued)

SENSOR			OBSERVE ACQUIRED
Master	119	126	135
3	49	45	58
4	58	52	56
5	64	58	62
6	71	66	68
7	64	62	62
8	62	58	60
9	70	64	66
10	57	56	54
11*	75	73	77
12	53	49	52
13	61	62	58
Avg Instr Temp	61	57	60
Slave			
3	69	64	66
4	67	59	63
5	62	58	60
6	55	53	53
7	57	56	54
8	62	56	59
9	56	51	54
10	58	56	55
11*	60	56	55
12	65	60	62
13	63	62	59
Avg Instr Temp	61	57	58
Supply Spool			
1	57	56	55
2	62	58	59

NOTE: All data corrected for self-heating, except injection.

Instrument averages do not include T/S #11.

[redacted]

Temperature Summary (Continued)

SENSOR	ORBITS ACQUIRED 119	126	135
Fairing/Barrel #1 ("A") ("B")			
1	4	7	4
2	-1	7	-1
3	16	35	19
4	60	97	63
5	58	83	58
6			
Barrel No 2			
1	54	83	55
2	55	95	55
3	19	39	19
4	4	13	4
5	9	19	9
Conic Adapter			
1	52	64	52
Clock			
1	66	60	59
2	66	62	62
Thrust Cone "A" to "B" SRV			
1	63	61	62
2	69	67	70
Stellar/Index "A" to "B"			
1	64	64	67
2	62	59	51
Recovery Batt "B" SRV			
1	80	84	82

NOTE: Only thrust cone data corrected for self-heating.

[redacted]

Handle V-9
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3, Self-Heating Test Summary of Self-Heating Correction Curves

TS	TC2	TS	TC1	TS	203	TS	212	TS	110	TS	207	TS	211
TS	202	TS	201	TS	209	TS	103	TS	210	TS	113	TS	111
				TS	106	TS	206	TS	213				
				TS	109	TS	205						
				TS	105	TS	108						
				TS	104	TS	112						
				TS	208	TS	107						

Time (Min)	No 1	No 2	No 3	No 4	No 5	No 6	No 7
0,10	0,5	0,5	0,9	1,1	1.3	2,0	4,4
0.13	0,6	0,6	1,1	1,4	1.6	2,6	5,5
0,16	0,7	0,8	1,4	1,8	2.0	3,2	6,9
0,20	0,9	1,0	1.6	2,0	2.3	3,6	7,9
0,25	1,0	1,2	1,8	2,3	2.5	3,9	9,0
0,32	1,1	1,4	2,1	2,5	2,9	4,4	10,4
0,40	1,3	1,7	2,4	2,9	3,3	4,9	12,2
0.50	1,6	2,0	2,8	3,4	3,8	5,6	14,2
0,63	1,9	2,5	3,4	3,9	4,5	6,4	16,9
0,79	2.1	2,8	3,7	4,3	5,0	7,0	18,6
1.00	2.2	3,0	4,1	4,7	5,4	7,6	20,1
1,26	2,3	3,1	4,4	5,0	5,7	8,1	21,0
1,58	2,5	3,3	4,7	5,4	6,1	8,6	22,1
2,00	2,6	3,5	5,1	5.8	6,6	9,3	23,5
2.51	2,7	3,6	5.3	6,1	6,9	9,6	24,1
3.16	2,8	3,7	5,6	6,4	7,3	10,1	25,9
3,98	2,9	3,8	6,0	6,8	7,7	10,7	27,8
5,01	3,0	4,0	6,4	7,3	8,3	11,4	27,0
6,31	3,1	4,1	6,7	7,6	8,6	11,8	27,5
7.94	3,1	4,1	7,0	7,9	9,1	12,3	28,9
10,00	3,2	4,3	7,4	8,4	9,6	13,0	29,8
12,59	3,3	4,3	7,6	8,7	9,9	13,4	29,5
15,85	3,3	4,4	7,9	9,0	10,4	13,8	29,9
19.95	3,4	4,4	8,3	9,5	10,9	14,5	29,9
25,12	3,4	4,5	8,6	9,8	11,3	14,9	30,1
31,62	3,5	4,5	8,9	10,2	11,8	15,6	30,4
39,81	3,5	4,5	9,2	10,5	12,2	15,7	30,5
50,12	3,6	4,6	9,5	10,9	12,7	16,2	30,5
63,10	3,6	4,6	9,8	11,3	13,2	16,7	30,6
79,43	3,7	4,6	10,1	11,7	13,7	17,2	30,6
100,00	3,7	4,7	10,4	12,2	14,3	17,7	30,7

[redacted]

APPENDIX D. MICRODENSITOMETRY

1. Definition Of Edge Spread Function

In an attempt to establish an objective measurement of image quality in mission photography, the technique of obtaining the spread function from microdensitometric edge traces is being investigated. The spread function curve represents the whole photographic system, and is a summation of the separate elements: lens, film, and uncompensated image motion due to vibration, velocity, roll, pitch, yaw, and aerial turbulence. By taking the Fourier Transform of the Spread Function the Modulation Transfer may be obtained.

To assign a single number to the spread function, the width is measured at 50 percent amplitude. This number, usually expressed in microns, may be converted by use of the scale factors to ground distance in feet.

Edges meeting the criteria described below have been found on domestic passes of missions in the same frame as resolution targets and have been scanned. The ground distance in feet, thus determined, has been approximately that determined from the resolution target. Although the techniques used are not refined and are considered to be still in the development stage, the potential of this type of objective analysis should be realized. The 6 examples of edge scans and their respective spread functions are included.

Any optical image can be thought of as being composed of an infinite number of image points of light, each being conjugate with points in the object. While the object points can be infinitesimal light sources, the image points are always mounds of distributions of light having finite size. The blurring of light points in a photographic system comes from diffraction and abberration in the lens, light spreading and diffusion in the emulsion, and image motion caused by camera movement and atmospheric shimmering. The fundamental building block of the image is the distribution of light in any of the image points. This distribution is called the spread function of the photographic system.

Lamberts and others have explained the mathematical and experimental correspondence of a sharp edge and its spread function. An analogy exists in the techniques of studying electrical system response. The analysis requires that the source or object fulfill the conditions of a unit step function, i.e., exist for an appreciable time or distance at a fixed signal level and instantaneously or abruptly change to a new level which is maintained for an appreciable time or distance. The spread function

[redacted]

is obtained by differentiating the signal output curve [illegible] 1,8;, measuring the rate of change of signal with time [illegible] and plotting signal amplitude versus time or distance.

As a starting point the mission is examined to locate [illegible] of best photography with edges long enough and [illegible] in the microdensitometer, and having uniform density on [illegible] the edge to fulfill the conditions of a unit step function [illegible] ment is usually achieved by portions of buildings [illegible] raphy, and only [illegible] of roadways [illegible].

The microdensitometer used is a Joyce-Loebl Double Beam Model [illegible]. It is used with an effective slit of 1 micron by [illegible]. The re-cording table and sample table are directly linked with a ratio of 1000:1. The speed of the scan is variable and is determined by the amount of pen deflection (as the pen is deflected the scan [illegible] giving the pen time to reach its maximum response). The [illegible] produced represents a plot of chart displacement versus distance. This plot is manually smoothed by the analyst and is a judgment of what the edge would be if grain and other anomalies were absent.

The data reduction is done manually at present, but the feasibility of using the UNIVAC 490 computer is being investigated. The linear slope of the calibrated step wedge in the microdensitometer is used to determine the densities at measured distance increments along the trace. The curve for the material showing density versus log exposure [illegible] is used to determine the log E and the [illegible] the exposure (E) required to produce the determined densities. The difference between adjacent values of E is divided by the corresponding difference of the measured distance increments to produce the slope values (dE/dX) of the original [illegible] reflectance distribution. Finally, 50 percent of the maximum slope is computed, and the distance between the 50 percent slope values is determined by interpolation. The value thus obtained represents the 50 percent amplitude width of the line spread function of the original edge. The actual line spread function curve may also be plotted and the 50 percent amplitude width [illegible] for verification of the computed value.

The 50 percent amplitude width value is shown on the enclosed original traces in terms of microns on the negative.

The following traces were made from the [illegible] frames of this mission.

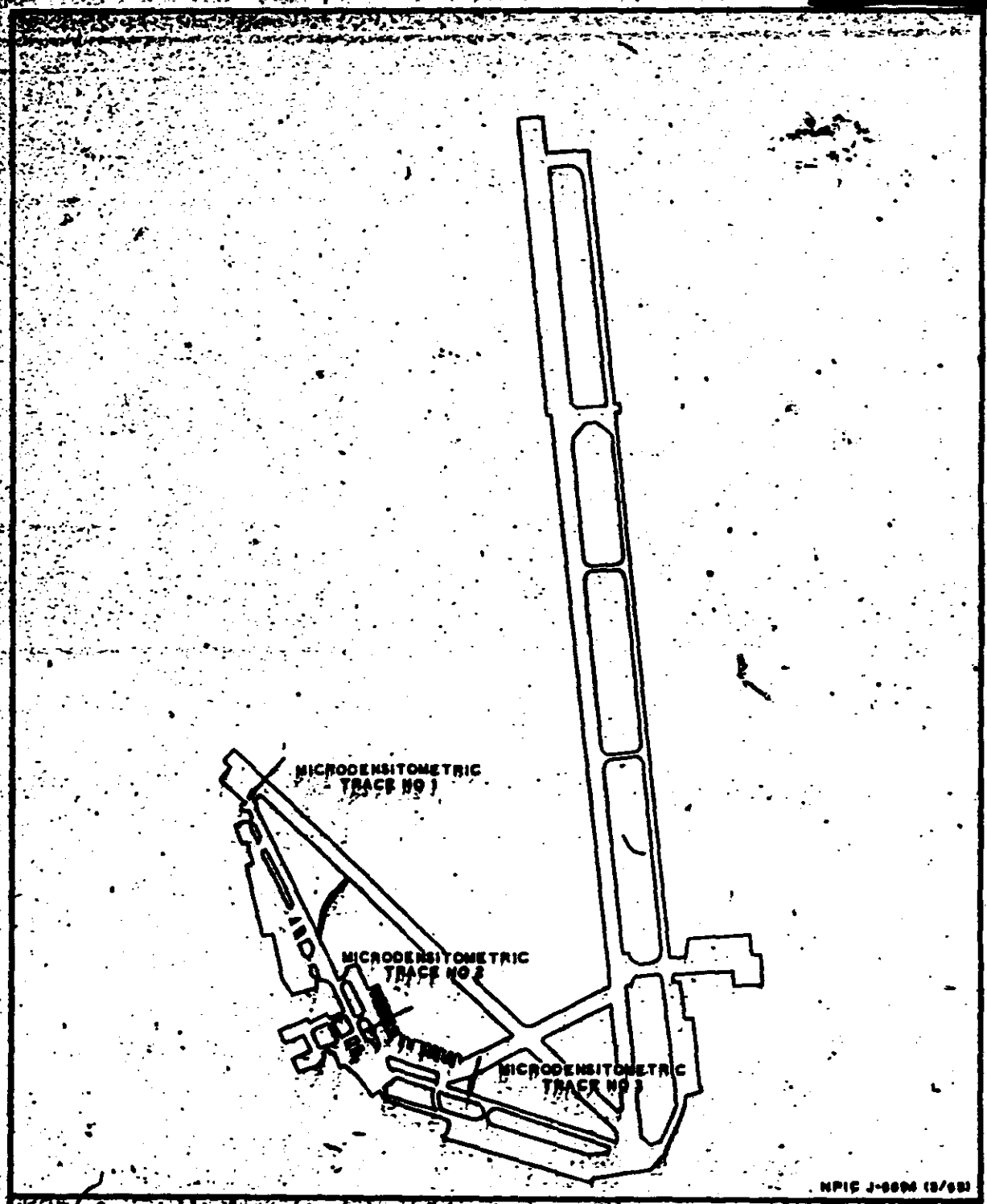

FIGURE 1: LOCATION OF EDGE TRACES 1-3. Arrow indicates scan direction.

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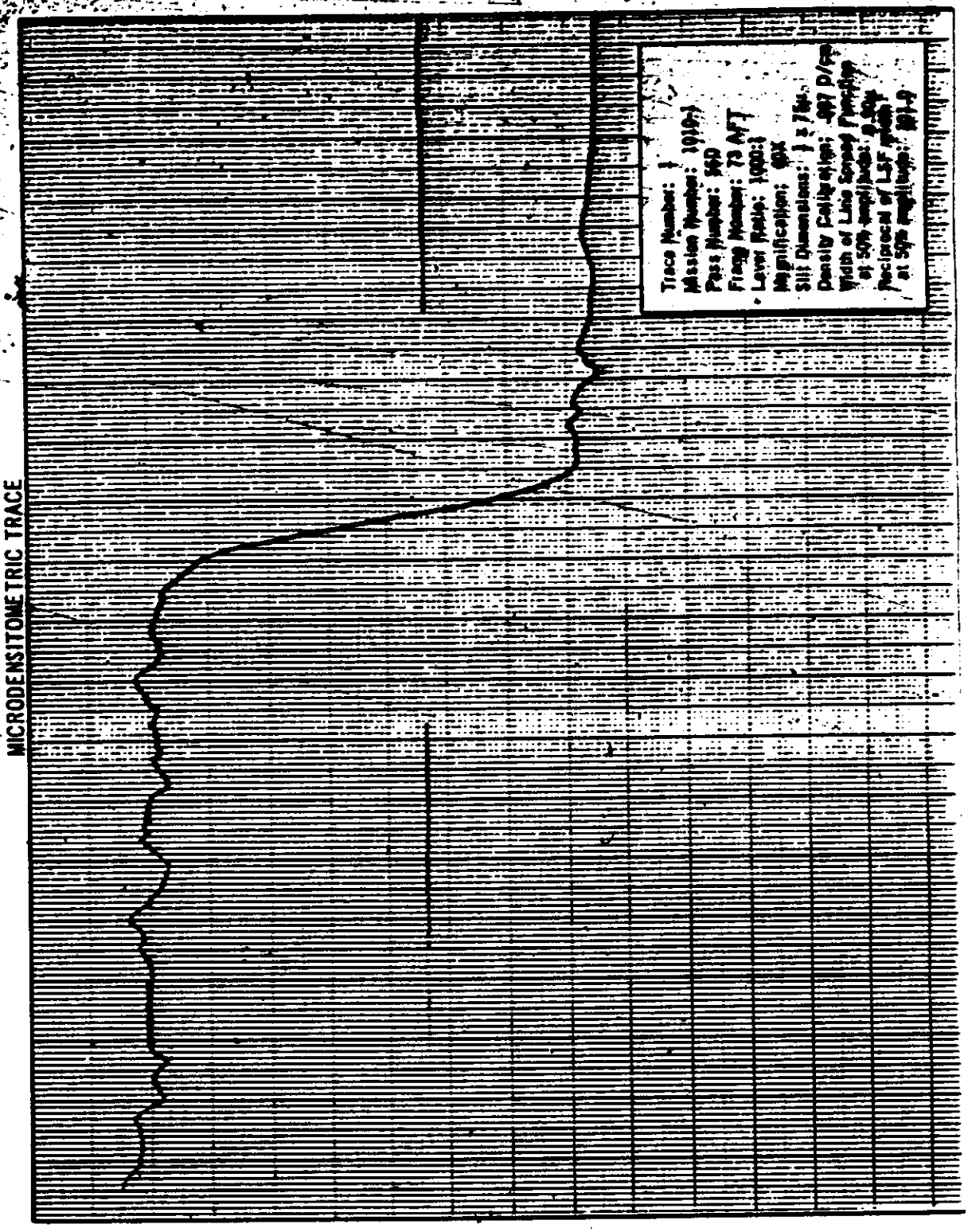

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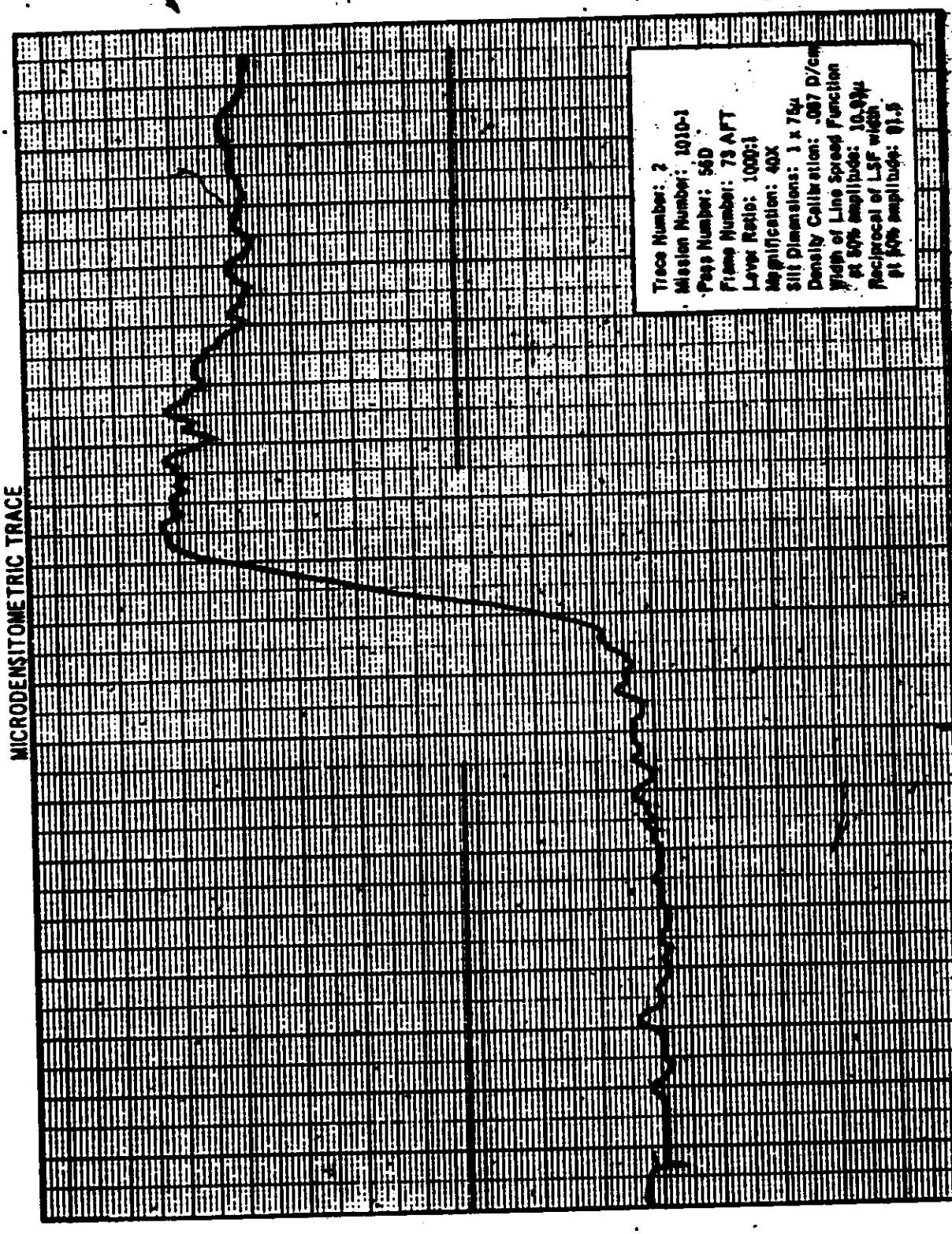

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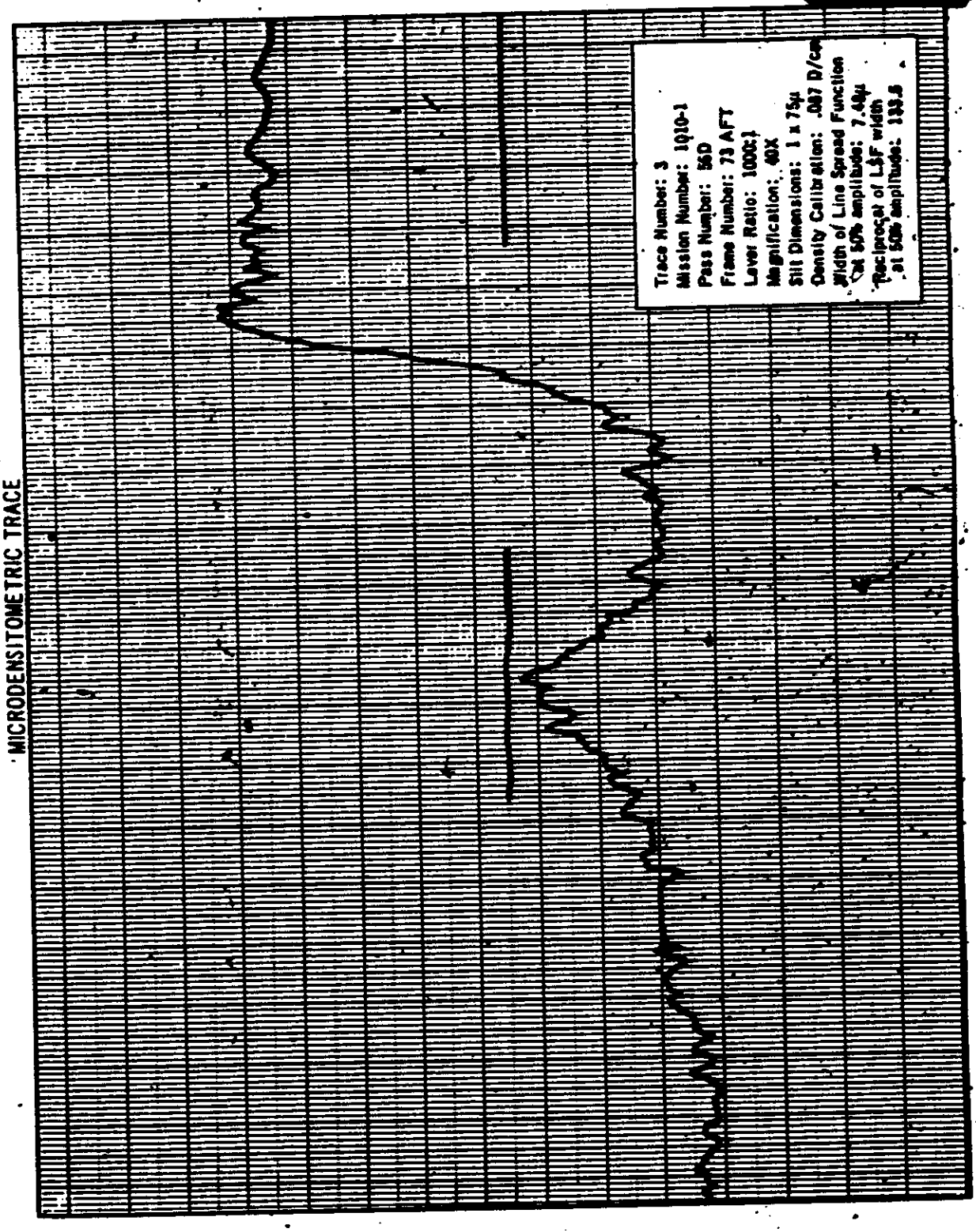
[redacted]



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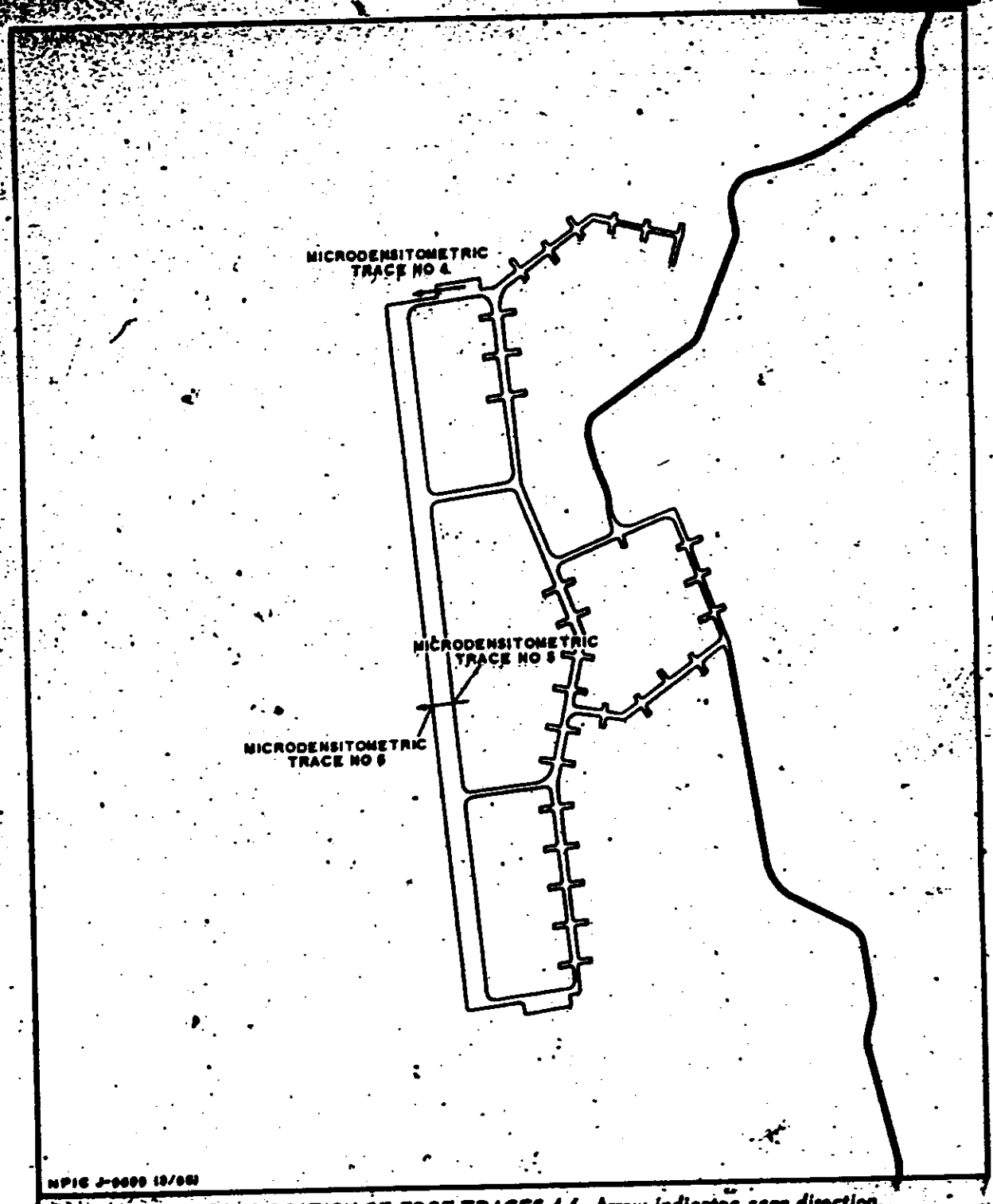

FIGURE 16. LOCATION OF EDGE TRACES 4-6. Arrow indicates scan direction.

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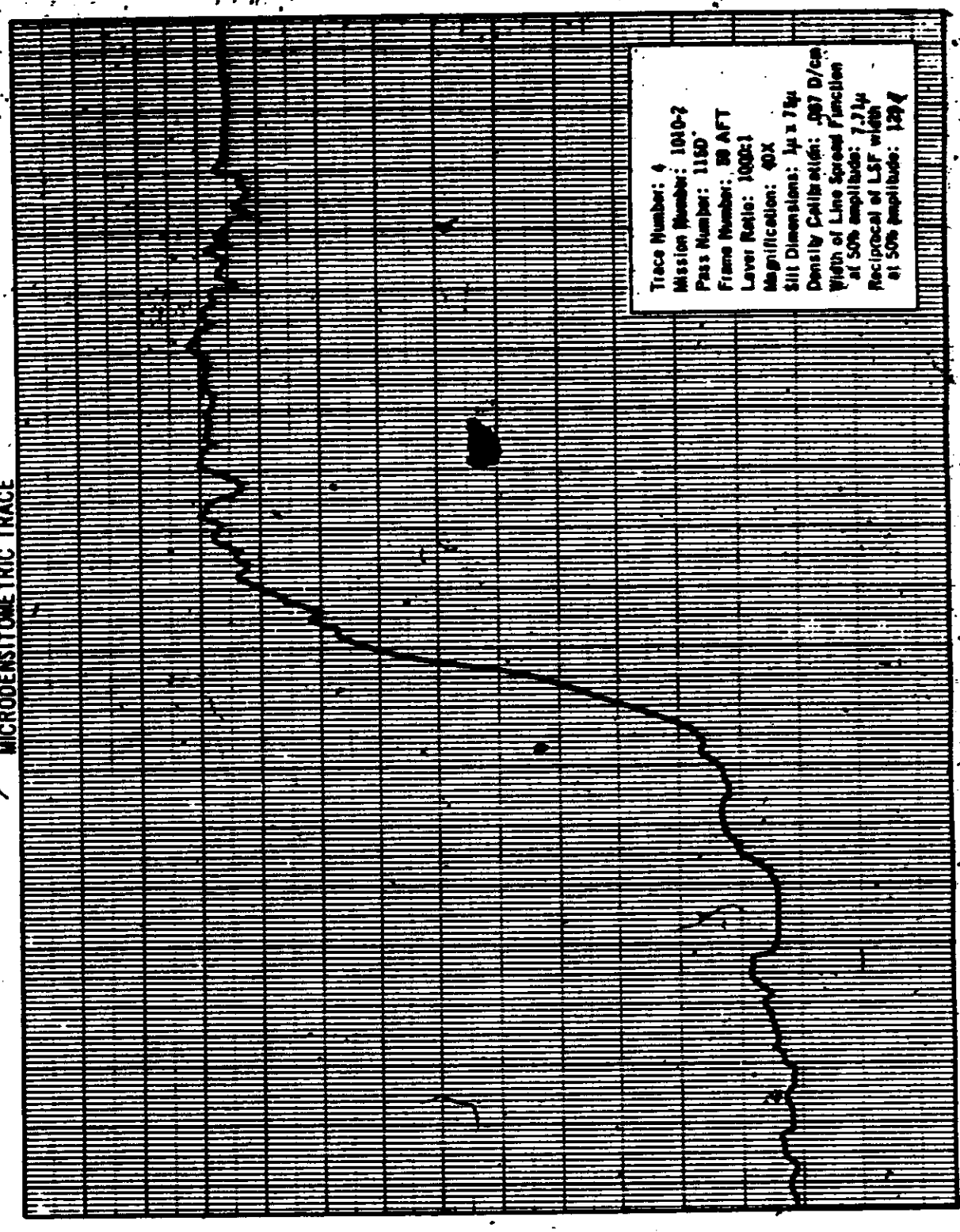
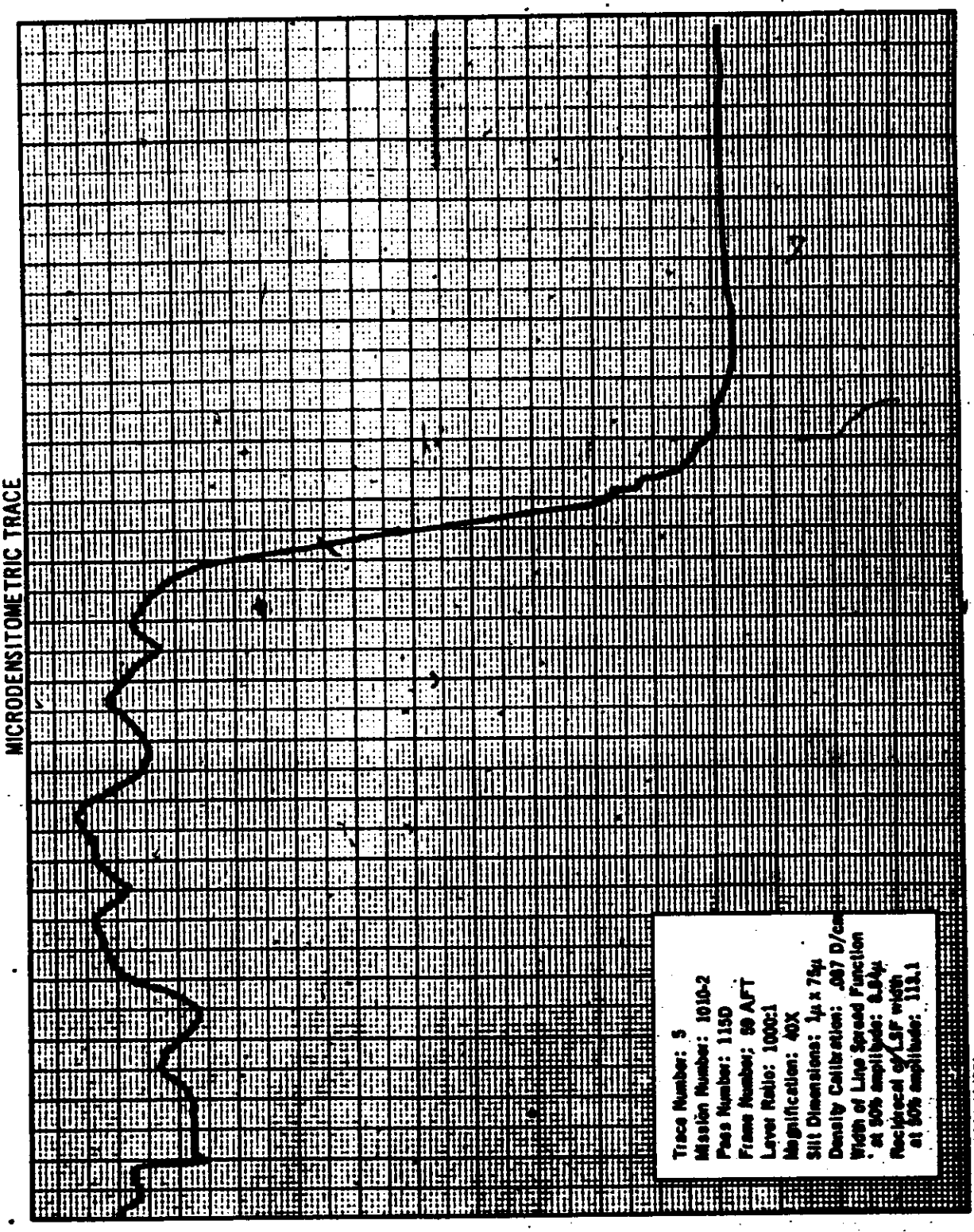
~~TOP SECRET RUFF~~

[redacted]


MICRODENSITOMETRIC TRACE
Trace Number: 4
Mission Number: 1040-2
Pass Number: 1150
Frame Number: 80 AFT
Lever Ratio: 1000:1
Magnification: 40X
Slit Dimensions: 1μ x 7μ
Density Calibration: .087 D/cm
Width of Line Spread Function at 50% amplitude: 7.2μ
Reciprocal of LSF width at 50% amplitude: 139
NPIC J-8889 10/68

~~TO LONGNUDDAM~~

[redacted]



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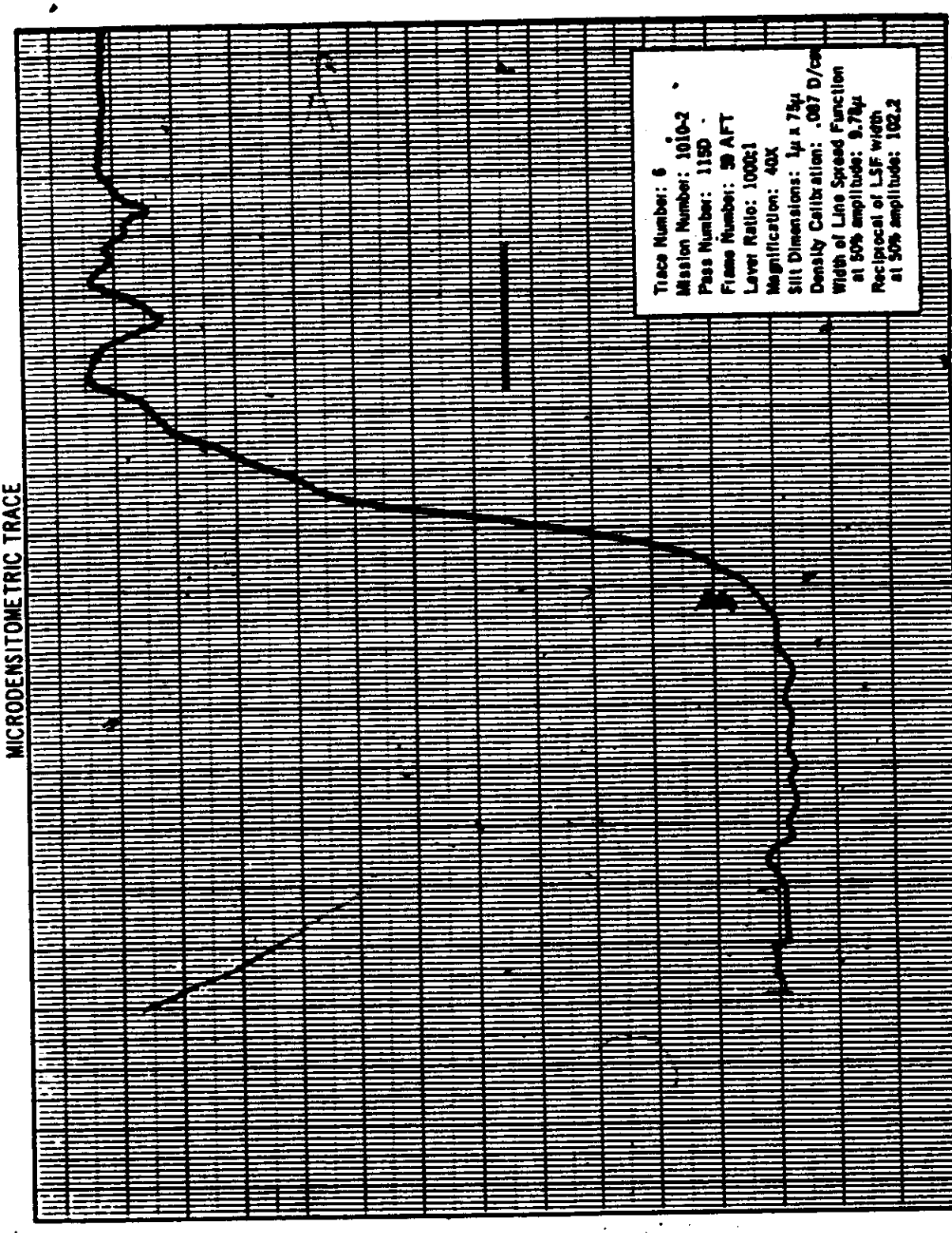
[redacted]



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APPENDIX E. DENSITY READINGS

The density of the first and last frame of each pass of stellar and index photography was measured on a Macbeth QuantaLog Densitometer, model EP 1000 with an EP 20 attachment and a 0.5 mm aperture.

The gross fog is included in all measurements.

Mission 1010-1

Pass	Frame	STELLAR				INDEX						
						Limiting				Terrain		
		Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta
1D	1	1.81	0.28	1.53	0.24	1.42	0.52	0.90	0.08	NR	NR	--
4D	2	1.48	0.26	1.22	0.24	1.37	0.27	1.10	0.08	1.37	0.34	1.03
4D	7	1.78	0.25	1.53	0.22	0.32	0.16	0.16	0.08	NR	NR	--
5D	8	1.97	0.28	1.69	0.22	1.52	0.26	1.26	0.08	0.56	0.26	0.30
5D	24	1.90	0.31	1.59	0.24	1.60	0.30	1.30	0.08	0.47	0.30	0.17
6D	25	1.69	0.28	1.41	0.24	1.29	0.38	0.91	0.08	1.23	0.38	0.85
6D	47	1.84	0.27	1.57	0.22	1.80	0.23	1.57	0.08	0.56	0.23	0.23
7D	48	1.75	0.26	1.49	0.22	0.87	0.26	0.61	0.08	0.47	0.26	0.21
7D	74	2.22	0.35	1.87	0.28	1.42	0.43	0.99	0.08	NR	NR	--
9AE	75	0.32	0.30	0.02	0.30	--	--	--	--	--	--	--
9D	76	1.76	0.37	1.39	0.32	1.22	0.80	0.42	0.08	NR	NR	--
9D	95	1.90	0.26	1.64	0.20	0.94	0.22	0.72	0.08	0.61	0.24	0.37
21D	96	1.84	0.26	1.58	0.19	1.60	0.25	1.35	0.08	0.70	0.25	0.35
21D	121	2.05	0.27	1.78	0.21	1.72	0.30	1.42	0.08	0.61	0.39	0.22
22D	122	1.73	0.24	1.49	0.19	1.14	0.25	0.80	0.08	0.62	0.25	0.37
22D	140	2.11	0.26	1.85	0.20	1.63	0.18	1.45	0.08	0.52	0.18	0.34
23D	141	1.47	0.24	1.23	0.21	1.30	0.28	1.02	0.08	0.48	0.28	0.20
23D	158	1.88	0.27	1.61	0.22	1.36	0.22	1.14	0.08	0.88	0.22	0.66
25D	159	1.73	0.28	1.45	0.23	1.36	0.16	1.20	0.08	NR	NR	--
25D	176	1.75	0.30	1.45	0.25	1.63	0.21	1.42	0.08	0.77	0.21	0.56
31D	177	2.16	0.31	1.85	0.24	1.89	0.18	1.71	0.08	0.78	0.34	0.44
31D	181	2.04	0.31	1.73	0.24	1.58	0.25	1.33	0.07	0.89	0.25	0.64
36D	182	1.93	0.31	1.62	0.25	1.51	0.22	1.29	0.07	1.18	0.22	0.96
36D	193	1.68	0.26	1.42	0.21	1.71	0.14	1.57	0.08	NR	NR	--
37D	194	1.92	0.27	1.65	0.20	1.50	0.32	1.18	0.08	NR	NR	--
37D	216	1.95	0.29	1.66	0.23	1.73	0.52	1.21	0.07	NR	NR	--
38D	217	1.52	0.26	1.26	0.22	0.47	0.20	0.27	0.07	0.47	0.20	0.27
38D	243	2.19	0.31	1.88	0.22	1.68	0.16	1.52	0.07	0.54	0.26	0.28
39D	244	1.64	0.27	1.37	0.22	1.40	0.24	1.16	0.07	0.40	0.24	0.16
39D	263	2.11	0.30	1.81	0.22	1.68	0.32	1.36	0.07	1.20	0.40	0.80
40D	264	1.70	0.26	1.44	0.22	1.26	0.22	1.04	0.07	NR	NR	--
40D	287	1.88	0.32	1.56	0.28	1.60	0.26	1.34	0.07	1.60	0.26	1.34
41D	288	2.00	0.36	1.64	0.30	1.38	0.22	1.16	0.07	NR	NR	--
41D	301	1.64	0.29	1.35	0.25	1.46	0.14	1.32	0.08	0.68	0.22	0.46
47D	302	1.72	0.27	1.45	0.22	0.26	0.26	1.00	0.08	0.84	0.38	0.46
47D	305	1.84	0.27	1.57	0.22	1.20	0.17	1.03	0.07	1.20	0.40	0.80
52D	306	1.79	0.28	1.51	0.23	1.38	0.32	1.06	0.09	0.42	0.32	0.10
52D	319	2.20	0.30	1.90	0.22	1.70	1.21	1.49	0.07	NR	NR	--
53D	320	1.97	0.29	1.68	0.20	1.02	0.21	0.81	0.07	1.02	0.21	0.81
53D	338	2.12	0.25	1.87	0.20	1.54	0.24	1.30	0.07	0.86	0.26	0.60
54D	353	1.52	0.23	1.29	0.20	1.48	0.28	1.20	0.07	0.54	0.28	0.26
54D	373	2.08	0.27	1.81	0.21	1.68	0.39	1.29	0.07	0.74	0.39	0.35
55D	374	1.98	0.30	1.68	0.21	1.46	0.25	1.21	0.07	0.46	0.25	0.21

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Mission 1010-1 (Continued)

Pass	Frame	STELLAR				INDEX						
						Limiting				Terrain		
		Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta
55D	395	2.08	0.29	1.79	0.22	1.02	0.39	0.63	0.07	0.90	0.42	0.57
56AE	396	0.23	0.22	0.01	0.22	--	--	--	--	--	--	--
56D	397	1.74	0.27	1.47	0.23	1.22	0.18	1.04	0.07	NR	NR	--
56D	418	1.85	0.58	1.27	0.33	1.42	0.29	1.13	0.07	0.93	0.29	0.64
61D	419	2.03	0.49	1.54	0.28	1.42	0.24	1.18	0.07	0.52	0.24	0.28
61D	423	NR	NR	NR	NR	1.52	0.32	1.20	0.07	NR	NR	--

Mission 1010-2

65D	1	0.92	0.31	0.61	0.29	1.59	0.20	1.39	0.08	NR	NR	--
65D	2	3.34	0.32	3.02	0.30	1.60	0.20	1.40	0.08	NR	NR	--
68D	3	1.28	0.35	0.93	0.31	1.60	0.22	1.38	0.11	0.45	0.22	0.23
68D	19	1.38	0.35	1.03	0.32	1.40	0.20	1.20	0.10	0.46	0.20	0.26
69D	20	1.16	0.42	0.74	0.33	1.00	0.28	0.72	0.10	0.50	0.28	0.22
69D	51	1.41	0.43	0.98	0.30	1.43	0.28	1.15	0.10	0.54	0.28	0.26
70D	52	1.41	0.36	1.05	0.30	1.36	0.30	1.06	0.10	0.45	0.30	0.15
70D	74	1.32	0.42	0.90	0.36	1.54	0.28	1.26	0.08	0.55	0.28	0.27
71AE	75	0.34	0.30	0.04	0.29	--	--	--	--	--	--	--
71AE	76	0.32	0.30	0.02	0.30	--	--	--	--	--	--	--
71D	77	1.24	0.36	0.88	0.30	1.60	0.24	1.36	0.10	0.42	0.24	0.18
71D	100	1.09	0.34	0.75	0.31	0.92	0.40	0.52	0.10	0.92	0.40	0.52
84D	101	1.31	0.34	0.97	0.28	1.34	0.30	1.04	0.10	1.34	0.38	0.96
84D	132	1.08	0.34	0.74	0.30	1.44	0.23	1.21	0.08	0.46	0.23	0.23
85D	133	1.16	0.32	0.84	0.30	0.78	0.20	0.58	0.08	0.42	0.20	0.22
85D	165	1.12	0.34	0.78	0.30	1.55	0.18	1.37	0.09	0.70	0.22	0.48
86D	166	1.15	0.35	0.80	0.30	0.92	0.18	0.74	0.09	0.38	0.18	0.20
86D	188	1.36	0.37	0.99	0.32	1.66	0.22	1.44	0.08	1.61	0.32	1.29
87D	189	1.26	0.34	0.92	0.30	1.65	0.28	1.37	0.08	NR	NR	NR
87D	203	1.07	0.34	0.73	0.29	1.32	0.24	1.08	0.08	1.32	0.70	0.62
88D	204	1.25	0.34	0.91	0.30	1.34	0.28	1.06	0.08	0.42	0.28	0.14
88D	221	2.34	0.33	2.01	0.30	1.11	0.25	0.86	0.08	1.11	0.45	0.66
93D	222	1.48	0.39	1.09	0.31	1.34	0.26	1.08	0.08	0.44	0.28	0.16
93D	227	1.34	0.41	0.93	0.37	1.42	0.22	1.20	0.08	0.54	0.22	0.32
98D	228	1.96	0.35	1.61	0.29	1.36	0.12	1.24	0.08	0.45	0.28	0.18
98D	234	1.19	0.34	0.85	0.29	1.31	0.28	1.03	0.08	0.42	0.28	0.14
100D	235	1.23	0.34	0.89	0.29	1.10	0.14	0.96	0.08	1.10	0.36	0.74
100D	267	1.04	0.32	0.72	0.29	1.51	0.26	1.25	0.08	0.61	0.28	0.33
101D	268	1.29	0.36	0.93	0.29	1.22	0.30	0.92	0.08	0.52	0.34	0.18
101D	291	1.38	0.34	1.04	0.30	1.72	0.25	1.47	0.08	0.69	0.25	0.44
103AE	292	0.33	0.31	0.02	0.30	--	--	--	--	--	--	--
103AE	293	0.32	0.30	0.02	0.29	--	--	--	--	--	--	--
115D	294	1.42	0.37	1.05	0.31	1.38	0.19	1.19	0.08	0.34	0.21	0.13
115D	303	1.39	0.35	1.04	0.29	1.36	0.24	1.12	NR	NR	NR	--
116D	304	1.12	0.32	0.80	0.29	0.99	0.50	0.49	0.08	0.99	0.50	0.49
116D	329	1.01	0.32	0.69	0.29	1.34	0.26	1.08	0.08	0.42	0.26	0.16
117D	330	1.37	0.34	1.03	0.29	1.39	0.24	1.15	0.08	1.39	0.24	1.15
117D	353	1.40	0.32	1.08	0.28	1.51	0.25	1.26	0.08	1.51	0.25	1.26
118D	354	1.04	0.33	0.71	0.29	0.88	0.30	0.58	0.08	NR	NR	--
118D	382	1.10	0.31	0.88	0.29	0.92	0.40	0.52	0.08	0.92	0.40	0.52

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Mission 1010-2 (Continued)

Pass	Frame	STELLAR				INDEX						
						Limiting			Gross Fog	Terrain		
		Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta		Dmax	Dmin	Delta
131D	383	1.28	0.36	0.92	0.29	1.46	0.16	1.30	0.08	0.40	0.20	0.20
131D	389	1.20	0.34	0.86	0.30	1.29	0.32	0.97	0.08	0.58	0.32	0.26
133D	390	1.42	0.34	1.08	0.30	0.52	0.20	0.32	0.08	0.50	0.20	0.30
133D	413	1.27	0.34	0.93	0.30	1.50	0.22	1.28	0.08	1.09	0.35	0.74
134D	414	1.40	0.36	1.04	0.29	1.48	0.28	1.20	0.08	0.45	0.28	0.17
134D	429	1.29	0.34	0.95	0.29	0.94	0.45	0.49	0.08	0.94	0.45	0.49
142D	430	1.28	0.32	0.96	0.29	1.64	0.14	1.50	0.08	0.90	0.31	0.59
142D	432	1.18	0.32	0.86	0.29	0.89	0.24	0.65	0.08	0.89	0.24	0.65

NR = Denotes No Reading made.

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APPENDIX F. CLOUD COVER ANALYSIS

1. Introduction

This study represents a statistical analysis of the cloud cover on the photography of Mission 1010. 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 KEYHOLE 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 by 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 percent per pass." This value is determined by the summation of the products of category percentage in each pass and the mean cloud percentage for that category as established in Table 1. For example: if it is determined that the following percentages exist in a given pass:

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

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

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

Hence, 43.8 percent of this pass is cloud covered.

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TABLE 1. Cloud Cover Categories

Category Number	Percent of Cloud Cover	Description	Mean Cloud Percentage
1	Less than 10%	Clear	5%
2	10% - 25%	Small Scattered Clouds	17.5%
3	26% - 50%	Large Scattered Clouds	38%
4	51% - 99%	Broken or Connected Clouds	75%
5	100%	Complete Overcast	100%

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2. Cloud Cover Data

Percentage of Cloud Cover Categories by Passes
Mission 1010-1

Pass Number	1	2	3	4	5	Cloud Cover % Per Pass
4D	61.9	7.1	14.1	15.8	1.1	22.6
5D	18.4	3.6	5.4	59.9	12.7	61.2
6D	26.3	4.8	9.7	55.2	4.0	51.2
7D	66.9	2.5	4.5	19.6	6.5	26.7
9D	49.0	6.6	5.6	17.7	21.1	40.1
21D	18.7	4.0	4.6	71.3	1.4	58.3
22D	18.4	6.3	3.5	70.6	1.2	57.5
23D	21.7	4.8	8.3	59.6	5.6	55.4
25D	63.4	5.4	3.9	25.6	1.7	26.5
36D	15.3	8.0	30.6	46.1	0.0	48.4
37D	7.7	6.6	18.9	52.3	14.5	62.4
38D	67.8	4.6	8.2	18.8	0.6	22.0
39D	15.9	4.0	7.9	49.7	22.5	64.2
40D	48.0	3.1	12.0	35.5	1.4	33.5
41D	27.6	8.6	18.7	42.3	2.8	41.5
52D	0.5	4.8	13.4	49.1	32.2	75.0
53D	17.0	7.6	18.1	46.1	11.2	54.8
54D	4.5	4.6	12.8	52.3	25.8	70.9
55D	50.4	2.7	14.7	30.4	1.8	33.2
56D	46.6	2.7	5.2	33.8	11.7	41.8
	32.7*	4.9*	10.5*	42.9*	9.0*	47.6**

* Average Percentage by Category for Mission.
** Overall Mission Cloud Cover Percentage.

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Percentage of Cloud Cover Categories by Passes
Mission 1010-2

Pass	1	2	3	4	5	Cloud Cover % Per Pass
68D	10.3	13.1	17.2	51.8	7.6	55.8
69D	60.6	3.8	6.8	12.1	16.7	32.0
70D	11.4	10.8	17.4	49.1	11.3	57.2
71D	88.1	4.3	3.0	4.6	0.0	9.8
84D	8.5	16.3	28.8	39.4	7.0	50.8
85D	42.2	3.7	14.8	36.7	2.6	38.5
86D	45.5	14.1	15.2	25.2	0.0	29.4
87D	30.1	7.2	14.8	39.4	8.5	46.4
88D	34.1	10.0	31.8	24.1	0.0	33.6
98D	48.7	5.3	13.4	29.0	3.6	33.8
100D	25.3	11.2	22.2	35.3	6.0	44.1
101D	21.9	5.4	10.5	61.5	1.0	52.9
115D	37.7	13.0	18.8	22.5	8.0	36.2
116D	12.3	3.0	12.4	35.9	36.4	69.2
117D	21.9	9.9	25.4	41.1	1.7	45.1
118D	29.6	4.5	4.2	29.8	31.9	58.1
131D	49.5	7.6	10.3	29.5	3.1	32.9
133D	60.5	8.9	11.3	18.4	0.9	23.6
134D	63.1	0.5	4.9	31.5	0.0	28.7
	35.1*	8.2*	15.3*	32.5*	8.9*	42.3**

* Average Percentage by Category for Mission.
** Overall Mission Cloud Cover Percentage.

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APPENDIX B. MISSION COVERAGE STATISTICS

Summary of Plottable Photographic Coverage
Mission 1010-1
15-18 September 1964

COUNTRY	FWD Camera L/nm	FWD Camera Sq/nm	AFT Camera L/nm	AFT Camera Sq/nm	Combined Coverage L/nm	Combined Coverage Sq/nm
USSR	12,048	1,[illegible]37,012	11,487	1,573,882	23,535	3,216,8[illegible]
China	6,641	874,180	6,345	832,206	12,986	1,706,3[illegible]
Mongolia	636	87,970	675	93,454	1,311	181,4[illegible]
India	445	60,520	262	35,632	707	96,1[illegible]
Rumania	305	42,044	320	44,332	625	86,3[illegible]
Mexico	181	25,040	77	10,692	258	35,7[illegible]
Bulgaria	170	16,644	139	13,764	309	30,4[illegible]
N. VietNam	164	22,960	143	20,020	307	42,9[illegible]
Poland	164	22,960	181	25,340	345	48,3[illegible]
Nepal	125	17,000	84	11,424	209	28,4[illegible]
Kashmir	123	16,728	135	18,360	258	35,0[illegible]
Bhutan	94	12,784	90	12,240	184	25,0[illegible]
Hungary	94	13,160	82	11,480	176	24,6[illegible]
Yugoslavia	94	13,160	82	11,480	176	24,6[illegible]
Afghanistan	82	11,152	41	5,576	123	16,7[illegible]
Turkey	82	7,752	148	14,144	230	21,8[illegible]
Czechoslovakia	47	6,580	41	5,740	88	12,3[illegible]
Sweden	41	1,120	135	5,600	176	6,7[illegible]
Thailand	41	5,740			41	5,7[illegible]
N. Korea	20	1,360	74	5,032	94	6,3[illegible]
S. Korea	20	544	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL	21,617	2,896,410	20,541	2,750,398	42,158	5,646,8[illegible]
Continental US	868	116,052	934	125,200	1,802	241,2[illegible]
GRAND TOTAL	22,485	3,012,462	21,475	2,875,598	43,960	5,888,10[illegible]

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Summary of Plottable Photographic Coverage
Mission 1010-2
19-23 September 1964

COUNTRY	[illegible]/D Camera L/nm	[illegible]/D Camera Sq/nm	AFT Camera L/nm	AFT Camera Sq/nm	Combined Coverage L/nm	Combined Coverage Sq/nm
China	9,931	1,311,240	9,839	1,298,440	19,770	2,609,680
USSR	9,379	1,262,800	9,914	1,338,260	19,293	2,601,060
Mongolia	1,051	147,140	1,169	164,160	2,220	311,300
India	510	71,400	435	60,900	945	132,300
Egypt	246	27,580	205	22,960	451	50,540
Syria	234	32,760	189	26,460	423	59,220
Formosa	185	7,840	185	7,840	370	15,680
Nepal	176	24,640	158	22,120	334	46,760
Iran	150	21,000	150	21,000	300	42,000
N. Korea	107	12,040	107	12,040	214	24,080
S. Korea	107	4,480	107	4,480	214	8,960
[illegible]	82	4,620	82	4,620	164	9,240
[illegible]	82	1,120			82	1,120
[illegible]	51	7,140	47	6,580	98	13,720
Thailand	51	7,140	47	6,580	98	13,720
[illegible]	24	3,360	25	3,500	49	6,860
Pakistan	24	3,360			24	3,360
Total	22,390	2,948,660	22,659	2,999,940	45,049	5,949,600
Continental U.S.	380	53,200	380	53,200	760	106,400
GRAND TOTAL	22,770	3,002,860	23,039	3,053,140	45,809	6,056,000