Copy [redacted]
114 Pages

May 1965

TECHNICAL PUBLICATION

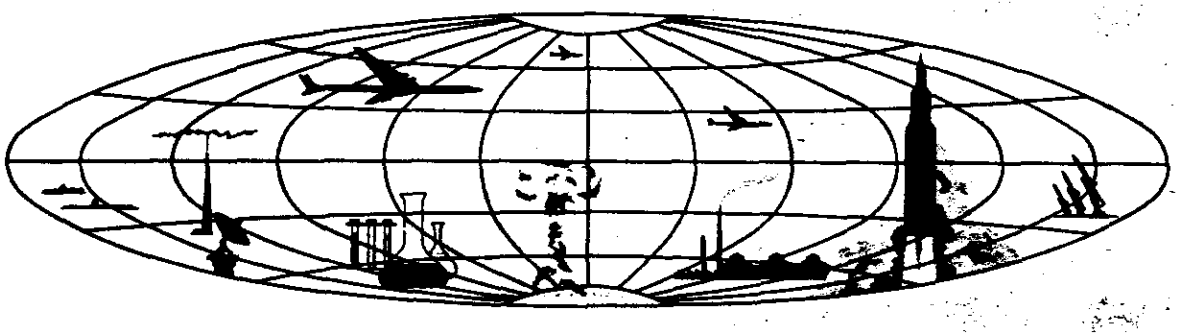
PHOTOGRAPHIC EVALUATION REPORT

MISSION 1011-1
5-9 OCTOBER 1964

[redacted]

WARNING

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER



[redacted]

TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT
MISSION 1011-1
5-9 OCTOBER 1964

May 1965

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

[redacted]

FIGURE 2. PHOTOGRAPH SHOWING EFFECTS OF NON-IMAGE FORMING LIGHT.

NPIC J-9469 (4/65)

This fog pattern occurs on the next-to-last frame of each Master camera operation.

[redacted]

TABLE OF CONTENTS

	Page
SYNOPSIS	1
GENERAL FLIGHT DATA	1
PART I. CAMERA OPERATIONS	2
1. Master (FWD) Panoramic Camera No 160	2
2. Slave (AFT) Panoramic Camera No 161	2
3. Horizon Cameras	3
4. Stellar Camera No 30	3
5. Index Camera No D30	4
6. Associated Equipment	4
PART II. FILM	5
1. Film Footage	5
2. Film Processing	5
3. Physical Film Degradations	5
4. Film Processing Curves	7
PART III. IMAGE QUALITY	14
1. Definition of Photographic Interpretation Suitability	14
2. PI Suitability, Mission 1011-1	15
3. Definition of Mission Information Potential (MIP)	16
4. MIP Rating for Mission 1011-1	17
5. Mensuration Data	18
APPENDIX A. SYSTEM SPECIFICATIONS	19
1. Cameras	19
2. Vehicle Layout	21
3. Format Layout	22
4. Format Dimensions	23
5. Horizon Camera Settings	26
APPENDIX B. DENSITY READINGS	27
1. Stellar Camera No 30	28
2. Index Camera No D30	29
APPENDIX C. MICRODENSITOMETRY	31
1. Edge Spread	31
2. Edge Traces, Mission 1011-1	33
APPENDIX D. SUMMARY OF VEHICLE TEMPERATURE	39

[redacted]

Page

APPENDIX E. CLOUD COVER ANALYSIS 52
1. Introduction 52
2. Cloud Cover Data, Mission 1011-1 53

APPENDIX F. MISSION COVERAGE STATISTICS. 55
1. Summary of Plottable Photographic Coverage, Mission 1011-1 . 55
2. Mission Coverage Tracks, Mission 1011-1. 57

[redacted]

LIST OF ILLUSTRATIONS

		Page
Figure 1.	Description of Photographic Data	4a
Figure 2.	Photograph Showing Effects of Non-Image Forming Light	4c
Figure 3.	Photograph Showing Effects of Non-Image Forming Light	4e
Figure 4.	Photograph Showing Effects of Non-Image Forming Light	4g
Figure 5.	Photograph Showing Equipment Shadowgraph	4i
Figure 6.	Photograph Showing Effects of Soft Imagery	4k
Figure 7.	Stellar Frame Nos. 1, 2, and 3	4m
Figure 8.	Index Frame No. 153	4o
Figure 9.	Stellar Frame Nos. 405, 406, and 407	6a
Figure 10.	Photograph of the MIP Frame	18a
Figure 11.	Photograph of the Same Area as the MIP Frame From the Master (FWD) Material	18c
Figure 12.	Photograph of Good Quality Imagery (Master Camera) .	18c
Figure 13.	Photograph of Good Quality Imagery (Slave Camera) .	18g
Figure 14.	Indian Springs Resolution Target (Master Camera) . .	18i
Figure 15.	Indian Springs Resolution Target (Slave Camera) . .	18k
Figure 16.	Photograph Showing Area of Microdensitometric Trace	34a

[redacted]

SYNOPSIS

Mission 1011 (System J-3) was a two-part satellite photographic reconnaissance mission. A normal orbit was achieved and photographic coverage was accomplished between 5 and 9 October 1964. The cameras and associated equipment functioned properly, producing good quality photography comparable to Mission 1010. A monoscopic photographic mode was employed twice on the Slave Panoramic Camera during pass 38D. Clouds covered approximately 40.5 percent of the mission.

The recovery capsule from 1011-1 was retrieved by air catch during revolution 64. The cameras were reactivated on revolution 65 and continued to function through 12 October. Recovery of the second capsule, utilizing the normal recovery mode with life boat back-up, was attempted during revolution 112. The normal mode failed, and the life boat back-up could not be used due to the inability of the tracking station to transmit commands. Another attempt to recover the second capsule was unsuccessful during revolution 128. The photography recovered in the first capsule was assigned an MIP rating of 85.

GENERAL FLIGHT DATA

Date of Launch: 5 October 1964

Orbital Parameters

	Planned	Actual (Rev 37)
Period:	90.88 min	90.68 min
Perigee:	100 nm	98.29 nm
Perigee Latitude:	Not available	21.4 degrees N
Eccentricity:	0.02005	0.01978
Inclination Angle:	80 degrees	79.99 degrees
Apogee:	246 nm	241.96 nm

Recovery:
Mission 1011-1: 9 October 1964
Mission 1011-2: Not Recovered

[redacted]

PART I. CAMERA OPERATIONS

1. Master (FWD) Panoramic Camera No 160

The Master Panoramic Camera was operational throughout the mission. The last frame is number 87 on pass 57D. Several more frames of this pass would have been included in the second part of the mission if recovery had been successful. A small out-of-focus area occurs near the supply end of a few frames on passes 47DE and 52D. It varies slightly in size, shape, and degree of softness when it appears, and constitutes approximately 0.4 percent of each affected frame. Other degradations, which are considered minor, include:

a. A fine scratch appears just inside the format area, under the camera number, and just outside the format on the edge opposite the camera number. These scratches, approximately 2.5 inches long, are roughly parallel to the format edges and occur on each frame of photography from the Master Camera.

b. A wavering minus density streak, near the center of the film, occurs on the last three frames of 52D. This streak varies in width from 0.2 inch to 0.45 inch and is probably caused by foreign matter being present close to the aperture.

c. Non-image forming light caused fogged areas and shadowgraphs of equipment in the first, next-to-last, and last frame of all camera operations. A narrow diagonal fog streak from the non-frequency mark edge is evident on the third frame after a camera-on. A hook shaped fog streak is present in the fifth or sixth frame from the end of camera operation on passes 9D, 30D, 32D, 36D, 39D, 41D, and 52D.

2. Slave (AFT) Panoramic Camera No 161

The Slave Panoramic Camera was operational throughout the mission. The last frame, number 51 on pass 57D, is only a partial frame. Several more frames of this pass would have been included in the second part of the mission if recovery had been successful. Small out-of-focus areas occur on both ends of most frames during the mission. Those at the take-up end of the frame appear to be an extension of the bonus area. The affected portion covers an area approximately 0.5 percent in excess of the bonus area. The soft imagery on the supply end of each frame varies slightly in size, shape, and degree of softness. This affects approximately 2 percent of each frame near the bonus area. Other minor degradations include:

[redacted]

a. A fine scratch appears just inside the format, under the camera number, and just outside the format on the edge opposite the camera number. These scratches, approximately 2.5 inches long, are roughly parallel to the format edges and occur on each frame of photography.

b. A minus density streak, which follows the path of the field flattener, is present throughout passes 5D, 6D, 55D, 56D, 57D and on approximately the last 75 percent of passes 53D and 54D. This streak is caused by foreign matter on or near the field flattener.

c. Non-image forming light caused fogged areas and shadowgraphs on the last three or four frames of each pass.

3. Horizon Cameras

All Horizon Cameras were operational throughout the mission. The starboard looking frames of photographic passes that begin in the northernmost latitudes are underexposed on approximately the first 20 frames. Examples of this underexposure are on passes 6D and 19D. Density of the imagery varied according to the solar elevation.

4. Stellar Camera No 30

The Stellar Camera was operational throughout the mission. There are 415 titled frames of photography. Star images to the 6th magnitude can be detected and as many as 17 stars were used in some frames. Most stellar images are elongated and appear dumbell shaped, as reported on previous missions. Flare effects approximately 40 percent of each format. A number of streaks, multidirectional in pattern and varying in density, effected a majority of the stellar formats in various degrees. These have been reported as images of crystallized jettisoned fuel.

5. Index Camera No D30

The Index Camera was operational throughout the mission. There are 415 titled frames of good-quality index photography. The overall density of the index imagery appears slightly thin but adequate for use. The correlation lamps are slightly bloomed during normal illumination and they appear as a faint semicircle when not in operation.

[redacted]

6. Associated Equipment

This equipment records the technical information required for correlation and mensuration of the primary cameras.

Anomalies which occur with the associated equipment of this mission include:

The Master Panoramic Camera number and binary index lamp are slightly bloomed throughout the mission. There are two camera-off markers at most camera-off positions of the Slave Panoramic Camera, and at the end of pass 9AE of the Master Panoramic Camera. The Slave Panoramic Camera frequency-mark lamp malfunctioned on passes 36D, frames 5-8 and 42-43; 37D, frames 1-4; 38D, frames 1-8; 39D, frames 1-17; 40D, frames 1-7; 41D, frames 1-17; and 47DE, frames 1-5. At these instances the frequency mark lamp remained illuminated, making a continuous streak from a half to one frame in length. After pass 47DE the lamp resumed normal operation.

[redacted]

FIGURE 1. DEFINITION OF PHOTOGRAPHIC DATA.

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

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

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

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

Enlargement Factor: The enlargement factor is included to indicate the 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.

[redacted]

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.

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. PHOTOGRAPH SHOWING EFFECTS OF NON-IMAGE FORMING LIGHT.

NPIC J-9469 (4/65)

This fog pattern occurs on the next-to-last frame of each Master camera operation.

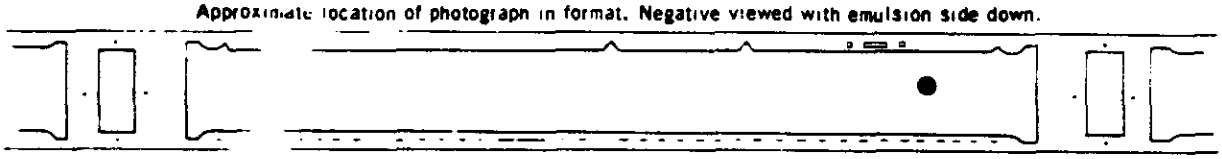
[redacted]

Camera	160 (Fwd)
Pass	9D
Frame	79
Date of Photography	6 Oct 64
Universal Grid Coordinates	71.5-12.0
Enlargement Factor	1.5X
Geographic Coordinates	41-32N 32-02E
Altitude (feet)	645,323
Vehicle:	
Pitch	15°16'
Roll	0°0'
Yaw	0°12'
Local Sun Time	1348
Solar Elevation	35°53'
Solar Azimuth	212°
Exposure	1 358

Approximate flight direction on photograph

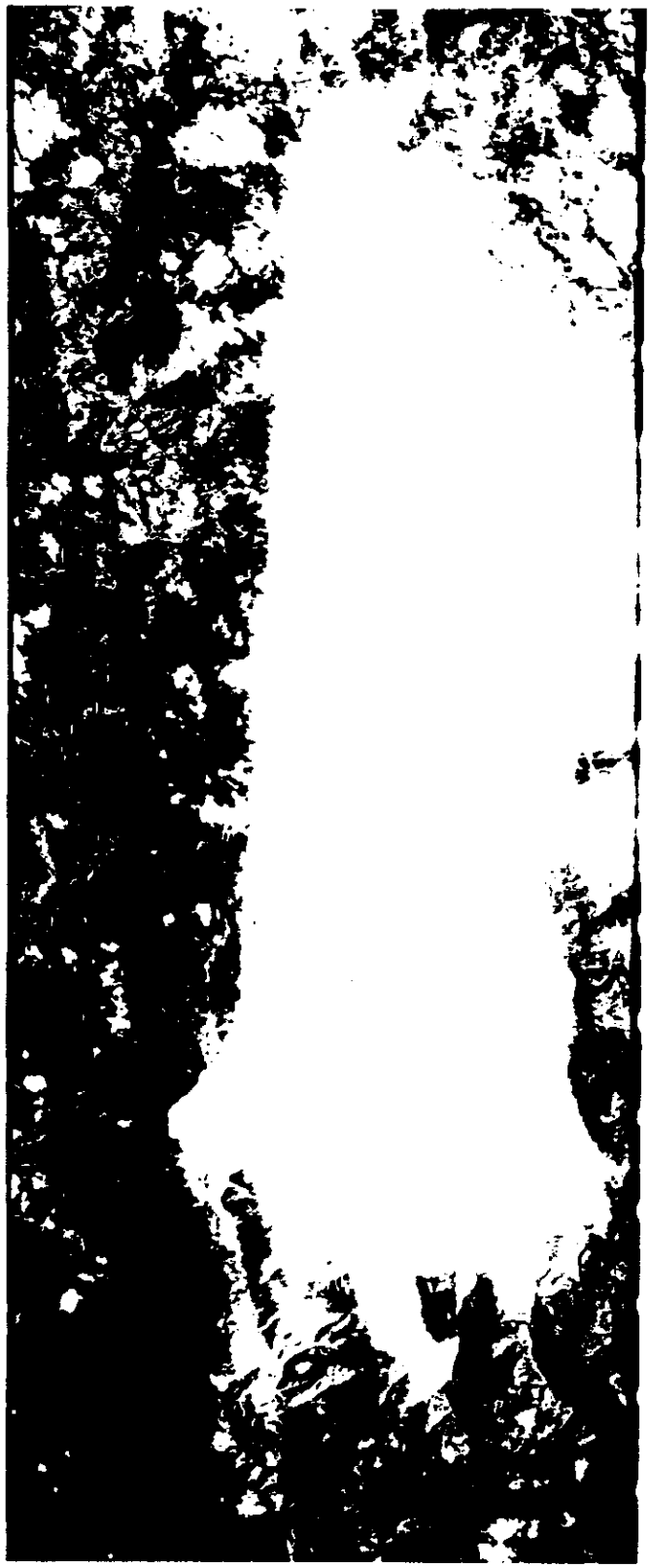
Approximate scan direction on photograph

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



[redacted]

Handle Via
TALENT-KEYHOLE
Control System Only



Handle Via
TALENT-KEYHOLE
Control System Only

[redacted]

[redacted]

FIGURE 3. PHOTOGRAPH SHOWING EFFECTS OF NON-IMAGE FORMING LIGHT.

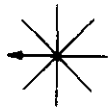
NPIC J-9470 (4/65)

This fog pattern occurs between the third and fourth frame from the end of each Slave camera operation.

[redacted]

[redacted]

Camera	161 (Aft)
Pass	9D
Frame	Between 76 and 77
Date of Photography	6 Oct 64
Universal Grid Coordinates	Not applicable
Enlargement Factor	2X
Geographic Coordinates	42-29N 031-44E
Altitude (feet)	645,394
Vehicle:	
Pitch	-14°46'
Roll	0°1'
Yaw	0°9'
Local Sun Time	1347
Solar Elevation	35°13'
Solar Azimuth	212°
Exposure	1/352



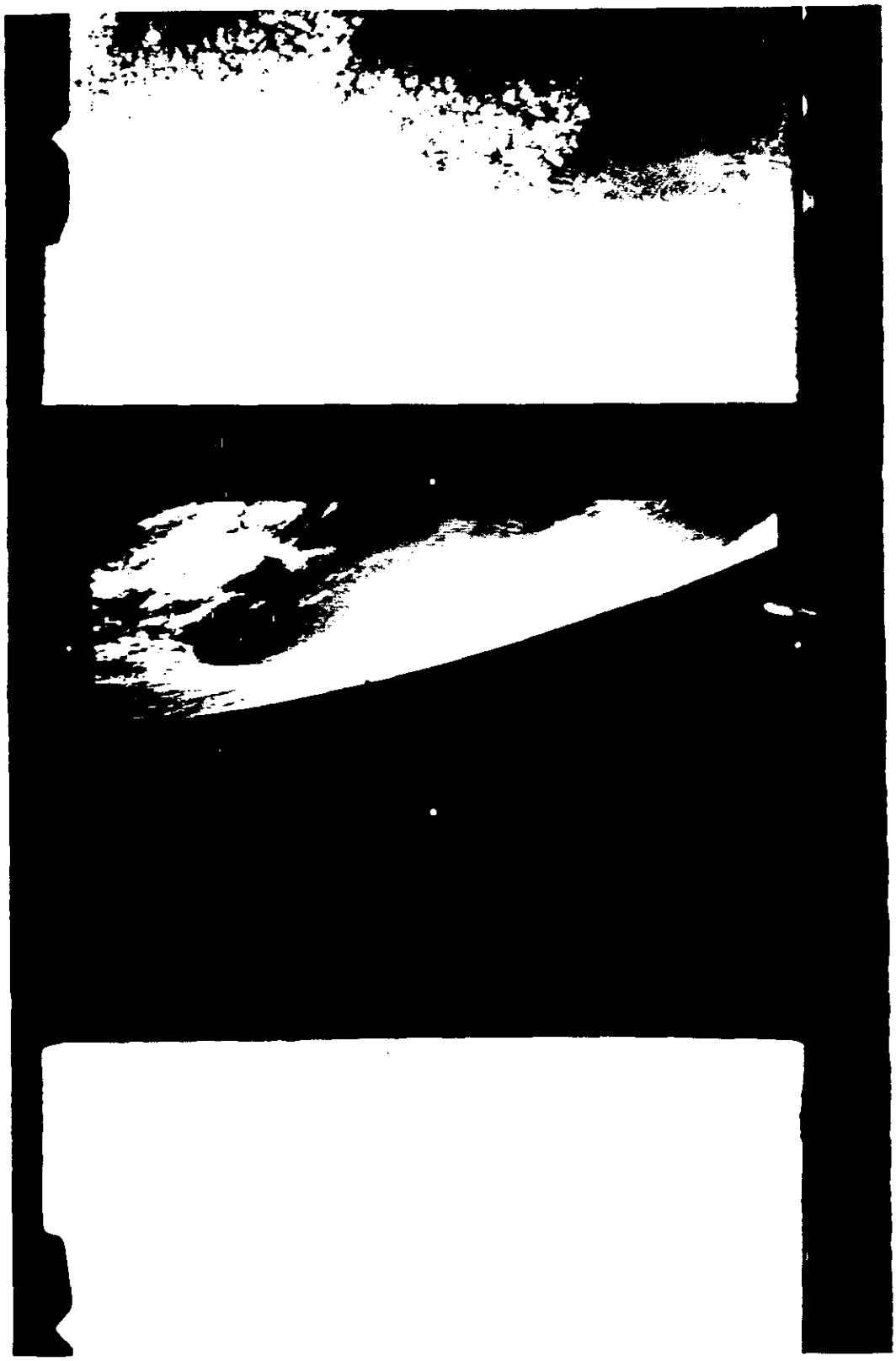
Approximate flight direction on photograph

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

[redacted]

[redacted]

Handle Via
~~TALENT-KEYHOLE~~
Control System Only



[redacted]

[redacted]

FIGURE 4. PHOTOGRAPH SHOWING EFFECTS OF NON-IMAGE FORMING LIGHT.

NPIC J-9471 (4/65)

This fog pattern occurs on the second frame from the end of each Slave camera operation.

[redacted]

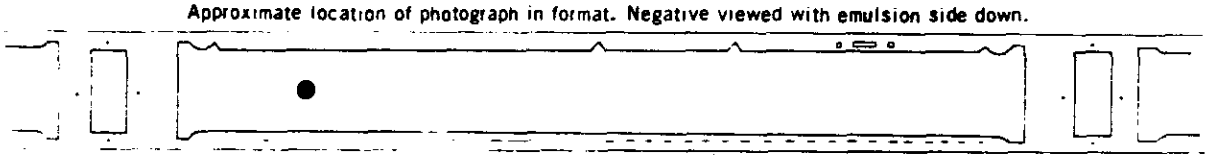
[redacted]

Camera	161 (Aft)
Pass	9D
Frame	78
Date of Photography	6 Oct 64
Universal Grid Coordinates	25.0-12.0
Enlargement Factor	2X
Geographic Coordinates	42-19N 031-46E
Altitude (feet)	644,781
Vehicle:	
Pitch	-14°45'
Roll	0°1'
Yaw	0°8'
Local Sun Time	1347
Solar Elevation	35°20'
Solar Azimuth	212°
Exposure	1/352

Approximate flight direction on photograph

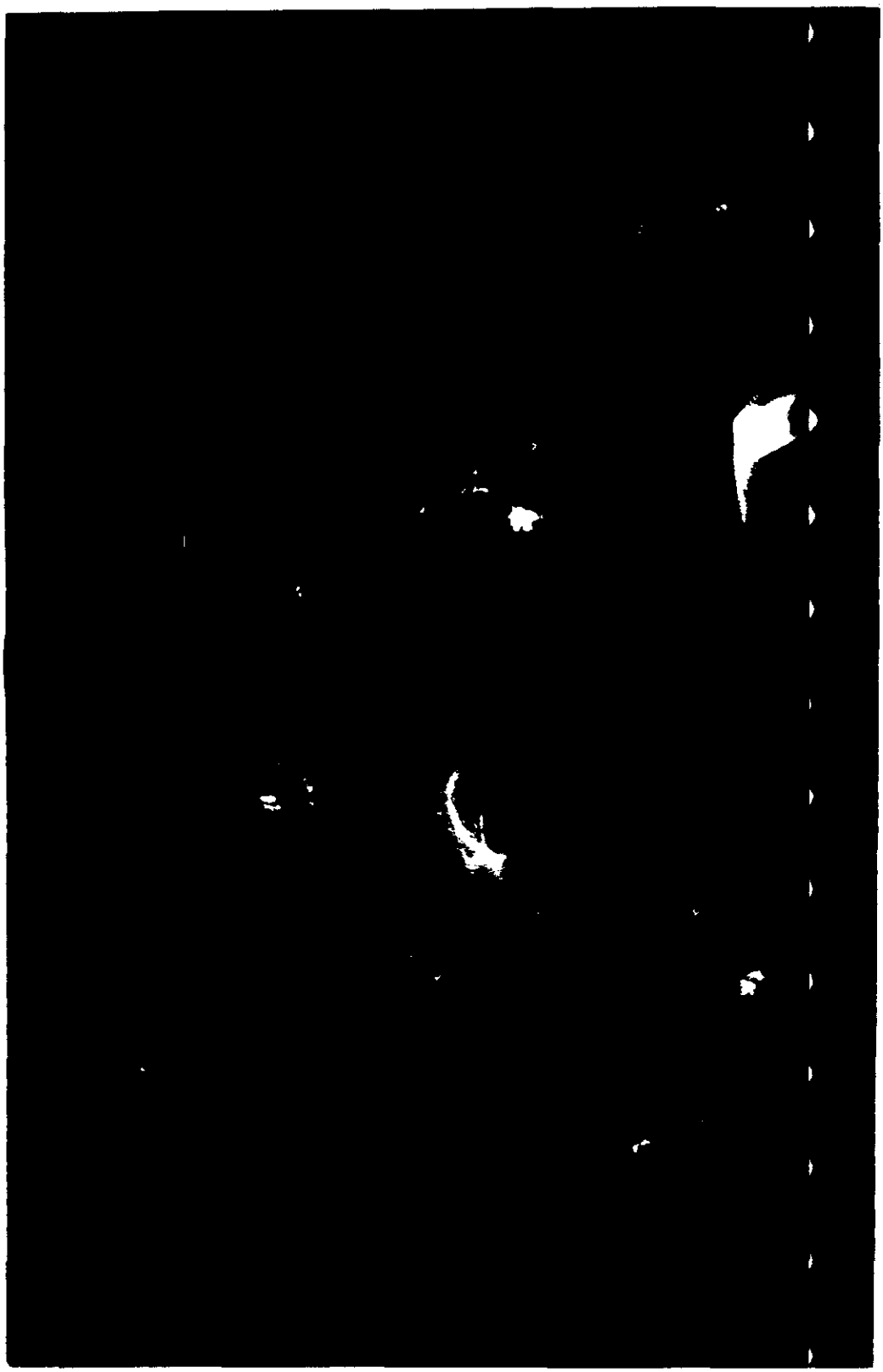
Approximate scan direction on photograph

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



Handle Via
TALENT KEYHOLE
Control System Only

[redacted]



Handle Via
TALENT KEYHOLE
Control System Only

[redacted]

[redacted]

FIGURE 5. PHOTOGRAPH SHOWING EQUIPMENT SHADOWGRAPH.

NPIC J-9472 (4/65)

This shadowgraph occurs on the last frame of each Slave camera operation.

[redacted]

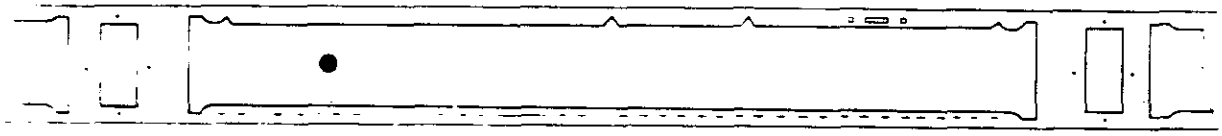
[redacted]

Camera	161 (Aft)
Pass	9D
Frame	79
Date of Photography	6 Oct 64
Universal Grid Coordinates	21.0 - 12.0
Enlargement Factor	2X
Geographic Coordinates	42-09N 031-49E
Altitude (feet)	644, 173
Vehicle:	
Pitch	Not Determined
Roll	Not Determined
Yaw	Not Determined
Local Sun Time	1347
Solar Elevation	35°27'
Solar Azimuth	212°
Exposure	1 352

Approximate flight direction on photograph

Approximate scan direction on photograph

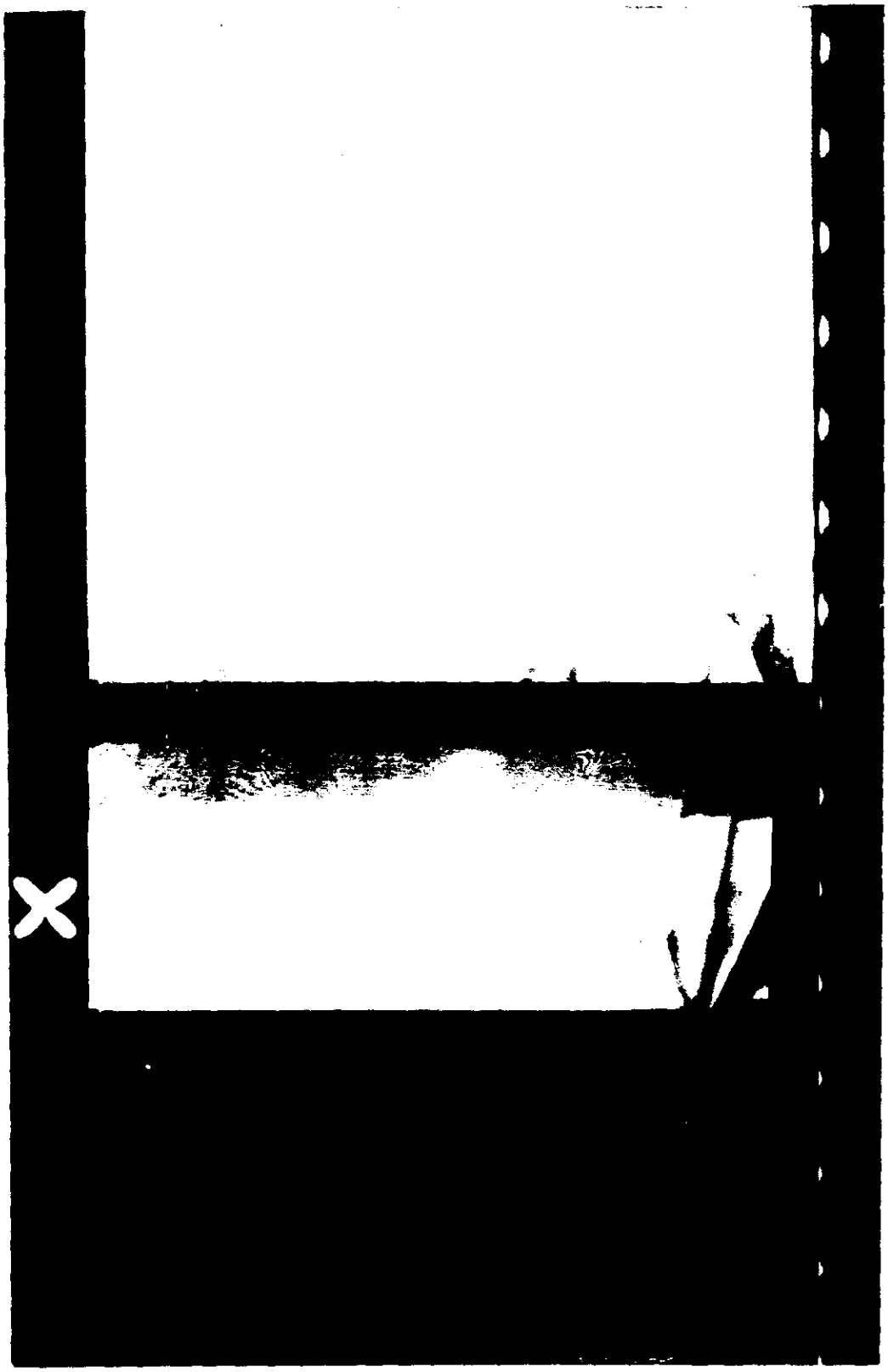
Approximate location of photograph in format. Negative viewed with emulsion side down.



[redacted]

Handle Via
TALENT KEYHOLE
Control System Only

[redacted]



Handle Via
TALENT-KEYHOLE
Control System Only

[redacted]

[redacted]

FIGURE 6. PHOTOGRAPH SHOWING EFFECTS OF SOFT IMAGERY.

NPIC J-9473 (4/65)

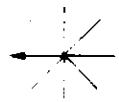
This degradation occurs on the supply end of each Slave camera frame.

[redacted]

[redacted]

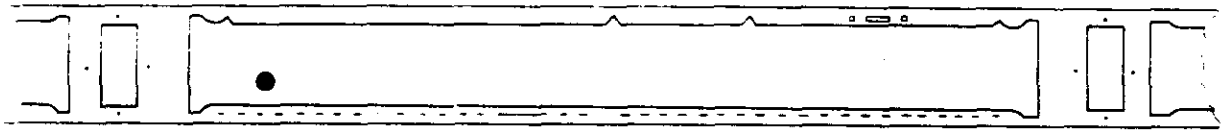
Camera	161 (Aft)
Pass	6D
Frame	35
Date of Photography	6 Oct 64
Universal Grid Coordinates	13.0-10.0
Enlargement Factor	10X
Geographic Coordinates	56-51N 94-51E
Altitude (feet)	718,897
Vehicle:	
Pitch	-14°24'
Roll	0°3'
Yaw	-0°9'
Local Sun Time	1323
Solar Elevation	24°24'
Solar Azimuth	158°
Exposure	1/322

Approximate flight direction on photograph



Approximate scan direction on photograph

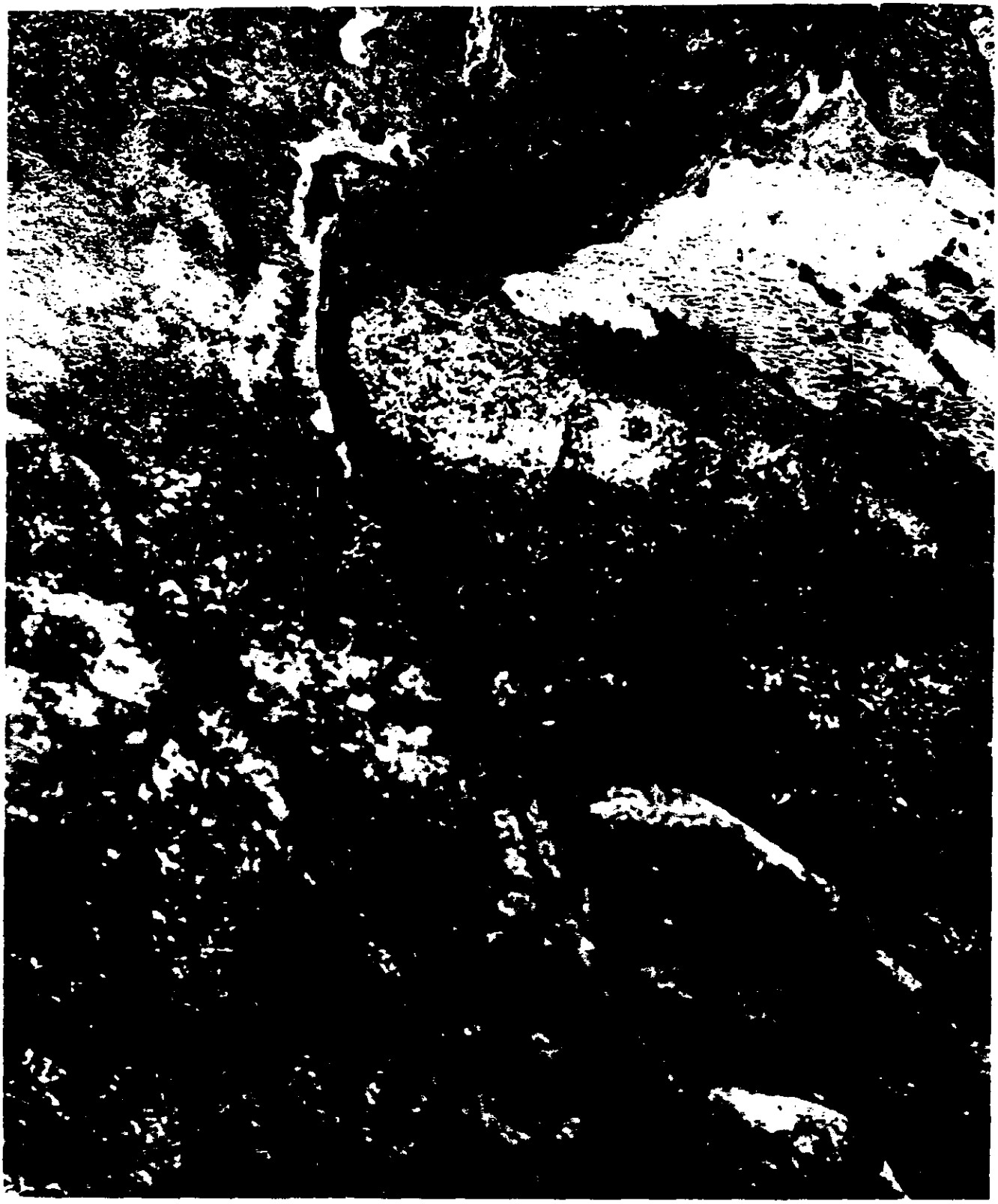
Approximate location of photograph in format. Negative viewed with emulsion side down.



[redacted]

Handle Via
~~TALENT-KEYHOLE~~
Control System Only

[redacted]



Handle Via
~~TALENT-KEYHOLE~~
Control System Only

[redacted]

FIGURE 7. STELLAR FRAME NOS. 1, 2, AND 3.

NPIC J-9474 (4/65)

This photograph shows the multidirectional streaks which are present in most frames. Note there is a date change between the middle and bottom frame.

[redacted]

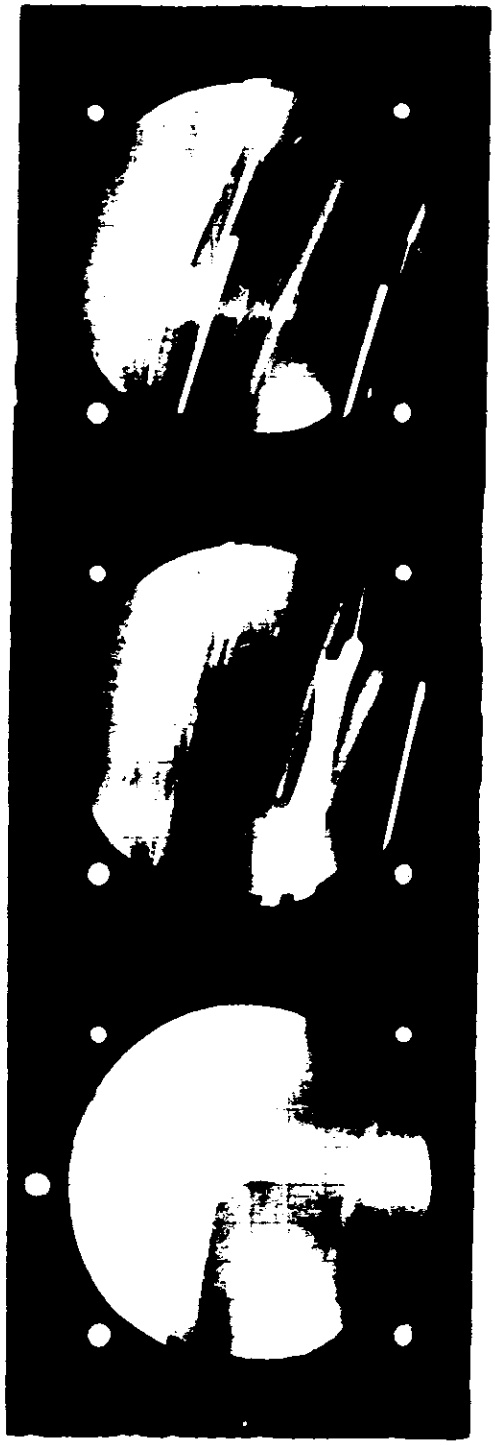
[redacted]

Stellar Frame Numbers	1, 2, and 3
Correlates with FWD Camera:	
Pass	1D - 5D
Frame	4, 11, & 17
Date of Photography	5, 6 Oct 64
Enlargement Factor	2X
Exposure Time	2.0 sec

[redacted]

Handle Via
TALENT-KEYHOLE
Control System Only

[redacted]



Handle Via
TALENT-KEYHOLE
Control System Only

[redacted]

FIGURE 8. INDEX FRAME NO. 153.

NPIC J-9475 (4/65)

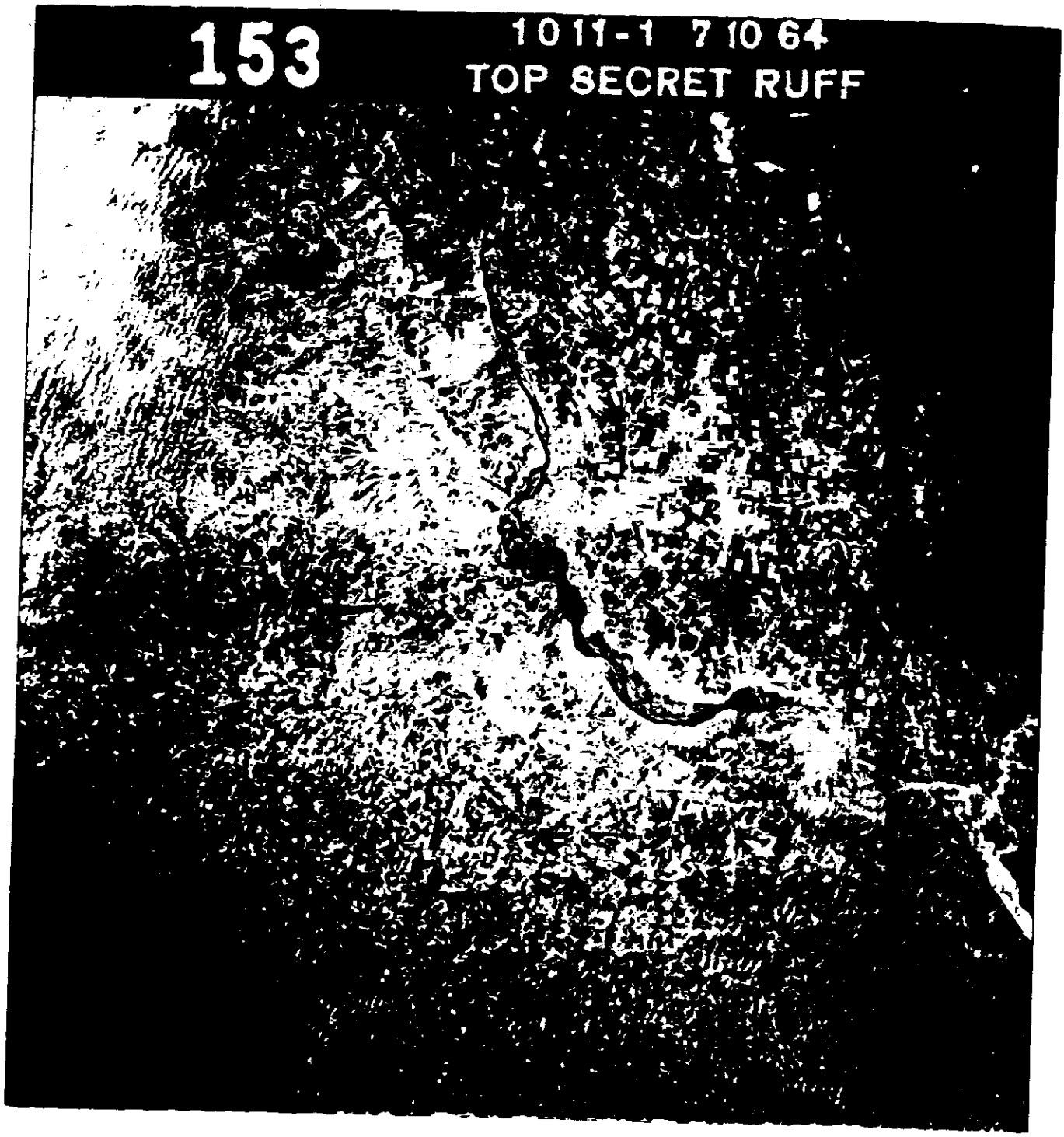
This photograph is an example of good image quality attained by the Index Camera. The panoramic film MIP frame falls within this area.

[redacted]

Index Frame Numbers	153
Correlates with FWD Camera:	
Pass	24D
Frame	73
Date of Photography	7 Oct 64
Enlargement Factor	3X
Exposure	1/500 sec

[redacted]

[redacted]



[redacted]

PART II. FILM

1. Film Footage: The film footage and the frames processed from each of the cameras employed in Mission 1011-1 are as follows:

CAMERA	FOOTAGE	FRAMES
Master Panoramic Camera No 160	8,112'	2,915
Slave Panoramic Camera No 161	8,138'	2,935
Stellar Camera No 30	20'	415
Index Camera No D30	107'	415

2. Film Processing: This section provides an evaluation of exposure, processing, and densities of the original negatives from the 8 cameras used in Mission 1011-1.

(a) The exposure was good throughout the mission.

(b) Infrared detection densitometry was employed to determine the optimum levels of development for the various portions of the mission. Twenty-six development level changes were made on the mission record from the master camera and 34 changes on the slave camera.

The following percentages were processed at the 3 possible levels:

LEVEL OF DEVELOPMENT	MASTER	SLAVE
Primary	2%	3%
Intermediate	23%	47%
Full	75%	50%

(c) The average density of this mission is better than on Mission 1010. However, a few frames processed at the full level of development contain minimum densities considered too thin for PI exploitation.

3. Physical Film Degradations: This section provides an evaluation of the non-camera induced physical film degradations of the original negative from Mission 1011.

(a) Master Camera: Edge fog along the frequency mark of the film occurs intermittently on passes 19D, 20D, 40D, 41D, 47DE, and 52D through 57D. Static electrical discharges of undetermined origin caused minor dendritic-type fogging along the frequency mark edge of the film on pass 39D, frames 148 through 151. Base scratches are

[redacted]

present intermittently on passes 1D, 6D, 24D, 37D, 47DE, and 57D. Emulsion scratches are present intermittently on passes 21D and 57D. Minus density comets are observed on pass 5D, frame 65, and pass 39D, frames 14 and 15. Handling marks, such as glove prints and crimps, occur on pass 6D, frame 103, and pass 53D, frame 86. Title information placed on the original negatives is partially removed on a number of frames on passes 30D, 54D, 55D, and pass 22D, frame 170. Foreign matter is noted on pass 47DE, frames 5, 6, and 7. A manufacturer's splice is present in frame 9 of pass 40D.

(b) Slave Camera: Edge fog along the non-frequency mark edge of the film occurs on the second frame of passes 30D and 52D and intermittently on passes 37D and 57D. Static electrical discharges of undetermined origin caused minor dendritic-type fogging along the frequency mark edge of the film on pass 5D. Minus density comets are observed on passes 6D, frame 3; 9D, frame 53; 25D, frame 15; and 36D, frame 120. Foreign matter and lifted emulsion occur on a few frames of passes 5D, 6D, and 14D. Passes 21D and 24D contain handling marks (fingerprints). Scratches on the base and emulsion side of the film are present intermittently on pass 30D and on pass 6D, frames 25 through 29. The original negative of pass 36D, frames 48 through 51, was severely damaged and partially repaired prior to this evaluation and after leaving the initial processing site. This damage consists of tears, wrinkles, emulsion digs and scrapes, portions of titling removed, numerous scratches, and several unrepaired holes. Manufacturer's splices are placed in passes 6D, frame 17, and 37D, frame 180.

(c) Stellar Camera: A group of small electrical discharges caused minor fogging between each frame of the mission. These discharges vary in intensity and in several instances, near the end of the mission, they become severe. Edge fog, along the film edge opposite the camera number, occurs intermittently throughout. The entire mission contains numerous base and emulsion scratches parallel to the film edges. These scratches are mostly attributed to film handling during data reduction. The film of the last 80 frames contain fine emulsion cracks, perpendicular to the film's edges and extending from end to end.

(d) Index Camera: There are several intermittent scratches, outside the format area, along the camera number edge.

[redacted]

FIGURE 9. STELLAR FRAME NOS. 405, 406, AND 407.

NPIC J-9476 (4/65)

This photograph shows the static discharges which occur between the stellar formats during this mission.

[redacted]

[redacted]

Stellar Frame Numbers	405, 406, and 407
Correlates with FWD Camera:	
Pass	56D
Frame	60, 67, and 74
Date of Photography	9 Oct 64
Enlargement Factor	2X
Exposure Time	2.0 sec

[redacted]

[redacted]

[redacted]

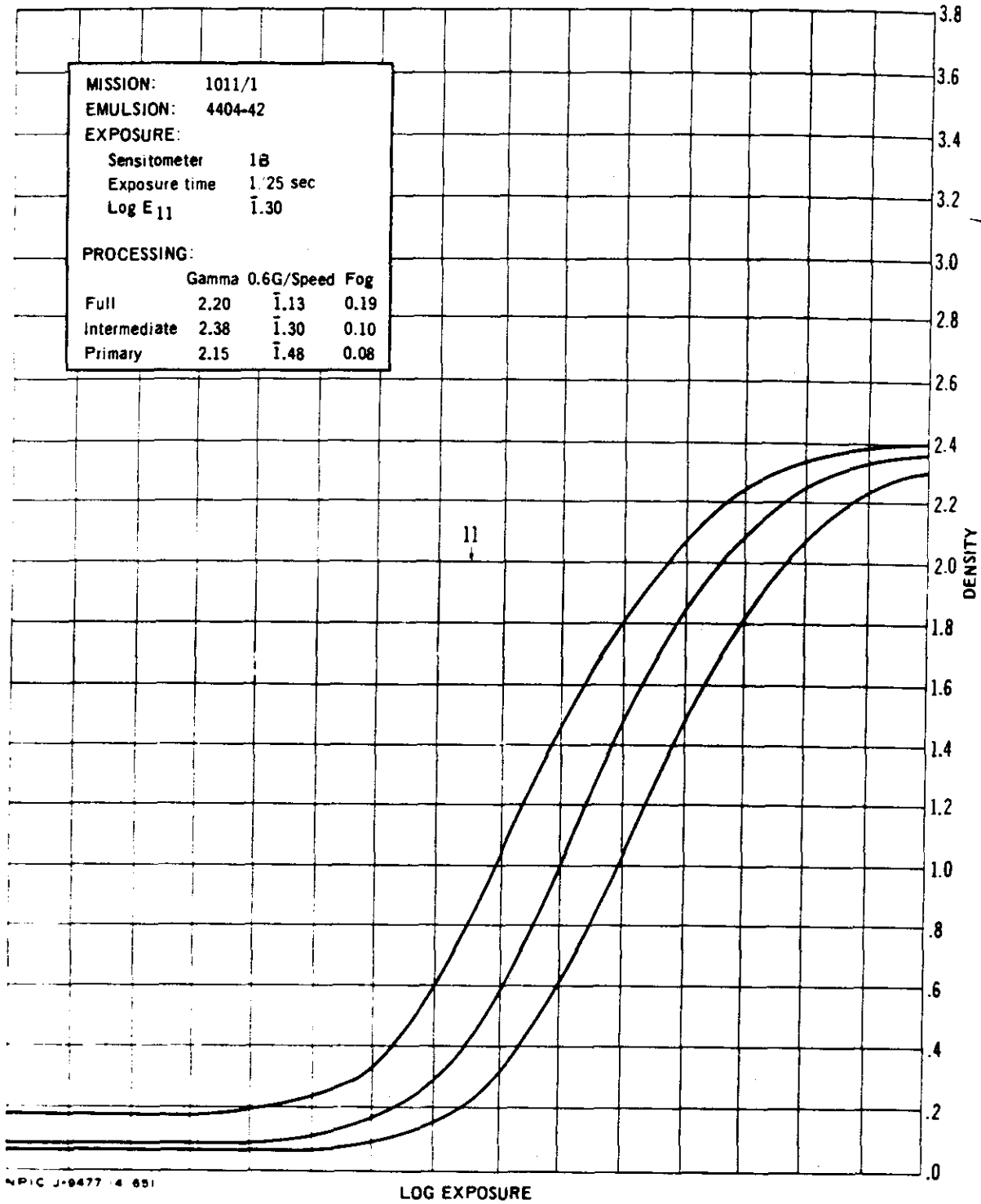
[redacted]

4. Film Processing Curves: The following processing curves are a product of the processing contractor:

[redacted]

[redacted]

STANDARD PROCESSING CONTROL CURVES



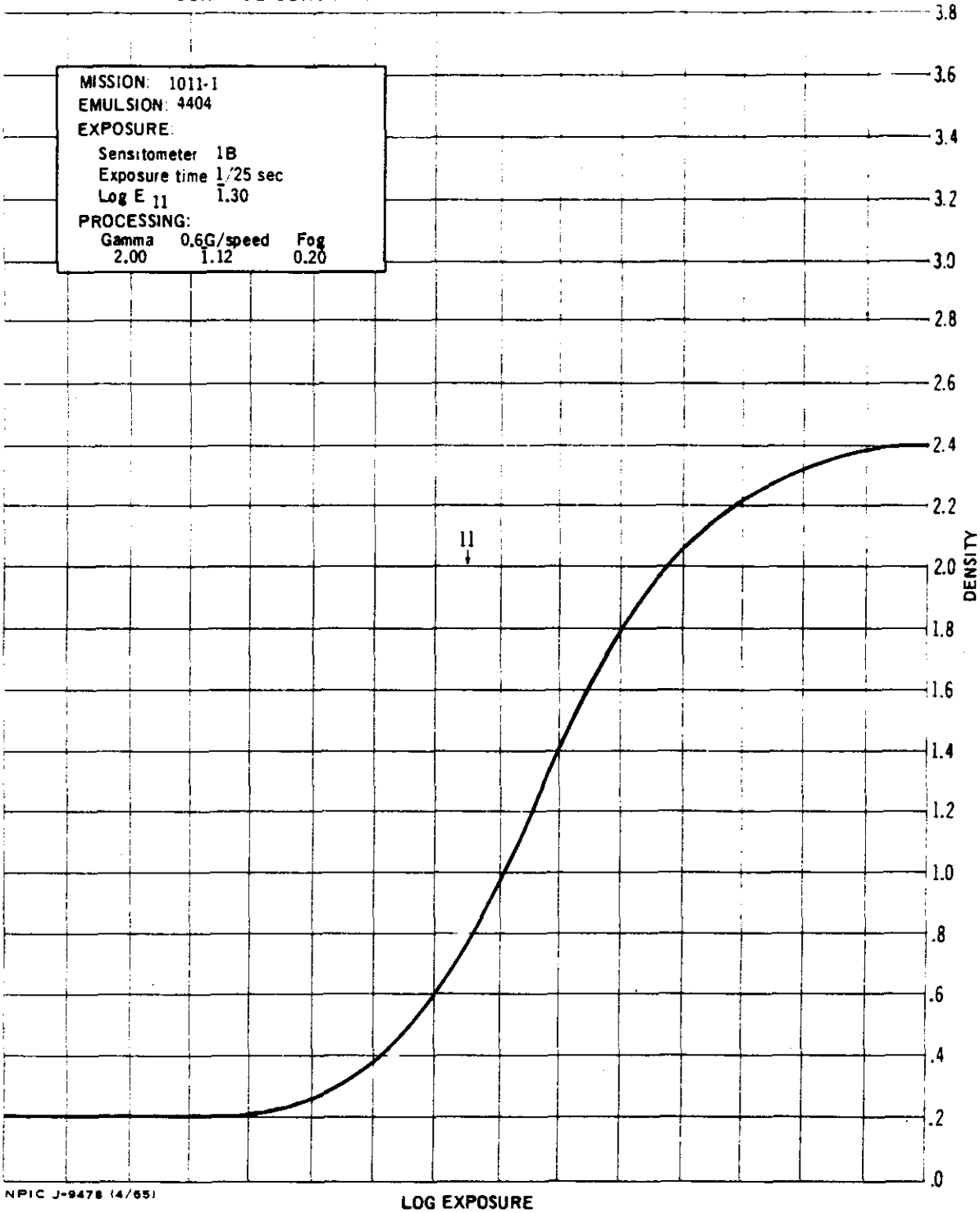
NPIC J-9477 4 65

[redacted]

Handle Via
~~TALENT-KEYHOLE~~
Control System Only

[redacted]

CONTROL CURVE FOR HEAD AND TAIL OF MISSION MATERIAL

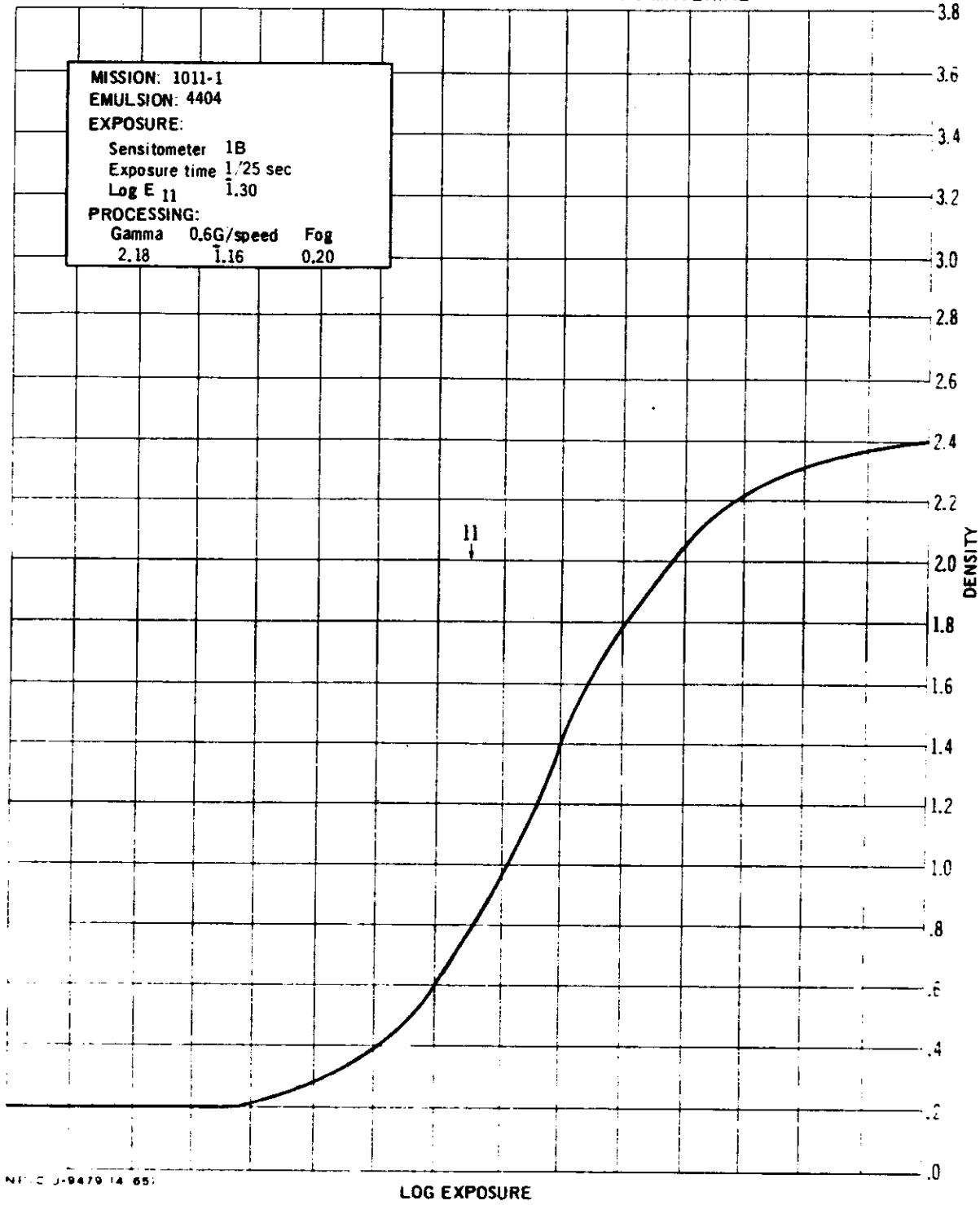


NPIC J-9478 (4/65)

Handle Via
~~TALENT-KEYHOLE~~
Control System Only

[redacted]

CONTROL CURVE FOR HEAD AND TAIL OF AFT MATERIAL

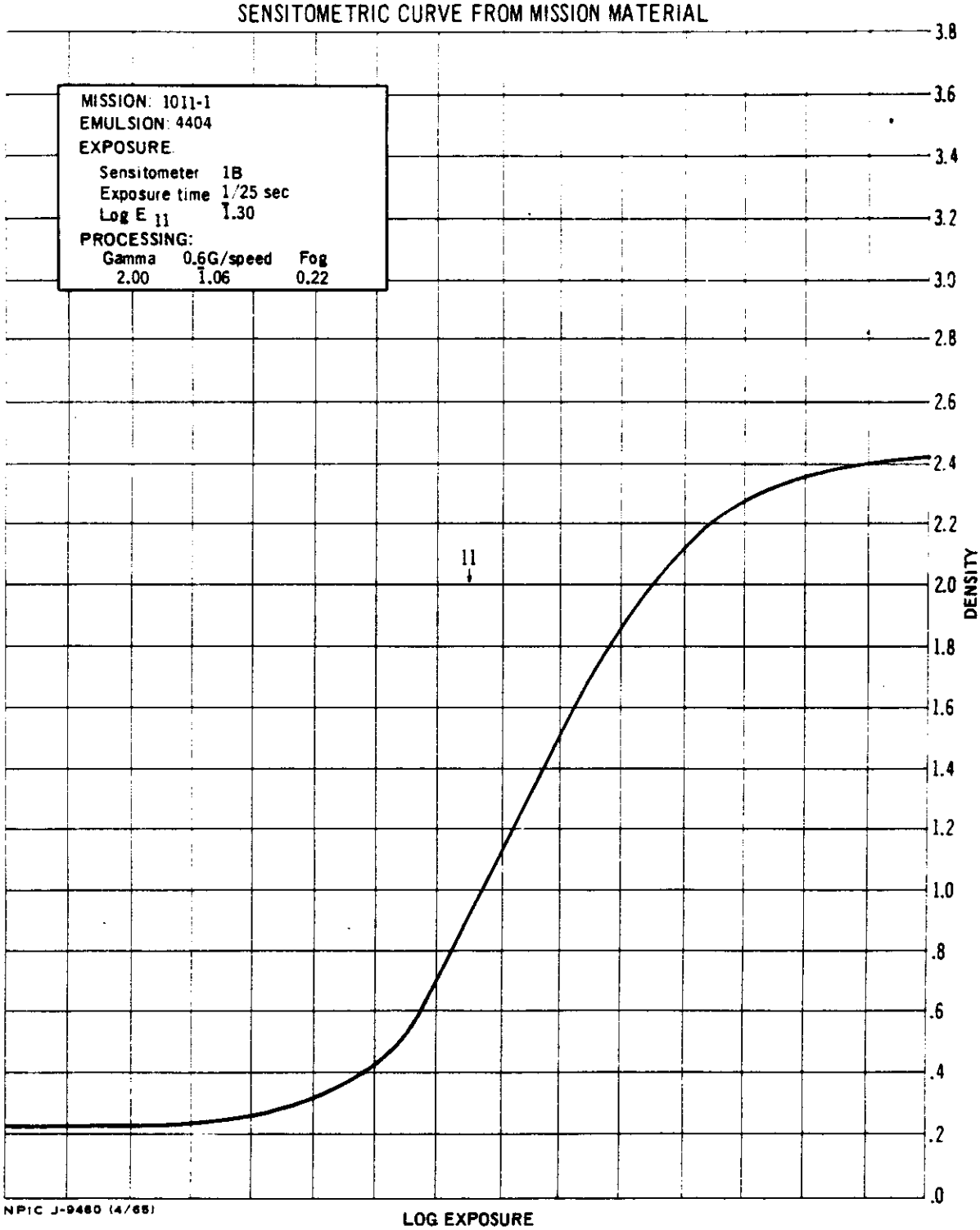


[redacted]

SENSITOMETRIC CURVE FROM MISSION MATERIAL

MISSION: 1011-1
EMULSION: 4404
EXPOSURE
Sensitometer 1B
Exposure time 1/25 sec
Log E 11 1.30
PROCESSING:

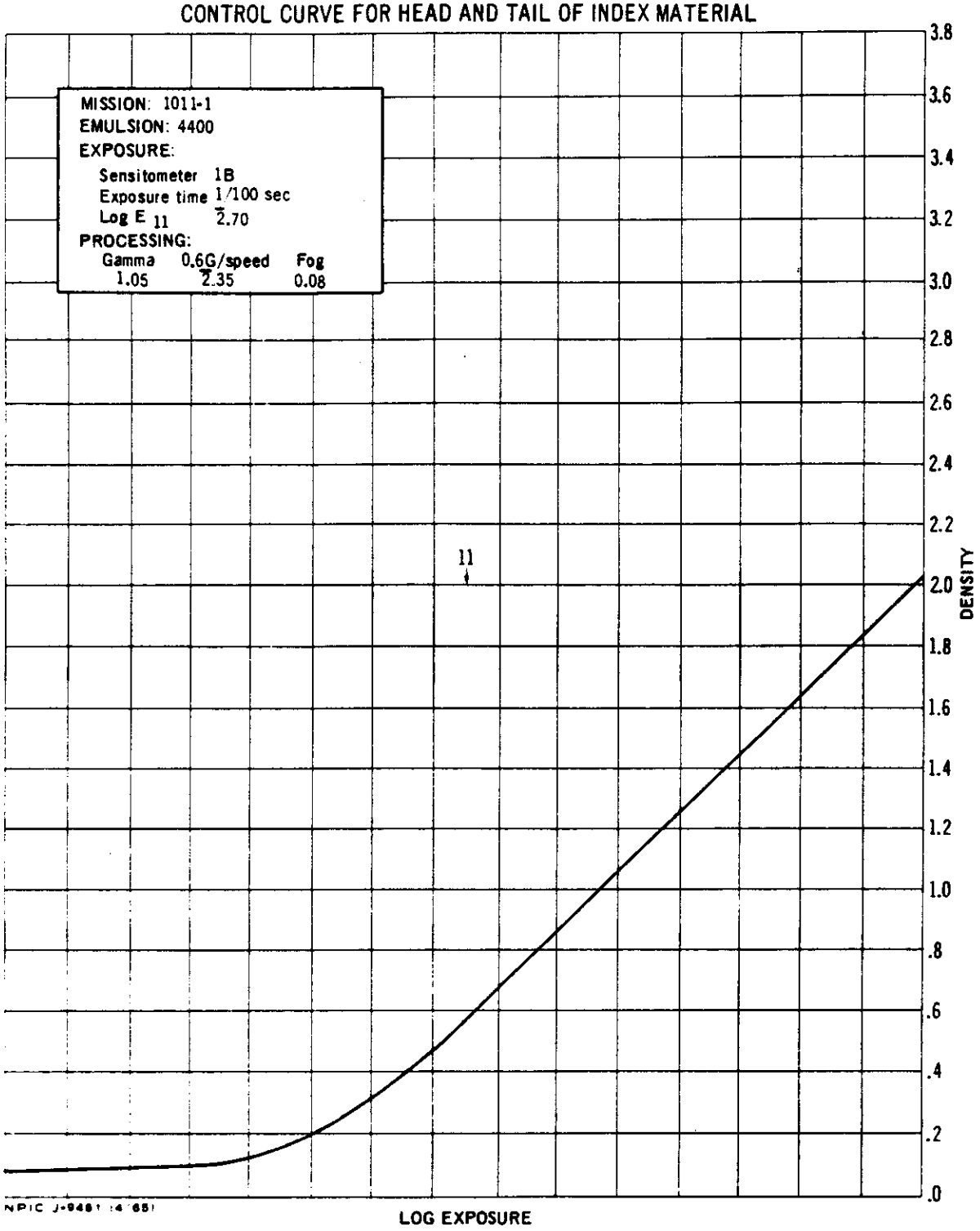
Gamma	0.6G/speed	Fog
2.00	1.06	0.22



NPIC J-9460 (4/65)

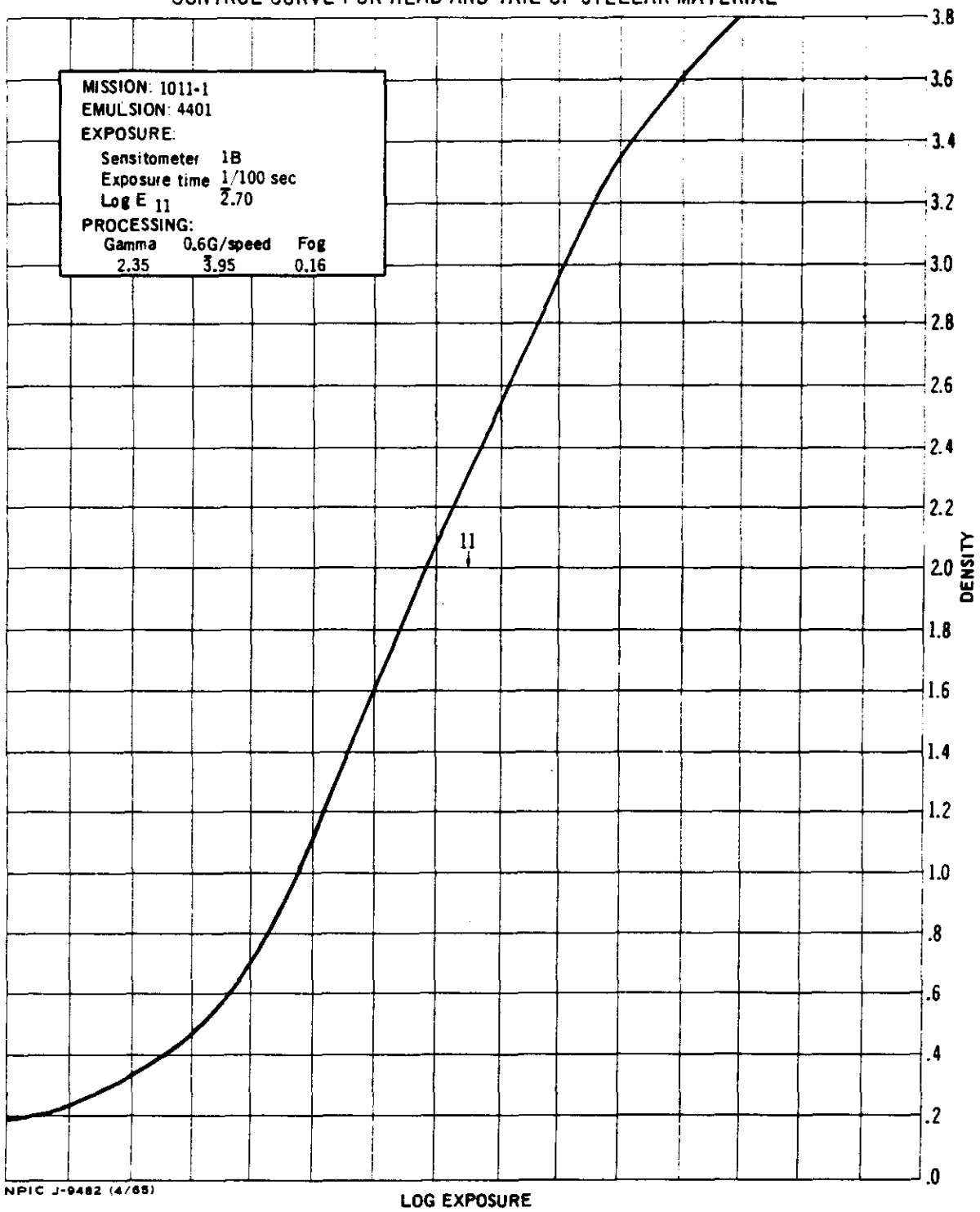
[redacted]

CONTROL CURVE FOR HEAD AND TAIL OF INDEX MATERIAL



[redacted]

CONTROL CURVE FOR HEAD AND TAIL OF STELLAR MATERIAL



NPIC J-9482 (4/65)

[redacted]

PART III. IMAGE QUALITY

1. Definition of Photographic Interpretation Suitability

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

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

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

[redacted]

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

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

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

2. PI Suitability for Mission 1011-1

The PI suitability is good for Mission 1011-1. Photographic interpreters reported on 117 priority and 13 bonus targets in the preliminary read-out. Twelve of these targets were reported as poor quality due to obliquity and haze, while several other targets were degraded by atmospherics.

It should be noted that the preliminary report represents the initial scan results only. More detailed study of the photography may develop additional information or may necessitate alteration of portions of the preliminary report.

The time of the launch and the inclination angle of the orbit were selected to produce optimum photographic coverage of the targets of interest. Since the majority of the targets of interest are between 40 degrees and 60 degrees north latitude, the combination of launch time and inclination angle located the sun on the western (starboard) side of the vehicle slightly forward of the beam of the vehicle at this time of day at these latitudes. Generally, this caused a variance in illumination across the format of most frames. The forward-looking camera starts taking the photograph of the terrain on the starboard side with the principal ray facing the light source.

[redacted]

When it completes the scan the rays of the sun are at right angles to the principal ray. The aft-looking camera starts taking the picture of the terrain on the port side with the principal ray facing away from and approximately parallel with the rays of the sun. When it completes the scan the rays of the sun are at right angles to the principal ray. This causes targets that are to be viewed in stereo to have radically different lighting, which may be beneficial for viewing some targets and detrimental for others. Examples are found on pass 21D, frames 55 FWD and 60 AFT. "Special" printing of 14 parts of the mission minimized the difference in contrast and density in the reproduction of the duplicate positives and no major complaints were voiced by the interpreters.

HIGHLIGHTS OF THE MISSION:

(a) One hundred-thirty targets were observed in the material from Mission 1011-1.

(b) Six newly identified launch sites were observed.

(c) A solid propellant test facility was reported as incomplete and not yet operational.

(d) A readout was made on a nuclear test site.

(e) Two missile test centers were observed with no apparent change in their facilities.

(f) Good, clear coverage reveals details of an atomic energy complex not previously reported.

3. Definition of Mission Information Potential (MIP)

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

[redacted]

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

Criteria for selection of the MIP frame:

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

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

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

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

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

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

g. Select frames having near optimum solar elevation.

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

4. MIP Rating for Mission 1011:

Pass 24D, frame 74 AFT, has been selected as the MIP frame for Mission 1011. It has been assigned an MIP rating of 85 (comparable to Mission 1010). The information potential of the area acquired by the FWD camera (frame 71) is almost comparable to the MIP frame.

[redacted]

5. Mensuration Data

The measurements in this analysis on Mission 1011-1 were accomplished with a one micron NRI comparator and found to be 0.53 percent or less in error. The accuracy of the mensuration was verified on domestic coverage where dimensions and reliable vehicle altitudes were available.

MEASURED OBJECTS and THEIR RESPECTIVE ERRORS

OBJECT	ACTUAL SIZE (ft)	MEASURED SIZE (ft)	ERROR %
Runway	5500	5471	0.53
Runway	6921	6940	0.27

[redacted]

FIGURE 10. PHOTOGRAPH OF THE MIP FRAME.

NPIC J-9483 (4/65)

The following photograph has been selected from the MIP frame of Mission 1011. Note the aircraft in flight off the end of the runway.

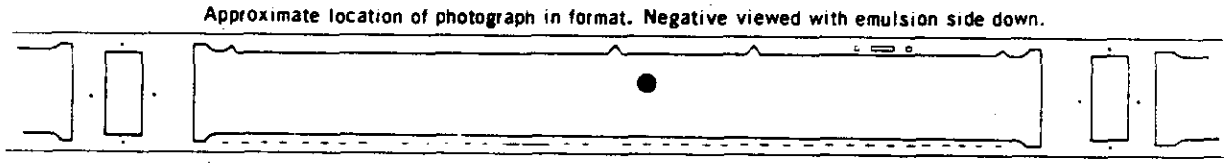
[redacted]

Camera	161 (Aft)
Pass	24D
Frame	74
Date of Photography	7 Oct 64
Universal Grid Coordinates	43.7-14.3
Enlargement Factor	20X
Geographic Coordinates	51-32N 46-05E
Altitude (feet)	670,708
Vehicle:	
Pitch	-15°14'
Roll	-0°3'
Yaw	0°19'
Local Sun Time	1324
Solar Elevation	28°50'
Solar Azimuth	203°
Exposure	1/347

Approximate flight direction on photograph

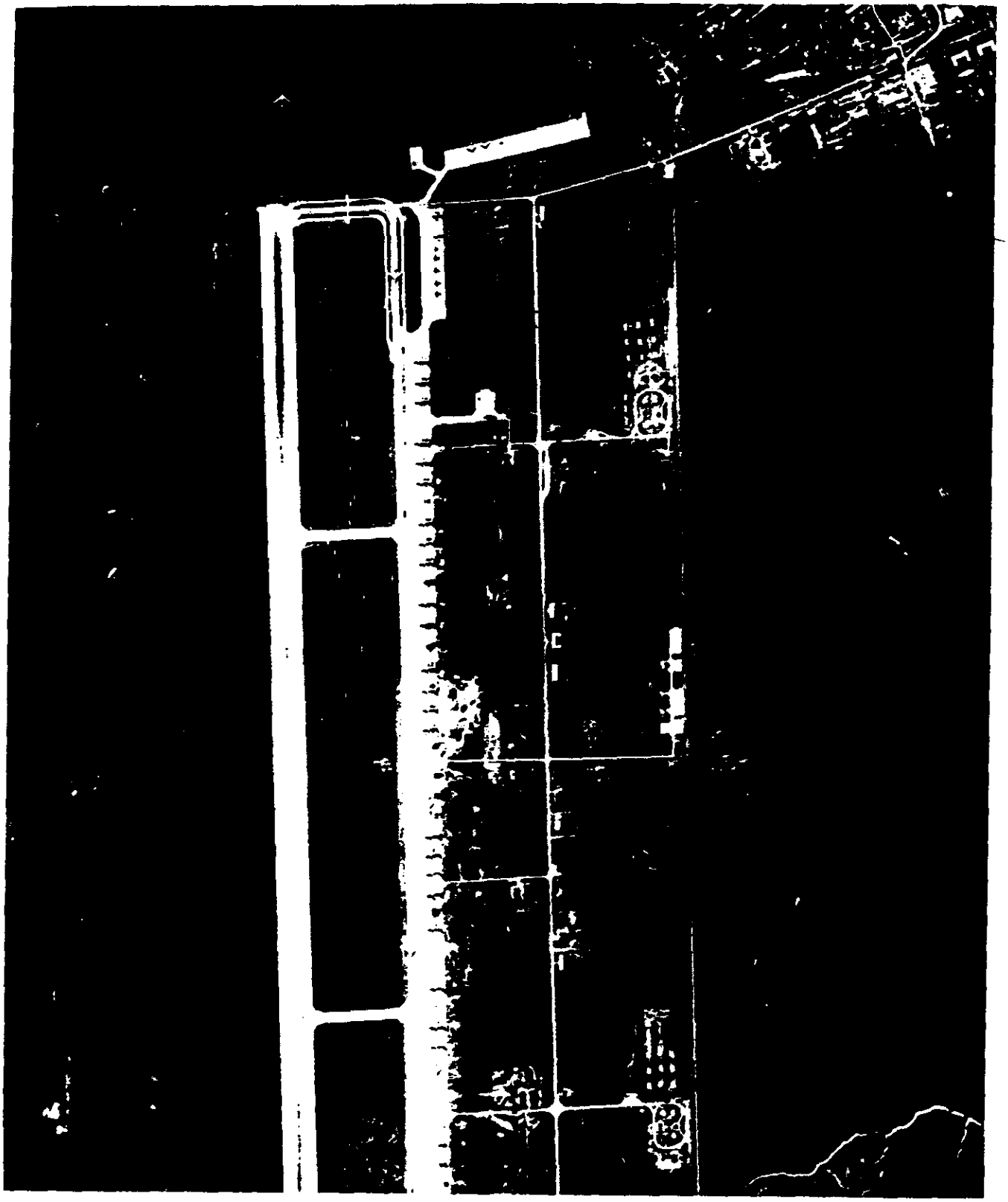
Approximate scan direction on photograph

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



Handle Via
TALENT-KEYHOLE
Control System Only

[redacted]



Handle Via
TALENT-KEYHOLE
Control System Only

[redacted]

FIGURE 11. PHOTOGRAPH OF THE SAME AREA AS THE MIP FRAME FROM THE MASTER (FWD) MATERIAL.

NPIC J-9484 (4/65)

The following photograph has been selected to show the comparative quality of the Master (FWD) material to the MIP frame of the Slave (AFT) material.

[redacted]

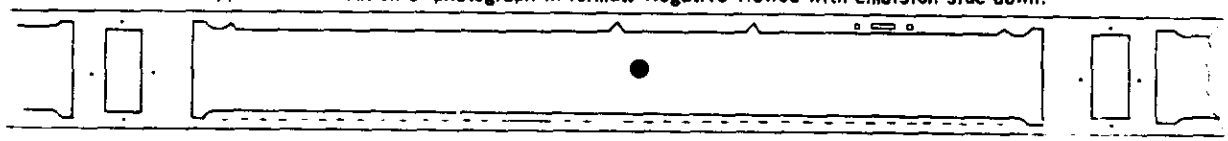
[redacted]

Camera	160 (Fwd)
Pass	24D
Frame	71
Date of Photography	7 Oct 64
Universal Grid Coordinates	47.0-11.9
Enlargement Factor	20X
Geographic Coordinates	51-29N 46-09E
Altitude (feet)	674,791
Vehicle:	
Pitch	14°46'
Roll	-0°11'
Yaw	0°24'
Local Sun Time	1324
Solar Elevation	28°53'
Solar Azimuth	203°
Exposure	1/353

Approximate flight direction on photograph

Approximate scan direction on photograph

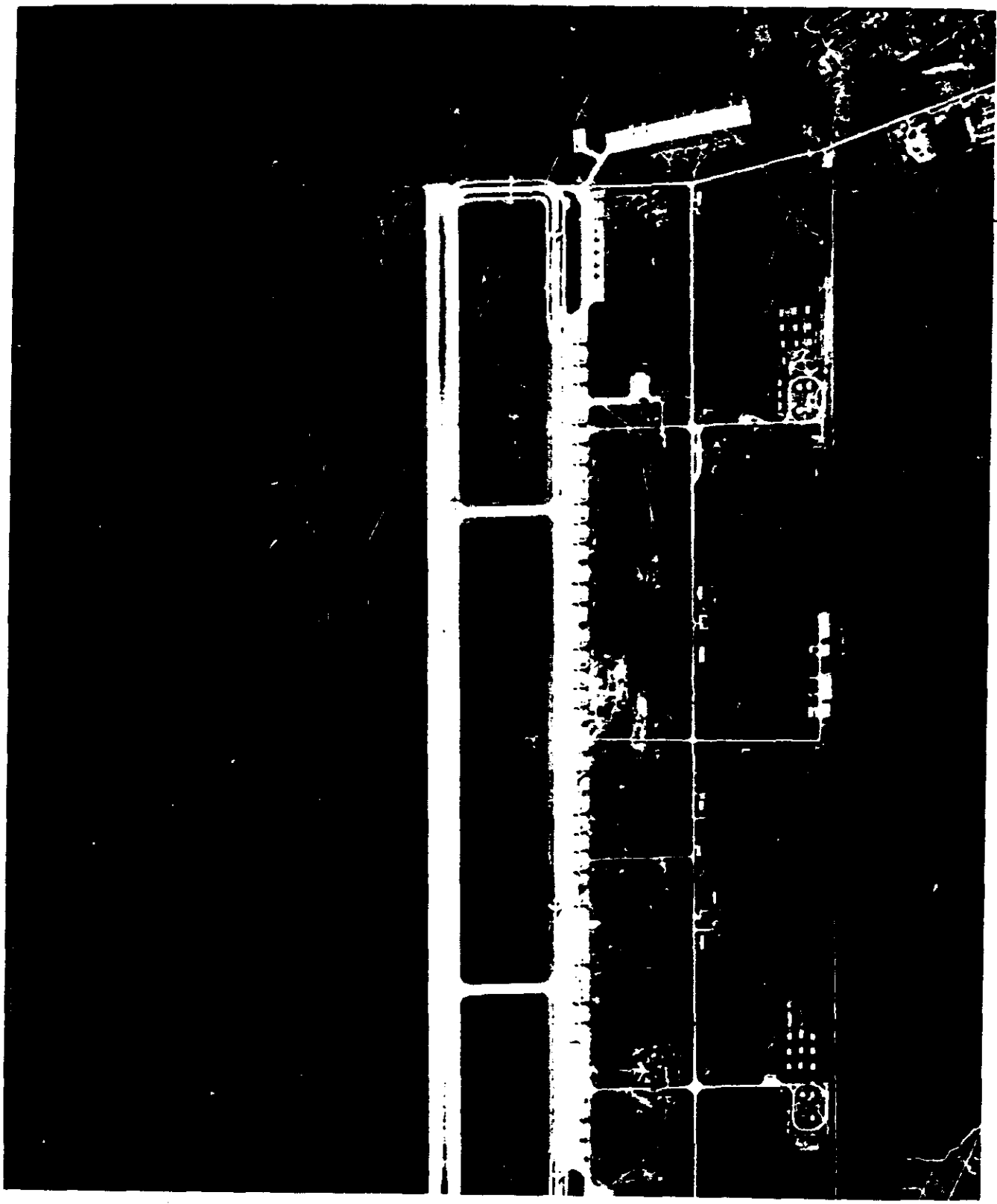
Approximate location of photograph in format. Negative viewed with emulsion side down.



[redacted]

Handle Via
~~TALENT-KEYHOLE~~
Control System Only

[redacted]



Handle Via
~~TALENT-KEYHOLE~~
Control System Only

[redacted]

[redacted]

FIGURE 12. PHOTOGRAPH OF GOOD QUALITY IMAGERY (MASTER CAMERA).

NPIC J-9485 (4/65)

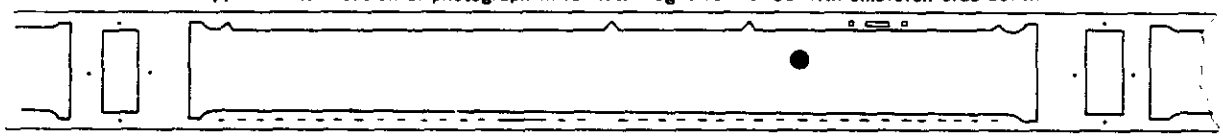
[redacted]

Camera	160 (Fwd)
Pass	37D
Frame	120
Date of Photography	8 Oct 64
Universal Grid Coordinates	58.7-14.1
Enlargement Factor	20X
Geographic Coordinates	39-56N 112-46E
Altitude (feet)	622,940
Vehicle:	
Pitch	15°33'
Roll	-0°11'
Yaw	0°24'
Local Sun Time	1333
Solar Elevation	38°6'
Solar Azimuth	209°
Exposure	1/383

Approximate flight direction on photograph

Approximate scan direction on photograph

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



[redacted]

Handle Via
~~TALENT-KEYHOLE~~
Control System Only

[redacted]

[redacted]

FIGURE 13. PHOTOGRAPH OF GOOD QUALITY IMAGERY (SLAVE CAMERA).

NPIC J-9486 (4/65)

[redacted]

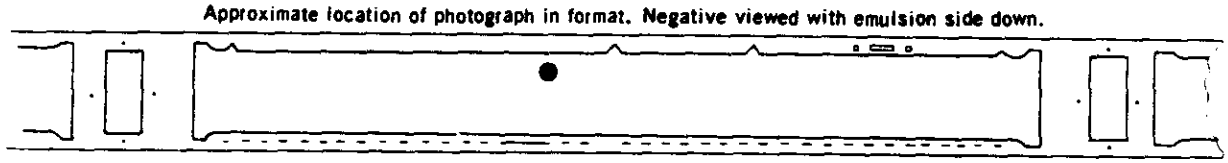
[redacted]

Camera	161 (Aft)
Pass	37D
Frame	121
Date of Photography	8 Oct 64
Universal Grid Coordinates	31.9-14.2
Enlargement Factor	20X
Geographic Coordinates	40-04N 112-41E
Altitude (feet)	620,872
Vehicle:	
Pitch	-14°11'
Roll	-0°10'
Yaw	0°33'
Local Sun Time	1333
Solar Elevation	38°0'
Solar Azimuth	209°
Exposure	1/372

Approximate flight direction on photograph

Approximate scan direction on photograph

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



[redacted]

Handle Via
TALENT-KEYHOLE
Control System Only

Handle Via
TALENT-KEYHOLE
Control System Only

[redacted]

FIGURE 14. INDIAN SPRINGS RESOLUTION TARGET (MASTER CAMERA).

NPIC J-9487 (4/65)

Visual readings indicate the ground resolution in the scan direction to be 9 feet 8 inches. The bar target could not be resolved in the flight direction.

[redacted]

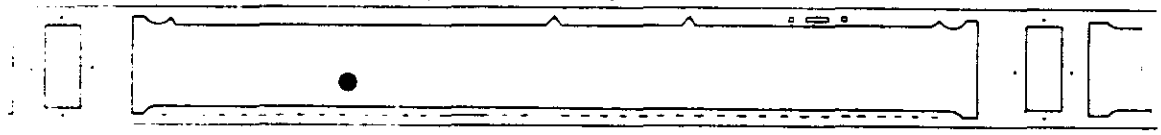
[redacted]

Camera	160 (Fwd)
Pass	47DE
Frame	5
Date of Photography	8 Oct 64
Universal Grid Coordinates	29.2-9.8
Enlargement Factor	40X
Geographic Coordinates	36-55N 114-55W
Altitude (feet)	611,419
Vehicle:	
Pitch	Not Determined
Roll	Not Determined
Yaw	Not Determined
Local Sun Time	1330
Solar Elevation	40°44'
Solar Azimuth	211°
Exposure	1.382

Approximate flight direction on photograph

Approximate scan direction on photograph

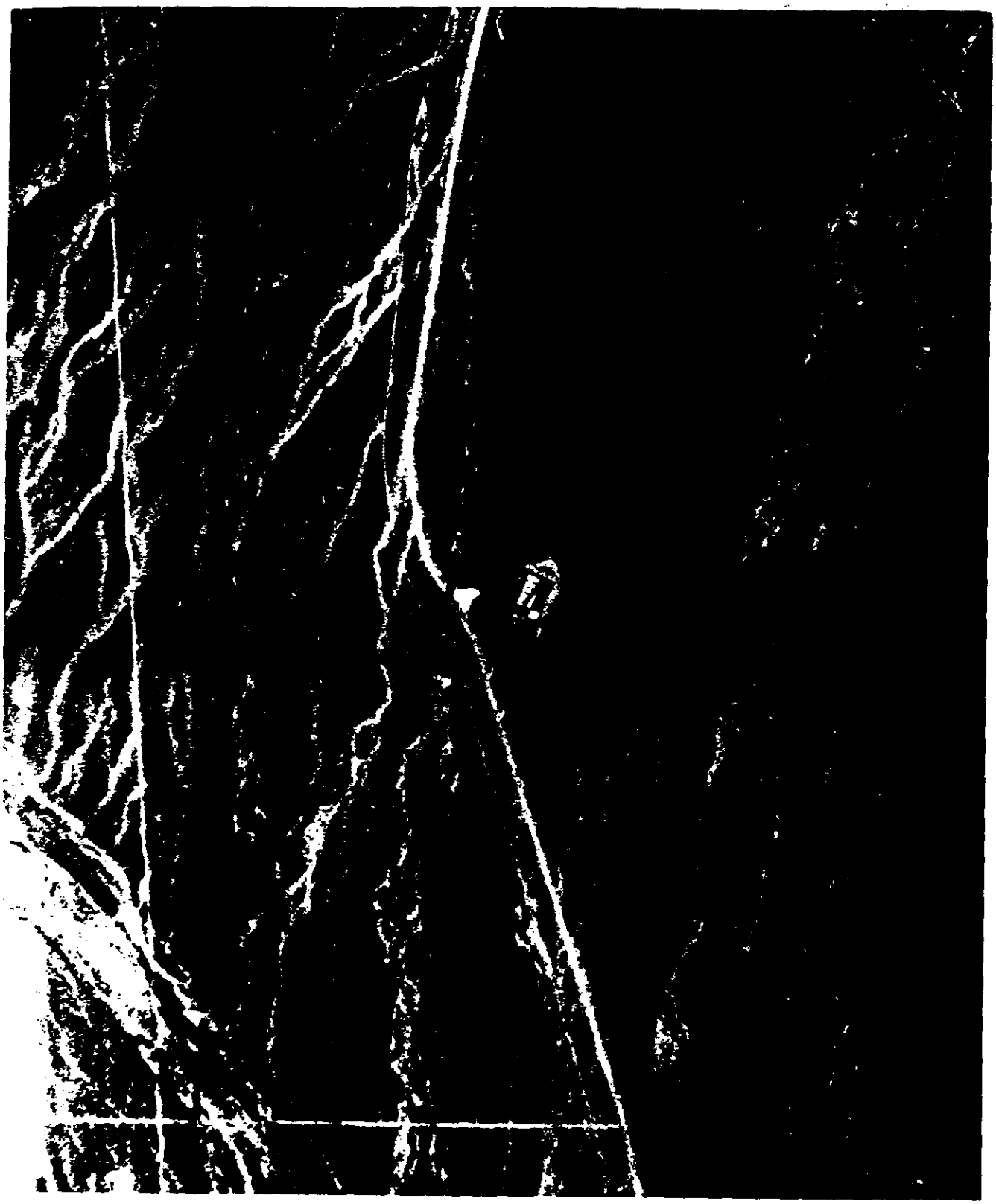
Approximate location of photograph in format. Negative viewed with emulsion side down.



[redacted]

Handle Via
~~TALENT-KEYHOLE~~
Control System Only

[redacted]



Handle Via
~~TALENT-KEYHOLE~~
Control System Only

[redacted]

FIGURE 15. INDIAN SPRINGS RESOLUTION TARGET (SLAVE CAMERA).

NPIC J-9488 (4/65)

Visual readings indicate the ground resolution in the scan direction to be 7 feet 8 inches. The bar target could not be resolved in the flight direction.

[redacted]

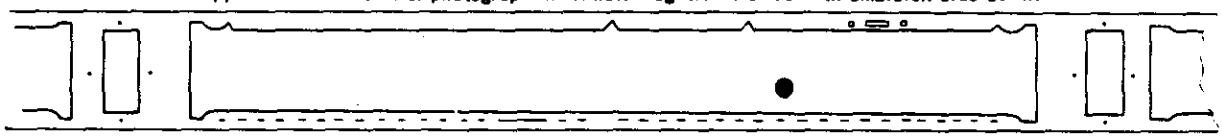
[redacted]

Camera	161 (Aft)
Pass	47DE
Frame	11
Date of Photography	8 Oct 64
Universal Grid Coordinates	61.35-10.27
Enlargement Factor	40X
Geographic Coordinates	36-47N 114-56W
Altitude (feet)	609,441
Vehicle:	
Pitch	Not Determined
Roll	Not Determined
Yaw	Not Determined
Local Sun Time	1330
Solar Elevation	40°50'
Solar Azimuth	211°
Exposure	1/372

Approximate flight direction on photograph

Approximate scan direction on photograph

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



[redacted]

[redacted]

[redacted]

[redacted]

APPENDIX A. SYSTEM SPECIFICATIONS

1. Cameras:

Panoramic Cameras	Master (FWD)	Slave (AFT)
Camera Number	160	161
Lens Serial Number	1352435	1332435
Slit Width	0.175"	0.175"
Aperture	f/3.5	f/3.5
Filter	Wratten 21	Wratten 21
Operational F/L	609.625 mm	609.549 mm
Film Type	7J-40	7J-40
Film Length	16,000	16,000
Splices	4	4
Emulsion	68-6-7-4	68-6-7-4
Static Bench Test:		
High Contrast	275 L/mm	256 L/mm
Low Contrast	166 L/mm	171 L/mm
Dynamic Test:		
ITEK High Contrast	187 L/mm	178 L/mm
ITEK Low Contrast	130 L/mm	125 L/mm
AP High Contrast	178 L/mm	173 L/mm
AP Low Contrast	115 L/mm	120 L/mm

Stellar and Index Cameras	Stellar	Index
Camera Number	30	D30
Lens Serial Number	10090	811897
Reseau Serial Number	30	D30
Filter	None	Wratten 21
Aperture	f/1.8	f/4.5
Exposure Time	2.0	1/500
Operational F/L	Not Available	Not Available
Film Type	3J-34	7J-33
Film Length	46'	92'
Splices	None	None
Emulsion	7-3-6-4	29-3-6-4

NOTE: Design focal length of the Stellar Camera is 85 mm and of the Index Camera is 38 mm.

[redacted]

[redacted]

Horizon Cameras	MASTER		SLAVE	
	Stbd(take-up)	Port(supply)	Stbd(supply)	Port(take-up)
Camera Number	160	160	161	161
Lens Serial Number	814025	814028	814027	814023
Exposure Time	1/100 sec	1/100 sec	1/100 sec	1/100 sec
Aperture	f/8.0	f/6.8	f/8.0	f/6.8
Filter	Wratten 25	Wratten 25	Wratten 25	Wratten 25
Operational F/L	54.65 mm	55.14 mm	55.60 mm	55.07 mm
Average L/mm	92 L/mm	97 L/mm	92 L/mm	86 L/mm
Radial Distortion				
10° off axis	0.000 mm	0.001 mm	0.003 mm	0.006 mm
20° off axis	0.001 mm	0.005 mm	0.004 mm	0.007 mm
Tangential Distortion	0.005 mm	0.007 mm	0.005 mm	0.002 mm

MASTER HORIZON CAMERAS

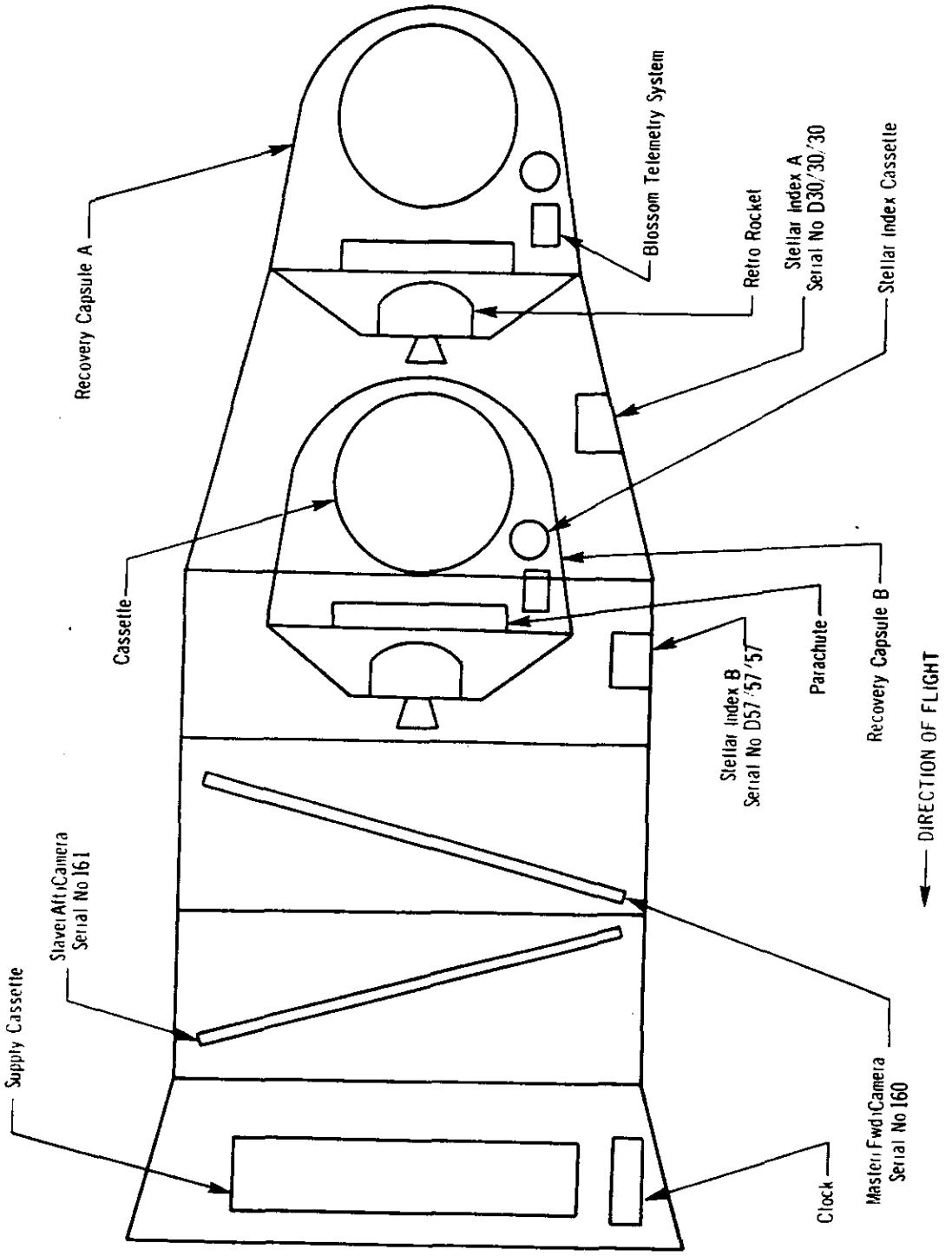
Resolution L/mm	Starboard (take-up)						Port (supply)					
Angle Off-Axis	0°	10°	15°	20°	25°	27.5°	0°	10°	15°	20°	25°	27.5°
Radial Resolution	170	118	79	67	83	56	170	132	92	76	77	59
Tangential Resolution	170	116	84	63	55	38	170	132	89	72	55	42

SLAVE HORIZON CAMERAS

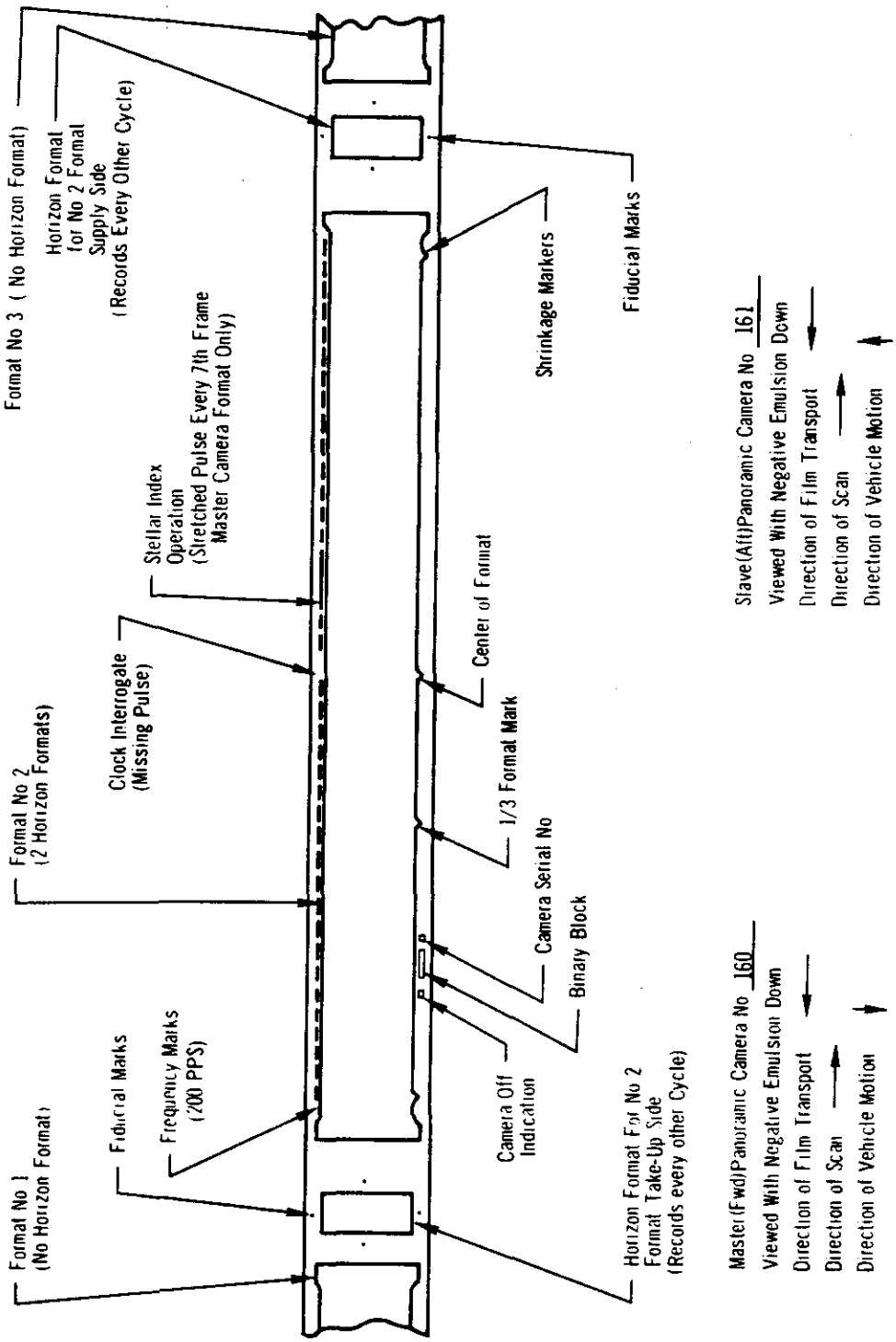
Resolution L/mm	Starboard (supply)						Port (take-up)					
Angle Off-Axis	0°	10°	15°	20°	25°	27.5°	0°	10°	15°	20°	25°	27.5°
Radial Resolution	170	105	65	60	65	67	170	118	69	75	73	59
Tangential Resolution	170	104	67	56	55	45	170	116	80	75	52	42

[redacted]

2. VEHICLE LAYOUT

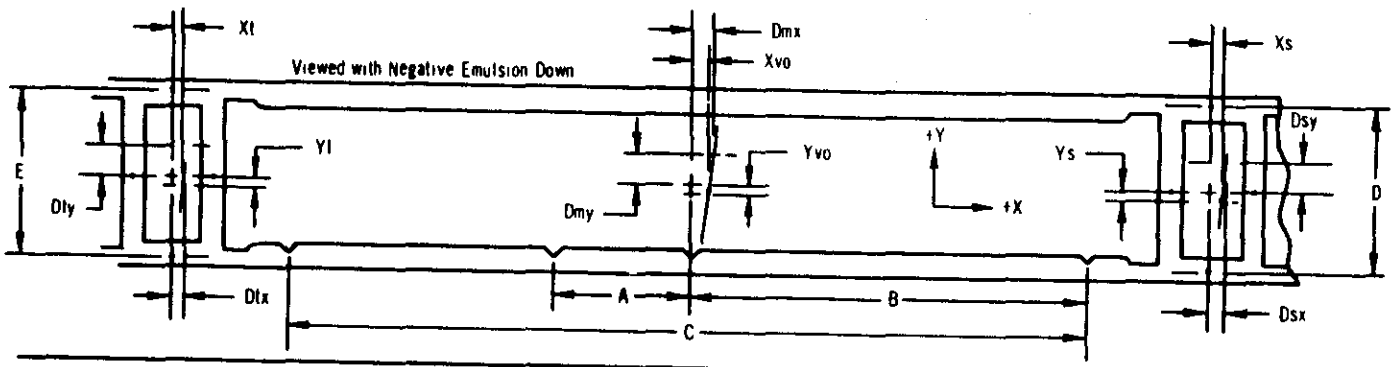


3. FILM SPECIFICATIONS
FORMAT LAYOUT



NPIC J-0495 (4/65)

4. FILM SPECIFICATIONS
FORMAT DIMENSIONS



Master (Fwd) Camera		Vehicle Motion		Scan Direction	
A	76.1	Xt	+0.198	Dtx	+0.193
B	355.3	Yl	−0.071	Dty	+2.425
C	710.6	Xs	−0.064	Dsx	−0.064
D	56.510	Ys	+0.006	Dsy	+2.599
E	56.519	Xvo	+0.990	Dmx	+0.996
		Yvo	+0.747	Dmy	−2.253

Format dimensions:

	Panoramic
Height	56.142
Width	755.3

Slave (Aft) Camera		Vehicle Motion		Scan Direction	
A	76.1	Xl	+0.381	Dtx	+0.374
B	355.5	Yl	−0.070	Dty	+2.035
C	710.9	Xs	+0.158	Dsx	+0.149
D	56.468	Ys	+0.065	Dsy	−2.309
E	56.518	Xvo	−0.859	Dmx	−0.862
		Yvo	−0.180	Dmy	−3.180

Format dimensions:

	Panoramic
Height	56.714
Width	753.9

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

−X+Y	+X+Y
−X−Y	+X−Y

NPIC J-9496 (4/65)

[redacted]

DEFINITION OF PANORAMIC CAMERA FORMAT CALIBRATIONS:

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

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

a. 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 degrees ±5 seconds from target one 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.

[redacted]

[redacted]

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

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

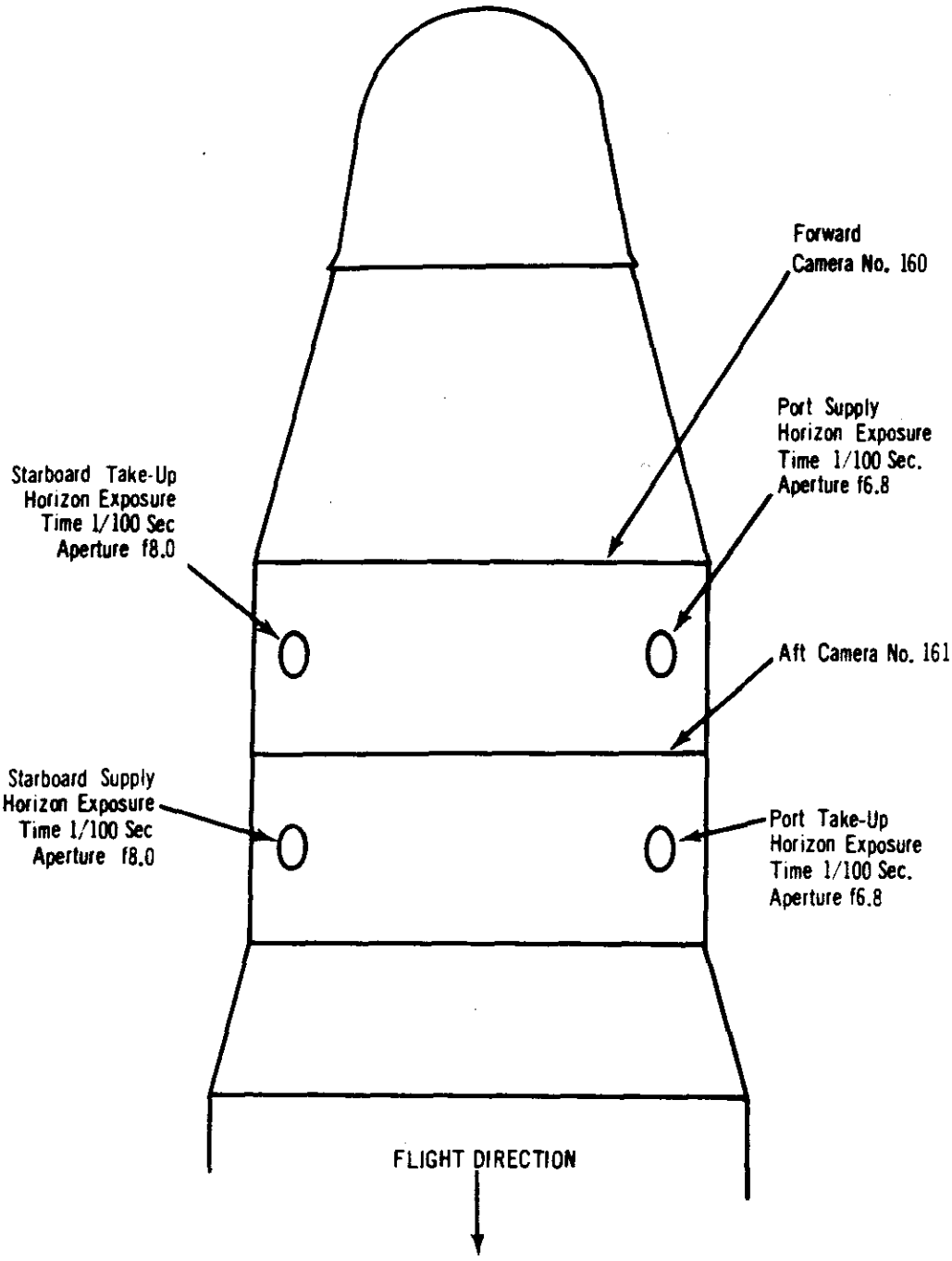
Measurements of the angle between the indicated axis of the panoramic cameras and the line of intersection of the plane defined in Paragraph 2 on the format is obtained from the offset dimensions Dmx and Dmy of Target 1 for each camera.

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

[redacted]

[redacted]

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



NPIC J-9497.14 65

[redacted]

[redacted]

APPENDIX B. DENSITY READINGS

Density readings were taken using a Macbeth QuantaLog Densitometer, Model EP 1000, with an ET 20 attachment and a 0.5 mm aperture. The values are correlated below.

[redacted]

[redacted]

STELLAR CAMERA NO 30

Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Pass	Frame	Dmax	Dmin	Delta	Gross Fog
1D	1	2.34	0.36	1.98	0.19	32D	182	1.24	0.30	0.94	0.22
	2	1.52	0.36	1.16	0.22		183	1.16	0.30	0.86	0.22
5D	3	1.18	0.30	0.88	0.21	36D	184	1.10	0.30	0.80	0.22
	12	2.30	0.38	1.92	0.22		202	1.80	0.33	1.47	0.21
6D	13	0.46	0.24	0.22	0.20	37D	203	0.64	0.26	0.38	0.20
	37	1.54	0.40	1.14	0.22		228	1.52	0.34	1.18	0.20
7D	38	0.85	0.28	0.57	0.22	38D	229	1.21	0.31	0.90	0.21
	50	0.88	0.32	0.56	0.22		245	1.38	0.32	1.06	0.21
9AE	51	0.22	0.22	0	0.22	39D	246	0.94	0.28	0.66	0.21
9D	52	1.32	0.32	1.00	0.22		266	1.24	0.30	0.94	0.21
	63	1.12	0.32	0.80	0.24	40D	267	1.18	0.28	0.90	0.21
14D	64	1.32	0.38	0.94	0.22		288	1.22	0.32	0.90	0.23
	67	1.23	0.38	0.85	0.24	41D	289	1.00	0.30	0.70	0.24
16D	68	1.14	0.31	0.83	0.22		296	1.30	0.34	0.96	0.24
	69	1.28	0.32	0.96	0.23	47DE	297	1.02	0.32	0.70	0.22
19D	70	0.26	0.26	0	0.22		300	1.06	0.30	0.76	0.22
	85	1.48	0.37	1.11	0.28	52D	301	1.12	0.28	0.84	0.22
20D	86	1.02	0.35	0.67	0.28		323	1.65	0.38	1.27	0.21
	97	1.10	0.29	0.81	0.24	53D	324	1.12	0.32	0.80	0.21
21D	98	1.00	0.26	0.74	0.22		348	1.85	0.40	1.45	0.22
	117	1.30	0.30	1.00	0.22	54D	349	1.45	0.38	1.07	0.21
22D	118	0.50	0.23	0.27	0.21		372	1.66	0.34	1.32	0.20
	142	1.78	0.38	1.40	0.22	55D	373	1.12	0.28	0.84	0.20
24D	143	0.75	0.24	0.51	0.21		396	1.43	0.32	1.11	0.22
	157	1.35	0.32	1.03	0.21	56D	397	1.14	0.30	0.84	0.23
25D	158	0.90	0.29	0.61	0.21		407	1.00	0.30	0.70	0.22
	174	0.98	0.32	0.66	0.23	57D	408	1.38	0.35	1.03	0.22
30D	175	1.16	0.36	0.80	0.24		415	1.73	1.73	0	2.30*
	181	1.70	0.44	1.26	0.22						

Dmax Range 2.34-0.22 Average Dmax 1.21 Gross Fog Range 0.28-0.19
Dmin Range 0.44-0.22 Average Dmin 0.32 Average Gross Fog 0.22

*Last Frame Fogged And Not Used in Average Density Computations

[redacted]

INDEX CAMERA NO D30

Pass	Frame	LIMITING			Gross Fog	TERRAIN		
		Dmax	Dmin	Delta		Dmax	Dmin	Delta
1D	1	1.14	0.19	0.95	0.08	NR	NR	NR
	2	1.34	0.15	1.19	0.07	NR	NR	NR
5D	3	1.31	0.20	1.11	0.07	NR	NR	NR
	12	0.98	0.18	0.80	0.08	0.50	0.30	0.20
6D	13	0.72	0.10	0.62	0.07	0.70	0.42	0.28
	37	1.68	0.14	1.54	0.08	0.50	0.14	0.36
7D	38	1.12	0.25	0.87	0.08	NR	NR	NR
	50	1.02	0.38	0.64	0.08	1.02	0.38	0.64
9AE	51	NR	NR	NR	0.08	NR	NR	NR
9D	52	1.01	0.16	0.85	0.08	0.38	0.16	0.22
	63	1.58	0.12	1.46	0.06	0.38	0.12	0.26
14D	64	1.68	0.25	1.43	0.08	1.00	0.78	0.22
	67	1.54	0.37	1.17	0.07	NR	NR	NR
16D	68	1.32	0.14	1.18	0.08	NR	NR	NR
	69	1.10	0.10	1.00	0.08	NR	NR	NR
19D	70	0.24	0.10	0.14	0.08	NR	NR	NR
	85	1.50	0.35	1.15	0.08	1.02	0.42	0.60
20D	86	1.12	0.18	0.94	0.08	0.38	0.18	0.20
	97	1.36	0.10	1.26	0.06	NR	NR	NR
21D	98	0.62	0.18	0.44	0.07	NR	NR	NR
	117	1.66	0.20	1.46	0.08	NR	NR	NR
22D	118	0.52	0.12	0.40	0.07	0.52	0.46	0.06
	142	1.72	0.20	1.52	0.08	1.72	0.20	1.52
24D	143	1.04	0.10	0.94	0.08	NR	NR	NR
	157	1.28	0.38	0.90	0.08	0.75	0.50	0.25
25D	158	1.12	0.16	0.96	0.08	0.42	0.30	0.12
	174	1.65	0.24	1.41	0.08	0.70	0.25	0.45
30D	175	0.62	0.20	0.42	0.08	0.62	0.20	0.42
	181	0.60	0.10	0.50	0.07	0.60	0.10	0.50
32D	182	1.25	0.70	0.55	0.08	NR	NR	NR
	183	1.14	0.68	0.46	0.08	NR	NR	NR

[redacted]

INDEX CAMERA NO D30

Pass	Frame	LIMITING			Gross Fog	TERRAIN		
		Dmax	Dmin	Delta		Dmax	Dmin	Delta
36D	184	1.15	0.25	0.90	0.09	0.42	0.30	0.12
	202	1.24	0.22	1.02	0.08	NR	NR	NR
37D	203	0.82	0.16	0.66	0.08	0.48	0.34	0.14
	228	1.50	0.22	1.28	0.08	NR	NR	NR
38D	229	1.18	0.26	0.92	0.08	NR	NR	NR
	245	1.70	0.26	1.44	0.08	0.55	0.30	0.25
39D	246	1.04	0.16	0.88	0.08	NR	NR	NR
	266	1.12	0.55	0.57	0.08	1.12	0.55	0.57
40D	267	1.08	0.20	0.88	0.07	1.08	0.32	0.76
	288	1.06	0.12	0.94	0.07	0.84	0.18	0.66
41D	289	1.35	0.34	1.01	0.08	NR	NR	NR
	296	1.30	0.18	1.12	0.08	0.52	0.22	0.30
47DE	297	1.68	0.28	1.40	0.08	0.95	0.30	0.65
	300	1.48	0.34	1.14	0.08	1.22	0.34	0.88
52D	301	0.76	0.14	0.62	0.08	0.76	0.14	0.62
	323	1.66	0.12	1.54	0.08	NR	NR	NR
53D	324	0.80	0.48	0.32	0.08	0.80	0.48	0.32
	348	1.60	0.25	1.35	0.08	0.48	0.36	0.12
54D	349	1.38	0.32	1.06	0.07	0.40	0.32	0.08
	372	1.62	0.13	1.49	0.06	0.90	0.30	0.60
55D	373	0.92	0.18	0.74	0.07	0.30	0.26	0.04
	396	0.92	0.42	0.50	0.07	0.92	0.60	0.32
56D	397	0.60	0.18	0.42	0.07	0.38	0.18	0.20
	407	1.00	0.24	0.76	0.06	0.42	0.26	0.16
57D	408	1.22	0.26	0.96	0.06	NR	NR	NR
	415	1.45	0.38	1.07	0.06	NR	NR	NR

	Limiting	Terrain
Dmax Range	1.72-0.24	1.72-0.30
Dmin Range	0.70-0.10	0.78-0.10
Dmax Average	1.19	0.69
Dmin Average	0.24	0.31

Gross Fog Range - 0.09-0.06 Gross Fog Average 0.08

[redacted]

APPENDIX C. MICRODENSITOMETRY

1. Edge Spread Function:

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

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

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

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

[redacted]

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

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

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

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

[redacted]

[redacted]

SUMMARY TABLE OF EDGE TRACES

Trace Number	Line Spread Function width at 50% amplitude	Reciprocal of LSF width at 50% amplitude
1	6.68 microns	149.7 L/mm
2	14.54 microns	68.8 L/mm
3	8.73 microns	114.5 L/mm
4	7.10 microns	140.8 L/mm

[redacted]

[redacted]

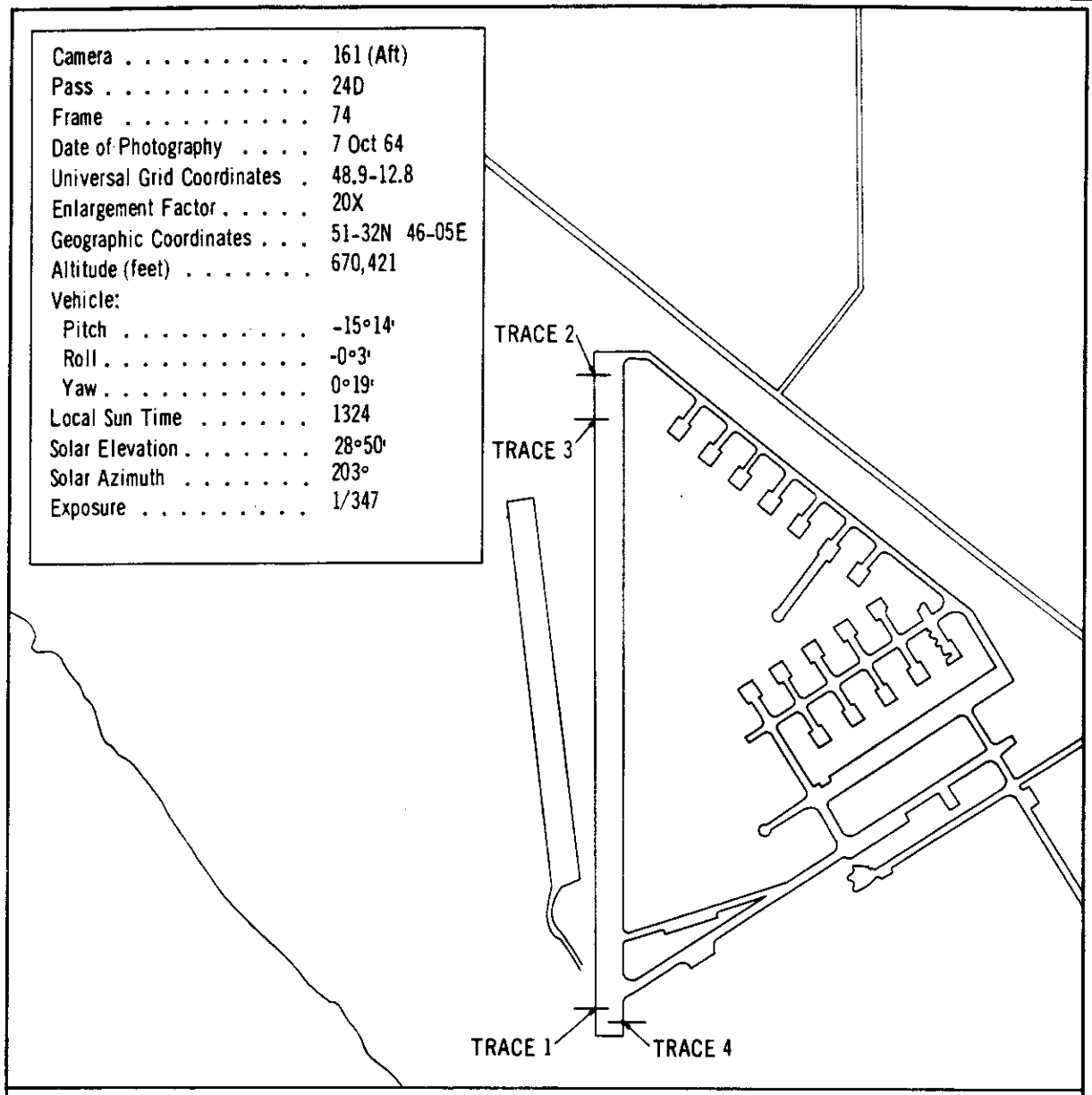
FIGURE 16. PHOTOGRAPH SHOWING AREA OF MICRODENSITOMETRIC TRACE.

NPIC J-9489 (4/65)

[redacted]

[redacted]

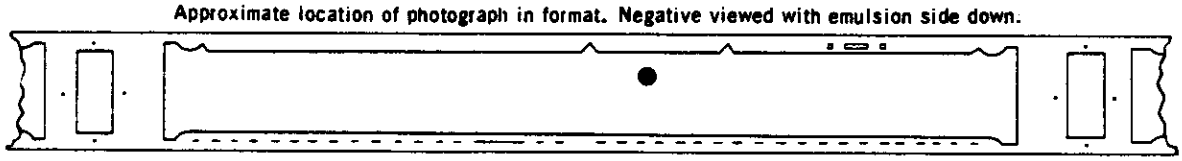
Camera	161 (Aft)
Pass	24D
Frame	74
Date of Photography	7 Oct 64
Universal Grid Coordinates	48.9-12.8
Enlargement Factor	20X
Geographic Coordinates	51-32N 46-05E
Altitude (feet)	670,421
Vehicle:	
Pitch	-15°14'
Roll	-0°3'
Yaw	0°19'
Local Sun Time	1324
Solar Elevation	28°50'
Solar Azimuth	203°
Exposure	1/347



Approximate flight direction on photograph

Approximate scan direction on photograph

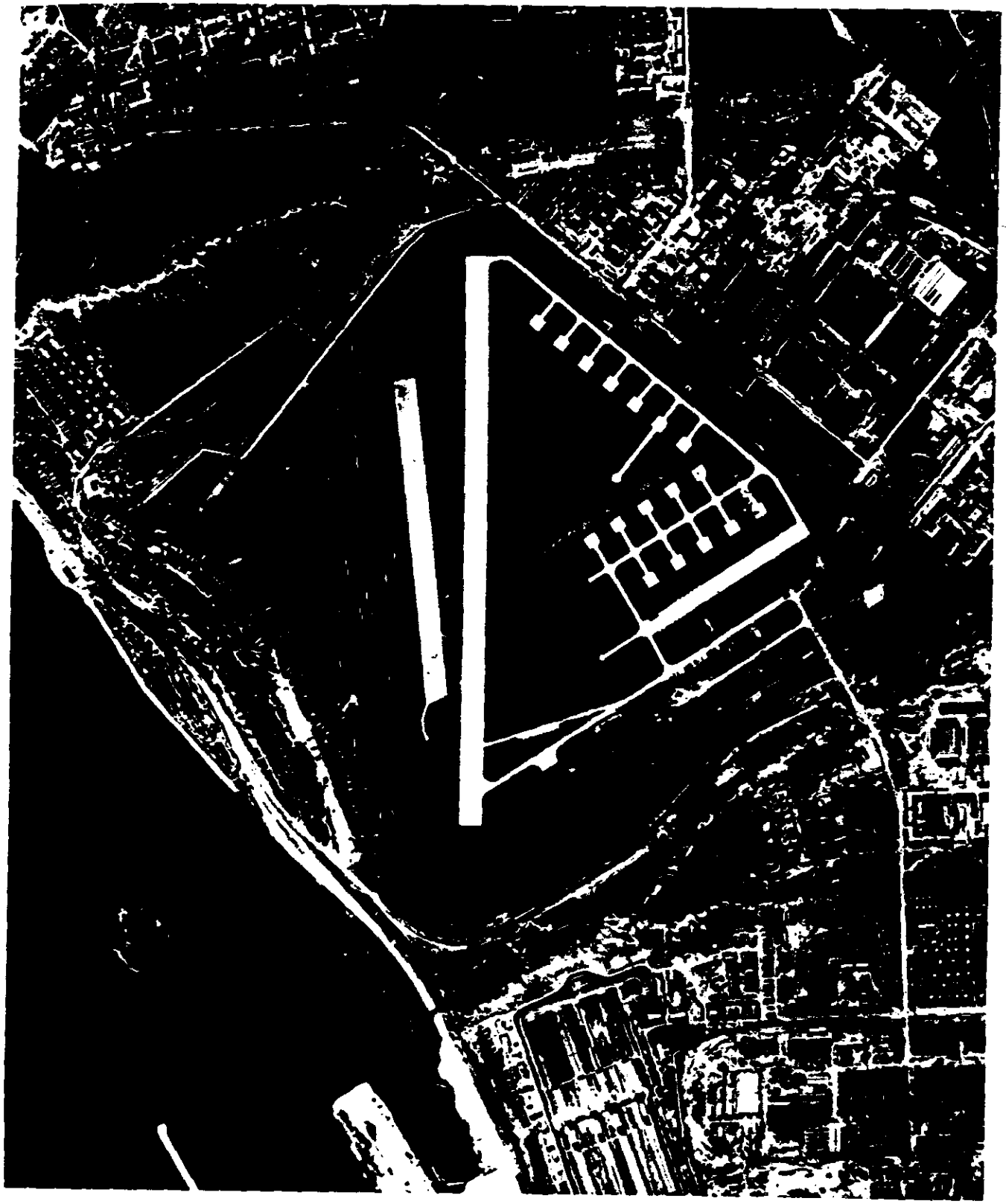
Approximate location of photograph in format. Negative viewed with emulsion side down.



[redacted]

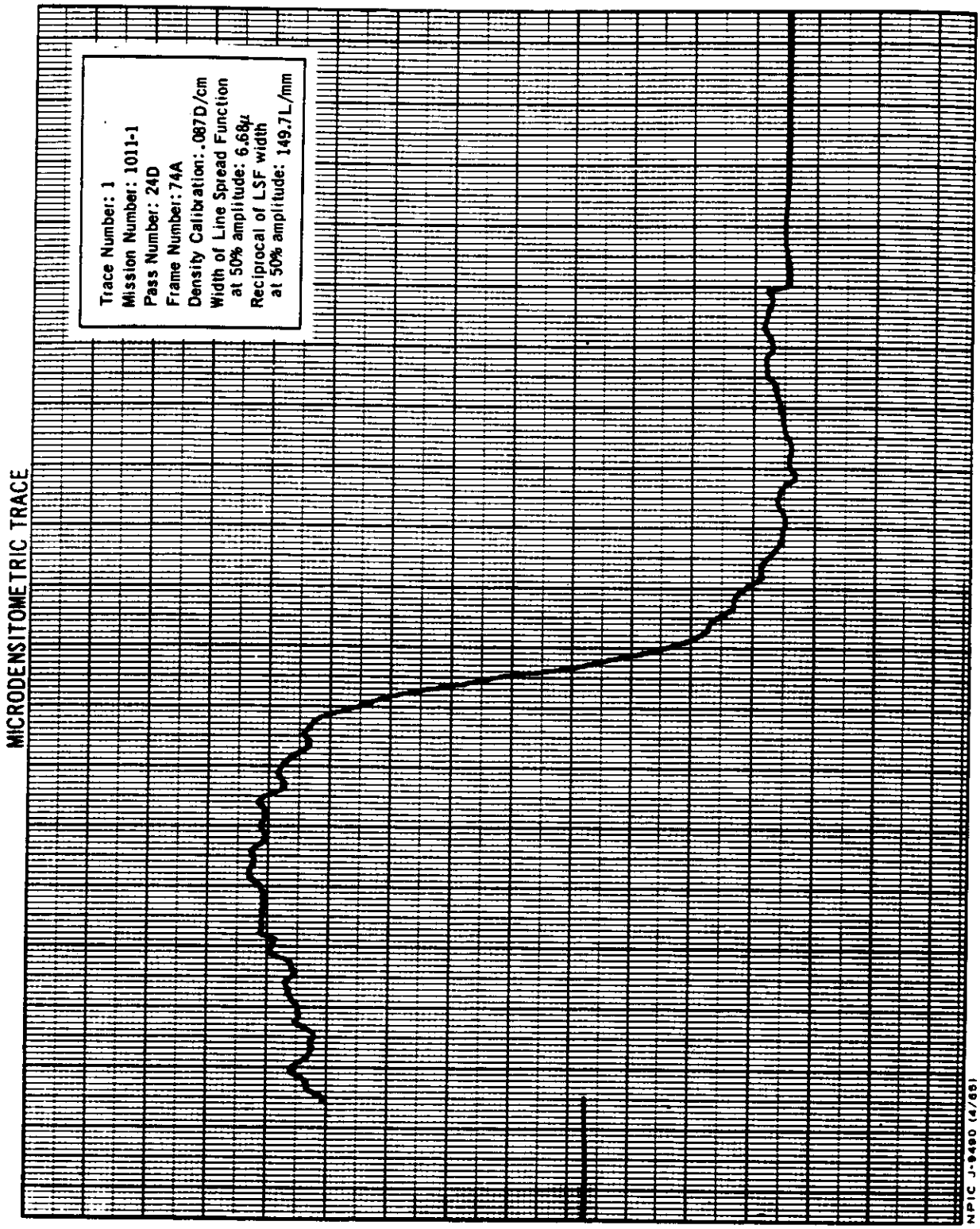
Handle Via
~~TALENT KEYHOLE~~
Control System Only

[redacted]



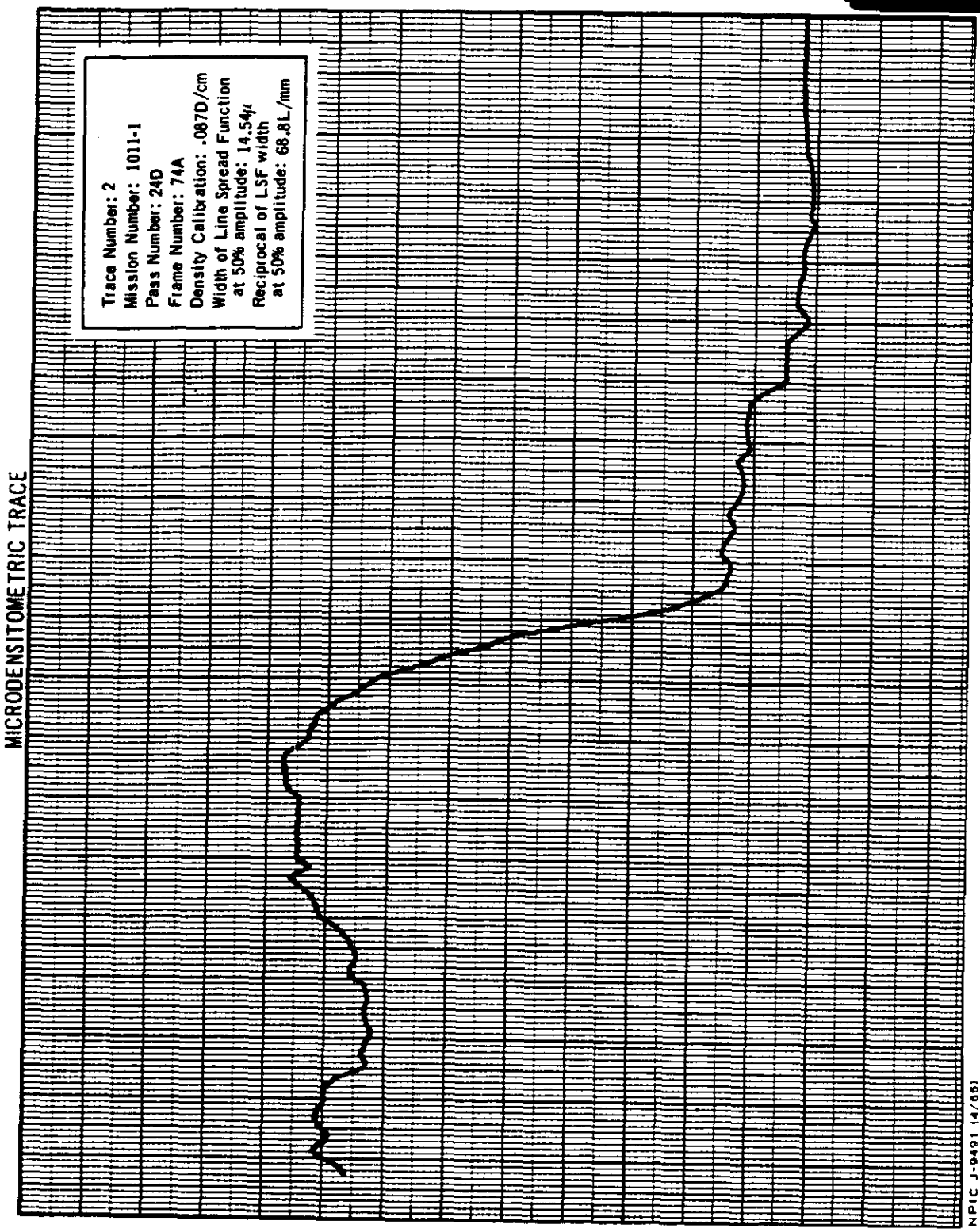
Handle Via
~~TALENT KEYHOLE~~
Control System Only

Handle Via
~~TALENT-KEYHOLE~~
Control System Only

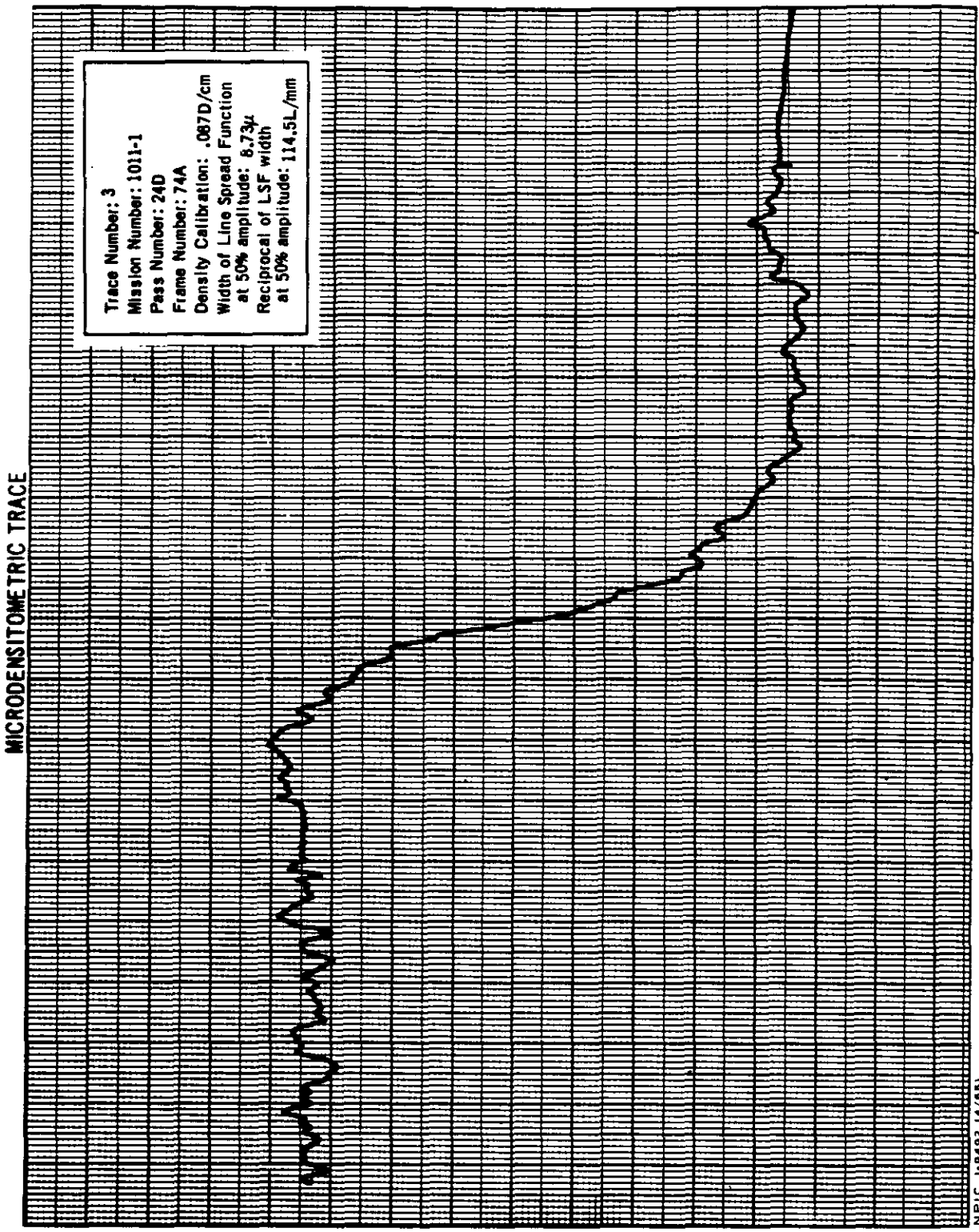


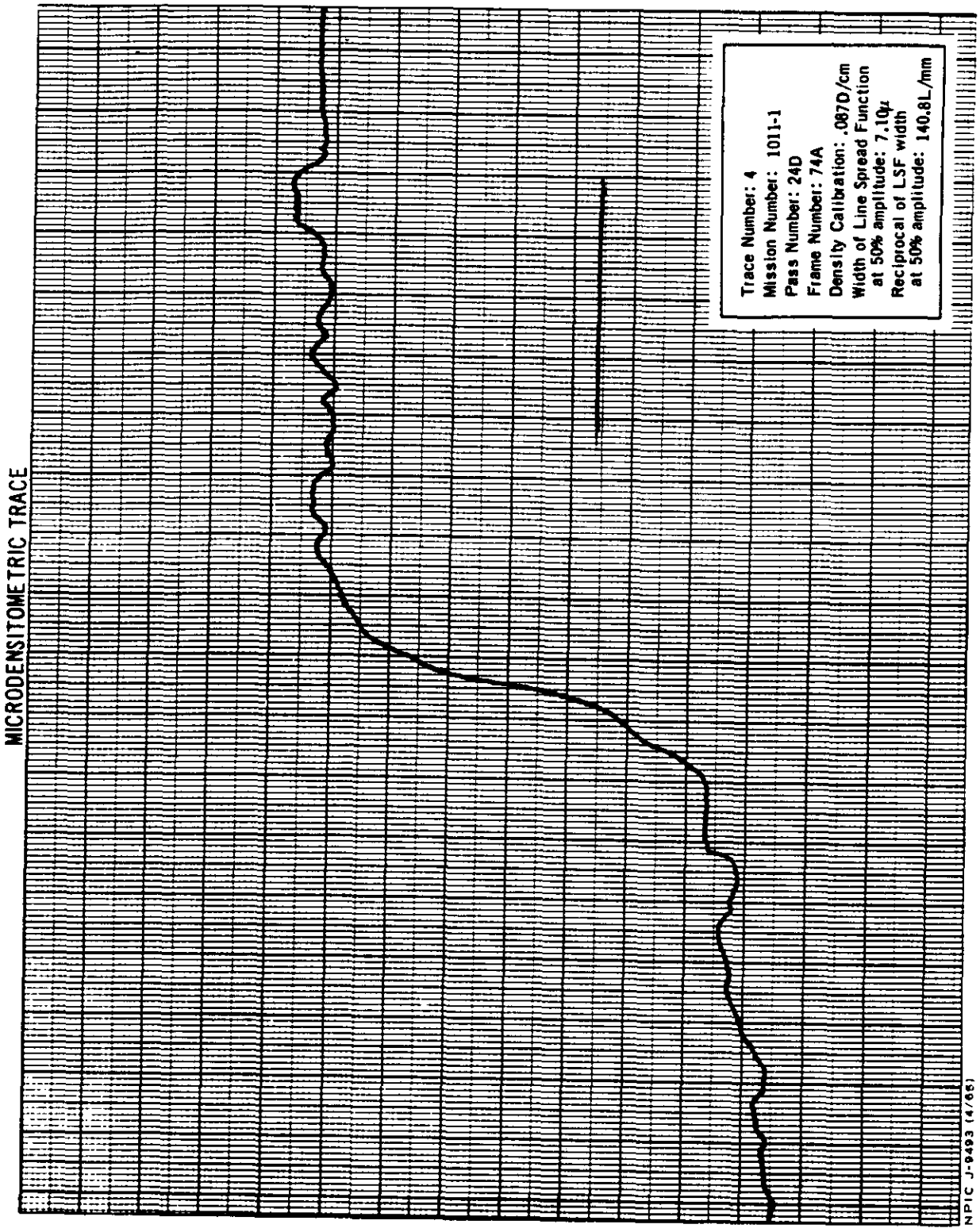
Handle Via
~~TALENT-KEYHOLE~~
Control System Only

[redacted]



[redacted]


MICRODENSITOMETRIC TRACE
Trace Number: 3
Mission Number: 1011-1
Pass Number: 24D
Frame Number: 74A
Density Calibration: .087D/cm
Width of Line Spread Function at 50% amplitude: 8.73μ
Reciprocal of LSF width at 50% amplitude: 114.5L/mm
NPIC J-8492 (4/66)


MICRODENSITOMETRIC TRACE
Trace Number: 4
Mission Number: 1011-1
Pass Number: 24D
Frame Number: 74A
Density Calibration: .087D/cm
Width of Line Spread Function at 50% amplitude: 7.10μ
Reciprocal of LSF width at 50% amplitude: 140.8L/mm
NPIC J-9493 (4/66)

[redacted]

APPENDIX D. SUMMARY OF VEHICLE TEMPERATURE

The following tables, graphs, and sketches are supplied by the vehicle contractor and their accuracy is undetermined. Indications are that the temperature had no degrading influence on the imagery of this mission.

[redacted]

TEMPERATURE SUMMARY

PAYLOAD J-03
VEHICLE 1170

SENSOR		ORBITS ACQUIRED											
Master	Injection	9	16	25	31	40	47	56	63	71	79	88	95
3	69	57	53	53	52	53	51	51	50	47	46	46	43
4	74	66	63	64	60	63	60	61	58	57	54	54	52
5	71	68	65	66	64	65	62	62	60	58	58	57	54
6	68	75	72	72	69	70	68	67	66	65	64	61	59
7	69	71	68	67	66	67	65	65	64	61	61	59	57
8	68	71	66	67	65	67	64	65	61	61	59	59	56
9	70	75	71	71	68	69	66	68	65	66	61	62	58
10	70	68	65	65	64	65	62	61	60	59	58	57	55
11	95	74	73	75	74	75	68	72	67	67	62	63	59
12	77	62	59	60	58	60	55	58	56	55	62	52	49
13	73	74	72	70	70	70	67	67	65	63	61	60	58
AVG. INSTR. TEMP.		69	65	66	65	66	62	63	61	60	59	57	55
Slave													
3	68	73	71	69	68	69	65	66	65	62	61	59	57
4	68	71	66	67	62	65	61	65	60	61	57	58	53
5	70	67	62	62	61	62	59	60	59	58	62	54	52
6	64	60	58	57	55	56	55	54	53	52	51	50	48
7	66	65	61	61	60	61	59	59	58	57	56	54	52
8	68	64	61	61	60	60	58	59	57	56	53	53	50
9	70	58	55	55	55	55	53	54	53	52	50	50	47
10	69	65	63	61	60	61	60	59	58	57	56	55	52
11	96	64	59	61	60	61	57	59	60	55	52	55	49
12	73	71	66	67	63	65	62	65	62	62	58	59	54
13	71	63	60	61	60	59	57	57	60	54	53	53	51
AVG. INSTR. TEMP.		65	63	67	60	61	58	60	59	57	56	54	51
Supply Spool													
1	69	58	57	55	55	57	55	56	54	53	52	50	49
2	70	67	62	63	61	64	59	58	58	58	55	56	51

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

[redacted]

[redacted]

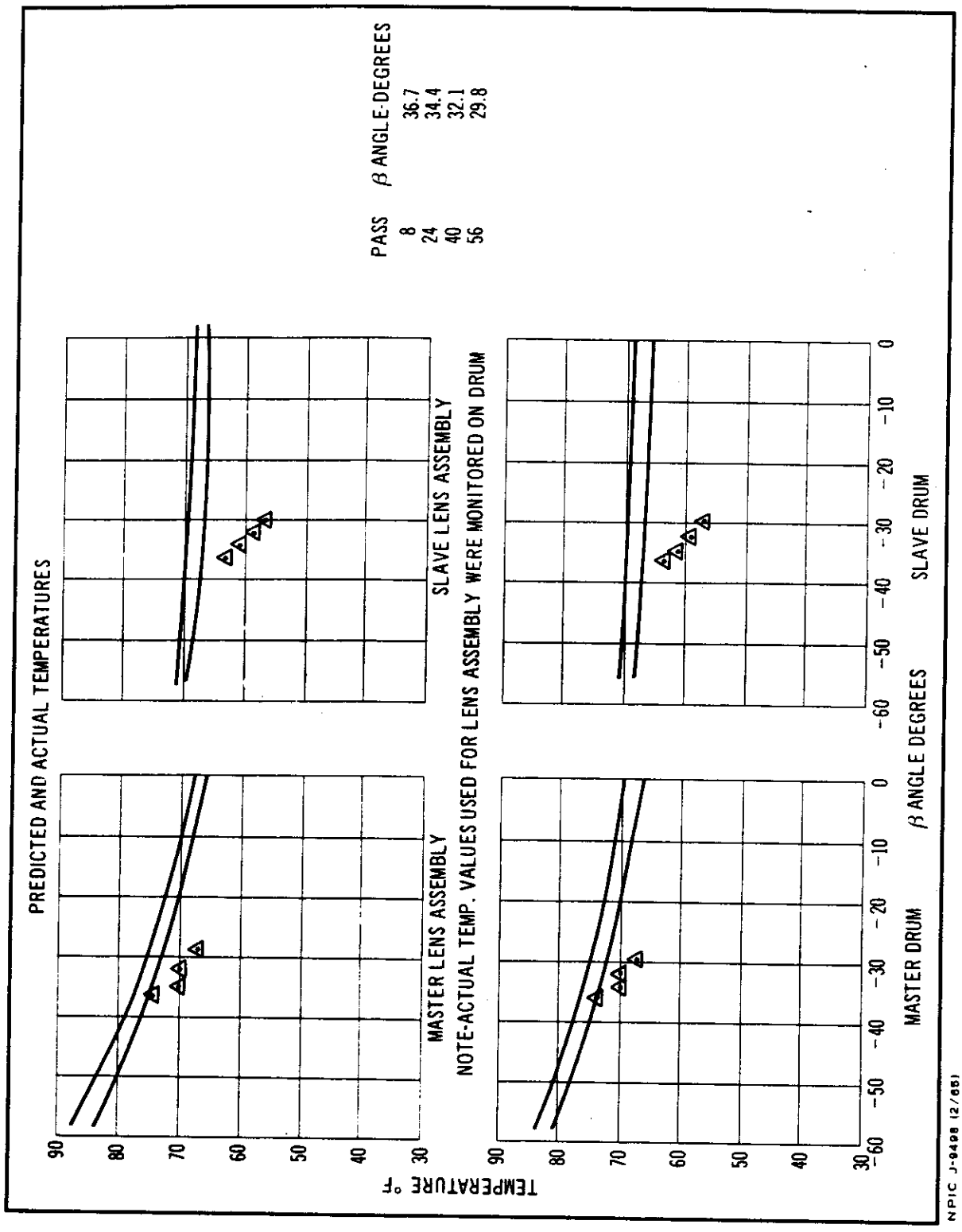
TEMPERATURE SUMMARY

PAYLOAD J-03
VEHICLE 1170

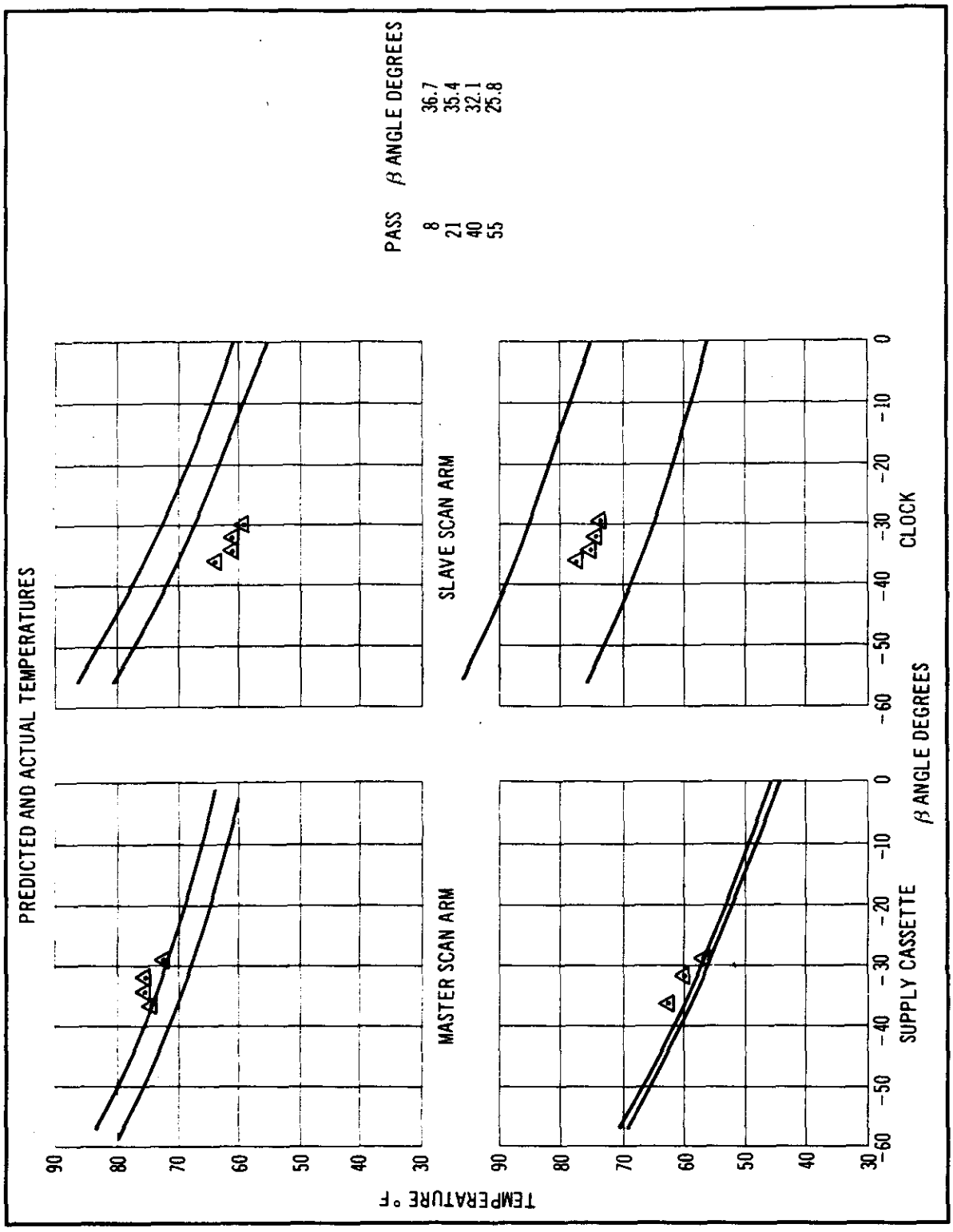
SENSOR		ORBITS ACQUIRED											
Fairing/Barrel #1 ("A") ("B")	Injection	9	16	25	31	40	47	56	63	71	79	88	95
1	OBH	43	46	39	43	46	49	39	33	7	16	3	16
2	OBH	16	6	13	3	16	3	13	3	5	-2	2	-2
3	OBH	10	10	4	7	7	10	4	7	25	44	22	44
4	230	63	59	56	56	59	56	56	53	43	77	36	68
5	OBH	87	87	78	78	84	74	74	68	53	69	47	63
6	OBH	77	97	70	92	77	92	70	77	--	--	--	--
Barrel No. 2													
1	155	64	83	58	74	61	71	55	68	48	61	45	58
2	157	62	101	59	98	62	98	55	87	55	84	49	78
3	194	28	47	24	47	28	54	24	41	28	44	21	44
4	205	8	1	4	1	8	1	4	1	4	1	1	-2
5	182	21	21	15	18	15	18	15	18	12	15	8	15
Conic Adapter													
1	179	75	96	72	90	72	87	69	78	59	69	53	66
Clock													
1	100	75	71	73	71	71	69	71	67	65	60	60	58
2	106	80	77	77	75	77	73	75	73	71	65	67	65
Thrust Cone "A" to "B" SRV													
1	116	44	38	40	35	38	38	36	34	56	53	53	52
2	79	71	62	62	59	63	61	61	57	69	67	66	65
Stellar/Index "A" to "B"													
1	88	65	58	58	55	55	52	55	52	57	53	53	50
2	82	67	64	61	58	61	58	61	58	63	60	60	57
Recovery Batt. "B" SRV													
1	79	79	78	74	75	73	74	72	73	89	92	93	92
Master Cassette "A" SRV													
2	101	57	51	52	50	51	51	51	50	--	--	--	--

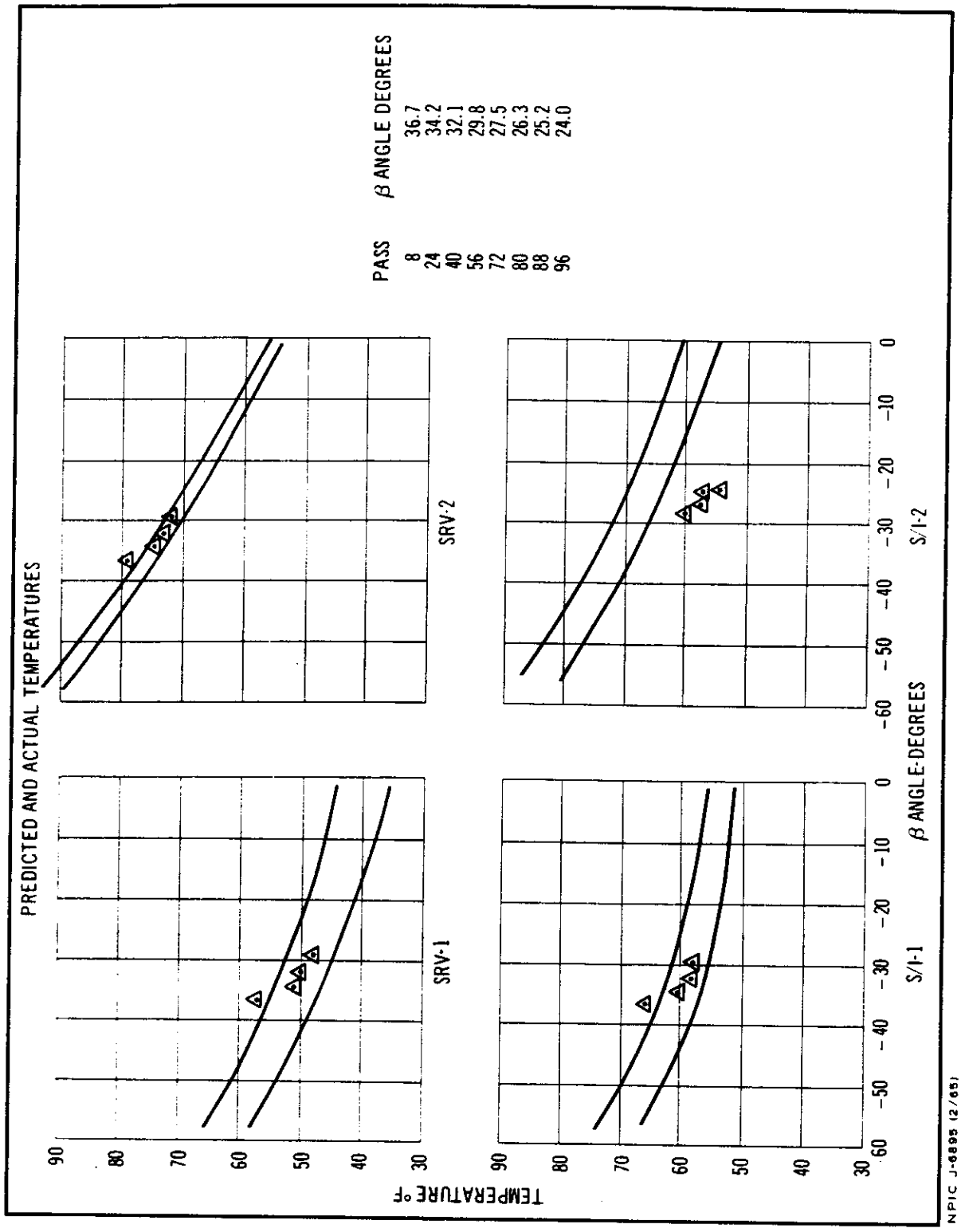
NOTE: Only Thrust Cone Data and Recovery Battery corrected for Self-heating.

Handle Via
~~TALENT KEYHOLE~~
Control System Only



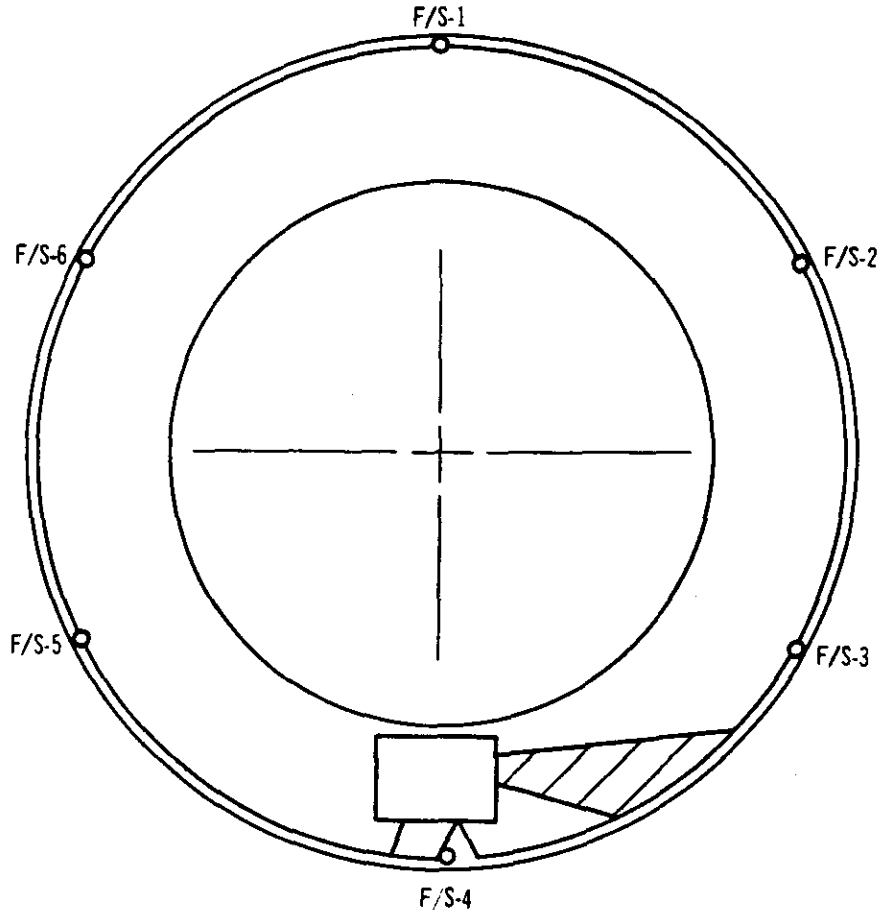
Handle Via
~~TALENT KEYHOLE~~
Control System Only


PASS β ANGLE DEGREES
8 36.7
21 35.4
40 32.1
55 25.8
PREDICTED AND ACTUAL TEMPERATURES
SLAVE SCAN ARM
CLOCK
MASTER SCAN ARM
SUPPLY CASSETTE
β ANGLE DEGREES
TEMPERATURE °F
90 80 70 60 50 40 30
0 -10 -20 -30 -40 -50 -60
NPIC J-9469 (2/85)


PASS
β ANGLE DEGREES
8 36.7
24 34.2
40 32.1
56 29.8
72 27.5
80 26.3
88 25.2
96 24.0
PREDICTED AND ACTUAL TEMPERATURES
SRV-2
S/I-2
SRV-1
S/I-1
β ANGLE-DEGREES
TEMPERATURE °F
90 80 70 60 50 40 30
0 -10 -20 -30 -40 -50 -60
NPIC J-6895 (2/65)

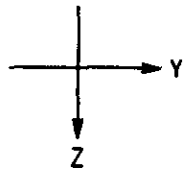
[redacted]

FAIRING TEMP SENSORS



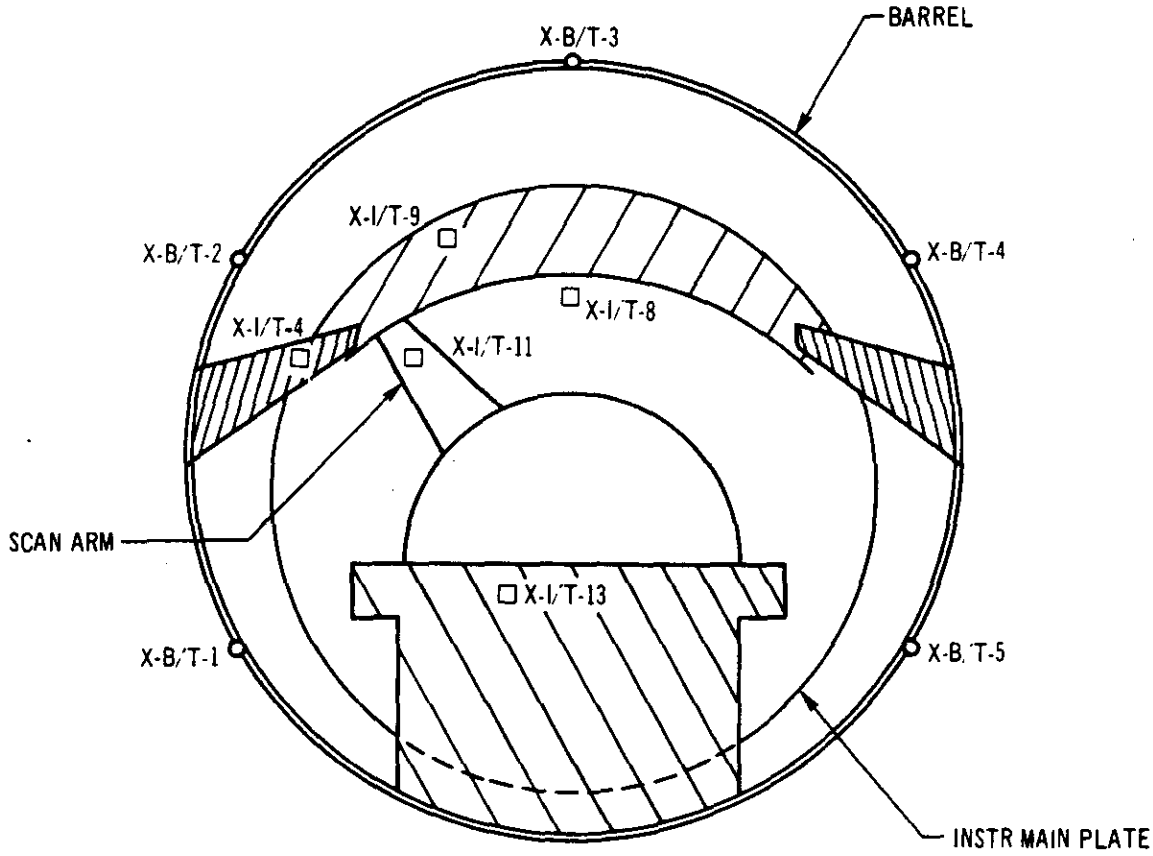
VIEW A-A
LOOKING FORWARD

NPIC J-7663 (2/65)

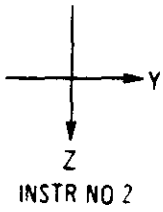


[redacted]

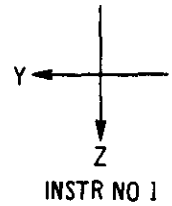
NO 1 & NO 2 TEMP SENSORS (FRONT FACE)
NO 1 & NO 2 BARREL TEMP SENSORS (SKIN)



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



INSTR NO 2

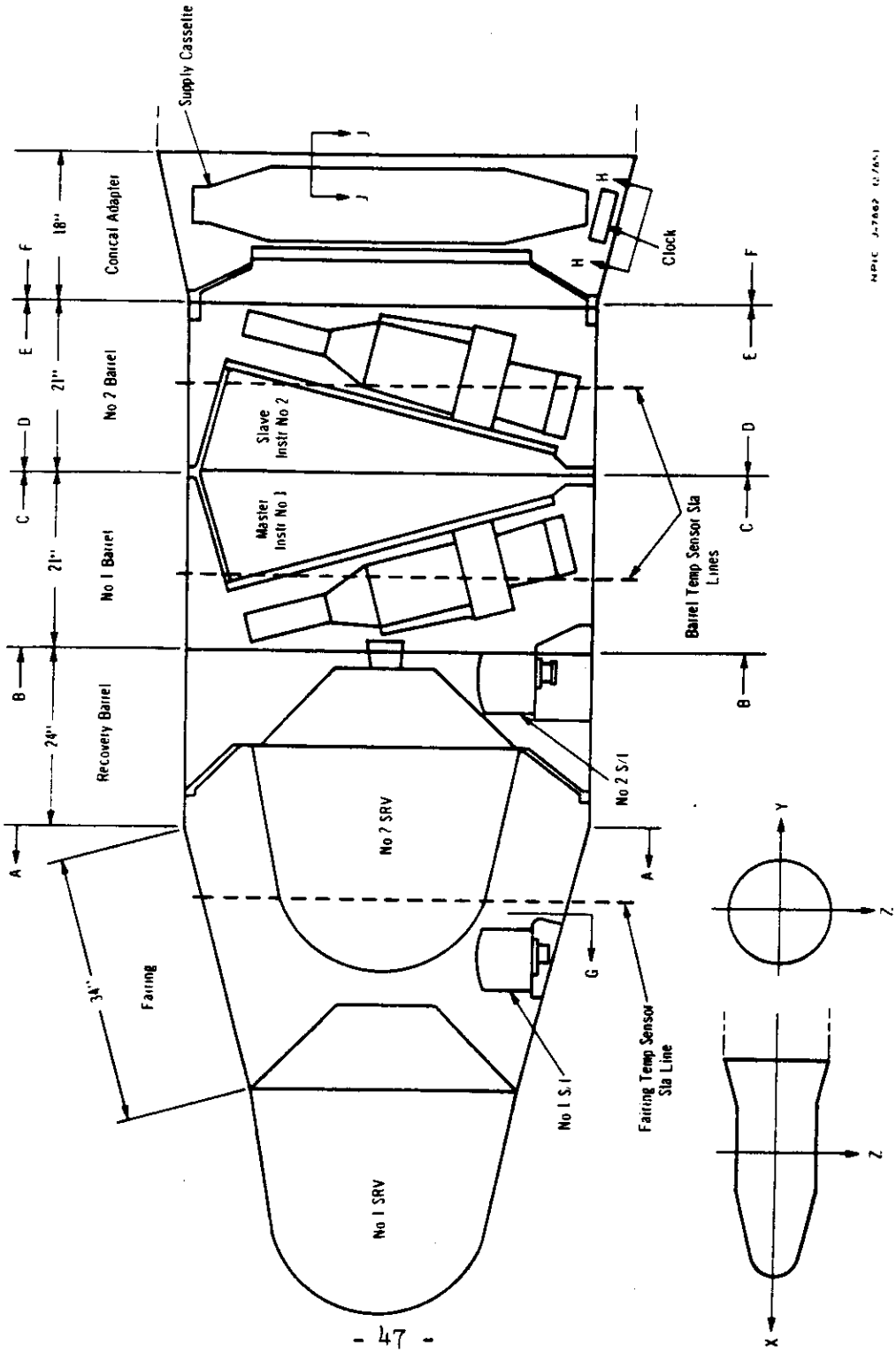


INSTR NO 1

NPIC J 8257 12/65

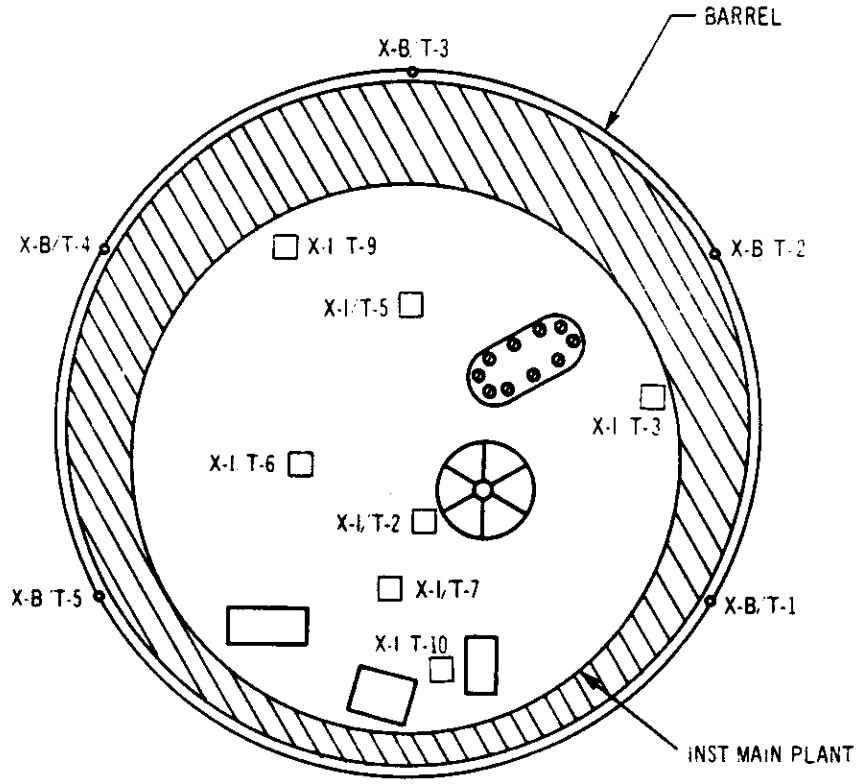
[redacted]

"J" PROFILE TO SHOW APPROXIMATE TEMP SENSOR LOCATIONS

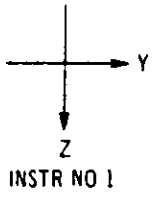


[redacted]

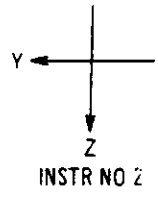
NO 1 & NO 2 INSTR TEMP SENSORS (BACKFACE)
NO 1 & NO 2 BARREL TEMP SENSORS (SKIN)



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



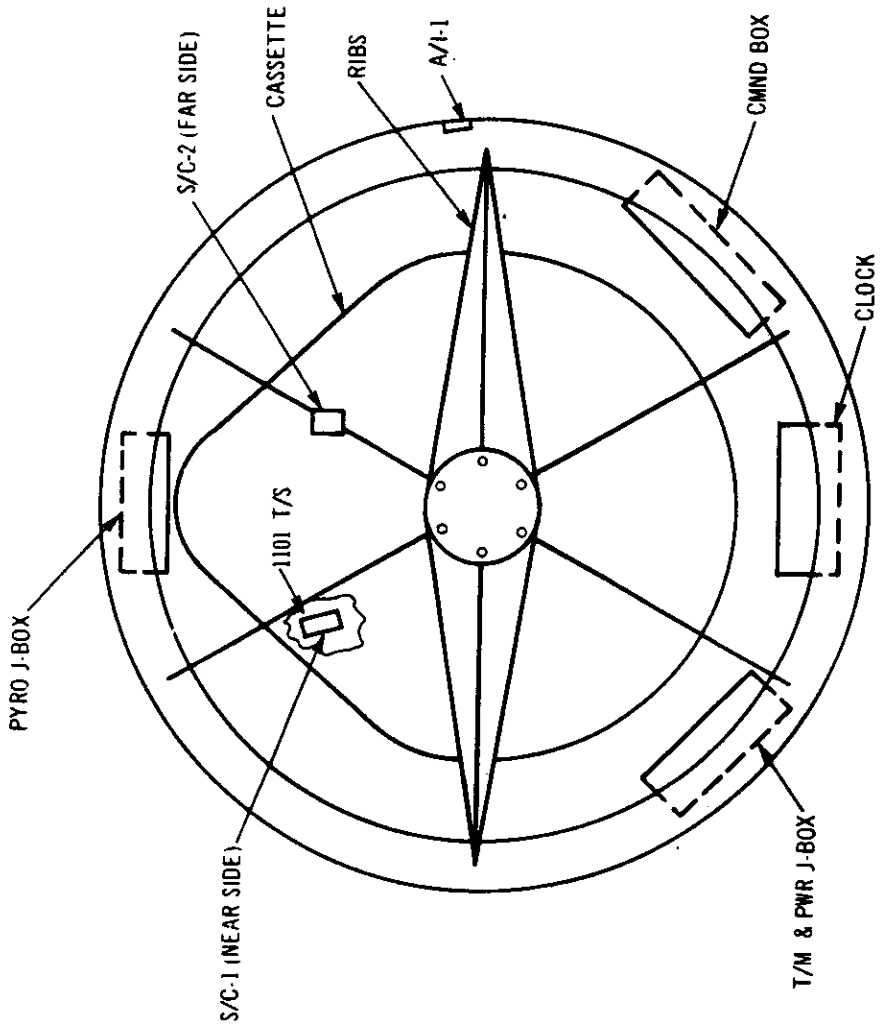
INSTR NO 1



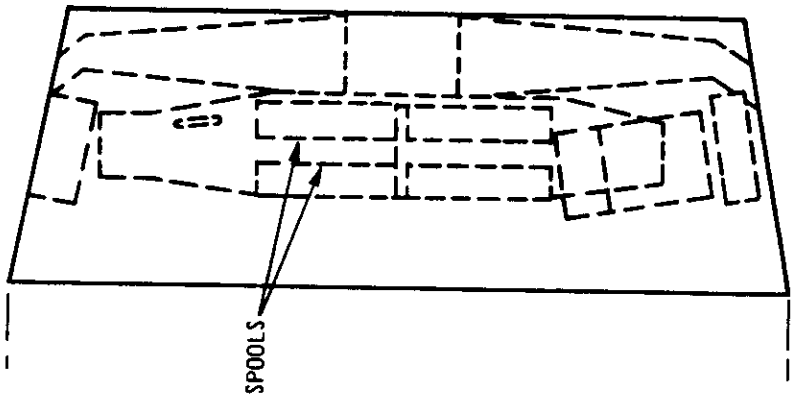
INSTR NO 2

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

VIEW E-E SUPPLY CASSETTE LOOKING AFT

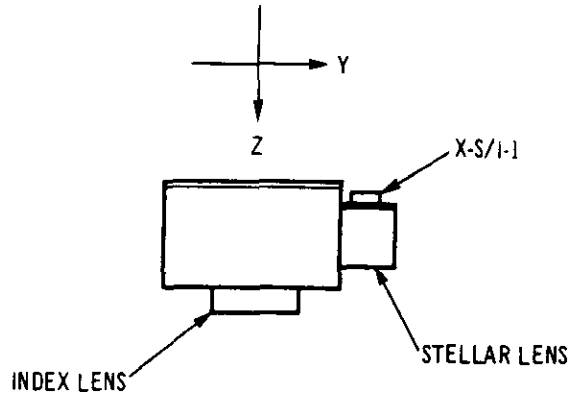


SIDE VIEW SHOWING SPOOLS

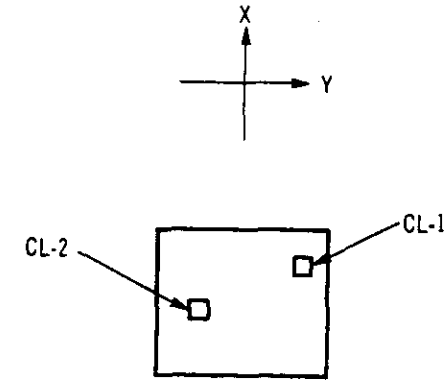


NPIC J-8259 2/65)

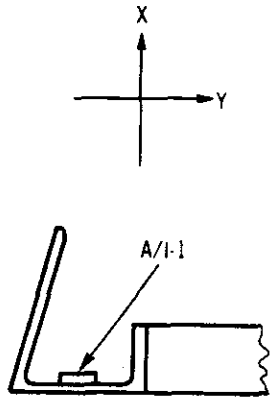
VIEW G-G
S/I TEMP SENSOR



VIEW H-H
CLOCK TEMP SENSOR



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



NO 1 AND NO 2 SRV TEMP SENSORS
Y
Z
X T/C-2
X-T/C-1
HEAT SHIELD
X-H/S-1
SECTION A A
THRUST CONE
TAKE UP CASSETTE
HEAT SHIELD
X-CS-2
FAR SIDE
X-CS-1
NEAR SIDE
A
A
X
RECOVERY BUCKET
KEY
X denotes No 1 or No 2 SRV
e.g.
X T/C 2 is
No 2 SRV thrust
cone temp sensor 2

[redacted]

APPENDIX E. CLOUD COVER ANALYSIS

1. INTRODUCTION

This study represents a statistical analysis of the cloud cover on the photography of Mission 1011-1. The basis of this study is the cloud cover data for each quarter segment of every individual frame of photography. The data is obtained by analysts specifically trained in estimating cloud cover by designated categories.

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

The occurrence of each cloud category within an operational pass is expressed as a percentage of 100 and appears in Table 2. Each percentage is a ratio of the number of occurrences of a given cloud cover category to the total number of cloud observations in a photo pass. For example: if the number of category 1 occurrences in a given pass is 200 out of a total of 1000 (250 frames x 4 quarters), all categories combined, then 20 percent of the pass would be classed as category 1.

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

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

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

[redacted]

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.

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%

[redacted]

TABLE 2

PERCENTAGE OF CLOUD COVER
CATEGORIES BY PASSES
MISSION 1011-1

Pass Number	1	2	3	4	5	Cloud Cover % Per Pass
05D	53.1	7.6	9.2	28.8	1.3	30.3
06D	49.5	4.5	6.2	25.2	14.6	39.1
07D	64.3	5.2	7.2	21.4	1.9	24.8
09D	69.3	16.2	9.7	4.8	0.0	13.6
14D	0.0	0.0	14.6	63.9	21.5	75.0
19D	17.2	12.5	14.3	40.0	16.0	54.5
20D	2.0	4.2	8.5	47.2	38.1	77.5
21D	35.2	6.7	7.5	16.7	33.9	52.2
22D	47.0	4.3	11.2	29.1	8.4	37.6
24D	15.5	8.0	22.0	40.1	14.4	55.0
25D	59.1	6.6	9.3	25.0	0.0	26.4
36D	21.1	12.7	16.4	46.4	3.4	47.7
37D	32.4	6.1	13.7	29.3	18.5	48.3
38D	38.6	7.1	9.5	39.0	5.8	41.8
39D	18.8	6.0	4.4	60.4	10.4	59.3
40D	92.6	1.1	0.9	4.9	0.5	9.3
41D	3.6	5.6	19.0	49.2	22.6	67.9
52D	70.5	11.4	14.3	3.8	0.0	13.8
53D	33.6	10.0	16.9	34.6	4.9	[illegible]
54D	54.1	2.1	8.9	29.6	5.3	33.9
55D	44.7	2.0	7.9	35.4	10.0	42.1
56D	93.6	2.1	3.7	0.6	0.0	6.9
57D	0.0	0.0	0.0	50.4	49.6	87.4
	42.5*	6.3*	10.2*	30.1*	10.9*	40.5**

*Average Percentage by Category for Mission.

**Overall Mission Cloud Coverage Percentage.

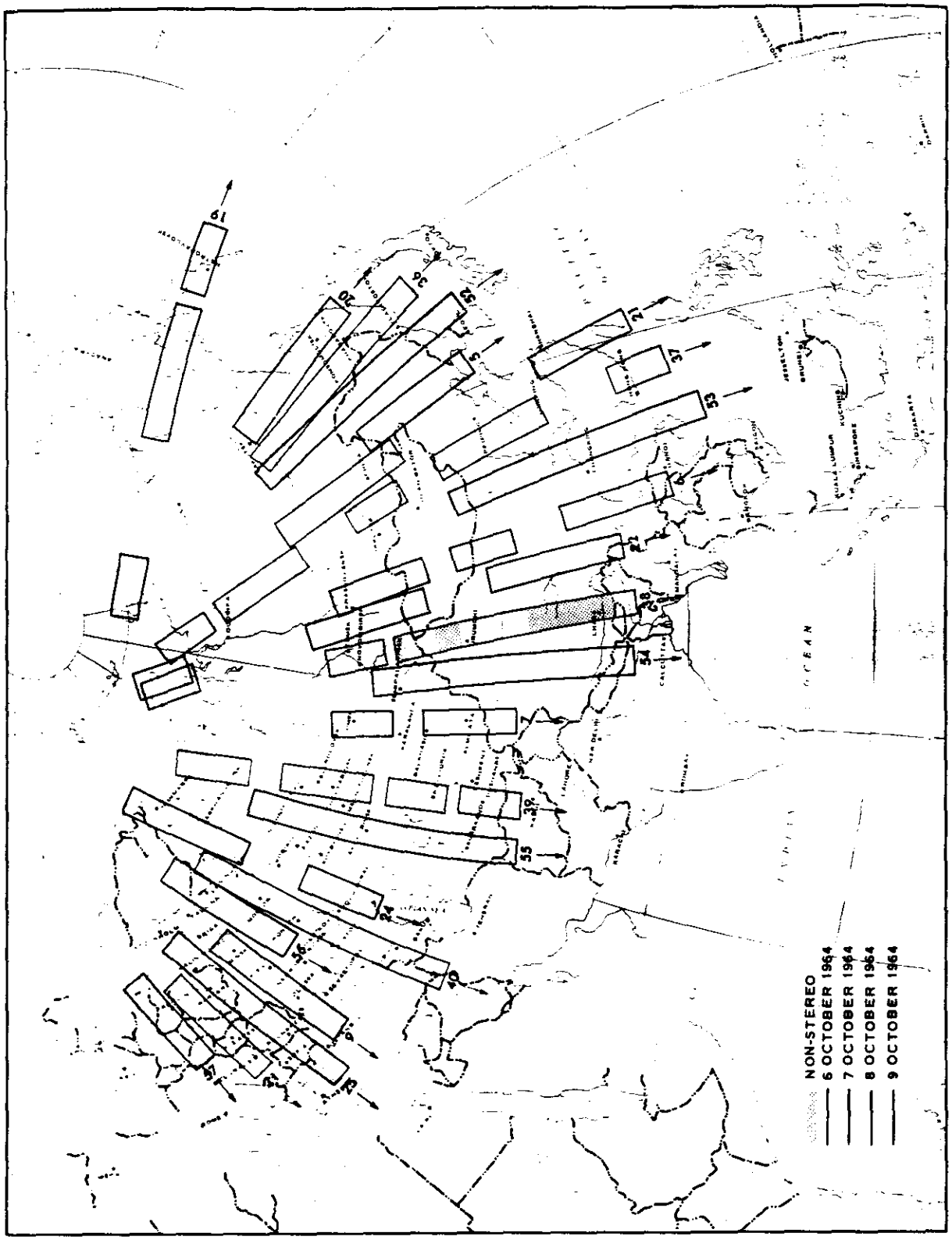
[redacted]

APPENDIX F. MISSION COVERAGE STATISTICS

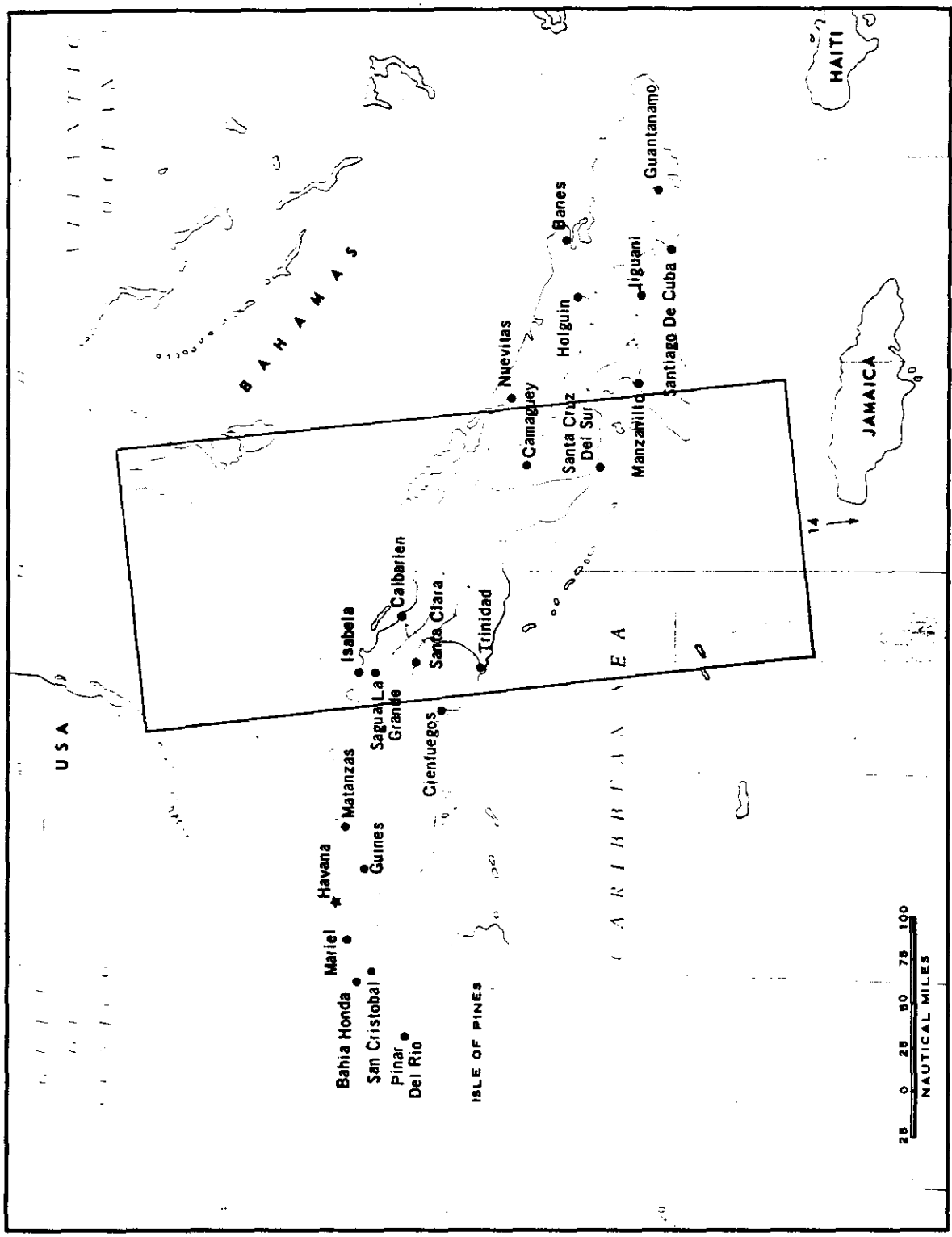
SUMMARY OF PLOTTABLE PHOTOGRAPHIC COVERAGE
MISSION 1011-1

COUNTRY	FORWARD CAMERA		AFT CAMERA		TOTALS	
	Linear nm	Square nm	Linear nm	Square nm	Linear nm	Square nm
USSR	12,521	1,902,626	12,944	2,004,282	25,465	3,906,908
China	5,761	816,026	6,107	886,626	11,868	1,702,652
Mongolia	479	70,818	508	76,002	987	146,820
Rumania	285	42,180	247	36,604	532	78,784
E. Germany	214	32,814	213	32,802	427	65,616
Turkey	205	27,036	154	22,578	359	49,614
Poland	200	30,432	405	61,560	605	91,992
Czechoslovakia	170	25,848	306	46,726	476	72,574
Nepal	141	20,586	100	14,600	241	35,186
N. Korea	129	12,410	163	11,570	292	23,980
India	117	16,540	185	26,796	302	43,336
W. Germany	115	17,710	107	16,478	222	34,188
Hungary	114	16,896	129	19,608	243	36,504
Bulgaria	107	15,836	141	20,868	248	36,704
Mexico	92	10,508	44	4,970	136	15,478
Burma	80	11,360	78	11,388	158	22,748
Finland	76	12,032	145	23.920	221	35,952
Norway	74	5,340	92	6,586	166	11,926
Yugoslavia	55	8,140	25	3,800	80	11,940
Iran	53	7,722	16	2,336	69	10,058
Greece	53	5,476	47	6,956	100	12,432
Taiwan	41	3,550	41	3,550	82	7,100
Laos	35	4,970	82	11,644	117	16,614
Austria	29	4,408	53	8,162	82	12,570
Denmark	29	3,080	53	8,162	82	11,242
Bhutan	25	3,500	107	15,408	132	18,908
Afghanistan	20	2,840	16	2,336	36	5,176
S. Korea	12	292	none	none	12	292
Sweden	6	154	74	2,340	80	2,494
TOTAL	21,238	3,131,130	22,582	3,388,658	43,820	6,519,788
CONTINENTAL US	745	105,790	849	120,558	1,594	226,348
GRAND TOTAL	21,983	3,236,920	23,431	3,509,216	45,414	6,746,136

[redacted]

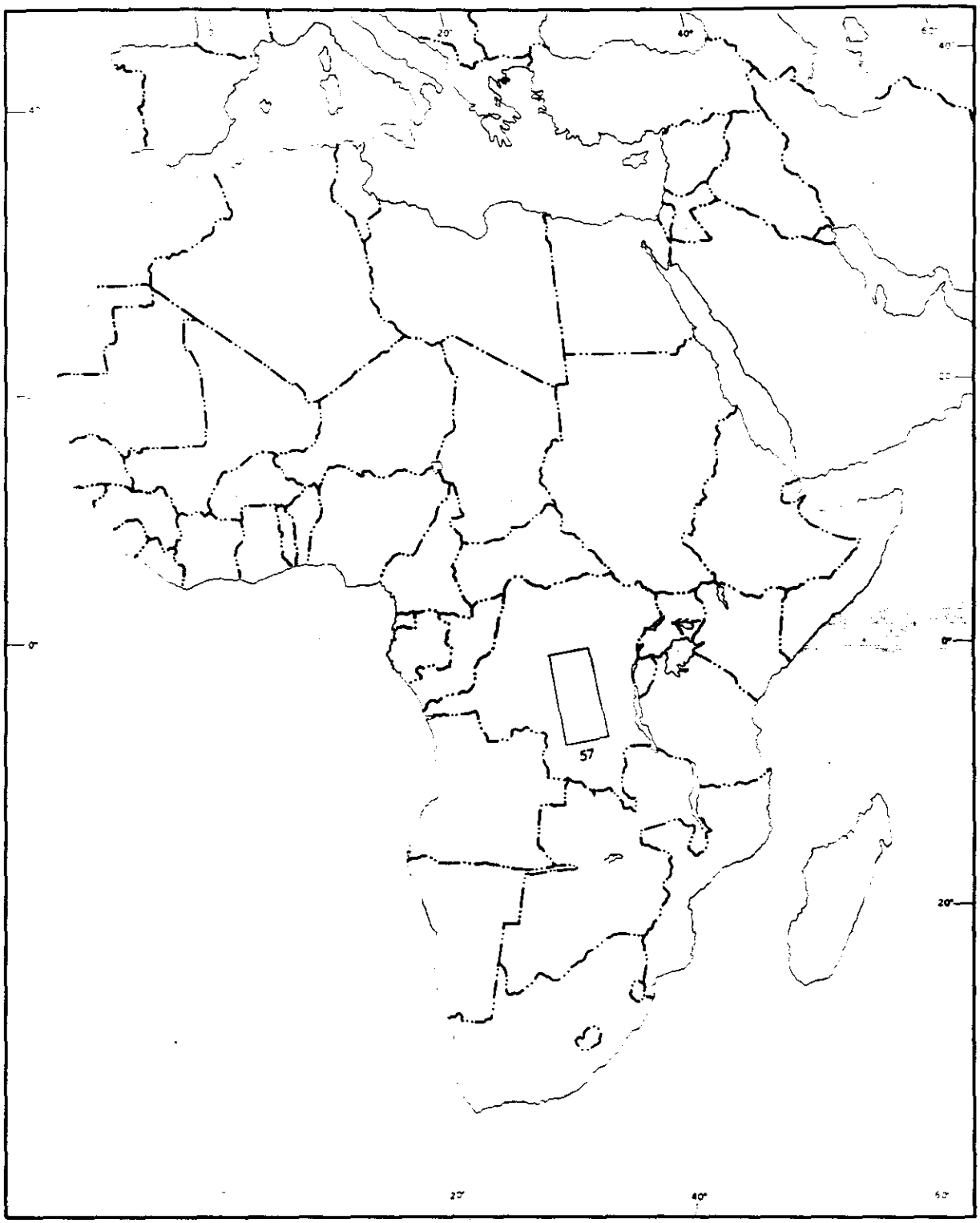


APPROXIMATE TRACK OF MISSION 1011-1, 6-9 OCTOBER 1964 OVER USSR, FAR AND MIDDLE EAST.



APPROXIMATE TRACK OF MISSION 1011-1, 6-9 OCTOBER 1964 OVER CUBA.

[redacted]



NPIC J-4627 (10/64)

APPROXIMATE TRACK OF MISSION 1011-1, 6-9 OCTOBER 1964 OVER AFRICA.

[redacted]