TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT MISSION 1041

SPECIAL STUDY - SLANT RANGE COMPUTATIONS RELATED TO UNIVERSAL GRID COORDINATES

[redacted]

AUGUST 1967

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57 PAGES

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TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT
MISSION 1041

AUGUST 1967

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

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LIST OF ILLUSTRATIONS

GLOSSARY OF TERMS

ABSOLUTE HEIGHT	Vertical distance from the vehicle to the mean ground level of the area being photographed.
ACUITY	Sharpness - Edge definition.
ACUTANCE	Measure of the ability of a lens to reproduce sharp images.
AIR BASE	Ground distance between 2 exposure stations.
ALTITUDE	Vertical distance from the vehicle to the Hough Ellipsoid at the time of exposure.
AZIMUTH OF THE PRINCIPAL RAY	Horizontal clockwise angle, measured from true north to the camera principal ray.
BASE HEIGHT RATIO	Ratio between the air base and the absolute attitude of a stereoscopic pair of photographs.
CAMERA NADIR	Geodetic latitude and longitude of a point vertically beneath the perspective center of the camera lens on the Hough Ellipsoid.
CONE ANGLE	Angle between the principal ray and the vehicle nadir.
COPY GENERATION	Number of reproductive steps by which a negative or positive photographic copy is separated from the original, i.e. the original negative is copy 1, a positive made from the original negative is copy 2, etc.
DATE OF PHOTOGRAPHY	Indicates the day, month, and year (GMT) that the photography was acquired.

EXPOSURE*	Total quantity of light received per unit area on a sensitized plate or film.
EXPOSURE DURATION	Time during which a light-sensitive material is subjected to the influence of light. Expressed in this test in fractions of a second. Formula: Exposure Time (sec) = $\frac{\text{Slit Width (in)}}{\text{Scan Rate (in per sec)}}$
EXPOSURE STATION	Position occupied by the camera lens at the moment of exposure.
FIDUCIAL MARK	A standard geometrical reference point imaged at the margin of a photograph. The intersection of the primary fiducial marks usually defines the principal point.
FOCAL LENGTH: CALIBRATED	Adjusted value of the equivalent focal length. Computed to distribute the effect of lens distortion over the entire field.
FOCAL LENGTH: EQUIVALENT	Distance measured along the lens axis from the rear nodal point to the plane of best average definition over the entire field. Points other than the rear nodal point may be used but must be specified for correct interpretation of data.
FOCAL PLANE	Plane perpendicular to the lens axis, in which images of points in the object field of the lens are focused.
FRAME	One of a series of full-format photographs comprising a roll of film.
GROUND RESOLUTION*	Resolved ground distance as determined from standard bar target resolution targets. A target is considered to be resolved when a grouping of 3 bars can be distinguished as 3 distinct lines. The lines need not have linear form.

HOLEY RAIL DOTS	Images of the rail holes associated with the pan geometry calibration of the camera.
IMC (Image Motion Compensation)	Correction for the forward motion of the vehicle while photographing the terrain.
ISODENSITOMETER	An instrument which is basically a microdensitometer with the capability of repeatedly scanning an image at pre-set intervals. Its output is in the form of a plot representing distance along 2 axes and density differences as code changes within each scan line.
LOCAL SUN TIME	Time of day computed from the position of the sun relative to the imaged terrain.
MICRODENSITOMETER	An instrument which measures the optical density of very small areas in an image. Its output is in the form of a continuous plot of density versus distance across an image. The microdensitometer used in NPIC can accurately measure distances as small as 1 micron and densities up to 5.0+.
NOD INDICATORS	A series of marks imaged in the border area of each frame for the purpose of defining the relative orientation of the optical axis and the ground scene.
NODAL TRACE	A continuous line imaged along the major axis of each frame to define the optical axis of the lens relative to any given instant of exposure.
PANORAMIC CAMERA	Photographs a partial or complete panorama of the terrain in a transverse direction through a scanning motion of the lens system.

PARALLAX	Apparent displacement of the position of an object in relation to a reference point, caused by a change in the point of observation.
PASS	Operational portion of an orbital revolution. A suffix D indicates the descending node and a suffix A indicates the ascending node. An additional suffix E indicates that the associated photography was generated for engineering purposes.
PITCH	Rotation of the camera about its transverse axis. Positive pitch indicates nose-up attitude.
PROCESSING LEVEL	Degree of development. Three levels of processing are currently employed: Primary, intermediate, and full.
PRINCIPAL RAY	That ray of light which emanates from a point in object space and passes undeviated through the lens to become imaged at the principal point of the camera system. It is co-incident with the optical axis of the lens.
RESOLUTION	Measure of the smallest array of point objects distinguishable as independent point images, expressed in lines/mm.
ROLL	Rotation of the camera about its longitudinal axis. Positive roll indicates left wing up attitude.
SHADOW FACTOR	A constant for each frame, used to calculate heights from shadow lengths.
SHRINKAGE MARKERS	Calibrated reference points used to calculate deformations of the photographic material.

SOLAR ELEVATION	Vertical angle measured from a plane (tangent to the surface of the earth at the point of intersection of the principal ray) to the sun, the vertex being at the center of the format.
STELLAR CAMERA	Used simultaneously with the index camera to photograph stars in order to determine vehicle attitude.
SYSTEM TIME LABEL	Binary presentation of the accumulative system time.
UNIVERSAL GRID	X, Y coordinate system used to locate images on photographic formats.
VEHICLE AZIMUTH	Clockwise horizontal angle measured from true north to the vehicle ground track.
VIGNETTING	Gradual reduction in density of parts of a photographic image due to the stopping of some of the rays entering the lens.
YAW	Rotation of the camera about its vertical axis. Positive yaw represents nose-left attitude, as viewed from the top of the camera.

*Defined differently than in the "Glossary of NPIC Terminology."

INDEX OF PHOTOGRAPHIC EVALUATION REPORTS AND SPECIAL STUDIES

PER	DOCUMENT NUMBER	SPECIAL STUDY
1037	[redacted]	None
1038		None
1039		None
1040		None
1041		Slant Range Computations Related to Universal Grid Coordinates for the KH-4 Camera System

[redacted]

SYNOPSIS

Mission 1041 was launched on 9 May 1967 at 2115Z. Due to the failure of the booster cut-off switch, the launch vehicle burned to exhaustion, resulting in a highly eccentric orbit with apogee at 430 nautical miles (nm) and perigee at 100 nm. The apogee and perigee for photographic requisition were 170 and 100 nm respectively.

Both buckets were recovered dry via air catch. The second bucket was defilmed on the west coast, and the mission material was shipped to the processing site after inspection of the recovery vehicle. A total of 87 photographic revolutions was accomplished on the 14-day mission.

The panoramic cameras operated satisfactorily throughout the mission. The image quality of both panoramic camera records is good. However, finer detail can be observed in the imagery of the forward-looking camera record. This is probably the result of the overall higher contrast imagery produced by the forward camera.

There is an out-of-focus area on the aft camera record near the supply end of each frame. It begins approximately 1.5 inches from the end of the frame and continues for about 6.0 inches along the frequency mark edge. At its maximum size, it extends about 1.25 inches into the format.

The horizon cameras functioned properly throughout the mission with the exception of one malfunction. The shutter of the starboard-looking horizon camera associated with the forward-looking panoramic camera remained open during acquisition of panoramic camera frames 13 and 14 of pass 69D.

The stellar/index cameras operated satisfactorily throughout the mission. The base plus fog densities of both the index and the stellar records are higher than normal on both parts of Mission 1041 with Mission 1041-2 fog densities significantly higher than those of Mission 1041-1. This data strongly suggests an exposure from radiation resulting from the unusually high apogee of the orbit. An unidentified image is present in stellar frames 85 through 89 (pass 21D) of Mission 1041-1, and again in frames 27 through 30 (pass 97D) of Mission 1041-2. The object is external to the vehicle system. The index camera produced good quality imagery.

[redacted]

[redacted]

PART I. GENERAL SYSTEM INFORMATION

A. Camera Numbers

Forward-Looking Panoramic Camera 208
Aft-Looking Panoramic Camera 209
Stellar/Index Camera (Mission 1041-1) D105/134/133
Stellar/Index Camera (Mission 1041-2) D102/127/127

B. Launch and Recovery Dates

	(Mission 1041-1)	(Mission 1041-2)
Launch	2152Z/9 May 67	NA
Recovery	0036Z/16 May 67	0008Z/24 May 67

C. Orbit Elements

Element	Planned	Rev No 45	Rev No 150	Photo Range
Period (min)	*	94.347	94.205	NA
Perigee (nm)	*	100.130	103.171	100.186 (Rev No 2D)
Apogee (nm)	*	430.650	430.010	171.412 (Rev No 37D)
Eccentricity	*	0.04460	0.04414	NA
Inclination (deg)	*	85.051	85.049	NA
Perigee Latitude (deg)	*	32.986N	57.978N	NA

* = Not Available.
NA = Not Applicable.

D. Photographic Operations

1. Panoramic Cameras

Type	Mission 1041-1 Revs	Mission 1041-1 Frames	Mission 1041-2 Revs	Mission 1041-2 Frames	Total Revs	Total Frames
Operational						
Fwd	31	2,888	41	2,911	72	5,799
Aft	31	2,870	41	2,922	72	5,792
Operational/Domestic						
Fwd	0	0	0	0	0	0
Aft	0	0	0	0	0	0
Domestic						
Fwd	2	24	5	70	7	94
Aft	2	24	6	72	8	96
Engineering (no imagery)						
Fwd	3	26	4	40	7	66
Aft	3	26	4	39	7	65
Totals						
Fwd	36	2,938	50	3,021	86	5,959
Aft	36	2,920	51	3,033	87	5,953

2. Secondary Cameras

Camera	Frames
Stellar (Mission 1041-1)	443
Index (Mission 1041-1)	443
Stellar (Mission 1041-2)	460
Index (Mission 1041-2)	460

E. Film Usage

	Film Load (Total)	Pre-Flight Footage	Processed Footage
Fwd-Looking (Mission 1041-1)	16,000*	277.7	8,071
Aft-Looking (Mission 1041-1)	16,000*	301.5	8,037
Fwd-Looking (Mission 1041-2)	NA	NA	7,913
Aft-Looking (Mission 1041-2)	NA	NA	7,935
Stellar (Mission 1041-1)	75	2.5	52
Stellar (Mission 1041-2)	75	3.0	51
Index (Mission 1041-1)	135	6.9	108
Index (Mission 1041-2)	135	4.2	119

*Total load for both buckets.
NA - Not Applicable.

PART II. IMAGE ANALYSIS

A. Fwd-Looking Panoramic Camera

1. Density: Approximately 70 percent of the original negative is of medium density. The remaining 30 percent is divided equally between the heavy and thin categories.

2. Contrast: The contrast of the imagery obtained by the fwd-looking camera is generally medium, 70 percent of the material falling in this category. The remaining 30 percent was divided as follows--20 percent high and 10 percent low.

3. Acuity: The acuity of the imagery is good. Finer detail can be observed in the imagery obtained from the fwd-looking camera. Mission 1041 produced generally good quality imagery and is comparable to that obtained from Mission 1040.

4. Imaged Degradations

a. Light Leaks: There is fog present on frame 5 and the second-to-last frame of most camera operations. (See Graphic #1, page 9.) These patterns are similar to those observed on the last several missions. The density varies with camera off durations, and the resulting degradation is minimal.

b. Static: None noted.

c. Other: None.

5. Physical Degradations: Rail scratches are continuous along both film edges throughout the mission. Scratches within the format produced by the scan head rollers occurred to an average extent.

6. Product Quality: The overall product quality of the fwd-looking camera record is good.

B. Aft-Looking Panoramic Camera

1. Density: Same as reported for the fwd-looking camera.

2. Contrast: The aft-looking panoramic camera produced a lower percentage of high contrast imagery than the fwd-looking camera. Approximately 70 percent of the mission was considered to be of medium contrast with 20 and 10 percent falling in the low and high categories respectively.

3. Acuity: The edge sharpness of the imagery obtained from the aft-looking camera is good; however, finer detail can be observed in the imagery obtained from the fwd-looking camera. The slightly higher contrast is considered to be a contributing factor. An area of out-of-focus imagery is present throughout the mission near the supply end of the format, along the frequency mark edge. (See Graphic #3, page 9.) The affected area covers approximately 2 percent of each format at the start of the mission and increases gradually until it covers about 6 percent of each format at the end of the mission. The cause of this anomaly appears to have been a film tracking bias across the platen which in turn caused the film to touch the guide rails, producing a small buckle.

4. Imaged Degradations

a. Light Leaks: Fog patterns of varying density are present on frame 5, the second-to-last frame, and the third-to-last frame of most camera operations. (See Graphic #2, page 9.)

b. Static: None noted.

c. Other: Minus density streaks, up to one-eighth inch wide, are intermittent but frequent throughout the aft camera record. They generally appear in groups of 3 and follow the path of the field flattener. This anomaly is caused by loose dirt particles which are randomly in contact with the field flattener.

5. Physical Degradations: Same as reported for the fwd-looking camera.

6. Product Quality: With the exception of the reported out-of-focus area, the quality of the product from the aft-looking camera is good.

C. Stellar Camera (Mission 1041-1)

1. Density: The base plus fog density of the original negative is slightly higher than that recorded on recent missions of this system; however, stellar images can be detected.

2. Contrast: Adequate for the detection of stellar images.

3. Image Shape: The shape of the stellar images varies from point type to elongated and dumbbell shaped.

4. Images Per Frame: Approximately 7 to 10 stellar images are detectable on each frame.

5. Flare Level; Flare affects approximately 60 percent of each stellar frame.

6. Image Degradations

a. Light Leaks: None noted.

b. Static: None noted.

c. Other: The reseau number image is illegible. Frame 195 is double exposed.

7. Physical Degradations: None noted.

8. Product Quality: The overall quality is considered good; however, some difficulty was encountered in the reduction process due to the higher-than-normal base plus fog density.

D. Stellar Camera (Mission 1041-2)

1. Density: The base plus fog density of the stellar record of Mission 1041-2 is significantly higher than that of Mission 1041-1. This data strongly suggests a radiation exposure resulting from the unusually high apogee of the orbit.

2. Contrast: Predominantly low, but adequate for the detection of stellar images.

3. Image Shape: Same as reported for Mission 1041-1.

4. Images Per Frame: Same as reported for Mission 1041-1.

5. Flare Level: Earth flare affects approximately 15 percent of each stellar frame.

6. Image Degradations

a. Light Leaks: None noted.

b. Static: None noted.

c. Other: None.

7. Physical Degradations: The last 20 frames are degraded by the usual scratches, pinholes, and emulsion gouges associated with film supply depletion.

[redacted]

8. Product Quality: Same as reported for Mission 1041-1, with the exception of the degradations induced by the high base fog.

E. Index Camera (Mission 1041-1)

1. Density: The density of the index camera record is generally medium. Seventy-five percent of the mission fell in this category.

2. Contrast: Medium.

3. Acuity: The image quality is good and compares favorably with recent missions of this system.

4. Imaged Degradations

a. Light Leaks: None noted.

b. Static: None noted.

c. Other: During a normal metering cycle, the film carried a small foreign particle, one square millimeter in size, into the active format area. This particle was deposited on the top surface of the reseau plate, causing a small minus density spot on the last 17 frames of the mission. A double exposure occurred on titled frame 195.

5. Physical Degradation: None noted.

6. Product Quality: Good.

F. Index Camera (Mission 1041-2)

1. Density: Same as reported for the index camera record of Mission 1041-1.

2. Contrast: Same as reported for the index camera record of Mission 1041-1.

3. Acuity: Same as reported for the index camera record of Mission 1041-1.

4. Imaged Degradations

a. Light Leaks: None noted.

b. Static: None noted.

c. Other: None.

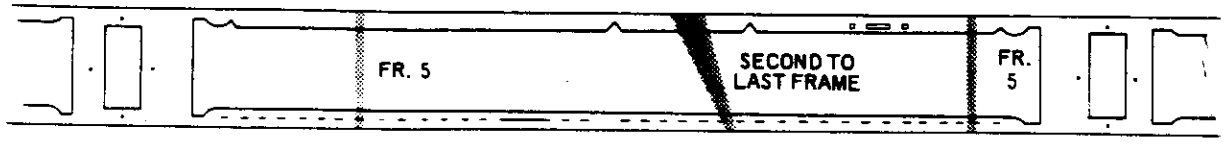
5. Physical Degradations: None noted.

6. Product Quality: Good.

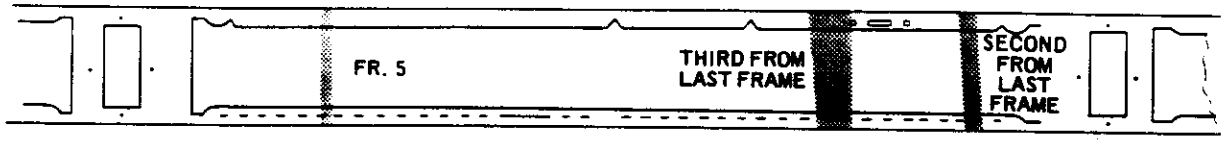
G. Graphic Display (Mission 1041)

The patterns illustrated below are referenced in the text of this report.

GRAPHIC 1



GRAPHIC 2



GRAPHIC 3

PART III. IMAGED AUXILIARY DATA

A. Fwd-Looking Panoramic Camera

1. Horizon Cameras

a. Starboard-Looking

(1) Imagery: Sharp and distinct.

(2) Fiducials: Well defined.

b. Port-Looking

(1) Imagery: Sharp and distinct.

(2) Fiducials: Well defined.

2. Frequency Marks: The frequency marks are missing for the first 1 to 6 inches of the first frame of most passes. Similar anomalies have been noted in several previous missions. A circuit modification to improve this condition is scheduled for introduction on systems J-49 and J-50.

3. Binary Time Word: All light images are of good quality. The only problem encountered was the drift of the binary block which occurred during the printing of the TI copy.

4. Binary Index: Sharp and well defined.

5. Camera Number: Slightly bloomed but readable.

6. Pan Geometry Dots: Not applicable.

7. Nodal Traces: Not applicable.

8. Nod Indicators: Not applicable.

B. Aft-Looking Panoramic Camera

1. Horizon Cameras

a. Starboard-Looking

(1) Imagery: Sharp and distinct.

(2) Fiducials: Well defined.

b. Port-Looking

(1) Imagery: Sharp and distinct.

(2) Fiducials: Well defined.

2. Frequency Marks: Good.

3. Binary Time Word: Same as reported for the fwd-looking camera.

4. Binary Index: Sharp and well defined.

5. Camera Number: Slightly bloomed but readable.

6. Pan Geometry Dots: Not applicable.

7. Nodal Traces: Not applicable.

8. Nod Indicators: Not applicable.

C. Stellar Camera (Mission 1041-1)

1. Grid Image Quality: Good.

2. Correlation Lamp Image Quality: Good. However, the reseau number is very indistinct.

D. Stellar Camera (Mission 1041-2)

1. Grid Image Quality: Sharp and distinct.

2. Correlation Lamp Image Quality: Good.

E. Index Camera (Mission 1041-1)

1. Grid Image Quality: Good.

2. Correlation Lamp Image Quality: Good.

3. Camera Number Legibility: Good.

F. Index Camera (Mission 1041-2)

1. Grid Image Quality: Good.

2. Correlation Lamp Image Quality: Good.

3. Camera Number Legibility: Good.

[redacted]

PART IV. MENSURATION QUALITY

A. Fwd-Looking Panoramic Camera

No problems were encountered from a mensuration standpoint. A total of 24 requests for measurements was handled by the Production Branch. All measurements that could be checked against previous work correlated well.

B. Aft-Looking Panoramic Camera

Same as reported for the fwd-looking camera.

[redacted]

PART V. FILM PROCESSING

A. Processing Machines and Process Gamma

Film	Part: Entire Mission Machine	Gamma	Part: NA Machine	Gamma
Fwd (Mission 1041-1)	Trenton	2.29	NA	NA
Aft (Mission 1041-1)	Trenton	2.28	NA	NA
Fwd (Mission 1041-2)	Trenton	2.20	NA	NA
Aft (Mission 1041-2)	Trenton	2.25	NA	NA
Stellar (Mission 1041-1)	Yardleigh	1.79	NA	NA
Stellar (Mission 1041-2)	Yardleigh	1.82	NA	NA
Index (Mission 1041-1)	Drape	1.33	NA	NA
Index (Mission 1041-2)	Drape	1.31	NA	NA

B. Processing Levels

1. Panoramic Cameras

Film	Primary	Intermediate	Full	Transition	Processing Changes
Fwd (Mission 1041-1)	8%	38%	54%	*	59
Aft (Mission 1041-1)	10%	40%	50%	*	53
Fwd (Mission 1041-2)	7%	26%	67%	*	37
Aft (Mission 1041-2)	10%	28%	62%	*	30

NA = Not Applicable.
* = Not Available.

2. Secondary Cameras

a. Stellar Cameras: The stellar records of Mission 1041 were processed in the Yardleigh processor, using a single stage viscous development. No interruption in processing was used.

b. Index Cameras: No interruption in processing was used.

Film	Primary	Intermediate	Full	Transition	Processing Changes
Index (1041-1)			Not Applicable.		
Index (1041-2)			"		

C. Film Handling Summary

1. Fwd-Looking Camera

a. Capsule De-Filming

(1) Mission 1041-1: The capsule arrived without a harness. It was unusually clean compared to other capsules. No problems were encountered during de-filming.

(2) Mission 1041-2: The capsule was de-filmed prior to shipment to the processing site. The mission material arrived at the processing site in 2 suitcases.

b. Pre-Processing Inspection

(1) Mission 1041-1: No problems encountered.

(2) Mission 1041-2: No problems encountered.

c. Manufacturing Splices

(1) Mission 1041-1: A manufacturing splice is located in frame 137, pass 55D of the fwd-camera record.

(2) Mission 1041-2: A manufacturing splice is located in frame 10, pass 144D of the fwd-camera record.

d. Processing Splices

(1) Mission 1041-1: Only those normal to system operation.

(2) Mission 1041-2: Same as (1).

e. Manufacturing Defects

(1) Mission 1041-1: Same as d (1).

(2) Mission 1041-2: " " " "

f. Processing Anomalies: The forward camera record was cut after processing 1,679 feet because of an electrical failure on Trenton 1 involving the IR scanner viewer and multiplexer unit. The failure occurred at 1,347 feet at which time an attempt was made to locate the problem. Readily accessible fuses were checked to no avail. After the processor had been shut down, an investigation

revealed that a secondary fuse in the 1.5 kva transformer, inside the IR viewer box, had blown. The processor was put back on the line but a decision was made to only use it as a backup, and the remainder of the fwd-camera record was processed on the Trenton 2.

g. Breakdown: No problems were encountered.

2. Aft-Looking Camera

a. Capsule De-Filming

(1) Mission 1041-1: Same as reported for the fwd-camera.

(2) Mission 1041-2: Same as reported for the fwd-camera.

b. Pre-Processing Inspection

(1) Mission 1041-1: Same as reported for the fwd-camera.

(2) Mission 1041-2: Same as reported for the fwd-camera.

c. Manufacturing Splices

(1) Mission 1041-1: Frame 69, pass 52D.

(2) Mission 1041-2: Frame 26, pass 126D.

d. Processing Splices

(1) Mission 1041-1: None.

(2) Mission 1041-2: None.

e. Manufacturing Defects

(1) Mission 1041-1: None noted.

(2) Mission 1041-2: None noted.

f. Processing Anomalies: None.

g. Breakdown: No problems encountered.

3. Index Camera

a. Capsule De-Filming

(1) Mission 1041-1: No problems encountered.

(2) Mission 1041-2: No problems encountered.

b. Pre-Processing Inspection

(1) Mission 1041-1: No problems.

(2) Mission 1041-2: No problems.

c. Manufacturing Splices

(1) Mission 1041-1: None.

(2) Mission 1041-2: None.

d. Processing Splices

(1) Mission 1041-1: None.

(2) Mission 1041-2: None.

e. Manufacturing Defects

(1) Mission 1041-1: None noted.

(2) Mission 1041-2: None noted.

f. Processing Anomalies: None.

g. Breakdown: Normal.

4. Stellar Camera

a. Capsule De-Filming

(1) Mission 1041-1: No problems encountered.

(2) Mission 1041-2: No problems encountered.

b. Pre-Processing Inspection

(1) Mission 1041-1: No problems encountered.

(2) Mission 1041-2: No problems encountered.

c. Manufacturing Splices

(1) Mission 1041-1: None.

(2) Mission 1041-2: None.

d. Processing Splices

(1) Mission 1041-1: None.

(2) Mission 1041-2: None.

e. Manufacturing Defects

(1) Mission 1041-1: None noted.

(2) Mission 1041-2: None noted.

f. Processing Anomalies: None.

g. Breakdown: Normal.

D. Timetable

Film	Recovered	Received at Processing Site	*Spec Ship at NPIC Recd	Priority 1A at NPIC Recd
Fwd (Mission 1041-1)	16 May 67/0036Z	16 May 67/1240 EDST	None	18 May 67/2224 EDST
Aft (Mission 1041-1)	"	"	"	"
Stellar (Mission 1041-1)	"	"	"	"
Index (Mission 1041-1)	"	"	"	"
Fwd (Mission 1041-2)	24 May 67/0008Z	24 May 67/1515 EDST	"	26 May 67/2254 EDST
Aft (Mission 1041-2)	"	"	"	"
Stellar (Mission 1041-2)	"	"	"	"
Index (Mission 1041-2)	"	"	"	"

*Special Shipment Explanation: There was no requirement for a special priority shipment on this mission.

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PART VI. PI SUITABILITY

A. Definition of Photographic Interpretation (PI) 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 Unuseable. 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 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 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 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-optimum 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.

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

B. PI Statistics

1. Target Coverage

	Mission 1041-1	Mission 1041-2	Totals
Priority 1 Targets Programmed	No specific priority 1 targets were programmed on this mission although specific areas were selected for the initial readout.		
Priority 1 Targets Covered	89	111	202

2. PI Quality Appraisal

Rating	Missiles	Nuclear Energy	Air Facilities	Ports	Elect Commo	Military Activity	Complex
Good	8	0	2	1	1	2	0
Fair	11	6	18	2	1	41	4
Poor	6	4	24	19	2	40	5
Totals*	25	10	44	22	4	83	9

3. Summary of PI Quality Ratings (Percentage)

Good	14 or 7.1%	25
Fair	83 or 42.1%	13
Poor	100 or 50.8%	44
	197	32
		4
		83
		9
		197

*A discrepancy exists between the total number of targets covered and the total PI reports because several targets are covered more than once.

C. PI Comments

1. Atmospheric Attenuation: Listed below is the photo interpreter's report of weather conditions for the priority 1 targets covered on this mission.

a. Clear: 83 or 42.1 percent.
b. Scattered Clouds: 79 or 40.1 percent.
c. Heavy Clouds: 20 or 10.2 percent.
d. Haze: 8 or 4.0 percent.
e. Cloud Shadow: 7 or 3.6 percent.

2. Terrain Conditions: The terrain conditions were considered good for interpretation purposes. One factor worth noting is that this was the first relatively snow free mission over the Soviet Union since last fall.

3. Product Interpretability: The photo interpretation suitability is somewhat limited for targets at the more northern latitudes because of the small photo scale resulting from the highly eccentric orbit. Further limitations result from the area of out-of-focus imagery of the aft camera (described in Part II of this report). Heavy cloud cover and other atmospheric attenuation in some target areas further limited the value of this mission for current intelligence. However, the photo interpreters judged the value of the mission as fair to good.

4. Resolution Target Analysis

RESOLUTION TARGET DATA

Target Designator	None Imaged.
Camera (Looking)	
Pass	
Frame	
Date of Photography	
Universal Grid Coordinates	
Geographic Coordinate of Format Center	
Altitude (ft)	
Camera	
Pitch (deg)	
Roll (deg)	
Yaw (deg)	
Local Sun Time	
Solar Elevation (deg)	
Solar Azimuth (deg)	
Exposure (fraction of second)	
Processing Level	
Vehicle Azimuth (deg)	
Filter (Wratten)	
Target Type	
Target Contrast	
Weather Conditions	

GROUND RESOLUTION IN FEET AS DETERMINED FROM THE ORIGINAL NEGATIVE

Target Designator	Observer Number 1		Observer Number 2		Observer Number	
	Along Track	Across Track	Along Track	Across Track	Along Track	Ac Tr

Not Applicable.

TOP SECRET RUFF
NO FOREIGN DISSEM

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PART VII. MISSION DATA

	Pan	Master Take-up Horizon	Master Supply Horizon	Slave Pan	Slave Take-up Horizon	Slave Supply Horizon	Mission 1041-1 Stellar	Mission 1041-1 Index	Mission 1041-2 Stellar	Mission 1041-2 Index
Camera Number	208	NA	NA	209	NA	NA	D105/134/133		D102/127/127	
Reseau Number	NA	NA	NA	NA	NA	NA	133	134	127	127
Lens Serial Number	2172435	12866	12861	2182435	19105	19101	11714	821943	10594	820199
Slit Width	.225	NA	NA	.175	NA	NA	NA	NA	NA	NA
Aperture	F3.5	F6.3	F8.0	F3.5	F6.3	F8.0	F1.8	F4.5	F1.8	F4.5
Exposure Time (sec)	1/350 avg	1/100	1/100	1/275 avg	1/100	1/100	2.0	1/500	1.0	1/500
Filter (Wratten)	23A	25	25	21	25	25	None	21	None	21
Focal Length (mm)	609.628	55.000	54.900	609.602	55.000	55.000	38.54	85 nom	38.42	85 nom
Film Length (ft)	16,000	NA	NA	16,000	NA	NA	75	135	75	135
Splices	2	NA	NA	2	NA	NA	None	None	None	None
Emulsion	278-3-4-7	NA	NA	278-3-4-7	NA	NA	183-14-10-6	122-6-7-6	183-14-10-6	122-6-7-6
Film Type	3404	3404	3404	3404	3404	3404	4401	4400	4401	4400
Resolution Data (L/mm)										
Static										
High Contrast	253	*	*	245	*	*	*	AWAR 71	*	AWAR 73
Low Contrast	131	*	*	130	*	*	*	*	*	*
Dynamic										
I High Contrast	201	*	*	199	*	*	*	*	*	*
I Low Contrast	128	*	*	119	*	*	*	*	*	*
P High Contrast	178	*	*	187	*	*	*	*	*	*
P Low Contrast	111	*	*	112	*	*	*	*	*	*

* - Not Available.
NA - Not Applicable.
Nom - Nominal.
Avg - Average.

FIGURE 1. BEST IMAGE QUALITY

Image quality comparable to the best of this mission.

FIGURE 2. CORRESPONDING COVERAGE

Corresponding coverage as imaged by the aft camera.

NPIC L-3777 NPIC L-3778

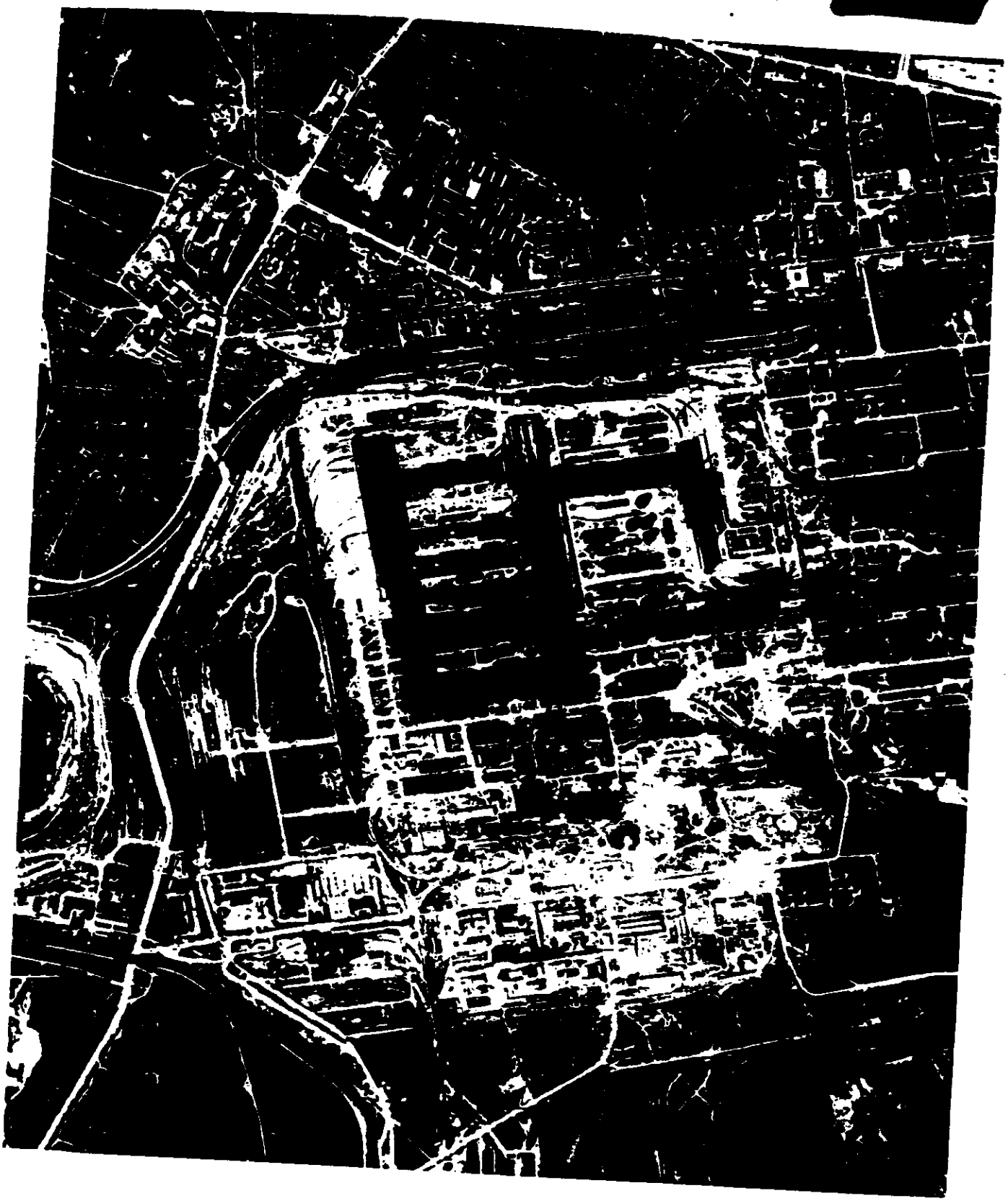
[redacted]

	FIGURE 1	FIGURE 2
Camera	208	209
Pass	39D	39D
Frame	83	83
Date of Photography (GMT)	12 May 67	12 May 67
Universal Grid Coordinates	38.5-10.5	54.0-14.5
Enlargement Factor	20X	20X
Geographic Coordinates	47-57N 033-47E	47-58N 033-40E
Altitude (ft)	665,993	660,682
Camera Attitude:		
Pitch	14°45'	-15°18'
Roll	-0°09'	-0°08'
Yaw	-2°36'	-2°40'
Local Sun Time	1331	1331
Solar Elevation	55°22'	55°22'
Solar Azimuth	220°	220°
Exposure (sec)	1/279	1/356
Vehicle Azimuth	174°51'	175°02'
Processing Level	Full	Intermediate

[redacted]

[redacted]

[redacted]



[redacted]

FIGURE 3. STELLAR FORMAT (MISSION 1041-1)

Flare typical throughout the mission.

FIGURE 4. STELLAR FORMAT (MISSION 1041-2)

Flare typical throughout the mission.

NPIC L-3779 NPIC L-3780

	FIGURE 3	FIGURE 4
Mission Number	1041-1	1041-2
Stellar Frame Numbers	183,184,185	248,249,250
Correlates with Master Camera Number	208	209
Pass	38D	159D
Frames	15,22,29	25,32,39
Date of Photography	12 May 67	20 May 67
Enlargement Factor	2.5X	2.5X
Exposure (sec)	2.0	1.0

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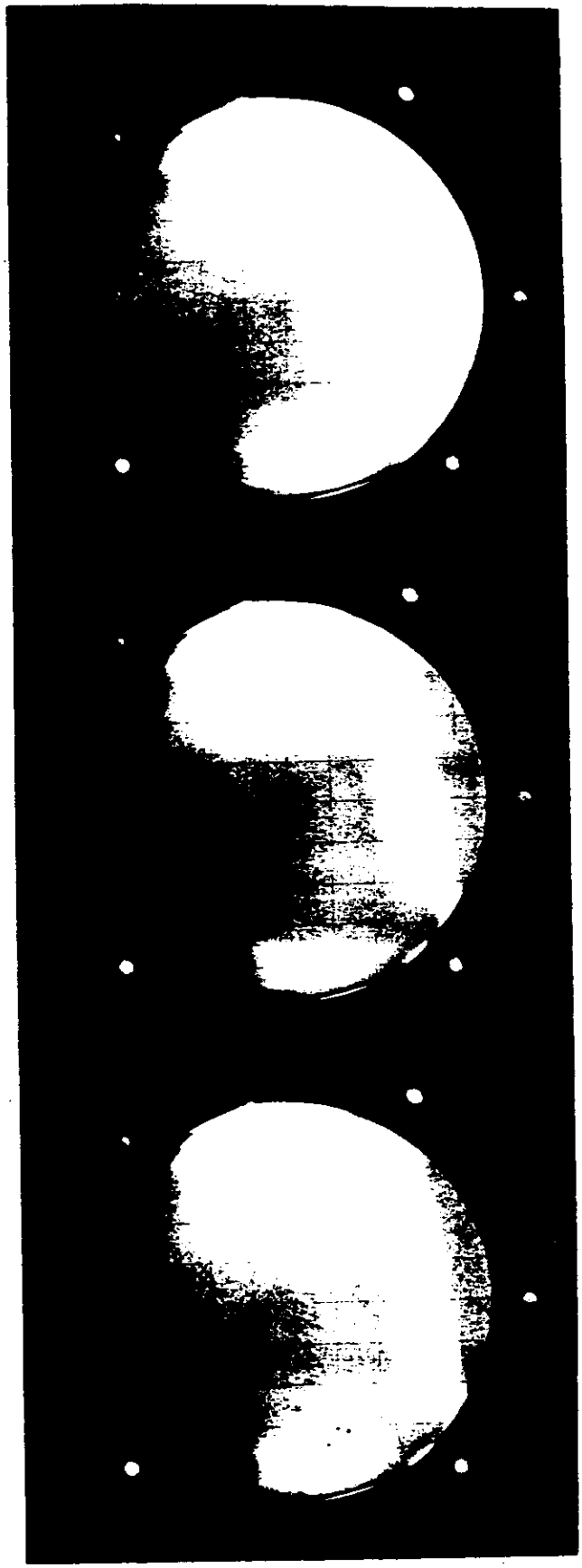
[redacted]



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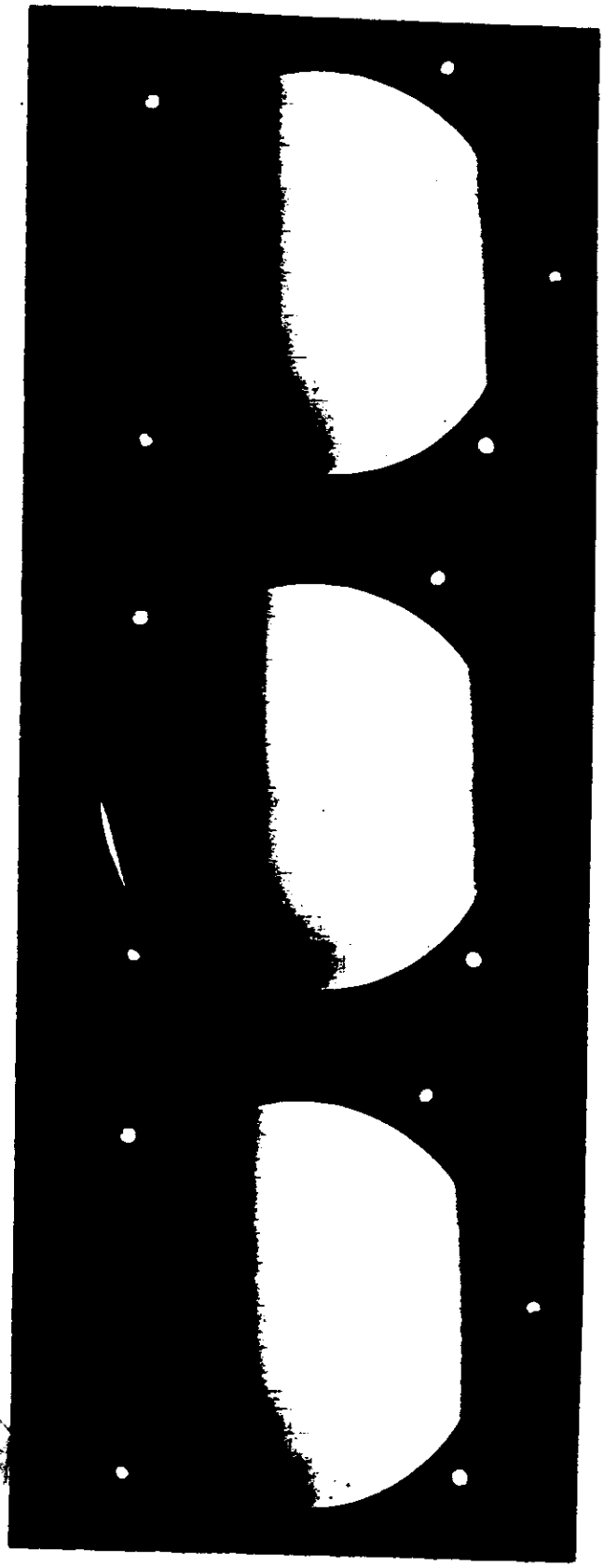

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[redacted]

FIGURE 5. OUT-OF-FOCUS IMAGERY ON THE AFT-LOOKING CAMERA RECORD.

NPIC L-3781

FIGURE 5

Camera	209
Pass	39D
Frame	83
Date of Photography (GMT)	12 May 67
Universal Grid Coordinates	19.2-10.3
Enlargement Factor	20X
Geographic Coordinates	47-58N 038-40E
Altitude (ft)	660,682
Camera Attitude:	
Pitch	-15°18'
Roll	-0°08'
Yaw	-2°40'
Local Sun Time	1331
Solar Elevation	55°22'
Solar Azimuth	220°
Exposure (sec)	1/356
Vehicle Azimuth	175°02'
Processing Level	Intermediate

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FIGURES 6 & 7. UNIDENTIFIED IMAGE APPEARING ON THE STELLAR RECORDS OF MISSIONS 1041-1 AND 1041-2.

An unidentified image appeared in stellar frames 85 through 89 (pass 21D) of Mission 1041-1 and again in stellar frames 27 through 30 (pass 97D) of Mission 1041-2. It is noted that passes 21D and 97D are synchronous, i.e., the same orbits are separated 5 days in time. The object is external to the vehicle system. Investigation of this phenomenon is being carried out by NPIC.

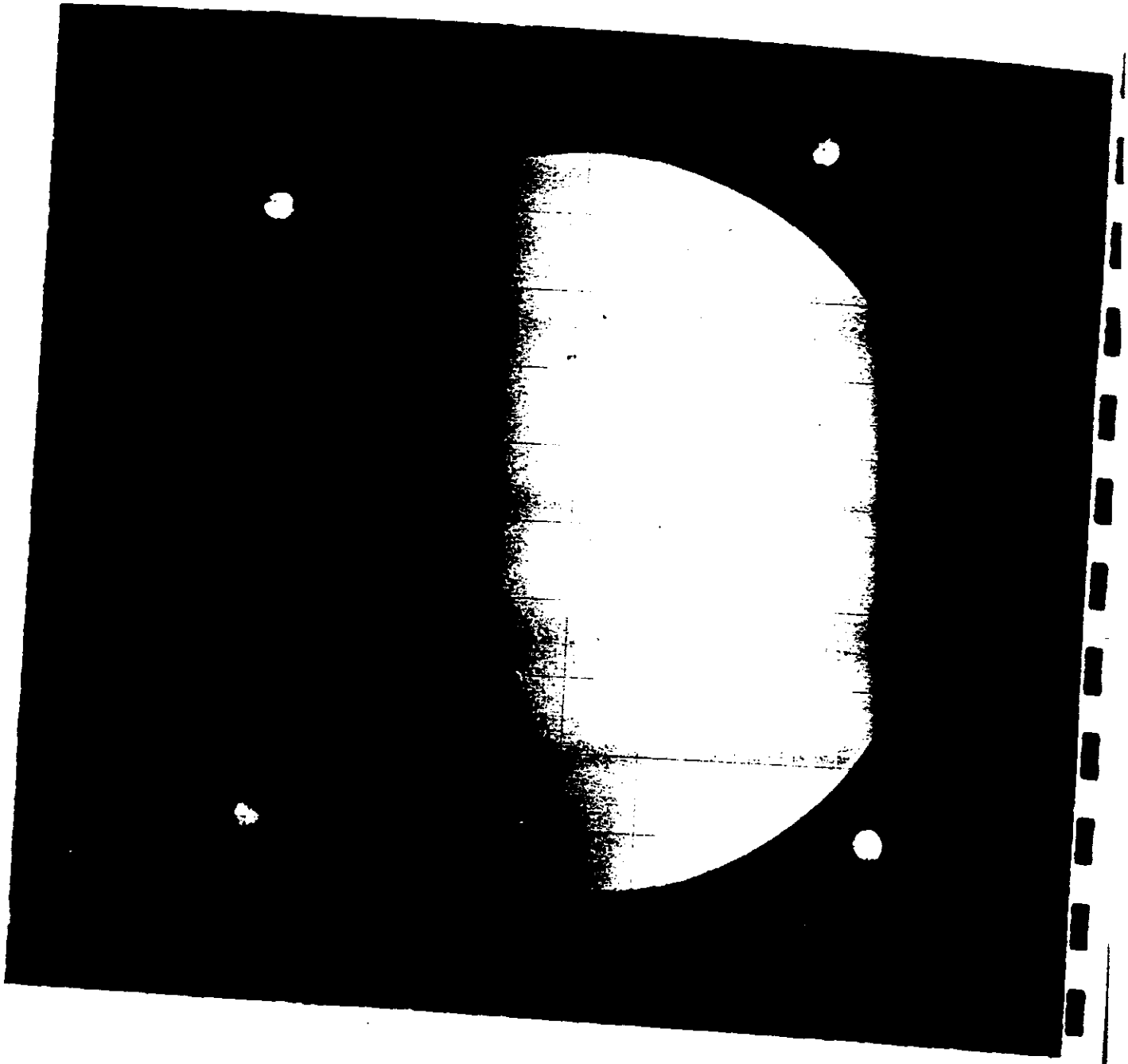
NPIC L-3782 NPIC L-3783

[redacted]

	FIGURE 6	FIGURE 7
Mission Number	1041-1	1041-2
Stellar Frame Number	87	29
Correlates with Master Camera Number	208	208
Pass	21D	97D
Frame	69	25
Date of Photography	11 May 67	16 May 67
Enlargement Factor	5X	5X
Exposure (sec)	2.0	1.0

[redacted]

[redacted]



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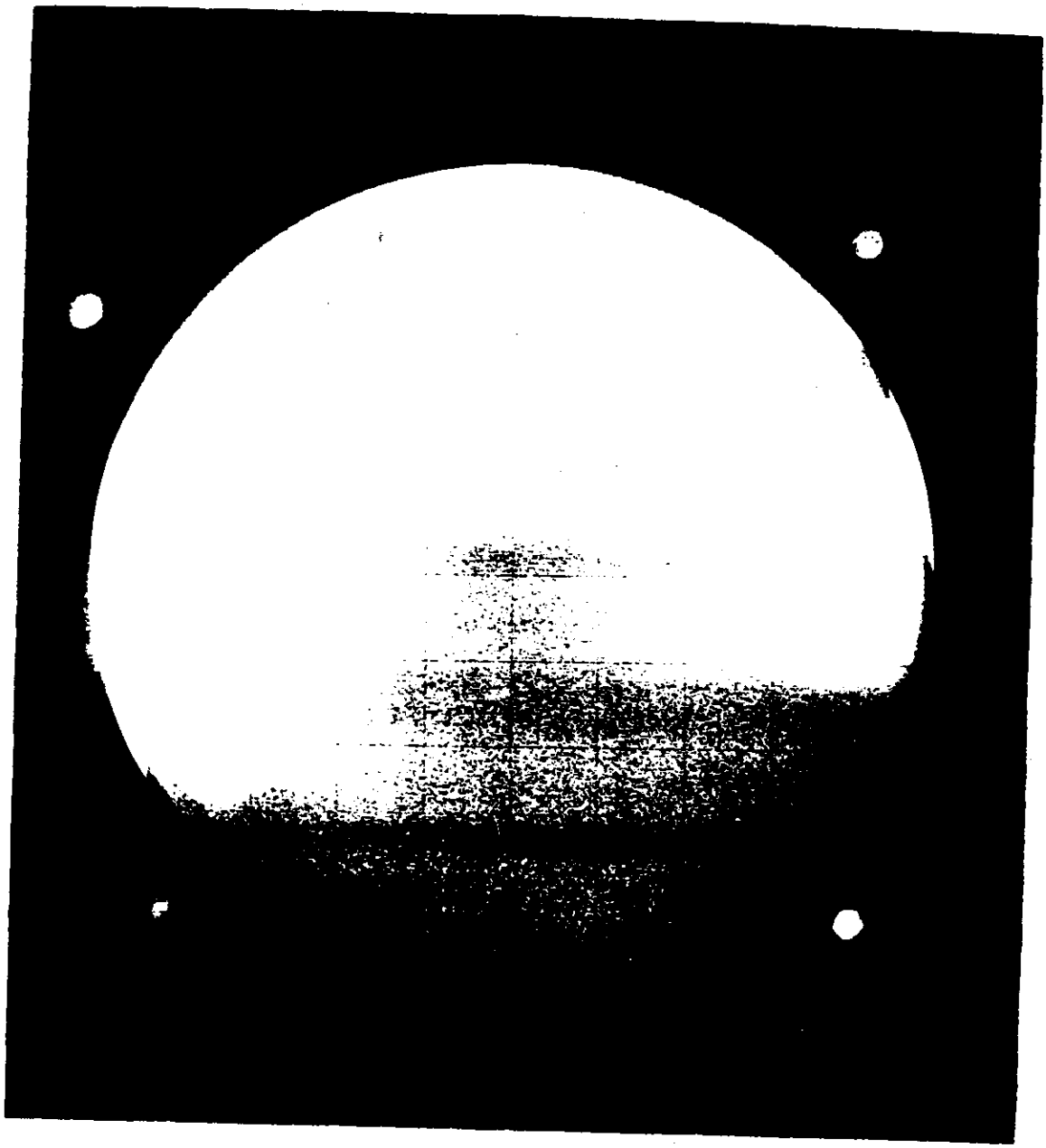

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