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PHOTOGRAPHIC EVALUATION REPORT

MISSION 1048

This document contains information referring to Project Corona

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TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT

MISSION 1048

FEBRUARY 1969

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

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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 altitude 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.

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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 text 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.

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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.

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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.

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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."

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INDEX OF PHOTOGRAPHIC EVALUATION REPORTS AND SPECIAL STUDIES

PER	[redacted]	SPECIAL STUDY
1033		None
1034		None
1036		None
1037		None
1038		None
1039		None
1040		None
1041		Slant Range Computations Related to Universal Grid Coordinates for the KH4A Camera System
1042		None
1043		Scan Speed Deviation Analysis of the Forward Camera, Mission 1043
1044		Dual Gamma/Viscose Vs Conventional/Spray Processing Analysis (Mission 1044)
1045		None
1046		S0230 Vs 3404 Evaluation
1047		None
1048		None
1101		Slant Range Computations Related to Universal Grid Coordinates for the KH4B Camera System
1102		None
1103		None
1104		S0-180 Evaluation Mission 1104

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SYNOPSIS

Mission 1048 was launched into a prograde orbit on 18 September 1968/ 2132Z. Photographic operations were initiated on 94 revolutions during the 15-day life span of the system. Mission 1048-1 was recovered dry on 28 September 1968, and Mission 1048-2 was recovered dry on 2 October 1968.

All cameras and related equipment were operational throughout Mission 1048-1. On pass 181D of Mission 1048-2, the film in the fwd camera separated, and the camera failed. The stellar/index unit, whose operation is dependent on the fwd camera, also failed. The aft camera continued to operate to the end of the mission.

The quality of the fwd imagery is below par for this system. The aft camera provided generally good photography throughout the mission, and an MTP rating of 85 is assigned to both mission segments. The horizon, stellar, and index imagery is good and provides imagery suitable for attitude reduction.

The panoramic camera material, with the exception of the damaged film associated with the film separation and camera failure, was processed in dual gamma chemistry.

Overall cloud cover for the entire mission is approximately 30 percent.

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PART I. GENERAL SYSTEM INFORMATION

A. Camera Numbers

Forward-Looking Panoramic Camera	222
Aft-Looking Panoramic Camera	223
Stellar/Index Camera (Mission 1048-1)	D121/155/160
Stellar/Index Camera (Mission 1048-2)	D116/147/136

B. Launch and Recovery Dates

	Mission 1048-1	Mission 1048-2
Launch	2132Z/18 Sep 68	2132Z/18 Sep 68
Recovery	0010Z/28 Sep 68	2305Z/2 Oct 68
Recovery Rev	145	224

C. Orbit Elements

Element	Planned	Mission 1048-1 Actual Rev 60	Mission 1048-2 Actual Rev 175	Photo Range
Period (min)	90.25	90.331	90.261	N/A
Perigee (nm)	100.0	98.462	100.173	98.4, rev 53
Apogee (nm)	210.6	220.510	233.560	129.9, rev 89
Eccentricity	0.015	0.01695	0.01715	N/A
Inclination (deg)	83.0	83.019	83.019	N/A
Perigee Latitude	N/A	31.235N	56.852N	N/A

N/A-Not Applicable.

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D. Photographic Operations

1. Panoramic Cameras

Type	Mission 1048-1 Revs	Mission 1048-1 Frames	Mission 1048-2 Revs	Mission 1048-2 Frames	Total Revs	Total Frames
Operational						
Fwd	50	2,925	19	1,076	69	4,001
Aft	50	2,911	35	2,974	85	5,885
Operational/Domestic						
Fwd	0	0	0	0	0	0
Aft	0	0	0	0	0	0
Domestic						
Fwd	3	70	1	16	4	86
Aft	3	70	4	63	7	123
Engineering (no imagery)						
Fwd	2	13	0	0	2	13
Aft	2	13	0	0	2	13
Totals						
Fwd	55	3,008	20	1,092	75	4,100
Aft	55	2,994	39	3,037	94	6,031

2. Secondary Cameras

Camera	Frames
Stellar (Mission 1048-1)	463
Index (Mission 1048-1)	463
Stellar (Mission 1048-2)	159
Index (Mission 1048-2)	159

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E. Film Usage

	Film Load (Total)	Pre-Flight Footage	Processed Footage
Fwd-Looking (Mission 1048-1)	16,300*	330	8,270
Aft-Looking (Mission 1048-1)	16,300*	328	8,132
Fwd-Looking (Mission 1048-2)	N/A	N/A	2,900
Aft-Looking (Mission 1048-2)	N/A	N/A	8,035
Stellar (Mission 1048-1)	75	9	52
Stellar (Mission 1048-2)	75	4	23
Index (Mission 1048-1)	135	13	98
Index (Mission 1048-2)	135	9	57

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

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F. Camera Anomaly and Film Damage

1. The Performance Evaluation Team (PET) for Mission 1048 convened at NPIC on 15 and 16 October 1968. The prime topic of discussion was the failure of the fwd-looking panoramic camera and film separation, which occurred on pass 181D. Because of the failure, approximately 5,000 feet of fwd camera film was not utilized, thereby eliminating stereo coverage on passes 182D through 216D.

2. Prior to and during the PET meeting, the system engineering personnel responsible for camera operation, together with NPIC technologists, investigated possible causes of the failure. In particular, the telemetry data and original film were reviewed for clues as to what took place. Following is a list of the possible causes and comments which were extracted from the Performance Evaluation Interim Report:

Anomaly: The fwd-looking camera failed on rev 181D with six inches of frame 70 being the last recovered photography. Post-flight analysis indicates the camera drive system was disconnected from the drive motor assembly. The failure prevented electrical shut down of the camera, resulting in the main drive motor being continuously powered. The recovered tail end of the film was noted to be a tear and not a water seal cut (guillotine cut).

Cause: A possible cause is a mechanical failure in the main drive assembly. Three major areas of data supporting this failure mode are:

(1) Telemetry data indicated that the main drive motor and tachometer assemblies were intact after the failure, with operate power continuously on. The tach also responded to V/H voltage changes.

(2) The lens drive and film metering control linkage were inoperative.

(3) Vehicle attitude data indicated a normal instrument coast down at time of failure.

Comments:

(1) Other failure modes were analyzed but not considered as likely as that described above.

(2) The condition of the damaged film at the end of both panoramic camera records in the Mission 1048-2 bucket is considered to be an effect and not a cause of the failure.

[redacted]

(3) The time of the film tear in pass 181D, in relation to known camera parameters, indicates that the tear probably occurred after camera shut down. An exhaustive analysis of telemetry and the flight film has failed to reveal the direct cause of the film tear. A full test program is not feasible due to the risk involved in using flight hardware from a future mission; however, limited tests will be conducted to determine what areas within the film path could cause the film to tear in a manner similar to that experienced in flight.

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PART II. IMAGE ANALYSIS

A. Fwd-Looking Panoramic Camera

1. Density: The average film density is adequate; however, the density of the majority of the targets is slightly heavier on Mission 1048-1 than on Mission 1048-2. This difference is the result of a larger proportion of Mission 1048-2 being exposed during low solar elevations at high latitudes.

The density range of pass 87D exceeded the latitude for optimum reproduction and was printed at two separate levels.

The film from this mission, with the exception of the final 43 feet, which was damaged, was processed in dual gamma chemistry. As a result, the overall density range is compressed, compared with conventional processed missions.

2. Contrast: Because of the dual gamma processing, there is little high contrast imagery.

3. Acuity: The image acuity is inconsistent and ranges from fair to poor, i.e., it not only varies throughout the mission but also within individual frames. Out-of-focus areas are evident outside the bonus areas and extend toward the center of the format up to five inches (See Graphic No 3, page 12). The imagery near the center of format represents the best quality but is not equal to the best aft imagery. It appears that a focus problem was experienced throughout the mission.

4. Imaged Degradations

a. Light Leaks: A band of fog is present near the supply end of the fifth frame of most passes (Examples: Passes 16D and 143D). A diagonal band of fog is present on the next-to-last frame of a few passes (Example: Frame 9, pass 16D), and equipment images are present on the last frame of a few passes. (Example: Frame 10, pass 16D).

b. Static: A few instances of dendritic static traces are present along the edge of the film from Mission 1048-1 (Examples: Frames 75-35, pass 84D). Traces of corona static are detectable at random throughout the record from Mission 1048-2. The traces are easy to detect within areas of low density and contrast, and their frequency and intensity increase slightly as the mission progresses (Examples: Pass 164D, see Graphic No 1, page 12).

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c. Other: Minor banding is noticeable near the take-up end of some frames.

5. Physical Degradation: Frames 58 through 70, pass 181D are degraded by a multitude of superficial degradations as a result of the film separation and instrument failure. Manufacturing splices are located within frame 13, pass 85D and frame 23, pass 180D.

6. Product Quality: The combined effect of the afore-mentioned anomalies significantly contribute to the overall fair quality rating for the fwd imagery.

B. Aft-Looking Panoramic Camera

1. Density: The density of the aft-looking material correlates with that of the fwd. Most of the imagery is generally medium with a slightly higher proportion of the targets from Mission 1048-1 recorded at a higher density level than on Mission 1048-2. Passes 54D and 101D required dual print reproductions.

2. Contrast: The aft material, with the exception of the final 89 feet (damaged material), was processed in dual gamma chemistry. The contrast ranges from low to medium.

3. Acuity: The image quality of the aft-looking camera material is superior to that of the fwd. An MIP rating of 85 was assigned to both mission segments. The best ground resolution obtained from a 25:1 contrast fixed B-2 target is 7.1 feet across track -- resolution along track is not resolved. The overall quality of the imagery is good but it should be noted that there are out-of-focus areas near the bonus area. The size of the out-of-focus area is inconsistent and varies throughout the mission (See Graphic No 4, page 12).

4. Imaged Degradations

a. Light Leaks: A thin band of fog is present on the fifth frame from the beginning of most passes, (Example: Passes 16D and 180D) and on the third frame from the end of a few passes (Examples: Frame 8, pass 16D and frame 22, pass 135D). Faint equipment images are also present on the third frame from the end of a few passes (Example: Frame 8, pass 16D, see Graphic No 2, page 12).

b. Static: Traces of dendritic static are present along both film edges intermittently from pass 23D through 88D. The traces at times extend into the format up to one inch (Examples: Pass 56D). In Mission 1043-2, there are traces of corona static present at random throughout the record. The traces are easy to detect within low density and low

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contrast areas, and their frequency and intensity increase slightly as the mission progresses (Examples: Pass 164D, see Graphic No 2, page 12).

c. Other: Minor banding is noticeable near the take-up end of some frames. The banding is more noticeable on the aft material than on the fwd. Two rows of plus density spots are present throughout the mission. The rows are located one inch and 1.1 inches, respectively from the time track edge of the film, and the spacing between the spots is 2.3 inches.

5. Physical Degradation: Minor superficial degradations to the film are present on passes 195D through 197D. Frame 117, pass 215D, to the end of the mission, contains a multitude of creases, scratches, kinks, and abrasions. Frames 18 through 20, pass 216D were damaged to the extend that they were not reproduced for dissemination.

6. Product Quality: The composite of the degradations is relatively severe, but the quality of the imagery outside these areas is generally good.

C. Stellar Camera (Mission 1048-1)

1. Density: Adequate for the detection of stellar images.

2. Contrast: The process gamma was 2.13, and the contrast is adequate for the detection of stellar images.

3. Image Shape: The stellar images are slightly smeared, and a short dumbbell pattern is formed.

4. Images Per Frame: More than 25 well-distributed stellar images are detectable on most frames.

5. Flare Level: Flare affects approximately 60 percent of each format.

6. Image Degradations

a. Light Leaks: None noted.

b. Static: None noted.

7. Physical Degradations: Emulsion cracks perpendicular to the major axis are present intermittently throughout the mission.

8. Product Quality: A double exposure occurred on frames 92 and 363. The quality of the remaining frames is good, and the material is considered adequate for attitude determination.

D. Stellar Camera (Mission 1048-2)

1. Density: Adequate for the detection of stellar images.

2. Contrast: The process gamma was 2.20, and the contrast is adequate for the detection of stellar images.

3. Image Shape: The stellar images are slightly smeared, and a short dumbbell pattern is formed.

4. Images Per Frame: More than 25 well-distributed stellar images are detectable on most frames.

5. Flare Level: Flare is minor and affects about 20 percent of each format.

6. Image Degradations

a. Light Leaks: None noted.

b. Static: Traces of dendritic edge static are present intermittently throughout the mission.

7. Physical Degradations: Emulsion cracks that span the width of the film are present every few inches throughout the mission.

8. Product Quality: Frame 1 was triple exposed, frame 3 was double exposed, and frame 102 contains 5 exposures. The camera did not operate after frame 159 because of the fwd camera failure. The overall quality of the photography is good, and the material is considered to be adequate for attitude determination.

E. Index Camera (Mission 1048-1)

1. Density: Generally medium.

2. Contrast: The process gamma was 0.93, and the contrast ranges from low to medium.

3. Acuity: The acuity is good and comparable to that of previous missions.

4. Image Degradations

a. Light Leaks: None noted.

b. Static: None noted.

5. Physical Degradations: None noted.

6. Product Quality: The overall rating for the index material is good with the exception of the double exposed frames 92 and 363.

F. Index Camera (Mission 1048-2)

1. Density: Generally medium.

2. Contrast: The process gamma was 1.01, and the contrast ranges from low to medium.

3. Acuity: The acuity is good and compares favorably to that of previous index materials.

4. Image Degradations

a. Light Leaks: None noted.

b. Static: None noted.

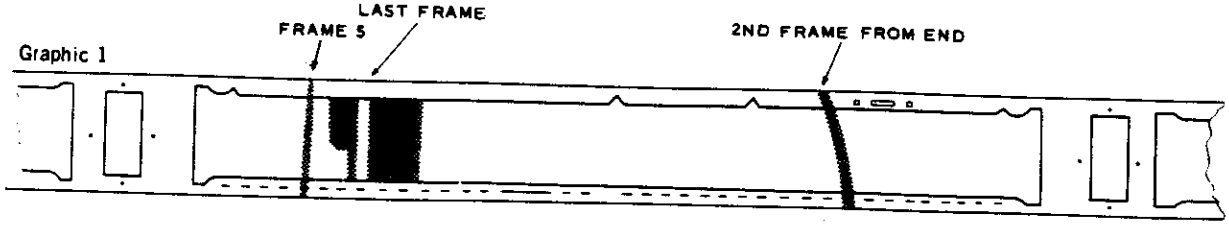
5. Physical Degradations: None noted.

6. Product Quality: Frame 1 was triple exposed, frame 3 was double exposed, and frame 102 contains 5 exposures. An obstruction of varying length and width, average size about 0.3 inch wide and 1.5 inches long, is present on frames 8 through 159. The appearance of the obstruction correlates with the recovery of Mission 1048-1. Evidently the obstruction is external of the camera and appears to be the image of a piece of tape (See Graphic No 5, page 13).

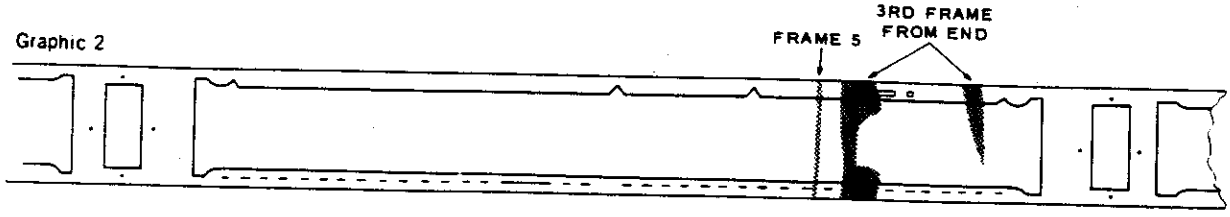
G. Graphic Display (Mission 1048)

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

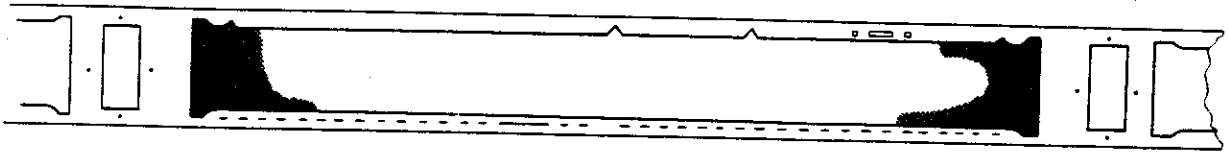
Graphic 1



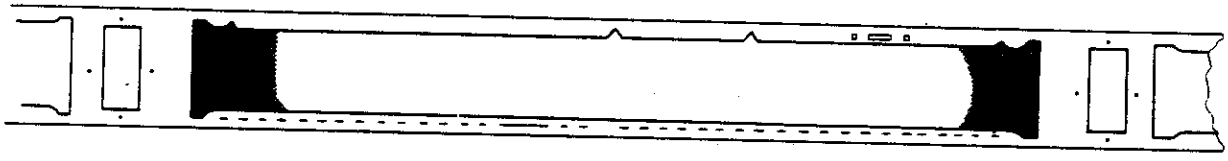
Graphic 2



Graphic 3



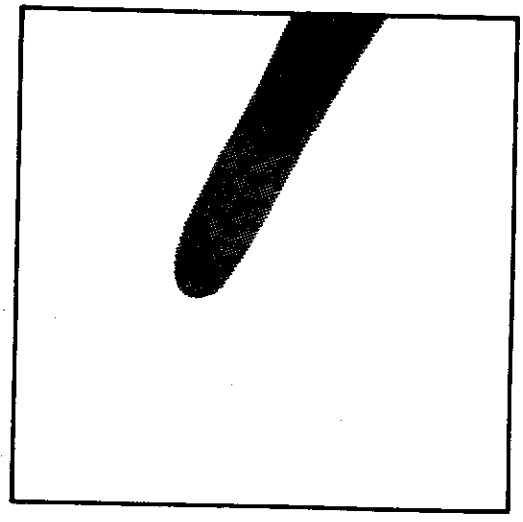
Graphic 4



NPIC M-5569

[redacted]

GRAPHIC 5



NPIC M-5570

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PART III. IMAGED AUXILIARY DATA

A. Fwd-Looking Panoramic Camera

1. Horizon Cameras

a. Starboard-Looking

(1) Imagery: The imagery is sharp. The density and contrast are adequate, and good horizon arcs are exhibited.

(2) Fiducials: Sharp and well defined.

b. Port-Looking

(1) Imagery: Same as for the starboard.

(2) Fiducials: Same as for the starboard.

2. Frequency Marks: The time track is missing at the beginning of scan in varying lengths up to 12 inches (Example: Frame 1, pass 152D), on the first frame of most operations. The density of the imaged frequency marks is adequate.

3. Binary Time Word: The binary time word is not imaged on frame 16, pass 40D, frame 113, pass 53D, and frame 70, pass 181D. The number 10 binary light came on at random throughout the mission.

4. Binary Index: The index image nearest the camera number is slightly bloomed and caused difficulty with the automatic reader.

5. Camera Number: The camera number image is 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: The imagery is sharp. The density and contrast is adequate, and good horizon arcs are exhibited.

[redacted]

[redacted]

(2) Fiducials: Sharp and well defined.

b. Port-Looking

(1) Same as for the starboard.

(2) Same as for the starboard.

2. Frequency Marks: The time track is missing at the beginning of scan in varying lengths up to 12 inches (Example: Frame 1, pass 114D), on the first frame of most operations. The density of the imaged frequency marks is adequate.

3. Binary Time Word: The binary time word is not imaged on frame 22, pass 84D and frame 31, pass 168D.

4. Binary Index: The index image nearest the camera number is slightly bloomed and causes difficulty in reading the time word.

5. Camera Number: The image of the number is bloomed but readable.

6. Pan Geometry Dots: Not applicable.

7. Nodal Traces: Not applicable.

8. Nod Indicators: Not applicable.

C. Stellar Camera (Mission 1048-1)

1. Grid Image Quality: The image is sharp and well defined within the flared area but is barely discernible outside the flared area.

2. Correlation Lamp Image Quality: Good.

D. Stellar Camera (Mission 1048-2)

1. Grid Image Quality: The image is sharp and well defined within the flared area, but it is difficult to detect outside the flared area.

2. Correlation Lamp Image Quality: Good.

E. Index Camera (Mission 1048-1)

1. Grid Image Quality: Sharp and well defined.

2. Correlation Lamp Image Quality: Good.

[redacted]

3. Camera Number Legibility: Readable.

F. Index Camera (Mission 1048-2)

1. Grid Image Quality: Sharp and well defined.

2. Correlation Lamp Image Quality: Good.

3. Camera Number Legibility: Readable.

[redacted]

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PART IV. MENSURATION QUALITY

A. Fwd-Looking Panoramic Camera

The mensuration quality of Mission 1048 ranges from fair to good with the data obtained from the aft material being more precise than that from the fwd. There were 100 requests for mensuration support that required 2,431 individual machine pointings and 100 dimensional sketches. The support required 350 man-hours, and there were no specific problems encountered.

B. Aft-Looking Panoramic Camera

See fwd-looking panoramic camera information.

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PART V. FILM PROCESSING

A. Processing Machines and Process Gamma

Film	Machine	Gamma	
Fwd (Mission 1048-1)	Yardleigh	1.80	
Aft (Mission 1048-1)	Yardleigh	1.77	
Fwd (Mission 1048-2)	Yardleigh	1.80	
	Trenton	2.18	Last 43 feet were damaged
Aft (Mission 1048-2)	Yardleigh	1.78	
	Trenton	2.24	Last 89 feet were damaged
Stellar (Mission 1048-1)	Trenton	2.13	
Stellar (Mission 1048-2)	Trenton	2.20	
Index (Mission 1048-1)	Drape	.93	
Index (Mission 1048-2)	Drape	1.01	

B. Processing Levels

1. Panoramic Cameras: The entire record, with the exception of the damaged material at the end of Mission 1048-2 (43 feet of fwd material and 89 feet of aft material), was processed in dual-gamma chemistry. The damaged material was processed at the full level of development without interruption in the Trenton machine.

2. Secondary Cameras

a. The stellar records were processed in the Trenton machine with no interruption in processing.

b. The index records were processed in the Drape machine with no interruption in processing.

C. Film Handling Summary

1. Fwd-Looking Camera

a. Capsule Defilming

(1) Mission 1048-1: An electrical plug (Deutsch) could not be separated from the capsule, hence the cable was cut so that defilming would not be delayed.

(2) Mission 1048-2: Because of the film separation and forward camera failure, on pass 181D, the defilming operation was to take place at the West Coast to determine the cause of the anomaly. However, after electrical testing and inspection of the capsule

[redacted]

and because of the tangled condition of the film, it was decided that the capsule should be forwarded to the processing site for defilming. At the processing site, it was determined that the tail portion of the aft record (later measured as 89 feet) was severely tangled around both the S/I take-up unit and the fwd puck arm and into the fwd take-up roll. It was necessary to remove the S/I film to permit the aft camera material to be untangled. The aft material was then cut in two places (10 feet and 89 feet from the tail), and the untangled portion was defilmed. The S/I take-up unit and fwd puck arm assembly were removed to permit the partial removal of the aft material. The fwd material was then defilmed enough to free the intertwined part of the aft material. Defilming of the fwd record was then completed in a normal manner. The final 43 feet of the fwd film and 89 feet of the aft, which were damaged, were processed separately in the Trenton processor. All the damaged material, except the final 10 feet of the aft, received full dissemination. The 10 feet was damaged to the extent that it was not practical to have it reproduced.

b. Pre-Spooling

(1) Mission 1048-1: No problems encountered.

(2) Mission 1048-2: No problems encountered after the film was untangled.

c. Manufacturing Splices:

(1) Mission 1048-1: A manufacturing splice is located within frame 15, pass 85D.

(2) Mission 1048-2: A manufacturing splice is located within frame 23, pass 130D.

d. Processing Splices

(1) Mission 1048-1: None other than normal.

(2) Mission 1048-2: The film was cut once during the capsule de-filming procedure in order to untangle the film.

e. Manufacturing Defects:

(1) Mission 1048-1: None noted.

(2) Mission 1048-2: None noted.

f. Processing Anomalies:

(1) Mission 1048-1: None.

(2) Mission 1048-2: None.

g. Breakdown: The start of breakdown was delayed approximately four hours because of the stop-in-transit of the capsule at the West Coast. Breakdown was further delayed because of the tangled condition of the materials within the capsule.

2. Aft-Looking Camera

a. Capsule De-Filming

(1) Mission 1048-1: See fwd information.

(2) Mission 1048-2: See fwd information.

b. Pre-Spooling

(1) Mission 1048-1: No problems encountered.

(2) Mission 1048-2: No problems after the film was untangled.

c. Manufacturing Splices

(1) Mission 1048-1: A manufacturing splice is located in frame 39, pass 63D.

(2) Mission 1048-2: Manufacturing splices are located in frame 109, pass 164D and frame 154, pass 214D.

d. Processing Splices

(1) Mission 1048-1: None other than normal.

(2) Mission 1048-2: The film was cut in frame 117, pass 215D and frame 18, pass 216D due to the tangled condition of the materials.

e. Manufacturing Defects

(1) Mission 1048-1: None noted.

(2) Mission 1048-2: None noted.

[redacted]

f. Processing Anomalies

(1) Mission 1048-1: None.

(2) Mission 1048-2: None.

g. Breakdown: See fwd information.

3. Index Camera

a. Capsule De-Filming

(1) Mission 1048-1: The material was defilmed directly from the capsule because the retainers that held the unit in the capsule were excessively tightened.

(2) Mission 1048-2: The material was defilmed directly from the capsule because the aft panoramic film was entangled in the unit.

b. Pre-Spooling

(1) Mission 1048-1: No problems.

(2) Mission 1048-2: No problems.

c. Manufacturing Splices

(1) Mission 1048-1: None.

(2) Mission 1048-2: None.

d. Processing Splices

(1) Mission 1048-1: Head and tail only.

(2) Mission 1048-2: Head and tail only.

e. Manufacturing defects

(1) Mission 1048-1: None noted.

(2) Mission 1048-2: None noted.

f. Processing Anomalies: None.

g. Breakdown: No problems encountered.

[redacted]

4. Stellar Camera

a. Capsule De-Filming

(1) Mission 1048-1: See index information.

(2) Mission 1048-2: See index information.

b. Pre-Spooling

(1) Mission 1048-1: No problems.

(2) Mission 1048-2: No problems.

c. Manufacturing Splices

(1) Mission 1048-1: None.

(2) Mission 1048-2: None.

d. Processing Splices

(1) Mission 1048-1: Head and tail only.

(2) Mission 1048-2: Head and tail only.

e. Manufacturing Defects

(1) Mission 1048-1: None noted.

(2) Mission 1048-2: None noted.

f. Processing Anomalies: None.

g. Breakdown: See index information.

D. Timetable

Film	Recovered	Received at Processing Site	Spec Ship at NPIC Recd	Priority 1A at NPIC Recd
Fwd (Mission 104[illegible]-1)	0010Z/28 Sep 68	1325 EST/28 Sep 68	None	1745 EST/30 Sep 68
Aft (Mission 104[illegible]-1)	"	"	"	"
Stellar (Mission 104[illegible]-1)	"	"	"	"
Index (Mission 104[illegible]-1)	"	"	"	"
Fwd (Mission 1048-2)	2305Z/2 Oct 68	1615 EST/3 Oct 68	"	0122 EST/6 Oct 68
Aft (Mission 1048-2)	"	"	"	"
Stellar (Mission 1048-2)	"	"	"	"
Index (Mission 1048-2)	"	"	"	"

[redacted]

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.

F. PI Statistics

1. Target Coverage

	Mission 1048-1	Mission 1048-2	Totals
Priority 1 Targets Programmed	No specific priority 1 targets were programmed for this mission, although specific priority areas were selected for the initial readout.		
Priority 1 Targets Covered	246	86	332

2. PI Quality Appraisal

Rating	Missiles	Nuclear Energy	Air Facilities	Ports	Elect Commo	Military Activity	Complex
Good	21	1	0	26	1	0	3
Fair	3	8	32	13	1	47	37
Poor	46	3	18	8	1	20	12
Totals*	150	12	50	47	3	67	52

3. Summary of PI Quality Ratings

Good 14%
Fair 58%
Poor 28%

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

C. PI Comments

1. Atmospheric Attenuation: The following data was extracted from the photo interpreter's report on priority targets and represent the atmospheric conditions to which the targets were subjected.

Atmospheric Conditions	Percentage of Targets
Clear	28.7
Scattered Clouds	19.4
Heavy Clouds	27.8
Haze	41.7
Cloud Shadows	12.0

2. Terrain Conditions: Some photography was acquired at high latitudes, but few targets were snow covered. The changes in terrain conditions that were encountered were recorded at an adequate level to permit the reproduction of satisfactory copies.

3. Product Interpretability: The overall interpretability of the imagery is below par for this system. The prime contributing factors are the out-of-focus condition of the fwd camera, the fwd film separation on pass 1301D, and the normal limits imposed by weather conditions in the target areas.

RESOLUTION TARGET DATA

Target Designator	A		B	
Camera (Looking)	Fwd	Aft	Fwd	Aft
Pass	63D	63D	95D	95D
Frame	37	36	3	3
Date of Photography	22 Sep 68	22 Sep 68	24 Sep 68	24 Sep 68
Universal Grid Coordinates	15.7-12.6	76.4-13.4	65.0-9.5	26.7-11.6
Geographic Coordinates of Format Center	31-40N 109-11W	31-43N 109-78W	36-44N 116-07W	36-38N 116-13W
Altitude (ft)	599,076	598,366	598,916	598,275
Camera				
Pitch (deg)	14°50'	-15°6'	14°47'	-15°4'
Roll (deg)	0°2'	0°9'	0°1'	0°7'
Yaw (deg)	-2°59'	-2°54'	-3°0'	-2°48'
Local Sun Time	1303	1303	1244	1243
Solar Elevation (deg)	54°4'	54°3'	50°46'	50°52'
Solar Azimuth (deg)	207	207	198	198
Exposure (sec)	1/338	1/452	1/307	1/401
Processing Level	Dual Gamma	Dual Gamma	Dual Gamma	Dual Gamma
Vehicle Azimuth (deg)	174°43'	174°49'	174°1'	174°10'
Filter (Wratten)	23A	21	23A	21
Target Type	Fixed	Fixed	Fixed B1	Fixed B1
Target Contrast	11:1	11:1	2:1	2:1
Weather Conditions	Clear	Clear	Clear	Clear

GROUND RESOLUTION IN FEET AS DETERMINED FROM THE ORIGINAL NEGATIVE

	A				B				
	Along Track		Across Track			Along Track		Across Track	
	Fwd	Aft	Fwd	Aft		Fwd	Aft	Fwd	Aft
Observer 1	*	10'	*	12'7"	Observer 1	*	*	*	*
Observer 2	*	10'	*	12'7"	Observer 2	*	*	*	*
Observer 3	*	10'	*	12'7"	Observer 3	*	*	*	*

*Not Resolved.

[redacted]

Target Designator	C	
Camera (Looking)	Fwd	Aft
Pass	95D	95D
Frame	6	5
Date of Photography	24 Sep 68	24 Sep 68
Universal Grid Coordinates	49.0-13.6	42.8-12.5
Geographic Coordinates of Format Center	36-16N 116-04W	36-19N 116-10W
Altitude (ft)	598,591	598,089
Camera		
Pitch (deg)	14° 49'	-15°4'
Roll (deg)	0°1'	0°7'
Yaw (deg)	-2° 56'	-2° 47'
Local Sun Time	1244	1245
Solar Elevation (deg)	51° 10'	51° 8'
Solar Azimuth (deg)	198°	198
Exposure (Sec)	1/337	1/438
Processing Level	Dual Gamma	Dual Gamma
Vehicle Azimuth (deg)	174° 5'	174° 13'
Filter (Wratten)	23A	21
Target Type	Fixed B2	Fixed B2
Target Contrast	25:1	25:1
Weather Conditions	Clear	Clear

GROUND RESOLUTION IN FEET AS DETERMINED FROM THE ORIGINAL NEGATIVE

	C			
	Along Track		Across Track	
	Fwd	Aft	Fwd	Aft
Observer 1	*	*	*	8'
Observer 2	*	*	*	7'1"
Observer 3	*	*	*	7'1"

*Not Resolved.

PART VII. MISSION DATA

	Fwd-Looking Pan	Fwd-Looking Take-up Horizon	Fwd-Looking Supply Horizon	Aft-Looking Pan	Aft-Looking Take-up Horizon	Aft-Looking Supply Horizon	Mission 1048-1 Stellar	Mission 1048-1 Index	Mission 1048-2 Stellar	Mission 1048-2 Index
Camera Number	222	*	*	223	*	*	D121	D121	D116	D116
Reseau Number	N/A	N/A	N/A	N/A	N/A	N/A	160	155	136	147
Lens Serial Number	2342243	23770	28515	223243	12894	23762	11361	825513	11461	823827
Slit Width	.200	N/A	N/A	.150	N/A	N/A	N/A	N/A	N/A	N/A
Aperture	F3.5	F8.0	F6.3	F3.5	F6.3	F8.0	F1.8	F4.5	F1.8	F4.5
Exposure Time (sec)	1/324	1/100	1/100	1/432	1/100	1/100	2.0	1/500	2.0	1/500
Filter (Wratten)	23A	25	25	21	25	25	None	21	None	21
Focal Length (mm)	609.602	54.670	54.930	609.602	55.000	54.650	85 nom	38.645	85 nom	38.436
Film Length (ft)	16,300	N/A	N/A	16,300	N/A	N/A	75	135	75	135
Splices	3	N/A	N/A	3	N/A	N/A	None	None	None	None
Emulsion	409-4-3-8	409-4-3-8	409-4-3-8	409-4-3-8	409-4-3-8	409-4-3-8	231-9-9-7	139-1-1-7	231-9-9-7	139-1-1-7
Film Type	3404	3404	3404	3404	3404	3404	3401	3400	3401	3400
Resolution Data (L/mm)										
Static										
High Contrast	*	187	209	*	187	209	*	87 (AWAR)	*	80 (AWAR)
Low Contrast	147	*	*	150	*	*	*	*	*	*
Dynamic										
I High Contrast	192	*	*	199	*	*	*	*	*	*
I Low Contrast	126	*	*	131	*	*	*	*	*	*
P High Contrast	174	*	*	187	*	*	*	*	*	*
P Low Contrast	123	*	*	131	*	*	*	*	*	*

N/A - Not Applicable.
* - Not Available.