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PHOTOGRAPHIC EVALUATION REPORT

MISSION 1103

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SEPTEMBER 1968

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PHOTOGRAPHIC EVALUATION REPORT

MISSION 1103

SEPTEMBER 1968

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.

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.

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		SPECIAL STUDY
[redacted]	[redacted]	None
		None
		None
		None
		None
		None
		None
		Slant Range Computations Related to Universal Grid Coordinates for the KH4A Camera System
		None
		Scan Speed Deviation Analysis of the Forward Camera, Mission 1043
		Slant Range Computations Related to Universal Grid Coordinates for the KH4B Camera System
		Dual Gama/Viscose Vs Conventional/Spray Processing Analysis (Mission 1044)
		None
		S0230 Vs 3404 Evaluation
		None
		None

SYNOPSIS

Mission 1103, a two part satellite reconnaissance mission, was launched at 2131Z on 1 May 1968. The first capsule was recovered dry on rev 115, 2355Z on 8 May 1968. The mission was terminated by air catch of the second satellite reentry vehicle on rev 220 at 2252Z on 15 May 1968. A total of 95 photographic passes was accomplished by the 13-day mission.

The best image quality of the fwd-looking camera record is superior to that of the aft-looking camera record in almost every case. The general image quality of the mission is considered to be fair and not as good as Mission 1102. Out-of-focus imagery is present on both main camera records near the take-up end of the format. This anomaly occurs on approximately the first five frames of most camera operations.

An MIP of 95 is assigned to this mission. Frame 15, rev 79D is the MIP frame and frame 21 aft, rev 79D has imagery corresponding to the MIP frame.

Approximately 70 percent of the mission contains cloud-free photography.

The dual-improved stellar index camera (DISIC) functioned properly throughout the mission. The index camera produced slightly better quality than that obtained on Mission 1102.

The proposed bicolor, SO-380 (UTB) film type and through exposure/ Wratten 12 experiments were conducted on Mission 1103. Detailed analysis of these experiments is being carried out by NPIC, and the results will be available in the near future.

PART I. GENERAL SYSTEM INFORMATION

A. Camera Numbers

Forward-Looking Panoramic Camera	307
Aft-Looking Panoramic Camera	306
DISIC Camera	5

B. Launch and Recovery Dates

	(Mission 1103-1)	(Mission 1103-2)
Launch	1 May 68/2131Z	*
Recovery	8 May 68/2355Z	15 May 68/2252Z
Recovery Rev	115	220

C. Orbit Elements

Element	Planned	Actual 1103-1 Rev 2	Actual 1103-2 Rev 176	Photo Range
Period (min)	NA	88.70	88.568	
Perigee (nm)	NA	86.90	80.4	82.38, rev 184
Apogee (nm)	NA	140.6	150.4	105.24, rev 3
Eccentricity	NA	0.00756	0.00916	
Inclination (deg)	NA	83.03	83.04	
Perigee Latitude	NA	18° 87'N	32°04'N	

NA - Not Available.
* - Not Applicable.

D. Photographic Operations

1. Panoramic Cameras

Type	Mission 1103-1 Revs	Mission 1103-1 Frames	Mission 1103-2 Revs	Mission 1103-2 Frames	Total Revs	Total Frames
Operational						
Fwd	39	2,683	41	3,103	80	5,786
Aft	39	2,686	41	3,099	80	5,785
Operational/Domestic						
Fwd	0	0	0	0	0	0
Aft	0	0	0	0	0	0
Domestic						
Fwd	7	191	4	79	11	270
Aft	6	172	5	102	11	274
Engineering (no imagery)						
Fwd	1	18	2	24	3	42
Aft	1	18	2	24	3	42
Totals						
Fwd	47	2,892	47	3,206	95	6,098
Aft	46	2,876	48	3,225	95	6,101

2. Secondary Cameras

Camera	Frames
Stellar (Mission 1103-1)	3,460 starboard, 3,460 port
Index (Mission 1103-1)	2,235
Stellar (Mission 1103-2)	3,985 starboard, 3,979 port
Index (Mission 1103-2)	2,364

[redacted]

E. Film Usage

	Film Load (Total, ft)	Pre-Flight Footage	Processed Footage
Fwd-Looking (Mission 1103-1)	*16,500	330	7,710 of 3404
Aft-Looking (Mission 1103-1)	*16,500	332	7,706 of 3404
Fwd-Looking (Mission 1103-2)	NA	NA	6,737 of 3404/1,750 of SO-380
Aft-Looking (Mission 1103-2)	NA	NA	6,767 of 3404/1,757 of SO-380
Stellar (Mission 1103-1)	*2,000	25	920 of 3401
Stellar (Mission 1103-2)	NA	NA	810 of 3401/180 of 3400
Index (Mission 1103-1)	*2,000	47	964 of 3400
Index (Mission 1103-2)	NA	NA	1,060 of 3400

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

PART II. IMAGE ANALYSIS

A. Fwd-Looking Panoramic Camera

1. Density: The density of the fwd-looking camera record is medium to heavy.

2. Contrast: The imagery obtained by the fwd-looking camera is generally of medium contrast.

3. Acuity: The imagery of the fwd-looking camera record is superior to that of the aft-looking camera record in almost every case. The general image quality of the mission is considered to be fair and not as good as Mission 1102. There is a significant variability in image quality that is greater than normally encountered with this system. This variability in image quality appears to be the result of a focus shift in the opposite direction than had been anticipated prior to launch.

4. Imaged Degradations

a. Light Leaks: Minor fog is present on the next to last and third from last frame of some camera operations. The patterns are of minor nature and do not degrade the imagery (Graphic 1, page 8). A fog pattern associated with the binary time word appears on one or more frames near the end of an operation of the fwd-looking camera. These fog patterns approximately match the two edges of the SLP block (Graphic 2, page 8).

b. Static: Dendritic type fog patterns are present intermittently throughout the fwd-looking camera record. In most cases, they are confined to the border areas.

c. Other: Out-of-focus imagery, somewhat restricted toward the ends of the format, is present on the fwd- and aft-looking camera records. The amount varies on the take-up end (forward and aft cameras) from approximately four inches on frame one and gradually becomes less until by frame seven about one inch of imagery is affected.

The supply end of the forward frames contains only one fourth inch of degraded imagery, whereas the supply end of the aft frames contains about one inch of degraded imagery. The above mentioned anomaly is believed to be caused by set period deformation of the film where it passes around various rollers or through air twists.

Small plus density dots are present throughout Mission 1103-2 on the fwd-looking camera record. These dots occur at a six and one fourth inch interval, one inch from the film time track edge. Apparently, a foreign particle was embedded in either the input metering roller or the frame metering roller, resulting in a plus density mark on the material each time the roller rotated.

5. Physical Degradations: None noted.

6. Product Quality: The imaged degradations listed for the fwd-looking camera record are generally of a minor nature and do not affect the

overall product quality.

B. Aft-Looking Panoramic Camera

1. Density: The density of the aft-looking camera record is medium.
2. Contrast: The imagery obtained by the aft-looking camera is generally of medium contrast.
3. Acuity: The image quality of the aft-looking camera record is less than that of the fwd-looking camera record. The aft record appears to have slightly softer imagery. Also see fwd-looking panoramic camera (acuity).
4. Imaged Degradations
   a. Light Leaks: There is fog present on the next-to-last frame of some camera operations. The patterns are of a minor nature and do not degrade the imagery (Graphic 3, Page 8).
   b. Static: Corona type fog patterns are present along the time track edge (in the format) intermittently throughout the aft-looking camera record. The probable cause of this anomaly is a malfunction of the high pressure valve in the pressure make-up system.
   c. Other: See Part II, paragraph C of the fwd-looking camera analysis.
5. Physical Degradation: Minor rail scratches appear along both film edges throughout the mission.
6. Product Quality: The imaged and physical degradations listed for the aft-looking camera record are generally of a minor nature and do not affect the overall product quality.

C. Stellar Camera

1. Density: The density of the stellar camera record (film type 3401) is generally medium. However, the exposure of the 180 feet of film type 3400 at the tail of Mission 1103-2 produced a thin stellar negative.

In all instances, the density of the stellar images is adequate. However, the thin density of the fiducials, reseau grid, and binary time word on film type 3400 hindered the stellar reduction.

2. Contrast: Adequate for the detection of stellar images.
3. Image Shape: The stellar images generally appear as point type.
4. Images per Frame: Approximately 10 to 20 stellar images can be detected in each stellar frame. The stellar field at which the camera was looking contained Cancer, Sextans, and Leo.
5. Flare Level: Flare affects approximately 10 percent of each stellar frame.
6. Imaged Degradations
   a. Light Leaks: None noted.

b. Static: Dendritic and corona-type fog patterns caused by static discharges are present intermittently throughout the stellar record. They vary in size and intensity and in some instances enter the format area.

c. Other: Most port camera frames contain repeated patterns of minus density spots which appear to be caused by dirt on the reseau plate. Degradation to the imagery is minor.

7. Physical Degradations: Pressure-induced fog patterns are present in the border area on both film edges on the entire stellar record. Neither the formats nor the data blocks are affected. This is a system characteristic that is not considered objectionable as long as the marks are clear of the formats and data blocks.

8. Product Quality: The product quality is considered to be good and suitable for attitude determination.

D. Index Camera

1. Density: The density of the index camera record on Mission 1103-1 is generally medium to heavy. On Mission 1103-2, the density was generally heavy with some areas of medium density.

2. Contrast: Generally low to medium.

3. Acuity: The image quality is good and slightly better than that obtained from Mission 1102. The terrain lens employed a modified shutter which provided a relative aperture of F/6.3 rather than the basic lens relative aperture of F/4.5. This change is considered to be the reason for the improved performance.

4. Imaged Degradation

a. Light Leaks: None noted.

b. Static: Dendritic-type fog patterns are present intermittently throughout the mission. However, image degradation is minimal.

c. Other: All index camera frames contain repeated patterns of minus density spots which appear to be caused by dirt on the reseau plate. Degradation to the imagery is minor.

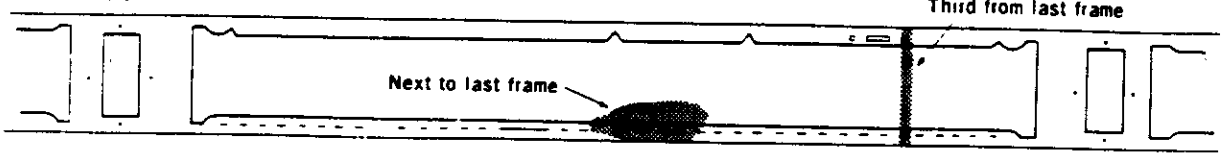
5. Physical Degradations: None noted.

6. Product Quality: The product quality of the index camera is rated good and suitable for relative orientation.

E. Graphic Display

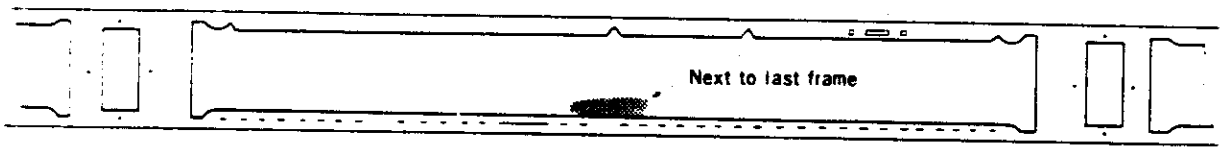
The patterns illustrated below are referenced in the text of this report.

GRAPHIC 1



GRAPHIC 2

GRAPHIC 3



NPIC M-4461

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: Good throughout the mission.
3. Binary Time Word: The binary time word is present throughout the mission. However, the image appears fuzzy on both main camera records intermittently throughout the mission. This fuzzy appearance is apparently due to slight variations in film tension, SLP alignment, or emulsion buildup. No difficulty was encountered during the automatic readout of the time words. The time words produced by both pan cameras are considered normal to the system and within manufacturing specifications.
4. Camera Number: Readable.
5. Rail Hole Images: The 27th rail hole image from the take-up end of the format on the binary time edge is missing on both fwd- and aft-looking camera records due to a manufacturing error. All other rail hole images are well defined.
6. Nodal Traces: Sharp and well defined throughout the mission.
7. Nod Indicators: Not applicable.

B. Aft-Looking Panoramic Camera

1. Horizon Camera
   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 and operational throughout the mission.
3. Binary Time Word: See binary time word for fwd-looking panoramic camera.
4. Camera Number: Readable.
5. Rail Hole Images: See rail hole images for fwd-looking panoramic camera.
6. Nodal Traces: Sharp and well defined throughout the mission.
7. Nod Indicators: Not applicable.

C. Stellar Cameras

1. Grid Image Quality: Sharp and well defined on film type 3401. However, the grid image has insufficient density on film type 3400.

2. Binary Time Word: The binary time words exhibit a fall-off in density in the direction away from the edge of the record. This is characteristic of a data block that is not adequately parallel to the film surface. Due to this fall-off in density, automatic readout could not be accomplished.

The binary time words recorded on film type 3400 (last 180 feet of stellar record on Mission 1103-2) have insufficient density for automatic readout.

3. Lens Serial Number: Good.

D. Index Camera

1. Grid Image Quality: Sharp and well defined.

2. Binary Time Word: The binary time words appear fuzzy.

The index and stellar binary time words are exposed through the base side of the film, resulting in images that have less than the maximum possible edge sharpness. These images, however, are normally within DISIC specification requirements. No problems were encountered in the automatic readout of the index binary time word.

3. Camera Number Legibility: Good.

PART IV. MENSURATION QUALITY

A. Fwd-Looking Panoramic Camera

There were 113 requests for mensuration on this mission. No problems were encountered. The image quality is considered to be good for mensuration purposes.

B. Aft-Looking Panoramic Camera

See above.

PART V. FILM PROCESSING

A. Processing Machines and Processing Gamma

Film	Part: Machine	Entire Mission Gamma	Film Type
Fwd (Mission 1103-1)	Trenton	2.02	3404
Aft (Mission 1103-1)	Trenton	2.21	3404
Fwd (Mission 1103-2)	Trenton	2.42	3404/SO-380
Aft (Mission 1103-2)	Trenton	2.46	3404/SO-380
Stellar (Mission 1103-1)	Trenton	2.18	3401
Stellar (Mission 1103-2)	Trenton	2.16	3401
		2.34	3400
Index (Mission 1103-1)	Yardleigh	1.72	3400
Index (Mission 1103-2)	Drape	1.68	3400

B. Processing Levels

1. Panoramic Cameras

Film	Primary	Intermediate	Full	Transition	Processing Changes
Fwd (Mission 1103-1)	12%	10%	61%	17%	37
Aft (Mission 1103-1)	14%	10%	61%	15%	38
Fwd (Mission 1103-2)	14%	13%	61%	12%	33
Aft (Mission 1103-2)	8%	11%	69%	12%	33

2. Secondary Cameras

a. Stellar Cameras: The stellar camera records were processed with a Trenton processor at a single level of development.

b. Index Cameras: The index camera records were processed in the Drape processor (immersion) at a single level of development.

C. Film Handling Summary

1. Fwd-Looking Camera
   a. Capsule De-Filming
      (1) Mission 1103-1: Both segments were defilmed on the West
      (2) Mission 1103-2: Coast and received at the processing site in suitcases.
   b. Pre-Processing Inspection
      (1) Mission 1103-1: No problems encountered.
      (2) Mission 1103-2: No problems encountered.
   c. Manufacturing Splices
      (1) Mission 1103-1: Pass 54D, frame 87; Pass 88D, frame 35.
      (2) Mission 1103-2: Pass 168D, frame 8; Pass 219D, frame 2. The fwd-camera material contained a pre-exposed, pre-processed indicator strip (approx 3.5 feet in length) to indicate the film type change from 3404 to SO-380. 22.25 inches of frame 142 and 20 inches of frame 143 of pass 187D were exposed on this non-sensitive strip and lost.
   d. Processing Splices
      (1) Mission 1103-1: None other than normal.
      (2) Mission 1103-2: None other than normal.
   e. Manufacturing Defects
      (1) Mission 1103-1: None noted.
      (2) Mission 1103-2: None noted.
   f. Processing Anomalies: None.
   g. Breakdown: No problems.
2. Aft-Looking Camera
   a. Capsule De-Filming
      (1) Mission 1103-1: Both segments were defilmed on the West
      (2) Mission 1103-2: Coast and received at the processing site in suitcases.
   b. Pre-Processing Inspection
      (1) Mission 1103-1: No problems encountered.
      (2) Mission 1103-2: No problems encountered.
   c. Manufacturing Splices
      (1) Mission 1103-1: Pass 40D, frame 4.
      (2) Mission 1103-2: Pass 123D, frame 68. The aft-camera material contained a pre-exposed, pre-processed indicator

strip (approx 3.5 feet in length) to indicate the film type change from 3404 to SO-380. 22.75 inches of frame 141 and 19.25 inches of frame 142 of pass 187D were exposed on this non-sensitive strip and lost.

d. Processing Splices
   (1) Mission 1103-1: None other than normal.
   (2) Mission 1103-2: None other than normal.

e. Manufacturing Defects
   (1) Mission 1103-1: None noted.
   (2) Mission 1103-2: None noted.

f. Processing Anomalies: None.

g. Breakdown: No problems encountered.

3. Index Camera

a. Capsule De-Filming
   (1) Mission 1103-1: Both segments were defilmed on the West
   (2) Mission 1103-2: Coast and received at the processing site in suitcases.

b. Pre-Processing Inspection
   (1) Mission 1103-1: No problems encountered.
   (2) Mission 1103-2: No problems encountered.

c. Manufacturing Splices
   (1) Mission 1103-1: None.
   (2) Mission 1103-2: None.

d. Processing Splices
   (1) Mission 1103-1: None other than normal.
   (2) Mission 1103-2: None other than normal.

e. Manufacturing Defects
   (1) Mission 1103-1: None noted.
   (2) Mission 1103-2: None noted.

f. Processing Anomalies: None.

g. Breakdown: Independent DISIC operation on revolutions 17, 28, 30, and 31 (which amounted to approximately 200 frames) did not appear in the daily performance estimate cable. For this reason, correlation and tilting were delayed considerably.

4. Stellar Cameras

a. Capsule De-Filming
   (1) Mission 1103-1: Both segments were defilmed on the West
   (2) Mission 1103-2: Coast and received at the processing site in suitcases.

b. Pre-Processing Inspection
   (1) Mission 1103-1: No problems encountered.
   (2) Mission 1103-2: No problems encountered.

c. Manufacturing Splices
   (1) Mission 1103-1: None.
   (2) Mission 1103-2: The following stellar frames were lost

due to a manufacturing splice between 3401 and 3400 film type -- 3,173 port and 3,178 starboard.

d. Processing Splices
   (1) Mission 1103-1: None other than normal.
   (2) Mission 1103-2: None other than normal.

e. Manufacturing Defects
   (1) Mission 1103-1: None noted.
   (2) Mission 1103-2: None noted.

f. Processing Anomalies: None.

g. Breakdown: See index breakdown.

D. Timetable

Film	Recovered	Received at Processing Site	Spec Ship at NPIC Recd	Priority 1A at NPIC Recd
Fwd (Mission 1103-1)	8 May 68/2355Z	NA	None	12 May 68/1356 Local Time
Aft (Mission 1103-1)	8 May 68/2355Z	NA	None	12 May 68/1356 Local Time
Stellar (Mission 1103-1)	8 May 68/2355Z	NA	None	12 May 68/1356 Local Time
Index (Mission 1103-1)	8 May 68/2355Z	NA	None	12 May 68/1356 Local Time
Fwd (Mission 1103-2)	15 May 68/2252Z	NA	None	19 May 68/1324 Local Time
Aft (Mission 1103-2)	15 May 68/2252Z	NA	None	19 May 68/1324 Local Time
Stellar (Mission 1103-2)	15 May 68/2252Z	NA	None	19 May 68/1324 Local Time
Index (Mission 1103-2)	15 May 68/2252Z	NA	None	19 May 68/1324 Local Time

NA - Not Available.

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 1103-1	Mission 1103-2	Totals
Priority 1 Targets Programmed	No specific priority 1 targets were programmed on this mission although specific areas were selected for initial readout.		
Priority 1 Targets Covered	123	113	236

2. PI Quality Appraisal

Rating	Missiles	Nuclear Energy	Air Facilities	Ports	Elect Commo	Military Activity	Complex	Bio Chem Warfare
Good	5	0	1	4	1	2	1	1
Fair	71	3	13	12	0	44	28	1
Poor	28	3	13	2	0	29	10	1
Totals*	104	6	27	18	1	75	39	3

3. Summary of PI Quality Ratings (Percentage)

Good	15 or 5%
Fair	172 or 63%
Poor	86 or 32%
Total	273

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

C. PI Comments

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

Weather	Number of Targets
a. Clear	190 or 70%
b. Scattered Clouds	32 or 12%
c. Heavy Clouds	16 or 6%
d. Haze	17 or 6%
e. Scattered Clouds/Cloud Shadow	18 or 6%
Total	273 or 100%

2. Terrain Condition: The terrain conditions were considered good for the interpretation of mission material.

3. Product Interpretability: The photo interpretability of the imagery on this mission is considered to be more variable than the imagery obtained on Missions 1101 and 1102. In addition, the imagery of the fwd-looking camera record is superior to that of the aft-looking camera record in almost every case. The overall mission interpretability is rated as fair.

PART VII. RESOLUTION TARGET DATA

Target Designator	A	B	
Camera (Looking)	Fwd	Fwd	Aft
Pass	16	16	16
Frame	6	7	13
Date of Photography	2 May 68	2 May 68	2 May 68
Universal Grid Coordinates	33.9 - 0.4	33.8 - 5.3	41.0 - 1.5
Geographic Coordinates of Format Center	34-54N 117-38W	34-47N 117-37W	34-48N 117-40W
Altitude (ft)	543,593	543,386	542,154
Camera			
Pitch (deg)	15°8'	15°9'	-15°22'
Roll (deg)	-0°1'	-0°2'	-0°5'
Yaw (deg)	-2°48'	-2°47'	-2°46'
Local Sun Time	1326	1326	1326
Solar Elevation (deg)	62°33'	62°37'	62°36'
Solar Azimuth (deg)	226	226	227
Exposure (sec)	1/401	1/401	1/402
Processing Level	Full	Full	Full
Vehicle Azimuth (deg)	174°18'	174°19'	174°26'
Filter (Wratten)	W/21	W/21	W/21
Target Type	B-1	B-1	B-1
Target Contrast	9:1	9:1	9:1
Weather Conditions	Scattered Clouds	Scattered Clouds	Scattered Clouds

GROUND RESOLUTION IN FEET AS DETERMINED FROM THE ORIGINAL NEGATIVE

A

		Along Track Fwd	Across Track Fwd
Observer 1	Neg	11'4"	8'11"
	Pos	8'11"	8'11"
Observer 2	Neg	11'4"	8'11"
	Pos	10'1"	8'11"
Observer 3	Neg	10'1"	8'0"
	Pos	11'4"	8'11"

B

		Along Track		Across Track	
		Fwd	Aft	Fwd	Aft
Observer 1	Neg	8'11"	11'4"	8'11"	11'4"
	Pos	8'11"	8'11"	8'11"	8'11"
Observer 2	Neg	10'1"	--	8'11"	11'4"
	Pos	8'0"	8'11"	8'11"	8'11"
Observer 3	Neg	10'1"	--	8'11"	11'4"
	Pos	10'1"	8'11"	8'11"	8'11"

Target Designator	C	D	
Camera (Looking)	Fwd	Fwd	Aft
Pass	16	16	16
Frame	6	7	13
Date of Photography	2 May 68	2 May 68	2 May 68
Universal Grid Coordinates	34.4 - 0.4	34.3 - 5.3	41.6 - 1.5
Geographic Coordinates of Format Center	34-54N 117-38W	34-47N 117-37W	34-48N 117-40W
Altitude (ft)	543,593	543,386	542,154
Camera			
Pitch (deg)	15°8'	15°9'	-15°22'
Roll (deg)	-0°1'	-0°2'	-0°5'
Yaw (deg)	-2°48'	-2°47'	-2°46'
Local Sun Time	1326	1326	1326
Solar Elevation (deg)	62°33'	62°37'	62°36'
Solar Azimuth (deg)	226	226	227
Exposure (sec)	1/401	1/401	1/402
Processing Level	Full	Full	Full
Vehicle Azimuth (deg)	174°18'	174°19'	174°26'
Filter (Wratten)	W/21	W/21	W/21
Target Type	B-2	B-2	B-2
Target Contrast	9:1	9:1	9:1
Weather Conditions	Scattered Clouds	Scattered Clouds	Scattered Clouds

GROUND RESOLUTION IN FEET AS DETERMINED FROM THE ORIGINAL NEGATIVE

C

		Along Track Fwd	Across Track Fwd
Observer 1	Neg	11'4"	8'0"
	Pos	7'1"	8'0"
Observer 2	Neg	8'11"	7'1"
	Pos	8'11"	8'0"
Observer 3	Neg	11'4"	8'0"
	Pos	10'1"	8'0"

D

		Along Track		Across Track	
		Fwd	Aft	Fwd	Aft
Observer 1	Neg	8'0"	11'4"	7'1"	8'11"
	Pos	8'11"	8'11"	7'1"	10'1"
Observer 2	Neg	7'1"	11'4"	7'1"	8'11"
	Pos	8'11"	8'11"	8'11"	10'1"
Observer 3	Neg	7'1"	11'4"	6'4"	8'11"
	Pos	8'0"	8'11"	7'1"	8'11"

Target Designator	E		F	
Camera (Looking)	Fwd	Aft	Fwd	Aft
Pass	16	16	97	97
Frame	14	21	7	13
Date of Photography	2 May 68	2 May 68	7 May 68	7 May 68
Universal Grid Coordinates	44.7 - 0.9	30.5 - 1.1	51.3 - 1.7	24.1 - 4.5
Geographic Coordinates of Format Center	33-52N 117-31W	33-46N 117-32N	38-12N 122-40W	38-13N 122-42W
Altitude (ft)	541,928	540,521	513,127	512,536
Camera				
Pitch (deg)	15°12'	-15°14'	15°15'	-15°17'
Roll (deg)	-0°3'	-0°2'	-0°11'	-0°10'
Yaw (deg)	-2°41'	-2°43'	-2°36'	-2°40'
Local Sun Time	1327	1327	1243	1243
Solar Elevation (deg)	63°5'	63°8'	66°43'	66°42'
Solar Azimuth (deg)	241	241	205	205
Exposure (sec)	1/402	1/403	1/416	1/416
Processing Level	Full	Full	Full	Full
Vehicle Azimuth (deg)	174°27'	174°34'	173°48'	173°55'
Filter (Wratten)	W/21	W/21	W/25	W/25
Target Type	51/51 T Bar	51/51 T Bar	51/51 T Bar	51/51 T Bar
Target Contrast	5:1	5:1	5:1	5:1
Weather Conditions	Scattered Clouds	Scattered Clouds	Haze	Haze

GROUND RESOLUTION IN FEET AS DETERMINED FROM THE ORIGINAL NEGATIVE

		E						F			
		Along Track		Across Track				Along Track		Across Track	
		Fwd	Aft	Fwd	Aft			Fwd	Aft	Fwd	Aft
Observer 1	Neg	--	--	--	--	Observer 1	Neg	16'	12'	16'	12'
	Pos	16'	16'	16'	16'		Pos	12'	16'	16'	16'
Observer 2	Neg	--	--	--	--	Observer 2	Neg	16'	12'	16'	12'
	Pos	16'	16'	16'	16'		Pos	12'	12'	16'	12'
Observer 3	Neg	--	--	--	--	Observer 3	Neg	16'	12'	16'	16'
	Pos	16'	16'	16'	16'		Pos	12'	12'	16'	16'

Target Designator	G	H	
Camera (Looking)	Fwd	Fwd	Aft
Pass	97	97	97
Frame	13	14	20
Date of Photography	7 May 68	7 May 68	7 May 68
Universal Grid Coordinates	53.5 - 0.3	54.0 - 5.2	21.8 - 1.1
Geographic Coordinates of Format Center	37-27N 122-34W	37-20N 122-33W	37-20N 122-35W
Altitude (ft)	512,520	512,439	511,912
Camera			
Pitch (deg)	15°14'	15°15'	-15°13'
Roll (deg)	-0°17'	-0°16'	-0°5'
Yaw (deg)	-1°15'	-1°16'	-2°38'
Local Sun Time	1244	1244	1245
Solar Elevation (deg)	67°19'	67°26'	67°25'
Solar Azimuth (deg)	205	205	205
Exposure (sec)	1/416	1/416	1/417
Processing Level	Full	Full	Full
Vehicle Azimuth (deg)	173°55'	173°56'	174°3'
Filter (Wratten)	W/25	W/25	W/25
Target Type	51/51 T Bar	51/51 T Bar	51/51 T Bar
Target Contrast	5:1	5:1	5:1
Weather Conditions	Haze	Haze	Haze

GROUND RESOLUTION IN FEET AS DETERMINED FROM THE ORIGINAL NEGATIVE

		G				H			
		Along Track Fwd	Across Track Fwd			Along Track Fwd	Along Track Aft	Across Track Fwd	Across Track Aft
Observer 1	Neg	12'	12'	Observer 1	Neg	12'	12'	12'	12'
	Pos	12'	16'		Pos	12'	12'	16'	12'
Observer 2	Neg	12'	12'	Observer 2	Neg	12'	12'	12'	12'
	Pos	12'	12'		Pos	12'	12'	16'	12'
Observer 3	Neg	12'	12'	Observer 3	Neg	12'	12'	12'	12'
	Pos	12'	12'		Pos	12'	12'	12'	12'

PART VIII. MISSION DATA

	Fwd Pan	Fwd Take-up Horizon	Fwd Supply Horizon	Aft Pan	Aft Take-up Horizon	Aft Supply Horizon	Mission 1103 Stellar Port	Mission 1103 Stellar Starboard	Mission 1103 Index
Camera Number	307	*	*	306	*	*	5	5	5
Reseau Number	*	*	*	*	*	*	8P	3	106
Lens Serial Number	I-192	E-23752	E-23772	I-166	E-23812	E-23792	8P	3	106
Slit Position/ Slit Width (in)	1/0.195 2/0.320 3/0.320 4/0.100 FS/0.300	*	*	1/0.135 2/0.185 3/0.260 4/0.135 FS/0.160	*	*	*	*	*
Aperture	*	F/8.0	F/6.3	*	F/6.3	F/8	F/2.8	F/2.8	F/6.3
Exposure Time (sec)	Variable	1/100	1/100	Variable	1/100	1/100	1.5	1.5	1/500
Filter (Wratten) Primary	W/25	W/25	W/25	W/21	W/25	W/25	None	None	W/12
Alternate	W/12			SF-05					
Focal Length (mm)	609.638	55	55	609.638	55	55	76.2	76.2	76.2
Film Length (ft)	16,500	*	*	16,500	*	*	2,000		2,000
Splices	6	*	*	4	*	*	1		0
Emulsion	SO-380-49-1-12-7	*	*	SO-380-49-1-12-7	*	*	3401-165-3/ 3404-252-13-8		173-1-3-8
Film Type	3404/SO-380 (UTB)	*	*	3404/SO-380 (UTB)	*	*	3401/3400		3400
Resolution Data (L/mm)	---------	209R 187T	209R 166T	---------	209R 187T	209R 187T	NA	NA	82R 79T
Static									
High Contrast	●145	NA	NA	▲269	NA	NA	NA	NA	NA
Low Contrast	●144	NA	NA	▲152	NA	NA	NA	NA	NA
Dynamic									
I High Contrast	●196	NA	NA	▲205	NA	NA	NA	NA	NA
I Low Contrast	●132	NA	NA	▲137	NA	NA	NA	NA	NA
P High Contrast	●234	NA	NA	▲205	NA	NA	NA	NA	NA
P Low Contrast	●147	NA	NA	▲136	NA	NA	NA	NA	NA

NA - Not Available.
* - Not Applicable.
R - Radial Resolution on Axis.
T - Tangential Resolution on Axis.
▲ - Resolution Tested Using a W/21 Filter.
● - Resolution Tested Using a W/25 Filter.
FS - Fail Safe.

PART IX. ENGINEERING EXPERIMENTS

A. Mission 1103 Experiments

All proposed engineering experiments on Mission 1103 were accomplished as scheduled. A description of each experiment is presented below.

1. Type SO-380 Film Test: Approximately 1,750 feet of type SO-380 film was used in each panoramic camera at the end of Mission 1103-2.

2. Bi-Spectral Test: A combination of a Wratten 25 (red filter) and a SF05 (green filter) was used on 26 passes to obtain conjugate imagery suitable for bicolor presentation.

3. Through Exposure/Wratten 12 Filter Test: A Wratten 12 (W-12) filter was used in the fwd-looking camera during portions of passes 16D and 97D. In addition, an exposure test was conducted on both cameras during these acquisitions to determine exposure criteria more accurately.

B. Analysis of Experiments

1. Through Exposure/Wratten 12 Filter Test, Bi-Spectral, and SO-380 UTB Experiments: The results of these evaluations are not available at this time. However, they will appear as a special study in a later PER.

C. Scheduled Future Experiments

Mission 1104	SO-180 Bi-Spectral	Color Infrared Film Wratten 25 and SF05 (Green Filter), Domestic
1105	SO-121	High Resolution Color Film

Tentative Experiments

1106 & 1107	Polarizer through Focus	Winter, Proper Azimuths Stepped Glass Filter.

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-looking camera.

NPIC N-0391 NPIC N-0392

	FIGURE 1	FIGURE 2
Camera	307	306
Pass	79D	79D
Frame	15	21
Date of Photography (GMT)	6 May 68	6 May 68
Universal Grid Coordinates	41.8 - 3.8	34.8 - 2.2
Enlargement Factor	20X	20X
Geographic Coordinates	41-23N 81-54W	41-24N 81-59W
Altitude (ft)	526,066	525,151
Camera Attitude:		
Pitch (deg)	15°17'	-15°12'
Roll (deg)	-0°18'	-0°9'
Yaw (deg)	-2°14'	-2°27'
Local Sun Time	1246	1246
Solar Elevation (deg)	62°15'	62°15'
Solar Azimuth (deg)	203	203
Exposure (sec)	1/411	1/412
Vehicle Azimuth (deg)	173°15'	173°24'
Processing Level	Full	Transition F-P

[redacted]

~~TOP SECRET · RUFF~~

[redacted]

[redacted]

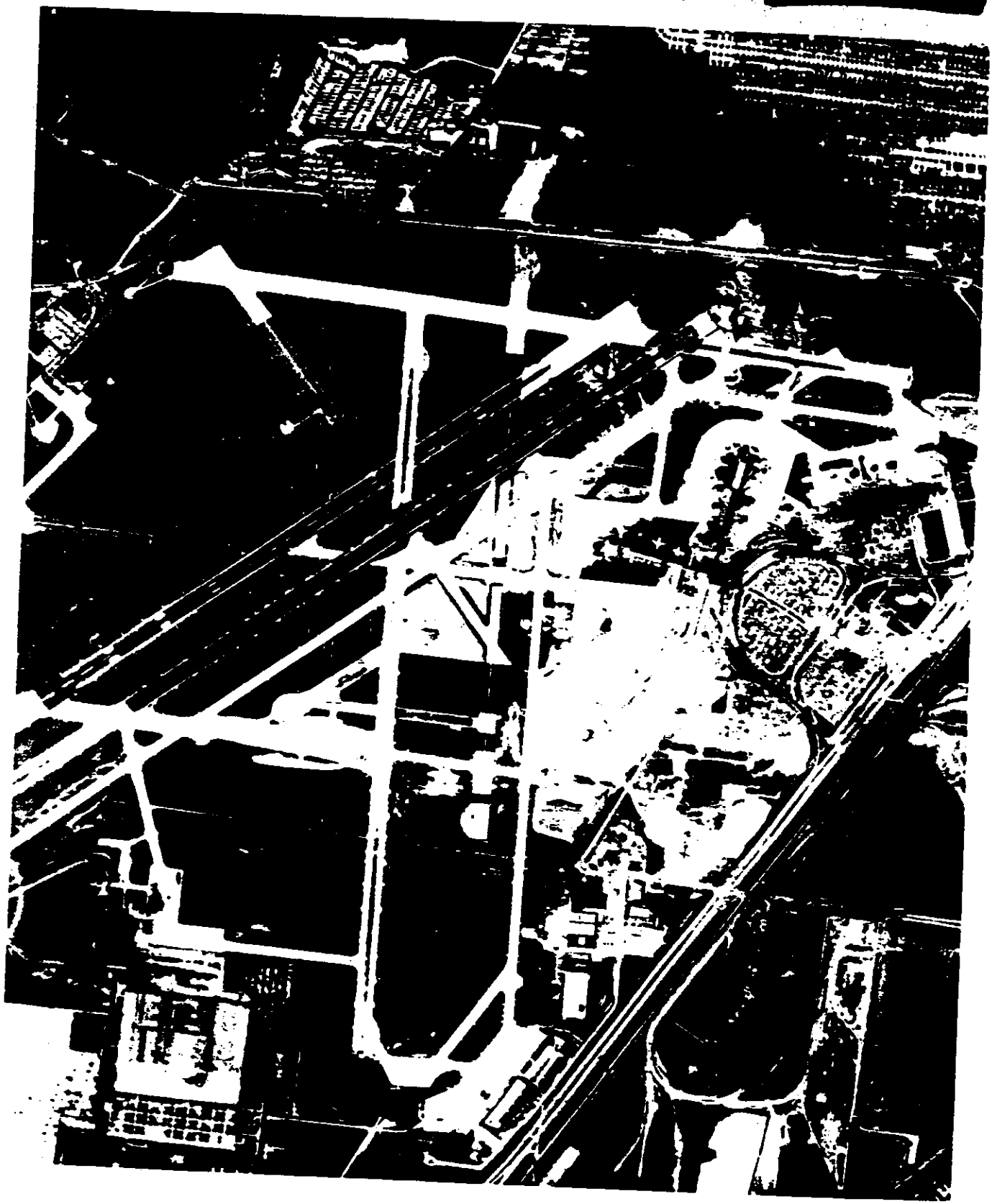


	FIGURE 3	FIGURE 4
Mission Number	1103-1	1103-2
Stellar Frame Numbers	P198, S204, P199	P28, S34, P28
Pass	6D	105D
Date of Photography (GMT)	2 May 68	8 May 68
Enlargement Factor	2.5X	2.5X
Exposure Time (sec)	1.5	1.5

FIGURE 3. STELLAR FORMAT (MISSION 1103-1)

FIGURE 4. STELLAR FORMAT (MISSION 1103-2)

The following photographs exhibit the flare pattern prevalent throughout the mission.

NPIC N-0393

NPIC N-0394

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[redacted]

[redacted]