~~TOP SECRET~~
~~NO FOREIGN DISSEM~~

IX

TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT MISSION 1106

REPORT ON PHOTO INTERPRETABILITY OF SO-121 (COLOR) FILM TYPE FROM MISSION 1106

[redacted]

JUNE 1969

COPY [redacted]

45 PAGES

[redacted] control only

TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT

MISSION 1106

JUNE 1969

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

DISTRIBUTION LIST

Number of Copies

[redacted]

[redacted]

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

INDEX OF PHOTOGRAPHIC EVALUATION REPORTS AND SPECIAL STUDIES

PER	DOCUMENT NUMBER	SPECIAL STUDY
1033	[redacted]	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	[redacted]	None
1043		Scan Speed Deviation Analysis of the Forward Camera, Mission 1043
1044	[redacted]	Dual Gamma/Viscose Vs Conventional/Spray Processing Analysis (Mission 1044)
1045	[redacted]	None
1046		SO-230 Vs 3404 Evaluation
1047		None
1048		None
1101		Slant Range Computations Related to Universal Grid Coordinates for the KH4B Camera System
1102	[redacted]	None
1103		None
1104		SO-180 Evaluation Mission 1104
1105		SO-121 Evaluation Mission 1105
1106	[redacted]	SO-180 Evaluation Supplement None

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) = $\frac{\text{Slit Width (in)}}{\text{Scan Rate (Rads per sec)}}$
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."

SYNOPSIS

Mission 1106, a two part satellite reconnaissance mission, was launched at 2159Z on 5 February 1969. The first capsule was recovered dry on revolution 66 at 0009Z on 10 February 1969. The mission was terminated by air catch of the second satellite re-entry vehicle on revolution 147 at 2359Z on 14 February 1969. A total of 59 photographic passes was accomplished on the nine-day mission.

The best imagery of Mission 1106 is provided by the fwd-looking camera. The best image quality is considered to be good and slightly better than the best obtained on Mission 1102.

An MIP of 105 is assigned to this mission. Frame 8 fwd, pass 32D is the MIP frame and frame 14 aft, pass 32D has imagery corresponding to the MIP frame.

Mission 1106 is the first mission of this system in which color material was used operationally to satisfy a specific intelligence requirement. However, due to the film separation on pass 105D this requirement was not fulfilled.

The overall image quality of the SO-121 (color) film of Mission 1106 is better than that obtained on Mission 1105. The ground resolution is estimated to be 20 to 25 feet.

Approximately 85 percent of the mission contains cloud-free photography.

PART I. GENERAL SYSTEM INFORMATION

A. Camera Numbers

Forward-Looking Panoramic Camera	313
Aft-Looking Panoramic Camera	312
DISIC Camera	6

B. Launch and Recovery Dates

	Mission 1106-1	Mission 1106-2
Launch	5 Feb 69/2159Z	*
Recovery	10 Feb 69/0009Z	14 Feb 69/2359Z
Recovery Rev	66D	147D

C. Orbit Elements

Element	Actual Mission 1106-1 Rev 10	Actual Mission 1106-2 Rev 93	Photo Range	Pass
Period (min)	88.600	88.529	*	*
Perigee (nm)	81.687	79.466	78.912	113D
Apogee (nm)	154.099	154.269	111.681	21D
Eccentricity	0.00988	0.01030	*	*
Inclination (deg)	81.54°	81.55	*	*
Perigee Latitude (geod)	35°46'	39°33'	*	*

*Not Applicable.

D. Photographic Operations

1. Panoramic Cameras

Type	Mission 1106-1 Revs	Mission 1106-1 Frames	Mission 1106-2 Revs	Mission 1106-2 Frames	Total Revs	Total Frames
Operational						
Fwd	20	2,792	25	2,920	45	5,712
Aft	20	2,793	20	2,455	40	5,248
Operational/Domestic						
Fwd	1	49	0	0	1	49
Aft	1	49	0	0	1	49
Domestic						
Fwd	5	80	3	80	8	160
Aft	5	81	1	52	6	133
Engineering (no imagery)						
Fwd	2	29	3	46	5	75
Aft	2	29	2	22	4	51
Totals						
Fwd	28	2,950	31	3,046	59	5,996
Aft	28	2,952	23	2,529	51	5,481

2. Secondary Cameras

Camera	Frames
Stellar (Mission 1106-1)	2,146 Starboard; 2,146 Port
Index (Mission 1106-1)	2,146
Stellar (Mission 1106-2)	2,500 Starboard; 2,499 Port
Index (Mission 1106-2)	2,262

E. Film Usage

	Film Load (Total)	Pre-Flight Footage	Processed Footage	Film Type
Fwd-Looking (Mission 1106-1)	16,000*	410	7,754	3404
Aft-Looking (Mission 1106-1)	16,000* ▲	402	7,824	3404
Fwd-Looking (Mission 1106-2)	NA	NA	8,051	3404
Aft-Looking (Mission 1106-2)	NA	NA	5,765	3404
			911	SO-121
Stellar (Mission 1106-1)	2,000*	44	606	3401
Stellar (Mission 1106-2)	NA	NA	658	3401
Index (Mission 1106-1)	2,000*	54	1,019	3400
Index (Mission 1106-2)	NA	NA	993	3400

*Total Load For Both Buckets.
NA - Not Applicable.
▲ Including 2,000 Feet of SO-121.

PART II. IMAGE ANALYSIS

A. Fwd-Looking Panoramic Camera

1. Density: The density of the original negative on Mission 1106 is generally heavy due to the predominance of snow covered terrain.

2. Contrast: In general, the imagery obtained by the fwd-looking camera is of medium contrast.

3. Image Quality: The best imagery of Mission 1106 was provided by the forward-looking camera. The best image quality is considered to be slightly better than the best obtained on Mission 1102, and an MIP rating of 105 has been assigned. The imagery on passes 1D through 5D is severely smeared due to a V/H programmer failure. The V/H programmer failed at the start of the mission so that all operations were run at start level cycle rates. Operations on passes 1D through 5D have large V/H mismatch due to the ramp settings being in a configuration consistent with normal programmer functioning. The mismatch for subsequent operations was minimized by adjusting the programmer start level to provide a near constant cycle rate. Image smear was not detected after pass 5D in relation to this anomaly. However, instances of image smear attributed to vehicle perturbations are noted on pass 113D.

4. Imaged Degradations:

a. Light Leaks: A minor fog pattern is present on the first frame of a few camera operations when low density imagery is present. (Graphic 1, page 9)

b. Static: None noted.

c. Other: None noted.

5. Physical Degradations: Minus density spots are noted on pass 1D of the fwd-looking camera record. These spots vary in size and shape. Their size ranges from minute pin holes to approximately 1/16 of an inch in diameter and are localized in a small number of frames (6 frames) occurring a few frames after the start of pass 1D. These spots appear on a three and one-eighth inch repeating pattern, indicating a one inch roller transfer of a substance affecting film sensitivity or development.

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

B. Aft-Looking Panoramic Camera

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

2. Contrast: Same as reported for the fwd-looking camera record.

3. Image Quality: The image quality of the aft-looking camera record is slightly poorer than that obtained from the forward-looking camera. The imagery on passes 1D through 5D is severely smeared due to a V/H mismatch, (See Fwd-Looking Panoramic Camera, Image Quality). The 911 feet of SO-121 (color) film was exposed on revs 103D, 104D, and 105D. The overall image quality of the SO-121 material is better than that obtained on Mission 1105. This quality improvement is credited to increased system tensions pulling the film flat and/or the short time period between launch and exposure limiting potential film drying in vacuum. Ground resolution of the SO-121 film is estimated to be 20 to 25 feet. The color balance and exposure are considered to be good except for photography over snow covered terrain at higher solar elevations. The photography in this region is considered to have been overexposed.

4. Imaged Degradations:

a. Light Leaks: A minor fog pattern is present on the first frame of a few camera operations when low density imagery is present (Graphic 2, page 9).

b. Static: No static discharges are noted on the 3404 film type. However, dendritic and corona type static discharges are present intermittently throughout the SO-121 film record.

c. Other: On passes 25D, 39D, 48D, and 55D, the starboard horizon shutter failed to close for one cycle and remained open during film transport. Due to this malfunction, two main frames of photography are fogged for each occurrence.

5. Physical Degradations:

a. Small plus density pressure marks are present through many of the starboard horizon formats. A horizon camera platen modification causes several density marks versus the single mark seen on previous systems. This will be characteristic of future systems.

b. Minus density spots are noted on pass 1D of the aft-looking camera record. These spots vary in size and shape, ranging from minute pin holes to approximately 1/16 of an inch in diameter. The

spots are localized in a small number of frames (2 frames). They occur a few frames after the start of pass 1D and appear to be caused by roller transfer of a substance affecting film sensitivity or development.

c. Very minor emulsion scratches are present intermittently throughout the mission on both the 3404 and SO-121 records.

d. The aft-camera film supply consisted of 2,000 feet of SO-121 color film. Color acquisition began on pass 103D, frame 171. Due to a film separation, frame 129 of pass 105D was the last frame recovered. A total of 347 frames or approximately 911 feet were acquired.

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

C. Stellar Cameras

1. Density: The density of the stellar frames from both the port and starboard cameras is generally medium. However, the port camera frames are somewhat thinner in density than the starboard camera frames.

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

3. Image Shape: The stellar images generally appear as point type images.

4. Images per Frame: Approximately 75 port and 15 starboard stellar images can be detected throughout the mission. The stellar field at which the cameras were looking contained Taurus and Orion.

5. Flare Level: Approximately five percent of each port stellar frame and 15 percent of each starboard stellar frame is affected by flare.

6. Imaged Degradations:

a. Light Leaks: None noted.

b. Static: None noted.

c. Other: None noted.

7. Physical Degradations: A characteristic pressure-induced fog pattern (skew bead marking) is present on the time word edge of the film.

This fog pattern is more dense than normal, and in many instances has a spur that projects toward the center of the film near the time word. This pattern had no effect on automatic time word readout. However, if this condition should become more severe it could cause automatic time word readout problems.

8. Product Quality: The overall quality of the stellar record is good and adequate for attitude determination.

D. Index Camera

1. Density: The density of the index camera record is generally medium to heavy.

2. Contrast: The contrast of the index camera record is generally medium.

3. Image Quality: The index camera image quality is good and compares favorably with Mission 1103 and Mission 1104 imagery.

4. Imaged Degradations:

a. Light Leaks: None noted.

b. Static: Very minor edge static is present intermittently throughout the index record. Minor corona static is present on the index record of Mission 1106-2.

c. Other:

(1) Plus density patterns are present between most formats throughout the mission. These patterns are caused by an incomplete coating of the edges of the focal plane plate. These patterns are located between formats and do not cause any degradation to the imagery.

(2) Minus density spots, which appear to be caused by dirt on the reseau plate, are present on the index camera record throughout the mission. Degradation to the imagery is minor.

5. Physical Degradations: None noted.

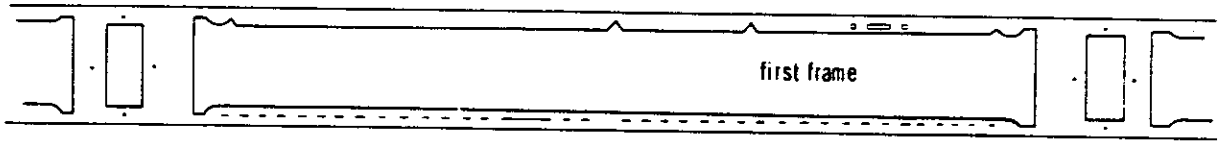
6. Product Quality: The overall quality of the index camera record is good and adequate for relative orientation.

E. Graphic Display

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

Graphic 1

Graphic 2



NPIC M-6469

PART III. IMAGED AUXILIARY DATA

A. Fwd-Looking Panoramic Camera

1. Horizon Cameras

a. Starboard Looking

(1) Imagery: Adequate for attitude determination where needed. However, slight vignetting is apparent on starboard horizon frames that display low density imagery.

(2) Fiducials: Sharp and well defined.

b. Port Looking

(1) Imagery: Adequate for attitude determination where needed.

(2) Fiducials: Sharp and well defined.

2. Frequency Marks: Imaged properly.

3. Binary Time Word (SLP): The SLP block exhibited a plus density bleeding between binary bits on all data block images throughout the mission. This plus density bleeding was caused by a wrinkled mylar coating on the front surface of the SLP data head. Reflections from this wrinkled surface printed between the data bits on the film. This anomaly caused no problems with the automatic data reader.

4. Camera Number: Readable.

5. Pan Geometry Dots: Sharp and well defined.

6. Nodal Traces: Sharp and well defined.

7. Nod Indicators: Not incorporated with this mission.

B. Aft-Looking Panoramic Camera

1. Horizon Cameras

a. Starboard Looking

(1) Imagery: Adequate for attitude determination where

needed; however, slight vignetting is apparent on starboard horizon frames that display low density imagery.

(2) Fiducials: Sharp and well defined.

b. Port Looking

(1) Imagery: Adequate for attitude determination.

(2) Fiducials: Sharp and well defined.

2. Frequency Marks: Imaged properly.

3. Binary Time Word (SLP): Sharp and well defined.

4. Camera Number: Readable.

5. Pan Geometry Dots: Sharp and well defined.

6. Nodal Traces: Sharp and well defined.

7. Nod indicators: Not incorporated with this mission.

C. Stellar Cameras

1. Grid Image Quality: Sharp and well defined.

2. Binary Time Word (SLP): Imaged properly. Dependent/independent mode indication has been incorporated on the data block of this and subsequent DISIC units. This added function operated properly throughout Mission 1106.

3. Camera Number Legibility: Good.

D. Index Camera

1. Grid Image Quality: Sharp and well defined.

2. Binary Time Word: Imaged properly. Dependent/independent mode indication has been incorporated in the data block of this and subsequent DISIC units. This added function operated properly throughout Mission 1106.

3. Camera Number Legibility: Good.

PART IV. MENSURATION QUALITY

There were 45 requests for mensuration on this mission. No problems were encountered. The image quality is considered to be good for mensuration purposes.

PART V. FILM PROCESSING

A. Processing Machines and Process Gamma

	Machine	Average Head & Tail Gamma	Film Type
Fwd (Mission 1106-1)	Yardleigh	1.69	3404
Aft (Mission 1106-1)	Yardleigh	1.65	3404
Fwd (Mission 1106-2)	Yardleigh	1.72	3404
Aft (Mission 1106-2)	Yardleigh	1.70	3404
	Grafton	NA	SO-121
Stellar (Mission 1106-1)	Trenton	2.10	3401
Stellar (Mission 1106-2)	Trenton	2.14	3401
Index (Mission 1106-1)	Drape	1.84	3400
Index (Mission 1106-2)	Drape	1.69	3400

NA - Not Available.

B. Processing Technique

1. Panoramic Cameras: The black and white portions of both panoramic camera records were processed by using the dual gamma single level viscous process. The entire color portion was processed in the Grafton processor, using a single level of development. Prior to processing, the timing track edge was flashed with calibrated filtered light to decrease the density and permit the standard edge titling technique to be used.

2. Secondary Cameras:

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

b. Index Camera: The index camera records were processed with a Drape processor at a single level of development.

C. Film Handling Summary

1. Fwd-Looking Camera:

a. Capsule De-Filming: Both segments were defilmed on the West Coast and received at the processing site in suitcases.

b. Pre-Processing Inspection: No problems encountered.

c. Manufacturing Splices

(1) Mission 1106-1: Pass 22D, frame 133 and pass 37D, frame 67.

(2) Mission 1106-2: Pass 55D, frame 196 and pass 78D, frame 6.

d. Processing Splices: None other than normal.

e. Manufacturing Defects: None noted.

f. Processing Anomalies: None.

g. Breakdown: Prior to primary breakdown, each lab part (1,000 foot segments of processed material) was printed and the resultant positive processed and certified as to proper densities, quality, etc. for subsequent production of an operational readiness inspection (ORI) duplicate negative. Thus the first lab part was delayed approximately two hours. During the breakdown, this procedure caused further delays totaling about 1.5 hours.

2. Aft-Looking Camera:

a. Capsule De-Filming: Both segments were defilmed on the West Coast and received at the processing site in suitcases.

b. Pre-Processing Inspection: No problems encountered.

c. Manufacturing Splices:

(1) Mission 1106-1: Pass 24D, frame 93 and pass 54D, frame 18.

(2) Mission 1106-2: Pass 74D, frame 54. The aft camera material contained a pre-exposed, pre-processed indicator strip (approximately three feet in length) to indicate the film type change from 3404 to SO-121. Part of frame 169 and all of frame 170 of pass 103D were exposed on this non-sensitive strip. A blank piece of film was inserted in the place of this strip and titled accordingly.

d. Processing Splices: None other than normal.

e. Manufacturing Defects: None noted.

f. Processing Anomalies: None.

g. Breakdown: See fwd-looking camera breakdown.

3. Index Camera:

a. Capsule De-Filming: Both segments were defilmed on the West Coast and received at the processing site in suitcases.

b. Pre-Processing Inspection: No problems encountered.

c. Manufacturing Splices: None.

d. Processing Splices: None other than normal.

e. Manufacturing Defects: None noted.

f. Processing Anomalies: None.

g. Breakdown: No problems encountered.

4. Stellar Cameras:

a. Capsule De-Filming: Both segments were defilmed on the West Coast and received at the processing site in suitcases.

b. Pre-Processing Inspection: No problems encountered.

c. Manufacturing Splices: None.

d. Processing Splices: None other than normal.

e. Manufacturing Defects: None noted.

f. Processing Anomalies: None.

g. Breakdown: No problems encountered.

D. Timetable

Film	Recovered	Processing Site	Spec Ship at NPIC Recd	Priority 1A at NPIC Recd
Fwd (Mission 1106-1)	10 Feb 69/ 0009Z	10 Feb 69/ 1800Z	None	0707Z
Aft (Mission 1106-1)	"	"	"	"
Stellar (Mission 1106-1)	"	"	"	"
Index (Mission 1106-1)	"	"	"	"
Fwd (Mission 1106-2)	14 Feb 69/ 2359Z	15 Feb 69/ 2130Z	"	0820Z
Aft (Mission 1106-2)	"	"	"	"
Stellar (Mission 1106-2)	"	"	"	"
Index (Mission 1106-2)	"	"	"	"

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 1106-1	Mission 1106-2	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	29	26	55

2. PI Quality Appraisal

Rating	Missiles	Nuclear Energy	Air Facilities	Ports	Military Activity	Complex	Other
Good	12	1	3	3	11	0	4
Fair	35	3	14	3	14	3	0
Poor	25	1	6	2	4	1	0
Totals*	72	5	23	8	29	4	4

3. Summary of PI Quality Ratings

Good: 34 or 23.4 percent
Fair: 72 or 49.7 percent
Poor: 39 or 26.9 percent

*A discrepancy can exist 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: Listed below is the photo interpreter's report of weather conditions for priority 1 targets covered on this mission.

a. Clear: 106 or 73.1 percent

b. Haze: 13 or 9.0 percent

c. Scattered Clouds and Haze: 7 or 4.8 percent

d. Scattered Clouds and Cloud Shadow: 10 or 6.9 percent

e. Heavy Clouds: 2 or 1.4 percent

f. Semi-darkness: 7 or 4.8 percent

2. Terrain Conditions: Snow cover was the predominant factor affecting terrain imagery.

3. Product Interpretability: The photographic interpretability of the black and white record of Mission 1106 is rated as fair to good. The interpretability of the SO-121 material from this mission is reported in PART IX of this report.

PART VII. RESOLUTION TARGET DATA

Target Designator	A		B	
Camera (Looking)	Fwd	Aft	Fwd	Aft
Pass	32D	32D	32D	32D
Frame	3	9	8	14
Date of Photography	7 Feb 69	7 Feb 69	7 Feb 69	7 Feb 69
Universal Grid Coordinates	11.2 - 3.5	64.7 - 2.7	8.0 - 2.0	58.3 - 4.4
Geographic Coordinates of Format Center	36-46N 114-37W	36-47N 114-43W	36-11N 114-31W	36-11N 114-37W
Altitude (ft)	492,983	492,940	492,944	492,933
Camera				
Pitch (deg)	15° 38'	-14° 54'	15° 40'	-14° 53'
Roll (deg)	0° 2'	0° 7'	0° 8'	0° 7'
Yaw (deg)	-2° 59'	-2° 58'	-2° 58'	-2° 56'
Local Sun Time	1328	1327	1328	1329
Solar Elevation (deg)	35° 5'	35° 5'	35° 35'	35° 35'
Solar Azimuth (deg)	154°	154°	154°	154°
Exposure (sec)	1/500	1/600	1/500	1/604
Processing Level	Dual gamma	Dual gamma	Dual gamma	Dual gamma
Vehicle Azimuth (deg)	172° 9'	172° 16'	172° 15'	172° 22'
Filter (Wratten)	W-23A	W-21	W-23A	W-21
Target Type	C	C	51/51	51/51
Target Contrast	8.8:1	8.8:1	5:1	5:1
Weather Conditions	Clear	Clear	Clear	Clear

GROUND RESOLUTION IN FEET AS DETERMINED FROM THE ORIGINAL NEGATIVE

A

		Along Track		Across Track	
		Fwd	Aft	Fwd	Aft
Observer 1	ON	6.83	7.67	7.67	9.67
	DP	7.67	8.61	9.67	10.86
Observer 2	ON	6.83	6.83	6.83	6.83
	DP	6.83	7.67	8.61	8.61
Observer 3	ON	6.08	6.83	6.08	7.67
	DP	7.67	7.67	7.67	8.61

B

		Along Track		Across Track	
		Fwd	Aft	Fwd	Aft
Observer 1	ON	8	12	12	8
	DP	12	8	12	12
Observer 2	ON	6.35	12	8	8
	DP	12	8	12	8
Observer 3	ON	8	12	12	8
	DP	12	8	12	12

TOP SECRET RUFF
Handle Via
Control System Only

Target Designator	C		D
Camera (Looking)	Fwd	Aft	Fwd
Pass	48D	48D	113D (mono)
Frame	7	13	5
Date of Photography	8 Feb 69	8 Feb 69	12 Feb 69
Universal Grid Coordinates	18.3 - 5.0	57.2 - 1.3	48.2 - 2.6
Geographic Coordinates of Format Center	33-25N 111-09W	33-26N 111-15W	37-26N 122-27W
Altitude (ft)	492,208	492,394	479,440
Camera			
Pitch (deg)	15° 38'	-14° 53'	ND
Roll (deg)	0° 16'	0° 16'	ND
Yaw (deg)	-3° 12'	-3° 4'	ND
Local Sun Time	1321	1322	1241
Solar Elevation (deg)	38° 56'	38° 57'	38° 56'
Solar Azimuth (deg)	155°	155°	168°
Exposure (sec)	1/349	1/466	1/352
Processing Level	Dual gamma	Dual gamma	Dual gamma
Vehicle Azimuth (deg)	172° 42'	172° 49'	172° 2'
Filter (Wratten)	W-23A	W-21	W-23A
Target Type	51/51	51/51	51/51
Target Contrast	5:1	5:1	5:1
Weather Conditions	Cloudy	*Fogged Frame	Scattered Clouds

GROUND RESOLUTION IN FEET AS DETERMINED FROM THE ORIGINAL NEGATIVE

C

		Along Track		Across Track	
		Fwd	Aft	Fwd	Aft
Observer 1	ON	12	16	12	16
	DP	12	16	12	NR
Observer 2	ON	6.35	16	12	16
	DP	8	16	12	16
Observer 3	ON	12	16	12	16
	DP	12	16	12	16

D

		Along Track Fwd	Across Track Fwd
Observer 1	ON	7.13	16
	DP	8	16
Observer 2	ON	5.66	16
	DP	5.66	12
Observer 3	ON	5.66	12
	DP	8	16

NR - Not Resolved.
ND - Not Determined.
*Horizon Shutter Malfunction.

PART VIII. MISSION DATA

	▲ Fwd Pan	Fwd Take-up Horizon	Fwd Supply Horizon	● Aft Pan	Aft Take-up Horizon	Aft Supply Horizon	Stellar Port	Stellar Starboard	Index
Camera Number	313	*	*	312	*	*	6	6	6
Reseau Number	*	*	*	*	*	*	11P	6	105
Lens Serial Number	I 206	E23797	E23761	I 190	E23782	E23783	11P	6	105
Slit Position/ Slit Widths (in)	1/0.160 2/0.195 3/0.245 4/0.305 FS/0.245	*	*	1/0.134 2/0.150 3/0.185 4/0.230 FS/0.185	*	*	*	*	*
Aperture	*	F/6.3	F/8.0	*	F/6.3	F/8.0	F/2.8	F/2.8	F/4.5
Exposure Time (sec)	Variable			Variable			1.50	1.50	1/500
Filter (Wratten) Primary	W/23A	W/25	W/25	W/21	W/25	W/25	None	None	W/12
Alternate	W/25			2E+20C+0.5ND					
Focal Length (mm)	610.438	45.50	45.40	610.431	45.40	45.30	76.2	76.2	76.2
Film Length (ft)	16,000	*	*	14,000/2,000	*	*	2,000		2,000
Splices	4	*	*	5	*	*	0		0
Emulsion	428-1-1-9	*	*	428-1-1-9/44-1(SO-121)	*	*	252-13-3-8		173-1-3-8
Film Type	3404	*	*	3404/SO-121	*	*	3401		3400
Resolution Data (1/mm)	- - -	209R/187T	209R/235T	- - -	209R/187T	166R/166T	NA		66.5 AWAR
Static									
High Contrast	280	NA	NA	262	NA	NA	NA		NA
Low Contrast	183	NA	NA	147	NA	NA	NA		NA
Dynamic									
I High Contrast	254	NA	NA	237	NA	NA	NA		NA
I Low Contrast	181	NA	NA	144	NA	NA	NA		NA
P High Contrast	266	NA	NA	194	NA	NA	NA		NA
P Low Contrast	184	NA	NA	130	NA	NA	NA		NA

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

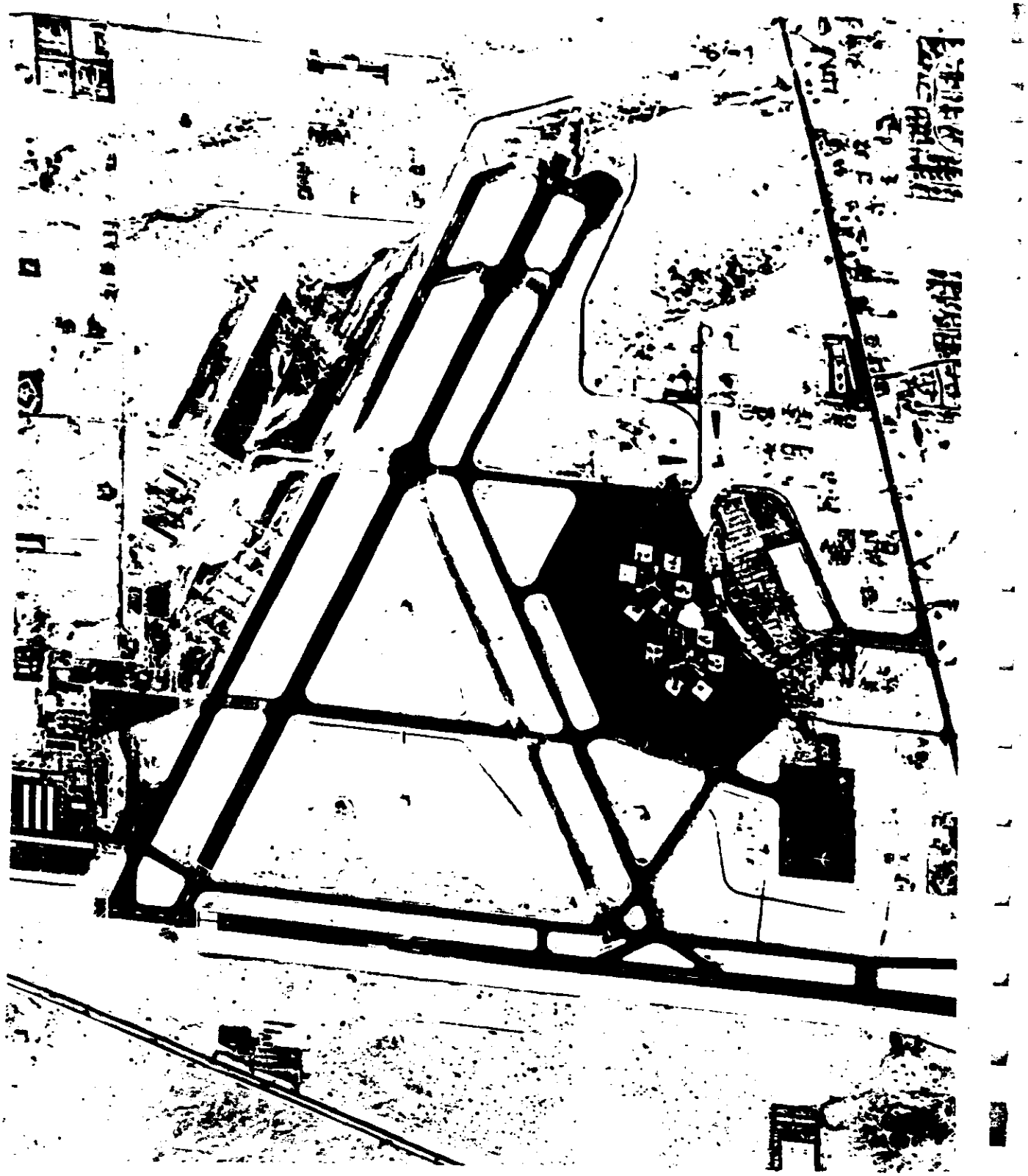
FIGURE 1. Best Image Quality
Image quality comparable to the best of this mission.

FIGURE 2. Corresponding Coverage
Corresponding coverage as imaged by the aft camera.

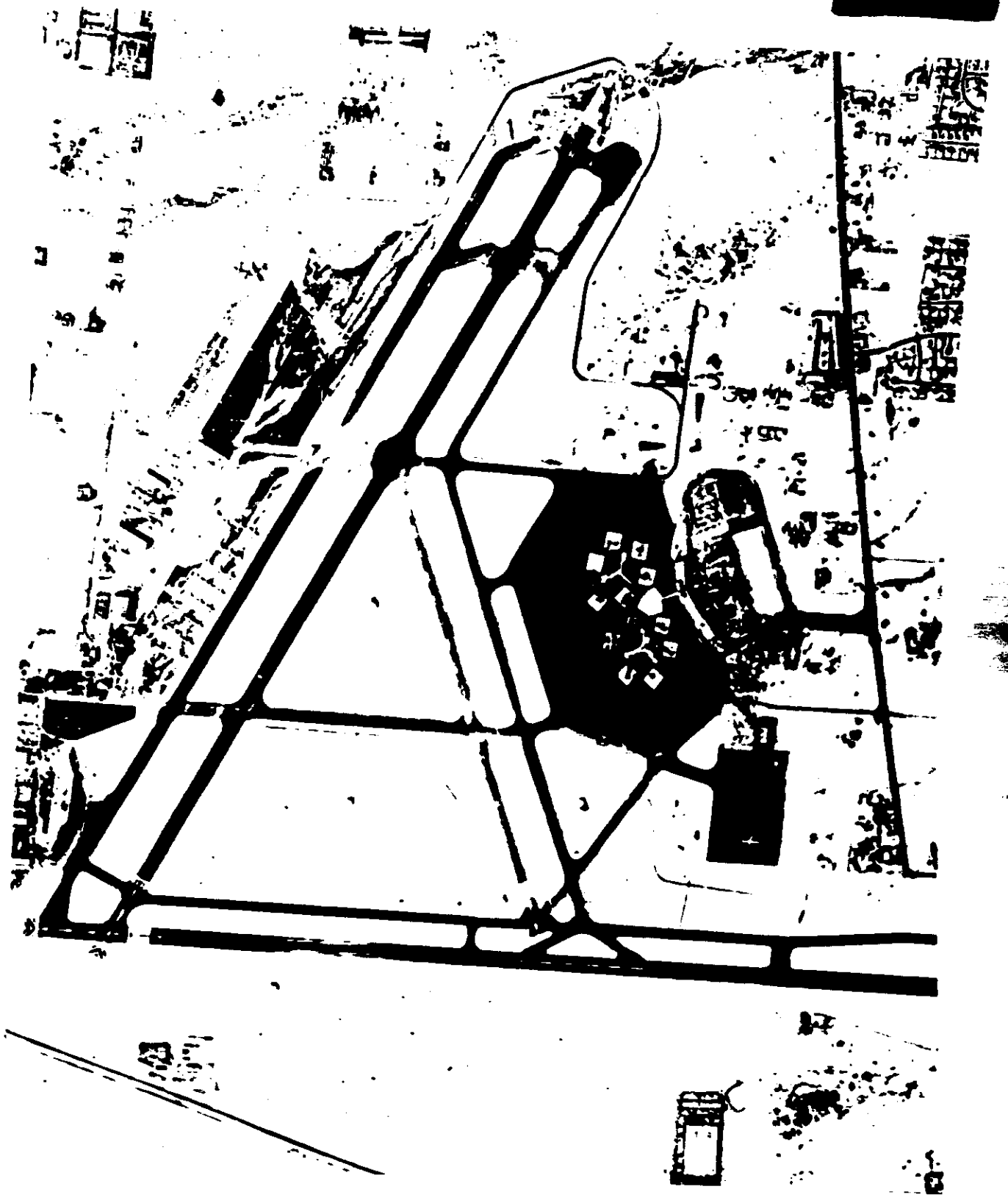
	FIGURE 1	FIGURE 2
Camera	313	312
Pass	32D	32D
Frame	8	14
Date of Photography (GMT)	7 Feb 69	7 Feb 69
Universal Grid Coordinates	17.9 - 1.8	58.3 - 4.6
Enlargement Factor	20X	20X
Geographic Coordinates	36-11N 114-31W	36-11N 114-37W
Altitude (ft)	492,944	492,933
Camera Attitude:		
Pitch (deg)	15° 40'	-14° 53'
Roll (deg)	0° 8'	0° 7'
Yaw (deg)	-2° 58'	-2° 56'
Local Sun Time	1328	1329
Solar Elevation (deg)	35° 35'	35° 35'
Solar Azimuth (deg)	154°	154°
Exposure (sec)	1/500	1/604
Vehicle Azimuth (deg)	172° 15'	172° 22'
Processing	Dual Gamma	Dual Gamma
Filter	W-23A	W-21

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

[redacted]



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



PART IX. INTERPRETABILITY OF SO-121 FROM MISSION 1106

1. The aft camera film load consisted of 14,000 feet of film type 3404 and 2,000 feet of SO-121 (color film). The SO-121 was intended for coverage of a specific target area. However, the specified area was not covered because of unforeseen circumstances. The 3404 material was expended at a rate faster than had been anticipated because of excellent weather conditions over target areas. This rapid use of material resulted in the availability of SO-121 for exposure earlier than originally expected. It was then decided to ration the use of SO-121 until the area of interest was within the ground track. However, the film separated on pass 105D, after approximately 911 feet of SO-121 was exposed, thereby eliminating possible coverage of the area with the remaining 1,089 feet of color film.

2. Fifteen priority targets (missiles, aircraft facilities, ground force activities, and complexes) were photographed with SO-121 and reported during the initial readout. Fourteen targets were rated fair and one target, located on the high oblique, was rated poor. These ratings are based on the black/white record and if only color had been received all targets would have been rated poor and most would have been categorized as "identification only". During the second phase readout, one interpreter located order of battle equipment on the black/white material after ground scars were detected on the color. However, in the majority of instances no additional intelligence information was derived from the SO-121. It should be noted that most existing PI requirements are spatial resolution oriented; there are no routine "color requirements." Therefore, in view of the existing requirements, the results of this photo interpreter's evaluation could have been predicted.

FIGURES 1A and 2A. Black/White and Color Comparisons

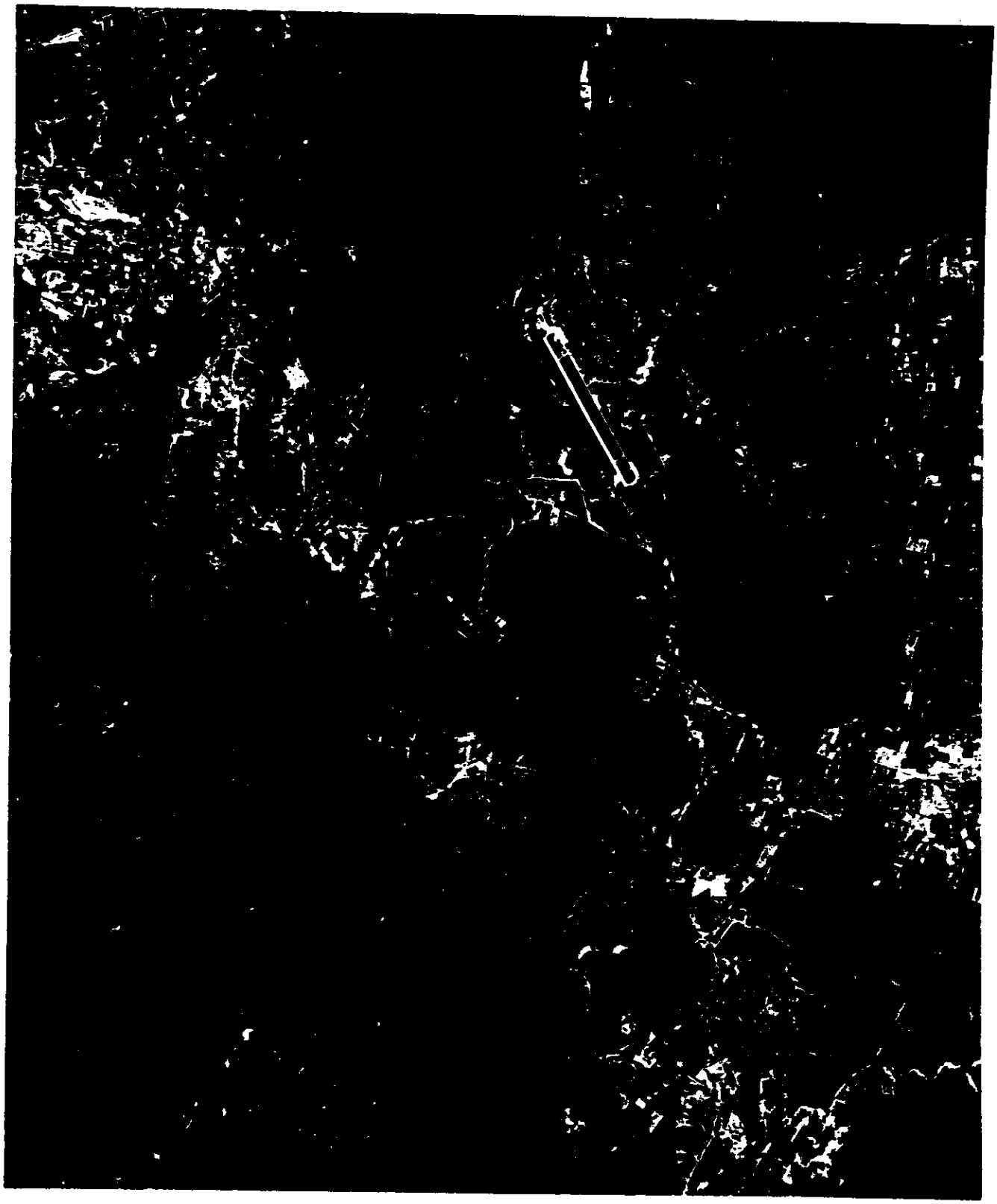
The following photographs are black/white and color comparisons of an area that contains a priority target. The target was assigned a fair quality rating based on the quality of the black/white record; vehicles are visible on the black/white film but cannot be located on the color. The enlargement factor is restricted to 4X to increase the area illustrated and improve the apparent color saturation.

[redacted]

	FIGURE 1A	FIGURE 2A
Camera	Fwd	Aft
Pass	103D	103D
Frame	184	190
Date of Photography (GMT)	12 Feb 69	12 Feb 69
Universal Grid Coordinates	67.3 - 4.0	8.4 - 4.0
Enlargement Factor	4X	4X
Geographic Coordinates	23-18N 102-36E	23-21N 102-30E
Altitude (ft)	494,841	495,812
Camera Attitude:		
Pitch (deg)	15°47'	-14°47'
Roll (deg)	0°13'	0°11'
Yaw (deg)	-2°56'	-2°54'
Local Sun Time	1313	1313
Solar Elevation (deg)	51°19'	51°16'
Solar Azimuth (deg)	154	154
Exposure (sec)	1/365	1/486
Filter	W-23A	Comb
Vehicle Azimuth (deg)	173°57'	174°01'

[redacted]

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



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

[redacted]

[redacted]

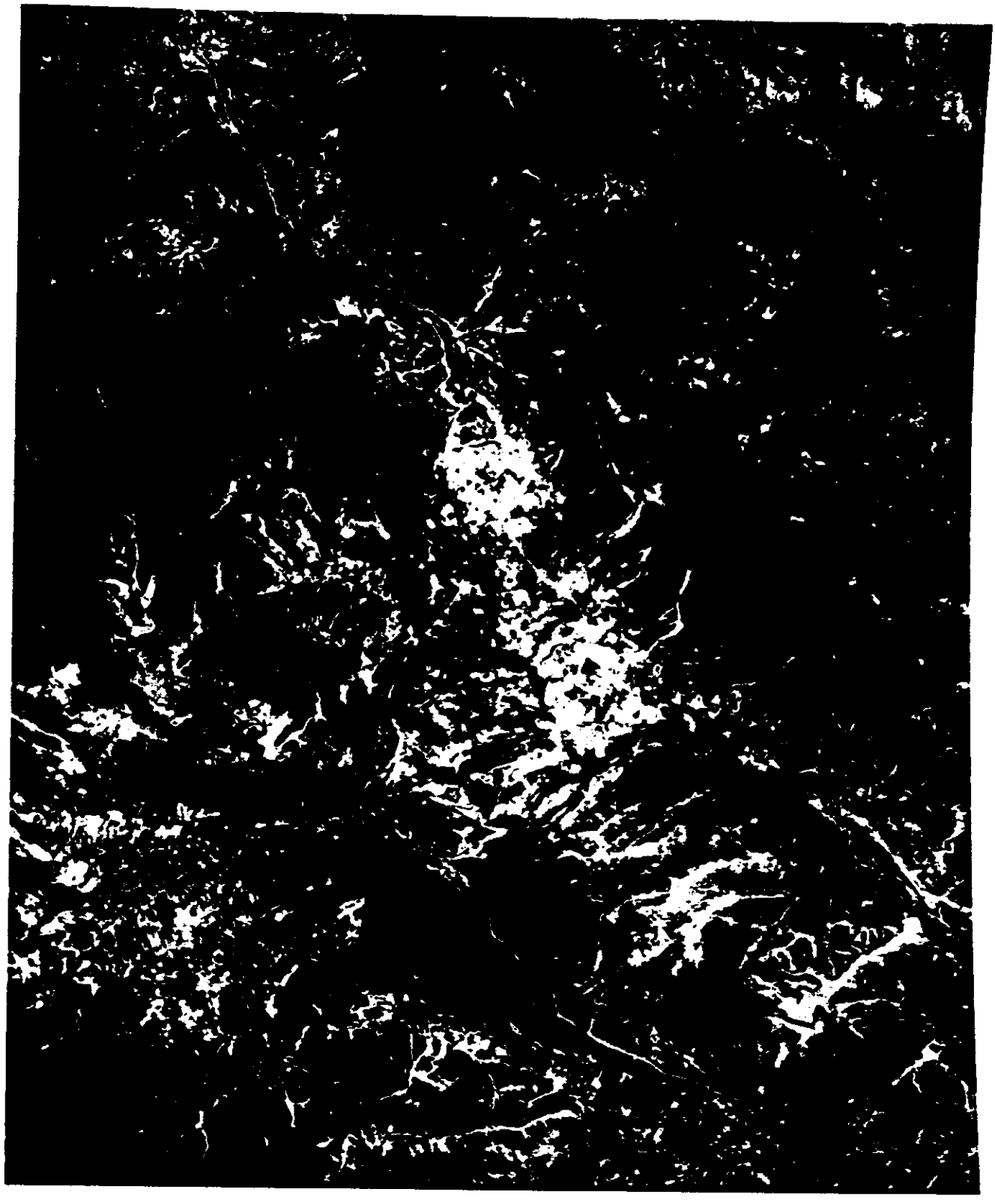
FIGURE 3A. Color Photograph

Color photography from this system is considered to be of significant value for location, identification, and assessment of the earth's resources. For example, on the following photograph color differences in the soil and water provides clues as to the ore and mineral content of the area.

FIGURE 3A

Camera	Aft
Pass	103D
Frame	186
Date of Photography (GMT)	12 Feb 69
Universal Grid Coordinates	41.5 - 3.5
Enlargement Factor	4X
Geographic Coordinates	23-48N 102-27E
Altitude (ft)	495,153
Camera Attitude:	
Pitch (deg)	-14° 46'
Roll (deg)	0° 11'
Yaw (deg)	-2° 54'
Local Sun Time	1313
Solar Elevation (deg)	50° 53'
Solar Azimuth (deg)	154
Exposure (sec)	1/486
Filter	Comb
Vehicle Azimuth (deg)	173° 58'

[redacted]



[redacted]