[redacted]

TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT
MISSION 1020-1
9-15 JUNE 1965
MISSION 1020-2
16 JUNE 1965

OCTOBER 1965

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

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SYNOPSIS

Mission 1020 (System J-20), a 2-part satellite reconnaissance mission, was launched at 2158Z on 9 June 1965. The first part (Mission 1020-1) was recovered dry during revolution 97 on 15 June 1965. The second part (Mission 1020-2) was terminated after 1 day of operation due to abnormal vehicle attitude induced by faulty control jets. Recovery was made using lifeboat procedure on 16 June 1965. Photography from the first part contained 36 operational, 5 domestic, and 4 night engineering passes. The film from the second recovery capsule contained 2 useable operational passes.

All cameras functioned normally throughout the mission. Clouds degraded or obscured approximately 40 percent of the mission photography. Solar elevations ranged from 29 degrees to 76 degrees in the mission.

The mission was assigned an MIP rating of 80.

[redacted]

GENERAL FLIGHT DATA

Date of Launch: 9 June 1965/2158Z

Revolution Number	8	50	97
Date	10 June	13 June	15 June
Time of Perigee	1003Z	0054Z	2310Z
Time of Apogee	1044Z	0134Z	2350Z
Perigee Altitude (ft)	583,179	584,643	588,744
Perigee Latitude	26°55'N	32°15'N	38°54'N
Apogee Altitude (ft)	1,212,951	1,199,979	1,183,110
Apogee Latitude	41°53'S	50°36'S	56°49'S
Inclination Angle	75°05'	75°05'	75°05'

The above information has been computed from final tracking data of Mission 1020. The altitudes indicate the vehicle height above the Hough Ellipsoid.

Recovery:

1020-1	15 June 1965*
1020-2	16 June 1965/2343Z

*Hour of recovery not available.

PART I. CAMERA OPERATION

1. Master (FWD) Panoramic Camera No 136

The master panoramic camera functioned properly on this mission. There is no major detriment to the material from this camera. Minor degradations include:

(a) The usual fog patterns caused by light leaks are present on the first, last 2, and sixth frame from the end of most camera operations. An additional plus density area, attributed to a light leak in the supply area, can be detected on the sixth frame of some passes. The density is commensurate with the duration between camera operations (Example: pass 39D, frame 6).

(b) The emulsion is scratched along both edges between the format and the edge of the film. Additional emulsion scratches are located in the format adjacent to the camera number on most frames of the forward material. Emulsion digs, 1.3 inches from the camera number edge, have been detected in pass 58D between frames 11 and 16. These digs are from 7.2 inches to 8.2 inches apart and vary in length from 0.05 inch to 0.3 inch.

(c) Foreign matter, possibly skiving, is present from the beginning of the mission through frame 50, pass 8D.

(d) Plus density streaks and fog induced by dendritic static, which appears to have been caused by an abrasion, appear intermittently along the camera number edge of the material. The length of the streaks vary from 2 inches to 5 inches and are indented from the emulsion side of the material. They have been detected only outside the format (Example: pass 8D, frame 50, through pass 24D).

(e) Unique marks of plus and minus density and associated creases and crimps occur approximately 20 times in the mission material. The configurations are diagonal and extend from the take-up at the camera number edge to the supply at the timing-mark edge. The marks appear to have been caused by an object rolling across the material. Examples are located in pass 5tD, frames 21, 22, and 23.

(f) Start-up banding, cloud smearing, and smearing from highly reflective surfaces recur throughout the mission. The smearing is associated with the solar elevation and azimuth.

(g) The results of dendritic static can be detected along both [illegible] of pass 3rD (Mission 1021-2).

2. Slave (AFT) Panoramic Camera No 137

The slave panoramic camera functioned properly on this mission. There is no major detriment to the material from this camera. Minor degradations include:

(a) The usual fog patterns caused by light leaks are present along the timing-track edge of the next-to-last frame of each camera operation. The usual splash-type plus density area is also present on the take-up end of the third frame from the end and occasionally extends through the horizon format and on the next to last frame. An additional plus density area, attributed to a light leak in the supply area, can be detected on the sixth frame of some passes. This plus density area also occurs on the sixth frame of the master material in a slightly different configuration. It appears that a pinpoint of light strikes the aft material and is reflected to the forward material (Example: pass 6D, frame 6). Equipment images can be detected on the fourth frame from the end and in the last frame of most passes. The density of all these areas is commensurate with the duration between camera operations.

(b) A row of minus density dots 3.1 inches apart and 1.5 inches from the camera number edge are present intermittently throughout the material. The dots diminish in intensity as the mission progresses.

(c) An irregular recurring minus density streak, varying in location, length and intensity is present throughout the material (Example: pass 18D, frame 36).

(d) Start-up banding and cloud smearing associated with solar elevations and azimuth recur throughout the material.

3. Master (FWD) Horizon Cameras

The master horizon cameras were operational throughout the mission. The exposure was adequate and the horizon images are good.

4. Slave (AFT) Horizon Cameras

The slave horizon cameras were operational throughout the mission. The exposure was adequate and the horizon images are good.

5. Stellar Camera Unit No 1, Reseau No 80 (Mission 1020-1)

The stellar camera functioned properly, recording 412 frames. The stellar images are extremely good. Stars to the seventh magnitude are [illegible] numerous stellar images are recorded in each frame. There are a minimum of bad configurations in the stellar images. The first frame

is double exposed. The flare level is low. The correlation mark edge of the film is crimped throughout the material. Emulsion cracking can be detected in the last half of the film. The last 3 feet is degraded by handling marks, static traces, and abrasions.

6. Stellar Camera Unit No 62, Reseau No 65 (Mission 1020-2)

The stellar camera functioned properly. There are only 12 usable frames due to the tumbling action of the vehicle. Frame 12 is double exposed.

7. Density readings from Stellar Material

The following is a compilation of the density values recorded from the stellar negatives. A Macbeth QuantaLog Densitometer, Model EP 1000, with an ET 20 attachment and an 0.50 millimeter aperture was used in taking the values listed.

STELLAR CAMERA MISSION 1009-1

Pass	Frame	Dmax	Dmin	Delta	Gross Fog
1D	1	0.91	0.26	0.65	0.24
	2	0.89	0.27	0.62	0.22
	6	2.12	0.25	1.87	0.22
4D	7	0.93	0.28	0.65	0.23
	17	1.07	0.27	0.80	0.23
7D	18	0.75	0.25	0.50	0.23
	38	1.00	0.27	0.73	0.23
9D	39	0.80	0.27	0.53	0.23
	50	0.70	0.25	0.45	0.23
9AE	51	0.23	0.23	0.00	0.23
10D	52	1.02	0.26	0.76	0.23
	60	0.67	0.24	0.43	0.23
11D	61	0.87	0.26	0.61	0.23
	70	0.69	0.27	0.42	0.24
14D	71	0.95	0.28	0.67	0.24
	72	0.94	0.28	0.66	0.25
17D	73	1.11	0.29	0.82	0.25
	82	0.91	0.27	0.64	0.23
22D	83	0.92	0.27	0.65	0.23
	107	0.70	0.26	0.44	0.23
23D	108	0.91	0.29	0.62	0.23
	121	0.97	0.29	0.68	0.24
24D	122	0.82	0.28	0.54	0.23
	136	0.72	0.27	0.45	0.23
25AE	137	0.23	0.23	0.00	0.23
	138	0.23	0.23	0.00	0.23
26D	139	0.97	0.27	0.70	0.22
	163	0.52	0.27	0.25	0.24
30D	164	0.77	0.27	0.50	0.24
	169	0.72	0.26	0.46	0.22
32D	170	0.92	0.26	0.66	0.22
	171	1.01	0.26	0.75	0.22
39D	172	0.90	0.25	0.65	0.22
	178	0.72	0.25	0.47	0.22
40D	179	0.74	0.28	0.46	0.22
	191	0.74	0.28	0.46	0.23
41AE	192	0.23	0.23	0.00	0.23
	193	0.23	0.23	0.00	0.23
48D	194	0.92	0.25	0.67	0.23
	195	0.91	0.27	0.64	0.23
49D	196	1.20	0.29	0.91	0.23
	201	1.08	0.28	0.80	0.22
52D	202	0.68	0.27	0.41	0.22
	204	0.82	0.29	0.53	0.22
53D	205	0.95	0.28	0.67	0.22
	217	1.15	0.25	0.90	0.22
54D	218	0.71	0.26	0.45	0.23
	239	1.35	0.31	1.04	0.22
55D	240	0.89	0.25	0.64	0.23
	250	1.22	0.27	0.95	0.23
57AE	251	0.23	0.23	0.00	0.23
	252	0.23	0.23	0.00	0.23
57M	253	1.01	0.27	0.74	0.23
	256	1.05	0.26	0.79	0.23
57D	257	1.02	0.28	0.74	0.23
	269	0.74	0.27	0.47	0.24
58D	270	0.82	0.27	0.55	0.23
	280	0.99	0.25	0.74	0.24
63D	281	1.01	0.29	0.72	0.24
	285	0.88	0.26	0.62	0.24
65D	286	1.40	0.28	1.12	0.23
	290	1.19	0.28	0.91	0.23
68D	291	0.94	0.26	0.68	0.23
	297	0.75	0.26	0.49	0.23
70D	298	1.12	0.27	0.85	0.23
	301	1.08	0.26	0.82	0.23
71D	302	1.04	0.28	0.76	0.22
	320	1.01	0.28	0.83	0.23
72D	321	1.72	0.30	0.92	0.23
	333	1.01	0.27	0.74	0.24
73D	334	3.21	0.27	2.94	0.22
	343	3.44	0.29	3.15	0.23
75D	344	1.18	0.28	0.90	0.23
	346	1.08	0.27	0.81	0.23
79D	347	0.95	0.25	0.70	0.23
	351	0.83	0.27	0.56	0.23
84D	352	1.23	0.28	0.95	0.23
	365	1.04	0.25	0.79	0.22
85D	366	1.55	0.30	1.25	0.23
	376	1.40	0.28	1.12	0.23
86D	377	1.05	0.27	0.78	0.23
	387	3.52	0.29	3.23	0.21
87D	388	0.95	0.26	0.69	0.22
	405	1.23	0.27	0.96	0.22
88D	406	0.92	0.26	0.66	0.22
	412	1.35	0.49	0.86	0.43
98D	1	2.01	0.51	1.50	0.26
	8	2.08	0.49	1.59	0.24
99D	9	1.92	0.49	1.43	0.25
	12	2.28	1.32	0.96	0.24
Range*		0.52	0.24	0.25	0.21
		3.52	1.32	3.23	0.43
Average*		1.12	0.29	0.83	0.23

* Does not include engineering passes

8. Index Camera Unit No 67, Reseau No 85 (Mission 1020-1)

The index camera functioned properly, recording 412 frames. The exposure was adequate and imagery is exceptionally good. The first frame is double exposed. The last 9.0 inches of the film are scratched and fogged due to film run out. Six minus density spots, which appear to result from foreign matter on the reseau, can be detected on each frame.

9. Index Camera Unit No 62, Reseau No 65 (Mission 1020-2)

The index camera functioned properly. There are only 12 usable frames on this mission.

10. Index Material Density Readings

The density and contrast of the index negatives from missions 1020-1 and 1020-2 are good. They compare favorably with the density and contrast of material from previous missions. There have been indications that recipients of this report do not require tabulated values of the densities of index negatives. If there is a requirement for this information the values will be furnished by the National Photographic Interpretation Center upon request.

11. Associated Equipment

This equipment records part of the information required for correlation and mensuration of the panoramic cameras.

(a) The binary word was bloomed, but readable on the material from both cameras.

(b) The density of the camera number varies from normal to overexposed.

(c) The last 2.0 inches of the timing marks are missing on all frames of the aft material.

PART II. FILM

1. Film Processing

This section provides an evaluation of exposure, processing, and densities of the original negatives from the cameras used in Mission 1020.

a. The exposure for all cameras was good throughout the mission.

b. Infrared detection densitometry was employed to determine the optimum level of development for the various portions of the panoramic photography. Fifty-seven processing changes were required for the master and 75 for the slave material from 1020-1. Three changes were required for the master and 5 for the slave on the usable imagery of 1020-2. The percentages processed at the various levels are as follows:

	1020-1		1020-2	
Development Level	Master	Slave	Master	Slave
Primary	13%	15%	0%	26%
Intermediate	48%	56%	71%	27%
Full	39%	29%	29%	47%

2. Physical Film Degradations

High level edge densities are present along the camera number edge throughout the preflight portion of the fwd material and extends through frame 50, 8D, where it terminates at a manufacturing splice. Although the edge densities are severe, they do not extend into the format or degrade the photography. Unexposed film samples supplied to the processing facility also contained the high edge densities. The conclusion is that the densities were caused prior to or during a manufacturing operation. Emulsion digs, scratches, pinholes, and handling marks are minor and considered normal. Manufacturing splices are located on the master negatives on passes 8D, frame 50, and 57D, frame 36. The slave material contains manufacturing splices in passes 57M, frame [illegible], and 67D, frame 82.

3. Film Footage

Camera	Footage	Frames
Master Panoramic Camera No 136 Mission 1020-1	7,986'	2,907
Mission 1020-2	2,852'	92 usable
Slave Panoramic Camera No 137 Mission 1020-1	7,881'	2,905
Mission 1020-2	2,858'	93 usable
Stellar Camera Unit No 67 Mission 1020-1	58'	412
Stellar Camera Unit No 62 Mission 1020-2	29'	12 usable
Index Camera Unit No 67 Mission 1020-1	82'	414
Index Camera Unit No 62 Mission 1020-2	52'	12 usable

PART III. IMAGE QUALITY

1. Definition of Photographic Interpretation (PI) Suitability

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

Excellent: The photography is free of degradations by camera malfunctions or processing faults and 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 or highlight areas. Detection and identification of small objects are possible but accuracy of mensuration is limited by the fall-off in image quality and the less-than-optimum contrast.

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

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

2. PI Suitability, Missions 1020-1 and 1020-2

Although the overall PI suitability for this mission has been rated as good, much of the photography is considered only fair. However, most of the photography is comparable to that from other recent satellite photographic missions of this type. Mission 1020-2 was recovered prematurely and was reported concurrently with Mission 1020-1. The majority of the poor quality photography resulted from atmospheric conditions at the time of acquisition, industrial haze, the scale of the photography, or obliquities in excess of 25 degrees. Isolated instances of non-stereo coverage were reported in pass 6D, frame 27 aft, and pass 87D, frame 23 aft. In both instances the target is not recorded by the fwd camera. The targets are an air facility and a missile complex.

The entire area of one of the major missile test centers is covered on good-quality, cloud-free, stereo photography. New construction was detected at this center that had not been visible in the material from Mission 1018, which covered the same area.

The photographic interpreters complained that there is a difference in the density level between the fwd and aft material and that the positives are grainy. The density levels are determined by the gamma of the original negatives and are reproduced to provide maximum detail in each, rather than balanced reproductions. If an attempt were made to provide reproduction of equivalent density, there would be a loss of detail in the imagery. Reproductions were selected and scrutinized to determine if there were any apparent clumping of grains that might cause the positives to appear grainy. Although various levels of densities, including the special print reproductions, were analyzed carefully, there is no evidence of grain clumping.

3. Definition of Mission Information Potential (MIP)

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

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

Criteria for selection of the MIP frame:

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

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

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

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

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

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

g. Select frames having near optimum solar elevation.

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

4. MIP, Missions 1020-1 and 1020-2

Mission 1020-2 was recovered prematurely and did not contain sufficient imagery to select an MIP frame.

A limited number of frames met the requirements for the selection of an MIP frame. A small airfield adjacent to a city complex in frame 78 fwd of pass 84D was selected as the MIP area for Mission 1020-1 and assigned a rating of 80.

5. Highlights of the Mission

a. Ninety-six targets were observed in the material from Mission 1020-1. No significant targets were observed on Mission 1020-2.

b. Two newly identified launch sites were detected.

c. A new launch complex under construction was identified.

d. A newly identified launch facility, with a possible central guidance area, was observed.

e. The construction of a reactor building was seen to have progressed.

f. A launch area was confirmed to be complete.

g. Two new launching complexes were observed.

h. A probable building triad was located and identified for the first time.

6. Image Analysis of Resolution Target

Mission 1020-1 provided excellent photography of a Military Standard 3-Bar Photographic Resolution Target. The target is made up of 3 legs radiating from a block containing 2 bar groups common to all 3 legs. The target is laid out in an "L" shape with 2 high contrast legs forming 1 line and the low contrast leg forming the other line. A Spectra Brightness Meter recorded the following reflectance from the high contrast legs in June 1964:

Black 8%
White 84%

The weather at the time of the acquisition of the photography was calm and cloud free. The flight direction of the vehicle and the orientation of the target provide criteria for both IMC (along track) and scan (across track) resolution.

The processing site provided 2 density levels of reproduction. The "special prints" of this particular pass had 0.8 higher density than the regular prints provided. The original negative, copies 1 and 5 of the regular positives and copies 1 and 3 of the "special prints" were analyzed by 3 qualified technicians to determine the comparative resolution and the consistency in reproduction.

The analysis determined that the resolution of the special print reproductions was higher than either the regular prints or the original negative. There were negligible deviations in the quality of either reproduction.

All readings were taken with the Bausch and Lomb zoom microscope at 100X magnification.

Data obtained from the bar target has been converted to lines per millimeter by the following equation:

$$H/DF = L/mm$$

where H = altitude in feet (588,733) (Slave)

F = focal length in millimeters (609.539) (Slave)

D = width of the line pair in inches

Target Group	Bar Width	Pair Width
4	7.0416'	14.0832'
5	6.2708'	12.5416'
6	5.5885'	11.1770'

The following information was derived:

	Scan Direction		Flight Direction	
	L/mm	Ground Res.	L/mm	Ground Res.
Original Negative	79.48	12.5'	62.29	15.8'
Regular Print	79.48	12.5'	62.29	15.8'
Special Print	89.18	11.8'	70.78	14.0'

FIGURE 1. DESCRIPTION OF PHOTOGRAPHIC DATA

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

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

DATE OF PHOTOGRAPHY: The date of photography indicates the day, month, and year (GMT) that the photography was acquired.

UNIVERSAL GRID COORDINATES: These coordinates are included to locate the illustrated photography within the panoramic format.

ENLARGEMENT FACTOR: The enlargement factor is included to indicate the number of diameters the original material has been enlarged in the photographic illustration.

GEOGRAPHIC COORDINATES: These coordinates are included to indicate the latitude and longitude of the center of the panoramic format.

ALTITUDE: This measurement is the vertical distance from the vehicle to the Hough Ellipsoid at the time of the acquisition of the photography.

PITCH: Rotation of the camera about its transverse axis. Using appropriate aeronautical terminology, positive readings indicate nose-up attitude and negative readings indicate nose-down attitude.

ROLL: Rotation of the camera about its longitudinal axis. Using appropriate aeronautical terminology, positive readings indicate left wing-up attitude and negative readings indicate right wing-up attitude.

YAW: Rotation of the camera about its vertical axis. Positive readings indicate counterclockwise rotation when viewing the ground nadir from the vehicle-mounted camera in flight.

LOCAL SUN TIME: This time is included to present to the viewer a realistic time of acquisition of the photography illustrated.

SOLAR ELEVATION: The solar elevation is the angular elevation of the sun above a plane tangent to the surface of the earth at the center of the panoramic format. A negative solar elevation indicates that the sun is below the plane.

SOLAR AZIMUTH: The solar azimuth is the angular measurement of the rays of the sun measured from true north in a clockwise direction.

EXPOSURE: The exposure is the duration of the photographic exposure expressed in a fraction of a second and is computed from the scan rate and slit width.

HOUGH ELLIPSOID: A mathematically adjusted ellipsoid which most nearly represents the "Average Geometric Earth" and approximates mean sea level over the entire surface of the earth.

APOGEE: The maximum distance between the vehicle and the reference ellipsoid during a given revolution.

PERIGEE: The minimum distance between the vehicle and the reference ellipsoid during a given revolution.

GROSS FOG LEVEL: The gross fog level is the density of the original negative in the unexposed border adjacent to the photography. A Macbeth QuantaLog Densitometer with a 0.5 mm aperture is used to record the density.

FIGURE 2. COMPARISON OF FWD AND AFT PHOTOGRAPHY

FIGURE 3. COMPARISON OF FWD AND AFT PHOTOGRAPHY

These illustrations are included to depict the difference between the fwd and aft imagery. Both negatives were processed at the same level. The enhanced imagery in the aft material can be attributed to:

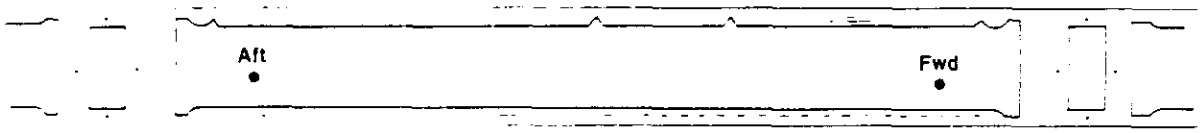
1. Shorter exposure time.
2. The Wratten 21 filter.
3. Solar azimuth relative to principal ray.
4. Combinations of the above.

NPIC K-5356 (10 '65) NPIC K-5357 (10 '65)

[redacted]

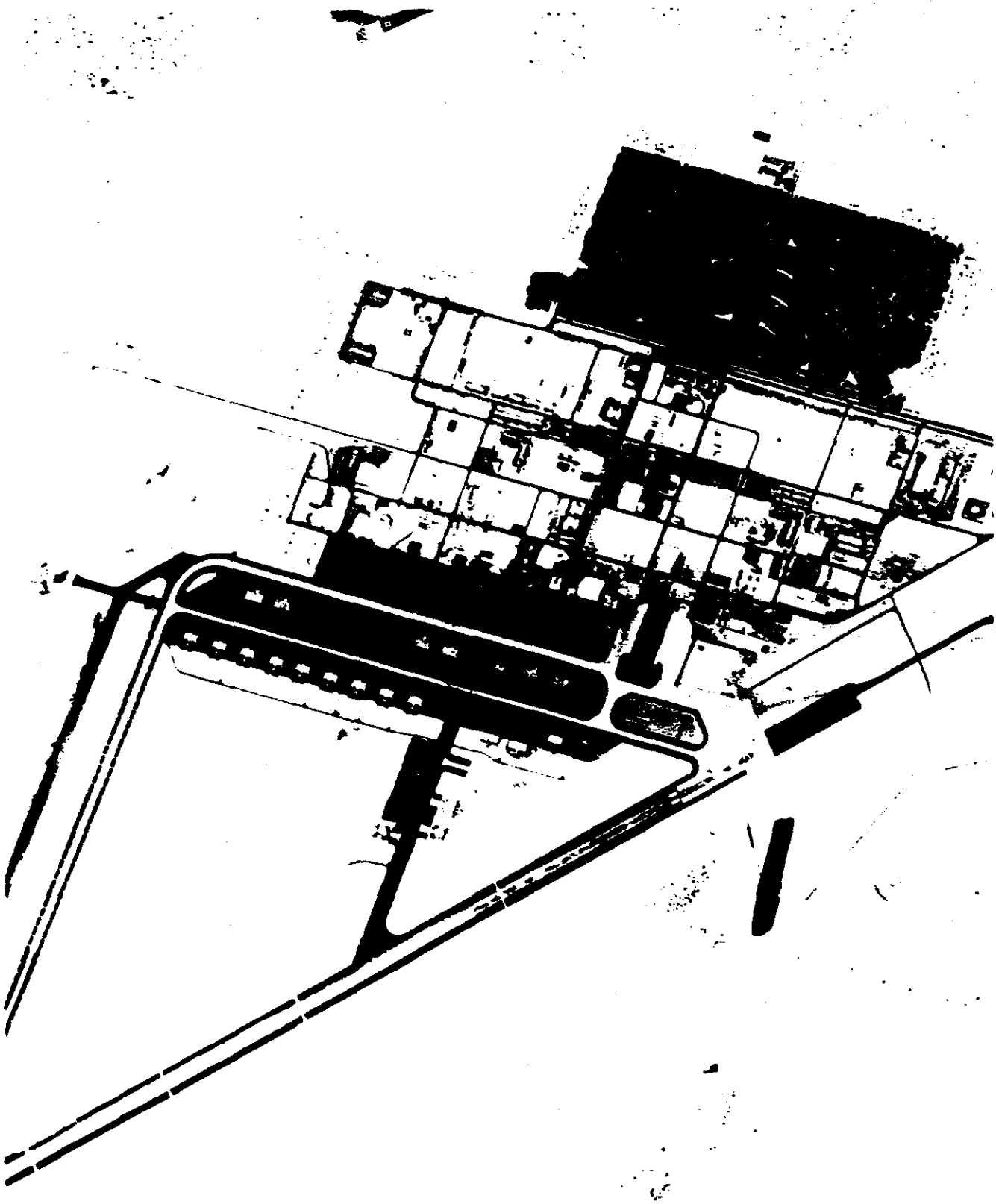
	FIGURE 2	FIGURE 3
Camera	Fwd	Aft
Pass	63D	63D
Frame	26	32
Date of Photography	13 Jun 65	13 Jun 65
Universal Grid Coordinates	71.3 - 10.0	19.4 - 12.4
Enlargement Factor	20X	20X
Geographic Coordinates	31-40N 107-14W	31-38N 107-16W
Altitude (feet)	584, 799	584, 963
Camera:		
Pitch	15°24'	-14°30'
Roll	-0°20'	-0°17'
Yaw	-0°17'	-0°19'
Local Sun Time	1312	1312
Solar Elevation	72°19'	72°19'
Solar Azimuth	248°	248°
Exposure (fractions of second)	1/268	1/384
Processing Level	Intermediate	Intermediate
Gross Fog	0.12	0.11
Vehicle Azimuth	165°12'	165°24'

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



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

[redacted]



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

[redacted]

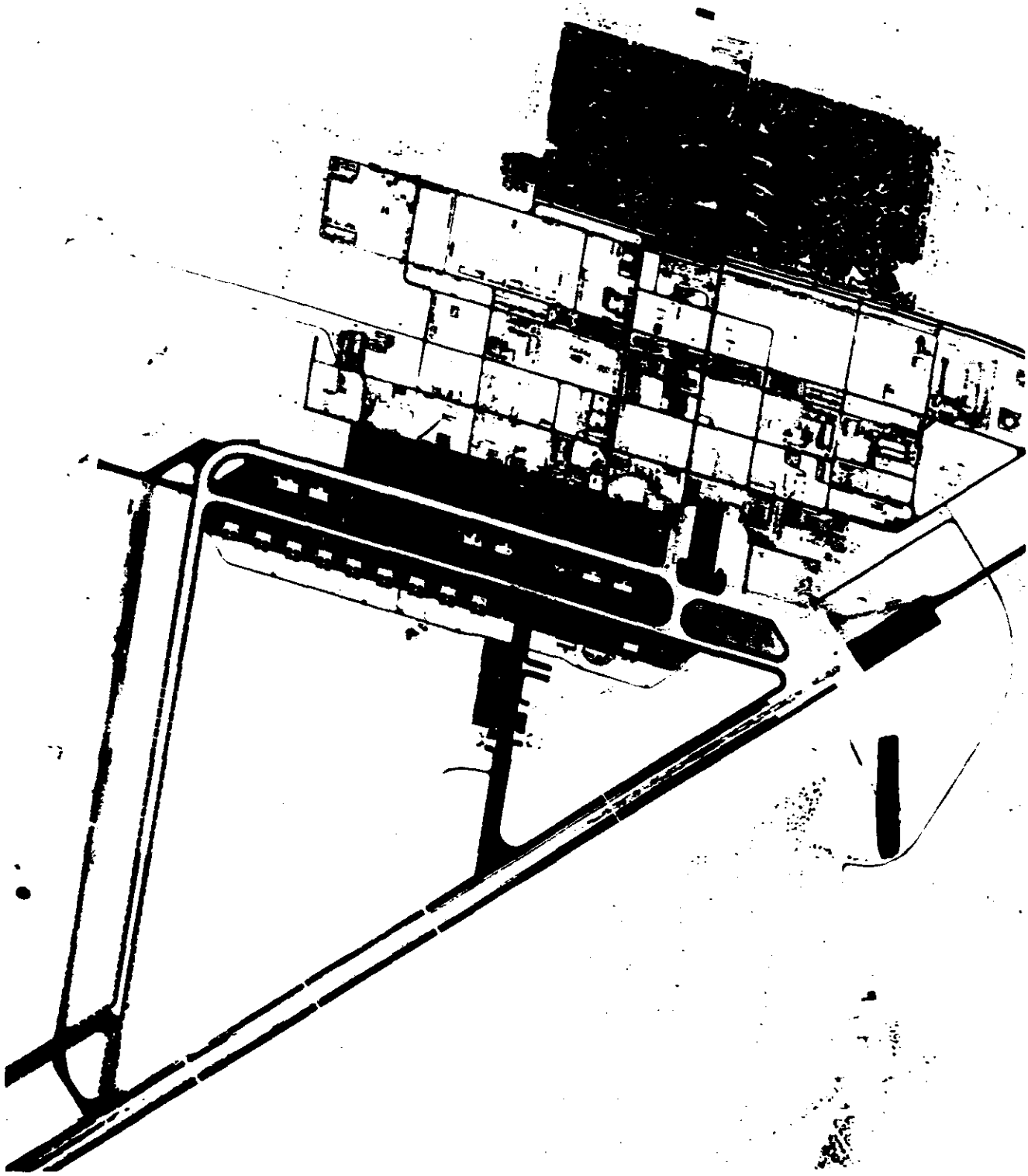


FIGURE 4. EXAMPLE OF DEGRADED IMAGERY

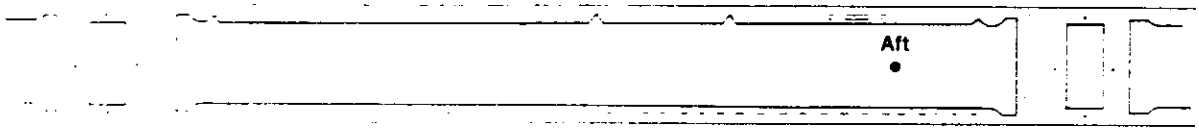
An isolated instance of degradation caused by a soft spot on the negative from the aft material. This soft spot area is confined to a narrow band approximately 0.5 centimeters wide across the format and was not detected elsewhere on this mission.

NPIC K-5358 (10/65)

FIGURE 4

Camera	Aft
Pass	39D
Frame	6
Date of Photography	12 Jun 65
Universal Grid Coordinates	66.5 - 12.0
Enlargement Factor	10X
Geographic Coordinates	58-30N 61-47E
Altitude (feet)	626, 773
Camera:	
Pitch	-15°02'
Roll	-0°11'
Yaw	0°23'
Local Sun Time	1226
Solar Elevation	54°25'
Solar Azimuth	188°
Exposure (fractions of second)	1/372
Processing Level	Full
Gross Fog	0.22
Vehicle Azimuth	152°38'

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



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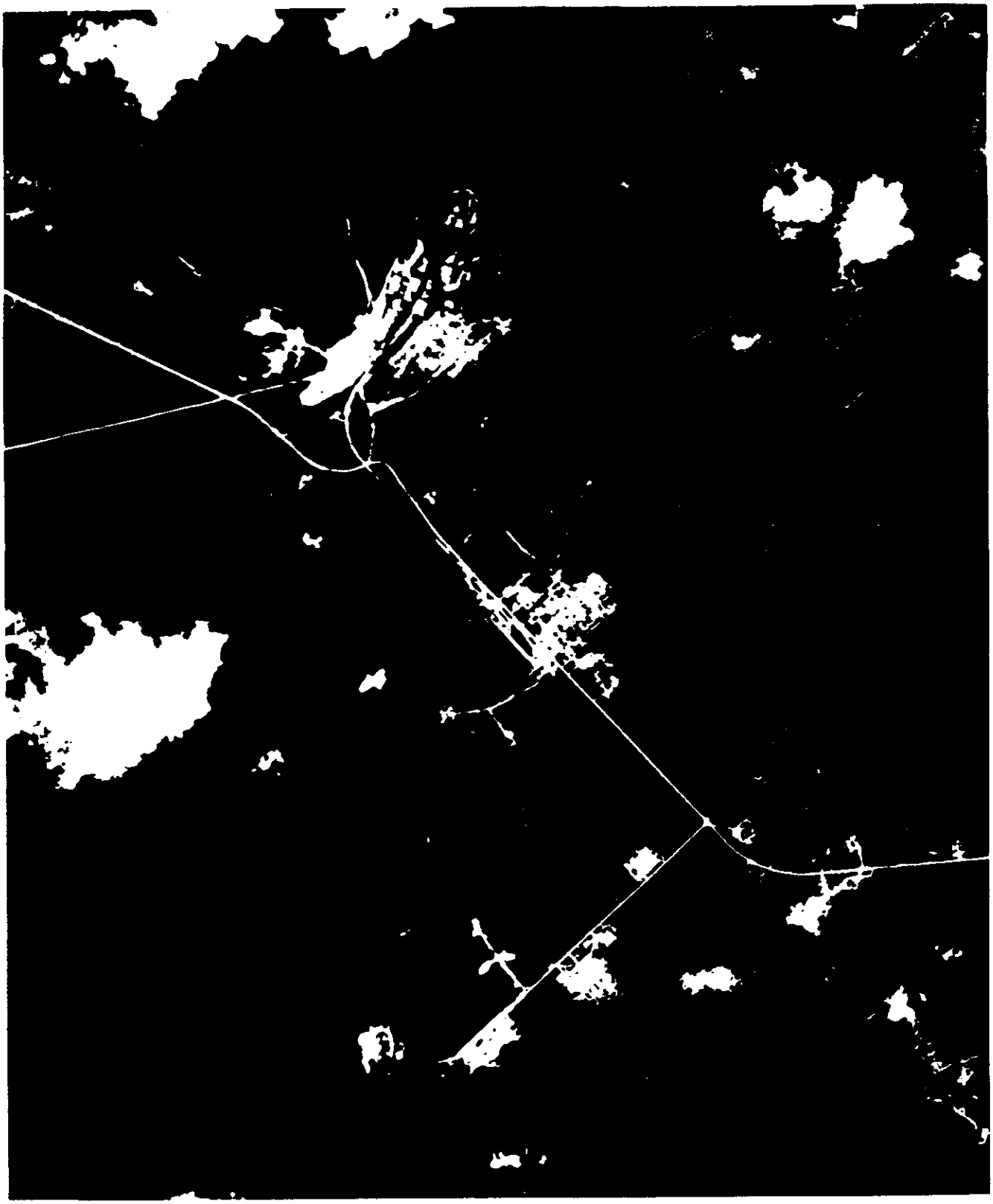

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FIGURE 5. TYPICAL PHOTOGRAPHY FROM MISSION 1020-1

FIGURE 6. TYPICAL PHOTOGRAPHY FROM MISSION 1020-1

These illustrations are included as an example of the subtle tonal differences between the fwd and aft material. They are typical of the photography acquired in this mission.

NPIC K-5359 (10/65) NPIC K-5360 (10/65)

	FIGURE 5	FIGURE 6
Camera	Fwd	Aft
Pass	85D	85D
Frame	16	22
Date of Photography	15 Jun 65	15 Jun 65
Universal Grid Coordinates	38.4 - 10.4	52.1 - 11.7
Enlargement Factor	20X	20X
Geographic Coordinates	37-31N 112-51E	37-28N 112-50E
Altitude (feet)	588, 131	588,048
Camera:		
Pitch	15°04'	-14°50'
Roll	-0°12'	-0°09'
Yaw	0°13'	0°11'
Local Sun Time	1244	1244
Solar Elevation	73°05'	73°06'
Solar Azimuth	213°	213°
Exposure (fractions of second)	1/268	1/382
Processing Level	Intermediate	Intermediate
Gross Fog	0.15	0.12
Vehicle Azimuth	163°38'	163°54'

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

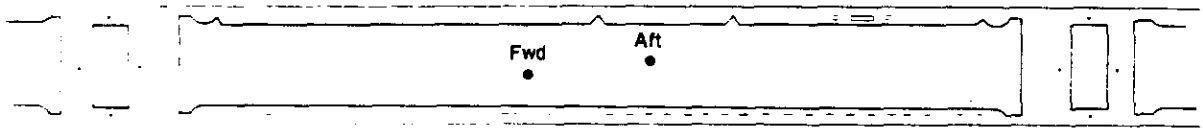

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FIGURE 7. HIGH ALTITUDE PHOTOGRAPHY

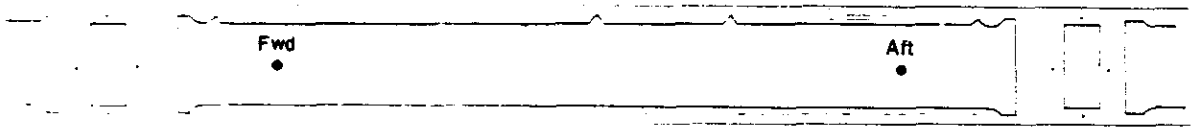
FIGURE 8. HIGH ALTITUDE PHOTOGRAPHY

These illustrations are included to show the results of high altitude photography in the southern hemisphere. The exposure/processing combination caused some loss of detail in the high reflective areas.

NPIC K-5361 (10/65) NPIC K-5362 (10/65)

	FIGURE 7	FIGURE 8
Camera	Fwd	Aft
Pass	26D	26D
Frame	136	142
Date of Photography	11 Jun 65	11 Jun 65
Universal Grid Coordinates	26.5 - 11.6	63.6 - 11.4
Enlargement Factor	20X	20X
Geographic Coordinates	11-36S 20-32E	11-40S 20-29E
Altitude (feet)	674, 809	679, 466
Camera:		
Pitch	14°32'	-15°22'
Roll	-0°09'	-0°06'
Yaw	-0°07'	-0°09'
Local Sun Time	1431	1431
Solar Elevation	39°22'	39°18'
Solar Azimuth	228°	228°
Exposure (fractions of second)	1/236	1/334
Processing Level	Full	Full
Gross Fog	0.23	0.20
Vehicle Azimuth	168°11'	168°07'

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



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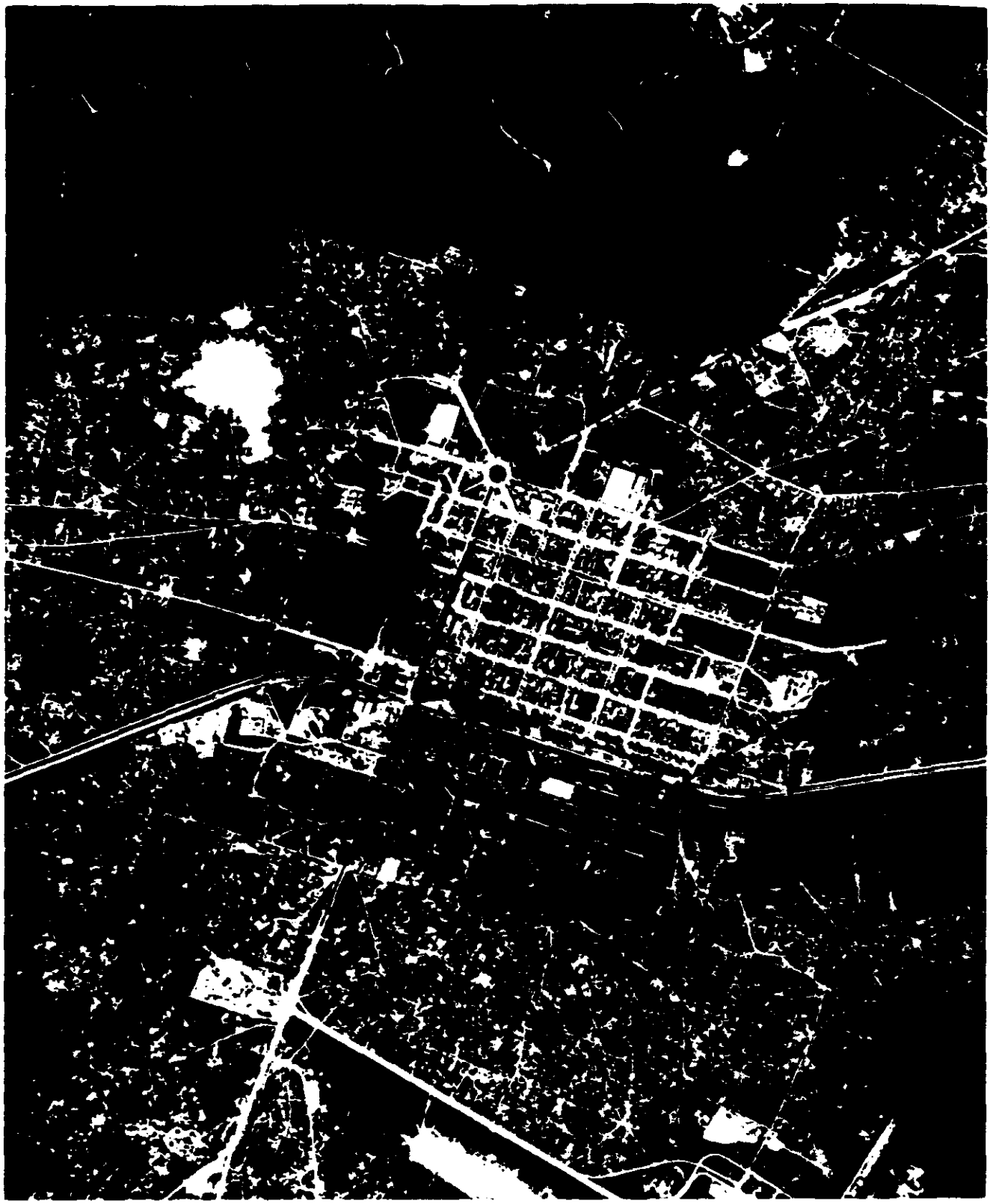

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FIGURE 9. EXAMPLE OF DEGRADED IMAGERY

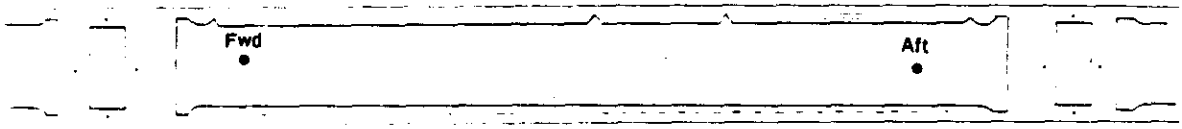
FIGURE 10. EXAMPLE OF TYPICAL IMAGERY

Figure 9 is an isolated instance of degraded imagery caused by a soft spot on the negative from the fwd material. The soft spot area is confined to 0.5 centimeters square and was not detected elsewhere in the fwd material from this mission. Figure 10 is the same area photographed by the aft camera.

NPIC K-5363 (10/65) NPIC K-5364 (10/65)

	FIGURE 9	FIGURE 10
Camera	Fwd	Aft
Pass	39D	39D
Frame	6	12
Date of Photography	12 Jun 65	12 Jun 65
Universal Grid Coordinates	20.5 - 13.0	70.5 - 10.8
Enlargement Factor	20X	20X
Geographic Coordinates	57-41N 62-36E	57-40N 62-35E
Altitude (feet)	626, 777	624, 315
Camera:		
Pitch	14°57'	-14°57'
Roll	-0°10'	-0°07'
Yaw	-0°29'	-0°31'
Local Sun Time	1229	1229
Solar Elevation	55°08'	55°09'
Solar Azimuth	188°	188°
Exposure (fractions of second)	1/261	1/379
Processing Level	Full	Full
Gross Fog	0.26	0.22
Vehicle Azimuth	152°38'	153°23'

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



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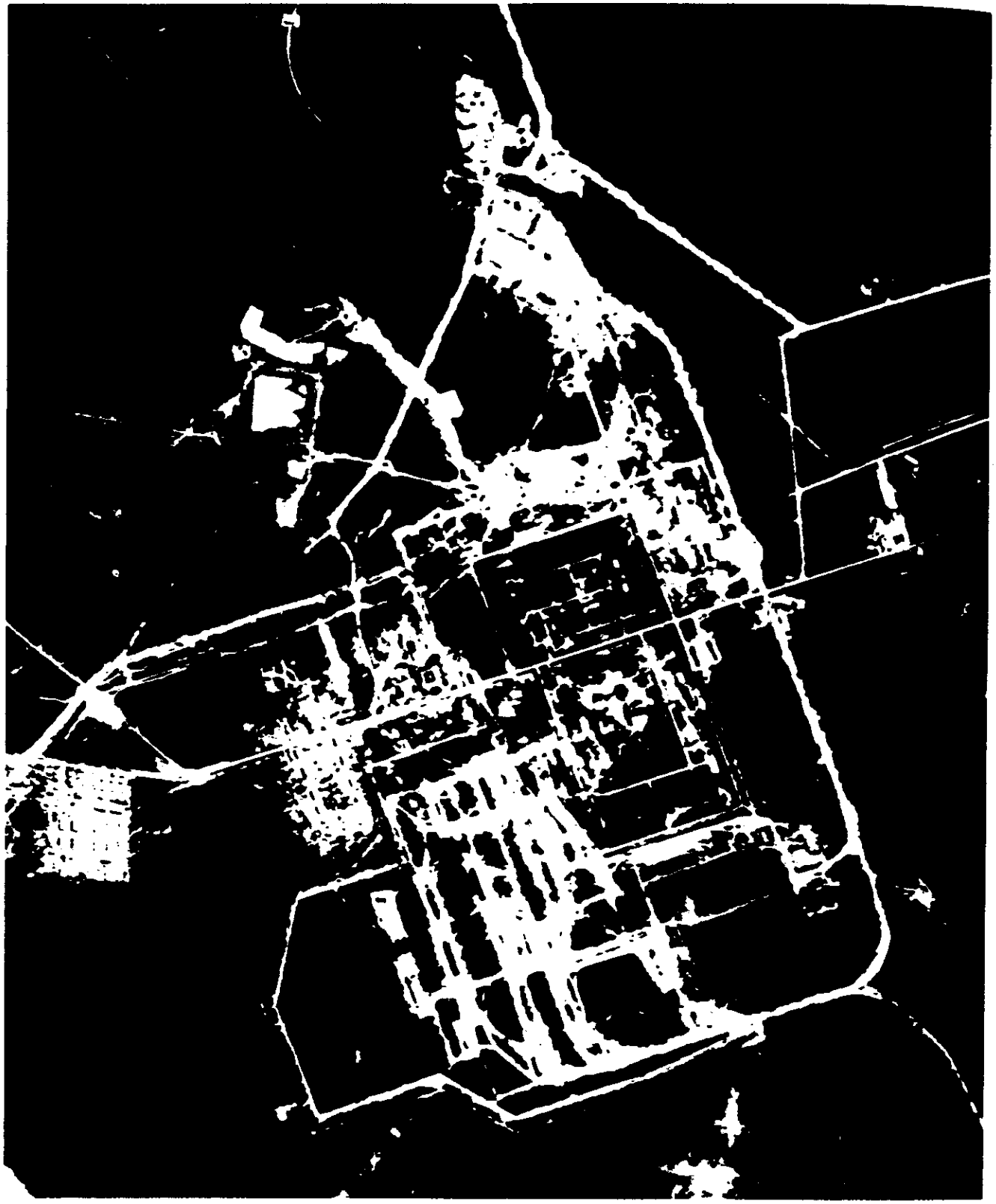

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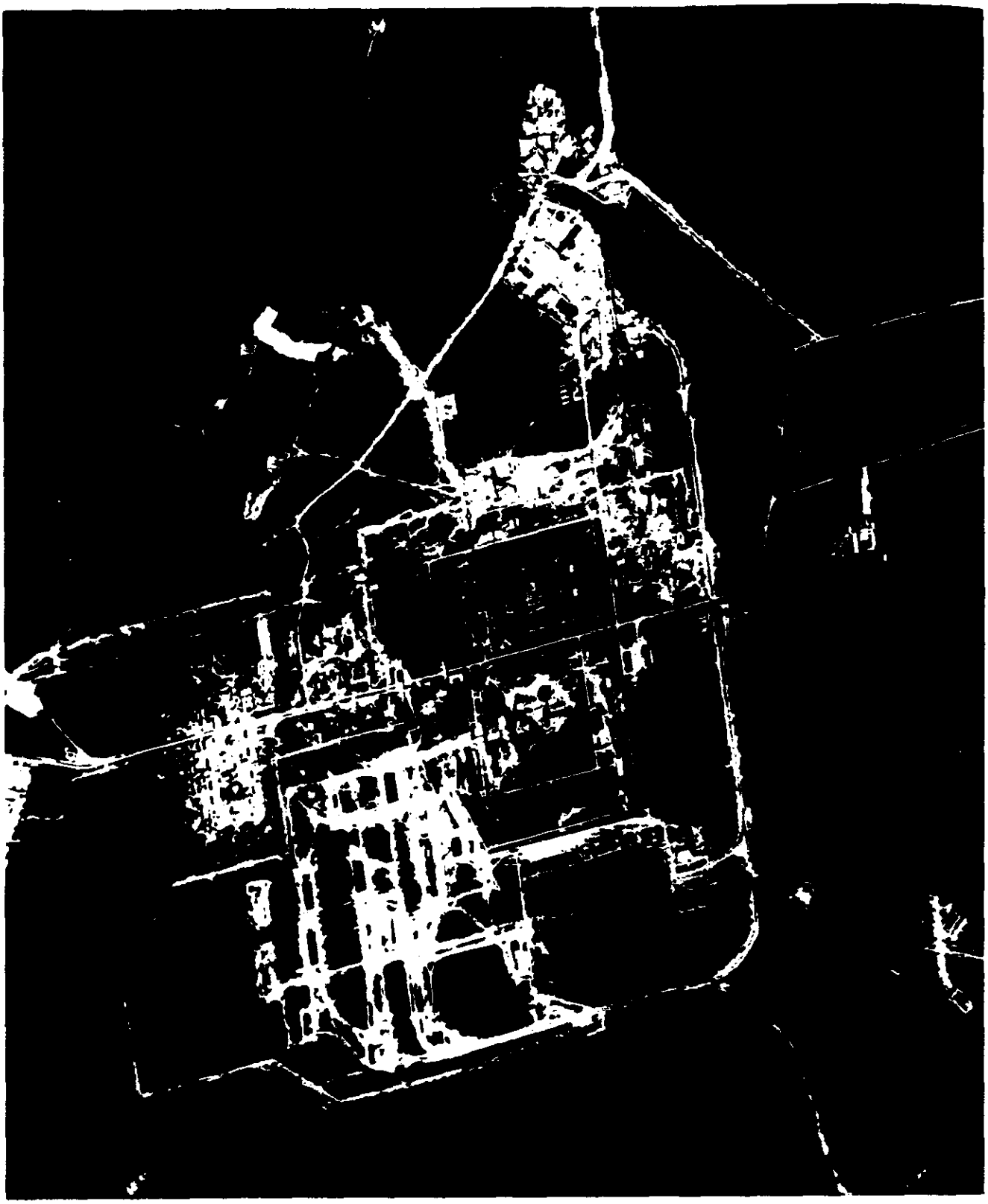

FIGURE 11. PHOTOGRAPH FROM THE MIP FRAME, FWD CAMERA

FIGURE 12. PHOTOGRAPH OF SAME AREA AS MIP FRAME, AFT CAMERA

NPIC K-5365 (10/65) NPIC K-5366 (10/65)

	FIGURE 11	FIGURE 12
Camera	Fwd	Aft
Pass	84D	84D
Frame	78	83
Date of Photography	15 Jun 65	15 Jun 65
Universal Grid Coordinates	52.7 - 14.2	38.1 - 13.7
Enlargement Factor	20X	20X
Geographic Coordinates	44-29N 132-37E	44-35N 132-30E
Altitude (feet)	591, 675	591,081
Camera:		
Pitch	15°24'	-14°30'
Roll	0°06'	0°09'
Yaw	-0°02'	-0°04'
Local Sun Time	1232	1232
Solar Elevation	67°57'	67°52'
Solar Azimuth	205°	205°
Exposure (fractions of second)	1/269	1/385
Processing Level	Full	Full
Gross Fog	0.20	0.17
Vehicle Azimuth	161°06'	161°24'

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

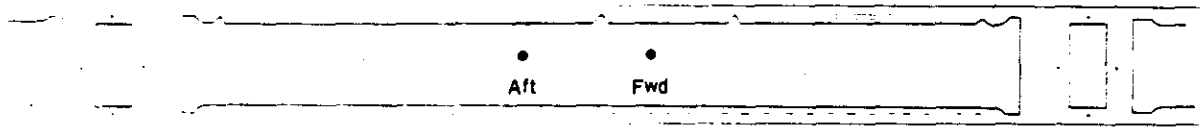

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FIGURE 13. EXAMPLE OF POOR QUALITY ATTRIBUTED TO INDUSTRIAL HAZE

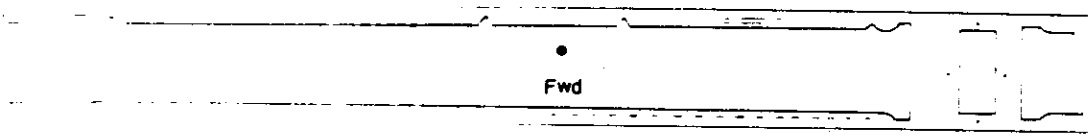
This area of the photography was given a poor quality rating during the initial scan. Possible reason is industrial haze.

NPIC K-5367 (10/65)

FIGURE 13

Camera	Fwd
Pass	24D
Frame	35
Date of Photography	11 Jun 65
Universal Grid Coordinates	50.5 - 14.5
Enlargement Factor	20X
Geographic Coordinates	56-14N 43-44E
Altitude (feet)	628, 995
Camera:	
Pitch	15°11'
Roll	-0°06'
Yaw	0°05'
Local Sun Time	1247
Solar Elevation	55°50'
Solar Azimuth	197°
Exposure (fractions of second)	1/261
Processing Level	Full
Gross Fog	0.22
Vehicle Azimuth	153°55'

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



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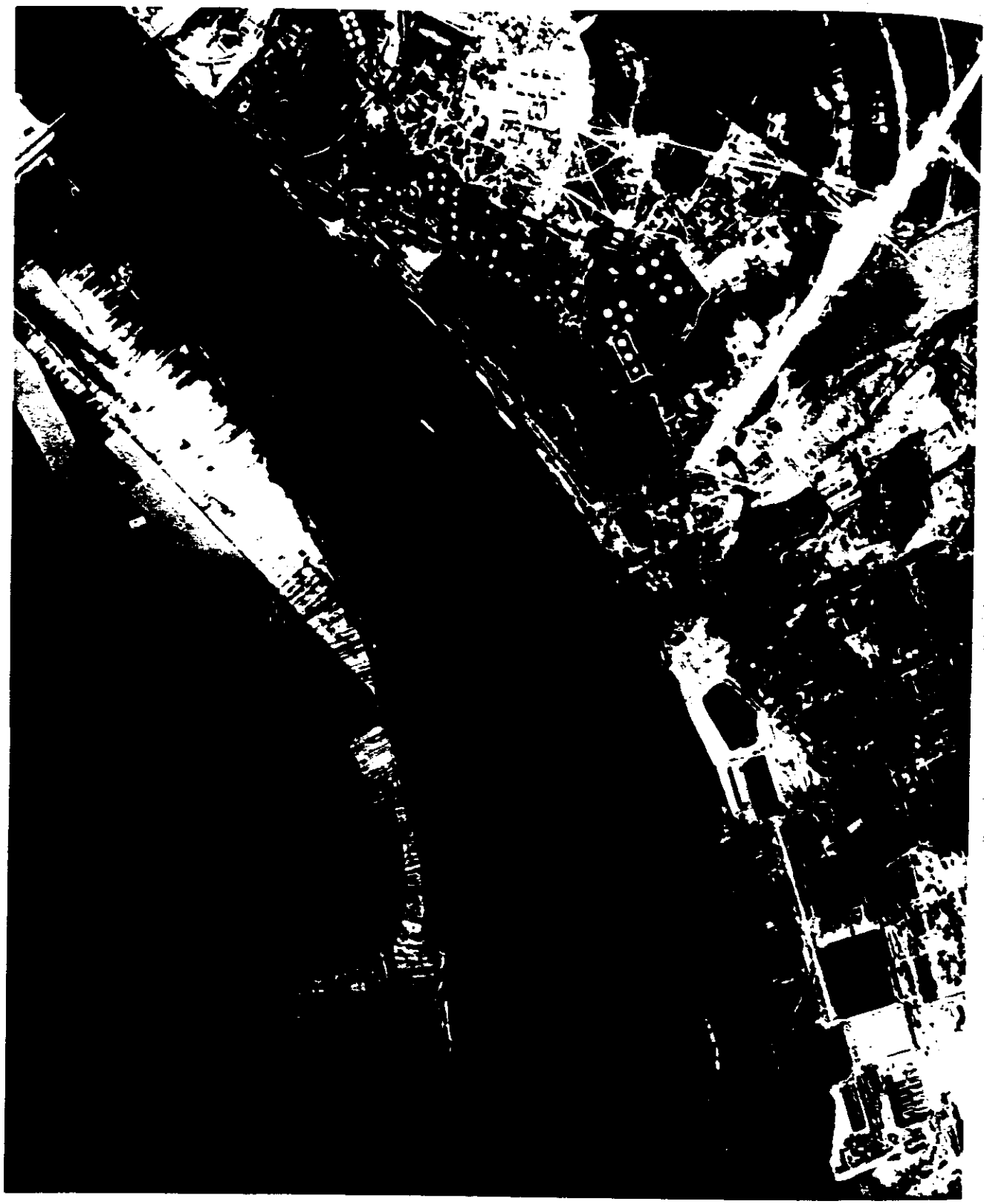

FIGURES 14 AND 15. COMPARISON OF FWD AND AFT PHOTOGRAPHY

These photographs are included to show the difference in acuity between the fwd and aft material under typical illumination conditions. The terrain was illuminated from the side during the acquisition of the fwd material, presenting imagery with excellent contrast. Because of the geometry of the system the terrain was subjected to extremely flat lighting during the acquisition of the aft material. Processing cannot compensate for such extremes in lighting.

NPIC K-5368 (10/65) NPIC K-5369 (10/65)

[redacted]

	FIGURE 14	FIGURE 15
Camera	Fwd	Aft
Pass	23D	23D
Frame	51	57
Date of Photography	11 Jun 65	11 Jun 65
Universal Grid Coordinates	69.6 - 11.5	21.2 - 12.0
Enlargement Factor	20X	20X
Geographic Coordinates	50-56N 70-21E	50-54N 70-18E
Altitude (feet)	614, 406	612, 239
Camera:		
Pitch	14°52'	-15°02'
Roll	0°15'	0°18'
Yaw	0°09'	0°07'
Local Sun Time	1305	1305
Solar Elevation	59°32'	59°33'
Solar Azimuth	209°	209°
Exposure (fractions of second)	1/267	1/382
Processing Level	Intermediate	Full
Gross Fog	0.13	0.18
Vehicle Azimuth	157°47'	158°17'

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

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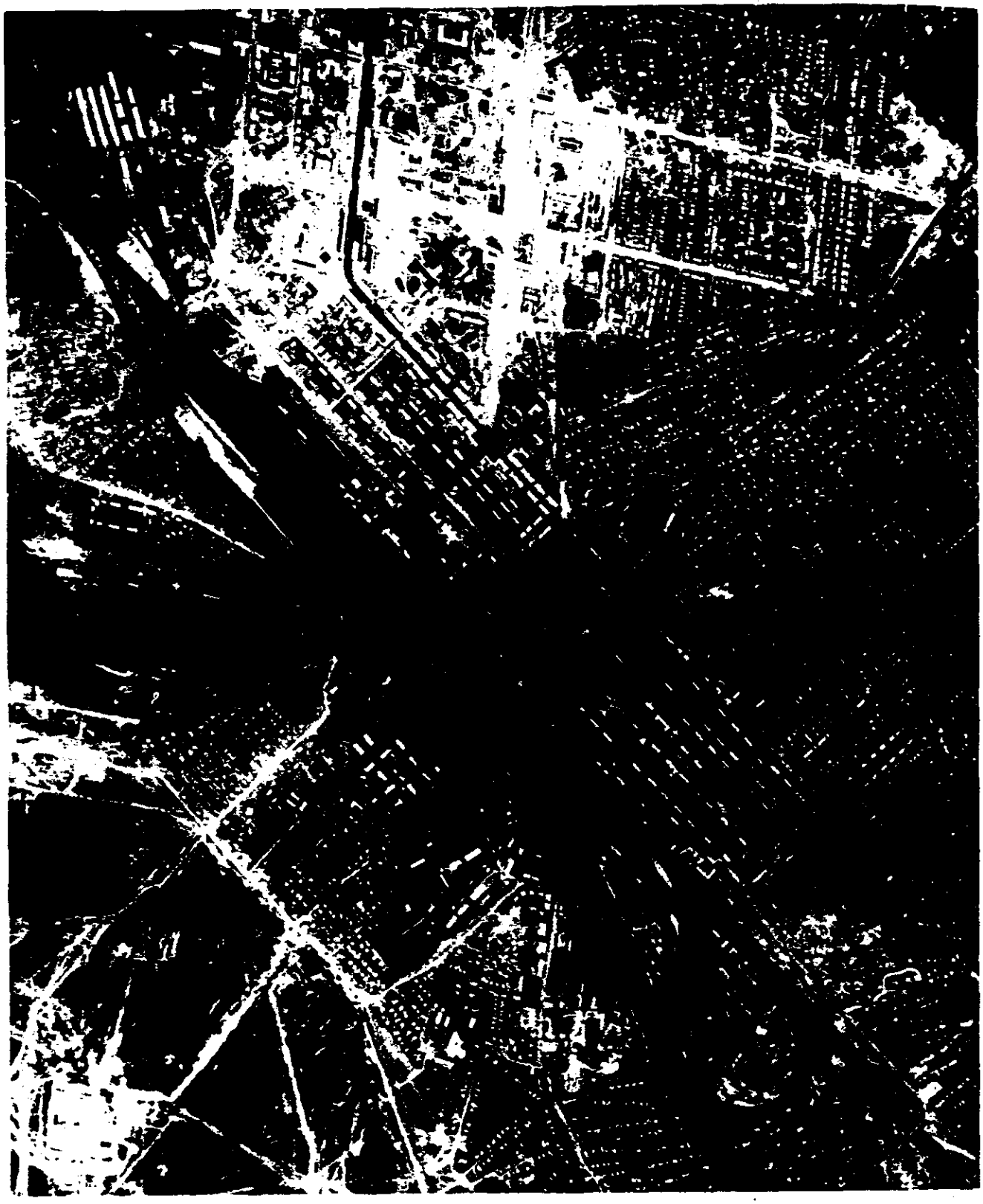

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FIGURES 16 AND 17. COMPARISON OF MISSION 1006 and 1020

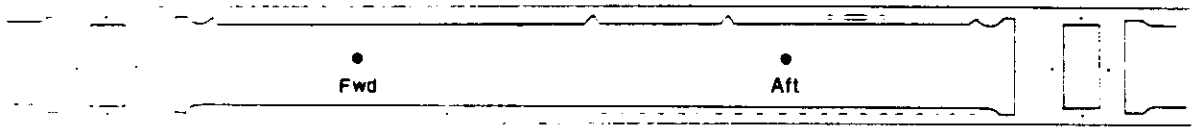
The following 4 illustrations are included to show the comparative quality of Missions 1006-1020. The difference between the forward and aft material from Mission 1020-1 can be attributed to the filter employed, the difference in exposure, or a combination of both.

NPIC K-5370 (10/65) NPIC K-5371 (10/65)

[redacted]

	FIGURE 16	FIGURE 17
Mission	1020-1	1020-1
Camera	Fwd	Aft
Pass	8D	8D
Frame	55	61
Date of Photography	10 Jun 65	10 Jun 65
Universal Grid Coordinates	25.8 - 11.0	65.0 - 11.0
Enlargement Factor	20X	20X
Geographic Coordinates	56-50N 45-00E	56-46N 45-48E
Altitude (feet)	638, 916	635, 812
Camera:		
Pitch	14°53'	-15°01'
Roll	-0°11'	-0°08'
Yaw	0°39'	0°37'
Local Sun Time	1258	1258
Solar Elevation	54°40'	54°43'
Solar Azimuth	205°	205°
Exposure (fractions of second)	1/246	1/354
Processing Level	Full	Full
Gross Fog	0.26	0.22
Vehicle Azimuth	153°24'	154°11'

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



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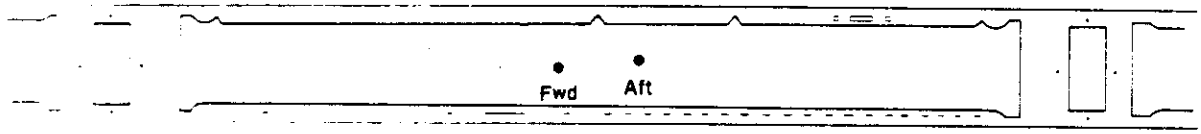
FIGURES 18 AND 19. COMPARISON OF MISSIONS 1006 AND 1020

NPIC K-5372 (10 65) NPIC K-5373 (10/65)

	FIGURE 18	FIGURE 19
Mission	1006-1	1006-1
Camera	Fwd	Aft
Pass	24D	24D
Frame	104	108
Date of Photography	6 Jun 64	6 Jun 64
Universal Grid Coordinates	40.0 - 10.3	50.0 - 13.2
Enlargement Factor	20X	20X
Geographic Coordinates	56-36N 45-00E	56-38N 44-58E
Altitude (feet)	523, 858	524, 339
Camera:		
Pitch	15°08'	-14°53'
Roll	-0°23'	-0°30'
Yaw	1°07'	1°07'
Local Sun Time	1401	1401
Solar Elevation	48°22'	48°23'
Solar Azimuth	226°	226°
Exposure (fractions of second)	1/346	1/343
Processing Level	Full	Full
Gross Fog	0.17	0.17
Vehicle Azimuth	160°00'	160°00'

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



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FIGURES 20 AND 21. COMPARISON OF MISSIONS 1007, 1010, AND 1020

The following 6 photographs are included to show the similarity of Mission 1020-1 and 2 previous missions. Although Missions 1007 and 1010 were assigned a higher MIP rating (85), portions of Mission 1020-1 compare favorably with these missions.

NPIC K-5374 (10/65) NPIC K-5375 (10/65)

	FIGURE 20	FIGURE 21
Mission	1007-2	1007-2
Camera	Fwd	Aft
Pass	118D	118D
Frame	239	243
Date of Photography	27 Jun 64	27 Jun 64
Universal Grid Coordinates	47.4 - 12.9	42.8 - 13.8
Enlargement Factor	20X	20X
Geographic Coordinates	45-37N 63-15E	45-23N 63-13E
Altitude (feet)	634, 621	637, 248
Camera:		
Pitch	14°50'	-15°08'
Roll	-0°47'	-0°47'
Yaw	Not available	Not available
Local Sun Time	1421	1421
Solar Elevation	54°11'	54°16'
Solar Azimuth	246°	246°
Exposure (fractions of second)	1/257	1/320
Processing Level	Intermediate	Intermediate
Gross Fog	0.11	0.10
Vehicle Azimuth	175°13'	175°25'

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

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FIGURES 22 AND 23. COMPARISON OF MISSIONS 1007, 1010, AND 1020.

NPIC K-5376 (10 65) NPIC K-5377 (10/65)

[redacted]

	FIGURE 22	FIGURE 23
Mission	1010-1	1010-1
Camera	Fwd	Aft
Pass	55D	55D
Frame	100	107
Date of Photography	18 Sep 64	18 Sep 64
Universal Grid Coordinates	71.6 - 10.1	19.2 - 10.2
Enlargement Factor	20X	20X
Geographic Coordinates	45-37N 62-12E	45-30N 62-10E
Altitude (feet)	594, 463	594, 896
Camera:		
Pitch	14°53'	-14°07'
Roll	-0°11'	-0°05'
Yaw	-0°19'	-0°04'
Local Sun Time	1424	1424
Solar Elevation	34°21'	34°26'
Solar Azimuth	227°	227°
Exposure (fractions of second)	1/387	1/391
Processing Level	Full	Intermediate
Gross Fog	0.18	0.11
Vehicle Azimuth	175°10'	175°20'

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

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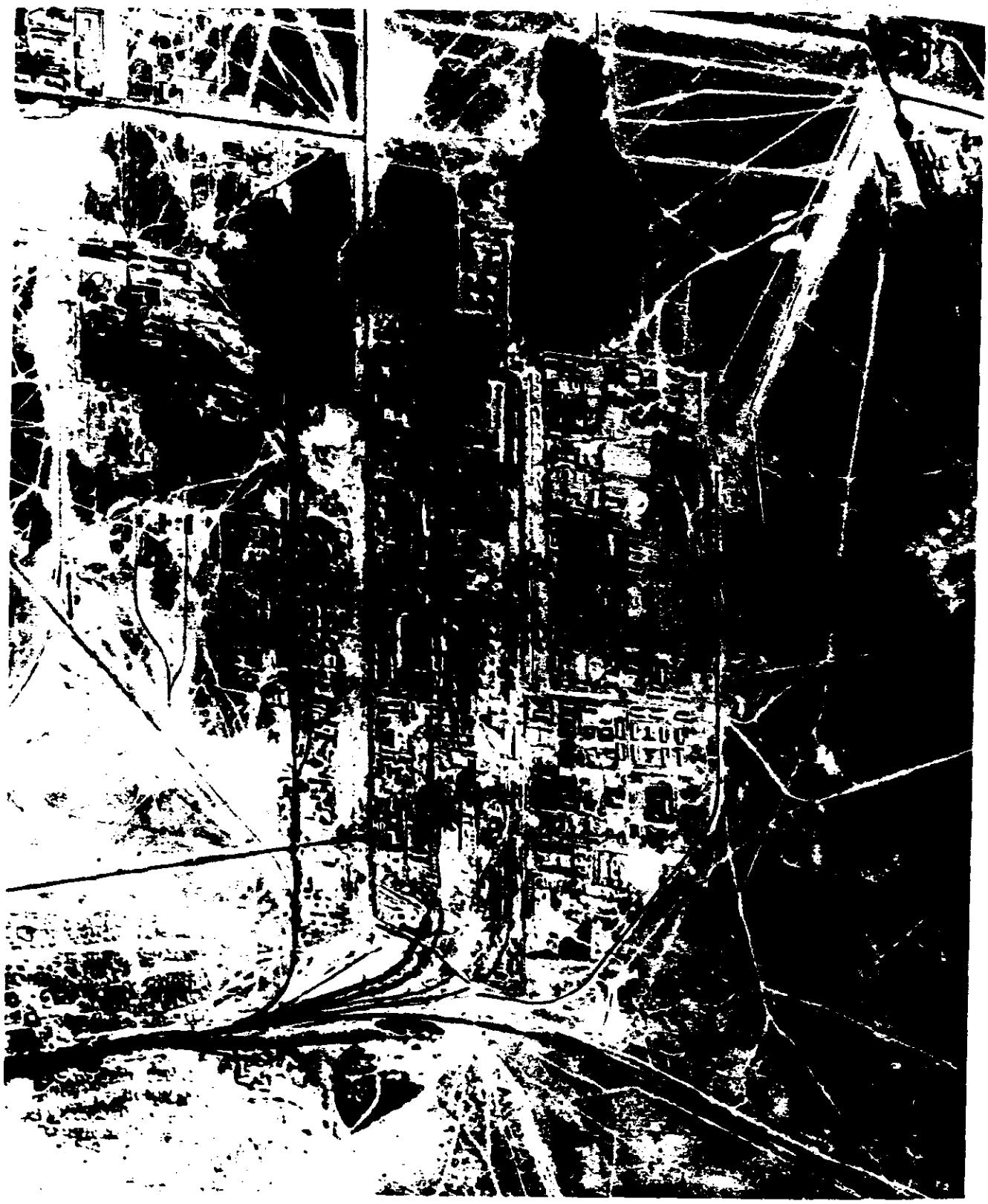


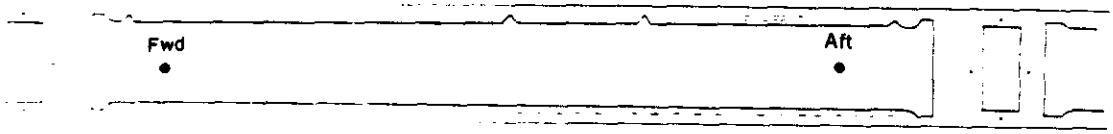
FIGURES 24 AND 25. COMPARISON OF MISSIONS 1007, 1010, AND 1020.

NPIC K-5378 (10/65) NPIC K-5379 (10/65)

[redacted]

	FIGURE 24	FIGURE 25
Mission	1020-1	1020-1
Camera	Fwd	Aft
Pass	87D	87D
Frame	102	108
Date of Photography	15 Jun 65	15 Jun 65
Universal Grid Coordinates	26.1 - 11.0	64.6 - 11.8
Enlargement Factor	20X	20X
Geographic Coordinates	45-53N 64-02E	45-50N 64-00E
Altitude (feet)	592, 367	591, 584
Camera:		
Pitch	14°52'	-15°02'
Roll	0°05'	0°08'
Yaw	0°14'	0°12'
Local Sun Time	1227	1227
Solar Elevation	66°54'	66°57'
Solar Azimuth	192°	192°
Exposure (fractions of second)	1/270	1/384
Processing Level	Primary	Primary
Cross For	0.09	0.09
Vehicel Azimuth	160°28'	160°52'

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



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FIGURES 26 AND 27. DEGRADATION OF IMAGERY DUE TO SOLAR ELEVATION/AZIMUTH

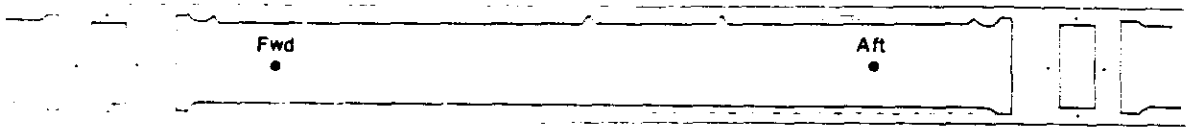
The solar elevation and azimuth during this mission were generally conducive to good photography. Figure 27 is an isolated instance of a loss of imagery. During the acquisition of Figure 26 the principal ray of the fwd camera was pointing directly at the sub-solar point. During the acquisition of Figure 27 the principal ray of the aft camera was at right angles to the solar azimuth.

NPIC K-5380 (10/65) NPIC K-5381 (10/65)

[redacted]

	FIGURE 26	FIGURE 27
Camera	Fwd	Aft
Pass	40D	40D
Frame	70	76
Date of Photography	12 Jun 65	12 Jun 65
Universal Grid Coordinates	27.2 - 12.2	63.8 - 10.5
Enlargement Factor	20X	20X
Geographic Coordinates	40-30N 50-31E	40-27N 50-28E
Altitude (feet)	590,052	589,066
Camera:		
Pitch	15°01'	-14°53'
Roll	0°05'	0°08'
Yaw	-0°46'	-0°48'
Local Sun Time	1315	1315
Solar Elevation	66°40'	66°41'
Solar Azimuth	231°	231°
Exposure (fractions of second)	1/269	1/385
Processing Level	Intermediate	Intermediate
Gross Fog	0.12	0.16
Vehicle Azimuth	162°40'	162°58'

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



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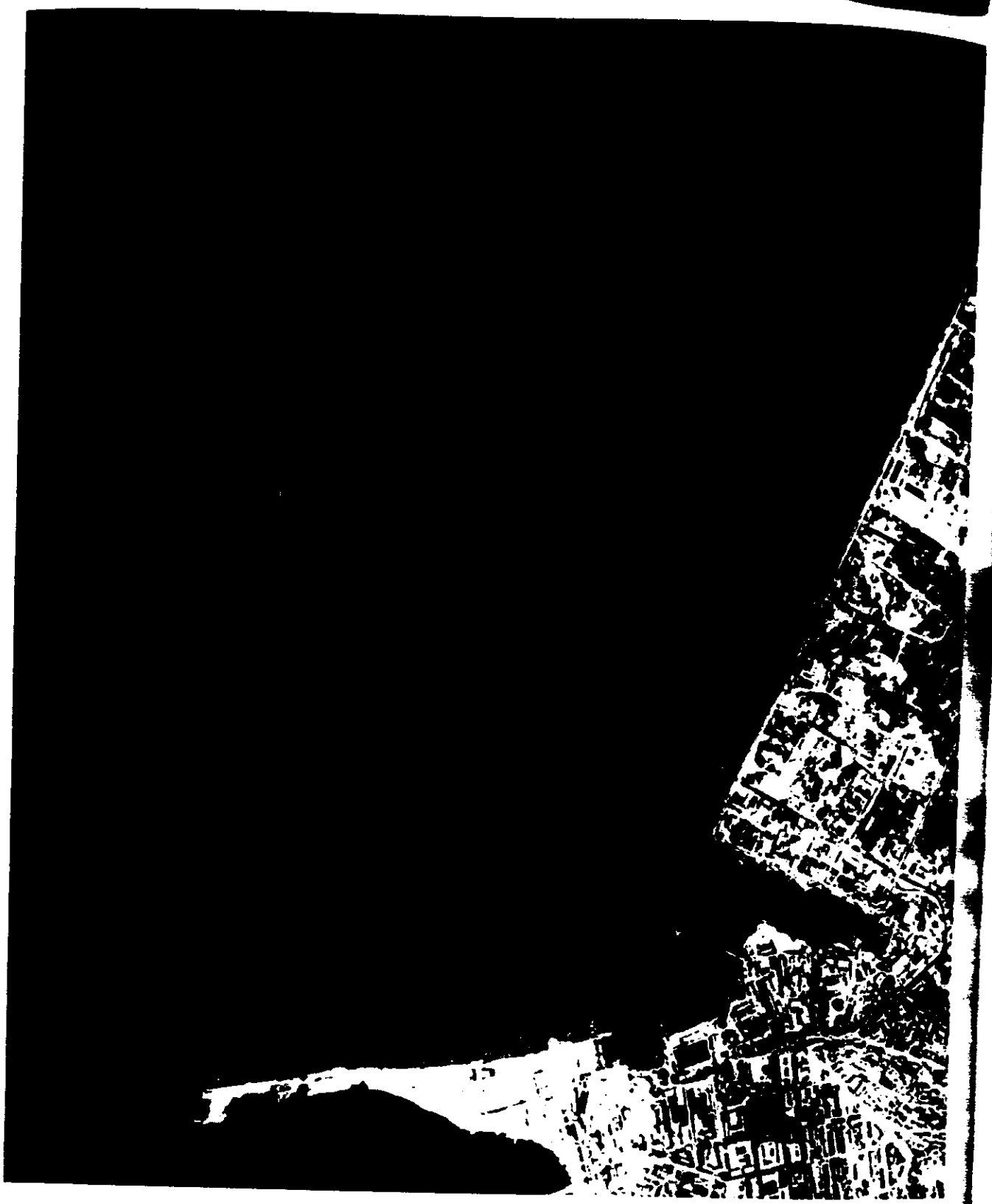

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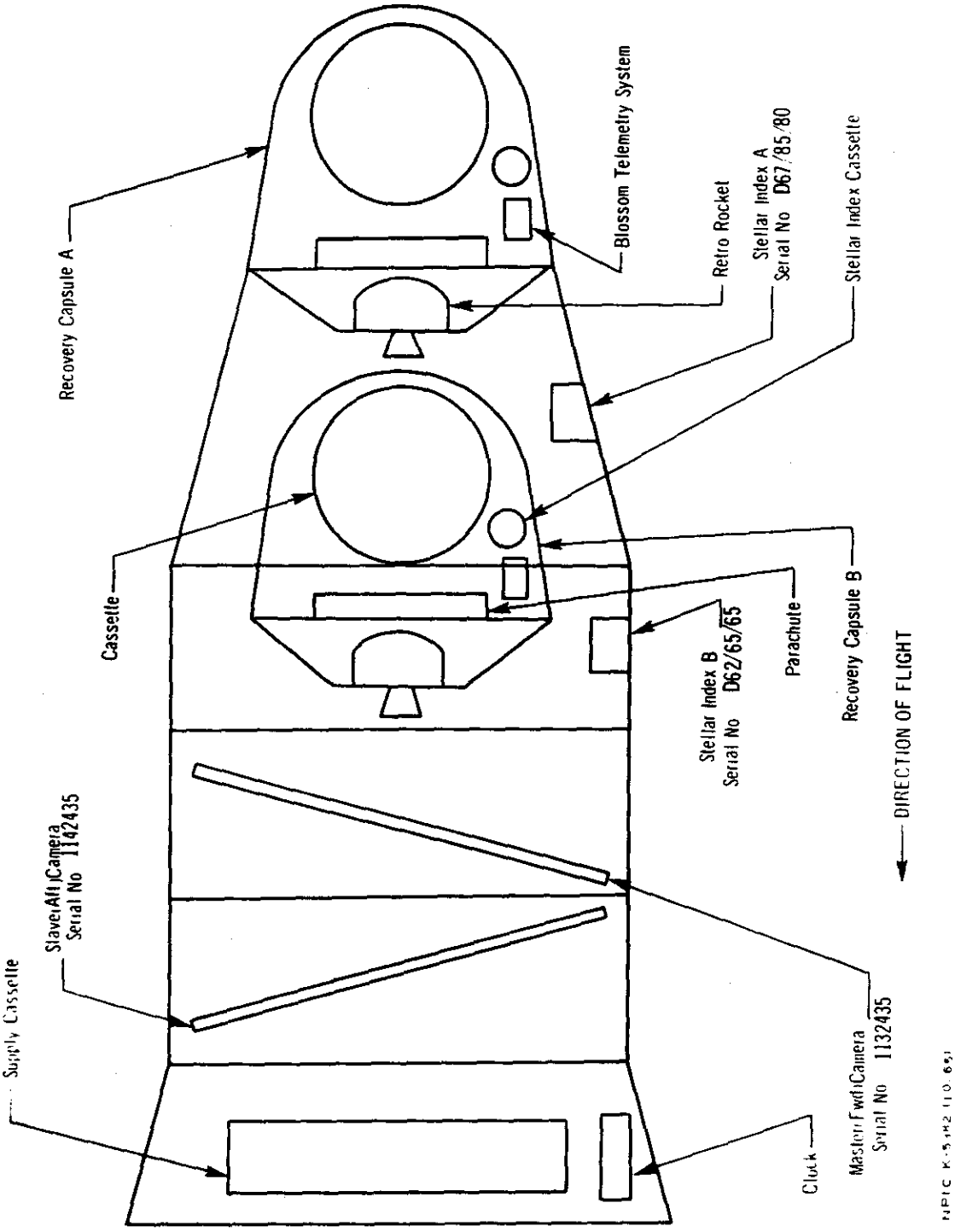
APPENDIX A. SYSTEM SPECIFICATIONS

1. Cameras

	Master (FWD) Panoramic	Master Take-up Horizon	Master Supply Horizon	Slave (FWD) Panoramic	Slave Take-up Horizon	Slave Supply Horizon	Mission 1020-1		Mission 1020-2	
							Stellar	Index	Stellar	Index
Camera No	136	NA	NA	137	NA	NA	67D#	67D#	62D#	62D#
Reseau No							80	85	65	65
Lens Serial No	1132435	814017	813518	1142435	812303	812278	10519	817456	10733	817458
Slit Width	0.350	NA	NA	0.175	NA	NA	NA	NA	NA	NA
Aperture	f/3.5	f/8.0	f/6.8	f/3.5	f/6.8	f/8.0	f/1.8	f/4.5	f/1.8	f/4.5
Exposure Time	(C)	1/100	1/100	(C)	1/100	1/100	2.0 sec	1/500	2.0 sec	1/500
Filter	21	25	25	21	25	25	None	21	None	21
Focal Length (mm)	609.638	54.84	54.37	609.539	54.90	54.90	84.00	38.52	85.00	38.57
Film Length	16,000'	- - -	- - -	16,000'	- - -	- - -	75'	135'	75'	135'
Splices	4	- - -	- - -	4	- - -	- - -	None	None	None	None
Emulsion	97-18-17-5-5	(A)	(A)	207-6-5-5	(B)	(B)	54-2-9-4	31-4-9-4	54-2-9-4	31-4-9-4
Film Type	3404	(A)	(A)	3404	(B)	(B)	4401	4400	4401	4400
Res. Data L/mm (D)	178	95	81	201	131	*	*	72	*	73

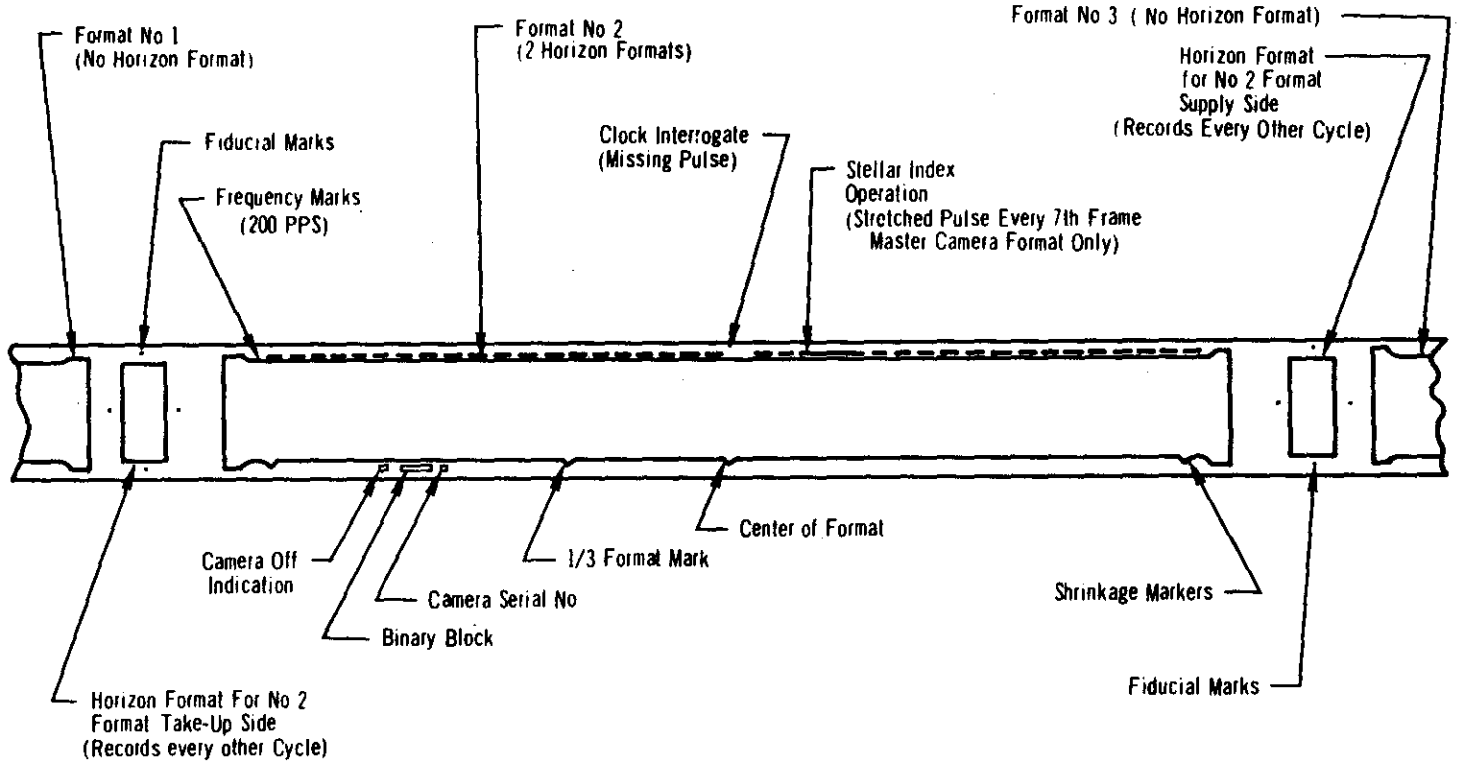
\# Stellar/Index Unit No
NA Not Applicable
* Not Available
(A) Same as Master Panoramic
(B) Same as Slave Panoramic
(C) Varied
(D) AWAR

2. VEHICLE LAYOUT



3. FILM SPECIFICATIONS

FORMAT LAYOUT



Master(Fwd)Panoramic Camera No 136
Viewed With Negative Emulsion Down
Direction of Film Transport ←
Direction of Scan →
Direction of Vehicle Motion ↓

Slave(Aft)Panoramic Camera No 137
Viewed With Negative Emulsion Down
Direction of Film Transport ←
Direction of Scan →
Direction of Vehicle Motion ↑

APPENDIX B. MICRODENSITOMETRY

1. Edge Spread Function

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

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

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

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

The microdensitometer used for the traces in this report is located at the SPPL facility. The location of the traces was directed by representatives from NPIC at SPPL. The instrument is the Mann-Data Micro-Analyzer used with an effective slit of 1 micron by 80 microns. A scan speed of 0.05 millimeters/minute and a chart speed of 4 inches/minute was used for a recording-to-specimen expansion of 2032:1. One inch on the recording equals 12.5 microns on the specimen. The traces produced represent a plot of deflection versus distance. The deflection of the pen is essentially linear with density and the horizontal lines on the chart numbered 1 to 7 equal 0 to 3.0 density. At the same time the traces were made, the electronic output signals from the instrument were digitized as density values and recorded on paper tape for direct analysis by an IBM 1710 computer.

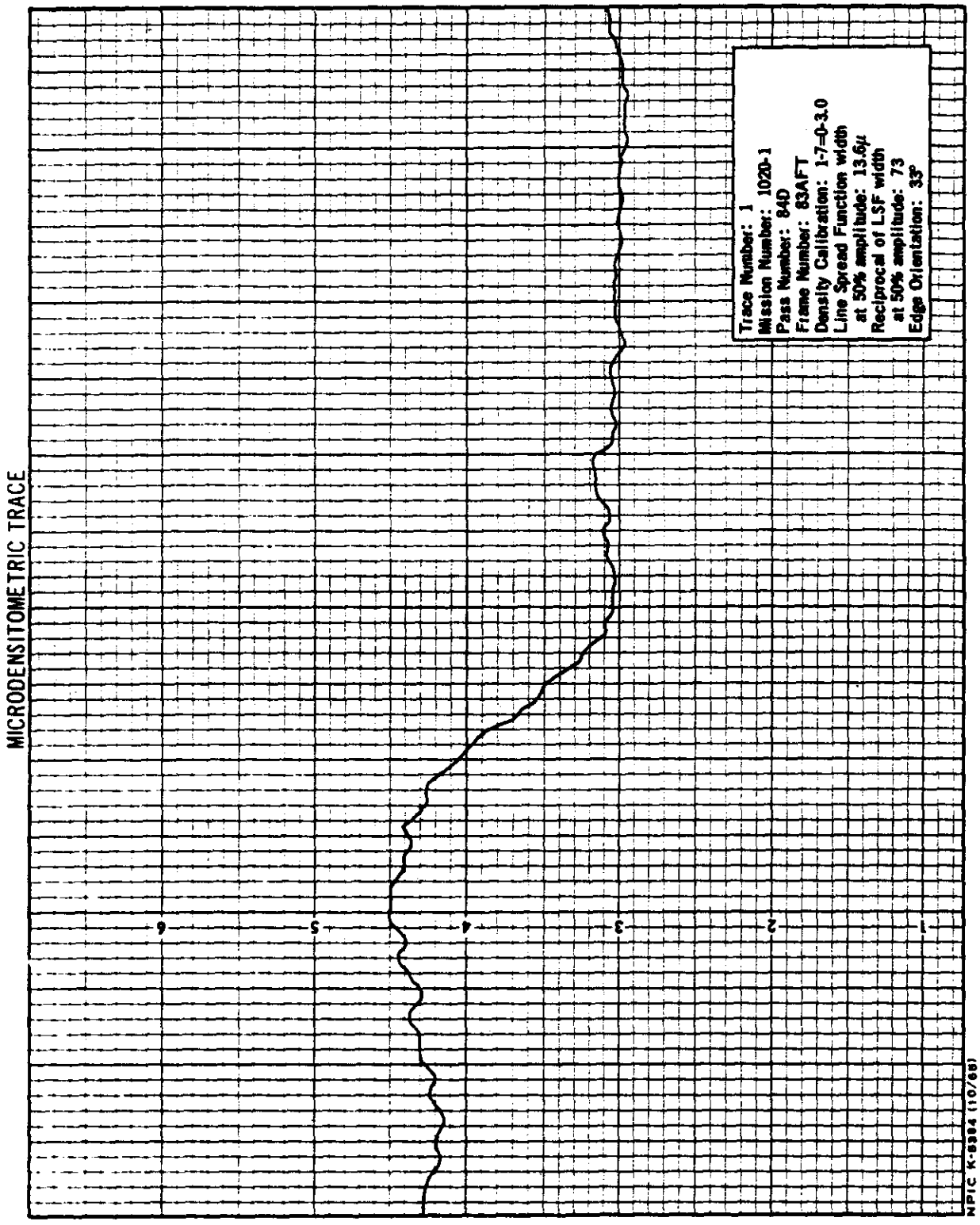
In the table on the next page the following computer outputs are listed for each edge traced: The 50 percent amplitude width of the Line Spread Function in microns, the reciprocal of the 50 percent width in millimeters, the computer-determined reciprocal edge spread (Machine RES), and the intersection point of the modulation transfer curve and the aerial image modulation curve. The procedure used in the derivation of these values is described in the SPPL Technical Report No. 101-31 (pages 79-82). The edge orientation angle is determined in the microdensitometer and is 0 degrees when the edge is parallel to the major axis of the film and 90 degrees when the edge is perpendicular to the major axis of the film.

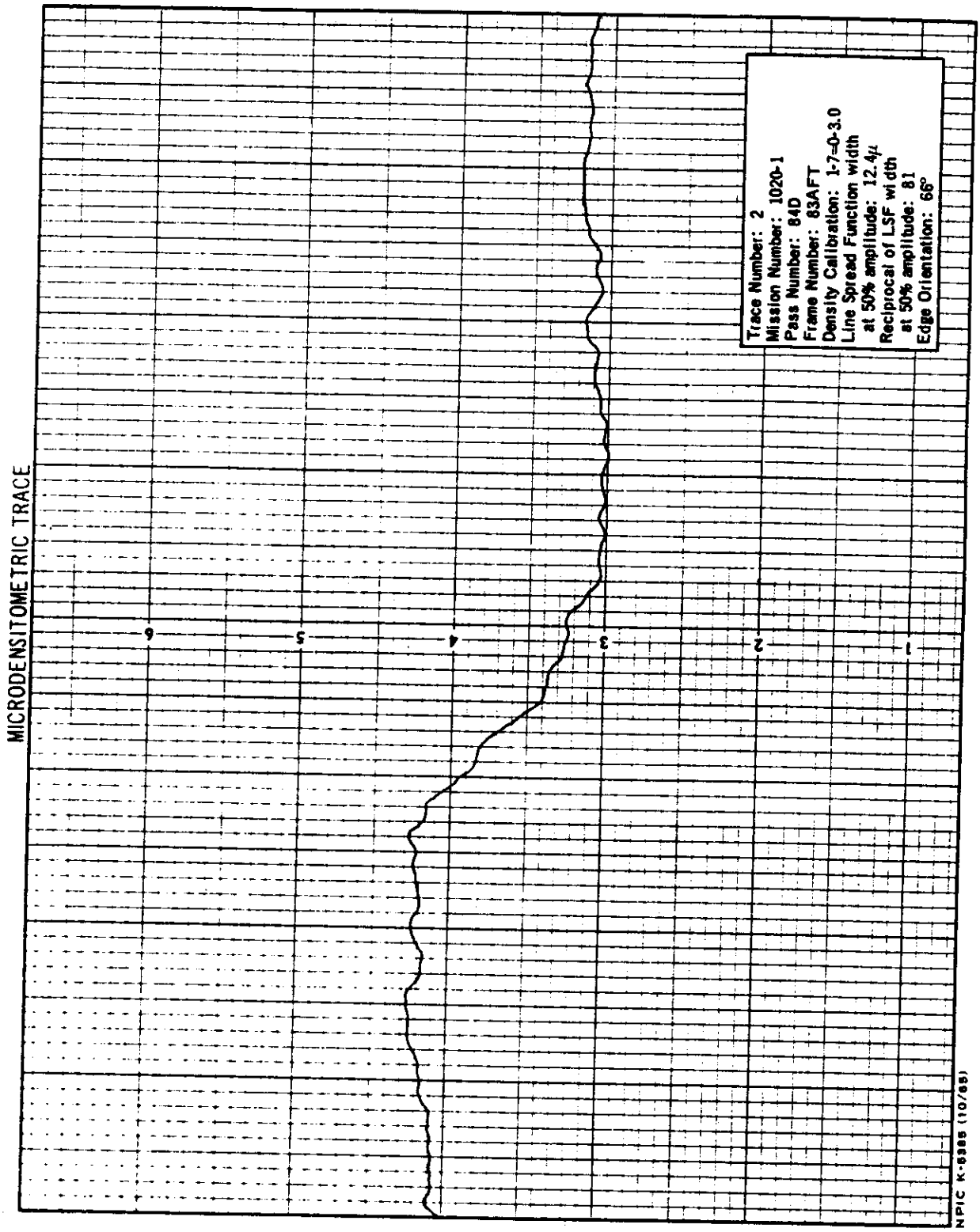
The edge traces were made on the original negatives of this mission. The imagery traced is contained in the frames considered to be typical of the best in the mission.

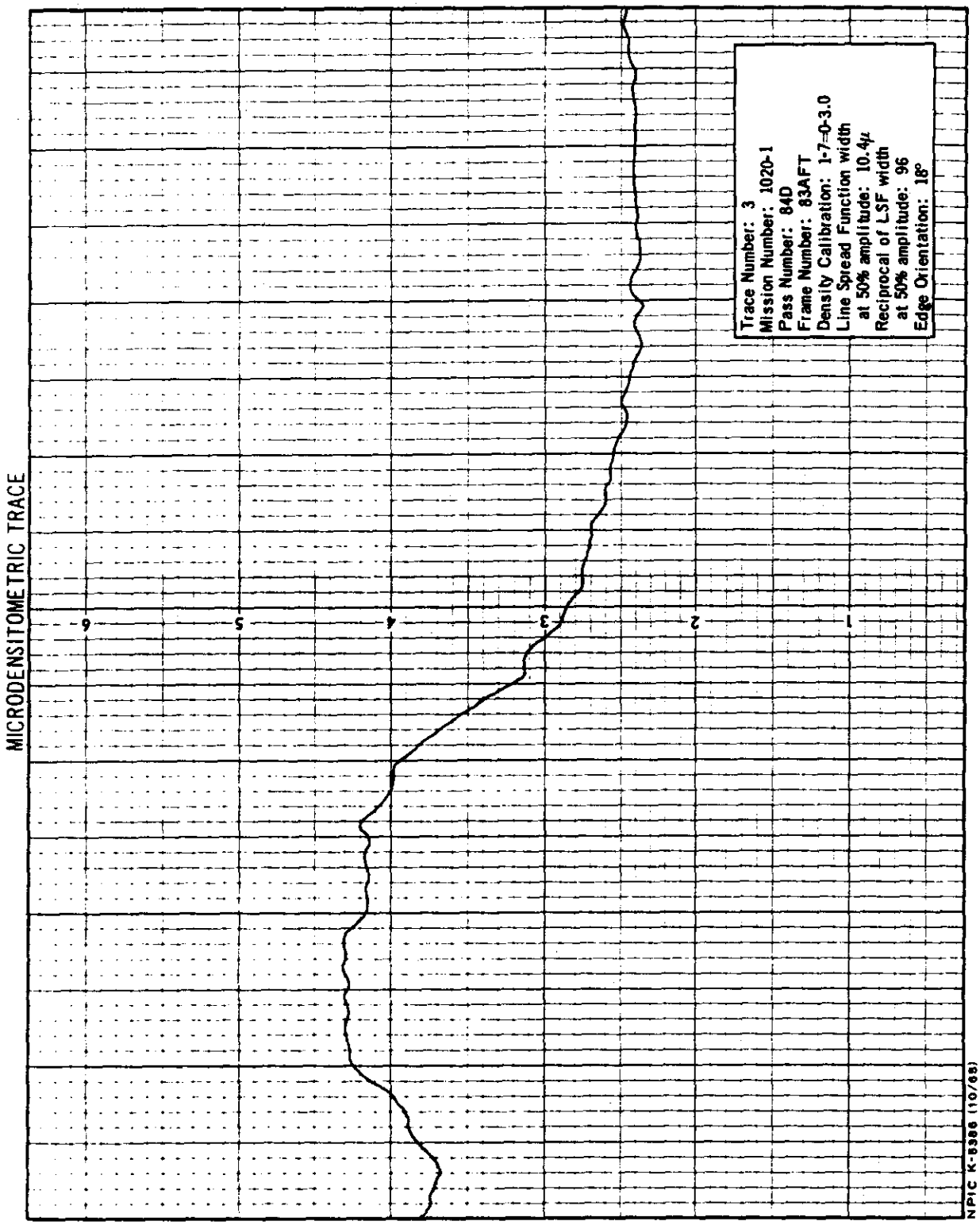
2. Summary Table of Edge Traces

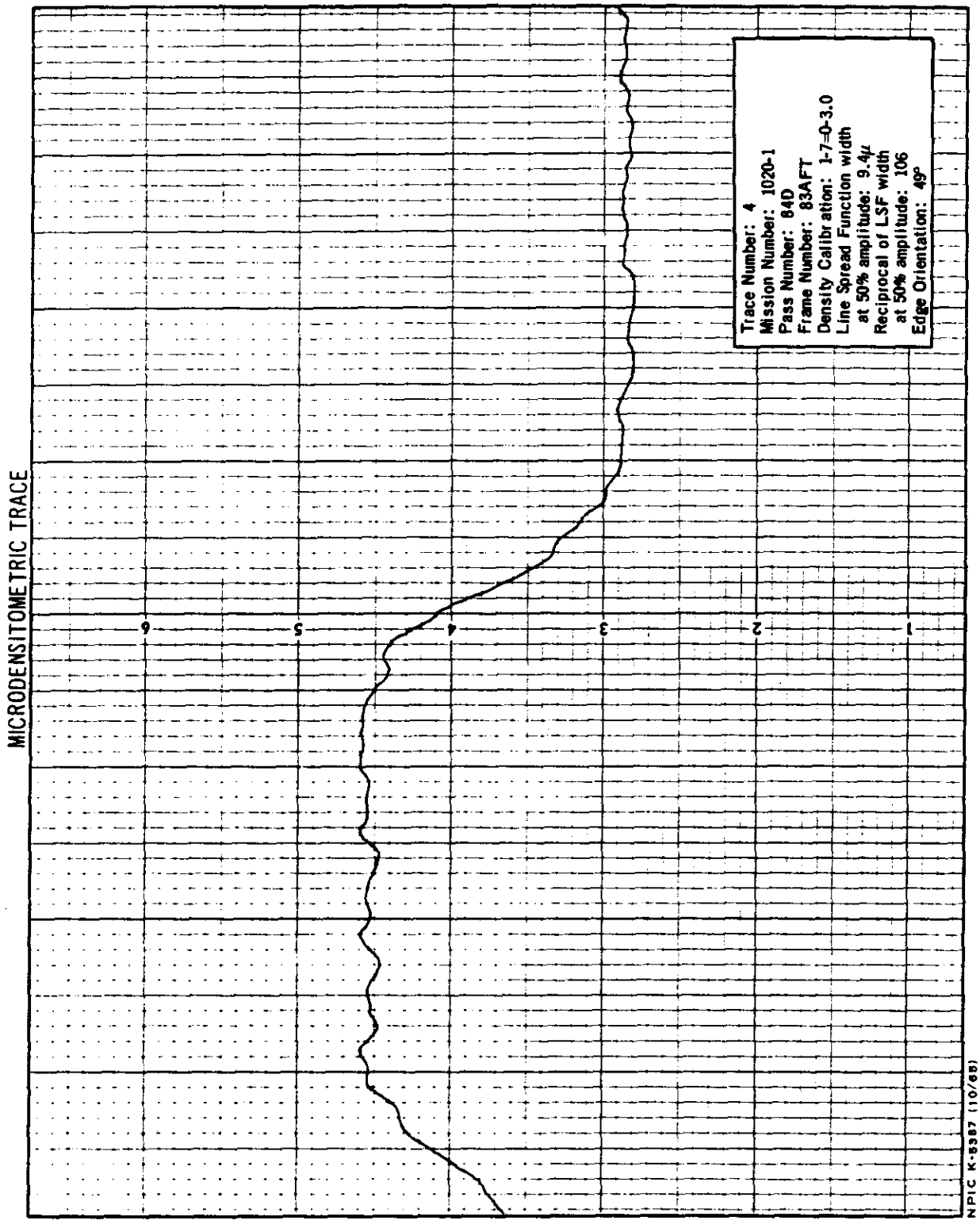
Trace Number	Pass/ Frame	LINE SPREAD FUNCTION			MTF/AIM Intersect	Edge Orientation
		50% Width	1000/50% Width	Machine RES		
1*	84D/83A	13.6	74	73	65	33°
2*	84D/83A	12.4	81	71	80	66°
3*	84D/83A	10.4	96	82	90	18°
4*	84D/83A	9.4	106	100	90	49°
5	84D/86A	13.5	74	73	70	48°
6	84D/86A	12.6	79	82	70	49°
7	84D/86A	12.3	81	62	76	49°
8	84D/86A	10.5	95	87	110	48°
9	84D/86A	16.2	62	59	57	43°
10	84D/77F	13.2	76	72	66	24°
11	84D/78F	12.9	78	71	71	51°
12	84D/80F	15.5	65	50	60	-5°
13	84D/80F	13.9	72	56	70	36°

*Graphs included in this report.


MICRODENSITOMETRIC TRACE
Trace Number: 1
Mission Number: 1020-1
Pass Number: 84D
Frame Number: 83AFT
Density Calibration: 1-7=0-3.0
Line Spread Function width
at 50% amplitude: 13.6μ
Reciprocal of LSF width
at 50% amplitude: 73
Edge Orientation: 33°
6
5
4
3
2
1
NPIC K-8384 (10/68)


MICRODENSITOMETRIC TRACE
6
5
4
3
2
1
Trace Number: 2
Mission Number: 1020-1
Pass Number: 84D
Frame Number: 83AFT
Density Calibration: 1-7=0-3.0
Line Spread Function width
at 50% amplitude: 12.4μ
Reciprocal of LSF width
at 50% amplitude: 81
Edge Orientation: 66°
NPIC K-9385 (10/68)


MICRODENSITOMETRIC TRACE
6
5
4
3
2
1
Trace Number: 3
Mission Number: 1020-1
Pass Number: 84D
Frame Number: 83AFT
Density Calibration: 1-7=0-3.0
Line Spread Function width
at 50% amplitude: 10.4μ
Reciprocal of LSF width
at 50% amplitude: 96
Edge Orientation: 18°
NPIC K-5386 (10/68)


MICRODENSITOMETRIC TRACE
6
5
4
3
2
1
Trace Number: 4
Mission Number: 1020-1
Pass Number: 84D
Frame Number: 83AFT
Density Calibration: 1-7=0-3.0
Line Spread Function width
at 50% amplitude: 9.4μ
Reciprocal of LSF width
at 50% amplitude: 106
Edge Orientation: 49°
NPIC K-5387 (10/68)

APPENDRIX C. CLOUD COVER ANALYSIS

1. Introduction

This study represents a statistical analysis of the cloud cover on the photography of Mission 1020-1. The basis of this study is the cloud cover data for each quarter segment of every individual frame of photography. The data is obtained by analysts specifically trained in estimating cloud cover by designated categories.

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

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

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

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

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

0.20 x 5.0 = 1.00%
0.15 x 17.5 = 2.63%
0.30 x 38.0 = 11.40%
0.25 x 75.0 = 18.75%
0.10 x 100.0 = 10.00%
43.75%

Hence, 43.8 percent of this pass is cloud covered.

TABLE 1

CLOUD COVER CATEGORIES

CATEGORY NUMBER	PERCENT OF CLOUD COVER	DESCRIPTION	MEAN CLOUD PERCENTAGE
1	Less than 10%	Clear	5%
2	10% - 25%	Small Scattered Clouds	17.5%
3	26% - 50%	Large Scattered Clouds	38%
4	51% - 99%	Broken or Connected Clouds	75%
5	100%	Complete Overcast	100%

2. Cloud Cover Data, Mission 1020-1

PERCENTAGE OF CLOUD COVER CATEGORIES BY PASSES

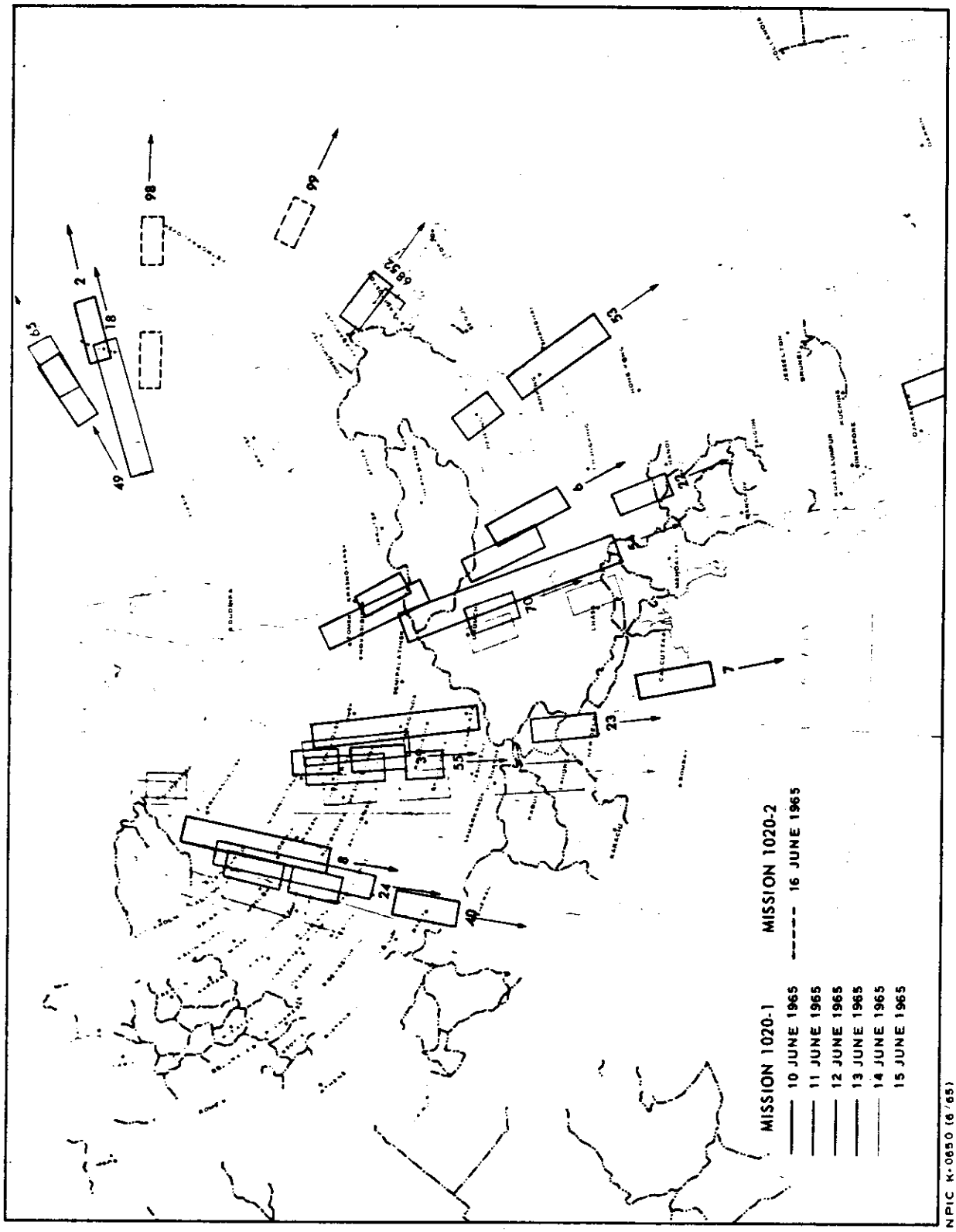
Pass Number	1	2	3	4	5	Cloud Cover % Per Pass
2D	0.0	0.6	6.9	79.4	13.1	75.4
6D	25.3	2.3	8.8	52.8	10.8	55.4
7D	26.0	16.6	25.5	31.9	0.0	37.8
8D	51.1	20.6	12.6	15.4	0.3	22.7
10D	82.6	7.9	8.7	0.8	0.0	9.4
11D	90.1	1.9	2.5	5.5	0.0	9.9
18D	22.8	13.9	16.2	27.2	19.9	50.1
22D	8.3	15.9	22.0	49.6	4.2	53.0
23D	57.7	15.3	14.3	12.7	0.0	20.5
24D	23.2	34.7	24.5	16.2	1.4	30.1
26D	48.0	9.2	9.3	20.5	13.0	35.9
30D	21.4	35.7	27.7	17.9	1.3	31.9
39D	60.8	19.0	15.9	4.3	0.0	15.7
40D	47.7	4.2	8.6	26.1	13.4	39.4
43D	34.1	8.0	15.3	21.0	21.6	46.3
52D	51.7	17.5	25.8	4.2	0.8	19.4
53D	9.8	5.9	22.9	49.8	11.6	59.2
54D	39.8	12.7	13.7	30.7	3.1	35.6
55D	13.4	18.9	34.3	31.4	2.0	42.6
57D	4.9	23.6	25.5	46.0	0.0	48.6
58D	81.5	3.6	4.2	10.1	0.6	14.5
65D	42.3	22.4	6.4	28.9	0.0	30.1
68D	74.1	11.2	10.8	3.9	0.0	12.7
70D	49.2	12.5	5.8	32.5	0.0	31.2
71D	75.0	7.9	5.0	12.1	0.0	16.1
72D	0.0	1.2	21.6	63.0	14.2	69.9
73D	55.7	13.0	13.3	18.0	0.0	23.6
74I	35.5	5.2	18.1	36.7	13.5	50.5
85D	50.0	26.0	17.6	6.4	0.0	18.6
90D	15.1	7.1	20.8	50.0	6.2	53.7
91I	44.5	6.3	10.5	34.5	3.7	37.0
92I	5.7	1.4	29.9	66.0	0.0	57.5
	30.4*	11.7*	16.0*	29.8*	5.1*	37.6**

*Average percentage by category for mission.
** Average total cloud cover percentage.

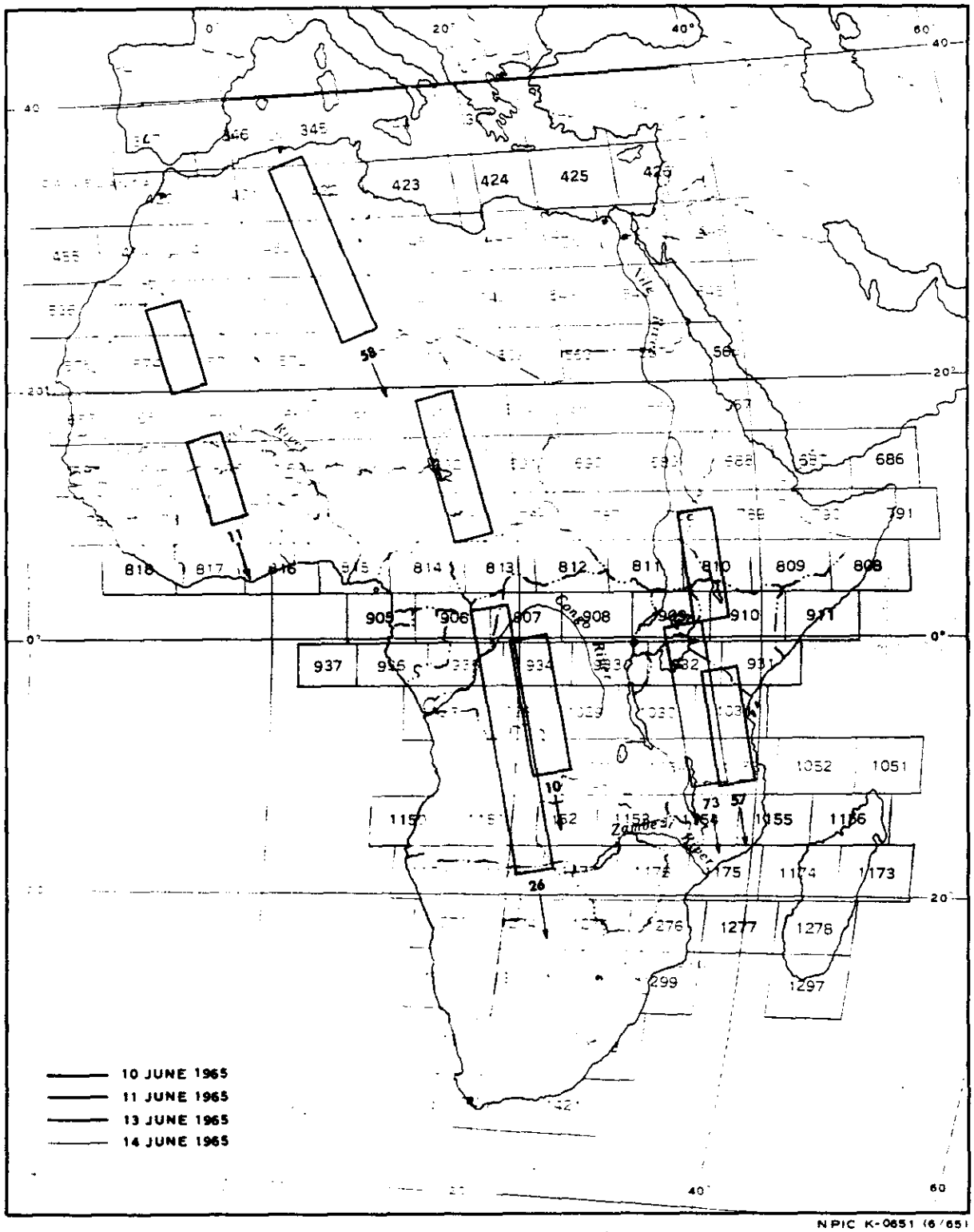
APPENDIX D. SUMMARY OF PLOTTABLE PHOTOGRAPHIC COVERAGE

1. Photographic Coverage, Mission 1020-1

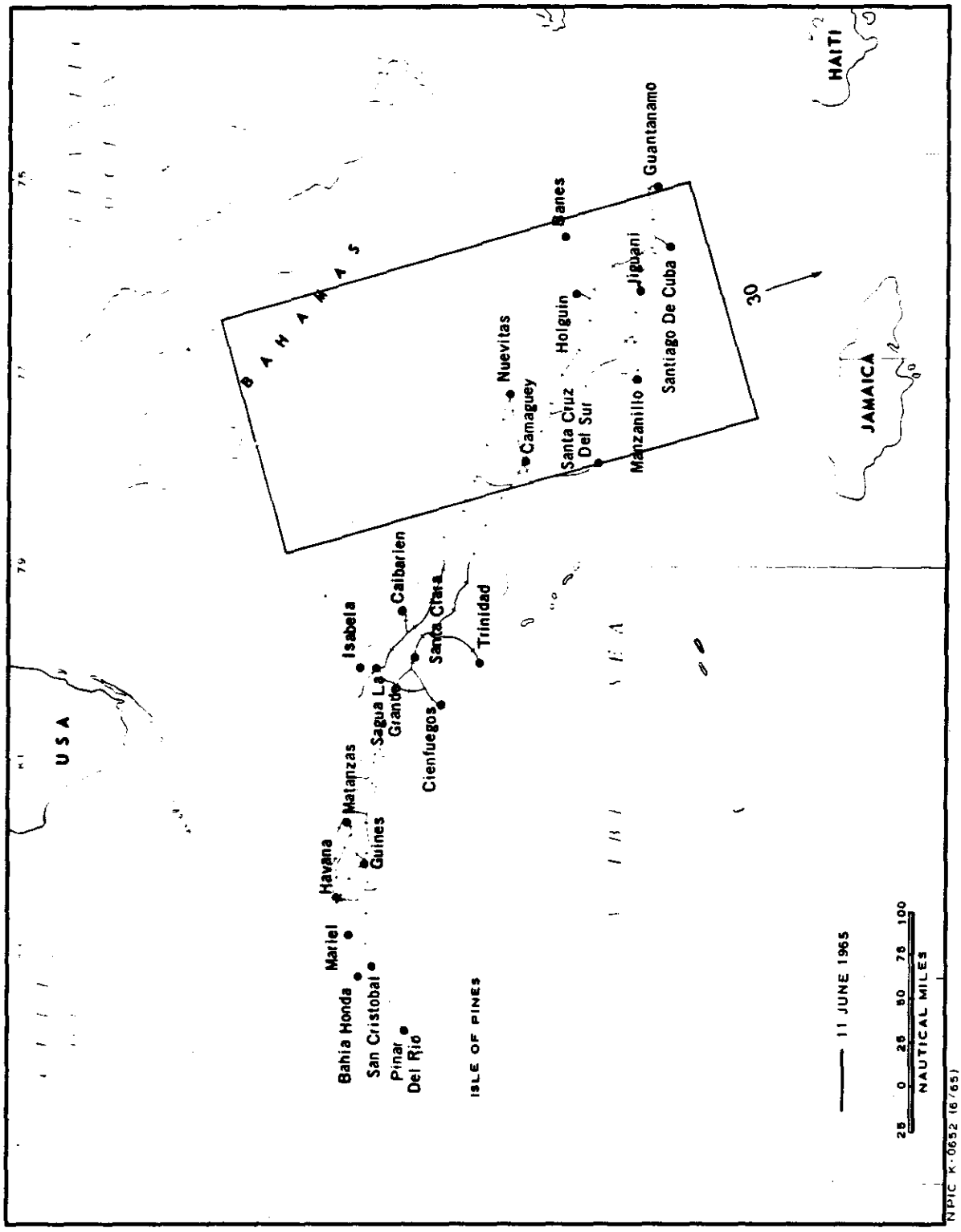
Country	FORWARD CAMERA (136)		AFT CAMERA (137)		TOTALS	
	Linear nm	Square nm	Linear nm	Square nm	Linear nm	Square nm
USSR	10,445	1,515,242	10,724	1,551,644	21,169	3,066,886
China	4,341	605,748	4,487	633,591	8,828	1,239,339
Congo	891	140,625	922	145,647	1,813	28,272
Tanganyika	732	111,996	732	111,996	1,464	223,992
India	634	85,362	557	79,469	1,191	164,831
Algeria	529	74,589	501	70,651	1,030	145,240
Angola	535	70,704	453	72,972	988	143,676
Mauritania	257	36,751	421	60,203	678	96,954
Chad	268	38,324	268	38,324	536	76,648
Pakistan	273	40,950	261	39,150	534	80,100
Indonesia	269	20,436	186	13,398	455	33,834
Mongolia	217	31,992	225	33,144	442	65,136
Cuba	211	12,600	223	10,050	434	22,650
Rhodesia	154	24,426	160	25,398	314	49,824
Mali	148	21,164	163	23,309	311	44,473
Kenya	132	20,196	168	25,704	300	45,900
Ethiopia	149	22,797	149	22,797	298	45,594
Kashmir	132	18,612	156	21,996	288	40,608
Sudan	112	17,136	112	17,136	224	34,272
Afghanistan	91	13,650	131	19,650	222	33,300
Greenland	62	4,960	149	19,040	211	24,000
Uganda	95	14,535	95	14,535	190	29,070
Upper Volta	89	12,727	74	10,582	163	23,309
Mexico	112	16,800	37	5,550	149	22,350
North Vietnam	83	11,869	37	5,291	120	17,160
Ivory Coast	60	8,580	50	7,150	110	15,730
British Cameroons	45	6,435	45	6,435	90	12,870
Cameroun	45	6,435	45	6,435	90	12,870
Niger	45	6,435	45	6,435	90	12,870
Nigeria	45	6,435	45	6,435	90	12,870
Burma	33	4,752	31	4,464	64	9,216
Taiwan	62	2,679	------	------	62	2,679
Ghana	30	4,290	25	3,575	55	7,865
Iran	27	450	------	------	27	450
Bhutan	25	3,525	------	------	25	3,525
Laos	21	3,003	4	572	25	3,575
Southwest Africa	15	2,430	------	------	15	2,430
Bechuanaland	11	1,782	------	------	11	1,782
Norway	------	------	8	150	8	150
Finland	------	------	6	900	6	900
Bahama Islands	------	------	4	20	4	20
TOTAL	21,425	3,041,422	21,699	3,113,798	43,124	6,155,220
Continental US	695	104,250	744	115,370	1,469	219,620
GRAND TOTAL	22,120	3,145,672	22,473	3,229,168	44,593	6,374,840



APPROXIMATE TRACK OF MISSION 1020-1 AND 2, 10-15 AND 16 JUNE 1965, OVER USSR, FAR AND MIDDLE EAST.



APPROXIMATE TRACK OF MISSION 1020-1 AND 2, 10-15 AND 16 JUNE 1965 OVER AFRICA.



APPROXIMATE TRACK OF MISSION 1020-1 AND 2, 10-15 AND 16 JUNE 1965 OVER CUBA.