TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT
MISSION 1023-1
17-22 AUGUST 1965
MISSION 1023-2
23-26 AUGUST 1965

DECEMBER 1965

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

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SYNOPSIS

Mission 1023 (J-23) was launched 17 August 1965 at 2100Z. The initial phase, designated Mission 1023-1, accomplished 37 photographic revolutions, which included 6 domestic (North American Continent) and 3 engineering (dark side) passes. Air retrieval of the payload was executed on 22 August 1965 and second-phase operations were initiated with no intervening deactivation period. Mission 1023-2 also accomplished 37 photographic revolutions, including 3 engineering passes, but domestic coverage increased to 8 passes. Air recovery of the second payload on 26 August 1965 terminated the mission.

The master (fwd) panoramic camera failed to operate during passes 103D-132D but resumed operation at the end of pass 133D and functioned normally through pass 135D, the last operational sequence performed by this instrument. Monoscopic coverage was acquired by the slave (aft) camera during the master instrument's inactive periods. The slave unit functioned through pass 142D.

Missions 1023-1 and 1023-2 were assigned MIP ratings of 85. However, the master panoramic record contains small out-of-focus areas in each format, similar to those noted in a number of recent missions. In this case, the out-of-focus condition is observed on the frequency mark edge of each master panoramic frame but is limited to relatively small areas at the supply and/or take-up ends. Consequently, the overall degradation is relatively minor.

Clouds obscured 35 percent of the terrain covered in Mission 1023-1 and 34 percent in Mission 1023-2.

GENERAL FLIGHT DATA

Launch Date, Mission 1023-1	17 August 1965
Recovery Date, Mission 1023-1	22 August 1965
Activation Date, Mission 1023-2	23 August 1965
Recovery Date, Mission 1023-2	26 August 1965

Orbital Parameters

Mission	1023-1	1023-2
Revolution Number	40	105
Date	20 August 1965	24 August 1965
Period	90.38 Min	90.29 Min
Perigee	97.8 nm	98.54 nm
Apogee	223.8 nm	220.66 nm
Eccentricity	0.0175	0.0170
Inclination Angle	70.039° N	70.040° N

Photographic Operations

Mission	1023-1	1023-2
Operational Passes	28	26
Domestic Passes	6	8
Engineering Passes	3	3
Recovery Revolutions	81	144

PART I. CAMERA OPERATION

1. Master (Fwd) Panoramic Camera No 170

A probable electro-mechanical malfunction interrupted camera operation after pass 101D. The instrument functioned briefly during the final phase of pass 102D (only the last 34 frames were acquired) then failed again and remained dormant until just prior to the conclusion of pass 133D, when it recorded the last 2 frames. Operation was normal through passes 134D and 135D, the last photographic sequences obtained with this camera.

A small out-of-focus area is present at the supply and/or take-up ends of the frequency mark edge of each format. Similar conditions have been reported in the evaluation of a number of recent missions. However, unlike previous investigations which indicated an apparent connection between format pitch (alignment on the film stock) and the absence or presence of out-of-focus areas within the formats, examination of this material reveals that there are no perceptible pitch variations or misalignments. The pitch is stabilized at 0.265 inches (take-up end) and 0.220 inches (supply end) throughout the film. Departures from those values are so small and infrequent that no significance is attached to them. Consequently, there is no ready explanation for the presence of the degraded areas.

The first well-defined example of the out-of-focus condition is observed in pass 21D, frame 94, where several villages or small towns are present in the affected area at the supply end of the format. Previous passes offer little opportunity to detect the degradation, due to cloud cover, unfavorable solar elevations, and lack of culture. However, close examination of the photography indicates that the anomaly is present to some degree from the start of the mission.

The out-of-focus area in pass 21D, frame 94, is typical of the degradation found throughout the material acquired in this mission. The affected area measures approximately 3 inches along the edge of the format from a point located 1 inch from the end of the frame. The deepest penetration into the imagery seldom exceeds 0.15 inches at any place along the contour of the degradation within the format. Consequently, degradation is minor with reference to its effect on the photography as a whole. However, regardless of the physical extent of the degradation, the presence of an unexplained out-of-focus condition is disturbing.

An excellent example of a similarly-degraded area at the take-up ends of the formats is observed in pass 87D, frame 91. In this case, some degradation is also noted at supply but the condition appears to

be more prominent at take-up. There are indications that the severity of the degradation at the supply ends decreased gradually as the film was expended in Mission 1023-1 and emphasis shifted to the take-up ends in Mission 1023-2. Again, measurement of the format pitch values reveals no change or instability.

A narrow, transverse light trace extends from edge to edge across the take-up end of the fifth frame following most of the camera-on sequences in the mission. In a few cases, this light trace is observed at supply of the fourth frame after camera-on or between the fourth and fifth frames. A rare exception is noted in pass 47DE, where the trace strikes across take-up of the second frame at the head of the pass record. The fifth-from-last frames of most of the pass records acquired in Mission 1023-1 contain areas of uniform fog, approximately 6 inches wide, near the frame centers. These uniform fog patches are seldom present in the second-phase material. A splash-type light trace appears in a few pass records, usually in the second-from-last or next-to-last frames. Examples of this are found in passes 26D, 42D, 47DE, and 50D.

2. Slave (Aft) Panoramic Camera No 171

The camera was operational throughout the mission and photography was acquired through revolution 142. No out-of-focus areas are detectable in this material. Degradations are confined to relatively minor minus-density streaks and light traces, as follows:

An irregularly-configured minus-density streak is present intermittently. The streak varies in length and location. Examples are found in pass 5D, frame 18 and pass 53D, frame 15. Fine, linear, minus-density streaks, parallel to the major film axis and to each other, are detectable in the thin-to-medium density areas of a number of passes. These streaks are first observed in pass 8D and intermittently thereafter, but it is probable that they are present throughout the film and are noted only where the density of the material facilitates their detection.

A light trace is present in the first frame of a few pass records, such as 8D and 24D. The sixth-from-last frame of most passes contains a light trace at take-up, which occasionally is observed in the preceding frame at the supply end of the format or between those 2 frames. Examples are found in pass 2D, frame 30 and pass 26D, frame 69. A narrow, diagonal light trace strikes across the next-to-last frame in a few passes. A splash-type light trace, similar to that noted in the master material, signals the impending camera-off action at the end of most of the passes. This trace is generally observed between the second and third frames from the last and is quite prominent. It is also present prior to a camera-off action within a pass but is considerably more difficult to detect at that position. Good examples of this light trace

are found in pass 40D between frames 142/143 and in pass 31D, frames 23/24.

3. Master (Fwd) Horizon Cameras

The port (supply) and starboard (take-up) horizon cameras were operational throughout the mission except during passes 103D-133D when the master instrument failed to perform. In general, the quality of the horizon imagery is good. Exposure was satisfactory except where low solar elevations prevailed.

4. Slave (Aft) Horizon Cameras

The port (take-up) and starboard (supply) horizon cameras were operational throughout the mission. Image quality is good. Exposure was adequate except where low solar elevations precluded effective horizon photography.

5. Stellar Camera No D17/Reseau No 82 (Mission 1023-1)

The instrument was operational throughout the mission. At least 30 stellar images were recorded in each format. The stellar field change from pass to pass is minimal and geometric distribution of the images is good but flare restricts accurate mensuration to less than half of the format area in more than 50 percent of the frames. However, the quality of the stellar images outside of the flared areas is excellent, and stellar reduction was accomplished without difficulty.

6. Stellar Camera No D66/Reseau No 72 (Mission 1023-2)

The camera was operational during all of the master (fwd) panoramic camera's operational periods. Since activation of the stellar/index unit is dependent on action of the master panoramic camera, no stellar photography was acquired during the master camera's dormant periods in passes 103D-133D.

Flare conditions in Mission 1023-2 are considerably reduced. Relatively small portions of each format were effected and stellar reduction was accomplished without difficulty. Quality of the stellar images is good, with the exception of frames 167-172 and 194-197, where streaked and/or double images are present. The field of view covers 39 stars, and their geometric distribution is good.

7. Index Camera No D17/Reseau No 19 (Mission 1023-1)

The camera performed satisfactorily throughout the mission and good-quality terrestrial imagery was obtained. Edge fog appears intermittently on both edges, and the last 4 frames are slightly degraded by uniform fog.

Reseau plate reflections are present throughout the material. Numerous small bits of foreign matter adhered to the base side of the film and are present in varying amounts from head to tail of the index record.

8. Index Camera No 66/Reseau No 75 (Mission 1023-2)

The instrument was operational throughout the master (fwd) panoramic camera's operational periods. Quality of the photography is good. Edge fog appears intermittently on the correlation mark edge of the film. A few base rubs are present in the material. Two continuous emulsion scratches, parallel to each other and to the major axis of the film, are present from head to tail of the index record. These scratches first appear in the pre-flight material and gradually shift toward the camera number edge as the film is expended.

9. Associated Equipment

The binary data block failed to record in pass 21D, frame 87 and pass 117D, frame 46. The data block is smeared in pass 141D, frame 12. In general, alignment and intensity of the lamps are good but a few exceptions occur, as in pass 26D where the alignment is extremely poor. The top row of light images is occasionally clipped by the edge of the film in a number of passes. The index lamp adjacent to the camera number is overexposed. Double end-of-pass markers are present in most of the early passes (1D-21D) and appear intermittently thereafter, as in passes 26D, 37D, and 42D. The frequency marks are properly recorded outside of the formats but appear to be underexposed throughout most of the pass records.

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 locate the illustrated photography within the panoramic format.

ENLARGEMENT FACTOR: The enlargement factor indicates the number of diameters the original material has been enlarged in the photographic illustration.

GEOGRAPHIC COORDINATES: These coordinates indicate the latitude and longitude 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.

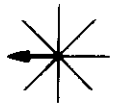
FIGURE 2. UNIDENTIFIED SPACE OBJECT RECORDED BY HORIZON CAMERA (1ST VIEW)

The unidentified object is located 0.50 inches inside the horizon arc and approximately 4 inches up from the bottom of the illustration format (nearly at photo-center).

NPIC K-5863 (12/65)

Camera	170
Pass	2D Fwd
Frame	2
Date of Photography	18 Aug 65
Universal Grid Coordinates	87.2 - 11.6
Enlargement Factor	10X
Geographic Coordinates	70-06N 126-10E
Altitude (feet)	840,600
Camera:	
Pitch	15°06'
Roll	00°06'
Yaw	-00°17'
Vehicle Azimuth	93°20'
Local Sun Time	0816
Solar Elevation	23°01'
Solar Azimuth	Not Determined
Exposure	f/8.0 @ 1/100 sec
Processing Level	Intermediate

Approximate flight direction on photograph



Approximate scan direction on photograph

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

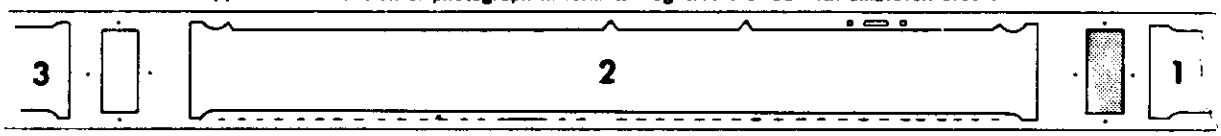


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FIGURE 3. UNIDENTIFIED SPACE OBJECT RECORDED BY HORIZON CAMERA (2D VIEW)

The unidentified object is located approximately 0.60 inches inside the horizon arc and 4.75 inches up from the bottom of the illustration format.

NPIC K-5864 (12/65)

Camera	170
Pass	2D FWD
Frame	6
Date of Photography	18 Aug 65
Universal Grid Coordinates	86.7 - 13.1
Enlargement Factor	10X
Geographic Coordinates	70-00N 128-45E
Altitude (feet)	835,144
Camera:	
Pitch	15°02'
Roll	00°06'
Yaw	-00°17'
Vehicle Azimuth	95°54'
Local Sun Time	0827
Solar Elevation	23°52'
Solar Azimuth	Not Determined
Exposure	f/8.0 @ 1/100 sec
Processing Level	Intermediate

Approximate flight direction on photograph

Approximate sun direction on photograph

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

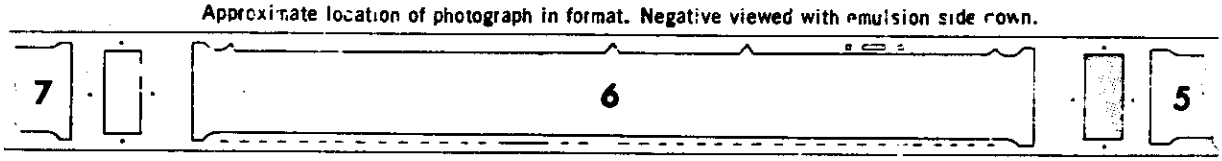

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FIGURE 4. EXAMPLE OF INDEX CAMERA PHOTOGRAPHY

This frame is representative of the general photographic quality achieved by the index camera in this mission.

NPIC K-5865 (12/65)

Index Frame Number	49
Correlates with Fwd Camera:	
Pass	87D
Frame	92
Date of Photography	23 Aug 65
Enlargement Factor	3X
Panoramic Camera Attitude:	
Pitch	15°06'
Roll	-00°30'
Yaw	00°34'
Exposure Setting	f/4.5 @ 1/500 sec

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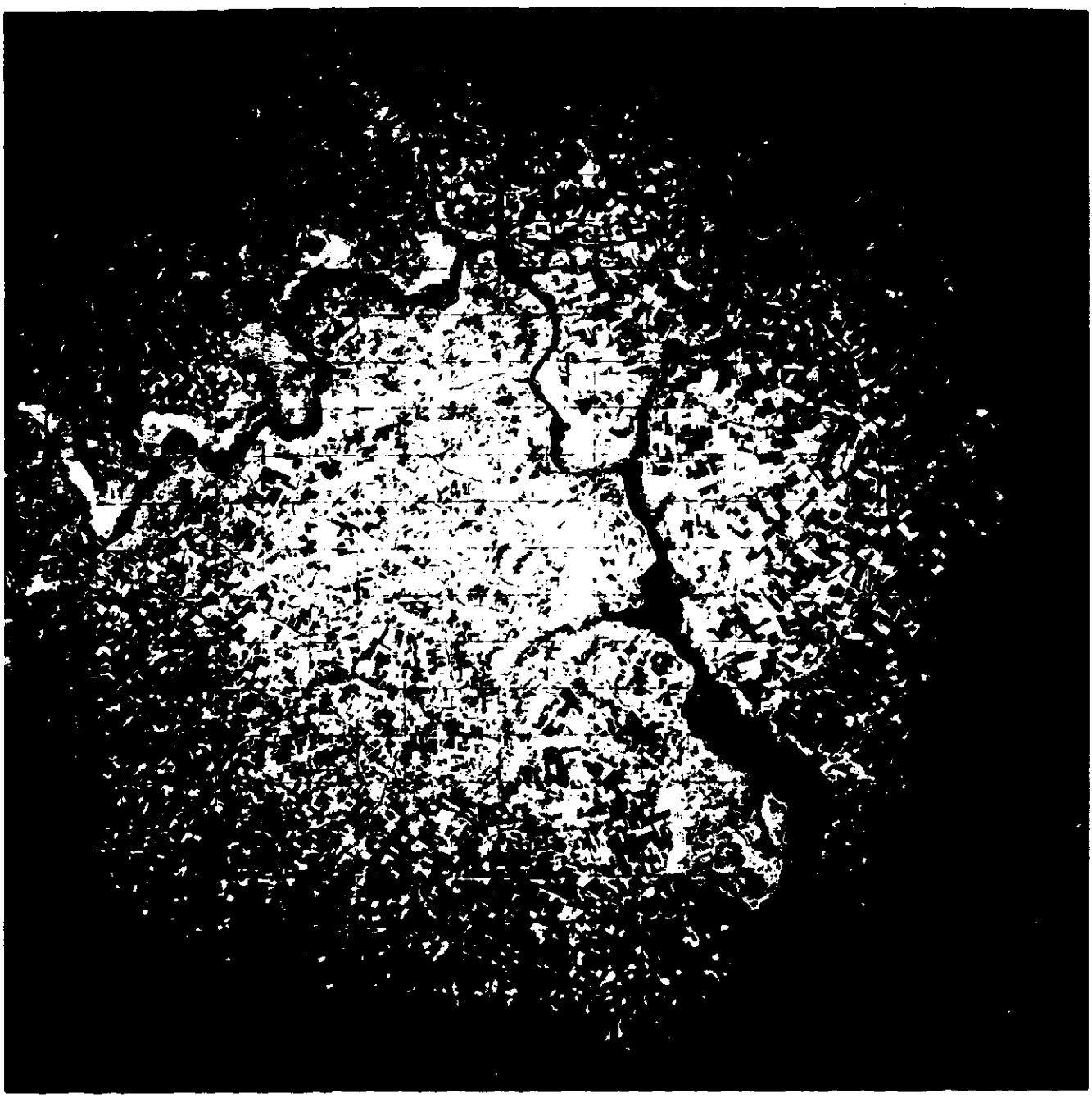
[redacted]



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PART II. FILM PROCESSING

1. Film Footage/Frame Totals

	Mission 1023-1	Mission 1023-2
Master (Fwd) Camera	8,150 feet/2,971 frames	3,953 feet/1,498 frames
Slave (Aft) Camera	8,164 feet/2,966 frames	7,815 feet/2,956 frames
Stellar Camera	46 feet/ 419 frames	30 feet/ 213 frames
Index Camera	90 feet/ 420 frames	52 feet/ 213 frames

Total Footage/Frames, Master (Fwd) Panoramic Camera 12,103 feet/4,469 frames
Total Footage/Frames, Slave (Aft) Panoramic Camera 17,979 feet/5,922 frames

2. Film Processing

Processing information is abstracted from records provided by the processing contractor. Pertinent data includes the number of development level changes executed in processing the panoramic film and the percent of film processed at each of the 3 development levels employed: primary, intermediate, and full. Infrared densitometry is utilized for determination of optimum processing requirements.

In Mission 1023-1, the master panoramic record received 28 development level changes and the slave material required 35 changes. However, an IR scanner malfunction was responsible for underprocessing of a significant portion of the master panoramic film. Notable examples are passes 2D, 6D, 9D, and 23D. No IR malfunction has previously been experienced, and it was not immediately detected. As soon as the malfunction was confirmed, the machine operators shifted to subjective evaluation of the material for determination of optimum development levels. Subsequent investigation revealed that a logic circuitry malfunction had biased the process level indications in the direction of decreased development.

In Mission 1023-2, only 10 processing level changes were made in putting through the master panoramic record but the slave material required 32 changes. The percentages of film processed at each level in both missions are as follows:

	Mission 1023-1		Mission 1023-2	
	Master	Slave	Master	Slave
Primary	19%	0%	0%	0%
Intermediate	54%	39%	19%	34%
Full	27%	61%	81%	66%

A subjective estimate of the overall density levels of the photography acquired in Mission 1023-1 and 1023-2 indicates the following:

Mission 1023-1

	Thin	Medium	Heavy
Master	20%	70%	10%
Slave	10%	75%	15%
Stellar	Adequate to determine the presence of stellar images		
Index	25%	70%	5%

Mission 1023-2

	Thin	Medium	Heavy
Master	20%	70%	10%
Slave	15%	75%	10%
Stellar	Adequate to determine the presence of stellar images		
Index	25%	65%	10%

3. Physical Film Degradations

The overall physical condition of the master and slave panoramic records acquired in Mission 1023-1 is good. A process machine malfunction occurred during the processing of the slave panoramic material from Mission 1023-2, and considerable film damage resulted. Details of the machine malfunction and resultant degradation of the material involved are as follows:

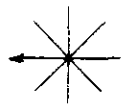
A roller malfunction allowed slack film footage to form up in the dryer. In turn, this caused the film to foul roller action elsewhere in the machine. Approximately 318 feet of film were damaged before the machine stoppage was cleared. All of pass 117D and 26 frames of pass 118D were affected to some degree. Severe stretching elongated frame 39 of pass 117D to 32 inches and reduced the film width to 50mm. Frames 90-94 of the same pass are heavily stained. Remaining damage consists of scratches, creases, minus-density streaks, and similar degradations. In addition, the cuts made to free the fouled film made it necessary to place opaque splices within a number of formats.

FIGURE 3. EXAMPLE OF VIGNETTING INSIDE THE HORIZON FORMAT

NPIC K-5824 (12/65)

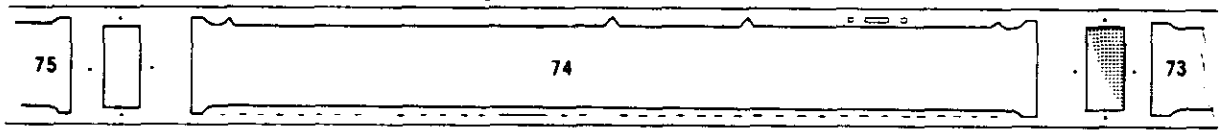
Camera	166
Pass	25D
Frame	73 aft
Date of Photography	20 May 65
Universal Grid Coordinates	Not Applicable
Enlargement Factor	3X
Geographic Coordinates	12-55N 038-13E
Altitude (feet)	663,490
Camera:	
Pitch	-14°45'
Roll	-0°08'
Yaw	0°04'
Local Sun Time	1014
Solar Elevation	63°14'
Solar Azimuth	66°
Exposure (fractions of second)	1/370
Processing Level	Full
Vehicle Azimuth	168°02'

Approximate flight direction on photograph



Approximate scan direction on photograph

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



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 (b) the degree to which a photo 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 degradation 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 optimal 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 superior quality of the photography.

Good: The photography is relatively free of degradations, or limiting weather conditions. Edges and corners of objects 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 but the acuity of the photography is less than optimum. Edges and corners of objects 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 reduced the quality 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 the photography completely precludes detection, identification, and mensuration of cultural details.

2. PI Suitability, Missions 1023-1 and 1023-2

The PI suitability of the photography acquired in Missions 1023-1 and 1023-2 is good. A total of 240 targets was reported in the preliminary PI reports. Mission 1023-1 covered 133 targets and Mission 1023-2 107 targets. Highlights of the PI scan include new identification of 7 missile sites and/or complexes, 3 radar facilities, and 3 nuclear warhead storage sites and confirmation of airfield construction.

The quality of most of the photography is rated from fair to good. Poor-quality coverage is noted in a few cases. Degradation is primarily due to haze and/or cloud shadow effects. Obliquity is also a factor in reducing the effectiveness of the coverage in a number of instances.

The comparatively extensive coverage afforded numerous opportunities to confirm previously suspect activities and to make new identifications. However, the preliminary PI reports represent the initial scan results only, which are accomplished in a relatively short time and prior to final refinement of ephemeris data. Future, more detailed analysis usually develops additional information and may uncover matters of interest not noted in the preliminary scan.

3. Definition of Mission Information Potential (MIP)

The MIP rating assigned to a mission is an arbitrary figure intended to indicate the quality of the best photography obtained in the mission. It is representative of the camera system's maximum capability for recording information as demonstrated by the instruments employed in each mission. In consideration of the information the MIP is intented to convey, photography containing adverse factors such as low solar elevation, poor atmospheric conditions, and similar degradations is eliminated in selection of the MIP example. The MIP rating assigned to a mission is indicative solely of the camera system's photographic capability exclusive of degradations which are not camera-derived. The selected photography may constitute a portion of a frame containing a particular target, an entire frame, or several frames. In any case, the selections do not indicate the success, quality, or PI suitability of the mission as a whole but only the camera system's maximum effort. The criteria which govern selection of suitable MIP examples are as follows:

a. The photography must be comparatively free of cloud cover and/or atmospheric interference.

b. The selected targets should be at or near frame center in order to minimize the effects of obliquity and similar distortive

factors.

c. No photography affected by system malfunctions or inherent degradations can be considered for MIP selection. This eliminates the first few and last few frames of a pass, since these may contain image motion. In addition, the photography must be free of effects induced by vehicle pitch, roll, or yaw deviations from normal.

d. Solar elevation must be near optimum. Overexposed or underexposed photography is not suitable for MIP selections.

e. Preferably, good-contrast targets such as airfields are chosen for comparison with similar targets covered in previous missions.

4. MIP, Missions 1023-1 and 1023-2

Based on the foregoing criteria, frame 8 of pass 63D Fwd and frame 91 of pass 87D Fwd are selected as the MIP examples for Missions 1023-1 and 1023-2. In both cases, the targets that exemplify the MIP (rated at 85) are airfields. Examination of the photography acquired by both panoramic cameras indicates that the master instrument produced slightly better imagery, on the whole. As has been observed in previous missions, such superiority is not consistent. Since the photography is influenced by a number of factors and variables, departures from established quality levels are not uncommon, and a specific target or frame may, at times, appear sharper in the film from either camera, regardless of the general quality trend.

5. Resolution Target Analysis

A number of fixed and mobile resolution targets were covered in the domestic passes. The targets conform with Military Standard 150-A, which calls for an aspect ratio of 5:1. In addition, along-track and cross-track bar group alignments are provided.

The data given below were obtained by viewing the targets at 70X magnification of the original negatives and taking an average of the readings made by a team of 3 photographic analysts. The smallest readable bar widths are given in each case. No conversions to the equivalent lines/millemeter or to ground resolution were made.

Pass	47DE
Frame and Universal Grid Coordinates (Fwd)	2,54.6-12.3
Frame and Universal Grid Coordinates (Aft)	7,35.9-10.7
Target Type and Location	Fixed, Indian Springs, Nev.

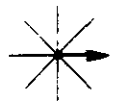
Smallest Distinguishable Bar Width (Fwd)	None Distinguishable
Smallest Distinguishable Bar Width (Aft)	4' 3.625"
Pass	47DE
Frame and Universal Grid Coordinates (Fwd)	3, 35.3-11.8
Frame and Universal Grid Coordinates (Aft)	8, 55.3-11.3
Target Type and Location	Fixed, Pahrump, Nev.
Smallest Distinguishable Bar Width (Fwd)	4' 10"
Smallest Distinguishable Bar Width (Aft)	5' 5.125"
Pass	47DE
Frame and Universal Grid Coordinates (Fwd)	4, 34.7-13.5
Frame and Universal Grid Coordinates (Aft)	8, 56.3-14.8
Target Type and Location	Mobile, Pahrump, Nev.
Smallest Distinguishable Bar Width (Fwd)	None Distinguishable
Smallest Distinguishable Bar Width (Aft)	6' 0"
Pass	77D
Frame and Universal Grid Coordinates (Fwd)	4, 37.4-11.0
Frame and Universal Grid Coordinates (Aft)	10, 53.3-12.0
Target Type and Location	Mobile, Columbus, O.
Smallest Distinguishable Bar Width (Fwd)	8' 0"
Smallest Distinguishable Bar Width (Aft)	None Distinguishable

FIGURE 5. MIP SELECTION, MISSION 1023-1 (FWD CAMERA)

The photography is representative of the best achieved in this mission. The matching aft imagery (Figure 6) is presented for the purpose of comparing the quality of the fwd and aft takes.

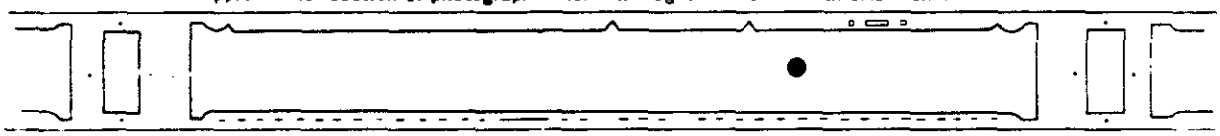
Camera	170
Pass	63D
Frame	8 fwd
Date of Photography	21 Aug 65
Universal Grid Coordinates	66.3 - 11.2
Enlargement Factor	20X
Geographic Coordinates	38-19N 122-01W
Altitude (feet)	608,477
Camera:	
Pitch	14°51'
Roll	-00°06'
Yaw	00°18'
Vehicle Azimuth	156°38'
Local Sun Time	1149
Solar Elevation	63°11'
Solar Azimuth	177°
Exposure	1/303 sec
Processing Level	Full

Approximate flight direction on photograph



Approximate scan direction on photograph

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



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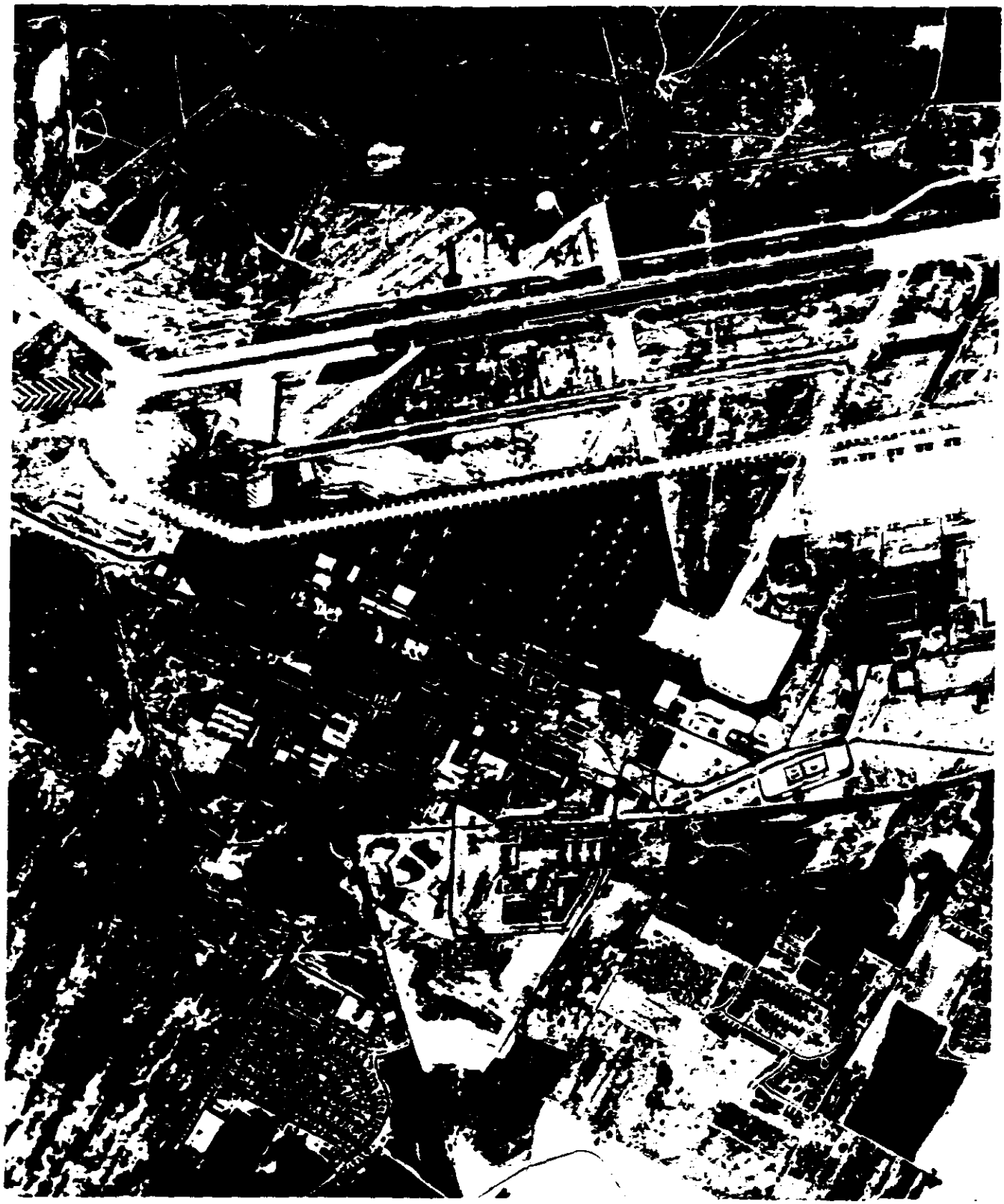
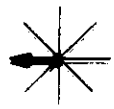


FIGURE 6. MIP MATCHING TARGET, MISSION 1023-1 (AFT CAMERA)

The aft imagery is slightly inferior to the fwd. In general, this is the case throughout the mission although the reverse is occasionally observed.

Camera	171
Pass	63D
Frame	9 aft
Date of Photography	21 Aug 65
Universal Grid Coordinates	24.2-11.0
Enlargement Factor	20X
Geographic Coordinates	38-15N 122-01W
Altitude (feet)	606,781
Camera:	
Pitch	-14°52'
Roll	00°07'
Yaw	00°21'
Vehicle Azimuth	157°01'
Local Sun Time	1149
Solar Elevation	63°16'
Solar Azimuth	177°
Exposure	1/442 sec
Processing Level	Full

Approximate flight direction on photograph



Approximate scan direction on photograph

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

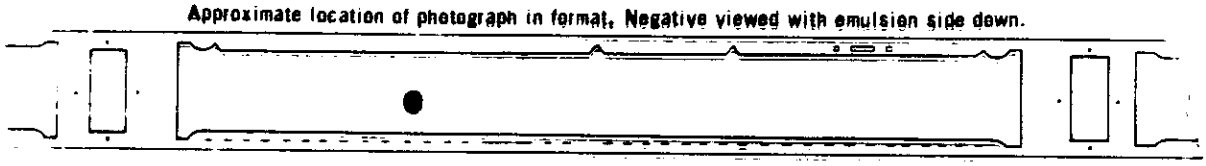


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FIGURE 7. MIP SELECTION, MISSION 1023-2 (FWD CAMERA)

The aft match is presented in Figure 8. Again, the fwd photography is superior to the aft. Note the 5 objects aligned just off the taxiway. These are not recorded on the aft matching frame. (Located on the illustration at a point 3.35 inches in from the left margin and 4.40 inches up from the bottom).

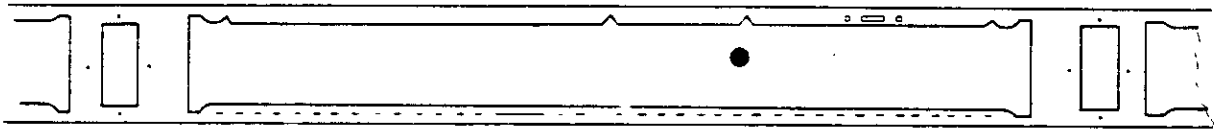
NPIC K-5868 (12/65

Camera	170
Pass	87D
Frame	91 fwd
Date of Photography	23 Aug 65
Universal Grid Coordinates	56.7 - 13.7
Enlargement Factor	20X
Geographic Coordinates	48-26N 43-24E
Altitude (feet)	629,564
Camera:	
Pitch	15°06'
Roll	-00°30'
Yaw	00°34'
Vehicle Azimuth	150°55'
Local Sun Time	1056
Solar Elevation	50°10'
Solar Azimuth	151°
Exposure	1/289 sec
Processing Level	Full

Approximate flight direction on photograph

Approximate scan direction on photograph

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



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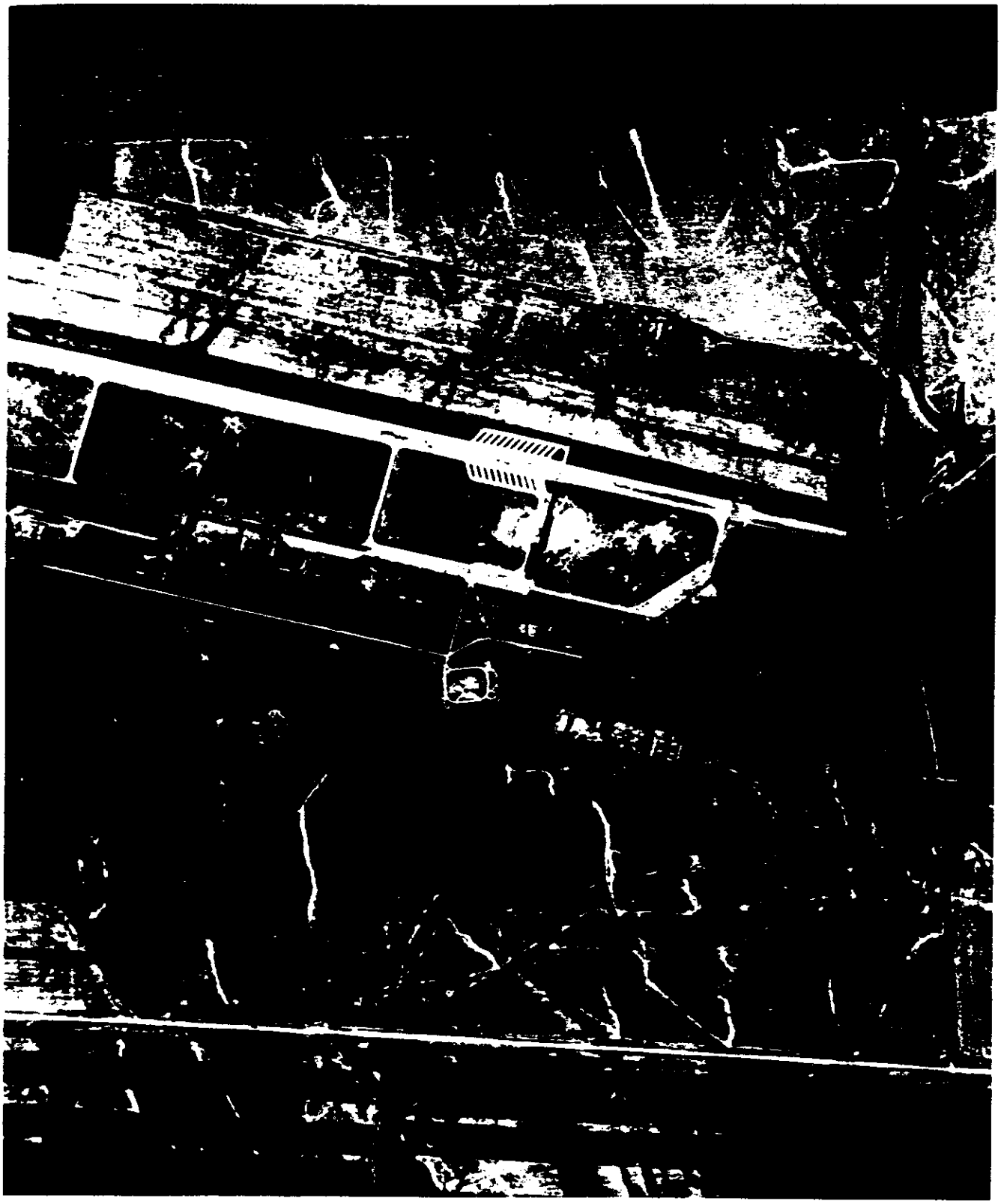


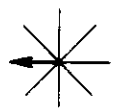
FIGURE 8. MIP MATCHING TARGET, MISSION 1023-2 (AFT CAMERA)

An unusual combination of camera viewing angle and local atmospheric conditions obliterate the 5 objects which are readily observed just off the taxiway in the fwd photography.

NPIC K-5869 (12/65)

Camera	171
Pass	87D
Frame	97 aft
Date of Photography	23 Aug 65
Universal Grid Coordinates	34.0 - 10.3
Enlargement Factor	20X
Geographic Coordinates	48-25N 43-22E
Altitude (feet)	627,078
Camera:	
Pitch	-13°37'
Roll	-00°31'
Yaw	00°37'
Vehicle Azimuth	151°30'
Local Sun Time	1056
Solar Elevation	50°11'
Solar Azimuth	151°
Exposure	1/431 sec
Processing Level	Full

Approximate flight direction on photograph



Approximate scan direction on photograph

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

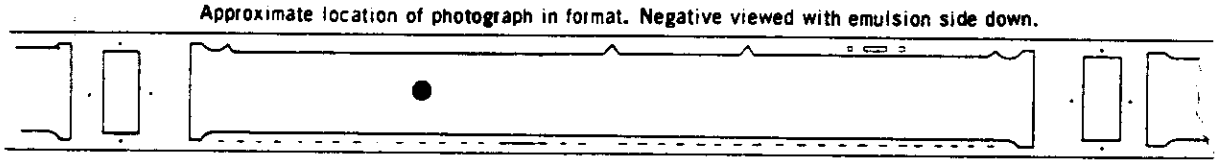


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FIGURE 9. EXAMPLE OF OUT-OF-FOCUS PHOTOGRAPHY, FWD CAMERA

The out-of-focus area is located on the frequency mark edge of the take-up end of the frame. In Mission 1023-1, the out-of-focus condition is more prominent at the supply end.

Camera	170
Pass	87D
Frame	91 fwd
Date of Photography	23 Aug 65
Universal Grid Coordinates	74.4 - 09.5
Enlargement Factor	20X
Geographic Coordinates	48-26N 43-24E
Altitude (feet)	629,564
Camera:	
Pitch	15°06'
Roll	-00°30'
Yaw	00°34'
Vehicle Azimuth	150°55'
Local Sun Time	1056
Solar Elevation	50°10'
Solar Azimuth	151°
Exposure	1/289 sec
Processing Level	Full

Approximate flight direction on photograph

Approximate scan direction on photograph

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

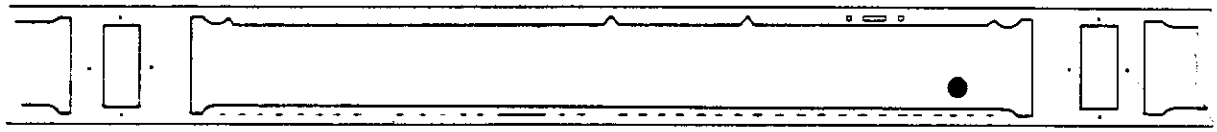

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FIGURE 10. MATCHING IMAGERY TO OUT-OF-FOCUS EXAMPLE, AFT CAMERA

The photographic quality is good despite the proximity of this area to the edge of the format. The imagery in Figure 9 should have been as good or better.

Camera	171
Pass	87D
Frame	97 aft
Date of Photography	23 Aug 65
Universal Grid Coordinates	15.7 - 09.5
Enlargement Factor	20X
Geographic Coordinates	48-25N 43-22E
Altitude (feet)	627,078
Camera:	
Pitch	-13°37'
Roll	-00°31'
Yaw	00°37'
Vehicle Azimuth	151°30'
Local Sun Time	1056
Solar Elevation	50°11'
Solar Azimuth	151°
Exposure	1/431 sec
Processing Level	Full

Approximate flight direction on photograph

Approximate scan direction on photograph

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

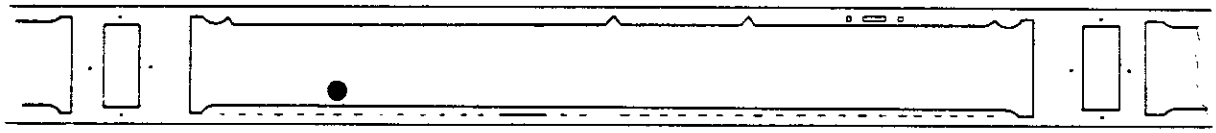

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FIGURE 11. EXAMPLE OF HAZE-DEGRADED PHOTOGRAPHY (FWD CAMERA)

Haze condition such as this is a prime factor in the reduction of PI suitability. Only gross cultural details may be defined.

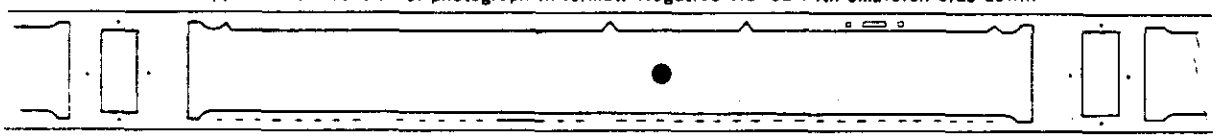
NPIC K-5872 (12/68)

Camera	170
Pass	87D
Frame	7 fwd
Date of Photography	23 Aug 65
Universal Grid Coordinates	49.6 - 11.3
Enlargement Factor	20X
Geographic Coordinates	59-49N 30-06E
Altitude (feet)	675,937
Camera:	
Pitch	14°39'
Roll	00°11'
Yaw	00°06'
Vehicle Azimuth	138°21'
Local Sun Time	1000
Solar Elevation	36°13'
Solar Azimuth	142°
Exposure	1/386 sec
Processing Level	Full

Approximate flight direction on photograph

Approximate scan direction on photograph

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



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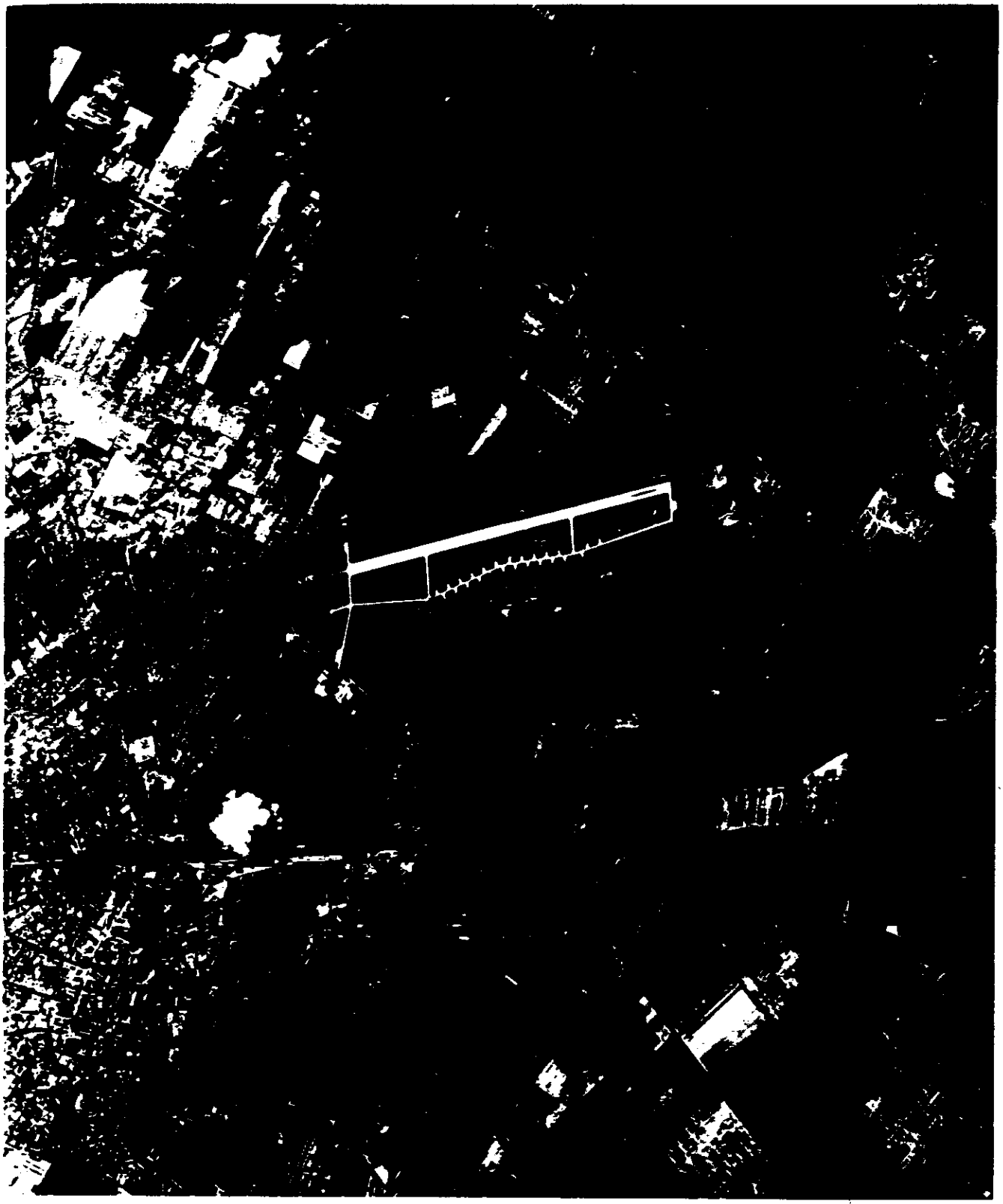

[redacted]

FIGURE 12. EXAMPLE OF HAZE-DEGRADED PHOTOGRAPHY (AFT CAMERA)

Degradation is similar to that noted in the fwd photography. Ocassionally, however, the difference in viewing angles between the cameras results in less degradation of one photograph or the other.

NPIC K-6073 (12/65)

Camera	171
Pass	87D
Frame	13 aft
Date of Photography	23 Aug 65
Universal Grid Coordinates	41.6 - 11.0
Enlargement Factor	20X
Geographic Coordinates	59-41N 30-07E
Altitude (feet)	671, 883
Camera:	
Pitch	-15°20'
Roll	00°12'
Yaw	00°09'
Vehicle Azimuth	139°25'
Local Sun Time	1000
Solar Elevation	36°07'
Solar Azimuth	142°
Exposure	1/396 sec
Processing Level	Full

Approximate flight direction on photograph

Approximate scan direction on photograph

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

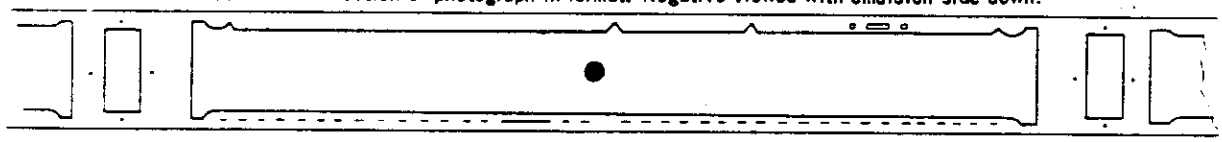

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FIGURE 13. EXAMPLE OF OBLIQUITY IN PANORAMIC PHOTOGRAPHY

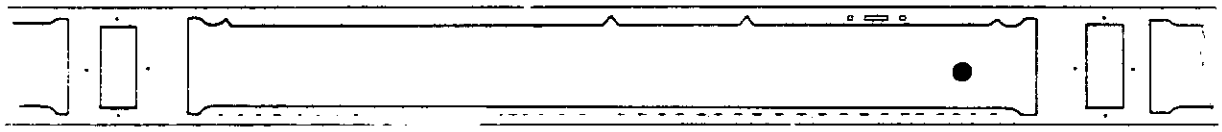
Obliquity is another significant factor in the reduction of PI suitability, particularly with regard to distortion of form and inaccuracy of mensuration.

Camera	170
Pass	25D
Frame	54 fwd
Date of Photography	19 Aug 65
Universal Grid Coordinates	77.5 - 11.2
Enlargement Factor	10X
Geographic Coordinates	47-00N 20-14E
Altitude (feet)	642,880
Camera:	
Pitch	14°41'
Roll	-00°01'
Yaw	00°06'
Vehicle Azimuth	151°56'
Local Sun Time	1200
Solar Elevation	55°30'
Solar Azimuth	180°
Exposure	1/278 sec
Processing Level	Intermediate

Approximate flight direction on photograph

Approximate scan direction on photograph

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



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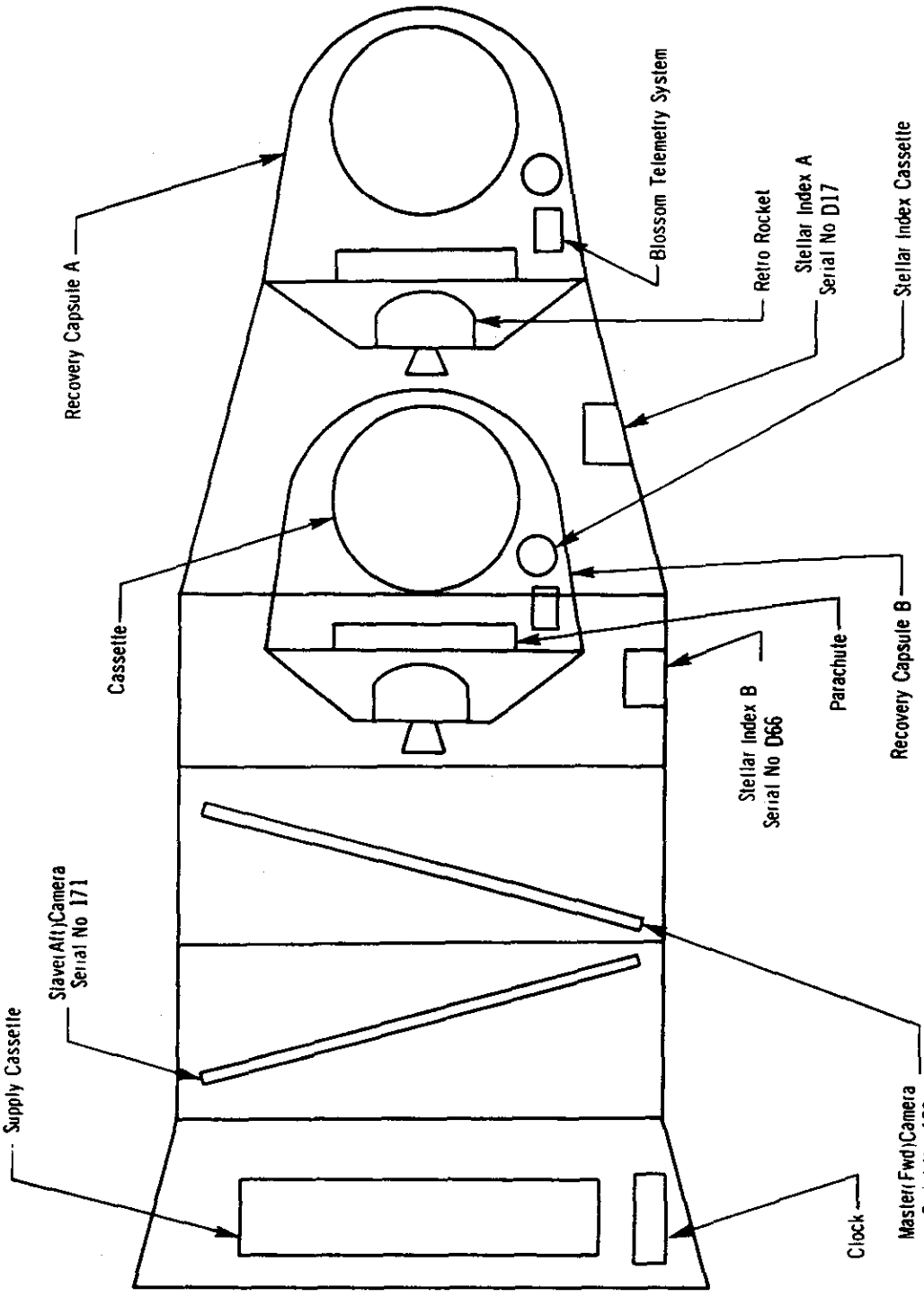
APPENDIX A. SYSTEM SPECIFICATIONS

1. Cameras:

	Master Panoramic	Master Port Horizon	Master Stbd Horizon	Slave Panoramic	Slave Port Horizon	Slave Stbd Horizon	Mission 1023-1		Mission 1023-2	
							Stellar	Index	Stellar	Index
Camera No	170	NA	NA	171	NA	NA	17	17	66	66
Lens Serial No	1592435	*	816639	1512435	816638	*	10789	811715	10710	817457
Reseau Grid No	NA	NA	NA	NA	NA	NA	82	19	72	75
Slit Width (in)	0.225	NA	NA	0.150	NA	NA	NA	NA	NA	NA
Aperture	f/3.5	f/6.8	f/8.0	f/3.5	f/8.0	f/6.8	f/1.8	f/4.5	f/1.8	f/4.5
Exposure (sec)	NA	1/100	1/100	NA	1/100	1/100	2	1/500	2	1/500
Filter (Wratten)	25	25	25	21	25	25	None	21	None	21
Focal Length (mm)	609.602	*	56.64	609.602	54.84	*	84	38.27	84	38.49
Film Length (ft)	16,000	NA	NA	16,000	NA	NA	46	90	30	52
Splices	4	NA	NA	3	NA	NA	NA	NA	NA	NA
Emulsion No	208-1-5-5	208-1-5-5	208-1-5-5	208-1-5-5	208-1-5-5	208-1-5-5	124-3585	104-1465	124-3585	104-1465
Film Type	3404	3404	3404	3404	3404	3404	3401	3400	3401	3400
Static Res Data:										
High Contrast	245 L/mm	*	*	255 L/mm	*	*	*	70(A)	*	70.5(A)
Low Contrast	138 L/mm	NA	NA	131 L/mm	NA	NA	*	*	*	*
Dynamic Res Data:										
I High Contrast	201 L/mm	NA	NA	185 L/mm	NA	NA	*	*	*	*
I Low Contrast	133 L/mm	NA	NA	127 L/mm	NA	NA	*	*	*	*
P High Contrast	206 L/mm	NA	NA	179 L/mm	NA	NA	*	*	*	*
P Low Contrast	116 L/mm	NA	NA	108 L/mm	NA	NA	*	*	*	*

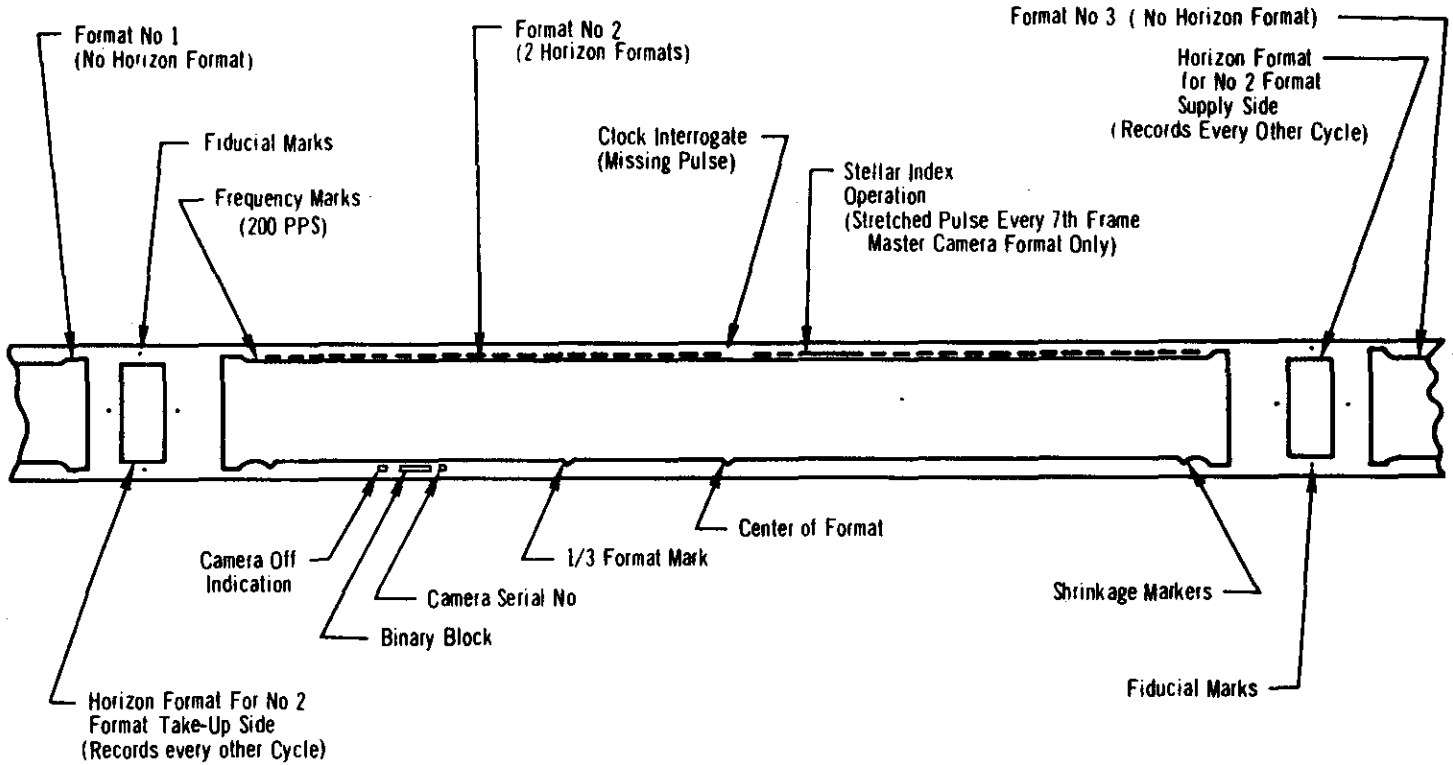
NA - Not Applicable (A) AWAR *Not Available

2. VEHICLE CONFIGURATION AND EQUIPMENT LAYOUT



NPIC K-5875 (12/65)

3. PANORAMIC FORMAT CONFIGURATION



Master(Fwd)Panoramic Camera No 170
Viewed With Negative Emulsion Down
Direction of Film Transport ←
Direction of Scan →
Direction of Vehicle Motion ↓

Slave(Aft)Panoramic Camera No 171
Viewed With Negative Emulsion Down
Direction of Film Transport ←
Direction of Scan →
Direction of Vehicle Motion ↑

APPENDIX B. DENSITY READINGS

The following pages contain a compilation of the stellar density values, obtained with a Macbeth QuantaLog Densitometer, Model EP 1000, fitted with an ET 20 attachment and an 0.05 millimeter aperture.

Stellar Camera No D17/Reseau No 82 (Mission 1023-1)

Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Pass	Frame	Dmax	Dmin	Delta	Gross Fog
1D	1	1.72	0.30	1.42	0.21	42D	231	2.10	0.42	1.68	0.18
	7	1.99	0.36	1.63	0.17		240	1.38	0.27	1.11	0.20
2D	8	1.18	0.25	0.93	0.16	47DE	241	2.07	0.41	1.66	0.20
	13	1.66	0.28	1.38	0.18		246	1.81	0.38	1.43	0.20
5D	14	1.67	0.32	1.35	0.16	50D	247	2.10	0.34	1.76	0.19
	19	1.94	0.34	1.60	0.15		253	1.82	0.33	1.49	0.20
6D	20	1.82	0.32	1.50	0.17	53D	254	1.78	0.31	1.47	0.19
	26	1.76	0.35	1.41	0.16		283	1.31	0.28	1.03	0.17
7D	27	2.00	0.35	1.65	0.16	54D	284	2.06	0.41	1.65	0.18
	43	1.98	0.38	1.60	0.16		305	2.21	0.42	1.79	0.18
9D	44	2.17	0.38	2.19	0.17	55D	306	2.04	0.35	1.69	0.18
	59	1.85	0.40	1.45	0.22		323	2.14	0.41	1.73	0.21
[illegible]	62	1.80	0.42	1.38	0.21	56D	324	2.34	0.43	1.91	0.23
	69	1.88	0.39	1.49	0.16		337	1.80	0.38	1.42	0.21
[illegible]	70	2.04	0.47	1.57	0.18	63D	338	1.84	0.39	1.45	0.20
	71	2.00	0.45	1.55	0.17		343	1.86	0.47	1.39	0.20
21D	72	2.21	0.45	1.76	0.17	68D	344	1.94	0.49	1.45	0.20
	86	1.93	0.40	1.53	0.16		356	1.98	0.48	1.50	0.19
23D	87	2.14	0.38	1.76	0.16	69D	357	1.82	0.40	1.42	0.20
	106	2.28	0.47	1.81	0.17		379	1.52	0.33	1.19	0.18
24D	107	2.30	0.51	1.79	0.17	70D	380	1.74	0.37	1.37	0.19
	122	1.81	0.33	1.48	0.17		400	2.38	0.52	1.86	0.18
25D	124	2.03	0.36	1.67	0.17						
	136	1.98	0.37	1.61	0.19						
26D	137	2.01	0.36	1.65	0.20	DMax Range 1.31-2.56			Av DMax 1.95		
	146	1.59	0.33	1.26	0.18	Dmin Range 0.25-0.51			Av Dmin 0.39		
31D	147	2.28	0.48	1.80	0.22	Gross Fog Range 0.15-0.22			Av Gross Fog 0.18		
	150	2.34	0.50	1.84	0.19						
36D	151	2.18	0.45	1.73	0.19						
	161	1.54	0.32	1.22	0.19						
37D	162	2.08	0.47	1.61	0.19						
	183	2.46	0.45	2.01	0.18						
38D	184	1.83	0.32	1.51	0.18						
	193	2.56	0.45	2.11	0.18						
39D	194	1.85	0.42	1.23	0.18						
	207	2.08	0.49	1.59	0.18						
40D	208	2.08	0.38	1.70	0.18						
	228	2.32	0.44	1.88	0.18						

Stellar Camera No D66/Reseau No 72 (Mission 1023-2)

Pass	Frame	Dmax	Dmin	Delta	Gross Fog
83D	2	2.39	0.95	1.44	0.18
	12	1.76	0.57	1.19	0.21
84D	13	1.82	0.58	1.24	0.23
	24	1.95	0.57	1.38	0.20
86D	25	2.02	0.58	1.44	0.23
	35	2.22	0.77	1.45	0.18
87D	36	2.26	0.73	1.53	0.20
	59	1.39	0.48	0.91	0.21
88D	61	1.97	0.43	1.54	0.18
	77	2.40	0.56	1.84	0.19
89D	78	1.49	0.45	1.04	0.21
	83	1.24	0.39	0.85	0.20
90D	84	1.71	0.56	1.15	0.19
	90	1.82	0.58	1.24	0.19
93D	91	1.73	0.53	1.20	0.19
	101	1.35	0.39	0.96	0.20
94D	102	1.82	0.45	1.37	0.24
	110	2.06	0.72	1.34	0.20
99D	111	2.13	0.59	1.54	0.16
	124	2.19	0.71	1.48	0.20
100D	125	1.66	0.43	1.23	0.21
	142	1.60	0.44	1.16	0.19
101D	143	2.19	0.84	1.35	0.20
	167	2.18	0.79	1.39	0.20
102D	168	2.24	0.69	1.55	0.18
	171	1.92	0.64	1.28	0.17
133D	172	2.36	1.03	1.33	0.18
134D	173	2.98	1.14	1.84	0.22
	197	1.66	0.58	1.08	0.19
135D	198	2.11	0.86	1.25	0.20
	213	1.58	0.52	1.06	0.20

Dmax Range 1.24-2.40 Av Dmax 1.94
Dmin Range 0.39-1.14 Av Dmin 0.63
Gross Fog Range 0.16-0.24 Av Gross Fog 0.20

TOP SECRET RUFF
NO FOREIGN DISSEM

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APPENDIX C. 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 taxiways 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 a step 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 SPPF facility. The location of the traces was directed by representatives from NPIC at SPPF. 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 mm/minute and a chart speed of 4 inches/minute was used for a recording-to-specimen expansion of 2032:1. One inch of the recording equals 12.5 microns of 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, 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 SPPF Technical Report No. 101-31 (page 79-82). The edge orientation angle is determined in the microdensitometer and is 0 degree 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.

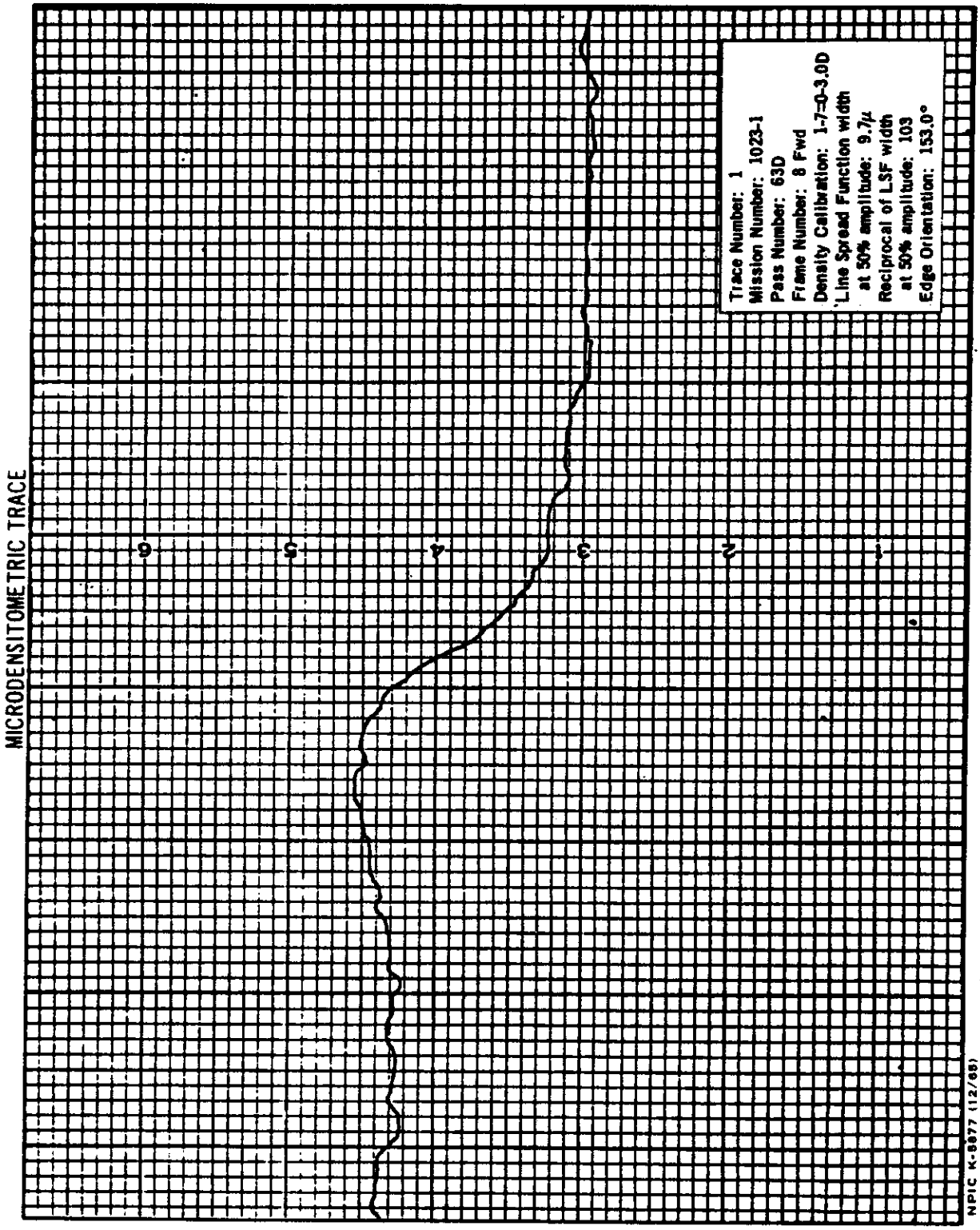
The edge traces were made on the original negative of this mission. The imagery traced is contained in the frames considered to be typical of the best in the mission.

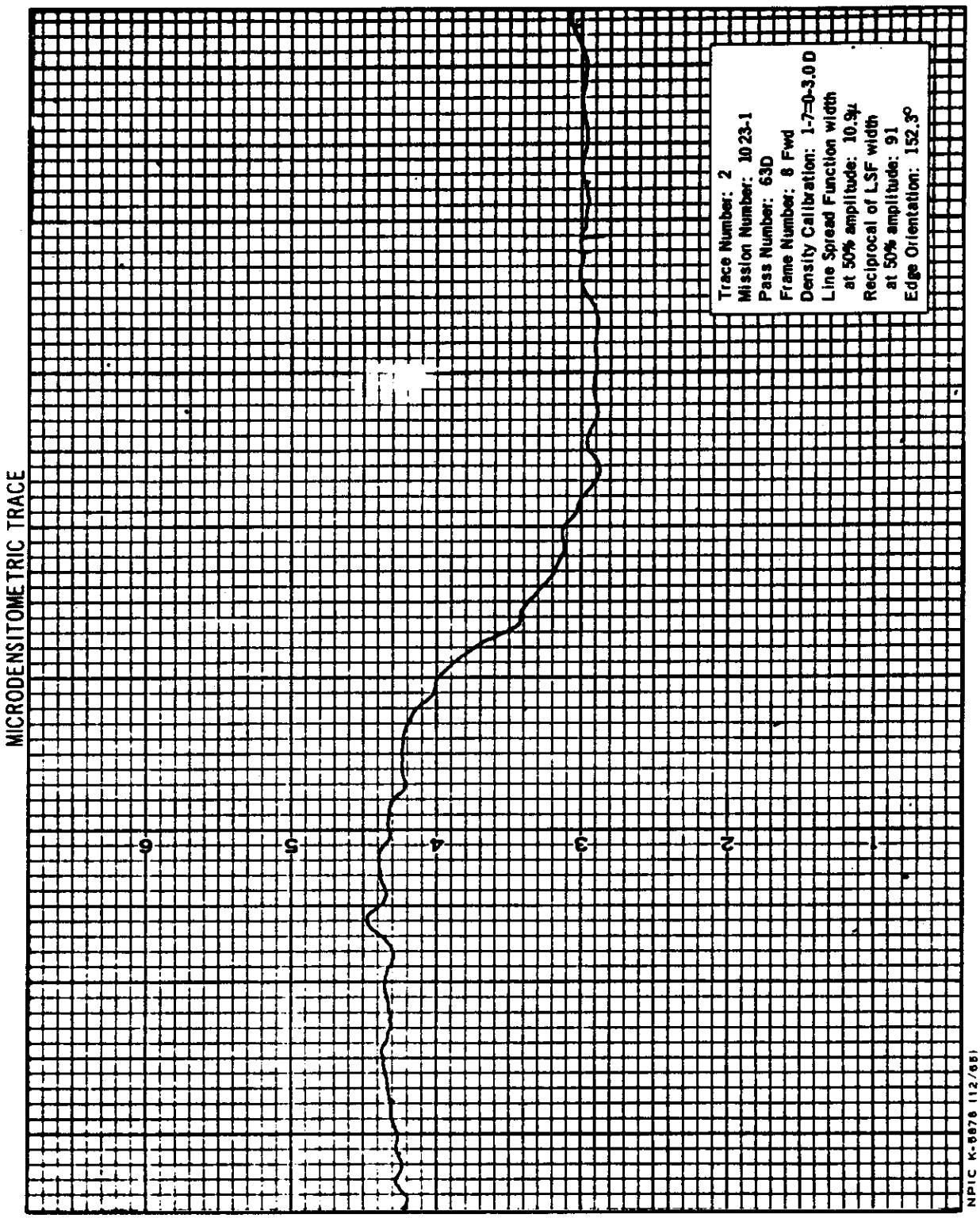
2. Edge Traces, Missions 1023-1 and 1023-2

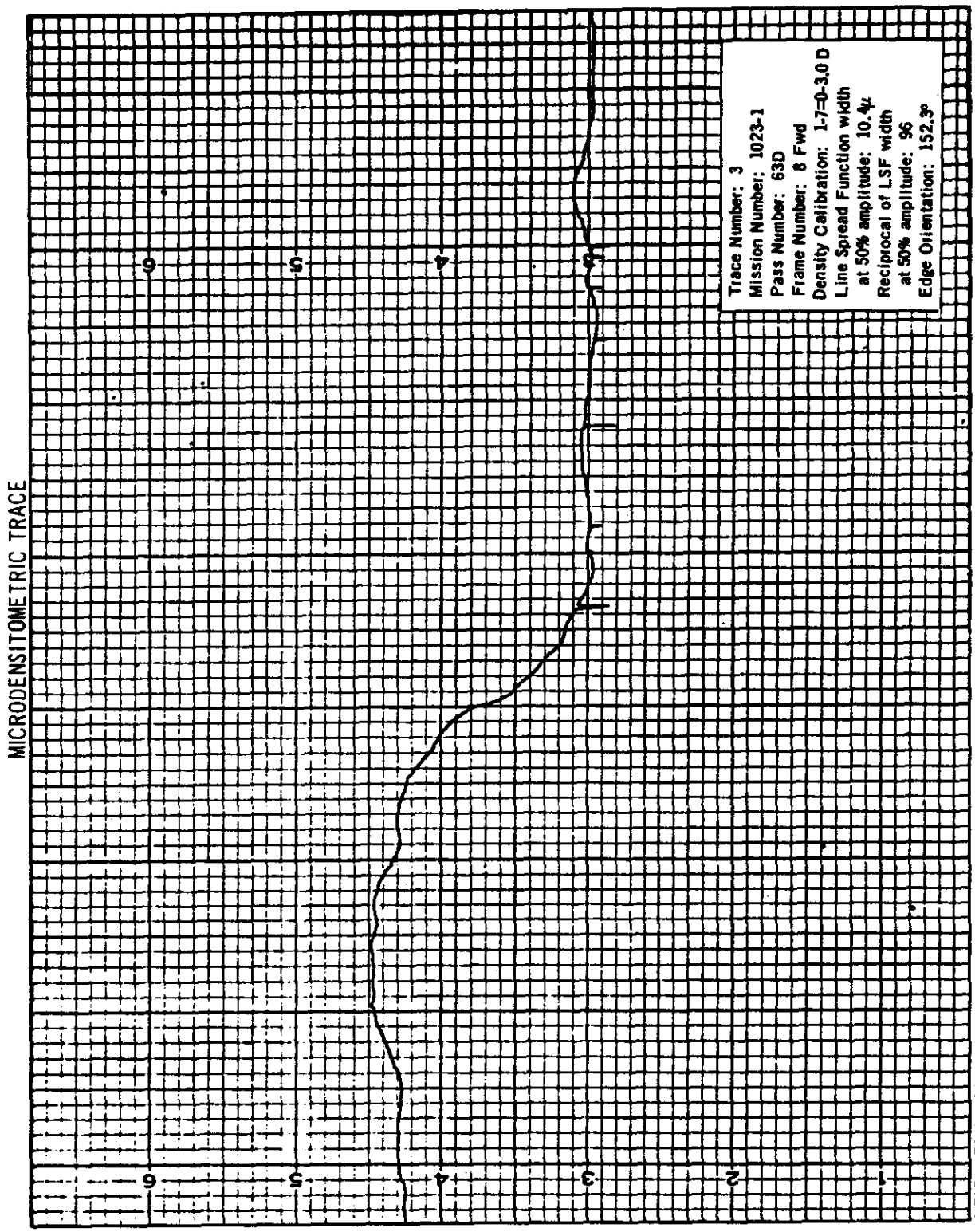
Trace Number	Pass/ Frame	Line Spread Function		MTF/AIM Intersect	Edge Orientation
		50% Width In Microns	1000/50% Width		
1	63D/008F	9.7	103	100	153.0°
2	63D/008F	10.9	91	95	152.3°
3	63D/008F	10.4	96	97	152.3°
4	63D/008F	9.1	110	81	152.0°
5	63D/008F	9.5	105	117	152.0°
6	87D/091F	12.0	83	76	166.0°
7	87D/091F	9.4	106	104	165.9°
8	87D/091F	10.8	92	93	165.9°

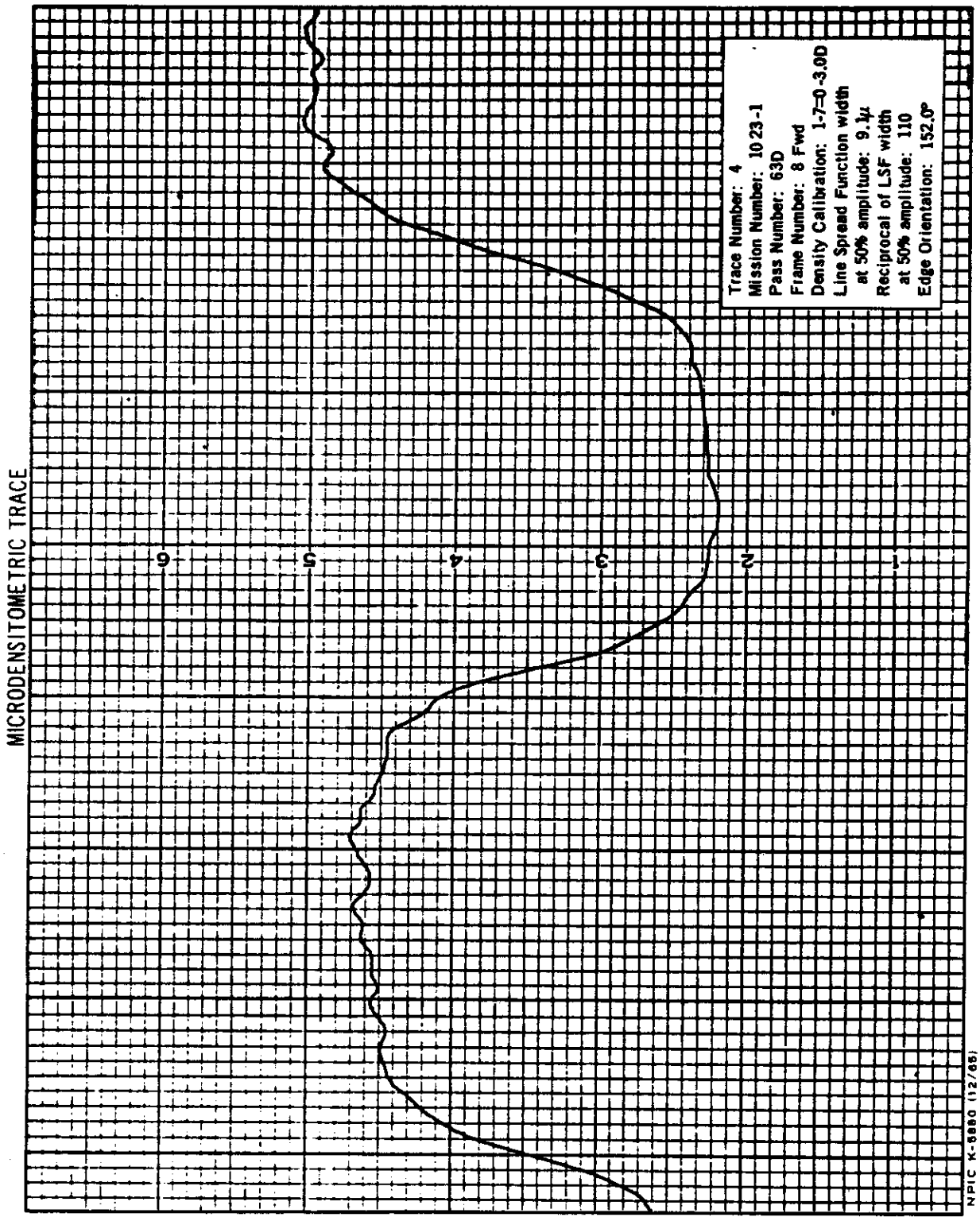
NOTE

Photographic reproductions of the microdensitometric trace targets selected in Mission 1023-1 (traces 1-5) are not available. Such targets are normally culled from the area covered by the MIP target illustration. However, in this case the traces were run on targets outside of that area. The publication deadline precludes reproduction of these targets for inclusion in this report.


MICRODENSITOMETRIC TRACE
6
5
4
3
2
1
Trace Number: 1
Mission Number: 1023-1
Pass Number: 63D
Frame Number: 8 Fwd
Density Calibration: 1-7=0-3.0D
Line Spread Function width
at 50% amplitude: 9.7μ
Reciprocal of LSF width
at 50% amplitude: 103
Edge Orientation: 153.0°
NPIC K-8877 (12/68)


MICRODENSITOMETRIC TRACE
6
5
4
3
2
1
Trace Number: 2
Mission Number: 1023-1
Pass Number: 63D
Frame Number: 8 Fwd
Density Calibration: 1-7=0-3.0 D
Line Spread Function width
at 50% amplitude: 10.9μ
Reciprocal of LSF width
at 50% amplitude: 91
Edge Orientation: 152.3°
NPIC K-6878 (12/65)


MICRODENSITOMETRIC TRACE
Trace Number: 3
Mission Number: 1023-1
Pass Number: 63D
Frame Number: 8 Fwd
Density Calibration: 1.7-0-3.0 D
Line Spread Function width
at 50% amplitude: 10.4μ
Reciprocal of LSF width
at 50% amplitude: 96
Edge Orientation: 152.3°
NPIC K-5879 (12/68)


MICRODENSITOMETRIC TRACE
6
5
4
3
2
1
Trace Number: 4
Mission Number: 1023-1
Pass Number: 63D
Frame Number: 8 Fwd
Density Calibration: 1.7=0 -3.0D
Line Spread Function width
at 50% amplitude: 9.1μ
Reciprocal of LSF width
at 50% amplitude: 110
Edge Orientation: 152.0°
NPIC K-5880 (12/66)

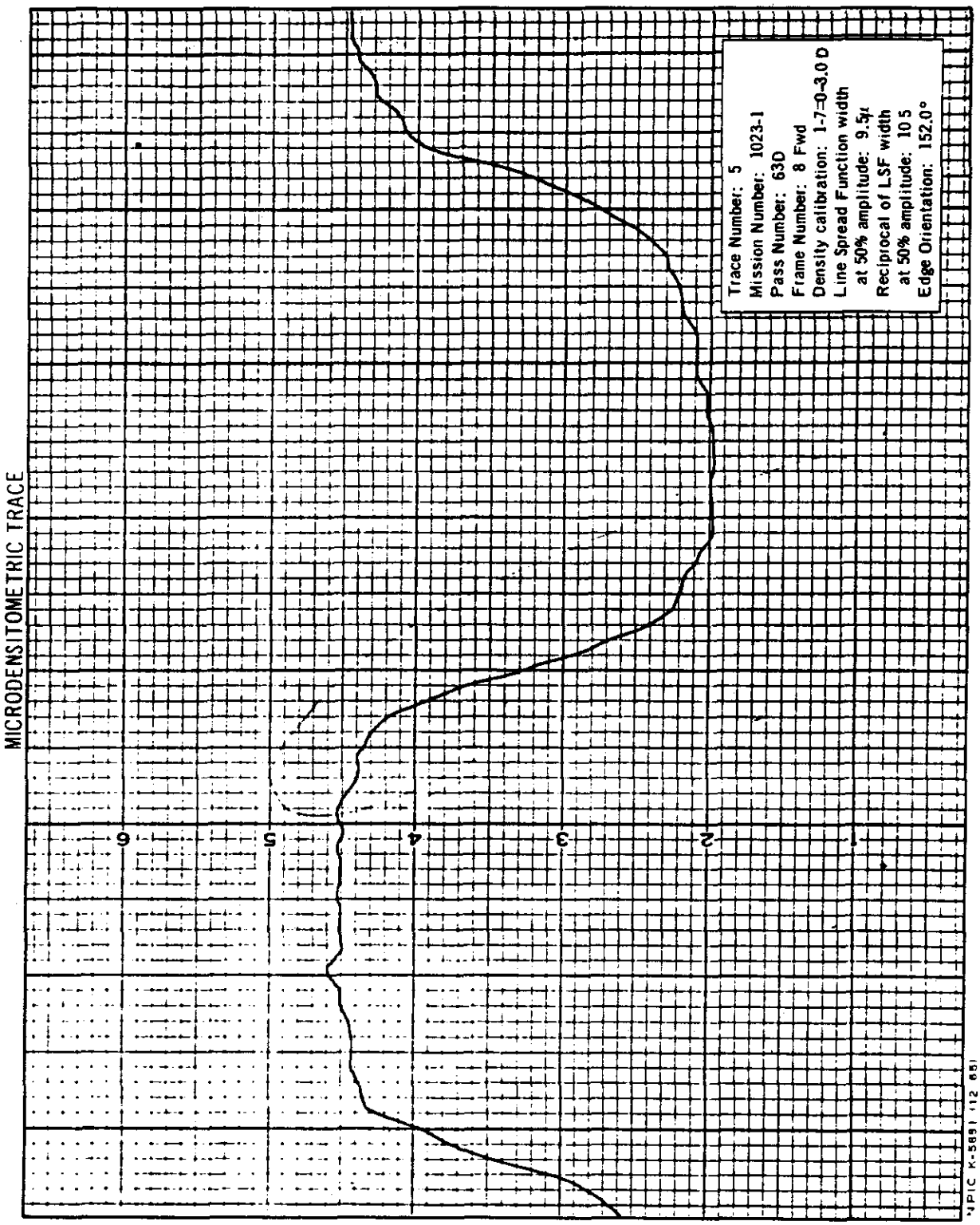
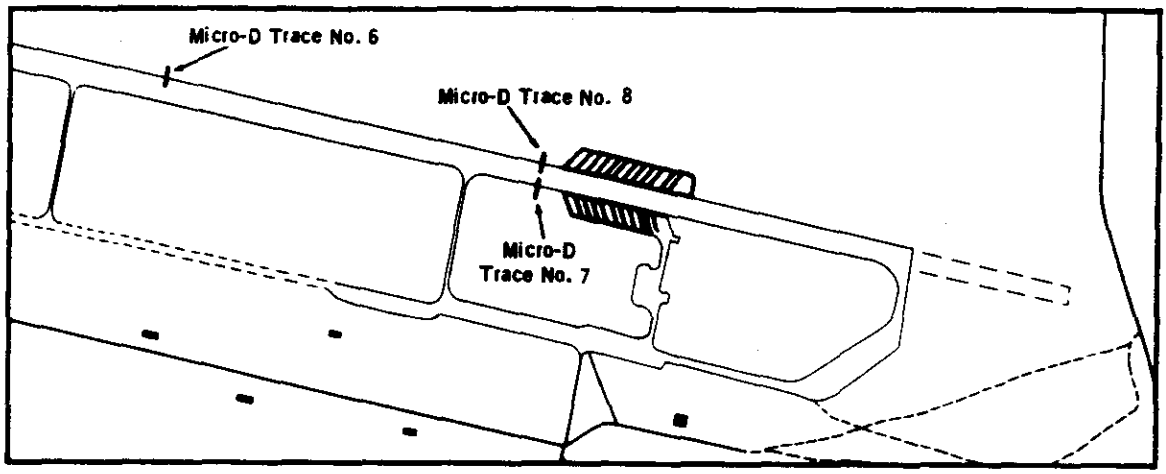

MICRODENSITOMETRIC TRACE
Trace Number: 5
Mission Number: 1023-1
Pass Number: 63D
Frame Number: 8 Fwd
Density calibration: 1-7=0-3.0 D
Line Spread Function width
at 50% amplitude: 9.5μ
Reciprocal of LSF width
at 50% amplitude: 10 5
Edge Orientation: 152.0°
6
5
4
3
2
1

FIGURE 14. TARGETS, MICRODENSITOMETRIC TRACES, MISSION 1023-2

Traces 6 - 8 are indicated on the diagram facing the photographic reproduction of the target area, which is the MIP selection for Mission 1023-2.

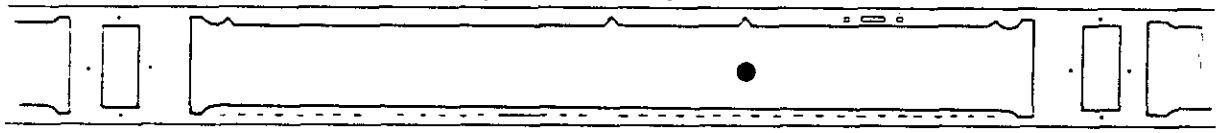
Camera	170
Pass	87D
Frame	91 fwd
Date of Photography	23 Aug 65
Universal Grid Coordinates	56.7 - 13.7
Enlargement Factor	20X
Geographic Coordinates	48-26N 43-24E
Altitude (feet)	629,564
Camera:	
Pitch	15°06'
Roll	-00°30'
Yaw	00°34'
Vehicle Azimuth	150°55'
Local Sun Time	1056
Solar Elevation	50°10'
Solar Azimuth	151°
Exposure	1/289 sec
Processing Level	Full

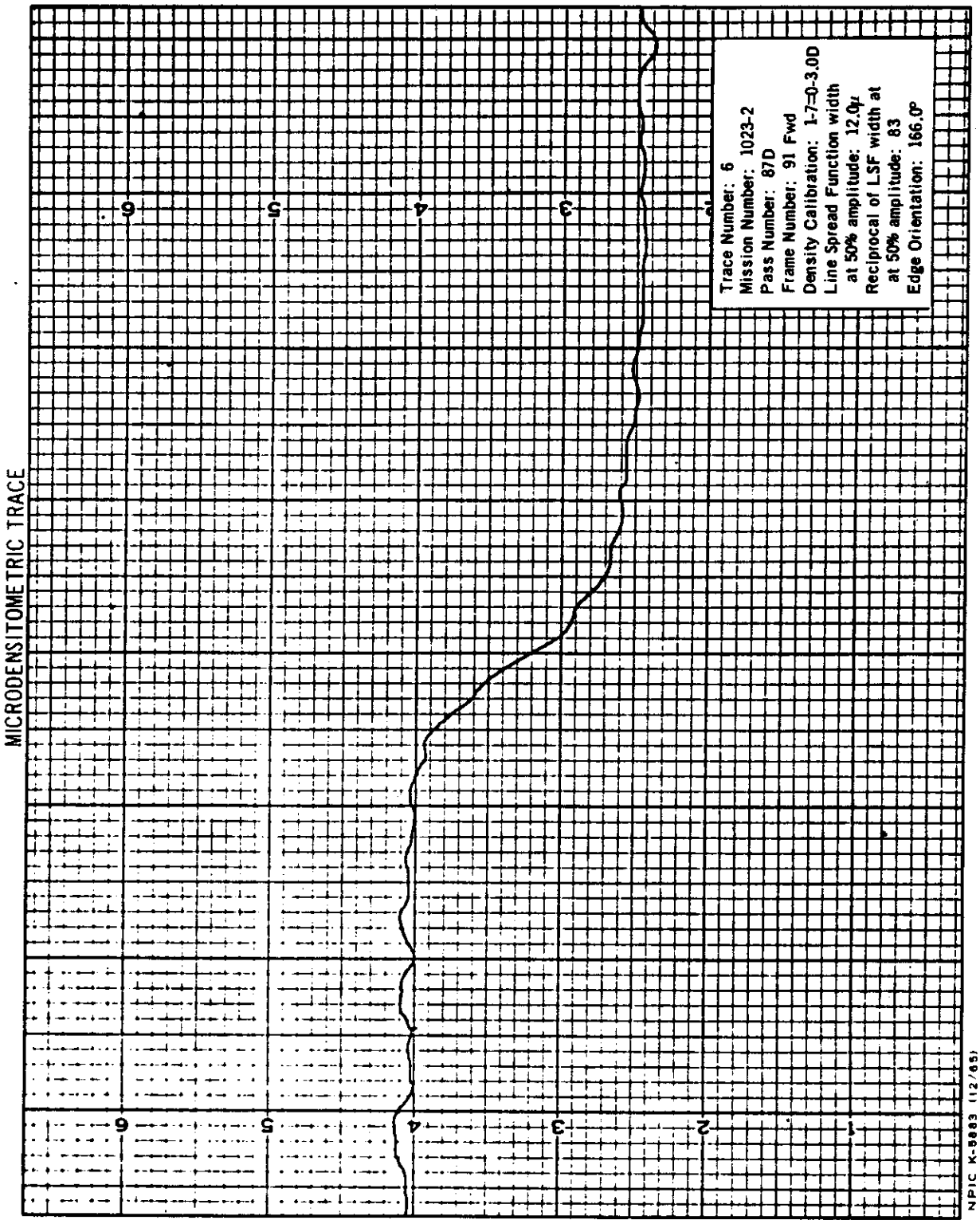


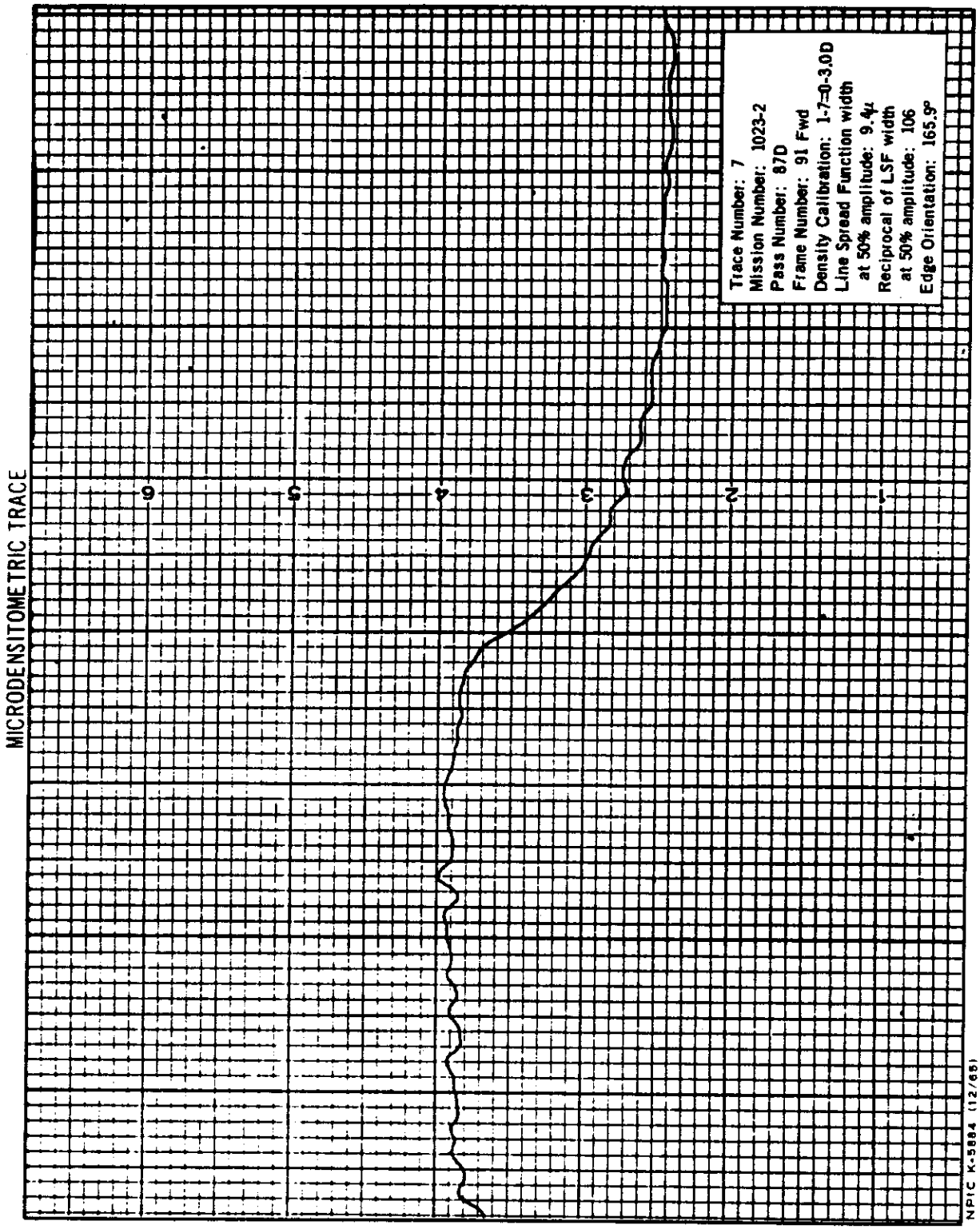
Approximate flight direction on photograph

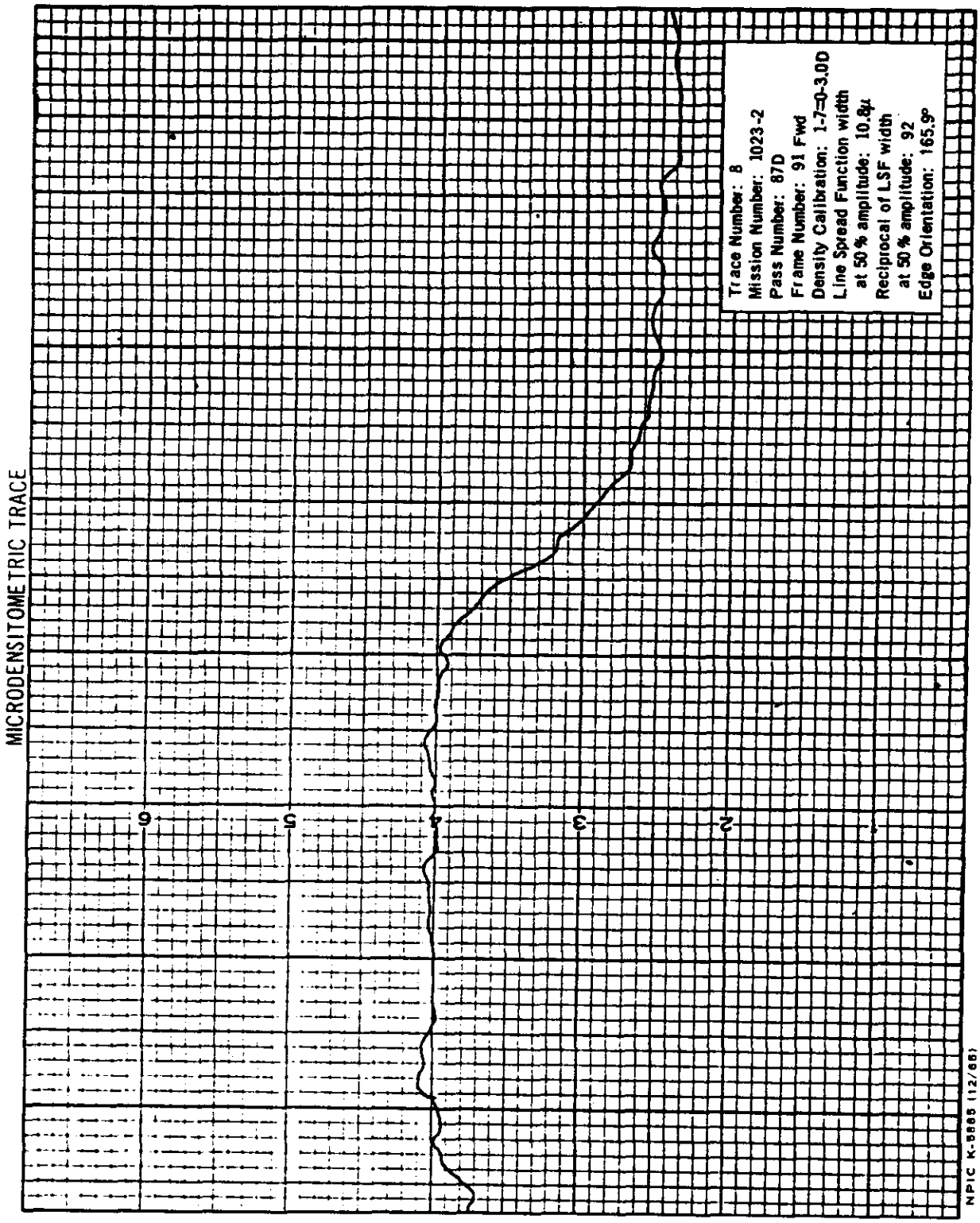
Approximate scan direction on photograph

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




MICRODENSITOMETRIC TRACE
Trace Number: 6
Mission Number: 1023-2
Pass Number: 87D
Frame Number: 91 Fwd
Density Calibration: 1-7=0-3.0D
Line Spread Function width
at 50% amplitude: 12.0μ
Reciprocal of LSF width at
at 50% amplitude: 83
Edge Orientation: 166.0°
NPIC K-5883 (12/65)


MICRODENSITOMETRIC TRACE
6
5
4
3
2
1
Trace Number: 7
Mission Number: 1023-2
Pass Number: 87D
Frame Number: 91 Fwd
Density Calibration: 1-7=0-3.0D
Line Spread Function width
at 50% amplitude: 9.4μ
Reciprocal of LSF width
at 50% amplitude: 106
Edge Orientation: 165.9°
NPIC K-5884 (12/65)


MICRODENSITOMETRIC TRACE
Trace Number: 8
Mission Number: 1023-2
Pass Number: 87D
Frame Number: 91 Fwd
Density Calibration: 1-7=0-3.0D
Line Spread Function width
at 50% amplitude: 10.8μ
Reciprocal of LSF width
at 50% amplitude: 92
Edge Orientation: 165.9°
6
5
4
3
2
1
NPIC K-5885 (12/66)

APPENDIX B. ISODENSITOMETRY

1. Introduction

The Joyce-Lobel Double Beam Microdensitometer used by TID/TSB has been adapted to include the recently developed isophotometer equipment made by Tech/Ops. When used with the attachment it is properly called an Isodensitracer (IDT).

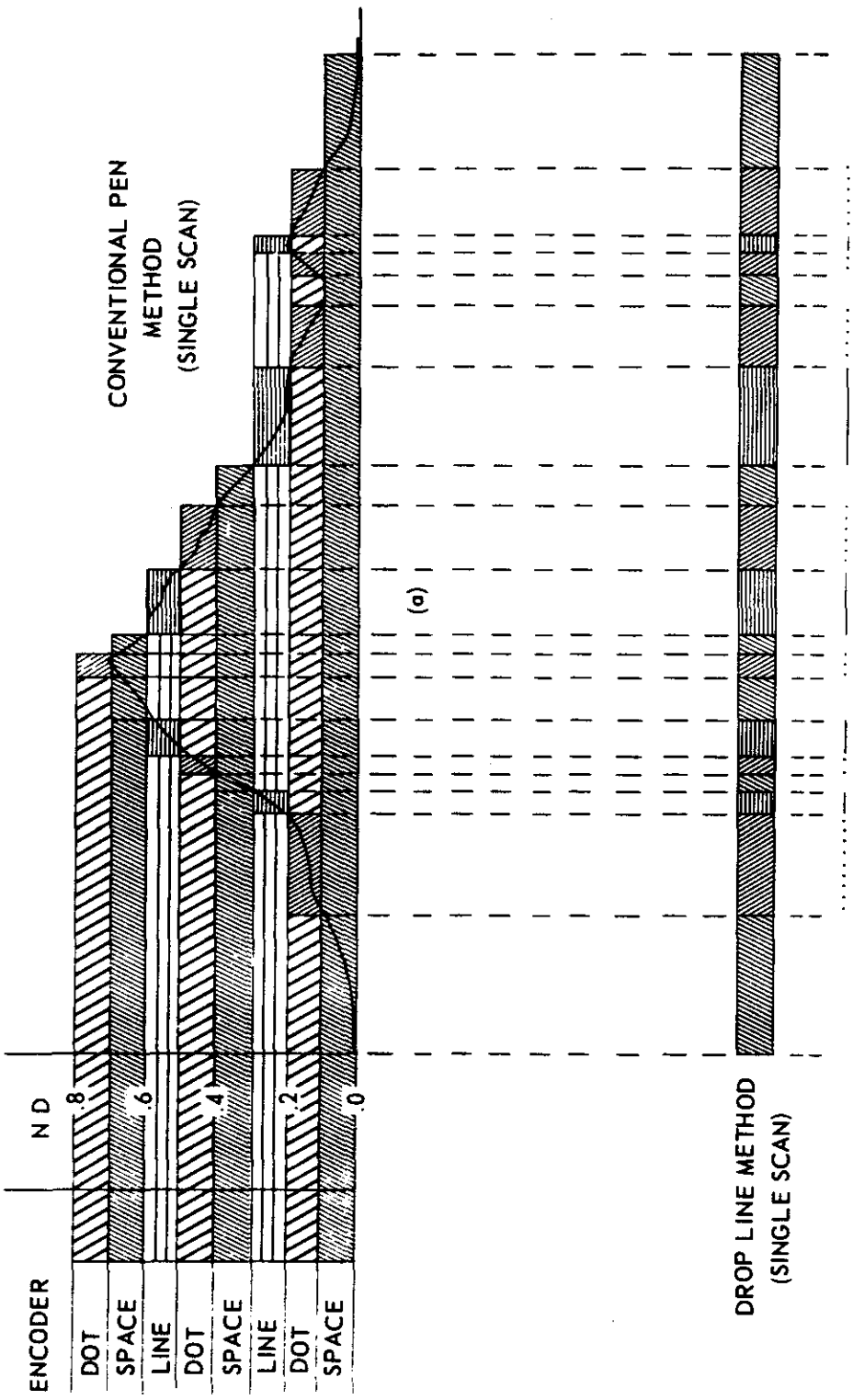
The optical system of the IDT automatically makes a series of closely spaced parallel scans. For each scan of the specimen, a corresponding coded parallel line is recorded, forming a contour map of the scanned area.

The code in the recorded lines indicates the amount of density change in known preset increments and also shows whether the density is increasing or decreasing. When density is increasing, the 3-symbol code line is printed in the following sequence: blank-dot-line-blank-dot-line. Whenever the density is decreasing the symbol sequence changes to: line-dot-blank-line-dot-blank. Each symbol in the sequence represents a density increment and is continuously plotted until the density in the specimen changes by that increment; then the next symbol in the sequence is plotted.

When the IDT has completed a scan, recording the density profile along that single scan line in code, the pen lifts from the recording paper and both the specimen table and the recording table return to the starting X position. At the same time, the specimen table and the recording pen step in the Y direction. Then the next scan is begun. This sequence is repeated automatically until the instrument has mapped the density of the specimen area. Contours are thus formed by adjacent like symbols.

Precise specimen-to-record magnifications can be set at from 1:1 to 1:1000 in the X direction as in the basic Joyce-Lobel instrument and at from 1:1 to 1:3100 in the Y direction. The X and Y ratios can be set separately.

The following illustration shows how a conventional microdensitometric trace is portrayed as a 3-symbol code line by the IDT. Each successive scan is a code line and is printed parallel to (b).



NPIC K-4839 (9/65)

DESCRIPTION OF ISODENSITOMETRIC CODE.

The information contained in the coded isodensity trace is directly related to the density of the image that is scanned. The trace effectively portrays the density contours of the image at a greatly expanded scale. By this high magnification of the image, small density changes and patterns are made evident but the small image degradations caused by limitations in the photographic system also become evident. Therefore, caution is recommended in establishing whether any minute density gradient in the trace relates directly to a change in the subject reflectivity. An object may appear to be regular or irregular when traced depending on the sun illumination angles and surface reflectivity. The reflectivity is influenced by the subject color, subject texture, shadows, and image edge gradient, to name just a few factors.

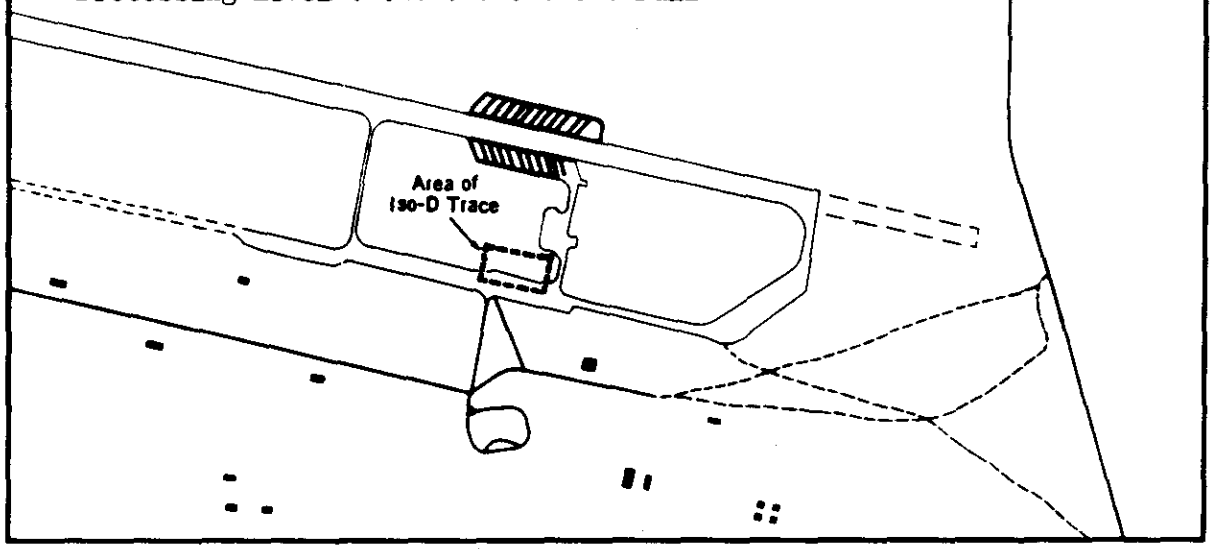
As a result of the above-mentioned factors, it is felt that any analysis of the isodensity traces must be carried out in conjunction with the original image, not as if it was a separate representation of the subject. It is further recommended that any concurrent perceptual and objective analysis of the density contour map and the image consider <u>all</u> known factors.

FIGURE 15. TARGET, ISODENSITOMETRIC TRACE, MISSION 1023-2

The matching diagram shows the area of interest on the photograph. Note the "disappearance" of the objects within that area in this shot, although they are readily detectable in the fwd camera photograph (Figure 7. MIP Selection, Mission 1023-2). The trace effectively indicates that the objects are still in place.

NPIC K-5866 (12/65)

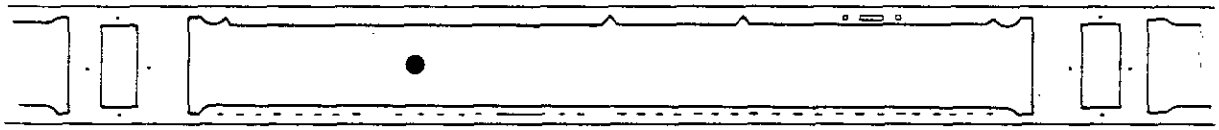
Camera	171
Pass	87D
Frame	97 Aft
Date of Photography	23 Aug 65
Universal Grid Coordinates	34.0 - 10.3
Enlargement Factor	20x
Geographic Coordinates	48-25N 43-22E
Altitude (Feet)	627,078
Camera:	
Pitch	-13° 37'
Roll	-00° 31'
Yaw	00° 37'
Vehicle Azimuth	151° 30'
Local Sun Time	1056
Solar Elevation	50° 11'
Solar Azimuth	151°
Exposure	1/431 sec
Processing Level	Full



Approximate flight direction on photograph

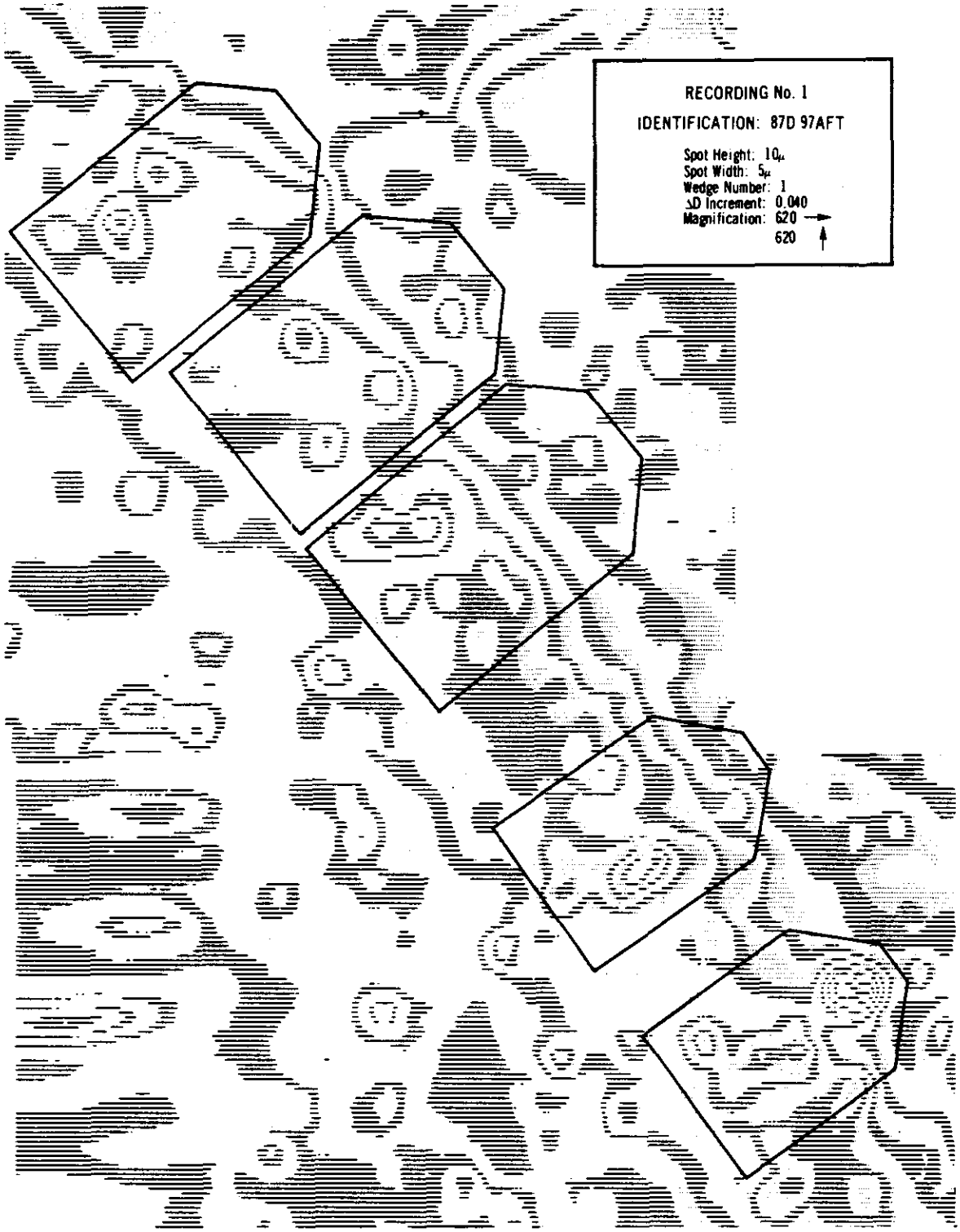
Approximate scan direction on photograph

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



[redacted]

[redacted]


RECORDING No. 1
IDENTIFICATION: 87D 97AFT
Spot Height: 10μ
Spot Width: 5μ
Wedge Number: 1
ΔD Increment: 0.040
Magnification: 620
620

APPENDIX E. CLOUD COVER ANALYSIS

1. Introduction:

This study represents a statistical analysis of the cloud cover on the photography of Mission 1023. 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 occurrence 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 1,000 (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 percentage 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, Missions 1023-1 and 1023-2

Mission 1023-1

Pass Number	1	2	3	4	5	Cloud Cover % Per Pass
01D	0.0	0.0	0.0	29.6	70.4	92.6
02D	34.5	15.5	11.3	38.7	0.0	37.7
05D	19.8	22.9	31.3	26.0	0.0	36.4
06D	62.5	19.6	10.3	7.6	0.0	16.2
07D	41.9	7.0	15.6	35.6	0.2	35.9
08D	38.9	13.4	14.1	33.6	0.0	34.9
09D	19.7	23.4	47.6	9.3	0.0	30.1
21D	32.6	11.8	19.9	21.8	13.9	41.5
23D	34.9	26.2	20.0	18.9	0.0	28.1
24D	13.3	7.7	10.8	67.1	1.1	57.5
25D	54.6	24.0	15.7	5.7	0.0	17.2
26D	84.5	1.4	1.2	12.9	0.0	14.6
36D	38.4	7.3	3.2	51.1	0.0	42.8
37D	24.9	2.9	12.7	46.5	13.0	54.5
38D	19.7	5.0	9.3	47.5	18.5	59.5
39D	65.4	3.6	0.9	26.2	3.9	27.8
40D	30.1	10.9	19.6	39.4	0.0	40.4
42D	97.9	1.2	0.9	0.0	0.0	5.4
50D	5.0	2.1	3.3	68.3	21.3	74.4
53D	58.5	18.8	12.5	10.0	0.2	18.7
54D	37.8	12.3	20.3	29.6	0.0	33.9
55D	65.3	5.7	9.5	19.5	0.0	22.5
56D	62.7	18.3	11.1	5.6	2.3	17.0
68D	2.6	11.8	17.4	62.4	5.8	61.4
69D	67.4	16.2	14.0	2.4	0.0	13.3
70D	23.4	5.0	5.5	61.5	4.6	54.9
71D	45.3	7.9	17.5	29.3	0.0	32.3
77D	46.4	17.9	20.2	15.5	0.0	24.7
	41.8*	11.4*	13.4*	29.6*	3.8*	35.2**

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

Mission 1023-2

Pass Number	1	2	3	4	5	Cloud Cover % Per Pass
83D	15.4	10.2	9.6	51.1	13.7	58.2
84D	55.7	15.9	9.4	18.2	0.8	23.6
86D	8.7	8.3	9.9	56.8	16.3	64.5
87D	71.0	13.5	10.6	4.9	0.0	13.6
88D	60.9	10.6	11.3	16.0	1.2	22.4
89D	94.4	5.6	0.0	0.0	0.0	5.7
90D	94.1	5.9	0.0	0.0	0.0	5.7
93D	75.7	2.1	3.1	19.1	0.0	19.7
99D	26.7	5.7	8.6	47.1	11.9	52.9
100D	86.0	6.0	6.1	1.9	0.0	9.1
101D	0.0	1.7	11.6	78.0	8.7	71.9
102D	6.6	4.7	15.4	60.1	13.2	65.3
103D	80.0	6.8	6.7	6.5	0.0	12.6
104D	47.9	3.6	3.1	9.4	36.0	47.2
105D	74.3	12.1	8.6	5.0	0.0	12.8
116D	34.9	26.9	16.2	22.0	0.0	29.1
117D	40.8	2.9	2.4	53.9	0.0	43.9
118D	87.4	8.3	4.3	0.0	0.0	7.5
119D	76.4	9.4	5.5	8.7	0.0	14.1
120D	0.0	0.0	12.5	62.5	25.0	76.6
130D	1.5	3.0	3.6	83.1	8.8	73.1
131D	64.5	21.1	8.8	5.6	0.0	14.4
132D	0.0	2.0	23.0	67.3	7.7	67.2
133D	57.9	5.9	14.4	19.6	2.2	26.3
134D	73.8	5.5	2.7	16.9	1.0	19.5
135D	23.9	10.4	11.7	40.5	13.5	51.3
	48.0*	8.8*	9.2*	29.1*	4.9*	34.1**

APPENDIX F. MISSION COVERAGE STATISTICS

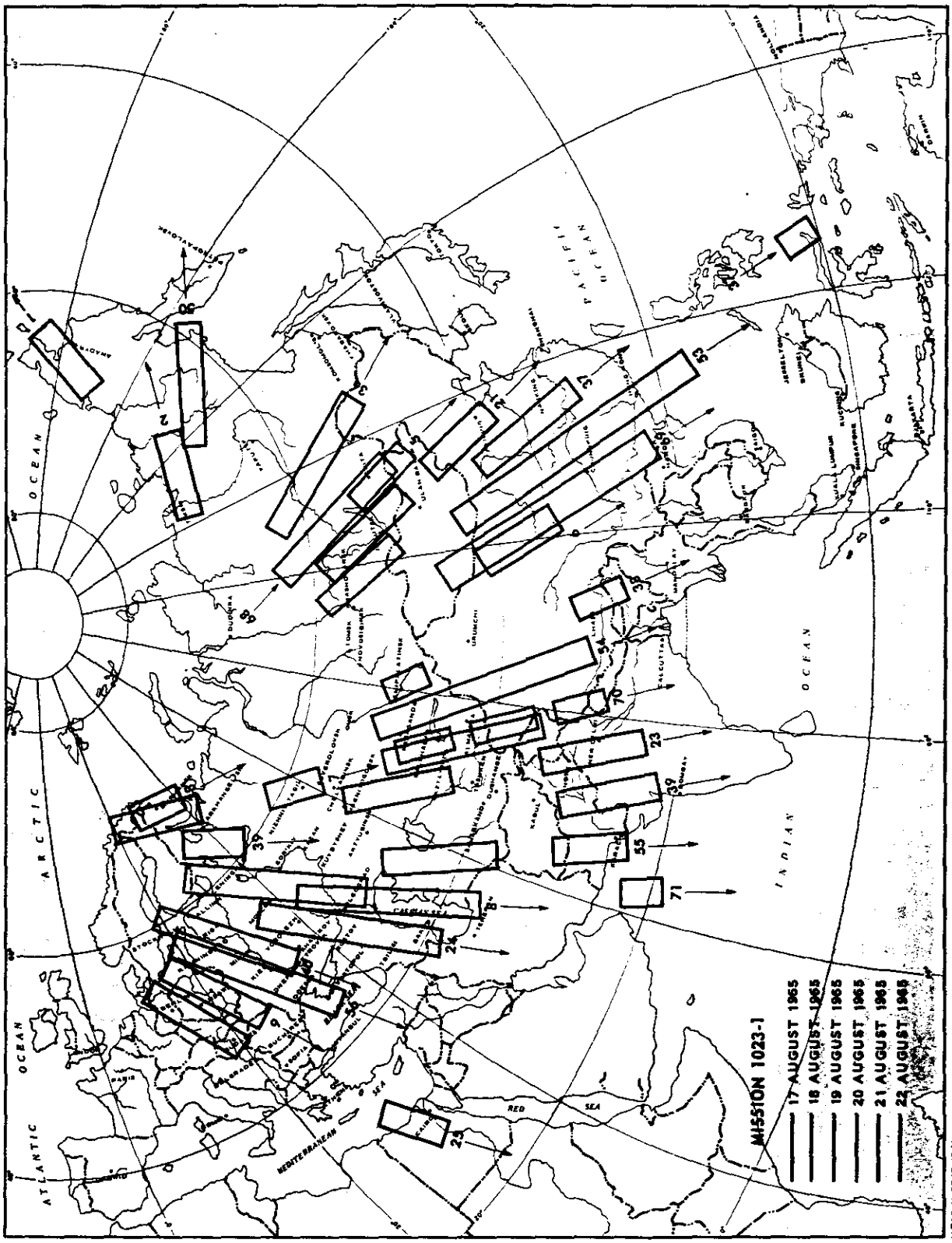
1. Summary of Plottable Photographic Coverage, Mission 1023

MISSION - 1023-1

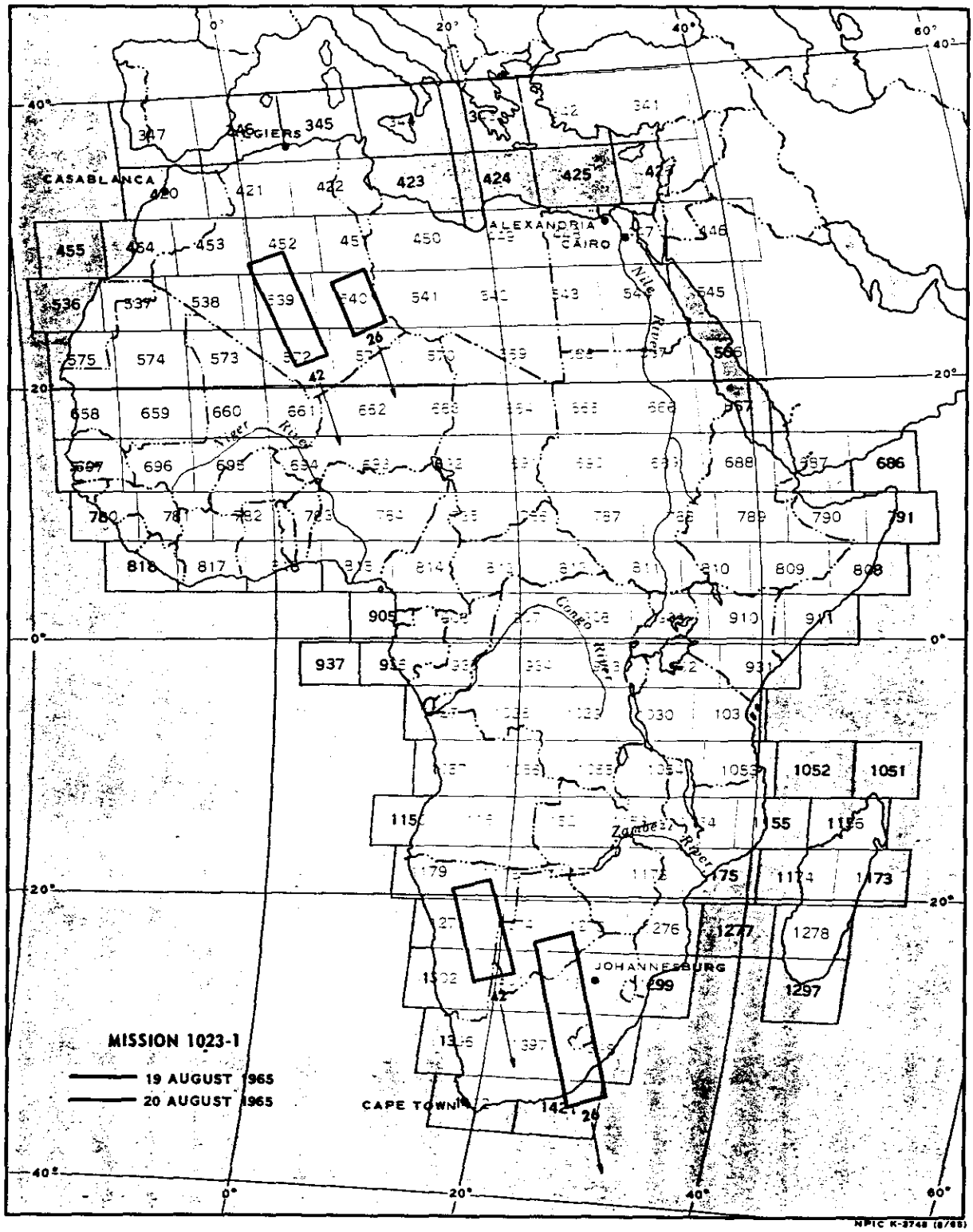
COUNTRY	FORWARD CAMERA		AFT CAMERA		TOTALS	
	LIN NM	SQ NM	LIN NM	SQ NM	LIN NM	SQ NM
USSR	12,497	1,989,986	12,696	2,031,860	25,193	4,021,846
CHINA	6,019	882,351	5,891	857,463	11,910	1,739,814
INDIA	883	125,416	793	112,606	1,676	238,022
PAKISTAN	673	90,312	706	95,424	1,379	185,736
ALGERIA	589	100,518	592	84,064	1,181	184,582
POLAND	507	76,128	529	79,476	1,036	155,604
UN OF SO AFRICA	457	80,710	423	74,770	880	155,480
MONGOLIA	424	65,492	439	66,692	863	132,184
MEXICO	409	31,666	372	25,418	781	57,084
AUSTRALIA	298	51,852	298	46,632	596	98,484
EGYPT	246	34,932	185	26,270	431	61,202
SOUTH-WEST AFRICA	217	37,758	268	46,632	485	84,390
CZECHOSLOVAKIA	150	23,400	162	25,224	312	48,624
IRAN	136	20,128	146	21,512	282	41,640
BECHUANALAND	119	21,162	127	22,874	246	44,036
FINLAND	118	14,728	170	21,212	288	35,940
EAST GERMANY	117	18,252	123	19,188	240	37,440
KASHMIR	101	14,588	96	13,866	197	28,454
HUNGARY	93	14,508	25	3,800	118	18,308
INDONESIA	62	1,800	62	1,800	124	3,600
NEPAL	52	7,540	41	5,822	93	13,362
BASUTOLAND	50	9,500	50	9,500	100	19,000
CUBA	50	2,130	34	994	84	3,124
AFGHANISTAN	41	5,822	86	12,212	127	18,034
BAHAMA ISLANDS	37	994	78	1,136	115	2,130
HAITI	37	1,562	---	---	37	1,562
NORWAY	37	6,956	83	13,724	120	20,680
TURKEY	37	5,476	---	---	37	5,476
RUMANIA	23	3,588	4	624	27	4,212
LIBYA	19	2,698	15	2,130	34	4,828
NORTH VIETNAM	10	1,420	6	852	16	2,272
AUSTRIA	2	312	2	312	4	624
SWEDEN	---	---	33	3,228	33	3,228
DENMARK	---	---	21	972	21	972
TOTAL	24,510	3,743,685	24,556	3,728,289	49,066	7,471,974
CONTINENTAL US	793	99,109	842	106,060	1,635	205,169
GRAND TOTAL	25,303	3,842,794	25,398	3,834,349	50,701	7,677,136

MISSION - 1023-2

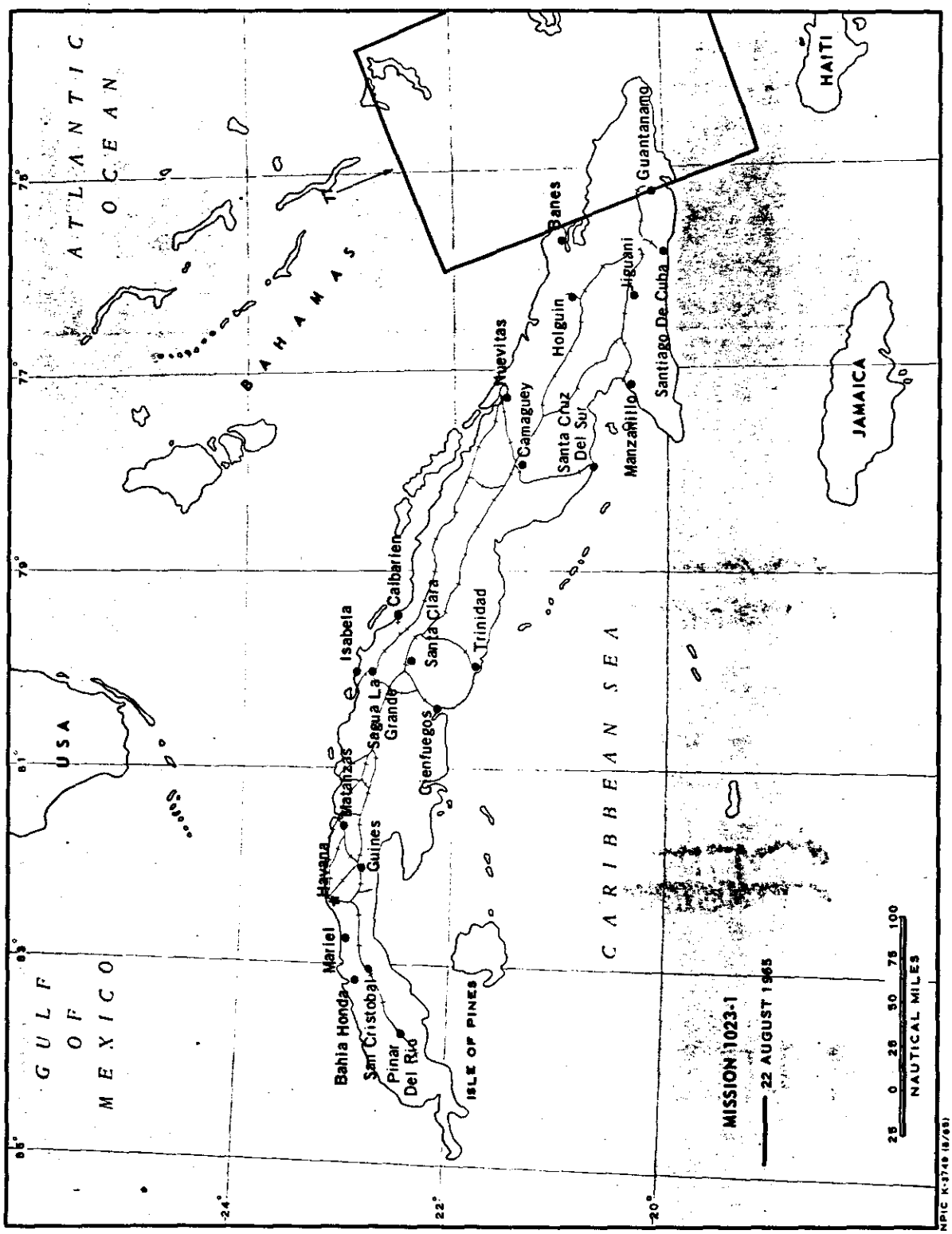
COUNTRY	FORWARD CAMERA		AFT CAMERA		TOTALS	
	LIN NM	SQ NM	LIN NM	SQ NM	LIN NM	SQ NM
USSR	5,485	829,664	11,035	1,665,164	16,520	2,494,828
CHINA	3,097	428,392	5,622	800,224	8,719	1,228,616
CANADA	701	117,768	1,320	213,888	2,021	331,656
ARGENTINA	1,025	184,500	979	176,220	2,004	360,720
POLAND	402	62,136	390	60,264	792	122,400
ALGERIA	---	---	670	95,140	670	95,140
UN OF SO AFRICA	312	54,288	312	54,288	624	108,576
MAURITANIA	238	33,796	253	35,926	491	69,722
RUMANIA	195	24,660	203	25,908	398	50,568
TURKEY	205	29,624	172	24,640	377	54,264
GREECE	123	9,516	198	19,020	321	28,536
SPANISH SAHARA	159	22,578	156	19,880	315	42,458
CZECHOSLOVAKIA	129	20,124	148	23,088	277	43,212
YUGOSLAVIA	61	9,516	213	29,616	274	39,132
SOUTH KOREA	---	---	271	24,124	271	24,124
BULGARIA	123	19,188	131	20,436	254	39,624
TAIWAN	102	5,822	123	6,958	225	12,780
INDIA	111	16,428	82	12,136	193	28,564
MEXICO	123	17,466	62	8,804	185	26,270
NORTH KOREA	---	---	180	18,648	180	18,648
RHODESIA	89	15,486	89	15,486	178	30,972
HUNGARY	61	9,516	91	14,096	152	23,612
ALASKA US	57	6,840	94	13,056	151	19,896
JAPAN	---	---	144	8,584	144	8,584
WEST GERMANY	---	---	144	22,464	144	22,464
FINLAND	---	---	143	15,276	143	15,276
EAST GERMANY	43	6,084	90	12,480	133	18,564
IRAN	80	9,472	39	3,404	119	12,876
MONGOLIA	---	---	103	15,408	103	15,408
BECHUANALAND	45	7,830	45	7,830	90	15,660
ALBANIA	---	---	68	7,992	68	7,992
DENMARK	---	---	49	1,560	49	1,560
BOLIVIA	---	---	25	4,500	25	4,500
NETHERLAND	---	---	20	3,120	20	3,120
MOROCCO	---	---	13	1,846	13	1,846
BURMA	12	1,776	---	---	12	1,776
HONG KONG	---	---	10	345	10	345
NEPAL	2	284	---	---	2	284
TOTAL	12,980	1,942,754	23,687	3,481,819	36,667	5,424,573
CONTINENTAL US	335	48,908	918	134,040	1,353	182,948
PLANT TOTAL	13,315	1,991,662	24,605	3,615,859	38,020	5,607,521



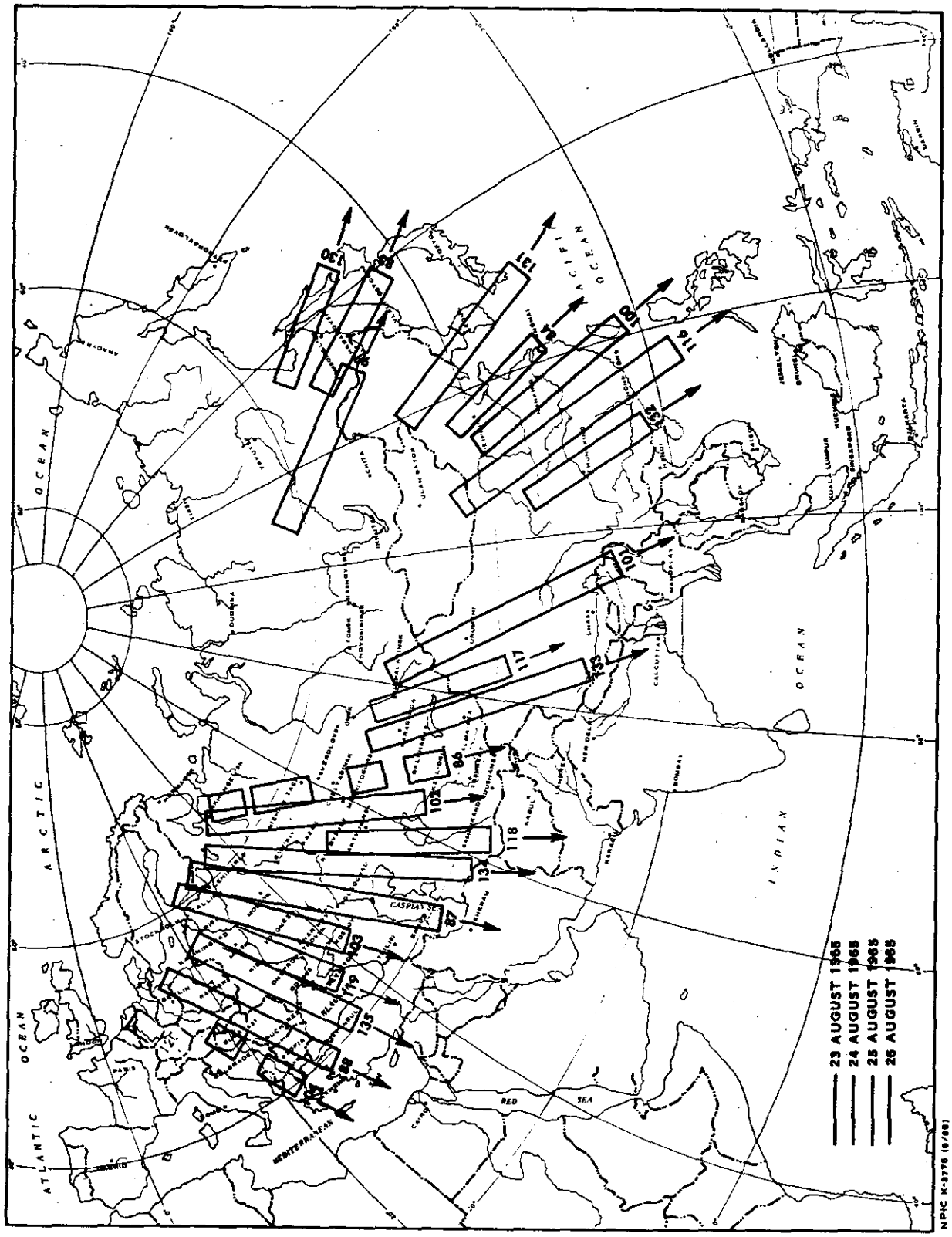
APPROXIMATE TRACK OF MISSION 1023-1, 17-22 AUGUST 1965 OVER USSR, FAR AND MIDDLE EAST.



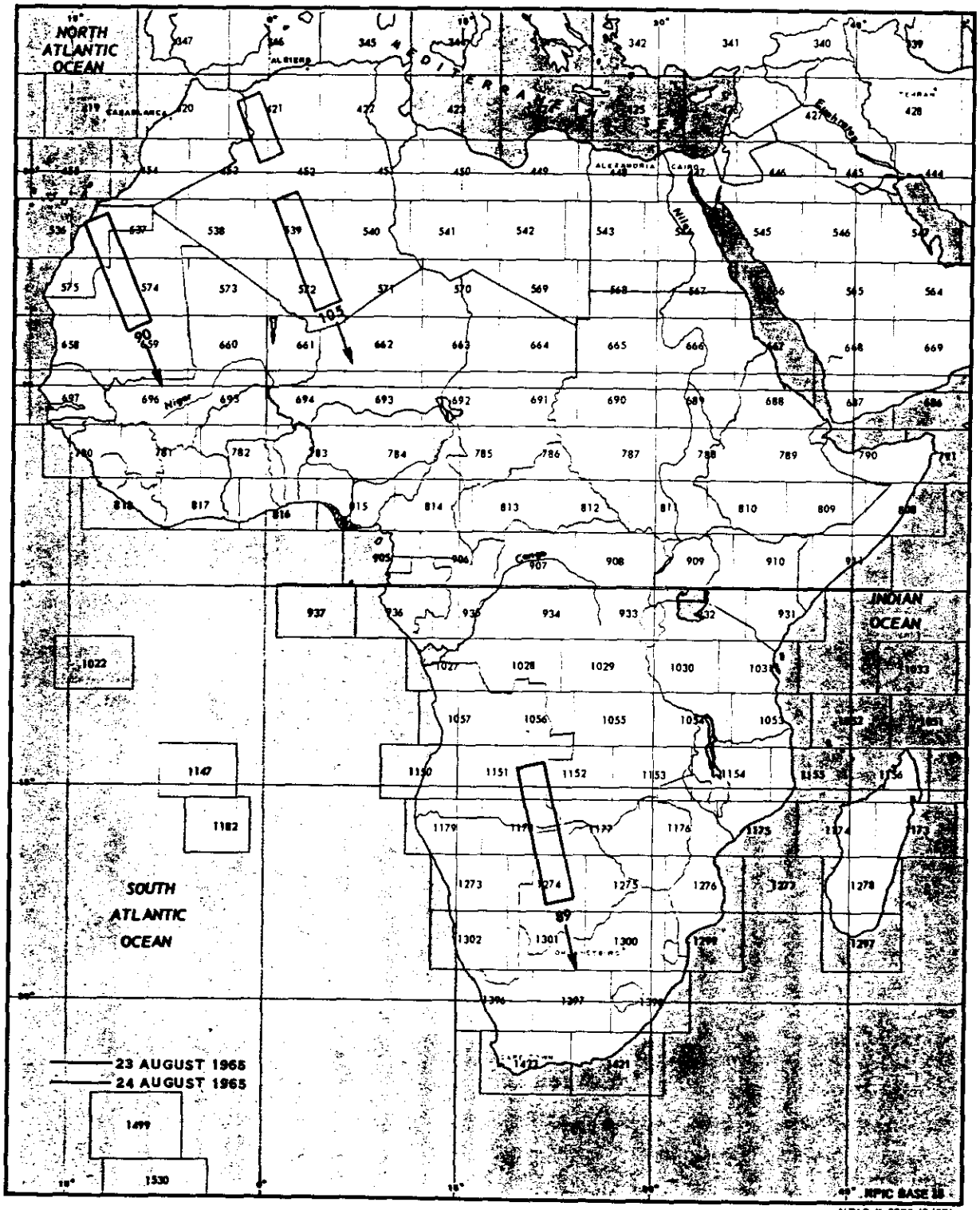
APPROXIMATE TRACK OF MISSION 1023-1, 17-22 AUGUST 1965 OVER AFRICA.



APPROXIMATE TRACK OF MISSION 1023-1, 17-22 AUGUST 1965 OVER CUBA.



APPROXIMATE TRACK OF MISSION 1023-2, 23-26 AUGUST 1965 OVER USSR, FAR AND MIDDLE EAST.



APPROXIMATE TRACK OF MISSION 1023-2, 23-26 AUGUST 1965 OVER AFRICA.