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TECHNICAL PUB ATION

PHOTOGRAPHIC EVALUATION REPORT

MISSION 1022-1

19-23 JULY 1965

MISSION 1022-2

24-28 JULY 1965

[redacted]

NOVEMBER 1965

[redacted]

40 PAGES

This document contains information referring to Project Corona

GROUP 1 EXCLUDED FROM AUTOMATIC DOWNGRADING AND DECLASSIFICATION

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TECHNICAL PUBLICATION

PHOTOGRAPHIC EVALUATION REPORT
MISSION 1022-1
19-23 JULY 1965
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24-28 JULY 1965

NOVEMBER 1965

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

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SYNOPSIS

Mission 1022 (J-22) was launched 19 July 1965. The initial phase, designated Mission 1022-1, accomplished 38 photographic revolutions, which consisted of 32 operational passes, 4 domestic passes, 1 combination pass (part operational, part domestic), and 1 engineering pass. The payload was air-recovered on 24 July 1965 and second-phase operations were initiated with no intervening deactivation period. Mission 1022-2 accomplished 34 photographic revolutions, consisting of 29 operational passes, 4 domestic passes, and 1 engineering pass. Air-recovery of the second payload on 28 July 1965 terminated the mission.

All of the cameras were operational throughout the mission. The panoramic photography was acquired at solar elevations ranging from 27 to 75 degrees. Clouds obscured 40 percent of the terrain covered in Mission 1022-1 and 41 percent in Mission 1022-2. The overall suitability for photographic interpretation and the general quality of the panoramic photography are good. Both phases of the mission were awarded MIP ratings of 85.

[redacted]

GENERAL FLIGHT DATA

1. Launch and Recovery Dates

Launch Date, Mission 1022-1	19 July 1965
Recovery Date, Mission 1022-1	24 July 1965
Activation Date, Mission 1022-2	24 July 1965
Recovery Date, Mission 1022-2	28 July 1965

2. Orbital Parameters (Actual)

	Mission 1022-1 (Rev 32)	Mission 1022-2 (Rev 103)
Period	91.01 min	90.93 min
Perigee	99.67 nm	101.63 nm
Apogee	254.20 nm	254.69 nm
Eccentricity	0.02136	0.02120
Inclination Angle	85.05°	85.05°
Perigee Latitude	50.26°N	47.79°N

3. Photographic Operations

A. Pass Information

	Mission 1022-1	Mission 1022-2
Operational Passes	32	29
Domestic Passes	4	4
Operational-Domestic Passes	1	0
Engineering Passes	1	1
Total Photographic Passes	38	34
Recovery Revolutions	65	144

B. Film Footage/Frame Totals

	Master (Fwd) Camera	Slave (Aft) Camera
Footage Available	16,000	16,000
Processed Footage (1022-1)	8,213	8,170
Processed Footage (1022-2)	7,758	7,849
Titled Frames (1022-1)	2,976	2,943
Titled Frames (1022-2)	2,935	2,967

PART I. CAMERA OPERATIONS

1. Master (Fwd) Panoramic Camera No 168

The instrument performed satisfactorily throughout the mission and the film is remarkably free of camera-induced degradations. Scratches are minor and few. No plus-density streaks are present in the material and the only notable examples of minus-density streaks occur in passes 56D and 70D, where frames 138-141 of the former and 1-24 of the latter are degraded by end-to-end streaks pitched at a slight diagonal across the formats.

A number of light-struck areas, contained in the frames immediately preceding or following camera on-off operations, are present in each pass record. These are commonly referred to as "sit marks" and the degree of degradation is dependent on the length of the camera-rest period and the solar elevation at that time. The sit mark repetition pattern in this mission is as follows:

Equipment shadowgraphs are detectable in the first and last frames of a number of pass records. The next-to-last frame of most of the pass records contains a light trace at take-up, which occasionally shifts into the supply end of the second-from-last frame. Exceptions to the general pattern are noted in passes 9D, 31D, and 62D. The fifth-from-last frame in each of these records displays an edge-to-edge bar-type light trace at or near frame-center. It is possible that similar light traces are present in other cases, but the background densities preclude their detection.

Stereo suppress operations were conducted during revolutions 1 and 47 in order to determine the effects of non-simultaneous camera start-up and shut-down. Preliminary evaluation indicates that the stereo suppress mode did not influence vehicle stability or degrade the imagery.

2. Slave (Aft) Panoramic Camera No 169

The camera operated without malfunction throughout the mission and camera-induced degradations are minor and few. Diagonal, end-to-end minus-density streaks similar to those noted in the fwd material are present intermittently in passes 67D-70D, inclusive. The longest continuous sequence of streak-degraded frames occurs in pass 70D, frames 1-24.

The aft film contains sit marks similar to those noted in the fwd material. Their repetition pattern is as follows:

The first frame of most pass records and the first frame immediately following a camera off-on sequence within a pass contain an edge-to-edge uniform fog band at or near frame-center. The third-from-last frame of most pass records contains a light trace at the supply end, which occasionally shifts into the take-up end of the second-from-last frame. The latter is also degraded by an equipment shadowgraph in most of the pass records. A similar shadowgraph appears in the last frame of a few passes. In general, degradation is more pronounced at the start and end of a pass, compared to the on-off sequences within a pass, but in no case is the degradation so severe as to merit specific attention.

Frame 65 of pass 70D contains a manufacturer's splice with associated small static discharge traces in frames 63-67. Spot static traces are present intermittently on the fiducial edge of frames 21-76 in pass 131D.

3. Master (Fwd) Horizon Cameras

The port (supply) and starboard (take-up) horizon cameras were operational throughout the mission. The image quality of the horizons is good. Exposure was adequate except where low solar elevations precluded effective acquisition of horizon photography. The inboard starboard horizon fiducial lamp failed in pass 8D, frame 40, and is not recorded from that pcint on.

4. Slave (Aft) Horizon Cameras

The port (take-up) and starboard (supply) horizon cameras were operational throughout the mission except in pass 7D, frame 46, and pass 75D, frames 13-21, where no horizon images were recorded. Image quality of the horizons is good, in general, but slightly inferior to the imagery produced by the master horizon cameras.

5. Stellar Camera No D65 (Mission 1022-1)

The instrument performed satisfactorily through frame 380. Frames 381-389 are degraded by static discharge traces and fog to such an extent that they are unusable for reduction purposes. The geometric distribution of the stellar images (at least 12 per exposure) is good. Some images are detectable in the format areas affected by earth albedo. No double images were detected but distorted and/or streaked stellar images were observed in 117 frames.

6. Stellar Camera No D24 (Mission 1022-2)

The camera was operational throughout the mission and produced at least 16 stellar images per exposure. Of the total 404 frames, all but the last one were employed in the attitude reduction procedure. Distorted and/or streaked images are detectable in 94 frames.

7. Index Camera No D65 (Mission 1022-1)

The camera functioned satisfactorily throughout the mission and produced good-quality terrestrial imagery. Each frame contains a small minus-density spot 0.45 inches from the take-up end and 0.43 inches down from the titled edge of the film. The cause is unknown. Frames 260-392 exhibit a variety of static discharge traces, including an unusual form of dendritic static, but degradation is not severe in any case. The last 4 frames (389-392) are seriously fogged and abraded.

8. Index Camera No D24 (Mission 1022-2)

The instrument was operational throughout the mission and produced 442 frames of good-quality imagery. Frame 239 contains the airfield selected as the MIP example for this mission (correlates with pass 103D, frame 104, of the panoramic photography) and is representative of the general quality of the material. The last 50 frames contain a non-linear minus-density streak near the titled edge of the film. A small, minus-density spot appears intermittently in the formats on the untitled edge of the film. When present, the spot is located 0.88 inches from the take-up end of the frame and 0.45 inches up from the film edge.

9. Associated Equipment

The binary data block failed to record in a number of frames throughout the mission, as follows:

Mission 1022-1, Master Camera:	Pass 53D, frame 33	
	Pass 56D, frame 154	
Slave Camera:	Pass 7D, frames 45, 46	
	Pass 10D, frame 11	
	Pass 19D, frame 64	
	Pass 20D, frame 40	
	Pass 56D, frame 2	
Mission 1022-2, Master Camera:	Pass 67D, frame 25	
	Pass 115D, frame 90	
	Pass 132D, frame 94	
Slave Camera:	Pass 75D, frames 13-22	
	Pass 86D, frame 31	

The binary index lamp adjacent to the camera number is bloomed. The frequency marks range from underexposed to adequately exposed. However, the marks are recorded outside the formats and are readable in all cases. The end-of-pass markers are considerably overexposed.

PART II. FILM PROCESSING

1. General Statement, Panoramic, Stellar, and Index Cameras

Infrared densitometry was employed to determine the optimum levels of development for the panoramic records. The material exposed in Mission 1022-1 required 45 processing level changes for the master panoramic camera film and 35 changes for the slave panoramic camera film. No processing level changes were made during development of the master panoramic material acquired in Mission 1022-2, but the slave panoramic record required 54 changes. The approximate percentage of imagery processed at each level is as follows:

Mission 1022-1:

Development Level	Master Record	Slave Record
Primary	8%	7%
Intermediate	36%	42%
Full	56%	51%

Mission 1022-2:

Development Level	Master Record	Slave Record
Primary	1%	10%
Intermediate	37%	44%
Full	62%	46%

In general, the density of the panoramic records is primarily medium (approximately 65 percent) and the index film contains a slightly higher percentage of medium densities (70 percent). The density of the stellar record is adequate to determine the presence of stellar images.

2. Physical Film Degradations

Except for the continuous rail scratches on both edges of the panoramic records, all scratches noted during examination of the film are of random occurrence and consist primarily of fine, short, emulsion scratches, which are not sufficiently degrading to itemize in detail. Pass 9D, frames 1-67, aft, may be considered an exception, since fine scratches are present in most of the format centers of those frames. The stellar/index material is relatively scratch-free. However, fine emulsion cracks are present on the last 125 frames of the stellar record acquired in Mission 1022-1. Similar emulsion cracks are present

on the last 25 frames of the index record, Mission 1022-2. The stellar/index records of Mission 1022-2 also contain abrasions on the correlation lamp edge of the respective films. These abrasions persist throughout the first half of each record and gradually dissipate. However, in no case do the abrasions intrude on the stellar or index formats.

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 1022-1 and 1022-2

The PI suitability of both phases of Mission 1022 is good. A total of 207 targets (109 in Mission 1022-1 and 98 in 1022-2) is reported in the preliminary PI reports. Highlights of the initial scan include the following:

a) New identification of 3 missile complex areas in early construction stages (2 probable, 1 possible).

b) New identification of 7 missile launch sites or areas, most of which are confirmed.

c) New identification of a missile assembly facility.

d) Confirmation of previous continuing construction as a probable new rocket engine test site.

The photographic quality categorizations in the PI reports are not sufficiently detailed to permit a valid assessment of the coverage quality. However, it appears that most of the coverage in the poor-to-fair category is degraded by atmospheric conditions rather than shortcomings in the camera system. Relatively few targets are covered by photography classified as "poor quality."

The preliminary PI reports represent the initial scan results only, accomplished in a short time and without resorting to the more sophisticated instruments normally employed in carrying out detailed read-outs. Continued study of the film may add to the number of observed targets and may alter some of the preliminary data.

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 1022-1 and 1022-2

Based on the foregoing criteria, frame 10 of pass 63D (Aft) is selected as the MIP frame for Mission 1022-1. The specific target within the frame is a well-defined airfield located not far off frame-center. The matching frame in the FWD photography is frame 5. Examination of the target airfield in both records provides the observer with a good approximation of the comparative photographic quality achieved by the master and slave panoramic cameras. The slave (Aft) photography is rated slightly better than the master.

Frame 100 of pass 103D (Fwd) is the MIP selection for Mission 1022-2. However, the target airfield is only partially covered in the matching Aft frame. Consequently, frame 67 (Fwd) and frame 73 (Aft) of pass 103D are selected as the quality comparison frames. Considerable culture is present, providing a good opportunity to assess image quality.

Both MIP frames are assigned MIP ratings of 85. In general, the photographic quality of the selected frames is slightly better than that achieved in recent missions which were also rated at 85, but is not sufficiently superior to merit upgrading to 90.

5. Resolution Target Coverage

A number of fixed and mobile resolution targets were covered in this mission. The ground resolution data are as follows (determined from examination of the original negatives):

Pass	31D
Frame (Fwd) & Universal Grid Coordinates	52, x-14.5 y-10.3
Frame (Aft) & Universal Grid Coordinates	57, x-76.5 y-12.8
Target Location	Fort Huachuca, Arizona
Target Description	3-Bar Standard Military, Fixed
Ground Resolution (Fwd)	Zero Resolution
Ground Resolution (Aft)	17' 8" in line of flight 19' 10" in scan direction

Pass	47DE
Frame (Fwd) & Universal Grid Coordinates	9, x-23.3 y-14.0
Frame (Aft) & Universal Grid Coordinates	Not Covered
Target Location	Pahrump, Nevada
Target Description	3-Bar Standard Military, Fixed
Ground Resolution (Fwd)	Zero Resolution

Pass	94D
Frame (Fwd) & Universal Grid Coordinates	4, x-35.9 y-10.4
Frame (Aft) & Universal Grid Coordinates	10, x-54.5 y-12.6
Target Location	32°46'N, 108°48'W
Target Description	3-Bar Standard Military, Mobile
Ground Resolution (Fwd)	12' 0" in line of flight 16' 0" in scan direction
Ground Resolution (Aft)	8' 0" in line of flight 8' 0" in scan direction

Pass	125D
Frame (Fwd) & Universal Grid Coordinates	26, x-36.2 y-11.2
Frame (Aft) & Universal Grid Coordinates	32, x-54.5 y-12.5
Target Location	31°33'N, 96°40'W
Target Description	3-Bar Standard Military, Mobile
Ground Resolution (Fwd)	16' 0" in line of flight 16' 0" in scan direction
Ground Resolution (Aft)	16' 0" in line of flight 12' 0" in scan direction

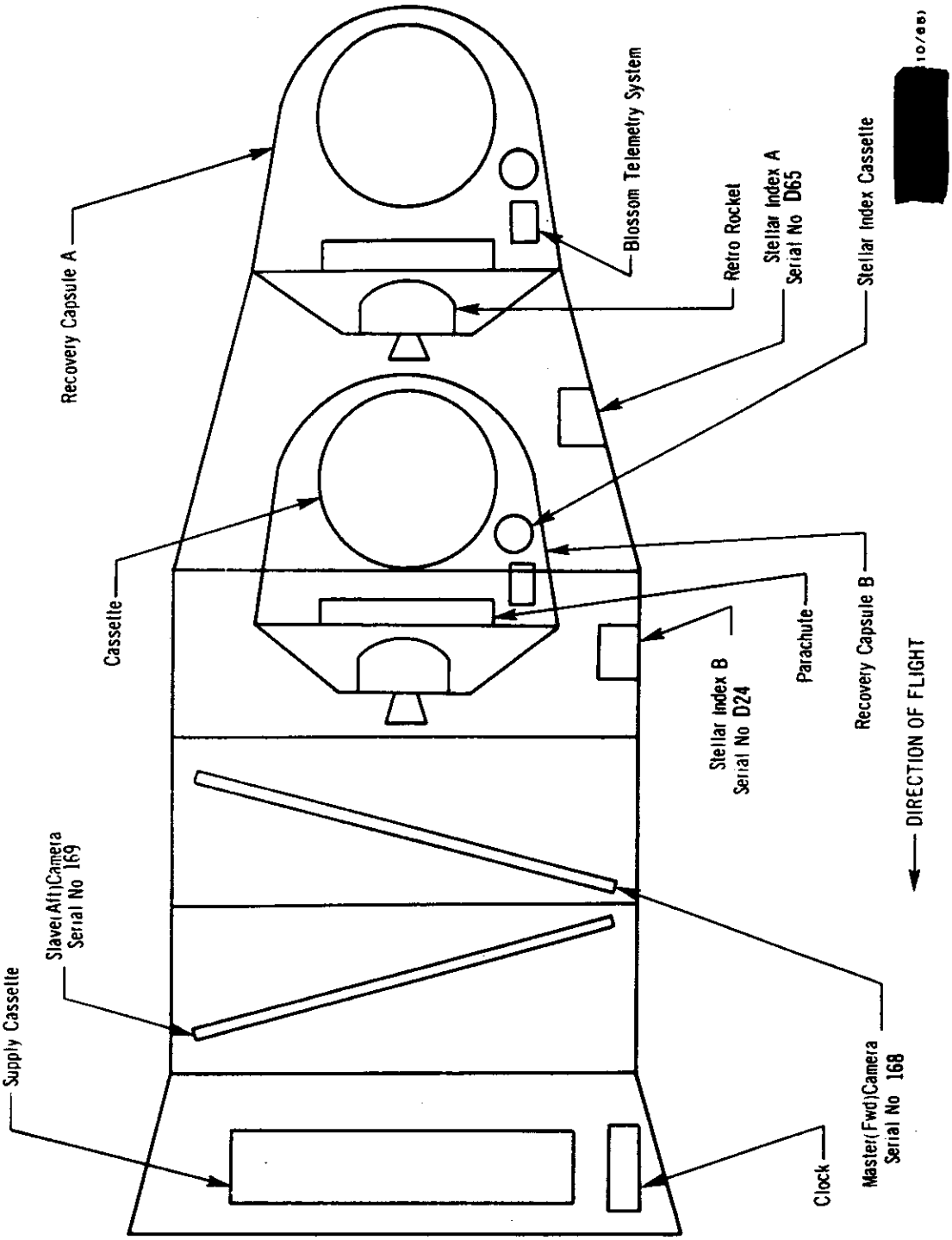
APPENDIX A. SYSTEM SPECIFICATIONS

1. General

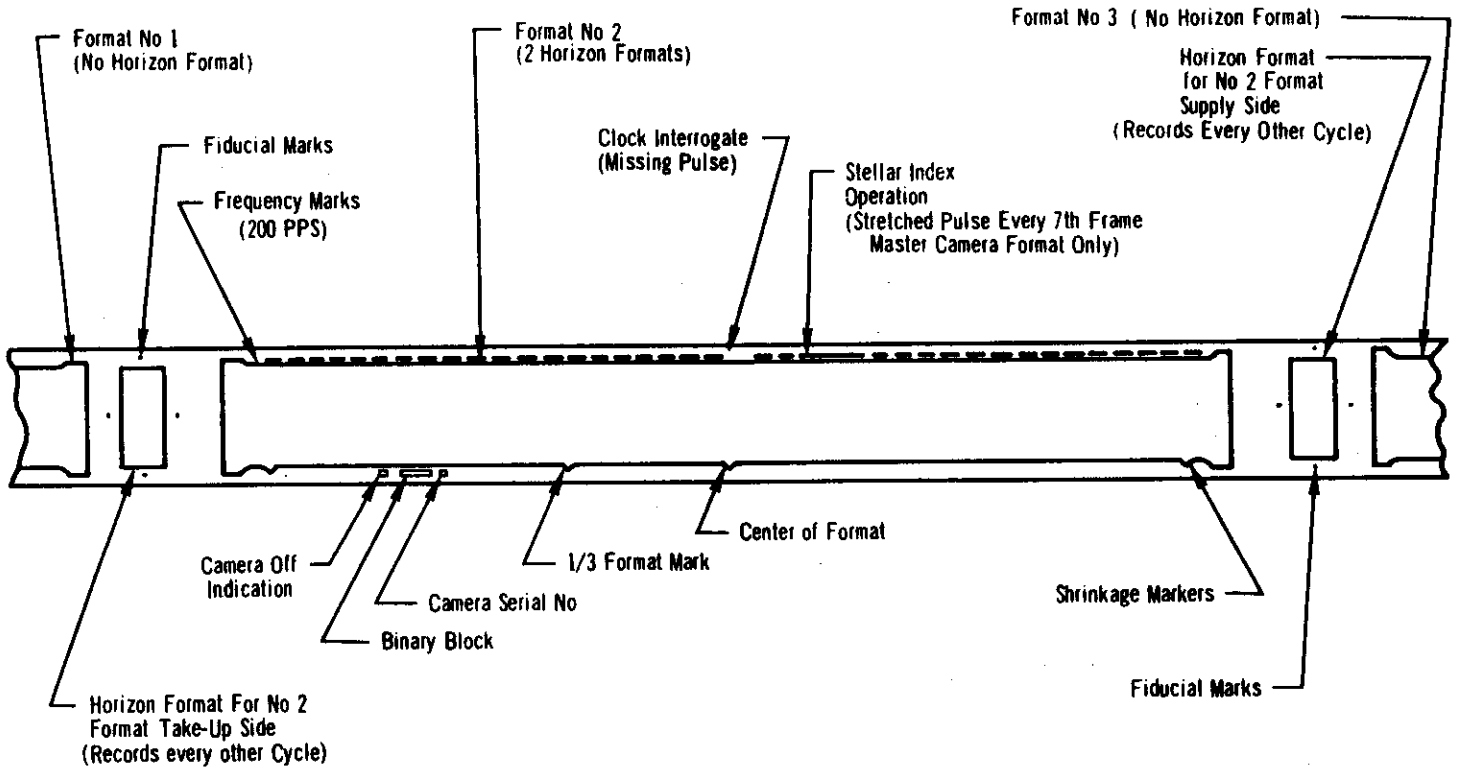
	MASTER PAN	MASTER TAKE-UP HORIZON	MASTER SUPPLY HORIZON	SLAVE PAN	SLAVE TAKE-UP HORIZON	SLAVE SUPPLY HORIZON	MISSION 1022-1		MISSION 1022-2	
							STELLAR	INDEX	STELLAR	INDEX
Camera No	168	N/A	N/A	169	N/A	N/A	D65	D65	D24	D24
Reseau No	N/A	N/A	N/A	N/A	N/A	N/A	70	77	24	24
Lens Serial No	1532435	813513	812308	1582435	812297	812311	11972	817461	10079	811900
Slit Width	.250	N/A	N/A	.175	N/A	N/A	N/A	N/A	N/A	N/A
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 (Sec)	Varied	1/100	1/100	Varied	1/100	1/100	2.0 sec	1/500	2.0 sec	1/500
Filter (Wratten)	25	25	25	21	25	25	None	21	None	21
Focal Length (mm)	609.625	54.59	55.07	609.60	55.159	55.187	84.00	38.35	83.76	38.37
Film Length (ft)	16,000	N/A	N/A	16,000	N/A	N/A	75	135	75	135
Splices	3	N/A	N/A	4	N/A	N/A	None	None	None	None
Emulsion	208-1-5-5	208-1-5-5	208-1-5-5	208-1-5-5	208-1-5-5	208-1-5-5	124-35-6-5	37-1-2-5	124-35-6-5	37-1-2-5
Film Type	3404	3404	3404	3404	3404	3404	3401	3400	3401	3400
Resolution Data (L/mm):										
Static										
High Contrast	238	116(A)	123 (A)	265	164 (A)	164 (A)	*	72.5 (A)	*	72.2 (A)
Low Contrast	142	N/A	N/A	139	N/A	N/A	*	*	*	*
Dynamic										
I High Contrast	184	N/A	N/A	193	N/A	N/A	*	*	*	*
I Low Contrast	131	N/A	N/A	128	N/A	N/A	*	*	*	*
P High Contrast	171	N/A	N/A	196	N/A	N/A	*	*	*	*
P Low Contrast	117	N/A	N/A	109	N/A	N/A	*	*	*	*

N/A Not applicable
* Not available
(A) AWAR

2. VEHICLE CONFIGURATION AND EQUIPMENT LAYOUT



3. PANORAMIC FORMAT CONFIGURATION



Master(Fwd)Panoramic Camera No 168
Viewed With Negative Emulsion Down
Direction of Film Transport ←
Direction of Scan →
Direction of Vehicle Motion ↓

Slave(Aft)Panoramic Camera No 169
Viewed With Negative Emulsion Down
Direction of Film Transport ←
Direction of Scan →
Direction of Vehicle Motion ↑

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APPENDIX B. DENSITY READINGS

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

Mission 1022-1

		STELLAR CAMERA				INDEX CAMERA						
						LIMITING				TERRAIN		
Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta
1D	1	0.84	0.22	0.62	0.19	1.55	0.26	1.29	0.07	1.08	0.26	0.82
	3	1.03	0.19	0.84	0.18	1.44	0.22	1.22	0.07	0.76	0.22	0.54
2D	4	1.11	0.20	0.91	0.18	1.50	0.70	0.80	0.07	1.50	0.70	0.80
	5	1.09	0.20	0.98	0.18	1.54	0.29	1.25	0.07	1.54	0.29	1.25
5D	6	0.90	0.19	0.71	0.17	1.42	0.30	1.12	0.07	1.24	0.34	0.90
	19	1.27	0.21	1.06	0.18	1.40	0.21	1.19	0.07	1.22	0.21	1.01
6D	20	0.68	0.19	0.49	0.18	0.85	0.13	0.72	0.07	1.77	0.13	1.64
	32	1.47	0.19	1.28	0.18	1.72	0.32	1.40	0.07	1.14	0.32	0.82
7D	33	0.81	0.19	0.62	0.18	1.56	0.23	1.33	0.07	0.54	0.23	0.31
	46	1.02	0.20	0.82	0.18	1.40	0.45	0.95	0.07	1.40	0.45	0.95
8D	47	1.32	0.20	1.12	0.18	1.67	0.86	0.81	0.07	NR	NR	NR
	60	0.74	0.20	0.54	0.18	1.20	0.22	0.98	0.07	1.20	0.22	0.98
*9AE	61	0.18	0.18	0.00	0.18	0.07	0.07	0.00	0.07	NR	NR	NR
*	62	0.18	0.18	0.00	0.18	0.07	0.07	0.00	0.07	NR	NR	NR
9D	63	0.95	0.18	0.77	0.18	1.63	0.15	1.48	0.07	0.44	0.15	0.29
	77	1.11	0.22	0.89	0.18	1.40	0.10	1.30	0.07	1.04	0.54	.50
10D	78	1.00	0.21	0.79	0.18	1.13	0.54	0.59	0.07	1.13	0.54	0.59
	82	0.99	0.22	0.77	0.18	1.35	0.70	0.65	0.07	1.35	0.70	0.65
11D	83	0.83	0.22	0.61	0.18	1.04	0.14	0.90	0.07	1.04	0.50	0.54
	88	1.02	0.22	0.80	0.18	1.48	0.75	0.73	0.07	1.48	0.75	0.73
16D	89	0.99	0.22	0.77	0.18	1.60	0.11	1.49	0.07	1.35	0.74	0.61
18D	90	1.18	0.22	0.96	0.18	1.40	0.28	1.12	0.07	NR	NR	NR
	97	0.76	0.23	0.53	0.22	1.17	0.18	0.99	0.07	0.75	0.18	0.57
19D	98	1.23	0.22	1.01	0.21	1.30	0.20	1.10	0.07	1.30	0.45	0.85
	108	0.98	0.24	0.74	0.20	1.45	0.14	1.31	0.07	1.35	0.15	1.20
20D	109	0.84	0.23	0.61	0.21	1.20	0.11	1.09	0.07	1.20	0.55	0.65
	121	0.52	0.20	0.32	0.18	0.80	0.20	0.60	0.07	0.80	0.20	0.60
22D	122	1.05	0.18	0.87	0.18	1.40	0.65	0.75	0.07	1.40	0.65	0.75
	145	0.80	0.20	0.60	0.18	1.85	0.14	1.71	0.07	1.03	0.40	0.63
23D	146	1.11	0.18	0.93	0.18	1.40	0.30	1.10	0.07	1.40	0.30	1.10
	170	1.29	0.23	1.06	0.18	1.97	0.49	1.48	0.07	1.25	0.64	0.61
24D	171	0.96	0.21	0.75	0.18	1.20	0.14	1.06	0.07	1.20	0.60	0.60
	174	1.10	0.23	0.87	0.18	1.67	0.27	1.40	0.07	1.47	1.12	0.35
25D	175	0.84	0.20	0.64	0.18	1.60	0.11	1.49	0.07	0.55	0.23	0.32
	192	0.76	0.21	0.55	0.18	1.20	0.14	1.06	0.07	0.65	0.28	0.37
26D	193	1.12	0.19	0.93	0.18	1.43	0.37	1.06	0.07	1.43	0.37	1.06
	198	0.96	0.22	0.74	0.18	1.40	0.65	0.75	0.07	1.40	0.65	0.75

TOP SECRET
CORONA
NO FOREIGN DISSEM

Mission 1022-1

	STELLAR CAMERA					INDEX CAMERA						
						LIMITING				TERRAIN		
Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta
27D	199	0.97	0.21	0.76	0.18	1.64	0.30	1.34	0.07	1.64	0.30	1.34
	201	1.16	0.21	0.95	0.18	1.60	0.54	1.06	0.07	1.60	0.54	1.06
28D	202	1.46	0.23	1.23	0.18	1.70	0.34	1.36	0.07	1.70	0.34	1.36
	206	1.25	0.21	1.04	0.18	1.75	0.10	1.65	0.07	1.20	0.24	0.96
29D	207	0.51	0.18	0.33	0.18	0.70	0.20	0.50	0.07	0.70	0.20	0.50
	215	0.51	0.20	0.31	0.18	1.08	0.20	0.88	0.07	0.75	0.20	0.55
30D	216	0.99	0.23	0.76	0.20	1.45	0.20	1.25	0.07	1.45	0.35	1.10
	220	1.21	0.23	0.98	0.20	1.35	0.20	1.15	0.07	1.35	0.20	1.15
31D	221	0.87	0.23	0.64	0.20	1.50	0.18	1.32	0.07	1.50	0.20	1.30
	230	1.22	0.23	0.99	0.20	1.80	0.45	1.35	0.07	0.70	0.45	0.25
35D	231	1.07	0.22	0.85	0.20	1.55	0.20	1.35	0.07	0.55	0.20	0.35
	237	1.26	0.23	1.03	0.20	1.55	0.17	1.38	0.07	1.34	0.30	1.04
36D	238	1.13	0.24	0.89	0.19	1.75	0.25	1.50	0.07	0.45	0.25	0.20
	246	1.07	0.22	0.85	0.19	1.73	0.27	1.46	0.07	NR	NR	NR
37D	247	0.97	0.20	0.77	0.18	1.50	0.23	1.27	0.07	1.17	0.23	0.94
	263	1.06	0.19	0.87	0.18	1.76	0.16	1.60	0.07	0.96	0.16	0.80
38D	264	0.91	0.18	0.73	0.18	1.52	0.22	1.30	0.07	1.52	0.27	1.25
	288	1.22	0.22	1.00	0.18	1.43	0.54	0.89	0.07	1.25	0.54	0.71
39D	289	1.25	0.20	1.05	0.18	1.65	0.28	1.37	0.07	1.10	0.28	0.82
	299	1.10	0.22	0.88	0.18	1.45	0.45	1.00	0.07	1.34	0.45	0.89
40D	300	1.10	0.18	0.92	0.18	1.43	0.41	1.02	0.07	NR	NR	NR
	315	1.23	0.27	0.96	0.25	1.52	0.25	1.27	0.07	0.90	0.25	0.65
42D	316	1.29	0.28	1.01	0.25	1.82	0.80	1.02	0.07	NR	NR	NR
	321	1.25	0.22	1.03	0.18	1.64	0.65	0.99	0.07	1.47	0.65	0.82
47DE	322	1.55	0.19	1.36	0.18	1.78	0.47	1.31	0.07	1.24	0.48	0.76
53D	323	1.24	0.20	1.04	0.18	1.93	0.14	1.79	0.07	0.54	0.15	0.39
	348	1.54	0.20	1.34	0.18	1.60	0.15	1.45	0.07	NR	NR	NR
54D	349	1.43	0.20	1.23	0.18	1.65	0.40	1.25	0.07	NR	NR	NR
	366	1.71	0.20	1.51	0.18	1.80	0.35	1.45	0.07	0.87	0.35	0.52
55D	367	1.43	0.20	1.23	0.18	1.70	0.67	1.03	0.07	NR	NR	NR
*	388	1.95	1.20	0.75	0.65	1.25	0.60	0.65	0.07	1.25	0.60	0.65
	392					1.84	1.27	0.57	1.46	NR	NR	NR

*These densities are not included in the ranges or averages.

NR - Denotes No Reading Made

Dmax Range 1.71 - 0.51 Average Dmax 1.07
Dmin Range 0.28 - 0.18 Average Dmin 0.21
Gross Fog Range 0.25 - 0.17 Average Gross Fog 0.21

Terrain Dmax Range 1.77 - 0.44 Limiting Dmax Range 1.97 - 0.70
Terrain Dmin Range 1.12 - 0.13 Limiting Dmin Range 0.86 - 0.10
Average Terrain Dmax 1.15 Average Limiting Dmax 1.48
Average Terrain Dmin 0.38 Average Limiting Dmin 0.32

Gross Fog Range 0.07 - 0.07
Average Gross Fog 0.08

Mission 1022-2

	STELLAR CAMERA NO D24					INDEX CAMERA NO D24						
						LIMITING				TERRAIN		
Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta
67D	1	3.40	0.58	2.82	0.28	1.32	0.23	1.09	0.08	1.32	0.23	1.09
	9	3.54	0.94	2.60	0.33	1.82	0.25	1.57	0.08	1.06	0.25	0.81
69D	10	3.39	0.65	2.74	0.31	1.42	0.24	1.18	0.08	1.12	0.28	0.84
	31	3.60	0.83	2.77	0.25	1.85	0.40	1.45	0.08	1.10	0.40	0.70
70D	32	3.39	0.60	2.79	0.28	1.53	0.55	0.98	0.08	NR	NR	NR
	55	3.45	0.65	2.80	0.30	1.98	0.45	1.53	0.08	0.89	0.62	0.27
71D	56	3.47	0.73	2.64	0.25	1.83	0.59	1.24	0.08	NR	NR	NR
	71	3.34	0.60	2.74	0.34	1.48	0.63	0.85	0.08	0.87	0.63	0.24
72AE	*72	0.28	0.28	0.00	0.28	0.08	0.08	0.00	0.08	NR	NR	NR
	*73	0.28	0.28	0.00	0.28	0.08	0.08	0.00	0.08	NR	NR	NR
75D	74	3.52	0.80	2.62	0.27	1.82	1.08	0.74	0.08	1.82	1.08	0.78
	77	3.50	0.74	2.76	0.29	1.75	0.22	1.53	0.08	1.59	0.53	1.06
79D	78	3.42	0.69	2.73	0.26	1.70	0.49	1.21	0.08	NR	NR	NR
	80	3.43	0.67	2.76	0.30	1.65	0.26	1.39	0.08	NR	NR	NR
83D	81	3.25	0.55	2.70	0.32	1.49	0.23	1.26	0.08	0.49	0.26	0.23
	89	3.44	0.67	2.77	0.25	1.91	0.16	1.75	0.08	0.80	0.39	0.41
85D	90	3.40	0.62	2.78	0.24	1.33	0.41	0.92	0.08	NR	NR	NR
	110	3.55	1.00	2.55	0.25	1.94	0.52	1.42	0.08	NR	NR	NR
86D	111	3.40	0.57	2.83	0.24	1.94	0.41	1.53	0.08	NR	NR	NR
	123	3.47	0.64	2.73	0.27	1.70	0.51	1.19	0.08	1.70	0.51	1.19
87D	124	3.52	0.75	2.77	0.25	1.80	0.28	1.52	0.08	0.63	0.28	0.35
	136	3.30	0.60	2.70	0.27	1.40	0.28	1.12	0.08	1.07	0.28	0.79
88D	137	3.28	0.58	2.70	0.26	1.13	0.28	0.85	0.08	0.80	0.38	0.42
	147	3.30	0.50	2.80	0.26	1.84	0.16	1.68	0.08	0.91	0.42	0.49
94D	148	3.54	0.77	2.77	0.25	2.04	0.43	1.61	0.08	1.18	0.43	0.75
	150	3.50	0.70	2.80	0.26	1.98	0.36	1.62	0.08	1.50	0.36	1.14
97D	151	3.30	0.57	2.73	0.27	1.68	0.24	1.44	0.08	1.68	0.24	1.44
	155	3.30	0.53	2.77	0.29	1.62	0.30	1.32	0.08	0.92	0.54	0.38
98D	156	3.40	0.67	2.73	0.28	1.42	0.24	1.18	0.08	1.42	0.78	0.64
	163	3.40	0.59	2.81	0.26	1.00	0.17	0.83	0.08	0.46	0.20	0.26
99D	164	3.48	0.74	2.74	0.27	1.87	0.28	1.59	0.08	0.60	0.38	0.22
	175	3.37	0.50	2.87	0.25	1.82	0.24	1.58	0.08	NR	NR	NR
100D	176	3.48	0.68	2.80	0.25	1.54	0.20	1.34	0.08	0.48	0.33	0.15
	191	3.64	0.94	2.70	0.26	1.81	0.33	1.48	0.08	1.12	0.72	0.40
101D	192	3.30	0.63	2.67	0.26	1.62	0.17	1.45	0.08	0.83	0.30	0.53
	216	3.52	0.80	2.72	0.24	2.04	0.39	1.65	0.08	0.86	0.59	0.27

*These densities are not included in the ranges or averages. NR - Denotes no reading made.
**Partial frame - Densities are not included in the ranges or averages.

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Mission 1022-2 (Continued)

		STELLAR CAMERA NO D24				INDEX CAMERA NO D24						
						LIMITING				TERRAIN		
Pass	Frame	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta	Gross Fog	Dmax	Dmin	Delta
102D	217	3.45	0.68	2.77	0.26	1.59	0.39	1.20	0.08	0.82	0.39	0.43
	224	3.30	0.63	2.77	0.24	1.40	0.80	0.60	0.08	1.40	0.80	0.60
103D	225	3.48	0.71	2.77	0.26	1.71	0.43	1.28	0.08	NR	NR	NR
	241	3.38	0.71	2.67	0.24	1.91	0.52	1.39	0.08	0.71	0.52	0.19
104D	242	3.22	0.65	2.57	0.27	1.98	0.29	1.69	0.08	0.50	0.31	0.19
	252	3.45	0.68	2.77	0.26	1.16	0.21	0.95	0.08	1.16	0.51	0.65
110DE	253	3.52	0.80	2.72	0.25	1.70	0.40	1.30	0.08	1.29	0.65	0.64
	257	3.30	0.58	2.72	0.24	1.67	0.17	1.50	0.08	1.42	0.72	0.70
115D	258	3.28	0.53	2.75	0.25	1.60	0.32	1.28	0.08	1.38	0.72	0.66
	279	3.33	0.70	2.63	0.26	1.82	0.28	1.54	0.08	NR	NR	NR
116D	280	3.50	0.79	2.71	0.26	1.81	0.27	1.54	0.08	NR	NR	NR
	309	3.59	0.73	2.76	0.26	1.63	0.19	1.44	0.08	1.10	0.42	0.68
118D	310	3.44	0.62	2.82	0.24	1.75	0.29	1.46	0.08	NR	NR	NR
	333	3.40	0.57	2.83	0.24	1.44	0.37	1.07	0.08	1.44	0.37	1.07
119D	334	3.48	0.77	2.71	0.25	1.95	0.27	1.68	0.08	0.67	0.27	0.40
	349	3.27	0.62	2.65	0.33	2.36	0.19	2.17	0.08	0.80	0.56	0.24
125DE	350	3.30	0.67	2.63	0.32	2.38	0.36	2.02	0.08	2.38	0.36	2.02
	355	3.40	0.62	2.78	0.27	1.96	0.17	1.79	0.08	0.75	0.60	0.15
126D	356	3.38	0.62	2.76	0.26	1.98	0.15	1.83	0.08	1.73	0.22	1.51
	357	3.45	0.65	2.80	0.26	1.63	0.21	1.42	0.08	1.10	0.21	0.89
131D	358	3.52	0.83	2.69	0.26	2.08	0.45	1.63	0.08	NR	NR	NR
	369	3.20	0.45	2.75	0.26	1.22	0.24	0.98	0.08	NR	NR	NR
132D	370	3.45	0.71	2.74	0.28	1.60	0.30	1.30	0.08	0.60	0.30	0.30
	392	3.33	0.61	2.72	0.28	2.02	0.47	1.55	0.08	2.02	0.47	1.55
134D	393	3.28	0.62	2.66	0.27	1.86	0.47	1.39	0.08	NR	NR	NR
	402	3.15	0.57	2.58	0.24	2.00	0.47	1.53	0.08	0.90	0.47	0.43
135D	403	3.40	0.83	2.57	0.24	1.96	0.36	1.60	0.08	0.91	0.36	0.55
	**404	2.12	0.89	1.23	0.24							
	419					1.76	0.41	1.35	0.08	1.00	0.41	0.59
136D	420					1.52	1.18	0.34	0.08	1.52	1.18	0.34
	427					1.59	0.85	0.74	0.08	1.33	0.85	0.48
137D	428					1.82	0.43	1.39	0.08	1.35	0.53	0.82
	433					1.60	0.57	1.03	0.08	0.93	0.68	0.25
138D	434					1.90	0.22	1.68	0.08	0.97	0.22	0.75
	442					1.90	0.20	1.70	0.08	1.56	0.20	1.36

**Partial frame - Densities are not included in the ranges or averages. NR - Denotes no reading made.

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STELLAR CAMERA NO D24

Dmax Range 3.64-3.15	Average Dmax 3.41	
Dmin Range 1.00-0.45	Average Dmin 0.67	
Gross Fog Range 0.34-0.24	Average Gross Fog 0.26	

INDEX CAMERA NO D24

	Limiting	Terrain
Dmax Range	1.00-2.38	0.46-2.38
Dmin Range	0.15-1.18	0.20-1.18
Average Dmax	1.73	1.11
Average Dmin	0.36	0.46
Gross Fog Range	0.08-0.08	
Gross Fog Average	0.08	

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APPENDIX C. MICRODENSITOMETRY

1. Edge Spread Function

The technique of obtaining the spread function from microdensitometer edge traces is used to provide 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, 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 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 2,032:1. 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 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.

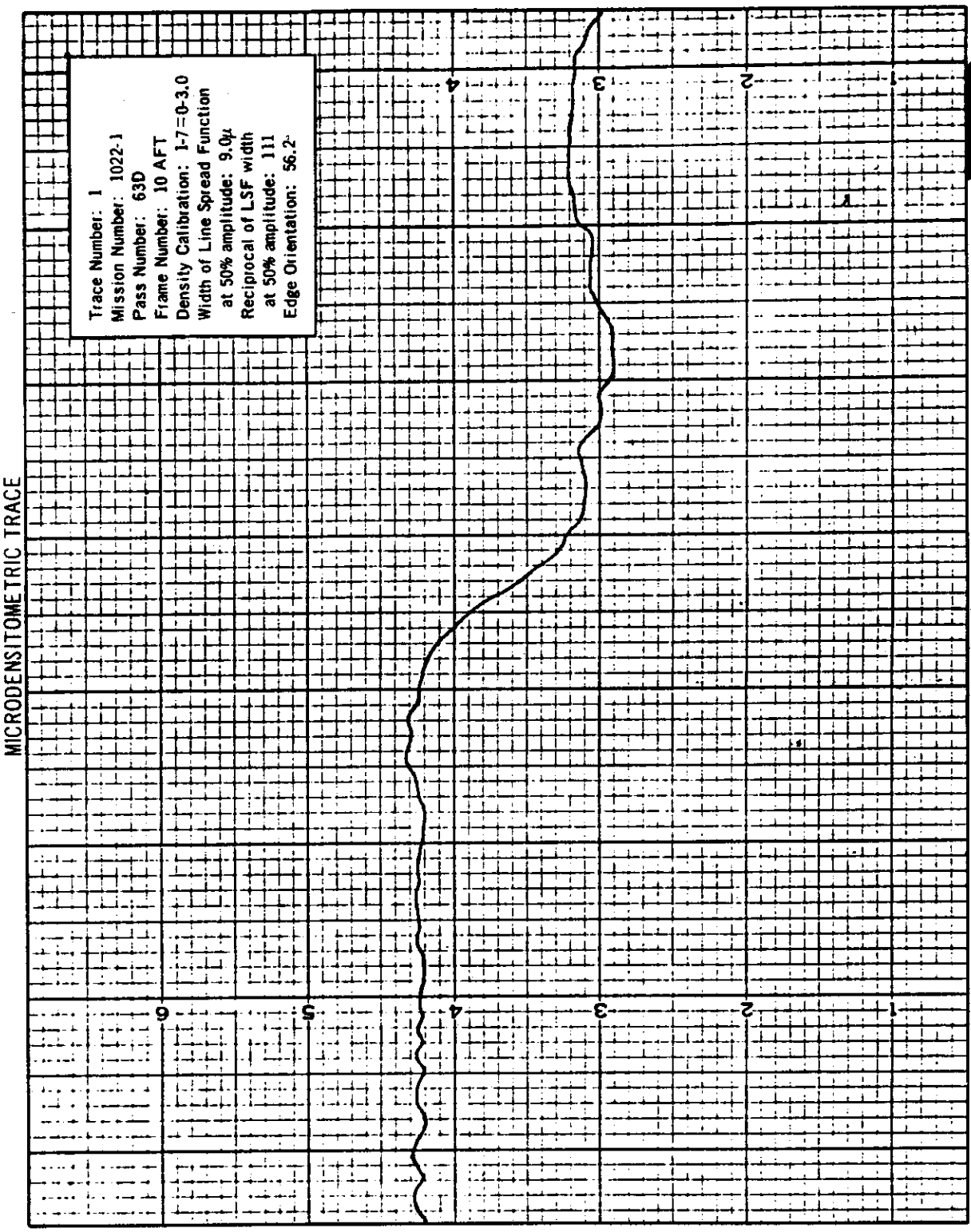
In the table on the next page, the following computer outputs are listed for each edge traced: The 50 percent amplitude width of the Line Spread Function in microns, the reciprocal of the 50 percent width in millimeters, the computer determined reciprocal edge spread (Machine RES), and the intersection 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.

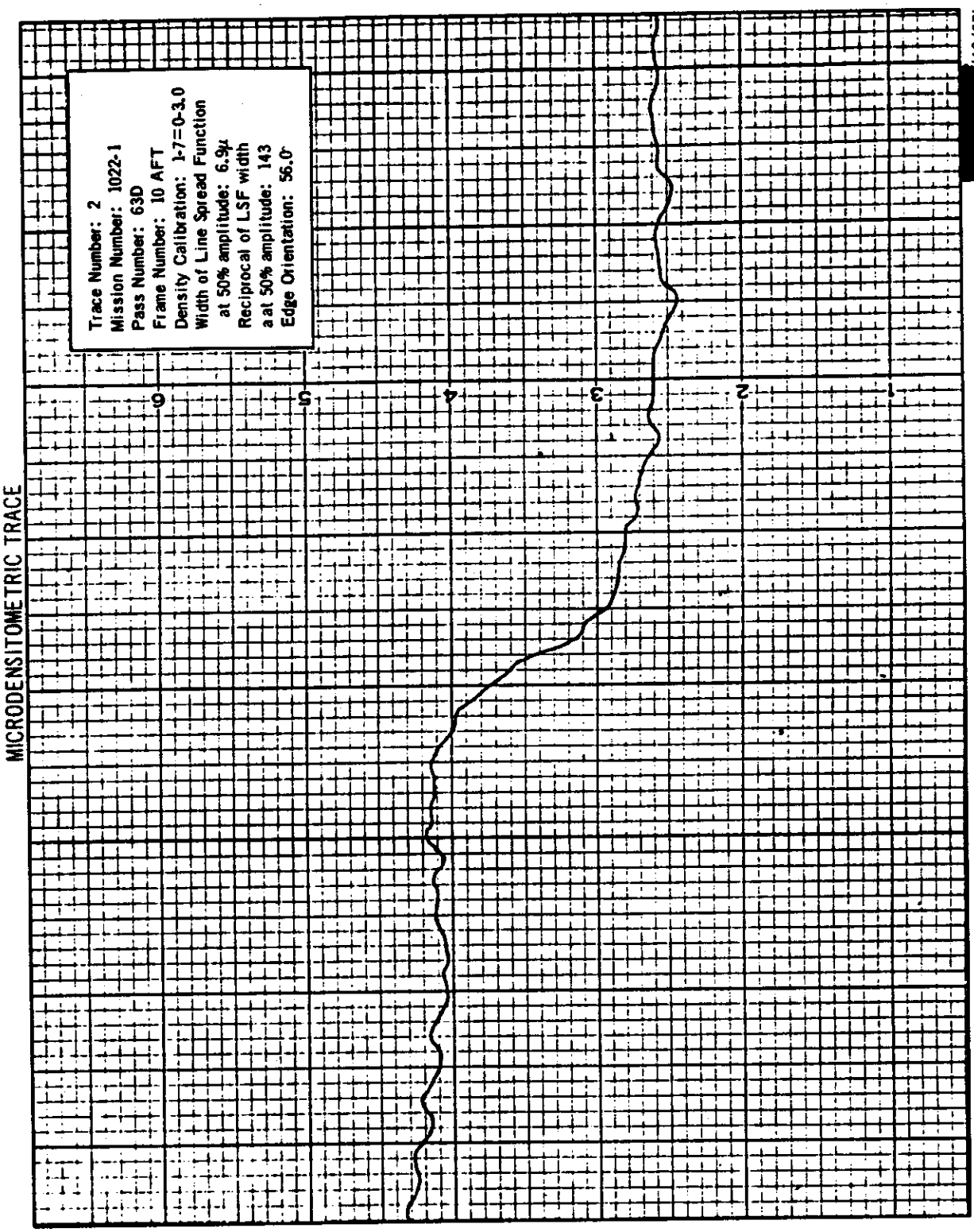
The edge traces were made on the original negative of this mission.

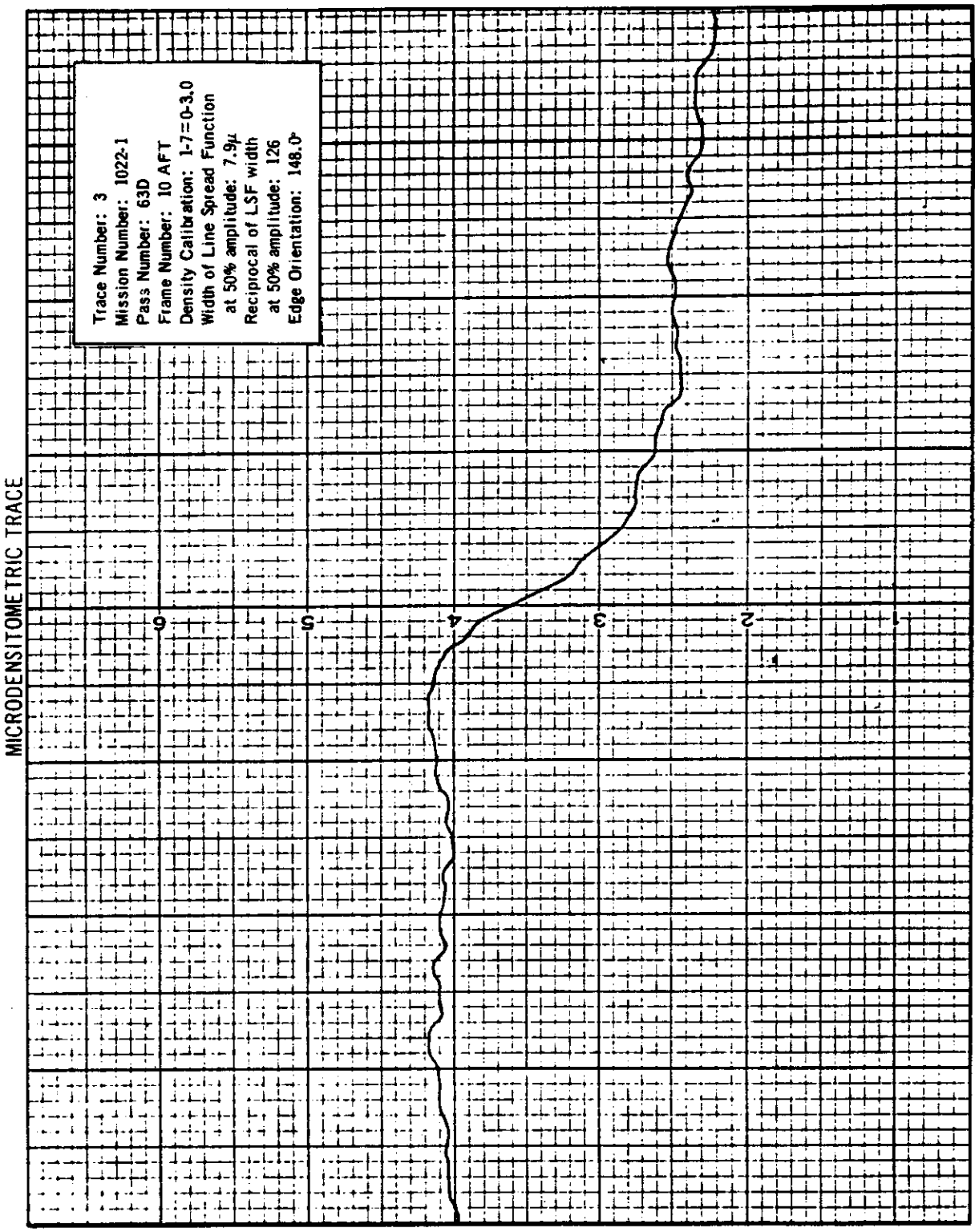
[redacted]

SUMMARY TABLE OF EDGE TRACES

Trace Number	Pass Frame	50% LSF Width	1000/50% LSF Width	Machine RES	MTF/AIM Intersect	Edge Orientation
1	63D/10A	9.0μ	111	98	114	56.2°
2	63D/10A	6.9μ	143	84	122	56.0°
3	63D/10A	7.9μ	126	87	91	148.0°
4	103D/100F	8.5μ	118	74	104	8.8°
5	103D/100F	11.8μ	84	74	74	8.1°
6	103D/100F	11.5μ	86	67	85	97.5°

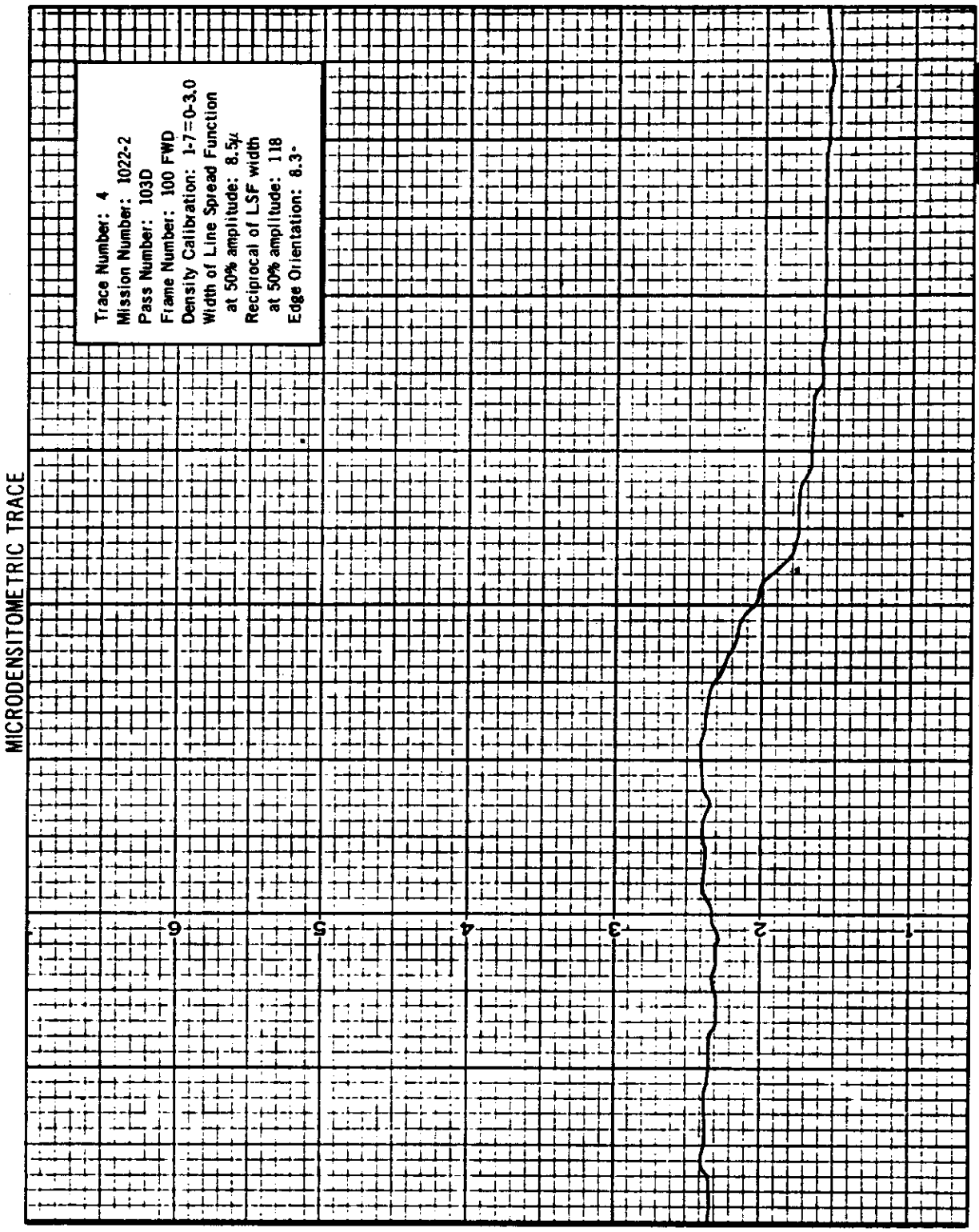

MICRODENSITOMETRIC TRACE
Trace Number: 1
Mission Number: 1022-1
Pass Number: 63D
Frame Number: 10 AFT
Density Calibration: 1-7=0-3.0
Width of Line Spread Function
at 50% amplitude: 9.0μ
Reciprocal of LSF width
at 50% amplitude: 111
Edge Orientation: 56.2°
1
2
3
4
5
6

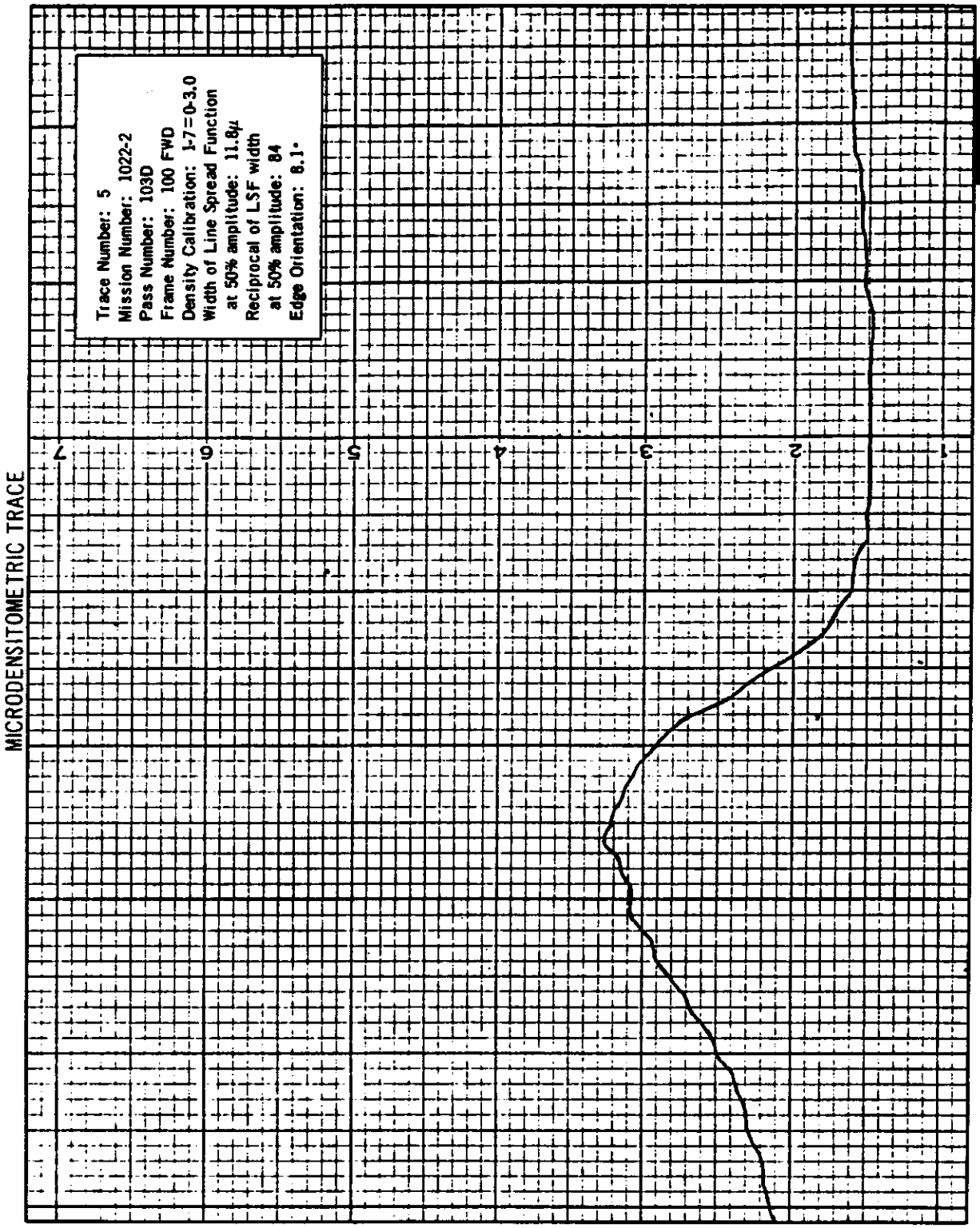

MICRODENSITOMETRIC TRACE
Trace Number: 2
Mission Number: 1022-1
Pass Number: 63D
Frame Number: 10 AFT
Density Calibration: 1-7=0-3.0
Width of Line Spread Function
at 50% amplitude: 6.9μ
Reciprocal of LSF width
a at 50% amplitude: 143
Edge Orientation: 56.0°
0
1
2
3
4
5
6

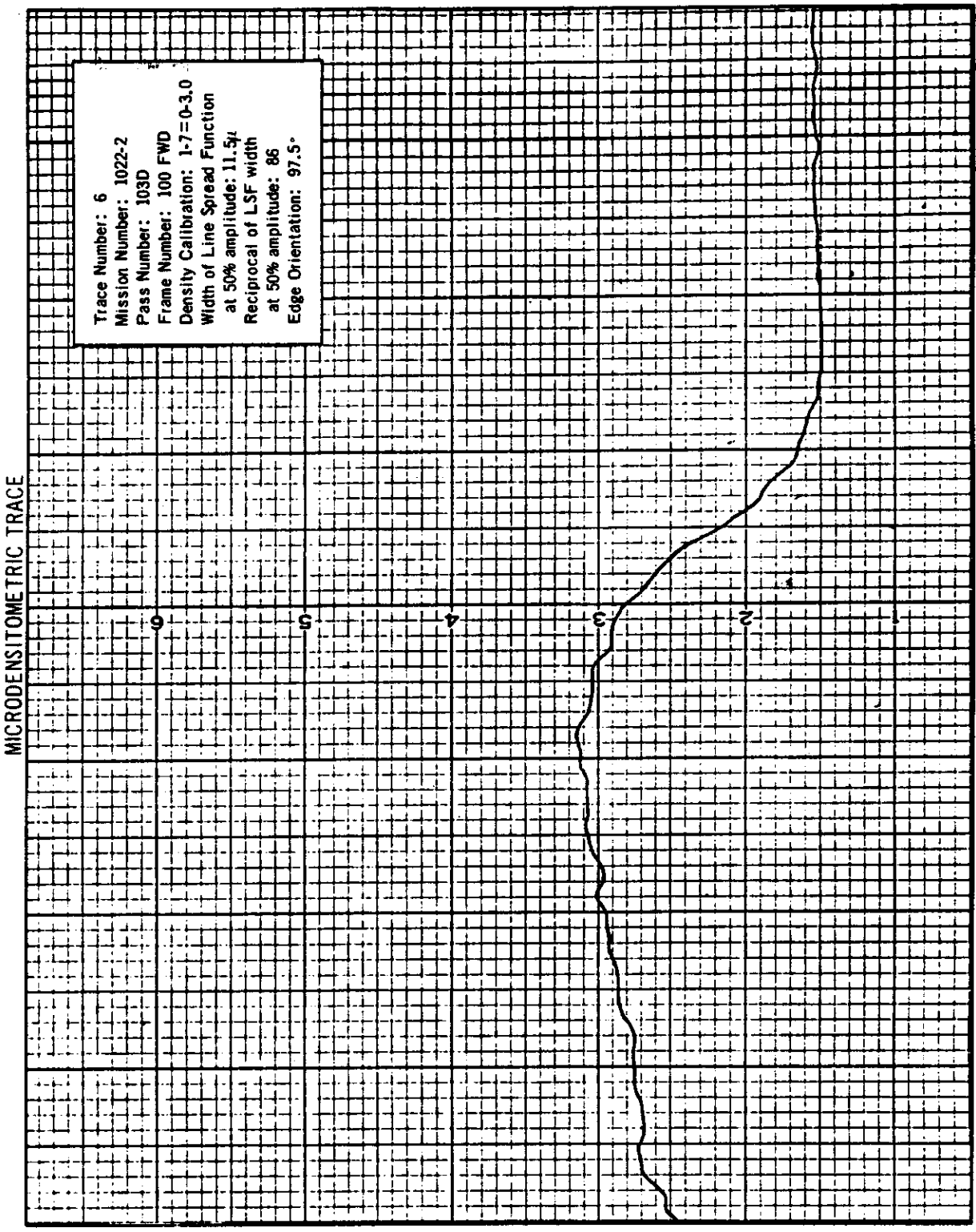

MICRODENSITOMETRIC TRACE
Trace Number: 3
Mission Number: 1022-1
Pass Number: 63D
Frame Number: 10 AFT
Density Calibration: 1-7=0-3.0
Width of Line Spread Function
at 50% amplitude: 7.9μ
Reciprocal of LSF width
at 50% amplitude: 126
Edge Orientation: 148.0°
1
2
3
4
5
6

*** NOTICE OF MISSING PAGES ***

PAGE 30 IS MISSING IN THE ORIGINAL COPY.


MICRODENSITOMETRIC TRACE
Trace Number: 4
Mission Number: 1022-2
Pass Number: 103D
Frame Number: 100 FWD
Density Calibration: 1-7=0-3.0
Width of Line Spread Function
at 50% amplitude: 8.5μ
Reciprocal of LSF width
at 50% amplitude: 118
Edge Orientation: 8.3°
1
2
3
4
5
6


Trace Number: 5
Mission Number: 1022-2
Pass Number: 103D
Frame Number: 100 FWD
Density Calibration: 1-7=0-3.0
Width of Line Spread Function
at 50% amplitude: 11.8μ
Reciprocal of LSF width
at 50% amplitude: 84
Edge Orientation: 8.1°
MICRODENSITOMETRIC TRACE
1
2
3
4
5
6
7


MICRODENSITOMETRIC TRACE
Trace Number: 6
Mission Number: 1022-2
Pass Number: 103D
Frame Number: 100 FWD
Density Calibration: 1-7=0-3.0
Width of Line Spread Function
at 50% amplitude: 11.5μ
Reciprocal of LSF width
at 50% amplitude: 86
Edge Orientation: 97.5°
1
2
3
4
5
6

APPENDIX D. CLOUD COVER ANALYSIS

I. Introduction

This study represents a statistical analysis of the cloud cover on the photography of Mission 1022. 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 (See 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 % 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%
		43.78%

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 1022

Mission 1022-1

Pass Number	1	2	3	4	5	Cloud Cover % Per Pass
2D	0.0	3.4	6.8	77.3	12.5	73.6
5D	61.1	7.9	13.4	13.4	4.2	23.8
6D	30.5	8.3	18.8	39.2	3.2	42.7
7D	56.2	10.5	8.5	24.4	0.4	26.6
8D	22.7	10.6	10.4	42.3	14.0	52.6
9D	18.2	10.9	48.3	22.6	0.0	38.1
10D	100.0	0.0	0.0	0.0	0.0	5.0
11D	75.0	7.4	10.2	7.4	0.0	14.5
18D	0.0	5.8	33.8	50.4	10.0	61.7
19D	55.0	13.1	13.1	13.3	5.5	25.6
20D	58.7	8.7	9.5	17.2	5.9	26.8
22D	14.8	15.7	26.2	30.6	12.7	49.1
23D	14.8	12.7	30.2	35.6	6.7	47.8
24D	86.7	7.5	3.3	2.5	0.0	8.8
25D	20.7	17.4	22.7	39.2	0.0	42.1
26D	99.0	1.0	0.0	0.0	0.0	5.1
29D	77.9	8.1	7.0	7.0	0.0	13.2
35D	40.0	7.5	7.9	20.8	23.8	45.7
36D	0.7	1.8	7.4	67.3	22.8	76.4
37D	25.9	14.5	19.5	37.1	3.0	42.0
38D	32.7	16.8	24.6	23.4	2.5	34.0
39D	62.4	9.1	6.2	10.0	12.3	26.9
40D	9.0	10.2	29.0	43.1	8.8	54.3
42D	18.4	19.9	34.7	27.0	0.0	37.9
53D	18.0	15.0	27.8	29.6	9.6	45.9
54D	3.6	9.3	18.8	59.7	8.6	62.3
55D	31.1	5.3	3.0	50.5	5.1	48.4
56D	38.1	7.3	25.9	24.2	4.5	35.7
58D	24.4	25.6	44.8	5.2	0.0	26.6
	32.4*	10.9*	20.1*	30.4*	6.2*	40.2**

Mission 1022-2

Pass Number	1	2	3	4	5	Cloud Cover % Per Pass
67D	57.0	3.9	2.8	12.3	24.0	37.8
69D	25.6	12.4	27.2	31.5	3.3	40.8
70D	13.7	12.3	23.1	40.3	10.6	52.5
71D	36.1	4.8	13.5	42.7	2.9	42.7
83D	60.9	10.3	9.0	18.6	1.3	23.5
85D	11.8	7.4	28.9	38.9	13.0	55.1
86D	48.0	12.4	25.5	14.1	0.0	24.8
87D	11.8	11.3	47.6	23.5	5.8	44.1
88D	46.6	16.8	19.8	16.8	0.0	25.4
97D	37.8	9.1	16.5	28.1	8.5	39.3
98D	83.1	10.2	5.9	0.8	0.0	8.8
99D	5.5	7.9	19.2	45.0	22.4	65.1
100D	4.2	18.0	47.7	23.1	7.0	45.8
101D	21.9	10.1	36.7	29.0	2.3	40.9
102D	11.5	5.7	67.6	15.2	0.0	38.6
103D	31.7	15.8	13.8	32.7	6.0	40.1
104D	69.3	6.3	6.0	9.4	9.0	22.9
115D	35.4	10.7	5.5	29.8	18.6	46.7
116D	28.2	30.7	25.6	13.0	2.5	28.8
118D	48.0	3.1	5.3	30.8	12.8	40.9
119D	22.8	9.1	33.9	15.9	18.3	45.8
131D	13.1	25.8	20.8	34.2	6.1	44.8
132D	15.6	20.9	47.0	12.8	3.7	35.6
134D	21.8	7.9	24.0	22.0	24.3	52.5
135D	4.9	11.7	17.7	60.4	5.3	59.6
136D	100.0	0.0	0.0	0.0	0.0	5.0
	28.7*	12.5*	24.0*	26.7*	8.1*	40.9**

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

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