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OPTICAL TECHNOLOGY DIVISION

PROJECT MEMORANDUM

PM-1519-X

19 AUGUST 1974

SENSOR SYSTEM POST FLIGHT REPORT

SV-8 (S/N 011)

Prepared by: Flight Operations and Evaluation Section

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PROJECT MEMORANDUM NUMBER: PM-1519-X

PREPARED BY; Flight Operations & Evaluation

DATE: 19 AUGUST 1974

SUBJECT: Sensor System Post Flight Report SV-8 (S/N 011)

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ABSTRACT: This report outlines the flight history for the SV-8 (S/N 011) Sensor System.

DESCRIPTORS:

Flight Report, S/N 011
Flight Operations, S/N 011

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LIST OF ILLUSTRATIONS

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MISSION 1208

SENSOR SYSTEM OPERATION

POST FLIGHT REPORT

1.0 INTRODUCTION

1.1 Mission Objective

The primary objective of the Hexagon Mission is to provide high resolution photography. The intent of the eighth flight was to demonstrate functional operation of the primary satellite vehicle 93 day capability. This objective was surpassed with an active mission life of 105 days.

1.2 Mission Description

The Hexagon Mission 1208 satellite vehicle was launched from VAFB, SLC-4E, at 1320PST 10 April 1974 using a Titan 3D booster vehicle. The first recovery vehicle was successfully retrieved from the water and the remaining three recovery vehicles were successfully air retrieved within predicted impact dispersions. Recoveries were Day 14, 42, 69 and 105 respectively.

During testing at the launch base, a small leak was detected in the fwd camera pneumatics. The leak was determined to be between the high pressure isolation valve (HPIV) and the regulator. To prevent any loss of nitrogen gas during the mission it was decided to operate with the HPIV-A closed. The count down and launch phase were accomplished without incident. After insertion, the sensor system was successfully uncaged. The constant velocity test on Rev 2 and the health check on Rev 4 were also accomplished successfully.

Operational photography began on Rev 5, Mission Op No. 4, and continued with no camera system malfunctions until Rev 980 when the system failed to execute two operations. The failure was determined to be a missing forward camera take-up Builder Roller (BR) down verification interlock signal. Operations were resumed on Rev 996 with the system configured in SCC II with BR down verification interlock disabled (VIA-DIS). When transfer to RV-4 was made, VIA was re-enabled and operated satisfactorily for the remaining portion of the mission.

With subsequent Vendor data the nitrogen gas leak, detected on the pad, was isolated to the low pressure side of the regulator and calculations showed the magnitude of the leak would not cause any significant increase in gas usage rate. On Rev 563 the HPIV-A was opened and the pneumatics system remained in it's normal configuration for the remaining portion of the mission.

On Rev 1268 the system shut down due to a failure of the aft camera take-up integrator servo to reset at TU brakes off. This failure necessitated eliminating nested operations when operations were resumed on Rev 1300. The system continued to operate normally for the rest of the mission.

Evaluation of the RV-1 film indicated a need to change the forward camera focal plane plus 8 microns and the aft camera in-track OOAA setting minus 3 steps. These changes were made on mission ops 156 and 160 respectively. Evaluation of the RV-2 film indicated a need to change the forward camera cross-track OOAA bias by plus 1 step. This change was accomplished on mission OP 399.

The aft camera film supply contained one 2600 foot segment of SO-255 color film and one 3000 foot segment of FE-3916 IR color film. The operational intervals associated with the color films were as follows:

SO-255	OPS 723 to 747	Revs 1511 to 1596
FE-3916	OPS 748 to 774	Revs 1597 to 1694

The active photographic mission was terminated with RV-4 recovery on day 105 following depletion of both film supplies. A solo phase of the mission extended the vehicle life to day 109, at which time the vehicle was deboosted and re-entered.

1.3 Mission Highlights

Sensor system highlights of the mission can be summarized as follows:

a. The sensor system demonstrated a functional orbital life of 105 days.

b. Both forward and aft cameras utilized 100% of their respecective film supplies. Approximately 95% of the available pneumatics was expended.

1.3 Mission Highlights - Cont'd.

c. The sensor system demonstrated the capability to operate satisfactorily with FE-3916 infrared color film and SO-255 color film in the aft camera.

d. [redacted]

e. The general over-all mission image quality for both cameras ranged from very good to poor; the poor being attributable to atmospheric conditions, high sun angles and specular/shadowless acquisitions. Majority of the good imagery was associated with the aft camera.

Figure 1-1 presents a graphic history of remaining system life percentages throughout the mission.

1.4 Launch Configuration

a. Mission Operation Number 1208.
b. Intra-range Operation No. 6245.
c. Satellite Vehicle - SV-8.
d. Sensor System - S/N 011.
e. Sensor System Configuration.

	Forward Camera	Aft Camera
Filter Types	W-12	W-12
Focal Length	59.9760 in.	59.9890 in.
Focus Setting	68 Microns	25 Microns
OOAA Setting		
In-Track	-4 CMD Steps	-2 CMD Steps
Cross-Track	1 CMD Step	-3 CMD Steps
Film Type	1414	1414/SO-255/FE-3916
Film Length	108,854	106,567
Film Weight	862.1 lbs.	861.4 lbs.
Spool Number	5077	5076
Pneumatics Loaded	35.4 lbs.	

1.5 Launch and Orbital Parameters

	Planned	Actual
Launch Time-GMT	2020Z	2020Z
Launch Time-SVT	67.0	67.0
Inclination-degrees	94.51	94.52

1.5 Launch and Orbital Parameters-Cont'd.

	Planned	Actual
Initial Perigee-n. miles	84.94	85.55
Initial Apogee-n. miles	162.22	164.73
Argument of Perigee-degrees	149.71	141.36
Initial Period-minutes	89.0	89.01

Table 1-1 and Figures 1-2 and 1-3 define the basic orbital parameter considerations for the active mission. Forty-three orbit adjusts were performed.

1.6 Mission Film Usage Summary

The distribution of film footage as functions of the various operating modes is presented in Figures 1-4 to 1-21. The mission segment to segment film usage is summarized as follows:

	Rev Span	Camera	Recovered Footage
RV-1	Launch-225	Forward	28042
		Aft	28111
RV-2	226-674	Forward	28848
		Aft	27766
RV-3	675-1116	Forward	25258
		Aft	24225
RV-4	1117-1700	Forward	26827
		Aft	26608

Of this footage, the engineering and other non-intelligence operations consumed approximately 4600 and 4800 feet for the A and B sides, respectively, as summarized in the following:

1208 Non-Intelligence

	Forward Camera	Aft Camera
Pre-Launch	1853	1991
RV-1 Engineering	1055	1055
RV-2 Engineering	702	702
RV-3 Engineering	437	478
RV-4 Engineering	596	605
Total Utilization	4643	4831
Film Recovered	108975	106710
PCT. Non-Intelligence	4.26	4.53

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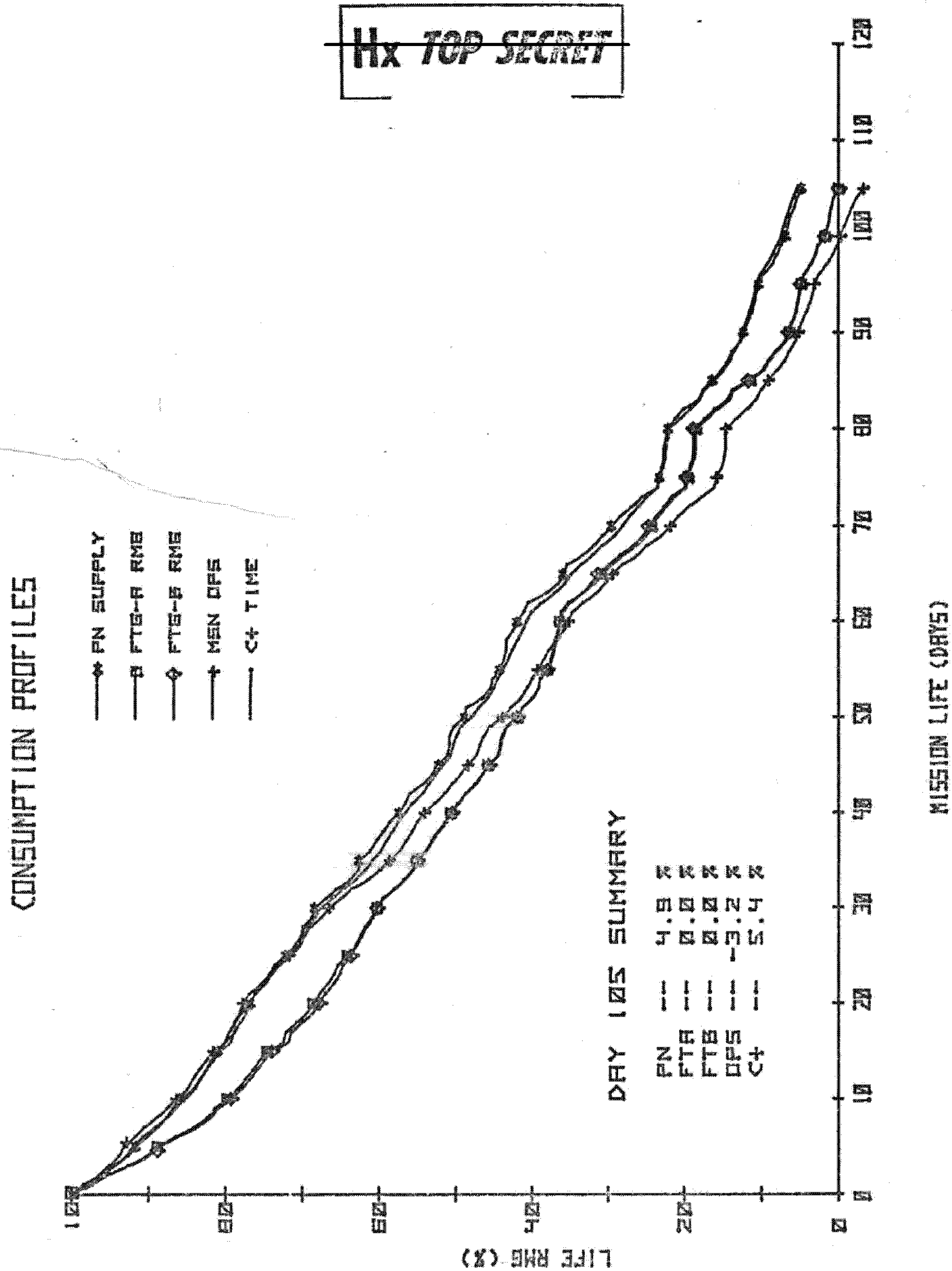

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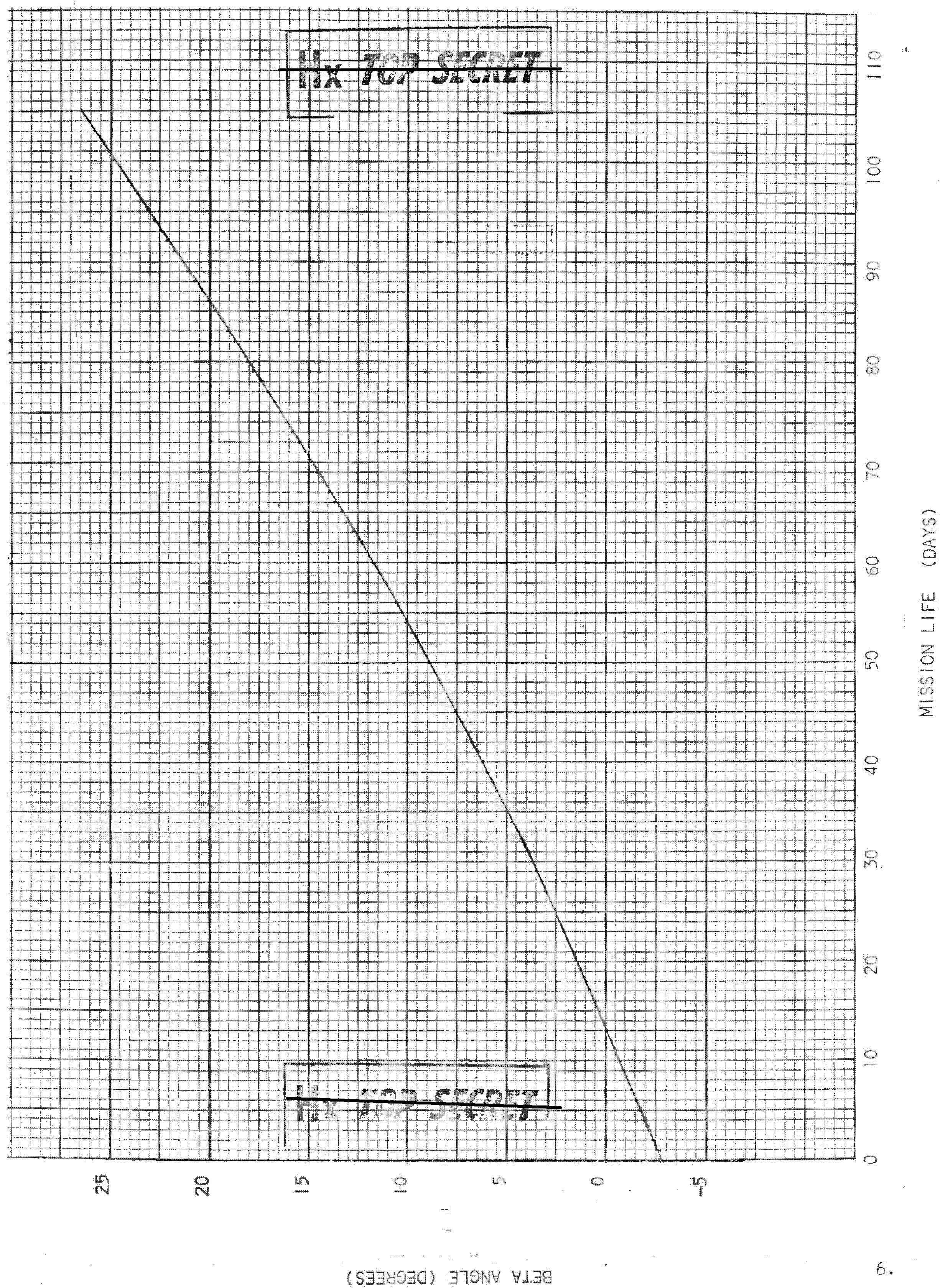
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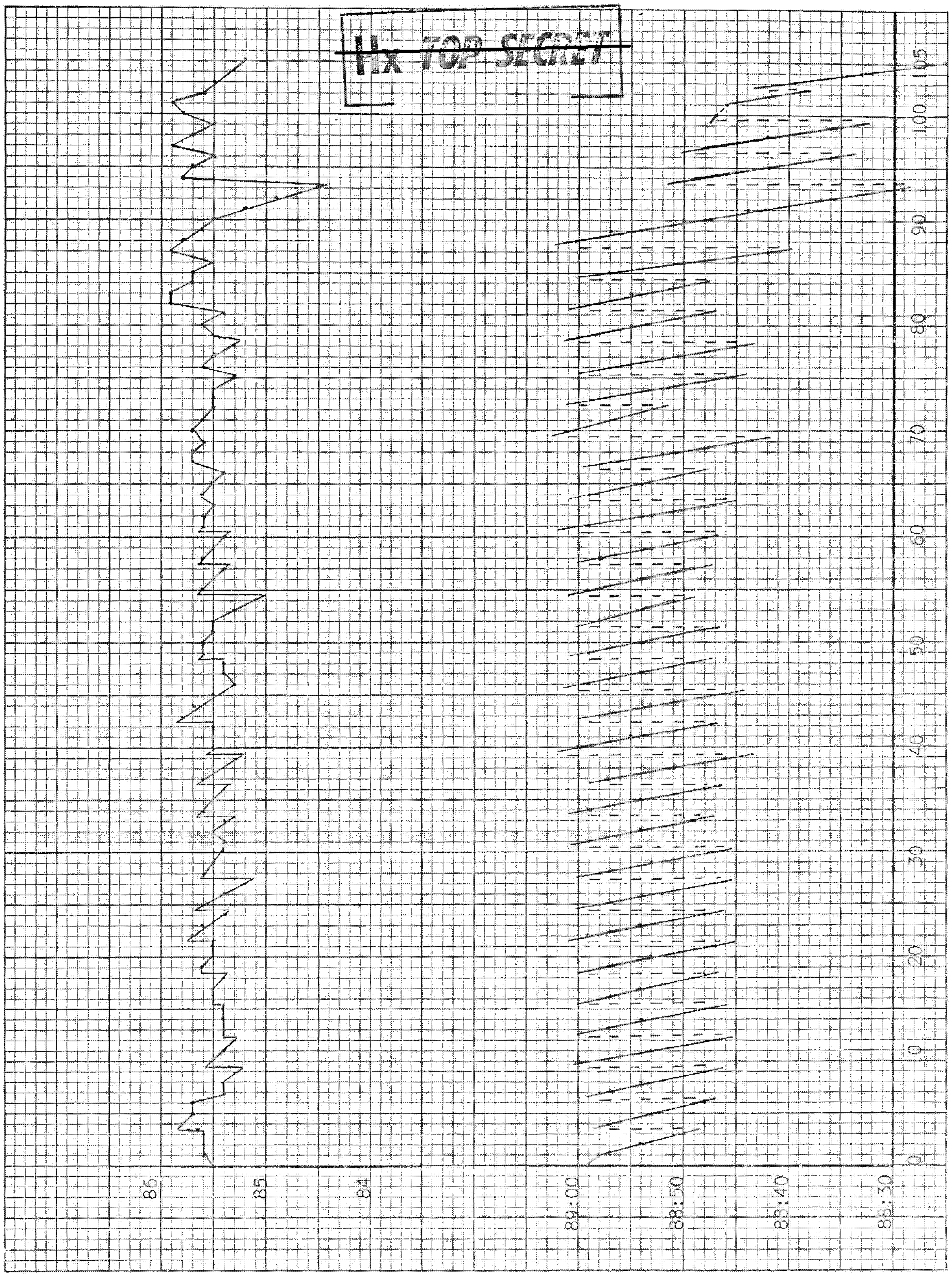
Hx TOP SECRET
0
10
20
30
40
50
60
70
80
90
100
110
MISSION LIFE (DAYS)
25
20
15
10
5
0
-5
BETA ANGLE (DEGREES)

FIGURE I - 3



PERIGEE ALTITUDE (N.M.) PERIOD (MIN:SEC)

TABLE I - I

BASIC ORBITAL PARAMETERS

DAY	REV	PERIOD	PERIGEE	APOGEE	INC	ARG/PER	B ANG
0	NOM	88:59	85.5	162.9	94.5	143.4	
0	1	89:00	85.5	164.5	94.5	141.0	-2.6
1	8	88:58	85.6	163.5	94.5	138.9	-2.6
2	24	88:54	85.6	161.0	94.5	134.8	-2.3
3	40	88:50	85.6	158.4	94.5	130.6	-2.1
OA#1	46						
4	57	88:57	85.8	165.1	94.5	130.9	-1.9
5	73	88:53	85.7	162.7	94.5	126.7	-1.7
6	89	88:48	85.7	160.1	94.5	122.7	-1.5
OA#2	94						
OA#3	96						
7	105	88:58	85.4	161.1	94.5	147.5	-1.3
8	121	88:54	85.4	158.5	94.5	143.2	-1.1
9	138	88:48	85.3	155.0	94.5	138.4	-0.9
OA#4	143						
10	156	88:58	85.5	162.4	94.5	140.4	-0.7
11	170	88:53	85.4	159.5	94.5	136.1	-0.5
12	186	88:47	85.3	156.5	94.5	132.0	-0.3
OA#5	192						
13	202	88:58	85.4	165.4	94.5	133.9	-0.1
14	218	88:54	85.4	162.5	94.5	129.8	+0.1
15	235	88:48	85.4	159.1	94.5	125.3	+0.3
OA#6	240						
OA#7	242						
16	251	88:58	85.5	160.7	94.5	147.2	0.5
17	267	88:54	85.5	158.0	94.5	143.0	0.8
18	283	88:49	85.4	155.2	94.5	138.8	1.0
OA#8	289						
19	299	88:58	85.6	162.7	94.5	140.1	1.2
20	313	88:53	85.5	160.2	94.5	135.5	1.4
21	332	88:47	85.5	156.3	94.5	131.2	1.6
OA#9	337						
22	348	88:59	85.7	166.2	94.5	133.4	1.9
23	364	88:54	85.6	163.1	94.5	129.6	2.1
24	380	88:48	85.4	159.5	94.5	125.5	2.3
OA#10	386						
OA#11	388						
25	397	88:58	85.6	160.3	94.5	147.2	2.5
26	413	88:52	85.4	157.2	94.5	142.8	2.7
27	429	88:47	85.2	154.2	94.5	138.4	3.0
OA#12	434						

TABLE I - I Cont'd.

BASIC ORBITAL PARAMETERS

DAY	REV	PERIOD	PERIGEE	APOGEE	INC	ARG/PER	B ANG
28	445	88:58	85.6	162.0	94.5	141.8	3.2
29	461	88:53	85.5	159.1	94.5	137.6	3.5
30	477	88:47	85.4	155.8	94.5	133.3	3.7
OA#13	483						
31	494	88:59	85.4	165.3	94.5	135.4	3.9
32	510	88:54	85.5	162.5	94.5	131.1	4.2
33	526	88:49	85.4	159.5	94.5	127.0	4.4
OA#14	532						
OA#15	534						
34	542	88:59	85.6	161.0	94.5	147.9	4.7
35	558	88:54	85.5	158.3	94.5	143.5	4.9
36	575	88:48	85.4	154.6	94.5	138.8	5.2
OA#16	580						
37	591	88:57	85.6	161.8	94.5	140.7	5.5
38	607	88:51	85.4	158.6	94.5	136.5	5.7
39	623	88:46	85.3	155.4	94.5	132.3	6.0
OA#17							
40	639	89:00	85.5	166.3	94.5	135.6	6.2
41	655	88:55	85.5	163.4	94.5	131.4	6.5
42	672	88:50	85.5	160.4	94.5	126.9	6.8
OA#18	683						
43	688	88:58	85.8	166.6	94.5	128.3	7.0
44	704	88:53	85.7	163.3	94.5	124.3	7.3
45	720	88:46	85.5	159.5	94.5	120.4	7.6
OA#19	726						
OA#20	728						
46	736	88:59	85.3	161.9	94.5	148.5	7.8
47	753	88:54	85.4	158.7	94.5	143.6	8.1
48	769	88:49	85.4	155.7	94.5	139.2	8.4
OA#21	774						
49	785	88:59	85.6	163.0	94.5	141.1	8.6
50	805	88:49	85.6	160.1	94.5	136.9	8.9
51	817	88:48	85.5	156.6	94.5	132.7	9.2
OA#22	823						
52	834	88:58	85.5	164.9	94.5	133.8	9.5
53	850	88:52	85.3	161.3	94.5	129.6	9.8
54	866	88:51	85.1	157.7	94.5	125.5	10.1
OA#23	871						
55	882	88:59	85.6	167.6	94.5	129.6	10.3
56	896	88:54	85.5	164.3	94.5	125.5	10.6
57	914	88:49	85.4	160.8	94.5	121.4	10.9

TABLE I - I Cont'd.

BASIC ORBITAL PARAMETERS

DAY	REV	PERIOD	PERIGEE	APOGEE	INC	ARG/PER	B ANG
OA#24	920						
OA#25	922						
58	931	88:58	85.6	160.6	94.5	147.6	11.2
59	947	88:53	85.5	157.8	94.5	143.1	11.5
60	963	88:48	85.4	154.9	94.5	138.7	11.8
OA#26	975						
61	979	88:59	85.6	162.9	94.5	142.5	12.1
62	996	88:53	85.6	159.5	94.5	138.2	12.4
63	1012	88:47	85.5	155.4	94.5	133.5	12.8
OA#27	1017						
64	1029	88:59	85.6	165.5	94.5	136.4	13.1
65	1044	88:54	85.5	162.2	94.4	132.2	13.4
66	1060	88:49	85.4	158.7	94.4	128.1	13.7
OA#28	1065						
67	1076	88:57	85.7	165.2	94.4	130.2	14.0
68	1092	88:52	85.7	161.7	94.4	126.1	14.3
69	1109	88:44	85.6	156.8	94.4	121.5	14.6
OA#29	1120						
70	1125	89:06	85.7	174.1	94.5	127.0	14.9
71	1141	88:59	85.6	169.8	94.5	122.8	15.2
72	1157	88:53	85.5	165.9	94.4	118.9	15.5
OA#30	1162						
OA#31	1164						
73	1173	88:58	85.5	160.2	94.4	147.7	15.9
74	1190	88:52	85.5	157.0	94.4	143.0	16.2
75	1206	88:46	85.3	153.5	94.4	138.5	16.5
OA#32	1211						
76	1222	88:57	85.6	161.8	94.4	141.1	16.8
77	1238	88:52	85.5	158.7	94.4	137.0	17.1
78	1254	88:45	85.3	154.1	94.4	132.8	17.4
OA#33	1260						
79	1270	88:59	85.5	164.9	94.4	137.5	17.8
OA#34	1282						
80	1286	88:55	85.6	162.3	94.4	134.1	18.1
81	1303	88:49	85.4	158.5	94.4	129.9	18.4
OA#35	1313						
82	1321	88:59	85.9	166.2	94.4	133.0	18.8
83	1335	88:55	85.9	163.3	94.4	129.3	19.1
84	1351	88:49	85.7	159.5	94.4	125.2	19.4
OA#36	1357						
85	1368	88:57	85.7	167.3	94.4	125.9	19.8

TABLE I - I Cont'd.

BASIC ORBITAL PARAMETERS

DAY	REV	PERIOD	PERIGEE	APOGEE	INC	ARG/PER	B ANG
86	1384	88:50	85.5	162.8	94.4	121.8	20.1
87	1400	88:42	84.9	156.8	94.4	117.6	20.4
OA#37	1406						
OA#38	1408						
88	1416	89:02	85.8	164.3	94.4	148.0	20.8
89	1432	88:57	85.6	160.7	94.4	143.6	21.1
90	1449	88:50	85.5	156.3	94.4	138.0	21.4
91	1465	88:44	85.2	152.3	94.4	134.4	21.8
92	1481	88:37	84.9	147.8	94.4	129.9	22.1
93	1497	88:29	84.5	142.9	94.4	125.5	22.4
OA#39	1502						
94	1513	88:49	85.8	155.1	94.4	138.0	22.8
95	1530	88:42	85.7	151.2	94.4	133.2	23.1
96	1546	88:36	85.5	147.2	94.4	128.8	23.4
OA#40	1551						
97	1562	88:48	85.9	155.1	94.4	134.3	23.8
98	1578	88:42	85.7	151.3	94.4	130.0	24.1
99	1594	88:35	85.5	147.2	94.4	125.7	24.4
OA#41	1600						
100	1611	88:47	85.8	156.1	94.4	130.3	24.8
OA#42	1616						
101	1627	88:46	85.9	155.6	94.4	128.6	25.1
102	1643	88:39	85.6	151.8	94.4	124.6	25.4
OA#43	1649						
103	1659	88:41	85.5	153.1	94.4	123.9	25.8
104	1676	88:33	85.2	148.3	94.4	119.3	26.1
105	1692	88:24	84.3	141.4	94.4	115.0	26.5

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MSN-1208
CAMERA A

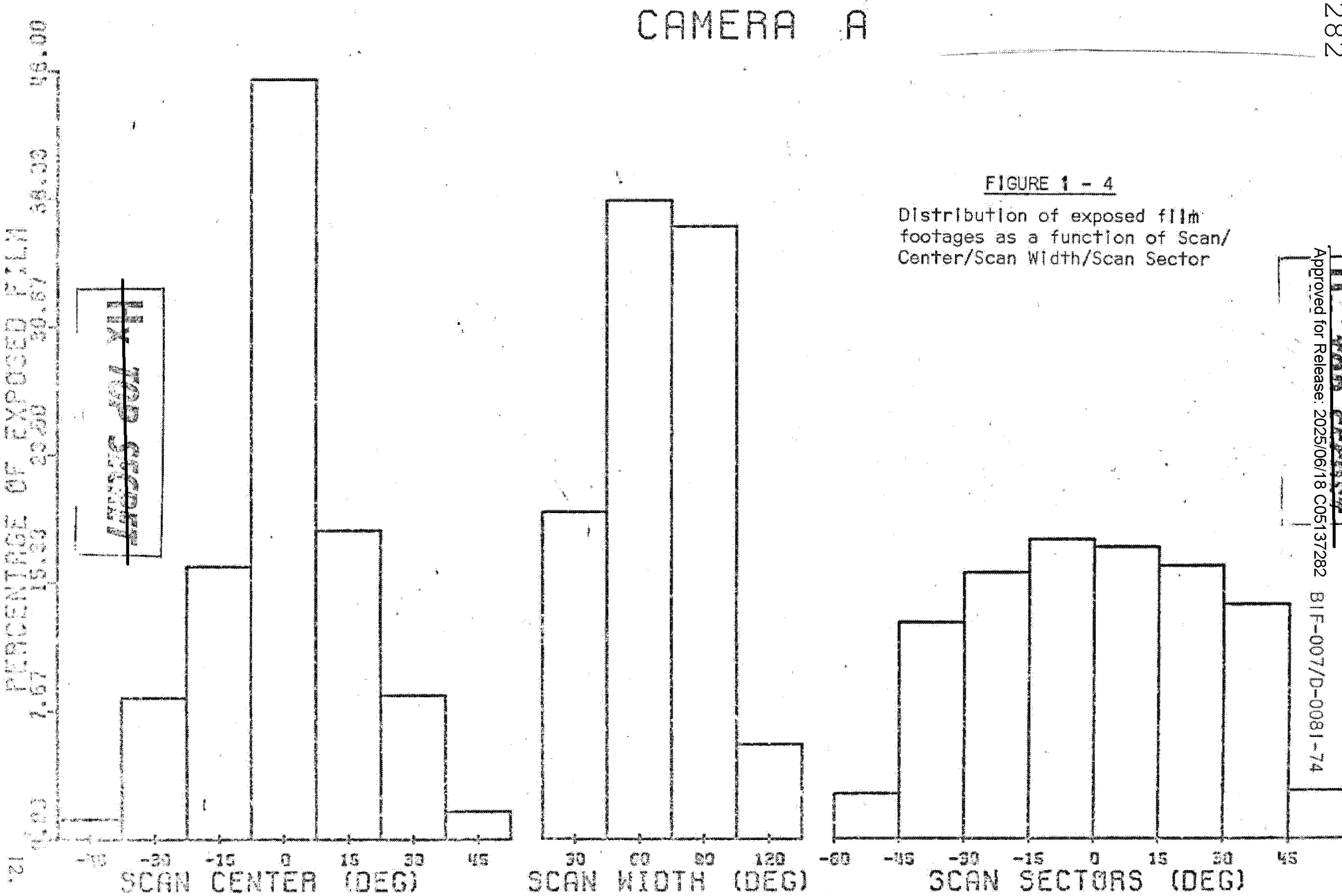

FIGURE 1 - 4

Distribution of exposed film footages as a function of Scan/Center/Scan Width/Scan Sector

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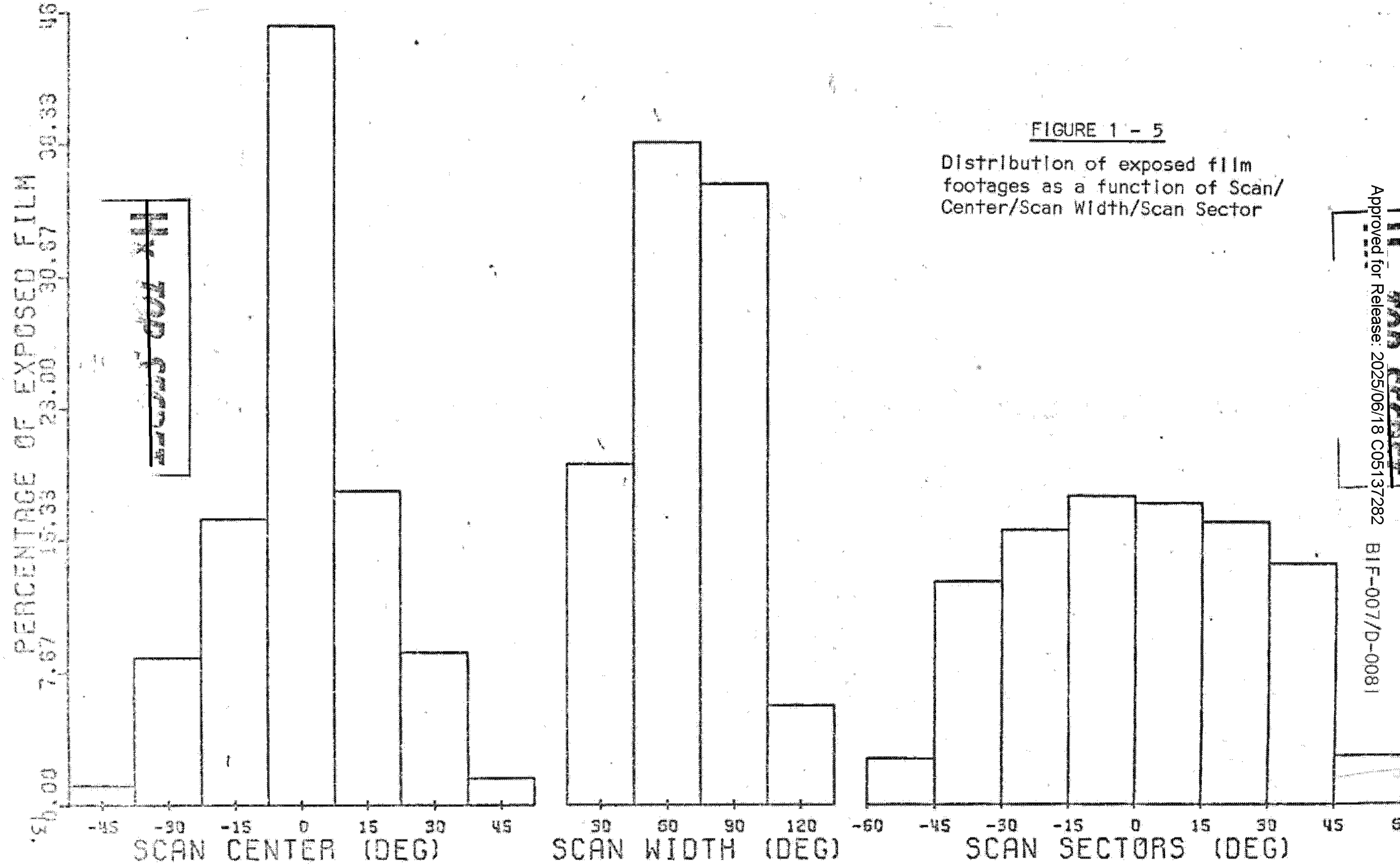
MSN-1208
CAMERA B

FIGURE 1 - 5

Distribution of exposed film footages as a function of Scan/Center/Scan Width/Scan Sector



13.

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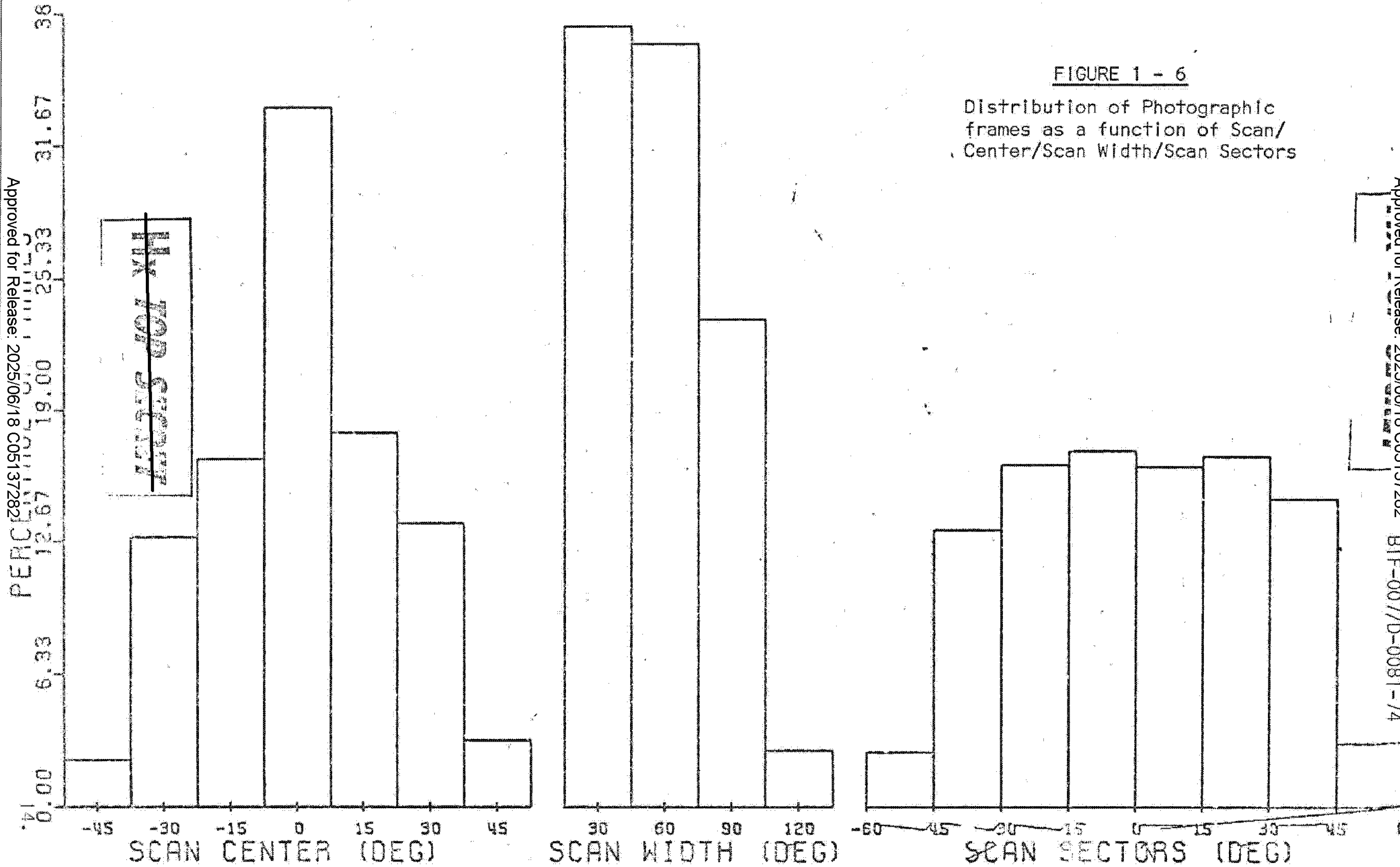
MSN-1208

CAMERA A

FIGURE 1 - 6

Distribution of Photographic frames as a function of Scan/Center/Scan Width/Scan Sectors



14.

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CAMERA B

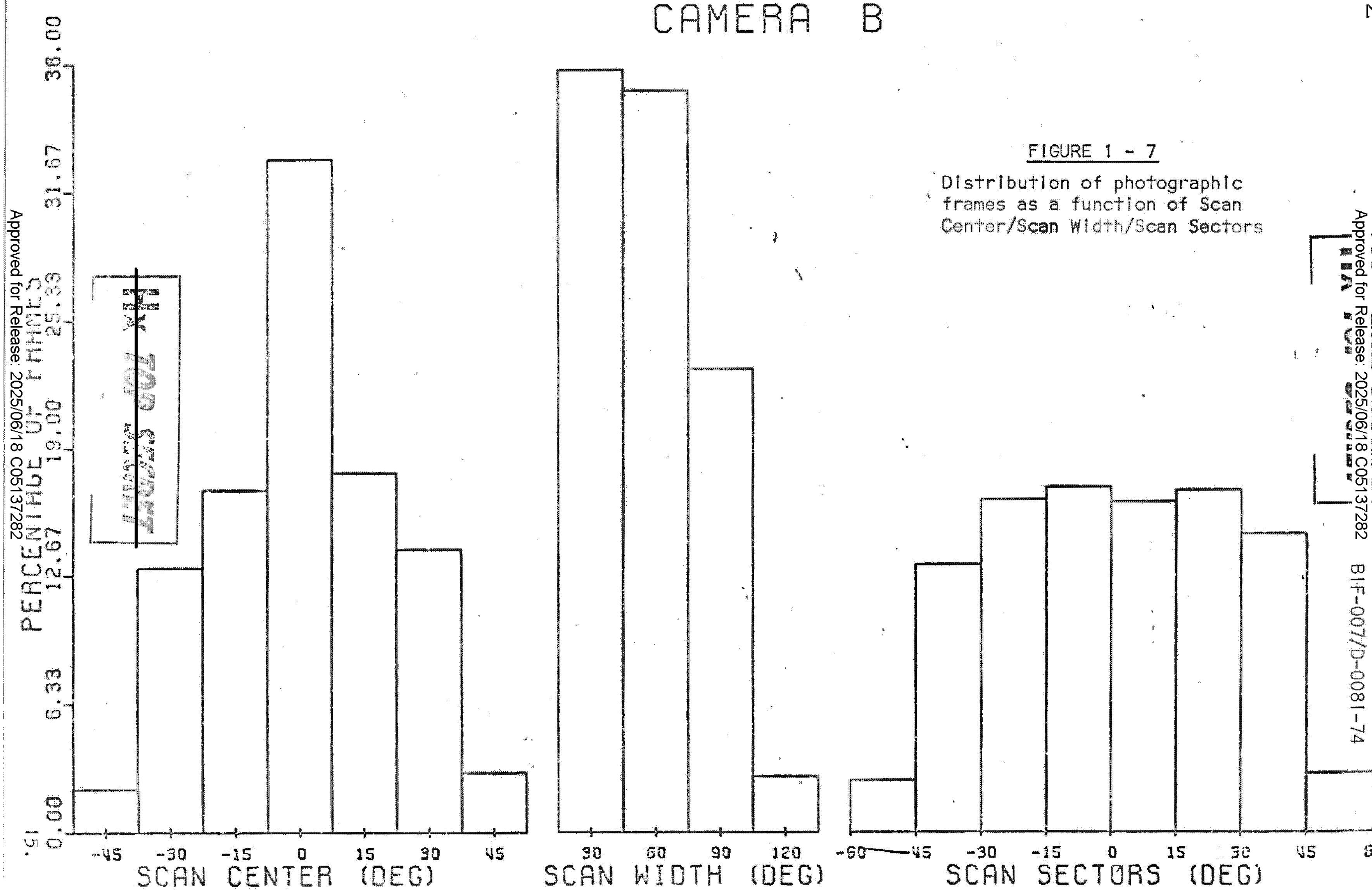

FIGURE 1 - 7

Distribution of photographic frames as a function of Scan Center/Scan Width/Scan Sectors

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FIGURE 1 - 8

Distribution of land mass coverage as a function of Scan Sectors

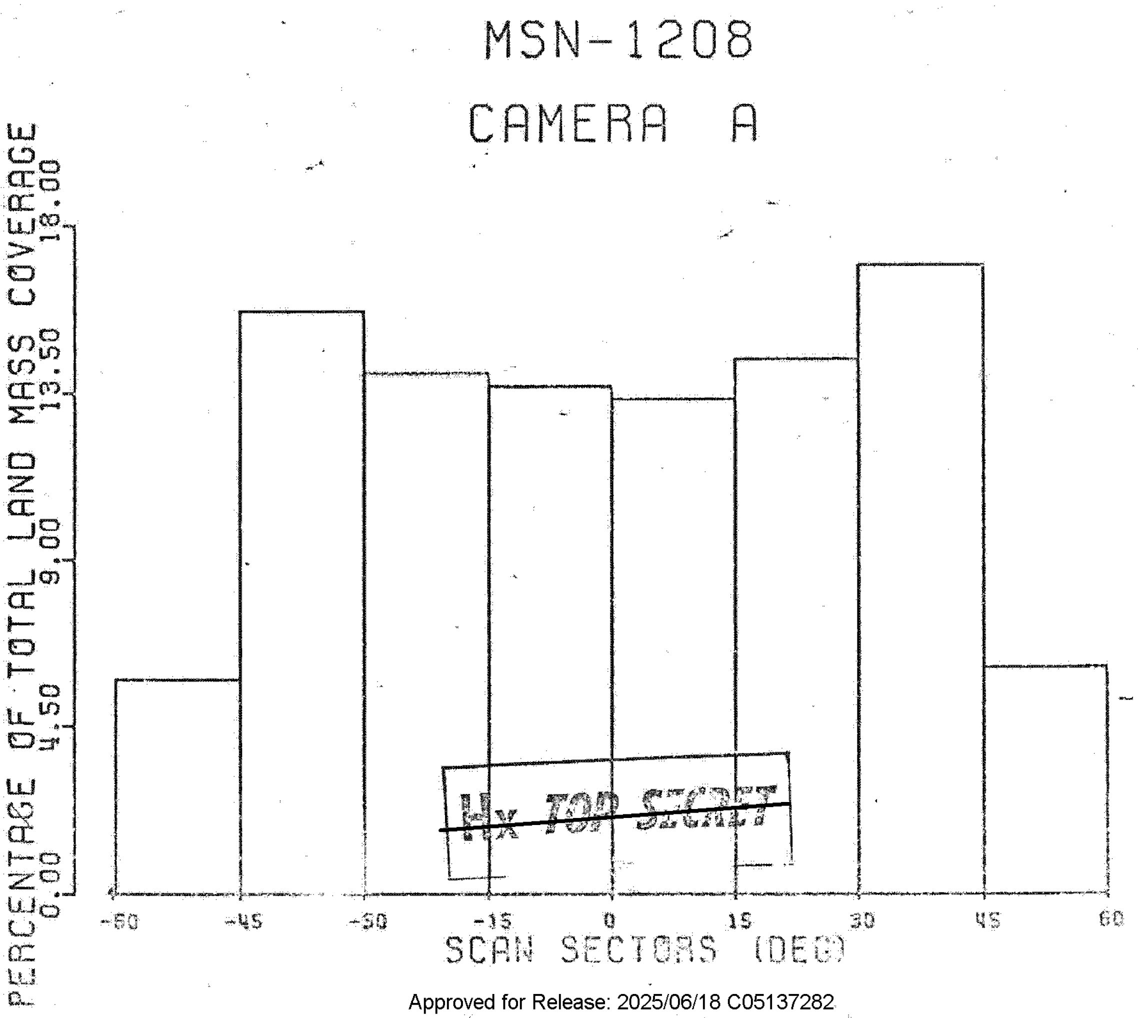
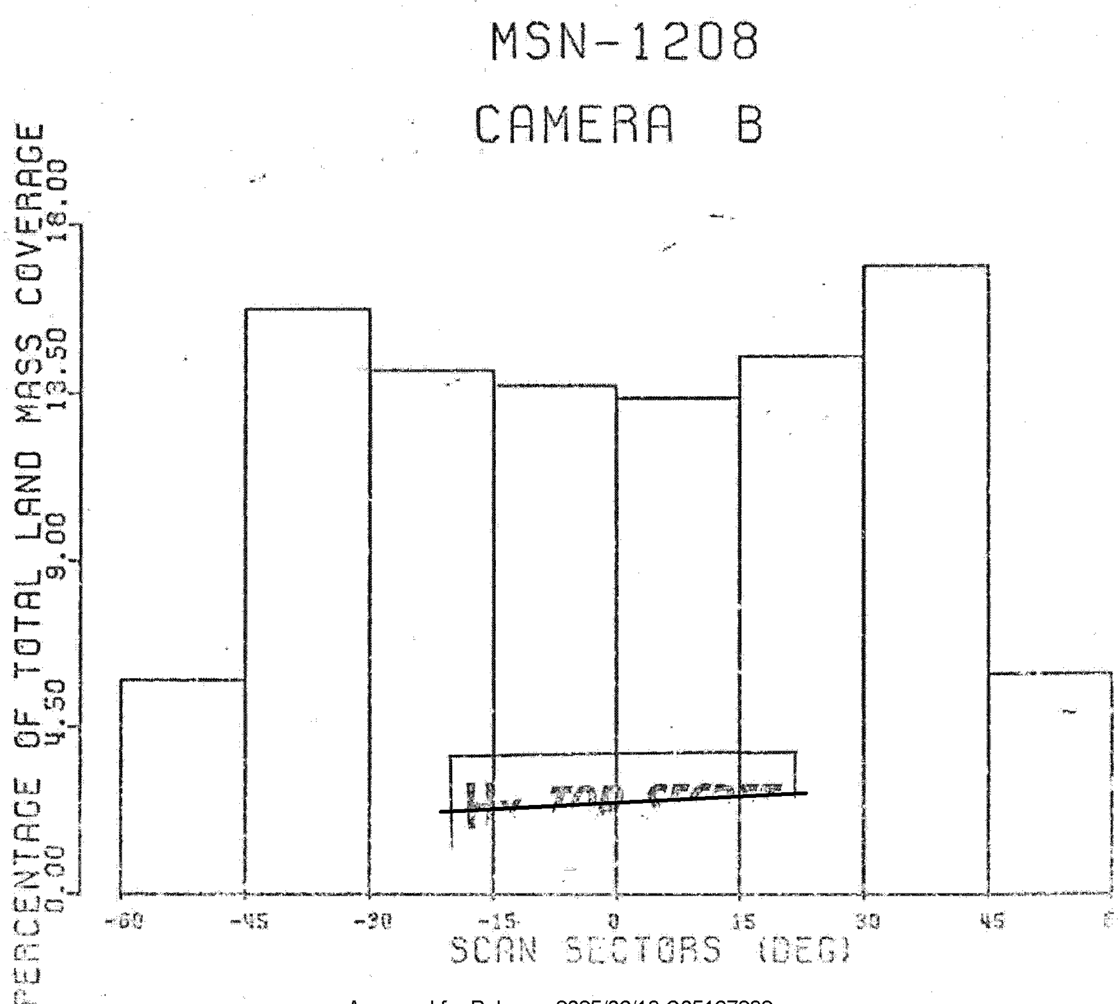


FIGURE 1 - 9

Distribution of land mass
coverage as a function of
Scan Sectors



MSN-1208
CAMERA A

FIGURE 1 - 10

Percentage of exposed film
vs.
Solar Evaluation

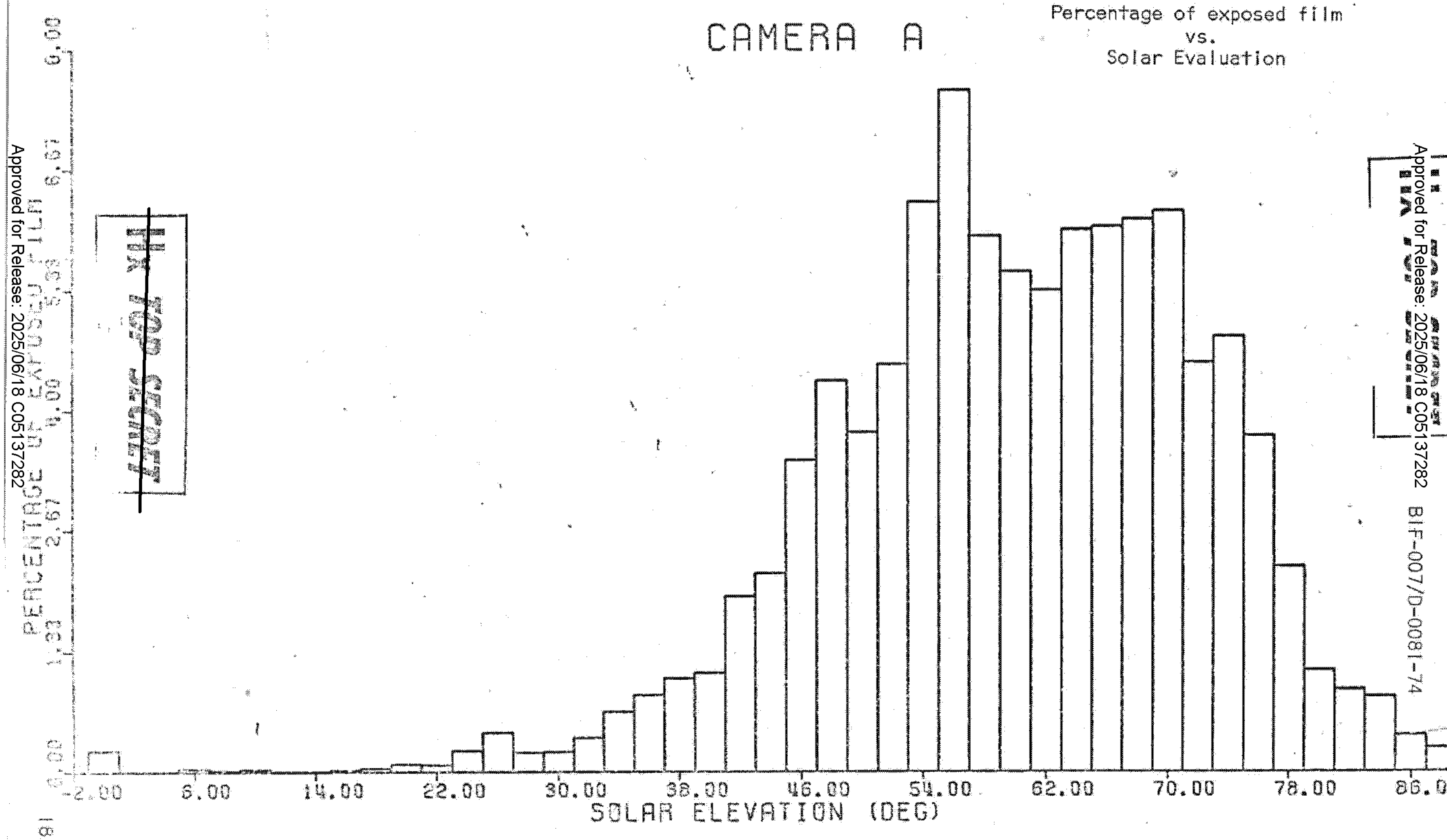


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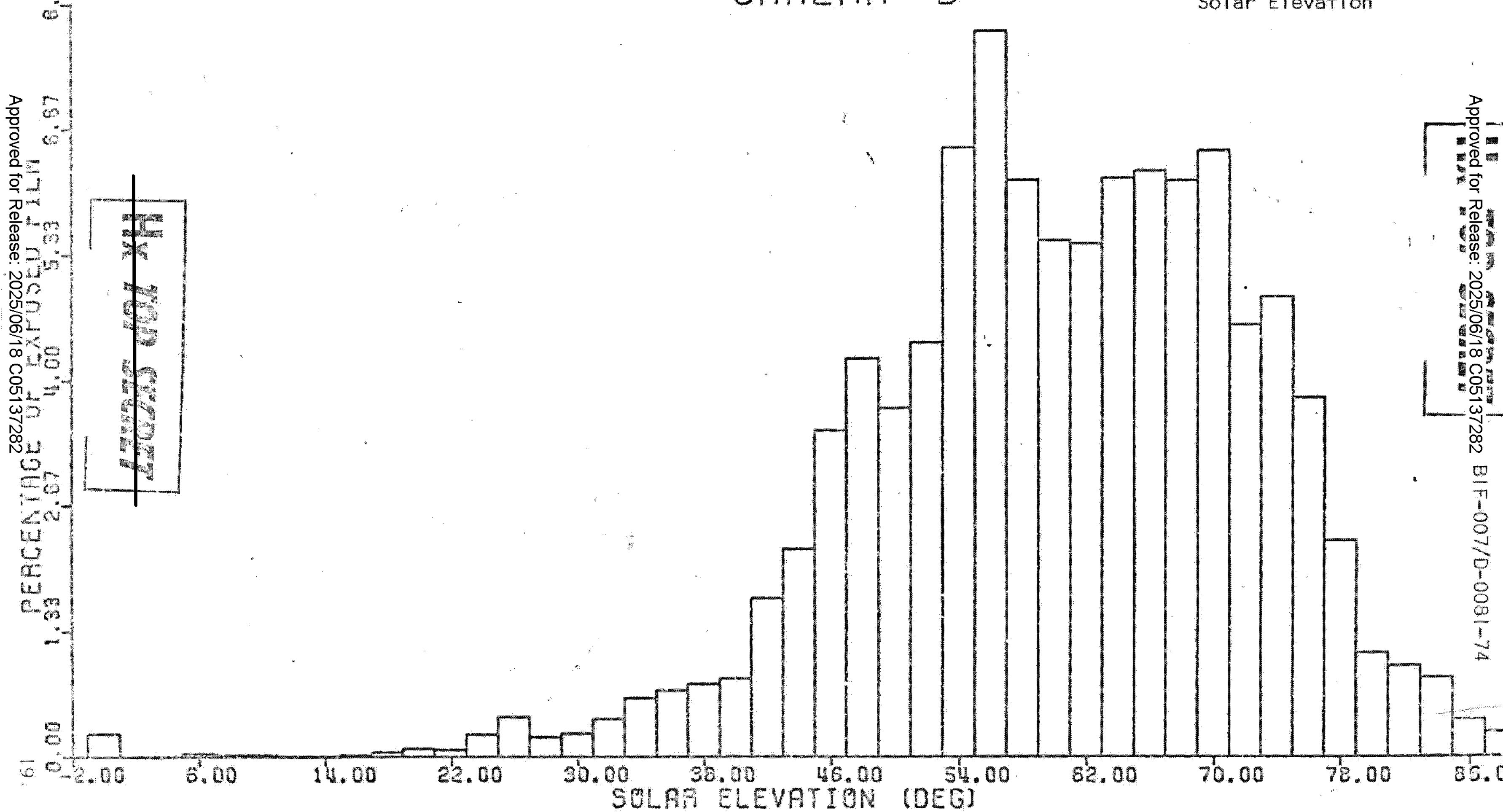
FIGURE 1 - 11
Percentage of exposed film
vs.
Solar Elevation

MSN-1208
CAMERA B



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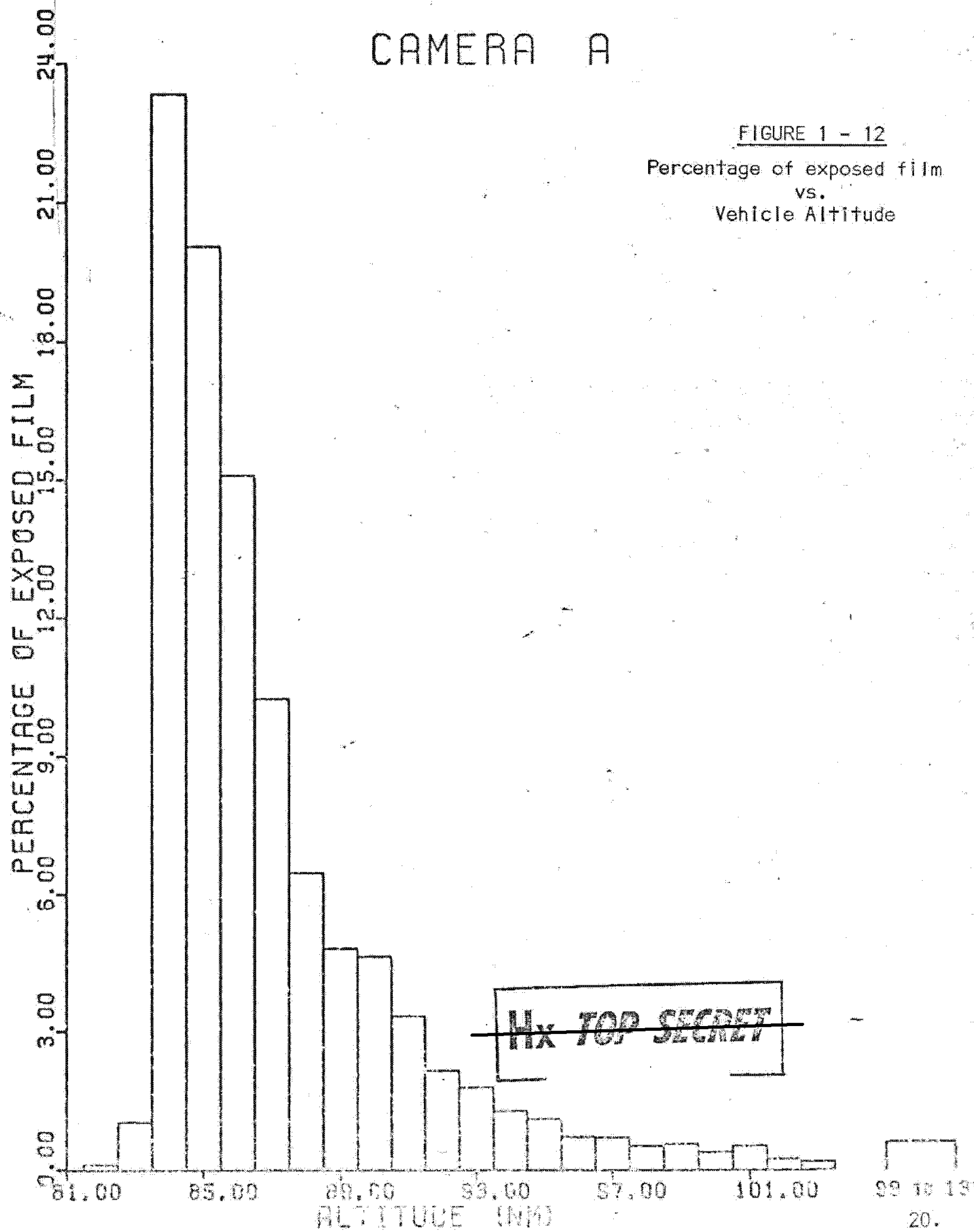
MSN-1208
CAMERA A

FIGURE 1 - 12

Percentage of exposed film
vs.
Vehicle Altitude



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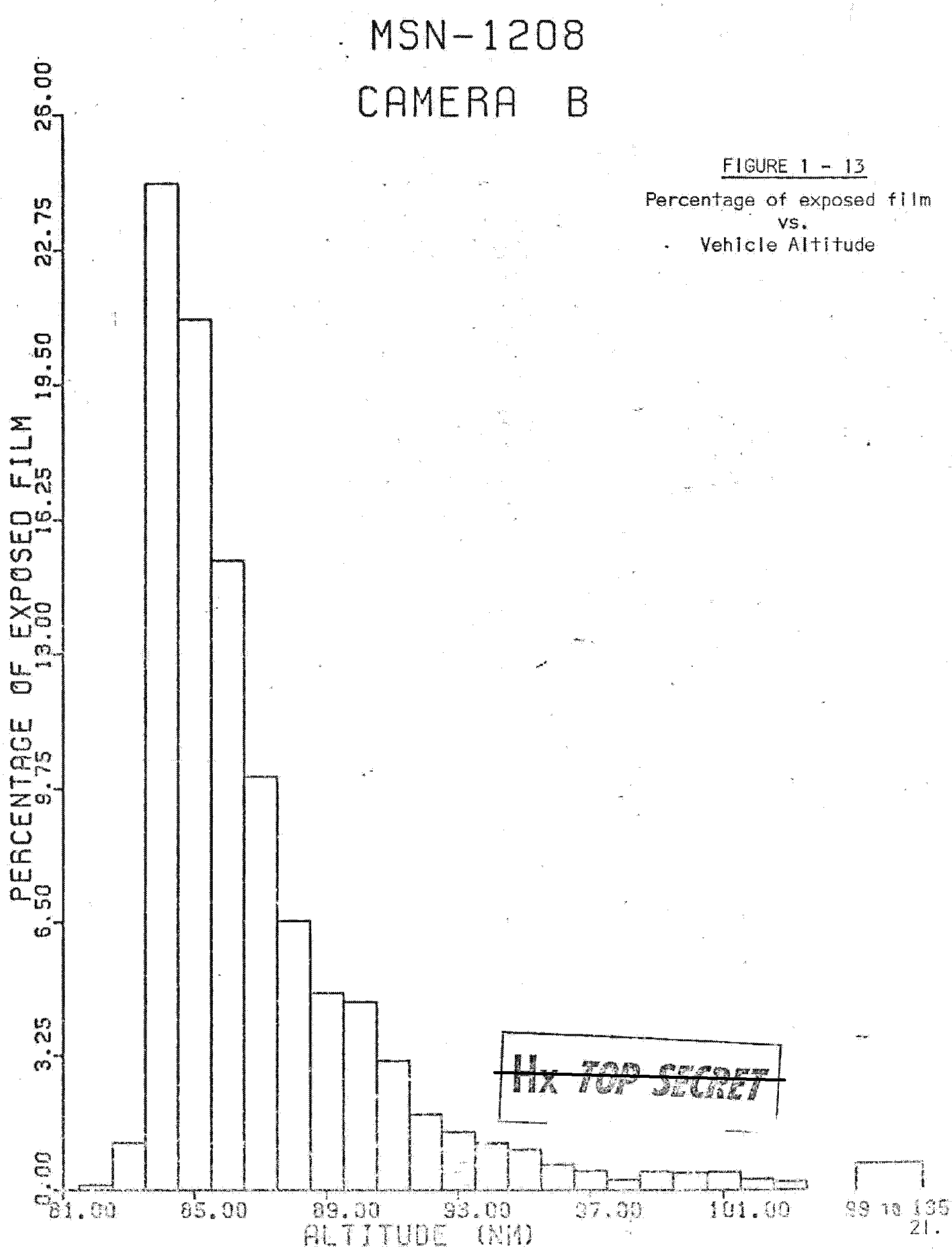


FIGURE 1 - 13

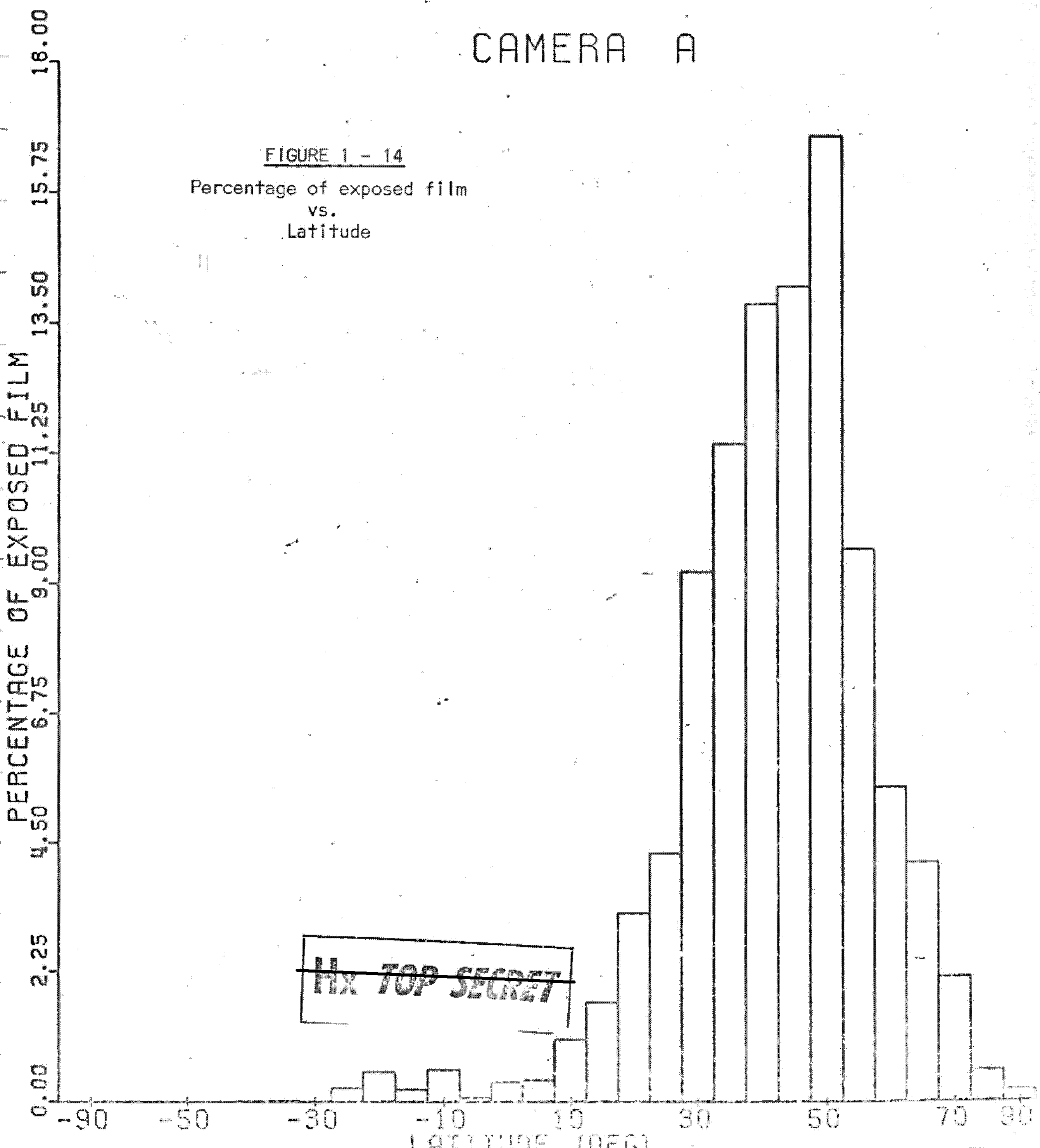
Percentage of exposed film vs. Vehicle Altitude

MSN-1208

CAMERA A

FIGURE 1 - 14

Percentage of exposed film vs. Latitude



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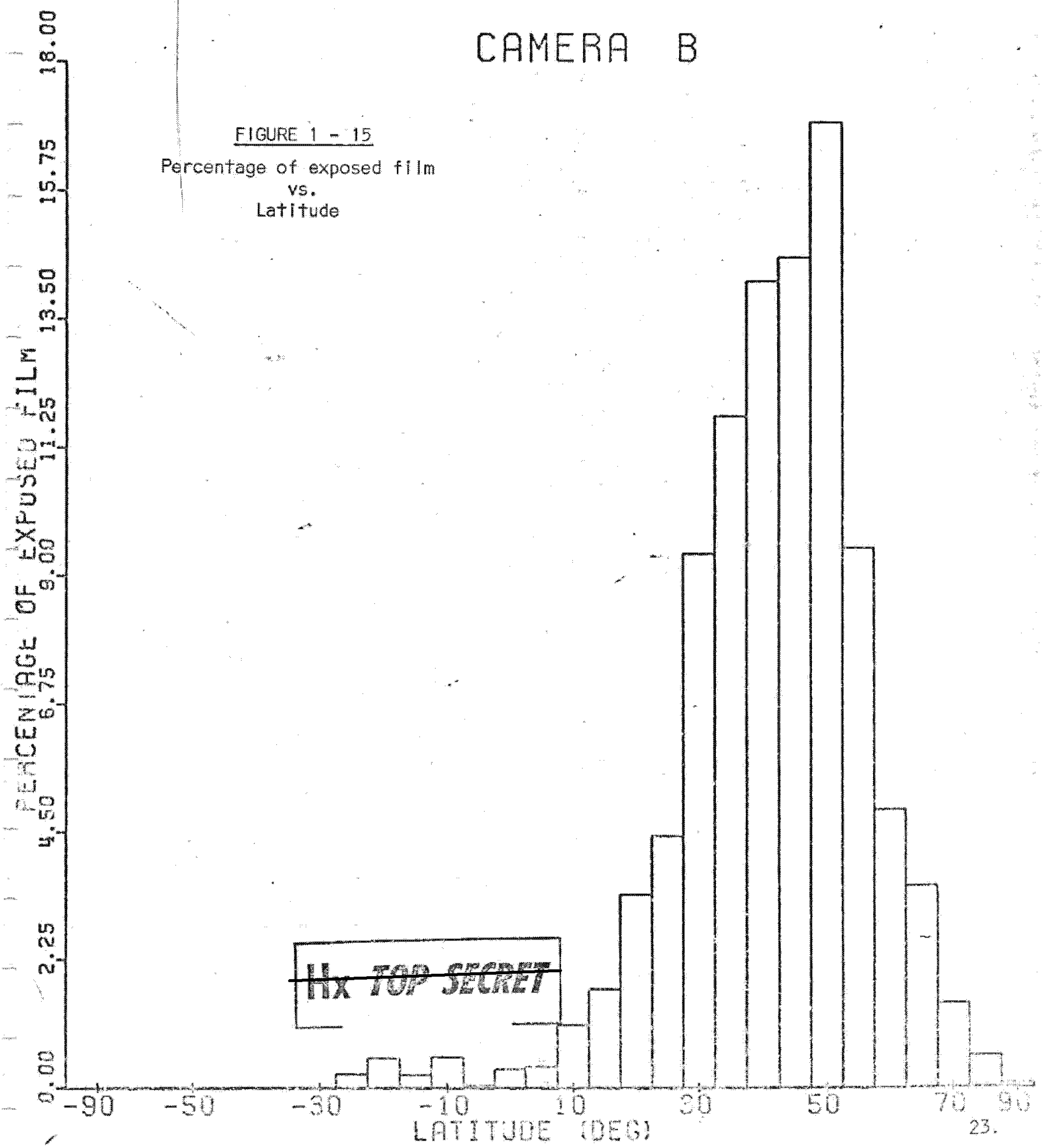
MSN-1208

CAMERA B

FIGURE 1 - 15

Percentage of exposed film
vs.
Latitude



1-15

STEP	CAL	STEP	CAL	STEP	CAL	STEP	CAL
1	0.080	9	0.150	17	0.281	25	0.525
2	0.086	10	0.162	18	0.303	26	0.568
3	0.094	11	0.175	19	0.328	27	0.615
4	0.101	12	0.190	20	0.355	28	0.665
5	0.109	13	0.205	21	0.384	29	0.719
6	0.118	14	0.222	22	0.415	30	0.778
7	0.128	15	0.240	23	0.449	31	0.841
8	0.138	16	0.259	24	0.486	32	0.910

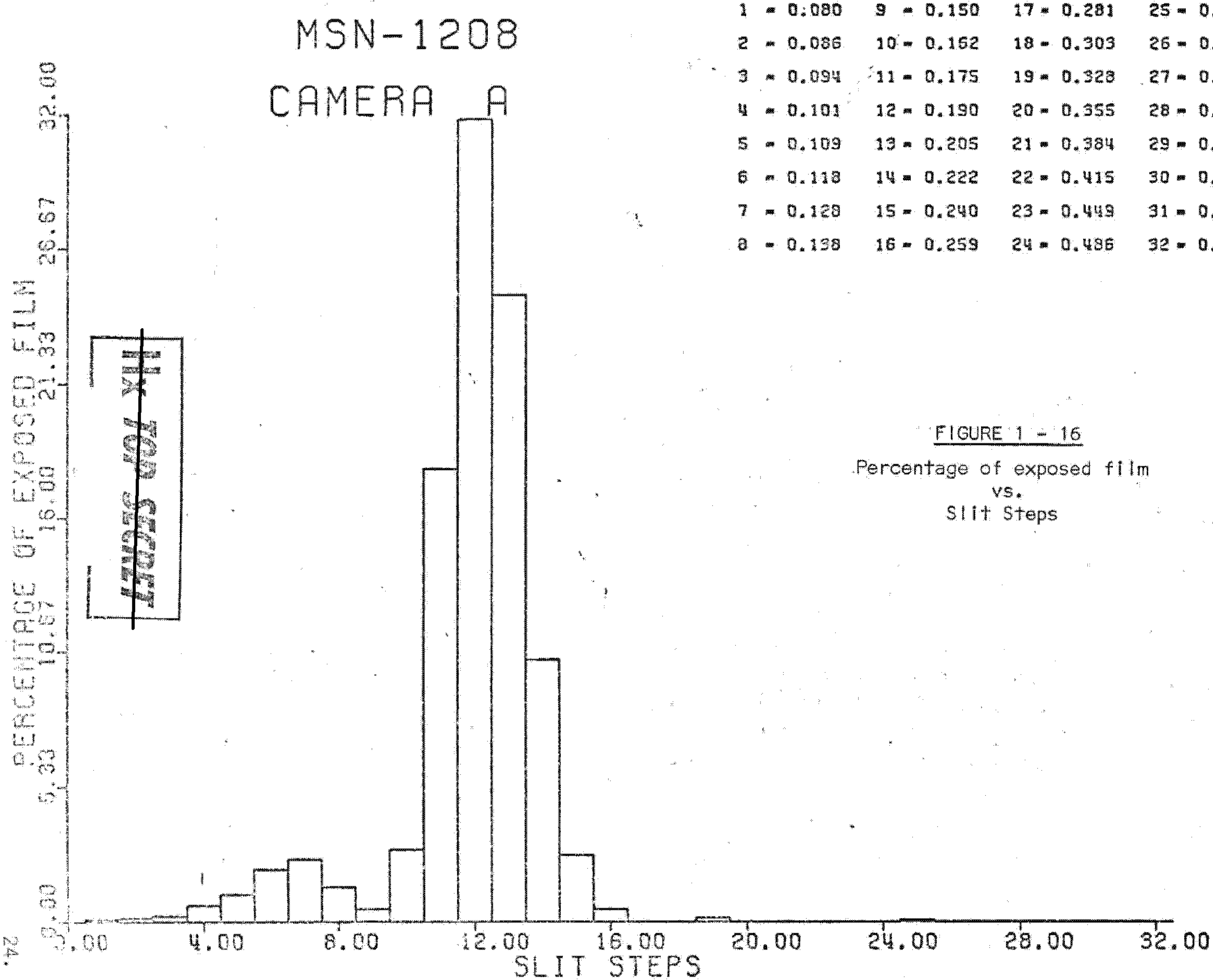


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FIGURE 1 - 16

Percentage of exposed film
vs.
Slit Steps

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STEP = CAL	STEP = CAL	STEP = CAL	STEP = CAL
1 = 0.000	9 = 0.150	17 = 0.281	25 = 0.525
2 = 0.085	10 = 0.162	18 = 0.303	26 = 0.568
3 = 0.094	11 = 0.175	19 = 0.328	27 = 0.615
4 = 0.101	12 = 0.190	20 = 0.355	28 = 0.666
5 = 0.103	13 = 0.205	21 = 0.384	29 = 0.719
6 = 0.113	14 = 0.222	22 = 0.415	30 = 0.778
7 = 0.128	15 = 0.240	23 = 0.449	31 = 0.841
8 = 0.138	16 = 0.259	24 = 0.486	32 = 0.913

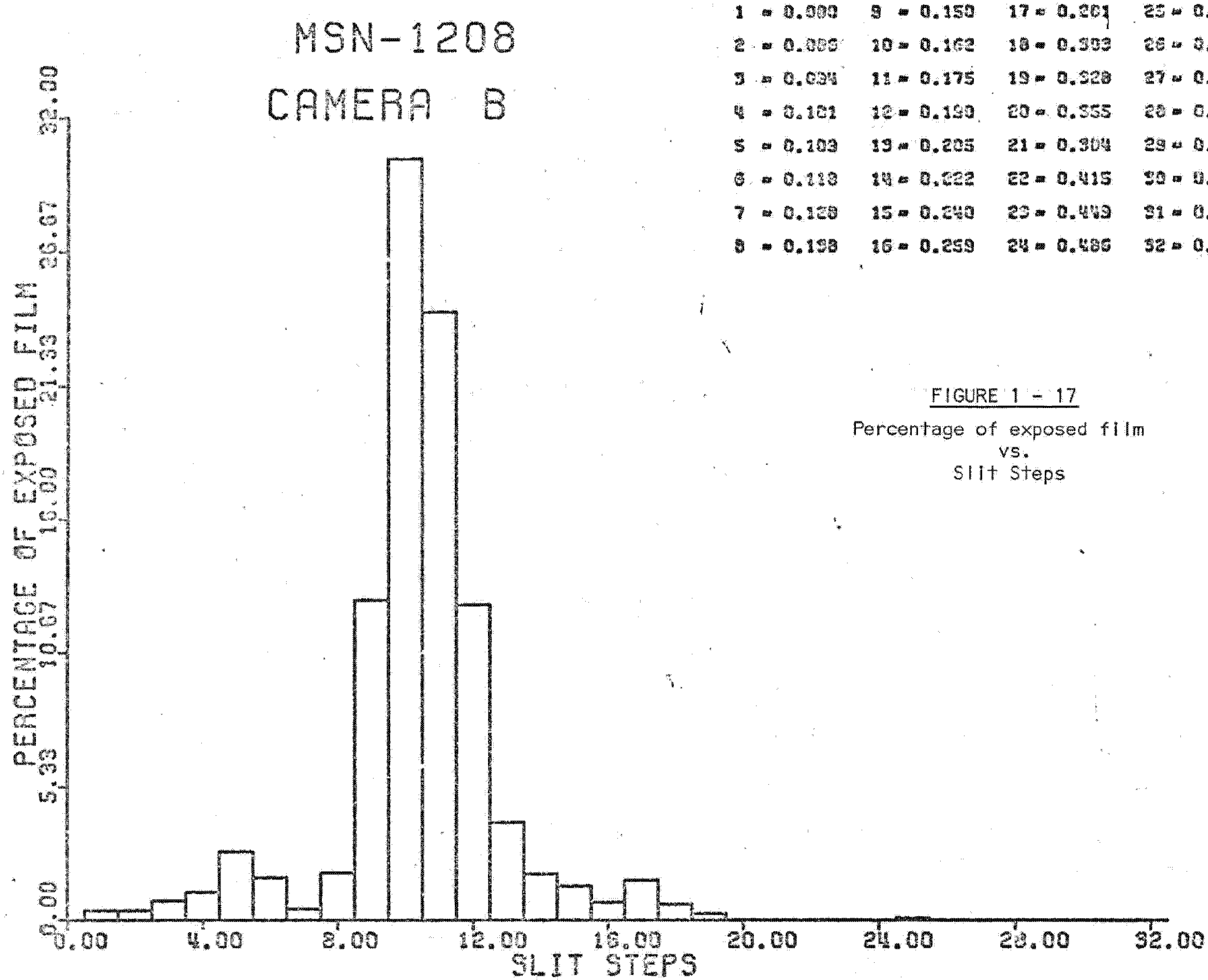
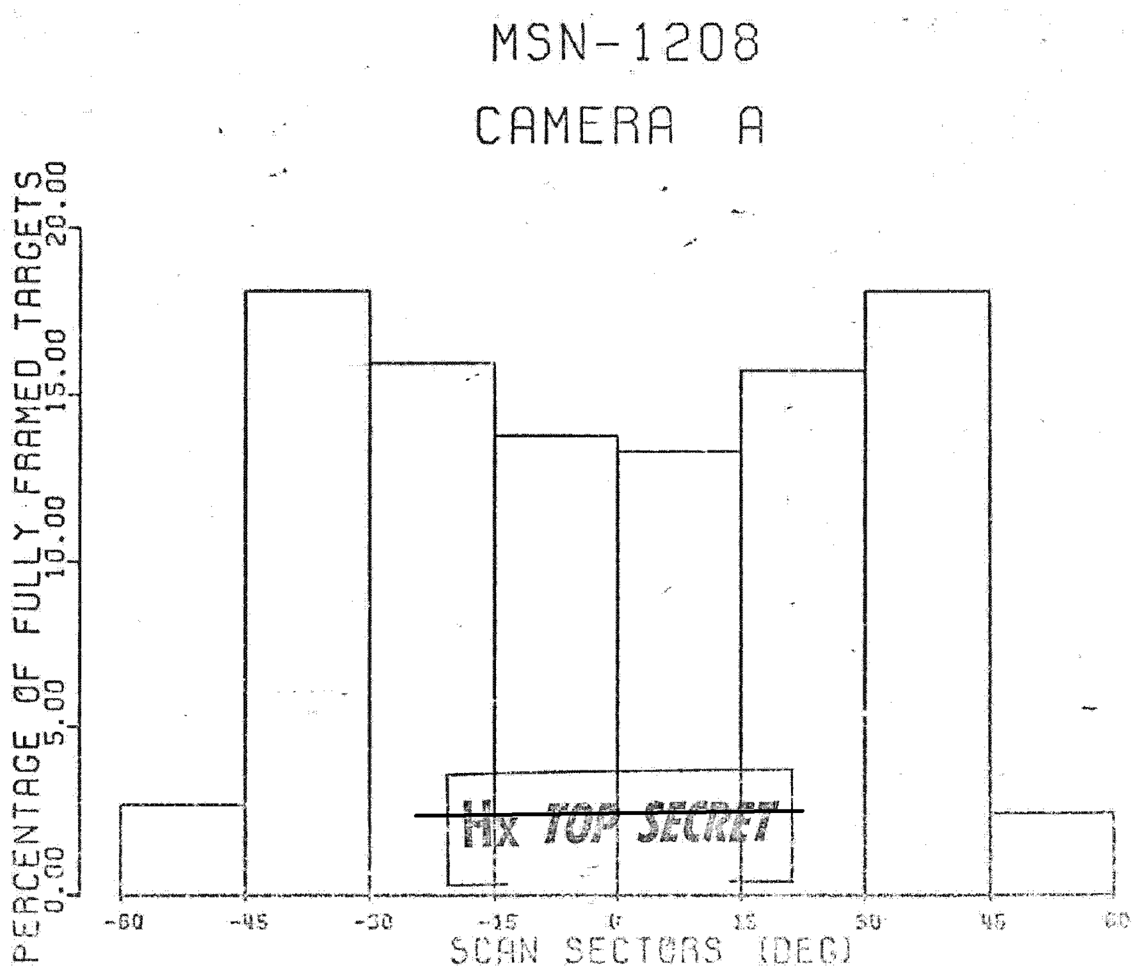


FIGURE 1 - 17

Percentage of exposed film
vs.
Slit Steps

FIGURE 1 - 18

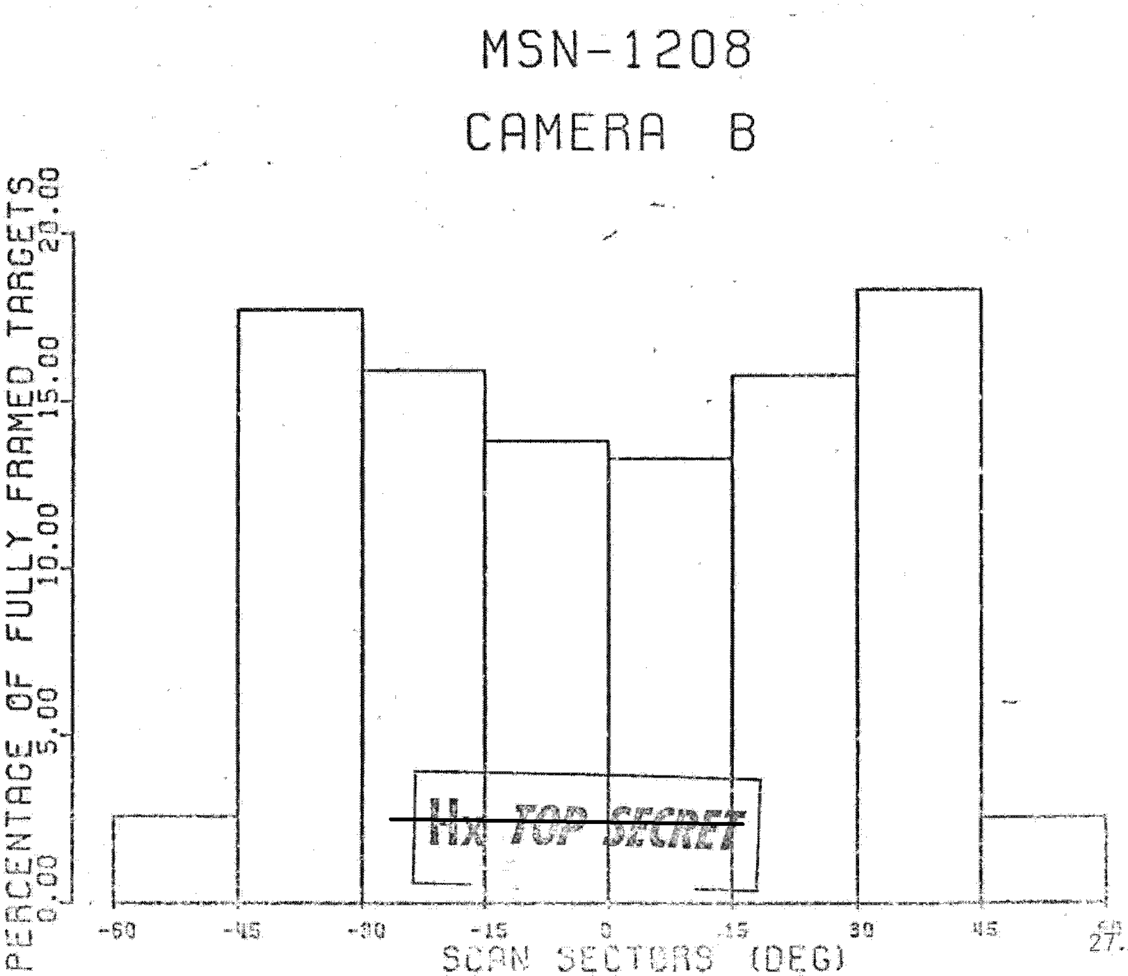
Distribution of fully framed Targets vs. Scan Sectors



1-18

FIGURE 1 - 19

Distribution of fully framed
Targets vs. Scan Centers



1-19

MSN-1208
CAMERA A

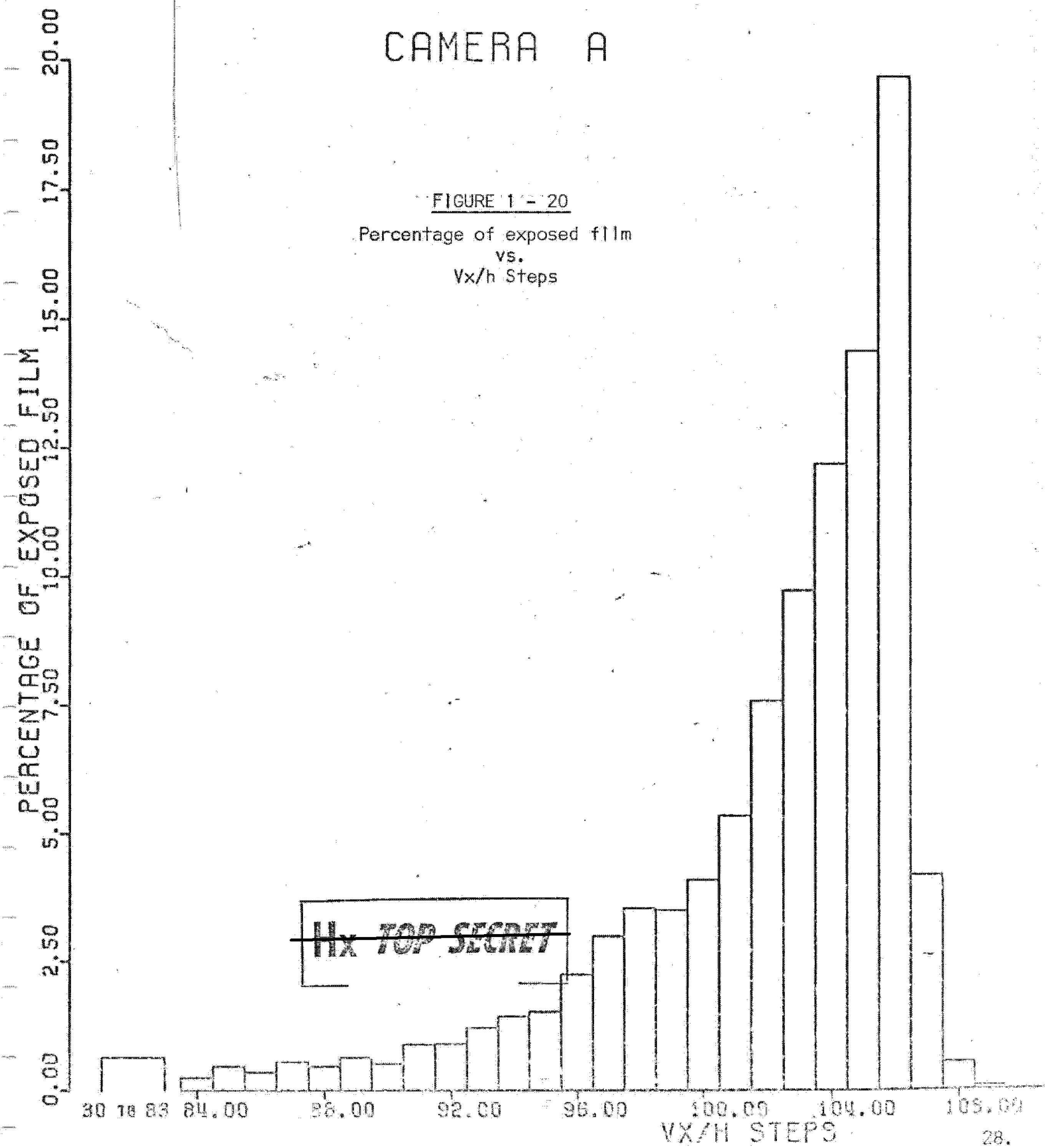


FIGURE 1 - 20
Percentage of exposed film
vs.
Vx/h Steps

MSN-1208
CAMERA B

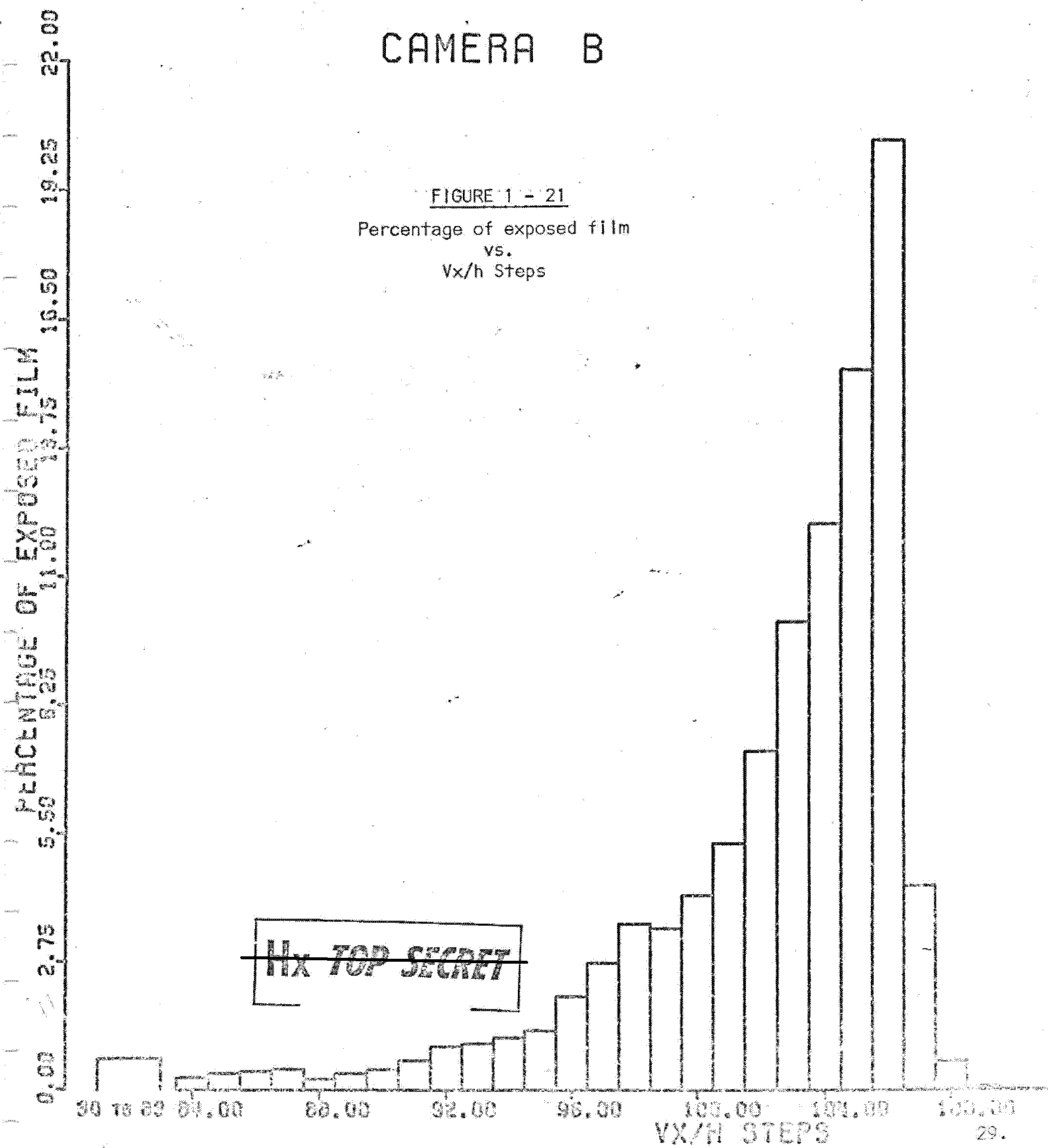


FIGURE 1 - 21

Percentage of exposed film
vs.
Vx/h Steps

1-21

2.0 SENSOR SYSTEM PERFORMANCE

2.1 Coarse Film Path

Coarse film path diagnostics indicated nominal performance throughout take-ups one, two and three. Analysis of a B-side emergency shut down (ESDB),which occurred during take-up four operations, indicated a hardware failure in the coarse path control electronics.

The ESDB occurred on the start-up of an operation planned for Rev 1268 and was due to a low tension condition in the coarse path. A B-side creep test conducted over 1283 Pogo also shut down, but this shutdown was due to a high tension coarse path condition.

Analysis of the Rev 1268 ESDB and primarily of the Rev 1283 ESDB indicated that the take-up integrator reset signal to the take-up servo loop was not operating. The Rev 1268 data was in telemetry mode C, as is most operational payload data, and the take-up integrator output signal is not included in the telemetry format. The Rev 1283 data was in telemetry mode B which does include the take-up integrator output signal.

The take-up integrator integrates the output coarse tension error from nominal and modifies the take-up servo error signal, which is also a function of the velocity command, velocity feedback and the coarse output tension offset. The take-up servo responds by altering the take-up velocity in a manner consistent with correcting the output coarse tension error.

Integration of the tension error begins at camera power turn-on. There is a small tension error at the start-up of most camera operations, and because of the nominal time delay between camera power on (CB+) and film transparts on (FT+), the integrator output at the time the take-up brakes are released can be substantial. Therefore, the integrator output is reset to null upon application of brake release power via the 35ms. reset signal generated within the take-up electronics.

In the absence of the reset signal, the integrator output will erroneously alter the error signal to the servo loop. The magnitude of the error introduced is dependent on the original coarse output tension offset and the time duration between camera power on and transports on.

In the case of the Rev 1268 ESDB, the CB+ to FT+ time was in excess of 120 seconds for film path pressurization purposes, and although the initial coarse tension offset was small, the integrator output was saturated by the time brakes released and indicative of a much larger over tension condition than what actually existed. The servo loop therefore overcorrected for the actual tension error and subsequently caused the under tension ESDB. The Rev 1283 ESDB resulted when the servo overcorrected for an initial undertension condition and drove the system into the high tension state.

Analysis of coarse tension data from currently available station tapes indicated integrator failure occurred between operations 598 and 605. Under normal operating conditions (i.e. initial coarse output tension greater than 2.2 lbs. and less than 2.8 lbs; CB+ to FT+ less than or equal to 17 seconds) the TU servo can recover from the integrator error present at brake release without the reset signal. The remainder of take-up four operations were constrained to a maximum C+ to FT+ time of 17 seconds and the startup coarse output tension limits noted above. No further problems in this area were encountered.

2.2 Fine Film Path

Fine film path diagnostics indicated proper hardware performance throughout the mission for both camera systems.

2.3 Command and Control

The sensor system performance with respect to the Command and Control Subsystem was nominal throughout the mission. All commands were properly received and executed.

2.4 Sensor System Control

On Rev 980 the sensor system failed to execute the second and third of three non-nested operations. The first operation, Msn OP 490, executed normally.

The set-up commands for the two Ops that failed to execute, up to and including seal doors open, were properly executed. Neither the SU nor the TU brakes were released and the film transports did not operate.

On Rev 989 both an A-Side and a B-Side CV test were run with verification interlocks enabled. The A-Side test failed to execute. The B-Side test executed normally. On Rev 991 an A-Side CV test was successfully executed with verification interlocks disabled.

On Rev 993 an A-Side CV test was run with SCC-II and verification interlocks disabled. This test also failed to execute which isolated the problem to the A-Side verification circuitry external to either SCC I or SCC II. The most probable suspect for the failure was an absence of the "Builder Roller Down" verify signal.

On Rev 995 a health check was successfully executed in SCC II with VIA disabled. Stereo operations were resumed on Rev 996 using SCC II with VIA disabled and continued without further problems through the remainder of RV-3.

When transfer to RV-4 was made, VIA was re-enabled and the mission successfully completed in that configuration with SCC II.

Upon receipt of the RV at Rochester, the outer shrouds were removed and a visual inspection was made with an infrared scope and infrared photographs were taken. Both the visual inspection and the photographs indicated that the condition of all portions of the Builder Roller and the lower verify switch were normal. Extensive electromechanical testing did not provide any information to help isolate the cause of the Builder Roller Verify signal failure.

2.5 Optical Bar Performance

The Optical Bars performed properly throughout the mission. Variations between commanded and actual OB velocities were no different than those noted during pre-flight systems test and were within the specification limits of .00054 rad/sec.

2.6 LSFS/Focus

Mission 1208 used pre-flight determined focus settings for 1414 black and white film, SO-255 color film and FE-3916 infrared film.

The forward camera was set at a nominal of 68 microns through RV-1. Image quality evaluation of the returned film resulted in a change to a new nominal of 76 microns commencing with Msn Op 156 in RV-2 and continuing through the remainder of the mission.

The aft camera was set to a nominal of 25 microns for 1414 material and 55 microns for both SO-255 and FE-3916. No readjustments from the pre-flight planned values were required.

The LSFS output, as with 1207, was deemed reliable only on the first operation of each day (i.e., after three hours of non-operation and during the first five minutes of the first subsequent OP). Readings of the LSFS output were taken only at these times throughout mission 1208.

2.7 Instrumentation

All instrumentation operated normally throughout the mission. The system provided consistent and accurate data for analysis of anomaly conditions and for the routine verification of camera status. Although not part of the sensor system instrumentation system, a MUX failure necessitated switching from the primary (MUX 4A) to the backup (MUX 4B) unit.

2.8 Pneumatics

The pneumatic system nitrogen reserve status for mission 1208 was as follows:

	TANK A			TANK B			
Event	Press. (psi)	Temp (°f)	Mass (lbs)	Press (psi)	Temp (°f)	Mass (lbs)	Total Mass (lbs)
Liftoff	3388	69	17.8	3374	68	17.7	35.5
End of Primary Mission	196	69	1.1	210	67	1.2	2.3

Toward the end of the mission it became necessary to manage camera operation in terms of the distribution of scan centers, scan lengths and frame count to avoid the possibility of depleting the gas supply prior to the total usage of the film supply. The computed PN+ use rate was a constant 0.023 lbs/min throughout the mission.

2.8.1 During the launch countdown, on Day R-1, the A side regulated pressure was observed to decay at an abnormally high rate, e.g., from 2.46 to 1.28 psi in 300 seconds. On the basis of this decay rate and the immediately available design data, several hundred manufacturing drawings, pertaining to the pneumatic system plumbing volumes, it was concluded that a leak had developed on the high pressure side of the regulator and was of sufficient magnitude to be unacceptable for flight operation, i.e., the continuous loss of gas would severely shorten the mission. An acceptable corrective action was taken by isolating the leak from the high pressure gas supply, tank pressure, by commanding the A side high pressure isolation valve (HPIV-A) to the closed position following the uncage and OB stow sequences executed on Rev 0. The only disadvantage to this configuration was a reduction in system reliability as a result of the loss of parallel redundancy in the D bar gas supply.

Subsequent to the launch, the plumbing system volumes were measured at the supplier's facility and determined to be significantly different from the values calculated from drawings. (The measured values were: high pressure stage = $0.290 in^3$, intermediate pressure stage = $0.036 in^3$, low pressure stage = $3.085 in^3$.) New analysis were performed and it was concluded that the leak was on the low pressure side of the regulator and was of negligible magnitude. Therefore, it was decided to open the HPIV-A to regain maximum system reliability.

As a precaution, on orbit tests were performed to verify that the leak was in the low pressure stage. The tests were conducted by momentarily opening the HPIV-A and monitoring the regulated pressure decay rate following valve closure. As a result of the analysis and tests, the HPIV-A was opened on Rev 563 and left open for the remainder of the mission.

A detailed analysis of the pneumatics system leak is provided in, "Memorandum #930, OTD, SED, SAE, To: C. Karatzas, From: H. Yanowitz and B.E. Nelson", dated: 2 May 1974.

2.8.2 Path Pressurization

For the first time in eight missions it became necessary to acuate the pneumatic system operate valves to maintain the film path pressure above the ballooning criterion. The initial repressurization occurred after transfer to TU-4 and was repeated as required for the remainder of the mission. Although the path leak rate was within specification requirements, the combination of short operations with corresponding small increases in path pressure, separated by long quiescent periods caused the repeated occurrence of the low pressure condition. To minimize the additional gas usage, a procedure was used wherein the path was repressurized, increased by approximately 0.1 psi, only at those times the path pressure had decayed to the ballooning pressure limit.

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2.9 Trend Analysis

A statistical trend analysis of sensor system performance was maintained by the Systems Integration Section throughout mission 1208. Data samples were taken from one operation per day, when available, and mean values and standard deviations were calculated and plotted for selected functions to facilitate the detection of any long term trands that would indicate the orbit of system degradation. The analysis indicated a momentary disturbance in all tension sensors and the A side metering capstan summed error in the first 12 scan degrees of operation 564, however, the signals returned to nominal values for the remainder of the operation. Although not regarded as a trend or anomaly, the B side metering capstan summed error mean valve shifted from 0.034 o_z. in. with 1414 material to approximately 0.043 o_z. in. with SO-255 film. The mean level returned to approximately 0.034 o_z. in. with FE3916 film. Otherwise, all system functions remained nominal throughout the mission with no indication of abnormal long term trend.

The functional parameters used for the analysis were as follows:

1. Film to Bar Sync Velocity Error (P451, P452)
2. Metering Capstan Summed Error (P403, P404)
3. Platen Skew Error (P415, P416)
4. Platen Photo Summer Error (P411, P412)
5. Input Drive Capstan Summed Error (P803, P804)
6. Output Drive Capstan Summed Error (P811, P812)
7. Supply Drive Summed Error (P105, P106)
8. Take-up in Use Drive Summed Error (TSEA, TSEB)
9. Optical Bar Summed Error (P501, P502)
10. OB Velocity Error
11. Looper Position (P601, P602)
12. Film Path Carriage Position (P713, P714)
13. Take-up Carriage Position (P951, P952)

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3.0 MISSION EVENT HISTORY

A summary listing of all sensor system photographic operations is presented in Appendix A-1 of this report. The summary primarily covers operational photography, but also includes SS and PFA engineering photography. The following is a chronological description of these engineering operations plus other special events that occurred during Mission 1208.

3.1 Ascent

The countdown and launch were accomplished without incident, with uncage (sequences 204 and 205) and OB stow (sequences 213 and 214) occurring in a normal manner following BV-SV separation. These events were verified from tape recorder playback at Rev 1 POGO.

3.2 Health Checks

Day 1 operations through Rev 4 were designed to verify system health and confirm orbit operational readiness. An engineering operation designed as a baseline test was performed on Rev 8. The health check events were as follows:

Rev 1: An uncage verification check, sequence 215, was performed over POGO to confirm the uncage event.

Rev 2: A constant velocity run, sequence 208, was performed over KODI. This was the first attempt to transport film after launch. The Sensor System worked properly, and the film was correctly aligned within the film path. Steerers, tensions, and take-up and supply drive summed errors were well within limits.

Rev 4: The sensor system health check, sequence 175, was performed over POGO. All sensor system executed commands were functionally verified, including all tested bits of the variable commands. Focal plane position indicated 68 microns for the forward camera, and 25 microns for the aft camera.

Rev 8: A scheduled engineering operation, sequence 209, was performed over COOK to provide characteristic telemetry data for comparison with data from any future identical functional check. In the event of an anomaly, the telemetry signatures of the two runs could then be equated and any suspected system degradation determined.

3.3 Engineering Events

Eleven engineering tests were defined in the SV-8 Engineering Photography Plan. This series of tests were designed to acquire data for assessment of on-orbit camera, lens and film performance. Following is a summary of the tests and their objectives:

	Test	Objective/Status
1.	Thru-Focus (1414)	Optimize Focus. Fully accomplished; confirmed focus (1414) was optimum in RV-2.
3.A	Smear Slits (1414)	Validate Image Motion Compensation settings. Completed in RV-2.
3.B	Smear Slits (SO255)	Evaluate smear slit for validating image motion compensation settings with color film. Completed in RV-4.
3.C	Smear Slits (FE3916)	Evaluate smear slit for validating image motion compensation settings with IR film. Completed in RV-4.
4.	Color Corn Acquisitions	Evaluate and radiometrically calibrate SO-255. Satisfactorily completed in RV-4.
5.	IR Color Corn Acquisitions	Evaluate image quality of FE3916. Accomplished in RV-4.
6.	Lens MTF (1414)	Measure on-orbit lens MTF. Completed in RV-3.
7.	Tucson Acquisition	Standard scene for quality assessment. Satisfied in RV-1,2,3 and 4.
8.	Color Thru-Focus (SO-255)	Optimize Focus. Completed in RV-4.
9.	Tri-Bars for Resolution	Photo quality assessment. Satisfied RV-1,2,3 and 4. Acquisitions common with Test 7.
10.	Smear versus Scan Angle (1414)	Assess smear as a function of scan angle location. Fully accomplished. Completed in RV-3.
12.	Dense Culture Acquisition (1414)	Photo/EM correlation. Satisfied in RV-1,2,3 and 4.

3.4 Mission 1208-1 Special Events

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
0.8				UNCAGE/SCC I SEL		
0.8				STOW A/STOW B HPIV A CLOSE		
1				UNCAGE VERIFY		
2				INHIBITED CV		102
4	1-3			SS HEALTH CHECK		163
8	8			SS ENGINEERING		63
14	13	1		1414 T/F-8,-16,-8,0,+8,0		
			75	BOSTON	99	
			75	PROVIDENCE	99	54
16	14	1		1414 T/F +16,+8,0		
			95	SAN DIEGO	90	29
56	42			PN EQUALIZE		
81	54	1		1414 T/F-16,-8,0		
			85	SACRAMENTO	95	
			80	SAN FRANCISCO	99	56
86	55			PN EQUALIZE		
96	63	3A		1414 SMEAR SLITS		
			70	DALLAS/FT WORTH	99	81

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3.4 Mission 1208-1 Special Events-Cont'd.

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG	
97	64	3A		1414 SMEAR SLITS			
			95	LOS ANGELES	99		
		10		1414 SMEAR VS SCAN			
			85	SAN DIEGO	99	124	
129	84	7,9,12	95	TUCSON W/5T RESO	99		
144	94	1		1414 T/F-8A,0,+8B,0			
			85	ATLANTA	99	27	
				PN EQUALIZE			
160	103	10		1414 SMEAR VS SCAN			
			85	BALTIMORE	99		
			85	WASHINGTON	99	93	
176	114	1		1414 T/F+16,+8,0,-8,0			
			75	NEW YORK	95		
		3A		1414 SMEAR SLITS			
			75	PHILADELPHIA	95	121	
184	115			PN EQUALIZATION			
225	130	1		1414 T/F+16,+8,0,-8,-16			
			80	DETROIT	99	34	
225	131			PROTECTIVE WRAP		108	
				1208-1 FOOTAGE		1055	
				ACCUMULATED FOOTAGE			1055

3.5 Mission 1208-2 Special Events

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
226				TRANSFER TO TU2-PREP 1		
227				COMPLETE TRANSFER-PREP 2		63
248	139/141			PN EQUALIZE		
281	156			PBF A SET TO 76 PER PFA DIRECTION		
291				IT-B SET TO -5 STEPS PER PFA DIRECTION		
313	165/166			PN EQUALIZE		
338	175	12		QUALITY VARIABILITY		
			70	MIAMI	75	38
356	187			PN EQUALIZE		
428	224			PN EQUALIZE		
435	228	10		1414 SMEAR VS SCAN		
			70	NEW YORK	80	
		3A		1414 SMEAR SLITS		
			70	PHILADELPHIA	30	144
451	234	3A		1414 SMEAR SLITS		
			70	BOSTON	99	
			70	PROVIDENCE	90	49
480				LEAK RATE TEST-5 SEC		
493	254/256			PN EQUALIZE		

3.5 Mission 1208-2 Special Events-Cont'd.

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
496				LEAK RATE TEST-180 SEC		
548	302	10		1414 SMEAR VS SCAN		
			65	BOSTON	99	
			65	PROVIDENCE	99	
563				HPIVA OPEN		
566	311	3.1		1414 LENS MTF		
			95	FLORENCE LINES	99	
		7,9,12	95	TUCSON W/5T RESO	85	114
629	338	1		1414 T/F+12,+6,0,-6,0		
			75	BOSTON	99	
			75	PROVIDENCE	99	46
631	339	10		1414 SMEAR VS SCAN		
			75	LOS ANGELES	85	88
647	346	6.1		1414 LENS MTF		
			95	LUKE LINES	99	52
				1208-2 FOOTAGE		702

ACCUMULATED FOOTAGE 1757

3.6 Mission 1208-3 Special Events

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
678				TRANSFER TO TU3-PREP 1		
679				COMPLETE TRANSFER-PREP 2		63
696	372	12	90	QUALITY VARIABILITY SACRAMENTO/ BAY AREA	80	30
728	388	6.2	95	1414 LENS MTF KINGMAN LINES	99	
		6.3	95	1414 LENS MTF QUARTZSITE LINES	85	78
744	397	7,9,12	90	TUCSON W/5T RESO	99	29
752				XT-A SET TO +2 STEPS PER PFA DIRECTION		
888	456	10	75	1414 SMEAR VS SCAN MONO B@-37° NEW YORK	85	83
989	491			ESD A/B INDICATION		
989				MONO A CV		
989				MONO B CV		12
991				MONO A CV VIA DIS		12

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3.6 Mission 1208-3 Special Events-Cont'd.

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG	
993				SCC 2 SELECT MONO A CV VI A ENA			
995				SCC HEALTH CHECK VI A DIS		163	
1003	502	6.1	95	1414 LENS MTF FLORENCE LINES	95	50	
1020				MONO A CV VIA ENA/DIS		12	
1092				PN EQUALIZE			
1099				SSP			
				1208-3 FOOTAGE		437A	478B
				ACCUMULATED FOOTAGE		2144A	2235B

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3.7 Mission 1208-4 Special Events

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
1115				TRANSFER TO TU4-PREP 1 VIA ENA		
1116				COMPLETE TRANSFER-PREP 2		63
[redacted]						
1181	620	7,9,12	99	TUCSON W/5T RESO	99	29
[redacted]						
1268	641			PN EQUALIZE ESD B		
1277				PN EQUALIZE		
1279				CREEP B		
1283				CREEP B	2	
1287				DITHER TEST		
1295				CV A-RELEASED FOR MONO A OPN JOG B		64
1299				CREEP B		7

3.7 Mission 1208-4 Special Events-Cont'd.

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
1300				SS ENGINEERING RELEASED FOR STEREO OPN		66
1309	651	3A		1414 SMEAR SLITS -16,-8		
			75	BALTIMORE	99	
			75	WASHINGTON	99	37
1461				PN EQUALIZE		
1487	719	3A		1414 SMEAR SLITS -16,-8,0		
			65	NEW YORK	65	43
1501				TRANSFER TO SO255		
1528				PN EQUALIZE		
1554	733	4,12		SO255 COLOR W/6C		
			99	LIVERMORE	99	37
1570	741	4		SO255 COLOR W/6C		
			95	VAN NUYS		
		8		SO255 T/F 14,0,-14		
			95	LOS ANGELES	99	87
1585	745	4,8		SO255 COLOR W/6C T/F +14		
			95	ST LOUIS	95	81

3.7 Mission 1208-4 Special Events-Cont'd.

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
1596				TRANSFER TO FE3916		
1633	756	3C		FE3916 SMEAR SLITS		
			75	PHILADELPHIA	95	31
1635	758	5		FE3916 W/6C		
			99	STOCKTON	99	29
1651				PN EQUALIZE		
1656				PN EQUALIZE		
1667	764	5		FE3916 W/6C		
			65	TUCSON	95	29
1687				PN EQUALIZE		
1700				PREP 2/CV		DEPLETED
				1208-4 FOOTAGE		596A 605B
				ACCUMULATED FOOTAGE		2740A 2840B

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3.8 Solo Phase

No solo phase experiments were performed on mission 1208.

4.0 SENSOR SYSTEM TEST OBJECTIVES

4.1 Photographic Performance

Determine the capability of the SS Optical System to provide the specified photographic performance.

The post flight material evaluation of mission segments 1208-1, 1208-2, 1208-3 and 1208-4 indicated in a general sense the capability of the SS Optical System to provide the specified photographic performance. Mission 1208 was a summer mission launched in April in a non sun synchrous orbit of 94.5° inclination angle, prior to the summer solstice. Summer missions in general acquire a large percentage of photography at solar altitudes above 30 degrees, resulting in smaller operational slits, shorter exposure times and less image smear. The overall image quality, however, was affected to some extent, as it always is at this time of the year, by varying degrees of weather and haze. In addition, specular reflections and shadowless acquisitions resulted in significant image quality degradations to the mission photography, similiar to Mission 1206.

In review, Mission 1206 was launched in July early in the afternoon in a sun synchronous orbit of 96.2 degrees following the summer solstice. This resulted in the specular reflection/front lighting problem to move south in latitude as a function of mission length, and the late launch caused the problem to locate at Nadir and simultaneously affect the imagery from both cameras. The sun synchrous inclination angle caused the problem to remain fixed in scan.

Mission 1208, however, was launched in April, early in the afternoon, prior to the summer solstice, at 94.5° inclination angle, non sun synchronous. This caused the specular reflection/front lighting problem to first move north and then slightly south in latitude. The lower inclination angle increased the precession and moved the local sun time over target closer to morning as the mission progressed. The problem, initially occurring near Nadir, moved across scan, as a function of mission length, ending up at approximately 30-35 degrees of scan at the end of the mission. Thus both cameras did not experience either anomaly at the same scan position.

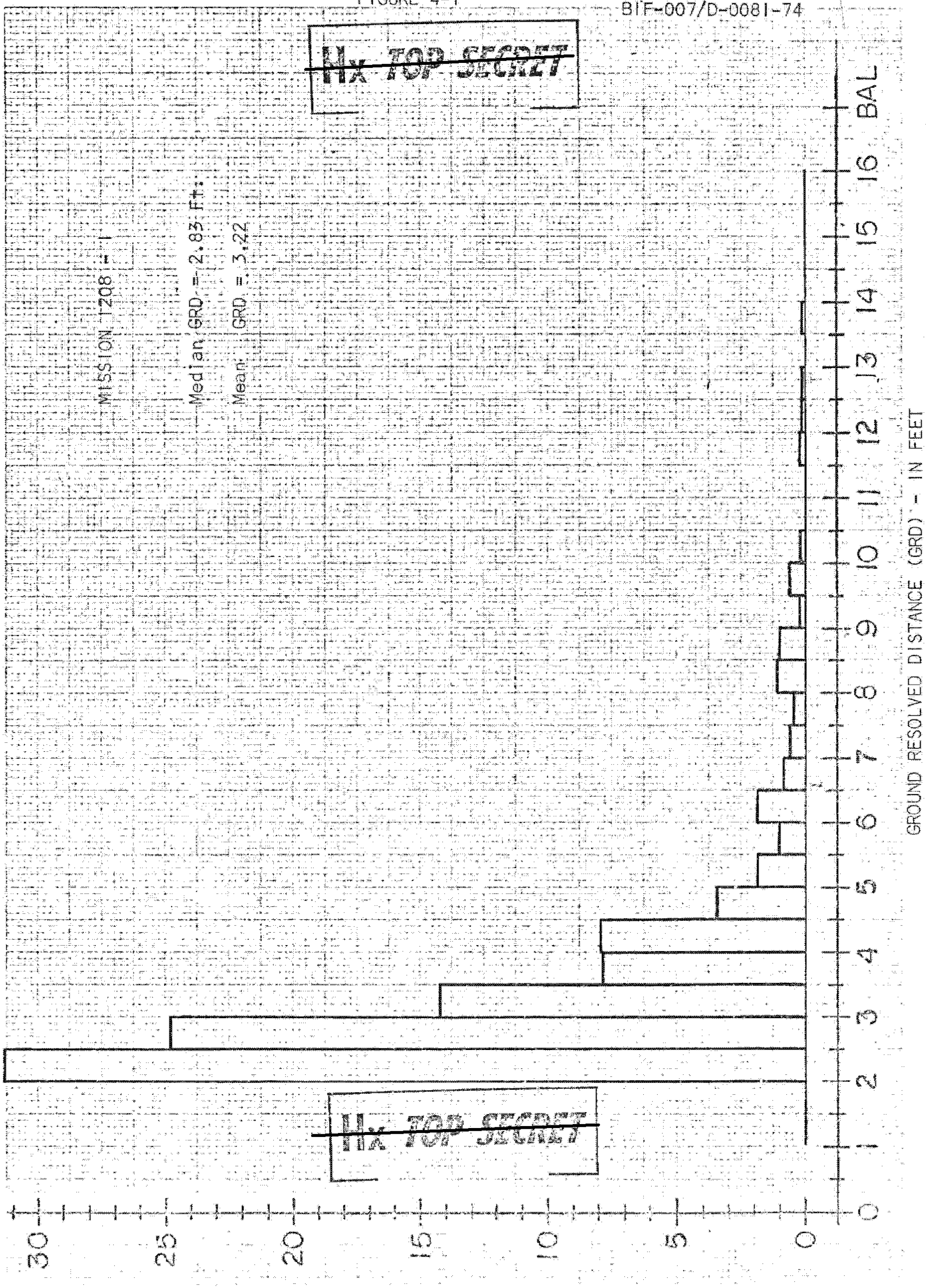
A much better operational plan for summer launches would be to launch early in the morning in a sun synchronous orbit. This places the anomaly out in scan, and the sun synchronous orbit fixes its position in scan. This intentional placement of the anomaly out in scan presupposes that operational target acquisition planning will not locate a large percentage of targets at these scan positions. Launching after the summer solstice will move the anomaly south away from the area of interest.

The general overall range in mission image quality for both cameras was very good to poor with the majority rated as fair to good. Orbital performance prediction using CRYSPER and the actual operational parameters are included in Figures 4-1 thru 4-4 for each mission segment and Figure 4-5 for the total mission length. A brief discussion of image quality and general photographic system performance as a function of mission progression is provided, abstracted in part from the PFA Rebound 831 messages.

4.1.1 Mission Segment 1208-1

The overall image quality of both cameras ranged from very good to poor with the majority rated as fair. Analysis of the thru focus engineering ops both subjectively and with VEM, resulted in the PFA directing an eight micron retreat to the fwd camera platen, which changed the nominal platen to 76 microns. No focus change was made to the aft camera. In addition to the focus change on the fwd camera, an O^2A^2 change was required on the aft camera in-track of minus three command steps, resulting in a new in-track nominal setting of minus five command steps. No O^2A^2 adjustment was made to the fwd camera.

Subjectively, the image quality of the aft camera appeared to be sharper than that of the fwd. In point of fact, the very good imagery on this mission segment, was limited to clear weather acquisitions on the aft camera. The poor image quality which subjectively exhibited an overall grainy appearance, and soft unsharp edges was in part the result of non optimum acquisition conditions, such as high scan angles, cloud cover, medium to heavy haze levels, and the defocused condition of the fwd camera. The very good imagery from the aft camera was comparable to the better photography produced from past Hexagon Missions. This assessment was substantiated by the good resolution readings obtained from the tri-bar corn target, and the direct subjective comparison of image quality from previous Hexagon Missions.


MISSION 1208-1
Median GRD = 2.83 Ft.
Mean GRD = 3.22
GROUND RESOLVED DISTANCE (GRD) - IN FEET
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
BAL
PERCENT OF PHOTO FOOTAGE
0
5
10
15
20
25
30

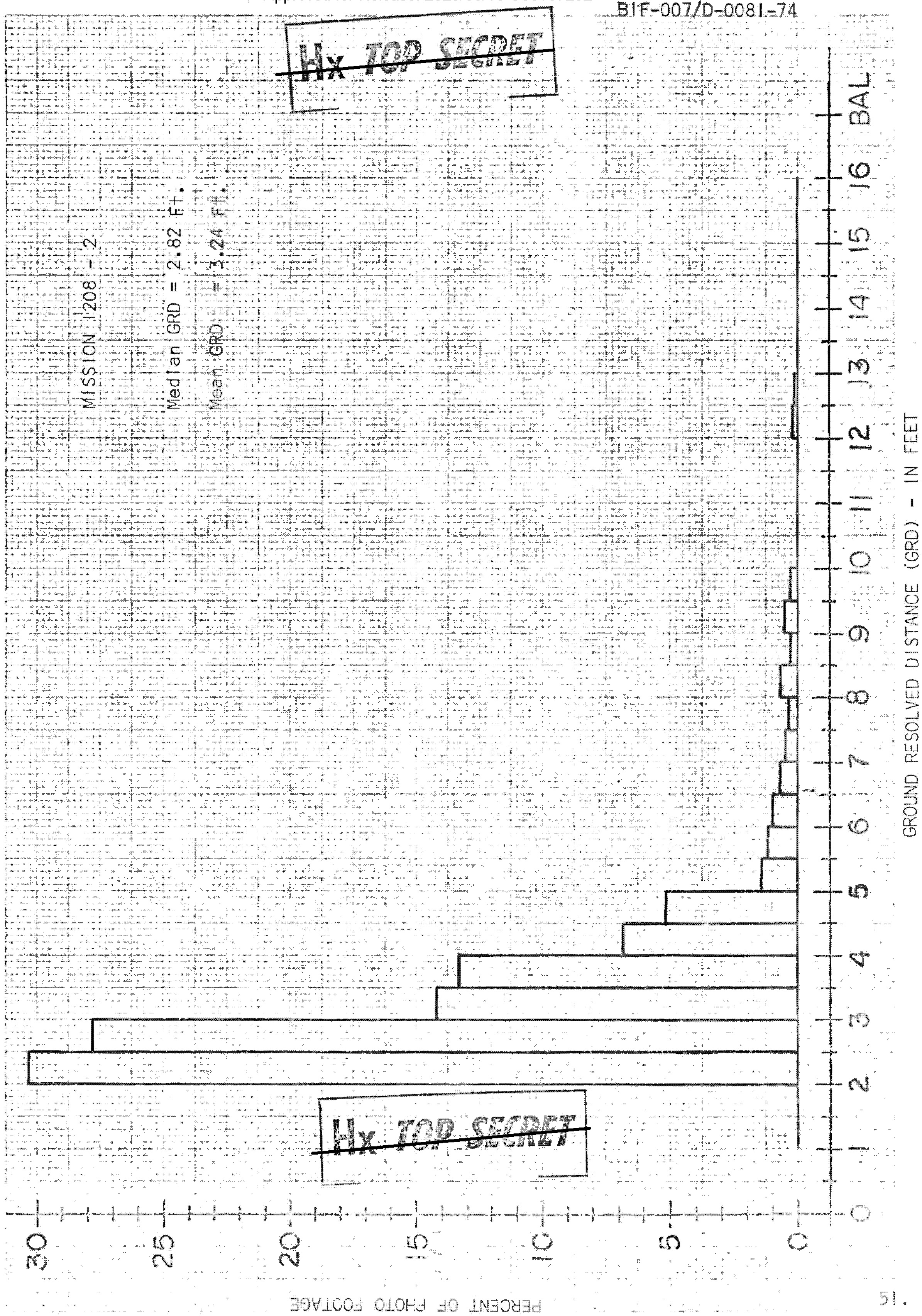

Hx TOP SECRET
MISSION 1208 - 2
Median GRD = 2.82 Ft.
Mean GRD = 3.24 Ft.
GROUND RESOLVED DISTANCE (GRD) - IN FEET
0 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 BAL
PERCENT OF PHOTO FOOTAGE
30 25 20 15 10 5 0
Hx TOP SECRET

FIGURE 4-3

BIF-007/D-0081-74

Hx TOP SECRET

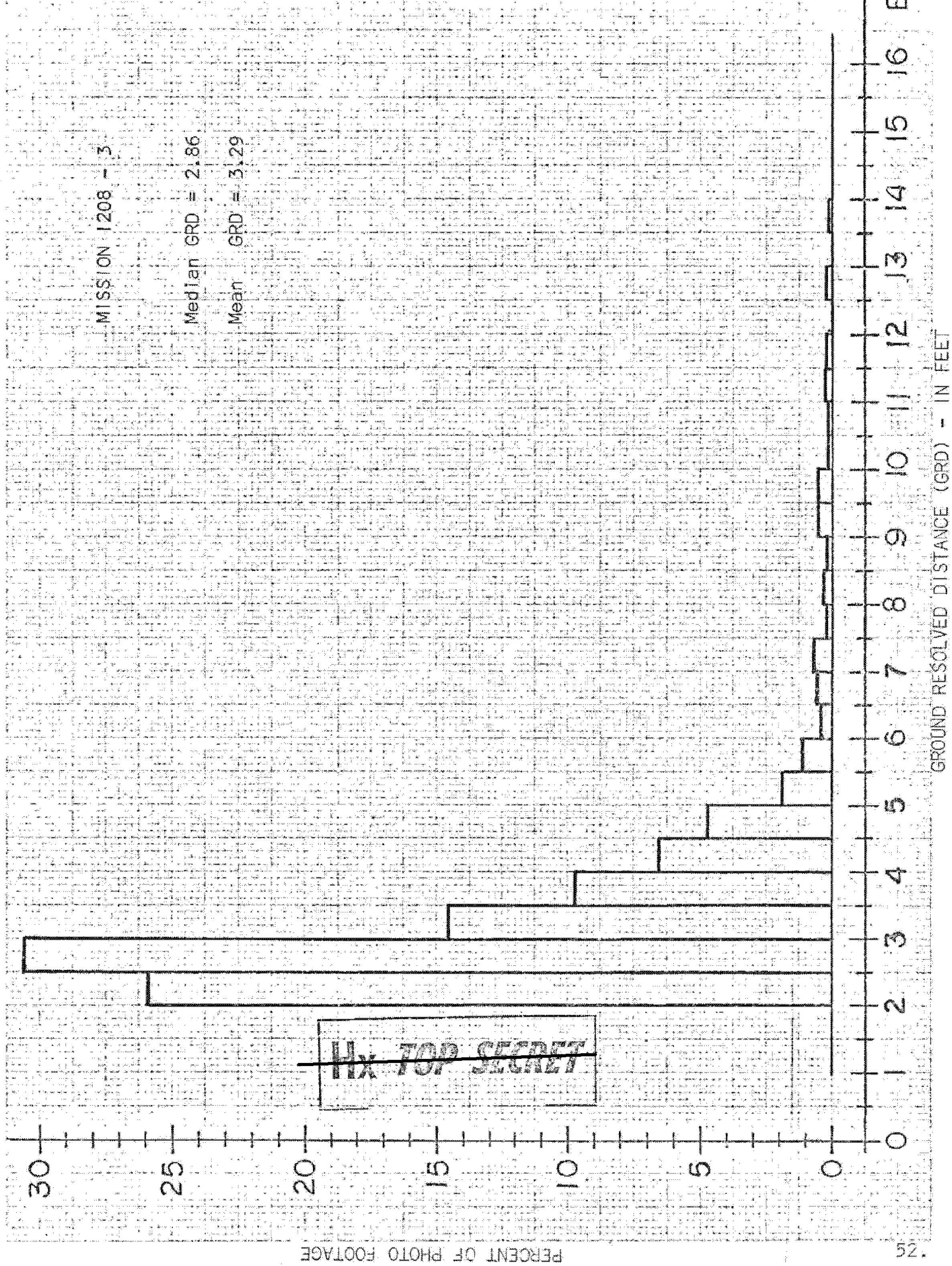
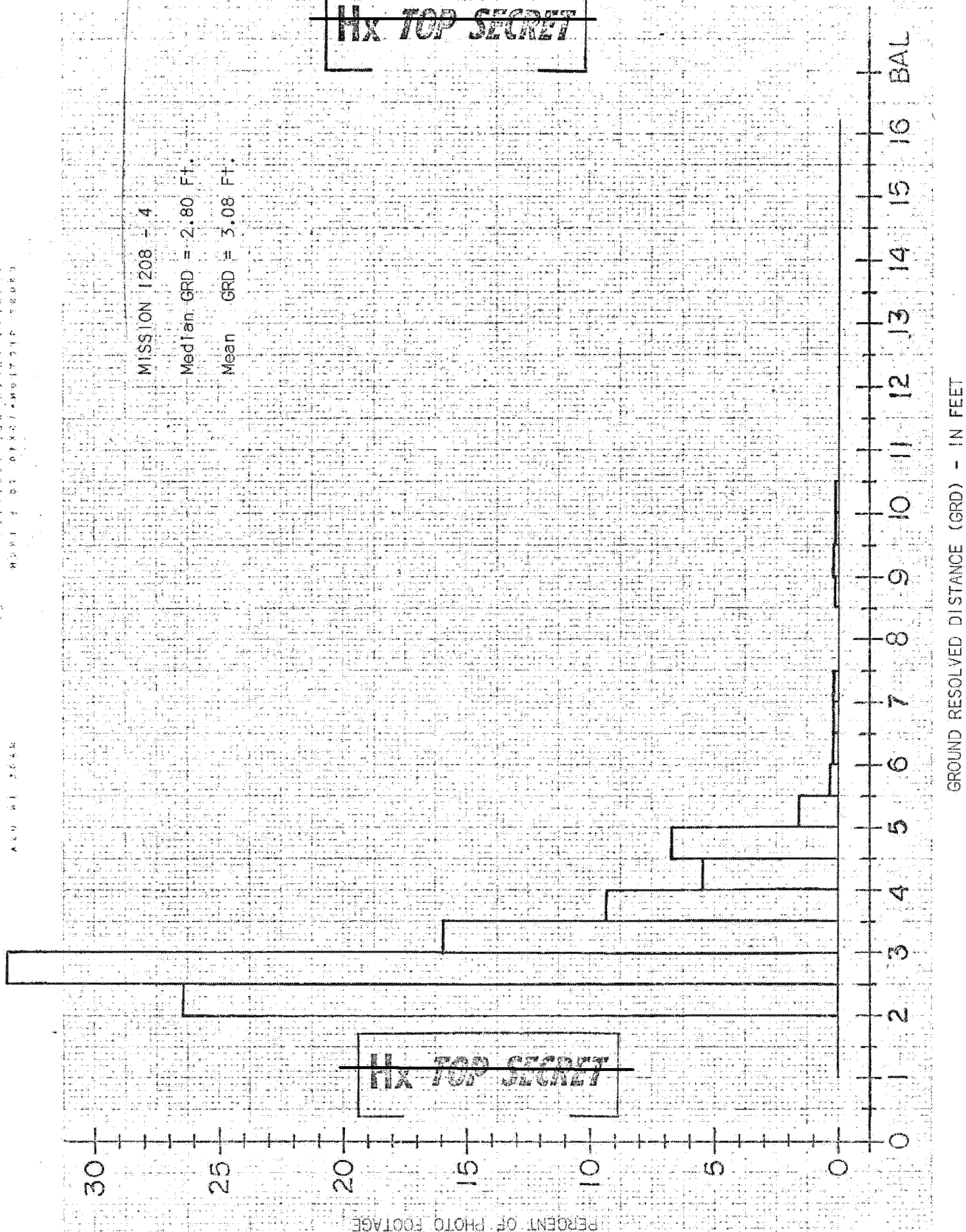


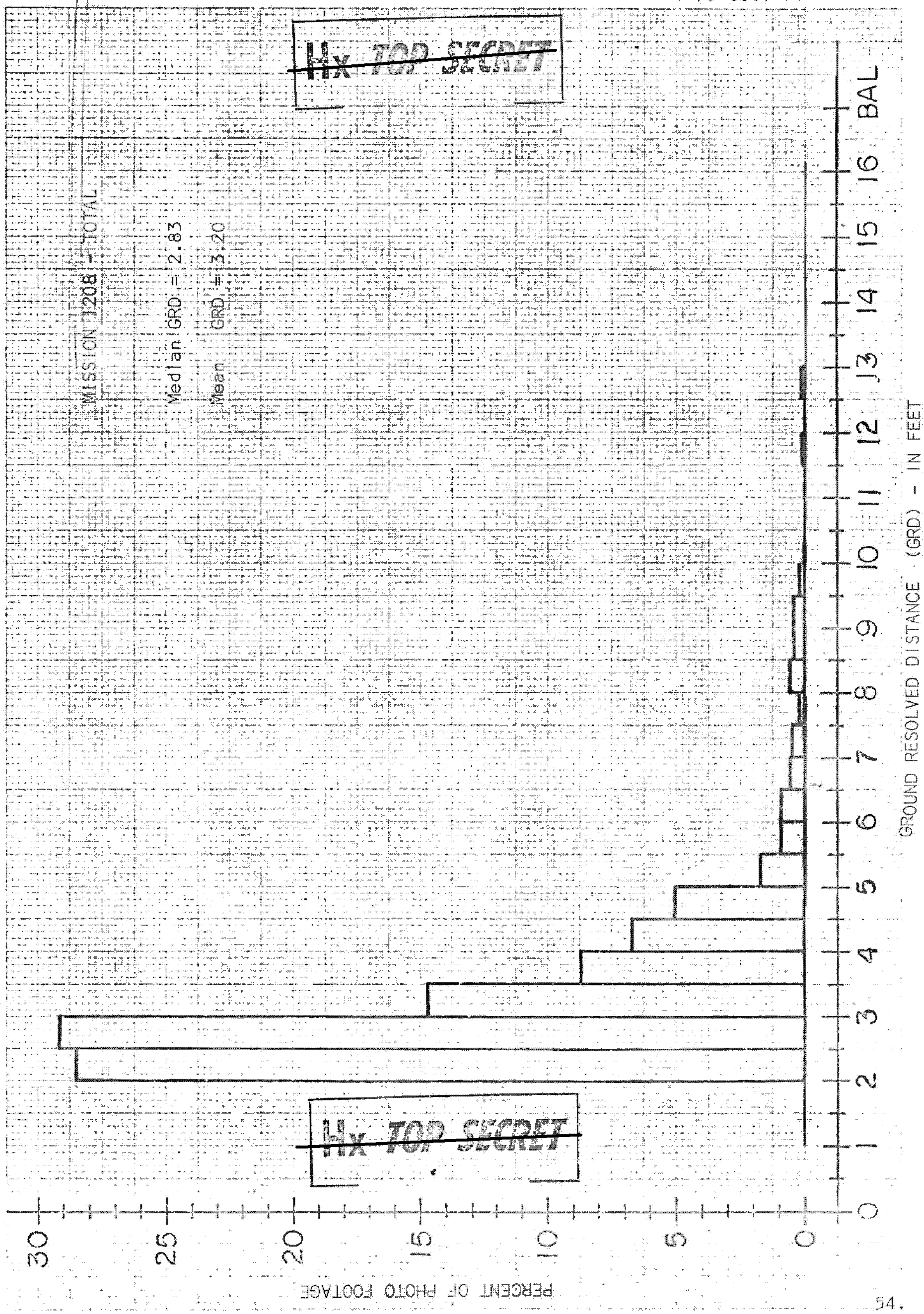
FIGURE 4-4

BIF-007/D-0081-74

~~Hx TOP SECRET~~



~~Hx TOP SECRET~~


Hx TOP SECRET
MISSION 1208 - TOTAL
Median GRD = 2.83
Mean GRD = 3.20
GROUND RESOLVED DISTANCE (GRD) - IN FEET
0
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
BAL
PERCENT OF PHOTO FOOTAGE
0
5
10
15
20
25
30
Hx TOP SECRET

One 51/51 tri-bar corn target was acquired on both the fwd and aft cameras. The data follows:

CAMERA	OP	FRAME	ANGLES SCAN	ANGLES FIELD	PLATEN	UNADJ GRD.(FT) IT	UNADJ GRD.(FT) XT	2:1 ADJ GRD.(FT) IT	2:1 ADJ GRD.(FT) XT
fwd	084	004	+1.1	-0.8	68	1.73	2.05	2.06	2.44
aft	084	004	-0.4	-2.0	25	1.52	2.25	1.86	2.73

Exposure on this mission was based on a mean urban/industrial scene density of 1.10 instead of 1.00.

Microdensitometer analysis of 13 frames (9 fwd, 4 aft) with vegetation surround indicated reasonably good exposure (-.02 log E from aim for the fwd, -.05 log E for the aft) requiring no alteration of the 1208 general recommendation. The two count exposure reduction bias given to the aft camera resulted in a better balance exposure between cameras.

The average scene range was found to be higher than was generally recorded for this time of the year. This was true for both foreign and domestic ops. As was generally the case, the scene range of the domestic areas was greater as was the areas acquired by the fwd unit.

Although two snow scenes examined were correctly exposed, portions of two other frames were underexposed (op 58, frame 15 fwd, op 118, frame 17 fwd). In both frames urban areas were grossly underexposed with accompanying low contrast. Evaluation indicated that the snow had melted in the urban areas, and because the urban area represents only a small portion of the frame, the snow bias was correctly applied.

4.1.2 Mission Segment 1208-2

The overall image quality of both cameras improved on 1208-2 from 1208-1. This general improvement was attributed in part to the focus adjustment of plus 8 microns on the fwd camera, and in part to the overall improved atmospherics, resulting from less snow and correspondingly less moisture in the atmosphere. A third contributing factor was the use of the 26DN process emplo[illegible] on 1208-2 because of abnormally high base plus fog on [illegible]fic sections of both original photographic recor[illegible]

4.1.2 Mission Segment 1208-2-Cont'd.

The image quality of both cameras on 1208-2 ranged from very good to poor with the majority rated as fair to good. As with Mission 1208-1, the very good imagery was associated with the aft camera. The aft camera image quality was superior to that of the fwd camera and subjective comparisons very clearly indicate that it was significantly sharper, and the aft camera consistently recorded very fine details. The fwd camera imagery was affected by specular reflections.

One 51/51 tri-bar corn target was acquired on both cameras. The data follows:

		ANGLES				UNADJ GRD (FT)		2:1 ADJ GRD (FT)	
CAMERA	OP	FR	SCAN	FIELD		IT	XT	IT	XT
fwd	311	12	+16	-1.7	76	1.83	2.38	2.03	2.63
aft	311	12	+17	-1.5	25	1.81	2.19	2.05	2.49

The late launch time of 1208 resulted in specular reflections on the fwd record, and full front lighting (shadowless acquisitions) on the aft photography. This condition occured near Nadir, and between approximately 5 to 30 degrees north latitude on this mission segment. This mission orbit was such that the specular reflections moved out in scan angle as the mission progressed and they were predicted to be at about 35 degrees scan at mission termination. The latitudes affected progressed to the north and then moved slightly south.

Many cases of specular reflections were found in the fwd camera imagery within the latitude bands and scan angles indicated. In this mission segment the effect of the specular reflections appeared more severe than the corresponding shadowless acquisitions. These shadowless acquisitions did in fact produce a loss in contrast due to the reduction of shadows in the scene, and a corresponding reduction in fine detail. The specular reflections occurred where ground water was standing. In these areas there was gross image blooming and loss of localized information in the direct vicinity of these reflections.

4.1.2 Mission Segment 1208-2-Cont'd.

A high base plus fog condition occurred on approximately 54 percent of the original negative. This condition existed on 1208-1 and was expected to be present throughout the remainder of the mission.

This anomaly was associated with specific manufactured film rolls and the probable cause was a pelloid backing contaminant, which, when in contact with the emulsion, caused a fog build-up with time, reduction of the density range, and a small speed and contrast change.

In an effort to compensate for the sensitometric change induced by the high fog found on 1208-1, EK evaluated several modified 19 DN processes. One of these, designated 26 DN, was selected for use on those segments of 1208-2 that could be expected to exhibit high fog in the standard 19 DN process. The 26 DN process reduced the fog somewhat and retained the desired sensitometry. Flashed stock was inserted at those manufacturing splices where a change from 19 DN to 26 DN or vise versa was required.

The developer switch was then accomplished as these flashed stock inserts were being processed and imagery was not affected by the transitions.

Comparisons were made of the duplicate positives from the normally processed low fog film, the 26 DN processed fogged film, and normally processed fogged film from 1208-1. The slightly increased contrast and the lower fog density of the 26 DN processed film over the 1208-1 fogged film was evident. More shadow and highlight detail was present in the imagery. Little discernable difference in image quality was present in comparisons made between the 26 DN processed fogged film and the normally processed low fog film in 1208-2.

Microdensitometer analysis of 29 acquisitions of vegetation surround, urban/industrial area imagery indicated generally satisfactory exposure with either 19 DN or 26 DN processing. The 26 DN process demonstrated higher contrast of the scene imagery accompanied by a slighter higher exposure of the scene mean (.02 log E). The high base fog level did not adversely affect any vegatation surround scene examined.

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4.1.2 Mission Segment 1208-2-Cont'd.

Continued monitoring of springtime snow surround imagery indicated increased occurance of underexposed and flat imagery of cultured areas due to melted and/or dirty snow within the area of interest. Examples of this appeared in ops 307 and 308 where underexposure ranged up to a stop.

Because of the magnitude and frequency of underexposure of snow surround scenes, the following snow bias criteria was recommended for the remainder of the mission:

Reported Snow Depth	Exposure Bias
Less than 2 inches	No bias
2 to 10 inches	-.13 log E
Greater than 10 inches	-.26 log E

While this change did not totally optimize exposure of snow surround scenes it was designed to prevent complete loss of information in shadow areas without grossly over-exposing areas of existing snow.

4.1.3 Mission Segment 1208-3

The overall image quality of both cameras ranged from poor to very good. This imagery was comparable to 1208-2. The instances of poor photography was attributed to atmospheric conditions, very high sun angles, specular reflections, and shadowless imagery. The aft camera image quality was superior to that of the forward and most of the very good imagery was on the aft record. The presence of specular reflections and shadowless acquisitions, particularly front lighting, continued to significantly degrade a large portion of the photography from this mission.

These problems, particularly that of the front lighting, became more severe during this mission segment, with approximately 40 percent of the frames affected by front lighting. The most severe front lighting was similar to that seen on 1206. The problem was primarily due to the present sun/orbit geometry and large number of acquisitions in the latitude range from approximately 10 to 50 degrees north. Objects acquired between minus 10 and minus 20 degrees scan at these latitudes were degraded by front lighting, and objects acquired between plus 10 and plus 20 degrees were affected by specular reflections.

4.1.3 Mission Segment 1208-3-Cont'd.

For acquisitions within this latitude range north of the sub-solar point the aft camera was affected by front lighting, and the fwd camera experienced specular reflections. The effects appeared on opposite cameras in acquisitions south of the sub-solar point.

The magnitude of the degradation resulting from front lighting was dependent upon the camera to target to sun acquisition angle (cats angle). The extent of area affected ranged from a few degrees to as much as 20 degrees of scan in the most severe cases. The image degradation from the front lighting was more extensive than that from the specular reflections. All targets acquired with front lighting exhibited some degree of degradation, whereas specular reflections tended to degrade only high reflectance objects and their surroundings.

One 51/51 tri-bar corn target was acquired on both the fwd and aft cameras. The data follows:

			ANGLES			UNADJ GRD.(FT)		2:1 ADJ GRD.(FT)	
CAMERA	OP	FRAME	SCAN	FIELD	PLATEN	IT	XT	IT	XT
fwd	397	3	-11	-1.5	76	1.7	2.5	1.9	2.8
aft	397	3	-11	-1.3	25	1.2	2.1	1.4	2.3

Microdensitometer analysis of vegetation surround urban area imagery indicated continued good exposure. There was also no significant change in mean scene density between use of 19 DN and 26 DN process chemistry. The following table gives the average exposure error of all vegetation surround scenes analyzed on 1208 (approx. 35 scenes) based on the optimum exposure criteria of 1.1 density.

	AVG. MEASURED LOG EXPOSURE ERROR	
	19 DN	26 DN
fwd camera	minus .02	minus .03
aft camera	minus .04	minus .04

4.1.4 Mission Segment 1208-4

This mission segment contained 2588 feet of SO-255 conventional color material, and 3036 feet of FE-3916 infrared color material in addition to the regular 1414 black and white material. The photographic performance for each material type is as follows:

Film Type 1414 - Black and White
The overall image quality of 1208-4 ranged from good to poor with the majority rated as fair to good. The instances of poor photography again were attributed in part to localized atmospheric conditions and specular/shadowless acquisitions. As with earlier mission segments the majority of the good imagery was associated with the aft camera. The aft camera image quality was superior to that of the fwd in that it was sharper. The combination of haze and shadowless acquisitions resulted in poor imagery which can be characterized as flat and grainy. This yielded imagery with soft and unsharp edges and significant loss in fine detail. This condition had a lesser impact on total performance than on 1208-3.

Five 51/51 tri-bar corn targets were acquired on the fwd camera and one target on the aft camera. The data follows:

CAMERA	OP	FRAME	ANGLES SCAN	ANGLES FIELD	PLATEN	UNADJ GRD. (FT) IT	UNADJ GRD. (FT) XT	2:1 ADJ GRD. (FT) IT	2:1 ADJ GRD. (FT) XT
fwd	620	3	+21.0	+1.9	76	2.25	3.27	2.72	3.99
aft	620	4	+22.0	+0.1	25	2.10	2.67	2.10	2.68
fwd	741	4	-16.0	-0.3	76	1.72	1.95	2.58	2.89
fwd	745	3	- 8.0	-2.3	76	1.85	2.25	2.24	2.80
fwd	758	3	-27.5	-2.5	76	2.20	3.04	3.25	4.37
fwd	764	3	+14.0	0.0	76	1.78	2.66	2.24	2.80

Film Type SO-255 - Conventional Color

The quality of the imagery (for color film) ranged from very good to poor, with mos[illegible] rated good. The very good imagery was comparable to the [illegible] quality SO-255 acquired with the Hexagon System to dat[illegible]-1). Poor imagery was generally associated with large [illegible]nts of haze. The color balance of the original was sl[illegible]ly yellow-green, and was similar to that of the SO-255 acquired on Mission 1207-1. Subjective evaluation of engineering photography for focus evaluation showed the nominal focus setting to be acceptable, although a slight bias to the plus side(6 microns) might have been in order.

4.1.4 Mission Segment 1208-4-Cont'd.

Subjective evaluation of exposure showed the original to be slightly overexposed.

Two 51/51 corn tri-bar targets were acquired on SO-255 film. The data follows:

			ANGLES			GRD. (FT)	
CAMERA	OP	FRAME	SCAN	FIELD	PLATEN	IT	XT
aft	741	4	-15.3	-2.3	55	2.83	3.03
aft	745	3	- 8.0	-0.5	55	3.17	4.03

NOTE: Procedures for the 2:1 contrast adjustment have not been established for SO-255.

Film Type FE-3916 - (Infrared color)

The overall image quality of the FE-3916 material was good, and was comparable to that of 1207-4. The fine detail quality of the 3916, however, continues to be significantly less than that of the conventional black and white 1414 material utilized on the fwd camera. The color balance of the original has a slight cyan cast; subjective evaluation of the photography showed the exposure to be adequate.

Two 51/51 tri-bar corn targets were acquired on the aft camera on the FE-3916 material. The data follows:

						UNADJ	
			ANGLES			GRD. (FT)	
CAMERA	OP	FRAME	SCAN	FIELD	PLATEN	IT	XT
aft	758	3	-27.5	-2.5	55	5.66	6.21
aft	764	4	+15.0	-2.3	55	4.80	5.94

NOTE: Procedures for the 2:1 contrast adjustment have not been established for FE-3916.

The presence of specular reflections and shadowless acquisitions, particularly front lighting, continued to degrade portions of the photography from this mission segment.

The extent of the degradation within a frame (slight to severe) was approximately plus and minus 10 degrees of scan about the minimum cats angle with the most severe cases occurring between minus 20 and minus 30 degrees of scan at a latitude range of 40 to 45 degrees north for this mission segment.

4.1.4 Mission Segment 1208-4-Cont'd.

Microdensitometer analysis of six SO-255 urban area acquisitions indicated an overexposure of approximately 0.10 log E. This overexposure was due in part to the overall scene brightness increase inherent in low shadow acquisitions. Low shadow scenes appeared quite frequently in aft camera acquisitions. This condition also appeared regularly in Mission 1206 with the same results in exposure. This amount of overexposure was considered significant and may have to be considered in the predictions of future summer missions.

Evaluation of three FE-3916 acquisitions showed a 0.08 log E overexposure. This was probably due in part to the shadowless conditions as well.

Although no microsensitometry was done on 1414 film in 1208-4 observation of clear weather imagery subjectively indicated continuing good exposure.

4.2 Take-Up Survival Thru Recovery

All the RV/TU assemblies arrived at the BRIDGEHEAD processing facility in good condition, with 1208-1 being a water recovery, and 1208-2,3 and 4 conventional air recoveries. The ability to maintain light tight integrity during orbital operations, separation, re-entry, recovery and transportation to the processing site, was fully demonstrated. The core locking pins were engaged and intact in TU's 1208-1,2 and 4 with the film well centered and stacked. The fwd camera core locking pin of TU 1208-3 was engaged and sheared and approximately 50 feet of film was spilled; on the aft camera, the core locking pin was engaged and bent causing some damage to the RV during pin removal. The film was well centered and stacked on both TU's of 1208-3. Small amounts of particulates were found in all the RV canisters.

Related de-filming observations for each mission segment follows:

4.2.1 Mission Segment 1208-1

The RV/TU arrived at the processing facility in good condition. All parachute apparatus was wet. The RV cover recesses had small amounts of water in them resulting from the wet recovery. The battery discharge units had not been installed on the RV. Both core locking pins were engaged and intact.

4.2.1 Mission Segment 1208-1-Cont'd.

Both film rolls were dry, well stacked and well centered in the T/U. A small amount of particulate was collected from the inside of the dome, as well as a one-inch long piece of wire which had been lodged in the fwd roll at OP 038 and had punctured four convolutions of the film. A severe dimple was detected near the head of the fwd roll at presplice. The cause was not found, but correlated with the puncture of fwd OP 001 10R. Tag ends were removed and processed prior to normal defilming to allow early PFA team image quality evaluation.

4.2.2 Mission Segment 1208-2

The RV/TU arrived at the processing facility in good condition. Both core locking pins were engaged and intact. Both rolls were well stacked and well centered on the TU with no festooning into the dome. The hinge and thermal access door on the entrance side was sprung. A white residue was noted around the fwd side exit door and cutter assembly.

During despooling it was discovered that the brake on the fwd side was not operational. It was commanded "on" several times but no braking could be accomplished. The audible sound of the brake solenoid actuation was detected thus concluding the problem to be in the brake assembly. This necessitated hand held tension on the stack when the motor was turned off for splicing.

Two deep scratches were noted inside the dome and a 1 inch tear in the acrylic tape covering the fiberglass on the relay housing was noted on the fwd side adjacent to a canister alighnment pin.

The dome was clean with only a small amount of particulate retrieved.

4.2.3 Mission Segment 1208-3

The RV/TU arrived at the processing facility in good condition.

Upon removal of the RV canister, it was evident that the de-orbit core locking pin on the fwd side had sheared resulting in a 50 foot film spill. Prior to handling the film, the builder roller arms were raised

4.2.3 Mission Segment 1208-3-Cont'd.

electrically using special test equipment. This was to preclude possible damage to the builder roller verify microswitch on the fwd side which evidenced intermittent failure during the mission. The 50 feet of spilled film was then respooled onto the TU stack.

The film stacks were good with the exception of a rough edge on the inside of the fwd stack approximately 3/4 inch from the outside diameter.

The most significant problem occurred when attempting to withdraw the aft core locking pin that had been bent during recovery. Normal techniques for removing a bent pin failed, requiring the pin assembly to be drilled out. This effort consumed 18 hours. However, processing time was not lost because the fwd side film was processed in parallel with this effort.

The RV suffered the following damage during removal of the bent core locking pin:

1. Complete destruction of the piston and actuating pin.
2. Cut wire bundle and damage to the solenoid assembly.
3. Removal and damage to actuator assembly plate.
4. A fracture in the support assembly cross frame member of approximately 7mm.
5. Damage to primary battery.
6. Minor physical damage (rubs, abrasions, etc.)to the aft side wire bundles in area of A-2 canister recess.

A small amount of particulate was retrieved from the dome.

4.2.4 Mission Segment 1208-4

The RV/TU arrived at the processing facility in good condition. No major problems occurred. The film stacks were good and the de-orbit pins did not shear. A small amount of shredded film was found in the RV cannister. The film was damaged by pulling the loose ends thru the camera. The TU electronics (A-2 and A-15) on aft side were removed and sent directly to the vendor for analysis of the integrator reset problem experienced during 1208-4 mission segment.

4.3 Optimum Focus Determination

Mission 1208 (SV8/SN11) was launched with orbital focal plane settings of 68 microns on the forward camera and 25 microns on the aft camera. These settings included a plus 14 micron adjustment on both cameras for the altitude shift from infinity (A-2 collimator settings) to 85 nautical miles mission altitude. They also included a minus 15 micron adjustment on the forward camera and a minus 19 microns on the aft camera for the folding flat gravity effects. The forward camera was further adjusted plus 2 microns to account for a defocus of the test collimator.

Following the evaluation of the on orbit thru-focus tests in RV-1 a retreat of plus 8 microns was recommended for the forward camera. The forward platen was retreated to 76 microns on OP 156. No focus change was deemed necessary for the aft camera.

A change in focus of plus 30 microns retreat was implemented on the aft camera when the material switched from 1414 black and white to the SO-255 conventional color. This focal plane position was also utilized for the FE-3916 infrared color material.

4.4 Optimum OOAA Settings

On-Orbit smear data was collected during all four of the mission segments of Mission 1208, on either the 1414 material or on the FE-3916 infrared color. No smear data was collected on the SO-255 conventional color material.

Analysis of the smear test material from mission segment 1208-1 identified an aft camera in-track velocity error. It was determined that the film velocity was 0.023 ips too fast and the PFA directed a minus three command step change to correct it. The ground settings for the forward camera, in-track and cross-track and the aft camera cross-track were determined to be correct. It is interesting to note that since the first use of smear slits on SV-6, all three systems have required an identical change to the aft camera in-track settings. This phenomenon is currently under investigation.

On mission segment 1208-2 ninety data points were measured from each camera. The minus three command step change made to the aft camera in the in-track direction was verified to be correct and within less than one command step of the indicated

4.4 Optimum OOAA Settings-Cont'd.

zero setting. The forward camera in the cross-track direction showed that the indicated mean error was slightly greater than one command step and was changed accordingly by plus one command step. The forward camera in-track and aft camera cross-track directions were both confirmed to be properly set. The smear slit imagery, both subjectively and objectively, indicated higher smear variability then past systems. Only one smear test (a type 10) was run on mission segment 1208-3, and this was a mono run on the aft camera. This data was not reduced.

Mission segment 1208-4 contained 2588 feet of SO-255 color and 3036 feet of FE-3916 infrared color material included in the aft camera record. No OOAA tests were acquired on the SO-255 material, however, subjective evaluation of the smear slit imagery indicated that the cross-track bias was adequate to account for the difference in material thickness.

A subjective evaluation of the smear slit imagery acquired on the FE-3916 material was performed. The inherent low resolution level of the IR film and subsequent very poor image quality in the smear slits negated any quantitave measurement or subjective assessment of the cross-track film synchronization. The PFA recommended that this test on FE-3916 not be performed on subsequent missions. Special thru-focus/O^2A^2 bias tests were conducted during this mission segment to determine if the minus eight microns focal plane bias was optimum. Analysis of the material indicated that the bias magnitude and direction was necessary and adequate.

4.5 Optics Thermal Profile

The following subparagraphs describe the thermal environment for Mission 1208. Definitions of measured and calculated temperature parameters are contained in the Mission 1207 Post Flight Report, PM-1496-X. Thermal control for SV-8 can be generally summarized as follows:

- All SS temperatures were within design limits throughout the mission.

4.5.1 SV Environment

SV thermal control parameters are summarized as follows:

- Orbital Elements (Ref. Paragraph 1.5)

Perigee Altitude	h_p = 85.6 n.m.
Period	τ = 88.5 min.
Inclination	I = 94.5 deg.
Argument of Perigee	α = 130 deg.
Beta	$\beta \doteq -2.6$ deg. (Rev 1) β = 26.5 deg. (Rev 1692)

- Midsection Thermal Control Design Values

Cocoon	α/ε = 0.359/0.265
Thermal Baffle	α/ε = 0.90/0.90

- MLI Effective Emittance

Lower 210 Degrees	ε^* = 0.0045
Fwd & Aft Bulkheads	ε^* = 0.0045
Viewport Baffle	ε^* = 0.0045
Under TCA Cocoon	ε^* = 0.04
Under SU Cocoon	ε^* = 0.6

4.5.2 TCA Environment

Table 4 - 1 is a summary of temperature levels, spatial distributions, and temporal variations over a typical orbital revolution in terms of the thermal ICD (1420316A) requirements. Figures 4 - 6 thru 4 - 8 show the corresponding orbital profiles of the ICD parameters.

TCA COMPARTMENT TEMPERATURES

(MISSION 1208 REV 861)

D[illegible]tion	Designated Zones	Max Allowable ICD Value(°f)	Flight Value(°f)
Temperature Level Index (T TCA)		70 ± 21	67
Zone I Mean Temp.	Not Applicable	N/A	67
Zone II Mean Temp.		N/A	65
Zone III Mean Temp.		N/A	66
Zone IV Mean Temp.		N/A	69
Forward Bulkhead		N/A	68
Middle Bulkhead		N/A	69
Variation of Mean Temp. Between Designated Zones	I to IV	9	2
	II to III	6	1
	I to II	4	2
	III to IV	4	3
	Bulkhead to Bulkhead	6	1
Spatial Variation of Time-Average Temp. Measurements at Locations Within Designated Zone	I	11	5
	II	9	2
	III	9	1
	IV	11	1
	Forward Bulkhead	5	2
	Middle Bulkhead	17	6
Temporal Variation (Peak to Valley) of Temperature Measurement at any one Location within Designated Zone	I	46	17
	II	20	1
	III	20	1
	IV	46	17
	Forward Bulkhead	26	4
	Middle Bulkhead	57	16

TABLE 4 - I

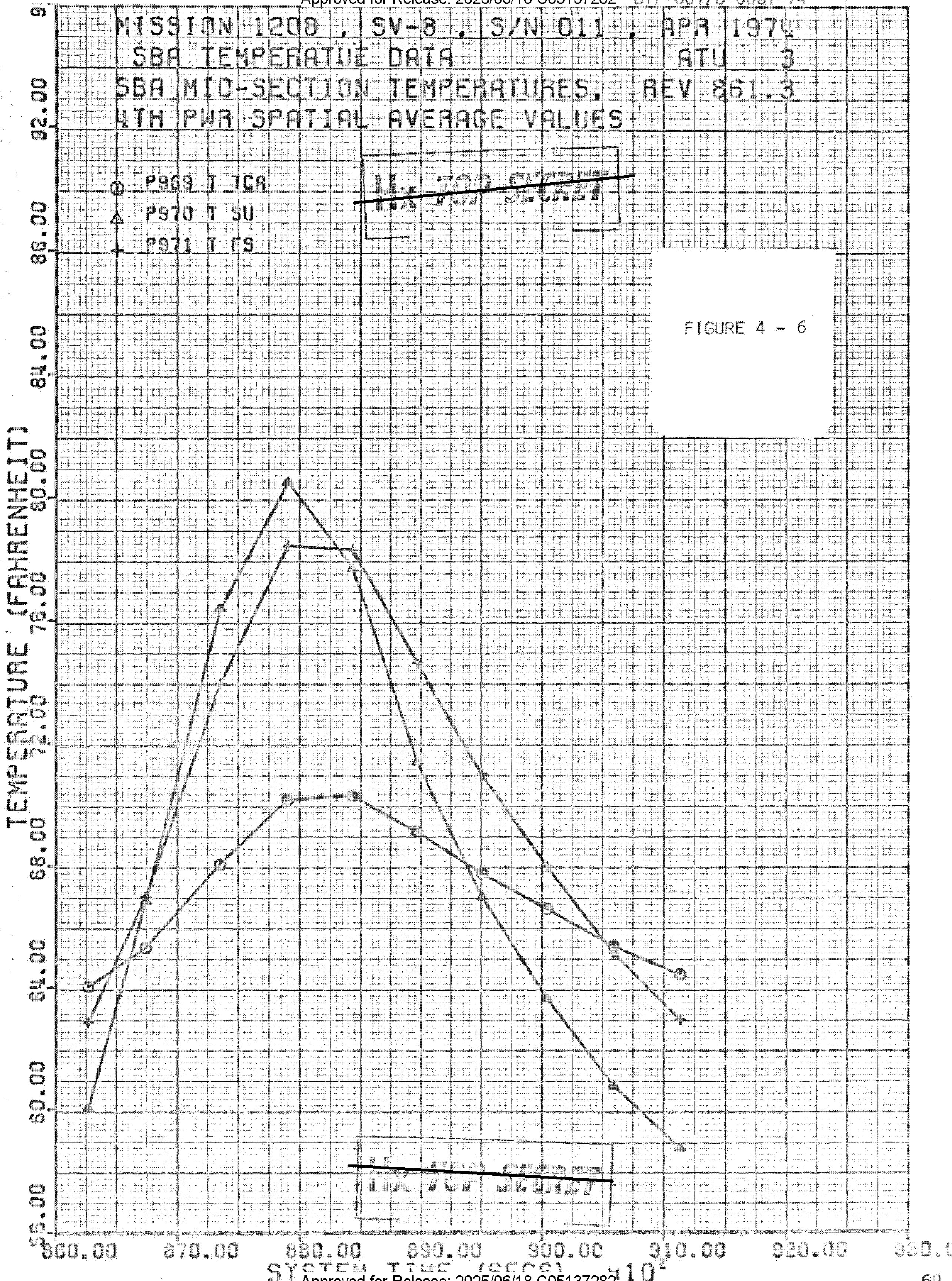
MISSION 1208 , SV-8 , S/N 011 , APR 1974
SBA TEMPERATUE DATA
ATU 3
SBA MID-SECTION TEMPERATURES, REV 861.3
4TH PWR SPATIAL AVERAGE VALUES
P969 T TCA
P970 T SU
P971 T FS
Hx TOP SECRET
TEMPERATURE (FAHRENHEIT)
92.00
88.00
84.00
80.00
76.00
72.00
68.00
64.00
60.00
56.00
860.00
870.00
880.00
890.00
900.00
910.00
920.00
930.0
SYSTEM TIME (SECS) x10²
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FIGURE 4 - 6

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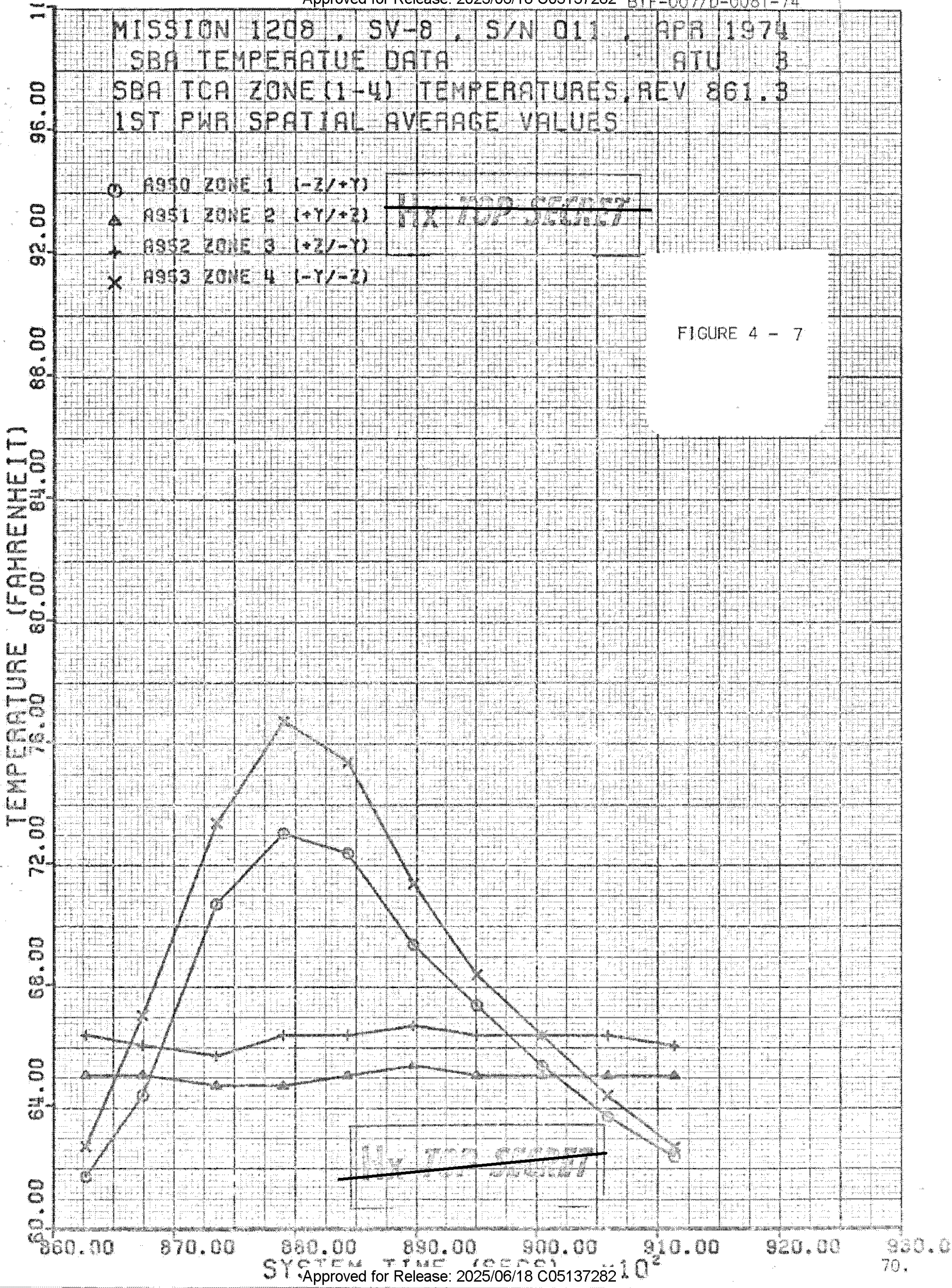

FIGURE 4 - 7

70.

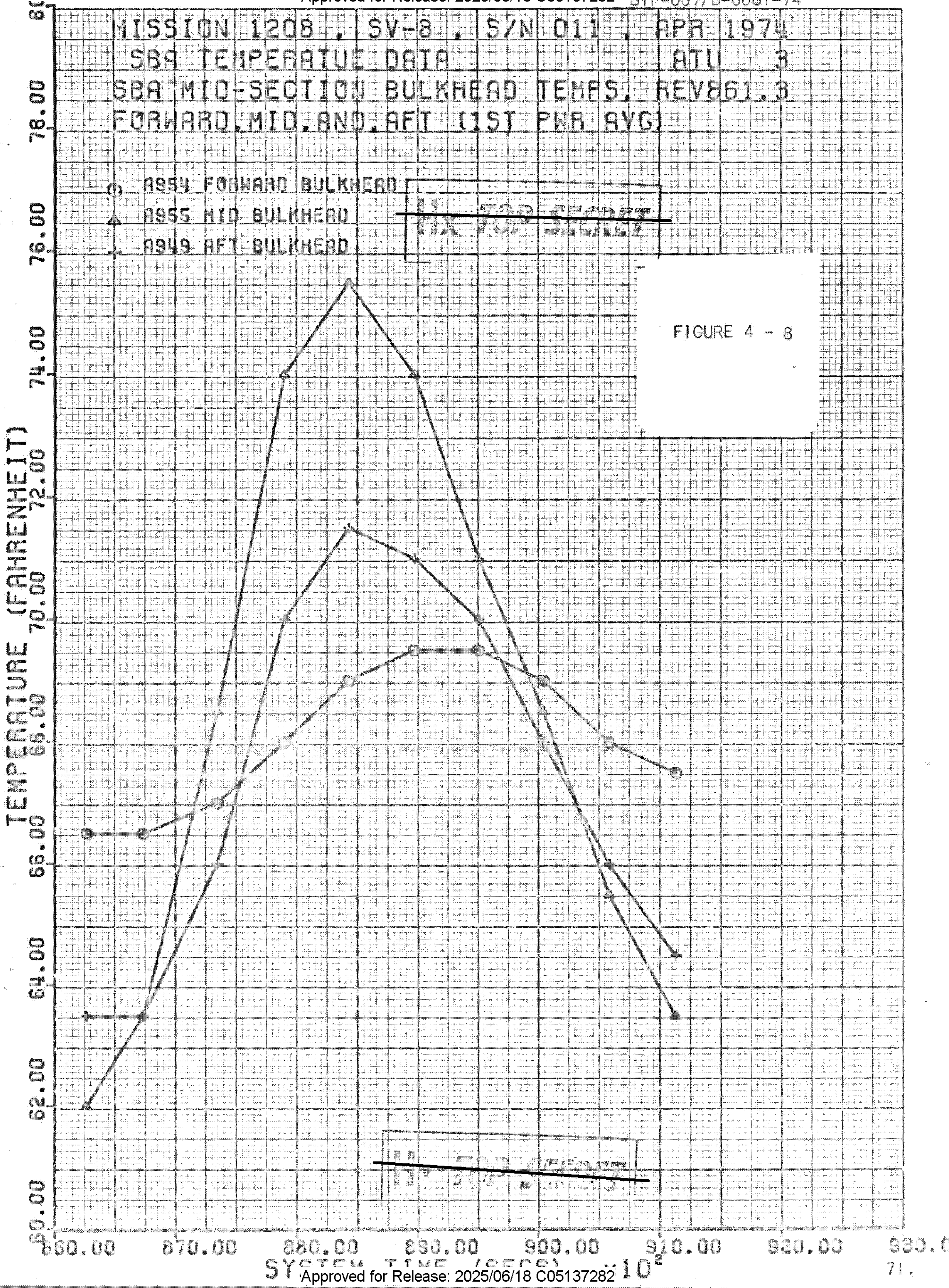
MISSION 1208 , SV-8 , S/N 011 , APR 1974
SBA TEMPERATUE DATA ATU 3
SBA MID-SECTION BULKHEAD TEMPS, REV861.3
FORWARD,MID,AND,AFT (1ST PWR AVG)
A954 FORWARD BULKHEAD
A955 MID BULKHEAD
A949 AFT BULKHEAD
TEMPERATURE (FAHRENHEIT)
SYSTEM TIME (SECS) x10²
860.00
870.00
880.00
890.00
900.00
910.00
920.00
930.0
62.00
64.00
66.00
68.00
70.00
72.00
74.00
76.00
78.00

FIGURE 4 - 8

4.5.3 Optical Bar Temperatures

T_{ref} was 67 ± 1°f throughout the mission. The equilibrium temperature levels for the A and B optical bars were approximately 66°f and 65°f respectively. Figure 4 - 9 shows an orbital profile of the OB temperatures in the stowed position.

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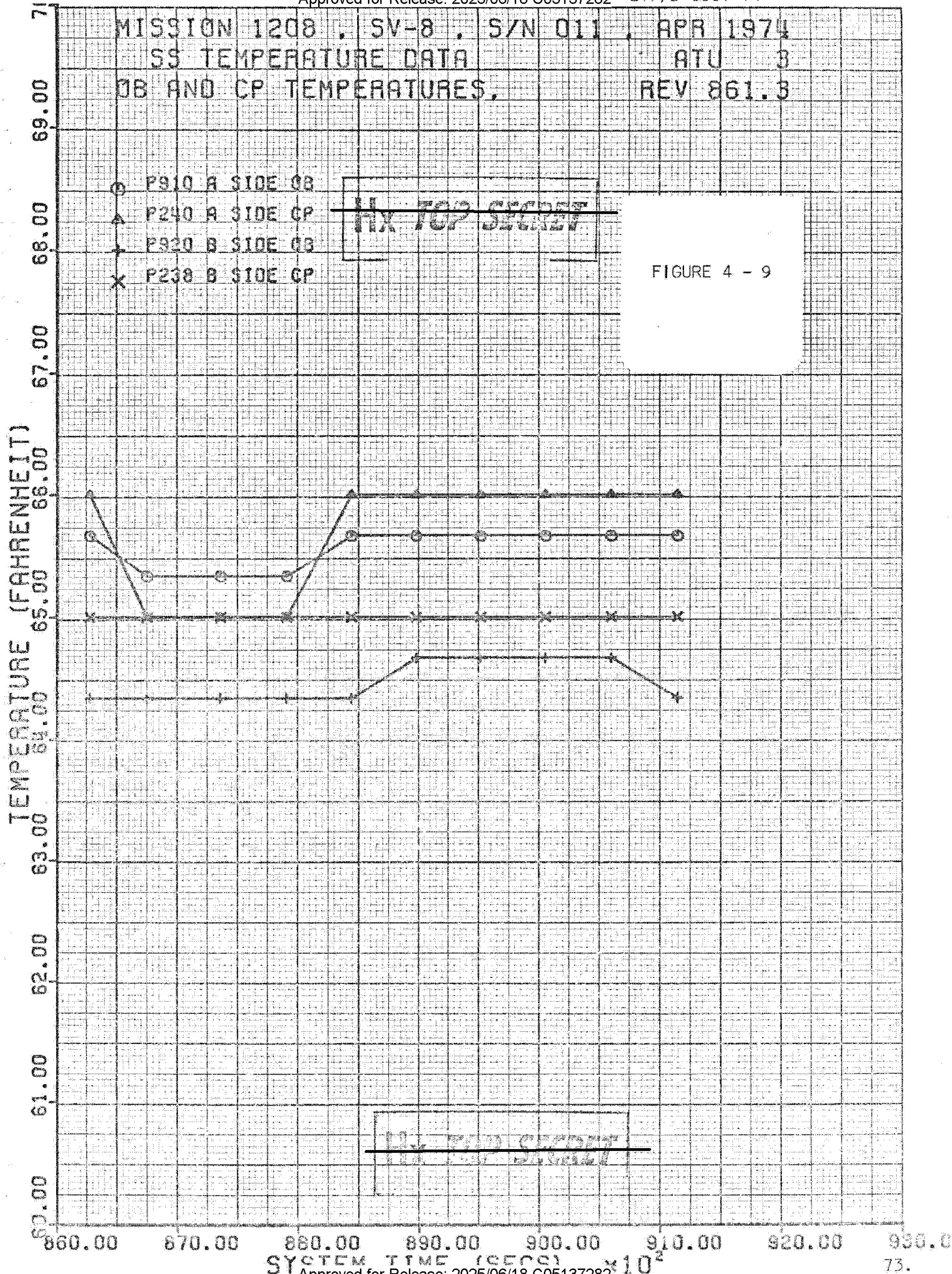

FIGURE 4 - 9

5.0 SCF SUPPORT

5.1 'TUNITY 'Mission 1208

The 'TUNITY MOD-2 software for Mission 1208 performed all of its functions nominally except for the following software problems.

In message 350, Rev 123, Operation 3, a desert polygon bias was applied where no desert polygon had been defined. This caused the operation to be under-exposed. A change was made to 'TAPWRP correcting the problem. The change was incorporated on the Flight Auxiliary Master.

Check message 38 appeared often, flagging insufficient time between FT- and C-. Errors flagged ranged up to .289 seconds. This problem occurred by tightening check message 38. The problem was determined to be flight critical because message 38 was in error due to truncation in both 'TFUNCHK and 'TUMP. Changes were made to both 'TFUNCHK and 'TUMP correcting the problem. The change was incorporated on the Flight Auxiliary Master.

5.2 Augie

5.2.1 Overall Performance

Real time performance of Augie data met all requirements expected. SSC real time modes are limited to verification of SS status. Playback performance of Augie data met all requirements expected. Time delays for play backs of data was reasonable with few exceptions.

5.2.2 Modifications

No changes to the Augie modes were required during the flight. One MCR was required to correct the processing of the shutter open and close telemetry monitors, this was a deficiency in the handling of the data by the mode processing.

Mode Change Requests have been submitted to change or add telemetry data processing to the mode for the next flight. The MCR's submitted are for the following reasons:

a. Change processing of shutter open and close telemetry so as to calculate and output shutter open and close times to OB position in degrees.

5.2.2 Modifications-Cont'd.

b. Correct Supply Command Signal processing to increase accuracy of output.

c. Output slit width A & B telemetry data by using the change in DIU counter to clock out the next sample of slit width A & B telemetry data.

d. Add Take-up Integrator Output telemetry monitors to the Format C diagnostic modes.

5.2.3 D.T.V.

SSC utilization of the DTV was limited to passive real time SS status verification. The use of the DTV will remain limited to status monitoring on the next flight also.

5.3 RTS Tapes and Microwave

5.3.1 RTS Tapes

RTS tapes were used minimally during the last half of the flight due to use of the microwave link between the STC and Bldg. 156. The tapes that were utilized, the majority being COOK, met SSC requirements with few exceptions.

5.3.2 The microwave capability between the STC and Bldg. 156 did reduce the number of tapes required by SSC tremendously. The link did experience many problems during the first portion of the flight, most of the problems fell into the category of not having the proper procedures set-up, however, most of these problems were corrected during the flight. Continued use of the microwave link with the STC is planned for the next flight.

APPENDIX

A-I

OPERATIONAL SUMMARY

1208-1   BIF-007/D-0081-74

B. CAMERA OPERATIONS SUMMARY REVS PAD THROUGH REV 225, OP 131

REV	MSN OP NUM	SCA	SCC	FRAMES FWD	FRAMES AFT	INTERCP FEET FWD	INTERCP FEET AFT	PHOTO-FT FWD	PHOTO-FT AFT	CUM-TU-FEET FWD	CUM-TU-FEET AFT
PRE	LO	60	0	6	6	72	78	33	33	105	111
PRE	LO	60	0	6	6	35	34	33	33	173	178
PRE	LO	30	30	6	6	76	69	17	17	266	264
PRE	LO	60	15	7	4	11	20	40	23	317	307
PRE	LO	30	30	6	6	3	11	17	17	337	335
PRE	LO	60	15	7	4	11	20	40	23	388	378
PRE	LO	120	0	8	8	38	70	87	87	513	535
PRE	LO	120	0	8	8	111	111	87	87	711	733
PRE	LO	60	0	6	6	81	65	33	33	825	831
PRE	LO	60	0	6	6	31	31	33	33	889	895
PRE	LO	60	0	6	6	31	31	33	33	953	959
PRE	LO	30	30	6	6	68	53	17	17	1038	1029
PRE	LO	60	15	7	4	11	20	40	23	1089	1072
PRE	LO	60	0	6	6	8	163	33	33	1130	1268
PRE	LO	30	30	6	6	26	18	17	17	1173	1303
PRE	LO	60	15	7	4	11	20	40	23	1224	1346
PRE	LO	120	0	8	8	38	70	87	87	1349	1503
PRE	LO	120	0	8	8	111	111	87	87	1547	1701
PRE	LO	60	0	6	6	81	65	33	33	1661	1799
PRE	LO	60	0	6	6	31	31	33	33	1725	1863
PRE	LO	60	0	6	6	31	31	33	33	1789	1927
PRE	LO	60	0	6	6	31	31	33	33	1853	1991
4	1	60	0	6	6	126	126	33	33	2012	2150
4	2	60	-15	6	6	24	25	33	33	2069	2208
4	3	60	30	6	6	36	35	33	33	2138	2276
5	4	30	-30	50	50	30	24	145	145	2313	2445
6	5	60	0	31	31	22	30	171	171	2506	2646
7	6	90	0	38	38	48	55	308	308	2862	3009
7	7	30	0	7	7	49	23	20	20	2931	3062
8	8	60	0	6	6	19	28	33	33	2983	3123
8	9	60	30	16	16	36	34	88	88	3107	3245
9	10	60	-15	16	16	35	37	88	88	3230	3370
10	11	90	0	68	68	46	53	551	551	3827	3974
10	12	90	0	23	23	67	67	186	186	4080	4227
14	13	30	0	14	14	49	33	40	40	4169	4300
16	14	30	0	5	5	14	14	14	15	4197	4329
19	15	30	30	7	7	14	13	20	20	4231	4362
21	16	30	-45	53	53	14	14	148	148	4393	4524
21	17	60	15	23	23	21	29	127	127	4541	4680
23	18	90	0	25	25	50	57	203	203	4794	4940
24	19	60	-30	23	23	55	48	127	127	4976	5115
25	20	30	-30	10	10	28	20	28	28	5032	5163
25	21	60	-15	8	8	20	28	44	44	5096	5235

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25	22	90	0	68	68	46	53	551	551	5693	5839
25	23	90	15	15	15	67	66	122	122	5882	6027
26	24	90	0	28	28	67	67	227	227	6176	6321
26	25	60	0	50	50	55	48	275	275	6506	6644
26	26	30	30	28	28	29	22	81	81	6616	6747
27	27	30	45	25	25	14	14	73	73	6703	6834
28	28	30	45	16	16	13	13	46	46	6762	6893
38	29	120	0	62	62	36	70	664	664	7462	7627
38	30	60	-30	36	36	79	64	198	198	7739	7889
38	31	60	15	13	13	37	36	72	72	7848	7997
39	32	90	15	22	22	44	51	178	178	8070	8226
41	33	60	-30	35	35	52	46	193	193	8315	8465
41	34	90	0	108	108	50	57	875	875	9240	9397
41	35	60	15	18	18	57	49	99	99	9396	9545
41	36	30	30	28	28	30	22	81	81	9507	9648
42	37	60	15	19	19	21	29	105	105	9633	9782
43	38	60	-30	26	26	34	36	143	143	9810	9961
48	39	60	-15	33	33	36	35	182	182	10028	10178
53	40	30	-15	29	29	30	21	84	84	10142	10283
54	41	30	45	7	7	14	14	20	20	10176	10317
56	42	30	45	13	13	14	14	38	38	10228	10369
57	43	90	0	89	89	32	48	720	720	10980	11137
57	44	30	0	5	5	49	33	15	15	11044	11185
58	45	90	-15	122	122	30	47	988	988	12062	12220
58	46	30	-30	7	7	49	33	20	20	12131	12273
59	47	60	15	31	31	21	28	171	171	12323	12472
68	48	30	0	4	4	29	21	12	12	12364	12505
70	49	60	15	22	22	22	29	121	121	12507	12655
71	50	120	0	35	35	64	81	375	375	12946	13111
73	51	90	15	65	65	91	83	527	527	13564	13721
76	52	90	0	16	16	68	68	130	130	13762	13919
80	53	90	0	37	37	67	67	300	300	14129	14286
81	54	30	0	14	14	50	35	41	41	14220	14362
86	55	60	-30	20	20	22	31	110	110	14352	14503
87	56	60	-30	26	26	38	38	143	143	14533	14684
87	57	120	0	68	68	67	81	728	728	15328	15493
88	58	90	0	25	25	90	82	203	203	15621	15778
89	59	60	15	10	10	57	48	55	55	15733	15881
89	60	30	30	26	26	29	22	75	75	15837	15978
89	61	90	0	26	26	33	50	211	211	16081	16239
90	62	60	-15	12	12	58	50	66	66	16205	16355
96	63	60	-30	8	8	37	37	44	44	16286	16436
97	64	60	30	16	16	37	35	88	88	16411	16559
103	65	90	0	86	86	45	54	697	697	17153	17310
104	66	60	-15	38	38	52	45	209	209	17414	17564
104	67	90	15	28	28	43	49	227	227	17684	17840
105	68	60	0	41	41	52	45	226	226	17962	18111
105	69	120	0	35	35	62	78	375	375	18399	18564
106	70	30	-30	65	65	71	48	189	189	18659	18801
106	71	60	30	34	34	21	28	187	187	18867	19016

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.13	72	30	30	8	8	29	21	23	23	18919	19060
117	73	60	-15	45	45	20	28	248	248	19187	19336
118	74	30	0	7	7	28	20	20	20	19235	19376
.19	75	30	-30	20	20	13	14	58	58	19306	19448
119	76	30	15	25	25	14	13	73	73	19393	19534
120	77	60	-15	31	31	20	29	171	171	19584	19734
.21	78	60	15	38	38	34	33	209	209	19827	19976
.21	79	30	45	22	22	28	20	64	64	19919	20060
122	80	90	0	37	37	33	50	300	300	20252	20410
.23	81	30	-30	6	6	48	32	17	17	20317	20459
.23	82	90	0	35	35	31	46	284	284	20632	20789
123	83	30	-15	31	31	47	32	90	90	20769	20911
129	84	30	0	6	6	15	14	17	17	20801	20942
.34	85	30	-45	4	4	14	15	12	12	20827	20969
135	86	30	45	31	31	14	13	90	90	20931	21072
137	87	30	-15	10	10	13	14	29	29	20973	21115
.37	88	60	-30	13	13	21	30	72	72	21066	21217
.37	89	60	0	17	17	37	36	94	94	21197	21347
137	90	90	0	39	39	50	58	316	316	21563	21721
.38	91	60	15	12	12	56	47	66	66	21685	21834
139	92	30	0	13	13	28	20	38	38	21751	21892
139	93	60	-15	7	7	21	30	39	39	21811	21961
144	94	30	-15	14	14	30	22	41	41	21882	22024
152	95	60	30	19	19	21	28	105	105	22088	22157
153	96	30	-45	6	6	28	21	17	17	22053	22195
153	97	90	0	49	49	32	47	397	397	22482	22639
153	98	60	-30	30	30	54	48	165	165	22701	22852
154	99	60	15	37	37	38	36	204	204	22943	23092
155	100	30	30	11	11	28	21	32	32	23003	23145
155	101	60	-15	56	56	20	28	308	308	23331	23481
155	102	90	15	19	19	49	56	154	154	23534	23691
160	103	60	30	10	10	57	48	56	56	23647	23795
165	104	30	0	4	4	28	22	12	12	23687	23829
167	105	30	15	15	15	14	13	44	44	23745	23886
168	106	60	30	19	19	21	28	105	105	23871	24019
169	107	90	0	44	44	47	56	356	356	24274	24431
170	108	30	30	34	34	49	33	97	97	24420	24561
171	109	30	-30	9	9	14	15	26	26	24460	24602
171	110	60	-15	21	21	21	29	116	116	24597	24747
171	111	60	15	16	16	37	36	88	88	24722	24871
171	112	60	30	16	16	38	38	83	88	24848	24997
172	113	60	15	19	19	36	36	105	105	24989	25138
176	114	60	0	15	15	37	37	83	83	25109	25258
184	115	90	0	35	35	49	57	284	284	25442	25599
185	116	60	30	19	19	57	45	105	105	25604	25753
186	117	60	-15	12	12	36	38	66	66	25706	25857
188	118	60	30	52	52	36	34	286	286	26028	26177
199	119	60	0	7	7	36	37	39	39	26103	26253
200	120	30	45	8	8	29	20	23	23	26155	26296
200	121	120	0	34	34	50	74	364	364	26569	26734

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201	122	30	0	10	10	74	51	29	29	26672	26814
202	123	60	0	46	46	21	28	253	253	26946	27095
203	124	30	30	31	31	29	21	90	90	27065	27206
216	125	30	30	14	14	14	14	41	41	27120	27261
216	126	120	0	36	36	51	75	385	385	27556	27721
216	127	60	15	19	19	82	65	105	105	27743	27891
218	128	30	15	4	4	29	22	12	12	27784	27925
218	129	60	0	22	22	22	30	121	121	27927	28076
225	130	30	30	7	7	29	21	20	20	27976	28117
225	131	60	0	4	2	21	30	22	15	28019	28162

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A. 1208-2

B. CAMERA OPERATIONS SUMMARY REV 225, OP 131 THROUGH REV 674, OP 364.

REV	MSN CP NUM	SCA	SCC	FRAMES FWD	FRAMES AFT	INTERCP FEET FWD	INTERCP FEET AFT	PHOTO-FT FWD	PHOTO-FT AFT	CUM-TU-FEET FWD	CUM-TU-FEET AFT
225	131	6C	0	7	9	0	0	43	51	43	51
23C	132	3C	-3C	4	4	89	81	12	12	144	144
232	133	6C	15	31	31	22	29	171	171	337	344
232	134	9C	C	59	59	49	57	478	478	864	879
235	135	3C	-15	6	6	49	33	17	17	930	929
236	136	6C	C	8	8	2C	29	44	44	994	10C2
236	137	3C	30	8	8	29	20	23	23	1C46	1045
247	138	12C	C	26	26	38	62	278	278	1362	1385
248	139	6C	15	16	16	69	53	88	88	1519	1526
248	14C	3C	-30	26	26	28	21	75	75	1622	1622
248	141	9C	-15	54	54	35	51	437	437	2C94	2110
249	142	9C	C	19	19	69	68	154	154	2317	2332
25C	143	6C	15	31	31	54	46	171	171	2542	2549
250	144	9C	C	10	1C	47	55	81	81	267C	2685
251	145	6C	15	16	16	54	46	88	88	2812	2819
251	146	6C	15	44	44	37	37	242	242	3C91	3098
252	147	6C	-15	8	8	34	35	44	44	3169	3177
252	148	3C	-15	16	16	27	19	46	46	2342	3242
253	149	3C	15	1C	1C	14	13	29	29	3285	3284
253	150	6C	-15	23	23	2C	29	127	127	3432	3440
258	151	3C	-15	6	6	30	22	17	17	3479	3479
268	152	3C	-30	23	23	14	13	67	67	3560	3559
268	153	3C	-3C	14	14	14	15	41	41	3615	3615
269	154	6C	15	16	16	20	27	88	88	3723	3730
273	155	6C	15	16	16	35	35	88	88	3846	3853
281	156	90	15	98	98	48	56	794	794	4688	47C3
282	157	9C	0	19	19	62	63	154	154	1904	492C
284	158	6C	C	19	19	5C	42	1C5	1C5	5C59	5C67
285	159	6C	0	16	16	35	34	88	88	5182	5189
291	16C	3C	0	13	13	28	21	38	38	5248	5248
279	161	12C	C	35	35	51	74	375	375	5674	5697
300	162	60	15	25	25	80	64	139	138	5892	5899
300	163	60	-15	16	16	37	38	88	88	6C17	6025
3C1	164	9C	C	68	68	46	54	551	551	6614	6630
313	165	3C	45	28	28	48	31	81	81	6743	6742
313	166	9C	-15	42	42	32	5C	340	340	7115	7132
314	167	12C	C	29	29	85	91	310	31C	7510	7533
329	168	6C	C	31	31	81	65	171	171	7762	7769
329	169	3C	30	11	11	29	21	32	32	7823	7822
329	17C	3C	-3C	24	24	14	14	70	7C	7907	7906
330	171	6C	15	43	43	22	3C	237	237	8166	8173
331	172	6C	-3C	8	8	37	37	44	44	8247	8254
332	173	3C	3C	22	22	29	21	64	64	834C	8339

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38	174	3C	3C	16	16	14	14	46	46	8400	8399
338	175	3C	C	8	8	14	15	23	23	8437	8437
338	176	3C	15	8	8	14	13	23	23	8474	8473
43	177	3C	-15	4	4	14	15	12	12	85CC	8500
45	178	6C	0	61	61	22	29	336	336	8858	8865
346	179	3C	-15	16	16	29	22	46	46	8933	8933
46	180	3C	3C	13	13	14	13	38	38	8985	8984
47	181	3C	-45	14	14	14	15	41	41	9C4C	9040
347	182	3C	-45	17	17	14	14	49	49	9103	9103
48	183	3C	C	25	25	14	14	73	73	919C	9190
48	184	3C	-30	9	9	14	14	26	26	923C	923C
349	185	6C	C	32	32	22	29	176	176	9428	9435
355	186	3C	-3C	14	14	29	22	41	41	9498	9498
56	187	3C	30	11	11	15	13	32	32	9845	9543
359	188	3C	45	4	4	14	14	12	12	9571	9569
361	189	6C	-15	34	34	22	30	187	187	9780	9786
163	190	12C	C	28	28	64	8C	300	30C	1C144	10166
164	191	6C	-30	11	11	8C	65	61	61	1C285	1C292
365	192	3C	-45	13	C	3C	0	38	C	1C353	1C292
365	193	3C	C	6	6	14	21	17	17	10384	1C330
37C	194	3C	45	1C	10	13	13	29	29	10426	10372
376	195	3C	45	25	0	13	C	73	C	1C512	10372
378	196	3C	C	19	19	14	14	55	55	1C581	1C441
379	197	3C	-15	9	9	14	14	26	26	1C621	10481
379	198	30	45	13	13	14	13	38	38	1C673	1C532
381	199	3C	-30	4	4	14	15	12	12	1C699	10559
381	2CC	3C	3C	43	43	14	13	125	125	1C838	1C697
382	201	3C	45	7	7	14	14	21	21	1C873	1C732
383	2C2	3C	45	7	7	15	15	21	21	1C9C9	10768
389	203	3C	-30	4	4	14	15	12	12	1C935	1C795
394	204	9C	0	28	C	27	C	227	C	11189	1C795
394	2C5	3C	-15	4	4	44	14	12	12	11245	10821
394	2C6	6C	C	15	15	22	29	83	83	1135C	10933
396	207	6C	15	35	35	35	35	193	193	11578	11161
396	2C8	9C	-15	3C	3C	46	55	243	243	11867	11459
396	2C9	3C	3C	11	11	48	31	32	32	11947	11522
396	21C	3C	-30	63	63	14	15	183	183	12144	11720
399	211	3C	15	19	19	14	12	55	55	12213	11787
399	212	3C	45	1C	10	12	13	29	29	12254	11829
410	213	3C	-30	17	17	14	15	49	49	12317	11893
411	214	9C	15	31	C	28	C	251	C	12596	11893
412	215	60	15	29	29	50	27	160	16C	128C6	1208C
412	216	6C	-30	3C	30	35	37	165	165	13CC6	12282
412	217	3C	-15	23	23	3C	21	67	67	131C3	1237C
413	218	3C	45	16	16	14	13	46	46	13163	12429
413	219	3C	-15	6	6	14	15	17	17	13194	12461
413	22C	3C	-45	9	9	14	14	26	26	13234	12501
414	221	3C	C	1C	10	14	13	29	29	13277	12543
414	222	3C	15	4	4	13	14	12	12	13302	12569
415	223	3C	-3C	11	11	14	14	32	32	13348	12615

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28	224	9C	0	35	35	32	47	284	284	13664	12946
429	225	6C	0	23	23	54	47	127	127	13845	1312C
430	226	30	45	19	19	29	20	55	55	13929	13195
3C	227	3C	C	3C	30	14	15	87	87	14030	13297
435	228	6C	30	14	14	21	28	77	77	14128	13402
435	229	3C	-15	5	5	30	23	15	15	14173	1344C
143	23C	6C	0	35	35	2C	27	193	193	14386	13660
43	231	3C	-30	25	25	28	21	73	73	14487	13754
445	232	3C	-15	25	25	14	14	73	73	14574	13841
446	233	6C	-15	22	22	22	3C	121	121	14717	13992
51	234	3C	0	12	12	3C	22	35	35	14782	14049
459	235	3C	3C	1C	1C	14	13	29	29	14825	14091
459	236	6C	-15	19	19	22	31	105	105	14952	14227
160	237	3C	0	4	4	30	22	12	12	14994	14261
461	238	6C	0	19	19	20	27	105	105	15119	14393
461	239	9C	0	27	27	45	53	219	219	15383	14665
462	24C	3C	30	28	28	48	32	81	81	15512	14778
162	241	3C	15	1C	10	14	15	29	29	15555	14822
462	242	3C	45	1C	10	14	13	29	29	15598	14864
462	243	3C	-15	8	8	14	15	23	23	15635	14902
162	244	3C	-15	4	4	14	13	12	12	15661	14927
467	245	3C	-15	4	4	14	14	12	12	15687	14953
473	246	9C	0	17	C	28	0	138	0	15852	14953
477	247	3C	-3C	29	29	45	14	84	84	15982	15051
478	248	3C	-15	41	41	14	14	119	119	16115	15184
478	249	3C	-15	22	22	14	14	64	64	16193	15262
478	25C	3C	15	7	7	14	14	20	2C	16227	15296
480	251	9C	15	7	7	34	49	57	57	16318	15402
491	252	3C	-45	16	C	49	0	46	C	16413	15402
491	253	3C	-30	34	34	14	34	99	99	16526	15535
493	254	3C	-45	4	4	14	14	12	12	16552	15561
493	255	9C	0	21	21	32	48	170	17C	16754	15779
493	256	3C	3C	5	5	48	32	15	15	16817	15826
494	257	6C	0	13	13	20	28	72	72	16909	15926
494	258	3C	45	1C	1C	28	19	29	29	16966	15974
494	259	3C	-45	11	11	14	15	32	32	17012	16021
494	26C	3C	-15	7	7	14	14	20	2C	17046	16055
495	261	3C	3C	13	13	14	13	38	38	17098	16106
496	262	3C	-30	14	14	14	15	41	41	17153	16162
496	263	3C	3C	1C	1C	14	13	29	29	17196	16204
508	264	6C	C	19	19	21	30	105	105	17322	16339
509	265	3C	0	7	7	30	22	20	2C	17372	16381
51C	266	60	15	15	15	21	28	83	83	17476	16492
510	267	6C	C	15	15	36	36	83	83	17595	16611
510	268	3C	0	36	36	29	22	104	104	17728	16737
51C	269	3C	-15	13	13	14	14	38	38	1778C	16789
511	27C	9C	0	25	25	31	46	203	203	18014	17038
511	271	60	-15	22	22	55	48	121	121	1819C	172C7
511	272	9C	C	39	39	5C	57	316	316	18556	17580
512	273	3C	3C	28	28	49	33	81	81	18686	17694

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17	274	9C	C	27	27	35	51	219	219	18940	17964
524	275	3C	-45	14	14	49	34	41	41	1903C	18039
524	276	3C	30	13	13	14	13	38	38	19082	18090
24	277	3C	3C	14	14	14	14	41	41	19137	18145
525	278	3C	30	22	22	14	14	64	64	19215	18223
525	279	3C	-30	18	18	14	15	52	52	19281	18290
25	28C	3C	3C	8	8	15	14	23	23	19319	18327
526	281	3C	30	4	4	14	14	12	12	19345	18353
526	282	6C	C	19	19	22	3C	105	105	19472	18488
527	283	3C	45	4	4	29	21	12	12	19513	18521
27	284	3C	-30	1C	10	14	15	30	30	19557	18566
527	285	3C	-15	14	14	14	14	41	41	19612	18621
528	286	3C	45	7	7	14	13	20	2C	19646	18654
528	287	9C	C	35	35	34	50	284	284	19964	18988
528	288	3C	-30	21	21	49	33	61	61	20074	19082
528	289	3C	-30	4	4	14	14	12	12	2010C	191C8
532	29C	3C	-3C	7	7	14	13	20	2C	20134	19141
540	291	3C	-15	16	16	14	14	46	46	20194	19201
541	292	60	-15	35	35	20	28	193	193	2C407	19422
542	293	3C	-15	25	25	29	20	73	73	2C509	19515
542	294	3C	-15	13	13	14	15	38	38	2C561	19568
542	295	3C	-15	14	14	14	14	41	41	2C616	19623
543	296	3C	-15	7	7	13	13	20	2C	2C649	19656
543	297	9C	C	35	35	29	44	284	284	2C962	19984
544	298	3C	-45	32	32	44	29	93	93	21C99	2C106
544	299	3C	C	8	8	14	13	23	23	21136	20142
544	3CC	3C	-3C	36	36	13	14	1C4	104	21253	20260
544	3C1	3C	-30	15	15	14	14	44	44	21311	20318
548	3C2	6C	-30	13	13	21	29	72	72	214C4	20419
556	3C3	3C	-15	1C	1C	29	21	29	29	21462	2C469
559	3C4	6C	15	25	25	19	26	138	138	21619	2C632
559	3C5	3C	-15	4	4	27	19	12	12	21658	2C664
559	3C6	3C	-30	4	4	14	15	12	12	21684	2C691
559	3C7	3C	15	4	4	13	13	12	12	217C9	2C716
56C	3C8	3C	0	13	13	14	13	38	38	21761	20767
561	309	3C	-45	26	26	13	14	75	75	21849	2C856
561	31C	3C	15	16	16	14	13	46	46	219C9	20915
566	311	6C	15	14	14	22	30	77	77	220C8	21022
572	312	3C	-30	35	35	29	22	1C2	102	22139	21146
574	313	6C	-15	26	26	21	29	143	143	223C3	21318
574	314	9C	0	31	31	49	56	251	251	22603	21625
575	315	6C	15	34	34	56	47	187	187	22846	21859
575	316	3C	-3C	1C	1C	28	22	29	29	22903	21910
575	317	3C	-3C	4	4	14	14	12	12	22929	21936
575	318	3C	-15	12	12	14	14	35	35	22978	21985
576	319	3C	30	1C	1C	14	13	29	29	23021	22027
576	32C	6C	15	13	13	22	3C	72	72	23115	22129
590	321	6C	0	14	14	36	36	77	77	23228	22242
590	322	6C	15	2C	2C	36	36	110	11C	23374	22388
591	323	3C	3C	7	7	28	2C	20	2C	23422	22428

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592	324	30	30	22	22	14	14	64	64	23500	22506
592	325	90	0	22	22	32	48	178	178	23710	22732
593	326	60	15	25	25	55	47	138	138	23903	22917
603	327	60	-30	16	16	35	36	88	88	24026	23041
604	328	30	30	34	34	29	20	99	99	24154	23160
606	329	60	-15	25	25	22	30	138	138	24314	23328
607	330	60	0	10	10	37	37	55	55	24406	23420
608	331	30	45	10	10	29	21	29	29	24464	23470
608	332	60	30	43	43	22	30	237	237	24723	23737
622	333	60	-15	25	25	37	38	138	138	24898	23913
623	334	90	0	13	13	50	57	105	105	25053	24075
625	335	90	0	47	47	67	67	381	381	25501	24523
626	336	30	45	55	55	48	32	160	160	25709	24715
626	337	30	-30	33	33	14	15	96	96	25819	24826
629	338	30	-15	11	11	14	14	32	32	25865	24872
631	339	60	-30	9	9	22	30	50	50	25937	24952
637	340	30	30	8	8	30	21	23	23	25990	24996
639	341	30	15	28	28	14	15	81	81	26085	25092
639	342	30	15	12	12	14	14	35	35	26134	25141
639	343	30	-30	17	17	15	15	49	49	26198	25205
641	344	60	0	16	16	20	27	88	88	26306	25320
641	345	30	-30	80	80	27	20	232	232	26565	25572
647	346	30	0	13	13	14	13	38	38	26617	25623
653	347	60	-30	11	11	22	31	61	61	26700	25715
654	348	60	-15	16	16	37	37	88	88	26825	25840
655	349	30	45	7	7	30	21	20	20	26875	25881
656	350	60	15	13	13	21	29	72	72	26968	25982
656	351	30	45	5	5	29	21	15	15	27012	26018
656	352	30	15	5	5	15	15	15	15	27042	26048
657	353	30	-30	23	23	13	14	67	67	27122	16129
657	354	90	0	48	48	32	47	389	389	27543	26565
669	355	30	30	16	16	48	32	46	46	27637	26643
669	356	60	0	16	16	22	30	88	88	27747	26761
671	357	30	-45	7	7	29	22	20	20	27796	26803
671	358	60	-15	32	32	22	30	176	176	27994	27009
671	359	30	-15	6	6	30	22	17	17	28041	27048
672	360	60	15	25	25	22	29	138	138	28201	27215
672	361	30	-30	10	10	29	22	29	29	28259	27266
673	362	90	0	34	34	33	48	275	275	28567	27589
673	363	60	15	17	17	56	48	94	94	28717	27731
674	364	90	0	10	9	49	58	80	65	28846	27854

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B. CAMERA OPERATIONS SUMMARY REV 674 CP 364 THROUGH REV 1111 OP 577

REV	MSN CP NUM	SCA	SCC	FRAMES FWD	FRAMES AFT	INTERCP FEET FWD	INTERCP FEET AFT	PHOTO-FT FWD	PHOTO-FT AFT	CUM-TU-FEET FWD	CUM-TU-FEET AFT
674	364	90	0	2	3	0	0	11	26	11	26
685	365	90	0	37	37	130	130	300	300	441	456
686	366	30	-30	13	13	49	33	38	38	528	527
686	367	30	30	11	11	14	13	32	32	574	572
687	368	30	-45	32	32	14	15	93	93	681	680
687	369	90	0	53	53	34	50	429	429	1144	1159
689	370	30	45	7	7	49	31	20	20	1213	1210
689	371	60	0	17	17	21	30	94	94	1328	1334
696	372	30	0	18	18	29	21	52	52	1409	1407
701	373	30	-30	4	4	14	15	12	12	1435	1434
701	374	90	0	14	14	34	49	332	332	1801	1815
702	375	30	30	25	25	49	33	73	73	1923	1921
704	376	30	30	7	7	14	14	20	20	1957	1955
704	377	30	30	16	16	14	14	46	46	2017	2015
705	378	60	-15	32	32	22	31	176	176	2215	2222
706	379	30	15	4	4	30	21	12	12	2257	2255
706	380	30	30	20	20	14	14	58	58	2329	2327
714	381	60	15	10	10	21	29	55	55	2405	2411
715	382	30	45	4	4	28	20	12	12	2445	2443
717	383	30	-30	7	7	14	15	20	20	2479	2478
717	384	60	30	19	19	18	24	105	105	2602	2607
718	385	60	0	30	30	33	34	165	165	2800	2806
720	386	30	-30	25	25	29	22	73	73	2902	2901
721	387	60	15	34	34	22	29	187	187	3111	3117
728	388	30	0	22	22	29	22	64	64	3204	3203
730	389	30	-30	13	13	14	13	38	38	3256	3254
734	390	60	-15	50	50	19	28	275	275	3550	3557
735	391	30	30	32	32	29	20	93	93	3672	3670
736	392	60	15	29	29	21	29	160	160	3853	3859
736	393	90	0	21	21	45	53	170	170	4068	4082
737	394	90	0	35	35	67	67	284	284	4419	4432
737	395	30	-15	4	4	49	34	12	12	4480	4479
738	396	30	-30	11	11	14	14	32	32	4526	4525
744	397	30	0	5	5	14	14	15	15	4555	4554
749	398	30	30	19	19	14	13	55	55	4624	4622
752	399	90	0	14	14	32	48	113	113	4769	4783
767	400	30	15	22	22	48	32	64	64	4881	4879
768	401	60	-15	13	13	21	29	72	72	4974	4980
770	402	30	-30	7	7	29	21	20	20	5023	5021
771	403	30	30	13	13	14	13	38	38	5075	5072
775	404	30	30	6	6	14	14	17	17	5106	5103
784	405	90	0	28	28	31	47	227	227	5364	5377
785	406	30	45	19	0	45	0	55	0	5464	5377

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785	4C7	3C	-30	8	8	13	31	23	23	55CC	5431
785	4C8	6C	30	19	19	21	28	1C5	1C5	5626	5564
786	4C9	3C	15	14	14	29	22	41	41	5695	5627
795	41C	6C	15	14	14	19	26	77	77	5791	5730
797	411	6C	C	30	3C	32	32	165	165	5988	5927
799	412	6C	C	65	65	34	34	358	358	638C	6319
800	413	6C	15	22	0	34	C	121	C	6535	6319
800	414	6C	15	24	24	34	36	132	132	67C1	6487
8CC	415	3C	-30	8	8	28	21	23	23	6752	6531
801	416	3C	15	7	7	14	13	2C	2C	6786	6564
801	417	3C	-30	13	13	13	14	38	38	6837	6616
801	418	3C	15	11	11	14	14	32	32	6883	6662
801	419	3C	0	8	8	15	14	23	23	6921	6699
801	42C	6C	15	35	35	23	32	193	193	7137	6924
802	421	3C	3C	7	7	3C	21	20	2C	7187	6965
807	422	3C	-30	7	7	14	15	20	2C	7221	70CC
813	423	6C	-3C	29	29	19	27	168	168	74C8	7195
815	424	3C	15	19	19	27	18	55	55	7490	7268
816	425	3C	C	6	6	14	15	18	18	7522	7301
817	426	3C	3C	28	28	14	13	81	81	7617	7395
818	427	3C	-3C	25	25	14	15	73	73	77C4	7483
819	428	3C	15	4	4	14	13	12	12	773C	75C8
819	429	6C	15	25	25	23	31	138	138	7891	7677
829	43C	3C	3C	4	4	29	21	12	12	7932	771C
831	431	9C	0	68	68	33	50	551	551	8516	8311
831	432	9C	C	16	16	71	7C	130	13C	8717	8511
833	433	3C	-30	22	22	49	34	64	64	883C	86C9
833	434	3C	-30	5	5	14	14	15	15	8859	8638
833	435	3C	30	4	4	14	13	12	12	8885	8663
834	436	60	15	19	19	22	30	1C5	1C5	9C12	8798
835	437	3C	30	1C	10	29	21	29	29	907C	8848
835	438	3C	-30	1C	10	14	15	29	29	9113	8892
835	439	6C	-15	11	11	23	31	61	61	9197	8984
835	44C	3C	30	1C	1C	29	20	29	29	9255	9033
841	441	3C	30	43	43	13	14	125	125	9393	9172
846	442	3C	45	28	28	13	12	81	81	9487	9265
847	443	9C	C	43	43	34	5C	348	348	9869	9663
851	444	3C	30	1C	10	49	33	29	29	9947	9725
851	445	6C	-15	2C	20	24	33	110	11C	1CC81	9868
863	446	3C	-30	12	12	30	22	35	35	1C146	9925
867	447	3C	15	4	4	14	14	12	12	1C172	9951
867	448	3C	-30	16	16	14	14	46	46	10232	10011
867	449	3C	3C	8	8	16	14	23	23	1C271	1C048
868	45C	3C	-45	16	16	13	15	46	46	1C33C	10109
880	451	3C	30	16	16	14	13	46	46	1C39C	1C168
881	452	3C	3C	7	7	14	14	20	2C	10424	102C2
882	453	3C	0	1C	10	14	14	29	29	1C467	1C245
883	454	9C	0	35	35	33	50	284	284	1C784	1C579
884	455	9C	-15	5C	5C	69	69	405	4C5	11258	11053
888	456	6C	-30	C	8	C	51	C	44	11258	11148

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897	457	30	15	7	7	50	21	20	20	11328	11189
897	458	60	15	13	13	22	30	72	72	11422	11291
898	459	30	-30	14	14	29	22	41	41	11492	11354
899	460	30	30	31	31	14	13	90	90	11596	11457
900	461	60	-30	43	43	23	32	237	237	11856	11726
914	462	30	-15	25	25	30	22	73	73	11959	11821
914	463	30	-15	25	25	14	14	73	73	12046	11908
915	464	30	45	4	4	14	12	12	12	12072	11932
916	465	30	30	10	10	13	14	29	29	12114	11975
917	466	30	-15	4	4	14	15	12	12	12140	12002
919	467	30	30	7	7	13	12	20	20	12173	12034
928	468	30	0	7	7	13	14	20	20	12206	12068
928	469	30	0	4	4	14	14	12	12	12232	12094
930	470	30	-30	10	10	14	14	29	29	12275	12137
930	471	30	15	5	5	14	14	15	15	12304	12166
931	472	30	-45	4	4	14	14	12	12	12330	12192
931	473	60	0	7	7	22	29	39	39	12391	12260
933	474	60	30	7	7	36	36	39	39	12466	12335
946	475	30	30	13	13	28	21	38	38	12532	12394
946	476	30	30	25	25	14	13	73	73	12619	12480
947	477	30	0	13	13	13	13	38	38	12670	12531
947	478	30	45	10	10	13	13	29	29	12712	12573
948	479	30	15	7	7	13	13	20	20	12745	12606
948	480	30	0	8	8	13	14	23	23	12781	12643
949	481	30	0	16	16	14	14	46	46	12841	12703
962	482	30	45	19	19	14	13	55	55	12910	12771
962	483	60	0	10	10	21	29	55	55	12986	12855
964	484	30	-30	10	10	28	21	29	29	13043	12905
964	485	30	0	11	11	14	14	32	32	13089	12951
964	486	30	30	7	7	14	13	20	20	13123	12984
970	487	30	30	34	34	14	14	99	99	13236	13097
978	488	30	30	16	16	14	14	46	46	13296	13157
979	489	30	-30	13	13	14	15	38	38	13348	13210
980	490	30	-15	4	4	14	13	12	12	13374	13235
995	491	60	0	6	6	25	33	32	33	13422	13301
995	492	60	-15	6	6	25	26	33	33	13490	13360
995	493	60	30	6	6	36	55	33	33	13559	13428
996	494	30	30	16	16	30	22	46	46	13635	13496
996	495	30	30	17	17	14	14	49	49	13698	13559
996	496	60	15	24	24	21	28	132	132	13851	13719
996	497	30	45	13	13	27	20	38	38	13916	13777
996	498	90	0	32	32	33	49	259	259	14208	14085
996	499	30	-45	26	26	48	33	75	75	14331	14193
1000	500	30	-30	7	7	13	13	20	20	14364	14226
1002	501	30	30	19	19	13	12	55	55	14432	14293
1003	502	30	0	12	12	14	14	35	35	14481	14342
1009	503	30	30	17	17	14	14	49	49	14544	14405
1010	504	30	-30	10	10	14	15	29	29	14587	14449
1011	505	60	-30	17	0	23	0	94	0	14704	14449
1011	506	60	0	19	0	35	0	105	0	14845	14449

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1011	507	60	15	19	19	37	29	105	105	14987	14583
1012	508	30	0	41	41	28	21	119	119	15134	14723
1012	509	30	-30	21	21	14	15	61	61	15209	14799
1012	510	30	-45	14	14	14	14	41	41	15264	14854
1012	511	30	45	16	16	14	13	46	46	15324	14913
1013	512	30	30	19	19	14	14	55	55	15393	14982
1013	513	90	15	53	53	34	50	429	429	15856	15461
1013	514	120	0	40	40	78	86	428	428	16362	15975
1019	515	60	15	22	22	71	55	121	121	16554	16151
1025	516	30	0	28	28	40	21	81	81	16675	16253
1025	517	60	15	21	21	21	29	116	116	16812	16398
1027	518	90	0	56	0	48	0	454	0	17314	16398
1028	519	60	-15	35	35	51	35	193	193	17558	16626
1028	520	30	30	49	49	28	19	142	142	17728	16787
1029	521	30	30	71	71	14	14	206	206	17948	17007
1029	522	30	-30	17	17	14	15	49	49	18011	17071
1035	523	60	-30	17	17	21	29	94	94	18126	17194
1041	524	30	15	59	59	29	20	171	171	18326	17385
1044	525	30	0	10	10	14	14	29	29	18369	17428
1044	526	30	-30	10	10	14	15	29	29	18412	17472
1044	527	60	-15	24	24	22	29	132	132	18566	17633
1045	528	60	15	34	34	36	36	187	187	18789	17856
1045	529	60	-15	28	28	36	36	154	154	18979	18046
1050	530	60	-15	31	31	35	36	171	171	19185	18253
1056	531	30	30	19	19	28	19	55	55	19268	18327
1057	532	60	15	10	10	22	30	55	55	19345	18412
1060	533	90	0	41	41	49	57	332	332	19726	18801
1061	534	60	-15	22	22	56	48	121	121	19903	18970
1061	535	60	0	13	13	37	37	72	72	20012	19079
1061	536	60	15	11	11	37	37	61	61	20110	19177
1061	537	60	15	16	16	37	37	88	88	20235	19302
1062	538	60	-30	29	29	34	36	160	160	20429	19498
1062	539	30	15	23	23	29	19	67	67	20525	19584
1074	540	30	30	31	31	13	13	90	90	20628	19687
1074	541	30	0	7	7	14	15	20	20	20662	19722
1075	542	30	30	10	10	14	13	29	29	20705	19764
1076	543	90	0	13	13	30	46	105	105	20840	19915
1076	544	90	0	44	44	64	64	356	356	21260	20335
1076	545	30	15	9	9	48	32	26	26	21334	20393
1076	546	30	-30	6	6	14	14	17	17	21365	20424
1076	547	30	45	12	12	13	13	35	35	21413	20472
1077	548	60	-30	32	32	20	25	176	176	21609	20677
1077	549	60	15	16	16	38	36	88	88	21735	20801
1077	550	30	30	12	12	29	22	32	32	21796	20855
1077	551	60	-15	10	10	22	31	55	55	21873	20941
1078	552	60	15	10	10	36	34	55	55	21964	21030
1078	553	30	30	17	17	28	20	49	49	22041	21099
1078	554	30	30	11	11	13	14	32	32	22086	21145
1090	555	60	30	37	37	20	27	204	204	22310	21376
1090	556	60	-30	15	15	35	27	83	83	22428	21496

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1090	557	60	-15	45	45	37	37	248	248	22713	21781
1090	558	30	30	13	13	29	20	38	38	22780	21839
1092	559	90	0	62	62	34	50	502	502	23316	22391
1093	560	30	30	7	7	48	32	20	20	23384	22443
1093	561	30	15	7	7	13	13	20	20	23417	22476
1094	562	60	15	52	52	20	28	286	286	23723	22790
1094	563	60	15	19	19	36	36	105	105	23864	22931
1099	564	30	0	5	5	28	20	15	15	23907	22966
1106	565	30	0	22	22	13	13	64	64	23984	23043
1106	566	30	30	14	14	13	13	41	41	24038	23097
1106	567	30	-30	8	8	15	16	23	23	24076	23136
1108	568	90	0	37	37	34	49	300	300	24410	23485
1109	569	60	0	34	34	56	48	187	187	24653	23720
1109	570	30	-15	10	10	28	21	29	29	24710	23770
1109	571	30	15	8	8	14	14	23	23	24747	23807
1109	572	30	0	16	16	14	14	46	46	24807	23867
1109	573	30	-30	7	7	14	14	20	20	24841	23901
1109	574	30	-45	11	11	14	14	32	32	24887	23947
1110	575	30	30	19	19	14	13	55	55	24956	24015
1110	576	60	30	9	9	22	29	50	50	25028	24094
1111	577	30	-15	65	65	29	23	187	188	25244	24305

B. CAMERA OPERATIONS SUMMARY REV 1111 OP 577 THROUGH REV 1694 OP 774

REV	MSN OP NUM	SCA	SCC	FRAMES FWD	FRAMES AFT	INTEROP FEET FWD	INTEROP FEET AFT	PHOTO-FT FWD	PHOTO-FT AFT	CUM-TU-FEET FWD	CUM-TU-FEET AFT
1111	577	30	-15	13	13	0	0	36	35	36	35
1122	578	30	-30	14	14	77	77	41	41	154	153
1122	579	30	30	24	24	14	13	70	70	238	236
1123	580	30	-30	14	14	14	15	41	41	293	292
1123	581	30	30	11	11	14	13	32	32	339	337
1125	582	30	30	10	10	14	14	29	29	382	380
1125	583	30	30	7	7	14	14	20	20	416	414
1126	584	60	15	28	28	21	29	154	154	591	597
1126	585	60	-15	13	13	35	36	72	72	698	705
1130	586	30	0	5	5	29	20	15	15	742	740
1139	587	90	0	43	43	33	49	348	348	1123	1137
1141	588	90	0	34	34	67	67	275	275	1465	1479
1141	589	30	-30	21	21	48	33	61	61	1574	1573
1142	590	30	-30	10	10	14	14	29	29	1617	1616
1142	591	30	-15	11	11	14	14	32	32	1663	1662
1142	592	30	-30	9	9	14	13	26	26	1703	1701
1142	593	30	-30	12	12	13	14	35	35	1751	1750
1142	594	30	0	7	7	14	13	20	20	1785	1783
1148	595	60	-15	22	22	20	28	121	121	1926	1932
1148	596	30	-15	8	8	29	21	23	23	1978	1976
1155	597	60	30	7	7	21	28	39	39	2038	2043
1155	598	60	0	16	16	36	36	88	88	2162	2167
1157	599	30	-15	13	13	28	21	38	38	2228	2226
1157	600	30	-30	12	12	14	14	35	35	2277	2275
1158	601	60	15	26	26	21	28	143	143	2441	2446
1158	602	60	0	13	13	36	37	72	72	2549	2555
1158	603	30	30	4	4	28	19	12	12	2589	2586
1159	604	60	15	50	50	21	29	275	275	2885	2890
1164	605	60	-15	10	10	33	34	55	55	2973	2979
1167	606	60	15	19	19	31	30	105	105	3109	3114
1169	607	30	0	10	10	25	18	29	29	3163	3161
1165	608	30	15	11	11	13	12	32	32	3208	3205
1169	609	30	-30	5	5	13	14	15	15	3236	3234
1171	610	60	-15	10	10	20	28	55	55	3311	3317
1171	611	60	-15	34	34	35	35	187	187	3533	3539
1171	612	60	15	7	7	37	36	39	39	3609	3614
1172	613	60	15	6	6	36	36	33	33	3678	3683
1174	614	60	-15	4	4	35	36	22	22	3735	3741
1174	615	30	0	19	19	27	18	55	55	3817	3814
1174	616	60	-15	14	14	20	30	77	77	3914	3921
1174	617	30	0	8	8	29	20	23	23	3966	3964
1180	618	30	-30	26	26	13	13	75	75	4054	4052
1180	619	30	-30	11	11	14	14	32	32	4100	4098

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81	620	30	15	5	5	14	13	15	15	4129	4126
1183	621	30	30	22	22	13	13	64	64	4206	4203
87	622	60	30	19	19	19	27	105	105	4330	4335
87	623	60	15	25	25	35	35	138	138	4503	4508
1187	624	60	0	10	10	36	36	55	55	4594	4599
1189	625	60	0	16	16	35	35	88	88	4717	4722
90	626	60	-15	27	27	34	35	149	149	4900	4906
90	627	60	30	13	13	35	34	72	72	5007	5012
1190	628	60	-15	4	4	36	37	22	22	5065	5071
91	629	90	0	74	74	47	54	599	599	5711	5724
203	630	60	15	10	10	54	46	55	55	5820	5825
1207	631	60	0	7	7	36	37	39	39	5895	5901
218	632	30	0	5	5	29	21	15	15	5939	5937
220	633	60	-15	19	19	20	27	105	105	6064	6069
1221	634	60	-15	11	11	32	33	61	61	6157	6163
1221	635	60	0	7	7	33	32	39	39	6229	6234
223	636	60	30	19	19	35	34	105	105	6369	6373
236	637	90	0	10	10	46	55	81	81	6496	6509
1236	638	60	15	25	25	54	46	138	138	6688	6693
237	639	60	15	16	16	36	36	88	88	6812	6817
245	640	60	15	10	10	36	36	55	55	6903	6908
1300	641	60	0	6	6	79	39	33	33	7015	6980
300	642	60	15	19	0	35	0	105	0	7155	6980
302	643	30	-45	29	29	29	20	84	84	7268	7084
1302	644	90	15	22	22	34	49	178	178	7480	7311
1303	645	60	30	13	13	55	46	72	72	7607	7429
303	646	60	-15	10	10	35	36	55	55	7697	7520
303	647	60	15	22	22	36	36	121	121	7854	7677
1304	648	90	0	37	37	48	56	300	300	8202	8033
304	649	30	0	17	17	48	33	49	49	8299	8115
305	650	60	-15	35	35	21	29	193	193	8513	8337
1309	651	30	0	8	8	29	21	23	23	8565	8381
316	652	60	30	13	13	20	26	72	72	8657	8479
316	653	60	-15	22	22	33	35	121	121	8811	8635
1317	654	60	15	9	9	37	36	50	50	8898	8721
1318	655	30	-30	10	10	28	21	29	29	8955	8771
318	656	60	-15	17	17	22	30	94	54	9071	8895
319	657	60	-15	26	26	36	36	143	143	9250	9074
1320	658	60	-15	74	74	36	36	407	407	9693	9517
320	659	30	-30	9	9	29	21	26	26	9748	9564
321	660	60	15	13	13	21	28	72	72	9841	9664
1321	661	60	-30	14	14	36	37	77	77	9954	9778
325	662	90	0	16	16	48	55	130	130	10132	9963
327	663	30	30	8	8	48	31	23	22	10203	10017
1332	664	90	0	22	22	32	48	178	178	10413	10243
1333	665	60	-15	21	21	55	48	116	116	10584	10407
334	666	60	15	17	17	36	35	94	94	10714	10536
334	667	60	-30	5	5	37	38	28	28	10779	10602
1335	668	60	15	21	21	36	35	116	116	10931	10753
336	669	60	15	122	122	35	35	671	671	11637	11459

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1336	670	30	15	5	5	29	20	15	15	11681	11494
1348	671	60	-15	14	14	20	29	77	77	11778	11600
1349	672	60	-15	13	13	37	37	72	72	11887	11709
1349	673	60	0	25	25	37	37	138	138	12062	11884
1350	674	60	-15	29	29	36	37	160	160	12258	12081
1351	675	60	15	16	16	37	36	88	88	12383	12205
1364	676	30	-30	49	49	28	21	142	142	12553	12368
1365	677	90	0	31	31	34	49	251	251	12838	12668
1366	678	90	0	73	73	67	67	591	591	13496	13326
1366	679	90	0	11	11	68	68	89	89	13653	13483
1367	680	30	30	45	45	48	32	131	131	13832	13646
1368	681	60	15	25	25	22	29	138	138	13992	13813
1369	682	60	15	89	89	36	37	490	490	14518	14340
1374	683	30	30	17	17	29	21	49	49	14596	14410
1375	684	60	0	38	38	21	29	209	209	14826	14648
1382	685	90	0	22	22	48	56	178	178	15052	14882
1382	686	60	15	21	21	57	49	116	116	15225	15047
1383	687	60	-15	14	14	36	37	77	77	15338	15161
1383	688	60	-15	13	13	37	37	72	72	15447	15270
1384	689	60	15	30	30	37	36	165	165	15649	15471
1385	690	90	0	87	87	48	56	705	705	16402	16232
1397	691	60	-15	14	14	56	48	77	77	16535	16357
1397	692	60	0	15	15	37	37	83	83	16655	16477
1399	693	30	-30	13	13	29	22	38	38	16722	16537
1400	694	60	-15	15	15	22	30	83	83	16827	16650
1401	695	60	-15	13	13	38	37	72	72	16937	16759
1401	696	30	30	33	33	29	21	96	96	17062	16876
1401	697	30	15	9	9	15	15	26	26	17103	16917
1402	698	60	15	17	17	23	30	94	94	17220	17041
1413	699	90	0	38	38	45	54	308	308	17573	17403
1415	700	60	15	26	26	50	42	143	143	17766	17588
1416	701	60	-15	9	9	33	34	50	50	17849	17672
1417	702	90	0	34	34	44	51	275	275	18168	17998
1422	703	30	-30	9	9	45	30	26	26	18239	18054
1429	704	90	0	54	54	31	46	437	437	18707	18537
1430	705	90	0	50	50	66	66	405	405	19178	19008
1431	706	60	15	30	30	54	46	165	165	19397	19219
1431	707	30	0	5	5	27	19	15	15	19439	19253
1433	708	60	0	9	9	20	31	50	50	19509	19334
1445	709	90	0	34	34	45	52	275	275	19829	19661
1449	710	60	-15	13	13	53	45	72	72	19954	19778
1449	711	60	30	9	9	35	34	50	50	20039	19862
1462	712	60	0	13	13	36	36	72	72	20147	19970
1466	713	60	15	17	17	34	34	94	94	20275	20098
1466	714	60	0	9	9	35	35	50	50	20360	20183
1471	715	90	0	16	16	48	56	130	130	20538	20369
1481	716	60	-15	25	25	57	49	138	138	20733	20556
1482	717	60	15	13	13	36	36	72	72	20841	20664
1482	718	30	30	9	9	28	20	26	26	20895	20710
1487	719	30	15	10	10	14	14	29	29	20938	20753

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1[illegible]87	720	60	-15	14	14	22	31	77	77	21037	20861
1497	721	30	-30	13	13	29	21	38	38	21104	20920
1[illegible]98	722	30	-30	12	12	14	14	35	35	21153	20969
1[illegible]11	723	60	0	13	13	21	28	72	72	21246	21069
1515	724	30	-15	9	9	28	21	26	26	21300	21116
1515	725	30	15	25	25	13	12	73	73	21386	21201
1[illegible]31	726	60	15	36	36	21	28	198	198	21605	21427
1535	727	30	-30	25	25	28	21	73	73	21706	21521
1536	728	30	-30	11	11	13	14	32	32	21751	21567
[illegible]36	729	60	15	10	10	22	29	55	55	21828	21651
1[illegible]46	730	60	-15	21	21	36	37	116	116	21960	21804
1547	731	30	0	15	15	28	20	44	44	22052	21868
1552	732	30	0	6	6	14	14	18	18	22084	21900
1554	733	30	0	8	8	14	14	23	23	22121	21937
1559	734	60	-15	47	47	21	29	259	259	22401	22225
1560	735	30	30	9	9	30	20	26	26	22457	22271
1561	736	30	-15	5	5	13	15	15	15	22485	22301
1562	737	60	0	19	19	20	27	105	105	22610	22433
1563	738	90	0	30	30	45	54	243	243	22898	22730
[illegible]368	739	60	-15	19	19	55	47	105	105	23058	22882
[illegible]569	740	30	-30	7	7	29	21	20	20	23107	22923
1570	741	60	0	9	9	22	29	50	50	23179	23002
[illegible]575	742	60	0	22	22	26	36	121	121	23326	23159
[illegible]576	743	30	0	46	46	28	20	133	133	23487	23312
1577	744	30	30	19	19	13	13	55	55	23555	23380
1585	745	30	0	6	6	13	13	17	17	23585	23410
[illegible]592	746	30	30	23	23	14	14	67	67	23666	23491
[illegible]595	747	30	30	30	30	14	14	87	87	23767	23592
1596	748	30	30	23	23	13	13	67	67	23847	23672
[illegible]597	749	30	15	5	5	15	15	15	15	23877	23702
[illegible]607	750	30	-30	58	58	13	14	168	168	24058	23884
1610	751	60	15	21	21	21	28	116	116	24195	24028
[illegible]612	752	90	0	78	78	47	55	632	632	24874	24715
[illegible]617	753	30	30	12	12	48	32	35	35	24957	24782
1628	754	60	0	12	12	21	29	66	66	25044	24877
1628	755	90	-15	22	22	48	57	178	178	25270	25112
[illegible]633	756	30	15	6	6	50	33	17	17	25337	25162
1633	757	30	0	6	6	13	13	17	17	25367	25192
1635	758	30	-15	5	5	13	14	15	15	25395	25221
[illegible]641	759	60	-15	16	16	17	25	88	88	25500	25334
[illegible]657	760	30	30	13	13	29	20	38	38	25567	25392
1657	761	30	15	8	8	14	15	23	23	25604	25430
[illegible]658	762	60	-15	14	14	22	30	77	77	25703	25537
[illegible]660	763	30	-15	7	7	29	21	20	20	25752	25578
1667	764	30	15	5	5	14	14	15	15	25781	25607
1673	765	60	-15	12	12	21	29	66	66	25868	25702
[illegible]677	766	60	0	15	15	37	36	83	83	25988	25821
[illegible]678	767	30	-30	5	5	28	21	15	15	26031	25857
1689	768	30	30	0	30	0	13	0	87	26031	25957
[illegible]690	769	30	-15	19	19	14	14	55	55	26100	26026

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591	770	30	-30	10	10	14	14	29	29	26143	26069
1693	771	60	0	7	7	22	29	39	39	26204	26137
1693	772	30	-30	9	9	28	21	26	26	26258	26184
593	773	90	0	15	15	36	51	122	122	26416	26357
594	774	60	-15	34	31	57	49	185	167	26658	26573
						32	62			26690	26635