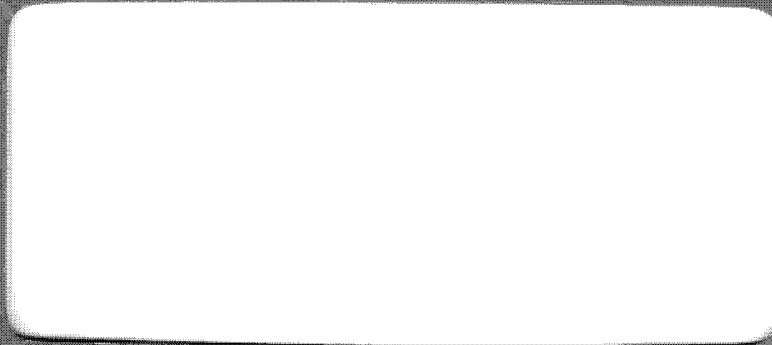


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PROJECT MEMORANDUM NUMBER:

PM-1496-X

PREPARED BY:

Flight Operations & Evaluation

DATE:

25 March 1974

SUBJECT:

Sensor System Post Flight Report
SV-7 (S/N 010)

DISTRIBUTION:

SF-7 (2)

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SSC/DCO

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P. Petty

ABSTRACT:

This report outlines the flight
history for the SV-7 (S/N 010)
Sensor System.

DESCRIPTORS:

Flight Report, S/N 010
Flight Operations, S/N 010~~TOP SECRET~~

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OPTICAL TECHNOLOGY DIVISION

PROJECT MEMORANDUM

PM-1496-X

25 MARCH 1974

SENSOR SYSTEM POST FLIGHT REPORT

SV-7 (S/N 010)

Prepared by: Flight Operations and
Evaluation Section

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~~TOP SECRET~~MISSION 1207SENSOR SYSTEM OPERATIONPOST FLIGHT REPORT1.0 INTRODUCTION1.1 Mission Objective

The primary objective of the Hexagon Mission is to provide high resolution photography. The intent of the seventh flight was to demonstrate functional operation of the primary satellite vehicle 90 day capability. This objective was surpassed with an active mission life of 103 days.

1.2 Mission Description

The Hexagon Mission 1207 satellite vehicle was launched from VAFB, SLC-4E, at 1210 PST 10 November 1973 using a Titan 3D booster vehicle. All four recovery vehicles were successfully air retrieved and were within predicted impact dispersion. Recoveries were on Day 14, 37, 64 and 103 respectively.

The countdown and launch phase were accomplished without incident. After insertion, the sensor system successfully uncaged. The constant velocity test on Rev 2 and the health check tests on Rev 4 were also accomplished successfully.

Operational photography began on Rev 6 with Mission Op No. 4, and continued with no camera system malfunctions through Rev 1650, at which time an ESD was experienced with the depletion of the Forward Camera film supply during the downramp of Mission Op 699 (Mono A). The Aft Camera supply was depleted, as intended, at the conclusion of Mission Op 700, Rev 1653. Rewind velocity was constrained to 5 IPS and photography at scan centers of ± 45 degrees was prohibited throughout the flight.

Because of recurring resonance in the fine film drive at path velocities associated with the initial orbit photographic altitudes, the nominal orbit perigee was raised by 2 miles on Rev 289.

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Evaluation of the RV-1 film indicated that the pre-flight determined plane of best focus for both cameras was correct, and no subsequent on-orbit corrections required. Evaluation of the RV-1 film did indicate that a correction to the in-track Aft Camera OQAA bias was required. The correction of minus 3 steps was made effective with Mission Op 132. A slight over exposure was evident in the Aft Camera RV-1 film and a reduction of 2 steps was made for RV-2 through RV-4 operations.

The Aft Camera film supply contained one 5,000 ft. segment of SO-255 color film, one 500 ft. segment of FE-3916 IR color film, and 100,400 ft. of 1414 black and white film. The operational intervals associated with the color films were as follows:

SO255	OPS 50 to 82	(Revs 80 to 135)	5000 Ft.
FE3916	OPS 694 to 700	(Revs 1644 to 1653)	500 Ft.

The active photographic mission was terminated with RV-4 recovery on Day 103 following depletion of film supplies. A solo phase of the mission extended the vehicle life to Day 124, at which time the vehicle was deboosted and re-entered. The extended solo phase was designed to "simulate" 180-day lifetime duty cycle.

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 103 days.
- b. Both the Forward and Aft looking cameras utilized 100% of their respective film supplies. Approximately 88% of the available pneumatics was expanded.
- c. The sensor system demonstrated the capability to operate satisfactorily with FE-3916 intra-red color film in the Aft Camera.
- d. The general over-all mission image quality for both cameras ranged from very good to poor; the poor being attributable to high haze levels, over-all generally poor weather, an increase in snow cover, and a large number of low solar elevation acquisitions.
- e.
- f. Direct exposure to the sun for times up to 2 milli-seconds was demonstrated to be non-catastrophic, with negligible thermal effects.

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Profiles of the film and gas consumption are presented in Figures 1-1 and 1-2. Figure 1-3 presents a graphic history of remaining system life percentages throughout the mission.

1.4 Launch Configuration

- a. Mission Operation Number - 1207
- b. Intra-range Operation No. 6630
- c. Satellite Vehicle - SV-7
- d. Sensor System - S/N 010
- e. Sensor System Configuration

	<u>Forward Camera</u>	<u>Aft Camera</u>
Filter Types	W-12/W2E3	W-12/W2E3
Focal Length	59.9917 in.	59.9680 in.
Focus Setting	137 Microns	33 Microns
Film Type	1414	1414/SO-255/FE-3916
Film Length	107,548	100,402/5530
Film Weight	850.1 lbs.	853.7 lbs.
Spool Number	2331	2470
Pneumatics Loaded	34.0 lbs.	

1.5 Launch and Orbital Parameters

	<u>Planned</u>	<u>Actual</u>
Launch Time-GMT	2009Z	2010Z
Launch Time-SVT	67.0	67.0
Inclination - degrees	96.9	96.9
Initial Perigee-n. miles	88.1	88.7
Initial Apogee-n. miles	148.9	154.4
Argument of Perigee-degrees	149.8	142.8
Initial Period-minutes	88.9	88.9

Table 1-1 and Figures 1-4 and 1-5 define the basic orbital parameter considerations for the active mission. Forty-three orbit adjusts were performed.

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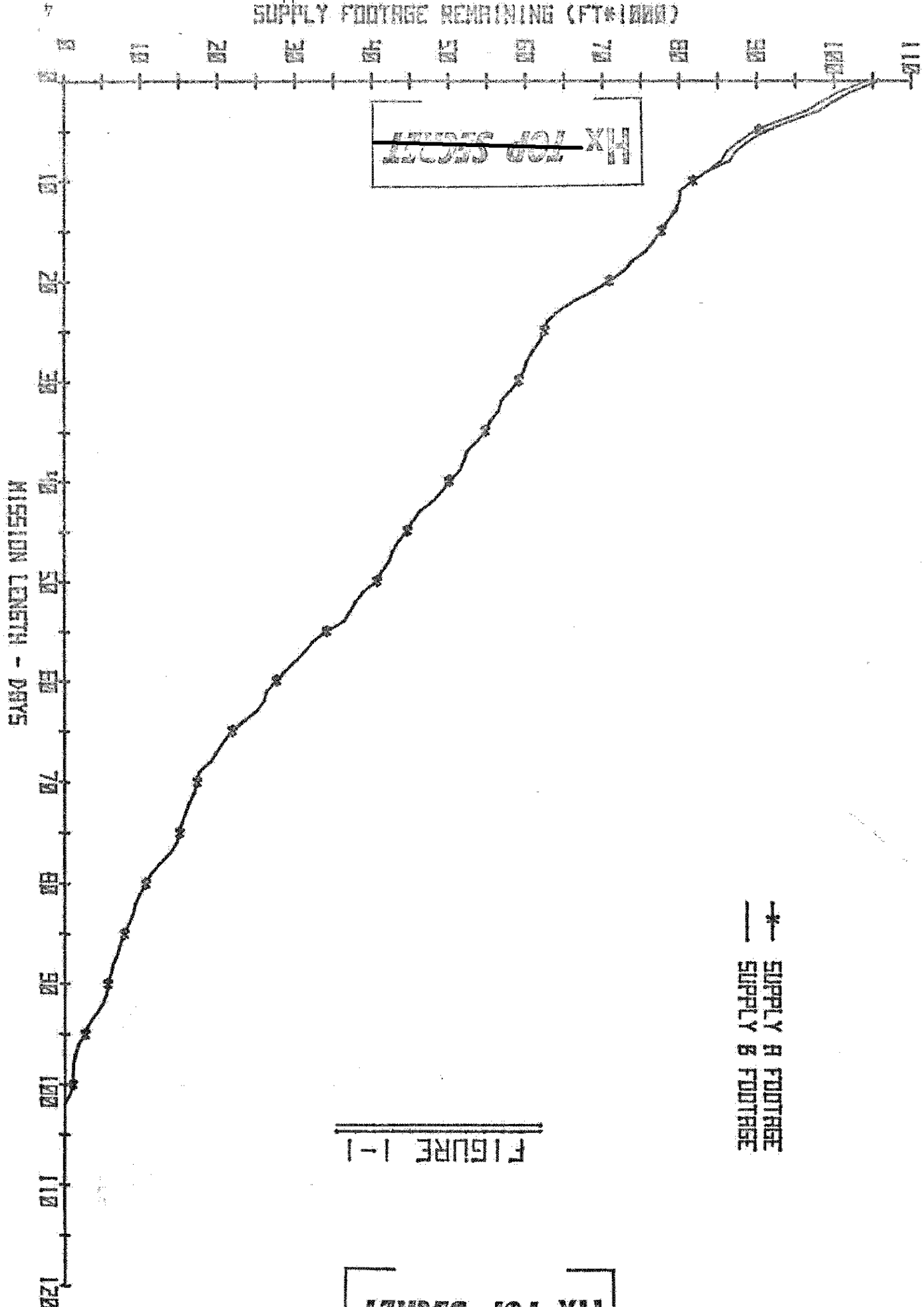


FIGURE 1-1

SUPPLY FOOTAGE REMAINING

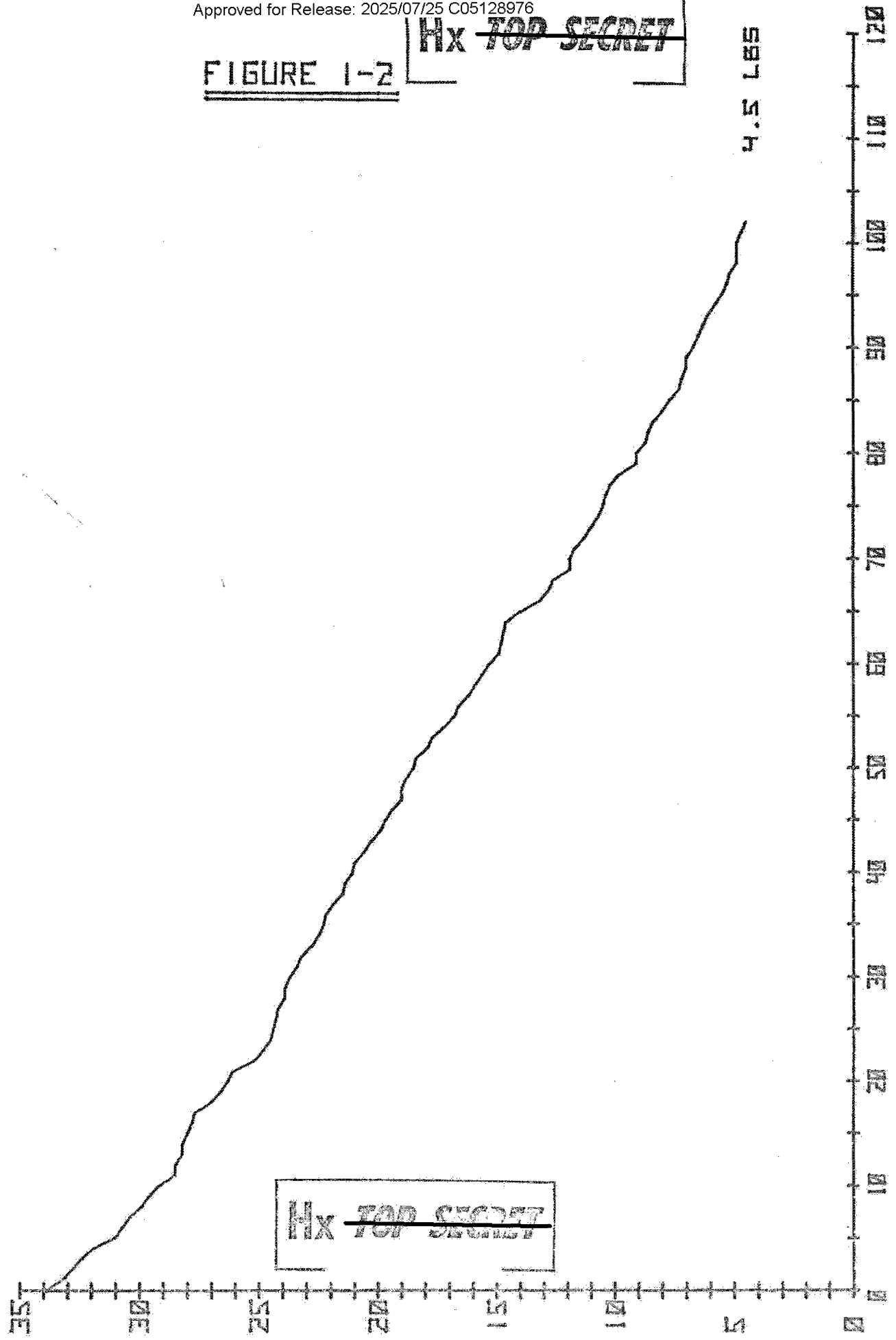
SV-7

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FIGURE 1-2

SV-7

PNEUMATICS SUPPLY REMAINING

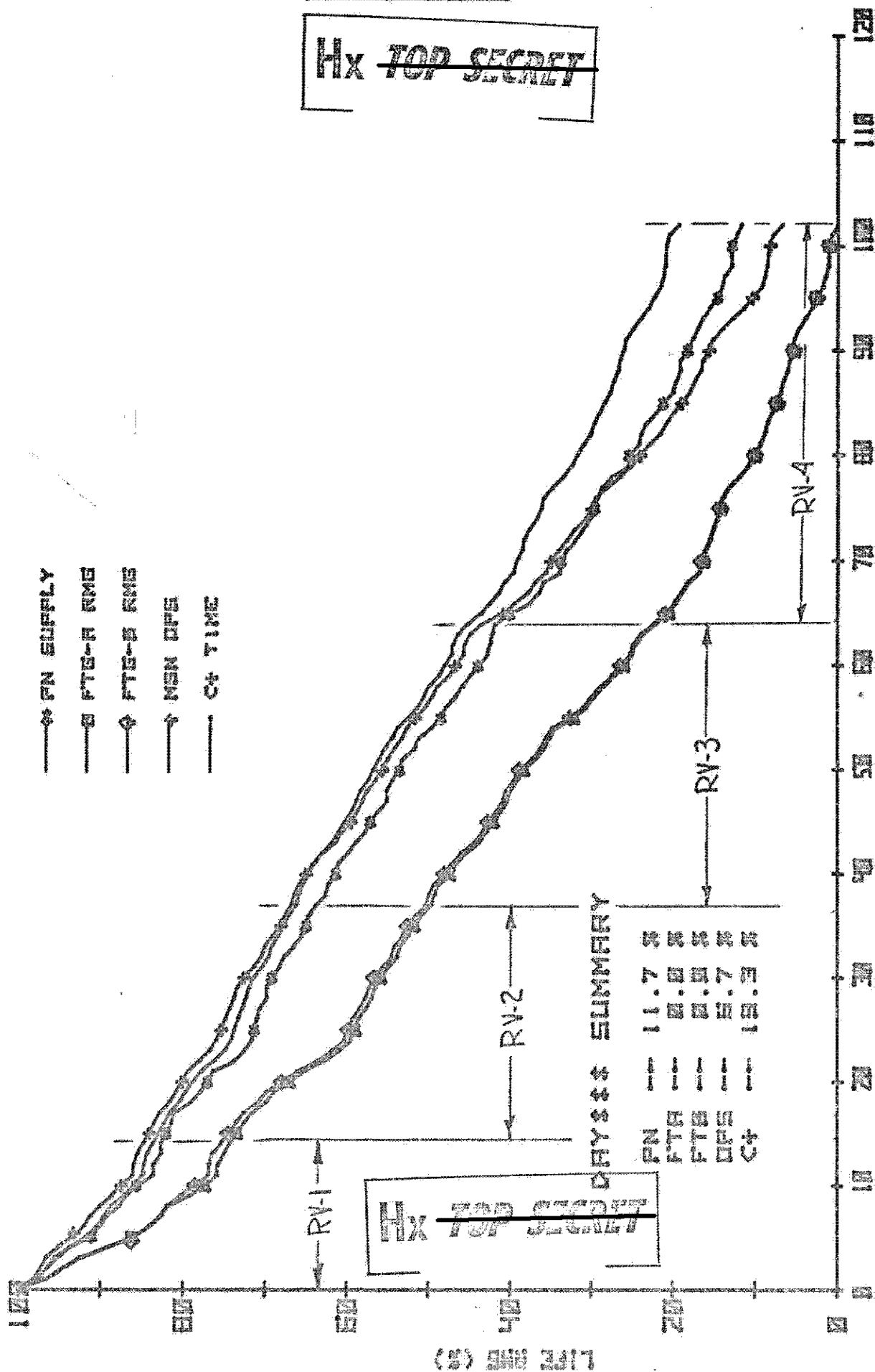


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CONSUMPTION PROFILES



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TABLE 1 - 1

BASIC ORBITAL PARAMETERS

DAY	REV	PERIOD	PERIGEE	APOGEE	INC	ARG/PER	B ANG
Pre L/O Nominal		88:53	88.7	154.4	96.9	142.8	
1	8	88:52	88.7	153.7	96.9	140.4	0.1
2	24	88:48	88.7	152.2	96.9	136.4	0.1
3	40	88:45	88.8	150.7	96.9	132.4	0.0
OA	46						
4	56	88:51	88.9	155.4	96.9	132.8	0.0
5	73	88:47	89.0	153.7	96.9	128.5	0.0
6	89	88:44	88.9	151.9	96.9	124.6	0.0
OA#2	94						
OA#3	97						
7	105	88:51	88.4	151.3	96.9	149.0	0.0
8	121	88:48	88.6	149.1	96.9	144.2	0.0
9	137	88:44	88.5	147.3	96.9	139.9	0.0
OA#4	143						
10	154	88:51	88.6	153.7	96.9	141.2	0.0
11	170	88:48	88.6	152.0	96.9	137.2	0.0
12	186	88:34	88.6	149.9	96.9	133.0	0.0
OA#5	192						
13	202	88:51	88.5	157.6	96.9	129.3	0.0
14	219	88:48	88.5	155.6	96.9	125.0	0.1
15	235	88:43	88.1	152.9	96.9	121.2	0.1
OA#6	240						
OA#7	242						
16	251	88:51	88.5	151.3	96.9	147.9	0.1
17	267	88:47	88.4	149.2	96.9	143.6	0.1
18	283	88:43	88.3	147.0	96.9	139.3	0.1
OA#8	289						
19	300	88:52	90.5	150.7	96.9	144.9	0.2
20	316	88:49	90.5	149.2	96.9	140.8	0.2
21	332	88:45	90.4	147.6	96.9	136.7	0.2
OA#9	338						
22	348	88:51	90.5	152.5	96.9	137.6	0.3
23	364	88:48	90.5	151.1	96.9	133.5	0.3
24	381	88:45	90.5	149.3	96.9	129.2	0.3
OA#10	386						
25	397	88:49	90.4	153.7	96.9	130.0	0.4
26	413	88:45	90.3	151.7	96.9	126.0	0.4
27	429	88:42	90.1	149.9	96.9	122.2	0.4
OA#11	435						
OA#12	437						
28	446	88:53	90.6	151.6	96.9	147.6	0.5

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TABLE 1 - 1 Cont'd.

BASIC ORBITAL PARAMETERS

DAY	REV	PERIOD	PERIGEE	APOGEE	INC	ARG/PER	B ANG
29	462	88:51	90.6	150.3	96.9	143.5	0.5
30	478	88:48	90.5	148.8	96.9	139.4	0.5
OA#13	484						
31	494	88:48	90.7	150.4	96.9	135.3	0.6
32	510	88:45	90.6	149.1	96.9	131.3	0.6
33	527	88:42	90.6	147.5	96.9	127.0	0.7
OA#14	534						
34	540	88:54	90.3	157.5	96.9	130.3	0.7
35	559	88:50	90.5	155.9	96.9	125.6	0.8
36	575	88:47	90.4	154.4	96.9	121.9	0.8
OA#15	581						
OA#16	583						
37	592	88:50	90.3	148.9	96.9	147.9	0.8
38	608	88:47	90.3	147.1	96.9	147.1	0.9
39	624	88:44	90.2	145.4	96.9	139.5	0.9
OA#17	630						
40	640	88:51	90.4	151.3	96.9	142.5	1.0
41	656	88:47	90.3	149.2	96.9	138.3	1.0
42	673	88:42	90.2	146.5	96.9	133.7	1.0
OA#18	678						
43	689	88:52	90.5	151.2	96.9	138.4	1.1
44	702	88:48	90.3	151.7	96.9	135.2	1.1
45	721	88:45	90.4	149.5	96.9	130.2	1.2
OA#19	727						
46	738	88:51	90.4	154.4	96.9	130.5	1.2
47	754	88:47	90.4	152.6	96.9	126.6	1.2
48	770	88:43	90.3	150.7	96.9	122.8	1.3
OA#20	776						
OA#21	778						
49	786	88:52	90.6	149.8	96.9	147.8	1.3
50	802	88:48	90.5	148.0	96.9	143.4	1.3
51	819	88:44	90.9	145.9	96.9	138.2	1.4
OA#22	824						
52	835	88:51	90.4	151.5	96.9	140.9	1.4
53	851	88:48	90.4	149.8	96.9	136.8	1.4
54	867	88:44	90.3	148.1	96.9	132.8	1.4
OA#23	873						
55	884	88:52	90.5	154.0	96.9	134.4	1.5
56	900	88:48	90.5	152.3	96.9	130.5	1.5
57	916	88:44	90.4	150.5	96.9	126.6	1.5
OA#24	922						

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TABLE 1 - 1 Cont'd.

BASIC ORBITAL PARAMETERS

DAY	REV	PERIOD	PERIGEE	APOGEE	INC	ARG/PER	B ANG
58	932	88:50	90.4	155.7	96.9	127.0	1.5
59	948	88:47	90.4	154.0	96.9	123.1	1.5
60	965	88:43	90.2	151.9	96.9	118.9	1.5
OA#25	970						
OA#26	972						
61	981	88:51	90.4	149.5	96.9	147.9	1.5
62	997	88:48	90.4	147.7	96.9	143.7	1.6
63	1013	88:44	90.3	145.9	96.9	139.4	1.6
OA#27	1019						
64	1029	89:12	90.5	167.3	96.9	150.2	1.6
65	1046	89:08	90.7	165.3	96.9	145.6	1.6
OA#28	1052						
66	1062	88:48	90.5	147.8	96.9	141.8	1.6
67	1078	88:43	90.3	145.4	96.9	137.7	1.5
68	1094	88:38	90.0	142.7	96.9	133.4	1.5
OA#29	1100						
69	1110	88:55	90.5	154.1	96.9	142.7	1.5
70	1127	88:50	90.4	151.5	96.9	138.2	1.5
71	1143	88:46	90.2	149.2	96.9	134.0	1.5
OA#30	1149						
72	1159	88:51	90.3	152.9	96.9	135.3	1.4
73	1175	88:46	90.2	150.5	96.9	131.2	1.4
74	1192	88:41	90.1	148.0	96.9	126.7	1.4
OA#31	1197						
75	1208	88:52	90.5	156.4	96.9	131.5	1.3
76	1221	88:49	90.5	154.5	96.9	127.7	1.3
77	1240	88:44	90.2	151.1	96.9	123.6	1.2
OA#32	1246						
OA#33	1248						
78	1256	88:51	90.2	149.8	96.9	148.0	1.2
79	1273	88:47	90.2	147.2	96.9	143.3	1.1
80	1289	88:43	90.0	144.9	96.9	139.0	1.1
OA#34	1295						
81	1305	88:52	90.6	151.2	96.9	144.7	1.0
82	1321	88:49	90.5	149.2	96.9	140.5	0.9
83	1338	88:44	90.5	146.8	96.9	135.7	0.9
OA#35	1343						
84	1354	88:51	90.7	152.2	96.9	138.4	0.8
85	1370	88:48	90.6	150.2	96.9	134.3	0.7
86	1386	88:43	90.5	148.0	96.9	130.2	0.6
OA#36	1392						

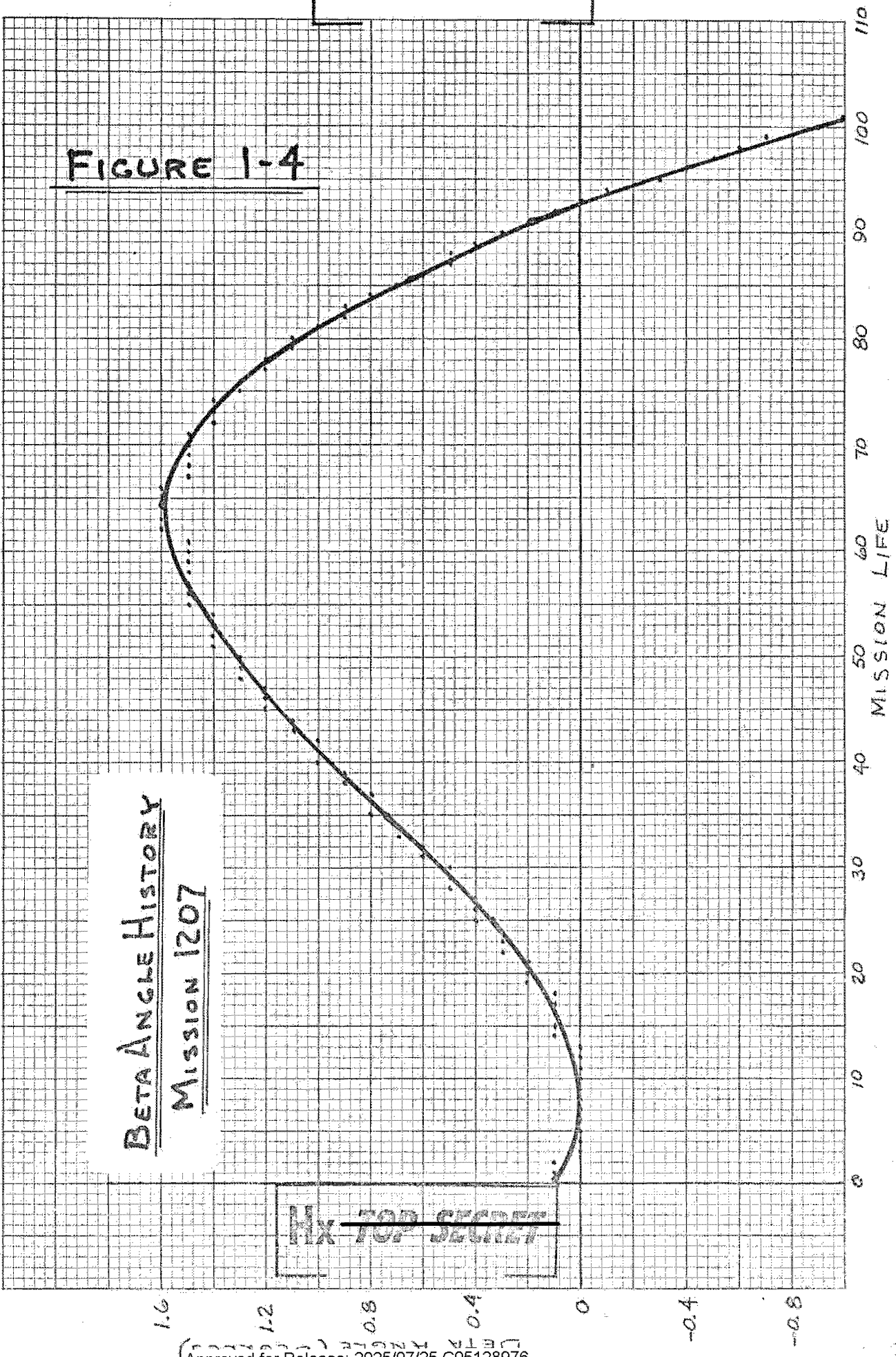
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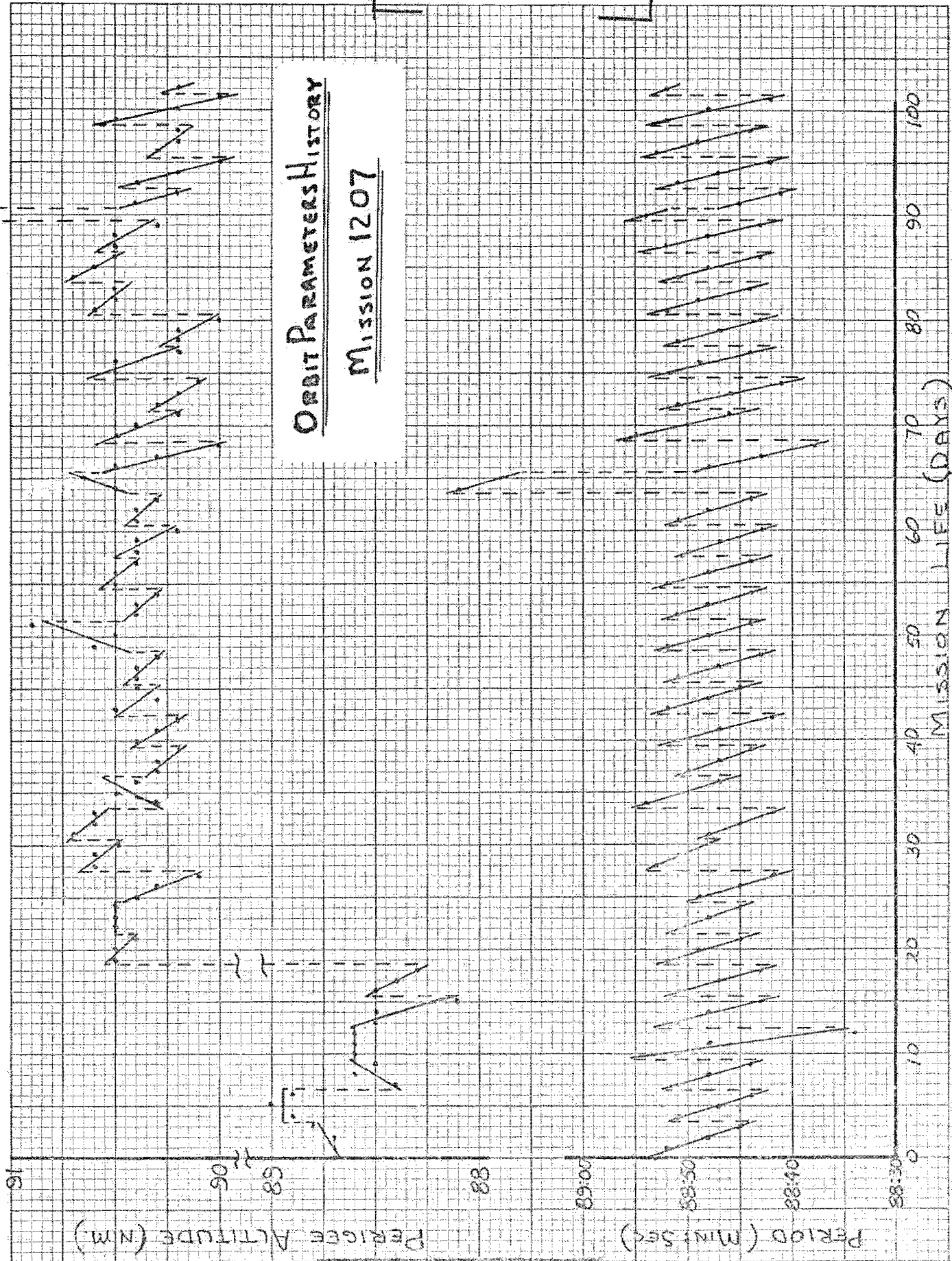
BASIC ORBITAL PARAMETERS

DAY	REV	PERIOD	PERIGEE	APOGEE	INC	ARG/PER	B ANG
87	1402	88:52	90.5	155.0	96.9	132.6	0.5
88	1419	88:48	90.5	152.5	96.9	126.0	0.5
89	1435	88:43	90.3	150.2	96.9	124.1	0.4
OA#37	1440						
OA#38	1443						
90	1451	88:54	91.5	151.8	96.85	145.5	0.3
OA#39	1459						
91	1467	88:45	90.4	145.1	96.85	144.0	0.2
92	1483	88:41	90.2	142.9	96.8	139.6	0.1
OA#40	1489						
93	1500	88:51	90.4	150.4	96.8	144.7	0.0
94	1516	88:47	90.2	147.8	96.8	140.4	-0.1
95	1532	88:42	90.0	144.8	96.8	136.1	-0.3
OA#41	1538						
96	1548	88:53	90.3	152.9	96.8	142.6	-0.4
97	1565	88:49	90.2	150.3	96.8	137.9	-0.5
98	1581	88:44	90.2	147.9	96.8	133.7	-0.6
OA#42	1587						
99	1597	88:52	90.5	153.4	96.8	136.8	-0.7
100	1610	88:48	90.2	151.3	96.8	133.5	-0.9
101	1629	88:42	90.0	148.1	96.8	128.1	-1.0
OA#43	1635						
102	1646	88:52	90.3	155.4	96.8	132.8	-1.1

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1.6

Mission Film Usage Summary

The distribution of film footage as functions of the various operating modes is presented in Figures 1-6 to 1-23. The mission segment to segment film usage is summarized as follows:

	<u>Rev Span</u>	<u>Camera</u>	<u>Recovered Footage</u>
RV-1	Launch-225	Forward	28,987
		Aft	27,451
RV-2	226 - 599	Forward	26,061
		Aft	26,059
RV-3	599 - 1036	Forward	29,018
		Aft	29,028
RV-4	1037 - 1654	Forward	23,457
		Aft	23,377

Of this footage, the engineering and other non-intelligence operations consumed approximately 4,800 and 4,600 feet for the A and B sides, respectively, as summarized in the following:

1207 Non-Intelligence

	<u>Forward Camera</u>	<u>Aft Camera</u>
Pre-Launch	1,836	1,721
RV-1 Engineering	1,275	1,275
RV-2 Engineering	412	412
RV-3 Engineering	197	197
RV-4 Engineering	1,119	968
Total Utilization	4,841	4,575
Film Recovered	107,523	105,915
PCT. Non-Intelligence	4.50	4.32

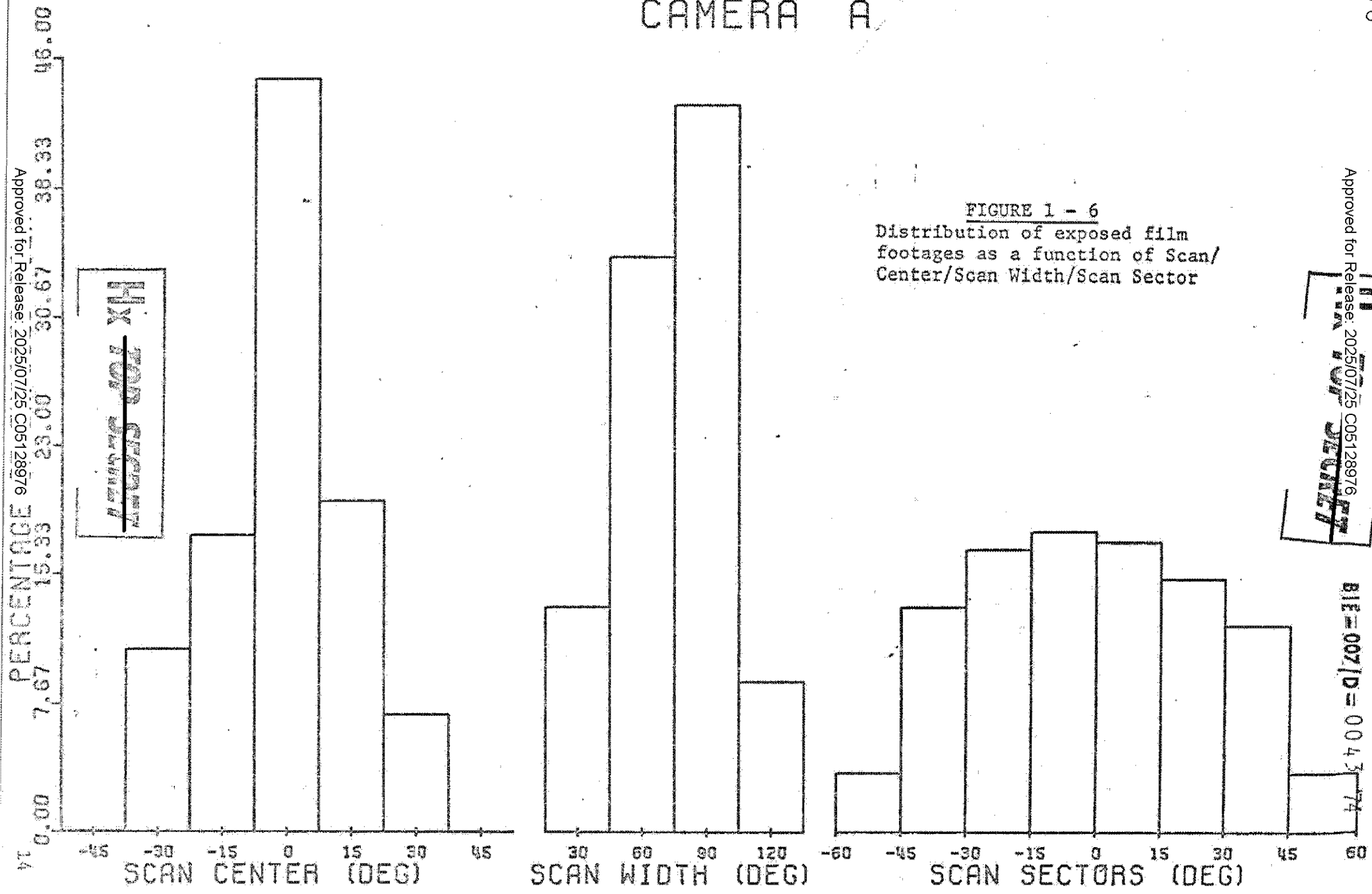
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MSN-1207 CAMERA A

FIGURE 1 - 6
Distribution of exposed film
footages as a function of Scan/
Center/Scan Width/Scan Sector



MSN-1207

CAMERA B

FIGURE 1 - 7
Distribution of exposed film
footages as a function of Scan/
Center/Scan Width/Scan Sector.

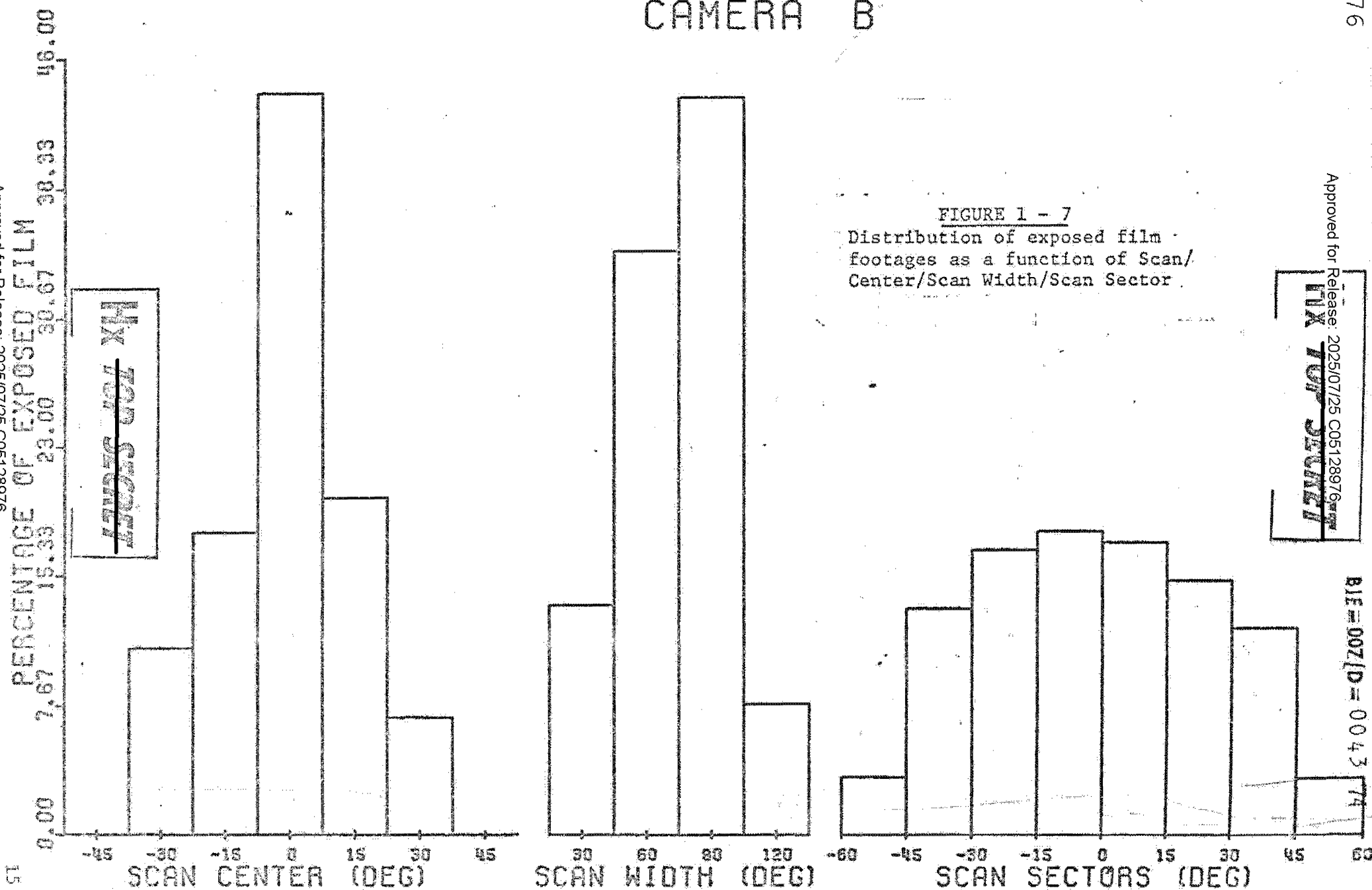
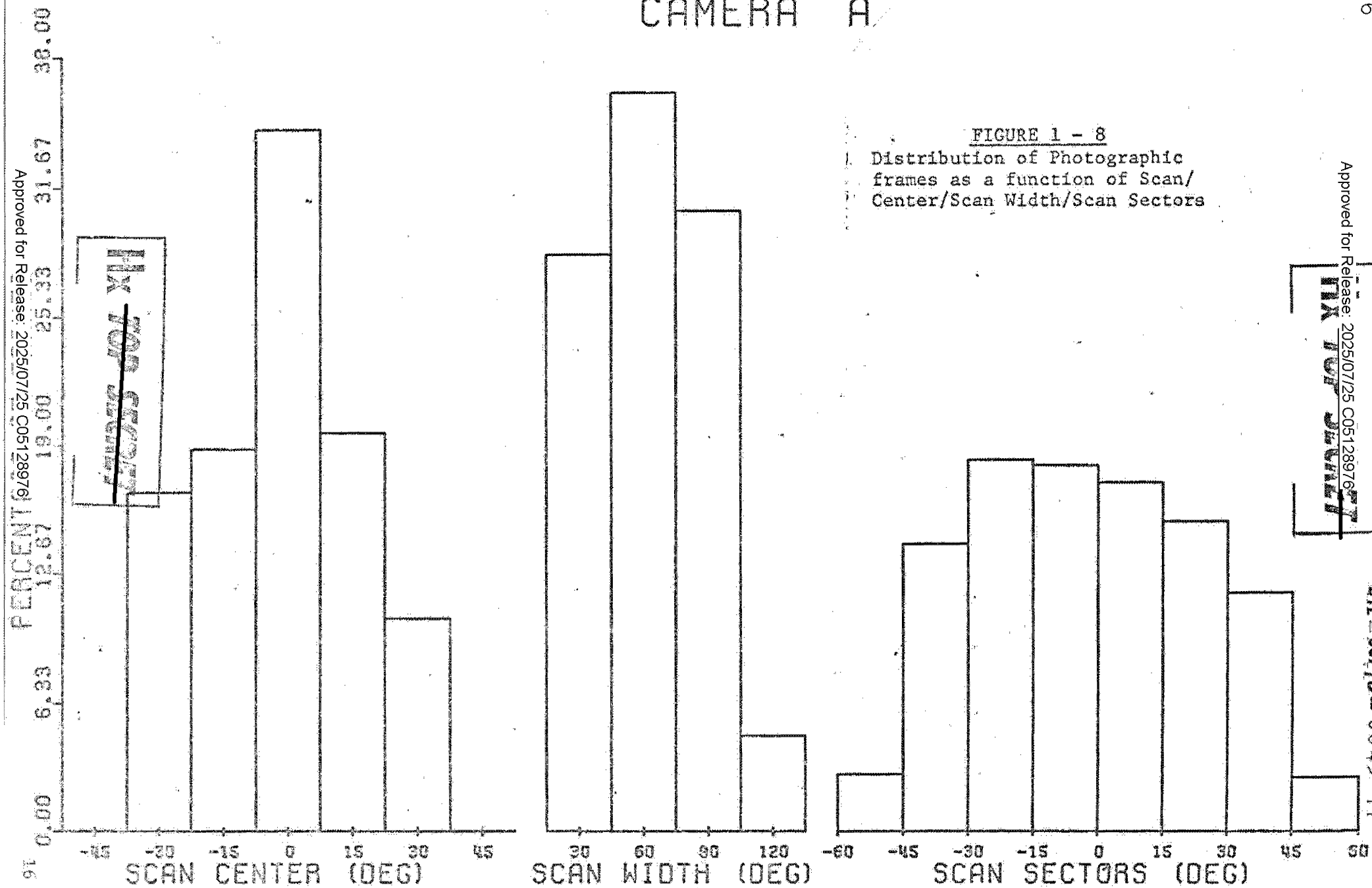


FIGURE 1 - 8

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



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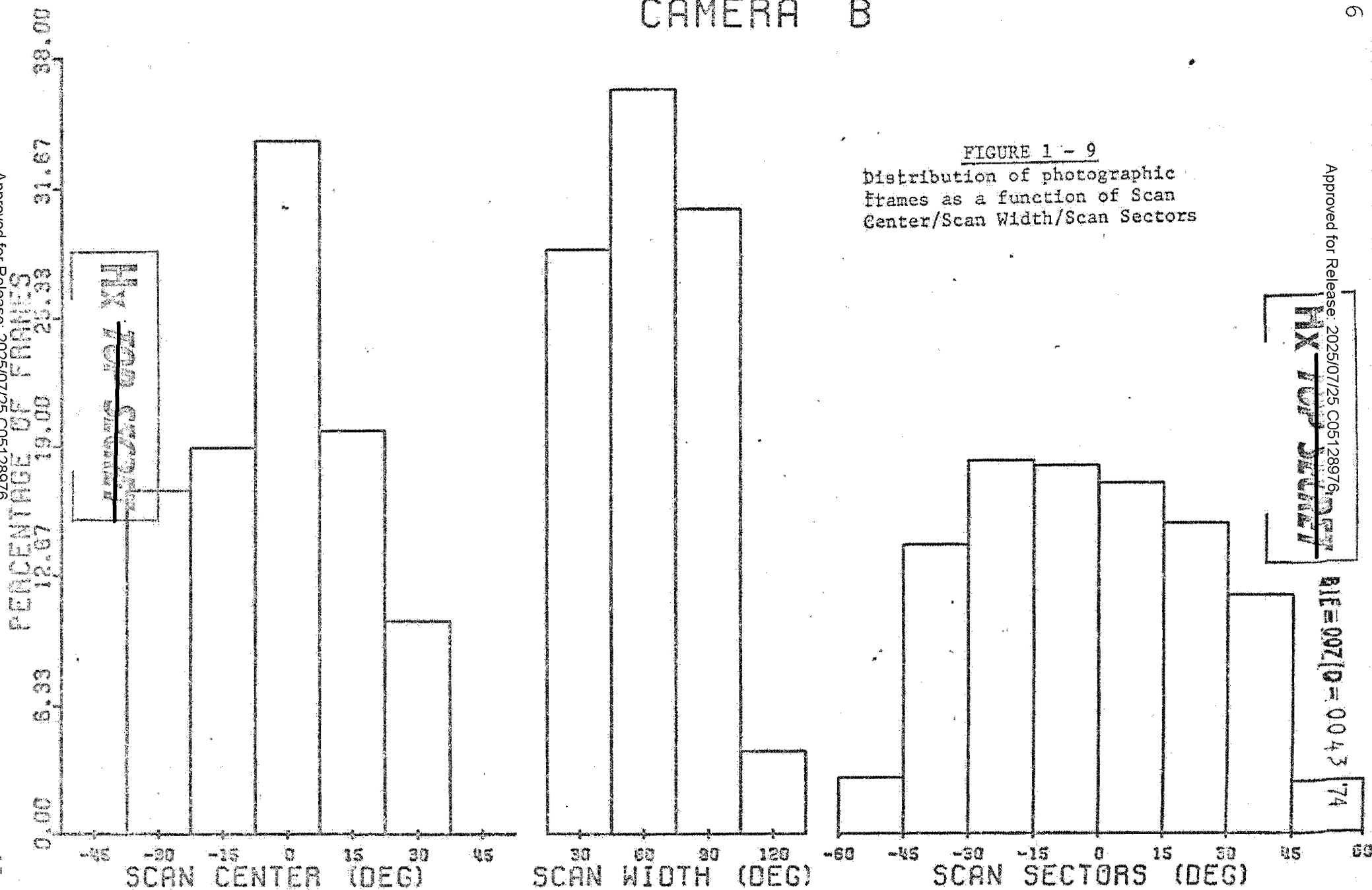
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MSN-1207

CAMERA B

FIGURE 1 - 9

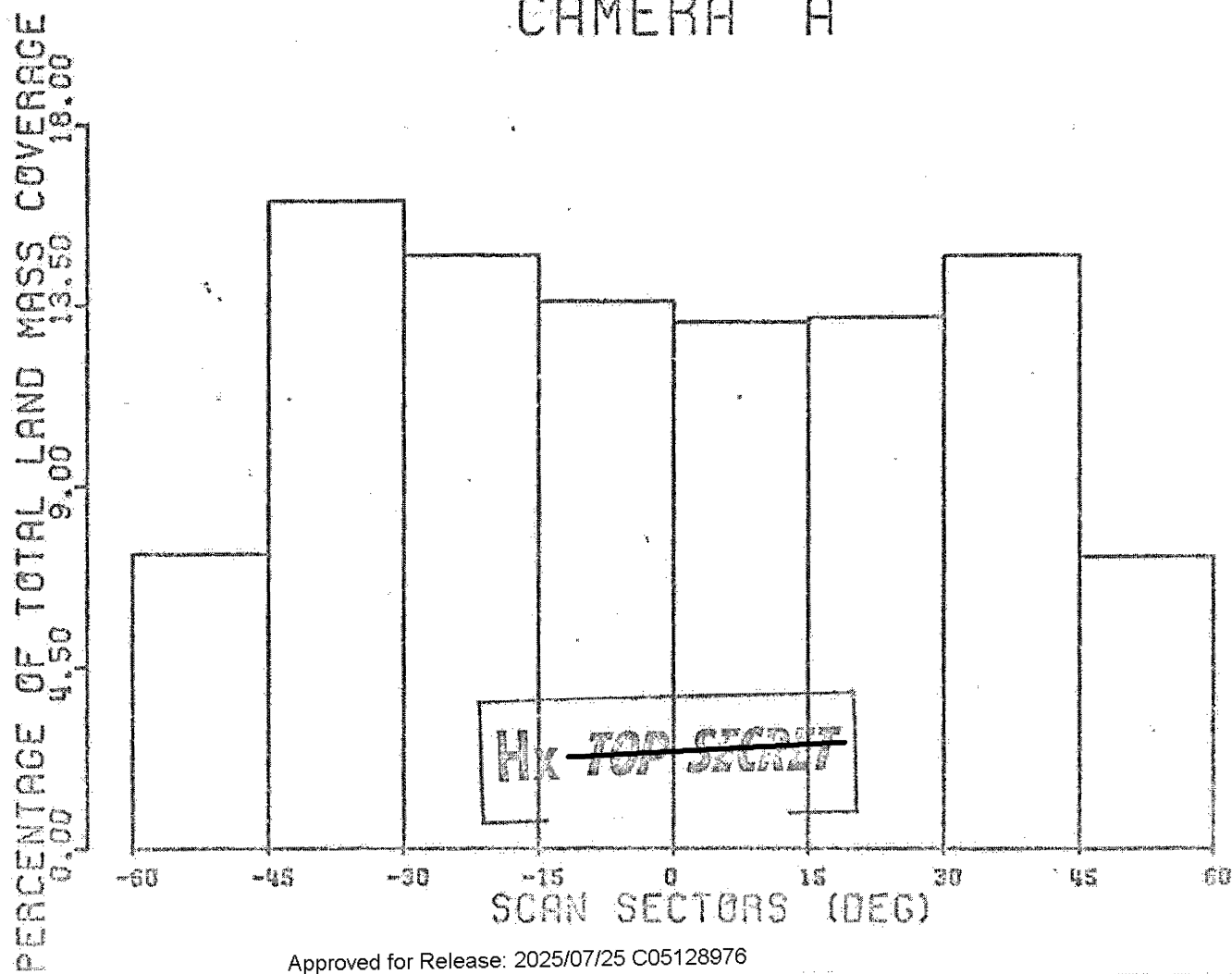
Distribution of photographic
frames as a function of Scan
Center/Scan Width/Scan Sectors



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FIGURE 1 - 10
Distribution of land mass
coverage as a function of
Scan Sectors

MSN-1207
CAMERA A



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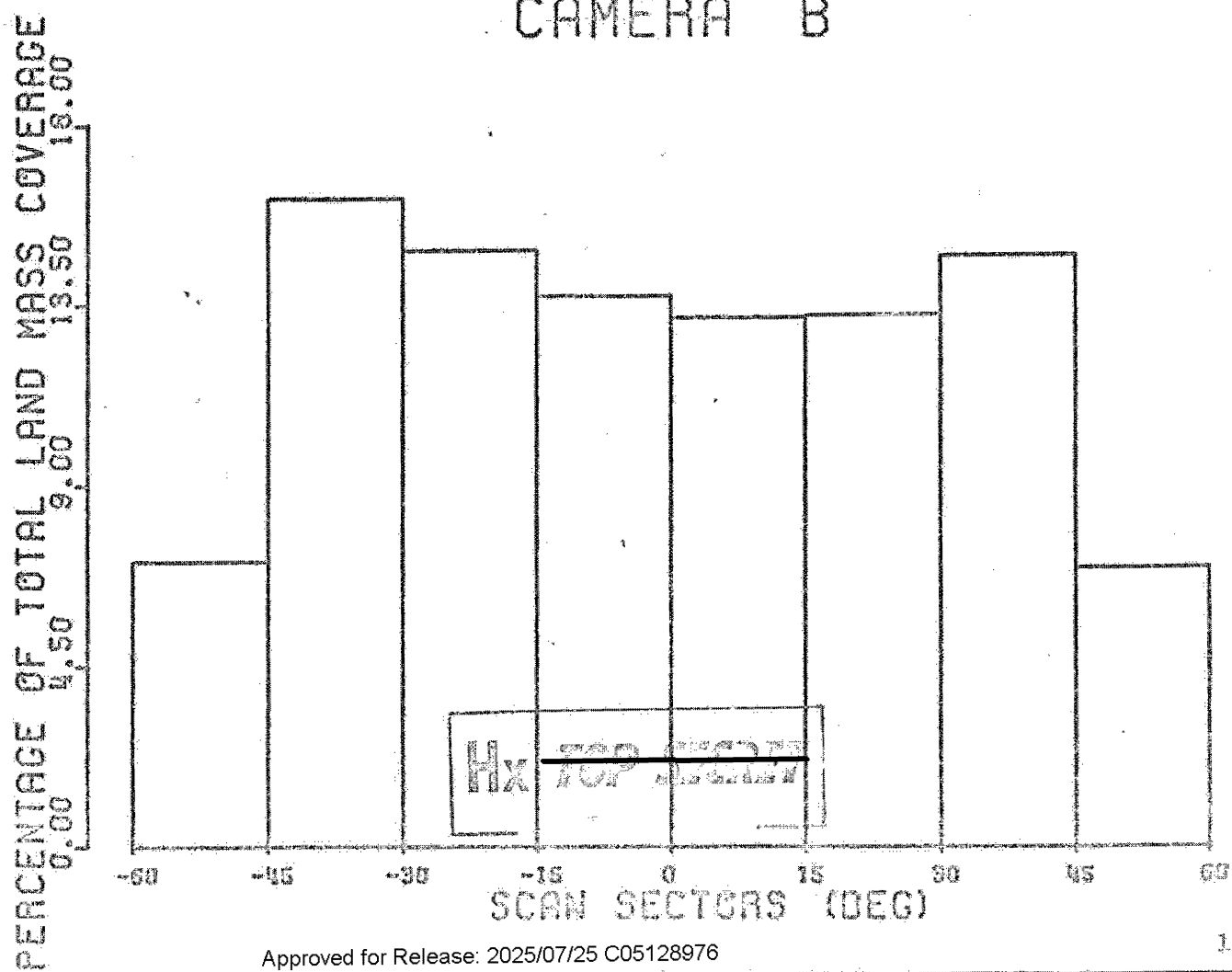
BIE=007/D=0043 '74

FIGURE 1 - 11

Distribution of land mass
coverage as a function of
Scan Sectors

MSN-1207

CAMERA B



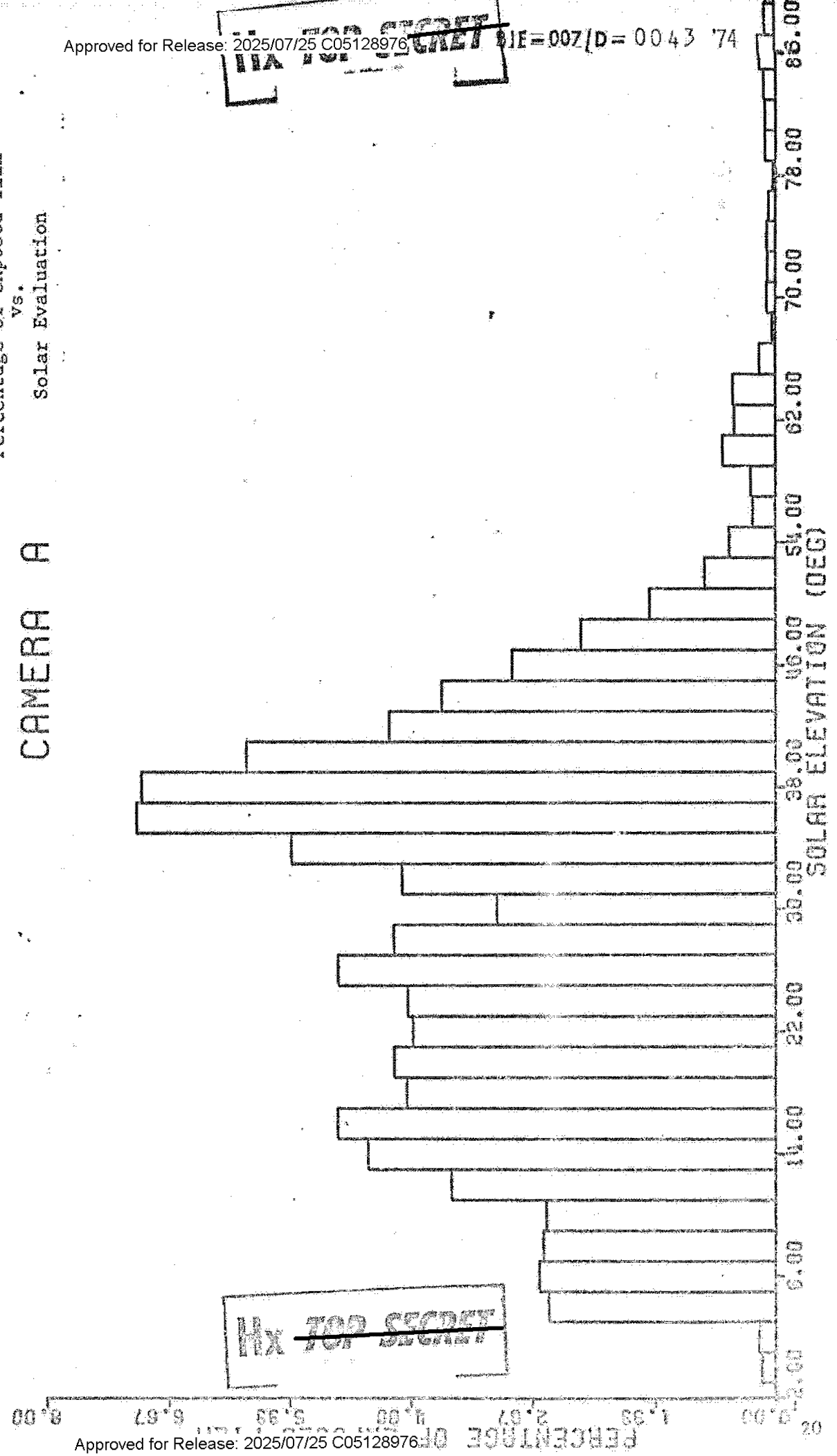
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REF=007/D=0043 74

FIGURE 1 - 12

Percentage of exposed film
vs.
Solar Evaluation

MSN-1207
CAMERA A

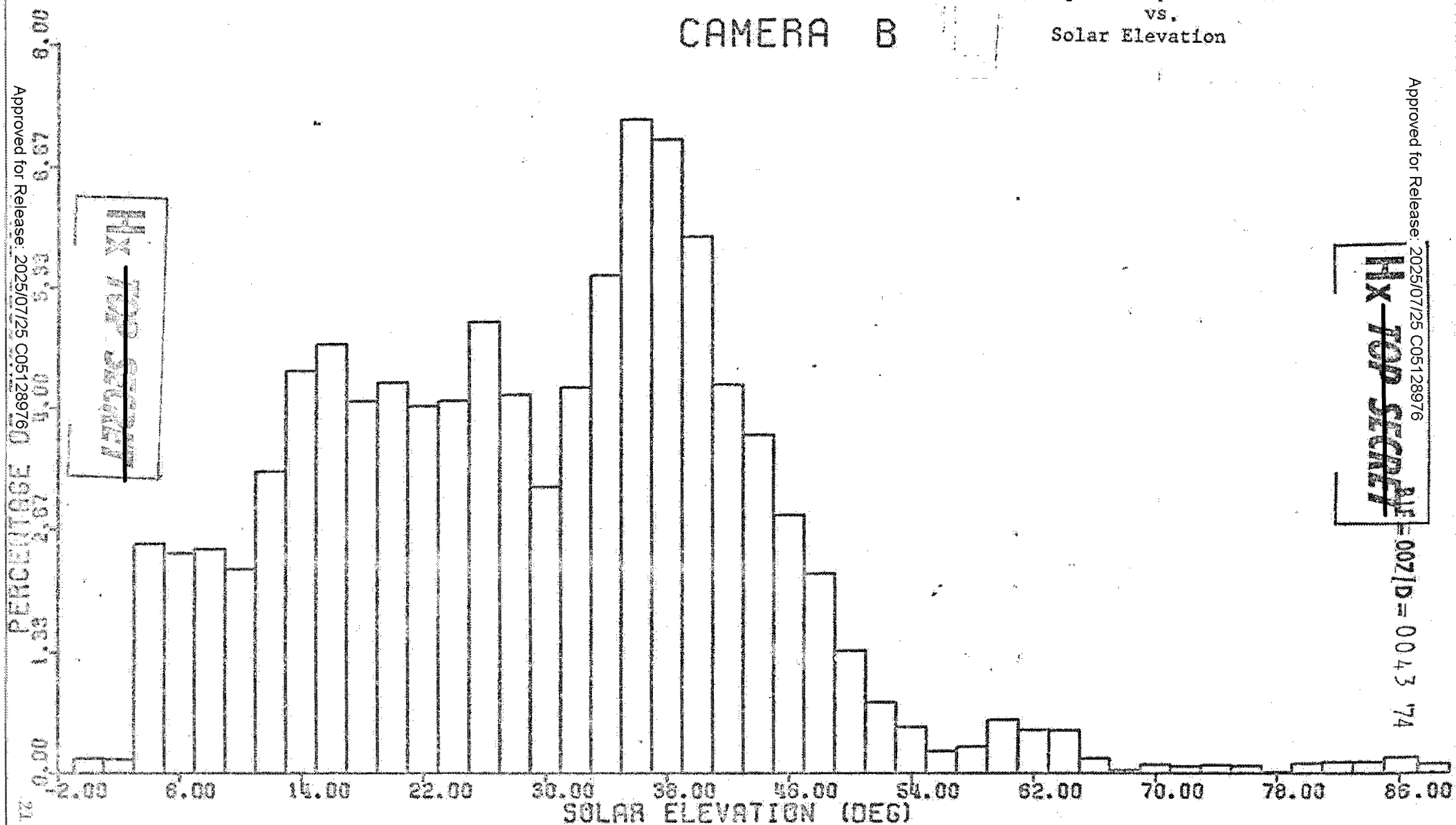


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REF = 00710 = 0043 74

FIGURE 1 - 13

Percentage of exposed film
vs.
Solar ElevationMSN-1207
CAMERA B~~TOP SECRET~~

00.0

25.0

50.0

75.0

100.0

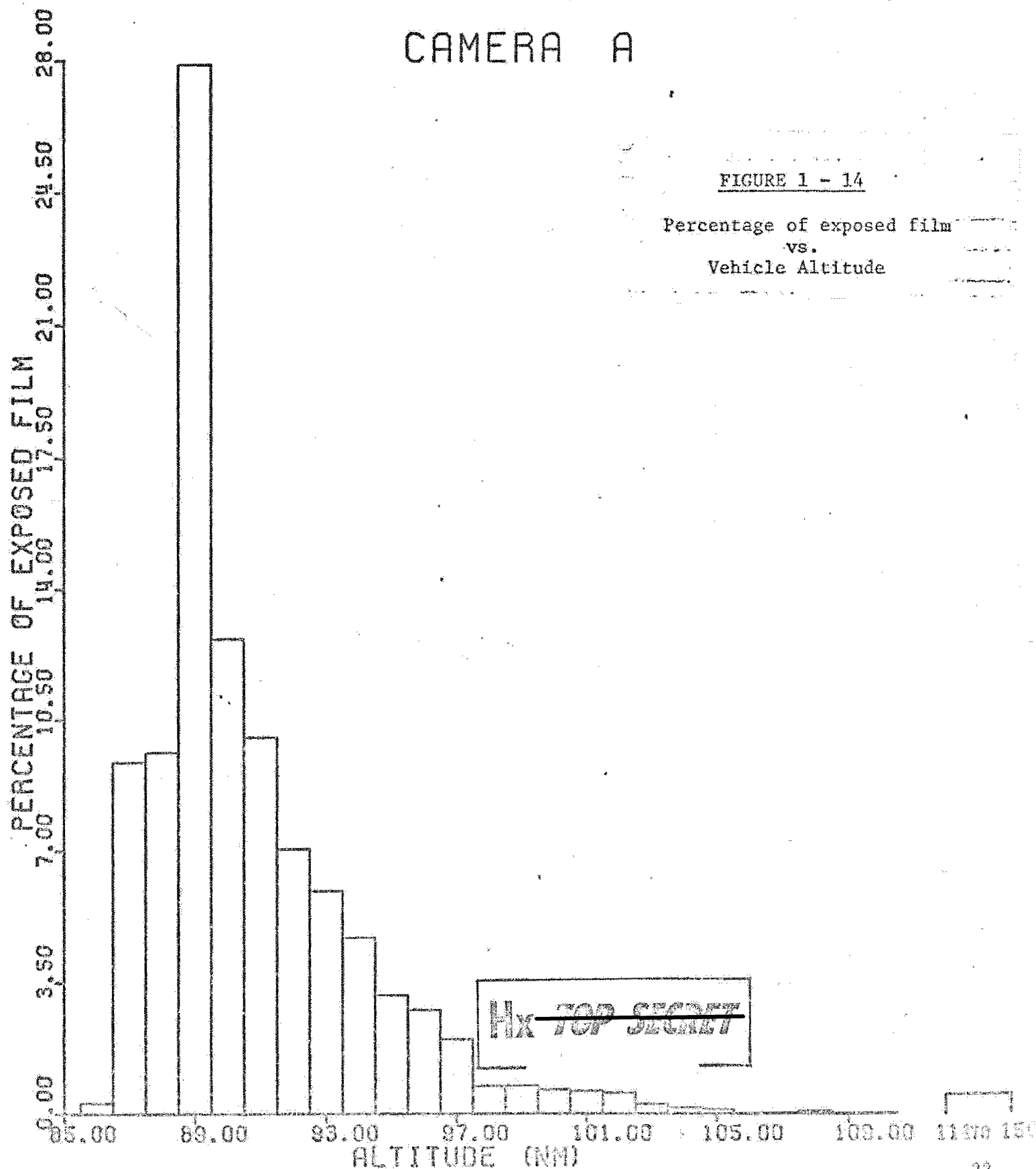
125.0

150.0

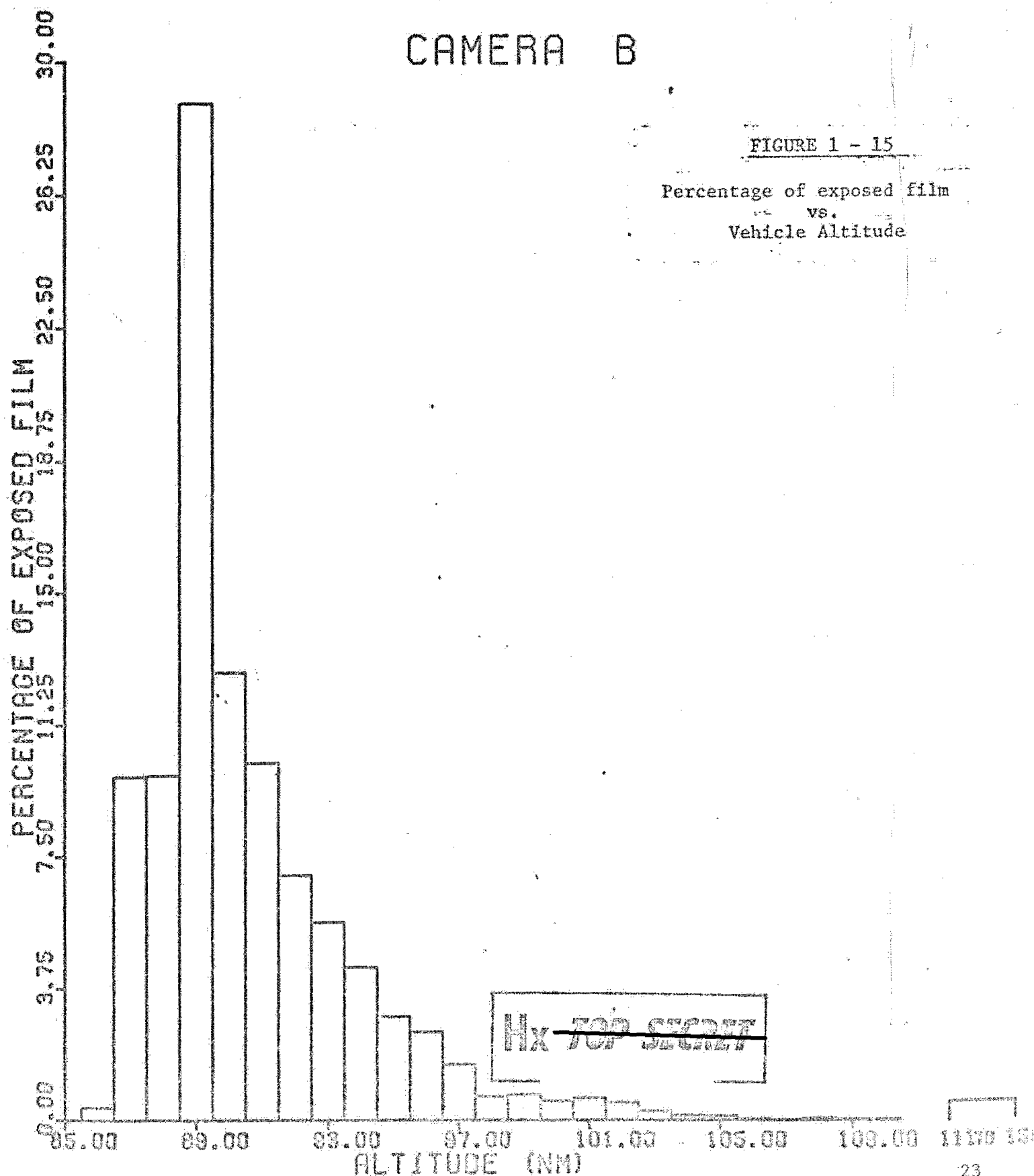
21

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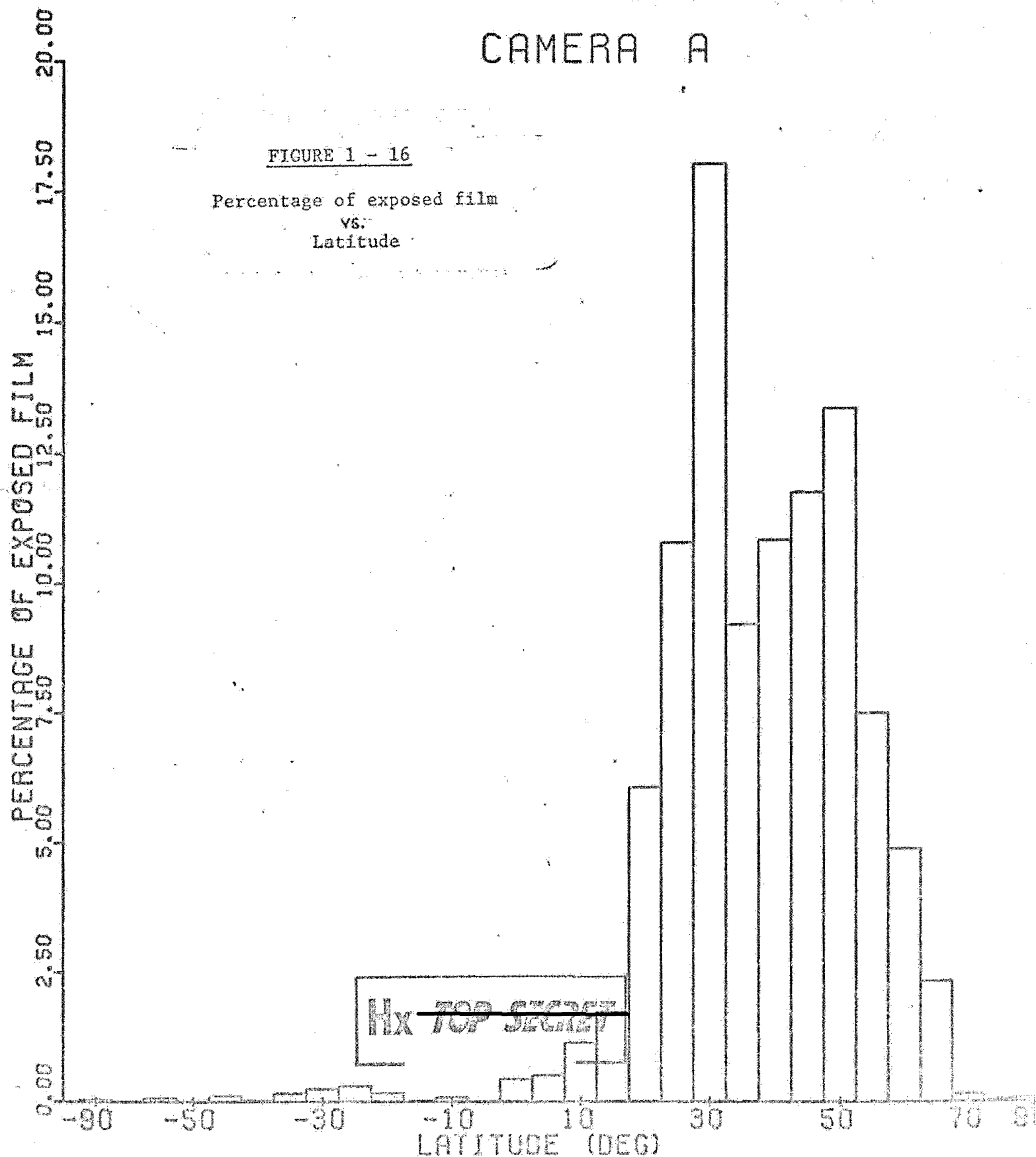
MSN-1207
CAMERA A

MSN-1207
CAMERA B



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BIE-007/D=0043 '74

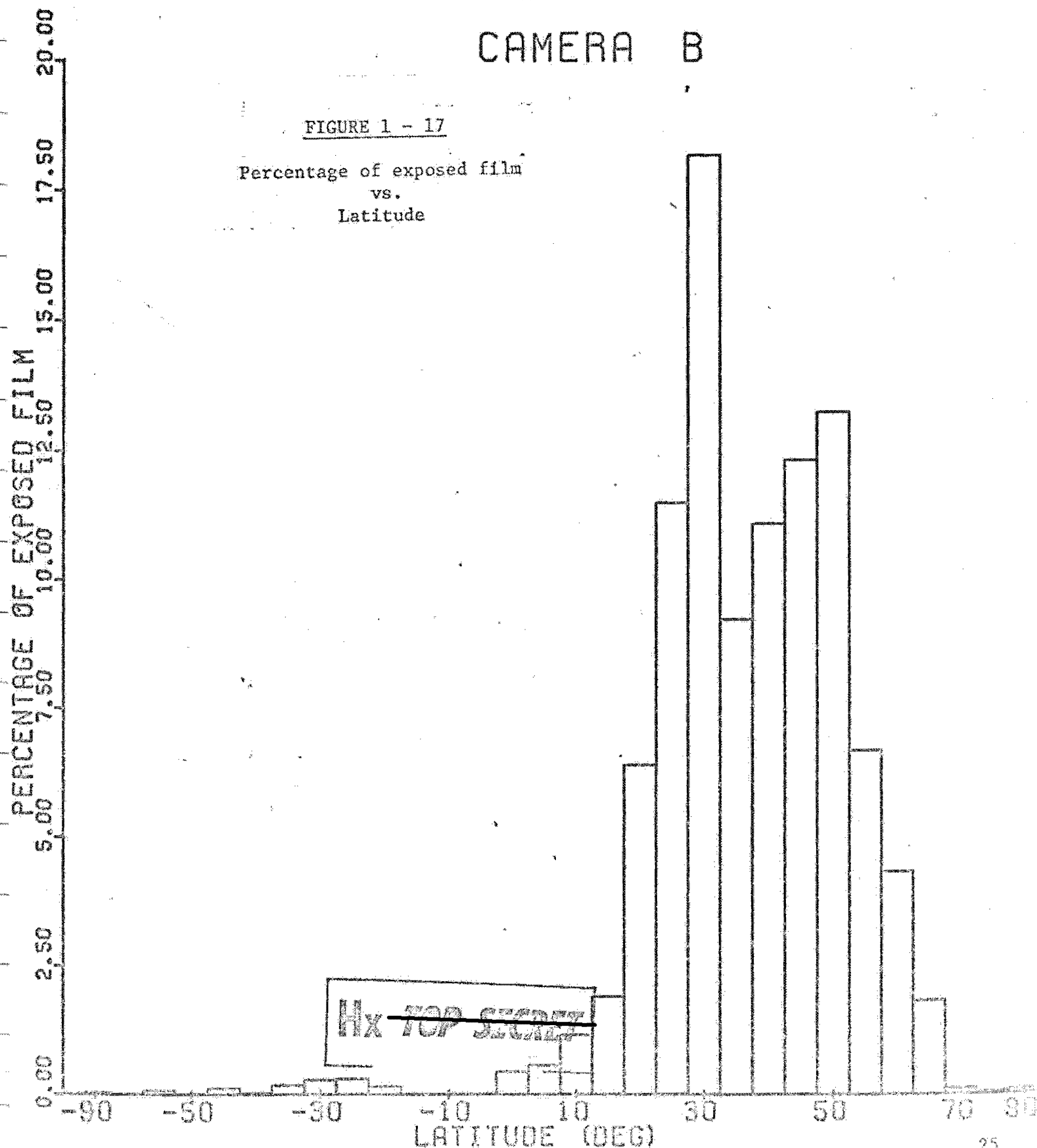
MSN-1207
CAMERA AFIGURE 1 - 16Percentage of exposed film
vs.
Latitude~~TOP SECRET~~

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MSN-1207
CAMERA B

FIGURE 1 - 17

Percentage of exposed film
vs.
Latitude~~TOP SECRET~~

STEP - CAL STEP - CAL STEP - CAL STEP - CAL

MSN-1207
CAMERA A

1 = 0.080	9 = 0.150	17 = 0.281	25 = 0.525
2 = 0.095	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

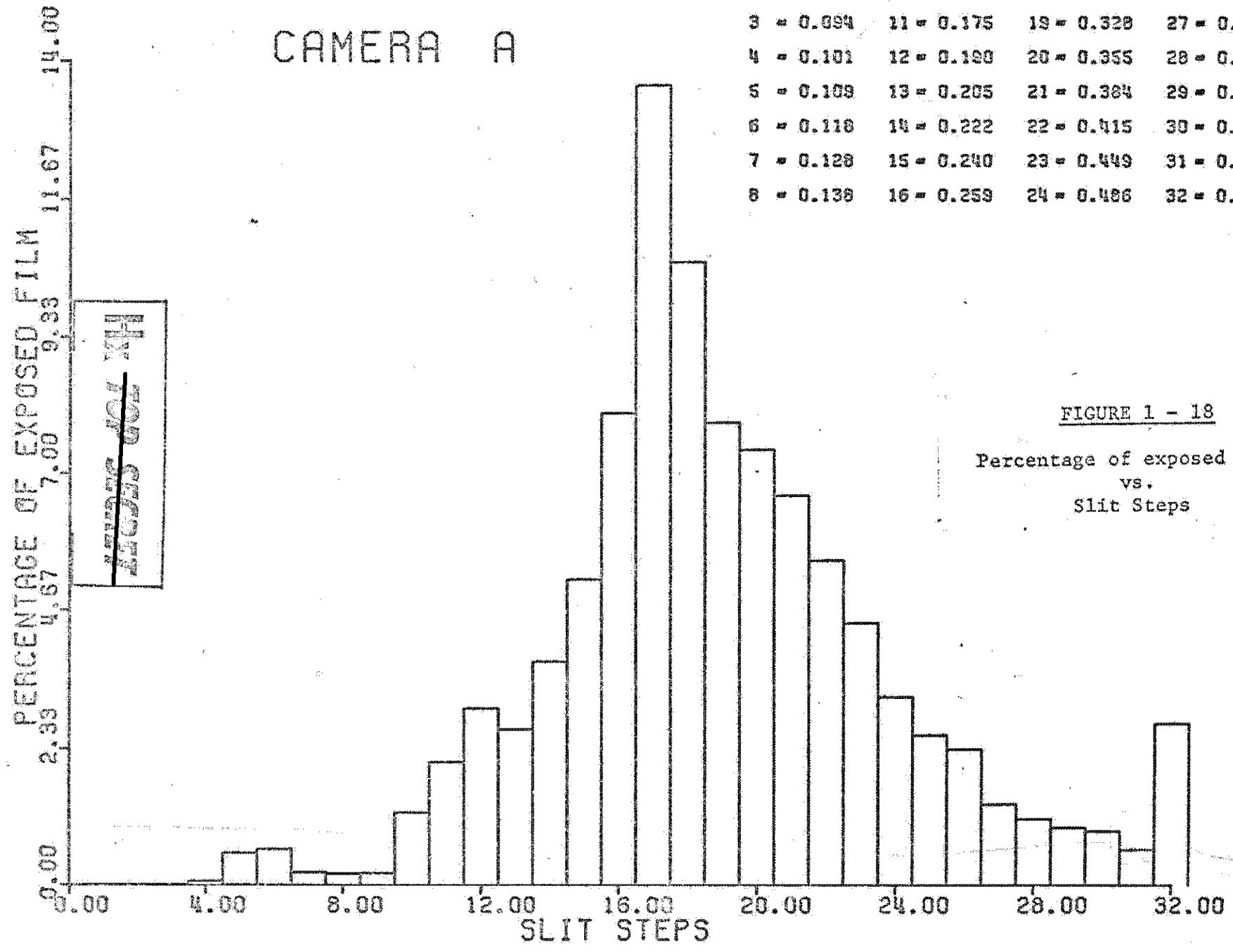


FIGURE 1 - 18
Percentage of exposed film
vs.
Slit Steps

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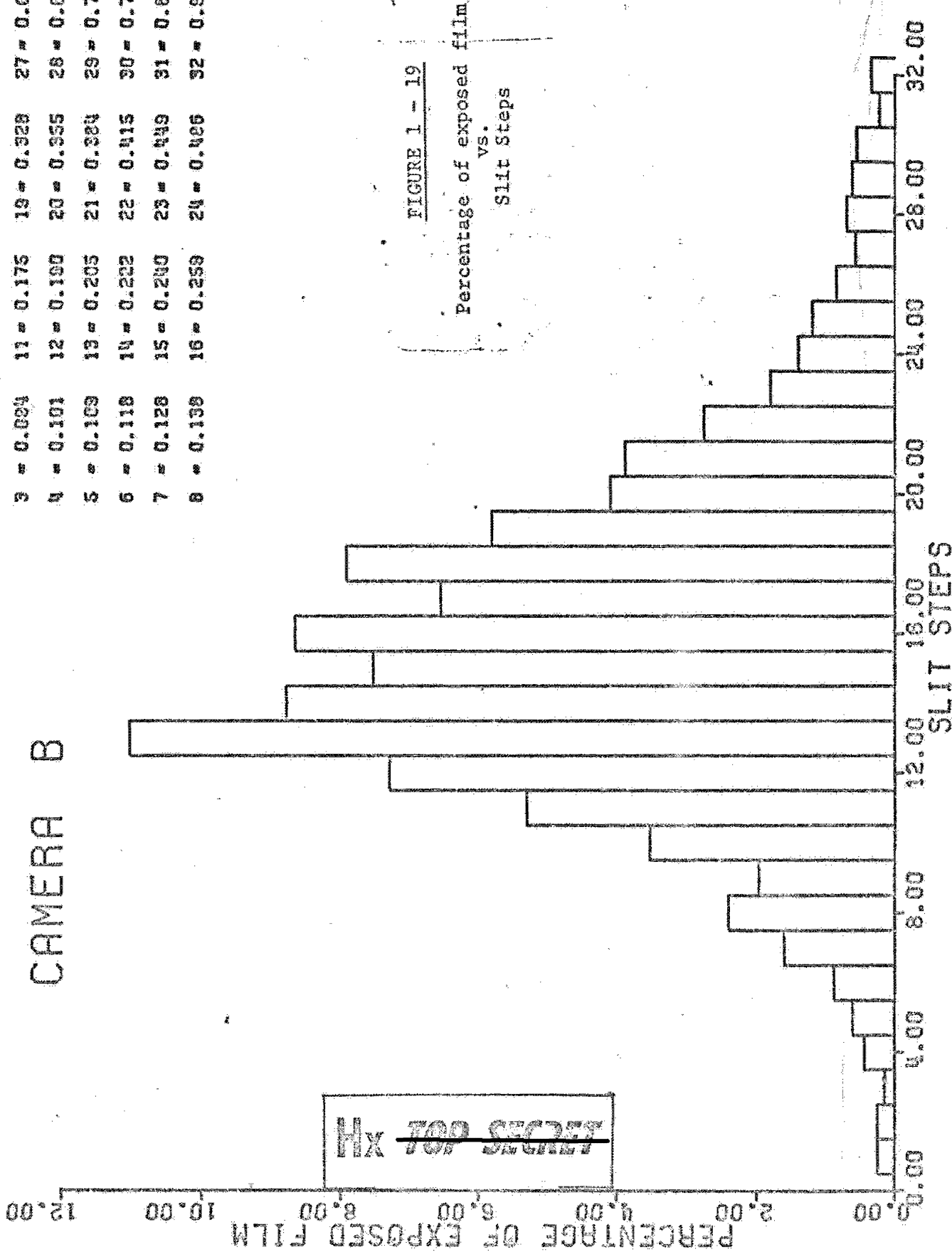
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MSN-1207

CAMERA B



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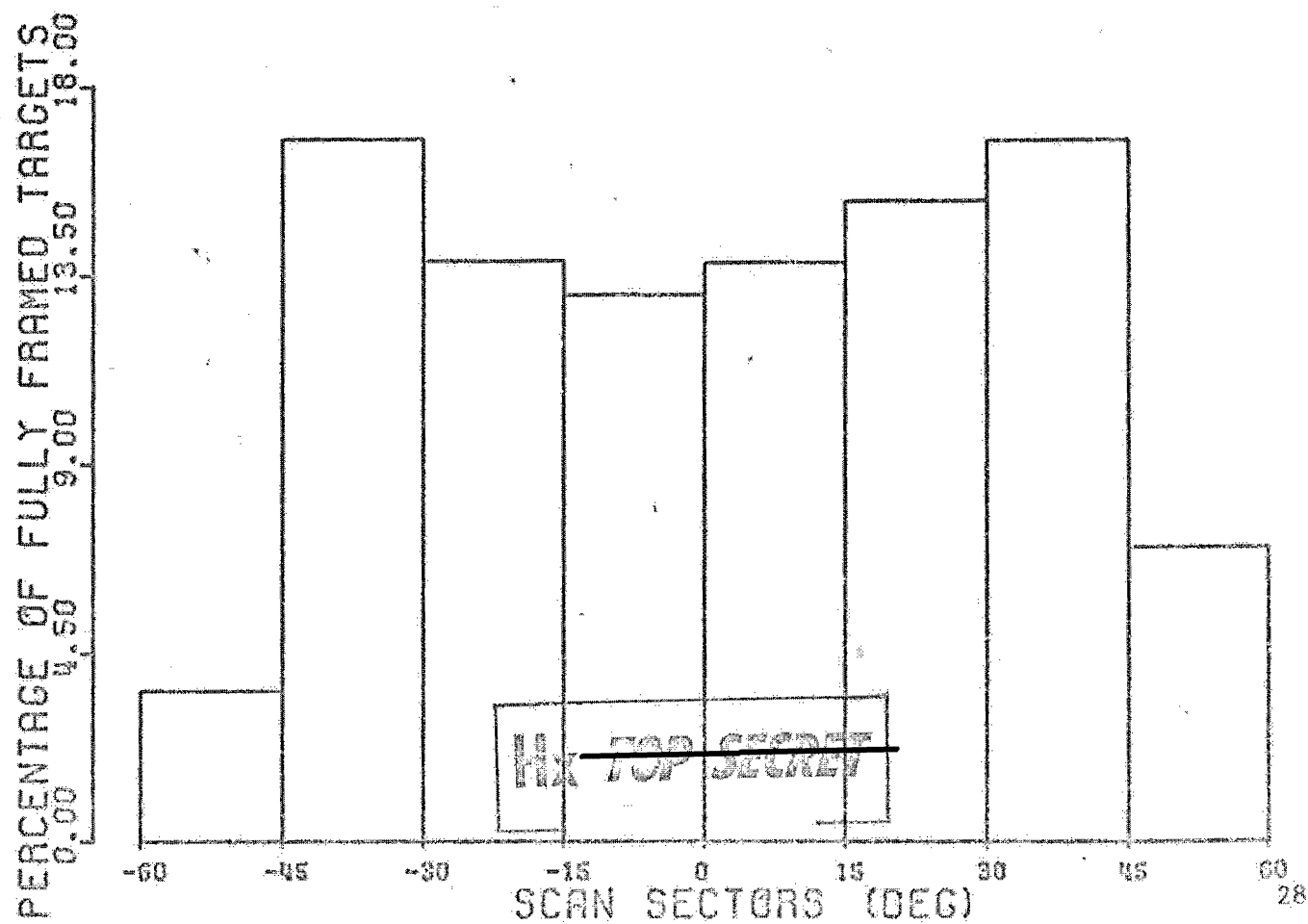
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FIGURE 1 - 20

Distribution of fully framed
Targets vs. Scan Sectors

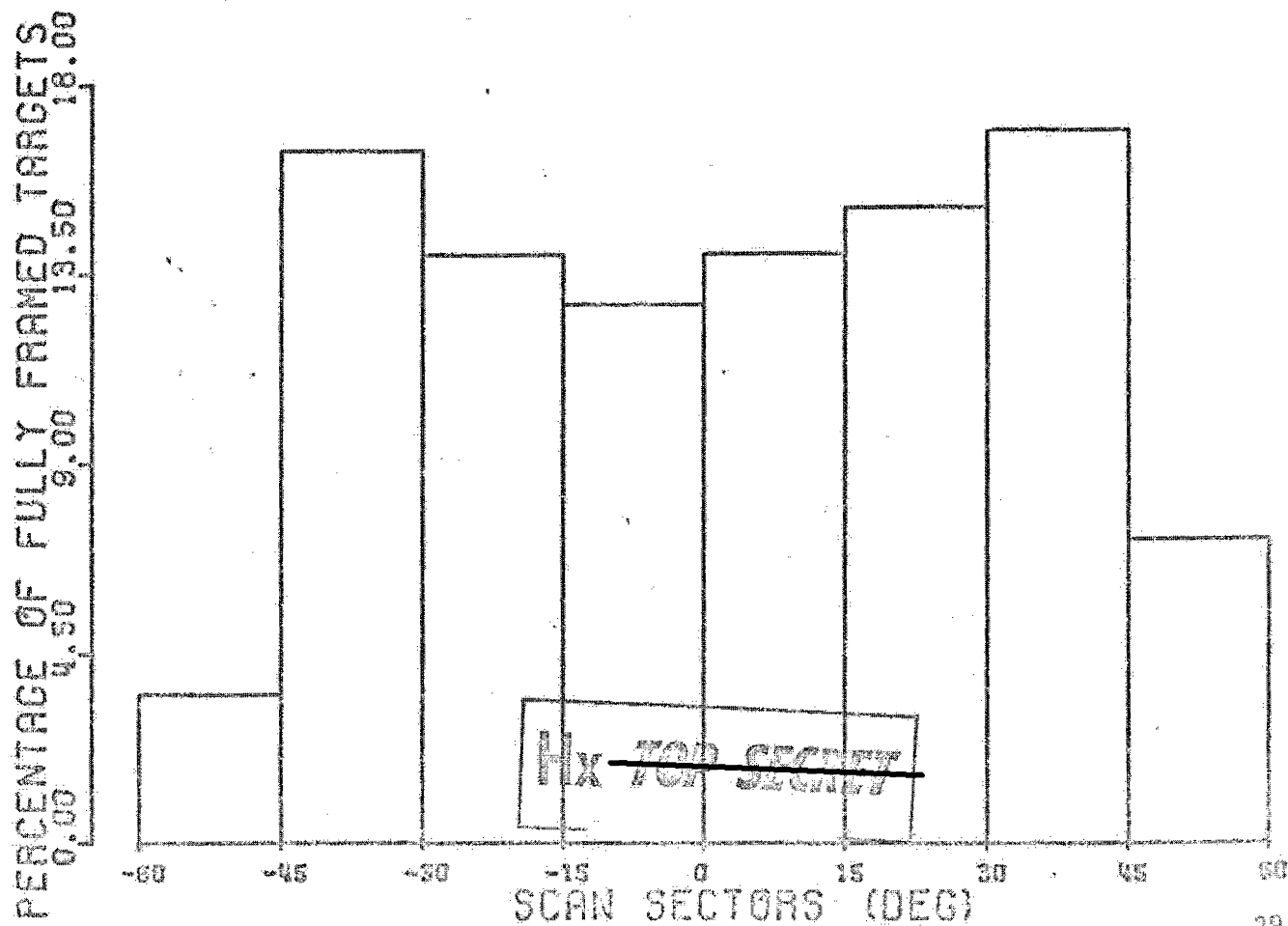
MSN-1207

CAMERA A



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FIGURE 1 - 21

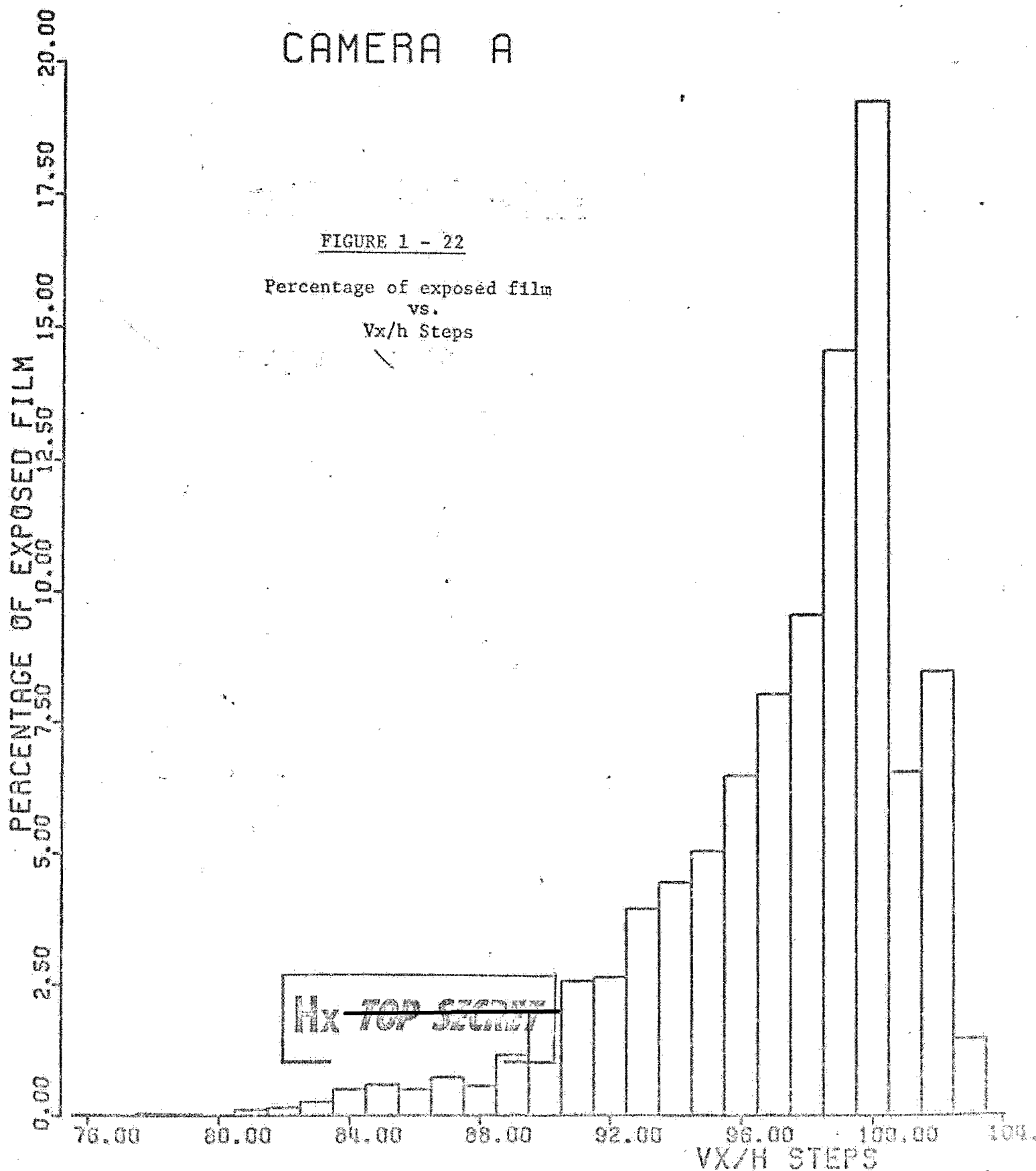
Distribution of fully framed
Targets vs. Scan Centers

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MSN-1207
CAMERA A

FIGURE 1 - 22

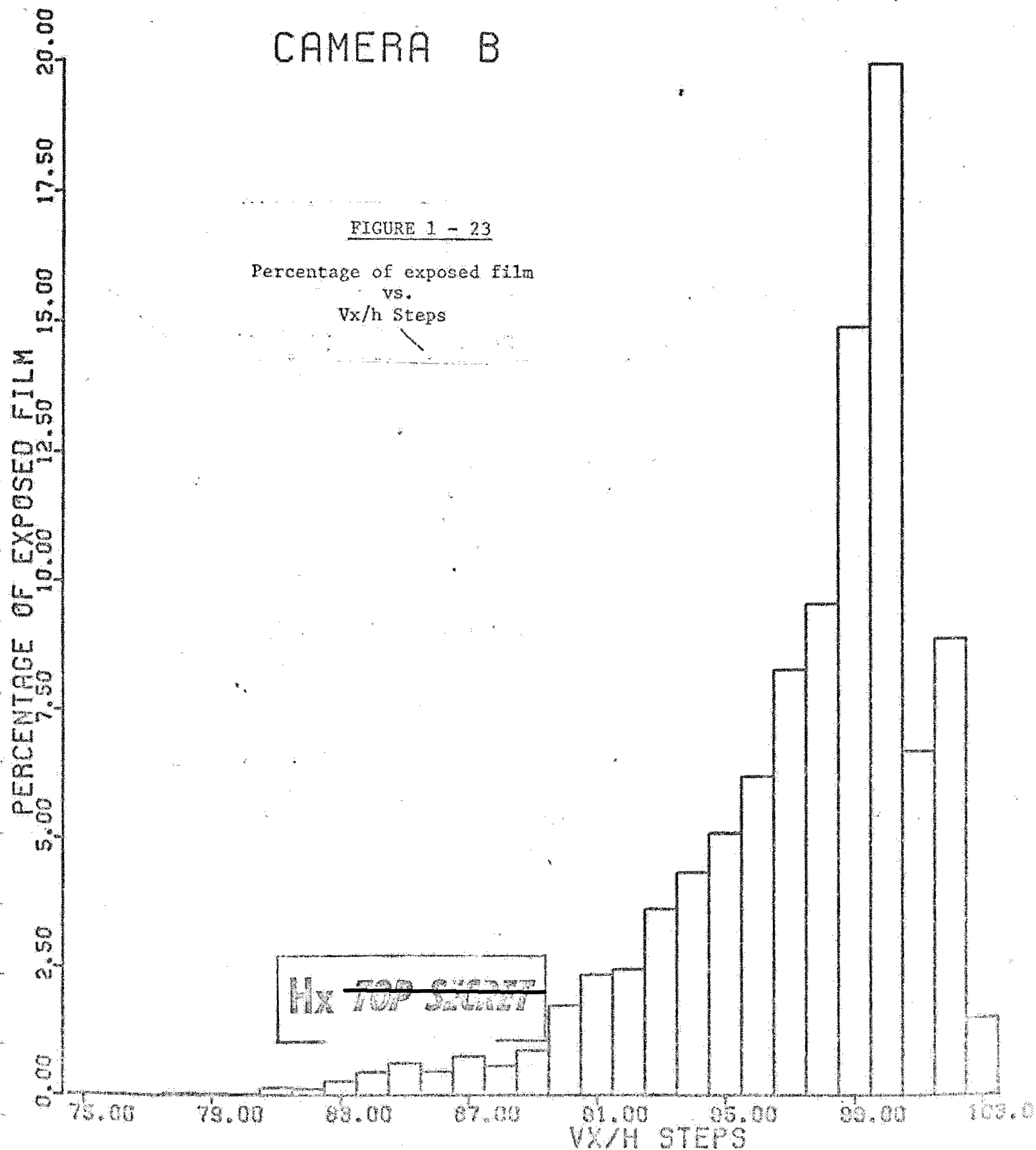
Percentage of exposed film
vs.
Vx/h Steps

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MSN-1207
CAMERA B

FIGURE 1 - 23

Percentage of exposed film
vs.
Vx/h Steps~~TOP SECRET~~

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2.0 SENSOR SYSTEM PERFORMANCE

2.1 Coarse Film Path

The coarse film path, consisting of the supply, looper, steerers and take-ups of both camera systems exhibited characteristic performance through-out the mission.

During pre-launch testing several instances of high tension and supply torque levels were observed on the forward camera at start-up. It was theorized, at that time, to be caused by the film sticking to the supply seal door. Examination of the material did not reveal any physical markings. Sensitometric tests and manufacturing quality examinations will be performed by the manufacturer.

2.1.1 Film Path Tracking

The system was operated with 0, ± 15 , or ± 30 degree scan centers, with no restrictions on scan angle and a maximum rewind of 5 ips.

Both take-ups were well stacked throughout the mission with the exception of three areas of mis-stacking in the aft camera during 1207-3. At the start of the third mis-stack, a film tear extending 2.9 inches into the web from the outboard edge was found. There were no abrasions, puncture or edge damage which may have indicated how the tear started. The imagery on both sides of the tear was good indicating that the film was not torn at the time of exposure in the platen. Evaluation of the telemetry data indicated a slight decrease in TU velocity, a deviation in the TU summed error and a slight increase in coarse tension. Analysis of these signatures locates the torn film at the RV-3 builder roller at the time the disturbance occurred. The cause of this tear is not presently known.

Evaluation of the film in RV-1 indicated a 40 foot segment, after a manufacturing splice, had edge scuffs and gouges. This could not be correlated to any abnormal behavior in either the coarse or fine film path through telemetry data evaluation. The film manufacturer is investigating the possible cause of this damage.

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2.1.2 Forward Camera Supply Depletion

During the last planned operation (699) the forward supply was depleted and the loss of tension in the film path initiated an emergency shutdown. A constant velocity sequence was run to pull the tag end of the film into the take-up.

2.1.3 Aft Camera Supply Depletion

The last planned operation (700) was completed with the system having a normal shutdown. At the start of the subsequent constant velocity sequence, the aft camera supply was depleted and the tag end of the film was pulled into the take-up.

2.2 Fine Film Path

The fine film path on the forward and aft camera functioned properly throughout the mission. However, the forward camera experienced areas of resonance.

2.2.1 Fine Film Path Tracking

The forward and aft camera tracking remained nominal throughout the mission.

2.2.2 Metering Capstan Summed Error Disturbances

High number of metering capstan summed error "out of limits" reports and smear slit evaluation on 1207-1 indicated the existence of resonance at V_x/h of .0474 and .0478. During 1207-2 the perigee altitude was raised 2 nautical miles in order to avoid the forward camera resonance. Smear slit evaluation on 1207-2 indicated that resonance was still present but a substantial improvement over 1207-1.

In addition to the resonance condition, there were several forward camera metering capstan summed error "out of limits" reports throughout the mission, but especially noticeable in segment 1207-4. The reports were associated with a random 78-Hz noise observed on the summed error T/M signal during photo mode. The source of the noise and its significance in terms of system operation is being investigated. There was no significant image degradation that could be related to those reports.

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.

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2.4 Sensor System Control

The sensor system control was accomplished throughout the mission on SCC II without anomalies or failures.

SCC I was not utilized during the active portion of the mission because of an unrepeatable short frame operation during pre-flight systems test.

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 1207 used pre-flight determined focus settings for both the 1414 black and white film and the SO-255 color film. The forward camera was set at a nominal 137 microns throughout the mission, while the aft camera was at 33 microns for the black and white and 63 microns for the color.

The LSFS system for SV-7 had shown, prior to flight, unreliable performance when operated within three hours of a previous operation or after five minutes of camera power on time had elapsed. Consequently, LSFS data was reviewed only once a day on Mission 1207 during the first primary operation of the day.

A plot of LSFS for both cameras versus mission day is shown in Figure 2-1. Day 5 and 11 readings were from Mono A operations and the previous B side readings were merely repeated for purposes of the figure. Similarly for day 6, the previous LSFS reading was repeated for the Mono B operation on that day. Days 7 through 11 represented color photography for the aft camera.

2.7 Instrumentation

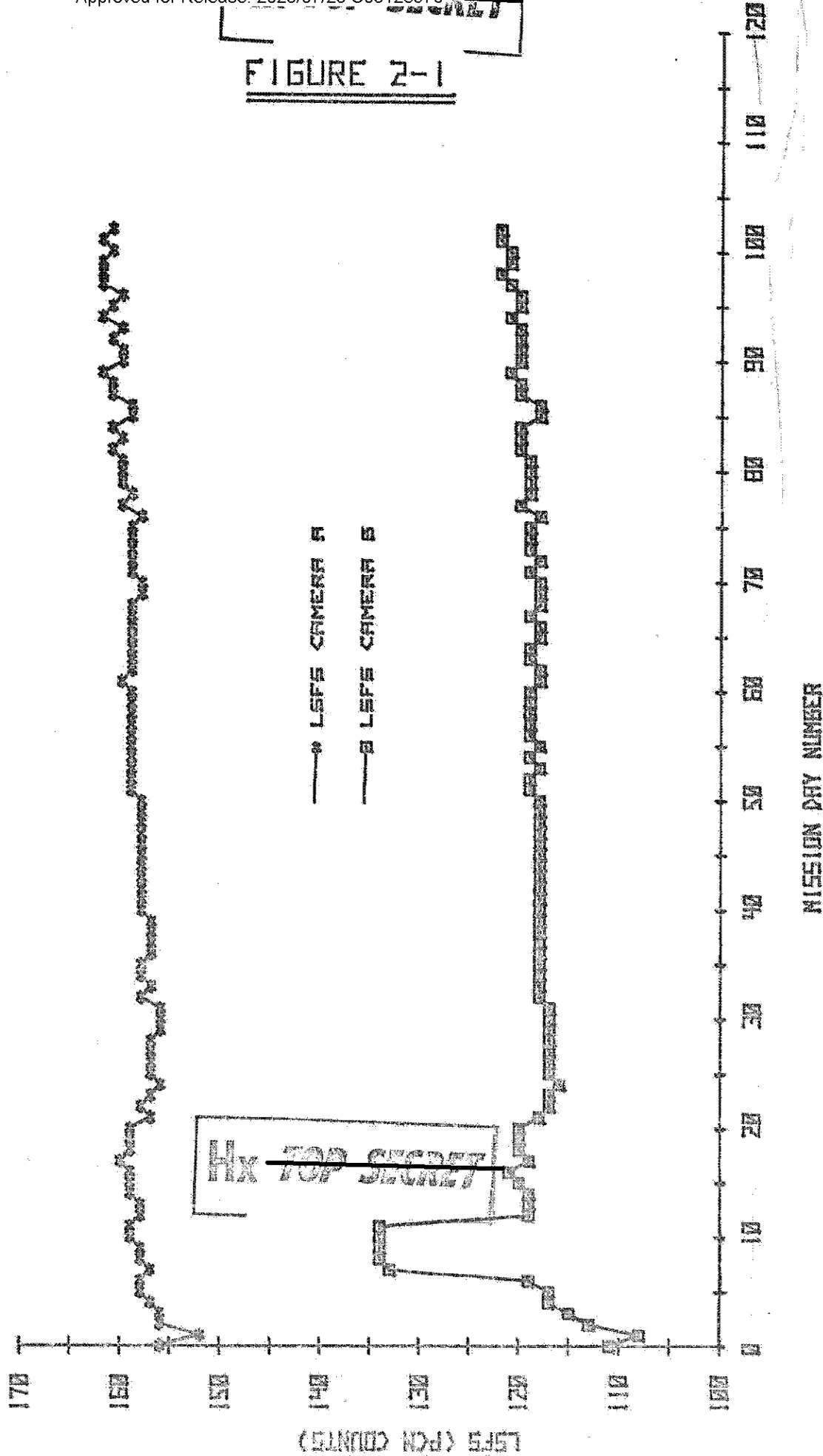
All telemetry instrumentation performed properly throughout the mission, with the exception of P257, the bulkhead and core pin temperature monitor for takeup 2B. This temperature point had been reading 68° when the vehicle was on the pad and steadily decreased slowly after liftoff to 54° by Rev 405. Other points having the same power source indicated no peculiarities and no other sensors in the area indicated abnormal temperatures.

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FIGURE 2-1

SV-7 DAILY LSFS DATA



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2.8 Pneumatics

The pneumatic system's nitrogen reserve status for mission 1207 was as shown below:

<u>Event</u>	<u>TANK A</u>			<u>TANK B</u>			<u>Total Reserve (lbs)</u>
	<u>(PSI)</u>	<u>Temp (°F)</u>	<u>Wt. (lbs)</u>	<u>Press (PSI)</u>	<u>Temp (°F)</u>	<u>Wt. (lbs)</u>	
Liftoff	3234	73	16.9	3262	72	17.1	34.0
End of Primary Mission (Rev 1654)	406	67	2.29	392	67	2.21	4.50

The computed PN+ use rate was a constant 0.025 lbs/min throughout the mission. The pneumatics consumption history is graphically presented in Figure 1-2.

2.9 Trend Analysis

Throughout Mission 1207 data samples were taken from selected operations and means and standard deviations were calculated and plotted to allow detection of any long term trends that might indicate system degradation. Of these points, only the A-side metering capstan summed error (P403) and film to bar sync velocity error (P451) signals showed frequent out of spec conditions. These occurrences are discussed in detail in Section 2.2 on Fine Film Path Performance.

The data points that were observed in the analyses 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 Summed 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 1207

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 3 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 3: 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, with the exception of the execution of the 00AA nominal settings. A loss of telemetry during a portion of the health check masked the execution of the 00AA nominal setting commands. Focal plane position and LSFS output indicated 137 microns and 156 counts, respectively, for the forward camera, and 33 microns and 111 counts respectively for the Aft.

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Rev 5: The 00AA nominal settings were again commanded and were verified in effect for operational photography which began on this Rev.

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-7 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:

<u>Test</u>	<u>Objective/Status</u>
1 Thru-Focus (1414)	Optimize Focus. Fully accomplished; confirmed focus (1414) was optimum in RV-1.
3A Smear Slits (1414)	Validate Image Motion Compensation settings. Fully accomplished; optimum biases determined in RV-1; confirmed in RV-2.
3B Smear Slits (S0255)	Evaluate smear slit for validating image motion compensation settings with color film. Completed in RV-1.
4 Color Corn Acquisitions	Evaluate and radiometrically calibrate S0-255. Satisfactorily completed in RV-1.
5 IR Color Corn Acquisitions	Evaluate image quality of FE3916. Accomplished in RV-4.
6 Lens MTF (1414)	Measure on-orbit lens MTF. Two acquisitions not usable; test cancelled after RV-3.
7 Tucson Acquisition	Standard scene for quality assessment. Satisfied only for RV-1, 2 and 4.

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	<u>Test</u>	<u>Objective/Status</u>
8	Color Thru-focus (S0-255)	Optimize Focus. Fully accomplished in RV-1; confirmed focus (S0-255) was optimum.
9	Tri-Bars for Resolution	Photo quality assessment. Satisfied only for RV-1, 2 and 4. Acquisitions common with Test 7.
10	Smear versus Scan Angle (1414)	Assess smear as a function of scan angle location. Fully accomplished mission goal.
11	Dense Culture Acquisition (1414)	Photo/EM correlation. Fully accomplished; system performance verified.

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3.4 Mission 1207-1 Special Events

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
0				UNCAGE/REDUNDANT UNCAGE		
0				STOW A/STOW B		
1				UNCAGE VERIFY		
2				INHIBITED CV		102
3				SCC II HEALTH CHECK		186
3				OOAA NOM SET		
5	4			OOAA NOM VERIFY DUE TO DATA DROPOUT REV 3		
8				SS ENGINEERING TEST		66
15	15	1	85	THRU F +16, +8, +16, 0 HOUSTON	80	31
32	22	7/9		TUCSON ACQUISITION	99	
47	27	1		1414 THRU F -8, 0 ATLANTA	99	30
65	39	1	25	1414 THRU F -16, -8, 0, +8 SAN FRANCISCO	00	37
80				AFT CAMERA SET FOR S0255 W2E FILTER, OOAA NOM		

3.4 Mission 1207-1 Special Events-Cont'd.

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
80	50	8	65	SO255 THRU F -14, 0, +14 DALLAS/FT WORTH	99	60
81	51	1	65	1414 THRU F -16, -8, 0 (A) SO255 SMEAR SLIT (B) LOS ANGELES	60	31
112	68	1 8	90	1414 THRU F +8, 0 (A) SO255 THRU F -14, 0 (B) BIRMINGHAM	99	30
113	69	4	75	SO255 TARGET GALLUP	99	30
129	77	4	65	SO255 TARGET TUCUMCARI	10	33
130	79	1 8	40	1414 THRU F -8, -16, 0 (A) SO255 -14, 0 (B) EVERETT/SEATTLE	00	40
136				AFT CAMERA SET FOR 1414 W2E FILTER OOAA, NOM		
146	87	10	95	1414 SMEAR VS SCAN, SAN FRANCISCO	85	65
154	92			PN EQUALIZATION		
160	95	3A		1414 SMEAR SLIT		124
			75	BOSTON	40	
			65	PROVIDENCE	75	

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3.4 Mission 1207-1 Special Events-Cont'd.

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
162	96	1	25	1414 THRU F +16, 0, -8, -16 RIVERSIDE/SAN DIEGO	95	129
173	105	1	95	1414 THRU F +16, +8, 0, -8, -16 PARIS/LESQURI	99	68
225	115	1	00	1414 THRU F +16, 8, 0, -8 NEW YORK	00	34
225	116			PROTECTIVE WRAP FLORIDA		179
				1207-1 FOOTAGE		1275
				ACCUMULATIVE FOOTAGE		1275

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3.5 Mission 1207-2 Special Events

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
226				TRANSFER TO TU 2-PREP I		
227				COMPLETE TRANSFER-PREP II		61
313	146			PN EQUALIZATION		
339	156	3A	70	1414 SMEAR SLIT CINCINNATI	95	33
355	166	3A	75	1414 SMEAR SLIT TAMPA/ST PETERSBURG	65	31
371	176	3A	90	1414 SMEAR SLIT NEW YORK/PHILADELPHIA	99	117
405	186	7/9	85	TUCSON ACQUISITION	80	
454	198	3A	90	1414 SMEAR SLIT LOS ANGELES	99	86
		6	75	1414 LENS MTF INYOKERN	99	
461	200			PN EQUALIZATION		
517	223	10	75	1414 SMEAR VS SCAN NEW YORK	10	84
1207-2 FOOTAGE						412
ACCUMLATIVE FOOTAGE						1687

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3.6 Mission 1207-3 Special Events

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
599				TRANSFER TO TU 3-PREP I		
600				COMPLETE TRANSFER-PREP II		61
616	253	6	99	1414 LENS MTF QUARTZSITE	99	50
681	279	10	70	1414 SMEAR VS SCAN LOS ANGELES	70	86
719	296			PN EQUALIZATION		
931	379					
	380			PN EQUALIZATION		
1032	423			PROTECTIVE WRAP		
1207-3 FOOTAGE						197
ACCUMLATIVE FOOTAGE						1884

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3.7 Mission 1207-4 Special Events

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
1037				TRANSFER TO TU 4-PREP I		
1038				COMPLETE TRANSFER-PREP II		61
1092	468			PN EQUALIZATION		
1184	511	10	90	1414 SMEAR VS SCAN (POS)	95	128
			75	SACRAMENTO SF BAY AREA	85	
1232	529	7/9	99	TUCSON ACQUISITION	99	30
1252	540			PN EQUALIZATION		
1263	552	11	65 65	1414 TM CORRELATION BALTIMORE WASHINGTON	25 70	133
1280	562	10	75	1414 SMEAR VS SCAN (NEG) DALLAS/FT WORTH	99	74
1281	563	11	90	1414 TM CORRELATION LOS ANGELES	99	121
1344	594	11	80	1414 TM CORRELATION NEW YORK	50	128
1362	601	10	95	1414 SMEAR VS SCAN (NEG) LOS ANGELES	99	79
1400	617			PN EQUALIZATION		

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3.7 Mission 1207-4 Special Events-Cont'd.

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
1409	620	10	90 90	1414 SMEAR VS SCAN (POS) NEW YORK PHILADELPHIA	99 99	112
1563	683			PN EQUALIZATION		
1644	694			AFT CAMERA SET FOR FE3916 WL2 FILTER, OAAA NOM		
1650	699			SOLAR (MONO A)		180
1653	700	5	55	FE 3916 IR (MONO B) HOUSTON	95	29
1653				PREP II/CV		DEPLETED
1654				CV		DEPLETED
1207-4 FOOTAGE					1119 (FWD)/968 (AFT)	
ACCUMLATIVE FOOTAGE					3003 (FWD)/2852 (AFT)	

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3.8 Solo Phase

The solo phase of Mission 1207 was utilized to perform several tests as follows.

3.8.1 SCC-1 Health Check

The operational health of SCC-1 was verified by commanding different values of Vy from each decoder during the solo phase after selecting SCC-1. The execution of the proper Vy value confirmed SCC-1 selection and operability.

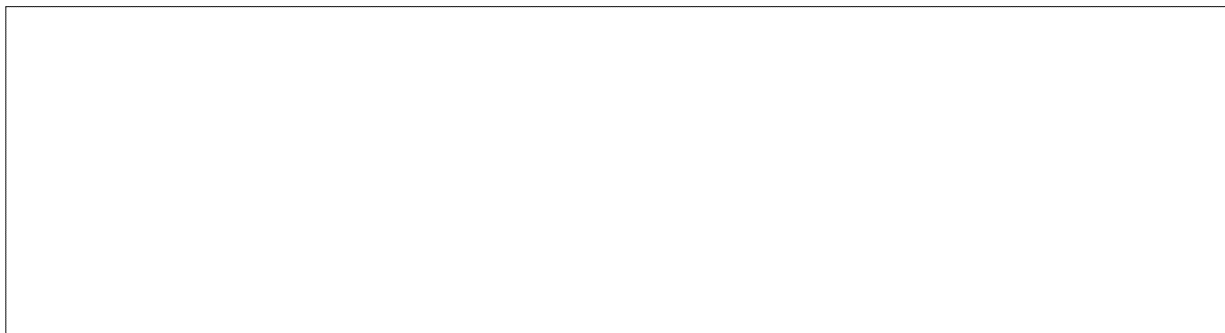
3.8.2 SS Thermal Test - Dark

Evaluation of thermal response of the optical systems directed toward "dark space" was performed with the maneuver and optical bar rotation on Rev 1696 and thermal records on Revs 1695 through 1701.

Several items defined in the Solo Plan as tests were run during the active portion of the Mission as follows.

3.8.3 Solar Photography

The solar photography test, Mission Op 699, was accomplished on Rev 1650 as a 9 frame fwd camera monoscopic operation. Preliminary PFA analysis indicated that the sun was imaged in all 9 frames with locally severe fogging occurring in all frames within ± 10 degrees of the sun image. No physical damage to the film was in evidence.

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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 1207-1, 1207-2, 1207-3 and 1207-4 indicated in a general sense the capability of the SS Optical System to provide the specified photographic performance. Mission 1207 was a fall launch; however, due to the mission length the flight extended well into late winter with its characteristically lower solar elevations at the northern latitudes, snow cover and extensive ground haze; Mission Segments 1207-2 and 1207-3 experienced all of these weather conditions. Mission Segment 1207-1 contained 5K feet of SO-255 and 1207-4 contained 500 feet of FE 3916.

The PFA Team reported that the general overall image quality of both the Forward and Aft looking cameras for the entire mission ranged from very good to poor with both cameras exhibiting comparable quality.

A discussion of the image quality as a function of the mission progress is provided, abstracted in part from the Rebound 831 messages.

4.1.1. Mission Segment 1207-1

The overall image quality of both cameras ranged from very good to fair, with the majority rated as good. Photography not affected by weather or haze produced imagery of sufficient quality to be viewed at high magnification (140X). Visual edge match data indicated that both cameras had uniform performance across the field and that the launch settings of focus were optimum. The best image quality of this mission segment was comparable to the best from previous missions. Two 51/51 tri-bar corn targets were acquired on the FWD Camera and one on the AFT Camera on 1414 material. The data was as follows:

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CAMERA	OP	FR	SCAN	FIELD	PLATEN POS	UNADJ GRD(FT)		2:1 ADJ GRD(FT)	
						IT	XT	IT	XT
FWD	22	3	24.0	2.0	137	2.25	2.94	2.75	3.62
FWD	69	3	5.3	-1.3	137	2.00	2.43	2.33	2.91
AFT	22	4	25.2	0.4	33	2.25	2.62	2.70	3.13

5007 feet of SO-255 color was acquired with the Aft Camera. The image quality of the SO-255 overall, ranged from very good to poor with most imagery considered good. The color balance of the original appeared to be slightly yellow-green. The very good imagery was the best quality SO-255 acquired with the Hexagon System. Subsequent smear slit measurements indicated a cross track film velocity error of -.050 IPS too slow. Subjective analysis indicated that focus was set properly. Most of the color operations were approximately 1/3 stop underexposed. Several Ops acquired at low solar elevation were slightly under exposed, which resulted in poor image quality.

One 51/51 tribar corn target was acquired on the Aft Camera on SO-255 material. The data was as follows:

CAMERA	OP	FR	SCAN	FIELD	PLATEN POS	UNADJ GRD (FT)	
						IT	XT
AFT	69	3	6.1	2.0	63	2.44	2.82

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

Exposure Assessment:- Microdensitometer analysis of five vegetation surround urban scenes on 1414 indicated exposure of both cameras to be within .05 log E of the 1.0 density aim criteria. However, an apparent exposure imbalance between cameras was observed and was correctable by the recommended two-tenths (.2) stop exposure reduction on the Aft Camera. In general the microdensitometer measurements agreed with subjective appraisals. Subjective assessment of culture with lightly exposed surrounds indicated underexposure, however, microdensitometer data indicated correct exposure for the culture area.

It should be noted that acquisitions at extremely low solar elevations were underexposed due to camera slit width limitations.

The SO-255 material was subjectively rated to be under exposed by .10 Log E. Limited scan data (2 urban scene scans) agreed with this assessment, averaging .06 Log E under exposure based on the 1.5 density aim green layer density criteria.

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Analysis of urban area imagery within the new desert polygon (conus polygon) indicated benefits from its use. Although only three of the seven scenes scanned within the polygon were given the one-half stop bias, extrapolation of density data indicated that within the conus area scenes averaged .15 Log E brighter than scenes evaluated outside the area.

4.1.2 Mission Segment 1207-2

The image quality of both cameras ranged from very good to poor with the majority rated as fair. Even though the best photography of 1207-2 was considered comparable to the best of 1207-1, there was an overall decrease in image quality on 1207-2. This decrease in image quality was due primarily to an overall increase in haze levels. In addition, the lower solar elevation (under 20 degrees) acquisitions in northern latitudes contributed to the general image quality reduction by lowering the overall scene contrasts.

One 51/51 tribar corn target was acquired on both the FWD and Aft Cameras. The data is as follows:

CAMERA	OP	FRAME	SCAN	FIELD	PLATEN	UNADJ		2:1 ADJ	
						GRD(FT)		GRD(FT)	
						IT	XT	IT	XT
FWD	186	4	1.5	-0.5	137	1.75	1.94	2.32	2.60
AFT	186	4	1.5	-2.5	33	2.00	2.83	2.40	3.56

Exposure Assessment:- Microdensitometer analysis of vegetation surround urban industrial scenes (8 FWD, 6 AFT) indicated satisfactory exposure on both cameras. The two count bias instituted on Op 138 was found to give an improved exposure balance between cameras. Thus no general exposure change was recommended.

Analysis of the stepped snow bias was made from 18 frames with various amounts of snow visible. The bias was found to lower the mean scene density to a level averaging about .15 Log E above that of the vegetation surround regardless of snow depth, thus achieving its purpose. In no case was the mean scene density found to be less than 1.0 density (vegetation surround scene aim).

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4.1.3 Mission Segment 1207-3

The overall image quality of both cameras ranged from good to poor with the majority rated as fair to poor. There was an overall decrease in image quality on 1207-3. The best photography of 1207-3 was of lower quality than the best of 1207-2. This decrease in image quality was attributed to high haze levels, an increase in snow cover, overall generally poor weather, and a greater number of low solar elevation acquisitions (less than 20 degrees). The low solar acquisitions required wider slits and thus subjected the imagery to increased amounts of smear. Visual edge match (minor axis profile) analysis also indicated a decrease in performance for this RV.

The following data represents a comparison of some adverse acquisition conditions for the first three buckets of this mission.

Percent of Exposed Film Acquired with Slits Larger than 0.48 Inches:

1207-1	1207-2	1207-3
9 percent	13 percent	25 percent

Percent of Exposed Film Acquired Below 20 Degrees Solar Elevation:

1207-1	1207-2	1207-3
16 percent	30 percent	46 percent

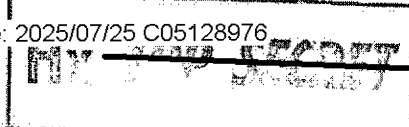
Percent of Frames with Predicted Snow Cover:

1207-1	1207-2	1207-3
10 percent	25 percent	33 percent

Exposure Assessment: - Microdensitometry analysis of snow surround imagery indicated that the present snow bias algorithm is satisfactory. This was confirmed by subjective appraisal of original negative imagery. Additional Micro-D scanning will be done to lend further credence to current snow bias algorithm.

Subjective analysis of samples of original negative material indicated no other exposure problems.

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4.1.4 Mission Segment 1207-4

The image quality of both cameras ranged from good to poor with the majority rated as fair. Although the best photography of 1207-4 is not as good as the best of 1207-1, it is clearly better than that of 1207-3.

The image quality for a large portion of this segment was significantly improved. This negated the concern that the performance of the camera system was degrading as a function of mission life. The operations acquired at high latitudes with low solar altitudes (below 20 degrees) were still severely degraded. This is attributed to the acquisition parameters for the areas: i.e. snow, haze, low light levels, and the resultant smear from using wider slits; however, the percentage of film exposed at these latitudes was decreased from 25 percent for 1207-3 to 15 percent for 1207-4 possibly accounting for some of the 1207-4 improvement.

The acquisitions of low latitude geographic areas indicated a marked improvement over the image quality from 1207-3. Contributing factors were: higher solar elevations, improved weather conditions resulting in less haze, and increased cloud free coverage in these target areas.

Visual edge match data showed that the camera system performance had not changed from 1207-1; resolving power values were virtually identical between 1207-1 and 1207-4. Also, the EMPFA review of the telemetry data showed no change in the electro-mechanical performance of the camera systems. Thus the lower quality imagery was attributed to the acquisition conditions discussed above.

A review of some adverse acquisition conditions for all four buckets indicate some interesting comparisons.

1. Percent Exposed Film Acquired With Slits Larger Than 0.48 Inches:

1207-1	1207-2	1207-3	1207-4
9	13	25	14.9

2. Percent Exposed Film Acquired Below 20 Degrees Solar Elevation:

1207-1	1207-2	1207-3	1207-4
16	30	46	34.3



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3. Percent Of Frames With Predicted Snow Cover:

1207-1	1207-2	1207-3	1207-4
10	25	33	44.4

Mission segment 1207-2 and 1207-4 are very similar in terms of percent exposed film acquired with slits larger than 0.48, and also in terms of percent exposed film acquired below 20 degrees solar elevation. In point of fact the image quality in 1207-4 appeared in general very similar to 1207-2.

These statistics were combined in CRYSPER predictions for each of the four segments, and are graphically depicted in Figures 4-1 through 4-4. This analytical presentation very accurately depicts the performance profile experienced. Figure 4-5 summarizes the CRYSPER predictions for the 1207 mission as a whole.

One 51/51 tri-bar corn target was acquired on each of the cameras the data was as follows:

CAMERA	OP	FRAME	SCAN	FIELD	PLATEN	UNADJ		2:1 ADJ	
						GRD.(FT)		GRD.(FT)	
			ANGLES			IT	XT	IT	XT
FWD	529	2	-21.4	-2.2	137	1.75	2.22	2.25	3.02
AFT	529	3	-20.6	+0.7	33	1.85	2.33	2.32	3.01

500 feet of FE-3916 was acquired with the Aft Camera. The overall image quality was considered good for FE-3916, but significantly less than that of the conventional black and white material (1414) utilized on the Forward Camera. This lower image quality was due primarily to the inherent lower resolution capability of the IR color film. The color balance of the original positive was an overall cyan cast. The color dupes, however, exhibited excellent color balance and color saturation. The overall exposure of the original positive was considered good. Approximately 50 percent of the acquired frames exhibited heavy snow conditions.

Subjective analysis indicated that focus was set properly, and that the cross track film velocity bias was proper.

One 51/51 tri-bar corn target was acquired on the Aft Camera on the FE-3916 film. The data was as follows:

CAMERA	OP	FRAME	SCAN	FIELD	PLATEN	UNADJ	
						(GRD)	
			ANGLES			IT	XT
AFT	700	2	+6.0	-0.6	63	5.1	5.9

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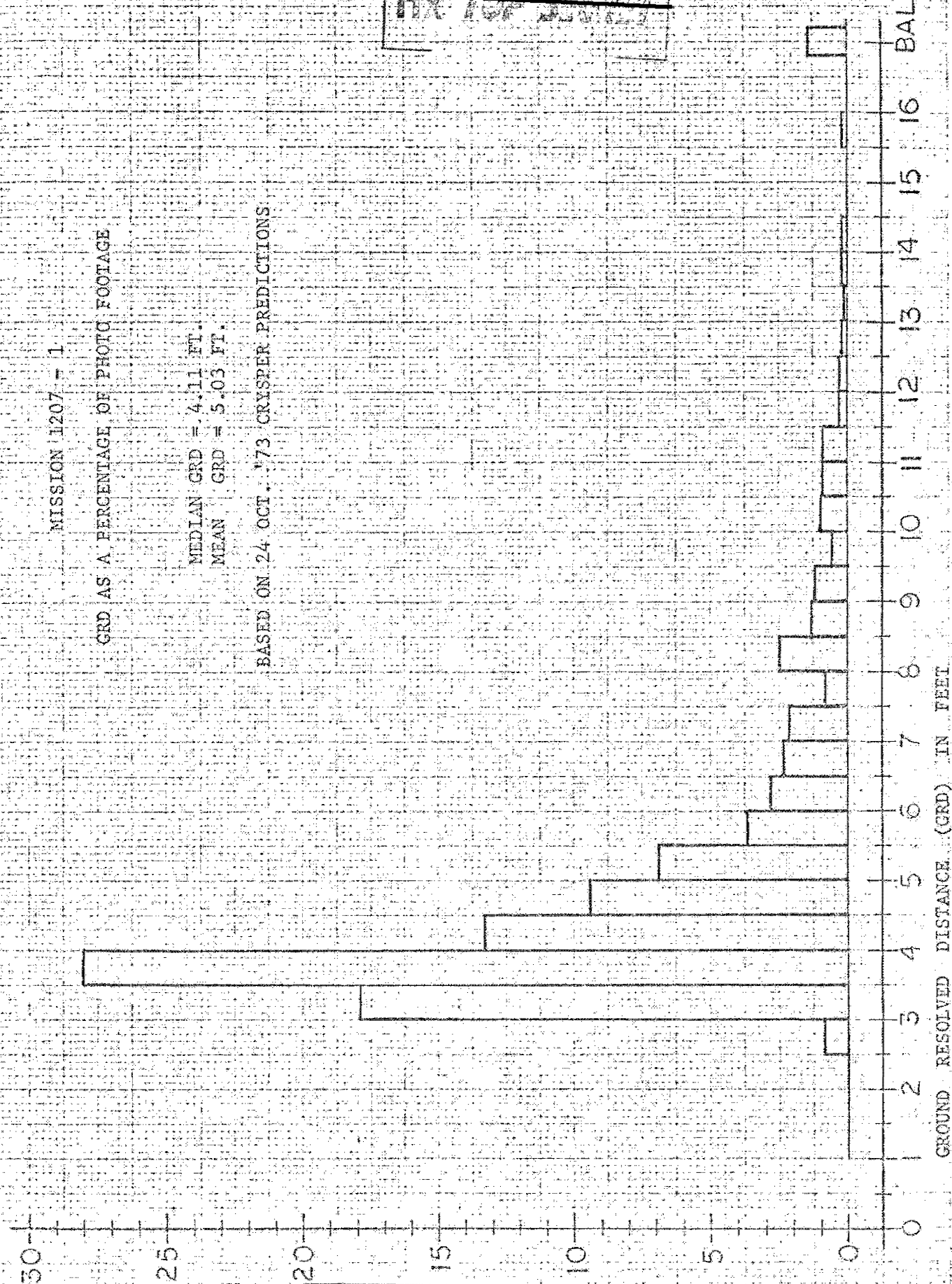
MISSION 1207 - 1

GRD AS A PERCENTAGE OF PHOTO FOOTAGE

MEDIAN GRD = 4.11 FT.

MEAN GRD = 5.03 FT.

BASED ON 24 OCT. '73 CRYSPER PREDICTIONS.

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PERCENT OF PHOTO FOOTAGE

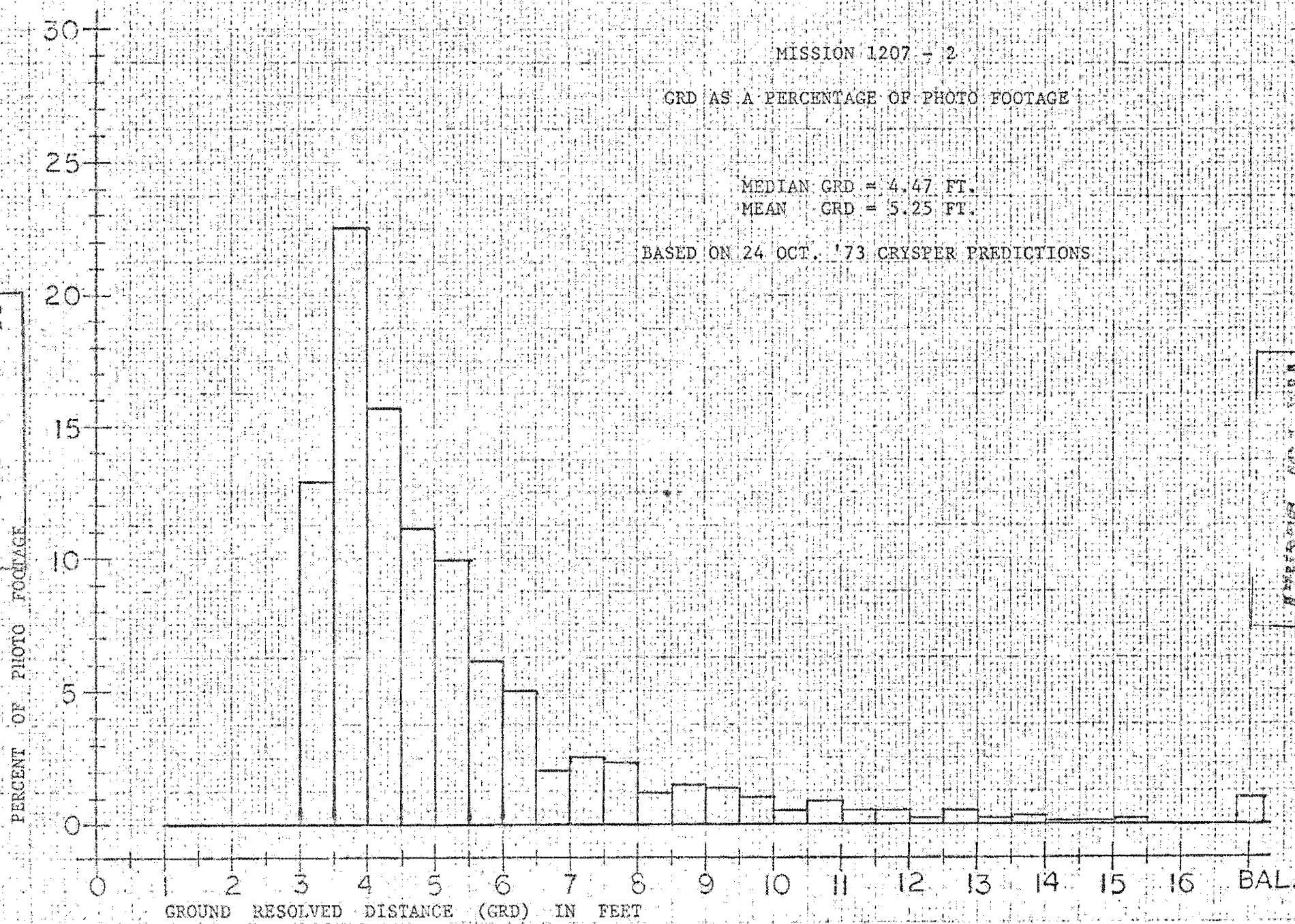


Figure 4 - 2

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MISSION 1207 - 3

GRD AS A PERCENTAGE OF PHOTO FOOTAGE

MEDIAN GRD = 5.03 FT.

MEAN GRD = 5.92 FT.

BASED ON 24 OCT. '73 CRYSPER PREDICTIONS

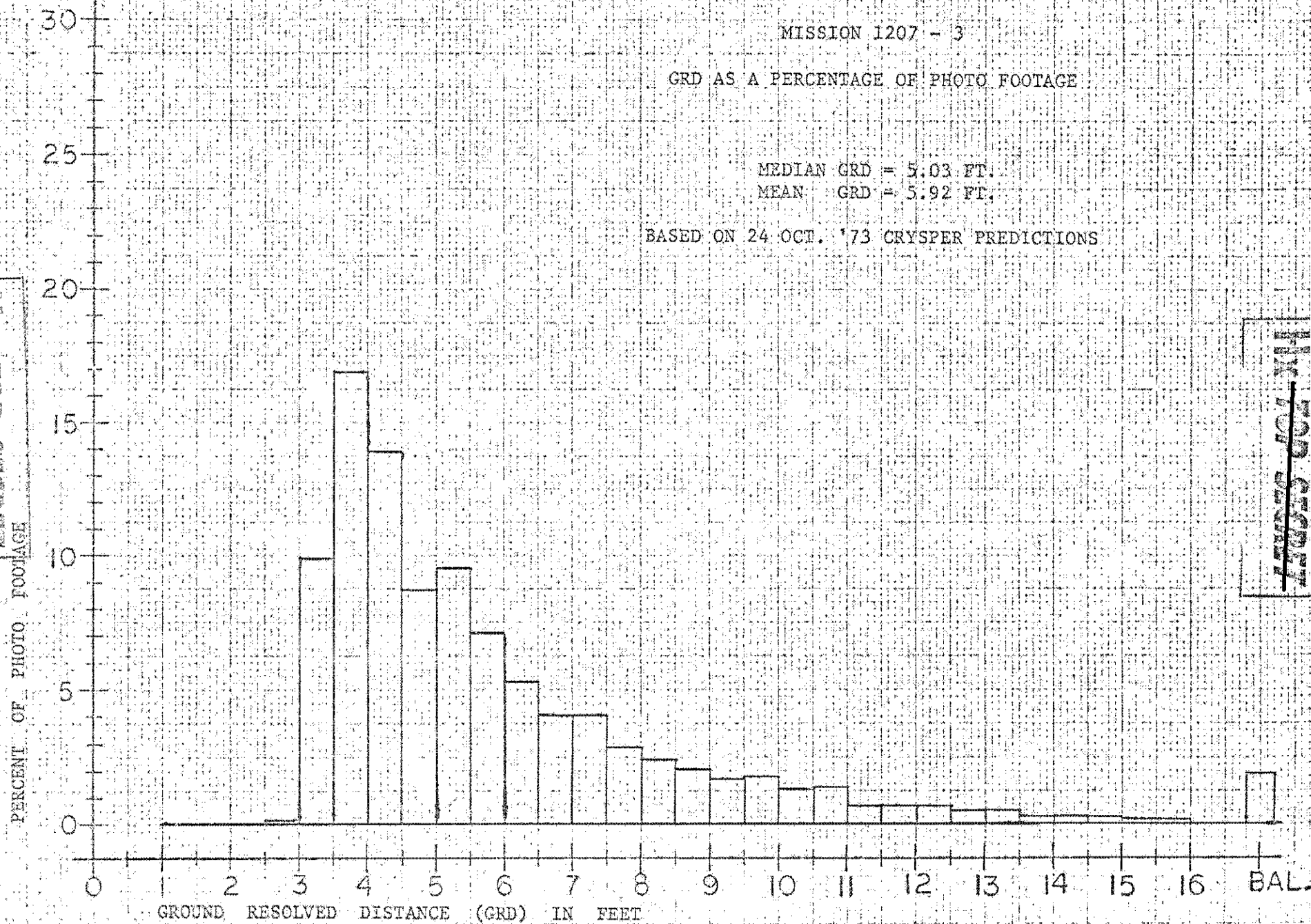


Figure 4 - 3

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MISSION 1207 - 4

GRD AS A PERCENTAGE OF PHOTO FOOTAGE

MEDIAN GRD = 4.53 FT.

MEAN GRD = 5.55 FT.

BASED ON 24 OCT. '73 CRYSPER PREDICTIONS

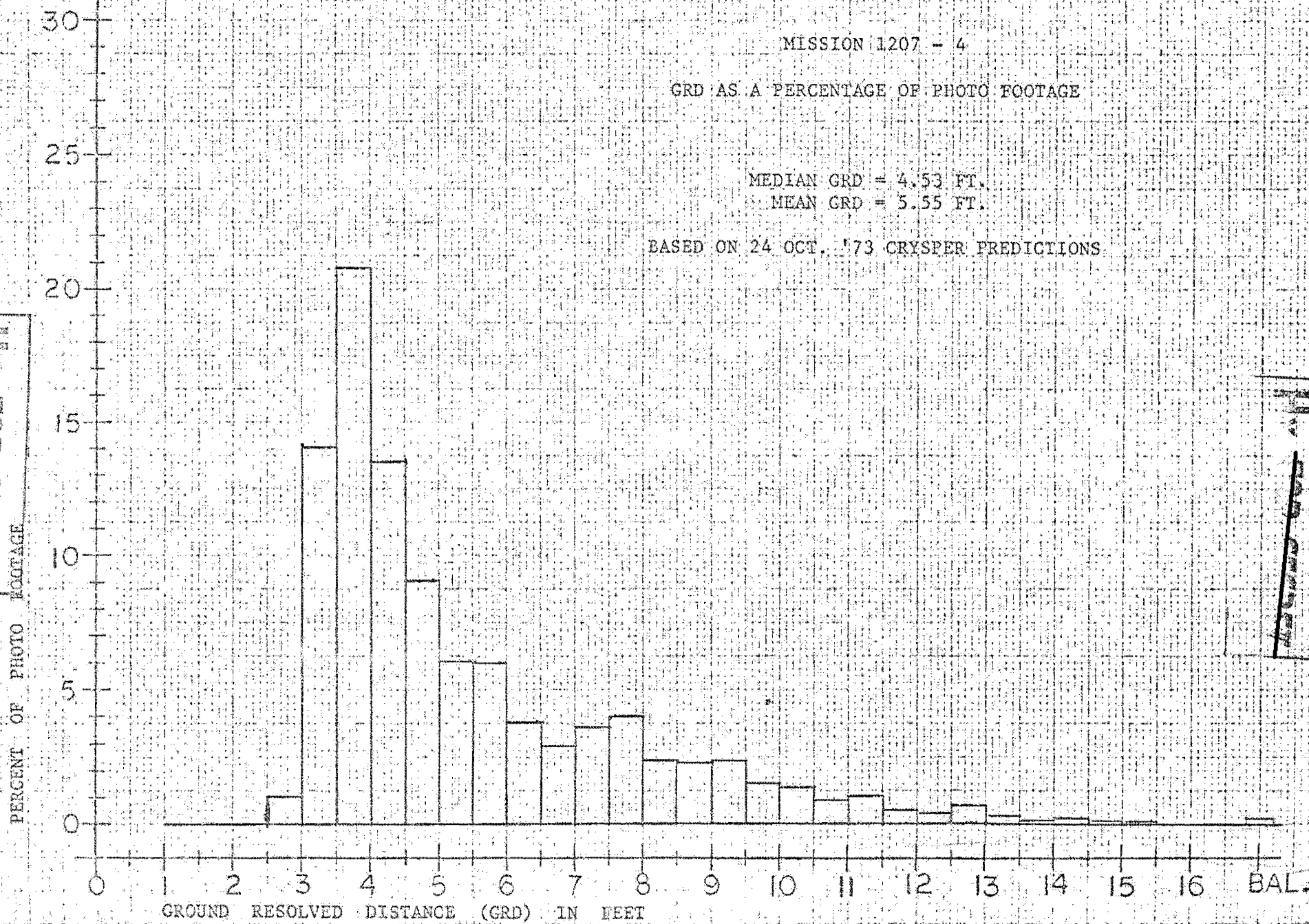


Figure 4 - 4

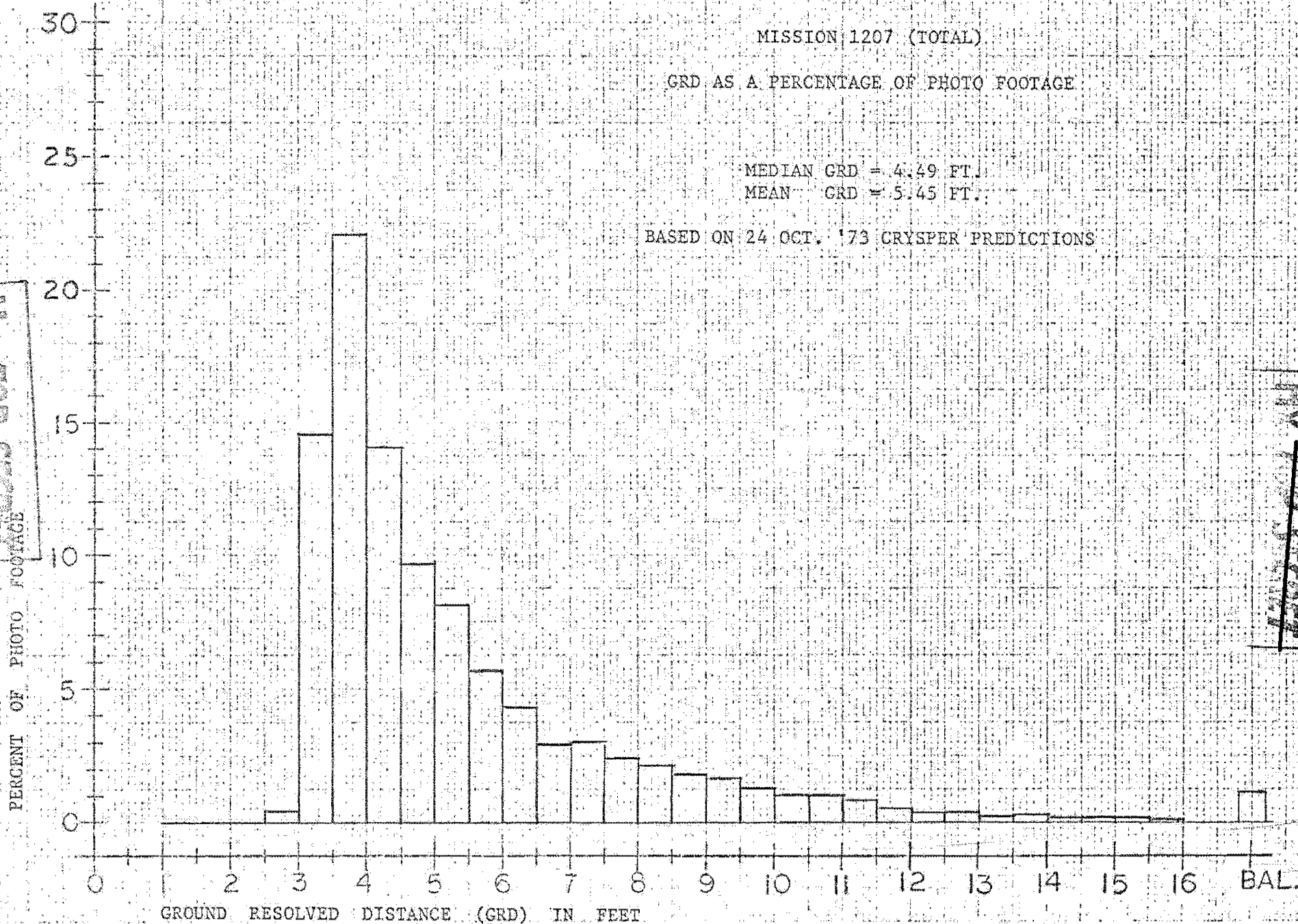


Figure 4 - 5

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Exposure Assessment:- Subjective evaluation of the FE-3916 color IR indicated correct exposure. This was verified by microdensitometer analysis of two cultured domestic areas. These two frames indicated a slight underexposure of - 0.08 Log E units from the aim density of 1.50.

Because of microdensitometer limitations these measurements were performed on the magenta dye layer (red sensitive) instead of the yellow dye layer (green sensitive) for which the exposure recommendation is made. Correctness of the conclusions drawn will be verified by additional scanning of another Micro-D in the near future.

4.2 Take-Up Survival Thru Recovery

All RV/TU assemblies fully demonstrated their ability to maintain light tight integrity during separation, re-entry, recovery, and transportation. As in previous missions the core locking pins sheared in most recoveries causing film to be spilled-off and subsequently damaged. A greasy substance, was present in two of the RV's and a small amount of particulate was collected from the inside of all RV domes.

Following is a description of the related de-filming observations and associated problems for each mission segment.

4.2.1 Mission 1207-1

The RV/TU arrived at the processing site in good condition. A small amount of particulate was collected from the inside of the dome. On the inside of both cannister retaining rings and for about 1.5 inches into the cannister wells, a greasy substance was present. Both core locking pins were engaged and intact. Film was well centered and well stacked on both rolls.

4.2.2 Mission 1207-2

The RV/TU arrived at the processing facility in good condition. Both core locking pins were engaged, but sheared. Approximately 90 ft. of FWD and 104 ft. of the AFT had spilled from the stack. This film incurred minimal damage and was respooled onto the TU by hand to permit subsequent defilming by normal procedures. The cluster roller assembly on the AFT roll was still threaded with film. Except for the spillage, both rolls were well-stacked, and well-centered on the TU cores.

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A small amount of particulate was collected from the RV dome. Both cannister wells contained a sticky substance which has been identified as thermally conductive grease used to prevent electronics overheating.

As a result of both take-up core pins shearing, approximately 100 feet of film on both cameras was despoiled into the RV cannister during recovery operations. During defilming it was noted that the loose film was adhering to the sticky tape used to capture particulate contamination in the RV. This caused emulsion pick-offs when the film was pulled from the tape.

4.2.3 Mission 1207-3

The RV/TU arrived at the processing facility in good condition. Both core locking pins were engaged, but sheared. Approximately 100 feet of the FWD and 110 feet of the AFT had spilled from the stacks. On the FWD side, this film was wrinkled and jammed under the builder roller. These portions were spooled back onto the stacks by hand to permit normal despooling.

Three instances of mis-stacking were noted in the AFT stack. In each case, the mis-stack was approximately 1/8 inch to the inboard side. The first occurrence was about one inch from the outside of the roll and continued for about 1/2 inch deep into the stack. Profile measurements made at the start of this mis-stack (5920 ft. from tail) showed no unusual condition. The second mis-stack began approximately two inches from the outside and continued for 1/2 inch of depth. The third began approximately 4 1/2 inches from the outside and continued for approximately 3/4 inch of depth. At the start of this mis-stack, a film tear extending 2 7/8 inches into the web from the untitled (outboard) edge was discovered.

Stack profile measurements were also taken on each stack after the spilled film was removed. The AFT film was well centered on the TU core, while the FWD was offset slightly to the outboard.

More contamination and debris was found in 1207-3 than in 1207-2 or 1207-1. Metallic particulates (solder balls and wire clippings) were identifiable and the cause of serious concern. A yellow EP-20 connector dust cap (ID No. NAS-820-20) was also found. Several drops of an oily substance were found on the inside wall of the RV cannister. This oil was identified by Eastman Kodak as a mineral type vacuum qualified oil, however, it was not SRC 60.

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4.2.4 Mission 1207-4

The RV/TU arrived at the processing facility, and inspection indicated a small amount of debris was found in the RV dome. The AFT side of the shipping container had a 6 inch long x 1/4 inch deep dent. The reinforced channel iron spanning the diameter of the shipping container cover was also damaged on one side.

The AFT side antenna on the RV bulkhead was broken off at the base. The cause is unknown and the antenna was not with the RV. A small amount of grease or oil was found on some of the bolt heads in the core area.

The film cutters were closed and no film was entrapped in the cutters. Both core locking pins were engaged but sheared. Two hundred and thirty feet of IR material of the AFT stack and approximately one hundred and fifty feet of the FWD stack were spilled in the dome.

Portions of the IR material were stuck to the dome particulate tape resulting in emulsion being pulled off. The area affected was in interop space and contained no imagery.

On the FWD side the film was jammed between the stacks and wrapped around the core of the drive motors. Thirty six feet was removed for off line repair and handling. The damaged film was all camera run out and contained no imagery. The AFT record had a 1/16 inch mis-track to the outboard edge approximately two inches from the core and the FWD stack a 1/16 inch mis-track to the outboard edge approximately 3/4 inch from the core. Edge centering of both stacks was good.

4.3 Optimum Focus Determination

Mission 1207 (SV-7/SN0010) was launched with orbital focal plane settings of plus 137 microns on the Forward Camera and plus 33 microns on the AFT Camera. These orbital focal plane positions included a plus 14 micron adjustment on both cameras for the altitude shift from infinity (A-2 collimator setting) to 85 nautical miles mission altitude. They also include a minus 12 microns on the Forward Camera and a minus 16 microns on the AFT for the folding flat gravity adjustment. A step-function change in focus of plus 30 microns retreat was accomplished when the material was

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first switched from 1414 to S0-255 color in RV-1, and then from 1414 to FE-3916 in RV-4. The quality of both the S0-255 and the FE-3916 imagery acquired, indicated that focus was set properly. One 51/51 tri-bar corn target was acquired on the Aft Camera on both the S0-255 and the FE-3916. The average unadjusted ground resolved distance was 2.6 feet for the S0-255 and 5.5 feet for the FE-3916. All color material on Mission 1207 was exposed with this plus 30 microns platen retreat adjustment. As a result of the evaluation of the RV-1 1414 thru-focus tests no focus change was deemed necessary. This represents the second consecutive Hexagon Flight System that did not require an in-flight focus change on either camera. Both cameras exhibited uniform performance across the field. Neither camera appeared to exhibit the significant loss of image quality at the plus 2.5 degree field position that was observed during pre-flight tests.

4.4 Optimum OQAA Settings

On-Orbit smear data was collected during all four of the mission segments of Mission 1207 on both the 1414 and the S0-255 film.

From the 1207-1 mission segment fifty image pairs were measured for the forward camera and one hundred for the aft. Analysis indicated that no adjustment was required to the forward camera in-track or cross-track, or to the aft camera cross-track settings. The aft camera in-track analysis indicated that the skew angle setting was too large, therefore, introducing an error of plus 0.043 in/sec, which is the equivalent of four command steps. After subjective analysis of the smear slit imagery, a minus three command count change (0.031 IPS) was recommended for the aft camera in-track OQAA setting. This change was implemented very early in 1207-2.

Seventy-nine 1207-2 image pairs measured in the smear slit area of the forward camera corroborate the 1207-1 in-track cross-track data and indicated the pre-launch settings to be correct. Ninety-two image pairs measured on the 1207-2 aft camera smear slit imagery indicated the cross-track pre-launch setting to be correct and confirmed that the in-track change of three counts made after 1207-1 was proper in both magnitude and direction.

Subsequent smear slit measurements made on the S0-255 color material indicated that the 1414 to S0-255 cross-track film velocity bias of -16 counts resulted in a velocity error of -0.050 IPS too slow. The correction for this error was not applied to the FE-3916 IR color in RV-4, however, a subjective analysis of the IR color smear slit imagery indicated that the cross-track film velocity bias was proper.

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4.5 Optics Thermal Profile

The data reported in the following sub-paragraphs describe the thermal environment for Mission 1207. Thermal control for SV-7 can be generally summarized as follows:

- ° All SS temperatures were within design limits.
- ° There were no excessive temperature changes on the OB's as a result of a 90 degree roll maneuver conducted during the solo phase of the mission.

4.5.1 SV Environment

SV Thermal Control Parameters are summarized as follows:

° Orbital Elements (Ref. Paragraph 1.5)

Perigee Altitude $h_p = 88.1$ n.m.

Period $\tau = 88.9$ min.

Inclination $i = 96.9$ deg.

Argument of Perigee $\alpha = 149.8$ deg.

Beta $\beta = 0.1$ deg.

° Midsection Thermal Control Design Values

Cocoon $\alpha/\epsilon = 0.359/0.265$

Thermal Baffle $\alpha/\epsilon = 0.90/0.90$

° MLI Effective Emittance

Lower 210 Degrees $\epsilon^* = 0.0045$

FWD & AFT Bulkheads $\epsilon^* = 0.0045$

Viewport Baffle $\epsilon^* = 0.0045$

Under TCA Cocoon $\epsilon^* = 0.04$

Under SU Cocoon $\epsilon^* = 0.6$

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4.5.2 TCA Environment

Table 4-1 is a summary of temperature levels, spatial distributions, and temporal variations for a typical orbital revolution in terms of thermal ICD (1420316A) requirements. Fig. 4-6 shows the location of temperature sensors used in the ICD parameters. Figures 4-7 thru 4-9 show typical profiles of the parameters. The ICD parameters for Block II vehicles (SV-7 thru SV-12) are defined by algorithms as follows:

° Temperature Level Index

In the following equation, $\overline{T}_\lambda$ is the time average temperature over one orbital period for each instrumentation point.

$$\overline{T}_{TCA} = \left\{ \sum_{\lambda=A408}^{\lambda=A421} \frac{(\overline{T}_\lambda + 460)^4}{14} \right\}^{1/4} - 460$$

° Mean Temperature of Zones

Zone	Algorithm ($\overline{T}_\lambda$ average of)
I	A410, A411, A412
II	A413, A414, A415
III	A415, A416, A417
IV	A408, A409, A410
FWD Bulkhead	A420, A421
Middle Bulkhead	A418, A419

4.5.3 Optical Bar Temperatures

Tref was $70 \pm 2^\circ\text{F}$ throughout the mission. The equilibrium temperature level for both optical bars was approximately $68 \pm 2^\circ\text{F}$. Figure 4-10 shows an orbital profile of the OB temperatures.

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TCA COMPARTMENT TEMPERATURES

(MISSION 1207 REV 35a)

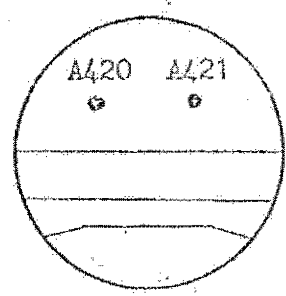
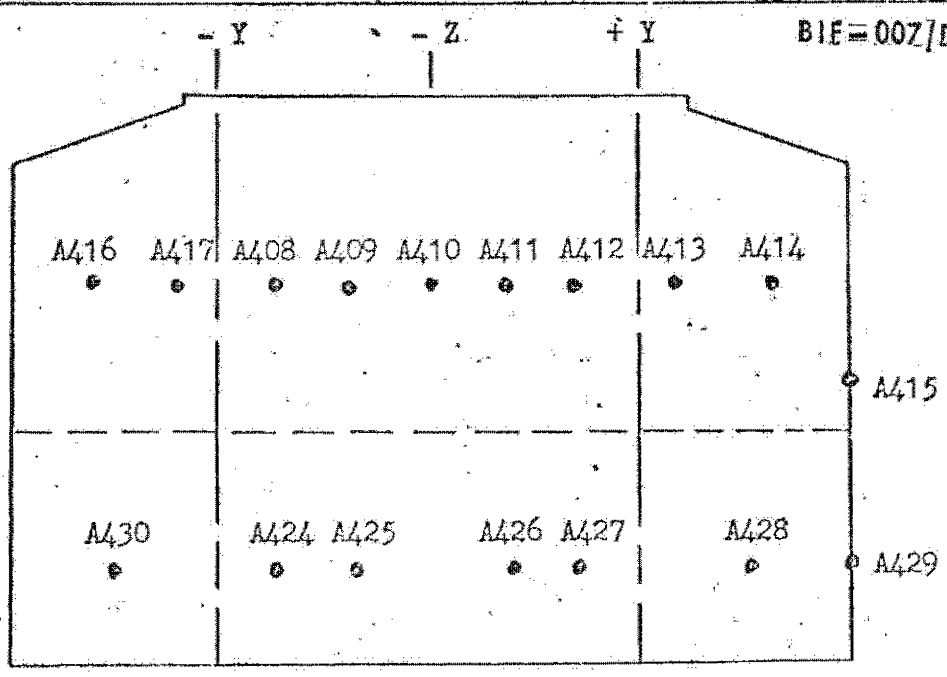
Description	Designated Zones	Max Allowable ICD Value(°F)	Flight Value(°F)
Temperature Level Index (T TCA)		70 ± 21	70
Zone I Mean Temp.	Not Applicable	N/A	71
Zone II Mean Temp.		N/A	69
Zone III Mean Temp.		N/A	68
Zone IV Mean Temp.		N/A	70
Forward Bulkhead		N/A	71
Middle Bulkhead		N/A	71
Variation of Mean Temp. Between Designated Zones	I to IV II to III I to II III to IV Bulkhead to Bulkhead	9 6 4 4 6	0 0 2 2 0
Spatial Variation of Time-Average Temp. Measurements at Locations Within Designated Zone	I II III IV Forward Bulkhead Middle Bulkhead	11 9 9 11 5 17	2 2 2 2 0 0
Temporal Variation (Peak to Valley) of Temperature Measurement at any one Location within Designated Zone	I II III IV Forward Bulkhead Middle Bulkhead	46 20 20 46 26 57	16 1 1 16 4 14

TABLE 4 - 1

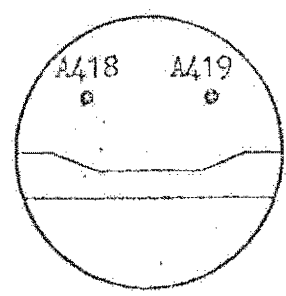
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TEMPERATURE SENSOR LOCATION

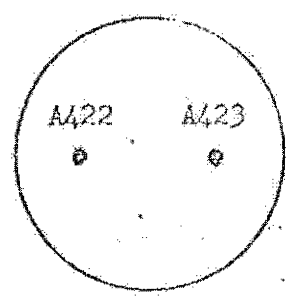
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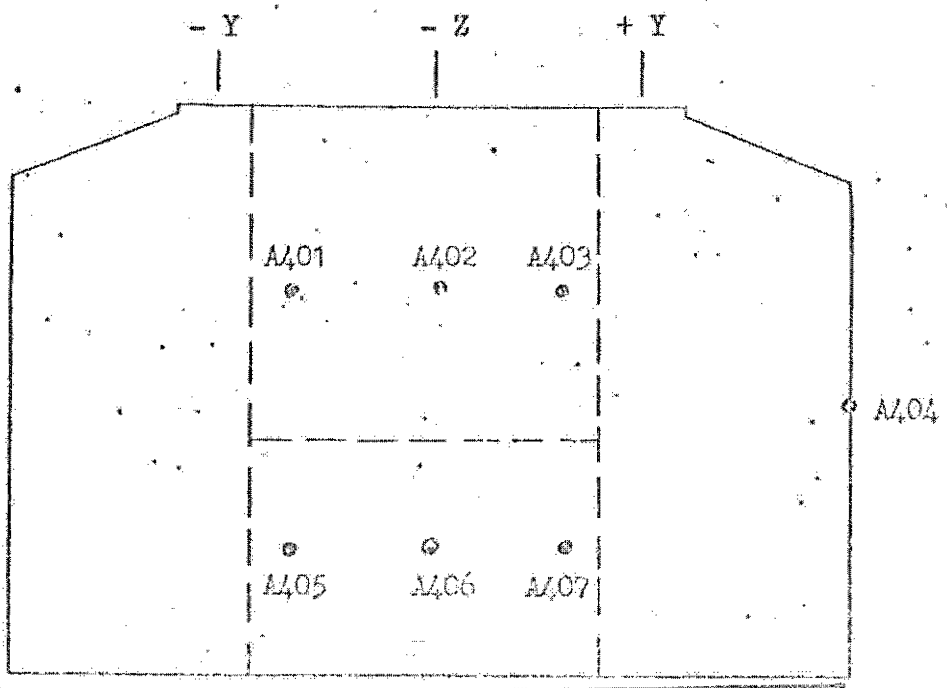
FWD BULKHEAD



MID BULKHEAD



AFT BULKHEAD



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Figure 4 - 6

MISSION 1207 . SV-7 . S/N 010 . NOV 1973
SBA TEMPERATURE DATA . ATU 2
SBA MID-SECTION TEMPERATURES . REV 358.3
4TH PWR SPATIAL AVERAGE VALUES

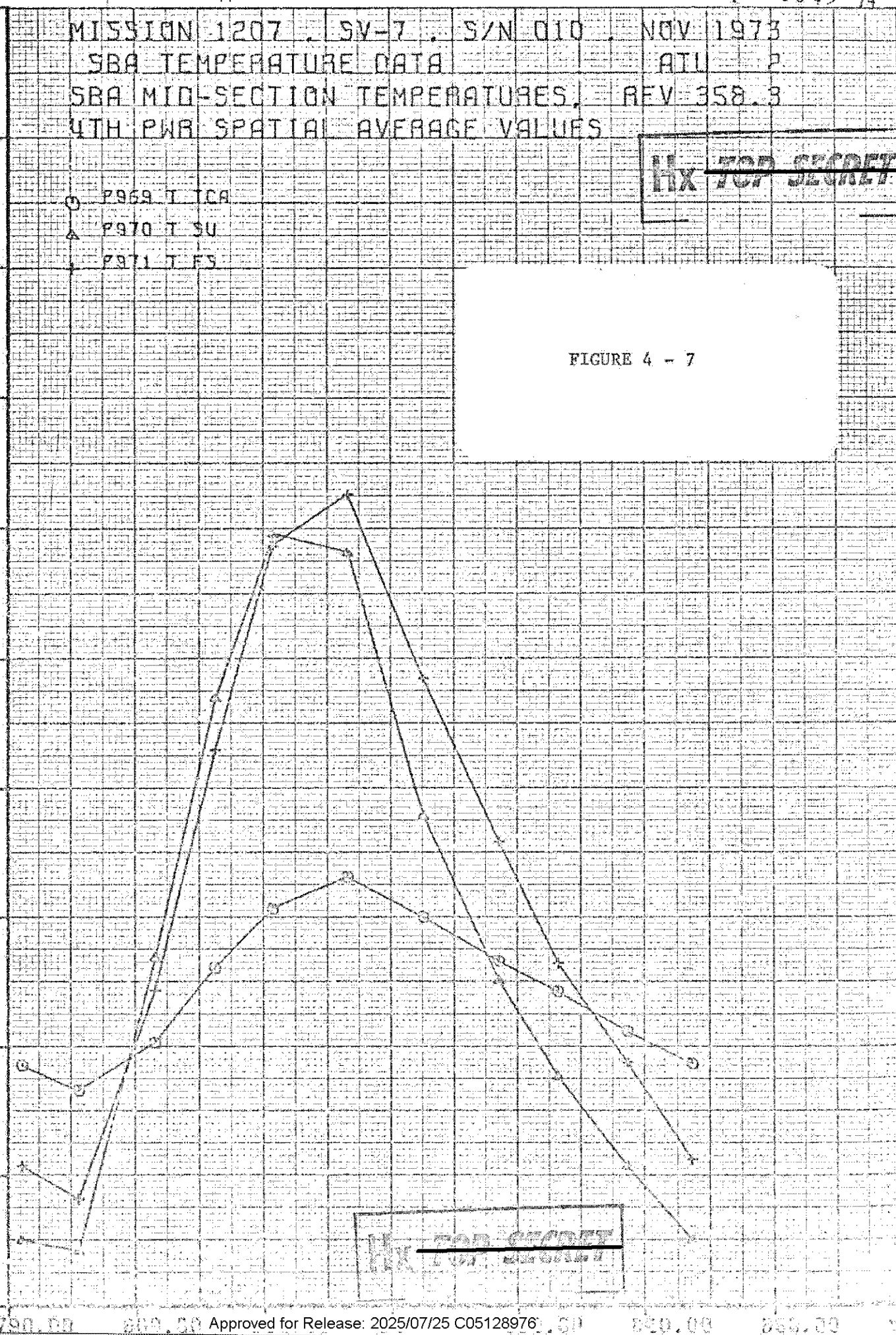
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○ P969 T TCA
△ P970 T SU
+ P971 T FS

FIGURE 4 - 7

TEMPERATURE (FAHRENHEIT)

100.00
98.00
96.00
94.00
92.00
90.00
88.00
86.00
84.00
82.00
80.00
78.00
76.00
74.00
72.00
70.00
68.00
66.00
64.00
62.00
60.00
58.00
56.00
54.00
52.00
50.00
48.00
46.00
44.00
42.00
40.00
38.00
36.00
34.00
32.00
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00



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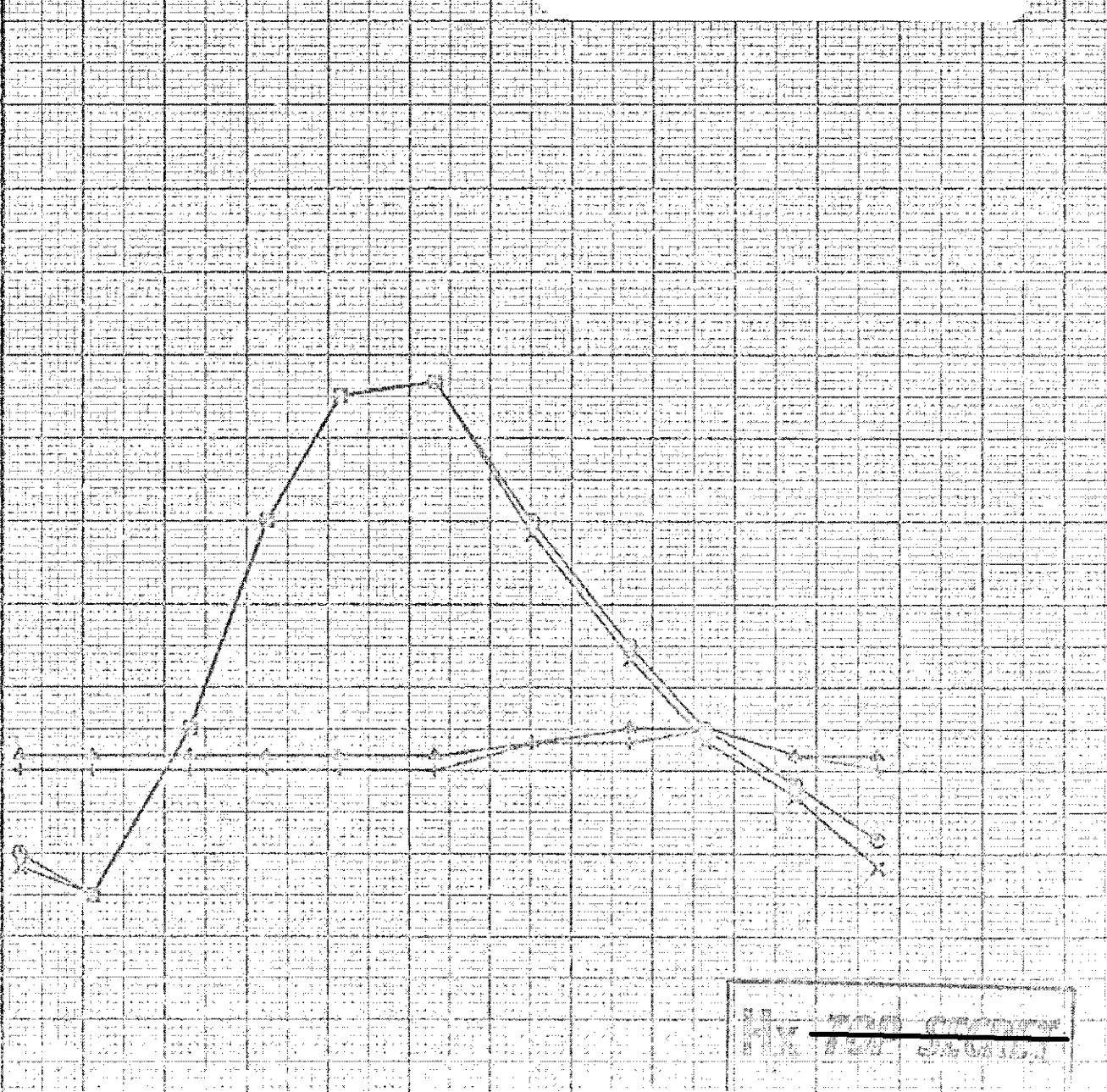
MISSION 1207 . SV-7 . S/N 010 . NOV 1973
SBA TEMPERATURE DATA ATU . 2
SBA TCA ZONE (1-4) TEMPERATURES, REV 350.3
1ST PWR SPATIAL AVERAGE VALUES

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FIGURE 4 - 8

TEMPERATURE (FAHRENHEIT)

- A950 ZONE 1 (-Z/+Y)
- △ A951 ZONE 2 (+Y/+Z)
- ▽ A952 ZONE 3 (+Z/-Y)
- ✱ A953 ZONE 4 (-Y/-Z)



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BIF-002710-0043-74

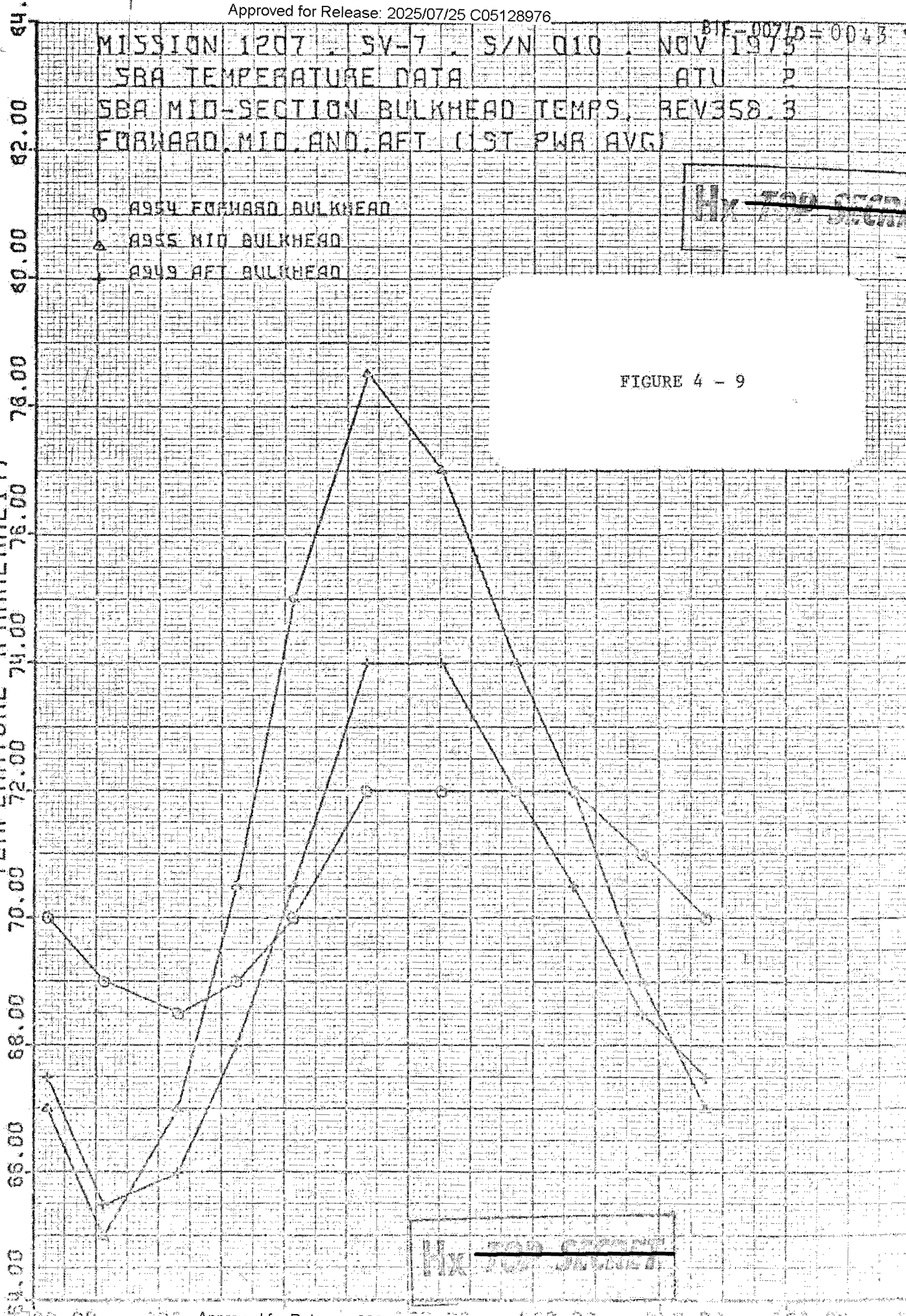
MISSION 1207 SV-7 S/N Q10 NOV 1973
SRA TEMPERATURE DATA ATU P
SBA MID-SECTION BULKHEAD TEMPS. REV 358.3
FORWARD, MID, AND AFT (1ST PWR AVG)

8954 FORWARD BULKHEAD
8955 MID BULKHEAD
8949 AFT BULKHEAD

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FIGURE 4 - 9

TEMPERATURE (FAHRENHEIT)

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MISSION 1207, SV-7, S/N 010, NOV 1978
SS TEMPERATURE DATA
OB AND CP TEMPERATURES, ATU 2
REV 358.3

P910 A SIDE OB
P240 A SIDE CP
P920 B SIDE OB
P238 B SIDE CP

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TEMPERATURE (FAHRENHEIT)

72.00
71.00
70.00
69.00
68.00
67.00
66.00
65.00
64.00
63.00
62.00
61.00

FIGURE 4 - 10

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4.5.4 Solo Roll Maneuver

During Rev 1696 the vehicle was intentionally rolled 90 degrees and left in inertial attitude for approximately 15 minutes. The OB's were continuously rotated for 4 minutes at the center of the time interval; 2 minutes either side of the solar sub-point. Temperature changes were observed on the OB's; however, they were within the range (2°F) normally observed with the vehicle in nominal flight attitude.

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5.0 SCF SUPPORT

5.1 'TUNITY Mission 1207

The 'TUNITY MOD-2 software for Mission 1207 performed all of its functions nominally except for the following software problems.

Message 840 for 91 Hula contained a 'TBALL selected operation, Mission OP 59. This operation was in approximately 1 degree solar elevation and in snow region that required a .875 stop snow bias. The desired command slit was .910 inches; however, 'TBALL computed and commanded .486 inches. Message 840 was rejected and OP-59 slits were altered to .910 inches. A Software Problem Report (SPR) was opened. It was discovered that 'TBALL was trying to complete the Log of a negative number in its conversion of slit width routines from inches to stops.

Mission OP-528 contained only 1 frame on B-side and 4 frames on the A-side. DOX had submitted a MOP with ON and OFF times that were less than 4 frames. 'TBALL's automatically selected operations would compute nothing less than a 4 frame OP. A software check was designed into 'TFUNCHK to flag any OP less than 4 frames. Investigation of the MOP input revealed a software problem with 'TFUNCHK and a 'TBALL limitation previously undocumented.

Hand computation of HSSOP's limitation yielded insufficient time for a 4 frame OP by 50 milliseconds. A check should have been drawn in the chronological command list. A hand computation of 'TFUNCHK's 4 frame check yielded enough time for a 4 frame OP by 90 milliseconds. A software fix to 'TFUNCHK's 4 frame check to reduce the time bias built into this check from 1 to 0.8 seconds was implemented on-orbit.

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BIE=007/D=0043 74

5.2 AUGIE

5.2.1 Overall Performance

Real time and play back performance of Augie data met SSC data analysis requirements. Real time data is utilized by SSC only for verification of SS status. There were minimal delays in the delivery of play back data attributed to the Augie system. Some delays were experienced due to having more data on the flight recorder than could be read out during a station contact.

5.2.2 Modifications

SSC Augie data processing did not require any changes during the flight. Changes requested for the next flight are intended to improve page readability and footage measurement accuracy.

5.2.3 D.T.V.

The D.T.V. was used by SSC for real time SS status verification (SS non-operating). It was satisfactory for this purpose, except for occasional contacts when the system was not brought up in time and it was necessary to revert to the use of the printers. The printers are used by SSC for real time status verification when the SS is operating over the station. It is planned to continue the use of the D.T.V. for passive status verification on the next flight.

5.3 RTS Tapes

A total of 129 RTS and microwave tapes were processed at the Building 156 Ground Station in support of the flight. Most of these were Cook Microwave tapes. There were 7 requests for new tapes due to inability to achieve decommutator synchronization. This was the result of bad symmetry, excessive jitter, or data drop-outs. The same kinds of problems were experienced on an additional 24 tapes, to a lesser degree, which did not prevent retrieval of satisfactory data. The remainder of the tapes processed, or 76%, were good to excellent quality.

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APPENDIX

A-1

OPERATIONAL SUMMARY

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A. 1207-1

B. CAMERA OPERATIONS SUMMARY REVS PAD THROUGH REV 225 OP 116

REV	MSN	SCA	SCC	FRAMES		INTERCP FEET		PHOTO-FT		CUM-TU-FeET	
CP	NUM			FWD	AFT	FWD	AFT	FWD	AFT	FWD	AFT
PRE	LC1	30	30	6	6	663	556	17	17	680	573
PRE	LC	60	15	7	4	11	19	39	22	730	614
PRE	LC	30	30	6	6	3	12	17	17	750	643
PRE	LC	60	15	7	4	11	19	39	22	800	684
PRE	LC	120	0	8	8	39	73	86	86	925	843
PRE	LC	120	0	8	8	113	113	86	86	1124	1142
PRE	LC	60	0	6	6	82	65	33	33	1239	1140
PRE	LC2	60	0	6	6	31	31	33	33	1303	1204
PRE	LC3	60	0	6	6	31	31	33	33	1367	1268
PRE	LC	60	0	6	6	31	31	33	33	1431	1332
PRE	LC4	60	0	6	6	31	31	33	33	1495	1396
PRE	LC	60	0	6	6	31	31	33	33	1559	1460
PRE	LC5	60	0	6	6	31	31	33	33	1623	1524
PRE	LC	60	0	6	6	31	31	33	33	1687	1588
PRE	LC6	60	0	6	6	31	31	33	33	1687	1588
PRE	LC6	60	0	6	6	31	31	33	33	1751	1652
PRE	LC	60	0	6	6	31	31	33	33	1815	1716
3	1	60	0	6	6	127	127	33	33	1975	1876
3	2	60	-15	6	6	24	25	33	33	2032	1934
3	3	60	30	6	6	35	34	33	33	2100	2001
5	4	90	0	53	53	42	50	428	428	2570	2479
6	5	120	0	83	83	71	79	389	389	3530	3447
7	6	90	-15	44	44	88	81	356	356	3974	3884
8	7	60	0	6	6	52	44	33	33	4059	3961
8	8	60	15	26	26	35	34	142	142	4236	4137
8	9	30	15	9	9	27	19	26	26	4289	4162
8	10	90	0	25	25	32	49	202	202	4523	4433
9	11	60	30	28	28	54	44	153	153	4730	4630
9	12	90	0	39	39	46	55	315	315	5051	5000
9	13	60	-30	23	23	55	48	126	126	5272	5174
10	14	60	-30	5	5	36	36	27	27	5335	5237
15	15	30	-15	6	6	29	21	17	17	5381	5275
22	16	60	30	43	43	20	26	236	236	5637	5537
22	17	90	-15	102	102	44	54	824	824	6505	6415
23	18	60	-15	50	50	55	47	274	274	6834	6736
24	19	120	0	32	32	62	77	343	343	7239	7156
25	20	60	-15	16	16	78	63	88	88	7405	7307
26	21	60	30	29	29	35	34	158	158	7598	7499
32	22	60	15	7	7	36	36	36	36	7672	7573
38	23	120	0	83	83	62	78	889	889	8623	8540
40	24	90	15	53	53	88	80	428	428	9139	9043
41	25	90	0	35	35	66	66	283	283	9488	9397

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42	26	90	C	24	24	65	65	194	194	9747	9656
47	27	60	0	15	15	55	47	82	82	9884	9785
48	28	30	C	7	7	28	20	20	20	9932	9825
48	29	60	15	13	12	20	28	71	71	10023	9924
54	30	90	15	128	128	45	53	1034	1034	11102	11011
55	31	60	15	44	44	54	46	241	241	11397	11298
56	32	90	15	110	110	45	53	889	889	12331	12240
56	33	60	-15	17	17	56	49	93	93	12480	12382
56	34	60	0	10	10	36	35	55	55	12571	12472
57	35	60	-30	10	10	34	35	55	55	12660	12562
58	36	90	15	29	39	46	53	315	315	13021	12930
58	37	60	30	50	50	54	46	274	274	13349	13250
64	38	60	-30	53	53	35	36	290	290	13674	13576
65	39	30	15	8	8	29	21	23	23	13726	13620
70	40	60	30	19	0	20	0	104	0	13850	13620
71	41	90	-15	38	38	46	49	307	307	14203	13976
72	42	60	15	35	35	56	46	192	192	14451	14214
72	43	30	-30	44	44	28	21	125	125	14604	14360
72	44	90	0	36	36	30	45	291	291	14925	14696
73	45	90	0	47	47	65	65	330	380	15370	15141
73	46	90	0	22	22	60	60	178	178	15608	15379
74	47	90	0	63	63	56	57	509	509	16173	15945
74	48	30	-30	9	9	47	31	26	26	16246	16002
75	49	90	0	32	32	31	46	259	259	16536	16307
80	50	30	0	16	16	47	32	46	46	16629	16385
81	51	30	15	6	6	14	13	17	17	16660	16415
85	52	30	0	7	7	14	14	20	20	16694	16449
85	53	120	0	8	8	32	56	86	86	16812	16591
86	54	90	0	23	0	73	0	189	0	17074	16591
87	55	90	-15	53	53	66	67	428	428	17568	17086
87	56	90	0	39	39	70	69	315	315	17953	17470
89	57	60	0	35	35	54	46	192	192	18199	17708
90	58	60	15	11	11	35	35	60	60	18294	17803
91	59	60	-30	10	10	34	35	55	55	18383	17893
91	60	60	15	40	40	35	34	219	219	18637	18146
103	61	90	0	26	26	45	53	210	210	18892	18409
103	62	90	0	33	33	68	68	267	267	19227	18744
105	63	90	0	74	74	62	62	598	598	19887	19404
106	64	30	-30	5	5	46	31	14	14	19947	19449
106	65	60	30	15	15	21	28	82	82	20050	19559
107	66	60	15	14	14	33	34	77	77	20160	19670
112	67	30	30	7	7	27	19	20	20	20207	19709
112	68	30	15	6	6	13	13	17	17	20237	19739
113	69	30	0	6	6	13	13	17	17	20267	19769
117	70	60	15	7	7	18	26	38	38	20323	19833
119	71	30	-30	50	50	26	19	143	143	20492	19995
121	72	60	0	12	12	20	27	66	66	20578	20088
123	73	60	15	12	12	32	32	66	66	20676	20186
123	74	90	0	20	20	44	52	162	162	20882	20400
123	75	90	15	10	10	65	64	81	81	21028	20545

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129	76	30	30	8	8	47	32	23	23	21098	20600
129	77	30	15	7	7	13	13	20	20	21131	20633
129	78	60	-15	17	17	21	30	93	93	21245	20756
130	79	30	15	9	9	29	20	27	27	21301	20803
135	80	120	0	92	0	40	0	985	0	22326	20803
135	81	90	15	38	38	84	45	307	307	22717	21155
135	82	60	-30	26	26	55	49	143	143	22915	21347
138	83	60	0	5	5	37	37	28	28	22980	21412
138	84	30	-30	7	7	30	22	20	20	23030	21454
139	85	30	-30	10	11	13	10	29	32	23072	21496
139	86	90	0	89	89	33	48	719	719	23824	22263
146	87	60	-15	18	18	55	48	99	99	23978	22410
151	88	90	0	66	66	45	53	533	533	24556	22996
152	89	90	0	31	31	65	65	251	251	24872	23312
152	90	60	15	17	17	55	46	93	93	25020	23451
153	91	30	30	6	6	29	21	17	17	25066	23489
154	92	90	0	32	32	27	43	259	259	25352	23791
155	93	30	30	12	13	44	28	37	37	25433	23856
155	94	60	-30	57	57	20	29	313	313	25766	24198
160	95	60	-15	16	16	36	36	89	88	25890	24322
162	96	60	-15	17	17	36	36	93	93	26019	24451
166	97	30	-30	6	6	29	21	17	17	26065	24489
167	98	60	30	7	7	21	27	38	38	26124	24554
167	99	60	0	10	10	35	36	55	55	26214	24645
168	100	60	-30	8	8	34	35	44	44	26292	24724
169	101	60	-15	14	14	36	35	77	77	26405	24836
169	102	60	-15	35	35	36	36	192	192	26633	25064
171	103	60	30	35	35	36	34	192	192	26861	25290
171	104	90	15	33	33	43	52	267	267	27171	25609
173	105	30	-15	19	19	48	33	54	54	27273	25656
186	106	60	-15	13	13	21	26	71	71	27365	25795
202	107	30	-30	13	13	29	24	37	37	27431	25856
204	108	30	0	9	9	14	13	26	26	27471	25895
204	109	90	15	22	22	31	47	178	178	27680	26120
209	110	30	0	5	5	48	33	14	14	27742	26167
218	111	60	15	38	38	21	23	208	208	27971	26403
219	112	60	-15	13	13	35	35	71	71	28077	26509
220	113	90	0	64	64	47	56	517	517	28641	27082
220	114	30	-15	8	8	48	31	23	23	28712	27136
225	115	30	-15	7	7	14	14	20	20	28746	27170
225	116	90	0	11	9	33	48	82	68	28861	27286

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A. 1207-2

B. CAMERA OPERATIONS SUMMARY REV 225 OP 116 THROUGH REV 599 OP 249.

REV	MSN	SCA	SCC	FRAMES		INTEROP		PHOTO-FT		CUM-TU-FEET	
OP											
NUM				FWD	AFT	FWD	AFT	FWD	AFT	FWD	AFT

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225	116	90	0	3	5	0	0	25	40	25	40
232	117	120	0	35	35	142	150	375	375	542	565
234	118	60	15	16	16	79	63	88	88	709	716
236	119	90	0	14	14	48	56	113	113	870	885
248	120	90	-15	53	53	64	64	428	428	1362	1377
249	121	60	30	20	20	51	42	110	110	1523	1529
249	122	30	-30	8	8	26	20	23	23	1572	1572
251	123	30	30	13	13	14	13	37	37	1623	1622
252	124	120	0	19	19	46	70	204	204	1873	1896
265	125	60	15	56	56	76	60	307	307	2256	2263
265	126	60	-15	14	14	35	36	77	77	2368	2376
266	127	60	-30	38	38	36	36	208	208	2612	2620
269	128	90	0	14	14	45	52	113	113	2770	2785
269	129	30	0	10	10	45	29	29	29	2844	2843
281	130	60	15	13	13	20	28	71	71	2935	2942
281	131	30	-30	11	11	28	20	31	31	2994	2993
282	132	60	30	50	50	22	29	274	274	3290	3296
283	133	60	15	4	4	36	36	22	22	3348	3354
284	134	60	-15	23	23	35	36	126	126	3509	3516
284	135	60	-15	15	15	34	34	82	82	3625	3632
285	136	30	-30	11	11	29	20	31	31	3685	3683
285	137	120	0	69	69	48	72	739	739	4472	4494
286	138	60	-15	17	17	79	64	93	93	4644	4651
291	139	60	15	38	38	36	35	208	208	4888	4894
297	140	60	0	26	26	34	35	143	143	5065	5072
298	141	90	-15	10	10	46	54	81	81	5192	5207
299	142	90	15	29	29	62	61	234	234	5488	5502
301	143	60	-30	28	28	51	44	153	153	5692	5699
302	144	30	0	6	6	28	20	17	17	5737	5736
307	145	60	-15	113	113	19	27	619	619	6375	6382
313	146	60	0	32	32	35	34	175	175	6585	6591
314	147	90	15	53	53	44	52	428	428	7057	7071
315	148	60	30	4	4	53	45	22	22	7132	7138
316	149	120	0	44	44	56	72	471	471	7659	7681
330	150	90	0	107	107	84	75	865	865	8608	8621
332	151	60	0	47	47	52	44	258	258	8918	8923
333	152	90	0	50	50	44	51	404	404	9366	9378
333	153	30	30	8	8	45	29	23	23	9434	9430
334	154	30	30	5	5	13	13	14	14	9461	9457
334	155	60	-15	20	20	20	29	110	110	9591	9596
339	156	30	0	7	7	28	19	20	20	9639	9635
340	157	60	0	44	44	20	23	241	241	9900	9904

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346	158	90	15	83	83	46	55	671	671	10617	10630
347	159	60	-30	74	74	53	45	406	406	11076	11081
347	160	30	30	19	19	28	19	54	54	11158	11154
348	161	120	0	47	47	42	67	503	503	11703	11724
349	162	60	-30	10	10	73	57	55	55	11831	11836
350	163	30	-30	5	5	27	19	14	14	11872	11869
350	164	60	-30	4	4	19	27	22	22	11913	11918
350	165	60	30	37	37	35	33	203	203	12151	12154
355	166	30	-15	6	6	28	22	17	17	12196	12193
362	167	60	15	13	13	21	28	71	71	12298	12292
363	168	60	-30	95	95	34	35	521	521	12843	12848
363	169	60	-30	44	44	35	35	241	241	13119	13124
364	170	60	15	53	53	35	34	290	290	13444	13448
365	171	30	30	8	8	27	19	23	23	13494	13490
366	172	90	0	45	45	31	47	364	364	13889	13901
367	173	60	15	25	25	54	46	137	137	14080	14084
367	174	60	15	7	7	35	35	33	38	14153	14157
368	175	30	30	5	5	28	20	14	14	14195	14191
371	176	60	0	15	15	20	28	82	82	14297	14301
378	177	30	-30	9	9	28	21	26	26	14351	14348
379	178	90	0	32	32	32	48	259	259	14642	14655
380	179	90	15	56	56	63	62	453	453	15158	15170
381	180	30	-30	4	4	45	29	12	12	15215	15211
382	181	90	15	50	50	30	45	404	404	15649	15660
395	182	60	-15	41	41	53	46	225	225	15927	15931
395	183	30	30	5	5	28	19	14	14	15969	15964
398	184	30	-30	6	6	13	14	17	17	15999	15995
398	185	60	15	19	19	21	28	104	104	16124	16127
405	186	90	0	7	7	46	54	57	57	16227	16238
411	187	60	-15	11	11	54	47	60	60	16341	16345
415	188	90	0	19	19	47	54	154	154	16542	16553
415	189	30	15	5	5	46	30	14	14	16602	16597
421	190	60	-15	4	4	20	29	22	22	16644	16648
427	191	90	0	41	41	47	57	331	331	17022	17036
431	192	90	0	10	10	65	66	81	81	17168	17183
431	193	90	0	36	36	65	66	291	291	17524	17540
443	194	60	-15	38	38	54	44	208	208	17786	17792
444	195	60	15	22	22	35	34	121	121	17942	17947
446	196	30	-30	8	8	28	21	23	23	17993	17991
447	197	90	-15	35	35	31	47	283	283	18207	18321
454	198	30	0	25	25	47	30	71	71	18425	18422
460	199	60	30	28	28	20	27	153	153	18598	18602
461	200	90	0	12	12	45	53	97	97	18740	18752
476	201	30	15	7	7	46	29	20	20	18806	18801
476	202	60	-15	12	12	19	28	66	66	18891	18895
477	203	60	-30	20	20	35	35	110	110	19036	19040
479	205	30	30	5	5	28	20	14	14	19217	19212
481	206	60	-30	29	29	19	29	159	159	19395	19400
492	207	30	-30	8	8	29	20	23	23	19447	19443
492	208	90	0	13	13	32	47	105	105	19584	19595

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495	209	60	-15	18	18	51	44	99	99	19734	19738
495	210	60	15	16	16	34	33	88	88	19856	19859
496	211	60	15	11	11	33	33	60	60	19949	19952
496	212	60	15	17	17	33	33	93	93	20075	20078
496	213	30	30	38	38	27	19	108	108	20210	20205
496	214	90	0	15	15	31	47	121	121	20362	20373
497	215	30	30	29	29	46	30	83	83	20491	20486
508	216	60	-15	10	10	19	28	55	55	20565	20569
508	217	30	30	34	34	28	19	97	97	20690	20685
509	218	30	-30	6	6	13	13	17	17	20720	20715
509	219	30	-30	15	15	13	14	43	43	20776	20772
511	220	60	-15	15	15	20	28	82	82	20878	20882
512	221	30	30	6	6	28	19	17	17	20923	20918
512	222	90	0	86	86	31	47	695	695	21649	21660
517	223	60	15	9	9	53	45	49	49	21751	21754
527	224	60	-15	12	12	35	36	66	66	21852	21856
528	225	60	0	19	19	35	34	104	104	21991	21994
540	226	90	0	29	29	46	54	234	234	22271	22282
541	227	30	-30	4	4	47	32	11	11	22329	22325
541	228	30	15	4	4	14	13	11	11	22354	22349
541	229	60	-15	16	16	20	29	88	88	22462	22466
542	230	60	-15	57	57	35	35	312	312	22809	22813
544	231	30	0	7	7	28	19	20	20	22857	22852
545	232	90	0	20	20	30	46	162	162	23049	23060
556	233	30	-30	8	8	46	31	23	23	23118	23114
557	234	30	-30	23	23	14	14	66	66	23198	23194
557	235	30	15	28	28	14	13	80	80	23292	23287
558	236	60	30	26	26	20	27	143	143	23455	23457
560	237	60	-15	11	11	34	36	60	60	23549	23553
560	238	60	0	7	7	33	33	38	38	23620	23624
561	239	60	-15	14	14	33	33	77	77	23730	23734
574	240	30	0	17	17	28	19	48	48	23795	23801
574	241	90	-15	45	45	29	46	364	364	24204	24211
577	242	60	15	20	20	55	46	110	110	24369	24367
577	243	90	0	36	36	46	54	291	291	24706	24712
589	244	30	0	44	44	46	30	125	125	24877	24867
589	245	60	-15	10	10	20	27	55	55	24952	24949
590	246	60	-15	20	20	33	34	110	110	25095	25093
592	247	60	15	11	11	34	33	60	60	25189	25186
593	248	90	0	69	69	44	52	558	558	25791	25796
599	249	90	0	10	8	64	64	76	62	25931	25922

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A. 1207-3

B. CAMERA OPERATIONS SUMMARY REVS 599 OP 249 THROUGH REV 1032 OP 423

REV	MSN OP NUM	SCA	SCC	FRAMES		INTEROP FEET		PHOTO-FT		CUM-TU-FEET	
				FWD	AFT	FWD	AFT	FWD	AFT	FWD	AFT

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599	249	90	0	2	4	0	0	16	50	16	80
606	250	30	30	22	22	105	89	63	63	184	182
607	251	60	15	10	10	19	27	55	55	253	264
608	252	90	0	14	14	42	51	113	113	413	423
616	253	30	0	13	13	45	28	37	37	495	493
621	254	60	-30	14	14	19	28	77	77	591	598
622	255	60	30	11	11	34	33	60	60	685	691
626	256	60	-30	50	50	34	35	374	274	993	1000
633	257	90	0	26	26	45	52	210	210	1248	1282
639	258	60	30	23	23	51	42	326	326	1425	1430
640	259	60	15	10	10	33	34	55	55	1513	1519
640	260	60	0	9	9	23	33	50	50	1546	1602
642	261	90	0	44	44	44	52	356	356	2096	2010
643	262	90	0	32	32	61	61	259	259	2316	2330
654	263	60	-15	19	19	52	45	104	104	2472	2479
655	264	30	-30	10	10	28	20	29	29	2529	2528
656	265	60	15	12	12	20	27	66	66	2615	2621
656	266	60	-15	44	44	33	34	241	241	2839	2836
656	267	60	0	12	12	33	32	66	66	2930	2994
656	268	30	-30	5	5	27	20	14	14	3020	3033
656	269	90	0	19	19	32	37	154	154	3215	3229
670	270	60	15	23	23	54	46	126	126	3395	3401
670	271	60	-30	17	17	39	39	93	93	3526	3533
671	272	60	-30	14	14	35	35	77	77	3638	3645
671	273	60	15	18	18	34	33	97	97	3769	3775
671	274	60	-15	8	8	24	25	44	44	3847	3854
671	275	30	30	6	6	29	20	17	17	3893	3891
671	276	90	15	27	27	30	45	219	219	4141	4154
673	277	60	15	23	23	52	45	126	126	4319	4325
674	278	60	-15	20	20	35	36	110	110	4464	4471
687	279	60	-30	9	9	36	38	50	50	4550	4557
687	280	90	0	13	13	45	52	105	105	4700	4714
687	281	30	0	45	45	45	23	128	128	4873	4871
687	282	90	0	39	39	29	46	315	315	5217	5232
687	283	90	15	17	17	65	64	138	138	5420	5434
688	284	60	-15	7	7	54	46	39	39	5519	5519
689	285	30	30	9	9	28	20	26	26	5587	5585
690	286	30	15	34	34	13	10	97	97	5677	5675
690	287	60	0	12	15	18	26	83	83	5778	5784
690	288	60	0	19	19	34	34	104	104	5916	5922
691	289	90	0	19	19	44	52	154	154	6114	6123
702	290	90	0	26	26	59	59	210	210	6383	6397

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703	291	60	15	44	44	50	42	241	241	6674	6680
703	292	30	-30	41	41	29	21	117	117	6819	6818
704	293	30	-30	32	32	14	14	91	91	6924	6923
704	294	60	0	13	13	19	27	71	71	7014	7021
706	295	60	15	13	13	33	23	71	71	7120	7125
719	296	60	-15	17	17	33	35	93	93	7245	7253
719	297	30	-15	21	21	27	19	60	60	7333	7332
719	298	60	15	21	21	19	26	115	115	7467	7473
720	299	30	15	10	10	28	20	29	29	7524	7522
720	300	60	-15	4	4	20	29	22	22	7556	7573
721	301	30	30	5	5	28	19	14	14	7608	7606
723	302	60	-15	11	11	19	25	60	60	7687	7694
723	303	90	15	19	19	46	52	153	153	7886	7899
735	304	90	0	42	42	64	63	339	339	8289	8303
735	305	30	-30	16	16	47	32	46	46	8382	8381
736	306	30	0	8	8	13	13	23	23	8418	8417
739	307	90	0	50	50	21	48	404	404	8853	8869
739	308	30	-15	7	7	48	30	20	20	8919	8919
740	309	30	-30	4	4	13	13	11	11	8943	8943
750	310	60	30	56	56	13	12	160	160	9116	9115
752	311	60	15	24	24	20	28	132	132	9268	9275
752	312	30	15	13	13	28	20	37	37	9333	9332
752	313	90	0	44	44	31	47	356	356	9720	9735
753	314	60	0	4	4	53	45	22	22	9795	9802
762	315	30	-30	8	8	22	20	23	23	9840	9845
769	316	30	15	59	59	14	13	158	158	10022	10026
769	317	60	15	11	11	23	30	60	60	10105	10116
769	318	60	0	7	7	34	25	39	39	10177	10189
783	319	60	-30	41	41	24	35	225	225	10436	10449
783	320	30	0	23	23	27	19	66	66	10529	10533
784	321	30	30	13	13	13	13	37	37	10579	10583
784	322	60	-15	12	12	21	30	66	66	10666	10679
786	323	60	-15	17	17	35	35	93	93	10734	10807
787	324	30	-15	23	23	23	19	66	66	10888	10892
787	325	90	15	11	11	34	50	39	39	11011	11081
789	326	60	-30	20	20	32	35	110	110	11179	11185
800	327	30	15	10	10	27	19	29	29	11239	11253
800	328	30	-30	16	16	13	14	48	48	11239	11253
800	329	30	-30	9	9	14	13	26	26	11338	11392
800	330	60	0	12	12	18	26	66	66	11412	11424
804	331	90	0	25	25	46	54	202	202	11660	11680
805	332	90	0	18	18	62	62	129	129	11851	11871
815	333	90	0	11	11	33	33	39	39	11998	12019
816	334	90	0	20	20	61	62	162	162	12221	12242
817	335	90	0	62	62	39	39	501	501	12739	12808
820	336	90	-15	50	50	65	66	404	404	13257	13278
822	337	90	0	19	19	63	63	154	154	13474	13498
833	338	90	0	77	77	63	62	622	622	14159	14179
834	339	60	15	4	4	53	35	22	22	14234	14236
838	340	60	-30	13	13	36	35	92	92	14350	14353

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830	343	30	20	25	25	27	18	72	71	14448	14442
833	342	60	15	10	10	20	28	55	55	14523	14525
841	343	30	0	4	4	25	17	11	11	14559	14553
847	344	30	30	10	10	11	11	29	29	14599	14592
843	345	30	-30	39	59	13	16	163	168	14780	14775
850	346	30	-15	17	17	14	13	43	42	14842	14836
852	347	30	30	8	8	13	13	23	23	14879	14872
852	348	60	-15	11	11	19	23	60	60	14957	14960
853	349	90	0	23	29	42	49	234	234	15233	15243
853	350	30	15	6	6	44	29	17	17	15294	15288
865	351	30	-15	11	11	13	13	31	31	15338	15332
867	352	90	0	7	7	31	47	57	57	15426	15416
869	353	60	15	69	62	54	44	373	373	15853	15833
869	354	30	-30	8	8	27	20	23	23	15903	15876
869	355	50	30	35	35	21	27	192	192	16116	16095
876	356	30	-30	6	6	28	21	17	17	16151	16133
880	357	60	-30	20	20	19	27	110	110	16290	16270
882	358	60	15	38	38	34	33	208	208	16532	16511
883	359	60	-15	14	14	34	34	77	77	16643	16622
894	360	20	-30	35	34	27	18	254	254	16924	16894
893	361	90	0	77	77	29	46	622	622	17575	17562
895	362	90	0	91	91	84	84	735	735	18374	18361
891	363	30	30	7	7	46	29	20	20	18440	18410
896	364	50	15	39	38	18	16	208	208	18666	18644
897	365	30	-30	8	8	27	20	23	23	18716	18687
898	366	30	0	15	15	14	13	54	54	18784	18754
898	367	30	-30	10	10	13	14	29	29	18826	18797
899	368	90	0	60	60	31	46	485	485	19342	19328
899	369	30	15	5	5	46	30	14	14	19402	19372
901	370	90	0	53	53	10	46	423	423	19880	19845
902	371	30	-30	47	47	46	31	134	134	20040	20011
905	372	60	-30	11	11	15	24	60	60	20116	20095
913	373	30	-15	13	13	24	15	37	37	20177	20147
913	374	30	-15	5	5	13	14	14	14	20204	20175
914	375	60	0	20	20	21	23	110	110	20385	20313
914	376	30	-30	9	9	27	20	26	26	20386	20359
917	377	60	-15	47	47	21	23	258	258	20667	20645
913	378	90	15	56	50	43	53	404	404	21113	21102
921	379	30	15	10	10	46	20	29	29	21101	21151
921	380	30	30	11	11	13	13	72	52	21236	21205
932	381	60	-30	24	24	20	25	132	132	21386	21367
933	382	120	0	59	59	54	75	632	632	22079	22074
933	383	60	30	47	47	75	57	253	253	22412	22389
944	384	30	15	15	15	24	21	54	54	22464	22464
946	385	30	-15	13	12	13	13	34	24	22541	22511
946	386	30	-15	7	7	13	13	30	20	22574	22544
947	387	30	-15	7	7	13	13	20	20	22607	22577
947	388	30	0	4	4	15	13	12	12	22691	22602
947	389	60	0	14	14	20	29	77	77	22729	22709
959	390	60	15	18	18	55	47	154	154	22819	22846

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634	391	50	0	45	45	33	33	247	247	23198	23176
650	392	50	-15	5	5	27	19	13	13	23239	23208
650	393	50	-15	21	21	20	38	115	115	23373	23351
650	396	90	0	39	39	47	33	315	315	23735	23721
668	395	50	-15	29	29	53	46	159	159	23947	23926
665	398	50	-15	41	41	34	34	225	225	24206	24185
669	397	50	15	13	13	26	35	71	71	24313	24291
666	398	90	0	38	38	47	35	307	307	24667	24653
667	399	50	30	25	25	53	45	137	137	24857	24835
677	400	50	0	13	13	27	20	37	37	24921	24892
677	401	30	-30	15	15	12	12	43	43	24976	24947
677	402	50	-15	4	4	19	26	49	49	25044	25022
670	402	30	30	19	19	26	13	54	54	25124	25094
679	404	30	15	15	15	28	43	121	121	25273	25258
682	405	30	-30	11	11	43	28	31	31	25347	25317
682	406	50	0	9	9	13	14	25	25	25546	25537
683	407	30	0	79	79	27	42	638	638	26051	26027
659	408	90	15	41	41	55	53	331	331	26441	26426
1005	409	90	-15	12	12	62	64	97	97	26500	26537
1013	410	30	0	5	5	47	30	14	14	26581	26631
1014	411	30	-15	23	23	19	28	126	126	26806	26735
1013	412	50	15	44	44	32	31	241	241	27079	27057
1013	412	90	15	41	41	46	53	331	331	27456	27441
1027	413	30	0	12	12	45	31	37	37	27538	27509
1027	415	30	15	7	7	12	12	20	20	27571	27541
1028	415	30	-30	17	17	13	14	43	43	27633	27603
1029	417	50	-15	12	12	18	26	65	66	27717	27696
1031	418	30	-30	20	20	26	18	57	57	27803	27771
1031	419	50	15	27	27	17	24	149	148	27965	27943
1033	420	30	-10	21	21	25	13	60	50	28050	28021
1031	421	120	0	48	48	45	62	525	525	28620	28614
1031	422	50	30	7	7	77	60	33	33	28725	28712
1033	423	50	0	10	9	33	33	53	46	28821	28791

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A. 1207-4

B. CAMERA OPERATIONS SUMMARY REV 1032 CP 423 THROUGH REV1653 CP 700.

REV	MSN	SCA	SCC	FRAMES		INTERCP		PHOTO-FT		CUM-TU-FEET	
CP											
KUM				FWD	AFT	FWD	AFT	FWD	AFT	FWD	AFT
1032	423	60	0	4	5	0	0	24	30	24	30
1042	424	30	30	7	7	85	77	20	20	129	127
1043	425	30	-30	5	5	12	13	14	14	155	154
1043	426	30	-30	26	26	13	12	74	74	242	240
1044	427	30	-30	10	10	12	13	29	29	283	282
1044	428	30	0	4	4	13	12	11	11	307	305
1044	429	30	30	15	15	13	13	43	43	363	361
1045	430	30	-30	13	13	12	13	37	37	412	411
1045	431	30	-30	32	32	13	12	91	91	516	514
1045	432	60	15	16	16	20	28	88	88	624	630
1046	433	30	30	10	10	26	18	29	29	679	677
1046	434	30	-15	6	6	12	13	17	17	708	707
1046	435	30	15	10	10	13	12	29	29	750	748
1047	436	30	-15	35	35	12	13	100	100	862	861
1047	437	30	-30	12	12	12	12	34	34	908	907
1047	438	60	-15	50	50	20	28	274	274	1202	1209
1048	439	30	30	23	23	27	18	71	71	1300	1298
1048	440	30	15	4	4	13	13	12	12	1325	1222
1048	441	30	-30	4	4	13	14	12	12	1350	1349
1049	442	30	-30	29	29	14	14	83	83	1447	1446
1050	443	30	0	35	35	14	13	100	100	1561	1559
1057	444	60	0	4	4	18	26	22	22	1601	1607
1060	445	30	30	10	10	25	17	29	29	1655	1653
1060	446	60	-15	14	14	18	27	77	77	1750	1757
1061	447	60	-15	7	7	32	32	38	38	1820	1827
1061	448	30	30	5	5	28	17	14	14	1860	1858
1061	449	30	-30	4	4	13	14	12	12	1885	1884
1063	450	30	0	50	50	14	13	143	143	2042	2040
1063	451	60	30	18	18	18	25	99	99	2159	2164
1063	452	30	-30	23	23	26	20	66	66	2251	2250
1064	453	30	30	7	7	14	13	20	20	2285	2283
1064	454	60	-15	56	56	19	28	307	307	2611	2618
1070	455	30	15	7	7	28	19	70	70	2659	2657
1076	456	60	-15	31	31	19	28	170	170	2848	2855
1077	457	30	-15	16	16	27	19	46	46	2921	2920
1077	458	30	0	7	7	13	12	30	20	2954	2952
1078	459	30	-30	4	4	13	13	12	12	2979	2977
1078	460	30	30	10	10	13	13	29	29	3021	3019
1078	461	30	0	4	4	13	14	12	12	3044	3042
1079	462	30	-15	16	16	11	12	46	46	3101	3100
1080	463	90	0	11	11	30	45	89	89	3220	3234
1080	464	30	15	9	9	44	28	26	26	3290	3288

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1080	465	60	-30	12	12	18	27	66	66	3374	3381
1081	466	60	0	11	11	35	24	60	60	3469	3475
1090	467	90	0	13	13	43	51	105	105	3617	3631
1092	468	90	0	23	23	62	62	186	186	3865	3879
1094	469	60	0	10	10	53	45	55	55	3973	3979
1095	470	30	30	25	25	26	18	71	71	4070	4088
1095	471	60	0	24	24	19	27	131	131	4220	4226
1095	472	30	15	13	13	27	19	27	27	4284	4282
1097	473	30	-30	8	8	12	14	23	23	4320	4319
1105	474	60	-15	26	26	19	26	142	142	4481	4487
1108	475	30	-30	4	4	25	18	11	11	4517	4516
1108	476	60	15	23	23	19	26	126	126	4662	4668
1106	477	30	-15	13	13	27	19	37	37	4726	4724
1109	478	30	-30	7	7	13	14	20	20	4759	4758
1109	479	60	15	14	14	19	26	77	77	4855	4861
1110	480	30	-30	11	11	26	19	31	31	4912	4911
1111	481	30	15	32	32	12	11	91	91	5035	5013
1111	482	30	-30	42	42	12	13	120	120	5147	5146
1112	483	120	0	56	56	46	69	600	600	5793	5815
1125	484	30	-15	8	8	68	44	23	23	5884	5882
1127	485	30	-30	4	4	12	13	11	11	5907	5906
1127	486	60	-15	10	10	20	27	55	55	5982	5988
1128	487	30	-15	26	26	27	19	74	74	6083	6081
1139	488	30	30	19	19	12	12	54	54	6149	6147
1140	489	30	0	7	7	13	13	20	20	6182	6180
1141	490	30	-30	29	29	13	14	83	83	6278	6277
1142	491	30	0	13	14	13	9	37	40	6328	6326
1146	492	30	30	12	13	13	13	37	37	6378	6376
1146	493	60	0	4	4	13	13	11	11	6402	6400
1146	494	30	-15	10	10	13	13	29	29	6444	6442
1156	495	30	-30	7	7	14	13	20	20	6478	6475
1157	496	30	-30	7	7	13	13	20	20	6511	6508
1157	497	30	30	5	5	14	13	15	15	6540	6536
1158	498	30	-30	53	53	13	14	151	151	6704	6701
1159	499	30	15	7	7	14	14	20	20	6738	6735
1160	500	60	-30	7	7	20	28	38	38	6796	6801
1160	501	30	0	16	16	27	18	46	46	6869	6865
1161	502	90	0	20	20	28	44	162	162	7059	7071
1171	503	30	-30	11	11	43	27	31	31	7133	7129
1172	504	30	0	4	4	12	12	12	12	7157	7153
1174	505	60	15	16	16	19	27	86	86	7264	7268
1175	506	30	15	10	10	23	20	29	29	7321	7317
1176	507	30	0	16	16	13	13	46	46	7380	7376
1178	508	30	30	19	19	13	13	54	54	7447	7443
1178	509	90	10	10	10	13	13	29	29	7489	7485
1182	510	20	30	5	5	13	13	14	14	7516	7512
1184	511	60	20	17	17	20	28	93	93	7629	7633
1187	512	20	20	10	10	28	20	29	29	7686	7682
1189	513	30	-30	10	10	13	14	29	29	7728	7725
1189	514	30	-30	5	5	14	14	14	14	7756	7752

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1190	515	30	30	16	16	14	13	46	46	7816	7812
1190	516	30	15	11	11	13	13	31	31	7860	7856
1190	517	30	30	12	12	13	13	37	37	7910	7906
1190	518	30	-15	6	6	13	13	17	17	7940	7936
1195	519	30	30	10	10	13	13	29	29	7982	7978
1203	520	30	-15	10	10	13	13	29	29	8024	8020
1205	521	60	-30	14	14	20	29	77	77	8121	8126
1206	522	30	-15	16	16	29	20	46	46	8156	8192
1206	523	30	15	10	10	13	13	29	29	8238	8234
1206	524	30	-30	29	29	13	14	83	83	8334	8331
1208	525	30	30	7	7	13	13	20	20	8367	8364
1220	526	30	0	4	4	12	12	11	11	8390	8387
1221	527	90	0	29	29	28	44	234	234	8652	8665
1222	528	30	-15	4	1	44	29	11	3	8707	8697
1232	529	30	-15	6	6	5	14	17	17	8729	8728
1238	530	30	-30	17	17	14	13	48	48	8791	8789
1236	531	30	-30	7	7	12	12	20	20	8823	8821
1237	532	60	15	35	35	18	26	192	192	9033	9039
1238	533	30	15	7	7	27	19	20	20	9080	9078
1238	534	30	-30	13	13	13	14	37	37	9130	9129
1239	535	30	-15	19	19	14	13	54	54	9196	9196
1240	536	30	-30	17	17	13	13	48	48	9259	9257
1240	537	60	-30	17	17	20	29	93	93	9372	9379
1242	538	60	30	6	6	35	34	33	33	9440	9446
1242	539	60	0	8	8	35	35	44	44	9519	9525
1252	540	30	-15	7	7	26	18	20	20	9565	9563
1252	541	30	15	5	9	11	11	26	26	9602	9600
1254	542	60	15	14	14	17	25	77	77	9656	9702
1264	543	30	-15	22	22	26	18	63	63	9785	9783
1265	544	30	-30	17	17	12	12	48	48	9845	9844
1266	545	30	-30	29	29	12	12	83	83	9940	9939
1266	546	30	-15	7	7	13	12	20	20	9973	9971
1266	547	30	-30	5	5	13	13	14	14	10000	9998
1267	548	90	-15	29	29	26	45	234	234	10260	10275
1268	549	60	-30	5	5	48	41	27	27	10335	10343
1268	550	90	0	39	29	46	52	315	315	10696	10710
1269	551	60	15	20	20	51	43	110	110	10857	10863
1269	552	90	0	12	12	41	50	97	97	10995	11010
1270	553	60	0	10	10	52	43	55	55	11102	11102
1271	554	60	15	38	38	34	34	208	208	11344	11350
1272	555	30	30	16	16	27	19	46	46	11417	11415
1273	556	60	0	13	11	18	26	60	50	11495	11501
1273	557	60	30	10	10	43	32	55	55	11593	11583
1274	558	60	15	16	16	32	23	68	68	11713	11709
1274	559	30	30	5	5	26	18	14	14	11733	11741
1274	560	60	-30	32	32	20	29	175	175	11948	11945
1275	561	30	15	7	7	38	18	20	20	11966	11983
1280	562	60	-30	7	7	20	29	38	38	12054	12050
1281	563	60	0	7	7	47	54	57	57	12158	12161
1283	564	30	-30	6	6	46	31	17	17	12221	12209

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1287	565	90	0	13	13	29	45	105	105	12355	12359
1288	566	30	15	6	6	45	28	17	17	12417	12404
1289	567	30	0	13	13	12	13	37	37	12466	12454
1290	568	60	15	19	19	18	25	104	104	12558	12552
1290	569	60	-15	23	33	31	32	181	181	12800	12796
1305	570	90	0	16	16	43	50	129	129	12972	12975
1305	571	60	-30	14	14	50	43	77	77	13099	13095
1305	572	60	0	13	13	33	32	71	71	13203	13198
1306	573	30	-15	24	24	24	17	69	69	13296	13284
1306	574	60	15	9	9	17	24	49	49	13362	13357
1307	575	30	15	5	5	26	18	14	14	13402	13389
1308	576	30	30	16	16	13	13	46	46	13461	13448
1308	577	30	-15	4	4	13	14	12	12	13466	13474
1312	578	30	-30	6	6	14	14	17	17	13517	13505
1317	579	60	-15	14	14	19	27	77	77	13613	13609
1319	580	30	0	16	16	26	17	46	46	13685	13672
1319	581	30	30	17	17	12	12	49	49	13746	13732
1320	582	30	30	7	7	13	13	20	20	13779	13766
1320	583	30	30	16	16	13	13	46	46	13838	13825
1320	584	30	-15	16	16	13	13	46	46	13897	13884
1322	585	30	-15	16	16	13	13	46	46	13956	13943
1322	586	30	30	15	15	12	12	43	43	14011	13998
1324	587	60	-15	8	8	19	28	44	44	14074	14070
1324	588	30	15	7	7	27	18	20	20	14121	14108
1336	589	30	-30	13	13	13	14	37	37	14171	14159
1336	590	30	0	9	9	13	12	26	26	14210	14197
1338	591	30	30	7	7	13	13	20	20	14243	14230
1338	592	30	15	7	7	13	13	20	20	14276	14263
1339	593	90	0	13	13	31	48	105	105	14412	14416
1344	594	90	0	0	8	63	62	65	65	14540	14543
1351	595	60	15	8	8	52	44	44	44	14636	14631
1353	596	30	15	10	10	27	19	29	29	14692	14679
1354	597	30	-30	10	10	13	14	29	29	14734	14722
1354	598	20	0	27	27	13	32	77	77	14824	14812
1355	599	60	15	25	25	20	28	137	137	14931	14976
1356	600	30	-30	5	5	26	18	14	14	15021	15008
1362	601	60	-30	8	8	20	29	44	44	15085	15081
1365	602	20	15	5	5	27	13	14	14	15126	15113
1370	603	30	30	16	16	12	12	46	46	15164	15171
1370	604	60	0	15	15	19	28	62	62	15285	15282
1371	605	30	-15	13	13	28	20	37	37	15350	15338
1371	606	60	-15	24	24	19	27	132	132	15501	15497
1372	607	90	0	8	8	46	53	65	65	15612	15615
1382	608	30	-15	4	4	44	29	11	11	15667	15655
1386	609	60	30	12	12	19	25	66	66	15732	15746
1386	610	60	-30	13	13	25	37	71	71	15858	15854
1387	611	30	-30	8	8	28	20	23	23	15909	15897
1387	612	30	-30	9	9	13	23	26	26	15948	15936
1387	613	30	-30	8	8	16	16	23	23	15987	15975
1387	614	30	-15	6	6	14	14	17	17	16018	16006

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1387	615	60	-15	15	15	19	27	82	92	16119	16115
1394	616	30	-15	5	5	27	18	14	14	16160	16147
1400	617	30	0	14	14	13	13	40	40	16213	16200
1401	618	30	15	10	10	13	13	29	29	16255	16242
1404	619	90	0	17	17	31	47	137	137	16423	16426
1409	620	60	30	14	14	54	45	77	77	16554	16548
1410	621	90	0	10	10	45	54	81	81	16680	16683
1416	622	60	15	10	10	53	45	55	55	16788	16783
1417	623	30	30	10	10	28	20	29	29	16845	16832
1417	624	30	-30	26	26	13	14	74	74	16932	16920
1419	625	60	15	12	12	21	28	66	66	17019	17014
1426	626	30	-30	5	5	25	18	14	14	17058	17046
1437	627	90	0	27	27	31	46	218	218	17307	17310
1449	628	60	-15	17	17	53	45	93	93	17453	17448
1451	629	30	15	10	10	27	19	29	29	17509	17496
1451	630	30	-30	16	16	13	13	46	46	17568	17555
1451	631	60	-30	15	15	20	29	82	82	17670	17666
1452	632	20	-30	10	10	28	19	29	29	17727	17714
1463	633	30	30	7	7	12	12	20	20	17759	17746
1465	634	30	-30	8	8	13	14	23	23	17795	17783
1469	635	30	-30	10	10	15	14	29	29	17839	17826
1469	636	30	30	7	7	13	13	20	20	17872	17859
1473	637	60	30	13	13	18	25	71	71	17961	17955
1480	638	30	-15	20	20	23	17	57	57	18041	18029
1482	639	30	-30	8	8	13	13	23	23	18077	18065
1483	640	30	0	13	13	13	12	37	37	18127	18114
1484	641	30	15	10	10	13	13	29	29	18169	18156
1485	642	30	0	8	8	13	13	23	23	18205	18192
1485	643	30	-15	5	5	13	13	14	14	18232	18219
1485	644	30	30	27	27	13	13	77	77	18322	18309
1486	645	60	15	8	8	20	28	44	44	18386	18381
1490	646	30	-30	7	7	28	20	20	20	18434	18421
1497	647	60	15	32	32	17	25	175	175	18626	18621
1497	648	30	-15	7	7	25	17	20	20	18671	18658
1447	649	20	-30	9	9	13	13	26	26	18710	18697
1500	650	30	-30	9	9	13	14	26	26	18749	18737
1500	651	30	-15	12	12	12	12	34	34	18795	18782
1500	652	30	15	15	15	12	13	43	43	18850	18837
1502	653	60	-15	47	47	19	27	258	258	19127	19122
1502	654	30	0	10	10	45	53	81	81	19253	19256
1514	655	60	-15	11	11	51	44	60	60	19364	19360
1514	656	30	-15	7	7	27	18	20	20	19411	19398
1514	657	90	0	15	15	30	47	121	121	19562	19566
1514	658	60	15	21	21	32	43	115	115	19725	19724
1514	659	30	-30	11	11	29	22	31	31	19739	19777
1514	660	30	-30	8	8	15	15	23	23	19827	19815
1515	661	30	-15	7	7	13	13	20	20	19860	19848
1516	662	30	-15	17	17	12	12	48	48	19920	19908
1516	663	30	-15	14	14	13	13	40	40	19973	19961
1518	664	60	15	18	18	19	27	99	99	20051	20057

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1518	665	30	-30	9	9	26	19	26	26	20143	20132
1520	666	60	C	12	12	20	27	65	66	20229	20225
1523	667	30	30	28	28	23	16	80	80	20337	20323
1512	668	60	-30	8	8	18	29	44	44	20399	20396
1530	669	30	C	7	7	28	20	20	20	20447	20436
1534	670	60	-15	14	14	19	26	77	77	20543	20539
1534	671	30	15	5	5	27	19	14	14	20584	20572
1535	672	30	30	13	13	13	13	34	34	20631	20619
1544	673	30	-30	23	23	12	13	66	66	20709	20698
1544	674	30	-30	6	6	12	12	17	17	20738	20727
1544	675	30	-30	8	8	12	12	23	23	20773	20762
1546	676	30	30	10	10	12	12	29	29	20815	20803
1547	677	30	C	16	16	13	13	46	46	20874	20862
1548	678	30	15	5	5	12	12	14	14	20900	20889
1550	679	60	-15	10	10	18	26	55	55	20973	20970
1550	680	60	15	10	10	34	33	55	55	21062	21058
1550	681	30	C	16	16	44	52	129	129	21235	21239
1555	682	30	15	5	5	45	25	14	14	21258	21282
1563	683	30	30	13	13	13	12	37	37	21344	21332
1565	684	60	-15	43	43	20	29	236	236	21600	21597
1580	685	30	-15	5	5	28	19	14	14	21642	21630
1582	686	90	C	23	23	30	45	267	267	21939	21943
1598	687	30	C	8	8	45	29	23	23	22007	21955
1611	688	30	-30	5	5	13	14	14	14	22034	22023
1621	689	30	C	7	7	12	11	20	20	22066	22054
1631	690	30	-15	6	6	10	11	17	17	22093	22082
1631	691	90	C	27	27	32	47	218	218	22243	22247
1627	692	60	-15	20	20	52	45	110	110	22505	22502
1642	693	30	C	11	11	27	18	31	31	22563	22551
1644	694	60	C	30	30	19	27	164	164	22746	22742
1646	695	30	C	12	12	27	19	34	34	22807	22795
1646	696	60	-15	10	10	21	30	55	55	22883	22880
1647	697	30	-15	5	5	28	19	14	14	22925	22913
1648	698	60	C	9	9	19	27	49	49	23992	22989
1650	699	120	C	9	0	71	0	96	0	23160	22989
1653	700	30	C	0	5	0	15	0	14	23160	23018
WRAP						39	65	0	0	23159	23083

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