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OPTICAL TECHNOLOGY DIVISION

PROJECT MEMORANDUM

PM-1550-X

7 APRIL 1975

SENSOR SYSTEM POST FLIGHT REPORT

SV-9 (S/N 012)

Prepared by: Flight Operations and Evaluation Section

Reviewed by: F.L. Harrigan Jr.
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Flight Operations and Evaluation

Approved by: W.C. Cottrell
W.C. COTTRELL, Manager
Field Operations Department

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PROJECT MEMORNADUM NUMBER: PM-1550-X

PREPARED BY: Flight Operations & Evaluation

DATE: 7 April 1975

SUBJECT: Sensor System Post Flight Report
SV-9 (S/N 012)

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ABSTRACT: This report outlines the flight history for the SV-9 (S/N 012) Sensor System.

DESCRIPTORS: Flight Report, S/N 012
Flight Operations, S/N 012

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MISSION 1209

SENSOR SYSTEM OPERATION

POST FLIGHT REPORT

1.0 INTRODUCTION

1.1 Mission Objective

The primary objective of the Hexagon Mission is to provide high resolution photography. The intent of the ninth flight was to demonstrate functional operation of the primary satellite vehicle 120 day capability. This objective was surpassed with an active mission life of 130 days.

1.2 Mission Description

The Hexagon Mission 1209 satellite vehicle was launched from VAFB, SLC-4E, at 1130 PST 29 October 1974 using a Titan 3D booster vehicle. All recovery vehicles were successfully air retrieved within predicted impact dispersions. Recoveries were Day 19, 55, 84 and 130 respectively.

Operational photography began on Rev 6, Mission Op 4 and continued with no camera system malfunctions throughout the mission. The Aft camera film supply was depleted on Rev 2086, Mission Op 757. The Foward camera film supply was depleted on Rev 2090, Mission Op 759.

Evaluation of RV-1 photography indicated a need to change the Aft camera OOAA in-track nominal from -3 steps to -7 steps. This change was made on Mission Op 156. Evaluation of Rv-2 photography indicated a need to change the Forward camera OOAA in-track nominal from -3 steps to -2 steps. This change was made on Mission Op 390.

The Aft camera film supply contained three segments of SO-255 color film and one segment of SO-130 IR color film. The lengths and operational intervals associated with these segments were as follows:

SO-255	2775 ft	Ops 162-183	Revs 378-431
SO-255	2875 ft	Ops 314-345	Revs 754-818
SO-255	2500 ft	Ops 458-471	Revs 1129-1177
SO-130	3400 ft	Ops 514-530	Revs 1275-1320

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1.2 Mission Description - Cont'd.

The active photographic mission was terminated with Rv-4 recovery on day 130 following depletion of both film supplies. A solo phase of the mission extended the vehicle life to day 141, at which time the vehicle was deboosted and re-entered.

1.3 Mission Highlights

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

a. The Sensor System demonstrated a functional orbital life of 130 days.

b. Both Forward and Aft cameras utilized 100% of their respective film supplies. Approximately 98% of the available pneumatics was expended.

c. The Sensor System demonstrated the capability to operate satisfactorily with SO-130 infrared color film and SO-255 color film in the Aft camera.

d. A stellar photography experiment was demonstrated on Rev 1769, Mission Op 713.

e. The image quality for both cameras ranged from very good to poor during the mission; the poor being attributable to atmospheric conditions, photography at both high and low solar elevations and climatic conditions associated with winter missions. The image quality of 1209 compared with previous missions, and there was a preference for the Aft camera imagery when compared to the Forward.

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

1.4 Launch Configuration

a. Mission Operation Number 1209
b. Intra-range Operation No. 7122
c. Satellite Vehicle - SV-9
d. Sensor System - S/N 012
e. Sensor System Configuration

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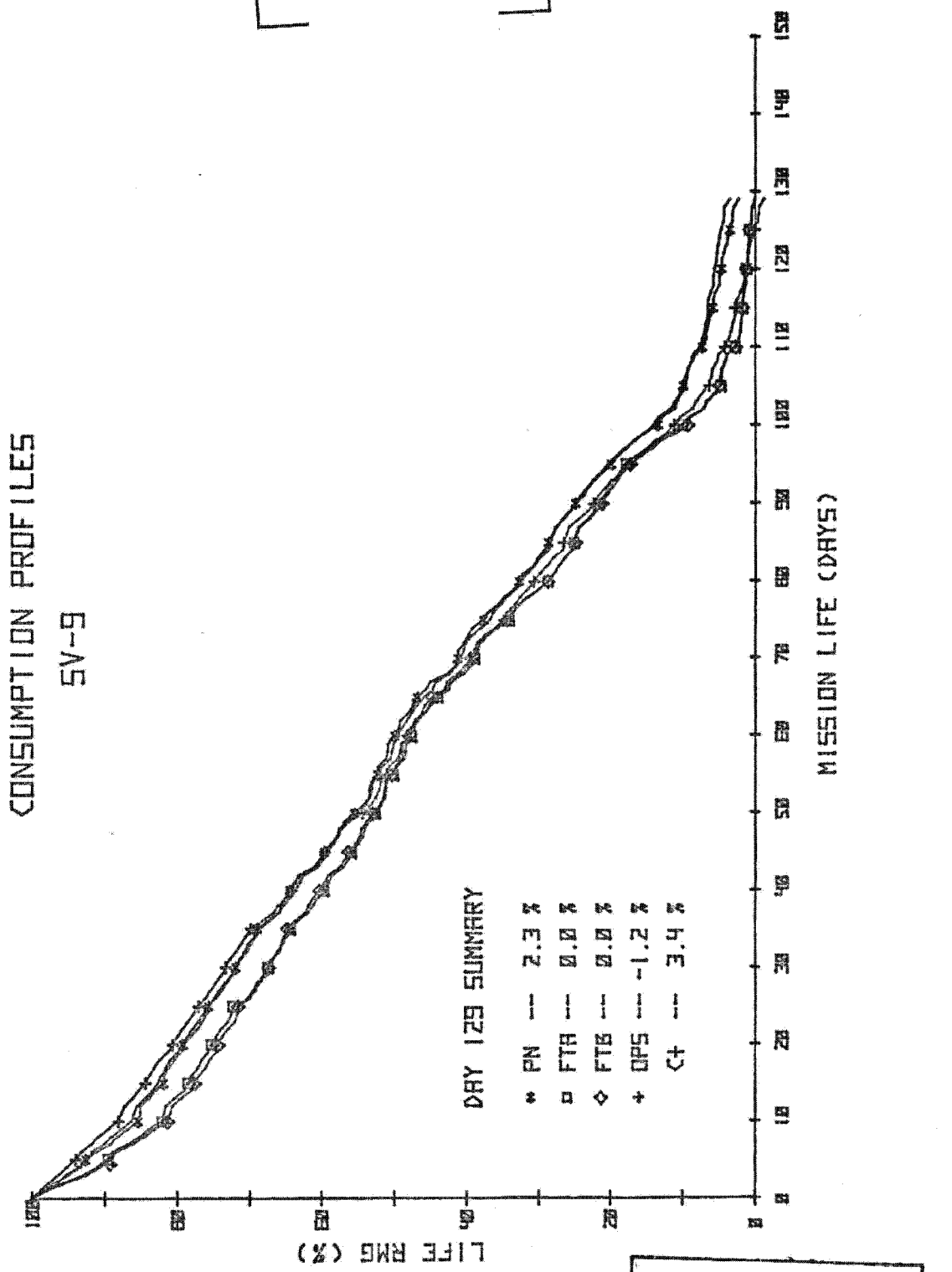

Figure I-1 Consumption Profiles

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1.4 Launch Configuration - Cont'd.

	Forward Camera	Aft Camera
Filter Types	W-12	W-12
Focal Length	60.0041 in.	59.9906 in.
Focus Setting	31 Microns	70 Microns
OOAA Setting		
In-Track	-3 CMD Steps	-3 CMD Steps
Cross-Track	+3 CMD Steps	-3 CMD Steps
Film Type	1414	1414/SO-255/SO-130
Film Length	116,930	111,958
Film Weight	920.0 lbs.	914.4 lbs.
Spool Number	5052	5048
Pneumatics Loaded	34.8lbs.	

1.5 Launch and Orbital Parameters

	Planned	Actual
Launch Time-GMT	1930Z	1930Z
Launch Time-SVT	67.0	67.0
Inclination-degrees	96.8	96.7
Initial Perigee-n.miles	87.1	85.3
Initial Apogee-n.miles	151.8	155.6
Argument of Perigee-degrees	160.2	163.3
Initial Period-minutes	88.89	88.94

Table 1-1 and Figure 1-2 define the basic orbital parameter considerations for the active mission. Fifty-one orbit adjusts were performed.

1.6 Mission Film Usage Summary

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

	Rev Span	Camera	Recovered
RV-1	Launch-307	Forward	29512
		Aft	29576
RV-2	308-888	Forward	29537
		Aft	26886
RV-3	889-1358	Forward	28505
		Aft	27652
RV-4	1359-2090	Forward	29250
		Aft	27733

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1.6 Mission Film Usage Summary-Cont'd.

Of this footage, the engineering and other non-intelligence operations consumed approximately 4400 and 4408 feet for the A and B sides, respectively, as summarized in the following:

1209 Non-Intelligence

	Forward Camera	Aft Camera
Pre-Launch	1601	1609
RV-1 Engineering	983	983
RV-2 Engineering	726	726
RV-3 Engineering	541	541
RV-4 Engineering	549	549
Total Utilization	4400	4408
Film Recovered	116804	111847
PCT. Non-Intelligence	3.77	3.94

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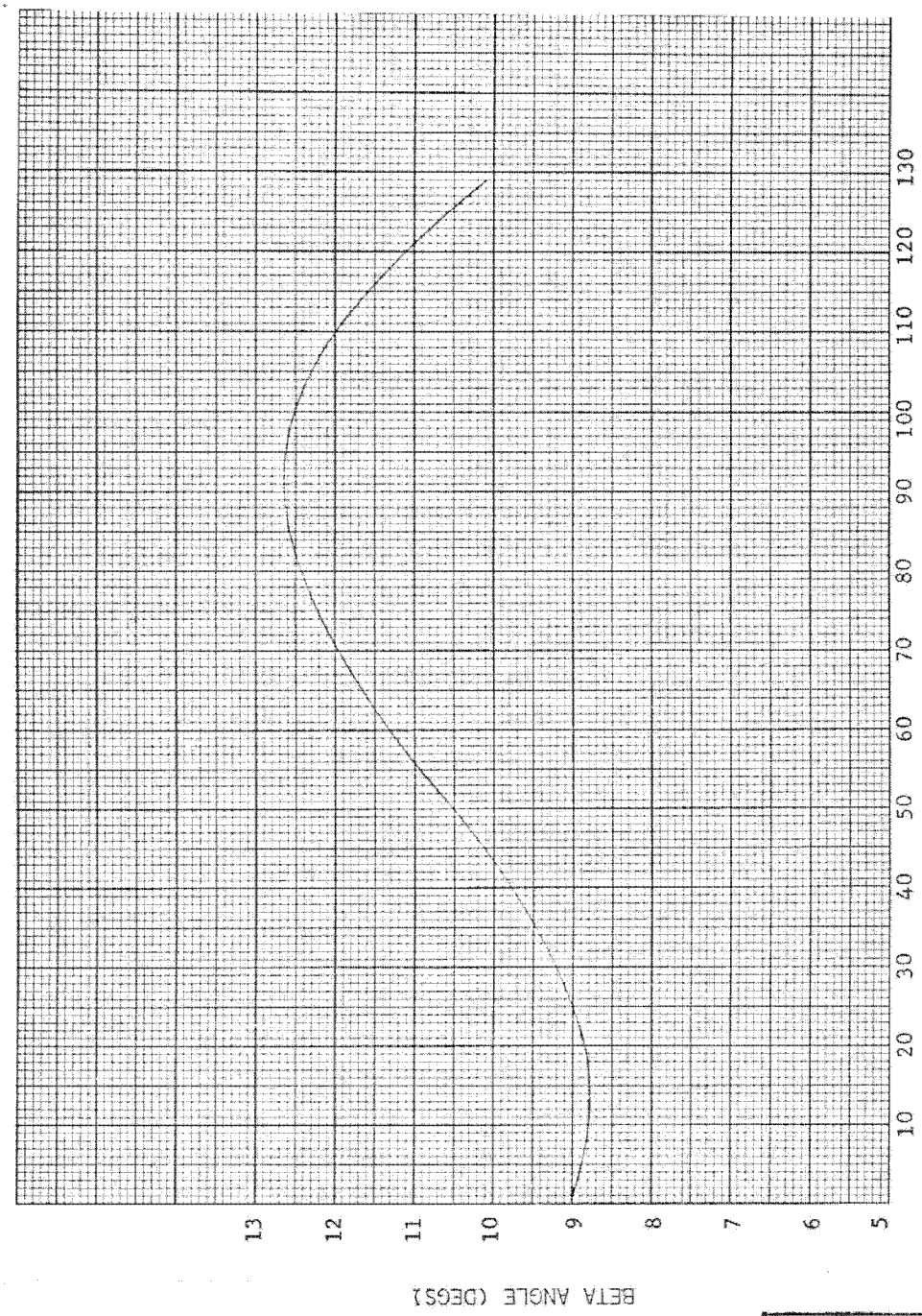

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FIG. I-2 BETA ANGLE vs MISSION DAY

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TABLE I - 1

BASIC ORBITAL PARAMETERS

DAY	REV	PERIOD	PERIGEE	APOGEE	INC.	ARG/PER	B ANG
L/O	NOM	88:54	87.3	152.5	96.8	158.4	9.0
0	1	88:57	85.3	155.8	96.7	168.4	9.0
1	8	88:56	85.4	154.8	96.7	166.0	9.0
2	24	88.52	85.0	152.4	96.7	161.6	9.0
3	40	88:48	84.8	150.0	96.7	157.1	8.9
4	57	88:44	84.7	147.3	96.7	152.2	8.9
OA# 1	63						
5	73	88:49	87.9	151.5	96.7	141.3	8.9
6	89	88:45	87.8	149.5	96.7	137.2	8.9
7	105	88:40	87.7	147.3	96.7	133.0	8.9
OA# 2	112						
8	122	88:51	88.0	155.7	96.7	136.8	8.8
9	142	88:47	87.8	153.1	96.7	131.9	8.8
10	154	88:44	87.8	151.3	96.7	128.7	8.8
OA# 3	159						
11	170	88:52	88.0	157.6	96.7	130.9	8.8
12	186	88:47	87.9	154.9	96.7	126.9	8.8
13	203	88:42	87.7	152.4	96.7	122.5	8.8
14	219	88:37	87.4	149.5	96.7	118.6	8.8
OA# 4	224						
15	235	88:55	87.8	162.8	96.7	125.4	8.8
16	251	88:50	87.7	160.3	96.7	121.6	8.8
OA# 5	257						
OA# 6	259						
17	268	88:49	87.9	152.7	96.7	137.6	8.8
18	284	88:45	87.9	151.0	96.7	133.4	8.8
OA# 7	286						
19	300	89:04	88.0	166.0	96.7	138.8	8.9
20	316	89:00	88.0	163.9	96.7	134.8	9.0
OA# 8	322						
21	332	88:49	88.0	155.1	96.7	131.2	8.9
22	349	88:44	88.0	152.7	96.7	126.8	8.9
23	365	88:40	87.7	150.2	96.7	122.8	9.0
OA# 9	370						
24	381	88:51	87.8	159.5	96.7	126.5	9.0
25	397	88:47	87.7	157.0	96.7	122.6	9.0
26	413	88:43	87.5	154.5	96.7	118.7	9.1
OA#10	420						
27	430	88:52	87.7	161.4	96.7	120.4	9.1
28	446	88:47	87.5	158.9	96.7	116.6	9.1
29	462	88:42	87.1	156.1	96.7	112.9	9.2

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TABLE I - 1 Cont'd.

BASIC ORBITAL PARAMETERS

DAY	REV	PERIOD	PERIGEE	APOGEE	INC.	ARG/PER	B ANG
OA#11	467						
OA#12	469						
30	478	88:52	88.0	155.9	96.7	137.8	9.2
31	494	88:48	88.0	153.9	96.7	133.6	9.3
32	511	88:44	88.0	151.8	96.7	129.2	9.3
OA#13	517						
33	527	88.50	87.7	157.3	96.7	129.6	9.4
34	543	88:46	87.8	155.1	96.7	125.1	9.4
35	559	88:42	87.6	152.4	96.7	121.2	9.5
OA#14	565						
36	576	88:52	87.8	160.4	96.7	123.6	9.6
37	592	88:47	87.7	158.2	96.7	119.7	9.6
38	608	88:43	87.5	155.9	96.7	115.9	9.7
OA#15	614						
OA#16	616						
39	624	88:51	88.1	155.2	96.7	137.9	9.7
40	640	88:48	88.1	153.3	96.7	133.8	9.8
41	657	88:44	88.1	151.0	96.7	129.3	9.9
OA#17	662						
42	673	88:49	87.9	156.3	96.7	129.2	9.9
43	689	88:45	87.7	153.9	96.7	125.3	10.0
44	705	88:41	87.6	151.4	96.7	121.4	10.1
OA#18	711						
45	722	88:53	87.9	161.0	96.7	124.7	10.2
46	738	88:49	87.7	158.9	96.7	120.9	10.2
47	754	88:45	87.6	156.7	96.7	117.1	10.3
OA#19	759						
48	770	88:50	87.8	161.0	96.7	117.3	10.4
49	786	88:46	87.6	158.8	96.7	113.6	10.5
50	803	88:41	87.3	155.8	96.6	109.6	10.5
OA#20	808						
OA#21	810						
51	819	88:51	87.9	154.6	96.6	137.6	10.6
52	835	88:46	87.7	152.2	96.6	133.5	10.7
53	851	88:41	87.6	149.7	96.6	129.5	10.8
OA#22	857						
54	868	88:51	88.0	157.1	96.6	133.0	10.8
55	884	88:47	88.0	154.9	96.6	128.8	10.9
56	900	88:43	87.7	152.3	96.6	124.8	11.0
OA#23	906						
57	916	88:52	87.9	159.3	96.6	126.8	11.1
58	932	88:47	87.8	156.8	96.6	122.9	11.1
59	949	88:42	87.5	153.8	96.6	118.6	11.2

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TABLE I - I Cont'd.

BASIC ORBITAL PARAMETERS

DAY	REV	PERIOD	PERIGEE	APOGEE	INC.	ARG/PER	B ANG
OA#24	961						
60	965	88:54	87.9	162.5	96.6	123.1	11.3
61	981	88:49	87.9	160.0	96.6	119.2	11.4
62	997	88:45	87.7	157.4	96.6	115.4	11.4
OA#25	1003						
OA#26	1005						
63	1014	88:50	88.1	154.2	96.6	137.4	11.5
64	1030	88:46	87.9	152.1	96.6	133.2	11.6
65	1046	88:42	87.9	149.8	96.6	129.1	11.6
OA#27	1052						
66	1062	88:53	88.0	158.3	96.6	132.0	11.7
67	1078	88:49	88.0	156.2	96.6	128.1	11.8
68	1095	88:44	87.8	153.2	96.6	123.7	11.8
OA#28	1100						
69	1111	88:50	87.9	158.9	96.6	125.0	11.9
70	1127	88:45	87.7	156.0	96.6	121.2	12.0
71	1143	88:40	87.4	152.9	96.6	117.3	12.0
OA#29	1149						
72	1159	88:52	87.9	161.8	96.6	121.5	12.1
73	1176	88:48	87.7	159.1	96.6	117.3	12.1
74	1192	88:43	87.4	156.5	96.6	113.5	12.2
OA#30	1198						
OA#31	1200						
75	1208	88:52	87.9	155.7	96.6	138.0	12.2
76	1224	88:48	87.9	153.6	96.6	133.9	12.3
77	1241	88:42	87.7	150.4	96.6	129.4	12.3
OA#32	1246						
78	1257	88:49	87.9	155.6	96.6	131.6	12.4
79	1273	88:44	87.7	152.9	96.6	127.6	12.4
80	1289	88:39	87.5	149.9	96.6	123.7	12.4
OA#33	1295						
81	1305	88:53	87.9	159.4	96.6	128.6	12.5
82	1322	88:48	87.8	156.6	96.6	124.3	12.5
83	1338	88:43	87.6	153.9	96.6	120.3	12.5
OA#34	1344						
84	1354	88:53	87.9	161.9	96.6	122.8	12.6
85	1370	88:48	87.9	159.1	96.6	118.8	12.6
86	1387	88:43	87.7	156.0	96.6	114.6	12.6
OA#35	1393						
87	1403	88:50	87.7	161.6	96.6	115.5	12.6
88	1419	88:45	87.4	158.6	96.6	111.8	12.6
89	1435	88:40	87.1	155.5	96.6	108.1	12.6
OA#36	1441						

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TABLE I - I Cont'd.

BASIC ORBITAL PARAMETERS

DAY	REV	PERIOD	PERIGEE	APOGEE	INC.	ARG/PER	B ANG
OA#37	1443						
90	1451	88:55	88.2	157.7	96.6	137.9	12.6
91	1468	88:50	88.4	154.7	96.6	133.2	12.6
92	1484	88:45	88.2	152.0	96.6	129.0	12.6
OA#38	1490						
93	1500	88:50	87.8	157.9	96.6	127.7	12.6
94	1516	88:46	87.7	155.2	96.6	123.7	12.6
95	1533	88:40	87.5	152.1	96.6	119.8	12.6
OA#39	1538						
96	1549	88:51	88.0	160.1	96.6	123.4	12.6
97	1565	88:46	87.7	156.9	96.6	119.5	12.6
98	1581	88:41	87.4	153.6	96.6	115.6	12.6
OA#40	1587						
99	1597	88:53	87.9	162.8	96.6	119.5	12.5
100	1614	88:47	87.6	159.4	96.6	115.4	12.5
101	1630	88:42	87.2	156.1	96.6	111.5	12.5
OA#41	1636						
102	1646	88:51	88.6	162.1	96.6	115.9	12.4
103	1662	88:46	88.3	158.9	96.6	112.2	12.4
104	1678	88:41	87.9	155.5	96.6	108.5	12.3
OA#42	1684						
105	1695	88:52	88.7	163.0	96.6	112.3	12.3
106	1711	88:46	88.2	159.3	96.6	108.6	12.2
107	1727	88:40	87.5	155.0	96.6	105.1	12.2
OA#43	1733						
OA#44	1735						
108	1743	88:54	89.0	156.4	96.6	137.7	12.1
109	1759	88:49	88.9	153.6	96.6	133.4	12.0
110	1776	88:43	88.7	150.4	96.6	128.6	12.0
OA#45	1782						
111	1792	88:50	89.1	155.3	96.6	131.1	11.9
112	1808	88:45	88.8	152.4	96.6	127.3	11.8
113	1824	88:40	88.6	149.3	96.6	123.3	11.8
OA#46	1830						
114	1841	88:52	89.0	157.9	96.6	127.9	11.7
115	1857	88:48	88.9	155.4	96.6	123.9	11.6
116	1873	88:43	88.7	152.5	96.6	119.9	11.5
OA#47	1879						
117	1889	88:52	89.0	160.1	96.6	122.5	11.4
118	1906	88:47	88.8	156.7	96.6	118.3	11.3
119	1922	88:41	88.3	153.5	96.6	114.4	11.2
OA#48	1928						
120	1938	88:52	88.8	161.5	96.6	118.0	11.1
121	1954	88:47	88.6	158.5	96.6	114.2	11.0
122	1970	88:42	88.3	155.5	96.6	110.5	10.9

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TABLE I - 1 Cont'd.

BASIC ORBITAL PARAMETERS

DAY	REV	PERIOD	PERIGEE	APOGEE	INC.	ARG/PER	B ANG
OA#49	1976						
123	1987	88:53	88.8	164.0	96.6	113.2	10.8
124	2003	88:48	88.4	160.7	96.6	109.4	10.7
125	2019	88:43	88.0	157.1	96.6	105.9	10.6
OA#50	2025						
126	2035	88:52	88.8	163.9	96.6	108.9	10.4
127	2051	88:46	88.5	160.6	96.6	105.4	10.3
128	2068	88:40	87.8	155.9	96.6	101.4	10.2
OA#51	2074						
129	2084	88:51	88.5	164.3	96.6	105.3	10.1

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FIGURE I - 4

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

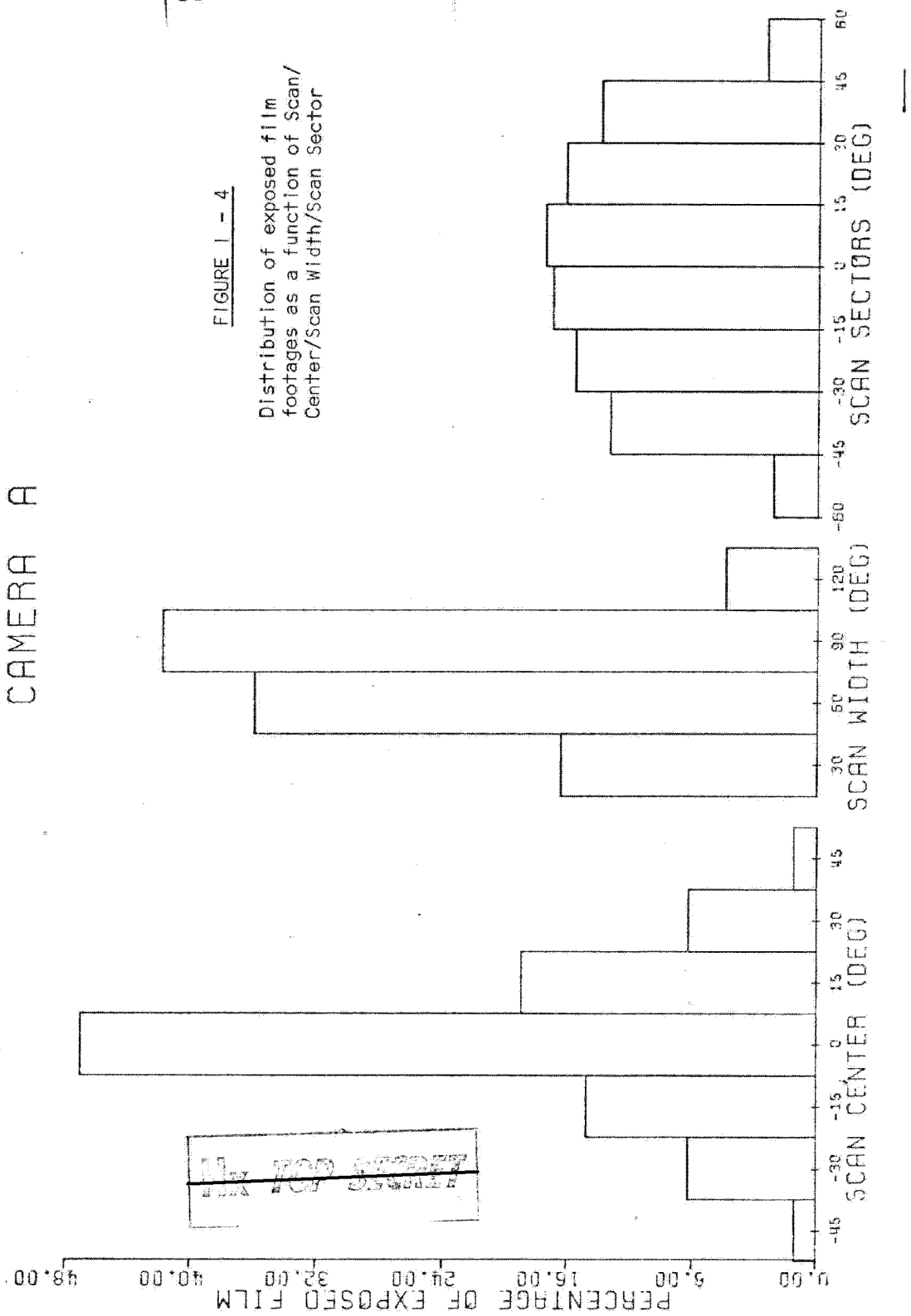

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FIGURE I - 5

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

1209

CAMERA B

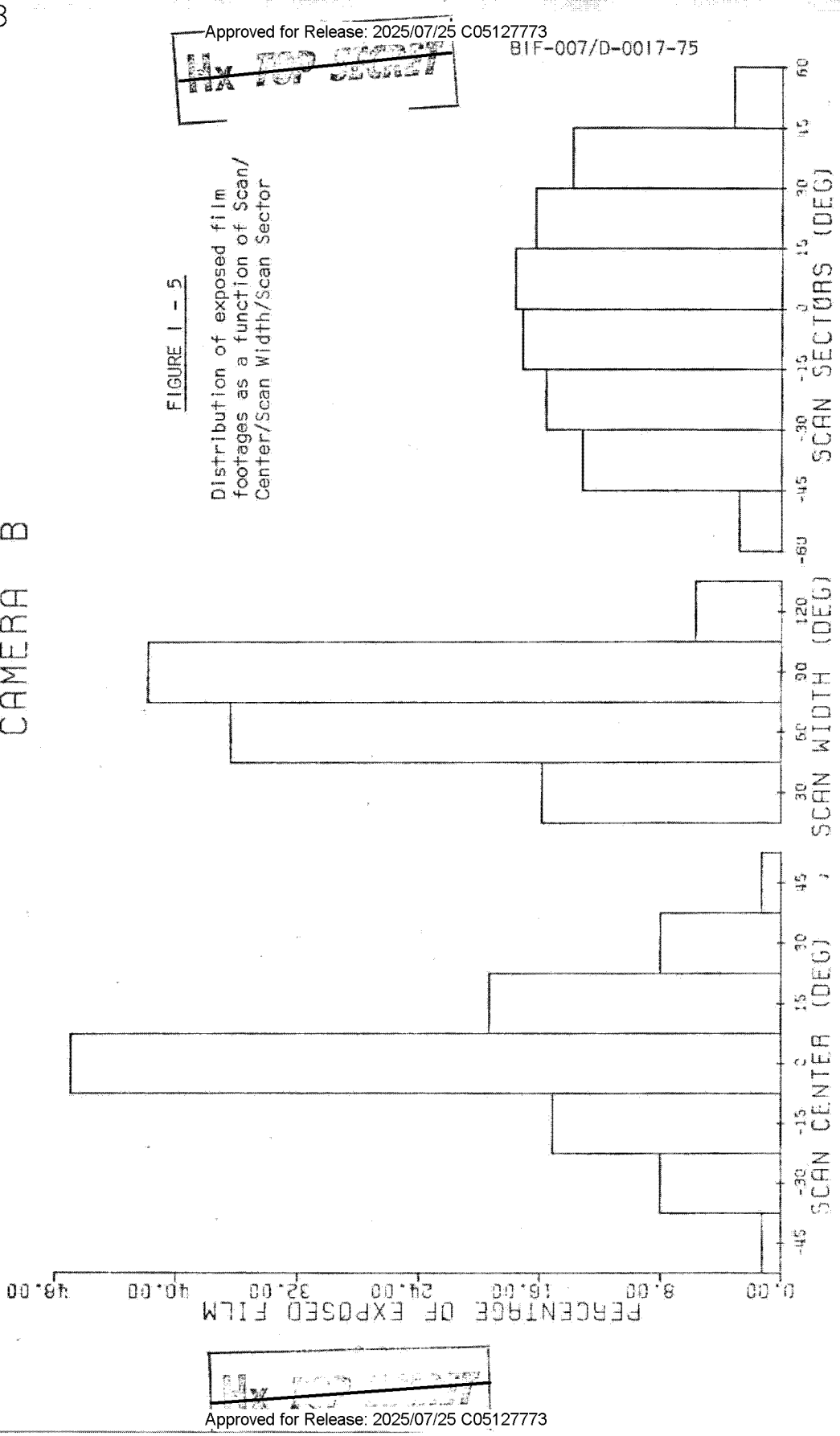

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FIGURE I - 6

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

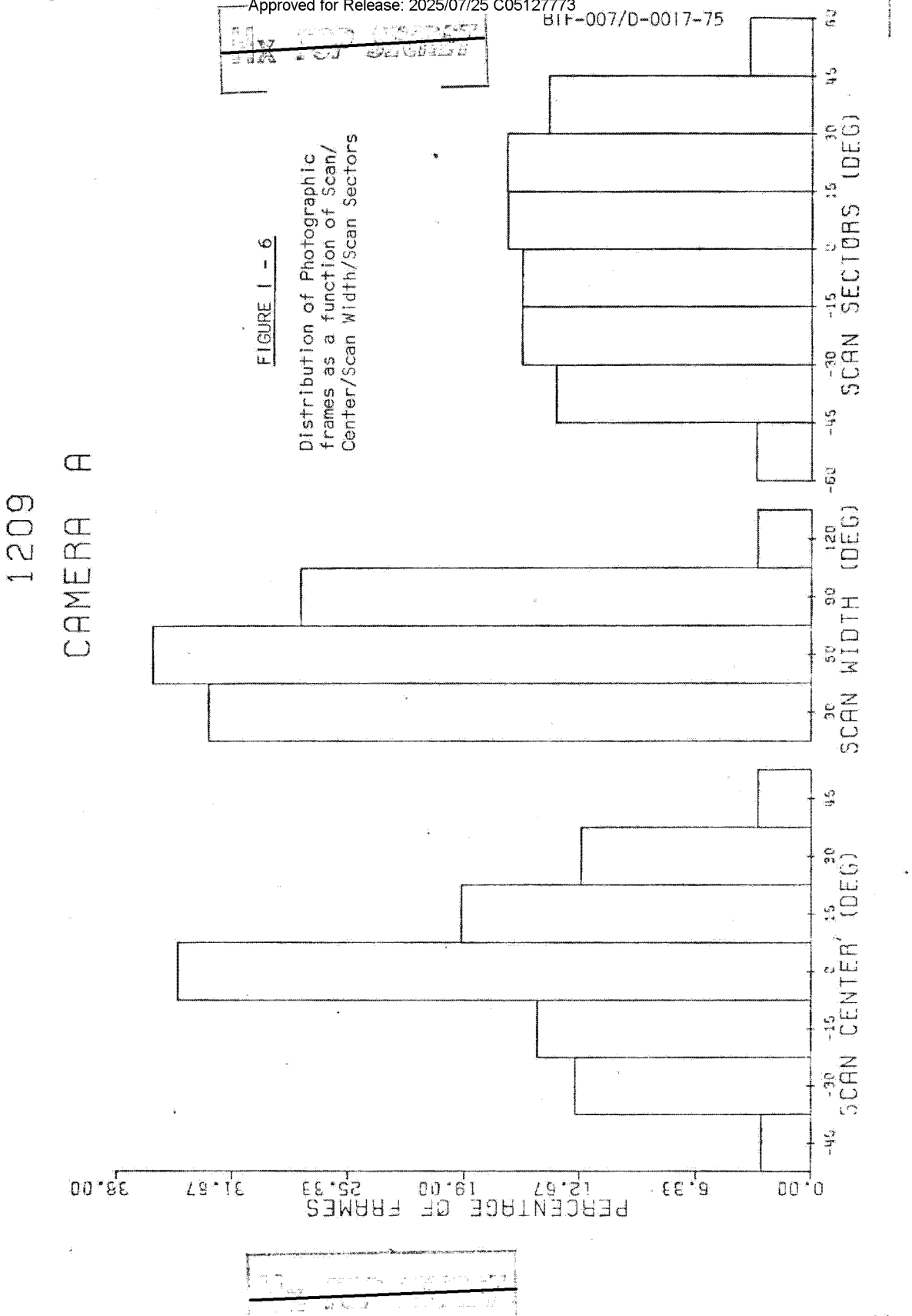

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FIGURE I - 7

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

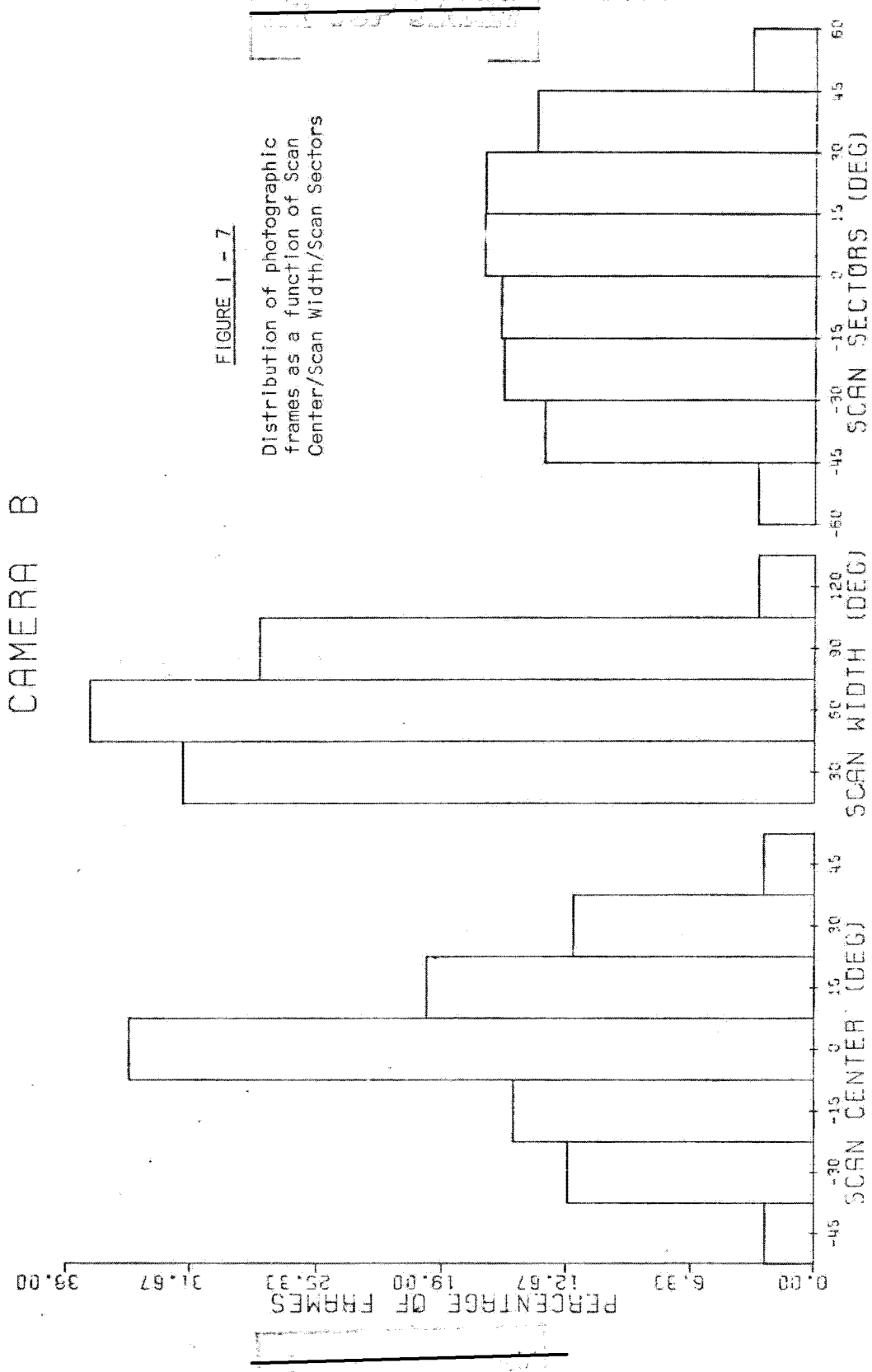

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FIGURE I - 8

Distribution of land mass coverage as a function of Scan Sectors

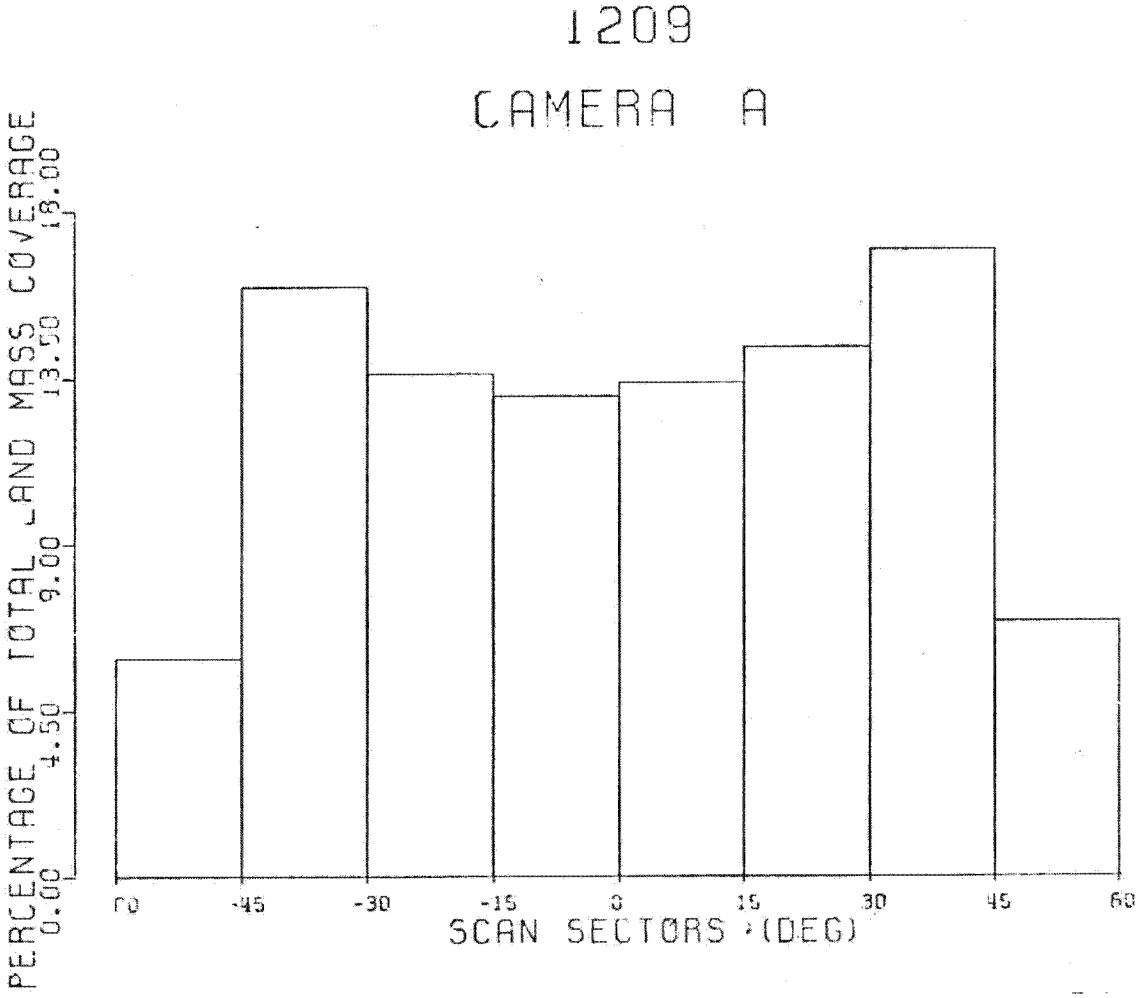

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FIGURE I - 9

Distribution of land mass coverage as a function of Scan Sectors

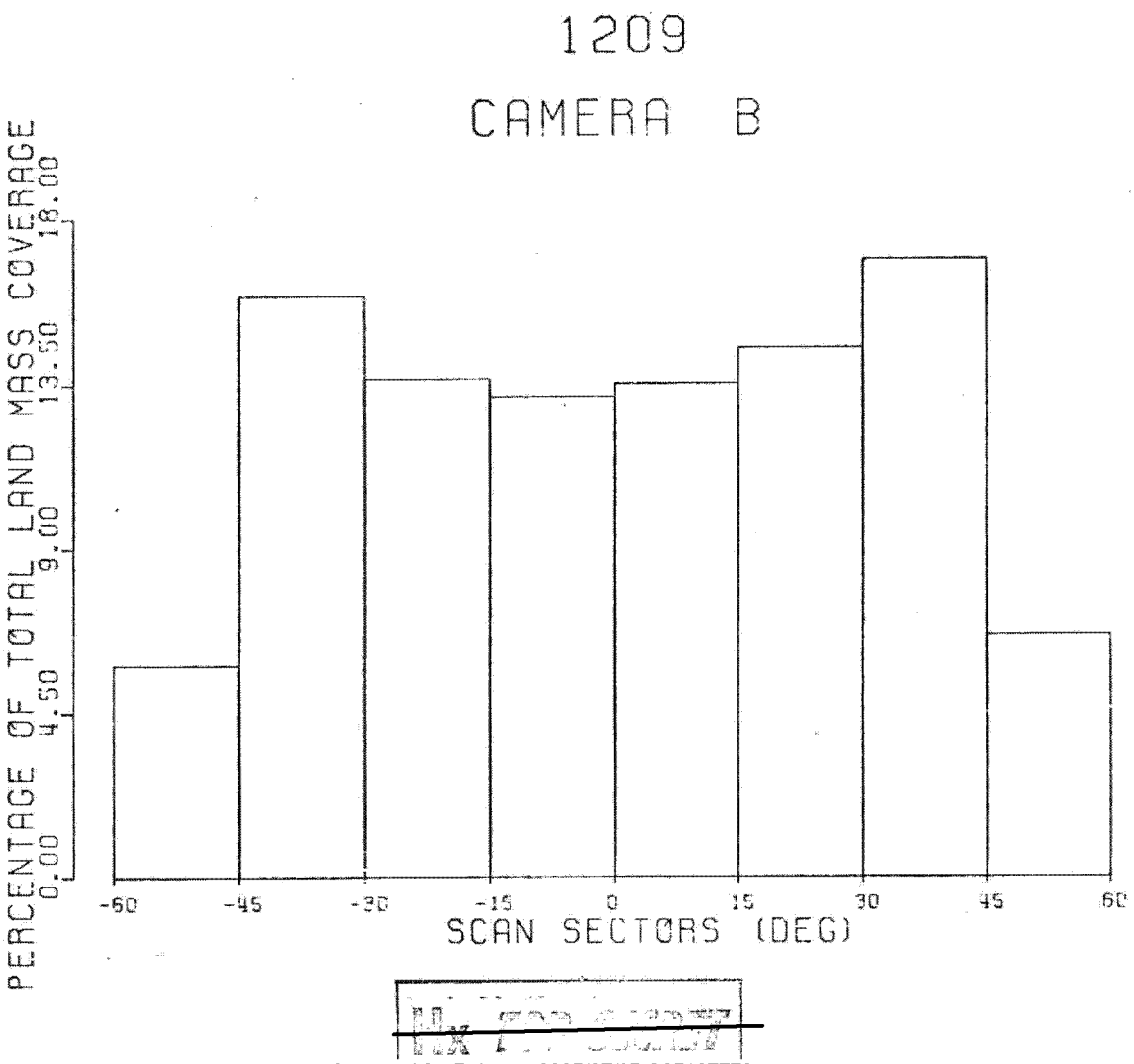

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FIGURE 1 - 10

Percentage of exposed film
vs.
Solar Evaluation

1209
CAMERA A

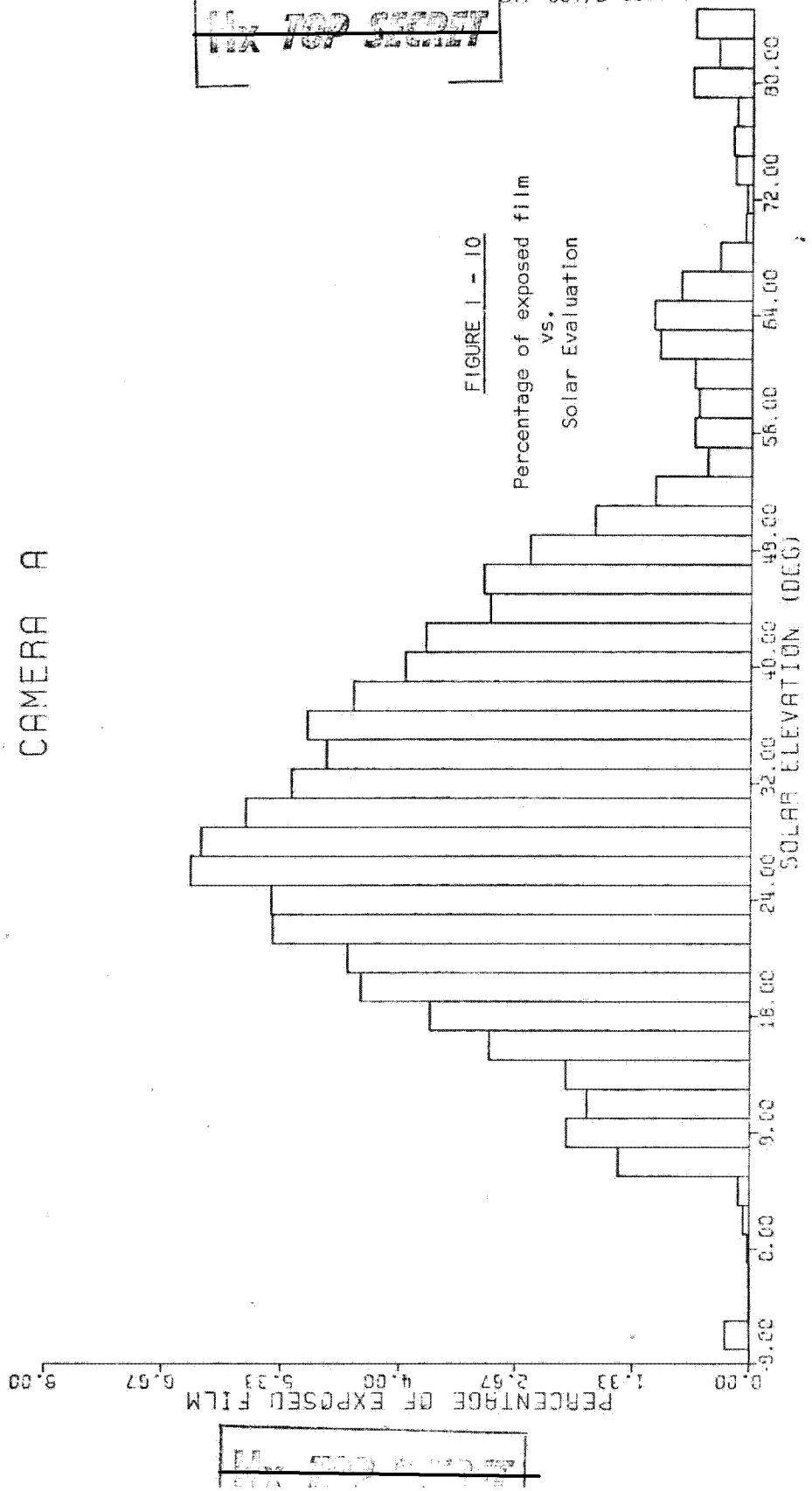

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FIGURE I - II

Percentage of exposed film
vs.
Solar Elevation

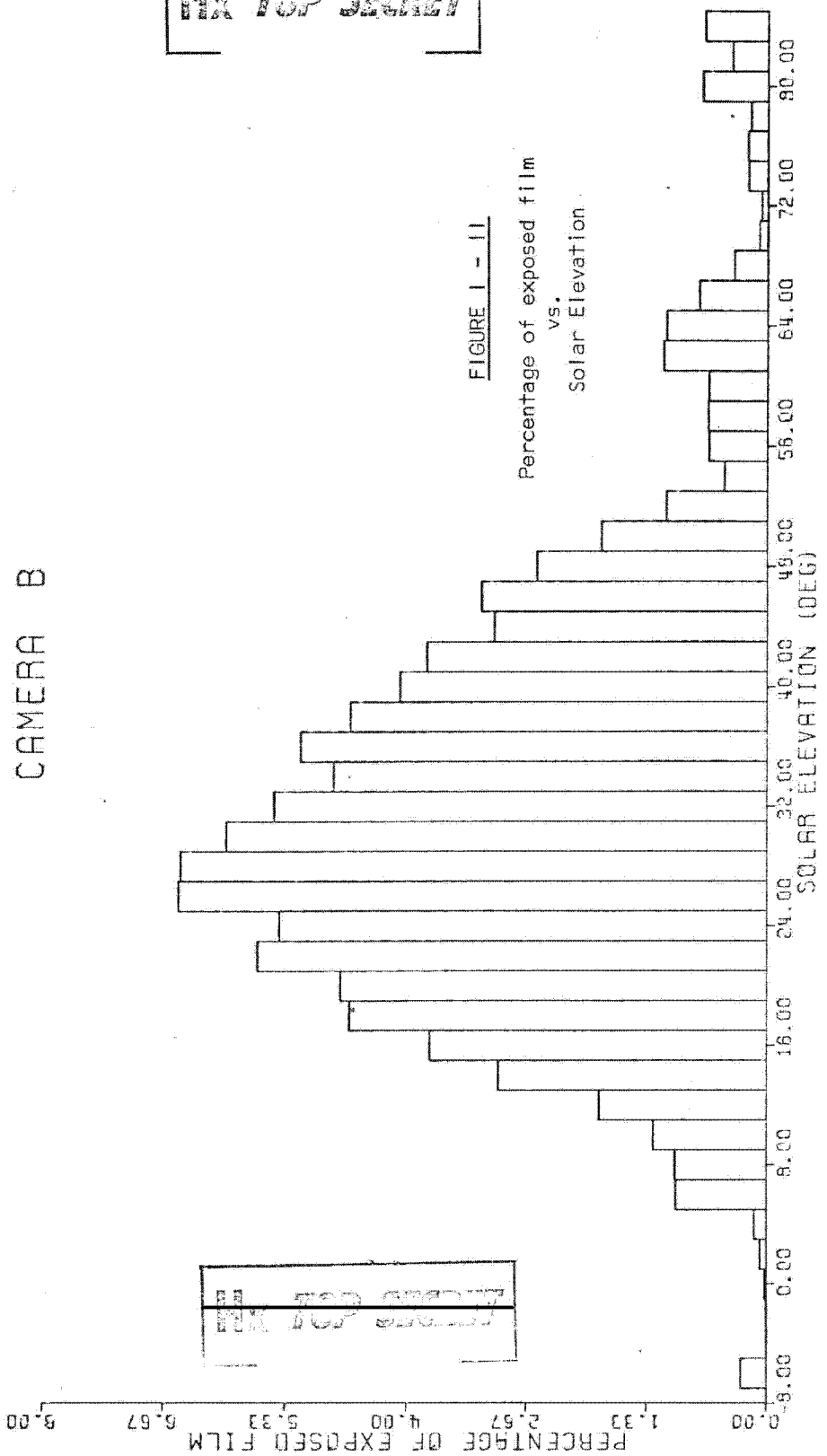

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FIGURE 1 - 12

Percentage of exposed film
vs.
Vehicle Altitude

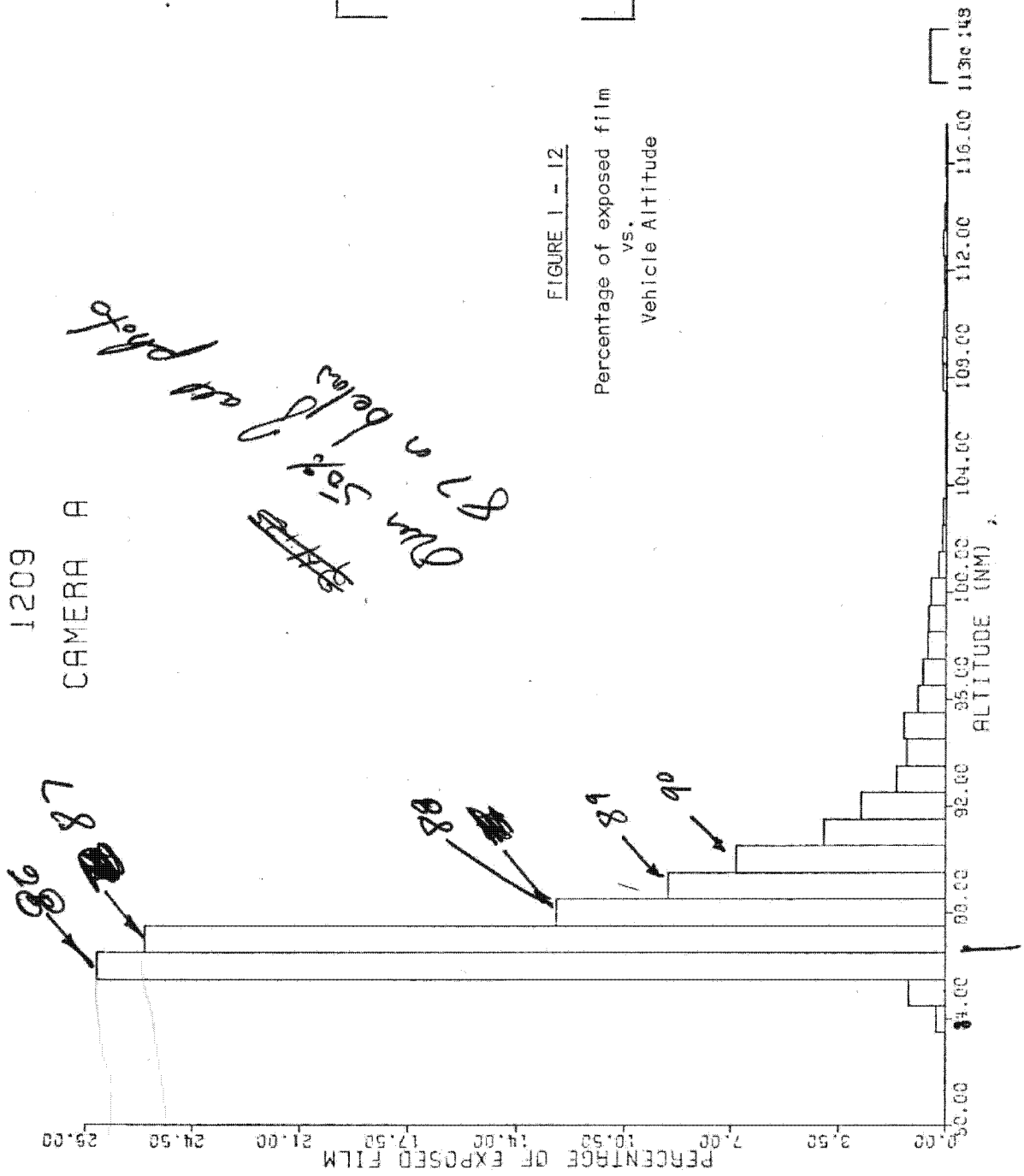

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FIGURE 1 - 13

Percentage of exposed film
vs.
Vehicle Altitude

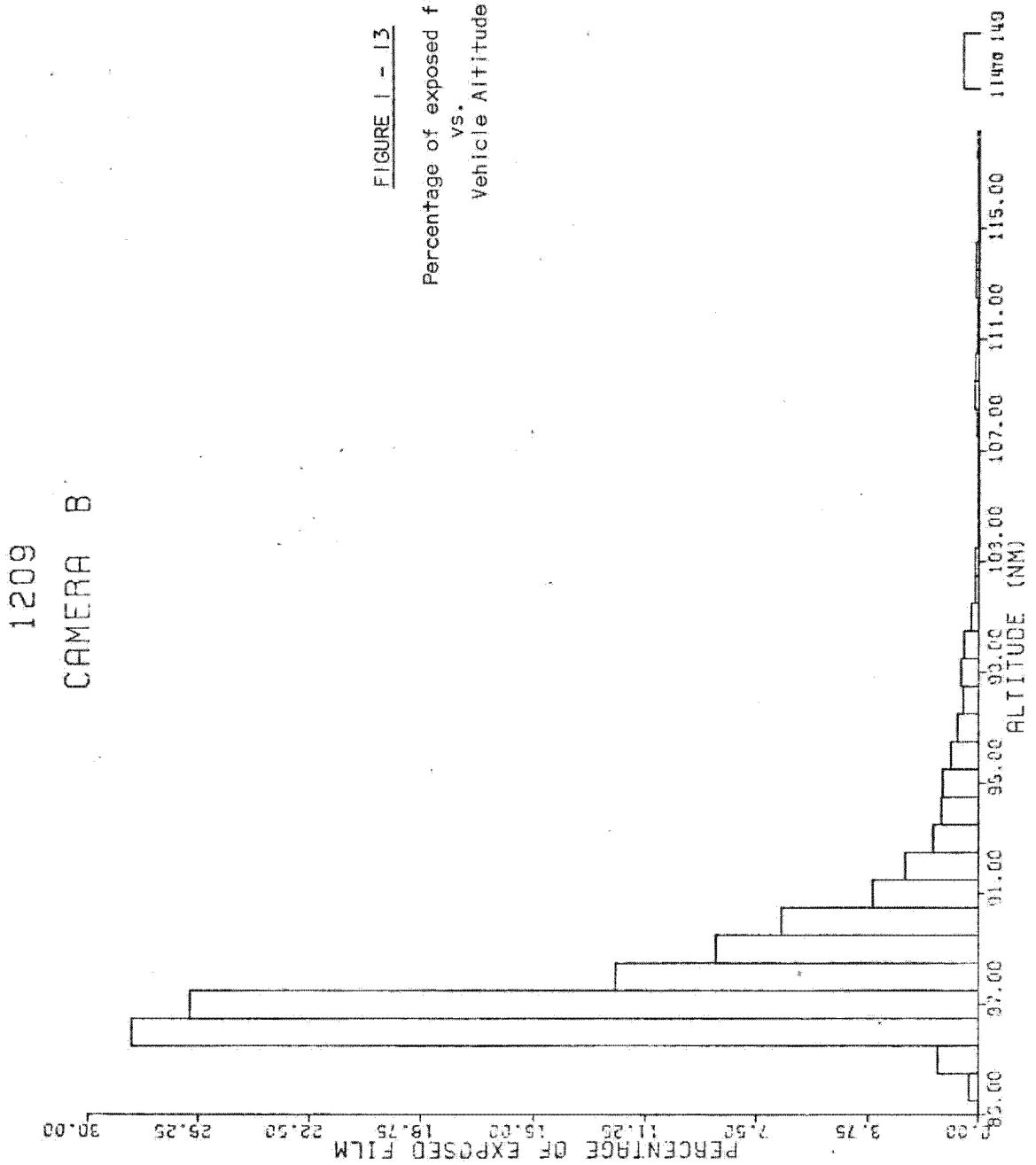

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FIGURE I - 14

Percentage of exposed film
vs.
Latitude

Between 30 → 50
10 + 10 + 12 + 14 + 15
+ 10 71%

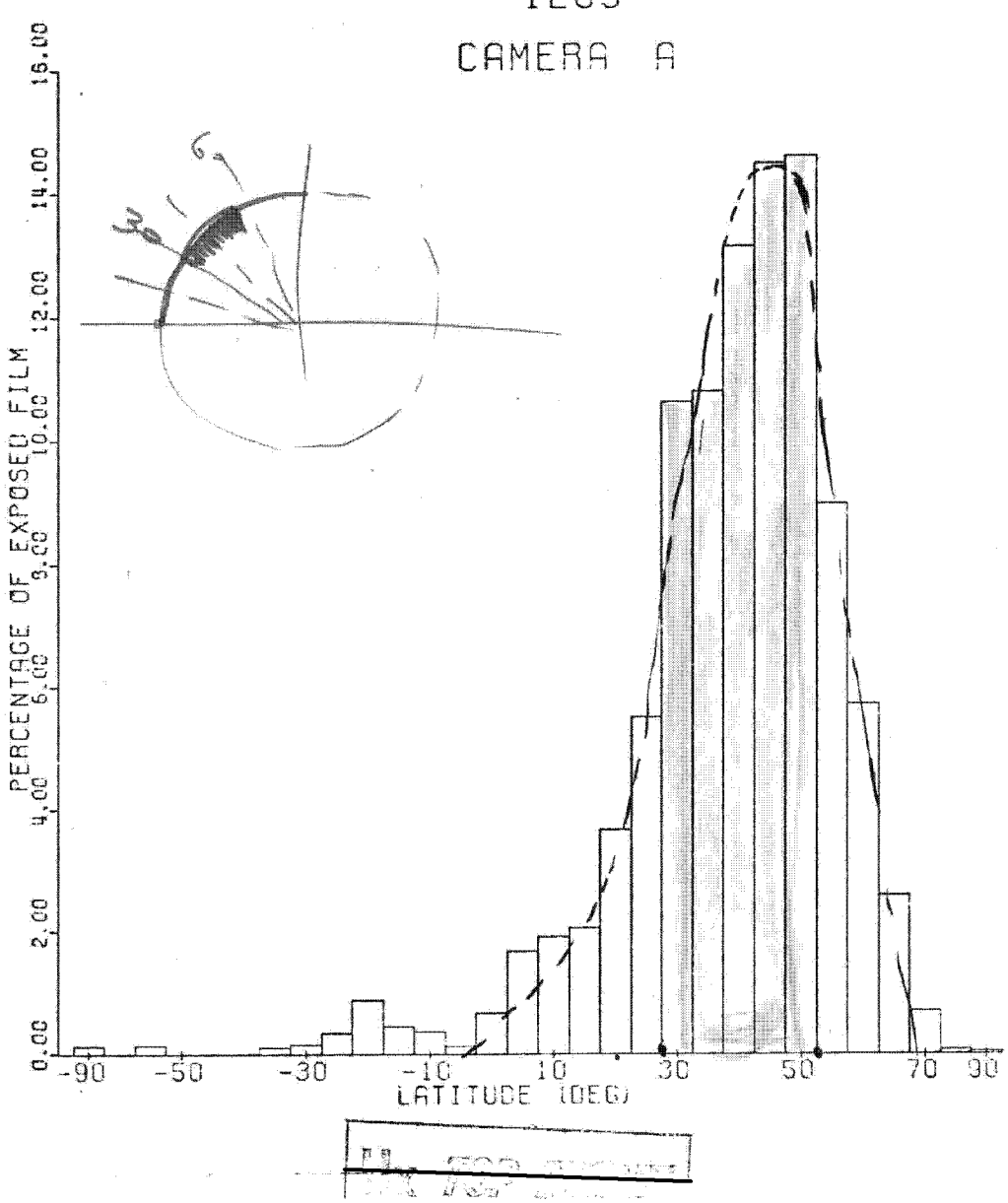

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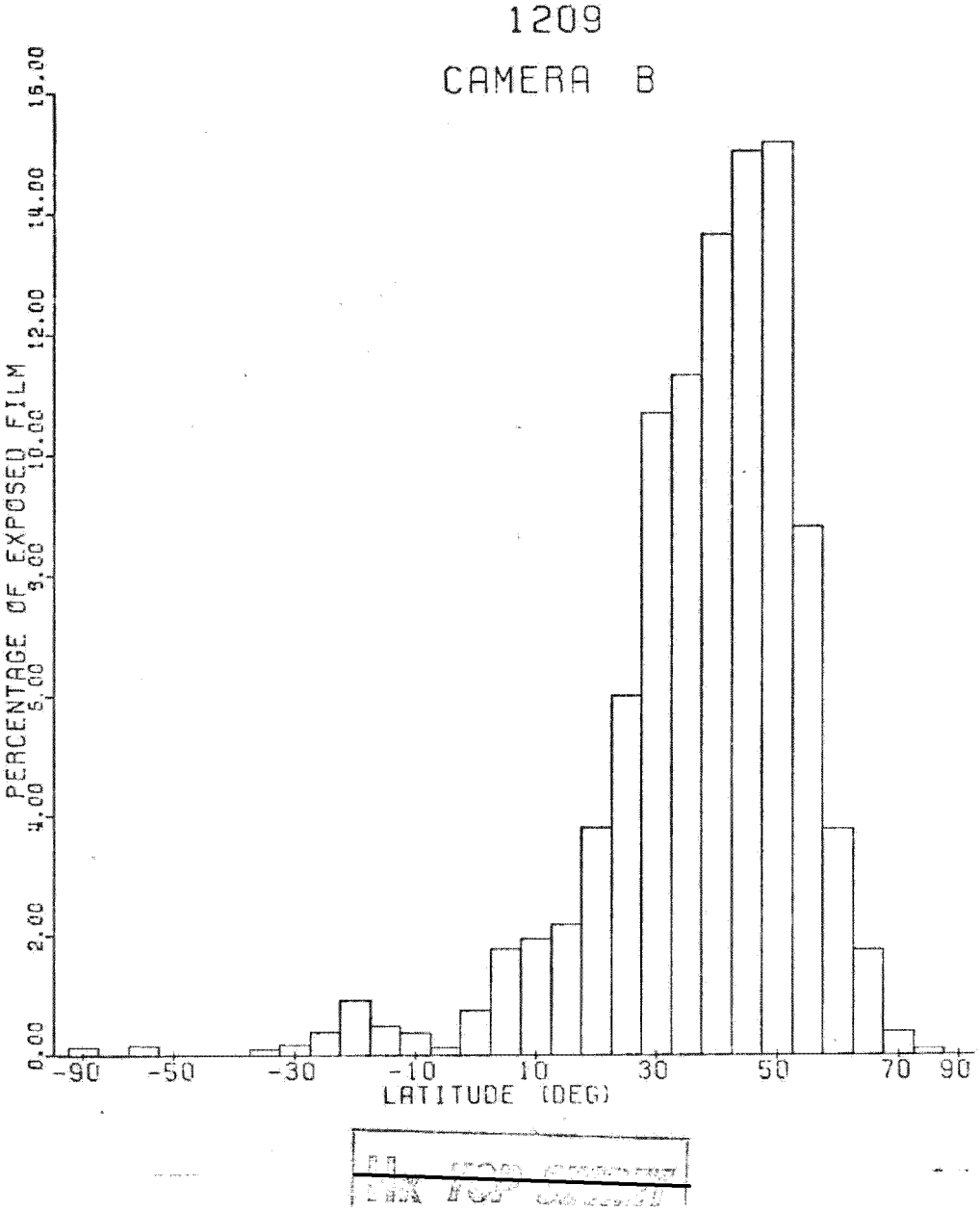
FIGURE I - 15

Percentage of exposed film
vs.
Latitude



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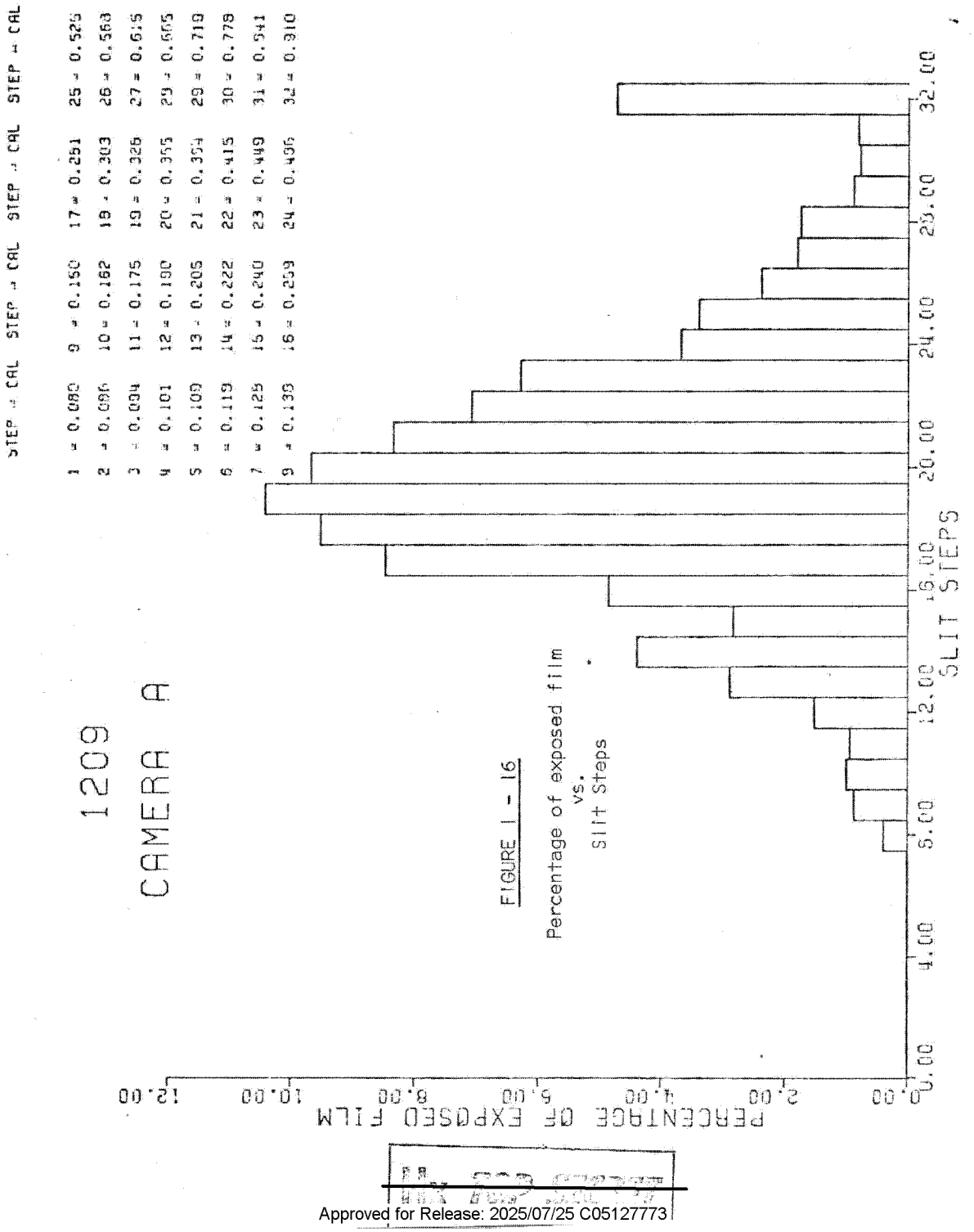

FIGURE 1 - 16

Percentage of exposed film
vs.
Slit Steps

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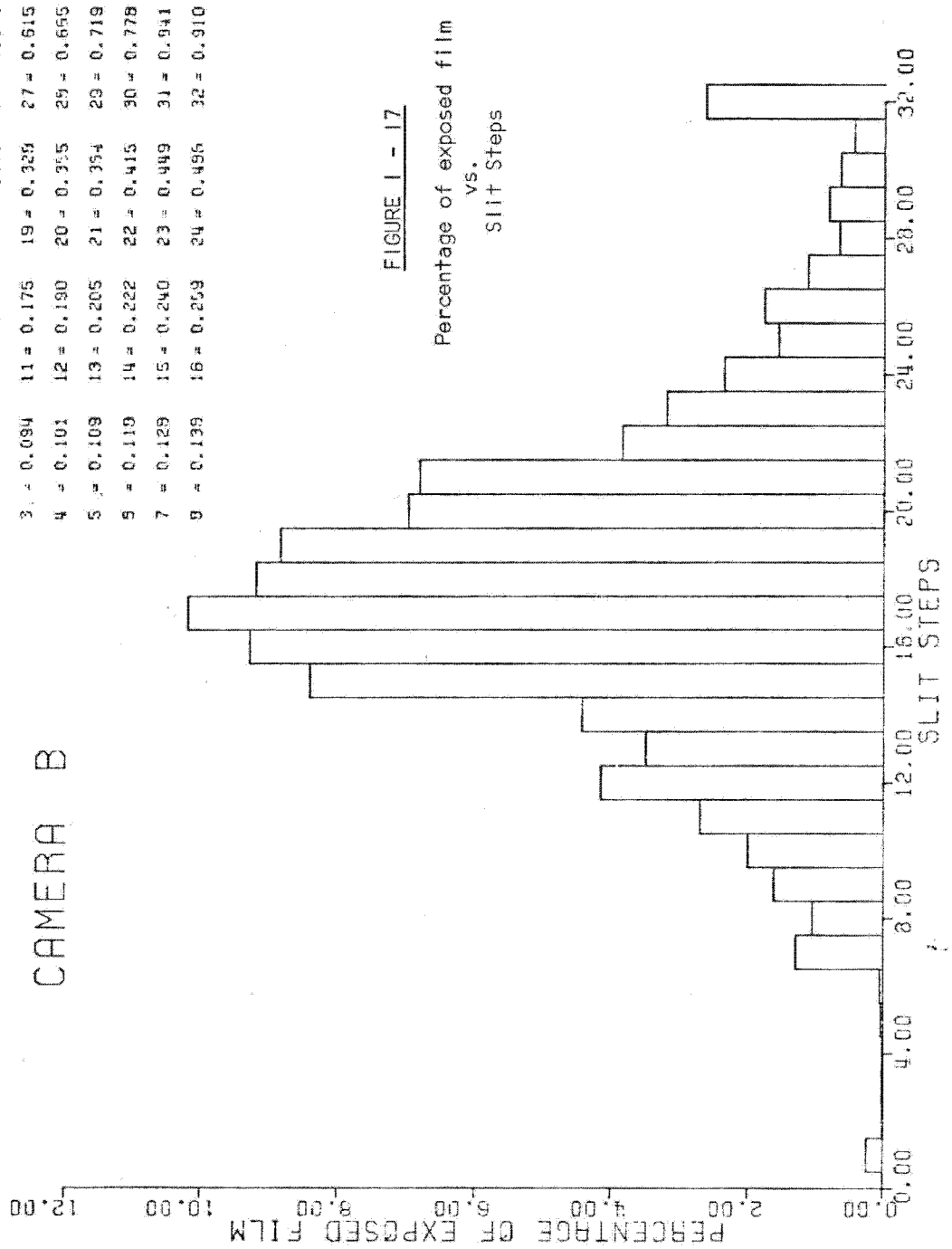

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FIGURE I - 18

Distribution of fully framed
Targets vs. Scan Sectors

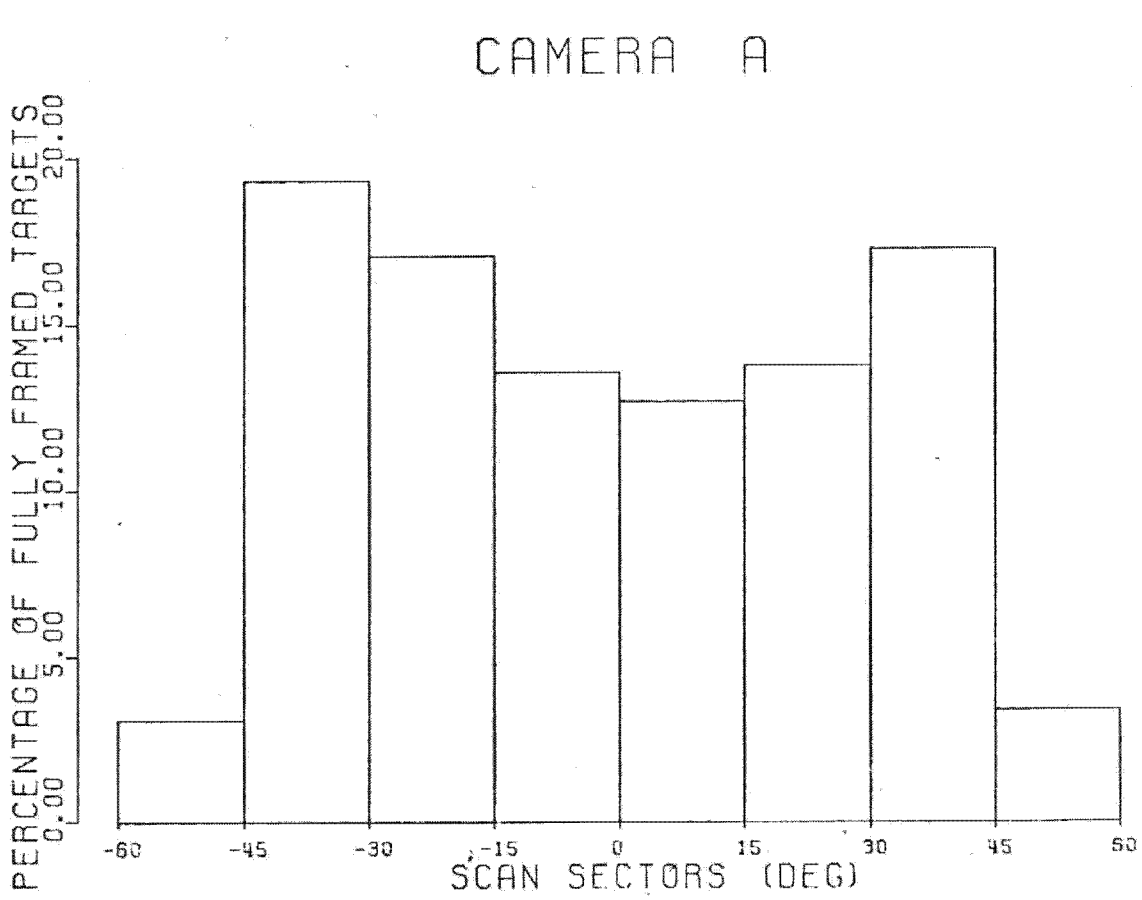

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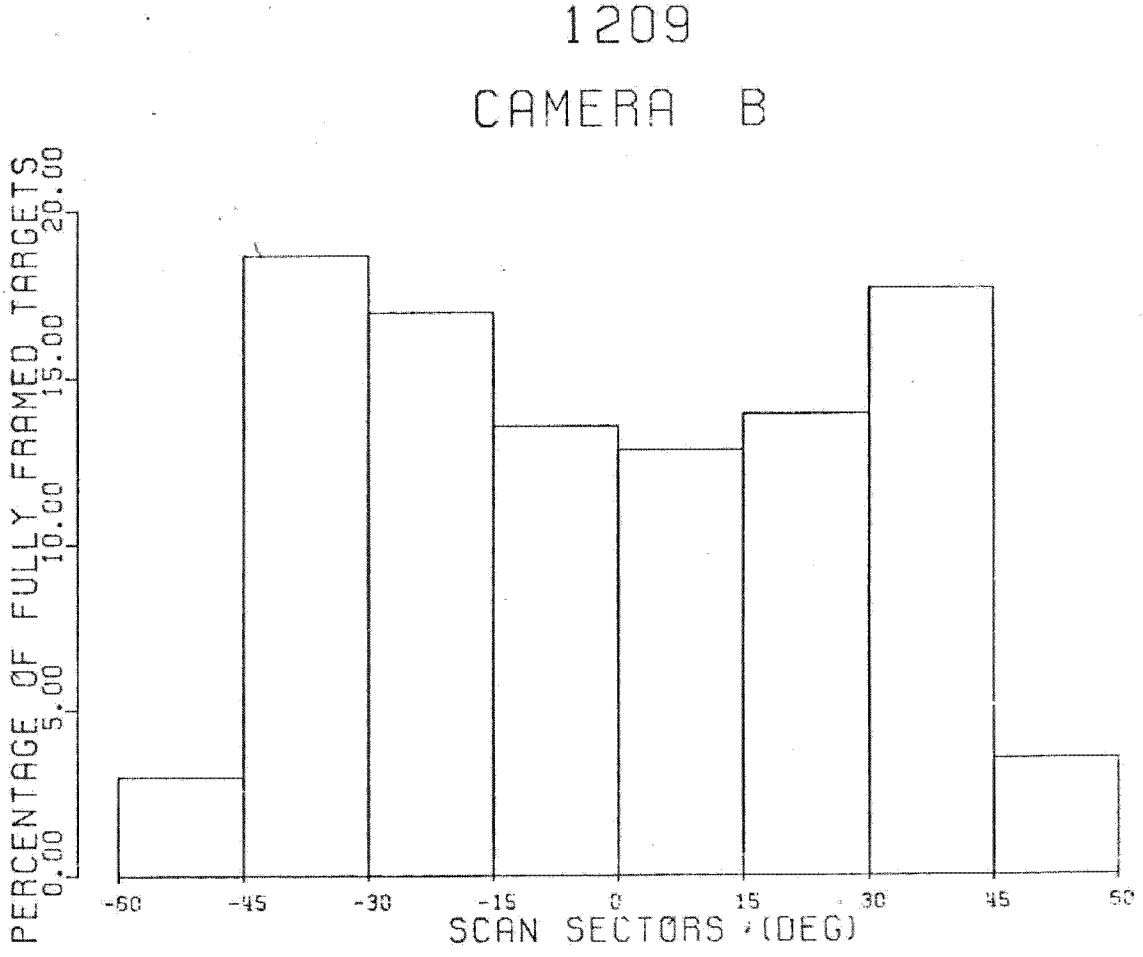
FIGURE I - 19

Distribution of fully framed
Targets vs. Scan Centers



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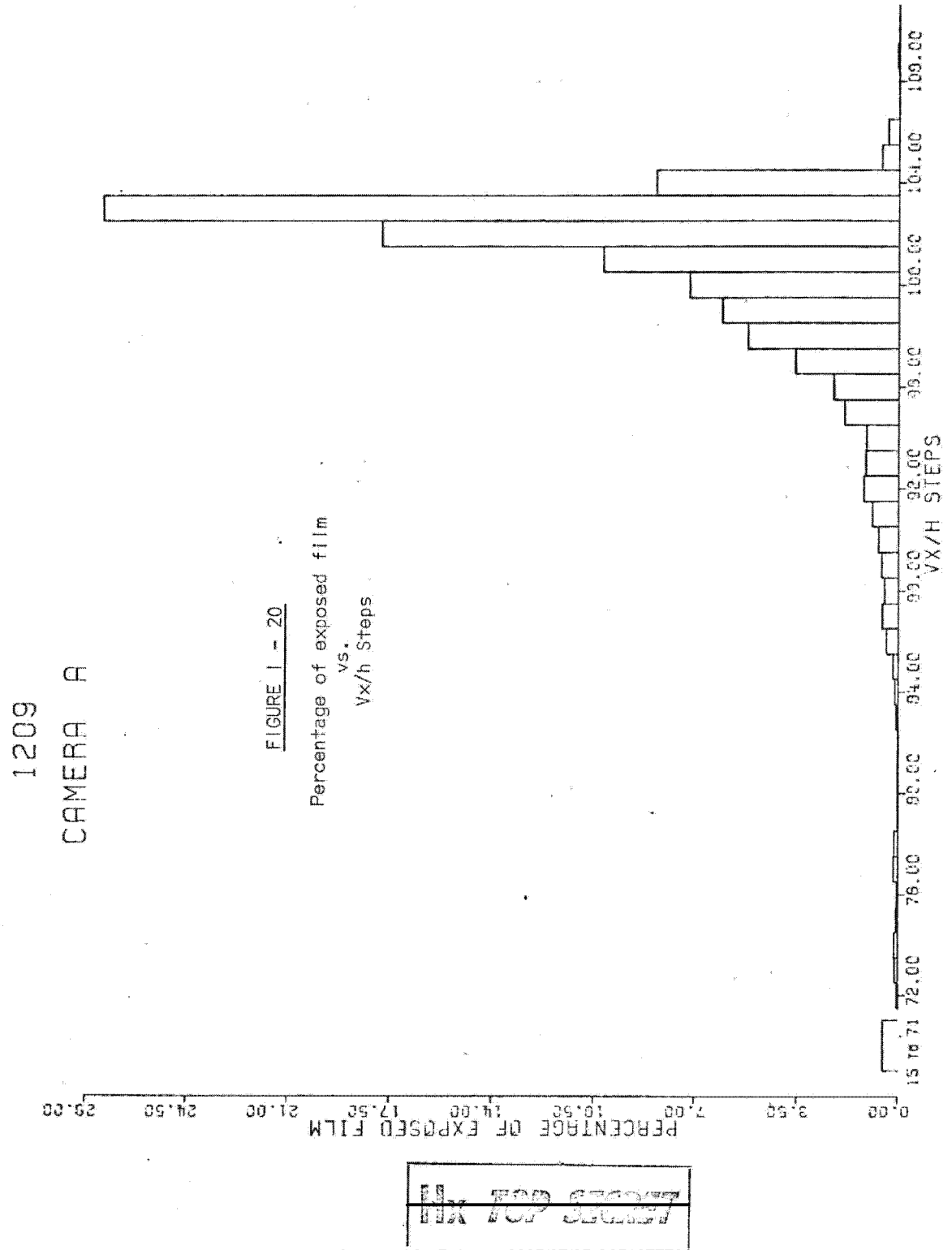

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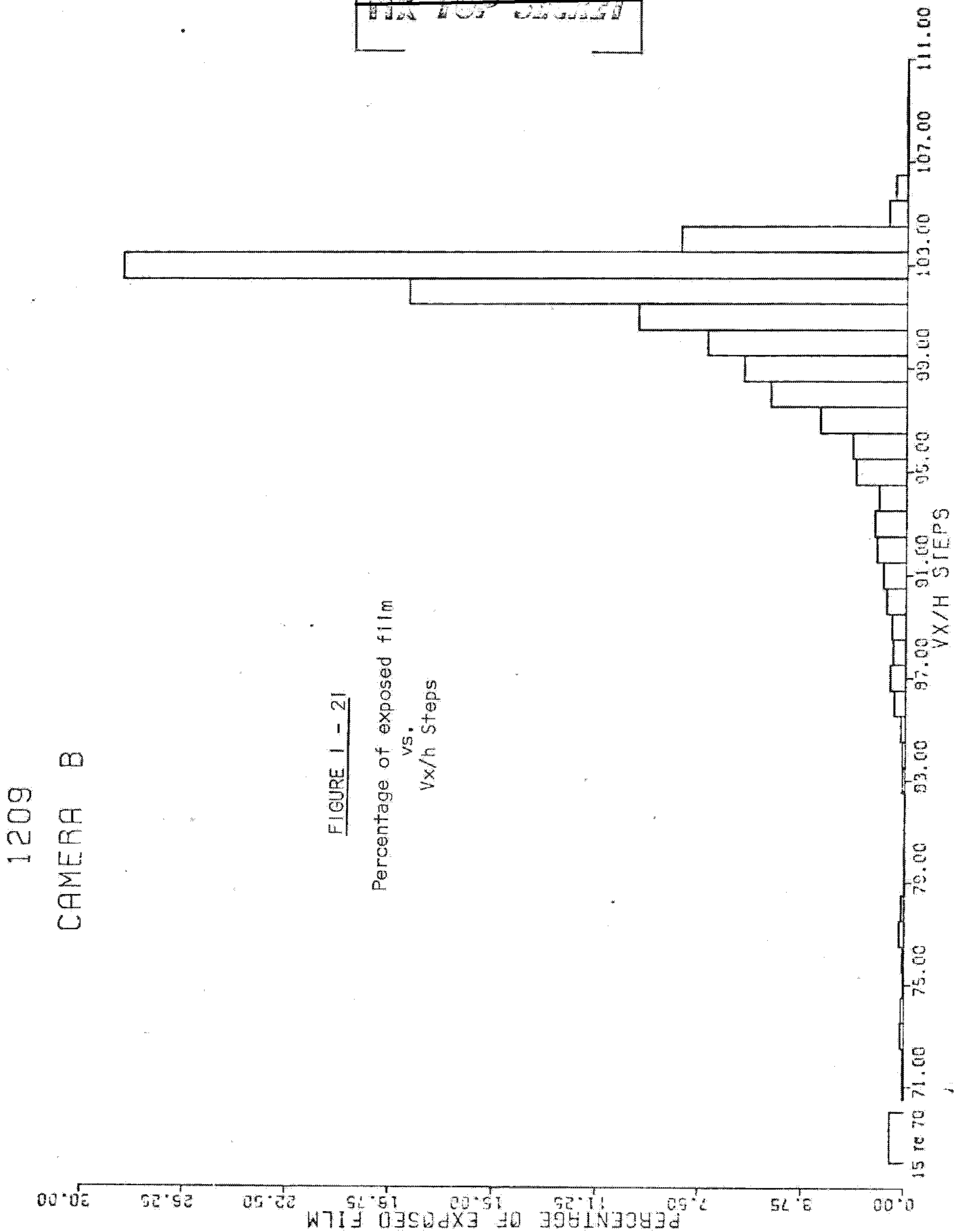

FIGURE I - 21
Percentage of exposed film
vs.
Vx/h Steps

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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 cameras exhibited characteristic performance throughout the mission.

2.1.1 Film Path Tracking

The system was operated with a maximum rewind of 5 ips, and no constraint on scan center or scan angle for this mission.

Both take-ups were stacked properly throughout the mission. Film stacks were well-centered on the take-up core and there was no evidence of mistracking.

2.1.2 Aft Camera Supply Depletion

On Rev 2086, Mission Op 757, during frame 10 of a planned 13 frame operation, the Aft Camera supply was depleted and loss of tension in the film path initiated an emergency shutdown.

2.1.3 Forward Camera Supply Depletion

On Rev 2090, Mission Op 759, during frame 16 of a planned 16 frame operation, the Forward Camera supply was depleted and loss of tension in the film path initiated an emergency shutdown.

2.1.4 Constant Velocity to Retrieve Film Tail

On Rev 2092, as part of the recovery prep sequence, a constant velocity was run with the emergency shutdown overridden to pull the remaining film forward into the take-up.

2.2 Fine Film Path

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

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2.2 Fine Film Path-Cont'd.

2.2.1 Fine Film Path Tracking

Both cameras tracked the film nominally for all scan lengths and scan centers throughout the mission. The Forward Camera tracking did not change from pre-launch, while the Aft Camera experienced an 0.8 mm mean tracking shift downward from pre-launch tracking.

2.3 Command and Control

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

2.4 Sensor System Control

The Sensor System Control was accomplished throughout the mission on SCCI without anomalies or failures.

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 system test and were within the specification limits of .00054 rad/sec.

2.6 LSFS/Focus

The LSFS output, as with previous Sensor Systems, was deemed reliable only on the first operation of each day (i.e., after three hours of non-operation and during the first five minutes of the first subsequent operation). Readings of the LSFS output were taken only at these times throughout mission 1209.

Pre-flight determined focus settings were:

31 microns for 1414 film on the Forward Camera; 70 microns for 1414 and 100 microns for both SO-255 and SO-130 on the Aft Camera.

2.7 Instrumentation

All instrumentation operated normally throughout the mission. The system provided consistent and accurate data for analysis and verification of camera status.

However, one segment of the instrumentation and data system, the strip charts, indicated that the Aft system's drive Sum Error signals appeared to have a peculiar high amplitude and

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2.7 Instrumentation - Cont'd.

low frequency oscillation from FT+ to the beginning of the 'P' mode when processed in format 'C' but not in format 'B'.

The explanation for this peculiarity is that the Aft system has an inherent 23 H_Z harmonic frequency which was beating against the format 'C's 25 samples/second sampling rate as opposed against format 'B's 500 sps rate, thus creating a 2 H_Z wave signal which was superimposed upon the existing Drive Sum Error trace.

Also it was reported by the P.I.'s,after reviewing the material from TU3, that the dimension from start of OP mark-to-start of first frame on the Forward system, had decreased to approximately 3.5 to 4 inches from the normally observed value of 4 to 4.5 inches. This decrease was originally thought to be an early indication of possible problems in the SCC. However, it appears that something; e.g. spring constants, emulsion, particles, had changed the shutter's mechanical delay mechanism.

As this dimensional decrease corresponds to the minimum granularity of the shutter open/close indicator in mode 122, it confirms the contention that this problem could not have been detected by utilizing the instrumentation data but only by visually inspecting the material.

2.8 Pneumatics

The pneumatic system nitrogen reserve status for mission 1209 was as follows:

	TANK A			TANK B			
Event	Press. (psi)	Temp (^{o}f)	Mass (lbs)	Press (psi)	Temp (^{o}f)	Mass (lbs)	Total Mass (lbs)
Liftoff	3332	75	17.33	3332	75	17.33	34.8
End of Primary Mission	112	71	0.63	140	71	0.78	1.4

The computed PN+ use rate was a constant 0.023 lbs/min. From the outset of the mission a statistical trand analysis was maintained to correlate use rate in terms of expended nitrogen mass per foot of spooled take-up film versus remaining supply unit film and

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nitrogen reserve. The analysis, presented in both graphical and tabular form, served the purpose of managing camera operation parameter (scan length, scan center, frame count) to preclude depletion of the nitrogen reserve prior to complete utilization of the SV film load.

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

2.9 Trend Analysis

A statistical trend analysis of sensor system performance was maintained by the Systems Integration Section throughout Mission 1209. Data samples were taken from one operation per day, when available, and mean values and standard deviations were calculated and plotted for selected functions to facilitate the detection of any long term trends that would indicate the onset of system degradation. The functional parameters used for the analysis were as follows:

1. Film to Bar Sync Velocity Error (P451, P452)
2. Metering Capstan Summed Error (403, P404)
3. Platen Skew Error (P415, P416)
4. Platen Photo Summer Error (P411, P412)
5. Input Drive Capstan Summed Error (P803, P804)
6. Output Drive Capstan Summed Error (P811, P812)
7. Supply Drive Summed Error (P105, P106)
8. Take-up in Use Drive Summed Error (TSEA, TSEB)
9. Optical Bar Summed Error (P501, P502)
10. OB Velocity Error
11. Looper Position (P601, P602)
12. Film Path Carriage Position (P713, P714)
13. Take-up Carriage Position (P951, P952)

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2.9 Trend Analysis-Cont'd.

System performance was normal throughout the mission. However, small shifts were evident in certain parameters and are summarized as follows:

- IDC-B & ODC-B The 2 Sigma deviation improved slightly after transfer from TU-1 to TU-2.
- TU-B Steerer Position The mean position gradually shifted from approximately +0.01 inches to -0.015 inches after transfer to TU-3.

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3.0 MISSION EVENT HISTORY

A summary listing of all sensor system photographic operations is presented in Appendix A-I 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 1209.

3.1 Ascent

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

3.2 Health Checks

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

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

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

Rev 4: The sensor system health check, sequence 175, was performed over POGO. All sensor system executed commands were functionally verified, including all tested bits of the variable commands. Focal plane position indicated 31 microns for the Forward camera, and 70 microns for the Aft camera.

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

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3.3 MISSION 1209 ENGINEERING

	TEST TYPE	OBJECTIVE
1	1414 THRU FOCUS	OPTIMIZE FOCUS SETTINGS. COMPLETED IN RV-1.
3A	1414 SMEAR SLITS	DETERMINE OPTIMUM SKEW ANGLE AND FILM VELOCITY 00AA SETTINGS. COMPLETED IN RV-2.
4A	SO255 RADIOMETRIC CAL	DETERMINE IMAGE TRANSFER AND RADIOMETRIC CALIBRATION. COMPLETED IN RV-2.
4B	SO255 TONE REPRODUCTION	DETERMINE TONE REPRODUCTION. COMPLETED IN RV-2.
4C	SO255 PROCESSING STUDIES	DETERMINE PROCESSING STUDIES. COMPLETED IN RV-2.
5	SO-130 RADIOMETRIC CAL	DUPE TONE REPRODUCTION AND RADIOMETRIC CALIBRATION. COMPLETED IN RV-3.
7	TUCSON ACQUISITION	STANDARD SCENE FOR MISSION TO MISSION QUALITY COMPARISON. COMPLETED IN RV-1,2 AND 4.
8	SO255 THRU FOCUS	OPTIMIZE FOCUS SETTINGS. TEST CANCELLED IN RV-1.
9	TRI-BARS FOR RESOLUTION	PHOTO QUALITY ASSESSMENT. COMPLETED IN RV-1,2,3 AND 4.
10	1414 SMEAR VS SCAN	ASSESS SMEAR AS A FUNCTION OF SCAN ANGLE. COMPLETED IN RV-4.
12	QUALITY VARIABILITY	PHOTO/EM CORRELATION. COMPLETED IN RV-1,3 AND 4.
13	STELLAR PHOTOGRAPHY	EVALUATE CAPABILITY OF ACQUIRING STELLAR IMAGES. COMPLETED IN RV-4.
14	1414 SPECIAL TARGETS	ASSESS PHOTO QUALITY. COMPLETED IN RV-4.
15	1414 DA TARGETS	EVALUATE DOUBLE ANNULUS TARGET FOR FOCUS/SMEAR DETERMINATION. COMPLETED IN RV-4.

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3.4 MISSION 1209-1 SPECIAL EVENTS

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
				PREFLIGHT FOOTAGE TUA		1601
				PREFLIGHT FOOTAGE TUB		1609
0.8				UNCAGE/SCC 1 SELECT		
0.8				STOW A/STOW B		
1				UNCAGE VERIFY		
2				UNINHIBITED CV		102
4	1-3			SS HEALTH CHECK		188
8	7			SS ENGINEERING TEST		63
65	37	1		1414 THRU FOCUS		41
			95	SAN FRANCISCO 10/0/-10	99	
167				PN EQUALIZATION		
177	93	1		1414 THRU FOCUS		54
			90	MILWAUKEE -10/0	20	
			95	CHICAGO 10/20	20	
178	94	1		1414 THRU FOCUS		28
			75	PHOENIX 6/0	99	
226	111	1		1414 THRU FOCUS		31
			99	DALLAS/FT WORTH -10/0	99	
248	119	1		1414 THRU FOCUS		45
			65	KOBE/OSAKA 20/10	25	
259	122	7,9		1414 QUALITY STANDARD		29
		15	80	TUCSON W/5T,DA	65	
264	123	1		1414 THRU FOCUS		36
			65	TOKYO -20/-10	95	
276	127	1		1414 THRU FOCUS		29
			65	VANCOUVER 20/0	00	

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3.4 MISSION 1209-1 SPECIAL EVENTS CONT'D

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
290	133	1		1414 THRU FOCUS		42
			95	BALTIMORE 20/0	20	
			95	WASHINGTON 10/0	75	
306	138	1		1414 THRU FOCUS		135
			35	NEW YORK 10/0/-10/-20	00	
307	139	1		1414 THRU FOCUS		30
			75	MINNEAPOLIS 20/10	65	
307	140	1		1414 THRU FOCUS		130
			00	DALLAS -20/-10	00	
				INCLUDES PROTECTIVE WRAP		
308				TRANSFER TO TU2-PREP 1		

TU FOOTAGE	2584	2592
TOTAL FOOTAGE	2584	2592

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3.5 MISSION 1209-2 SPECIAL EVENTS

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
308				TRANSFER TO TU2 - PREP 1		13
309				TU2 - PREP 2		50
340	151	7,9 15	 75	1414 QUALITY STANDARD TUCSON W/ST,DA	 95	29
350				1414 OOAA PSIB NOM TO -7		
367				TRANSFER TO S0255		
378	162			FIRST OPN S0255		
388	168	4B	 90	S0255 TONE REPRODUCTION KANSAS CITY	 99	29
405	173 174	4C	 90 90	S0255 PROCESSING STUDIES OGDEN/SALT LAKE -1/3,NOM PHOENIX -1	 99 99	68
421	180	4C	 99	S0255 PROCESSING STUDIES ALBUQUERQUE -2/3	 99	28
434				TRANSFER TO 1414		
435	184			FIRST OPN 1414		
438	185	10	 90	1414 SMEAR VS SCAN SAN FRANCISCO +SECTOR	 90	37
486	201	15 14	 90	1414 SPECIAL TARGET TUCSON W/DM STATIC DISP	 99	29
519	212	3A	 35	1414 SMEAR SLITS SAN FRANCISCO BAY AREA	 50	36
534	217	3A	 85	1414 SMEAR SLITS DALLAS/FT WORTH	 99	35
566	227	3A	 75	1414 SMEAR SLITS DETROIT	 00	35

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3.5 MISSION 1209-2 SPECIAL EVENTS CONT'D

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
582	240	3A	80	1414 SMEAR SLITS TAMPA/ST PETERSBURG	99	35
605	254			PN EQUALIZATION		
616	257	3A	95	1414 SMEAR SLITS SAN DIEGO	99	31
681	280	3A	90	1414 SMEAR SLITS LOS ANGELES	99	34
754				TRANSFER TO S0255		
754	314			FIRST OPN S0255		
777	323	4B	90	S0255 TONE REPRODUCTION BATON ROUGE	99	32
778	324	4A	99	S0255 RADIOMETRIC CAL PHOENIX	99	27
794	331	4B	90	S0255 TONE REPRODUCTION ALBUQUERQUE	99	28
817	343			PN EQUALIZATION		
819				TRANSFER TO 1414		
819	346			FIRST OPN 1414		
886	366			PROTECTIVE WRAP		150
890				TRANSFER TO TU3-PREP 1		

TU FOOTAGE	726	726
TOTAL FOOTAGE	3310	3318

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3.6 MISSION 1209-3 SPECIAL EVENTS

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
890				TRANSFER TO TU3-PREP 1		13
891				TU3 - PREP 2		50
960				PATH PRESSURIZATION		
979				1414 0000 PSIA NOM TO -2		
1054	421	12	80	1414 QUALITY VARIABILITY LOS ANGELES	90	36
1127				TRANSFER TO SO255		
1129	458			FIRST OPN SO255		
1180				TRANSFER TO 1414		
1189	472			FIRST OPN 1414		
1223	490			PN EQUALIZATION		
1247	501	10	75	1414 SMEAR VS SCAN ATLANTA -SECTOR	99	29
1265	508	10	55	1414 SMEAR VS SCAN SAN FRANCISCO -SECTOR	05	34
1275				TRANSFER TO SO-130		
1275	514			FIRST OPN SO-130		
1297	521	5	90	SO-130 RADIOMETRIC CAL PHOENIX	85	29
1313	527	5	95	SO-130 RADIOMETRIC CAL ALBUQUERQUE	95	29

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3.6 MISSION 1209-3 SPECIAL EVENTS CONT'D

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
1320	530			TRANSFER TO 1414		
1321	531			FIRST OPN 1414		
1345	541	12	90	1414 QUALITY VARIABILITY DALLAS/FT WORTH	99	32
1356	550			PROTECTIVE WRAP		289
1360				TRANSFER TO TU4-PREP 1		

TU FOOTAGE	541	541
TOTAL FOOTAGE	3851	3859

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3.7 MISSION 1209-4 SPECIAL EVENTS

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
1360				TRANSFER TO TU4-PREP 1		13
1361				TU4 - PREP 2		50
1377				PATH PRESSURIZATION		
1378	552	7,9 15	99	1414 SPECIAL TARGET TUCSON W/DA	99	29
1385				PATH PRESSURIZATION		
1392				PATH PRESSURIZATION		
1400				PATH PRESSURIZATION		
1411	560	12	90	1414 QUALITY VARIABILITY SAN FRANCISCO	99	37
1426	568	10	99	1414 SMEAR VS SCAN DALLAS/FT WORTH -SECTOR	99	31
1427	569	14 15	99	1414 SPECIAL TARGET BARSTOW MCSC,DA	99	28
1476	589	10	70	1414 SMEAR VS SCAN SAN FRANCISCO +SECTOR	70	34
1555	631	14 15	65	1414 SPECIAL TARGET CAPE CANAVERAL W/DA	60	29
1571	640	10	80	1414 SMEAR VS SCAN NEW YORK -SECTOR	99	38
1621	667			PN EQUALIZATION		
1637	675	10	99	1414 SMEAR VS SCAN DALLAS/FT WORTH +SECTOR	99	36
1725				PN EQUALIZATION		
1769	713	13		STELLAR PHOTOGRAPHY		153

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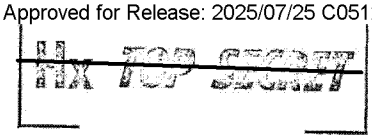

3.7 MISSION 1209-4 SPECIAL EVENTS CONT'D

REV	OPN	TEST	PRE WX	EVENT/LOCATION	VER WX	FTG
1836				PATH PRESSURIZATION		
1857				PATH PRESSURIZATION		
1836	730	10		1414 SMEAR VS SCAN		38
			99	BALTIMORE -SECTOR	99	
			99	WASHINGTON -SECTOR	99	
1872				PATH PRESSURIZATION		
1905				PATH PRESSURIZATION		
1969				PATH PRESSURIZATION		
1978				PATH PRESSURIZATION		
2010	748	10		1414 SMEAR VS SCAN		33
			75	DALLAS/FT WORTH -SECTOR	99	
2052				PATH PRESSURIZATION		
2065				PATH PRESSURIZATION		
2079				PATH PRESSURIZATION		
2086	757			LAST AFT OP (10 FR)		
2090	759			LAST FWD OP (16 FR)		
2092				TU4-PREP 2/CV		

TU FOOTAGE	549	549
TOTAL FOOTAGE	4400	4408

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3.8 Solo Phase

Solo testing on SV-9 was performed to meet three specific objectives:

1. Test SS-1 was designed to provide data which would determine the gas flow impedance of the Film Exit Vestibule (FEV) when a pressurized supply was exhausting to a TCA in vacuum.

2. Test SS-2 was designed to confirm previously determined constraints of plus 170 microns and minus 120 microns respectively as the maximum and minimum allowable focal plane position.

3. Test SS-3 was performed to provide temperature data which would allow estimation of TCA frame and midsection bending during a simulated stellar camera calibration.

3.8.1 Test SS-1

Test SS-1 was performed in three separate steps. In step one, the supply was first pressurized to .73 psi. The supply was then vented to the TCA via the A-side seal door (SLDA) during a five minute Mono-A constant velocity operation.

The data for this portion of the test was as follows:

Vehicle Time	Supply Pressure (psi)	Average Supply Temperature	Event
348427.0	0.73	72.5	SLDA OPEN
348728.0	0.69	72.5	SLDA CLOSE

This data established a decay rate of .000133 psi/second

In steps two and three of Test SS-1, the supply was not re-pressurized. Since, the B-side pneumatics tank was depleted during the supply pressurization in step 1, the High Pressure Crossover Valve (HPCV) was opened for the duration of the second part of the SS-1 test. This was to assure proper regulator pressure on the B-side for seal door operation.

In step two, a Mono-B constant velocity operation was performed and the supply was vented to the TCA via the B-side seal door (SLDB). The data from this operation are as follows:

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Vehicle Time	Supply Pressure (psi)	Average Supply Temperature	Event
496622.8	0.63	71.5	SLDA/B OPEN
496924.8	0.60	71.5	SLDA/B CLOSE

The data established a decay rate of .000099 psi/second.

In step three of test SS-1, the supply was vented to the TCA for twenty minutes via SLDA and SLDB during a constant velocity operation. The data was as follows:

Vehicle Time	Supply Pressure (psi)	Average Supply Temperature	Event
667054.8	.57	66/69	SLDA/B OPEN
668255.8	.43	65/69	SLDA/B CLOSE

This data established a decay rate of .000117 psi/second.

The data for parts one, two and three of test SS-1 are on tracking station tapes 2113P, 2141C, and 2175H, respectively.

3.8.2 Test SS-2

To confirm the maximum focal plane adjustment constraint of plus 170 microns, Focal Plane A (FPA) and Focal Plane B (FPB) were retreated from the Best Plane of Focus (BPF) to the plus 170 micron constraint value. This amounted to a 140 micron retreat for FPA and a 100 micron retreat for FPB. When this was achieved, the focal planes were commanded to retreat another 40 microns in four 10 micron steps given at six second intervals. The FPA telemetry indicated a stop position of 203.1 microns with a corresponding LSFS value of 173 counts. The FPB telemetry indicated a maximum position of 210.4 microns. However, the LSFSB saturated at an indicated FPB position of 201.2 microns.

To confirm the constraint of minus 120 microns for the low end of allowable focal plane position, FPA and FPB were first commanded to advance 310 microns. They were then commanded to advance another 100 microns in 10 micron intervals. At this time the focal planes were commanded to retreat 10 microns to determine whether they had driven off the drive cam and become imoperable.

FPA telemetry indicated that the FPA stopped advancing at a position of minus 188.3 microns and that it did not respond to the final 10 microns retreat commanding.

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Test SS-2 Cont'd.

FPB telemetry indicated that FPB advanced to a minus 166.1 microns before it stopped. Upon receipt of the 10 micron retreat commanding, FPB retreated, according to telemetry, to a position of minus 155.1 microns.

The LSFSA and LSFSB data indicated low saturation was reached on both systems somewhere in the region of minus 90 to minus 100 microns. Since the FP systems were still being advanced when these positions were achieved, a more precise functional limit on the minimum allowable FP position could not be ascertained.

The commanding and telemetry data are summarized in Figures 3-1 & 3-2. The telemetry data was played back at 2124C.

3.8.3 Test SS-3

Test SS-3 was performed in conjunction with Solo Test EDAP-2 (SBAC) on Rev 2186. Camera power and Optical Bars were turned on at the midpoint of the dark side orbit interval and thermal data was obtained at this time. During this period the vehicle was oriented with the plane of the TCA perpendicular to the earths gravity vector and in the direction of deep space. Vehicle time for camera power on was 739689 and for power off was 739967. The thermal data record (Mode 125) was obtained at 2189P.

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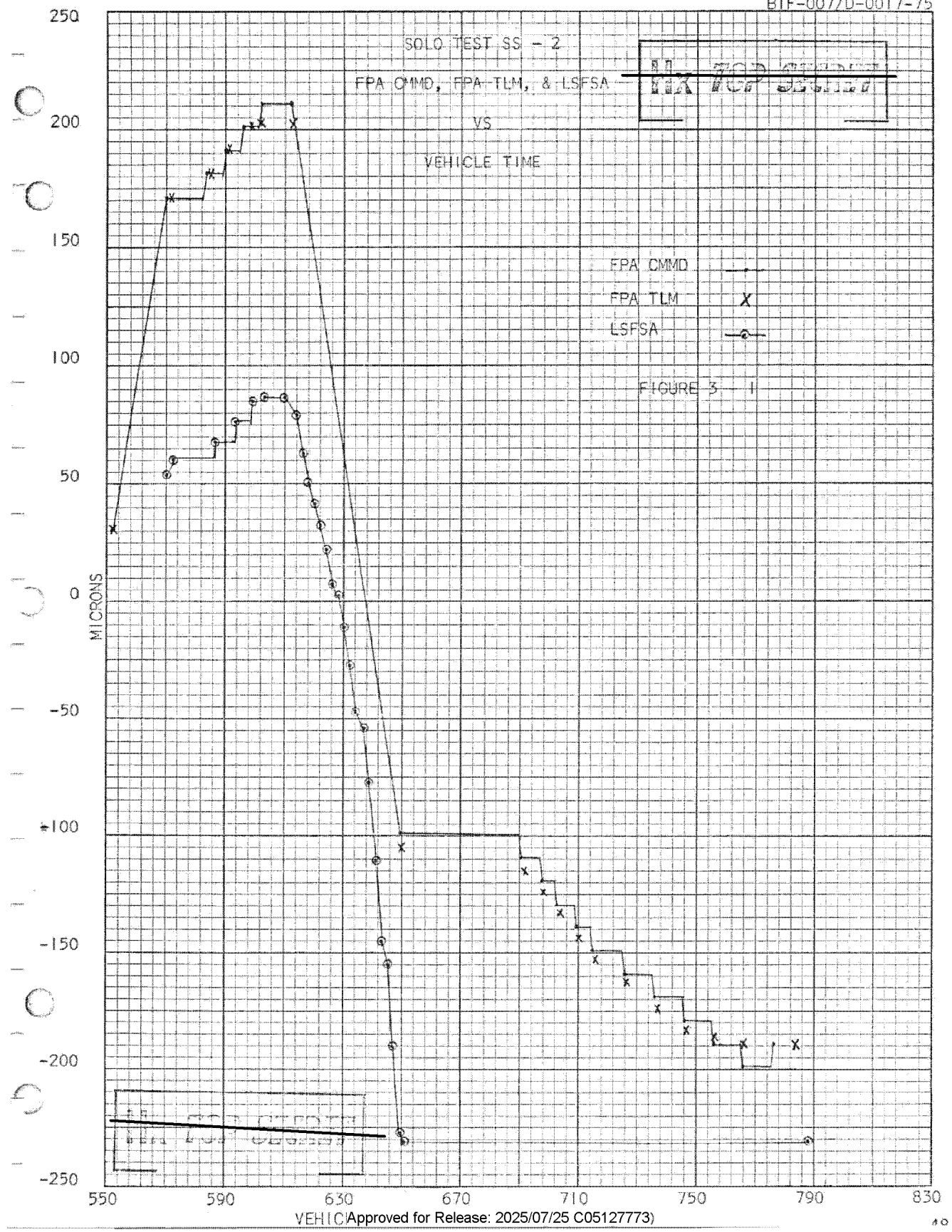

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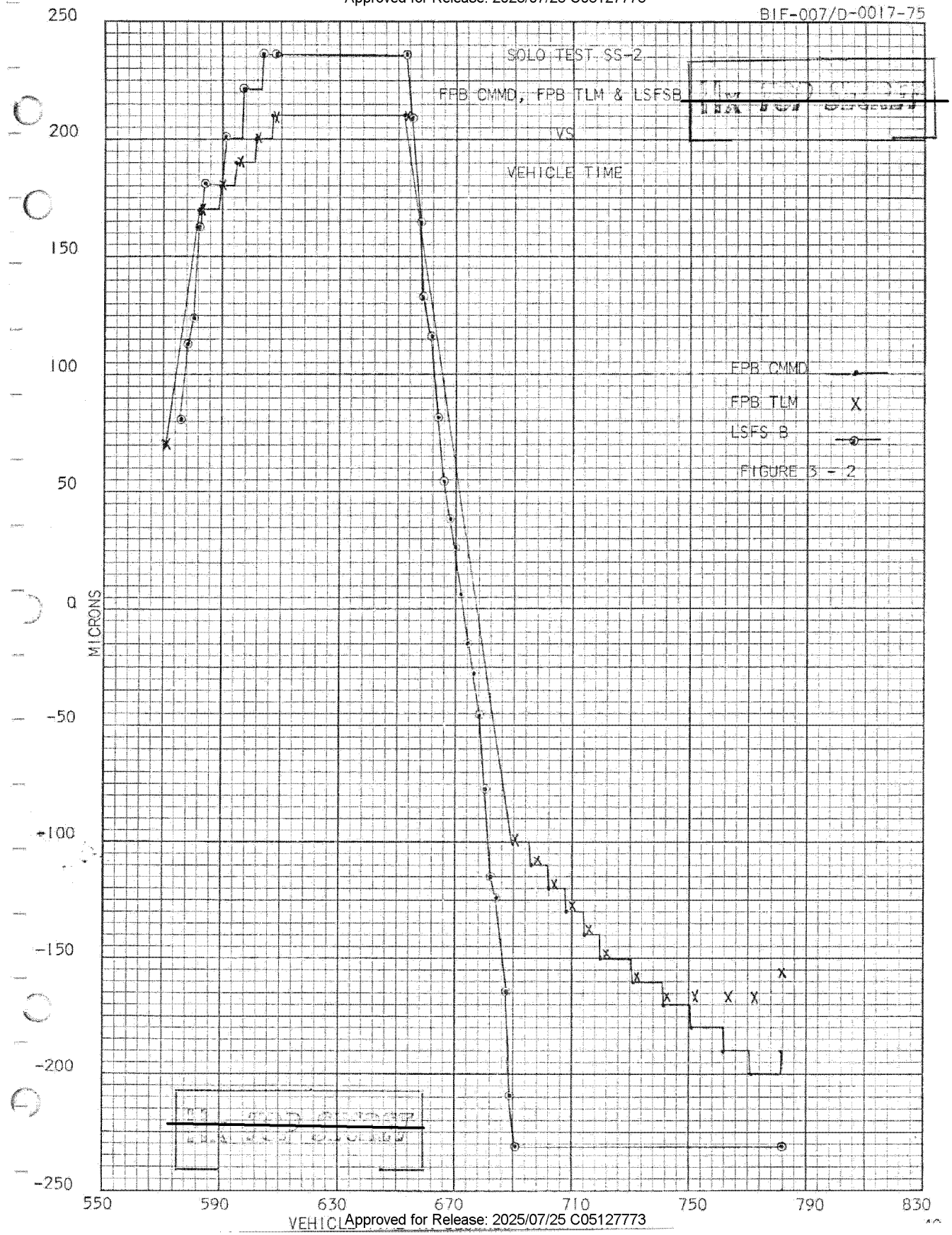

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4.0 SENSOR SYSTEM TEST OBJECTIVES

4.1 Photographic Performance

The post flight material evaluation of mission segments 1209-1 through 1209-4 indicated the capability of the SS optical system to provide the specified photographic performance. Mission 1209 was a fall launch in early November; however, due to the active mission length of 130 days, (longest active Hexagon mission to date) the flight extended into late winter and terminated in early March.

Winter missions have characteristically lower solar elevations at the northern latitudes, snow cover and extensive ground haze. When the solar elevation becomes low, exposure times must be increased to compensate for loss of illumination. The longer exposure times thus increase the smear in the imagery. Snow cover was most prevalent at northern latitudes where the sun was lowest and the resulting shadows were longest. When the sun was very low, many targets did not receive direct lighting which lowered the contrast of the target area. Some very graphic examples of low solar elevation acquisitions were obtained during 1209-1. These acquisitions ranged from minus 0.3 degrees through plus 4.5 degrees.

Mission segment 1209-2 contained two parts of SO-255 conventional color material. Mission segment 1209-3 contained one part of SO-255, and one part of SO-130 infrared color.

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 a consistant prefrence for the Aft camera image quality. Orbital performance prediction using CRYSPER and the actual operational parameters are included in Figures 4-1 thru 4-4 for each mission segment and Figure 4-5 for the total mission length. The discussions of image quality as a function of mission segment, which follows, is abstracted in part from the REBOUND 831 messages.

Mission Segment 1209-1

The image quality of both cameras ranged from very good to poor. Both cameras were at optimum focus. This was confirmed by both VEM and subjective analysis. The poor imagery exhibited on this mission segment was for the most part attributed to hazy or inclement weather. This imagery was characterized by a grainy

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Figure 4-1

MISSION 1209-1

Median GRD=3.30 ft.
Mean GRD=4.09 ft.

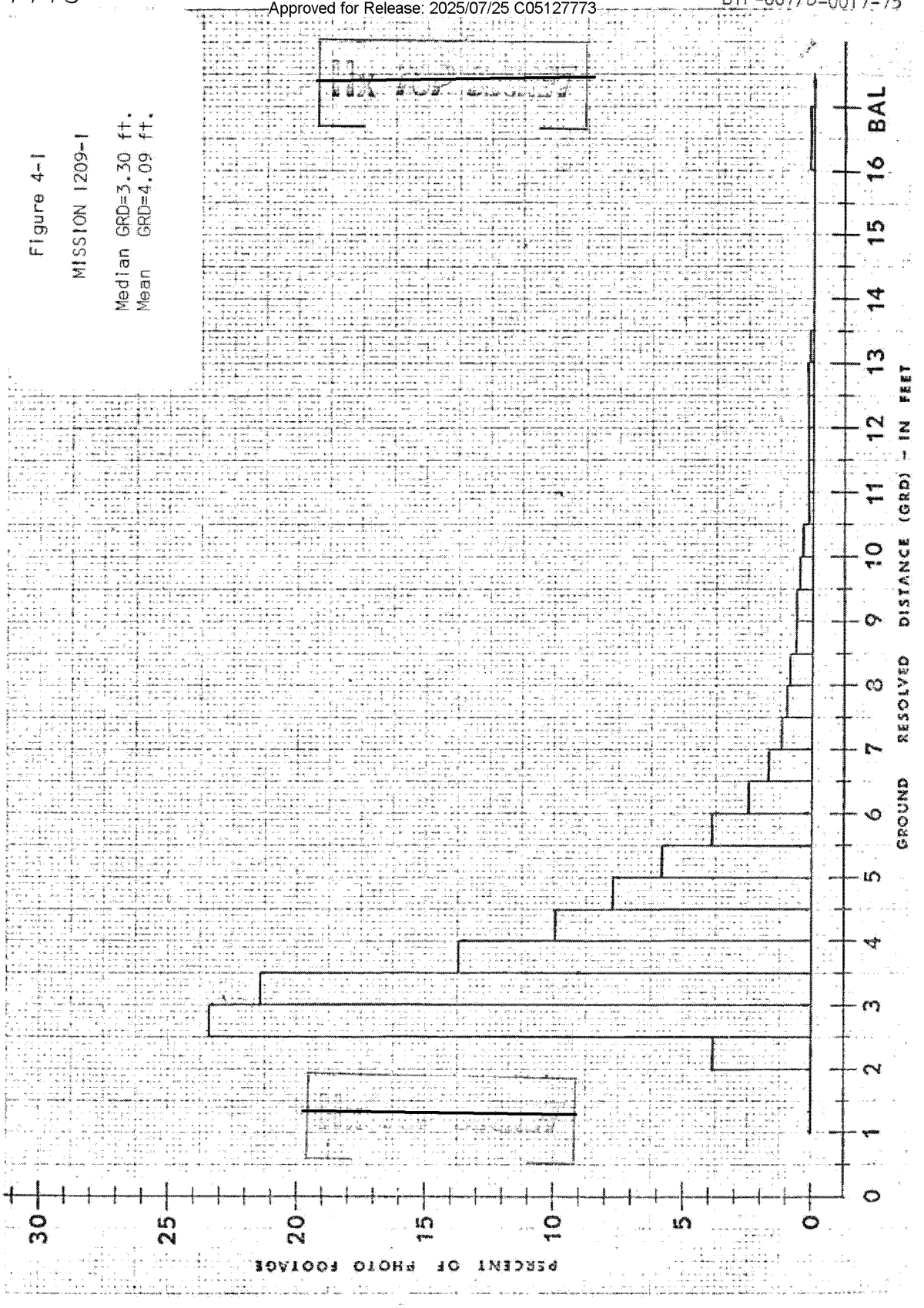

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Figure 4-2

MISSION 1209-2

Median GRD=3.38 ft.
Mean GRD=4.11 ft.

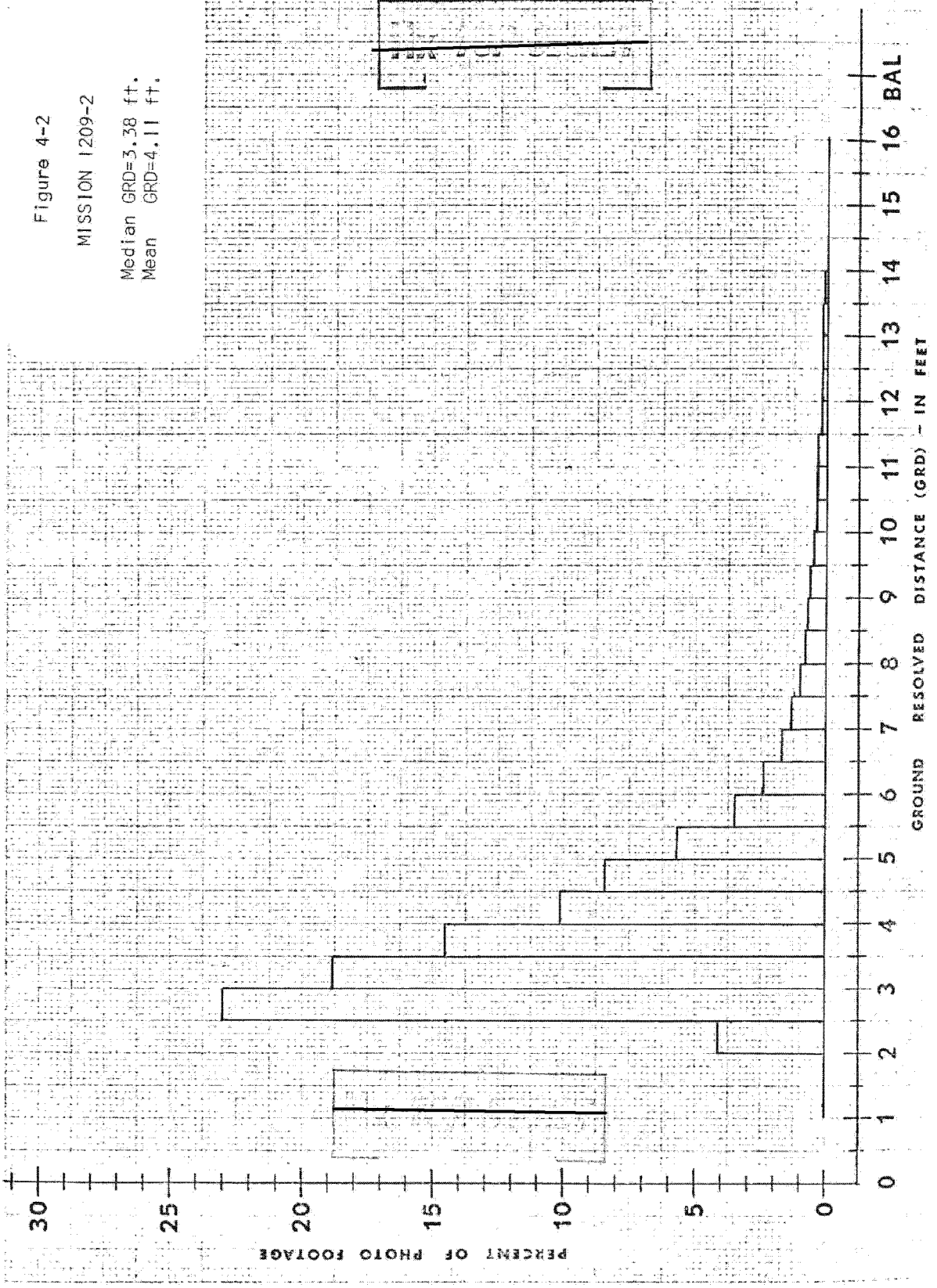

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Figure 4-3

MISSION 1209-3

Median GRD=3.39 ft.
Mean GRD=4.16 ft.

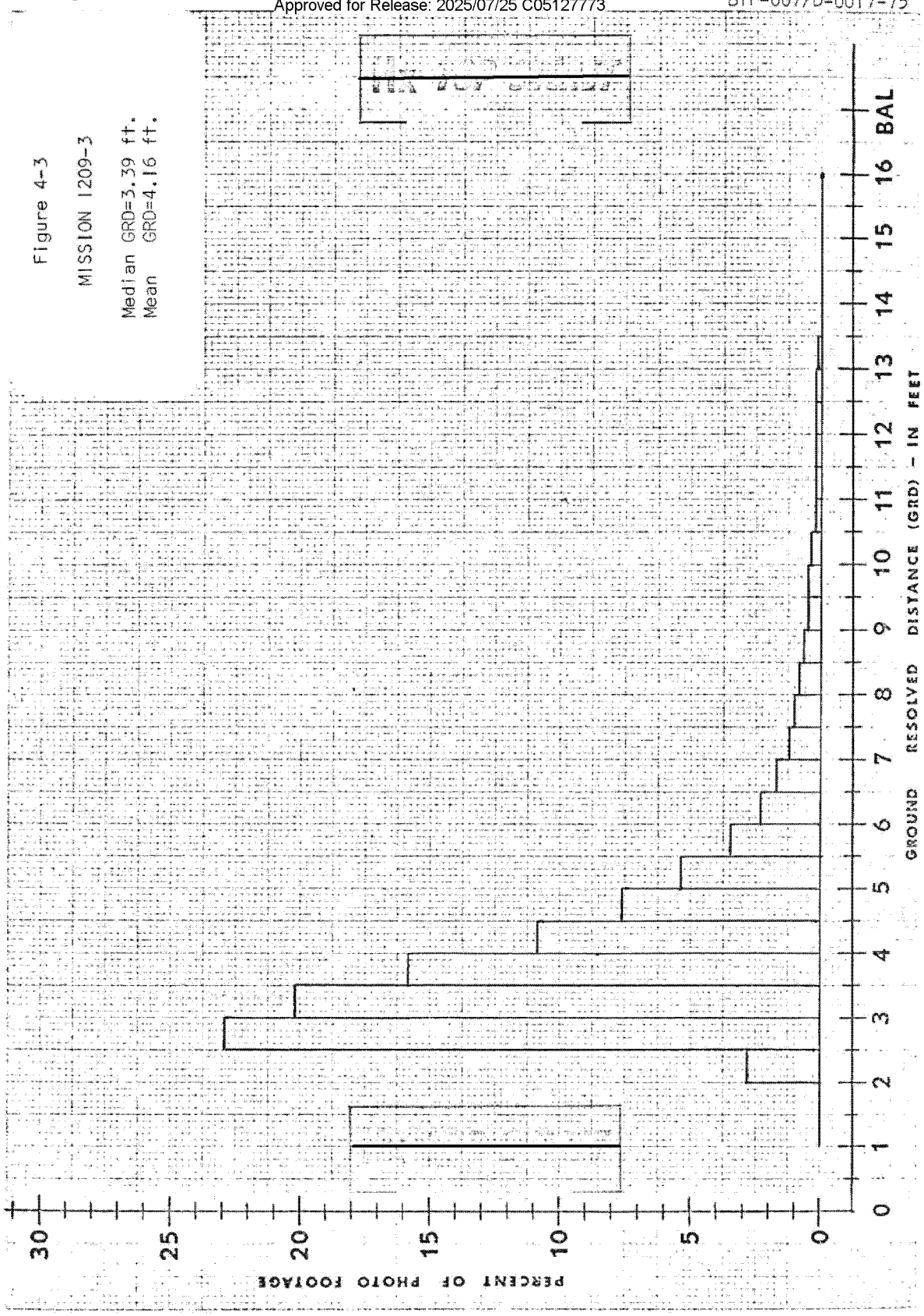

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Figure 4-4

MISSION 1209-4

Median GRD=3.53 ft.
Mean GRD=4.34 ft.

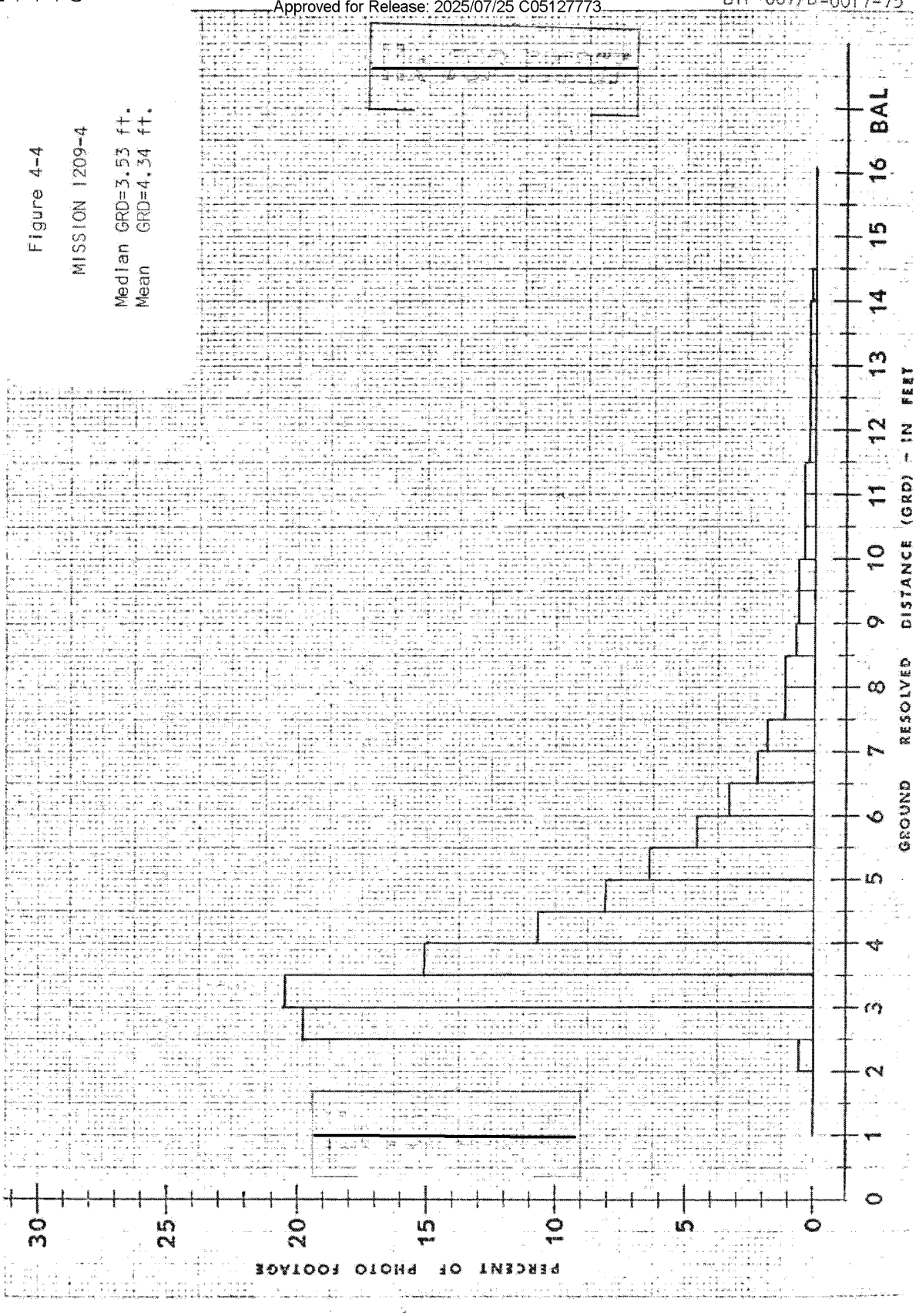

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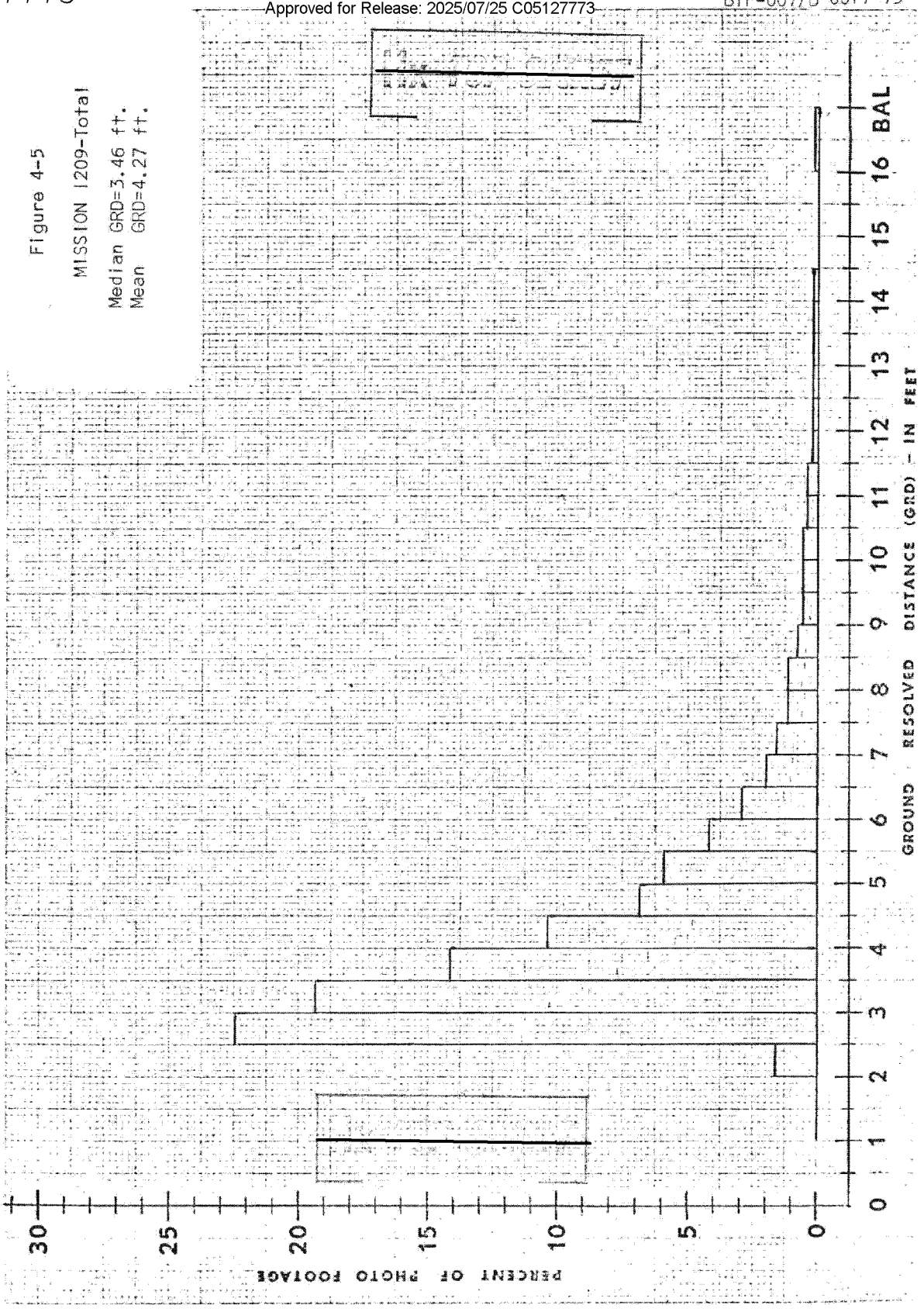
Figure 4-5

MISSION 1209-Total

Median GRD=3.46 ft.
Mean GRD=4.27 ft.



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Mission Segment 1209-1 Cont'd.

appearance and poor edge definition. A majority of the 1209-1 imagery ranged from fair to good with the good quality being comparable to previous Hexagon missions. There was a definate preference for the Aft camera imagery when compared to the Forward.

During this mission segment, specific ops were acquired at very low solar elevations, and required special processing treatment. Underexposure ranged from one to eight stops. The processing chemistries utilized to gain additional film speed resulted in high base fogs of 0.50 to 0.55 density, reduced contrast and increased graininess. These parameters restricted usable magnification of this imagery to less than 30x. The image quality was generally poor.

One 51/51 tribar corn target was acquired on both the Forward and Aft cameras. The data follows:

						UNADJUSTED GRD (FT)		2:1 ADJUSTED GRD (FT)	
CAMERA	OP	FR	SCAN	FIELD	PLATEN	IT	XT	IT	XT
FWD	122	3	-17.8	-2.0	31	2.52	3.09	3.04	3.77
AFT	122	3	-16.1	-0.1	70	2.06	2.25	2.63	2.88

Mission Segment 1209-2

1414 Film - The image quality of both cameras ranged from very good to poor, with the majority being good. There were a few instances where the 1209-2 Aft imagery was better than the 1209-1 Aft imagery. This was attributed in part to the minus four command step change in the Aft camera in-track 00AA setting implemented on 1209-2. There was again a definite preference for the Aft camera imagery when compared to the Forward.

Eight 51/51 corn targets were acquired on the 1414 material. Six on the Forward and two on the Aft as follows:

						UNADJUSTED GRD (FT)		2:1 ADJUSTED GRD (FT)	
CAMERA	OP	FR	SCAN	FIELD	PLATEN	IT	XT	IT	XT
FWD	151	4	-11.0	-0.5	31	1.81	1.75	2.19	2.13
FWD	168	2	-15.0	-1.0	31	1.75	2.60	2.22	3.34
FWD	201	2	+ 9.0	+1.3	31	1.72	2.25	2.11	2.76
FWD	323	3	-11.0	-0.9	31	1.85	2.36	2.28	2.92
FWD	324	4	+ 9.0	-2.5	31	2.35	2.26	2.97	2.84
FWD	331	2	+10.0	+2.4	31	1.61	2.64	1.91	3.12
AFT	151	4	-11.0	-1.7	70	1.90	2.59	2.28	2.15
AFT	201	3	+10.0	+0.5	70	1.55	1.87	1.99	2.35

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SO-255 Color - A total of 5640 feet of SO-255 was exposed in the Aft camera in two segments. The first segment was 2774 feet while the second was 2866 feet.

The image quality of the color material compared to previous color acquisitions ranged from very good to fair with most rated good. This was due in part to good weather conditions and 15 per cent cloud cover. Twenty percent of the ops exhibited very light to medium snow cover. The color balance was slightly greenish yellow for the majority of the imagery. Exposure evaluation indicated a slight bias towards under exposure of one third to one half stop. A three count (0.10 log E) exposure increase was recommended for the balance of the SO-255.

Four 51/51 corn tribar targets were acquired on SO-255.

CAMERA	OP	FR	SCAN	FIELD	PLATEN	UNADJUSTED GRD (FT) IT	XT
AFT	168	2	-15.0	-1.5	100	3.41	3.91
AFT	323	3	-11.0	-1.7	100	3.49	4.11
AFT	324	4	+ 9.0	-0.9	100	2.83	3.17
AFT	331	3	+10.0	+0.2	100	3.10	2.83

Mission Segment 1209-3

1414 Film - The overall image quality ranged from very good to poor, with the majority rated as fair. The quality was considered comparable to previous winter missions flown during late December and early January. The very good imagery was limited to the Aft camera, while the Forward camera imagery was rated from fair to good. The poor imagery was attributed to haze, snow cover, weather and low solar elevation acquisitions. This imagery was characterized by an overall grainy appearence, poor edge sharpness, and lack of contrast. The best imagery of 1209-3 was comparable to the best of 1209-2.

Six 51/51 corn tribar targets were acquired on 1414, four on the Forward camera and two on the Aft. The data is as follows:

CAMERA	OP	FR	SCAN	FIELD	PLATEN	UNADJUSTED GRD (FT) IT	XT	2:1 ADJUSTED GRD (FT) IT	XT
FWD	507	4	+3.0	-1.5	31	1.92	2.08	2.24	2.44
FWD	507	4	+3.0	-1.5	31	1.80	1.75	2.26	2.20
FWD	521	3	-9.0	-1.5	31	2.25	2.25	2.82	2.82
FWD	527	3	+7.5	-1.2	31	2.00	2.17	2.51	2.72
AFT	507	4	+4.0	-1.2	70	1.64	2.52	2.06	3.20
AFT	507	4	+4.0	-1.2	70	1.75	2.26	2.09	3.16

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SO-255 Color

A total of 2508 feet of SO-255 color film was included in the Aft camera. The quality of the color photography ranged from good to poor with the majority rated as fair. The poor imagery was affected by the same conditions as that of the 1414 acquisitions. Sixty percent of the color ops had snow cover ranging from very light to medium. The color balance was slightly greenish yellow. Examination of the SO-255 indicated generally good exposure effected by the three count (.10 log E) exposure increase implemented for 1209-3.

SO-130 Infrared Color

The Aft camera exposed 3384 feet of SO-130 infrared color in this mission segment. Overall, the image quality was good compared to previous SO-130 acquisitions, and is the best IR photography to date. The ground resolution, however, is still significantly lower than the 1414 acquisitions. The color balance exhibited a slight cyan cast. Subjective analysis indicated satisfactory exposure.

Two 51/51 corn tribar targets were acquired on the SO-130 material on the Aft camera. The data is as follows:

CAMERA	OP	FR	SCAN	FIELD	PLATEN	UNADJUSTED GRD (FT) IT	XT
AFT	521	3	-8.0	-1.0	100	5.00	5.73
AFT	527	3	+7.5	-1.7	100	5.66	5.66

Mission Segment 1209-4

The overall image quality of both cameras ranged from good to poor with the majority rated as fair. The poor imagery was characterized by an overall grainy appearence, poor edge sharpness and overall lack of crispness. Subjective comparisons of image quality between the Forward and Aft cameras indicate a continued preference for the Aft camera imagery in that it is sharper and renders fine detail somewhat better.

Subjective comparisons of the best photography of 1209-3 with 1209-4 indicated a slight decrease in image quality on the Aft camera of 1209-4. This slight decrease in image quality was attributed to haze, a significant increase in snow cover, a greater number of low solar elevation acquisitions, and a slight increase in the percent of film exposed at poorer scale. There

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Mission Segment 1209-4 Cont'd.

were 90 operations requiring exposure biases for snow on 1209-4 versus 46 operations on 1209-3. The percent of film exposed below 30 degrees solar elevation increased from 61 percent in 1209-3 to 67 percent in 1209-4. VEM analysis did not indicate any change in the Aft camera performance between 1209-3 and 1209-4.

Six 51/51 corn tribar targets were acquired on 1414 film; three on the Forward camera and three on the Aft.

CAMERA	OP	FR	SCAN	FIELD	PLATEN	UNADJUSTED GRD (FT) IT	UNADJUSTED GRD (FT) XT	2:1 ADJUSTED GRD (FT) IT	2:1 ADJUSTED GRD (FT) (FT)
FWD	552	3	-14.1	-0.6	31	1.94	2.32	2.25	2.69
FWD	569	3	+13.6	-1.2	31	1.75	2.00	1.92	2.18
FWD	631	2	-13.8	-1.2	70	2.00	1.87	2.76	2.58
AFT	552	3	-13.3	-2.1	70	2.32	3.00	2.59	3.38
AFT	569	3	+14.4	-2.2	70	2.00	2.75	2.28	3.15
AFT	631	2	-13.0	-1.3	70	1.94	2.33	2.56	3.11

Subjective analysis on 1209-4 led to the conclusion that good exposure had been maintained. Evaluation of snow surround imagery indicated that the two step snow bias performed as anticipated.

4.2 Take-Up Survival Through Recovery

All the RV/TU assemblies arrived at the processing facility in good condition, thereby demonstrating that these assemblies maintained light tight integrity during orbital speration, re-entry, recovery and transportation to the processing site.

The core locking pins were engaged and intact in TU's 1209-1, 3 and 4. In TU 1209-2 both core locking pins were sheared and 250 feet of Forward and 350 feet of Aft film was spilled. The film was well stacked and centered on all TU's. TU 1209-4 had 50 feet off-spooled into the dome on the Forward stack. Small amounts of particulates were found in 1209-1, 2 and 3 canisters.

Related discussion of de-filming for each segment of the mission follows.

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4.2 Take-Up Survival Through Recovery-Cont'd.

Mission Segment 1209-1

The RV/TU arrived at the processing site in good condition on 18 November 1974.

Both stacks were well centered on the TU core and there was no evidence of mistracking. Both core-locking pins were engaged and not sheared, with no difficulty encountered in retracting.

A small amount of particulate was collected from inside the dome, but in general there was less contamination than found in previous missions.

Mission Segment 1209-2

The RV/TU arrived at the processing facility on 24 December 1974 in good condition.

The core locking pins were both sheared, resulting in film spills of approximately 250 feet on the Forward and 350 feet on the Aft, causing some wrinkling and folding. The Aft side was most severely damaged from film wedged under the builder roller. The film was found to be well centered with no evidence of mistracking.

A small amount of contamination consisting of very small pieces of verious materials were found in the RV cannister. This material was collected and sent for analysis.

Mission Segment 1209-3

The RV/TU arrived at the processing facility in good condition on 22 January 1975.

Both core locking pins were engaged and not sheared. There was no film telescoping, spilling or despooling evident.

Three pieces of film (20, 7.5 and 2 inches long) were entrapped in the entrance cutter/sealer. A piece of white tape, 0.75 inches by 1 inch, was found on the Forward exit cutter blade. The canister was vacuumed and a small amount of material collected which was sent for analysis along with the tape.

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4.2 Take-Up Survival Through Recovery-Cont'd.

Mission Segment 1209-4

The fourth RV/TU arrived at the processing site 8 March 1975. Both the shipping container and RV were in good condition.

Core locking pins were engaged and not sheared. Both stacks were in good condition and no telescoping observed. The outer wraps of the Forward stack, with approximately 50 feet damaged, had off-spooled into the RV dome. The most probable cause was pulling through the cutter bars and wrapping of the tail with zero tension while on orbit. The head end of the Aft stack had wrinkles, creases and foldovers (approximate 28 inches starting 2 feet from head), the most probable cause being film misalignment during manual de-spooling.

4.3 Optimum Focus Determination

Mission 1209 (SV9/SN12) was launched with focal plane settings of 31 microns on the Forward camera and 70 microns on the Aft camera. Based upon the resolution performance the platen positions for best resolution across the field from readiness test data were 30 microns for the Forward and 75 microns for the Aft camera. These platen positions were corrected for vehicle altitude, gravity effects, and collimator focus as follows:

> A plus 14 micron adjustment on both cameras for the altitude shift from infinity (A-2 collimator settings) to 85 nautical miles mission altitude. A minus 15 micron adjustment on the Forward and a minus 19 micron on the Aft camera for the folding flat gravity effects. A plus 2 micron adjustment on the Forward camera to account for a defocus of the test collimator.

Following the evaluation of the on orbit thru-focus tests performed in RV-1 no focus change was recommended for either the Forward or Aft cameras. Both the VEM and subjective analysis indicated that both cameras were at optimum focus.

A change in focus of plus 30 microns retreat was implemented on the Aft camera when the material switched from 1414 black and white to the SO-255 conventional color and the SO-130 infrared color material.

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4.4 Optimum OOAA Settings

On-orbit smear data was collected during the second, third and forth mission segments of Mission 1208.

Subjective assessment of smear slit imagery from thru-focus engineering ops 94, 111, 122, 123 and 133 was utilized to evaluate the adequacy of the nominal OOAA settings. Smear slit imagery on the Aft camera untitled edge of the format in the in-track direction showed consistent double imagery with a mean separation of approximately 10 microns, 5.6 microns being due to orbital fixed known errors. The titled edge revealed no in-track image doubling. Both observations are consistent with the skew angle being too large, the equivalent magnitude of the error being approximately 0.04ips. Both subjective evaluation and VEM analysis performed across the format minor axis indicated that the image quality was poorer on the untitled edge than on the titled, corraborating the smear slit assessment. An OOAA change was implemented to the Aft camera in-track setting of minus four command steps. The Forward camera smear slit imagery in the cross-track direction indicated variable image doubling predominantly indicative of the film velocity being too fast. The variability in the image doubling negated the ability to determine the mean value of the error with a high enough degree of confidence to recommend a change.

Analysis of smear slit imagery from the OOAA engineering ops 212, 217, 240 and 257 verified the minus four command step change implemented to the Aft camera in the in-track direction to be correct. The in-track direction on the Forward camera was determined to be too slow by approximately 0.010ips and the PFA directed a plus one command step change resulting in a new nominal orbital setting of minus two. The cross-track settings on both cameras were determined to be correct.

Since the initial use of smear slits on Mission 1206, all four systems have required an identical change to the Aft camera in-track settings. To date, the possible sources of this residul error in setting the Aft in-track OOAA flight nominal from the ground test sync-flash data have not been determined, and is currently under investigation.

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4.5 Optics Thermal Profile

The following subparagraphs describe the thermal environment for Mission 1209. Definitions of measured and calculated temperature parameters are contained in the Mission 1207 Post Flight Report, PM-1496-X. Thermal control for SV-9 can be generally summarized as follows:

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

4.5.1 SV Environment

SV thermal control parameters are summarized as follows:

- Orbital Elements (Ref. Paragraph 1.5)

Perigee Altitude	h_p = 87.7 n.m.
Period	τ = 88.8 min.
Inclination	I = 96.6 deg.
Argument of Perigee	α = 124 deg.
Beta Range	β = 8.8 deg. (Day 13) β = 12.7 deg. (Day 92)

- Midsection Thermal Control Design Values

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

- MLI Effective Emittance

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

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4.5.2 TCA Environment

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

4.5.3 Optical Bar Temperatures

Tref was 71 ± 3°F. throughout the mission. The equilibrium temperature levels for the A and B optical bars were approximately 71 ± 3°F respectively. The 3°F tolerances shown for the above nominal values indicate overall shifts in average temperature levels, not random scatter in the data. The shift is attributable to saveral factors including:

- o Transition through perihelion and the corresponding variation in insolation.
- o Variable average internal power dissipation related to camera duty cycle.
- o Beta angle changes.

Figure 4-9 shows an orbital profile of the OB temperatures in the stowed position.

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Description	Designated Zones	Max Allowable ICD Value(°f)	Flight Value(°f)
Temperature Level Index (T TCA)		70 ± 21	72
Zone I Mean Temp.	Not Applicable	N/A	72
Zone II Mean Temp.		N/A	69
Zone III Mean Temp.		N/A	71
Zone IV Mean Temp.		N/A	75
Forward Bulkhead		N/A	73
Middle Bulkhead		N/A	74
Variation of Mean Temp. Between Designated Zones	I to IV	9	3
	II to III	6	2
	I to II	4	3
	III to IV	4	3
	Bulkhead to Bulkhead	6	2
Spatial Variation of Time-Average Temp. Measurements at Locations Within Designated Zone	I	11	5
	II	9	4
	III	9	2
	IV	11	1
	Forward Bulkhead	5	3
	Middle Bulkhead	17	8
Temporal Variation (Peak to Valley) of Temperature Measurement at any one Location within Designated Zone	I	46	15
	II	20	1
	III	20	1
	IV	46	15
	Forward Bulkhead	26	4
	Middle Bulkhead	57	15

TABLE 4 - I

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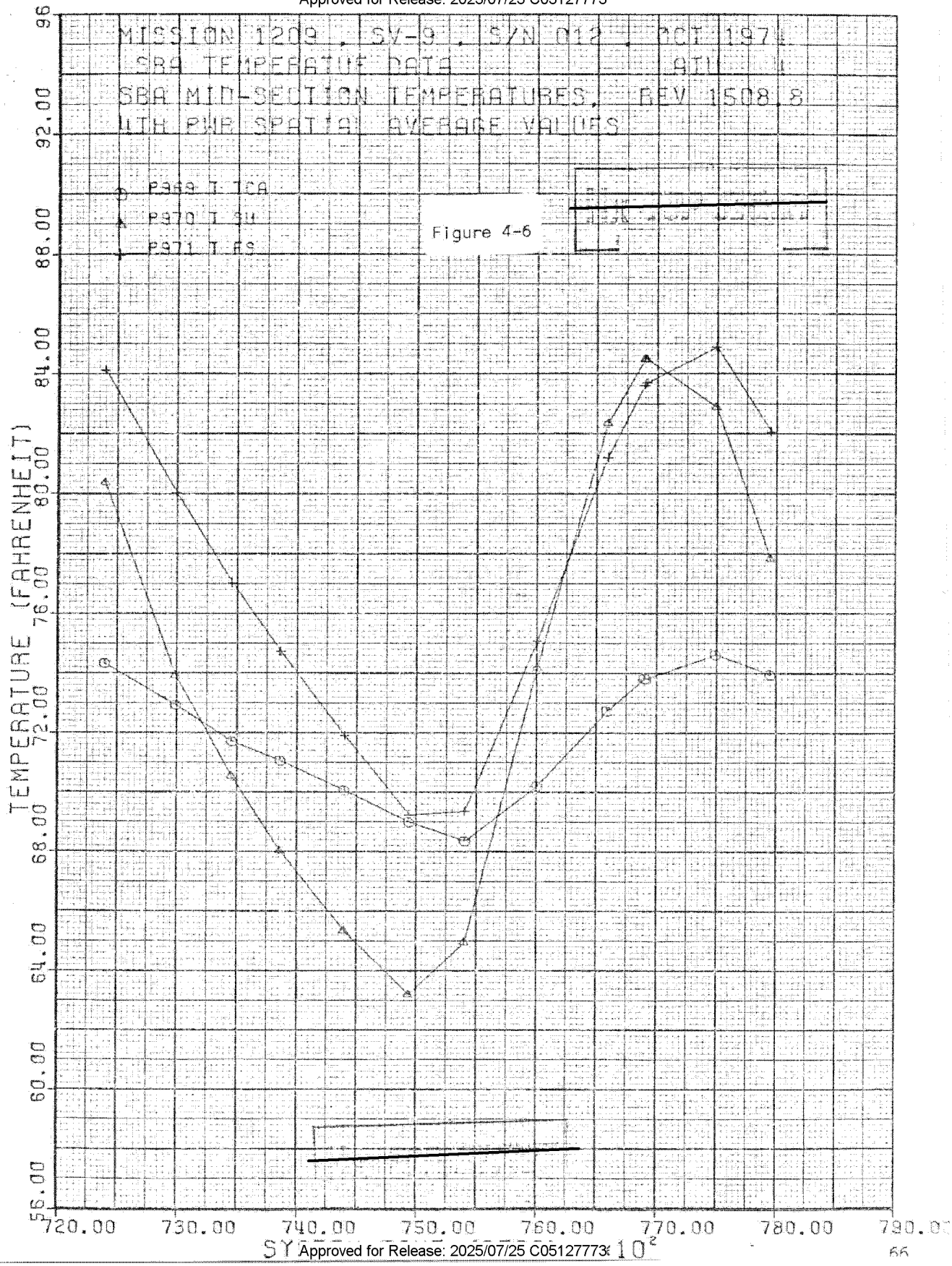

Figure 4-6

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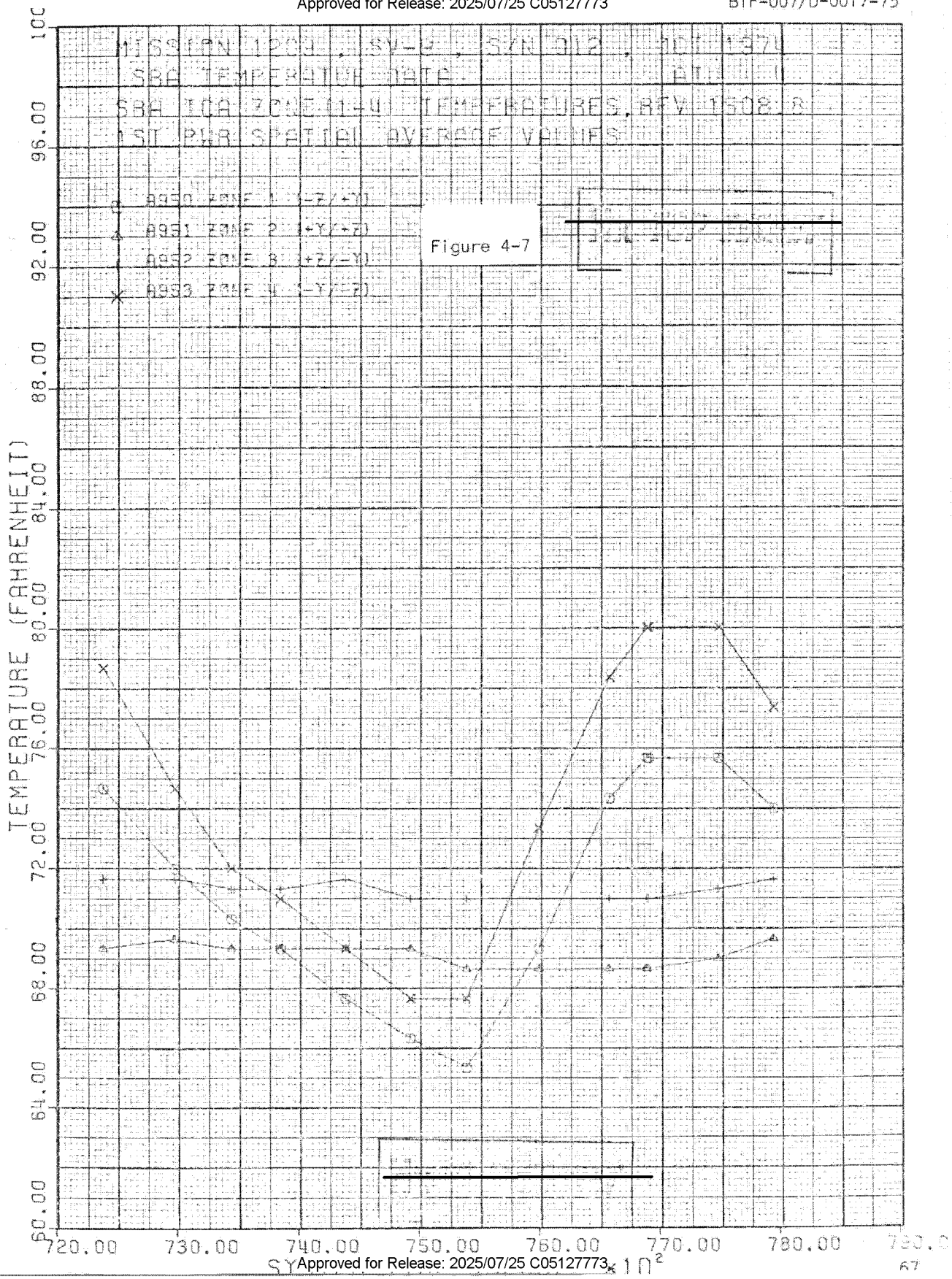

Figure 4-7

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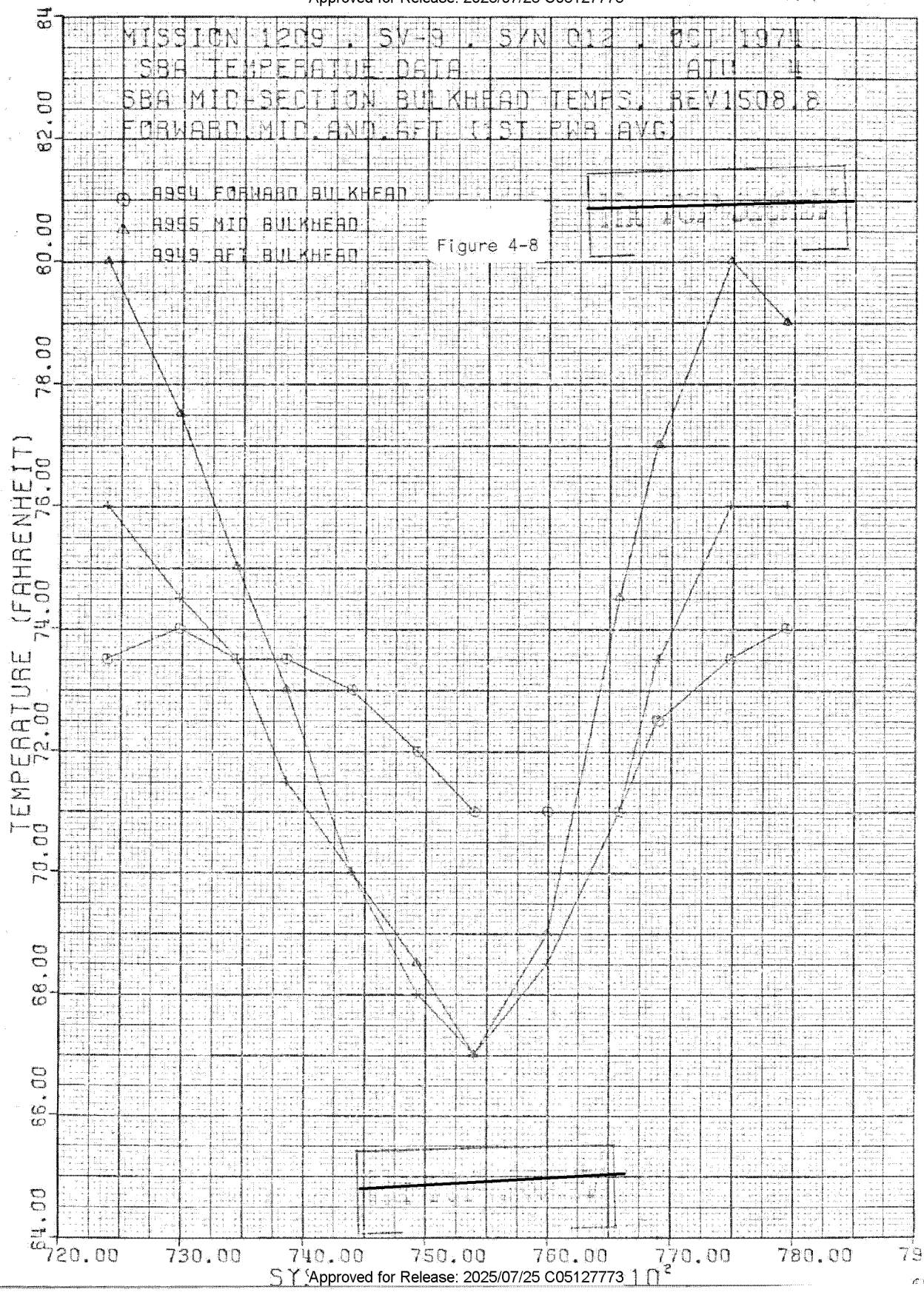

Figure 4-8

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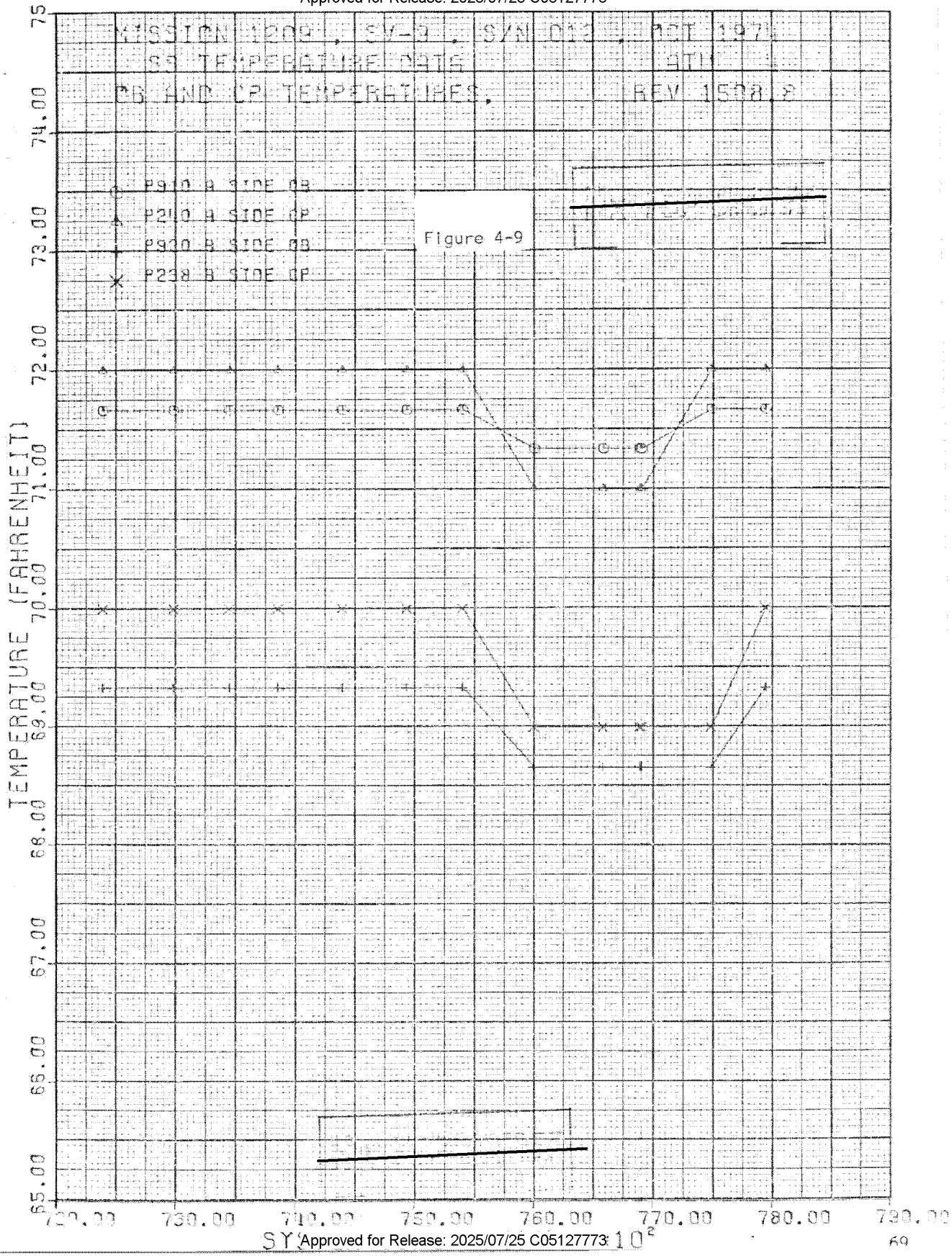

Figure 4-9

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5.0 SCF SUPPORT

5.1 'TUNITY MISSION 1209

The 'TUNITY software for Mission 1209 performed all of its functions nominally except for the following software problem:

The problem occurred in message 360 on Rev 316 (Op 144). The message contained a mono A operation (Op 143) followed by a stereo operation (Op 144). The mono operation included an automatic focus A ADVANCE only. This was achieved through the use of a SUB card for mono sequences. The return to the null position did not occur until the set-up for the following stereo operation. The SUB card for the mono sequences did not extend that far, therefore, the nominal focus sequence was used and RETREATS for both A and B cameras were commanded. The result was that the focus position of camera A was at the null position but the focus position of B was at plus 2 microns.

5.2 AUGIE

5.2.1 Overall Performance

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

5.2.2 Modifications

Modifications required during flight were made to complete the change requested for the shutter open/close processing and to modify the slit width output processing.

A mode change request has been submitted for the next flight. The change requested is to process the steerer sum error by averageing each second and reporting if this average changes by 5PCM counts from last output.

5.2.3 DTV

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

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5.3 RTS Tapes and Microwave

5.3.1 RTS Tapes

The use of RTS tapes was minimal due to reliance on the microwave link capability between the STC and Bldg. 156. RTS tapes met all SSC requirements when used.

5.3.2 Microwave Link

The microwave link into Bldg. 156, its associated terminals and the SSTC were successful in receiving and processing more than 95% of the data transmissions from VTS via the STC. When necessary, unsuccessful data transmissions were either successfully retransmitted post pass, or obtained from a tape dub supplied by the STC ground station.

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APPENDIX

A-1

OPERATIONAL SUMMARY

HA FOR SECRET

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A. 1209-1

B. CAMERA OPERATIONS SUMMARY REVS PAD THROUGH REV 307 OP 140.

REV	MSN OP NUM	SCA	SCC	FRAMES FWD	FRAMES AFT	INTEROP FEET FWD	INTEROP FEET AFT	PHOTO-FT FWD	PHOTO-FT AFT	CUM-TU-FEET FWD	CUM-TU-FEET AFT
PRE LO		30	30	6	6	160	154	17	17	177	171
PRE LO		60	15	7	4	4	13	38	22	219	206
PRE LO		120	0	8	8	40	73	86	86	345	365
PRE LO		120	0	8	8	80	79	86	86	511	530
PRE LO		30	30	6	6	44	19	17	17	572	566
PRE LO		60	15	7	4	4	13	38	22	614	601
PRE LO		60	0	6	6	9	26	33	33	656	660
PRE LO		60	0	6	6	32	33	33	33	721	726
PRE LO		60	0	6	6	32	32	33	33	786	791
PRE LO		60	0	6	6	32	32	33	33	851	856
PRE LO		30	30	6	6	68	59	17	17	936	932
PRE LO		60	15	7	4	4	13	38	22	978	967
PRE LO		30	30	6	6	2	12	17	17	997	996
PRE LO		60	15	7	4	4	13	38	22	1039	1031
PRE LO		120	0	7	7	50	83	75	75	1164	1189
PRE LO		120	0	7	7	90	89	75	75	1329	1353
PRE LO		60	0	6	6	47	31	33	33	1409	1417
PRE LO		60	0	6	6	31	31	33	33	1473	1481
PRE LO		60	0	6	6	31	31	33	33	1537	1545
PRE LO		60	0	6	6	31	31	33	33	1601	1609
4	1	60	0	6	6	126	126	33	33	1760	1768
4	2	60	-15	6	6	29	25	33	33	1822	1826
4	3	60	30	6	6	35	33	33	33	1890	1897
6	4	90	0	29	29	46	54	235	235	2171	2186
7	5	90	0	77	77	59	59	624	624	2854	2869
7	6	90	-15	50	50	64	65	405	405	3323	3339
8	7	60	0	6	6	54	46	33	33	3410	3418
8	8	60	0	10	10	33	32	55	55	3498	3505
8	9	30	30	13	13	26	18	38	38	3562	3561
22	10	90	0	137	137	28	44	1110	1110	4700	4715
23	11	90	0	41	41	63	63	332	332	5095	5110
23	12	30	-45	57	57	45	30	165	165	5305	5305
24	13	120	0	54	54	40	63	578	578	5923	5946
24	14	60	-30	45	45	71	56	248	248	6242	6250
24	15	30	30	36	36	28	20	104	104	6374	6374
25	16	60	30	41	41	20	26	226	226	6620	6626
29	17	60	-15	10	10	32	34	55	55	6707	6715
36	18	60	15	22	22	31	30	121	121	6859	6866
38	19	90	0	144	144	42	50	1166	1166	8067	8082
39	20	60	-15	21	21	52	45	116	116	8235	8243
39	21	90	0	26	26	46	53	211	211	8492	8507
40	22	60	0	44	44	54	46	242	242	8788	8795
40	23	90	0	15	15	43	51	122	122	8953	8968

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40	24	30	30	30	30	47	31	87	87	9087	9086
41	25	30	45	47	47	14	13	136	136	9237	9235
41	26	60	-15	29	29	20	30	160	160	9417	9425
41	27	60	15	49	49	37	36	270	270	9724	9731
46	28	60	15	13	13	35	35	72	72	9831	9838
54	29	30	-15	13	13	28	21	38	38	9897	9897
54	30	90	0	20	20	36	51	162	162	10095	10110
55	31	90	0	50	50	61	61	405	405	10561	10576
55	32	60	30	43	43	51	42	237	237	10849	10855
56	33	30	30	40	40	27	20	116	116	10992	10991
56	34	90	0	46	46	33	49	373	373	11398	11413
58	35	30	15	13	13	48	32	38	38	11484	11483
58	36	90	15	34	34	33	49	275	275	11792	11807
65	37	30	30	9	9	49	33	26	26	11867	11866
70	38	60	30	28	28	19	26	154	154	12040	12046
71	39	90	15	43	43	44	53	348	348	12432	12447
72	40	90	0	16	16	66	66	130	130	12628	12643
73	41	90	0	26	26	65	65	211	211	12904	12919
73	42	60	15	9	9	53	45	50	50	13007	13014
74	43	60	0	28	28	33	34	154	154	13194	13202
74	44	60	-30	56	56	34	34	308	308	13536	13544
78	45	30	30	6	6	28	19	17	17	13581	13580
81	46	30	-30	8	8	13	14	23	23	13617	13617
86	47	60	-15	56	56	20	28	308	308	13945	13953
88	48	60	15	25	25	34	33	138	138	14117	14124
88	49	30	0	7	7	27	19	20	20	14164	14163
88	50	30	-45	26	26	13	14	75	75	14252	14252
90	51	60	-30	7	7	21	28	39	39	14312	14319
97	52	30	30	59	59	29	21	171	171	14512	14511
102	53	90	-15	35	35	31	48	284	284	14827	14843
103	54	60	15	28	28	53	44	154	154	15034	15041
104	55	60	30	34	34	34	33	187	187	15255	15261
104	56	120	0	33	33	62	79	353	353	15670	15693
105	57	60	-30	35	35	78	63	193	193	15941	15949
105	58	30	0	68	68	29	20	197	197	16157	16166
106	59	90	0	50	50	30	46	405	405	16602	16617
106	60	30	30	4	4	47	31	12	12	16661	16660
107	61	60	15	22	22	20	28	121	121	16802	16809
107	62	30	15	4	4	28	20	12	12	16842	16841
119	63	60	15	92	92	19	27	506	506	17367	17374
120	64	90	0	17	17	46	54	138	138	17551	17566
120	65	60	-15	11	11	55	48	61	61	17667	17675
121	66	120	0	74	74	58	73	792	792	18517	18540
121	67	30	0	18	18	68	44	52	52	18637	18636
123	68	60	-15	10	10	20	29	55	55	18712	18720
135	69	90	0	26	26	47	54	211	211	18970	18985
136	70	30	-30	5	5	48	33	15	15	19033	19033
136	71	60	15	17	17	23	30	94	94	19150	19157
137	72	60	15	34	34	35	35	187	187	19372	19379
138	73	60	-15	31	31	35	36	171	171	19578	19586

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139	74	30	-15	8	8	29	21	23	23	19630	19630
139	75	90	15	22	22	31	46	178	178	19839	19854
139	76	30	45	49	49	48	32	142	142	20029	20028
140	77	30	30	10	10	13	13	29	29	20071	20070
141	78	30	15	6	6	13	13	17	17	20101	20100
141	79	30	-30	4	4	13	14	12	12	20126	20126
145	80	90	0	41	41	32	47	332	332	20490	20505
151	81	30	-30	71	71	48	33	206	206	20744	20744
152	82	90	0	41	41	32	47	332	332	21108	21123
152	83	90	-15	17	17	68	68	138	138	21314	21329
153	84	60	15	23	23	56	47	127	127	21497	21505
154	85	90	0	56	56	45	54	454	454	21996	22011
154	86	60	0	10	10	54	47	55	55	22105	22113
155	87	30	-30	10	10	28	20	29	29	22162	22162
155	88	30	0	6	6	14	13	17	17	22193	22192
157	89	30	-30	7	7	13	14	20	20	22226	22226
162	90	60	-15	15	15	21	29	83	83	22330	22338
167	91	60	-15	21	21	36	36	116	116	22482	22490
168	92	30	-30	20	20	29	21	58	58	22569	22569
177	93	30	0	14	14	14	13	41	41	22624	22623
178	94	30	0	5	5	13	13	15	15	22652	22651
185	95	60	-30	16	16	20	29	86	88	22750	22768
188	96	60	-30	21	21	36	36	116	116	22912	22920
200	97	90	0	23	23	47	54	186	186	23145	23160
201	98	90	0	31	31	66	65	251	251	23462	23477
202	99	30	15	13	13	48	32	38	38	23548	23547
202	100	30	-30	25	25	13	14	73	73	23634	23634
204	101	60	0	37	37	21	28	204	204	23859	23866
204	102	60	-15	31	31	36	36	171	171	24066	24073
204	103	60	0	10	10	36	36	55	55	24157	24164
205	104	30	15	12	12	28	20	35	35	24220	24219
216	105	90	0	113	113	32	48	915	915	25167	25182
217	106	60	-15	44	44	55	48	242	242	25464	25472
219	107	30	-30	32	32	29	21	93	93	25586	25586
220	108	60	0	10	10	21	29	55	55	25662	25670
220	109	30	0	11	11	30	21	32	32	25724	25723
221	110	30	-15	9	9	13	14	26	26	25763	25773
226	111	30	0	6	6	14	14	17	17	25794	25804
233	112	30	-30	13	13	14	14	38	38	25846	25856
233	113	30	0	20	20	13	12	58	58	25917	25926
233	114	30	-15	13	13	12	13	38	38	25967	25977
236	115	30	-45	23	23	14	14	67	67	26048	26058
236	116	90	0	12	12	33	48	97	97	26178	26203
236	117	60	-30	20	20	55	46	110	110	26343	26361
248	118	60	-15	14	14	37	36	77	77	26457	26474
248	119	30	15	11	11	29	21	32	32	26518	26527
253	120	30	-45	13	13	13	13	38	38	26569	26578
253	121	90	0	43	43	32	48	348	348	26949	26974
259	122	30	-15	5	5	48	33	15	15	27012	27022
264	123	30	15	8	8	14	13	23	23	27049	27058

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269	124	90	15	22	21	28	43	170	170	27247	27271
269	125	60	-15	22	22	51	45	121	121	27419	27437
273	126	90	0	58	58	42	49	470	470	27931	27956
276	127	30	15	5	5	42	26	15	15	27988	27997
282	128	60	-15	17	17	20	29	94	94	28102	28120
285	129	30	-30	10	10	29	20	29	29	28150	28169
285	130	60	-15	23	23	18	27	127	127	28305	28323
285	131	30	15	19	19	29	20	55	55	28389	28398
285	132	90	0	16	16	32	48	130	130	28551	28576
290	133	30	0	10	10	48	32	29	29	28628	28637
290	134	30	30	8	8	12	12	23	23	28663	28672
299	135	30	30	10	10	13	13	29	29	28705	28714
301	136	90	0	44	44	31	47	356	356	29092	29117
302	137	60	-15	25	25	55	46	138	138	29285	29301
306	138	60	-15	18	18	35	37	99	99	29419	29437
307	139	30	15	6	6	29	20	17	17	29465	29474
307	140	60	0	8	7	20	29	44	37	29529	29540

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A. 1209-2
B. CAMERA OPERATIONS SUMMARY REVS 307 OP 140 THROUGH REV 866 OP 366

REV	MSN OP NUM	SCA	SCC	FRAMES FWD	FRAMES AFT	INTEROP FEET FWD	INTEROP FEET AFT	PHOTO-FT FWD	PHOTO-FT AFT	CUM-TU-FEET FWD	CUM-TU-FEET AFT
307	140	60	0	8	9	0	0	43	51	43	51
315	141	30	0	7	7	92	83	20	20	155	154
315	142	60	-30	14	0	20	0	77	0	252	154
316	143	30	45	34	0	29	0	99	0	380	154
316	144	60	-15	22	22	21	29	121	121	522	304
317	145	30	15	4	4	29	21	12	12	563	337
329	146	30	-30	35	0	12	0	102	0	677	337
329	147	30	-30	10	10	13	14	29	29	719	380
330	148	30	-30	26	26	14	14	75	75	808	469
330	149	30	15	23	23	14	13	67	67	889	549
332	150	60	-15	59	59	20	29	325	325	1234	903
340	151	30	-15	5	5	29	21	15	15	1278	939
346	152	90	0	34	34	33	43	275	275	1586	1262
349	153	60	0	31	31	56	48	171	171	1813	1431
348	154	60	15	32	32	36	36	176	176	2025	1693
349	155	30	0	4	4	28	21	12	12	2065	1726
362	156	30	-30	19	19	13	14	55	55	2135	1795
362	157	90	0	63	63	32	47	510	510	2675	2352
365	158	30	30	13	13	48	32	38	38	2761	2422
366	159	60	-15	10	10	20	29	55	55	2836	2506
366	160	60	0	17	17	37	36	94	94	2967	2636
366	161	90	0	16	16	44	52	130	130	3141	2818
378	162	60	-15	11	11	55	48	61	61	3257	2927
379	163	30	30	10	10	29	20	29	29	3315	2976
380	164	30	-45	56	0	13	0	162	0	3490	2976
381	165	30	-30	26	26	13	14	75	75	3578	3065
383	166	30	30	4	4	14	13	12	12	3604	3090
384	167	60	15	16	16	21	28	88	88	3713	3206
388	168	30	-15	5	5	29	22	15	15	3757	3243
394	169	30	30	7	7	14	14	20	20	3791	3277
395	170	30	15	4	4	13	13	12	12	3816	3302
396	171	30	0	7	7	13	13	20	20	3849	3335
396	172	30	0	44	0	13	0	128	0	3990	3335
405	173	30	-15	8	8	13	14	23	23	4026	3372
405	174	30	15	6	6	14	13	17	17	4057	3402
410	175	30	30	52	0	14	0	151	0	4222	3402
410	176	30	-15	4	4	13	15	12	12	4247	3429
411	177	90	0	161	161	34	49	1304	1304	5535	4782
412	178	120	0	35	0	81	0	375	0	6041	4782
413	179	90	0	30	30	92	66	243	243	6376	5091
421	180	30	15	5	5	48	32	15	15	6439	5138
427	181	30	-30	23	23	13	14	67	67	6519	5219
427	182	60	0	56	56	21	28	308	308	6848	5555
431	183	60	30	13	13	35	35	72	72	6955	5662

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435	194	60	15	37	37	31	31	204	204	7190	5897
438	185	30	45	8	8	25	17	23	23	7238	5937
443	186	30	-30	41	41	14	15	119	119	7371	6071
443	187	30	-15	15	15	14	13	44	44	7429	6128
445	188	30	0	5	5	13	13	15	15	7457	6156
447	189	60	15	53	53	21	29	292	292	7770	6477
450	190	60	-15	7	7	31	32	39	39	7840	6548
459	191	90	0	19	19	45	52	154	154	8039	6754
460	192	60	15	25	25	55	47	138	138	8232	6939
461	193	30	15	6	6	28	20	17	17	8277	6976
462	194	30	-30	16	16	13	14	46	46	8336	7036
463	195	90	-15	47	47	34	50	381	381	8751	7467
465	196	90	0	10	10	68	67	81	81	8900	7615
476	197	60	15	49	49	54	46	270	270	9224	7931
477	198	30	-30	19	0	28	0	55	0	9307	7931
477	199	30	30	23	0	12	0	67	0	9586	7931
479	200	60	-15	25	0	19	0	138	0	9543	7931
486	201	30	0	5	5	27	21	15	15	9585	7967
491	202	60	15	31	31	21	28	171	171	9777	8166
492	203	60	15	28	28	36	35	154	154	9967	8355
495	204	30	30	40	40	28	21	116	116	10111	8492
502	205	30	0	7	7	13	13	20	20	10144	8525
502	206	30	-15	9	9	14	14	26	26	10184	8565
508	207	90	0	26	0	31	0	209	0	10424	8565
510	208	30	30	28	0	46	0	78	0	10548	8565
510	209	90	0	14	14	32	49	113	113	10693	8727
511	210	90	0	43	43	66	66	347	347	11106	9140
512	211	90	0	16	16	66	66	129	129	11301	9335
519	212	30	0	8	8	48	32	23	23	11372	9390
527	213	60	15	10	10	20	28	54	54	11446	9472
528	214	60	-15	20	20	36	37	109	109	11591	9618
528	215	60	0	20	20	39	38	109	109	11739	9765
528	216	60	15	38	38	35	34	206	206	11980	10005
534	217	30	-15	7	7	27	20	20	20	12027	10045
540	218	30	30	4	4	13	13	11	11	12051	10069
541	219	60	-15	41	0	19	0	221	0	12291	10069
541	220	60	15	40	40	35	28	218	218	12544	10315
544	221	30	15	7	7	28	20	20	20	12592	10355
549	222	60	30	13	13	18	25	72	72	12682	10452
557	223	30	-30	10	10	26	20	28	28	12736	10500
560	224	60	-15	22	22	21	28	120	120	12877	10648
560	225	30	0	4	4	26	18	12	12	12915	10678
561	226	90	0	26	26	32	49	211	211	13158	10938
566	227	30	15	7	7	48	31	20	20	13226	10989
571	228	60	15	22	22	19	27	121	121	13366	11137
573	229	30	30	7	7	28	20	20	20	13414	11177
573	230	90	0	26	26	33	49	211	211	13658	11437
575	231	30	45	26	28	49	32	81	81	13788	11550
575	232	60	30	10	10	21	29	55	55	13864	11634
576	233	30	45	34	34	28	20	99	99	13991	11753

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576	234	30	45	11	11	14	14	32	32	14037	11799
576	235	30	45	25	25	13	13	73	73	14123	11885
576	236	30	-15	4	4	13	14	12	12	14148	11911
577	237	60	-30	8	8	21	30	44	44	14213	11985
578	238	30	30	28	28	30	20	81	81	14324	12086
582	239	60	15	4	4	21	30	22	22	14367	12138
582	240	30	15	7	7	30	22	20	20	14417	12180
582	241	30	15	17	17	13	12	49	49	14479	12241
589	242	30	30	16	16	13	14	46	46	14538	12301
590	243	60	-30	26	0	22	0	143	0	14703	12301
590	244	90	0	52	52	48	50	421	421	15172	12772
591	245	30	15	31	31	66	65	251	251	15439	13088
592	246	90	-15	32	32	66	68	259	259	15814	13415
592	247	30	15	11	11	49	32	32	32	15895	13479
595	248	30	30	7	7	13	13	20	20	15928	13512
595	249	30	30	7	7	14	14	20	20	15962	13546
599	250	30	-30	44	44	13	14	128	128	16103	13688
599	251	90	0	18	18	33	48	146	146	16282	13882
600	252	30	45	8	8	46	30	23	23	16351	13935
604	253	90	0	25	0	33	0	203	0	16587	13935
605	254	30	-15	16	16	48	15	46	46	16681	13996
608	255	60	-15	14	14	20	29	77	77	16778	14102
614	256	60	-15	12	12	36	35	66	66	16880	14203
616	257	30	-15	6	6	28	21	17	17	16925	14241
622	258	30	0	16	0	13	0	46	0	16984	14241
622	259	60	-15	10	10	29	28	55	55	17068	14324
623	260	60	-30	38	38	34	34	209	209	17311	14567
625	261	60	15	22	22	35	33	121	121	17467	14721
626	262	30	30	19	19	27	20	55	55	17549	14796
629	263	30	-45	11	11	11	12	32	32	17592	14839
632	264	30	-30	4	4	13	13	12	12	17617	14864
639	265	90	-15	38	38	32	47	303	308	17957	15219
640	266	30	-30	10	10	47	32	29	29	18033	15280
641	267	60	30	56	56	21	27	308	308	18362	15615
641	268	30	15	21	21	28	21	61	61	18451	15697
641	269	30	-30	15	15	13	14	44	44	18508	15755
654	270	60	15	34	34	21	28	187	187	18716	15970
655	271	60	15	25	25	35	35	138	138	18889	16143
656	272	60	15	28	28	35	35	154	154	19076	16332
657	273	90	0	10	10	47	55	81	81	19206	16468
658	274	30	30	10	10	47	31	29	29	19282	16528
664	275	90	0	50	50	32	47	403	403	19717	16978
670	276	30	-30	13	13	47	33	38	38	19802	17049
672	277	30	-15	7	7	14	14	20	20	19836	17083
673	278	30	30	10	10	14	13	29	29	19879	17125
680	279	30	-30	50	50	13	14	141	141	20033	17280
681	280	30	30	7	7	14	13	20	20	20067	17313
686	281	60	-15	16	16	21	29	88	88	20176	17430
686	282	60	-30	30	30	35	36	165	165	20376	17631
686	283	60	0	7	7	37	36	39	39	20452	17706

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687	284	90	15	16	16	48	55	130	130	20630	17891
687	285	30	-30	24	24	47	33	70	70	20747	17994
688	286	30	15	19	19	14	13	55	55	20816	18062
688	287	30	30	7	7	13	13	20	20	20849	18095
688	288	30	0	5	5	13	13	15	15	20877	18123
688	289	30	15	22	22	13	13	64	64	20954	18200
690	290	90	15	38	38	32	47	308	308	21294	18555
691	291	30	-30	8	8	47	33	23	23	21364	18611
691	292	30	30	43	43	14	13	125	125	21503	18749
691	293	30	30	6	6	15	13	17	17	21535	18779
692	294	30	-30	10	10	13	14	29	29	21577	18822
702	295	30	-45	26	26	13	14	75	75	21665	18911
702	296	30	-30	45	45	14	14	131	131	21810	19056
703	297	60	15	16	16	22	29	88	88	21920	19173
706	298	30	0	4	4	28	20	12	12	21960	19205
706	299	60	0	60	60	21	29	330	330	22311	19564
706	300	30	15	7	7	28	20	20	20	22359	19604
721	301	30	30	46	46	13	13	133	133	22505	19750
721	302	60	15	20	20	20	23	110	110	22635	19888
722	303	90	0	23	23	46	54	186	186	22867	20128
729	304	60	0	26	26	44	46	143	143	23054	20317
734	305	60	-15	16	16	35	35	88	88	23177	20440
735	306	60	30	24	24	36	35	132	132	23345	20607
735	307	30	0	29	29	28	21	84	84	23457	20712
735	308	30	-30	39	39	13	14	113	113	23583	20839
736	309	30	-30	16	16	14	14	46	46	23643	20899
737	310	60	15	31	31	22	28	171	171	23836	21098
739	311	60	-15	17	17	36	38	94	94	23966	21230
744	312	90	0	17	17	48	54	138	138	24152	21422
753	313	30	30	23	23	47	31	67	67	24266	21520
754	314	60	-15	13	13	21	29	72	72	24359	21621
755	315	60	15	47	47	35	35	259	259	24653	21915
755	316	30	0	9	9	29	21	26	26	24708	21962
766	317	30	30	7	7	11	11	20	20	24739	21993
767	318	30	0	4	4	12	12	12	12	24763	22017
767	319	30	-30	7	7	13	14	20	20	24796	22051
769	320	60	0	7	7	22	29	39	39	24857	22119
772	321	30	-15	4	4	29	22	12	12	24898	22153
776	322	90	15	31	31	30	44	251	251	25179	22448
777	323	30	-15	6	6	43	29	17	17	25239	22494
778	324	60	30	13	13	22	28	72	72	25333	22594
782	325	60	15	22	22	31	31	121	121	25485	22746
785	326	30	30	37	37	23	16	107	107	25615	22869
786	327	30	30	13	13	13	13	38	38	25666	22920
788	328	30	30	13	13	13	13	38	38	25717	22971
788	329	30	30	19	19	14	14	55	55	25786	23040
793	330	30	15	13	13	14	15	38	38	25833	23093
794	331	30	15	5	5	14	13	15	15	25867	23121
798	332	60	-15	15	15	16	24	83	83	25965	23228
800	333	30	15	22	22	24	16	64	64	26054	23308

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800	334	30	0	17	17	13	13	49	49	26116	23370
801	335	30	15	16	16	13	13	46	46	26175	23429
801	336	30	15	25	25	13	13	73	73	26261	23515
802	337	30	30	25	25	13	13	73	73	26347	23601
802	338	30	-30	14	14	13	14	41	41	26401	23656
802	339	30	15	10	10	14	13	29	29	26444	23698
802	340	30	15	7	7	13	13	20	20	26477	23731
803	341	30	-30	16	16	13	14	46	46	26536	23791
804	342	60	0	10	10	22	29	55	55	26613	23875
817	343	60	-15	19	19	36	36	105	105	26754	24016
818	344	90	0	18	18	44	52	146	146	26944	24214
828	345	30	15	47	47	45	29	136	136	27125	24379
819	346	30	-30	26	26	13	13	75	75	27213	24467
819	347	30	30	13	13	13	13	38	38	27264	24518
819	348	90	-15	11	11	34	50	89	89	27387	24657
820	349	60	15	13	13	55	47	72	72	27514	24776
821	350	60	30	11	11	34	34	61	61	27609	24871
825	351	60	15	21	21	36	35	116	116	27761	25022
834	352	60	-15	13	13	34	36	72	72	27867	25130
834	353	30	0	4	4	28	19	12	12	27907	25101
835	354	30	-15	4	4	13	14	12	12	27932	25187
837	355	90	0	17	17	31	46	138	138	28101	25371
837	356	30	30	20	20	46	30	58	58	28205	25459
852	357	30	45	6	6	13	13	17	17	28235	25489
853	358	30	30	13	13	14	13	38	38	28287	25540
853	359	60	0	13	13	20	30	72	72	28379	25642
869	360	30	0	5	5	29	20	15	15	28423	25677
869	361	30	-15	6	6	13	13	17	17	28453	25707
874	362	90	0	28	28	33	49	227	227	28713	25983
883	363	60	-15	38	38	55	48	209	209	28977	26240
885	364	60	0	19	19	36	35	105	105	29118	26380
885	365	90	0	19	19	47	55	154	154	29319	26589
886	366	60	0	12	11	55	47	71	64	29445	26700

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A. 1209-3

B. CAMERA OPERATIONS SUMMARY REV 886 OP 366 THROUGH REV 1356 OP 550

REV	MSN OP NUM	SCA	SCC	FRAMES		INTEROP FEET		PHOTO-FT		CUM-TU-FEET	
				FWD	AFT	FWD	AFT	FWD	AFT	FWD	AFT
886	366	60	0	6	7	0	0	33	39	33	39
899	367	30	45	19	0	91	0	55	0	179	39
900	368	60	0	32	32	20	99	176	176	375	314
902	369	60	-15	26	26	36	36	143	143	554	493
908	370	30	15	8	8	29	21	23	23	606	537
912	371	60	15	19	19	22	29	105	105	733	671
913	372	30	45	19	0	28	0	55	0	816	671
913	373	60	0	37	37	21	36	204	204	1041	911
914	374	60	30	15	0	36	0	83	0	1160	911
914	375	90	0	10	10	47	56	81	81	1288	1048
914	376	30	30	37	37	47	31	107	107	1442	1186
915	377	60	30	37	37	20	27	204	204	1666	1417
918	378	60	15	19	19	36	37	105	105	1807	1559
931	379	60	15	19	0	35	0	105	0	1947	1559
931	380	60	15	10	10	36	36	55	55	2038	1650
938	381	30	30	13	13	27	19	38	38	2103	1707
950	382	60	15	10	0	19	0	55	0	2177	1707
962	383	60	-15	14	14	34	29	77	77	2288	1813
963	384	60	15	31	31	37	35	171	171	2496	2019
966	385	30	0	16	16	28	21	46	46	2570	2086
966	386	90	-15	19	19	29	46	154	154	2753	2286
967	387	30	30	22	22	45	28	64	64	2862	2378
968	388	30	0	7	7	13	13	20	20	2895	2411
971	389	90	0	16	16	32	48	130	130	3057	2589
979	390	90	0	19	19	65	65	154	154	3276	2808
980	391	30	15	4	4	46	30	12	12	3334	2850
980	392	30	0	25	25	13	13	73	73	3420	2936
993	393	30	-45	53	53	13	14	154	154	3587	3104
994	394	30	30	7	7	14	13	20	20	3621	3137
994	395	30	-30	5	5	13	14	15	15	3649	3166
995	396	30	-30	7	7	14	14	20	20	3683	3200
996	397	60	30	7	7	22	28	39	39	3744	3257
999	398	30	30	19	19	28	21	55	55	3827	3343
999	399	30	0	26	26	13	14	75	75	3915	3432
1011	400	90	15	8	8	31	46	65	65	4011	3543
1012	401	120	0	44	44	81	89	471	471	4563	4103
1013	402	60	15	19	19	78	62	105	105	4746	4270
1013	403	30	30	8	8	28	20	23	23	4797	4313
1014	404	30	30	13	13	13	13	38	38	4848	4364
1015	405	30	15	7	7	13	14	20	20	4881	4398
1016	406	30	-30	7	7	14	14	20	20	4915	4432
1019	407	60	15	19	19	19	26	105	105	5039	4563

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1026	408	90	0	16	0	43	0	130	0	5212	4563
1028	409	90	15	34	0	65	0	275	0	5552	4563
1031	410	60	-15	19	19	54	34	105	105	5711	4702
1031	411	90	0	18	18	49	56	146	146	5906	4904
1033	412	30	15	7	7	48	32	20	20	5974	4956
1036	413	90	0	10	10	33	49	81	81	6088	5086
1044	414	60	0	22	22	55	48	121	121	6264	5255
1044	415	60	-15	43	43	36	36	237	237	6537	5528
1044	416	60	-30	33	33	35	35	182	182	6754	5745
1045	417	30	15	4	4	29	20	12	12	6795	5777
1047	418	30	-30	16	16	14	14	46	46	6855	5837
1049	419	90	15	20	20	32	48	162	162	7049	6047
1052	420	90	0	13	13	68	69	105	105	7222	6221
1054	421	60	0	7	7	56	48	39	39	7317	6308
1059	422	60	-15	17	17	36	36	94	94	7447	6438
1060	423	120	0	18	18	81	76	193	193	7701	6707
1061	424	120	0	47	47	104	104	503	503	8308	7314
1062	425	60	0	17	17	79	63	94	94	8481	7471
1062	426	30	-45	20	20	28	21	58	58	8567	7550
1063	427	60	-30	19	19	20	28	105	105	8692	7683
1065	428	60	0	28	28	35	34	154	154	8881	7871
1077	429	60	0	7	7	36	36	39	39	8956	7946
1078	430	30	-45	10	10	28	21	29	29	9013	7996
1078	431	60	15	15	15	21	28	83	83	9117	8107
1079	432	30	45	10	10	23	20	29	29	9174	8156
1081	433	30	15	7	7	13	13	20	20	9207	8189
1086	434	60	-30	17	17	21	30	94	94	9322	8313
1092	435	30	15	16	15	29	20	46	46	9397	8379
1092	436	30	30	32	32	13	13	93	93	9503	8485
1093	437	120	0	26	26	49	73	278	278	9830	8836
1094	438	60	0	38	38	60	64	209	209	10119	9109
1094	439	30	-30	14	14	28	21	41	41	10188	9171
1094	440	30	-15	6	6	14	13	17	17	10219	9201
1094	441	30	45	51	51	13	12	148	148	10380	9361
1095	442	30	45	19	19	13	14	55	55	10448	9430
1095	443	30	-30	25	25	14	15	73	73	10535	9518
1095	444	30	45	32	32	15	13	93	93	10643	9624
1096	445	60	-30	5	5	21	31	28	28	10692	9683
1096	446	30	0	16	16	29	20	46	46	10767	9749
1096	447	30	45	17	17	13	13	49	49	10829	9811
1101	448	60	15	13	13	21	29	72	72	10922	9912
1102	449	60	-15	19	19	37	38	105	105	11064	10055
1108	450	90	0	4	4	46	53	32	32	11142	10140
1108	451	30	30	46	46	46	30	133	133	11321	10303
1111	452	60	0	10	10	21	29	55	55	11397	10387
1112	453	90	0	31	31	47	56	251	251	11695	10694
1113	454	30	-30	47	47	48	32	136	136	11879	10862
1114	455	30	-15	37	37	14	14	107	107	12000	10983
1123	456	60	15	59	59	22	28	321	321	12343	11332
1125	457	90	0	28	28	48	57	226	226	12617	11615

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1129	458	90	0	26	26	66	66	210	210	12893	11891
1142	459	30	0	7	7	47	31	20	20	12960	11942
1144	460	90	0	59	59	33	49	475	475	13468	12406
1157	461	90	0	11	11	67	67	89	89	13624	12622
1159	462	60	-15	31	31	55	48	171	171	13850	12841
1160	463	30	30	13	13	29	20	38	38	13917	12899
1173	464	60	15	10	10	24	28	55	55	13993	12982
1173	465	30	-15	8	8	28	22	23	23	14064	13027
1173	466	90	0	6	6	31	45	49	49	14124	13121
1174	467	60	15	19	19	54	46	105	105	14233	13272
1175	468	60	15	13	13	36	36	72	72	14391	13380
1175	469	60	-15	30	30	36	37	165	165	14592	13582
1177	470	60	-15	8	8	36	36	44	44	14672	13662
1177	471	90	0	41	41	48	55	332	332	15052	14049
1189	472	90	0	28	28	68	69	227	227	15347	14345
1190	473	30	30	20	20	48	32	58	58	15453	14435
1190	474	60	-15	14	14	20	29	77	77	15550	14541
1192	475	60	30	40	40	36	35	220	220	15806	14796
1193	476	90	0	33	33	48	56	267	267	16121	15119
1194	477	60	30	16	16	55	47	88	88	16264	15254
1194	478	90	0	19	19	49	58	154	154	16467	15466
1197	479	90	0	13	13	55	54	105	105	16627	15625
1200	480	120	0	47	47	66	74	503	503	17196	16202
1205	481	30	-30	29	29	69	46	84	84	17349	16332
1207	482	30	0	4	4	14	13	12	12	17375	16357
1207	483	30	-30	5	5	13	14	15	15	17403	16386
1208	484	60	30	27	27	22	28	149	149	17574	16563
1209	485	30	15	44	44	28	21	128	128	17730	16712
1209	486	90	0	38	38	32	49	308	308	18070	17069
1209	487	60	-15	33	33	53	45	182	182	18305	17296
1210	489	60	30	19	19	34	32	105	105	18444	17433
1215	489	60	-15	17	17	35	37	94	94	18573	17564
1223	490	90	0	26	26	46	53	211	211	16830	17828
1226	491	60	-15	39	39	52	45	215	225	19097	18088
1239	492	90	15	34	34	47	53	275	275	19419	18416
1239	493	30	-30	23	23	46	32	67	67	19532	18515
1240	494	60	0	12	12	22	29	66	66	19620	18610
1241	495	30	30	17	17	28	20	49	49	19697	18679
1241	496	30	-15	30	30	13	14	87	87	19797	18780
1241	497	30	-30	10	10	15	15	29	29	19841	18824
1241	498	60	15	17	17	21	28	94	94	19956	18946
1241	499	30	0	5	5	29	21	15	15	20000	18982
1243	500	30	30	34	34	13	13	99	99	20112	19094
1247	501	30	-30	5	5	13	14	15	15	20240	19123
1248	502	60	-30	41	41	22	30	226	226	20388	19379
1255	503	60	-15	41	41	36	36	226	226	20650	19641
1256	504	90	15	62	62	48	54	502	502	21200	20197
1258	505	60	-15	18	18	54	48	99	99	21353	20344
1259	506	90	0	34	34	47	54	275	275	21675	20673
1263	507	30	0	8	8	46	31	23	23	21744	20727

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1265	508	30	-30	7	7	14	14	20	20	21778	20761
1270	509	60	15	22	22	22	29	121	121	21921	20911
1271	510	30	30	22	22	28	20	64	64	22013	20995
1274	511	30	-30	19	19	13	14	55	55	22081	21064
1274	512	60	15	43	43	21	28	237	237	22339	21329
1274	513	60	30	23	23	36	35	127	127	22502	21491
1275	514	90	15	92	92	45	53	745	745	23292	22289
1281	515	30	-15	9	9	47	33	26	26	23365	22348
1285	516	60	0	12	12	21	28	66	66	23452	22442
1286	517	90	-15	4	4	47	56	32	32	23531	22530
1290	518	60	-30	16	16	58	50	88	88	23677	22668
1290	519	120	0	29	29	60	74	310	310	24047	23052
1291	520	90	0	65	65	84	77	527	527	24658	23656
1297	521	30	-15	5	5	48	33	15	15	24721	23704
1303	522	90	0	40	40	33	48	324	324	25078	24076
1304	523	30	0	13	13	47	34	38	38	25163	24145
1304	524	60	-15	36	36	21	29	198	198	25382	24372
1305	525	60	-30	11	11	36	37	61	61	25479	24470
1307	526	60	-15	30	30	37	36	165	165	25681	24671
1313	527	30	0	5	5	28	20	15	15	25724	24706
1319	528	30	-30	41	41	13	14	119	119	25856	24839
1319	529	30	-30	17	17	15	14	49	49	25920	24902
1320	530	30	15	31	31	13	13	90	90	26023	25005
1321	531	60	-15	17	17	21	29	94	94	26138	25126
1321	532	30	-45	41	41	29	21	119	119	26286	25268
1322	533	30	30	13	13	13	13	38	38	26337	25319
1323	534	60	-15	17	17	21	29	94	94	26452	25442
1335	535	90	0	8	8	47	55	65	65	26564	25562
1335	536	90	0	11	11	65	65	89	89	26718	25716
1336	537	60	15	29	29	55	47	160	160	26933	25923
1338	538	30	30	10	10	28	20	29	29	26990	25972
1339	539	30	15	7	7	13	13	20	20	27023	26005
1339	540	90	0	43	43	34	50	348	348	27405	26403
1345	541	30	15	6	6	47	31	17	17	27469	26451
1351	542	60	15	7	7	21	28	39	39	27529	26518
1352	543	60	0	10	10	36	37	55	55	27620	26610
1352	544	30	-30	19	19	28	21	55	55	27703	26686
1353	545	60	-15	13	13	22	29	72	72	27797	26787
1353	546	30	0	7	7	28	20	20	20	27845	26827
1354	547	30	-45	7	7	14	15	20	20	27879	26862
1355	548	90	0	34	34	34	49	275	275	28188	27186
1356	549	30	30	10	10	47	31	29	29	28264	27246
1356	550	60	-15	41	40	21	29	226	219	28510	27494

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B. CAMERA OPERATIONS SUMMARY REV 1356 OP 550 THROUGH REV 2090 OP 759

REV	MSN OP NUM	SCA	SCC	FRAMES FWD	FRAMES AFT	INTEROP FEET FWD	INTEROP FEET AFT	PHOTO-FT FWD	PHOTO-FT AFT	CUM-TU-FEET FWD	CUM-TU-FEET AFT
1356	550	60	-15	4	6	0	0	22	28	22	28
1368	551	60	-15	34	34	99	100	187	187	308	315
1378	552	30	-15	5	5	29	21	15	15	352	351
1386	553	90	0	8	8	32	47	65	65	449	463
1392	554	60	-15	17	17	50	42	94	94	593	599
1403	555	60	0	23	23	32	32	127	127	752	758
1404	556	60	0	10	10	36	36	55	55	843	849
1404	557	60	-15	18	18	35	36	99	99	977	984
1409	558	60	0	10	10	36	36	55	55	1058	1075
1409	559	90	0	7	7	47	54	57	57	1172	1186
1411	560	30	-15	8	8	46	31	23	23	1241	1240
1416	561	60	30	16	16	22	28	88	88	1351	1356
1416	562	90	-15	13	13	48	58	105	105	1504	1519
1417	563	60	15	77	77	55	46	424	424	1983	1989
1419	564	60	15	10	10	35	35	55	55	2073	2079
1419	565	90	15	11	11	48	55	89	89	2210	2223
1420	566	60	30	19	19	55	47	105	105	2370	2375
1420	567	60	15	22	22	33	33	121	121	2524	2529
1426	568	30	-45	0	6	24	18	17	17	2565	2564
1427	569	30	15	5	5	14	13	15	15	2594	2592
1431	570	60	15	16	16	21	29	88	88	2703	2709
1432	571	30	15	4	4	29	21	12	12	2744	2742
1432	572	90	0	27	27	31	47	219	219	2994	3008
1433	573	30	-30	4	4	47	32	12	12	3053	3052
1433	574	60	-15	32	32	22	29	176	176	3251	3257
1437	575	60	-15	26	26	35	36	143	143	3429	3436
1438	576	30	30	10	10	29	20	29	29	3487	3485
1449	577	60	15	16	16	21	28	88	88	3596	3601
1451	578	30	-30	19	19	28	21	55	55	3679	3677
1452	579	60	15	28	28	20	28	154	154	3853	3859
1452	580	60	15	16	16	35	35	88	88	3976	3982
1453	581	90	0	25	25	44	52	203	203	4223	4237
1453	582	60	15	17	17	52	44	94	94	4369	4375
1465	583	30	30	43	43	28	20	125	125	4522	4520
1465	584	60	-15	24	24	19	28	132	132	4673	4680
1465	585	30	-30	30	30	29	20	87	87	4789	4787
1466	586	60	30	49	49	21	28	270	270	5080	5085
1466	587	30	30	11	11	27	20	32	32	5139	5137
1475	588	30	-45	7	7	13	14	20	20	5172	5171
1476	589	30	45	7	7	14	13	20	20	5205	5204
1481	590	60	-15	14	14	21	30	77	77	5304	5311
1482	591	60	-15	23	23	36	35	127	127	5467	5473

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1484	592	30	30	7	7	28	20	20	20	5515	5513
1485	593	60	30	25	25	21	29	138	138	5674	5680
1485	594	30	15	8	8	28	20	23	23	5725	5723
1487	595	60	0	41	41	21	30	226	226	5972	5979
1497	596	60	30	19	19	37	35	105	105	6114	6119
1498	597	30	30	22	22	28	21	64	64	6206	6204
1498	598	90	0	32	32	33	49	259	259	6498	6512
1500	599	60	-30	10	10	55	48	55	55	6608	6615
1500	600	30	15	4	4	30	21	12	12	6650	6648
1501	601	60	15	16	16	18	26	88	88	6756	6762
1502	602	30	-30	28	28	26	19	81	81	6863	6862
1506	603	30	-45	4	4	14	14	12	12	6889	6888
1513	604	60	0	10	10	22	29	55	55	6966	6972
1513	605	30	-15	20	20	29	21	58	58	7053	7051
1514	606	90	-15	11	11	32	49	89	89	7174	7189
1514	607	30	-15	13	13	48	32	38	38	7260	7259
1514	609	30	-30	12	12	13	13	35	35	7308	7307
1514	609	30	-30	7	7	14	14	20	20	7342	7341
1517	610	90	15	7	7	33	47	57	57	7432	7445
1517	611	30	-30	17	17	47	32	49	49	7528	7526
1517	612	30	-30	33	33	13	14	96	96	7637	7639
1518	613	30	-30	10	10	14	14	29	29	7680	7679
1529	614	60	15	13	13	22	28	72	72	7774	7779
1530	615	30	0	13	13	28	21	38	38	7840	7838
1530	616	30	-30	4	4	13	14	12	12	7865	7864
1532	617	30	0	7	7	14	13	20	20	7899	7897
1533	618	60	-15	35	35	21	30	193	193	8113	8120
1533	619	60	-30	24	24	37	37	132	132	8282	8289
1534	620	90	0	41	41	49	56	332	332	8663	8677
1534	621	30	15	4	4	48	32	12	12	8723	8721
1546	622	30	-30	13	13	13	13	38	38	8774	8772
1546	623	30	15	24	24	13	13	70	70	8857	8855
1546	624	30	-15	30	30	13	13	87	87	8957	8955
1547	625	30	-30	44	44	13	13	128	128	9098	9096
1548	626	30	30	19	19	13	13	55	55	9166	9164
1548	627	60	-30	11	11	21	30	61	61	9248	9255
1548	628	30	15	11	11	29	20	32	32	9309	9307
1549	629	30	0	4	4	13	13	12	12	9334	9332
1550	630	90	0	110	110	31	47	891	891	10256	10270
1555	631	30	-15	5	5	47	32	15	15	10318	10317
1562	632	90	15	26	26	34	50	211	211	10563	10578
1563	633	60	15	16	16	56	46	88	88	10707	10712
1564	634	30	45	10	10	28	21	29	29	10764	10762
1564	635	30	-30	5	5	13	13	15	15	10792	10790
1565	636	30	-15	16	16	13	13	46	46	10851	10849
1565	637	60	15	11	11	21	28	61	61	10933	10938
1566	638	90	0	98	98	47	56	794	794	11774	11788
1567	639	90	0	16	16	66	66	130	130	11970	11984
1571	640	30	-30	8	8	48	32	23	23	12041	12039
1579	641	30	-15	13	13	13	13	38	38	12092	12090

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1579	642	60	0	11	11	24	32	61	61	12177	12183
1579	643	60	-15	23	23	36	36	127	127	12340	12346
1580	644	60	0	26	26	36	36	143	143	12519	12525
1580	645	30	-45	26	26	28	20	75	75	12622	12620
1582	646	60	-30	56	56	21	30	308	308	12951	12958
1583	647	60	-15	19	19	37	36	105	105	13093	13099
1583	648	30	-30	47	47	28	21	136	136	13257	13256
1583	649	30	30	21	21	14	15	61	61	13332	13332
1594	650	90	0	44	44	32	48	356	356	13720	13736
1595	651	60	30	25	0	53	0	138	0	13911	13736
1595	652	60	-15	10	10	36	47	55	55	14002	13838
1597	653	60	0	31	31	36	36	171	171	14209	14045
1598	654	30	30	34	34	28	20	99	99	14336	14164
1598	655	30	-45	22	22	14	14	64	64	14414	14242
1598	656	30	0	7	7	13	13	20	20	14447	14275
1599	657	120	0	68	68	47	71	728	728	15222	15074
1599	658	90	0	69	69	88	80	559	559	15869	15713
1600	659	60	-30	4	4	55	48	22	22	15946	15783
1607	660	60	15	13	13	36	34	72	72	16054	15889
1612	661	30	-30	25	25	27	20	73	73	16154	15982
1612	662	30	30	25	25	14	13	73	73	16241	16068
1613	663	60	0	19	19	21	29	105	105	16367	16202
1614	664	60	15	16	16	35	35	86	88	16490	16325
1615	665	90	0	89	89	49	57	721	721	17260	17103
1616	666	90	0	34	34	67	67	275	275	17602	17445
1621	667	30	-45	4	4	47	32	12	12	17661	17489
1627	668	90	0	47	0	33	0	381	0	18075	17489
1628	669	30	-15	4	4	47	13	12	12	18134	17514
1628	670	30	15	7	7	13	13	20	20	18187	17547
1630	671	90	0	11	11	33	49	89	89	18289	17635
1631	672	90	0	19	19	66	66	154	154	18509	17905
1632	673	30	30	7	7	48	31	20	20	18577	17956
1636	674	60	-15	9	9	21	31	50	50	18648	18037
1637	675	30	45	8	8	29	20	23	23	18700	18080
1643	676	60	-15	22	22	20	29	121	121	18841	18230
1644	677	90	0	26	0	45	0	211	0	19097	18230
1644	678	30	-30	66	0	45	0	191	0	19333	18230
1644	679	60	-15	16	16	21	35	88	88	19442	18353
1645	680	90	-15	37	37	44	53	300	300	19786	18706
1647	681	90	0	20	20	62	61	162	162	20010	18929
1647	682	90	45	57	57	65	64	462	462	20537	19455
1647	683	30	30	10	10	46	31	29	29	20612	19515
1648	684	60	15	65	65	21	29	358	358	20991	19902
1648	685	30	-15	9	9	28	20	26	26	21045	19948
1661	686	90	0	29	0	31	0	235	0	21311	19948
1661	687	30	0	7	7	46	13	20	20	21377	19981
1663	688	60	0	19	19	21	29	105	105	21503	20115
1665	689	60	-15	17	17	35	36	94	94	21632	20245
1668	690	90	0	13	13	45	52	105	105	21782	20402
1674	691	60	30	19	19	52	43	103	103	21937	20548

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1679	692	30	-15	4	4	29	22	11	11	21977	20581
1680	693	90	0	70	70	33	49	567	567	22577	21197
1681	694	60	15	22	22	55	47	120	120	22752	21364
1684	695	90	0	16	16	37	47	130	130	22919	21541
1685	696	30	-30	4	4	38	23	12	12	22969	21576
1692	697	90	0	35	35	33	48	282	282	23284	21906
1693	698	30	15	7	7	46	30	20	20	23350	21956
1693	699	60	15	16	16	21	29	87	87	23458	22072
1696	700	60	0	13	13	35	35	71	71	23554	22178
1696	701	60	-15	6	6	35	35	33	33	23632	22246
1700	702	30	-45	11	11	27	20	32	32	23691	22298
1701	703	30	-15	4	4	13	13	12	12	23716	22323
1710	704	60	-30	11	11	21	29	60	60	23797	22412
1728	705	90	-15	11	11	48	55	89	89	23934	22556
1735	706	60	-30	8	8	56	48	44	44	24034	22648
1741	707	60	0	22	22	36	35	121	121	24191	22804
1744	708	60	15	10	10	34	34	55	55	24280	22893
1745	709	60	15	19	19	35	35	105	105	24420	23033
1745	710	60	0	7	7	36	36	39	39	24495	23108
1759	711	60	15	13	13	24	34	72	72	24591	23214
1762	712	90	0	18	18	44	52	146	146	24781	23412
1769	713	120	0	11	11	44	51	118	118	24943	23581
1774	714	60	15	13	13	44	29	72	72	25059	23682
1776	715	30	-30	16	16	28	21	46	46	25133	23749
1777	716	90	0	62	62	32	47	502	502	25667	24298
1777	717	60	-15	17	17	54	47	94	94	25815	24439
1778	718	90	0	26	26	47	54	211	211	26073	24704
1792	719	30	30	10	10	46	30	29	29	26148	24763
1793	720	60	-30	16	16	20	29	88	88	26256	24880
1793	721	30	-30	7	7	28	20	20	20	26304	24920
1794	722	90	0	32	32	33	48	259	259	26595	25227
1800	723	30	45	13	13	46	30	38	38	26680	25295
1804	724	60	-15	7	7	21	29	39	39	26740	25363
1810	725	60	-15	22	22	36	36	121	121	26897	25520
1816	726	30	-45	13	13	28	21	38	38	26963	25579
1826	727	30	30	7	7	14	13	20	20	26997	25612
1842	728	60	0	10	10	20	28	55	55	27072	25695
1842	729	60	-30	14	14	34	35	77	77	27183	25807
1863	730	30	-45	8	8	28	20	23	23	27234	25850
1881	731	60	-15	13	13	22	29	72	72	27328	25951
1886	732	30	-30	7	7	28	21	20	20	27376	25992
1887	733	30	-30	14	14	14	14	41	41	27431	26047
1890	734	30	30	7	7	14	13	20	20	27465	26080
1906	735	30	-30	4	4	13	13	12	12	27490	26105
1907	736	30	-30	5	5	15	15	13	14	27518	26134
1907	737	60	15	22	22	22	28	121	121	27661	26283
1907	738	30	-30	19	19	28	20	55	55	27744	26358
1940	739	60	0	19	19	21	29	105	105	27870	26492
1946	740	30	45	13	13	28	20	38	38	27936	26550
1951	741	30	30	4	4	13	13	12	12	27961	26575

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1955	742	60	-15	10	10	21	29	55	55	28037	26659
1972	743	30	30	10	0	28	0	29	0	28094	26659
1988	744	30	-15	7	7	13	21	20	20	28127	26700
2003	745	30	15	4	4	14	13	12	12	28153	26725
2004	746	30	30	10	10	13	13	29	29	28195	26767
2004	747	30	15	4	4	13	13	12	12	28220	26792
2010	748	30	45	7	7	13	13	20	20	28253	26825
2020	749	30	0	13	13	14	14	38	38	28305	26877
2027	750	60	15	13	13	21	29	72	72	28396	26978
2031	751	60	-15	13	13	36	36	72	72	28506	27086
2033	752	30	30	19	19	28	20	55	55	28589	27161
2053	753	60	15	7	7	20	28	38	38	28647	27227
2069	754	60	15	10	10	35	35	55	55	28737	27317
2084	755	60	15	22	22	34	34	121	121	28892	27472
2084	756	30	-45	8	8	28	20	23	23	28943	27515
2086	757	60	15	13	10	21	29	72	55	29036	27599
2088	758	30	45	7	0	11	0	20	0	29067	27599
2090	759	60	0	16	0	20	0	88	0	29175	27599
CONSTANT VELOCITY(PREP 21						60	60	0	0	29235	27659

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