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26 MAR 1966

MEMORANDUM FOR: Chief, Design and Analysis Division, OSP
SUBJECT : Mission 1106 Post-Mission Report

INTRODUCTION

1. Mission 1106 presents two significant--although related--new features in the CORONA Reconnaissance Program. These are the Digital Shift Register (DSR) hardware and the [redacted] software. [redacted] in making efficient camera operation selections with the more flexible mode of operation available with the DSR.

2. Mission 1106 was launched on 5 February for a planned mission duration of 15 days. Perigee altitude and inclination were 85 n.m. and 81.5 degrees, respectively.

3. Approximately 16,000 feet of type 3404 Standard Thin Base (STB) was loaded for the forward-looking camera, while 2,000 feet of SO-121 color film was spliced into the spool following the STB film for the aft-looking camera. Due to the difference in thickness of STB and SO-121, there were 116 more frames in the forward-looking camera.

4. The aft-looking camera failed to function on revolution 105, and the remainder of the coverage was monoscopic. This failure occurred after 911 feet (365 frames) of color film had been exposed. It should be noted that approximately 95 percent of the film had been exposed at the time of failure.

5. The first bucket was recovered on revolution 66, 10 February, and the second bucket on revolution 148, 14 February.

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SUMMARY

Operational Performance

1. [REDACTED]
2. [REDACTED]
3. [REDACTED]

Photographic Coverage

1. The expected cloud-free coverage of the Semi-annual requirement area was approximately 1,350,000 sq. n.m. of the 2,330,000 sq. n.m. on film. These areas correspond to 18 and 31 percent of the total Semi-annual requirement (7,520,000 sq. n.m.). About 80 percent of the Semi-annual area photographed was not overdue. The relatively high accomplishment status of 81 percent (pre-mission) implied that there was little overdue area for targeting purposes.

2. A significant portion of the not overdue area was photographed when a cloud-free probability of .90 or better was forecast. An additional factor was the LARGE HPA requirement within the Semi-annual requirement region for South China, China Search, and the Soviet Border.

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3. The expected cloud-free coverage of the Annual requirement area was 390,000 sq. n.m. of the 790,000 sq. n.m. photographed. These areas correspond to 12 and 23 percent, respectively, of the total Annual requirement (3,260,000 sq. n.m.). Approximately 78 percent of the Annual area photographed was not overdue. It must be noted that the accomplishment status of 83 percent (pre-mission) influenced the annual coverage. Annual area was, also, photographed in connection with LARGE HPA, i.e., Mongolia. Not overdue area was selected at other times when cloud-free probabilities were .90 or better.

4. Mission 1106 photographed approximately 970,000 sq. n.m. of the 2,100,000 sq. n.m. HPA requirement. Expected cloud-free coverage was 460,000 sq. n.m. or 48 percent of the area photographed.

5. The cloud-free return in terms of LARGE (number of cells > 100) and SMALL HPA were 46 percent and 75 percent, respectively. This deviation in cloud-freeness is due in part to differences in SMALL and LARGE HPA targeting logic. Another factor may have been the SOC tendency to extend LARGE HPA camera operations.

6. Mission 1106 photographed approximately 310,000 sq. n.m. of Mapping area of which 150,000 sq. n.m. were expected to be cloud-free. This coverage was obtained mainly through day 5. Apparently due to the high film expenditure at this point in the mission, Mapping and Charting coverage was de-emphasized.

 OPERATIONAL MESSAGES



SUBJECT: Mission 1106 Post-Mission Report

Pre-Mission Report

1. This message contains (1) the Mission Requirement Summary, (2) the Search Age Distribution, and (3) a list of High Priority Areas (HPA).

2. The Mission 1106 Requirement Summary is shown in Figure 1. Requirements for each category are presented in terms of both WAC-50 cells and area. The HPA requirement is listed separately as Priority 1 and Priority 2 as well as totaled. Some type of requirement existed for 22.3 million sq. n.m.

3. Figure 2 is the Search Age Distribution. Both the number of cells and percent of the total cells in each search requirement are presented for 30-day intervals for a two year period. For example, 13917 cells or 37.1 percent of the Semi-annual search area have an age of 1-2 months. Mission 1049 is the only one which was flown during this period, and hence its contribution to the periodic status is readily identifiable. The number of cells or area which is overdue as of the current launch date for each requirement type is also presented in Figure 2. Semi-annual accomplishment status at the beginning of Mission 1106 was 80.9 percent relative to the 80-90 percent requirement, while the annual accomplishment status was 82.8 percent relative to the 75 percent requirement.

4. The third section of the pre-mission report lists the COMIREX Identification, number of cells within the HPA, the targeting thresholds (probability of accomplishment, average cloud-free probability, and the required incremental probability), the expected number of geometric accesses, and the revolutions on which these will occur. This "look ahead" section may be generated at any time provided an orbital ephemeris is available. An example of this display is not shown.

Daily Reports

1. 

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2.

[REDACTED]

3.

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1.

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MISSION RESULTS

All area coverage presented in this report is stereo. The aft-looking camera malfunctioned on the seventh day, revolution 105, of Mission 1106. Data for film utilization, camera operations, and area coverage analysis were derived from the daily status reports [REDACTED]

Pre-Mission Requirements

1. The Coverage Requirements Summary in Figure 3 represents the various categories of coverage (HPA, Search, Mapping and Charting) and respective amounts of area within each type. Both Semi-annual and Annual Search Areas are shown by total and overdue. That amount of area which will be overdue next mission exclusive of the current mission return is also listed.
2. High Priority Areas (HPA) have been divided into LARGE (number of cells > 100) and SMALL areas for targeting purposes. Mission 1106 contained 140 SMALL HPAs and 9 LARGE HPAs. As shown in Figures 3 and 4, 91 percent of the total HPA is located within the LARGE set. South China, for example, contains 30 percent and the Soviet Border Region an additional 21 percent. The set of SMALL HPAs include 38 Domestic Targets and 12 color targets. Each of these are single cell areas and the overall contribution is .5 percent of the total HPA.
3. The unusually high accomplishment status of Semi-annual and Annual Search areas, 80.9 and 82.8 percent respectively, at the beginning of Mission 1106 definitely influenced the photographic coverage. Also, the fact that the accomplishment status--exclusive of Mission 1106 photographic coverage--at the beginning of Mission 1050 (19 March) will be 75.8 and 80.4 percent, respectively, indicates a low percentage of "near overdue" area for both the Semi-annual and Annual Requirements.
4. Figures 5 and 6 illustrate the age distribution of the Search requirement areas. Note the relatively high performances [REDACTED]

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of Mission 1049 (December 1968) and Mission 1105 (November 1968). The contributions of these missions appear at 2 and 3 months, respectively, in Figures 5 and 6.

5. The remaining Mapping and Charting requirement is approximately 9.1 million sq. n.m. Approximately equivalent amounts of this area are Priority 1 and Priority 2. Note in Figure 3 that this category contains the largest single requirement area.

Film Distribution

1. Approximately 6073 frames were expended through day 8 (revolution 121) as determined from telemetry readout. However, the stereo coverage (5709 frames) ended on rev 105 of day 7. Figure 7 presents the cumulative and daily film expenditure for EPISOD data (telemetry derived) for all camera operations. Expected film consumption for camera operations actually selected by the [redacted] are also plotted in Figure 7, again both cumulative and daily.

2. Differences in expected and actual film expenditure at first appear quite large. However, it must be noted that the actual stereo coverage will always be greater than that requested due to the time pads which are added in the command generation process to assure the desired coverage. Punches on the orbital tape were available at 6, 10, 17, and 26 second intervals, which also added expenditure for each operation. For example, if a stereo camera operation with a duration of twenty seconds was selected in a six-second cascade region, the actual camera on-time will be 48 or 54 seconds with zero time pads, whereas the expected consumption is based on about 45 seconds (20 seconds stereo; 25 seconds for monoscopic, timing error, and smeared first frame).

3. Figure 8 presents film expenditure by coverage category (HPA, Mapping and Charting, Semi-annual/Annual Search Area). Note that approximately equivalent amount of film were utilized for HPA and Search type of coverage (44 percent vs. 37 percent). A further breakdown of film expenditure for HPA purposes appears in Figure 4. Approximately three-fourths of the HPA film was

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expended on the LARGE HPAs, defined as containing 100 or more WAC-50 cells each. Fifty percent more film was used for large HPAs than Semi-annual Search (32 percent vs. 21 percent). All the percentages given are in terms of total film load.

Camera Operations

The distribution of camera operations with respect to forecast cloud-free probability are presented in Figure 9. A mean cloud-free probability per camera operation is .77 for the 75 camera operations. The three camera operations which had a forecast value of .05 occurred on revolution 22. These three operations did not cover the desired area due to a load error at the command station. Also, the one operation at .15 was taken for engineering purposes. Disregarding these four camera operations, the mean cloud-free probability is .80.


Area Coverage

1. Semi-annual Requirement. Figure 10 presents the daily cumulative photographic coverage of the Semi-annual area. Approximately 31 percent of the total area was photographed during Mission 1106. The expected cloud-free, stereo coverage is 18 percent or 1,350,000 sq. n.m. An estimated 3 percent or 226,000 sq. n.m. of overdue area was collected cloud-free. All percentages are based on the total requirement area of 7,520,000 sq. n.m. The expected cloud-free return from photography of Semi-annual area is approximately 60 percent.

2. The number of WAC-50 cells which were photographed are plotted with respect to age in Figure 11. Also, the pre-mission age distribution (cells) is presented for comparative purposes. For example, 4,900 of the 13,900 cells which had an age of one to two months were photographed. Figure 12 presents the age distribution of the Semi-annual area actually photographed. For example, 41 percent of the Semi-annual area photographed had an age of one to two months. An interesting point here is that 79 percent of the area photographed was not overdue. A substantial portion of this not overdue coverage can be attributed to collocation with HPAs. An example of this is South China and the Soviet Border Region.


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3. Annual Requirement. The photographic coverage of the Annual area is presented in Figure 13. Expected cloud-free coverage is about 12 percent or 390,000 sq. n.m. of the total Annual requirement area, whereas 23 percent or 750,000 sq. n.m. was photographed. The estimated overdue cloud-free coverage is 2.5 percent or 82,000 sq. n.m. All percentages are based on the total Annual requirement area of 3,260,000 sq. n.m. It should be noted that Mongolia is considered to be part of the Annual requirement.

4. The number of Annual cells photographed are presented in Figure 14 with respect to age. The pre-mission age distribution is also plotted for comparison. Note that significant numbers of cells which were less than five months old were photographed. As an example, 951 of the 3826 Annual cells which were less than three months old were photographed. The age distribution of the Annual area photographed is presented in Figure 15. In this display, the normalizing factor is the total number (3717) of Annual cells which were photographed. Figure 15 indicates 78 percent of Annual cells photographed were not overdue. Approximately 83 percent of the Annual cells were not overdue (pre-mission statistics, Figure 3).

5. High Priority Area Coverage. Approximately 46 percent of the total HPA (2.1 million sq. n.m., 10419 cells) was photographed during Mission 1106. The expected cloud-free return is 2247 cells or 22 percent. Daily performance in HPA collection (LARGE and SMALL areas) is presented in Figures 16 and 17. The probabilistic accomplishment distribution is illustrated in Figure 16 for 101 areas. The Domestic and Color targets are not included in this set. Note that 32 areas have an expected accomplishment of 80 percent or better with the largest group (23) at 99 percent. These areas with higher probabilistic accomplishment ($> .55$) are all SMALL. The probability of accomplishment for the LARGE set are shown in Figure 4. Mongolia and the Soviet Border Region rank highest of the LARGE HPA at 55 and 41 percent.

6. It is noted in Figure 17 that the expected cloud-free return amounts to approximately 75 percent of the SMALL area photographed. On the other hand, with respect to the LARGE area, 20 percent was expected to be cloud-free in comparison with 46 percent area photographed. The cloud-free return for the LARGE HPA set is then

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about 42 percent or considerably lower than that for the SMALL areas. A point of interest is the near linearity of the daily photographic coverage for HPAs.

7. Mapping and Charting Coverage. Approximately 310,000 sq. n.m. (1550 cells) of Mapping and Charting area were photographed. See Figure 18. The expected cloud-free area is about 50 percent of the area on film or 150,000 sq. n.m. However, it must be noted that the Mapping specifications state that a minimum size (approximately 10,000 sq. n.m.) for contiguous area is required before accomplishment is considered. The figures mentioned here are the total number of cloud-free cells without the minimum area constraint. Mapping area coverage was obtained at a near constant daily rate through day 5. A slight amount Mapping and Charting area was photographed on days 6 and 7. The reason for this decrease in coverage is probably the high film expenditure for other types of coverage.

 DIFFERENCES

1. 

2. 

3. 

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4.

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5.

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NUMBER OF CELLS AREA (SQ. N.M.)

*** SEARCH AREAS 53909 10780133

QUARTERLY 0 0

SEMI-ANNUAL 37510 7520149

ANNUAL 16399 3259984

*** HIGH PRIORITY AREAS 9443 1 87C749

EXTRAORDINARY 0 0

PRIORITY 1 7297 1435412

PRIORITY 2 2146 435337

*** MAPPING AREAS 44211 9049845

PRIORITY 1 21326 4340665

PRIORITY 2 22885 4709180

PRIORITY 3 0 0

PRIORITY 4 0 0

*** EQUATORIAL BELT AREA 40108 8358199

*** DISIC AREA 0 0

*** TOTAL NON-REDUNDANT 109996

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MISSION 1106

COVERAGE REQUIREMENTS SUMMARY

	<u>AREA</u> <u>(10⁶ SQ N MI)</u>	<u>NO. OF</u> <u>CELLS</u>	<u>PERCENT</u>
o SEMI-ANNUAL SEARCH	7.52	37,510	100.0
OVERDUE THIS MISSION		7,168	19.11
OVERDUE NEXT MISSION		9,093	24.24
o ANNUAL SEARCH	3.26	16,399	
OVERDUE THIS MISSION		2,815	17.17
OVERDUE NEXT MISSION		3,212	19.59
o HIGH PRIORITY AREA	2.09	10,419	100.0
SMALL HPA		918	8.8
LARGE HPA		9,501	91.2
o MAPPING AND CHARTING	9.09	44,211	100.0
PRIORITY 1		21,326	48.2
PRIORITY 2		22,885	51.8

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HIGH PRIORITY AREA SUMMARY

<u>HPA SIZE (NO. CELLS)</u>	<u>NUMBER OF AREAS</u>	<u>NUMBER OF CELLS</u>	<u>PERCENT OF TOTAL</u>	<u>PERCENT TOTAL FILM LOAD</u>
1	105*	105	1.0	
2-10	8	52	0.5	
11-20	11	165	1.6	
21-30	6	149	1.4	
31-40	4	128	1.2	
41-50	5	235	2.3	
51-100	1	84	0.8	(12.1)
<hr/>				
	<u>PROB ACCOMP (PCT)</u>			
SOUTH CHINA	28.0	3093	29.6	6.0
SOVIET BORDER	40.8	2180	20.9	12.5
MIDDLE EAST	15.0	1298	12.5	5.3
CHINA SEARCH	40.0	920	8.8	1.3
MONGOLIA (EAST OF 105°)	55.0	832	8.0	3.2
SOMALIA REPUBLIC	43.0	370	3.6	2.1
CUBA	0.0	290	2.8	0.0
NORTH VIETNAM	10.0	279	2.7	0.3
NORTH KOREA	41.0	239	2.3	1.2
			(91.2)	(31.9)

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* INCLUDES 38 DOMESTIC TARGETS, 12 COLOR TARGETS

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FIGURE 5
COLUMBIA MISSION 1106

SEMI-ANNUAL SEARCH AREA

PRE-MISSION AGE DISTRIBUTION

PERCENT OF SEMI-ANNUAL AREA

AGE (MONTHS)

20 324

18

16

14

12

10

8

6

4

2

0

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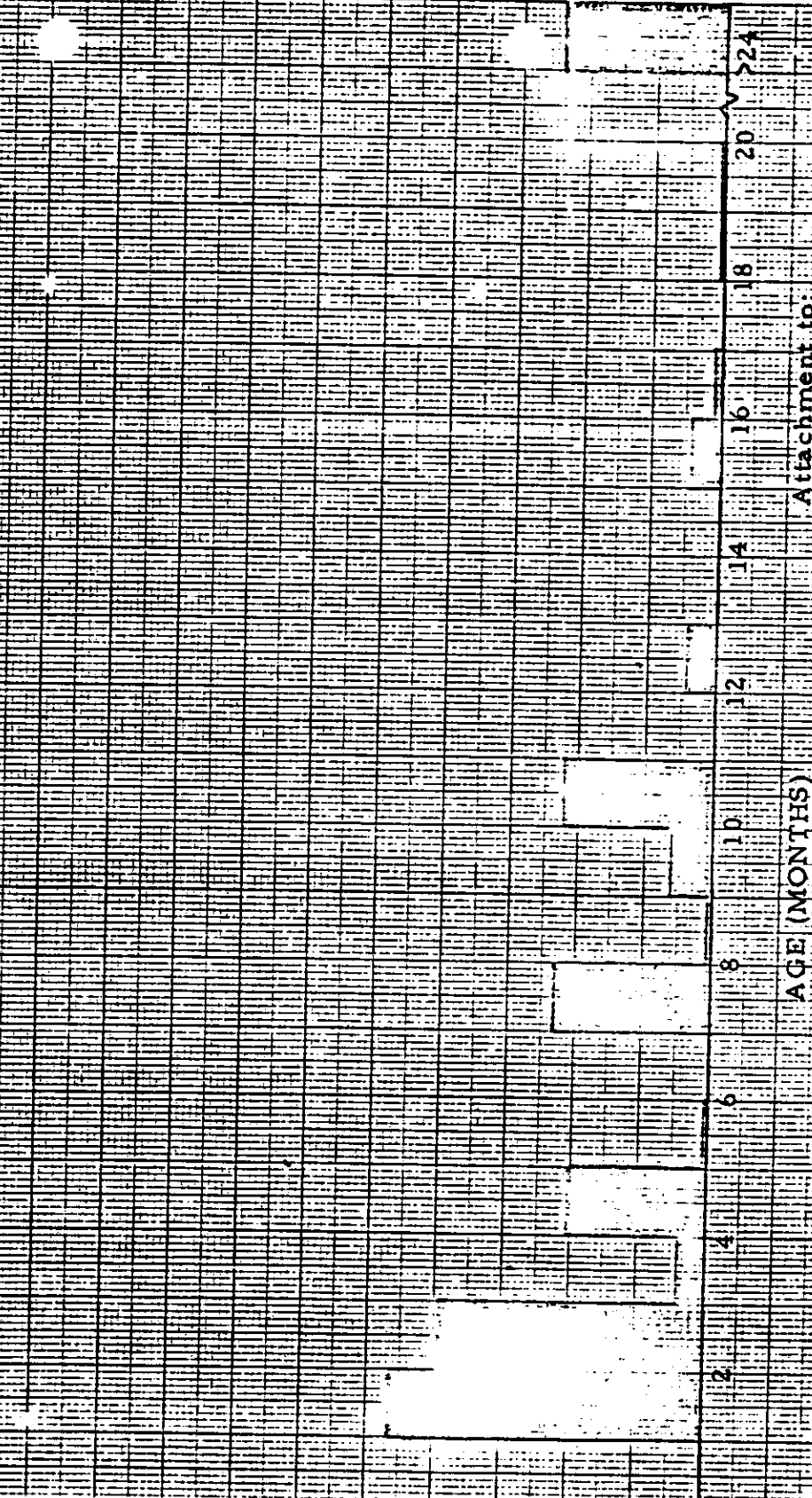
TOWNSHIP FIGURE 5
COLUMBIA MISSION 1106
COLUMBIA

ANNUAL SEARCH AREA

PRE-MISSION AGE DISTRIBUTION

PERCENT OF ANNUAL AREA

AGE (MONTHS)



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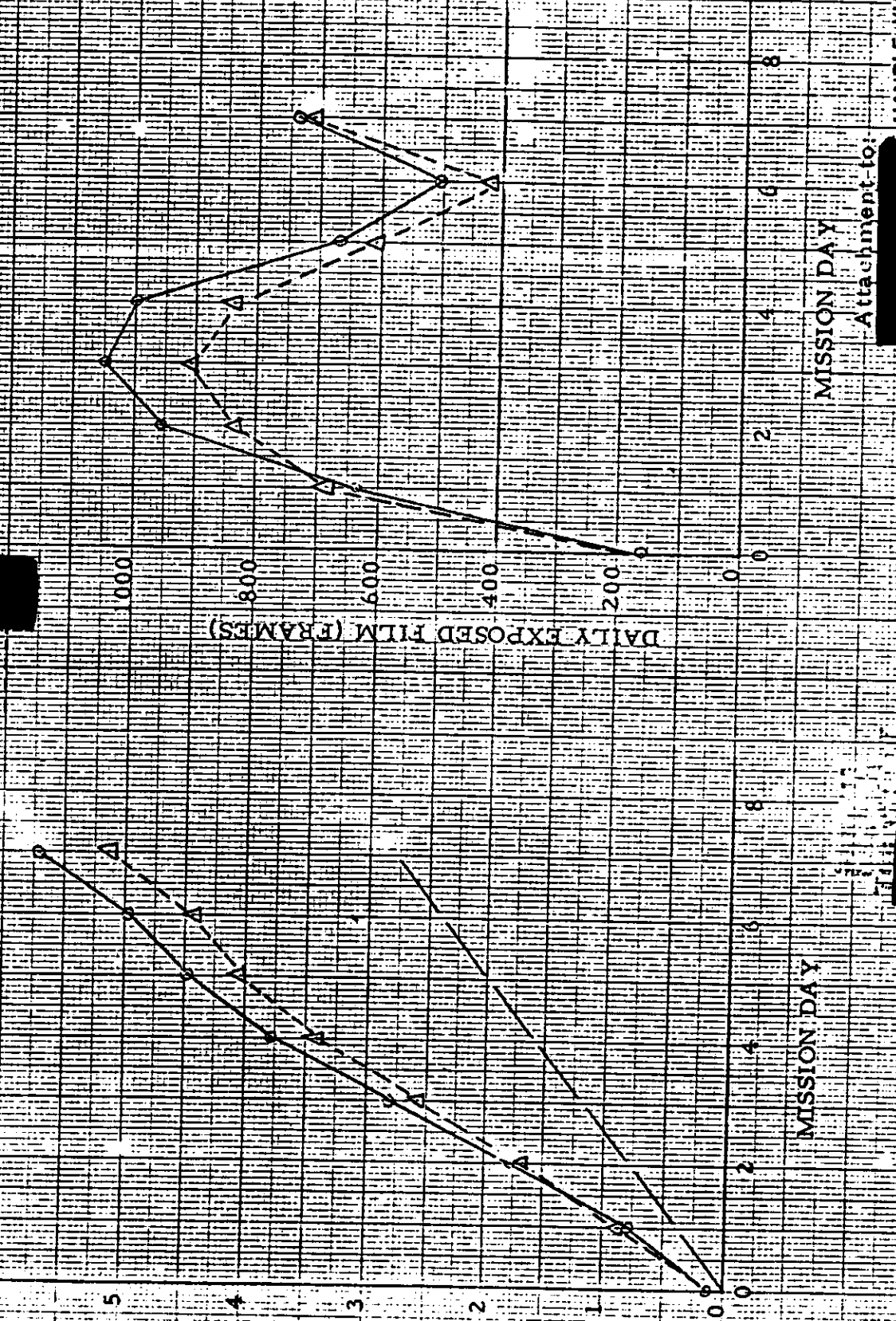
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FIGURE 7
CUMULATIVE MISSION 1106

FILM EXPENDITURE

EPISODE

MISSION DAY

CUM. FILM EXPOSED (1000 FRAMES)



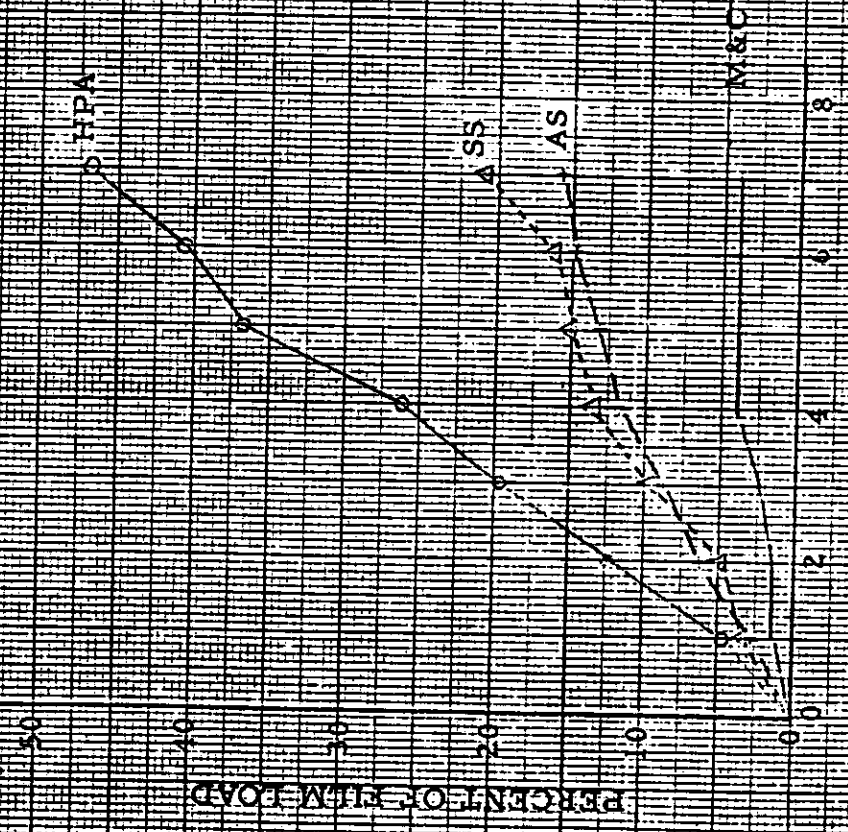
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FIGURES &
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FILM DISTRIBUTION BY REQUIREMENT



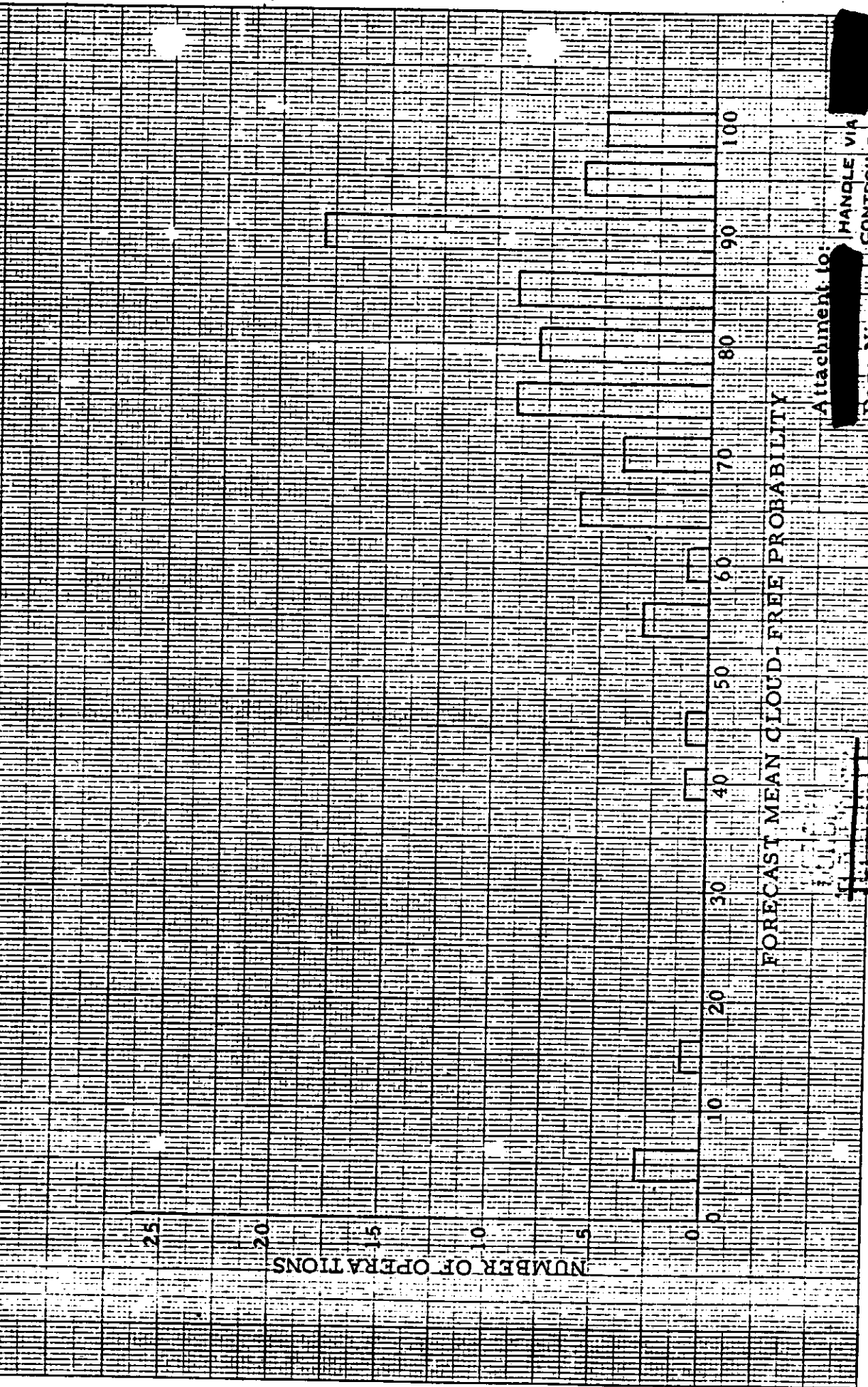
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