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[redacted] Copy [redacted] of [redacted]
26 August 1968

MEMORANDUM FOR: Chief, Design and Analysis Division, OSP

SUBJECT : Extended Life CORONA Mission

REFERENCES : 1. [redacted] Examination of CORONA System Capabilities for Various Launch Rates and Mission Lives, 8 July 1968

2. [redacted] Explanation of Trade Off Between Mission Life, Film Load and Launch Rate, 22 July 1968

The recent decision to utilize a 3/4 speed H-timer has resulted in the capability to extend active life of the CORONA System to twenty days. This capability will be realized in an incremental fashion with mission length extended to sixteen days initially, then to eighteen and eventually twenty days for all J-3 missions.

In order to assess the impact of extended life missions and reduced launch rates on the search coverage capabilities of the CORONA system, several series of simulation runs were used to study the effect. The data compiled in this study shows the effect of mission life, film load, and number of launches on the expected performance against the search requirements.

All simulations were performed on the General Purpose Search and Surveillance System Simulation (GP4-S) Program at the SETS computer facility and utilized the value function methodology incorporated in the [redacted] All runs used the same set of threshold values for purposes of commonalty. Variation of these parameters should not change any conclusions based on the current set of runs, however.

Used by the NRO
In Accordance with E. O. 12958
on NOV 26 1997

GROUP 1
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The new 1959-1963 historical cloud cover data file was used for all runs and also incorporated the probability file based on this historical file. The model used for simulating the annual and semiannual search areas was composed of 20 x 20 nmi equal area cells. A constant interval launch schedule was also used for each series.

All results are shown in terms of stereo frames, i.e., the film for both cameras. Figure 1 shows the stereo film load in frames vs. percent of total film load for both UTB and STB film so that the data following can be used for either type of film. Note that in the results that follow, film load will refer to only that expended against search requirements

Figures 2-5 display the effect of film load and days on orbit on the average percent search area overdue for six missions per year. Percent overdue is determined at the end of each mission, which is consistent with the current COMIREX reporting scheme.

The results shown in Figures 2-5 are most surprising indeed, in that percent overdue is greatly influenced by film expended and practically insensitive to days on orbit over the range studied. From Figure 2, it is seen that the required 80% semiannual coverage can be met with six 20 day missions that utilize about 14,000 stereo frames. This is equivalent to nearly 80% of a full UTB film load and obviously more than the full 12,100 frame STB film available. Comparing Figures 2 and 4, it is noted that this film load represents an overkill of the annual search which has been characteristic of results obtained with the [redacted] value function methodology.

The fact that percent overdue is insensitive to days on orbit as shown in Figures 3 and 5 is difficult to clearly understand. However, as seen in Figure 6, the portion of the familiar days on orbit curve represented by the mission series run is in the region of diminishing return. The fact that the slope of these constant film load curves is less than predicted by the statistical simulations (Chain 5 type runs) is primarily explained by the role played by TCOP (film utilization efficiency threshold) in [redacted] methodology.

[redacted]

HANDLE VIA [redacted]
CONTROL SYSTEM ONLY

SUBJECT: Extended Life CORONA Mission

Since TCOP is driving the film to depletion at the end of the active mission life, the difference between sixteen and twenty days is not significant for the low access capability of the CORONA System. To a large extent, TCOP "washes-out" the effect for additional active days for search relative to what might be expected for high priority areas where additional accesses would be more important. Essentially, TCOP will allow selection of camera operations with lower cloud-free probability as film available increases, and the statistics of the problem show better results from expending more film than extending life in the region of values examined.

Additional evidence of these facts is shown in Figure 7, where the percent overdue at the end of each mission is plotted as a function of day of year. For a 6 launch/20 day life sequence, note the significant improvement when film per mission is increased from 10,440 frames to 13,920. Utilizing the same total film load per year but for 8 launches/14 day life yields nearly identical results.

Figure 8 summarizes the effect of number of launches and mission life on the semiannual search performance.

CONCLUSIONS

Based on the results obtained from this study, six CORONA launches per year with twenty day life can achieve both the semi-annual and annual search requirements under the following conditions:

All missions carry a full UTB film load.

Approximately 75% of the film loan is expended against search area.

There are no unusually large special search areas.

[redacted] is utilized for targeting.

[redacted]

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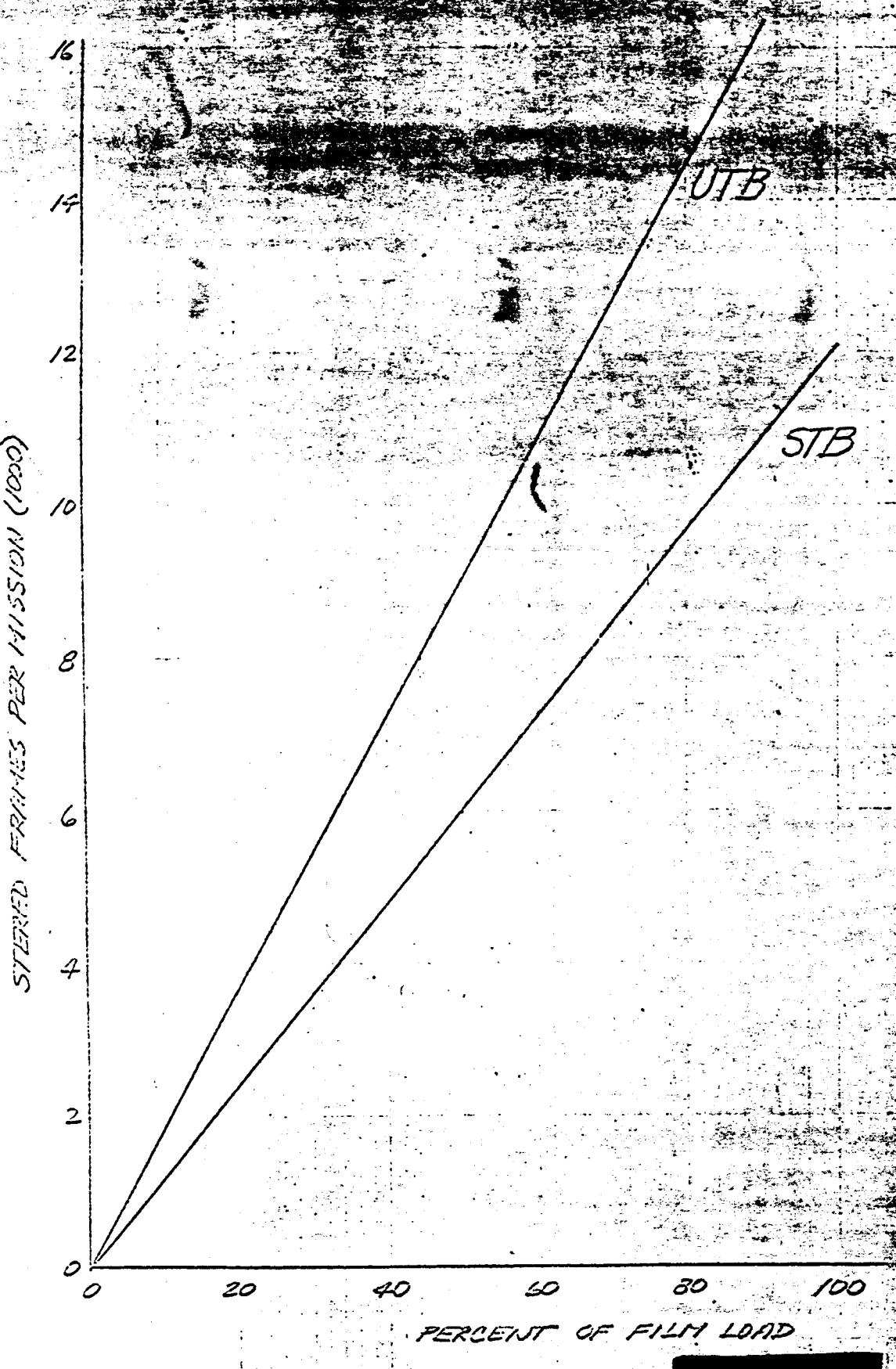
It might be noted here that the current average percent overdue for semiannual search over the past eighteen months has been 34%. Hence, this study would also indicate that this performance could be met or exceeded with six 20 day missions using only 60% of a full UTB film load for search or about 80% of a full STB film load.

[redacted]
Chief, Utilization Analysis Section

Attachments: A/S
Distribution
[redacted]

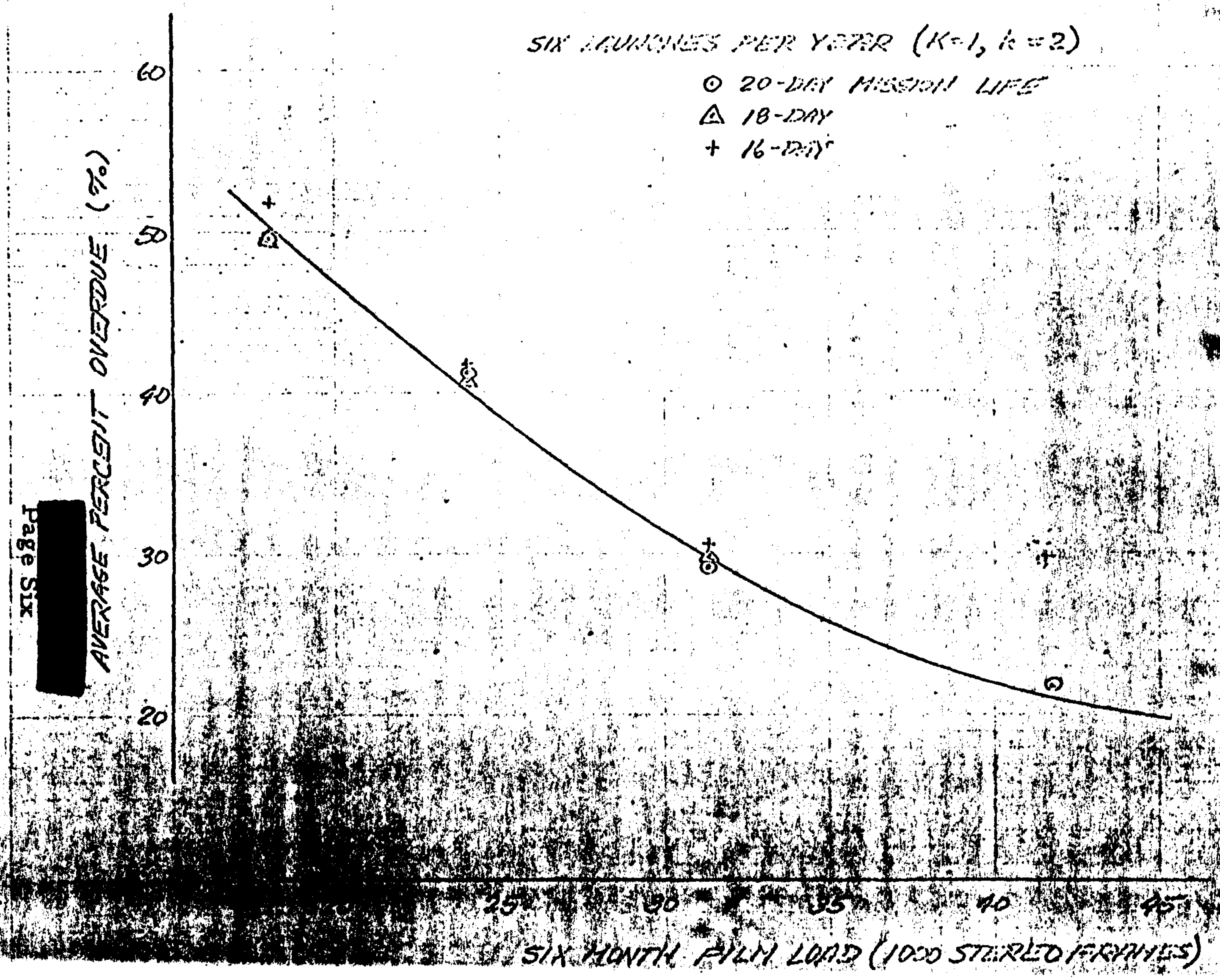
[redacted]


UTB
STB
16
14
12
10
8
6
4
2
0
0
20
40
60
80
100
STEREO FRAMES PER MISSION (1000)
PERCENT OF FILM LOAD

[redacted]

EFFECT OF FILM LOAD

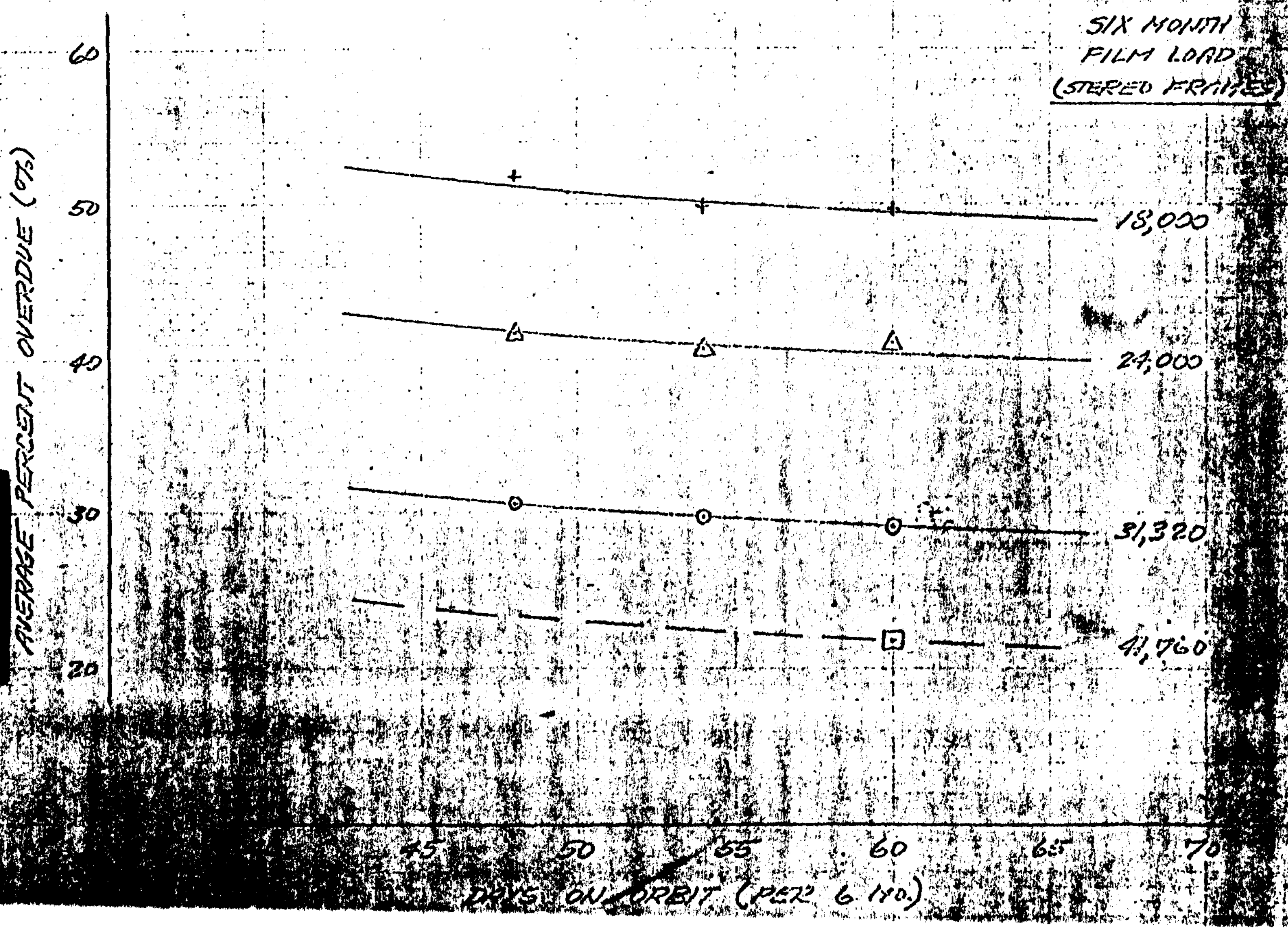
SEMI-ANNUAL SEARCH



EFFECT OF DAYS ON ORBIT

SEMI-ANNUAL SEARCH

SIX LAUNCHES PER YEAR (K=1, k=2)



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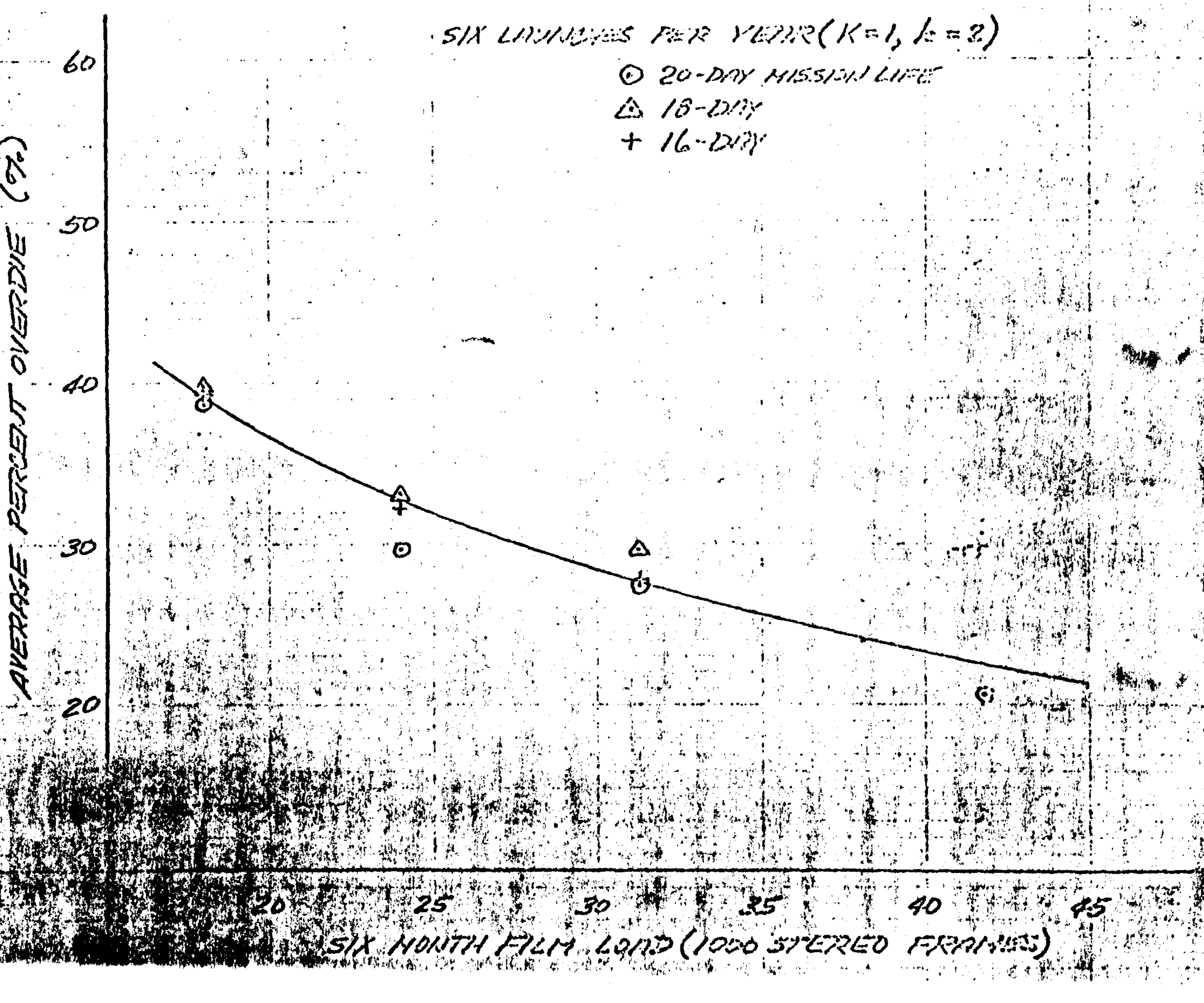
EFFECT OF FILM LOAD

ANNUAL SEARCH



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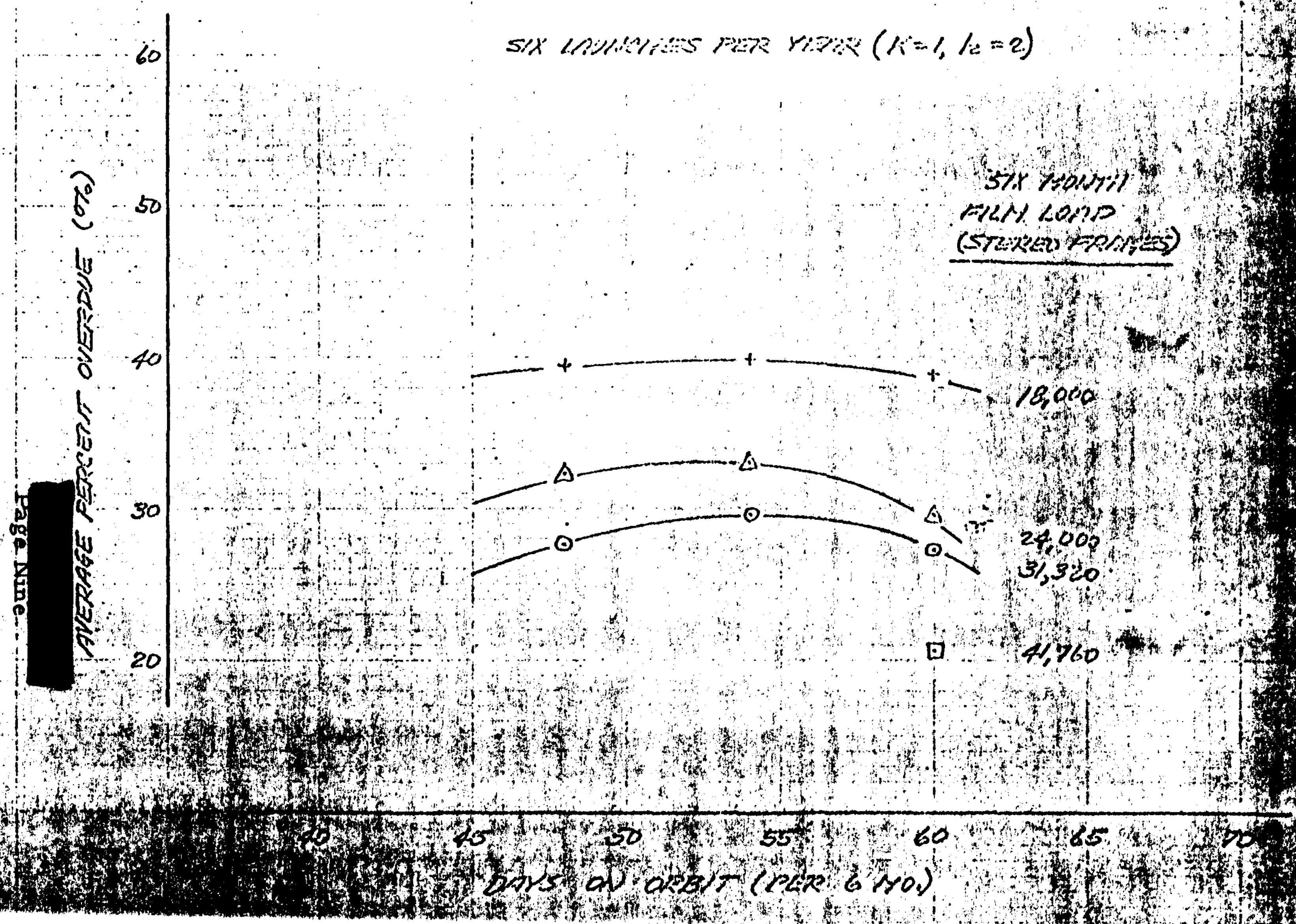
EFFECT OF DAYS ON ORBIT

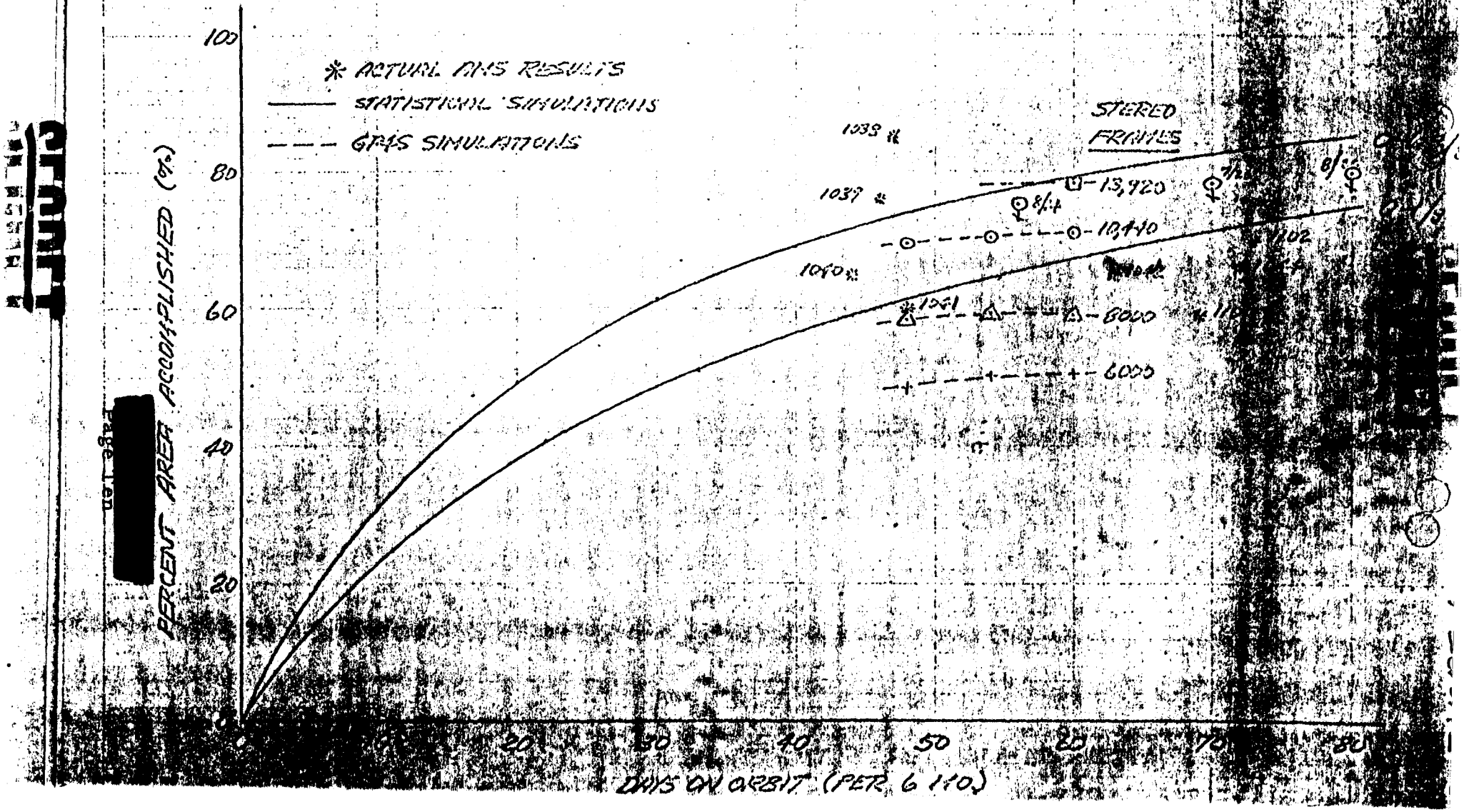
ANNUAL SEARCH



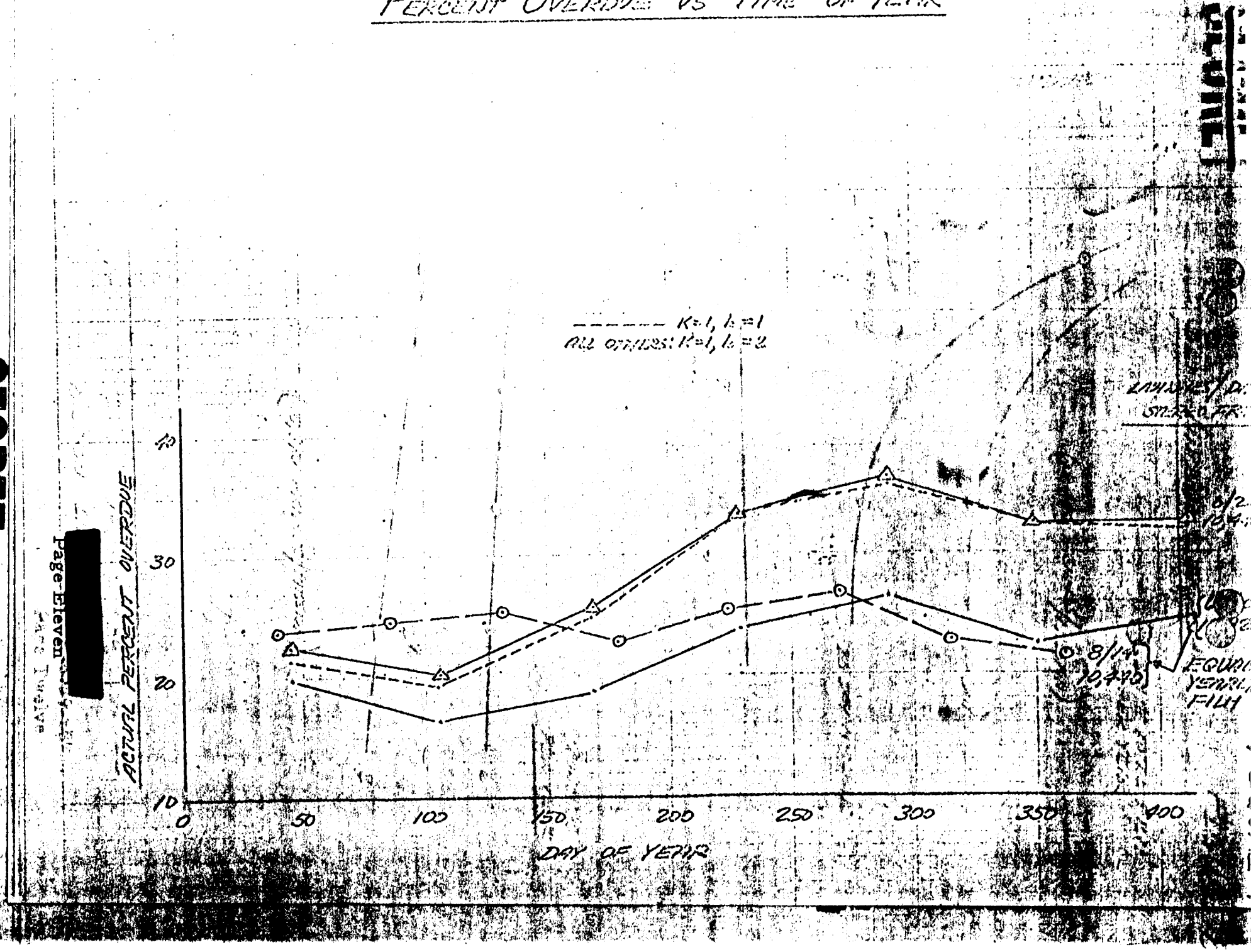
[redacted]

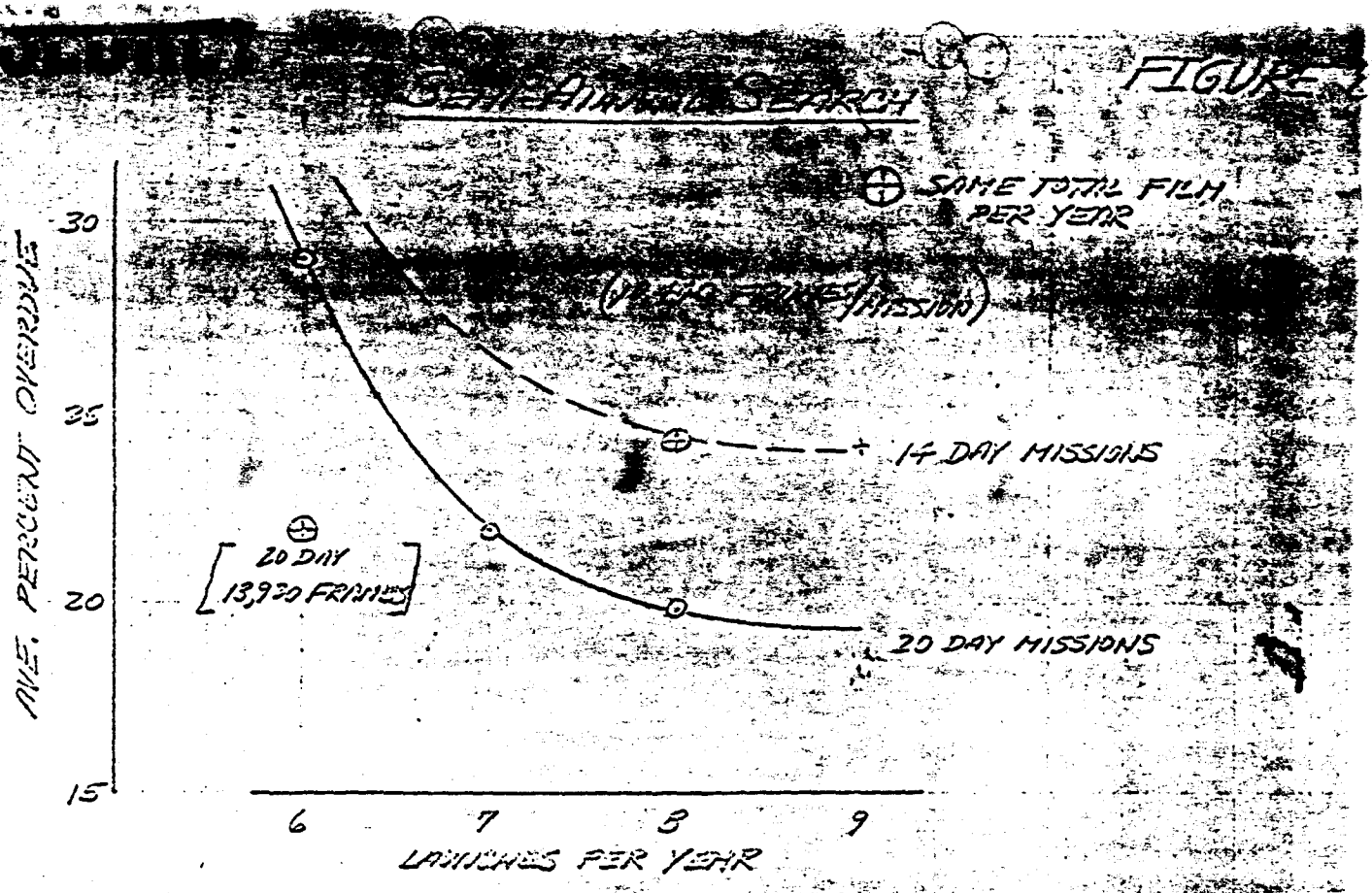
PERFORMANCE COMPARISON

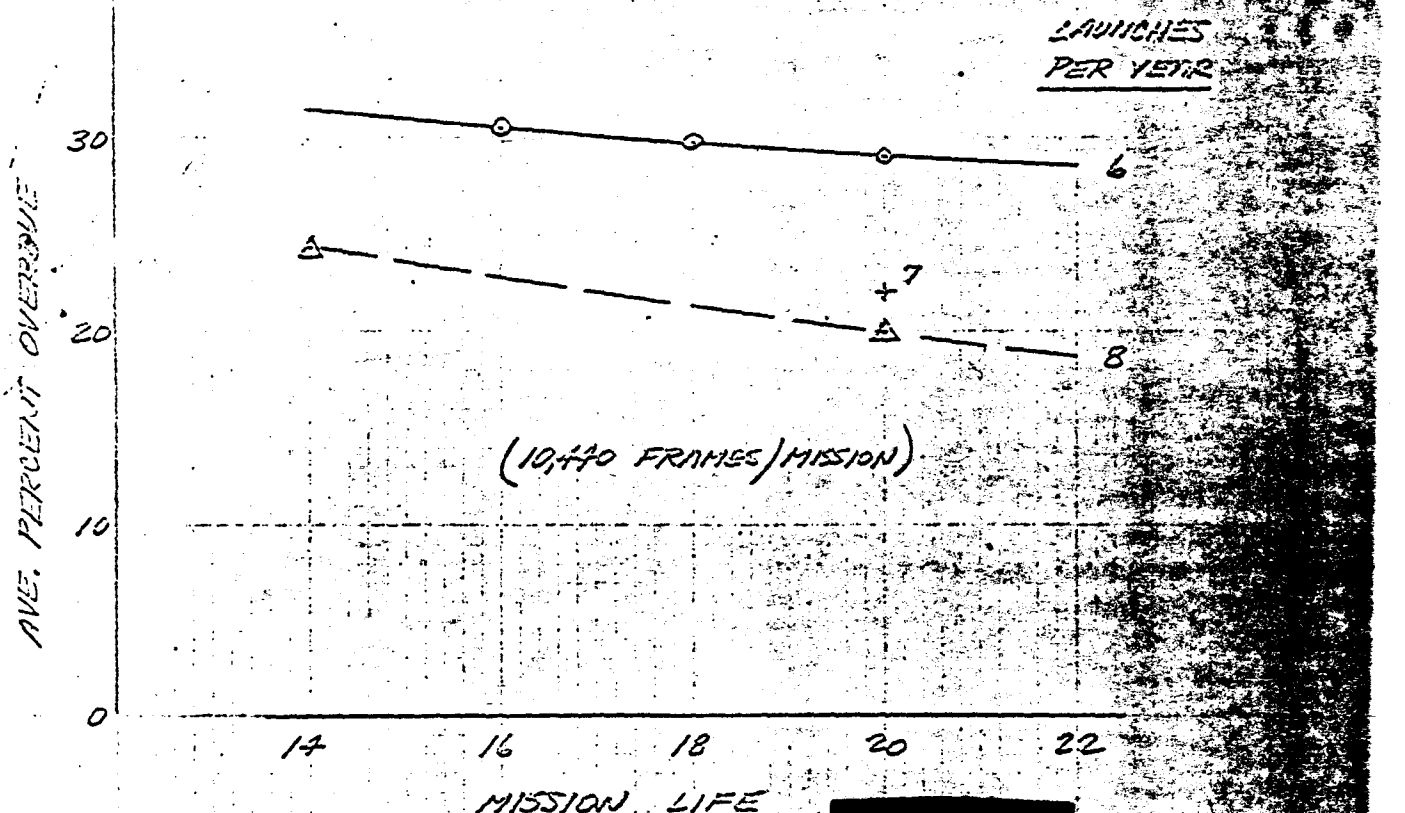
SEMI-ANNUAL SEARCH



PERCENT OVERDUE VS TIME OF YEAR




SAME TOTAL FILM PER YEAR
(1440 FRAMES/MISSION)
14 DAY MISSIONS
20 DAY
13,920 FRAMES
20 DAY MISSIONS
AVE. PERCENT OVERRIDE
30
25
20
15
6
7
8
9
LAUNCHES PER YEAR


LAUNCHES PER YEAR
6
7
8
(10,440 FRAMES/MISSION)
AVE. PERCENT OVERRIDE
30
20
10
0
14
16
18
20
22
MISSION LIFE