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GAMBIT

15 June 1971

MEMORANDUM FOR: Holders of COMIREX-M-127

SUBJECT : Interim Crisis-Response Planning--  
Film Readout GAMBIT (FRO-G)

Forwarded herewith for your information and record are copies of the briefing aids used by Colonel Bonner in his 27 May 1971 briefing on the proposed Film Readout GAMBIT (FRO-G) system. Recipients are reminded of the sensitivity of the system development data presented and are requested to handle it accordingly.

*Frank J. Denny*  
Frank J. Denny  
Executive Secretary

Committee on Imagery Requirements and Exploitation

Attachment

BYE-2261-71  
Copy 27 of 35

GROUP 1 - EXCLUDED FROM  
AUTOMATIC DOWNGRADING  
AND DECLASSIFICATION

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Annex to  
COMIREX-M-127  
27 May 1971  
Limited Distribution

THE NRO INTERIM NRT AND  
CRISIS RESPONSE SATELLITE IMAGERY SYSTEM

FRO-GAMBIT  
(PROGRAM 10662)

Briefing presented to COMIREX  
by Colonel M. M. Bonner (SAFSP)

27 May 1971

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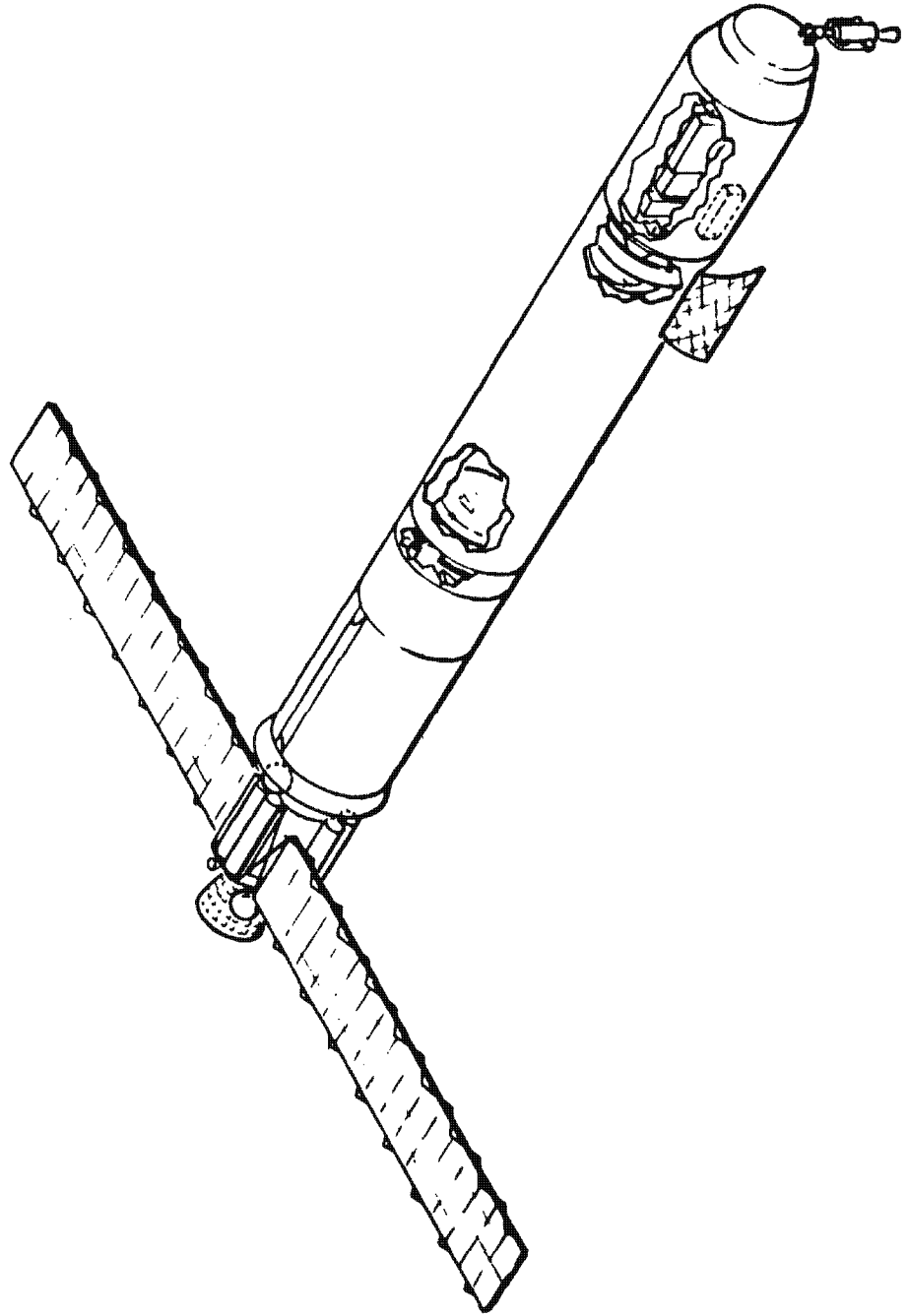
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SATELLITE VEHICLE

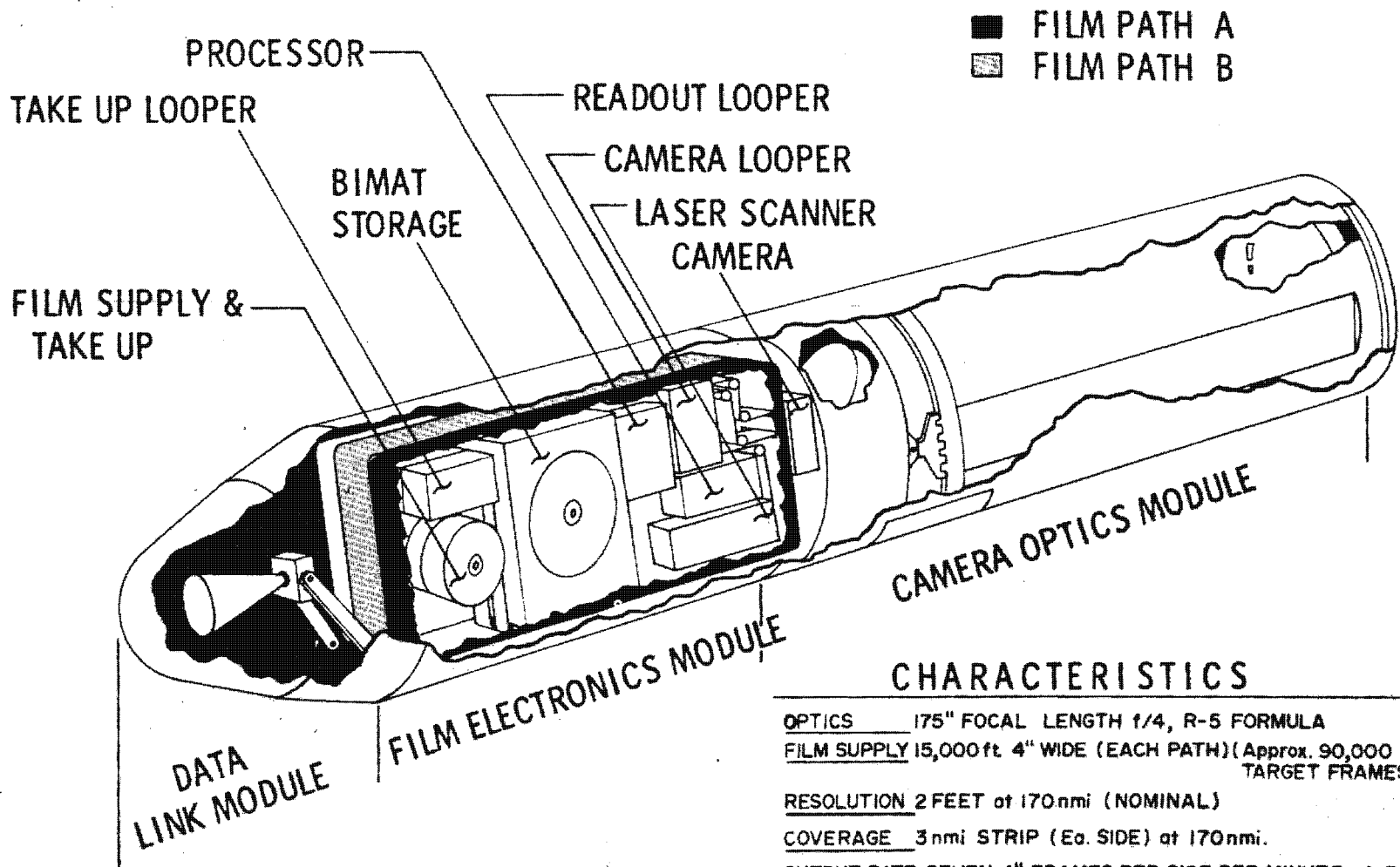


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### OPTICS and READOUT MODULE CONFIGURATION CONCEPT



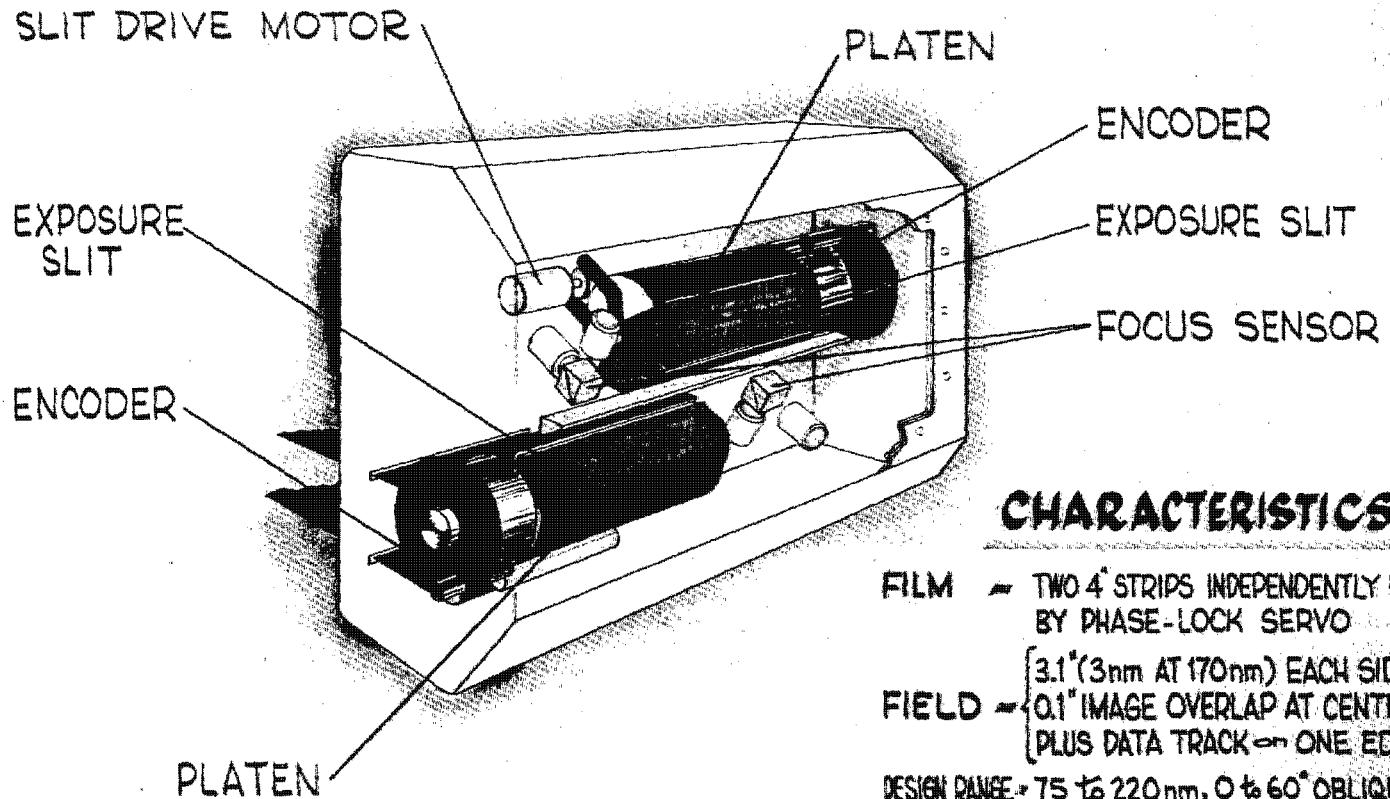
#### CHARACTERISTICS

- OPTICS 175" FOCAL LENGTH 1/4, R-5 FORMULA
- FILM SUPPLY 15,000 ft 4" WIDE (EACH PATH) (Approx. 90,000 TARGET FRAMES)
- RESOLUTION 2 FEET at 170nmi (NOMINAL)
- COVERAGE 3nmi STRIP (Ea. SIDE) at 170nmi.
- OUTPUT RATE SEVEN 4" FRAMES PER SIDE PER MINUTE of READOUT

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# CAMERA CONFIGURATION CONCEPT



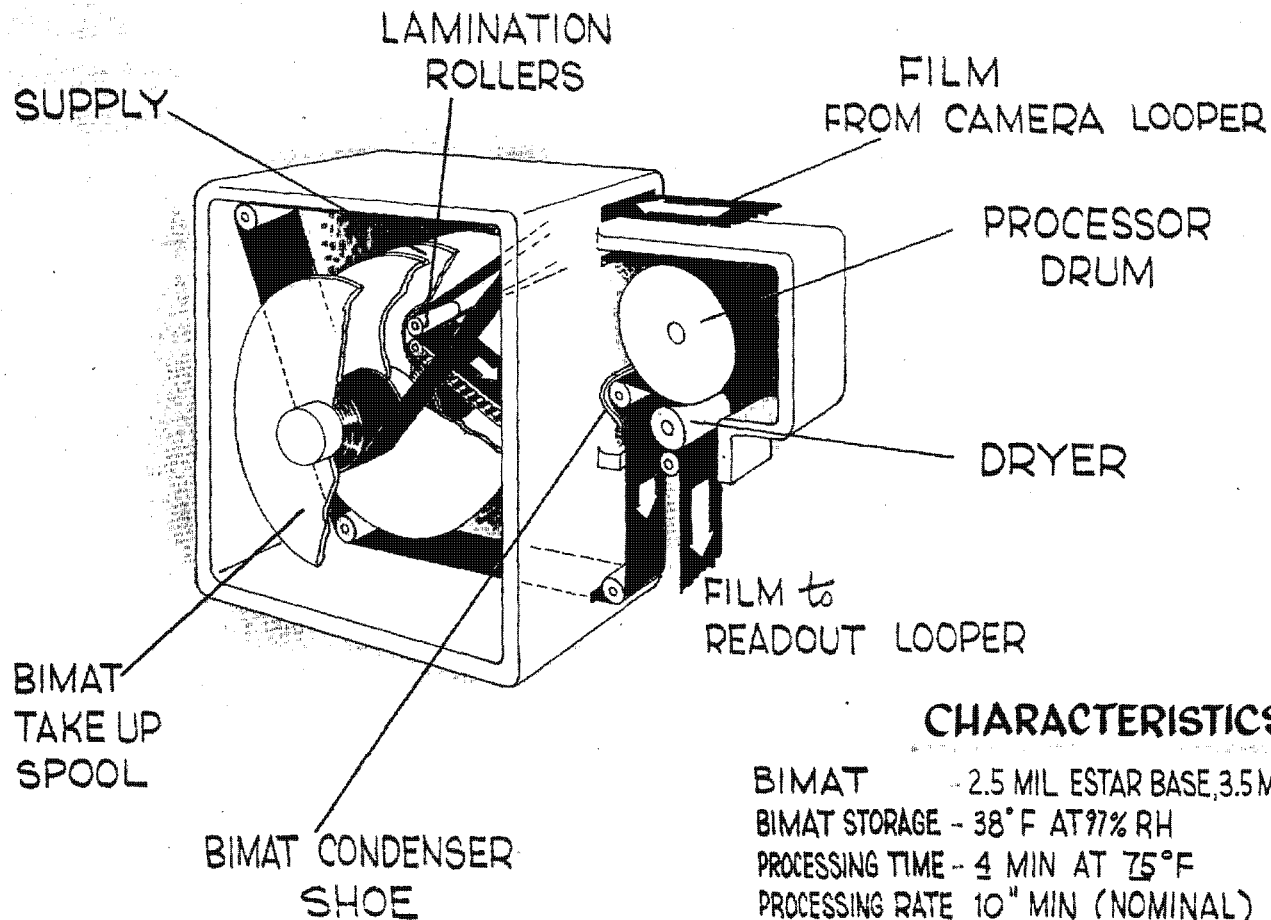
## CHARACTERISTICS

- FILM - TWO 4" STRIPS INDEPENDENTLY DRIVEN BY PHASE-LOCK SERVO
- FIELD - { 3.1" (3mm AT 170nm) EACH SIDE  
0.1" IMAGE OVERLAP AT CENTER  
PLUS DATA TRACK ON ONE EDGE
- DESIGN RANGE - 75 to 220 nm, 0 to 60° OBLIQUITY
- FILM DRIVE - PHASE LOCK DRIVE, 700 SPEED STEPS
- FOCUS - TWO INDEPENDENT SOLID STATE FOCUS SENSORS, EACH PLATEN ADJUSTABLE
- EXPOSURE - INDEPENDENTLY ADJUSTABLE SLITS

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# PROCESSOR CONFIGURATION CONCEPT



## CHARACTERISTICS

BIMAT - 2.5 MIL ESTAR BASE, 3.5 MIL GEL, SPECIAL IMBIBANT  
BIMAT STORAGE - 38°F AT 97% RH  
PROCESSING TIME - 4 MIN AT 75°F  
PROCESSING RATE 10" MIN (NOMINAL)  
INPUT LOOPER - 200" CAPACITY  
OUTPUT LOOPER - 400' CAPACITY

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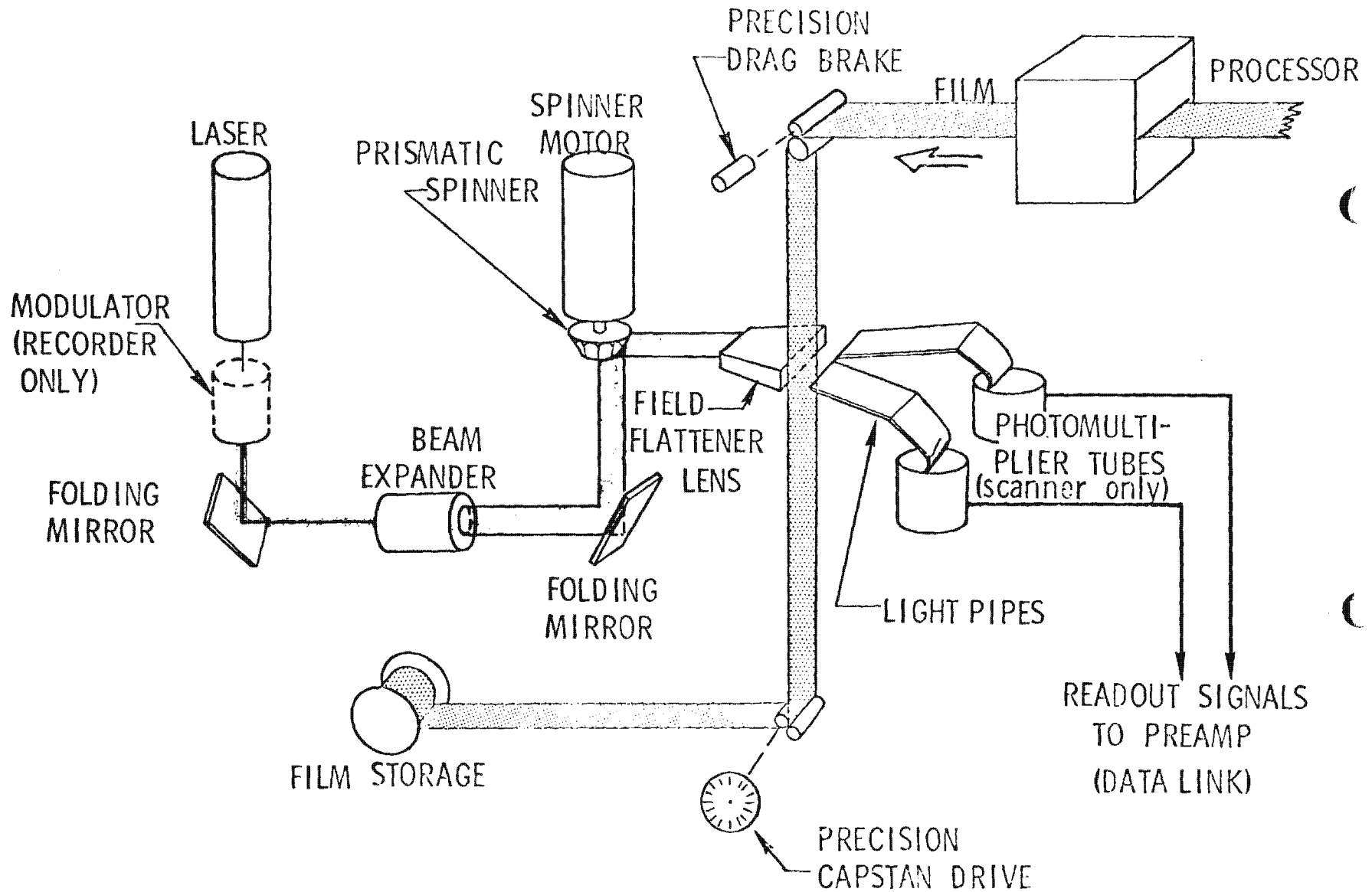
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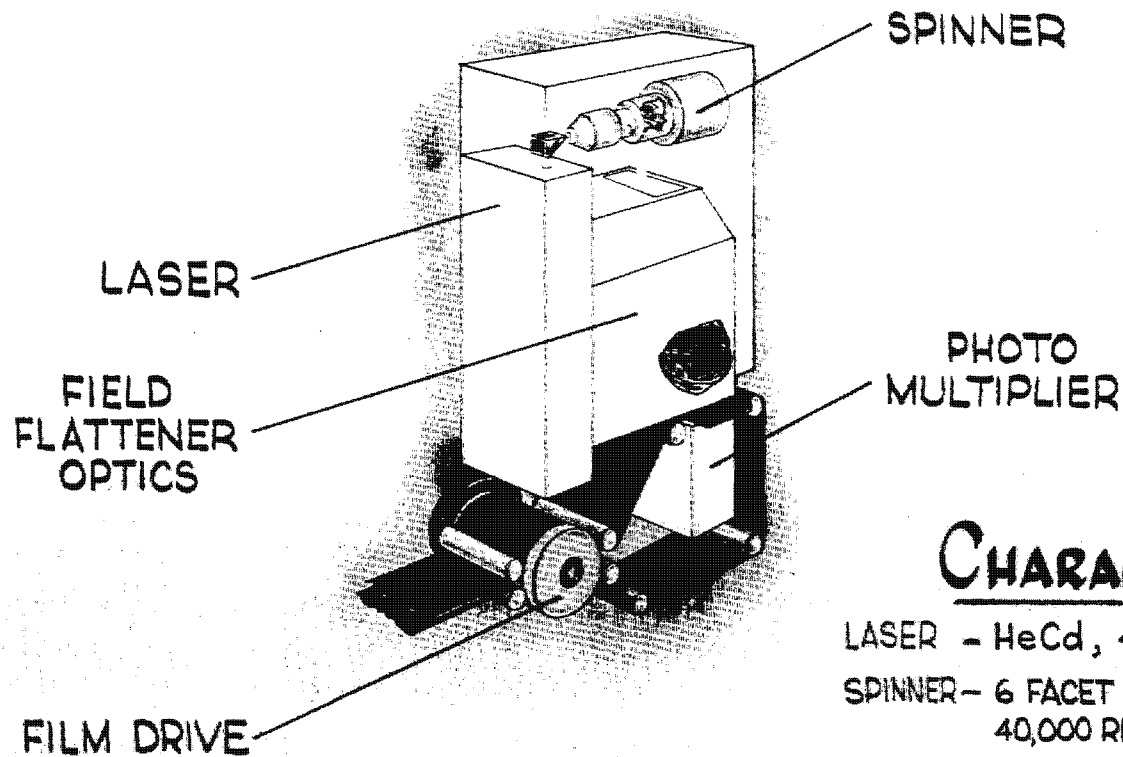
LASER SCANNER & RECORDER SCHEMATIC



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# LASER SCANNER CONFIGURATION CONCEPT



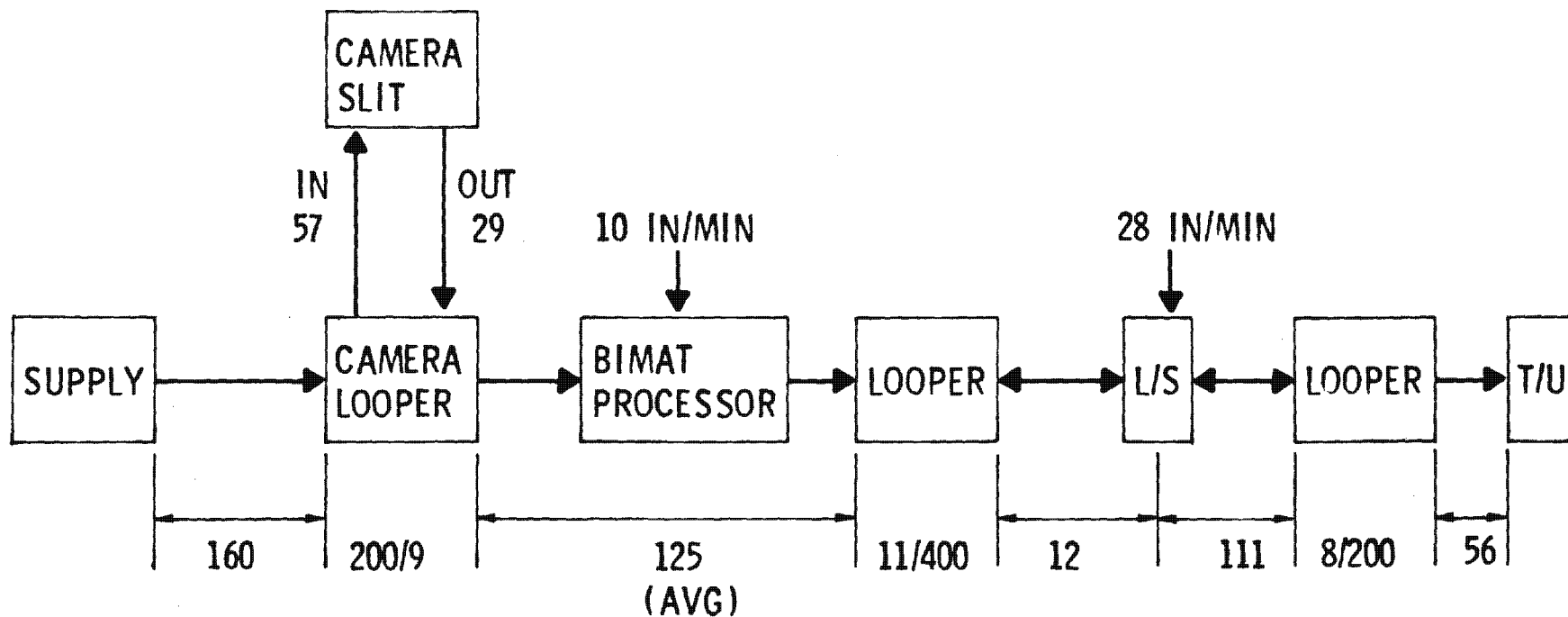
## CHARACTERISTICS

- LASER - HeCd, 4416A°
- SPINNER - 6 FACET END FIRE MIRROR  
40,000 RPM (4000 SCANS/SEC)
- OPTICS - f/6 FLAT FIELD
- SCAN - FULL FORMAT
- RATES - 28 INCHES/MIN (40 MHz) DIRECT and  
21 INCHES/MIN (30 MHz) RELAY

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FILM PATH LENGTHS, INCHES

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FILM READOUT SYSTEM DEVELOPMENT STATUS(s)

	NEW TECHNOLOGY	NEW ENGINEERING OF EXISTING TECHNOLOGY	MODIFICATION OF SIMILAR EXISTING DESIGN	EXISTING DESIGN OR MINOR MODIFICATION
IOCV				
BASIC GAMBIT AGENA				X
SOLAR PANELS			X	
ATTITUDE CONTROL SYS		X		
ROLL JOINT			X	
SECONDARY PROPULSION SYSTEM			X	
COMMAND SYSTEM			X	
ORM				
OPTICS				X
CAMERA			X	
PROCESSOR		X		
SCANNER		X		
DATA LINK				
TRANSMITTER/ MODULATOR			X	
ANTENNA			X	
TRACKER			X	
GROUND RECORDER		X		
GROUND STATION				X

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WEIGHT AND BOOSTER PERFORMANCE SUMMARY

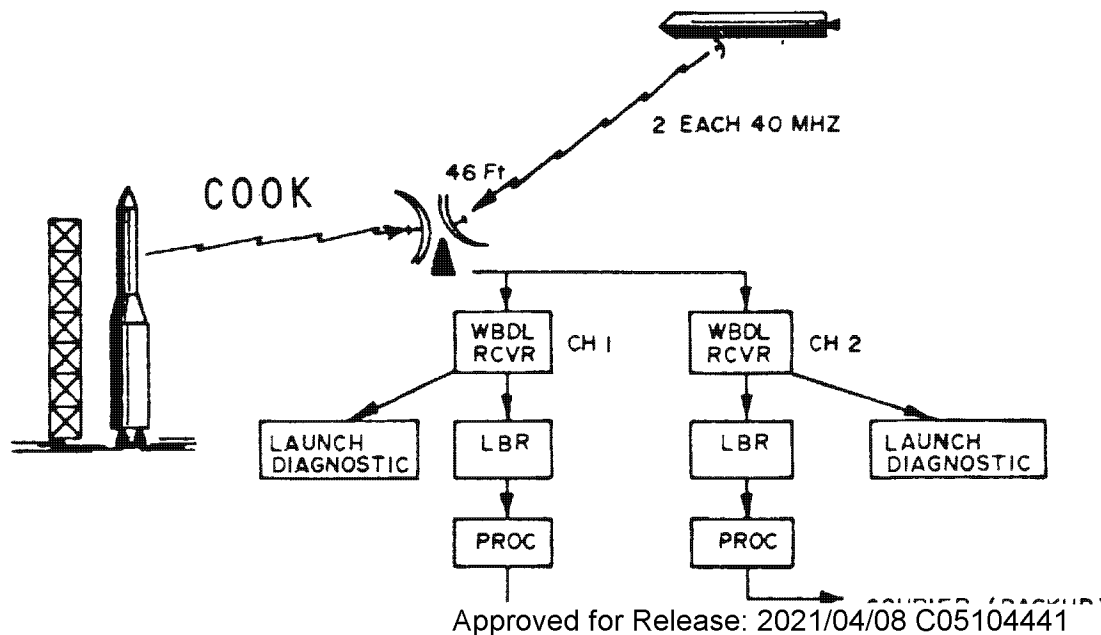
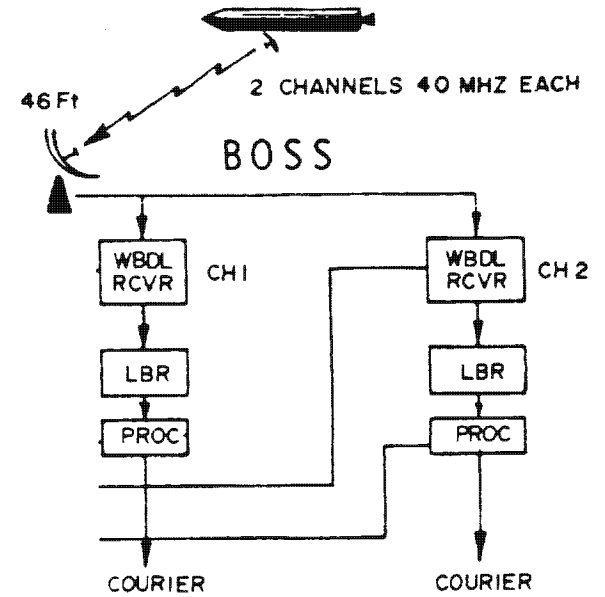
POUNDS

OCV	3142
ORM	3948
CONTINGENCY	460
EXPENDABLES	1565
<hr/>	
TOTAL	9115

9588 — AGENA NOZZLE EXTENSION (COULD ADD 100 LBS)  
9488 — 5% TURBINE SPEED INCREASE (COULD ADD 300 LBS OR MORE)  
  
9188 — TITAN IIIB + AGENA CAPABILITY (MINUS 3 SIGMA)  
9115 — TOTAL SATELLITE VEHICLE WEIGHT

<sup>7</sup>  
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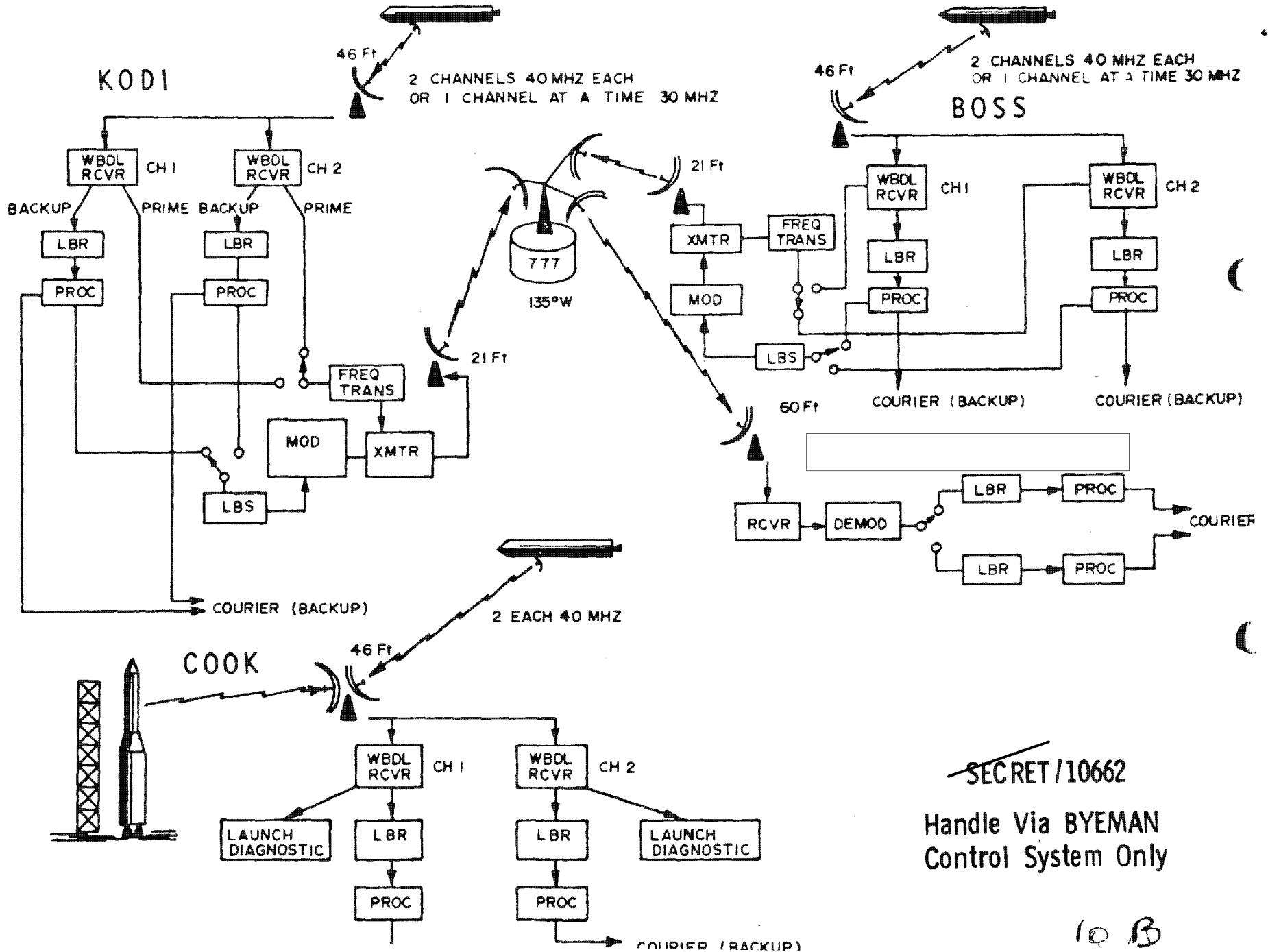


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# DATA RECOVERY SCHEMATIC



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MAXIMUM CAPACITY (TWO VEHICLES)

	AVERAGE CONTACT TIME PER DAY (MINUTES)	NUMBER OF FRAMES PER DAY	
		TO GROUND STATION	IMMEDIATE RELAY
BOSS	36	504 252	188 188
		440	
BOSS + KODI	84	1176 588	440 440
		1028	
COOK	36	504	

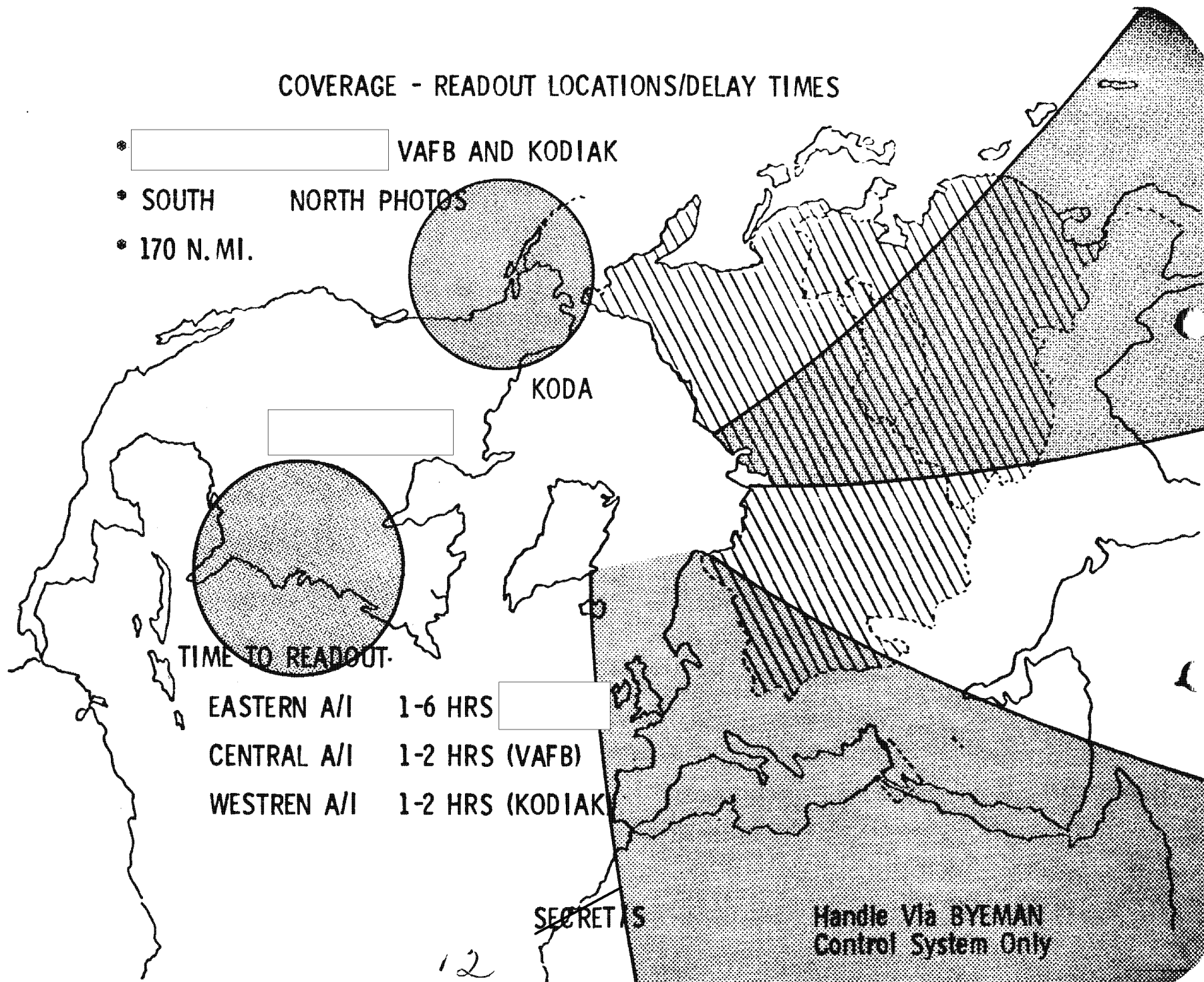
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### COVERAGE - READOUT LOCATIONS/DELAY TIMES

- VAFB AND KODIAK
- SOUTH NORTH PHOTOS
- 170 N. MI.



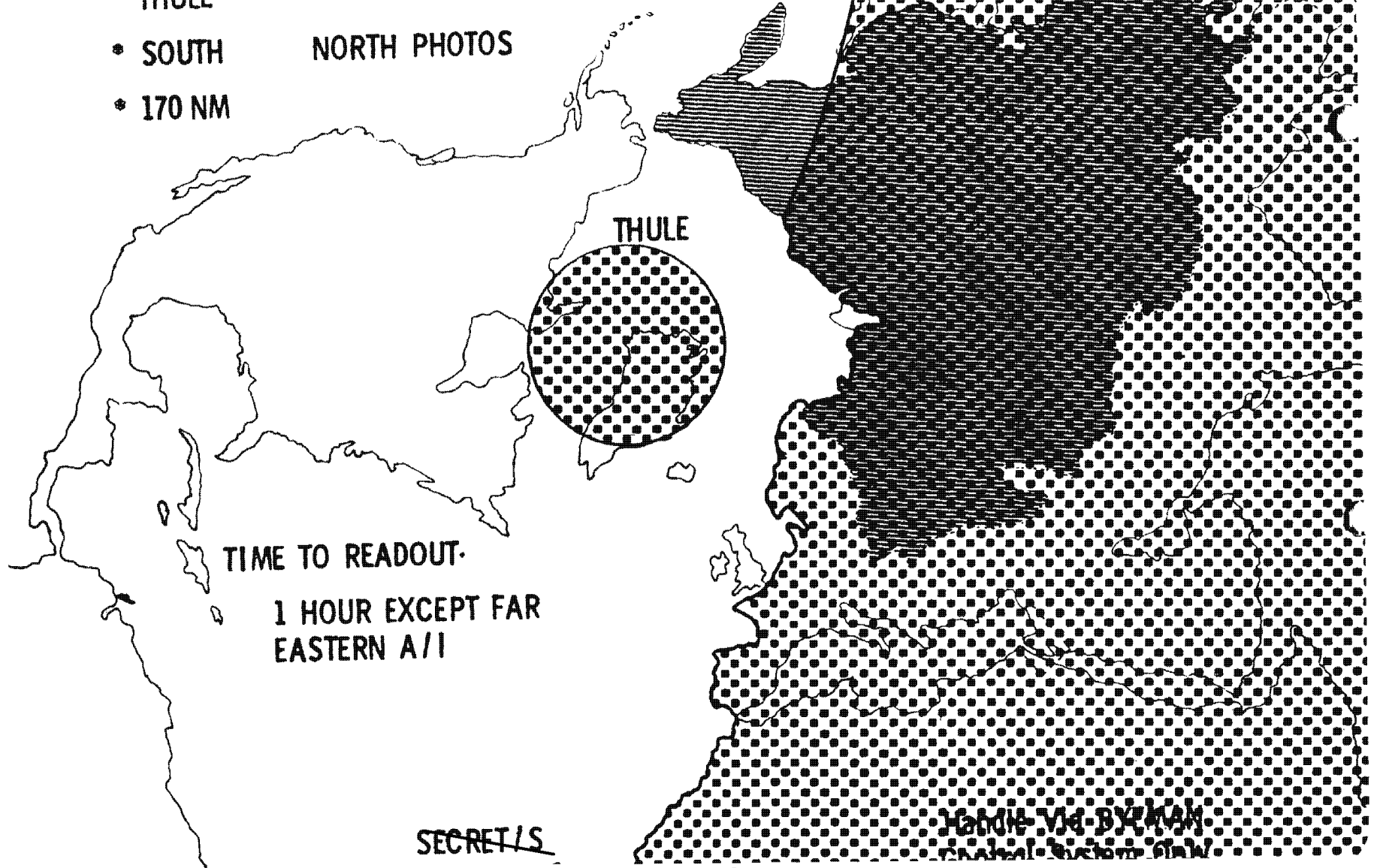
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COVERAGE - READOUT LOCATIONS DELAY TIMES

- THULE
- SOUTH
- 170 NM

NORTH PHOTOS



TIME TO READOUT.  
 1 HOUR EXCEPT FAR  
 EASTERN A/I

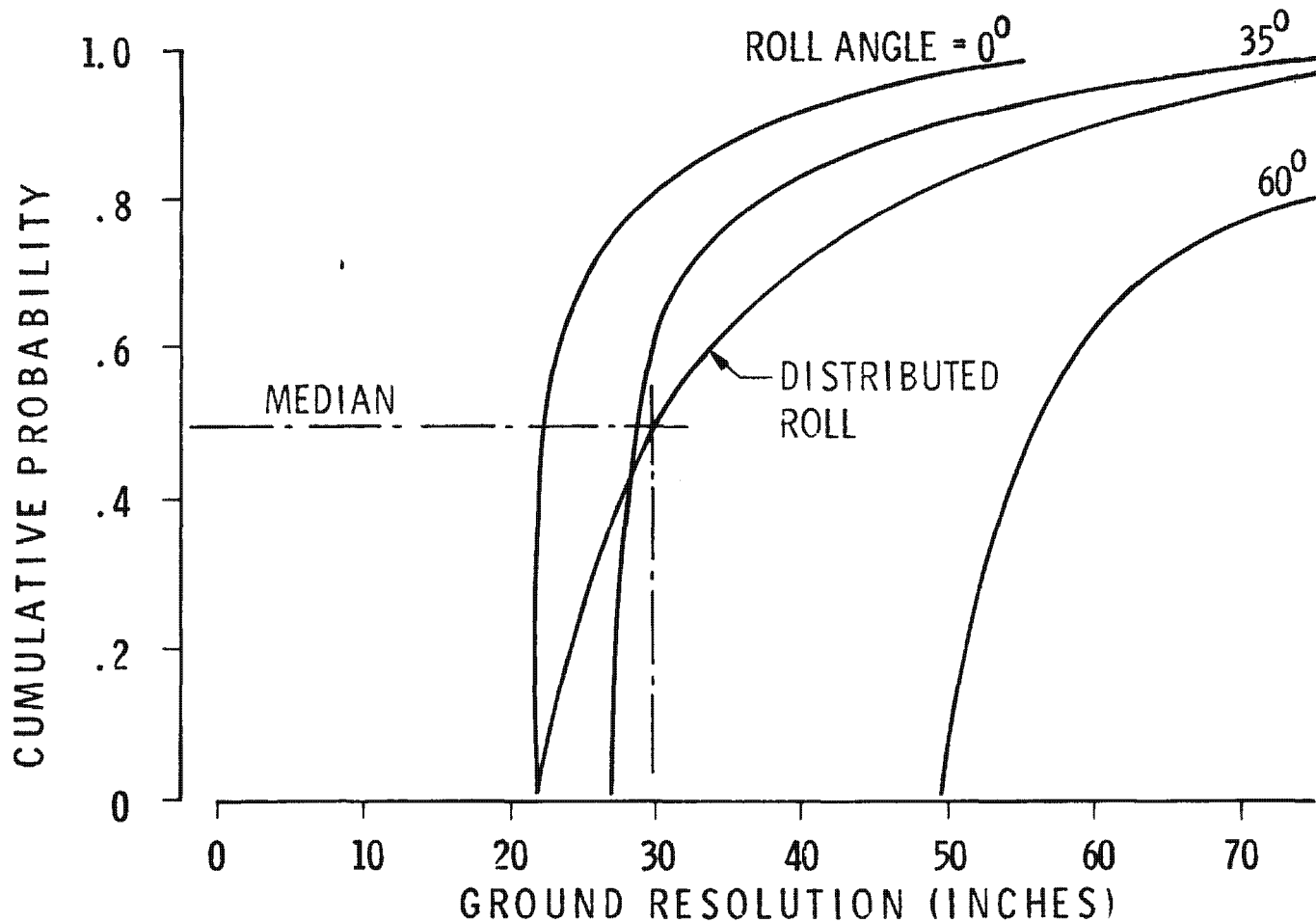
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GROUND RESOLUTION

- \* ALTITUDE = 170 NMI
- \* TIME = ALL YEAR
- \* TARGET CONTRAST = 3:1
- \* LAT. DIST. = 20°-70° N



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#4 A

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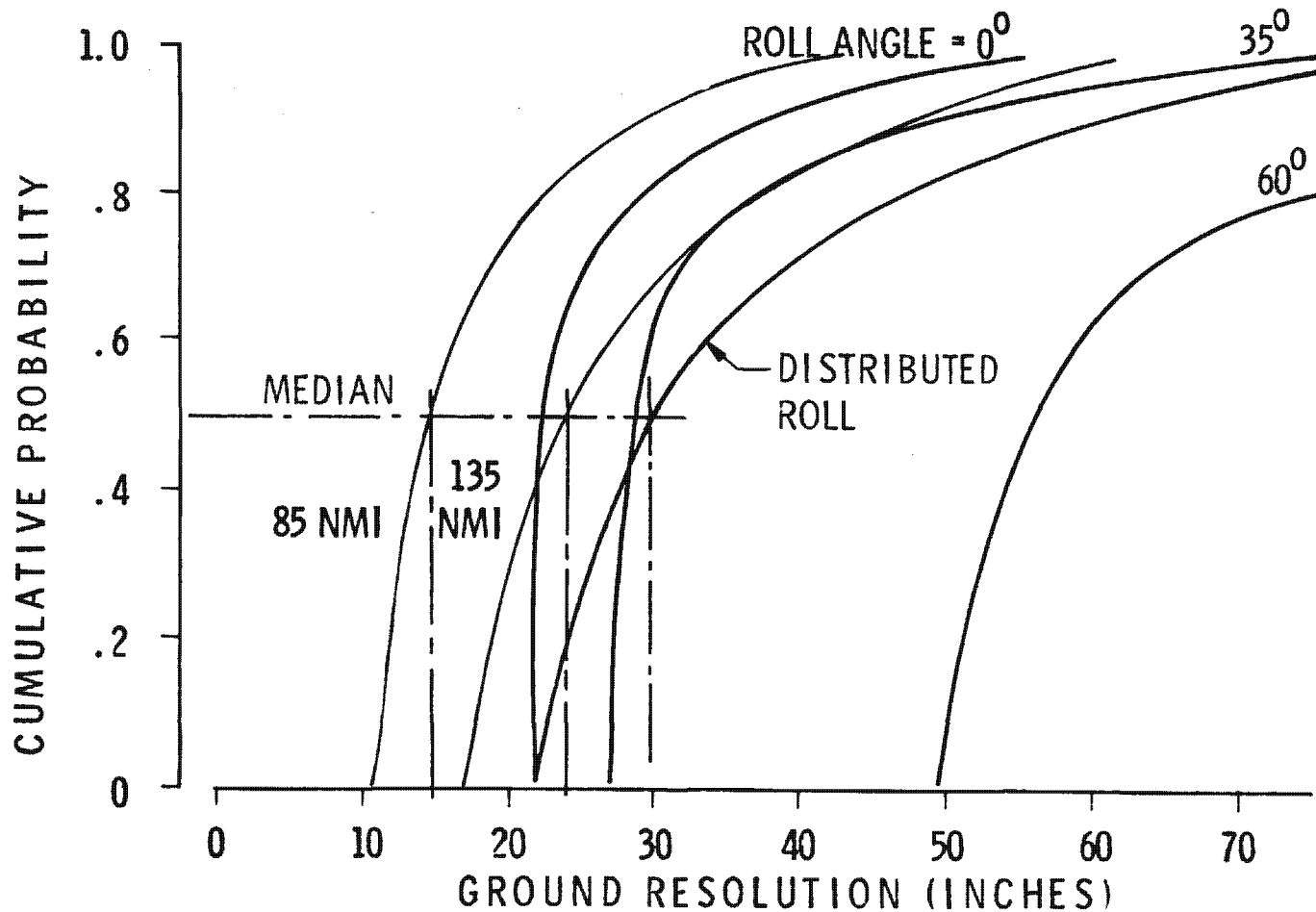
## GROUND RESOLUTION

\* ALTITUDE = 170 NMI

\* TIME = ALL YEAR

\* TARGET CONTRAST = 3:1

\* LAT. DIST. = 20°-70° N

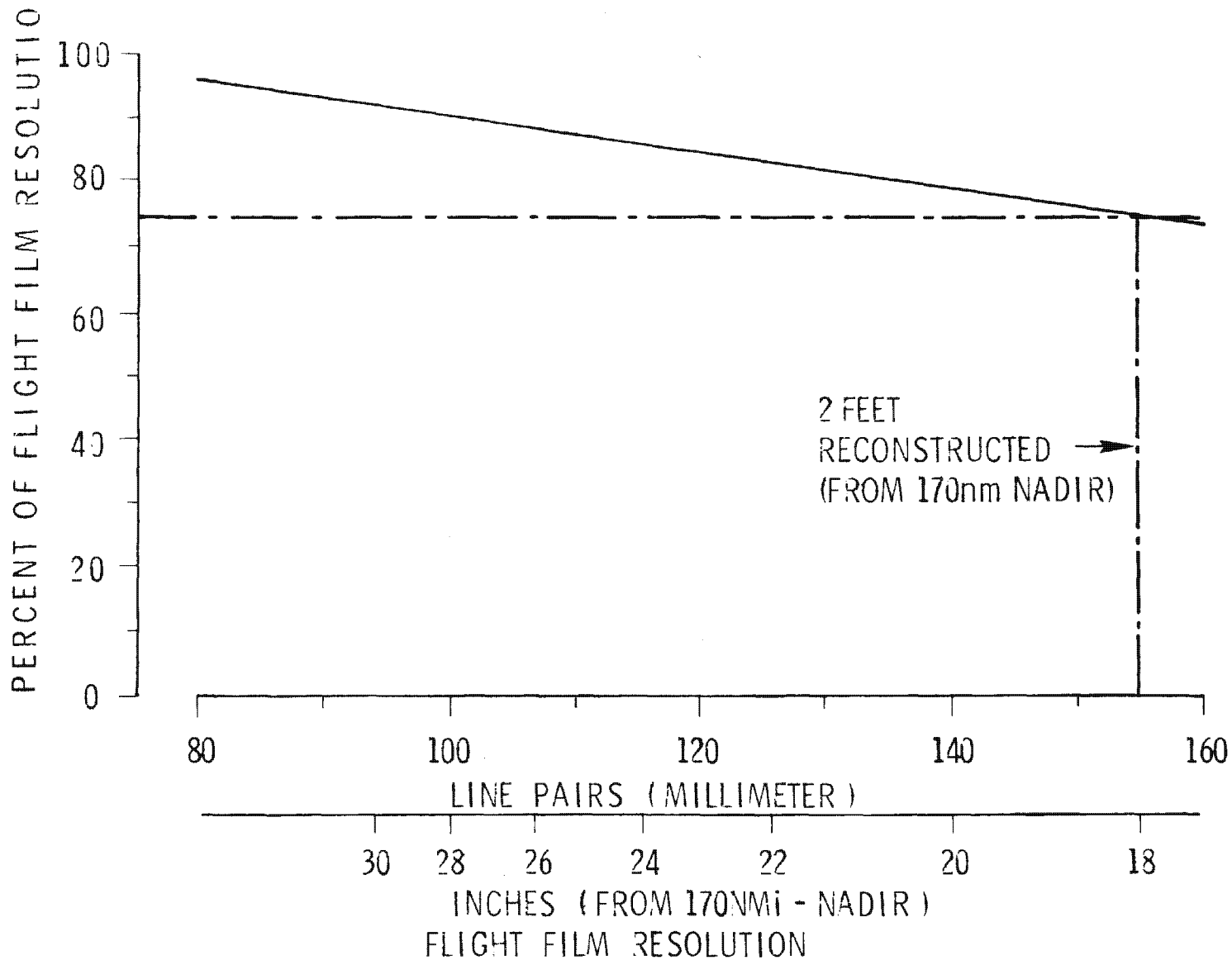


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14 B

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RECONSTRUCTED RESOLUTION  
vs FLIGHT FILM RESOLUTION



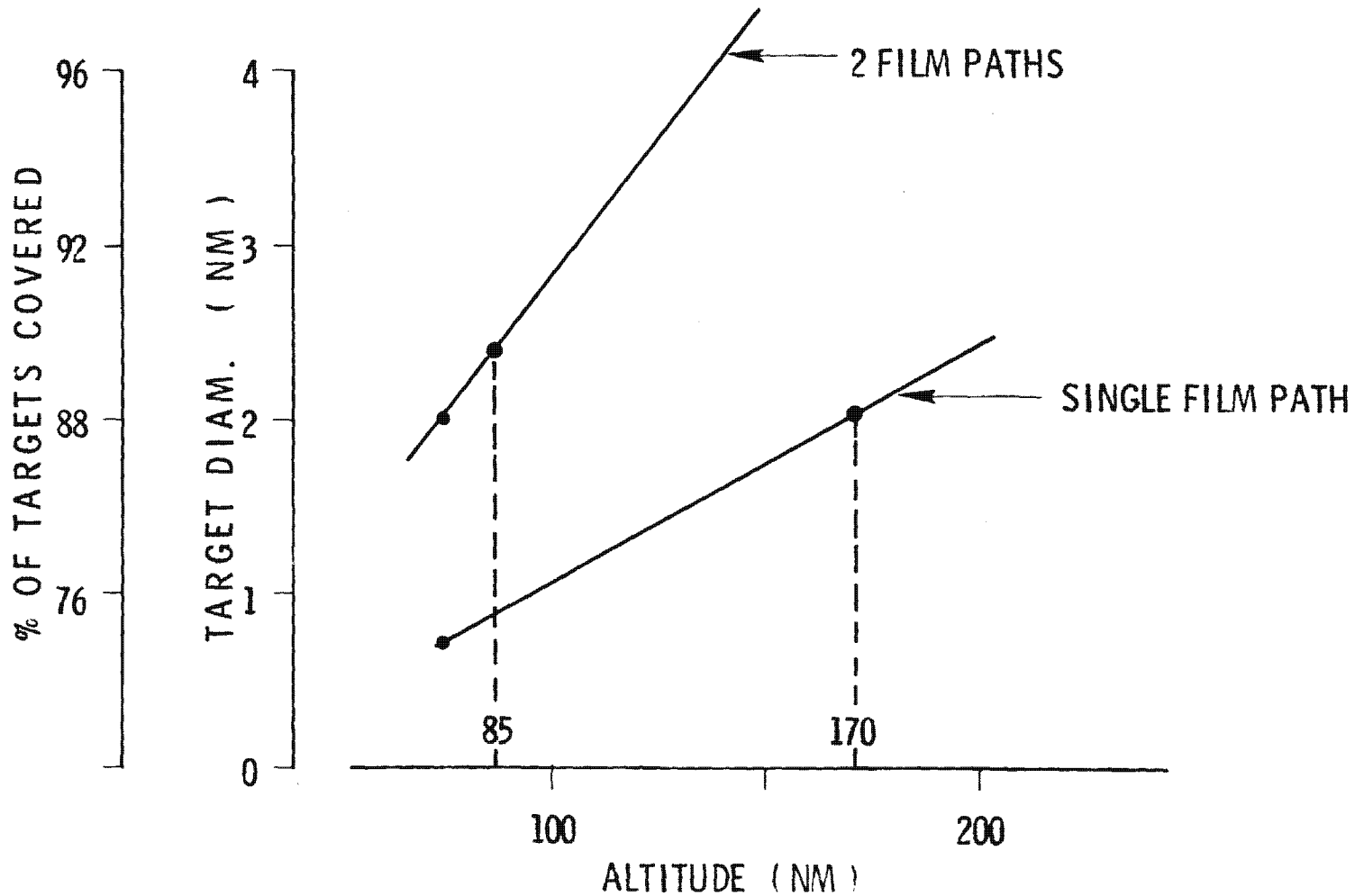
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TARGET SIZE CAPABILITY  
(NADIR)

95% PROBABILITY

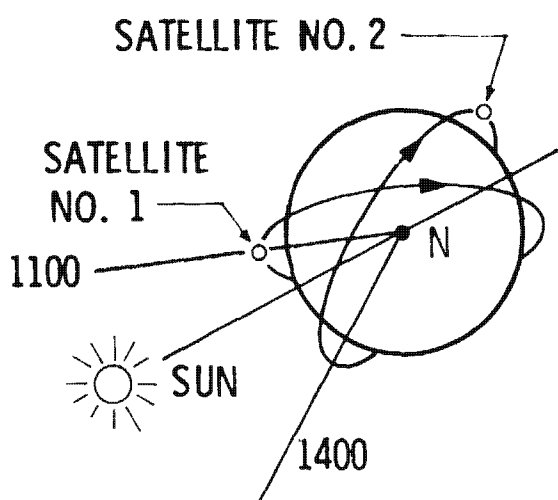
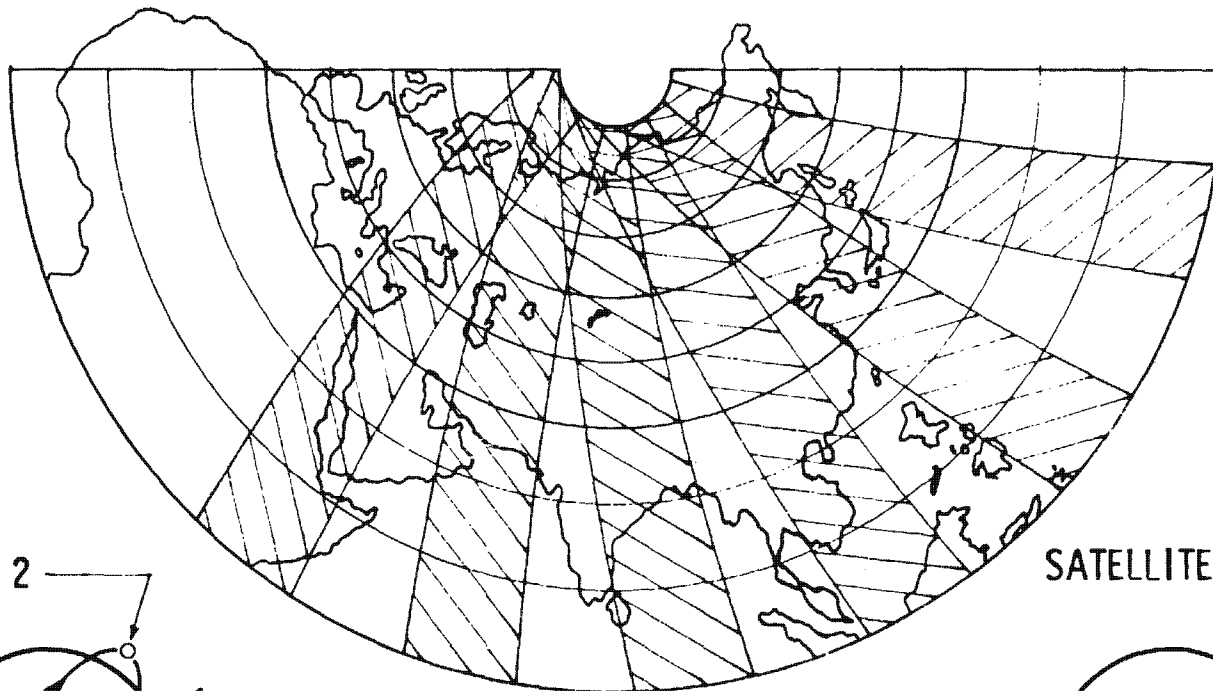


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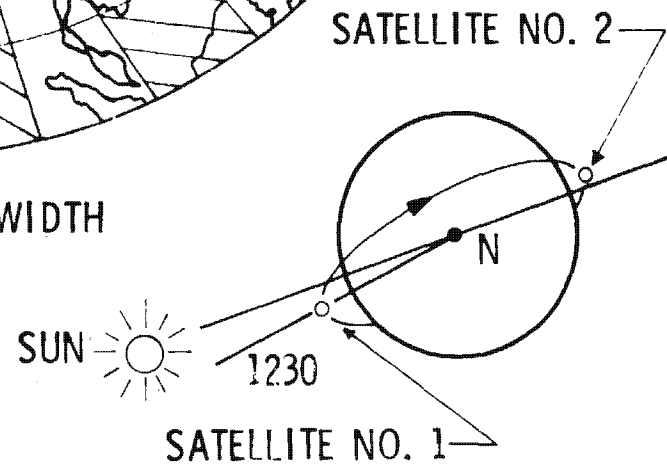
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# SATELLITE DEPLOYMENT

## 170-NM CIRCULAR ORBIT - SINGLE VEHICLE



670 NM SWATH WIDTH



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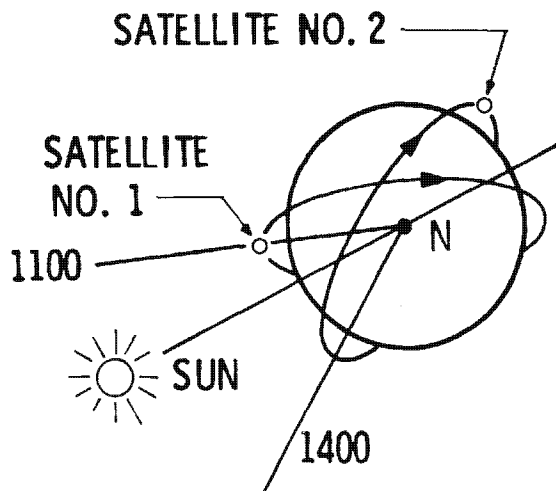
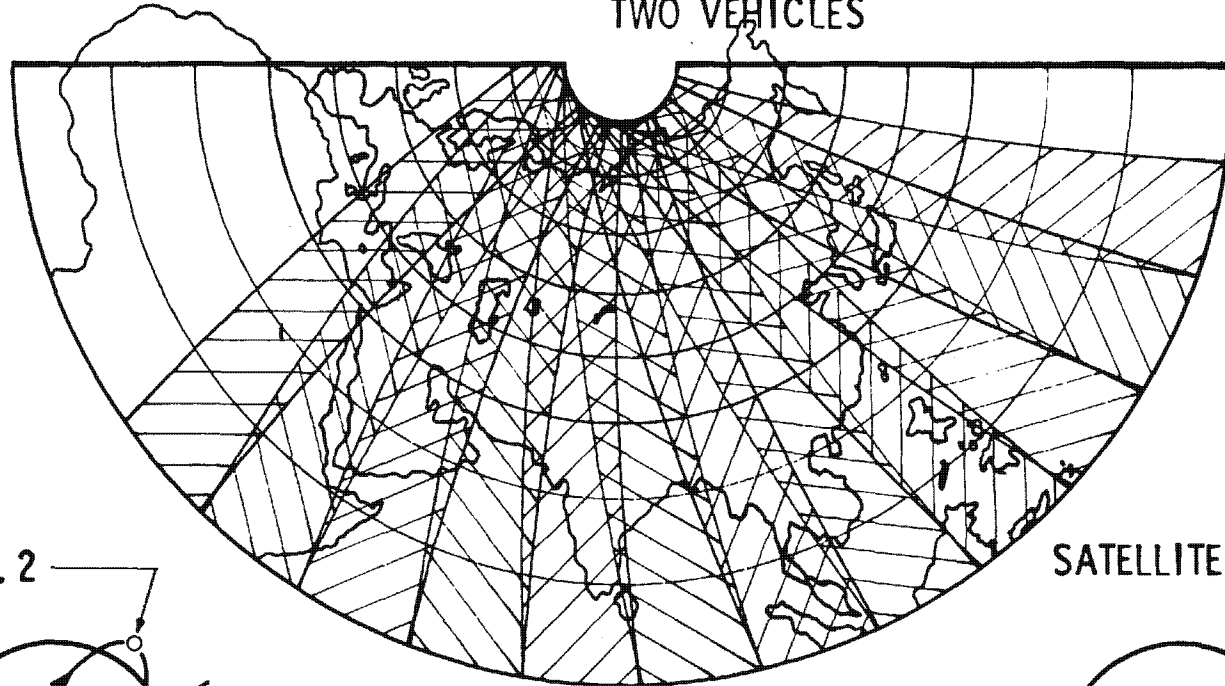
17A

SAFIS P

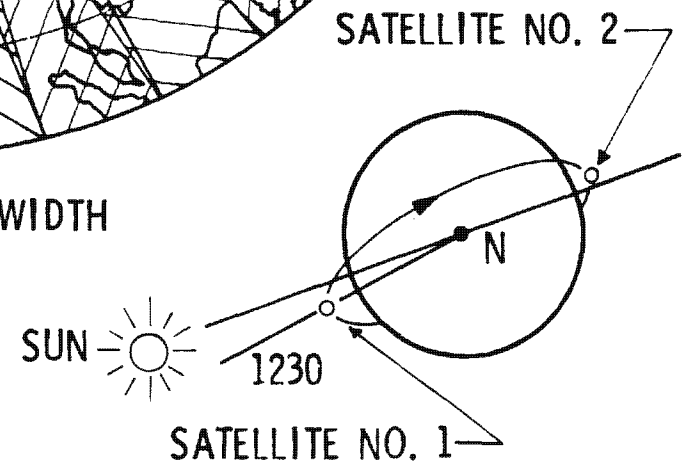
# SATELLITE DEPLOYMENT

170-NM CIRCULAR ORBIT -

TWO VEHICLES



670 NM SWATH WIDTH



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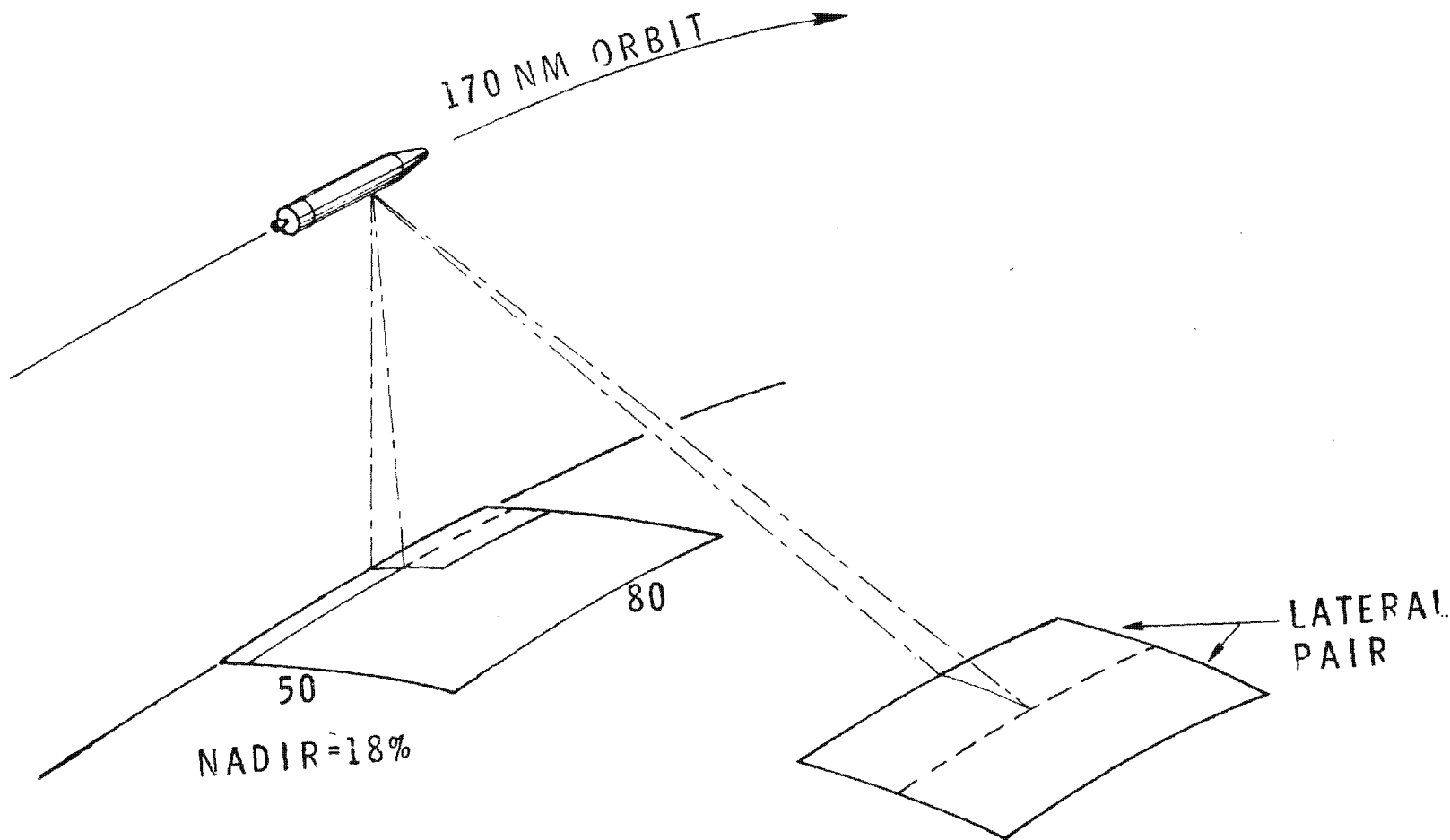
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AREA COVERAGE - CRISIS



57° ROLL = 100%

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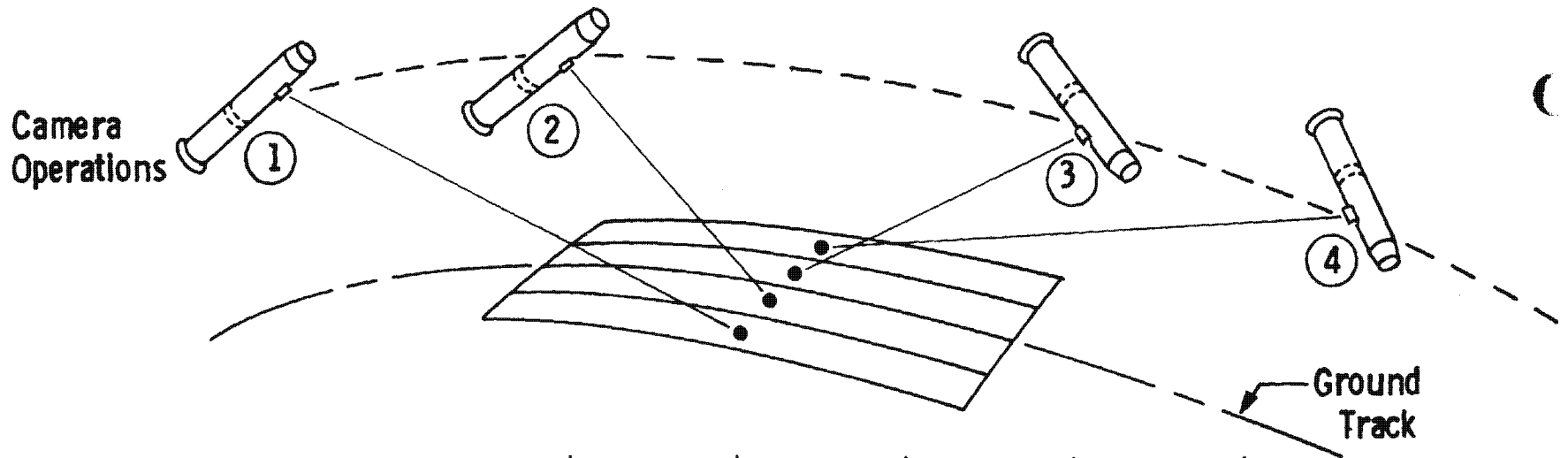
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CRISIS MISSION COVERAGE

PITCH AGILITY OPTION, 2 FILM PATHS, 1 SATELLITE



CAMERA OPERATIONS	1	2	3	4
Pitch Attitude (Deg)	53.60	53.60	-53.60	-53.60
Mirror Angle (Deg)	8.65	-8.65	8.65	-8.65
Roll Angle (Deg)	-3	-1	1	3

Coverage: 100% OF 50x80 NM AREA

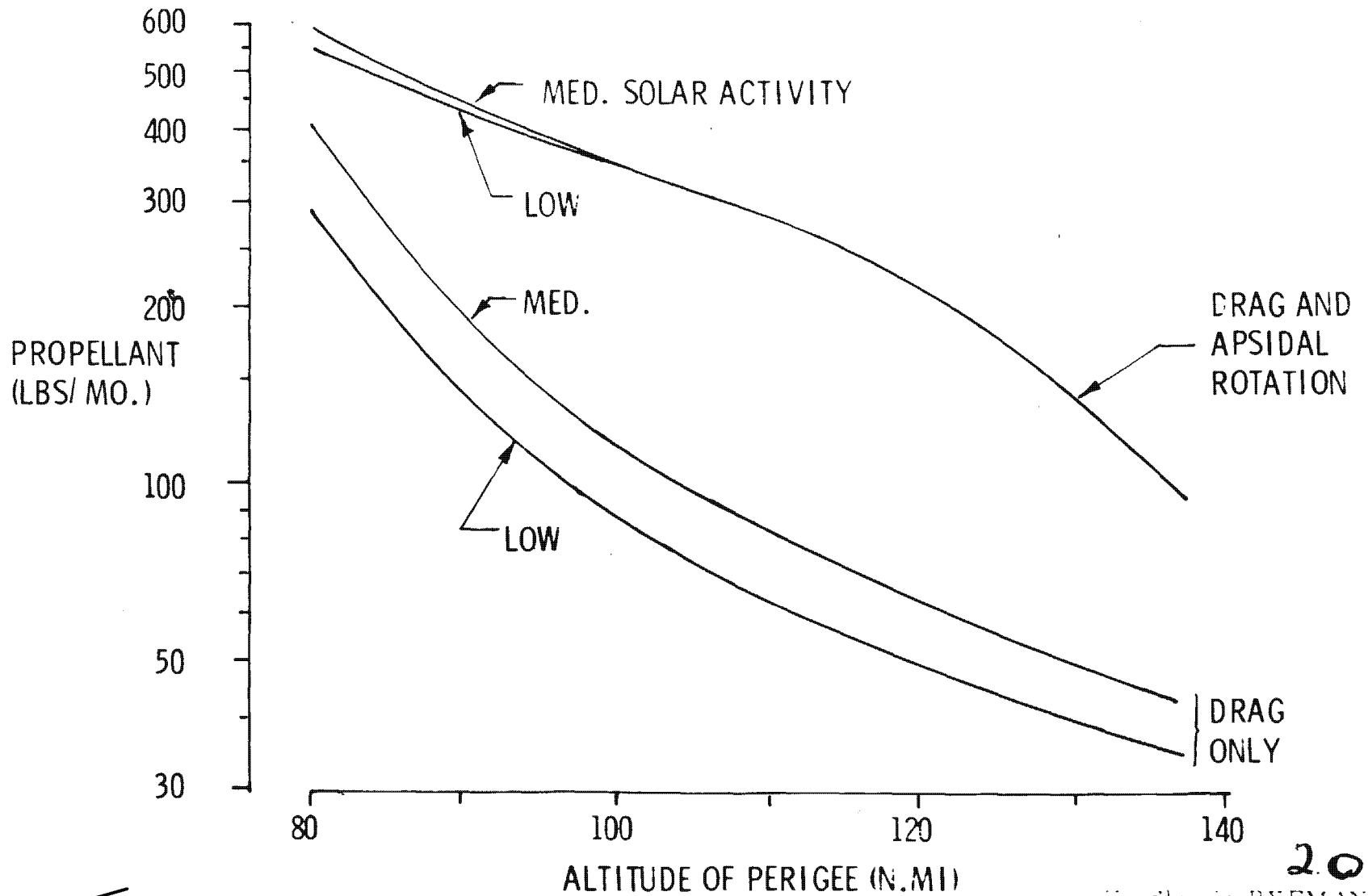
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### PROPELLANT REQUIRED TO MAINTAIN DAILY REPEATING ORBITS



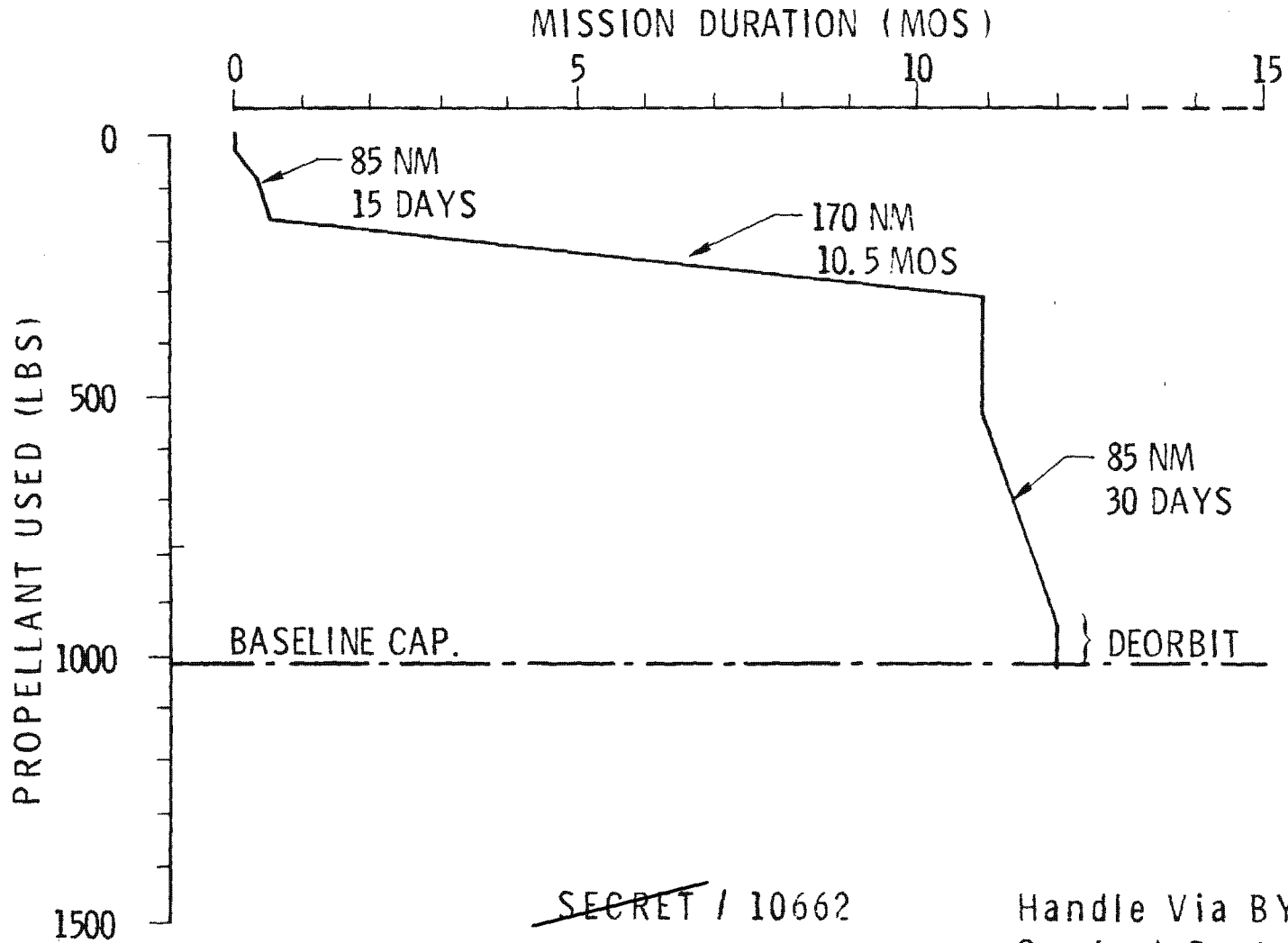
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ON-ORBIT PROPULSION CAPABILITY

- NON-CRISIS OPTION



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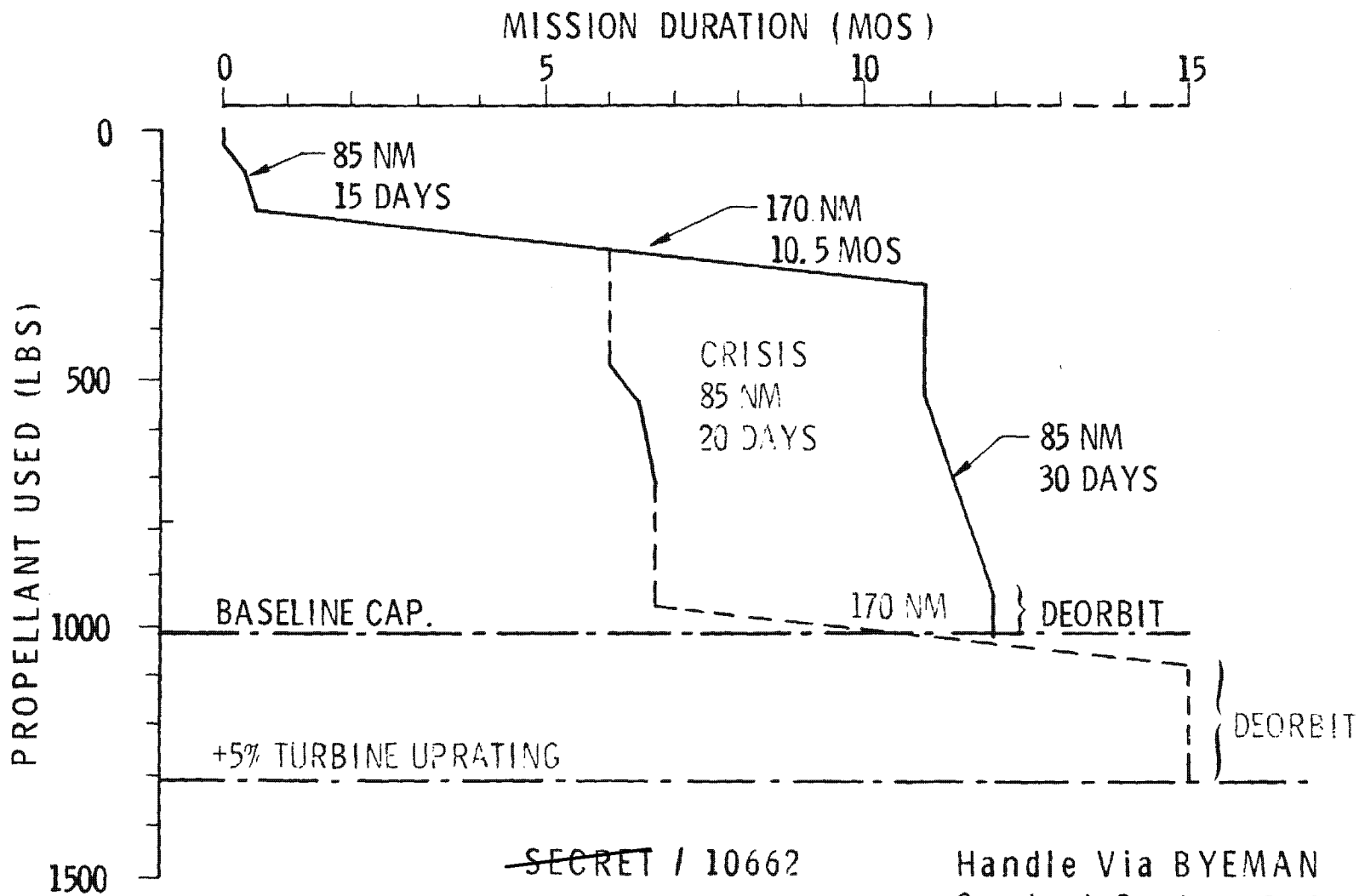
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# ON-ORBIT PROPULSION CAPABILITY

- NON-CRISIS OPTION - CRISIS OPTIONS



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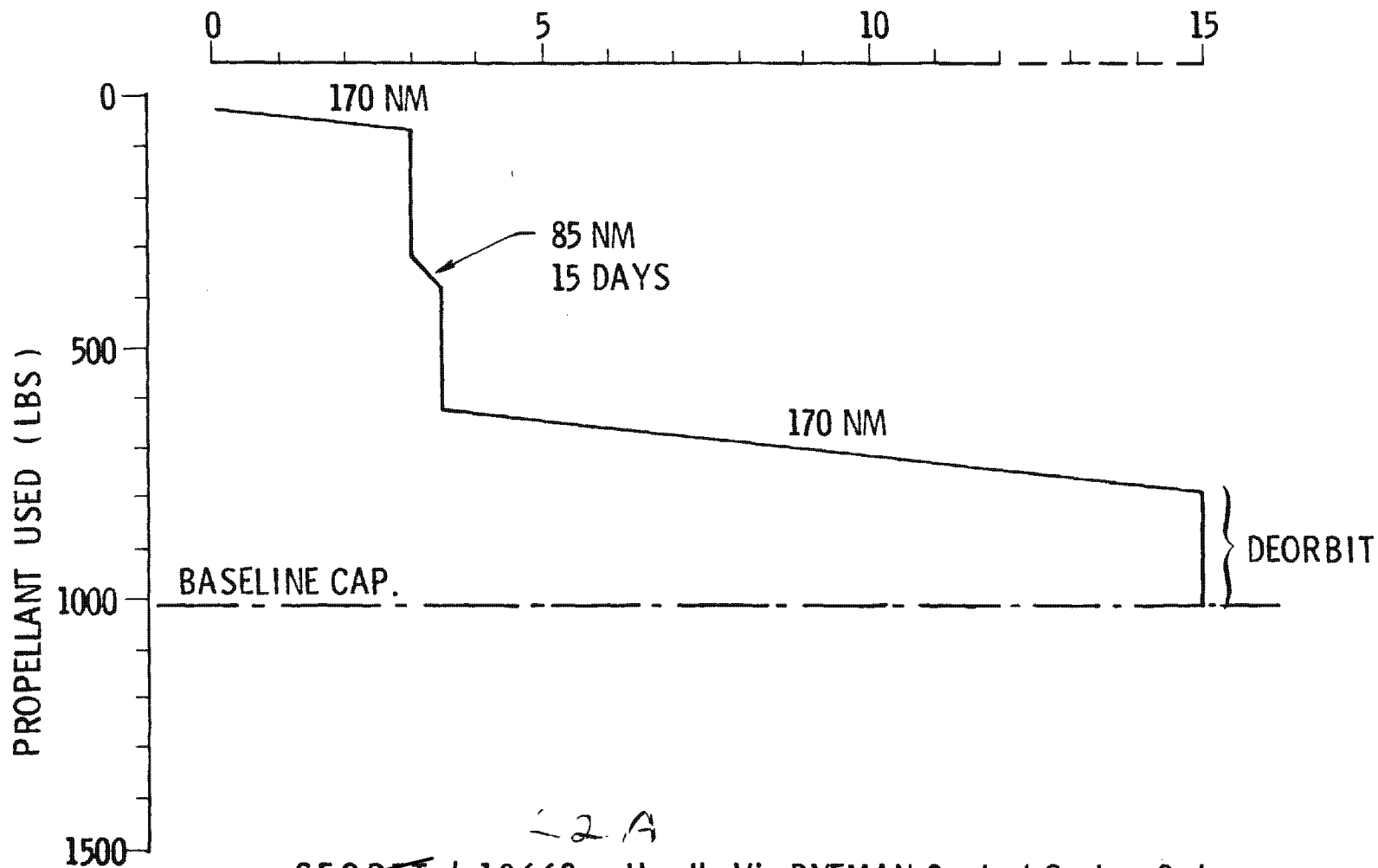
21A

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ON-ORBIT PROPULSION CAPABILITY

- CRISIS OPTION TO 85 NM

MISSION DURATION (MOS)



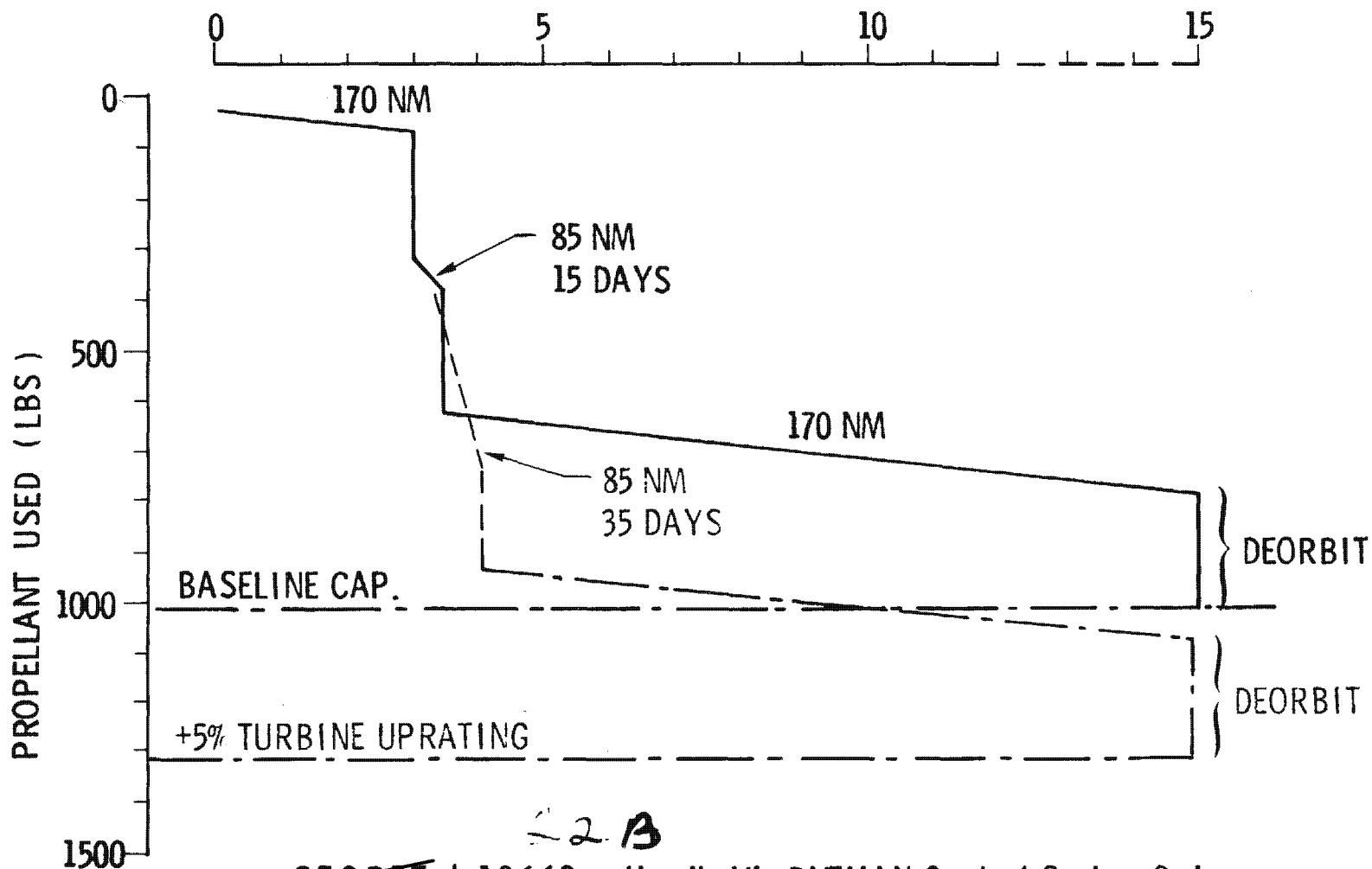
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ON-ORBIT PROPULSION CAPABILITY

- CRISIS OPTION TO 85 NM

MISSION DURATION (MOS)



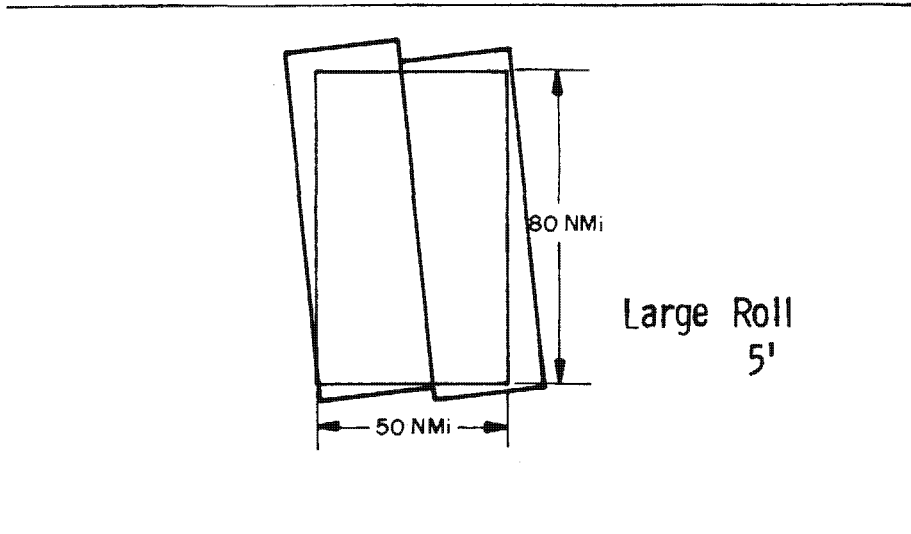
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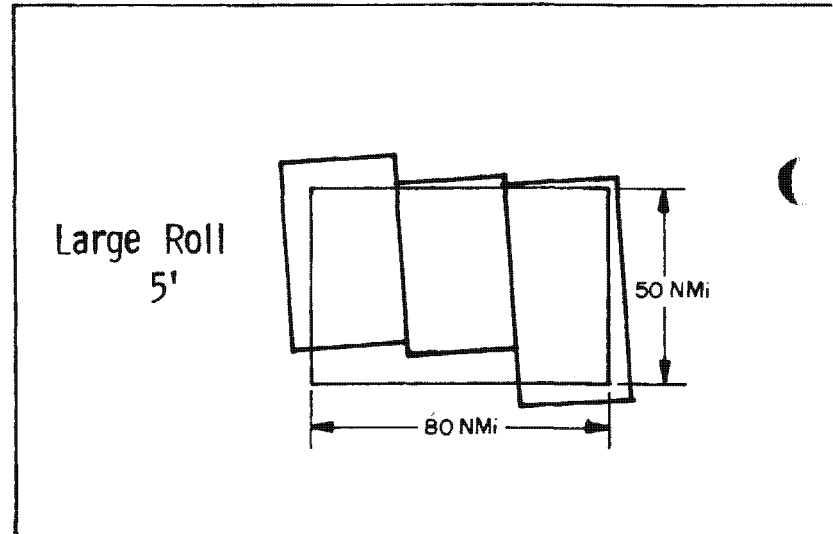
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## SPECIFIC COLLECTION PROBLEMS FRO-G

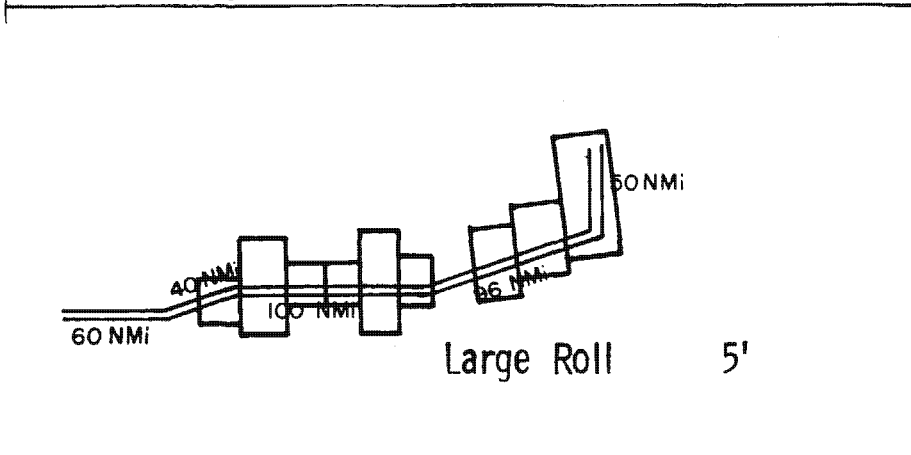
### AREA COVERAGE -- IN-TRACK



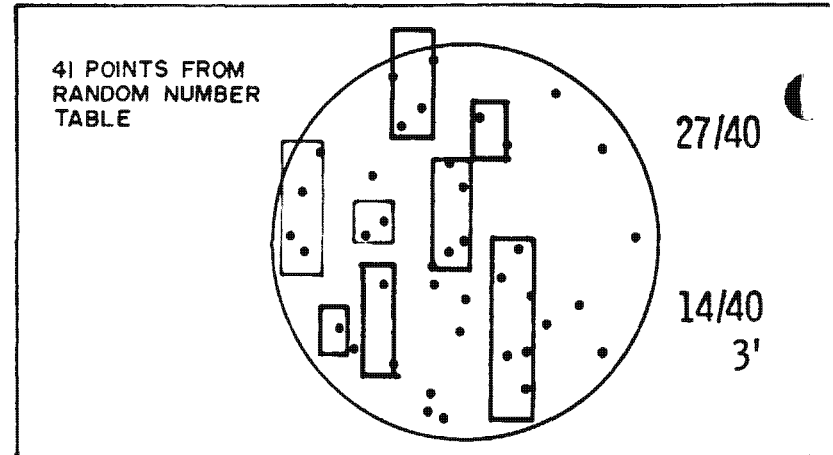
### AREA COVERAGE -- CROSS-TRACK



### LINES OF COMMUNICATION



### INSTALLATIONS



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FRO-G<sup>3</sup> CCRP AND EW / I PERFORMANCE

REQUIREMENT: CCRP - APPROXIMATELY 1000 CLOUD-FREE  
TARGETS PER QUARTER

EW / I - NOT DEFINED

CCRP: CLUSTER SURVEILLANCE SATISFIES 75% OF CCRP  
REQUIREMENT. REMAINING 25% REQUIRES APPROXIMATELY  
500 FRAMES OVER THE QUARTER.

EW / I: AFTER SATISFYING THE HEXAGON CLUSTER REQUIREMENT  
AND THE CCRP, OVER 140 NOMINAL FRAMES PER DAY  
ARE AVAILABLE FOR USE AGAINST EW / I TARGETS. THIS  
EQUATES TO ALMOST 51,000 FRAMES PER YEAR FOR EW / I.

NOTE: IN A QUARTER WHEN HEXAGON IS ON ORBIT, THE CCRP  
WILL REQUIRE APPROXIMATELY 2000 FRAMES LEAVING  
APPROXIMATELY 34,000 FRAMES FOR EW / I.

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FRO-G<sup>3</sup> SURVEILLANCE OF HEXAGON CLUSTERS

REQUIREMENT: 80% OF 40,000 SQ. NM CLOUD-FREE

TOTAL FILM REQUIRED ASSUMING 75% FILM USE EFFICIENCY IS 7240 FT  
OR 1810 FT / FILM STRAND.

OVER 90-DAY PERIOD THIS IS 20.1 FT / DAY / STRAND.

AVAILABLE FILM IS 33.3 FT / DAY / STRAND NOT INCLUDING 25% CRISIS  
CONTINGENCY.

STEREO COVERAGE OF SPECIFIC TARGETS / AREAS CAN BE PROVIDED ON  
REQUEST.

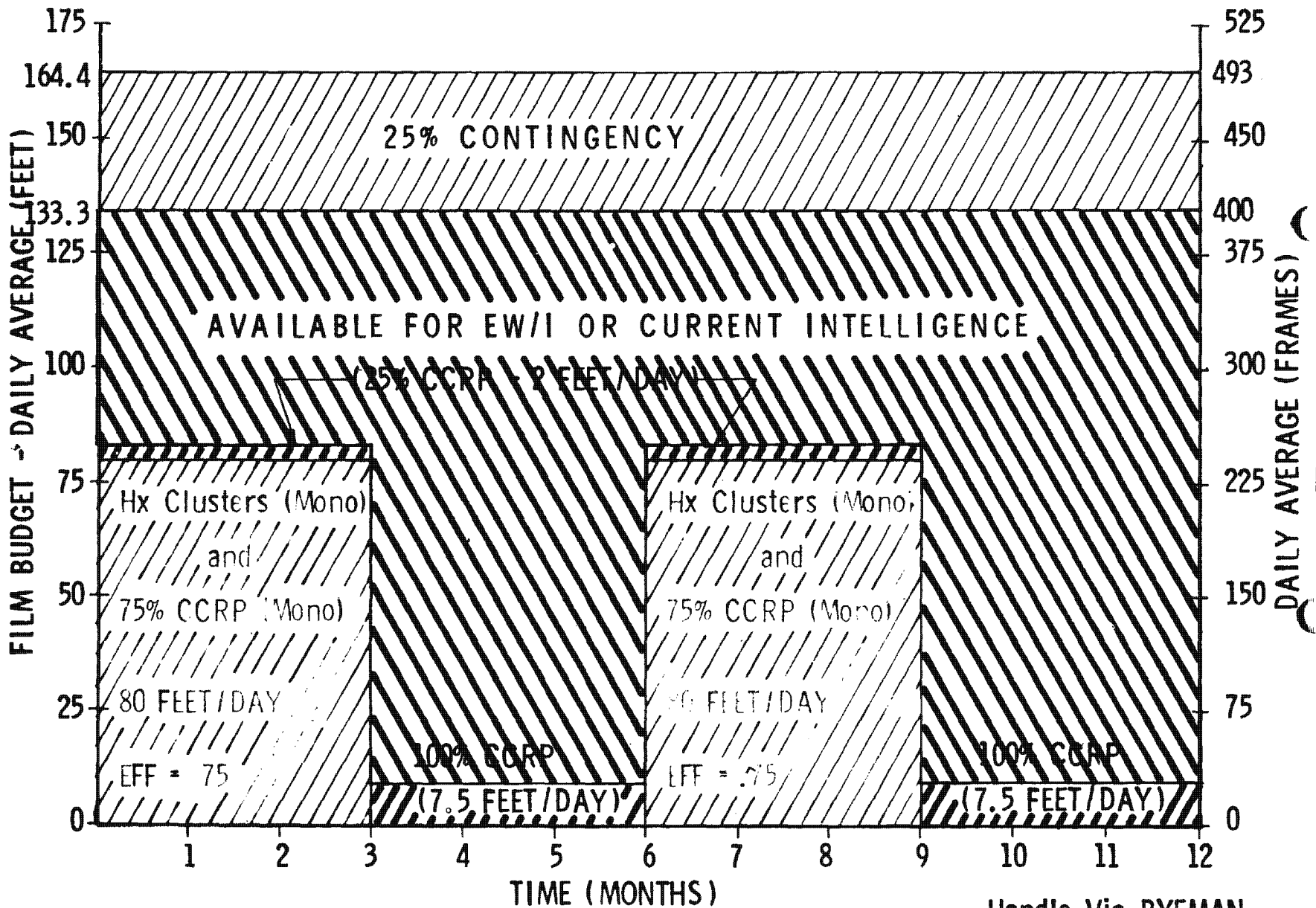
INCIDENTAL TARGET ACQUISITIONS DURING CLUSTER SURVEILLANCE WILL  
SATISFY APPROXIMATELY 75% OF GAMBIT CCRP TASK.

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### FRO-G<sup>3</sup> FILM BUDGET



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FILM READOUT SYSTEM PERFORMANCE SUMMARY

TWO VEHICLES IN 170 NM ORBIT

SYSTEM WILL PROVIDE:

- COVERAGE - 365 DAYS PER YEAR (2.8 LAUNCHES/YR)
- ACCESS - DAILY TO 99% OF EARTH (100% IN 2 DAYS)
- DATA RETURN - 400 FRAMES PER DAY (MIN) TO PRIME READOUT STATION (800 F/DAY WITH BOTH STATIONS)
- EXPOSURE TO READOUT TIME - PRIORITY - 3-12 HOURS; ROUTINE - 12-24 HOURS
- RESOLUTION - (MONO OR STEREO)
  - AT 170 NM ALTITUDE
  - AT NADIR- 60%  $\leq$  2 FEET
  - AT 60 DEG VIEW ANGLE - 60%  $\leq$  5 FEET
  - ONE FOOT NADIR BEST AT 85 NM ALTITUDE
- AREA COVERAGE
  - EACH SATELLITE:
  - TWO SATELLITES:- SPECIFIC CRISIS AREA - TWO FILM PATHS  
UP TO 6,000 SQ MILE AREAS  
CONTINUE WORLD WIDE COVERAGE  
OBTAIN TWICE AS MUCH CRISIS COVERAGE
- RELAY OPTION - RELAY THROUGH 777 SATELLITE ENHANCES FAST DATA RESPONSE, 1.5 - 6 HRS

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IMAGERY REQUIREMENTS FOR CRISIS-RESPONSE SATELLITE SYSTEMS

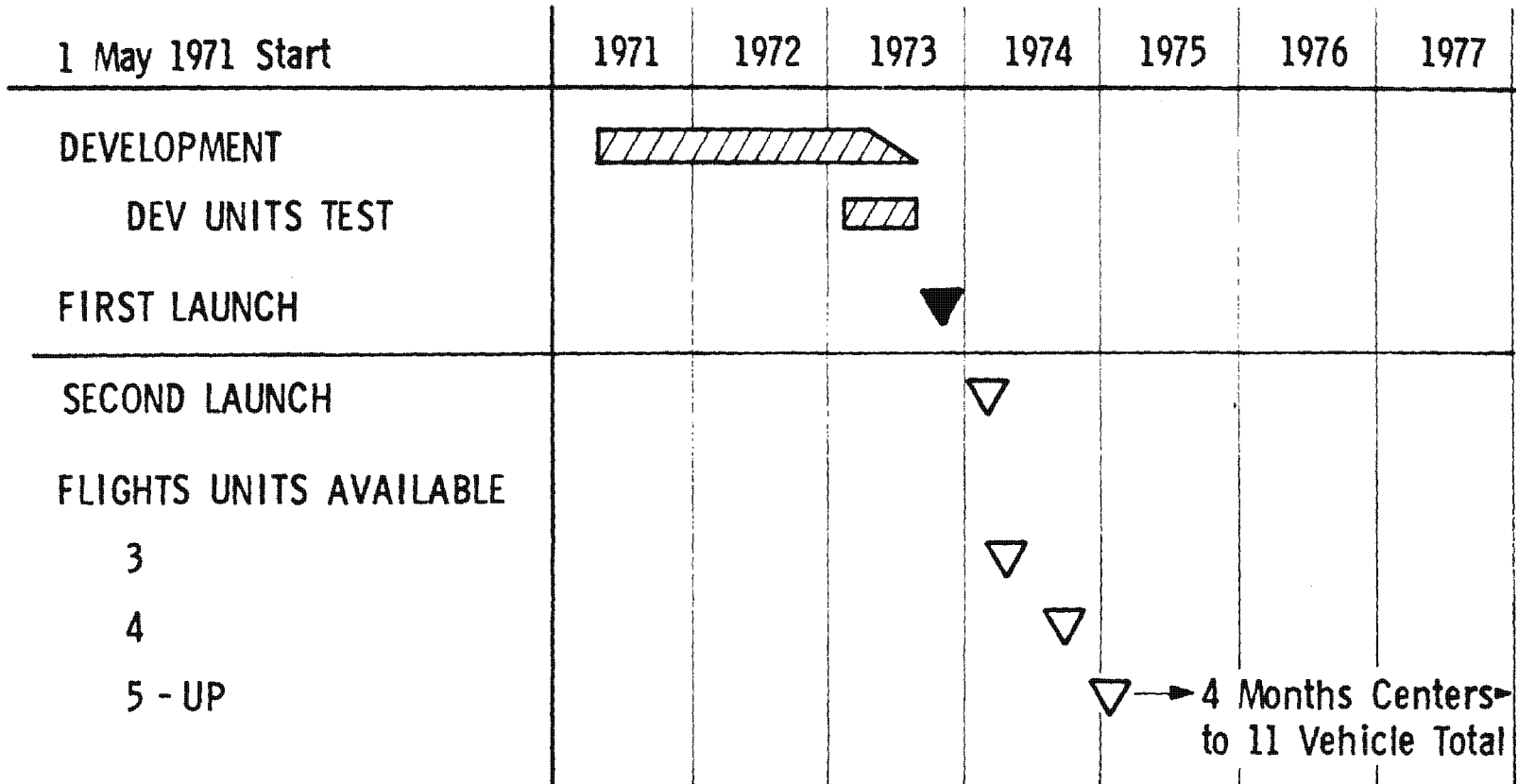
	<u>OPTIMUM</u>	<u>NOMINAL</u>	<u>POOREST ACCEPTABLE</u>
<u>1. RESOLUTION</u>			
INSTALLATION SURVEILLANCE	≤ 1'	2' - 3'	5'
AREA SEARCH	2' - 3'	3' - 5'	5'
LINES OF COMMUNICATION	2' - 3'	3' - 5'	5'
<u>MODE</u>	ALL STEREO	STEREO - SOME MONO ACCEPTABLE	MONO - SOME STEREO DESIRED
<u>2. GROUND AREA IMAGED</u>			
INSTALLATION SURVEILLANCE	> 3 X 3 NM	3 X 3 NM	≥ 2 X 2 NM
AREA SEARCH	≥ 10,000 NM <sup>2</sup>	4,000 NM	2,000 NM <sup>2</sup>
LINES OF COMMUNICATION	≥ 5 X 500 NM <sup>2</sup>	5 X 300 NM	3 X 100 NM
<u>ACCESS (FROG AND EXTENT)</u>	DAILY WORLD-WIDE	DAILY TO CRISIS ZONES AND ASSOC W/1 TGTS	DAILY TO LOCALIZED REGION
<u>DURATION OF OPS</u>	CONTINUOUS	≥ 30 DAYS	TWO WEEKS
<u>FREQUENCY OF OPS</u>	8 PER YEAR	3 - 5 PER YEAR	2 PER YEAR
<u>IMAGE CAPACITY AND RATE</u>			
INSTALLATION/DAY	> 200	70	20
AREA (NM <sup>2</sup> )/DAY	≥ 10,000	4,000	2,000
<u>IMAGE DELIVERY TIME</u>	≤ 1 HOUR	≤ 12 HOURS	< 20 HOURS
<u>DELIVERY LOCATION</u>			OPIC
<u>ACTIVATION TIME</u>	< 1 HOUR	1 - 12 HOURS	72 HOURS

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## PROGRAM SCHEDULE



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COST SUMMARY

	<u>MILLIONS</u>
TOTAL NONRECURRING	165
RECURRING PER YEAR	103
RECURRING PER LAUNCH	
VEHICLE	30.4
OPERATIONS	<u>6.3</u>
TOTAL	36.7

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~~SECRET~~/10662

Handle Via BYEMAN  
Control System Only