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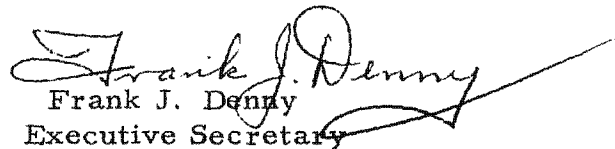
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GAMBIT

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
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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GAMBIT

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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Film Readout GAMBIT

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Annex to
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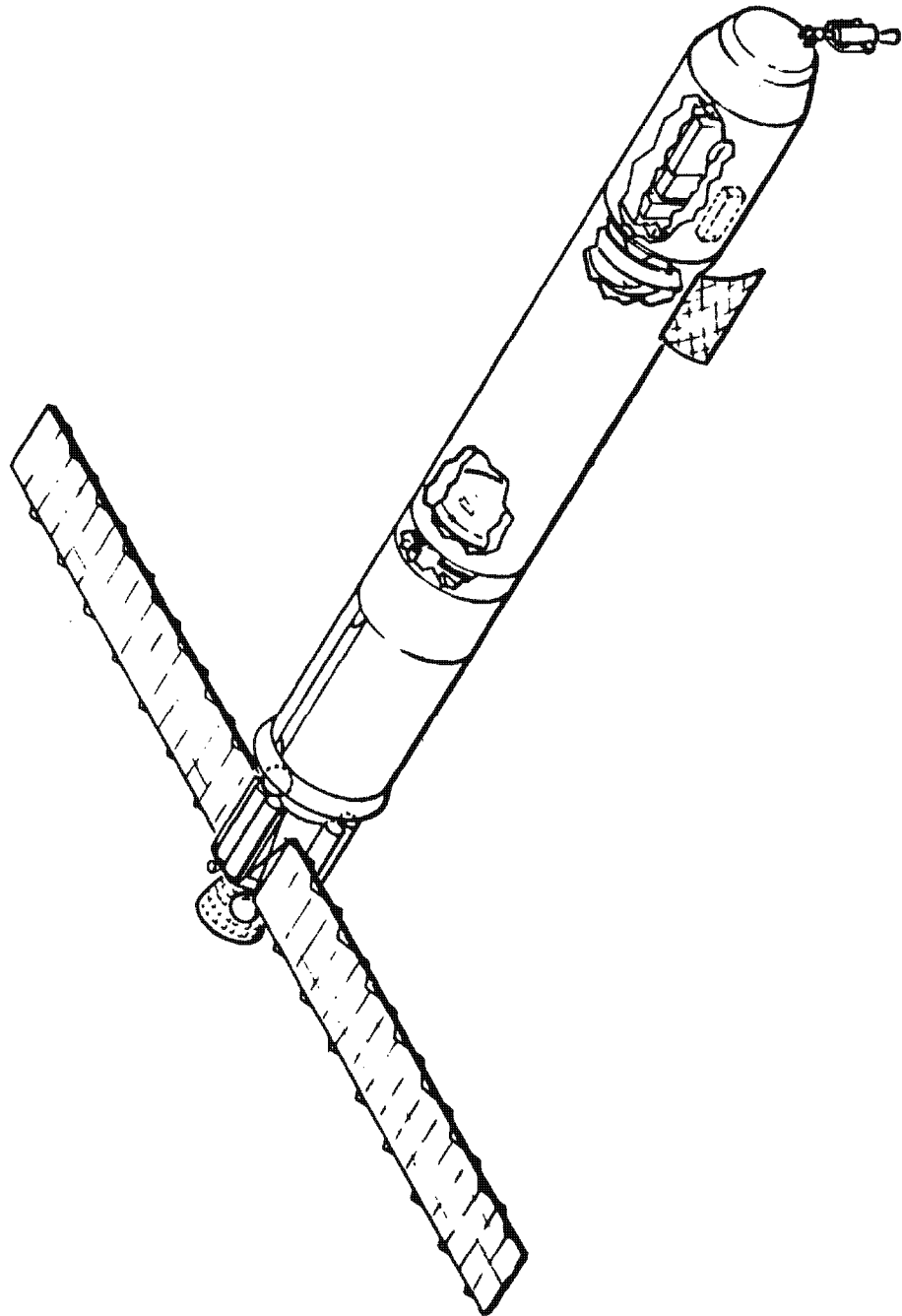
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SATELLITE VEHICLE



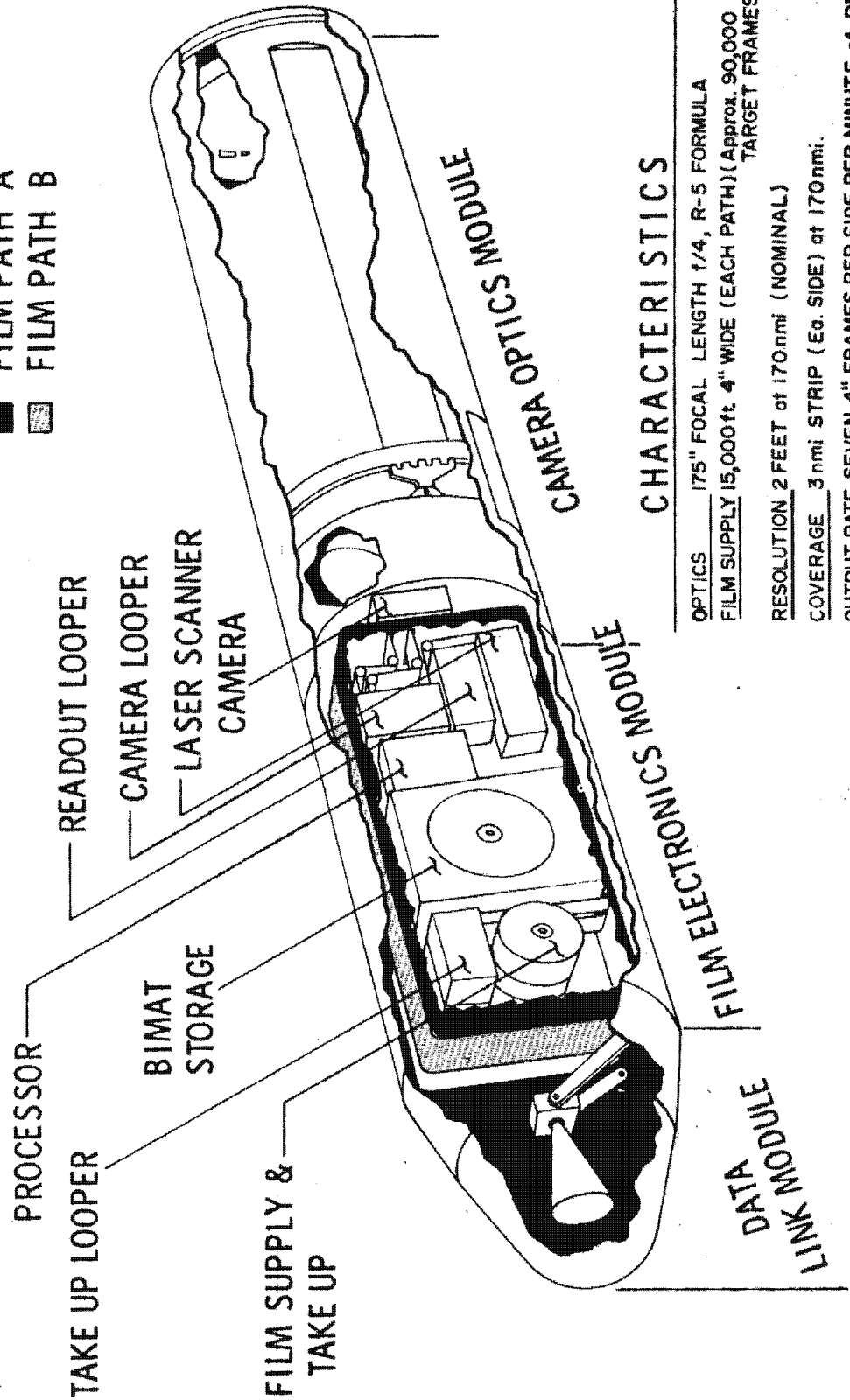
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OPTICS and READOUT MODULE CONFIGURATION CONCEPT

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FILM PATH A
FILM PATH B



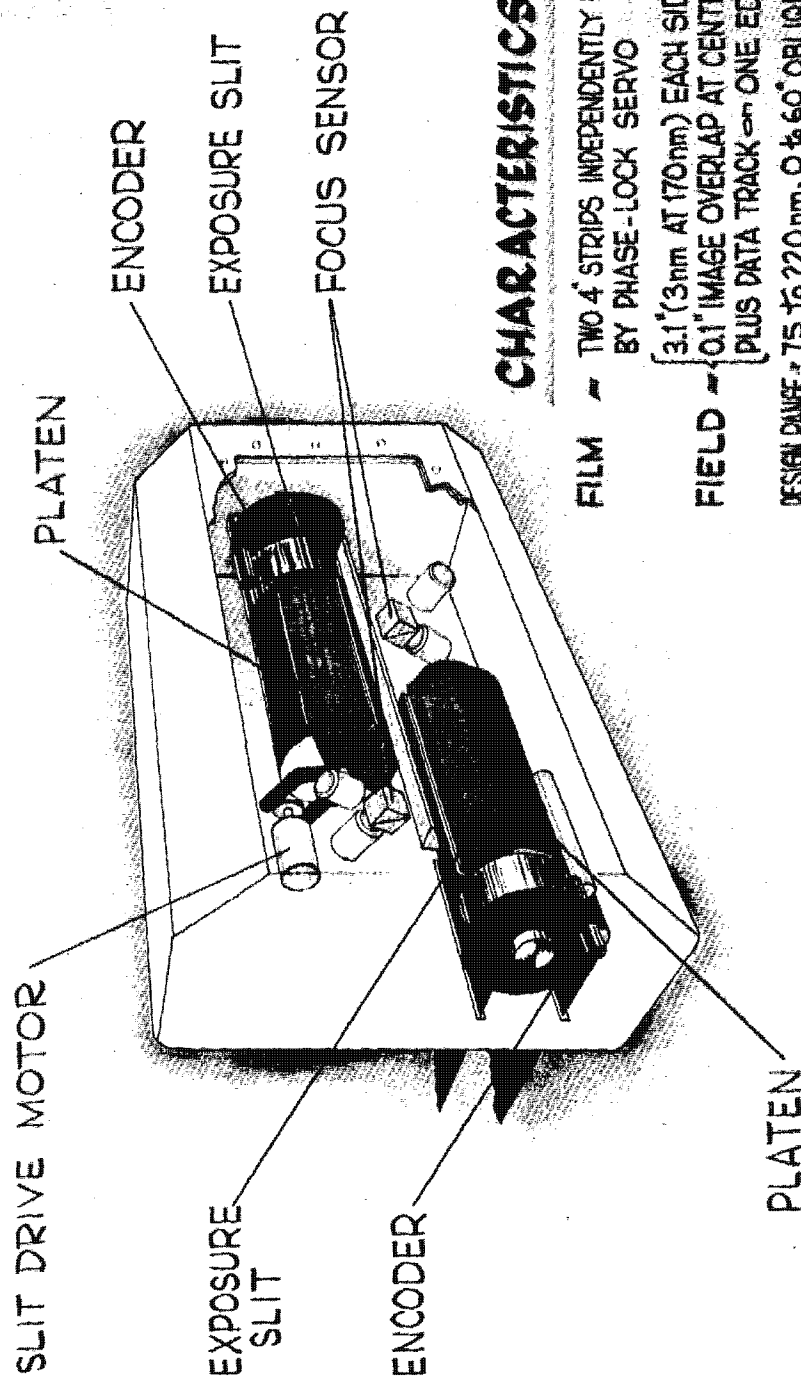
CHARACTERISTICS

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 of 170nm (NOMINAL)
COVERAGE 3 nm STRIP (Eq. SIDE) at 170nm.
OUTPUT RATE SEVEN 4" FRAMES PER SIDE PER MINUTE of READOUT

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CAMERA CONFIGURATION CONCEPT



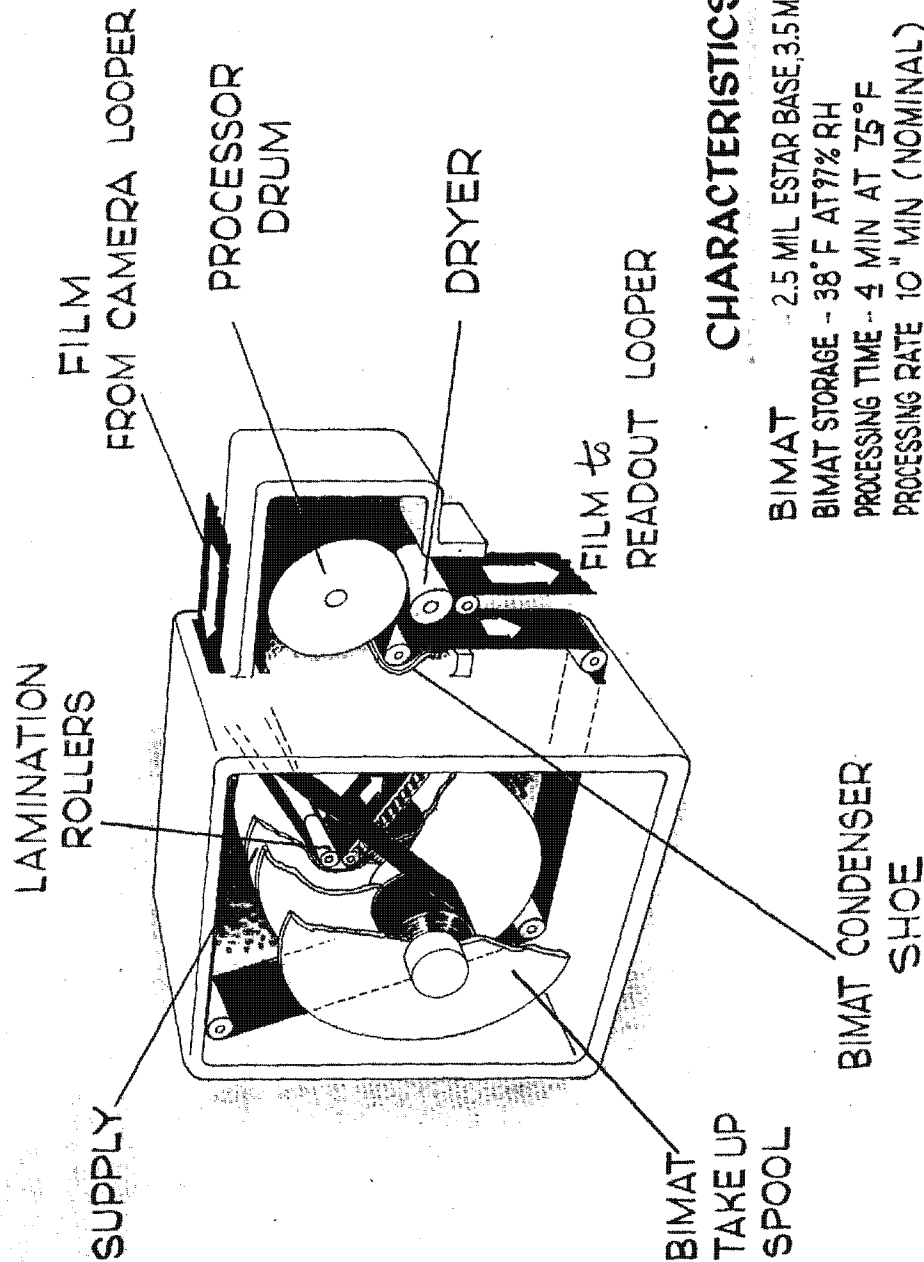
CHARACTERISTICS

- FILM - TWO 4" STRIPS INDEPENDENTLY DRIVEN BY PHASE-LOCK SERVO
- FIELD - $\left\{ \begin{array}{l} 3.1" (3 \text{ nm AT } 170 \text{ nm}) \text{ EACH SIDE} \\ 0.1" \text{ IMAGE OVERLAP AT CENTER} \end{array} \right\}$ 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 77% RH
 PROCESSING TIME - 4 MIN AT 75° F
 PROCESSING RATE 10" MIN (NOMINAL)
 INPUT LOOPER - 200" CAPACITY
 OUTPUT LOOPER - 400" CAPACITY

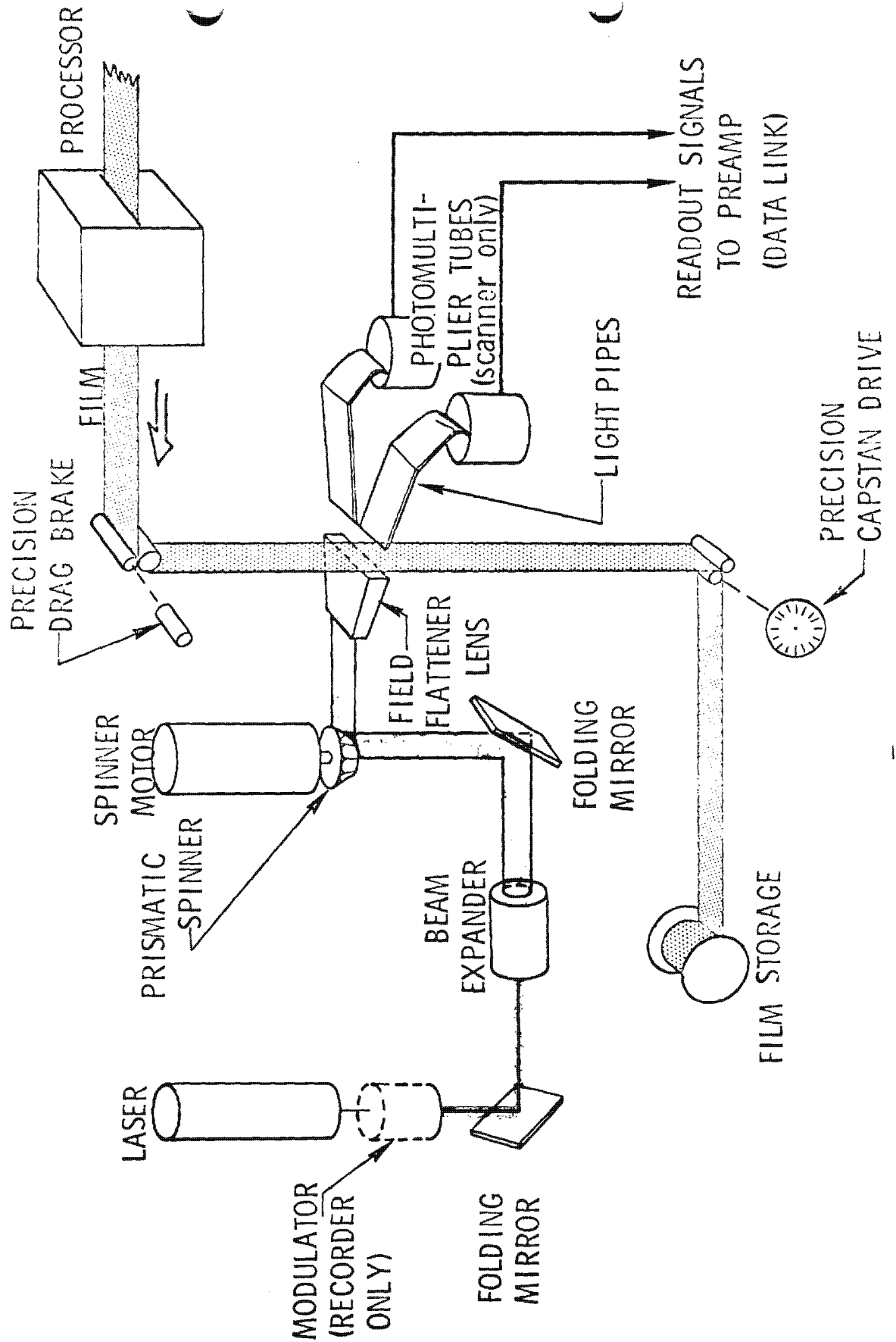
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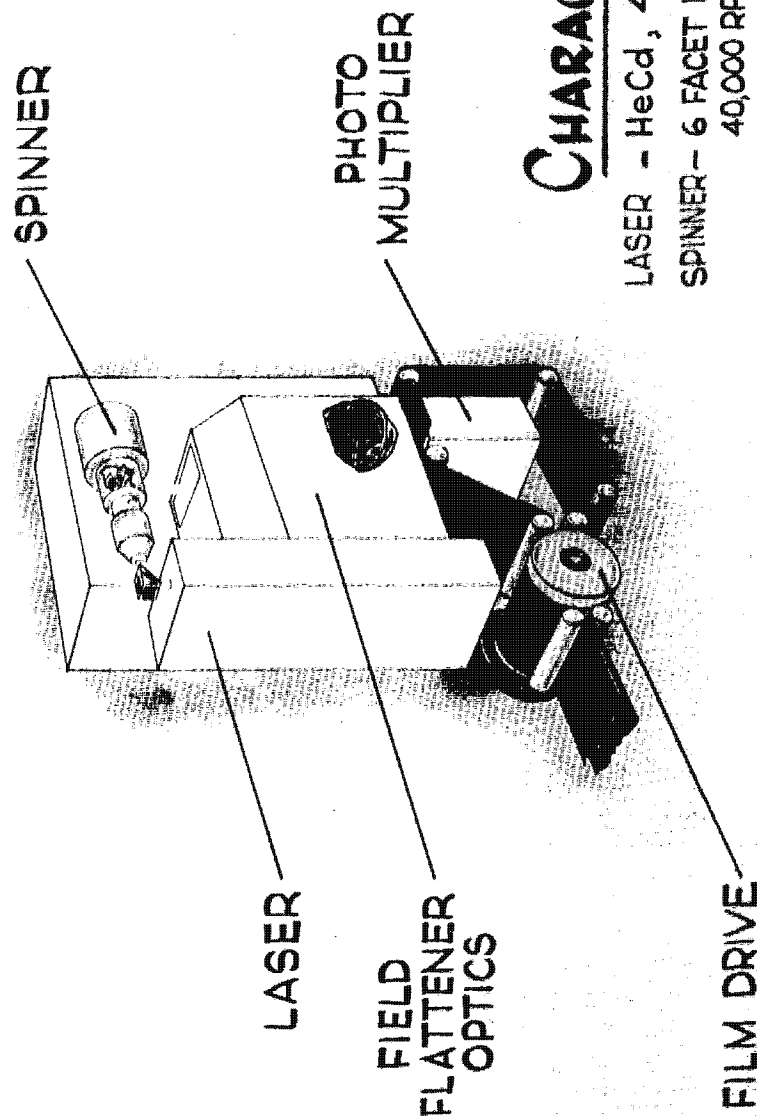
LASER SCANNER & RECORDER SCHEMATIC



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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

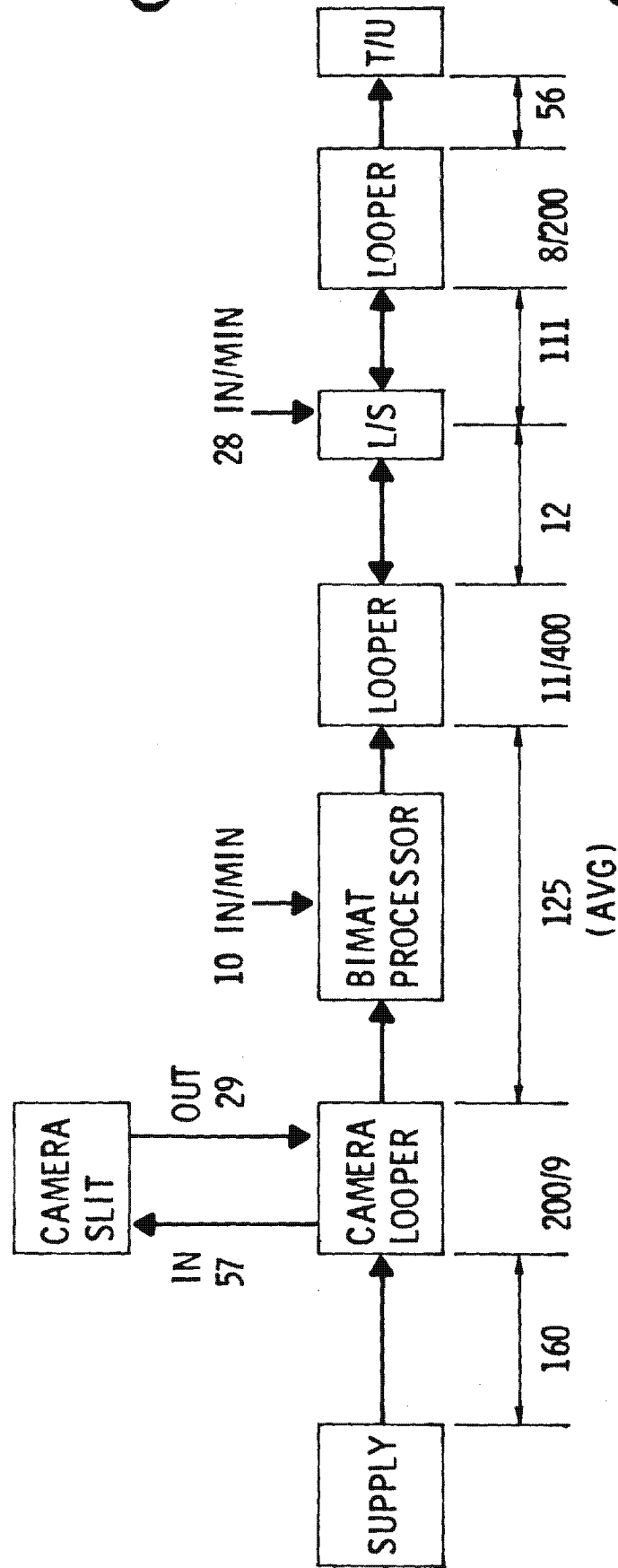
SCAN - FULL FORMAT

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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SAFSP 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

SAFSP

WEIGHT AND BOOSTER PERFORMANCE SUMMARY

OCV	3142
ORM	3948
CONTINGENCY	460
EXPENDABLES	1565
TOTAL	9115

POUNDS

9588

AGENA NOZZLE EXTENSION (COULD ADD 100 LBS)

9488

5% TURBINE SPEED INCREASE (COULD ADD 300 LBS OR MORE)

9188

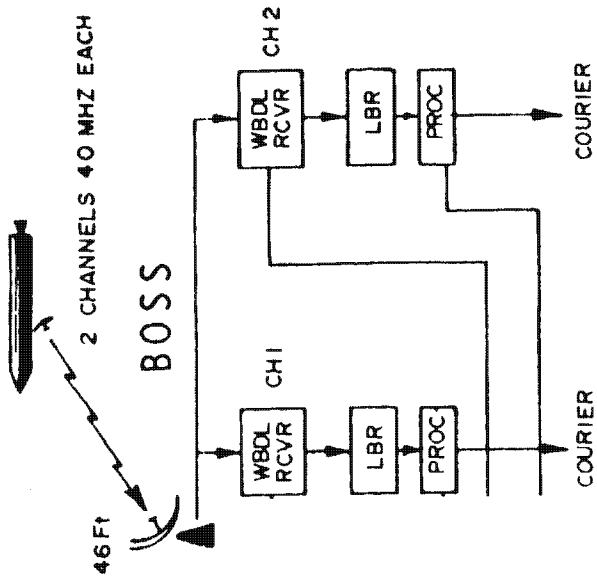
TITAN 111B + AGENA CAPABILITY (MINUS 3 SIGMA)

9115

TOTAL SATELLITE VEHICLE WEIGHT

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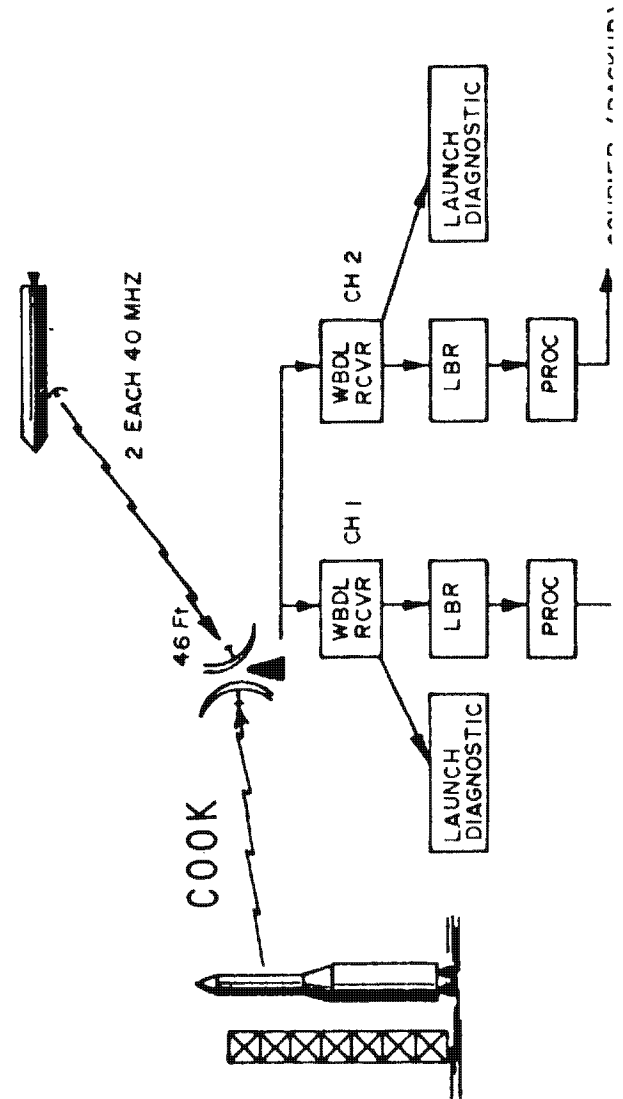
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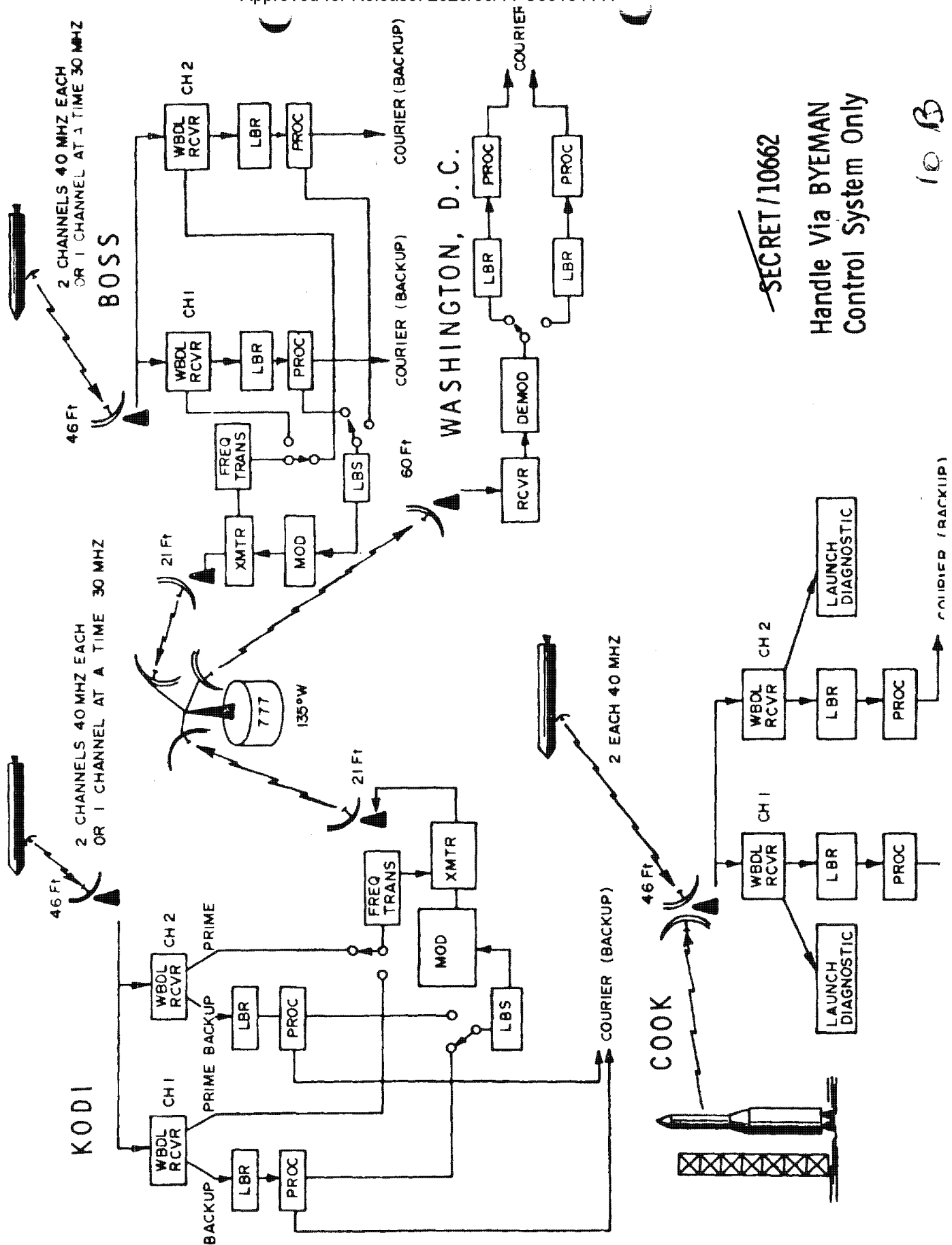
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10 A



DATA RECOVERY SCHEMATIC



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10 B

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MAXIMUM CAPACITY (TWO VEHICLES)

	AVERAGE CONTACT TIME PER DAY (MINUTES)	NUMBER OF FRAMES PER DAY	
		TO GROUND STATION	IMMEDIATE RELAY TO WASHINGTON VIA 777
BOSS	36	504	OR 188
		252	AND 188
		440	
BOSS + KODI	84	1176	OR 440
		588	AND 440
		1028	
COOK	36	504	

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COVERAGE - READOUT LOCATIONS/DELAY TIMES

- WASHINGTON, D.C., VAFB AND KODIAK
- SOUTH NORTH PHOTOS
- 170 N. MI.

KODA

WASHINGTON

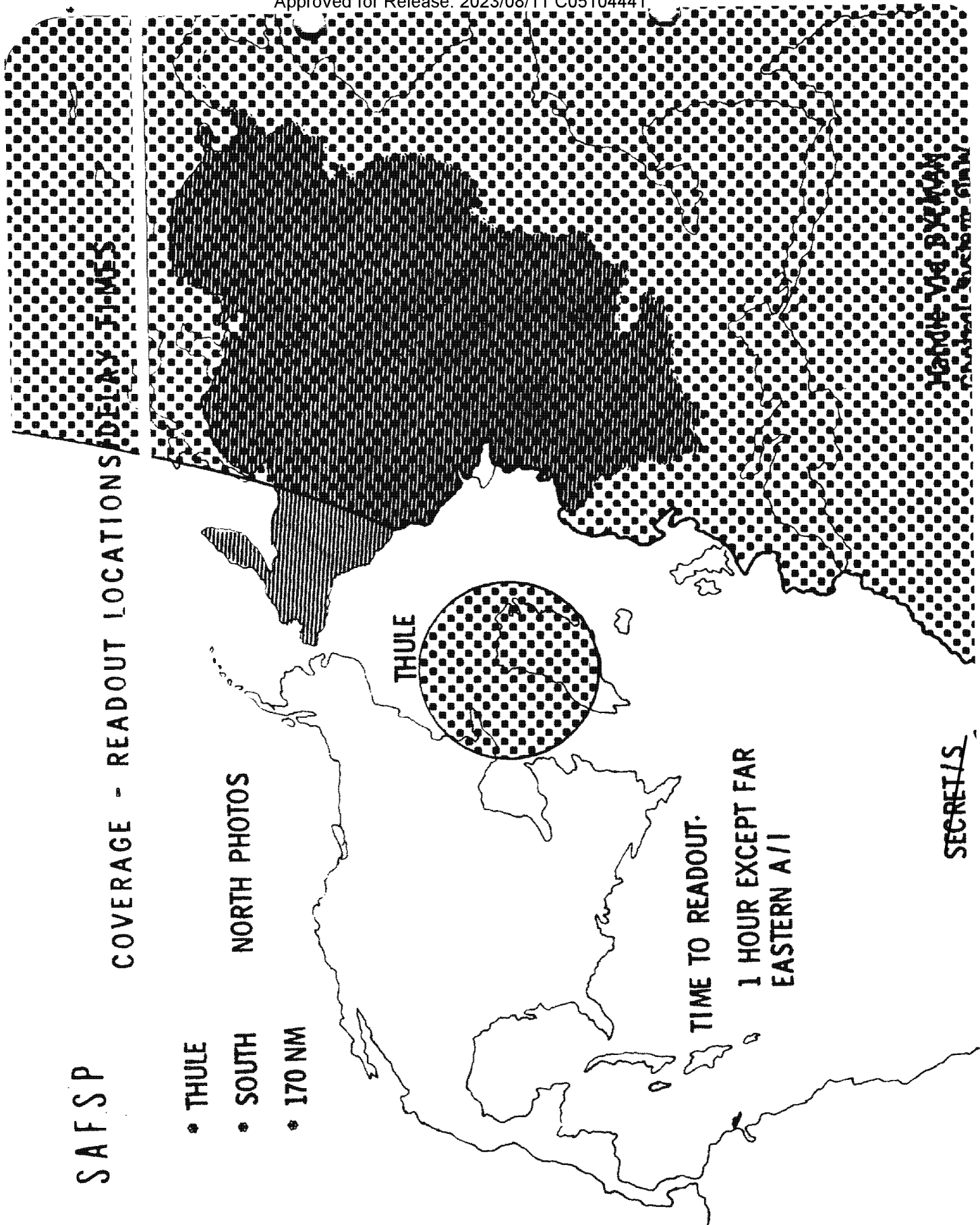
TIME TO READOUT.

EASTERN A/I	1-6 HRS (WASH.)
CENTRAL A/I	1-2 HRS (VAFB)
WESTERN A/I	1-2 HRS (KODIAK)

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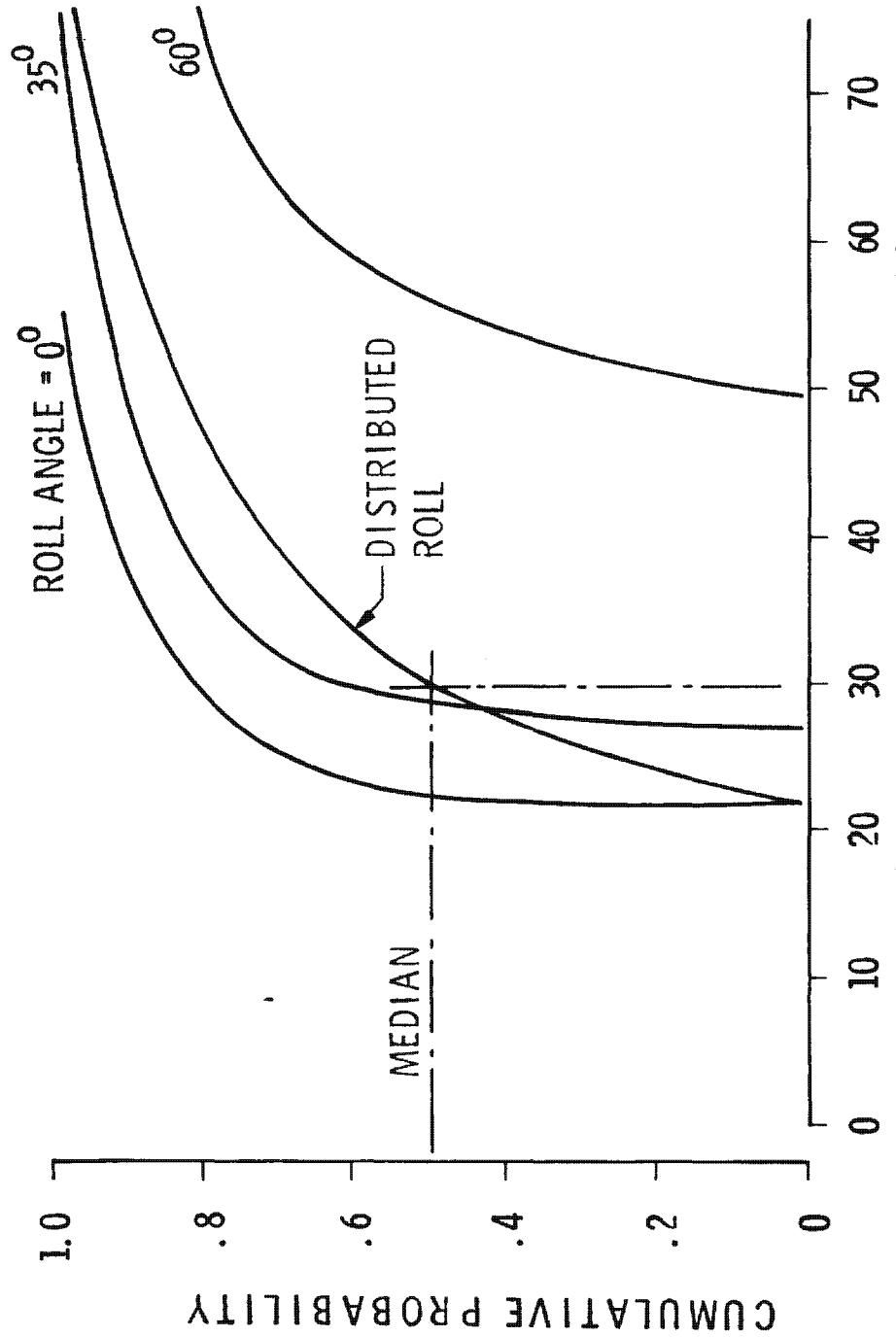
12



SAFSP

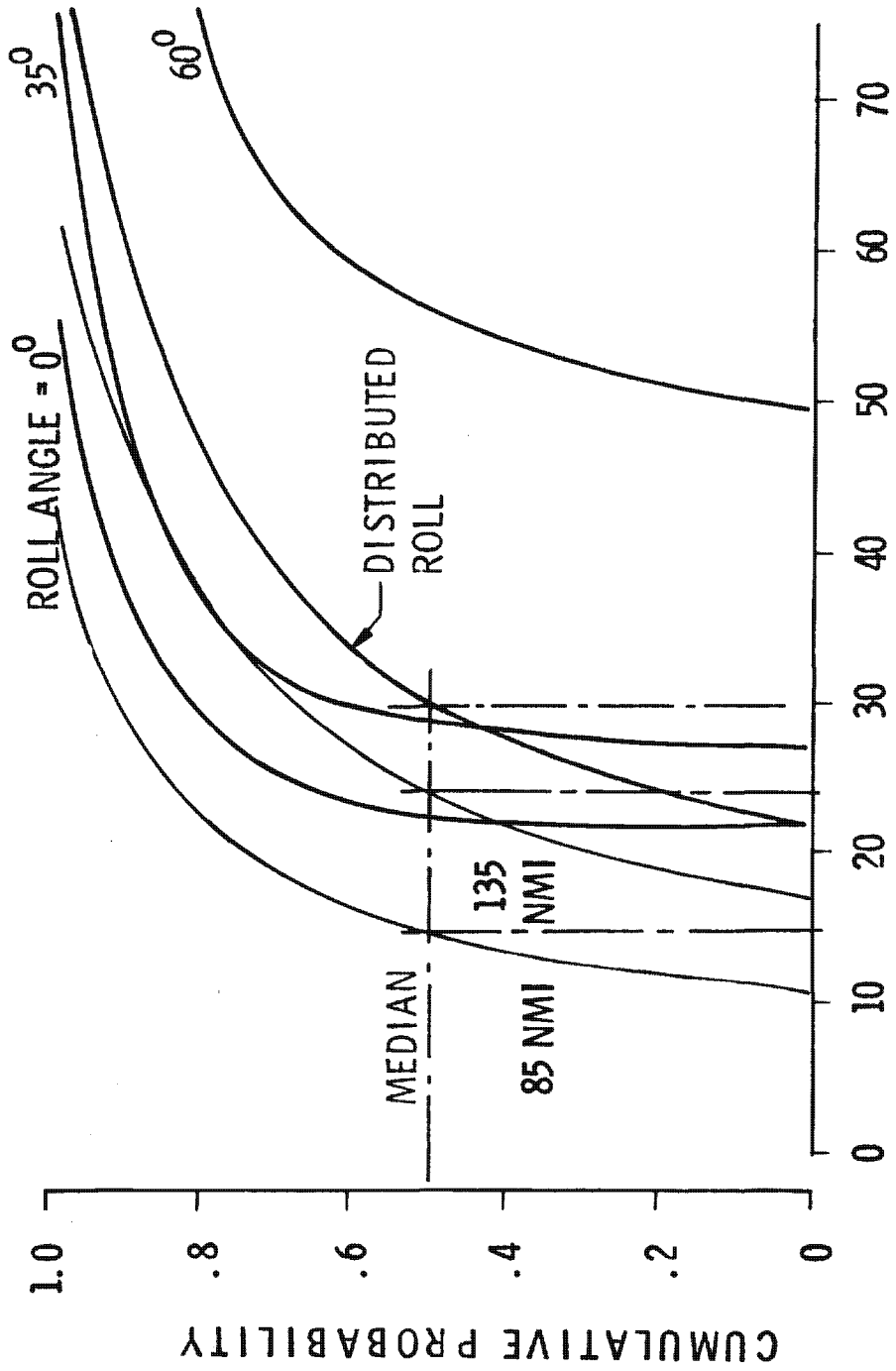
GROUND RESOLUTION

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



SECRET / 10442 HANDS Via RYEMAN Control System Only 14 A

GROUND RESOLUTION

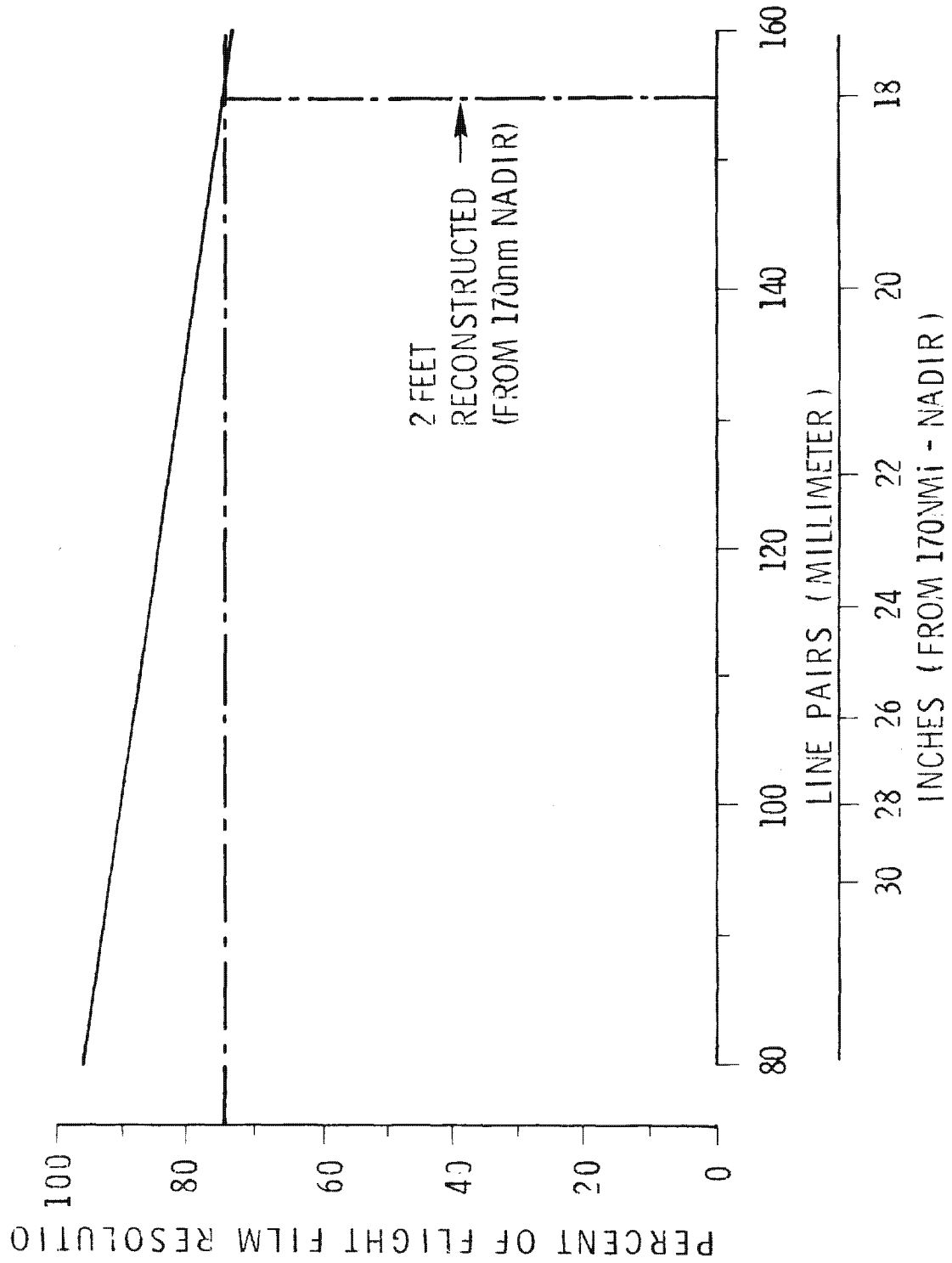
* TARGET CONTRAST = 3:1
* LAT. DIST. = 20°-70° N

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RECONSTRUCTED RESOLUTION VS FLIGHT FILM RESOLUTION

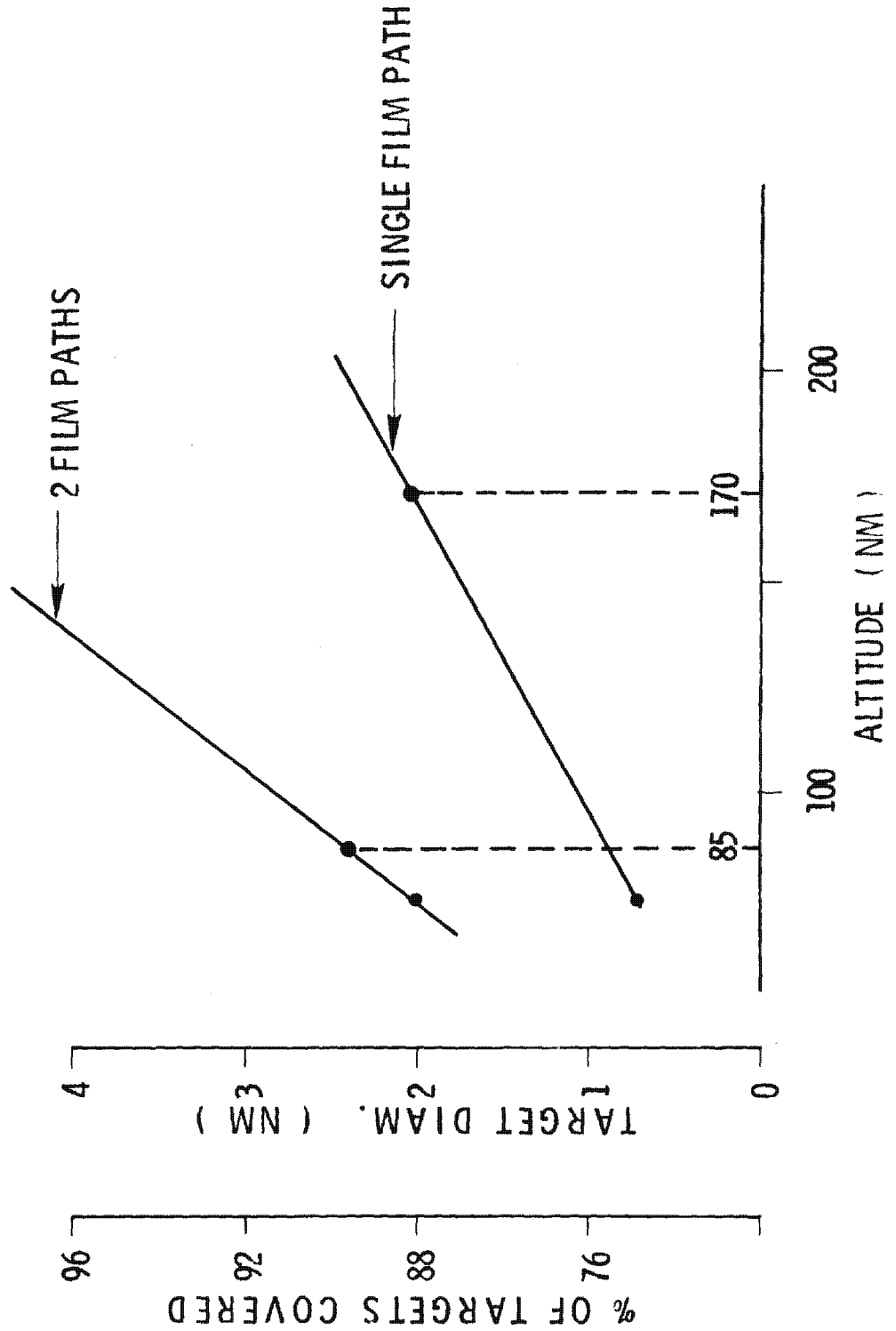


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TARGET SIZE CAPABILITY
(NADIR)

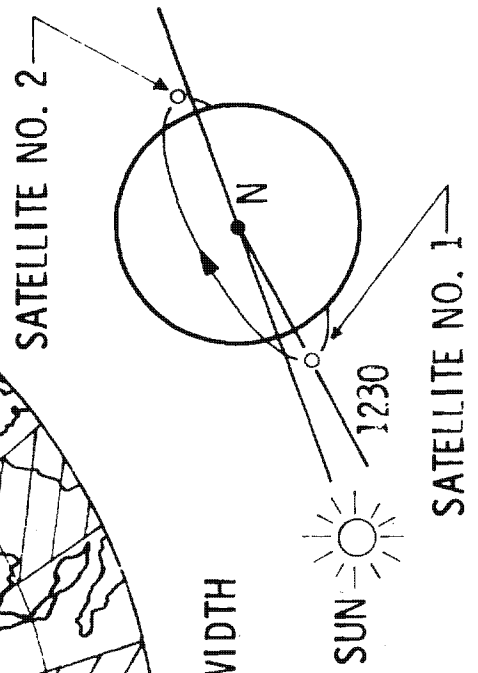
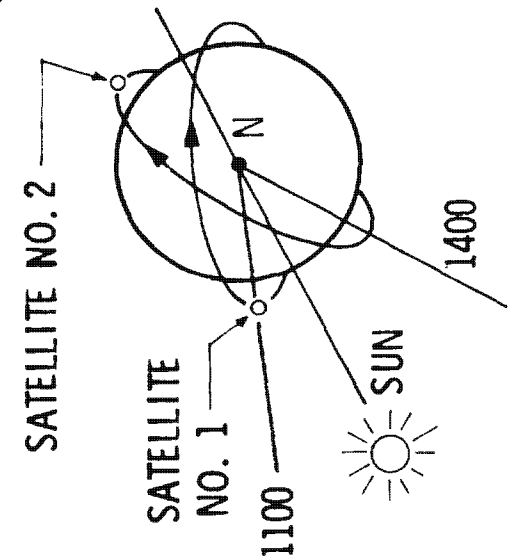
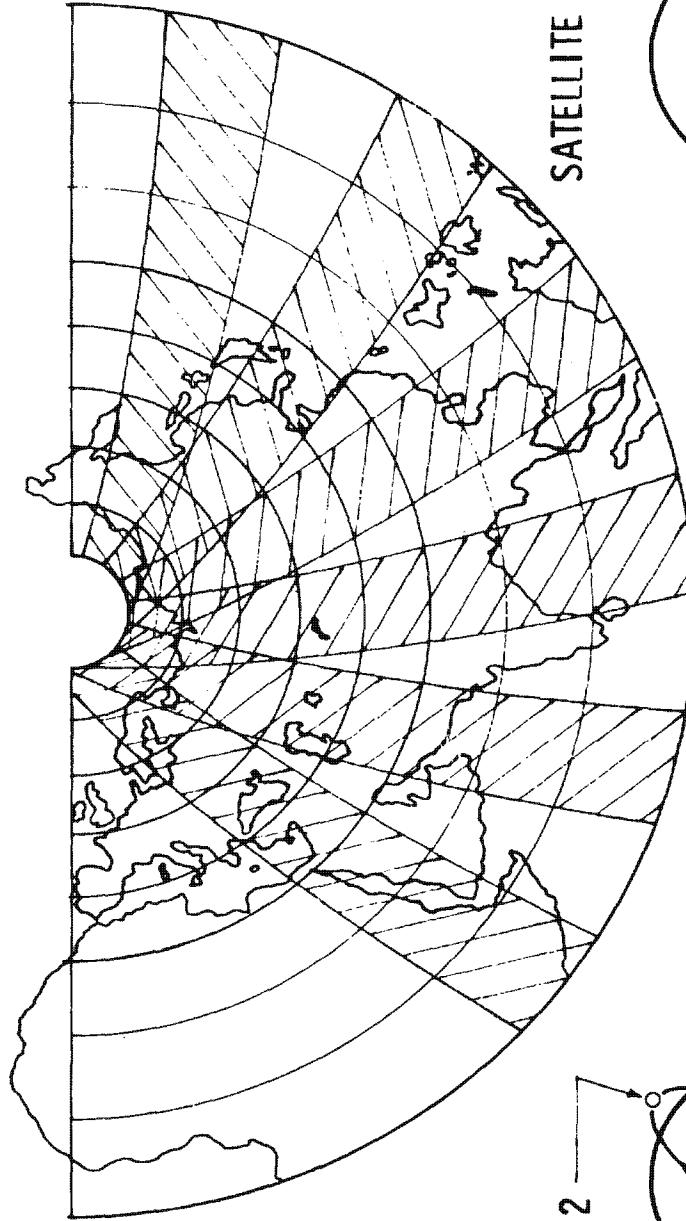
95% PROBABILITY



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SATELLITE DEPLOYMENT

170-NM CIRCULAR ORBIT - SINGLE VEHICLE



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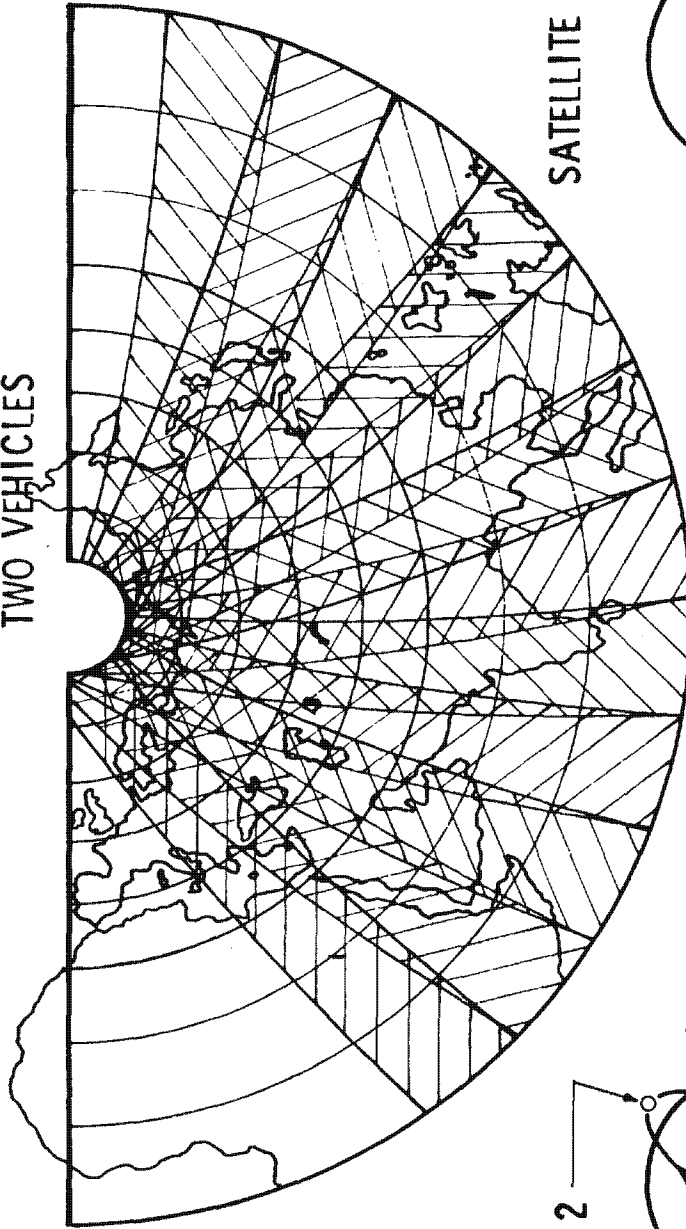
1-1 A

SATELLITE DEPLOYMENT

SAFISP

170-NM CIRCULAR ORBIT -

TWO VEHICLES



SATELLITE NO. 2

SATELLITE NO. 1

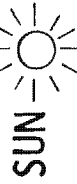
1100



SUN

1400

670 NM SWATH WIDTH

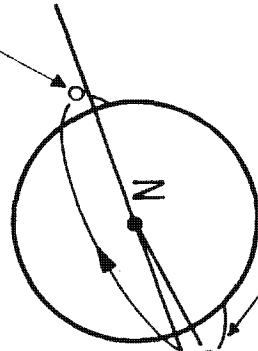


SUN

1230

SATELLITE NO. 1

SATELLITE NO. 2

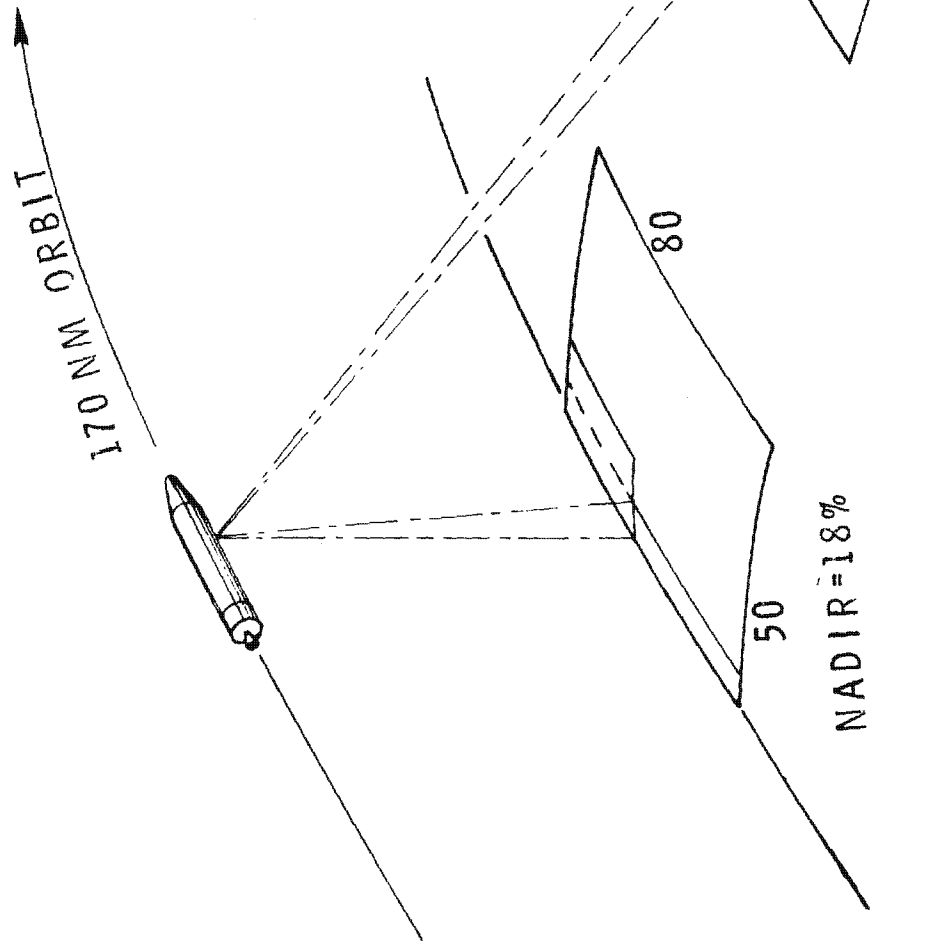


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1-18

SAFSP AREA COVERAGE - CRISIS

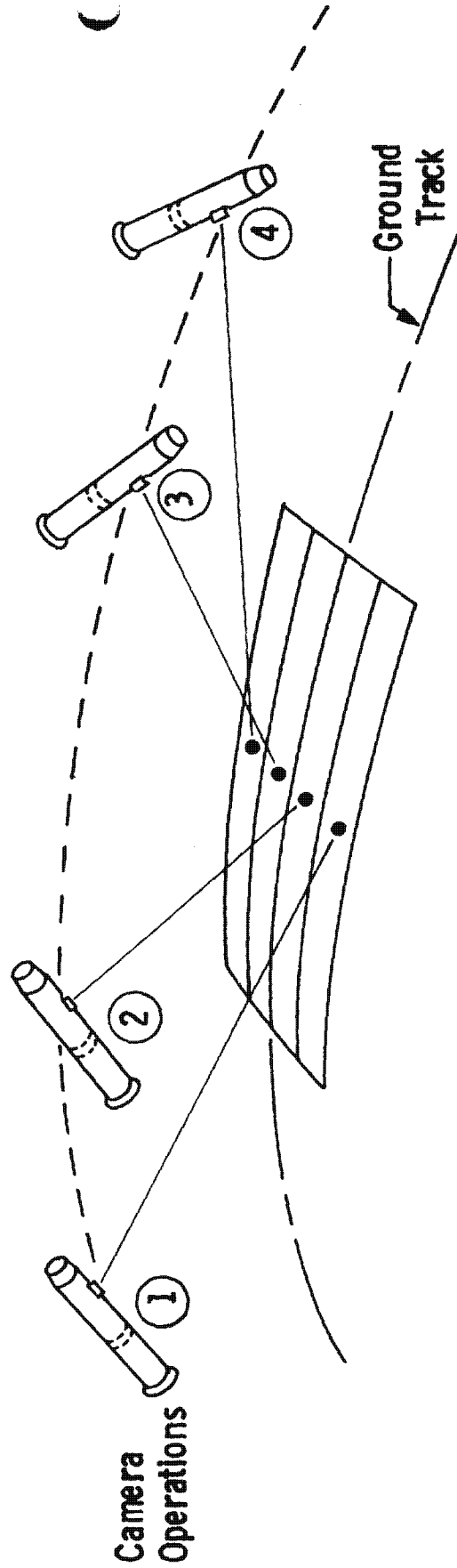


18
57° ROLL = 100%
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CRISIS MISSION COVERAGE

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

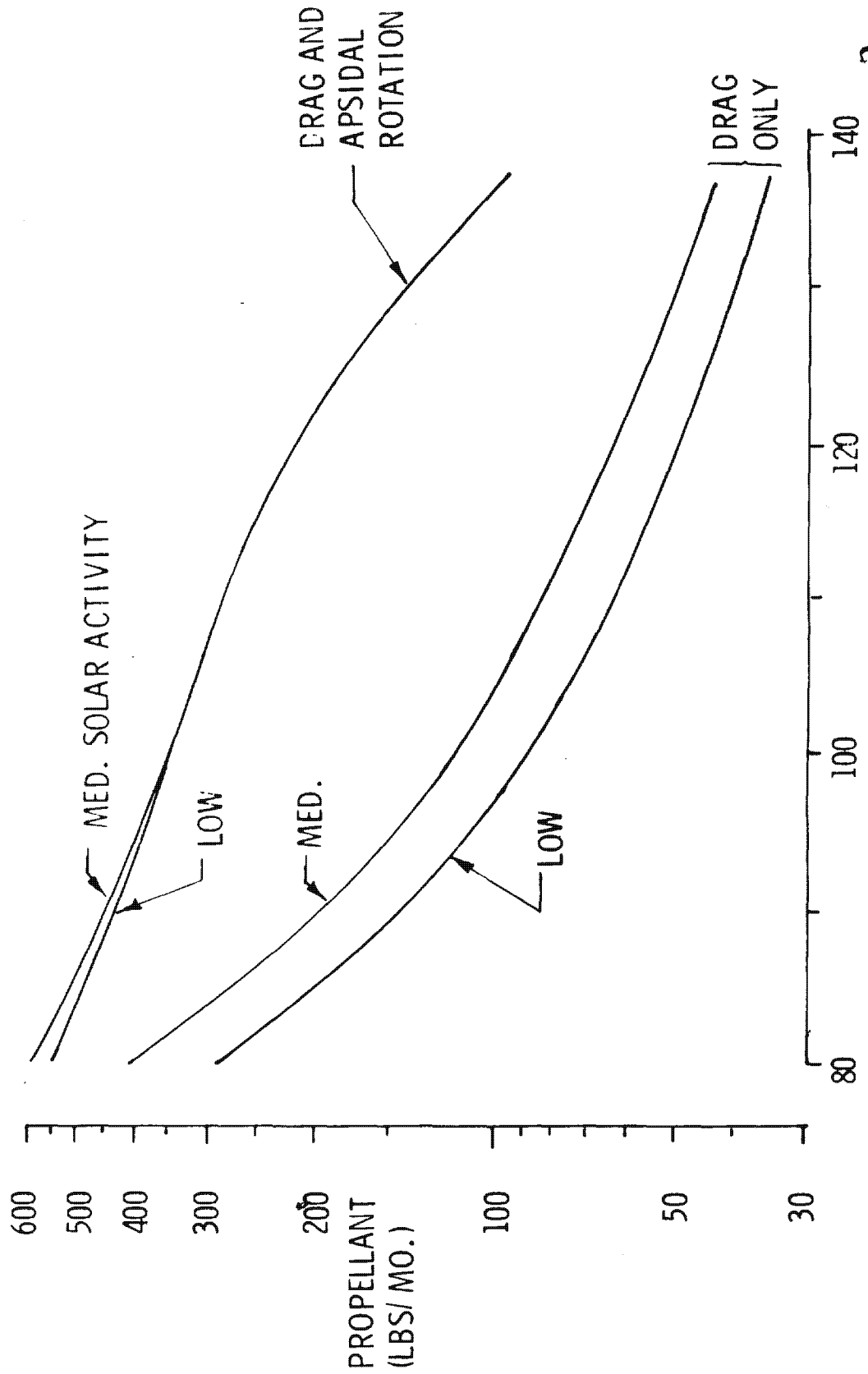
Coverage: 100% OF 50x80 NM AREA

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PROPELLANT REQUIRED
TO MAINTAIN DAILY REPEATING ORBITS



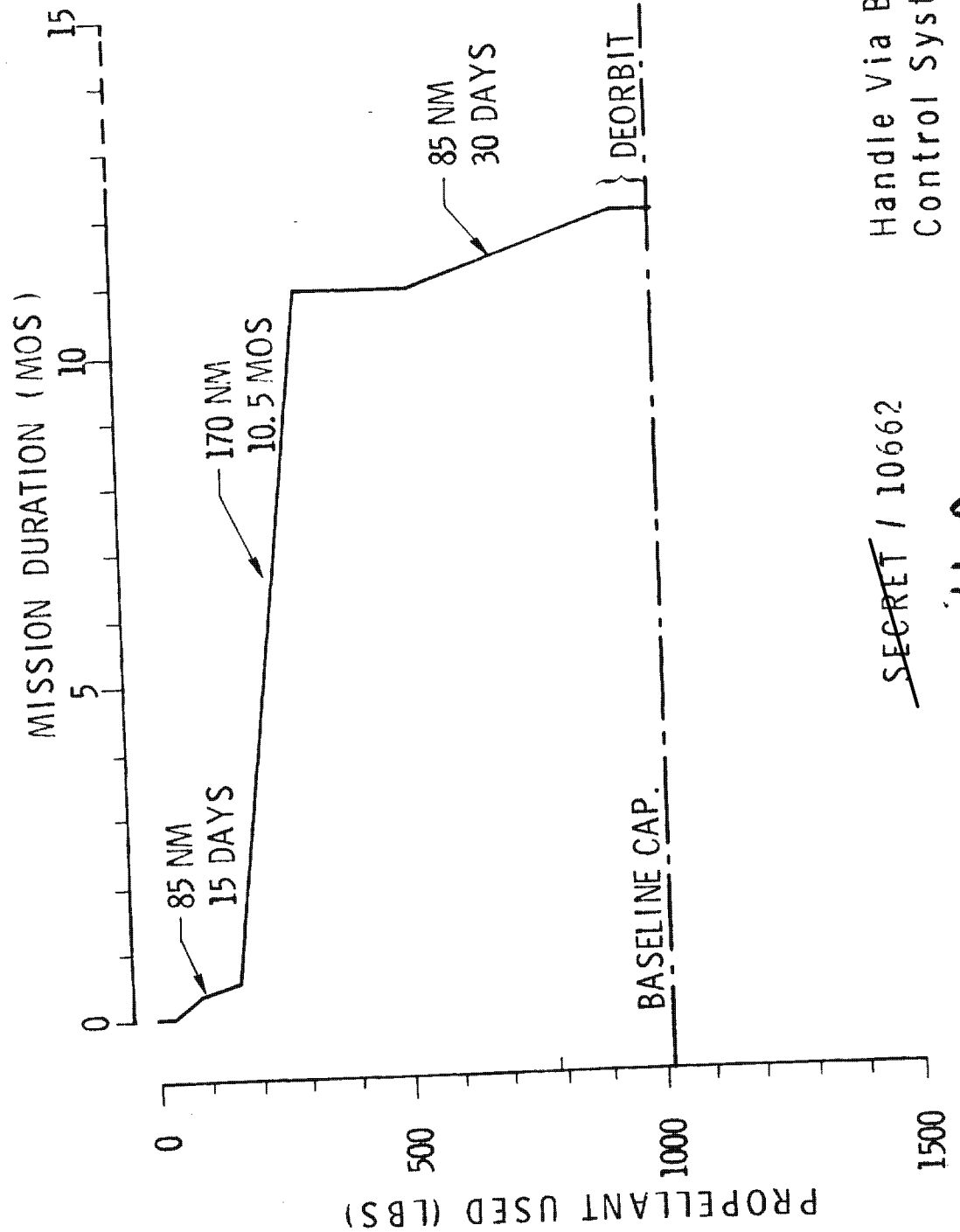
20
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ON-ORBIT PROPULSION CAPABILITY

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- NON-CRISIS OPTION



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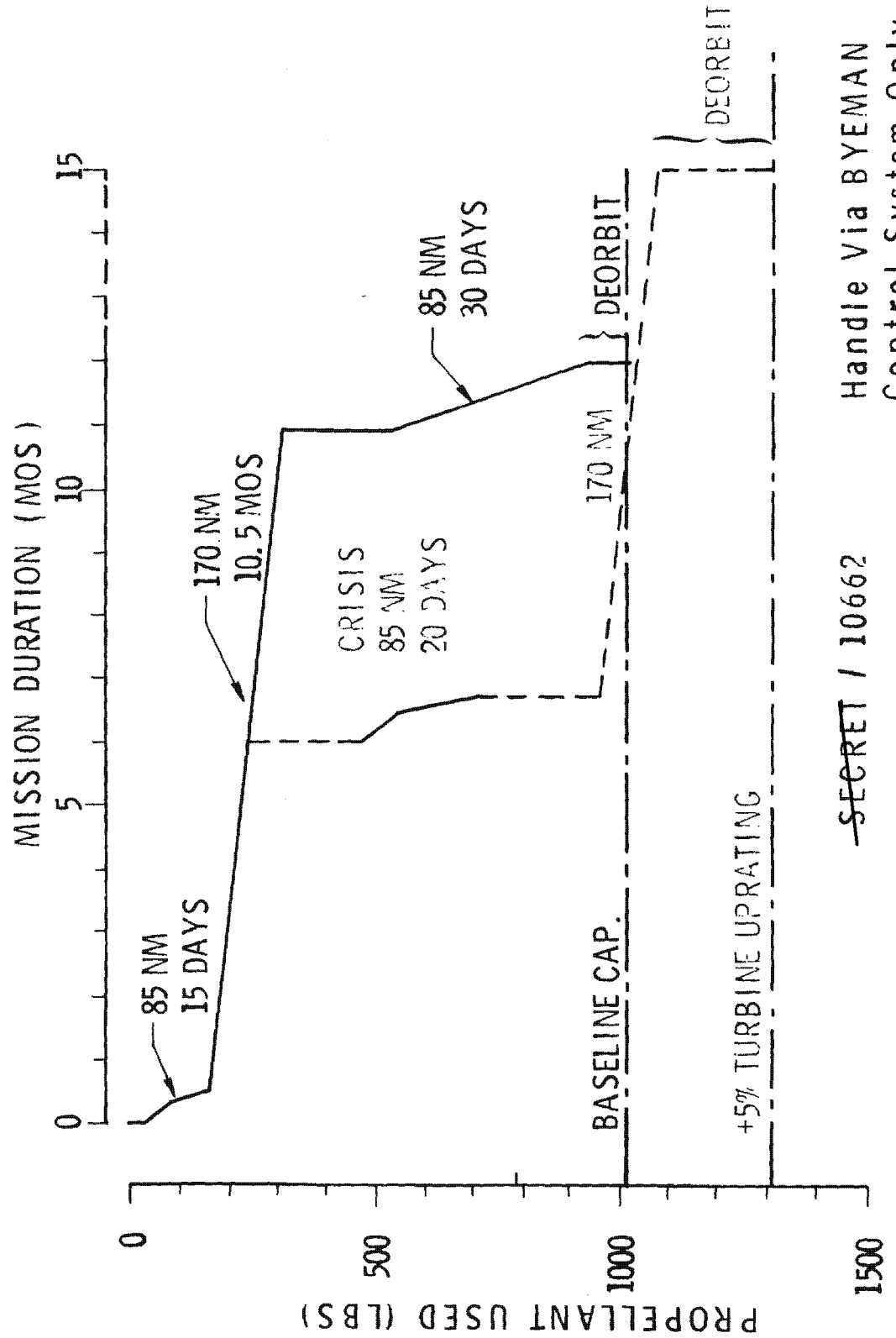
21 A

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ON-ORBIT PROPULSION CAPABILITY

- NON-CRISIS OPTION - CRISIS OPTIONS



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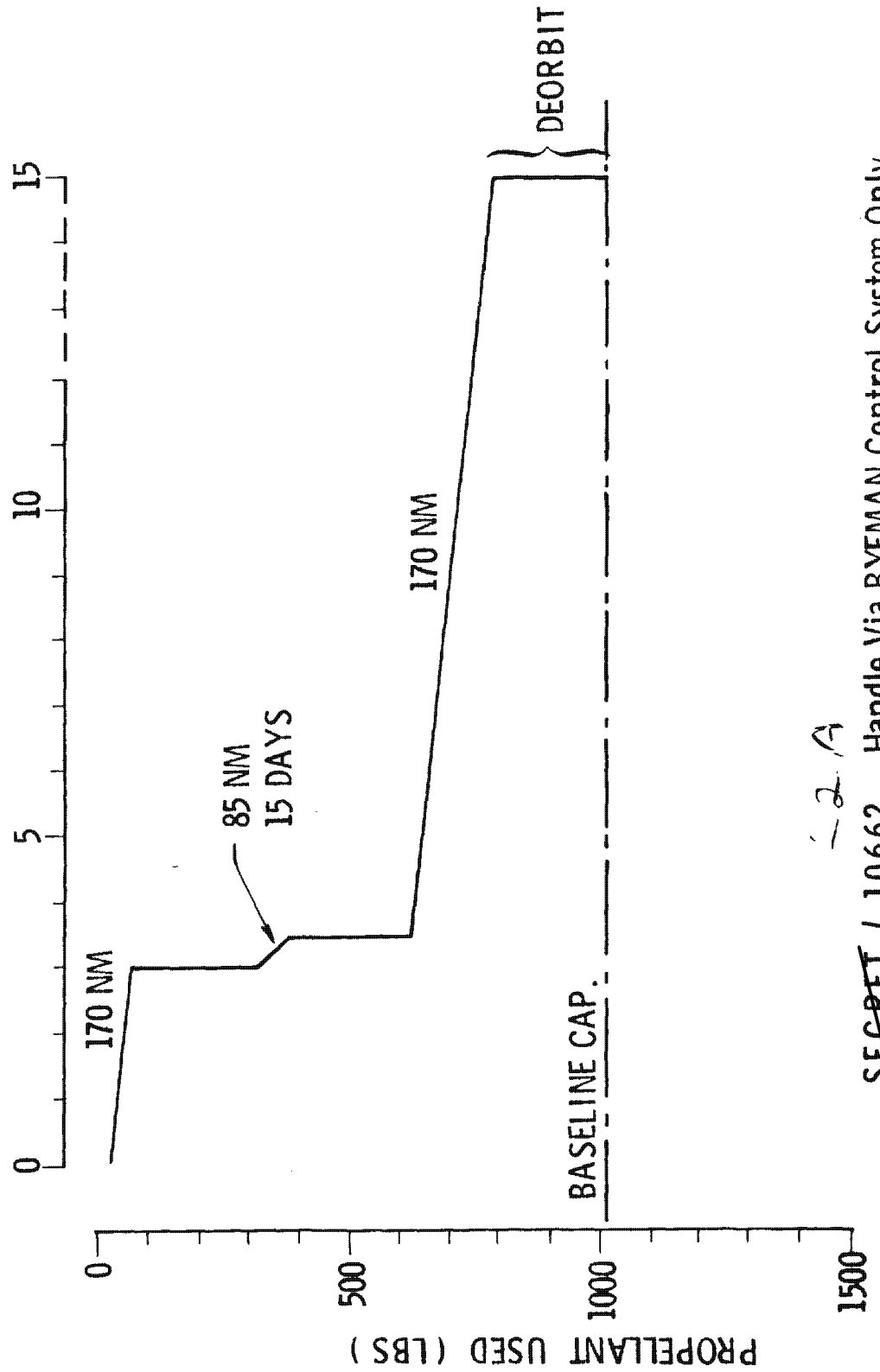
21 A

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ON-ORBIT PROPULSION CAPABILITY

- CRISIS OPTION TO 85 NM

MISSION DURATION (MOS)



2A

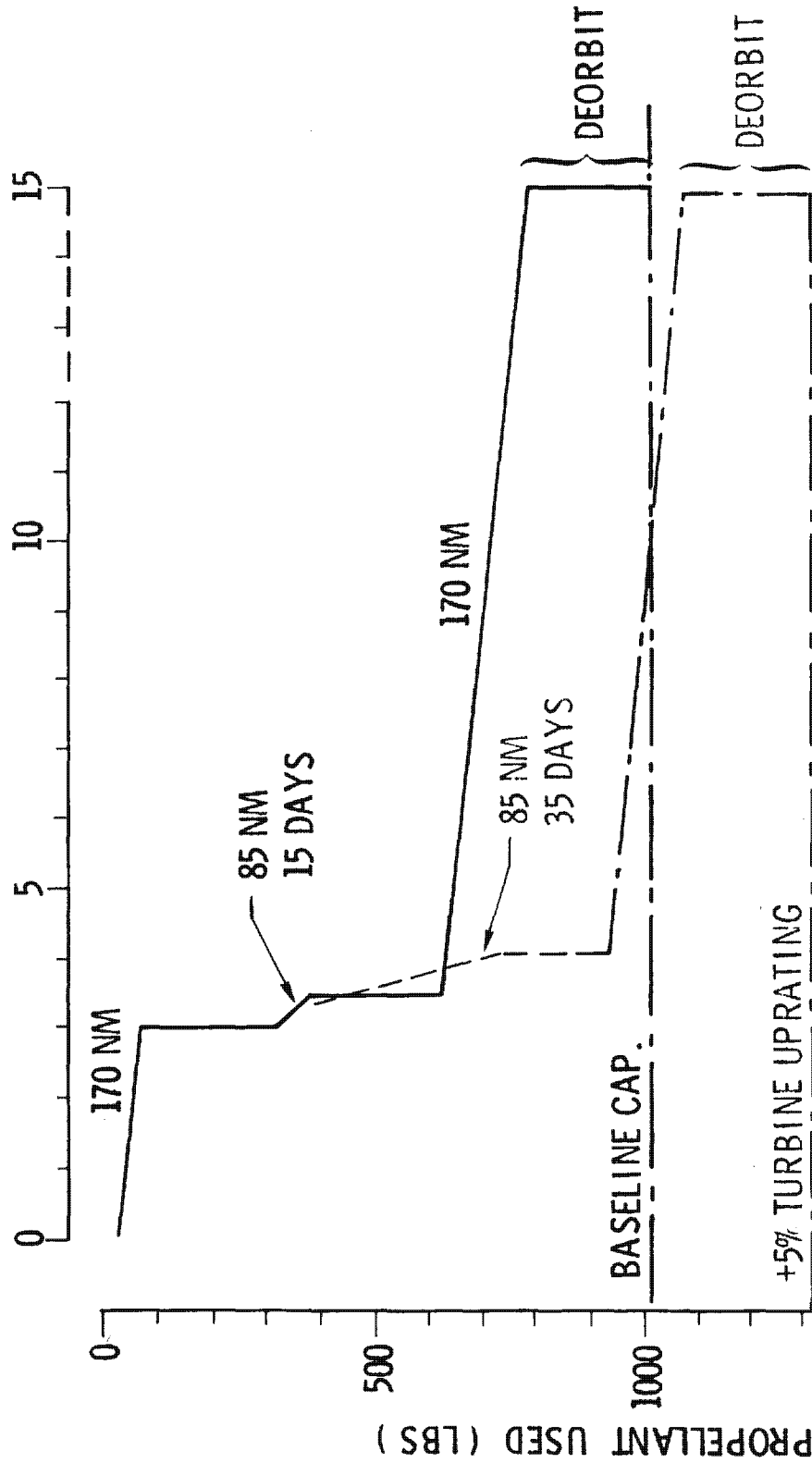
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ON-ORBIT PROPULSION CAPABILITY

- CRISIS OPTION TO 85 NM

MISSION DURATION (MOS)



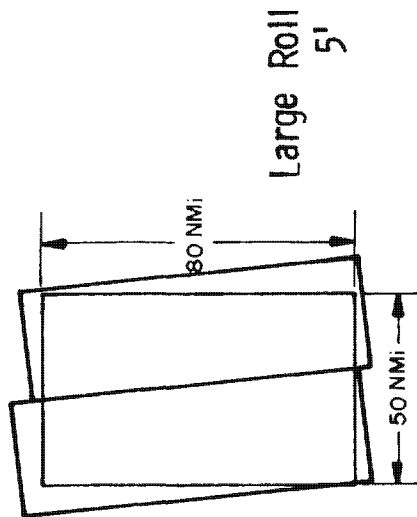
22B

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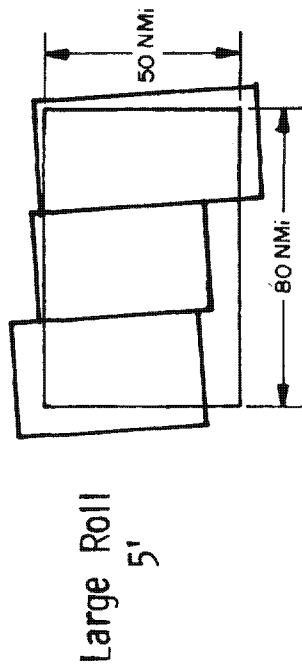
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SPECIFIC COLLECTION PROBLEMS FRO-G

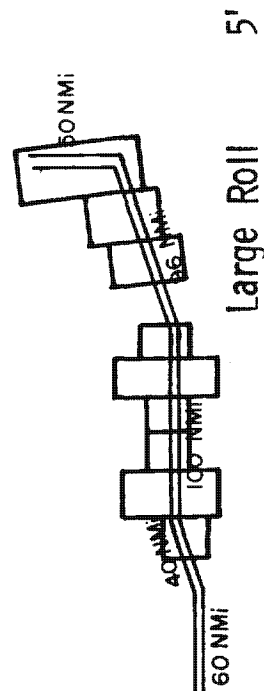
AREA COVERAGE -- IN-TRACK



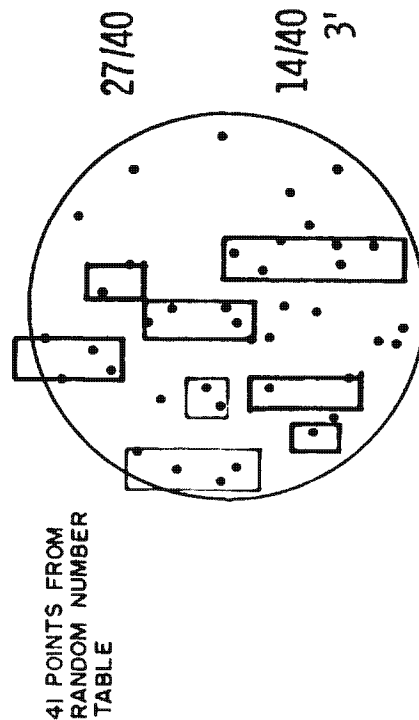
AREA COVERAGE -- CROSS-TRACK



LINES OF COMMUNICATION



INSTALLATIONS



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SAFISIP

FRO-G³ 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-G³ 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.

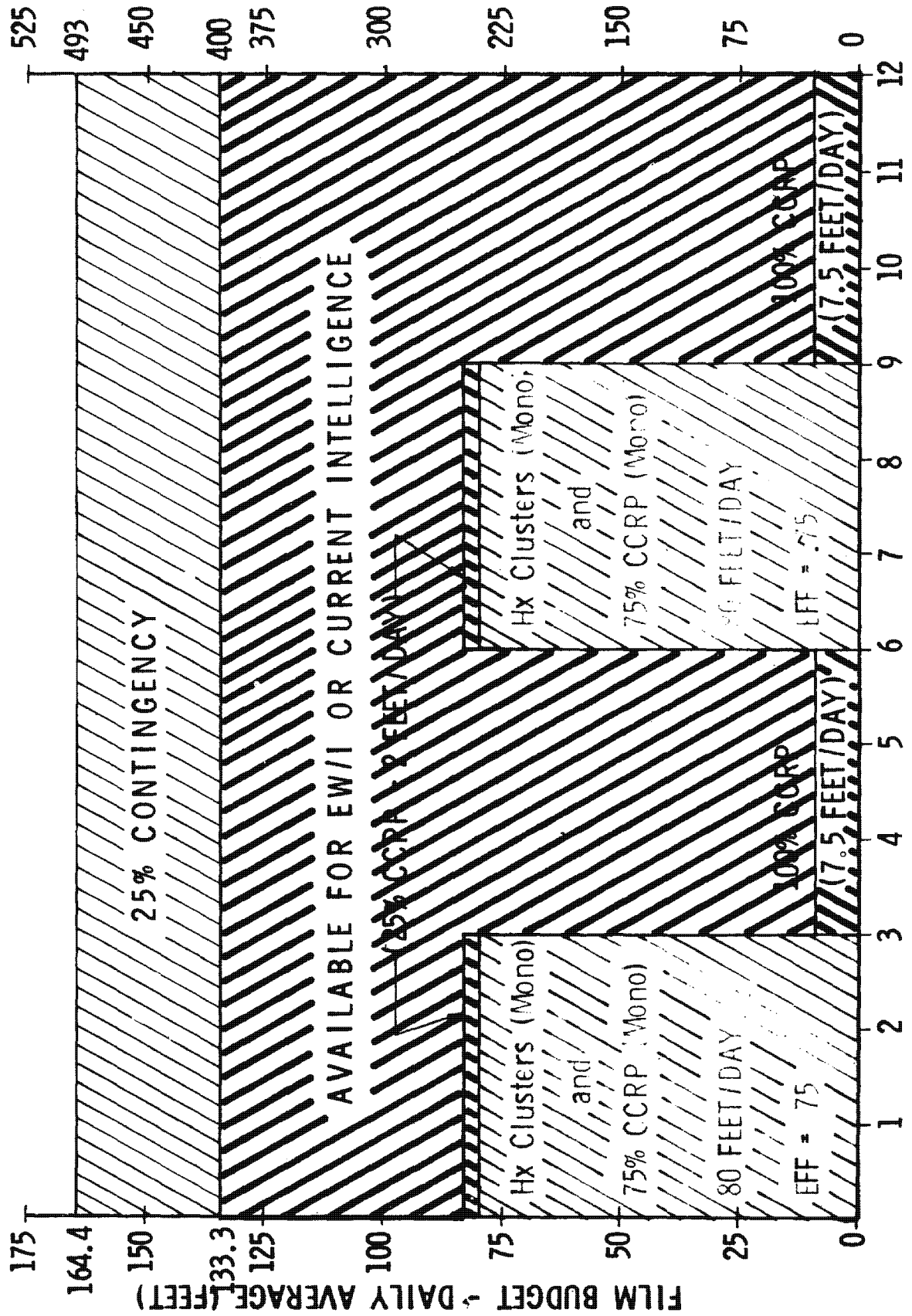
INCIDENTAL TARGET ACQUISITIONS DURING CLUSTER SURVEILLANCE WILL SATISFY APPROXIMATELY 75% OF GAMBIT CCRP TASK.

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FRO-G³ FILM BUDGET



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FILM READOUT SYSTEM PERFORMANCE SUMMARYTWO 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
 - 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

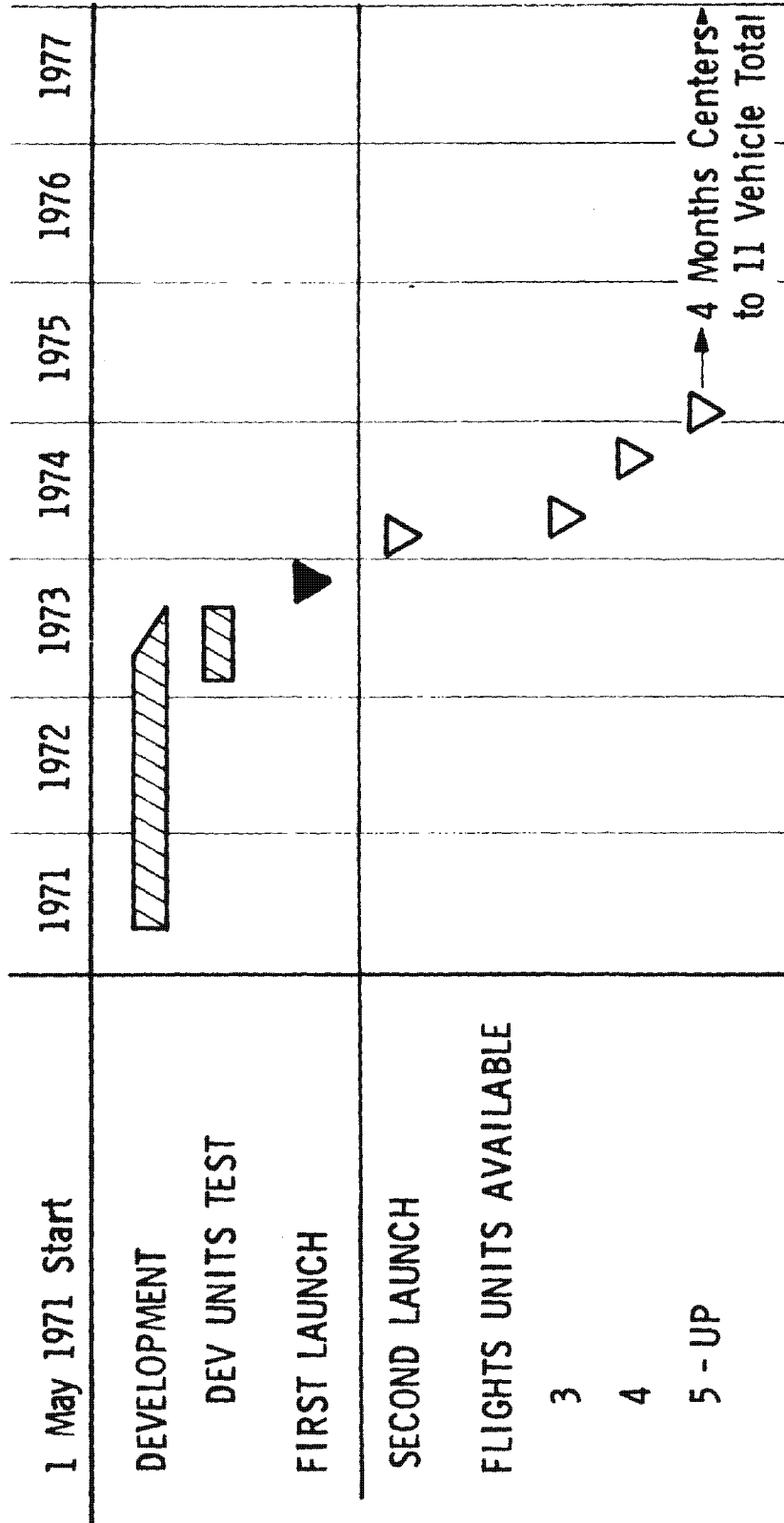
<u>1. RESOLUTION</u>	<u>OPTIMUM</u>	<u>NOMINAL</u>	<u>POOREST ACCEPTABLE</u>
INSTALLATION SURVEILLANCE	≤ 1'	2' - 3'	5'
AREA SEARCH	2' - 3'	3' - 5'	5'
LINES OF COMMUNICATION	2' - 3'	3' - 5'	5'
<u>MODE</u>	ALL STEREO	STEREO - SOME MONO ACCEPTABLE	MONO - SOME STEREO DESIRED
<u>2. GROUND AREA IMAGED</u>			
INSTALLATION SURVEILLANCE	≥ 3 X 3 NM	3 X 3 NM	≥ 2 X 2 NM
AREA SEARCH	≥ 10,000 NM ²	4,000 NM	2,000 NM ²
LINES OF COMMUNICATION	≥ 5 X 500 NM ²	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 ²)/DAY	≥ 10,000	4,000	2,000
<u>IMAGE DELIVERY TIME</u>	≤ 1 HOUR	≤ 12 HOURS	≤ 20 HOURS
<u>DELIVERY LOCATION</u>	WASH/THEATER	WASHINGTON	OPIC
<u>ACTIVATION TIME</u>	< 1 HOUR	1 - 12 HOURS	72 HOURS

28 TOP SECRET

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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	6.3
TOTAL	<u>36.7</u>

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