

CIA
Job # [redacted]
File # [redacted]
Bx [redacted]

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CONTROL NO. [redacted]

REFERRED TO OFFICE	RECEIVED			RELEASED		SEEN BY	
	SIGNATURE	DATE	TIME	DATE	TIME	NAME & OFFICE SYMBOL	DATE
[redacted]							

Handle Via Indicated Controls

~~TALENT-KEYHOLE~~

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.....
.....
.....

WARNING

~~This document contains information affecting the national security of the United States within the meaning of the espionage laws U. S. Code Title 18, Sections 793 and 794. The law prohibits its transmission or the revelation of its contents in any manner to an unauthorized person, as well as its use in any manner prejudicial to the safety or interest of the United States or for the benefit of any foreign government to the detriment of the United States. It is to be seen only by personnel especially indoctrinated and authorized to receive information in the designated control channels. Its security must be maintained in accordance with regulations pertaining to TALENT-KEYHOLE Control System.~~

Declassified and Released by the N R O

In Accordance with E. O. 12958

on NOV 26 1997

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GROUP 1
Excluded from automatic
downgrading and declassification

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[REDACTED]
19 March 1969

MEMORANDUM FOR: Distribution

SUBJECT : Copies of Viewgraphs Presented at
12 September 1968 CORONA Exposure
Meeting

] Attached is a set of most of the viewgraphs presented at the subject meeting. I have attempted to order the copies in a logical sequence; however, I cannot guarantee that they are in the order as presented. Because of the time involved in making these copies, I am providing only one set per organization. Thank you again for your attendance and participation.

Distribution;

[REDACTED]

[REDACTED]

GROUP 1
Excluded from automatic
downgrading and
declassification

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HANDLE VIA
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RED DOG TESTS

61 LOW ALTITUDE TESTS IN

46 HIGH ALTITUDE TESTS

12 MILITARY AIRCRAFT

3 VEHICLES

2 INSTRUMENT CONFIGURATIONS

9 INSTRUMENT CONFIGURATIONS

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UNITED STATES GOVERNMENT PRINTING OFFICE: 1964 O 344-000

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EXPOSURE EXPERIMENTS IN OPERATIONAL MISSIONS

[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

1101 COMPARE EXPOSURE OF FIVE SLITS • RANGE LESS THAN ONE STOP. (CHECK
1102 COMPARE EXPOSURE OF EIGHT SLITS ADJUST FOR KNOWN RANGE)

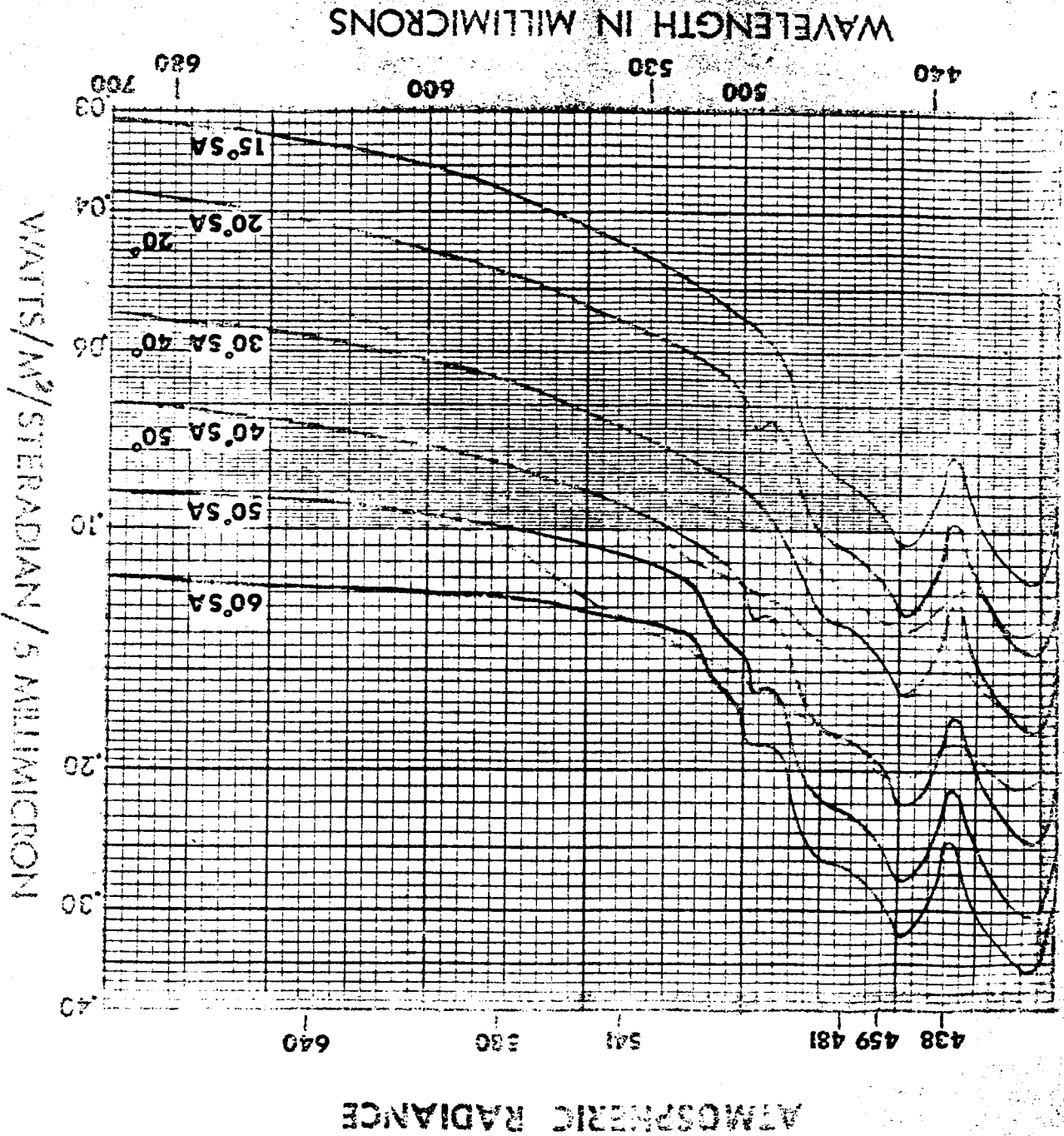
1101 COMPARE 3400 AND SO-230 IN DISIC • SO-230 700 SLOW

1101, 1102 SPECIAL FILTER EXPERIMENTS • EXPOSURE SAME AS IN MAIN (ORDER)

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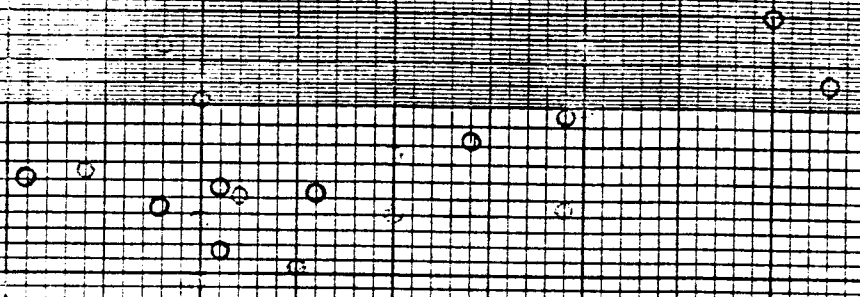
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0 10 20 30 40 50 60 70

SOLAR ALTITUDE

WATTS/M²/STERADIAN

○ DUNTLEY (1)
○ DUNTLEY (2)
8A & 8B (1)
8A & 8B (2)

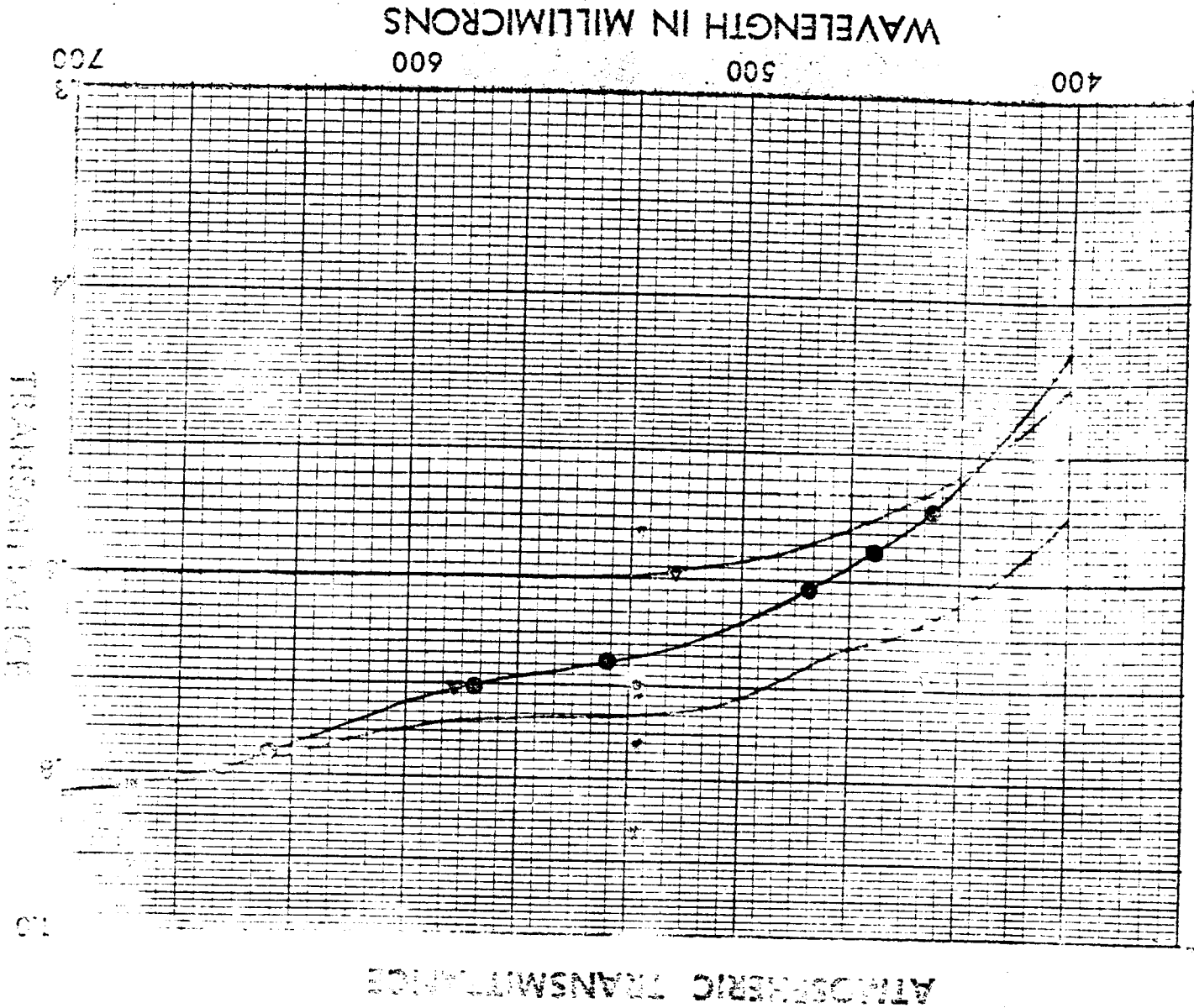


VERTICAL PATH RADIANCE
AT VERY HIGH ALTITUDE

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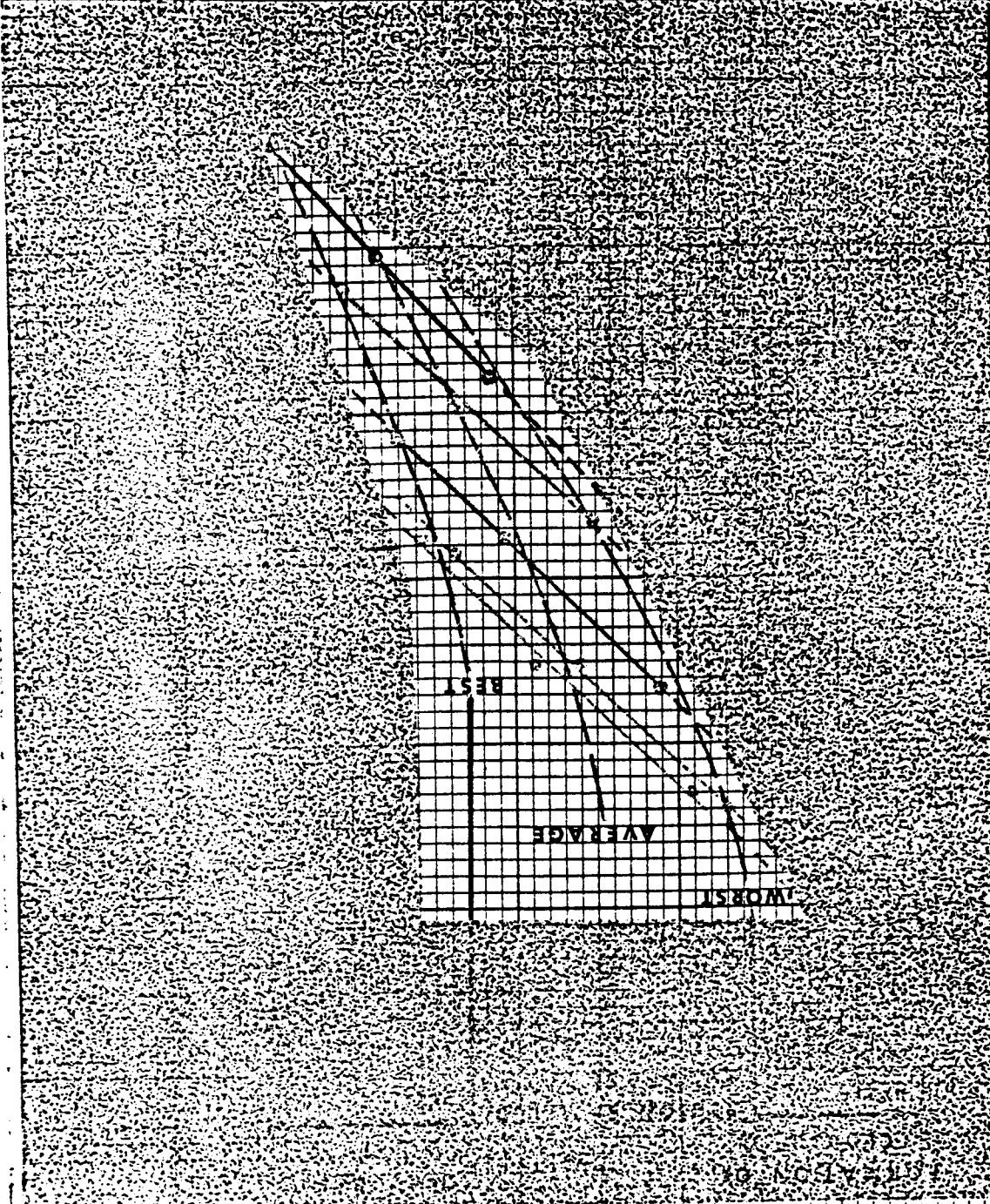
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PRODUCT NUMBER

ATMOSPHERIC TRANSMISSION

0 1 2 3 4 5 6 7 8 9 10



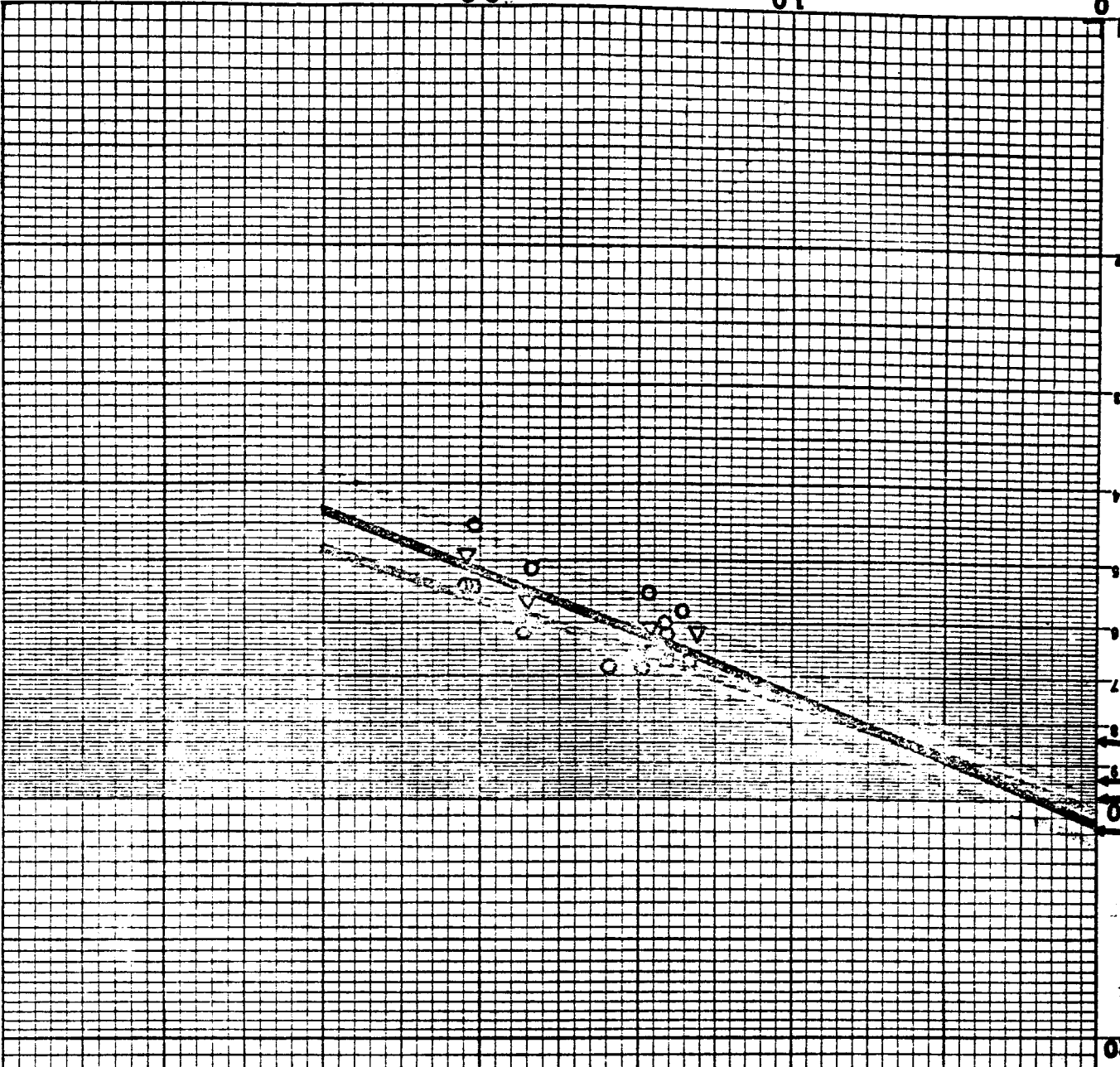
SKY RADIANCE (W/m²/steradian)

SKY RADIANCE VS. TRANSMITTANCE
SDR MEASUREMENTS
40° SOLAR ALTITUDE

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TALENT

11-7-73
REVISION 2



WAVELENGTH	COLOR	SYMBOL	JOHNSON'S SOLAR DATA
640 "	—	◆	8.30
581 "	—	▼	9.35
541 "	—	■	9.90
481 mμ	—	●	10.80

IRRADIANCE VS. AIR MASS

U.S. GOVERNMENT PRINTING OFFICE
1950 O-481-100

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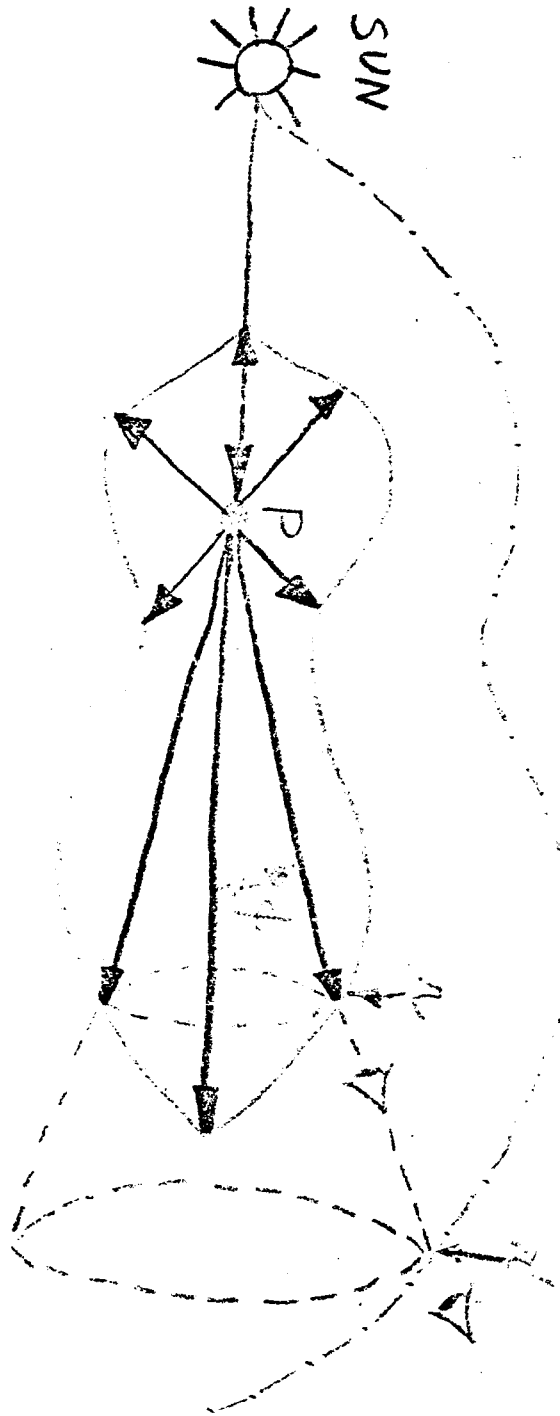
CRYSTAL BALL

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UNITED STATES TRANSPACIFIC CORPORATION

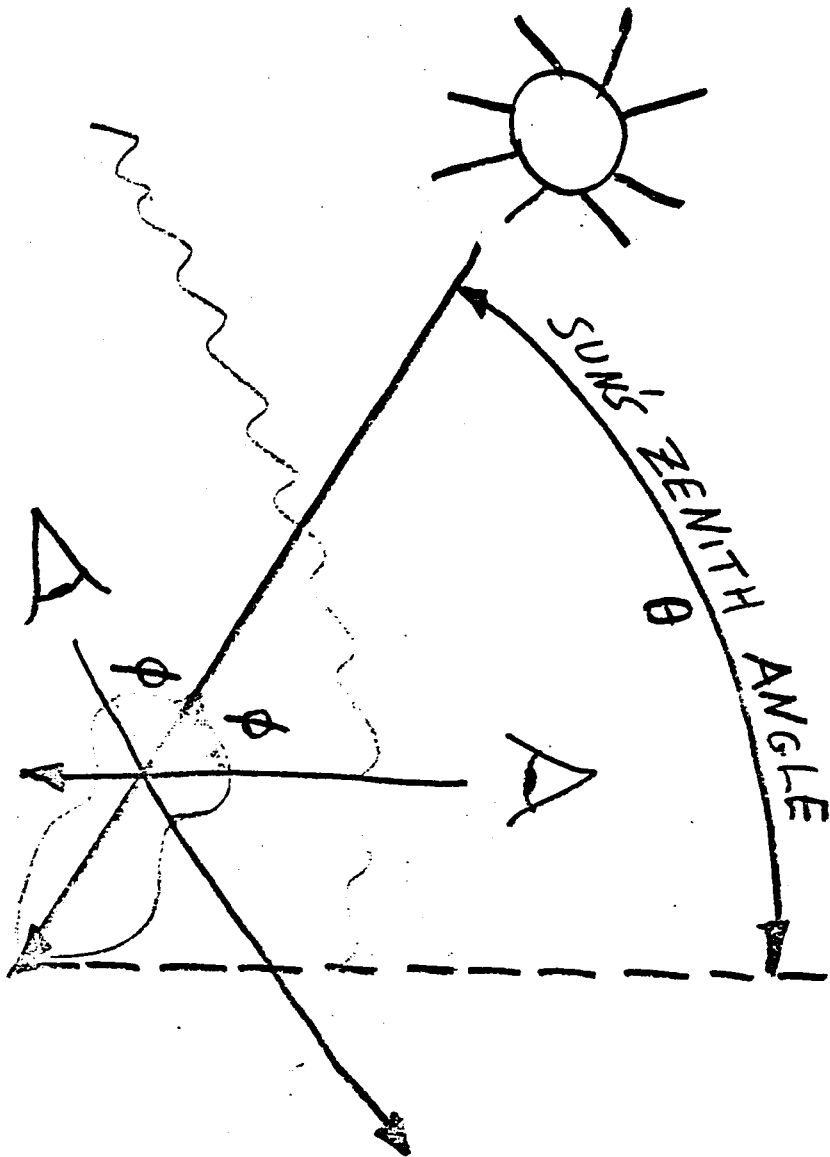
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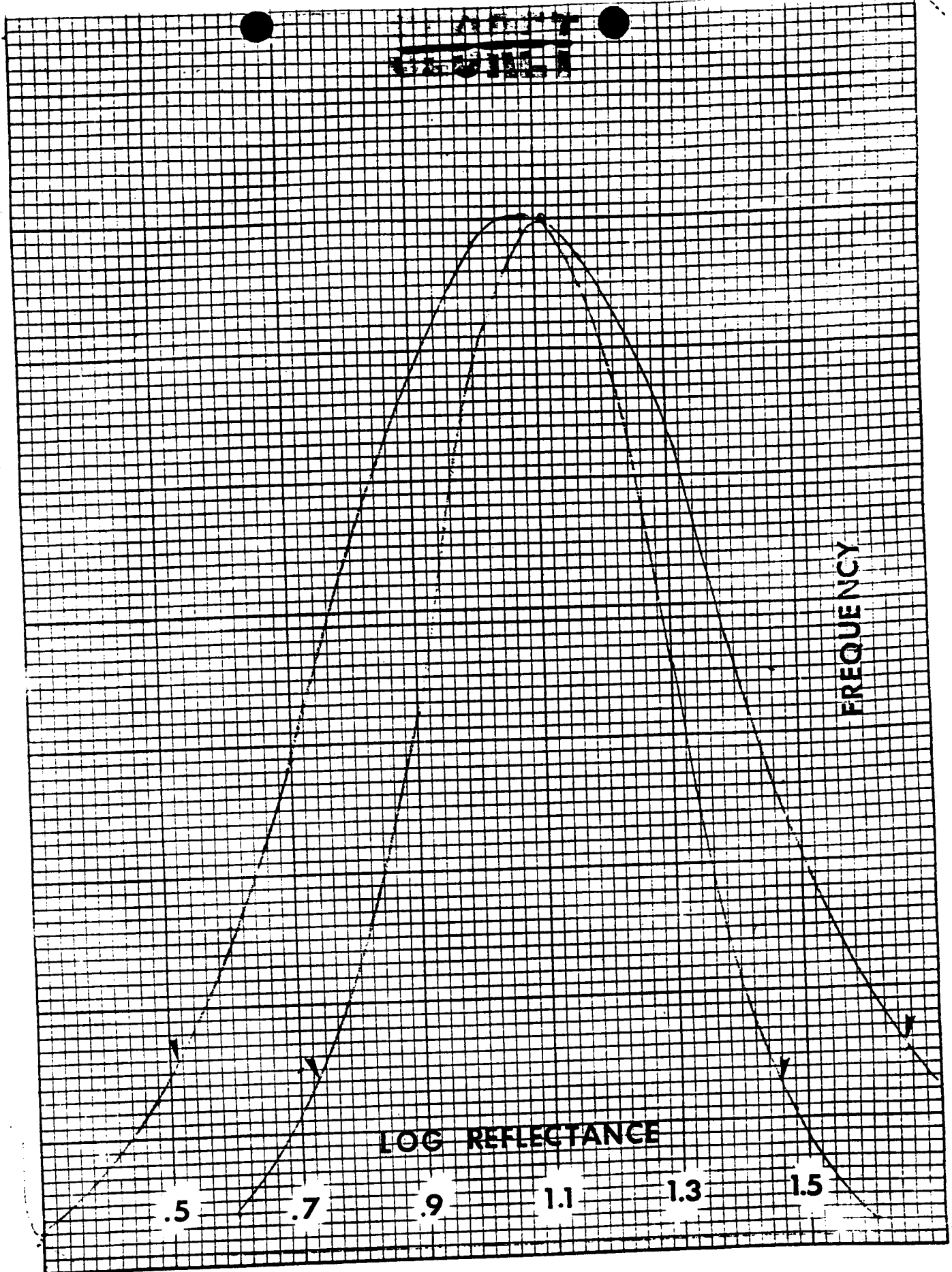
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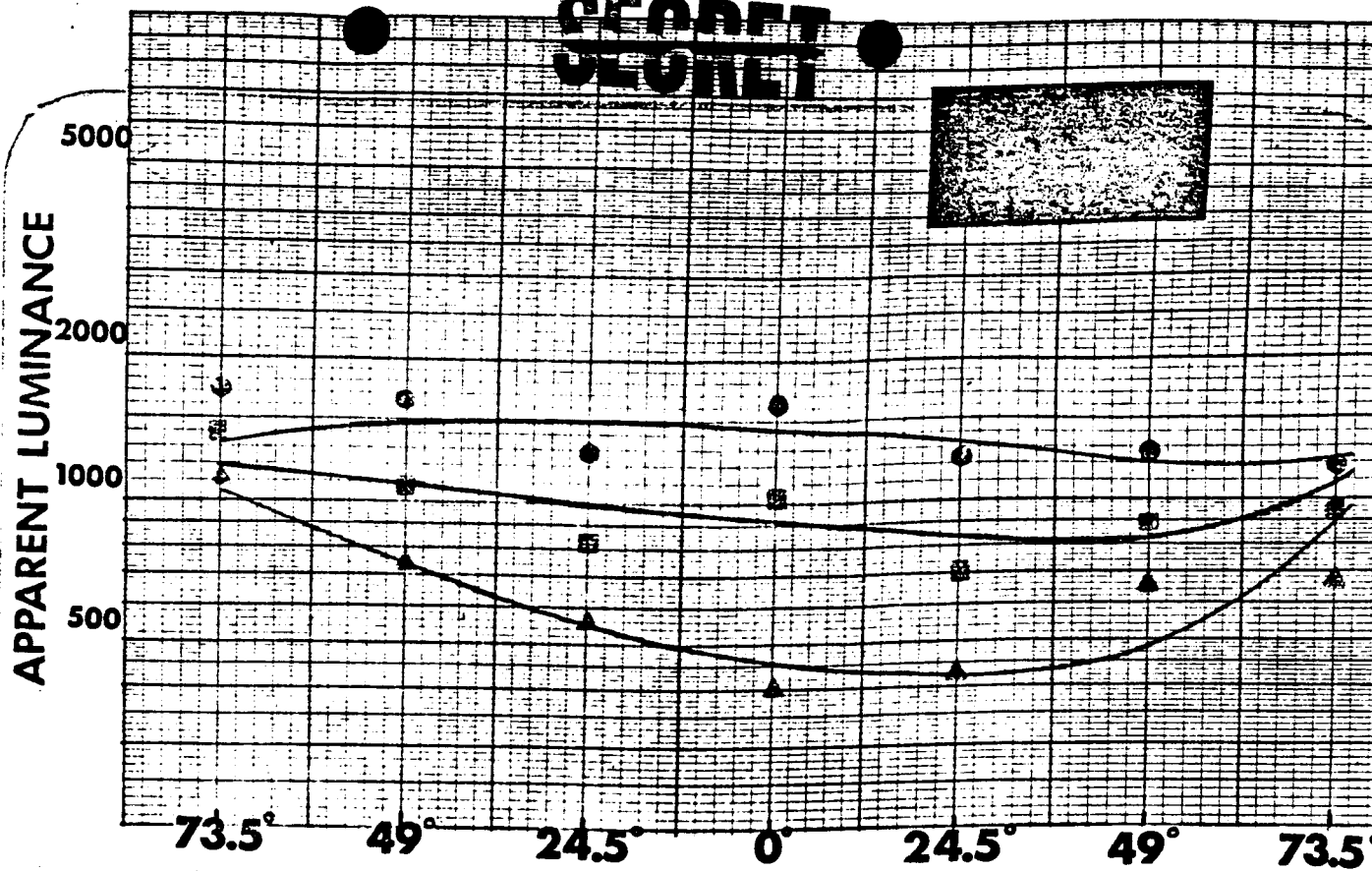
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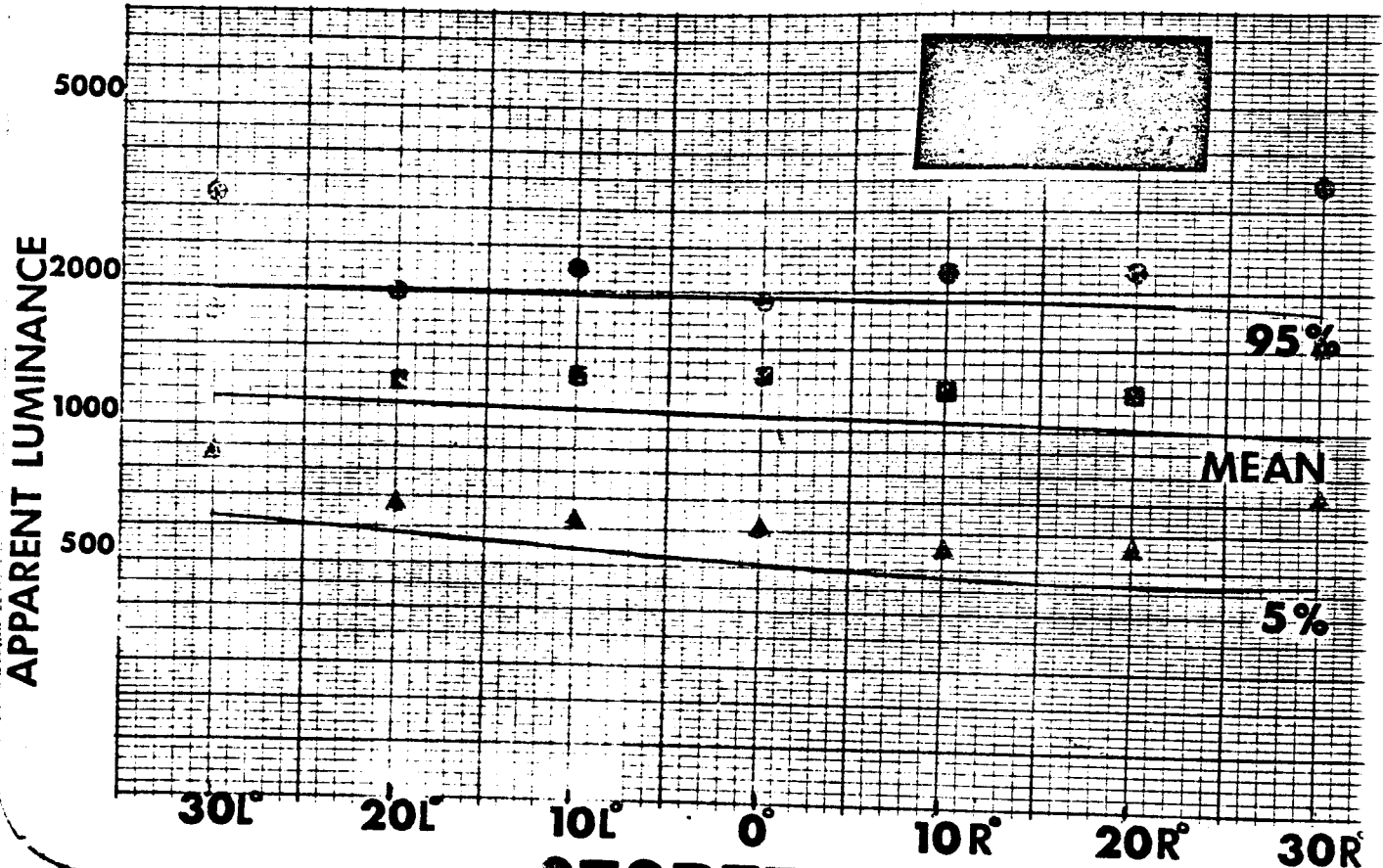


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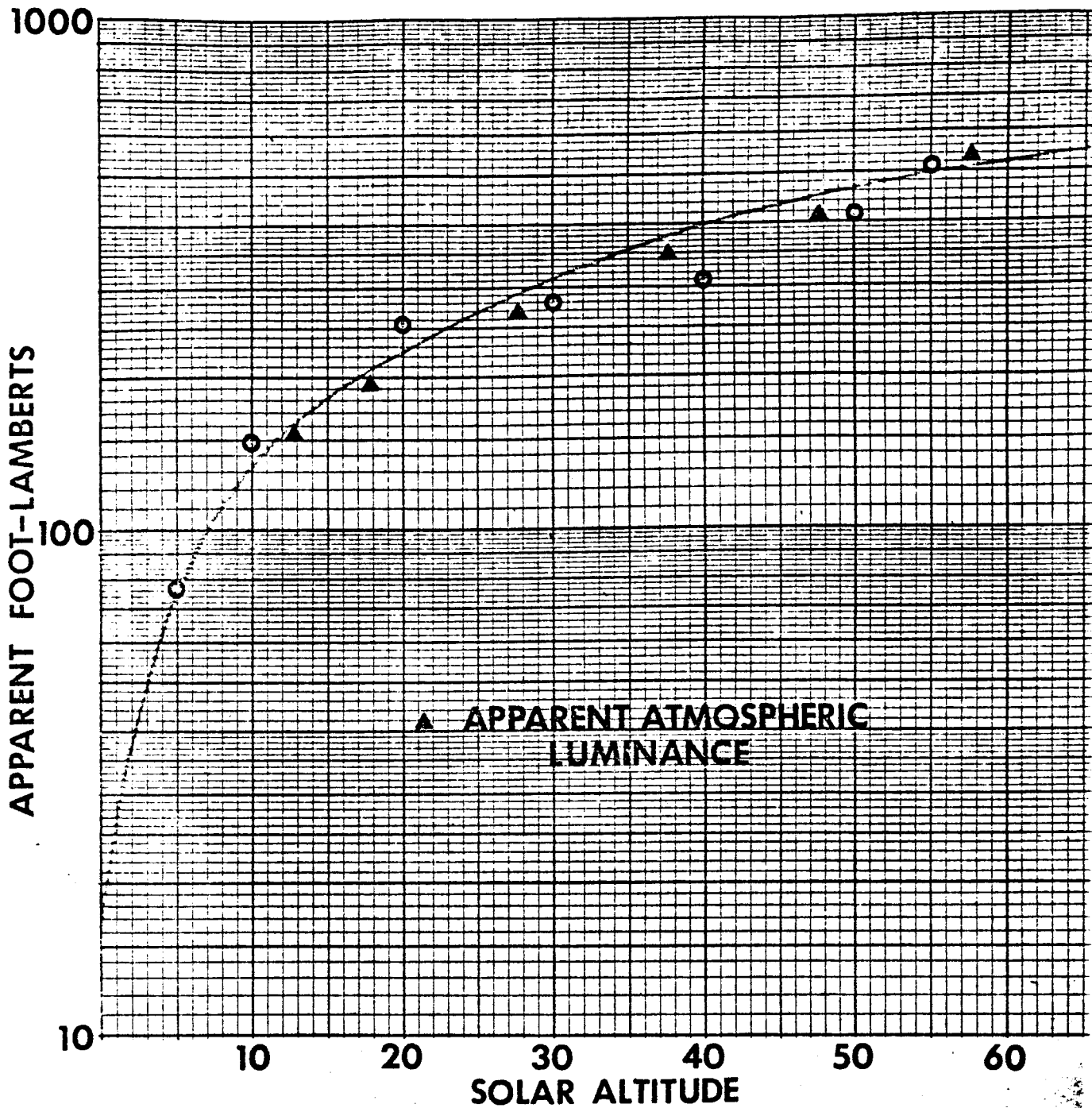
SCAN STATISTICS vs
CRYSTAL BALL PREDICTIONS



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DERIVED ATMOSPHERIC LUMINANCE DATA

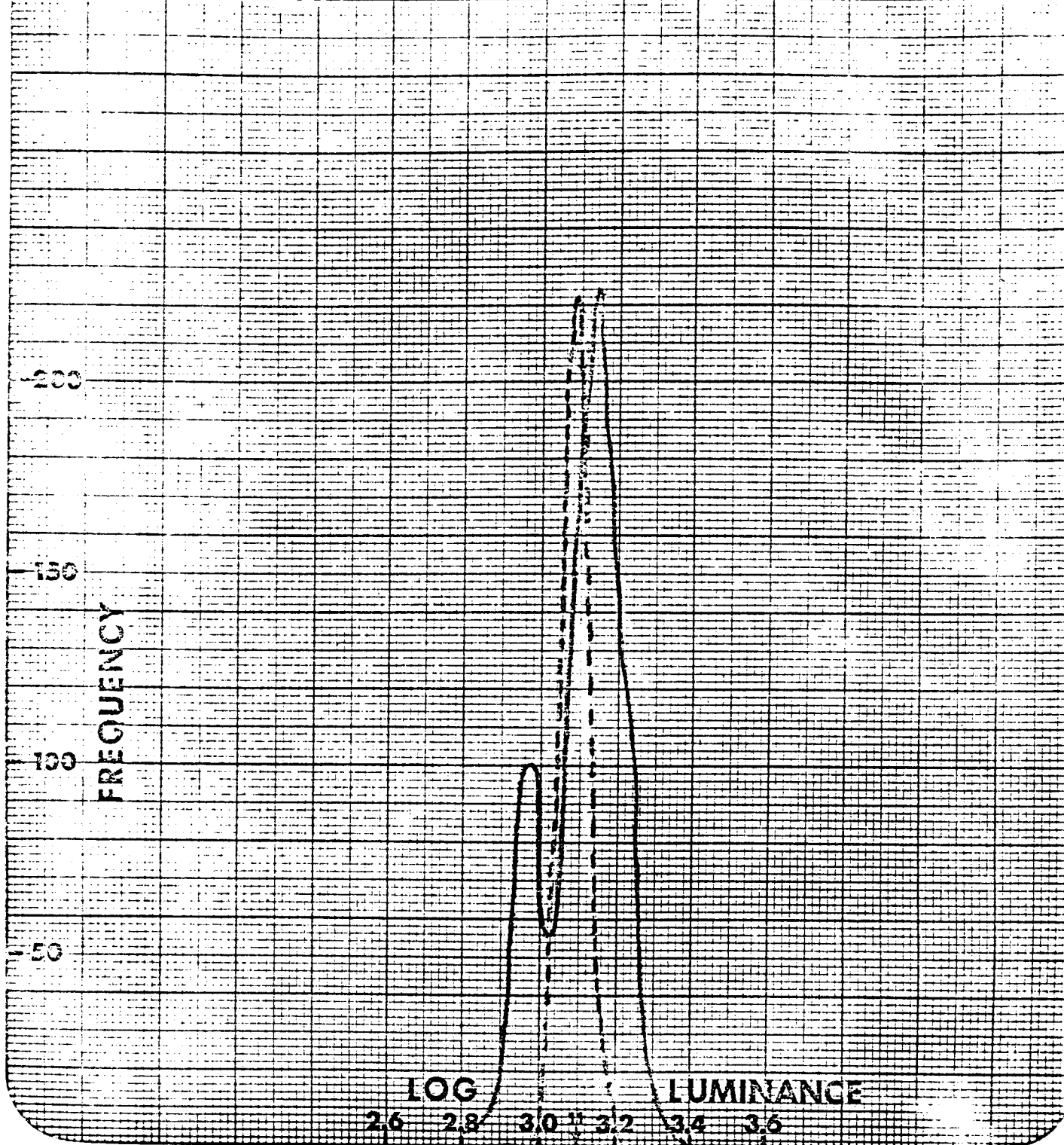


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LOG LUMINANCE FREQUENCY DISTRIBUTION

--- DAY 1
— DAY 2

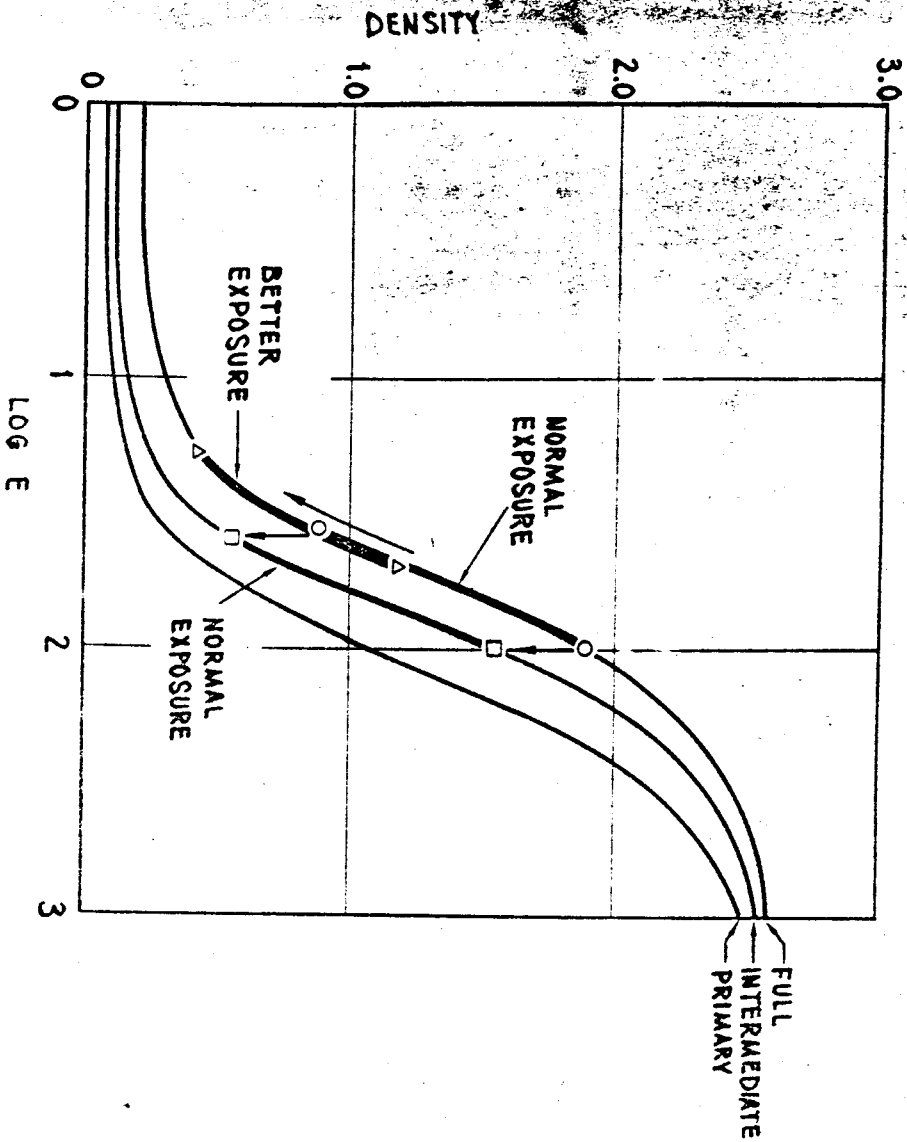


LOG LUMINANCE
2.6 2.8 3.0 3.2 3.4 3.6

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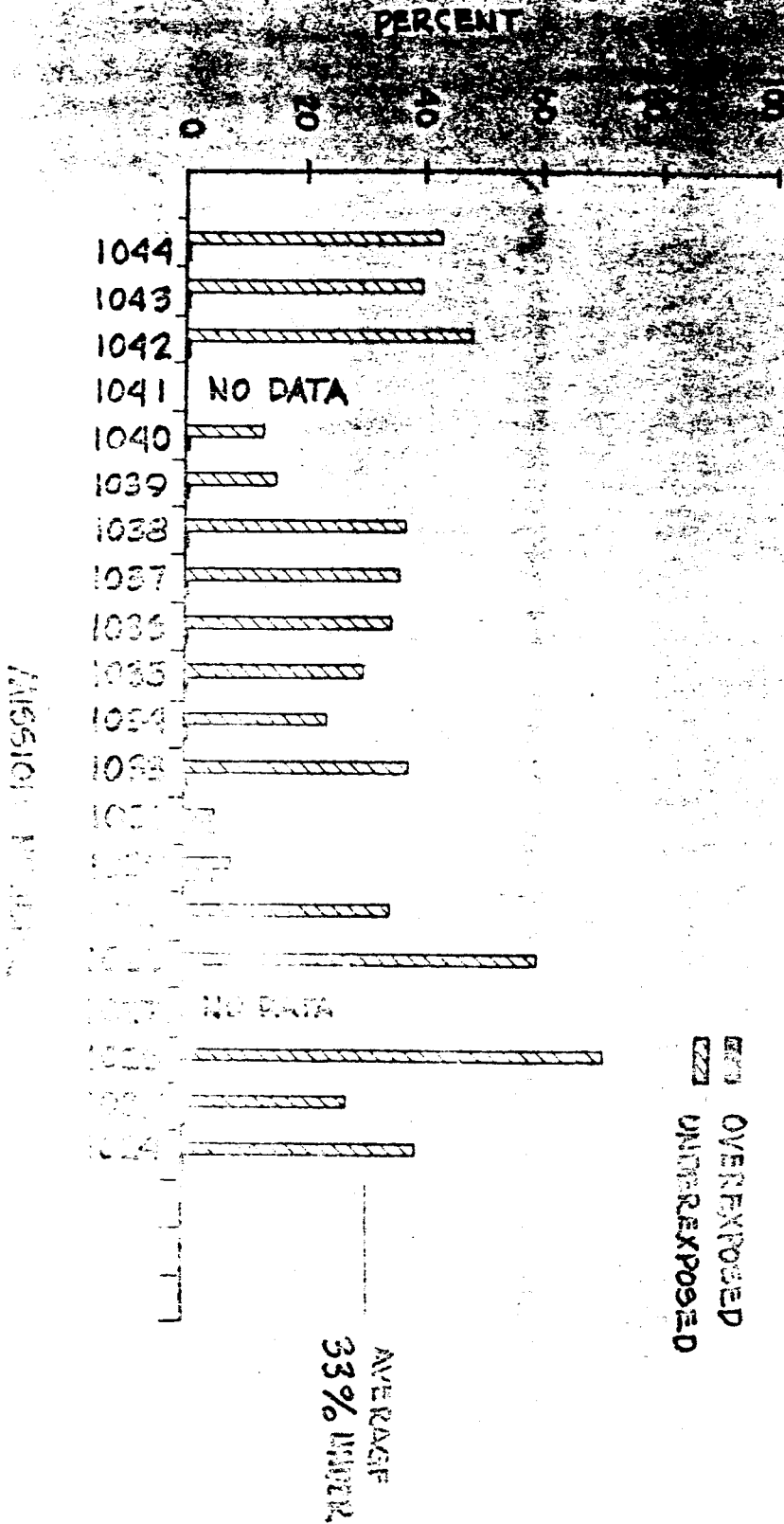
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3404 CHARACTERISTIC CURVES

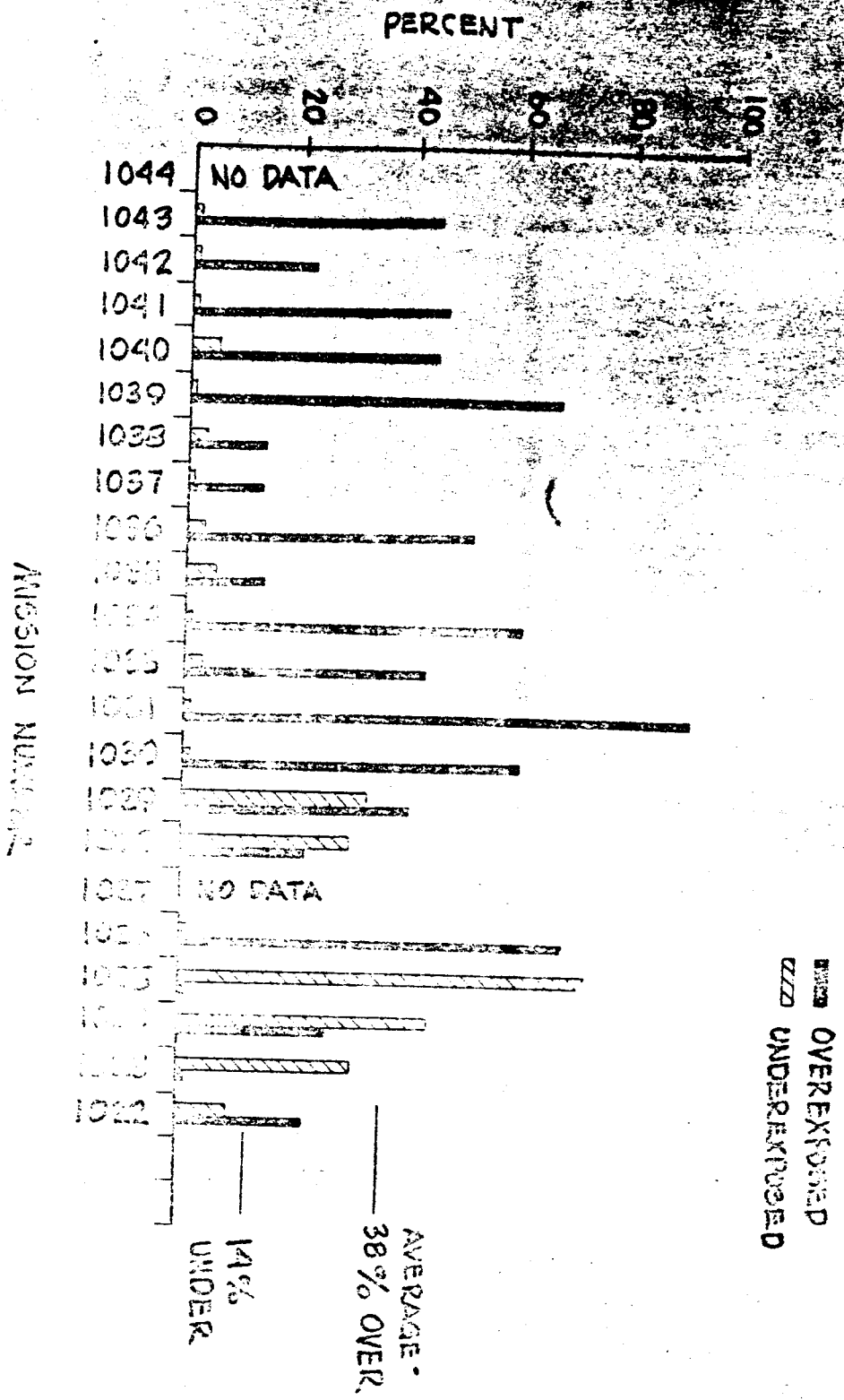


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PERCENT FRAMES OVER/UNDEREXPOSED FROM TERRAIN CRITERIA

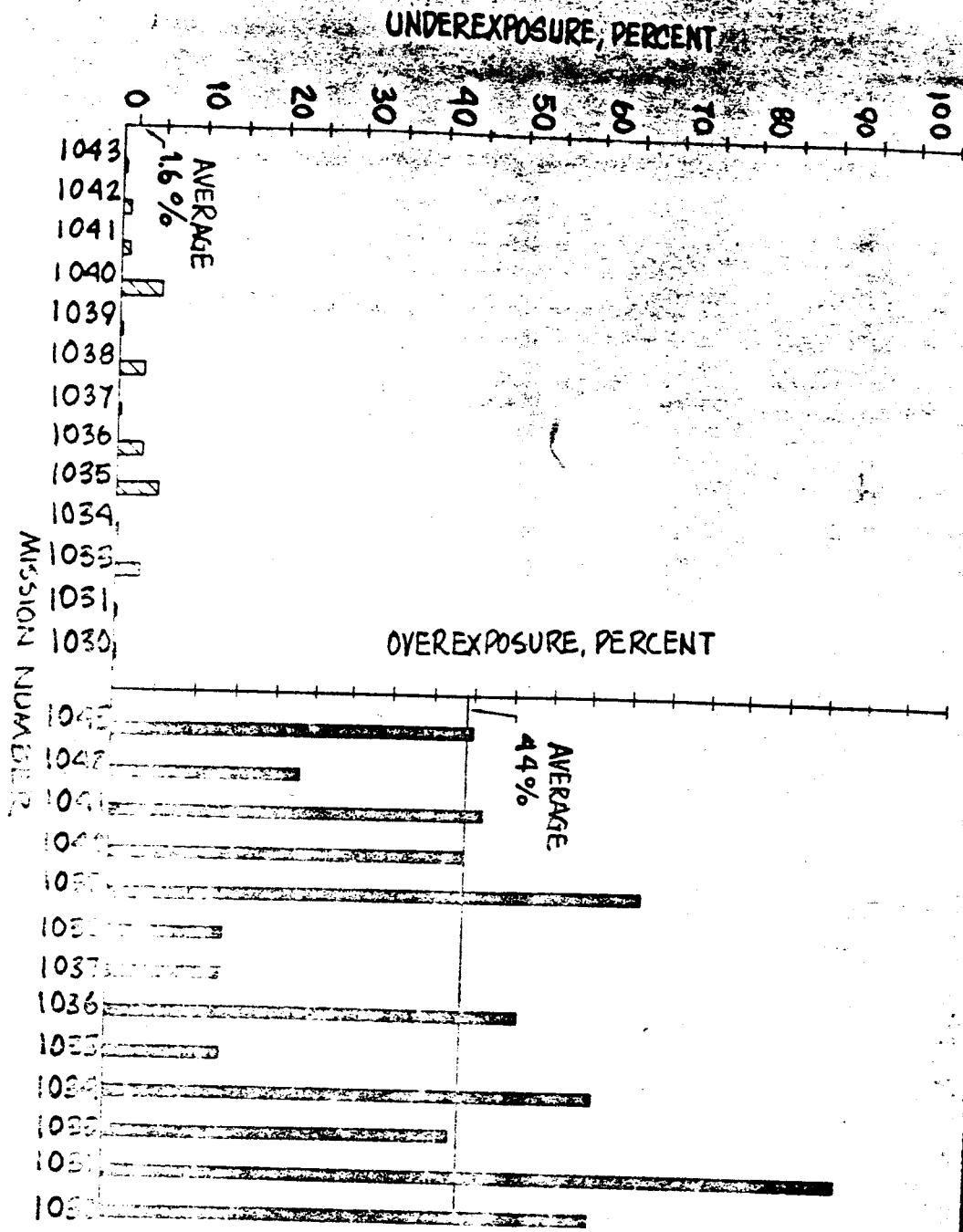


PERCENT FRAMES OVER AND UNDEREXPLORED TARGET CRITERIA



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EXPOSURE FROM PROJECT SUNNY TARGET SCANS



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RE-EVALUATION OF MISSIONS

786 TARGETS MEASURED FROM MISSION 1022 TO 1041

38 % OVEREXPOSED

14 % UNDEREXPOSED

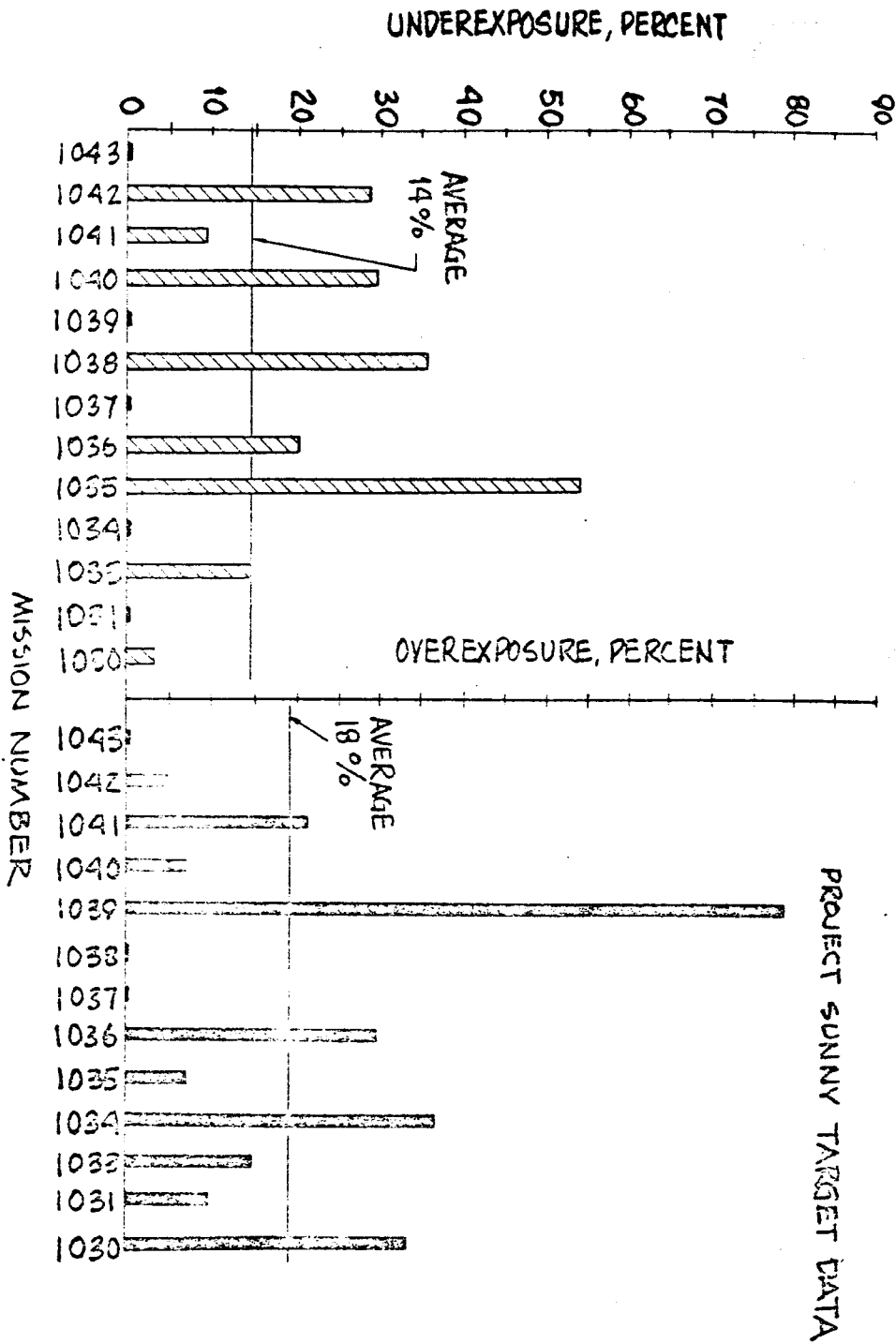
TARGETS MEASURED FROM MISSION 1030 TO 1044

44 % OVEREXPOSED

1.6 % UNDEREXPOSED

THEREFORE, 44% OF THE TARGETS MEASURED FROM MISSION 1030 TO 1044 COULD HAVE HAD AT LEAST 1-STOP LESS EXPOSURE.

PREDICTED EXPOSURE WITH 1/3 STOP EXPOSURE DECREASE



HINDSIGHT EVALUATION OF EXPOSURE

WHAT WOULD HAVE HAPPENED IF THESE MISSIONS HAD RECEIVED LESS EXPOSURE

	% UNDEREXPOSED	% OVEREXPOSED
STANDARD EXPOSURE	1.6	4.4
1/2 STOP DECREASE	14	18
2/3 STOP DECREASE	32	7.0
1 STOP DECREASE	44	3.0

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CONCLUSION

A 1/3 STOP DECREASE IN EXPOSURE WOULD HAVE IMPROVED THE QUALITY OF TWO TARGETS FOR EACH ONE UNDEREXPOSED

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RESOLUTION ANALYSIS



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GROUND RESOLVED DISTANCE (GRD) feet

$$GRD = \frac{SF}{R_d}$$

SF = SCALE FACTOR - A FUNCTION OF FOCAL LENGTH,
ALTITUDE, AND (X, Y) COORDINATES OF IMAGE

R_d = DYNAMIC SYSTEM RESOLUTION, LINES/mm

$$R_d = \frac{R_s}{[1 + (b_f R_s)^{E_1}]^{E_2}}$$

R_s = STATIC SYSTEM RESOLUTION (NO IMAGE SMEAR), LINES/mm

b_f = IMAGE SMEAR, mm

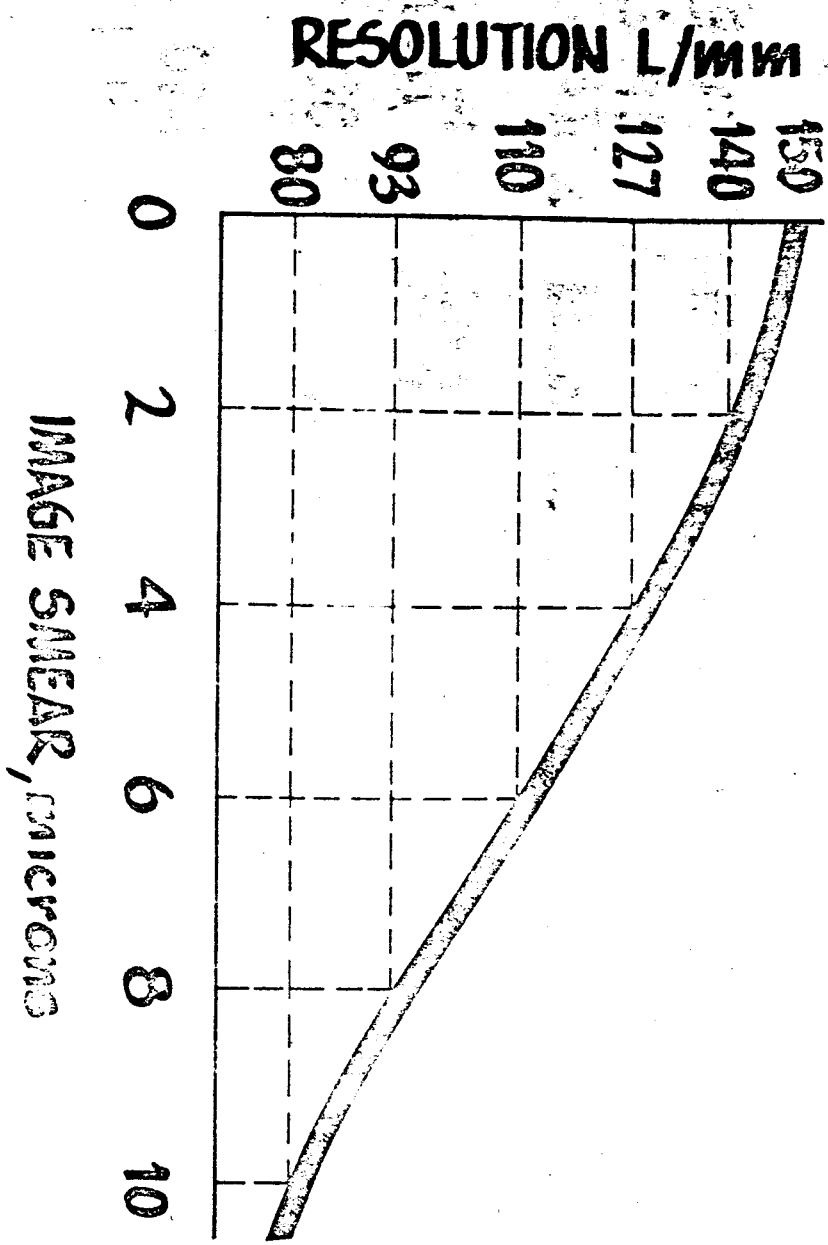
E_1 AND E_2 = EXPERIMENTALLY DETERMINED EXPONENTS

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RESOLUTION VS IMAGE SMEAR



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GROUND RESOLVED DISTANCE (GRD) feet (GRT)

R_s DETERMINATION

R_s (β, ρ) IS GENERALLY OBTAINED AS A FUNCTION OF LENS FIELD ANGLE, β, AND FOCUS POSITION, ρ, FROM LABORATORY LENS RESOLUTION TESTS [R_s(β, ρ)]

$$\beta = \tan^{-1} \left(\frac{y-2.8}{f} \right)$$

f = FOCAL LENGTH OF LENS

ρ IS OBTAINED FROM FILM FLATNESS TESTS AND FINAL FOCUS SETTING

GROUND RESOLVED DISTANCE (GRD) feet (CONT)

b_g DETERMINATION

$$b_g = |b_s| + b_r$$

b_s SYSTEMATIC IMAGE SMEAR (MAGNITUDE AND ALGEBRAIC SIGN) COMPUTED FROM EPHEMERIS INFORMATION AND KNOWLEDGE OF SYSTEM OPERATION

b_r RANDOM IMAGE SMEAR (ALGEBRAIC SIGN UNKNOWN, OR MAGNITUDE KNOWN STATISTICALLY ONLY)

b_r AND b_s ARE FUNCTIONS OF EXPOSURE TIME, FOCAL LENGTH, ALTITUDE, VEHICLE VELOCITY, STEREO ANGLE, (X, Y) COORDINATES OF IMAGE POINT, CAMERA SCANNING RATE, AND CAMERA AND VEHICLE OPERATION CHARACTERISTICS

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EMPIRICAL RESOLUTION EQUATION

$$R_p = \frac{R_s}{[1 + (b_r R_s)^{E_1}]^{E_2}}$$

DYNAMIC RESOLUTION, 1/MM

STATIC RESOLUTION, 2:1 CONTRAST

TOTAL IMAGE SMEAR, MICRONS (X 1,000)

E1/E2 = EMPIRICALLY DETERMINED CONSTANTS

SPECIFIC RESOLUTION TEST

90 NM ALTITUDE, 3.24 RAD/SEC SCAN RATE

SECOND GENERATION PETZVAL LENS

WRATTEN NO. 21 FILTER

FULL PROCESSING

$E_1 = 2.90$

$E_2 = 0.35$

2:1 APPARENT CONTRAST

2 μ /MS RANDOM SMEAR

3 SOLAR ALTITUDES - 20°, 40°, 60°

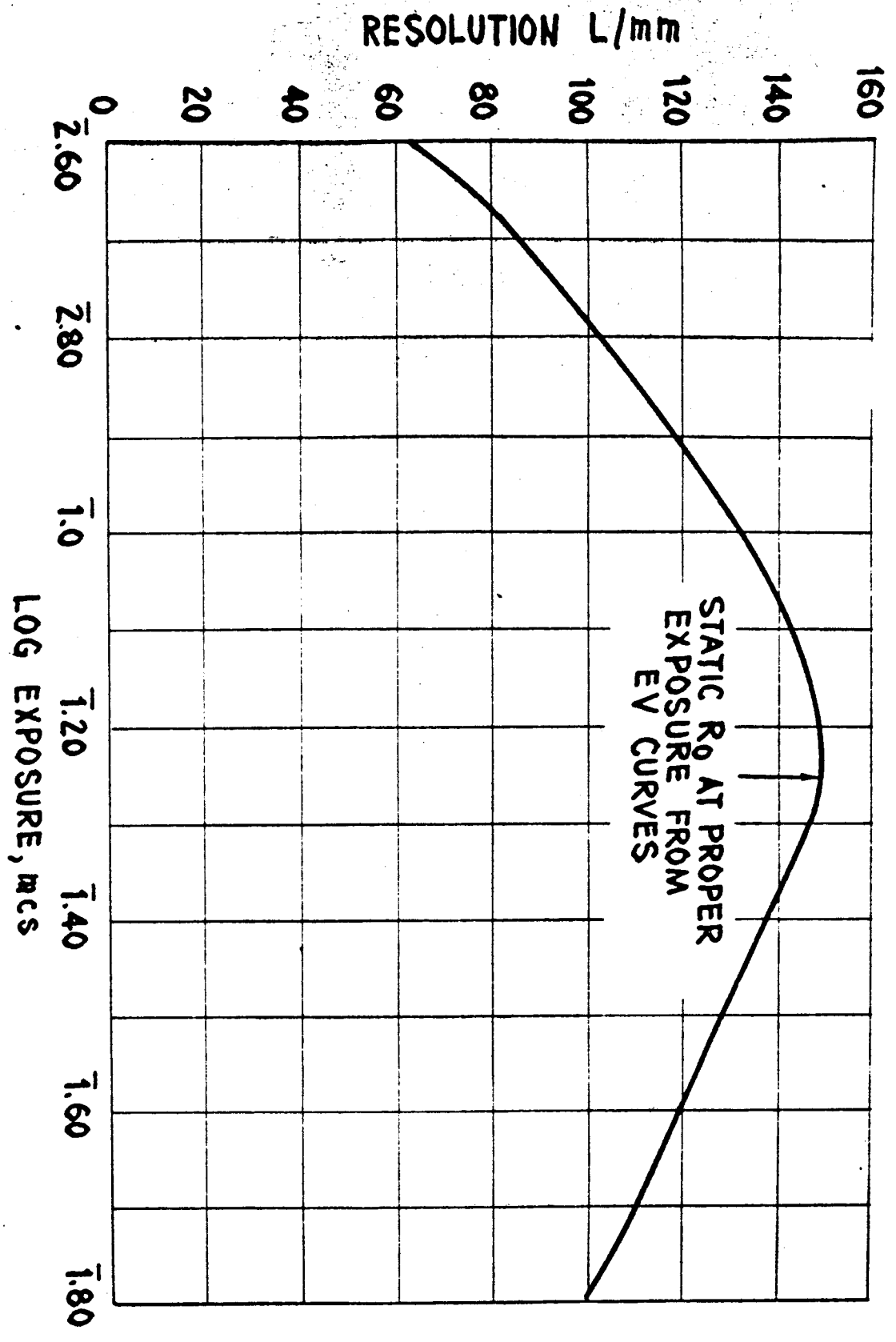
R₀=STATIC RESOLUTION OF PETZVAL/3404 COMBINATION

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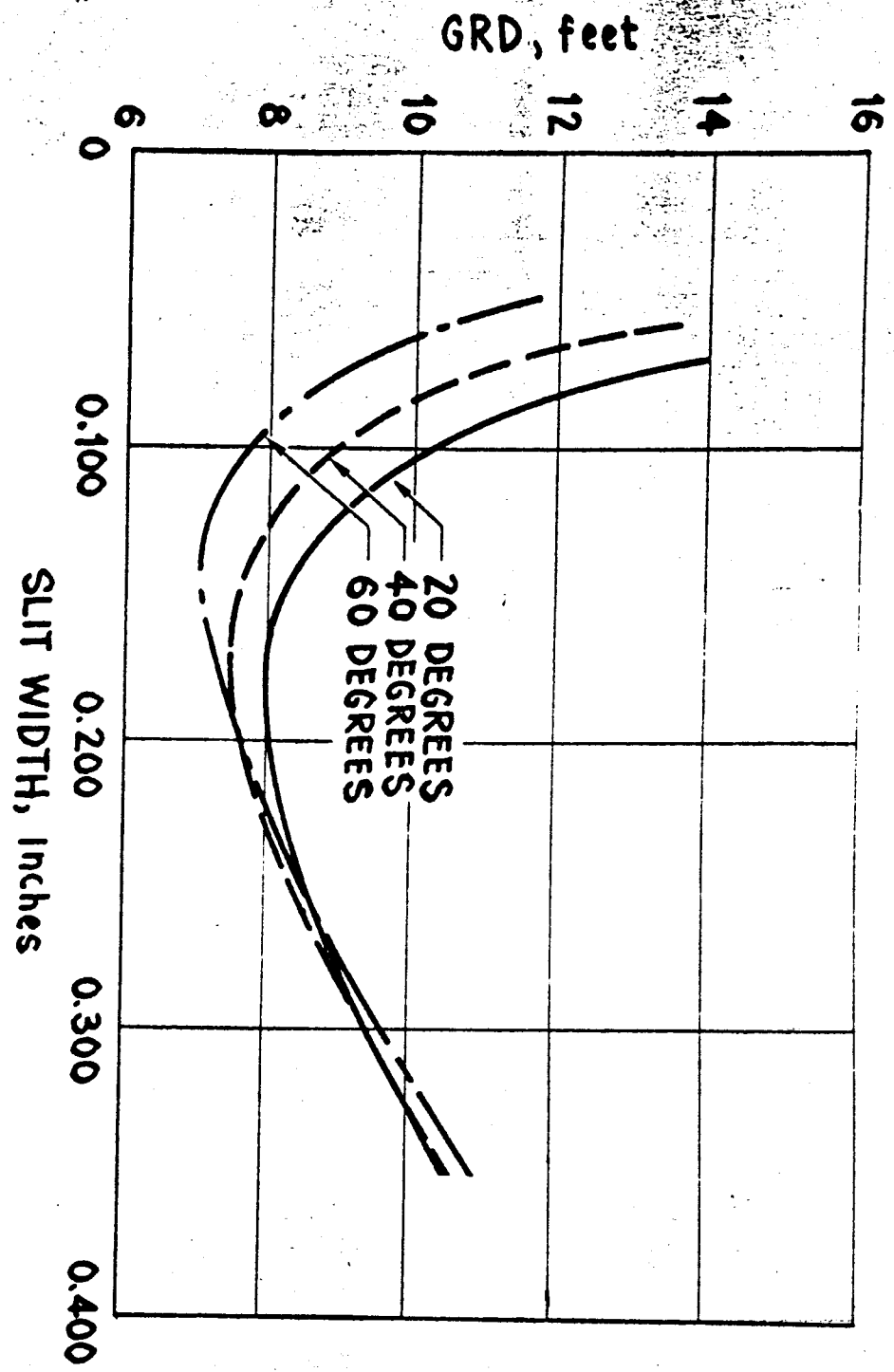
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2:1 CONTRAST STATIC RESOLUTION



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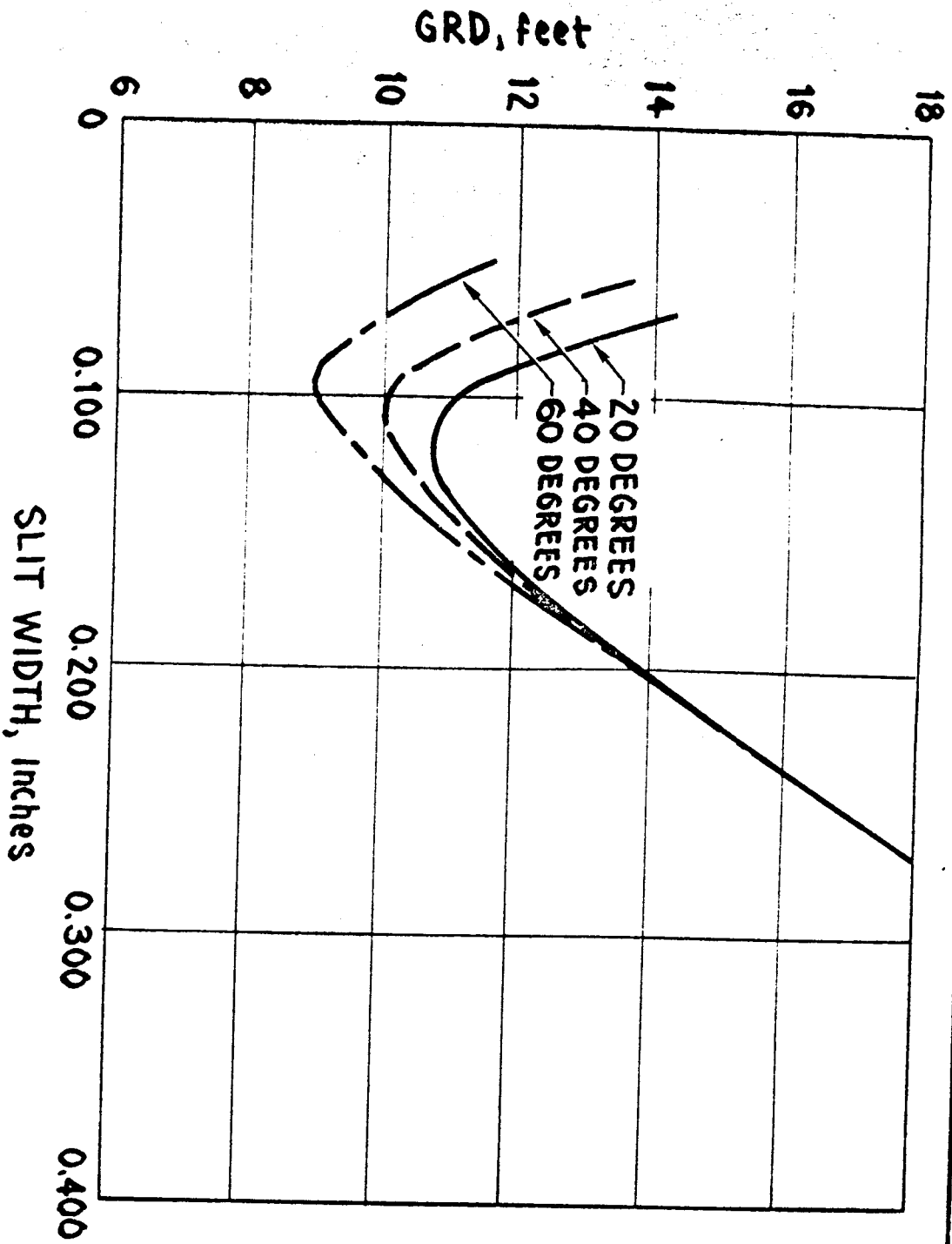
2 μ/ms RANDOM BLUR



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5 μ /ms RANDOM BLUR



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A F S P P F

DENSITY

PROCESSING/EXPOSURE

ANALYSIS

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TECHINGE TEMPLATE
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TECHINGE TEMPLATE
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FRAME SAMPLING CRITERIA

- 10% OF MISSION.
- EXCLUDE CLOUD FRAMES.
- EXCLUDE WATER FRAMES.
- EXCLUDE TRANSITION PROCESSING.
- EXCLUDE FIRST/LAST THREE FRAMES OF ON/OFF OPERATIONS.

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TECHINGE TEMPLATE

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TECHINGE TEMPLATE

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TECHINGE TEMPLATE

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DENSITY SAMPLING CRITERIA

- THREE DMIN TERRAIN READINGS
 - THREE DMAX TERRAIN READINGS
 - TWO BASE + FOG READINGS
 - ONE DMAX CLOUD READING
- EXCLUDE SPECULAR REFLECTIONS
EXCLUDE CLOUD SHADOW

TECHNIQUE TEMPLATE

TECHNIQUE TEMPLATE

TECHNIQUE TEMPLATE

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TECHNIQUE TEMPLATE

OUT OF CONTROL CATEGORIES

CATEGORY

DEFINITION

- (1) OVERDEVELOPED
WHEN DMIN VALUE IS ABOVE 0.90 AND/OR DMAX VALUE IS ABOVE 2.00;
WHEN LESS DEVELOPMENT WOULD POSITION DMIN AND DMAX VALUES
WITHIN LIMITS.
- (2) UNDERDEVELOPED
WHEN DMIN VALUE IS BELOW 0.40; WHEN INCREASED DEVELOPMENT
WOULD POSITION DMIN AND DMAX VALUES WITHIN LIMITS.
- (3) OVEREXPOSED
WHEN DMIN VALUE IS ABOVE 0.90 AND/OR DMAX VALUE IS ABOVE 2.00;
WHEN LESS EXPOSURE WOULD POSITION DMIN AND DMAX VALUES WITHIN
LIMITS.
- (4) UNDEREXPOSED
WHEN DMIN VALUE IS BELOW 0.40; WHEN INCREASED EXPOSURE WOULD
POSITION DMIN AND DMAX VALUES WITHIN LIMITS.

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REPORT FORMATS

- DIFFUSE DENSITY LISTING
- DENSITY SUMMARIES
- FREQUENCY DISTRIBUTION
- PROCESSING/EXPOSURE ACCURACY
- TEXTUAL DATA

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TECHINGE TEMPLATE
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TECHINGE TEMPLATE
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TECHINGE TEMPLATE
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SUNNY DATA ANALYSIS

- SUNNY DATA PROVIDED (PUNCHED CARDS)
 - MINIMUM AND MAXIMUM DENSITIES FOR TARGETS AND TERRAIN
 - PROCESSING LEVEL USED
 - TARGET NUMBER
 - CAMERA POSITION (FWD OR AFT)
 - MISSION, PASS, AND FRAME NUMBER
- DATA ADDED TO CARDS
 - SOLAR ELEVATION
 - ACTUAL EXPOSURE TIMES
- COMPUTATION OF LUMINANCE FROM DENSITY DATA
 - FILTER FACTOR FOR EACH CAMERA
 - STANDARD PROCESSING CURVES
 - ACTUAL EXPOSURE TIMES
- LUMINANCE DATA ELIMINATES EXPOSURE VARIATIONS AND FILTER EFFECTS

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SUNNY DATA ANALYSIS

- AVERAGED DATA OBSERVATIONS
 - LUMINANCE AVERAGES BY
 - CAMERA POSITION
 - MISSION
 - TARGET
 - SOLAR ELEVATION CLASS
 - PROCESS LEVEL
 - DATE
- EXAMPLES
 - FRAME VS TARGET DATA
 - CAMERA POSITION EFFECTS
 - SOLAR ELEVATION - TARGET DISTRIBUTION

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SUNNY DATA ANALYSIS

o RANKED DATA OBSERVATIONS

o DATA SORTED BY COMBINATIONS OF:

o MINIMUM TARGET LUMINANCE

o CAMERA POSITION

o MISSION

o TARGET

o SOLAR ELEVATION

o DATE

o EXAMPLE

o 1) TARGET, 2) SOLAR ELEVATION

o 16 SORTS WITH UP TO 3 SUBCATEGORIES USED

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SUNNY DATA ANALYSIS

- ANALYTICAL METHODS
 - THE DATA AND BASIC COMPUTATIONS
 - AVERAGED DATA
 - RANKED DATA
 - COMPUTER PLOTTING
- AN INTERIM EXPOSURE CRITERION
 - PRELIMINARY EXPOSURE CURVE
 - SEASONAL VARIATIONS
 - DENSITY DISTRIBUTIONS
- FUTURE INVESTIGATION

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SUNNY DATA ANALYSIS

TARGET ACQUISITIONS VS SOLAR ELEVATION INTERVAL

TARGET NUMBER	RANKED BY AVERAGE MINIMUM LUMINANCE														
	← HIGHEST							← LOWEST →							
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
63		2	1	2	3	1	6	1	6	6	1	4	2	4	
181		2	2	4	4	3	4	4	9	6	6	4	2	4	
108		2	3	4	4	7	6	4	6	6	1	4	2	4	
28	1	2	5	3	6	1	3	6	9	6	6	4	2	4	
114		9	4	4	1	2	4	2	6	2	2	2	2		
90		3	4	1	7	4	2	6	6	2	2	2	2		
24	5	3	4	3	1	2	2	2	6						
46	4	2	2	6	2	4	2	2	6						
45	2	6	4	4	2	4	4	4	6						
97		6	2	4	2	4	4	4	2						
44		6	4	4	2	4	4	4	4						
29	2	6	2	8	2	5	2	2	4						
127		6	6	4	1	2	2	2	6						
185		6	6	4	4	4	3	2	5						
137		6	2	4	2	4	2	2	4						
93	2	4	5	6	7	2	4	8	4						
115		4	5	2	4	1	4	2	4						
123		4	10	6	4	2	4	2	4						
51		4	2	2	6	6	4	4	4						
135		4	2	7	7	9	10	1	9						
174		4	2	7	7	2	10	8	6						
146		4	6	6	14	8	16	7	5						
132		4	6	6	9	12	10	10	4						
62	2	4	6	9	12	9	7	7	4						
165		4	2	4	3	2	10	8	9						
193		4	2	4	3	1	10	8	9						
195		4	1	1	2	5	4	2	2						
31		4	1	1	2	2	4	2	2						
5		4	1	1	2	5	4	2	2						
194		4	1	1	2	2	4	2	2						
6		4	1	1	2	2	4	2	2						

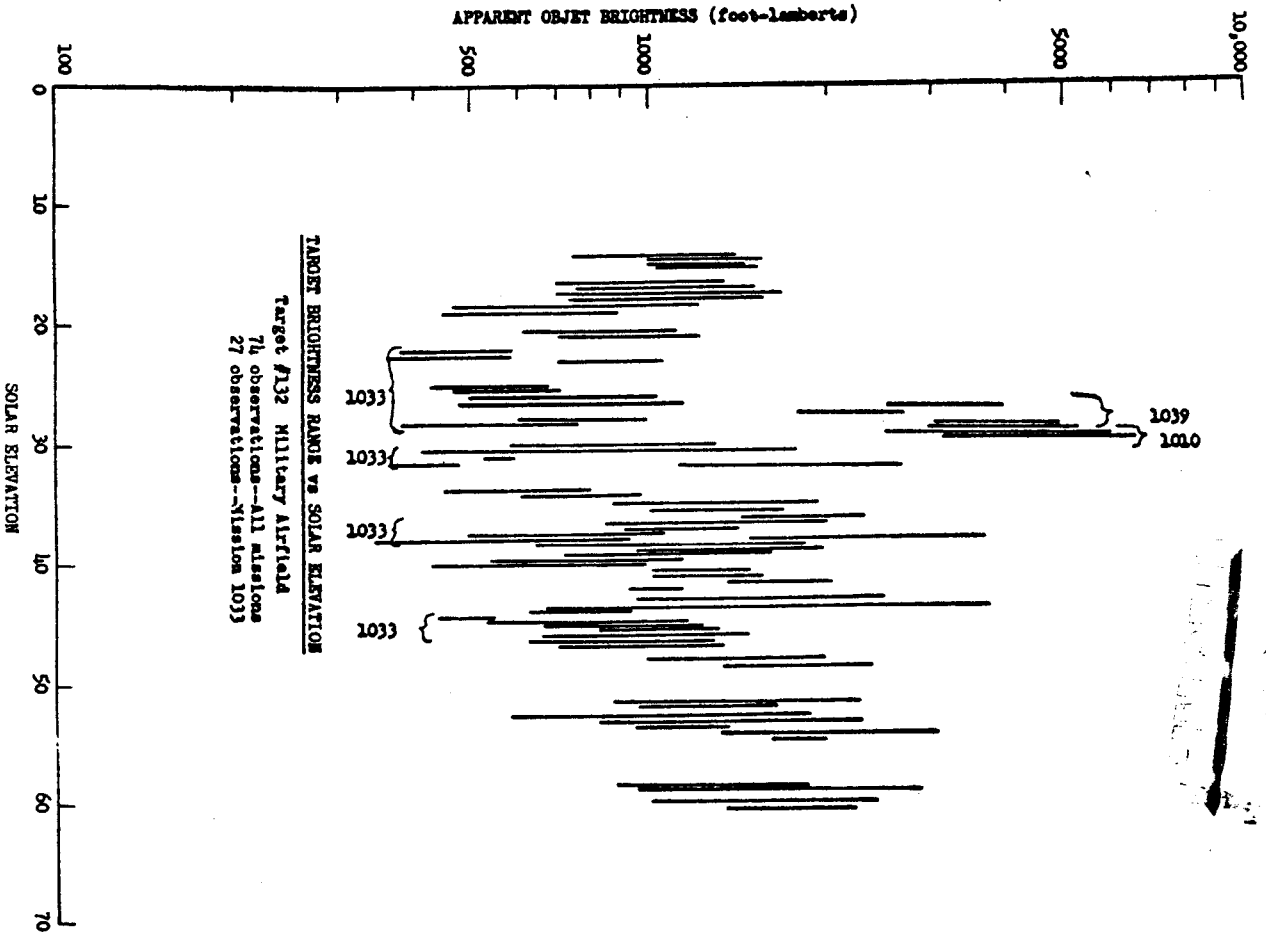
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SUNDT DATA ANALYSIS
 Data ranked by 1) Target number, 2) Solar elevation



TGT NBR	MISN	REV	FRM/	FI	MIN	OV	YR	FRAME	FRAME	FRAME	TARGET	TARGET	TARGET	PROC	SUN	SUN	SCAN	EXP.	SPL.
				LM				FLMIN	FLMAX	RATIO	FLMIN	FLMAX	RATIO	LEVEL	ELEV	AZI	ANG.	TIME	COND
132	1017	24	90A	0	2	1	65	2939.5	5909.4	2.01	2479.1	5909.4	2.38	P	29.5	0	0.0	245	0
132	1017	24	84F	0	2	1	65	2835.2	6739.9	2.38	3090.3	6636.2	2.15	P	29.6	0	0.0	245	0
132	1011	24	74A	0	10	1	64	473.0	1165.3	2.46	577.5	1281.7	2.22	F	30.3	0	0.0	351	0
132	1011	24	71F	0	10	1	64	435.2	767.9	1.76	409.3	1766.6	4.32	F	30.3	0	0.0	351	0
132	1033	99	32A	0	5	1	66	329.6	794.8	2.41	524.2	586.7	1.12	F	31.3	0	0.0	274	0
132	1033	99	32E	0	5	1	66	331.0	473.0	1.43	365.2	478.5	1.31	F	31.4	0	0.0	271	0
132	1030	8	68F	0	3	1	66	454.0	2119.1	4.67	1117.0	2627.7	2.35	F	32.0	0	0.0	209	0
132	1033	83	32F	0	5	1	66	392.7	497.2	1.27	442.0	796.9	1.80	F	34.2	0	0.0	272	0
132	1030	8	33A	0	3	1	66	369.2	770.9	2.09	599.4	970.3	1.62	F	34.2	0	0.0	274	0
132	1030	8	75A	0	3	1	66	593.3	2178.5	3.67	857.3	1928.5	2.25	I	35.2	0	0.0	336	0
132	1024	40	95A	0	9	1	65	375.8	1048.4	2.79	996.1	1669.2	1.68	F	36.3	0	0.0	415	0
132	1024	40	89F	0	9	1	65	473.7	900.8	1.90	1412.1	2288.5	1.62	F	36.3	0	0.0	273	0
132	1024	56	52F	0	9	1	65	522.9	1197.7	2.29	831.6	1992.6	2.40	F	36.7	0	0.0	279	0
132	1024	56	58A	0	9	1	65	478.8	1193.9	2.49	899.3	1039.9	1.16	F	36.7	0	0.0	420	0
132	1033	67	34A	0	5	1	66	345.0	778.9	2.26	489.4	1067.8	2.18	F	36.9	0	0.0	274	0
132	1033	67	34F	0	5	1	66	366.5	796.9	2.17	342.5	943.1	2.75	F	36.9	0	0.0	272	0
132	1018	25	38F	0	3	1	65	1426.3	4241.3	2.97	1448.6	3694.4	2.55	P	38.5	0	0.0	268	0
132	1040	56	80F	0	3	1	67	479.4	2635.2	5.50	636.2	1837.3	2.89	F	38.6	0	0.0	288	0
132	1018	25	44A	0	3	1	65	855.7	2129.8	2.49	938.3	1960.2	2.09	I	38.6	0	0.0	385	0
132	1040	56	61A	0	3	1	67	477.8	2177.9	4.56	710.3	1596.9	2.25	F	38.9	0	0.0	367	0
132	1033	51	34A	0	5	1	66	356.7	853.8	2.39	530.3	1148.6	2.17	F	39.5	0	0.0	274	0
132	1033	51	33F	0	5	1	66	332.2	847.6	2.55	425.9	983.2	2.31	F	39.5	0	0.0	272	0
132	1023	134	79A	0	8	1	65	442.9	903.1	2.04	1004.6	1463.5	1.46	F	41.1	0	0.0	436	0
132	1023	134	73F	0	8	1	65	455.8	929.4	2.04	1033.9	1555.8	1.50	F	41.1	0	0.0	288	0
132	1033	35	33A	0	5	1	66	1034.1	1369.5	1.32	1344.5	2016.5	1.50	I	42.1	0	0.0	274	0
132	1033	35	32F	0	5	1	66	757.3	1026.0	1.35	913.0	1140.2	1.25	F	42.1	0	0.0	272	0
132	1009	24	129A	0	8	1	64	687.5	1836.6	2.67	941.9	2449.4	2.60	I	43.7	0	0.0	329	0
132	1009	24	124F	0	8	1	64	567.5	1412.4	2.49	659.1	3750.4	5.69	F	43.7	0	0.0	329	0
132	1033	104	97A	0	5	1	66	351.8	1029.0	2.93	614.0	925.1	1.51	F	44.0	0	0.0	248	0
132	1033	104	95F	0	5	1	66	408.1	895.6	2.17	432.6	547.4	1.27	F	44.0	0	0.0	245	0
132	1033	19	30F	0	5	1	66	443.5	770.6	1.74	526.9	1159.7	2.20	F	44.5	0	0.0	263	0
132	1033	19	32A	0	5	1	66	412.9	1283.5	3.11	654.3	1223.9	1.87	F	44.6	0	0.0	267	0
132	1031	56	26A	0	4	1	66	467.0	1249.6	2.68	804.1	1305.5	1.62	F	45.9	0	0.0	335	0
132	1031	56	25F	0	4	1	66	544.5	1061.7	1.95	655.8	1466.0	2.24	F	45.9	0	0.0	212	0
132	1033	3	33F	0	5	1	66	460.5	720.3	1.55	615.8	1283.0	2.08	F	46.9	0	0.0	270	0
132	1033	3	34A	0	5	1	66	442.0	993.3	2.25	694.0	1337.9	1.93	F	46.9	0	0.0	272	0
132	1023	71	83A	0	8	1	65	622.8	1495.8	2.39	986.8	1968.7	1.99	F	48.4	0	0.0	424	0
132	1023	71	77F	0	8	1	65	646.9	1507.2	2.33	1314.1	2338.8	1.78	F	48.4	0	0.0	279	0
132	1033	152	99A	0	5	1	66	436.6	577.9	1.32	814.1	2231.3	2.74	F	51.9	0	0.0	256	0

132 1033 152 99A 0 5 1 66 436.6 577.9 1.32 814.1 2231.3 2.74 F 51.9 0 0.0 256 0



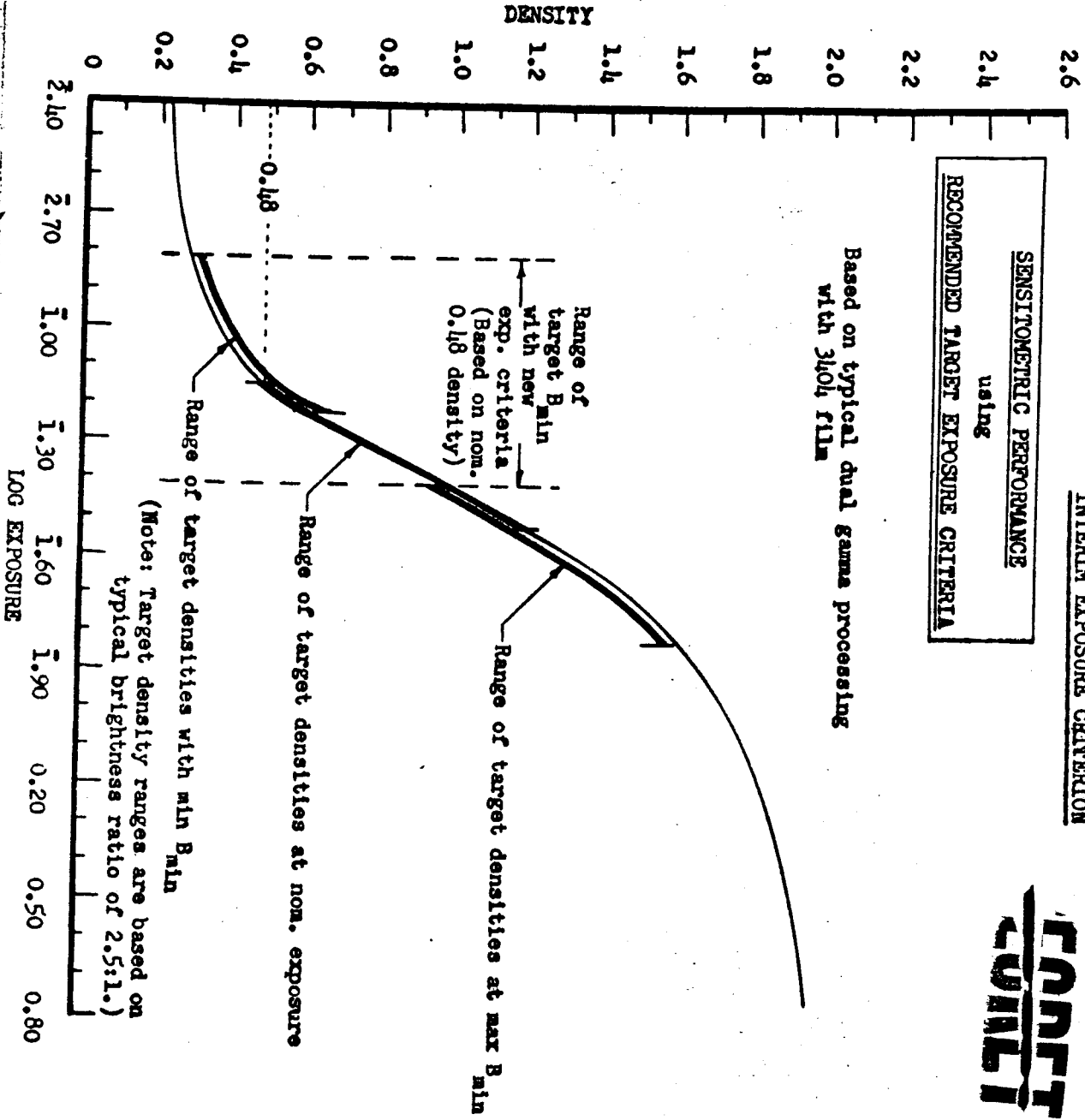
TARGET BRIGHTNESS RANGE vs SOLAR ELEVATION
 Target #132 Military Airfield
 74 observations--All altitudes
 27 observations--Kiasion 1033

INTERIM EXPOSURE CRITERION



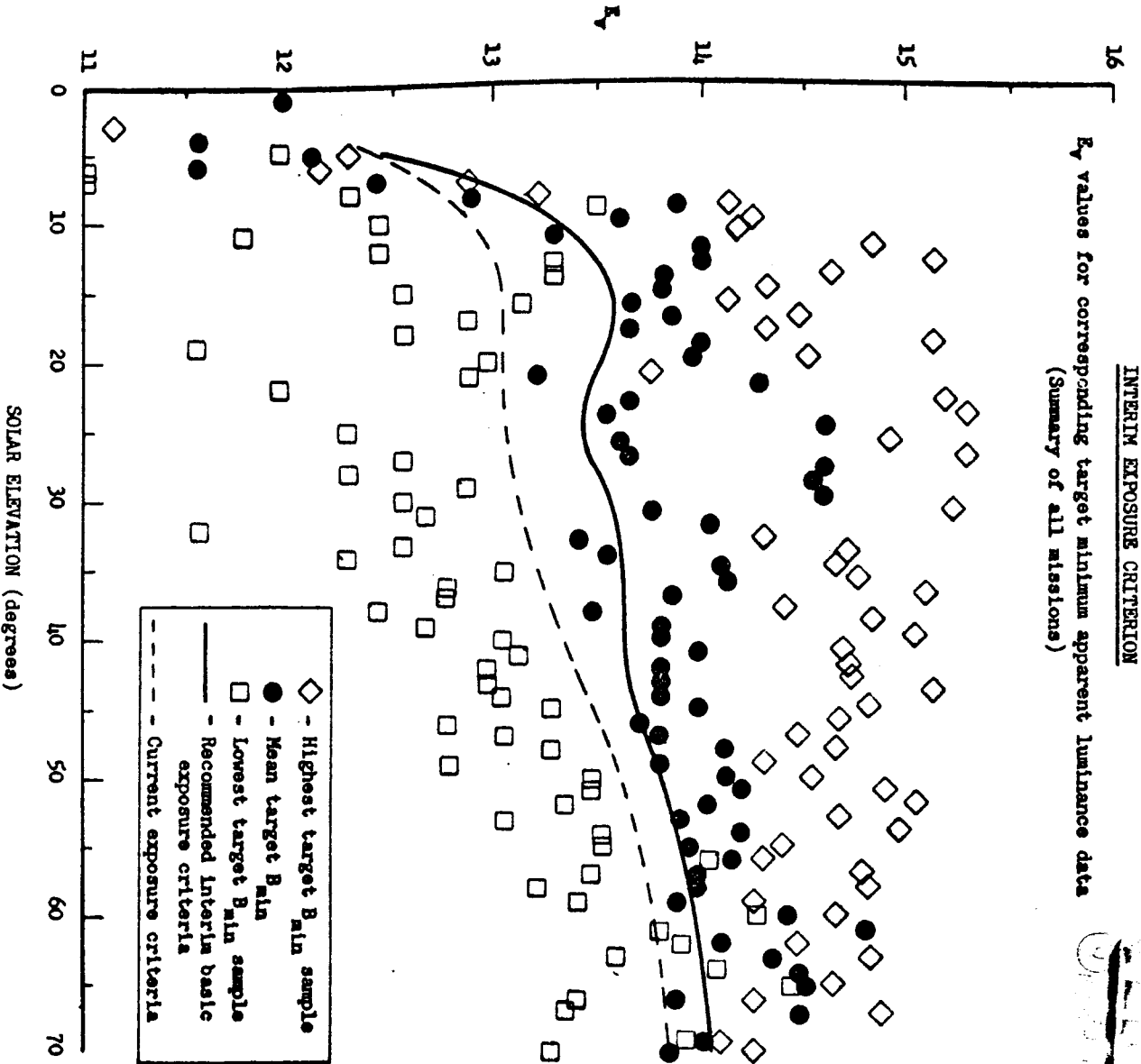
SENSITOMETRIC PERFORMANCE
using
RECOMMENDED TARGET EXPOSURE CRITERIA

Based on typical dual gamma processing
with 3404 film



INTERIM EXPOSURE CRITERION

E_v values for corresponding target minimum apparent luminance data
(Summary of all missions)



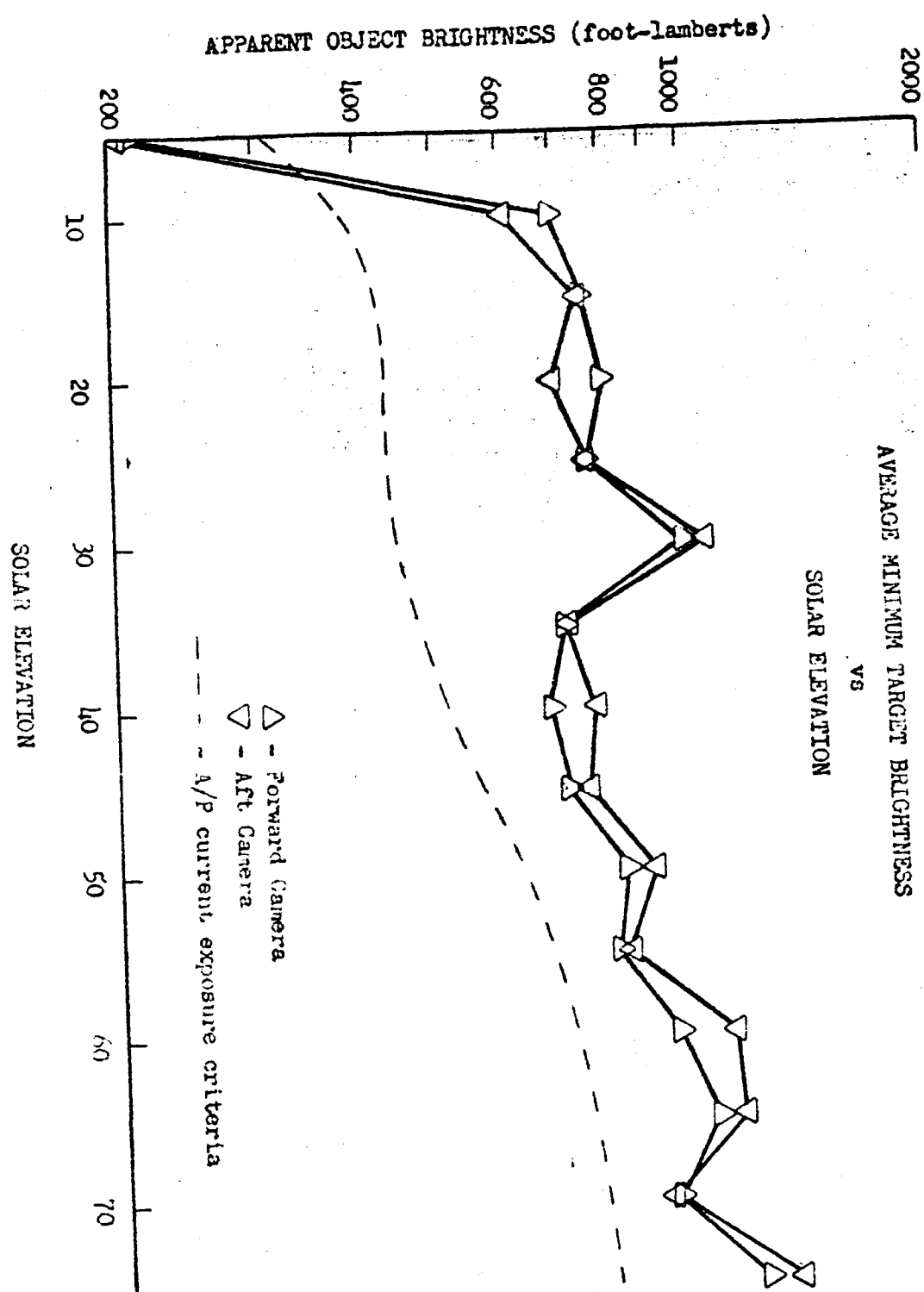
STAFF
SECURITY

SUNNY DATA ANALYSIS

AVERAGE MINIMUM TARGET BRIGHTNESS

VS

SOLAR ELEVATION



APPARENT OBJECT BRIGHTNESS (foot-lamberts)

SOLAR ELEVATION

- △ - Forward Camera
- △ - Aft Camera
- - - A/P current exposure criteria

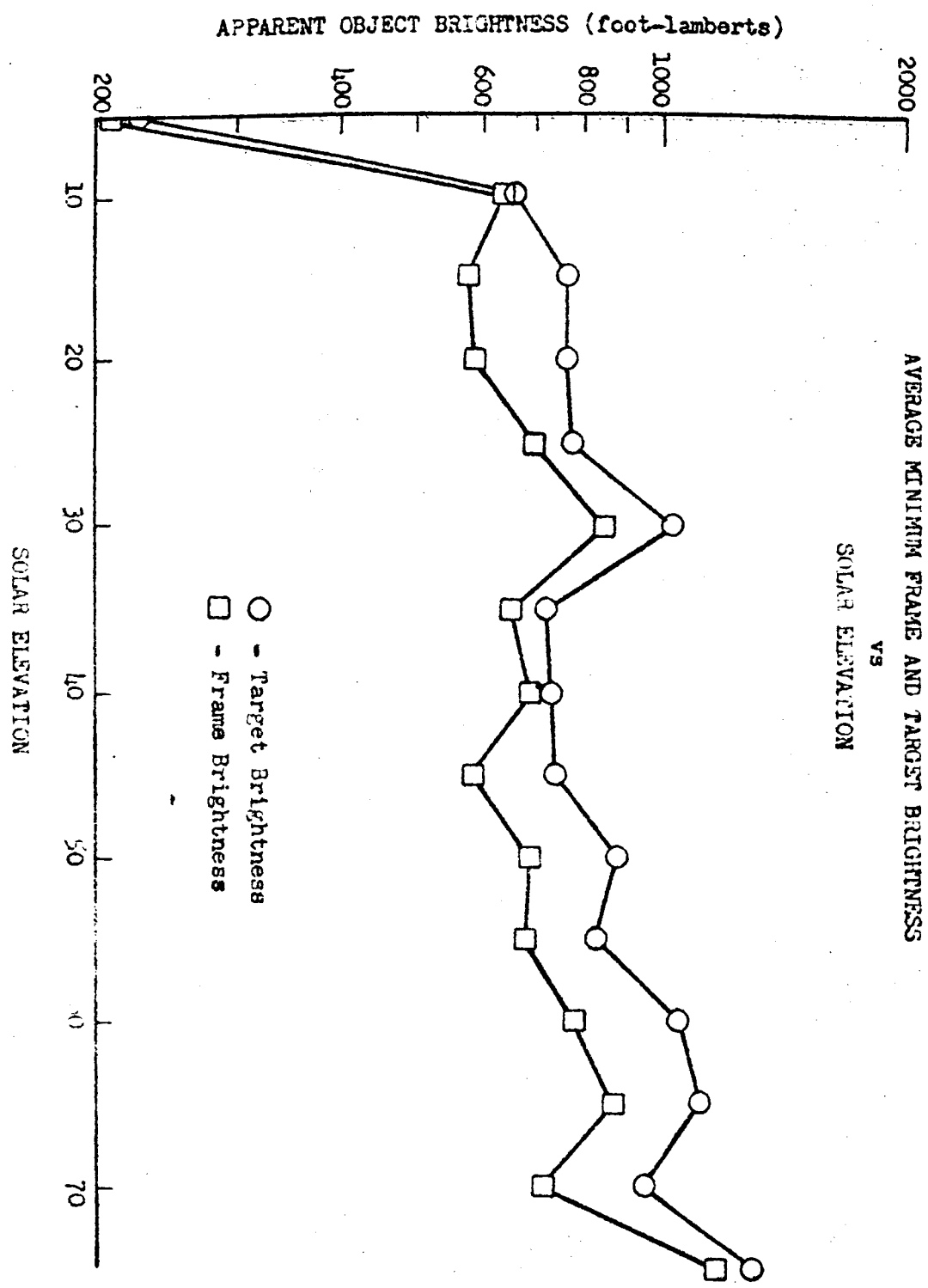
[Handwritten signature]

SUNNY DATA ANALYSIS

AVERAGE MINIMUM FRAME AND TARGET BRIGHTNESS

VS

SOLAR ELEVATION



SOLAR ELEVATION

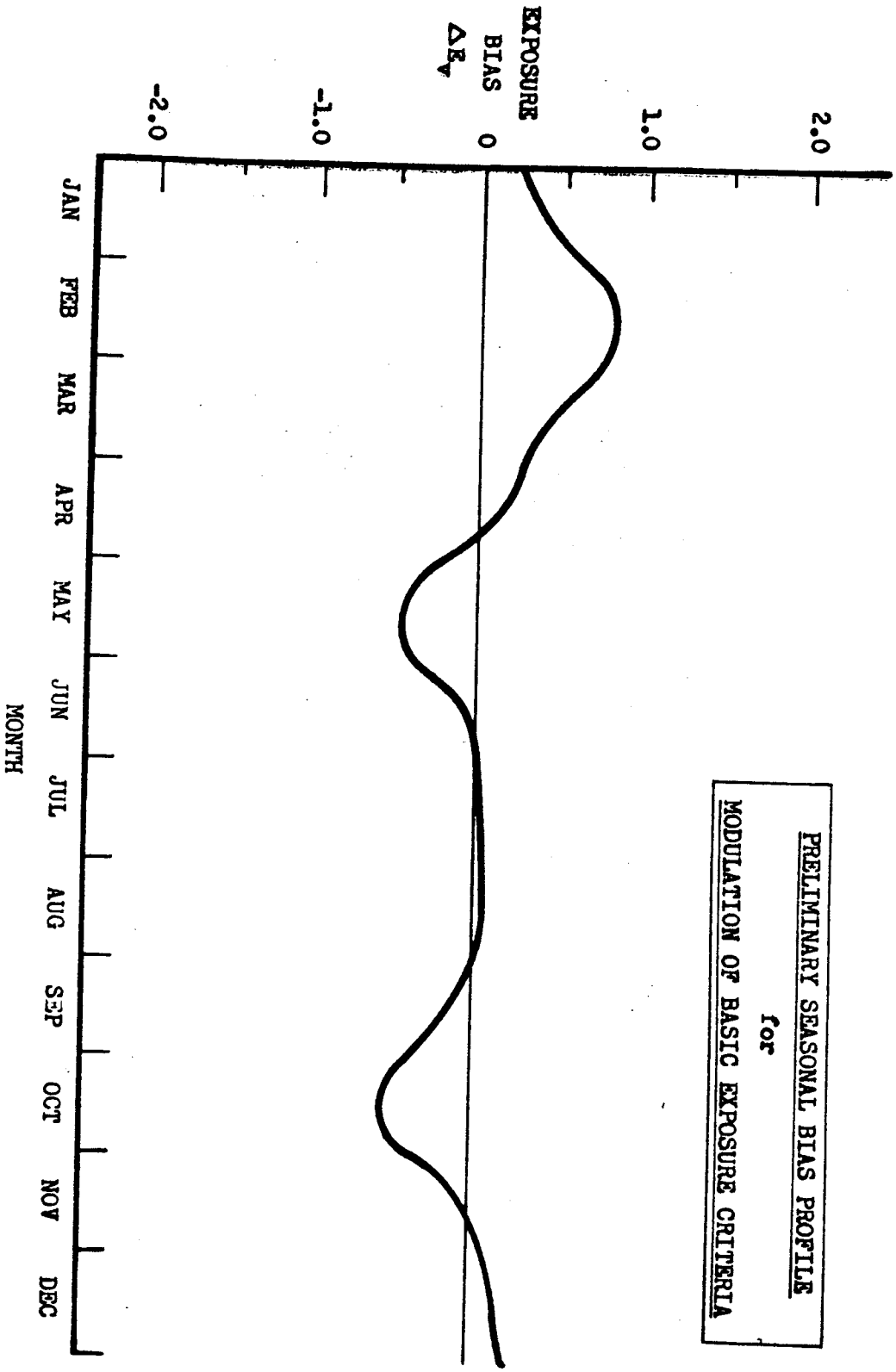
- - Target Brightness
- - Frame Brightness

~~SECRET~~

INTERIM EXPOSURE CRITERION

~~CONFIDENTIAL~~

PRELIMINARY SEASONAL BIAS PROFILE
for
MODULATION OF BASIC EXPOSURE CRITERIA



~~CONFIDENTIAL~~

INTERIM EXPOSURE CRITERION

- PROBLEMS
 - UNCERTAINTIES ABOUT DATA
 - SIZE OF DATA BASE
 - IMPROVEMENTS POSSIBLE WITH PRESENT DATA
- RECOMMENDED INTERIM APPROACH
 - USE SINGLE LUMINANCE/SOLAR ELEVATION CURVE SHAPE
 - BIAS CURVE FOR SEASONAL EFFECTS

~~SECRET~~

FUTURE INVESTIGATION

- CRITERIA FOR TARGET OBSERVATIONS
 - USER SIGNIFICANCE
 - SOURCES OF VARIABILITY
- ADDITIONAL DATA
 - WEATHER CONDITIONS
 - SCAN ANGLE
 - SOLAR AZIMUTH
 - ACTUAL PROCESS DATA

NEW EXPOSURE CRITERIA

- CONSIDER BOTH:
 - SIGNIFICANT LUMINANCE FACTORS
 - SYSTEM CAPABILITIES

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IN-FLIGHT EXPOSURE CONTROL

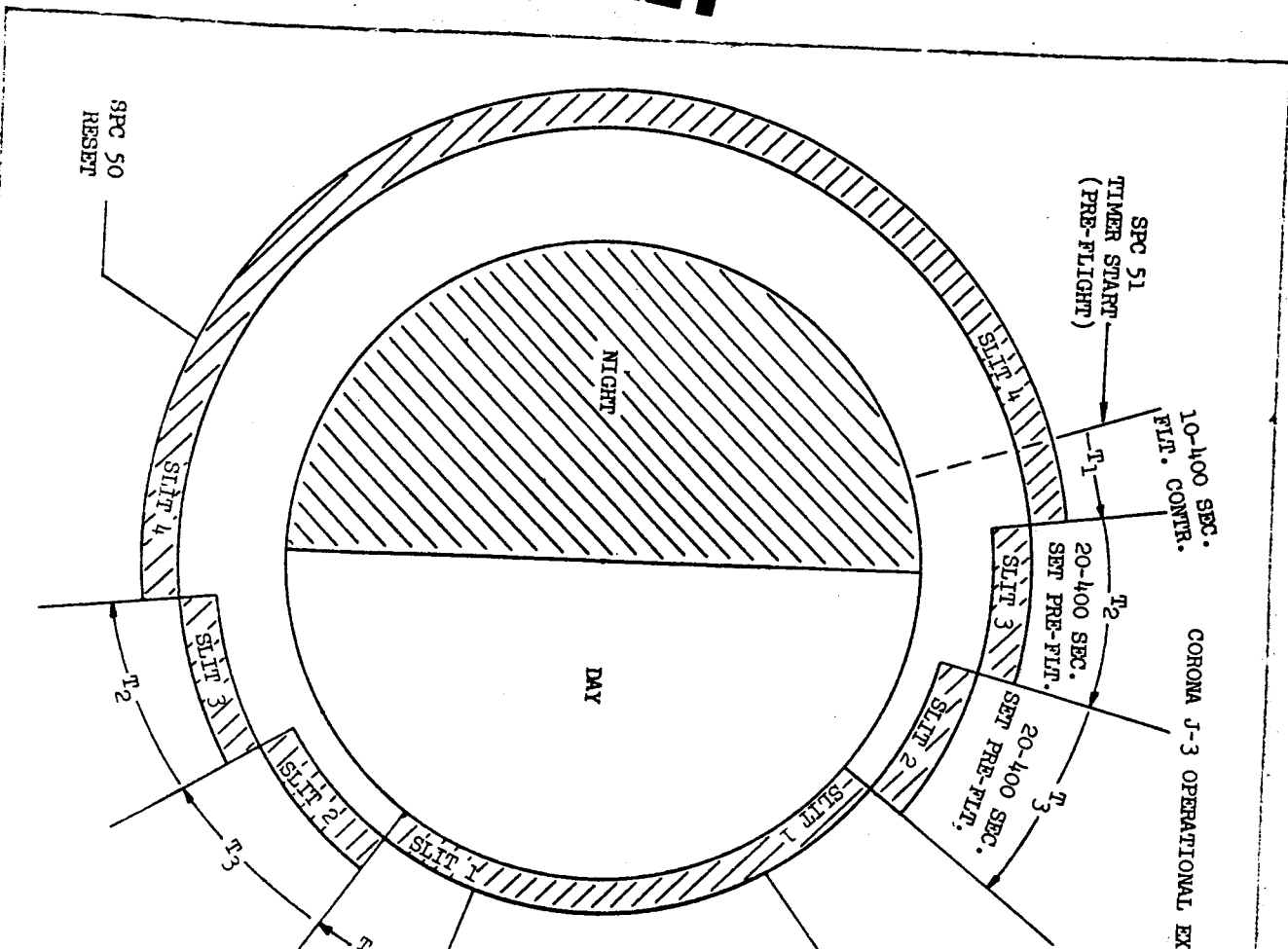
- IDEAL EXPOSURE PLOF GENERATED ONCE DAILY BASED ON PREDICTED ORBIT
 - INCLUDES ALL FILM/FILTER COMBINATIONS
- OVERLAY OF COMMAND CAPABILITY ANALYZED - "BEST" COMMAND SETTINGS ARE SELECTED
 - EXPOSURE CONTROL NORMALLY BASED ON TOTAL ORBIT PROFILE
 - PRIMARY AREA OF INTEREST (30° - 60°N) HEAVILY WEIGHTED IN ANALYSIS
 - EXTREME UNDEREXPOSURE AVOIDED IF POSSIBLE
 - EXPOSURE CONTROL MODE CHANGED ONLY BY REAL TIME COMMAND
- EXPOSURE CONTROL IS A CONSIDERATION IN SELECTION OF DRAG MAKE-UP ROCKET FIRINGS

EXPOSURE CONTROL PLANNING

SECRET

- DEFINE FLIGHT SLITS - R-60 TO R-45
 - ASSUME PROBABLE ORBIT PARAMETERS
 - ASSUME FLIGHT FILM AND FILTERS
 - ASSUME LAUNCH DAY
 - ANALYZE AND ASSUME PROBABLE LAUNCH WINDOW
 - ANALYZE NOMINAL AND DISPERSED CASES
 - ANALYZE AND SELECT OPTIMUM SLIT WIDTHS FOR MOST PROBABLE IDEAL SLIT WIDTH PROFILE
- DEFINE ΔT 'S AND SFC-50, 51, 52 PROGRAMMING - R-9
 - CALIBRATED VALUES OF FLIGHT SLITS ARE USED
 - NOMINAL MISSION ORBIT PARAMETERS ARE USED
 - SELECTED FLIGHT FILM AND FILTERS ARE USED
 - SELECTED LAUNCH WINDOW IS USED
 - SELECTED LAUNCH DATE IS USED
 - ANALYZE NOMINAL AND DISPERSED CASES
 - SELECT OPTIMUM ΔT VALUES FOR MOST PROBABLE IDEAL SLIT VALUE PROFILE
 - USING PLANNED ORBIT HISTORY, DEFINE SFC-50, 51, 52 PROGRAMMING

SECRET



CORONA J-3 OPERATIONAL EXPOSURE CONTROL

Time Increments Apply to Both Cameras
COMMAND OPTIONS:

- o Both in Auto
- o Both in Any Same Fixed Slit
- o One in Failsafe, Other in Auto
- o One in Failsafe, Other in Any Fixed Slit

COMMAND OPTIONS NOT PROVIDED:

- o Both in Different Fixed Slits
- o One in Auto, Other in any Fixed Slit (Other Than Failsafe,)

MAXIMUM POSSIBLE SLIT WIDTH - .340"
 MINIMUM POSSIBLE SLIT WIDTH - .134"

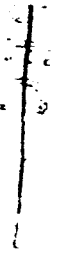
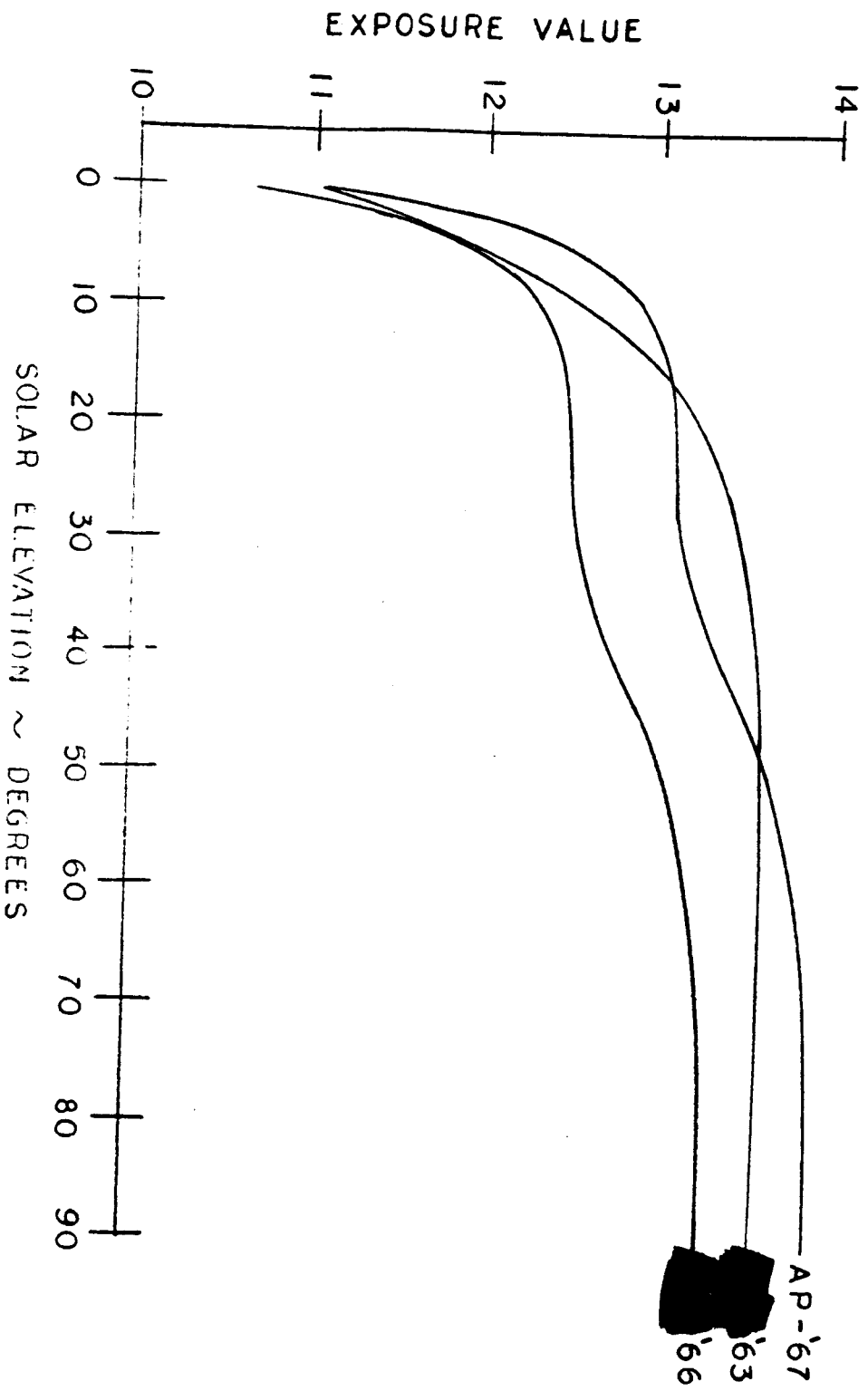
TWO FILTERS FOR EACH CAMERA
 EXPOSURE CONTROL MODE CHANGE BY RTC ONLY
 FILTER CHANGE BY RTC OR FILM CHANGE DETECTOR

SPC 52 TIMER START PROGRAMMED PRE-FLIGHT
 SPC 50 RESET
 SPC 51 TIMER START (PRE-FLIGHT)

SPC 50
 RESET

SECRET

EXPOSURE CRITERIA ~ 3404 FILM
FULL PROCESSING



SECRET

CORONA EXPOSURE CONTROL

- TWO SEPARATE PROBLEMS
 - COMPUTATION OF IDEAL EXPOSURE FUNCTION
 - IN-FLIGHT MATCHING OF EXPOSURE CONTROL FUNCTION TO IDEAL EXPOSURE FUNCTION
- IDEAL EXPOSURE FUNCTION FACTORS
 - LUMINANCE MODEL
 - CAMERA APERTURE/LENS/FILTER FACTORS
 - FILM/PROCESSING
 - DENSITY CRITERIA
 - ORBIT PARAMETERS
- IN-FLIGHT FUNCTION TO FUNCTION MATCHING
 - HARDWARE CAPABILITY AND LIMITATIONS
 - ACTUAL VS PLANNED ORBIT PARAMETERS
- CORONA EXPOSURE CONTROL EFFECTED BY CONTROLLING SLIT WIDTH

COMPUTATION OF IDEAL EXPOSURE FUNCTION
(SLIT WIDTH)

- INPUT
 - EXPOSURE VALUE VS SOLAR ELEVATION CURVE FOR SPECIFIED FILM AND PROCESSING
 - LENS/FILTER TRANSMITTANCE (APERTURE VALUE A_v)
 - ORBITAL ELEMENTS
 - LAUNCH DATE AND TIME
 - ORBIT REV NUMBER
- COMPUTATIONS

- SOLAR ELEVATION FOR DESIRED TIME AND LATITUDE INCREMENTS
- LOOK-UP EXPOSURE VALUE (EV) FROM TABLE
- COMPUTE SCAN VALUE R_v FROM SCAN RATE (PROPORTIONAL TO V/H)

$$R_v = \frac{\log (\text{SCAN RATE})}{\log 2}$$

- COMPUTE SLIT VALUE (SL_v)

$$E_v = A_v + T_v \quad T_v = R_v + SL_v$$

$$E_v = A_v + R_v + SL_v$$

$$SL_v = EV = A_v - I_v$$

$$SL_v = \frac{\log (1/\text{SLIT WIDTH})}{\log 2}$$

EXPOSURE CONTROL ACCURACY

- COMPUTATION OF IDEAL SLIT WIDTH PROFILE
 - ORBIT CALCULATIONS ~ NEGLIGIBLE ERROR
 - SOLAR ELEVATION $\pm .01$ DEGREE
 - $V/H \approx 2\%$ OR $.02$ F STOP
 - ACCURACY OF EV VS SOLAR ELEVATION TABLE IS ACCURACY OF IDEAL SLIT COMPUTATION
 - ACCURACY NOT ESTIMATED
- CONTROL SYSTEM FUNCTION TO FUNCTION MATCH ACCURACY
 - IDEAL SLIT PROFILE CHANGES DURING MISSION
 - ORBIT β ANGLE PRECESSION
 - TOTAL CHANGE IN β DEPENDENT UPON INCLINATION ANGLE AND MISSION LIFE
 - SEVERITY OF EFFECTS ON IDEAL SLIT PROFILE DEPENDENT ON β ANGLE RANGE AND SEASON
 - PERIGEE LOCATION MOVEMENT
 - PERIGEE ALTITUDE CHANGES
 - ACTUAL AND PLANNED IDEAL SLIT PROFILES ARE DIFFERENT
 - LAUNCH TIME WITHIN WINDOW
 - ORBIT INJECTION DISPERSIONS
 - PERIGEE ALTITUDE ± 10 N.M.
 - PERIGEE LOCATION $\pm 50^\circ$ OF LATITUDE

AFOMPT
UNCLASSIFIED

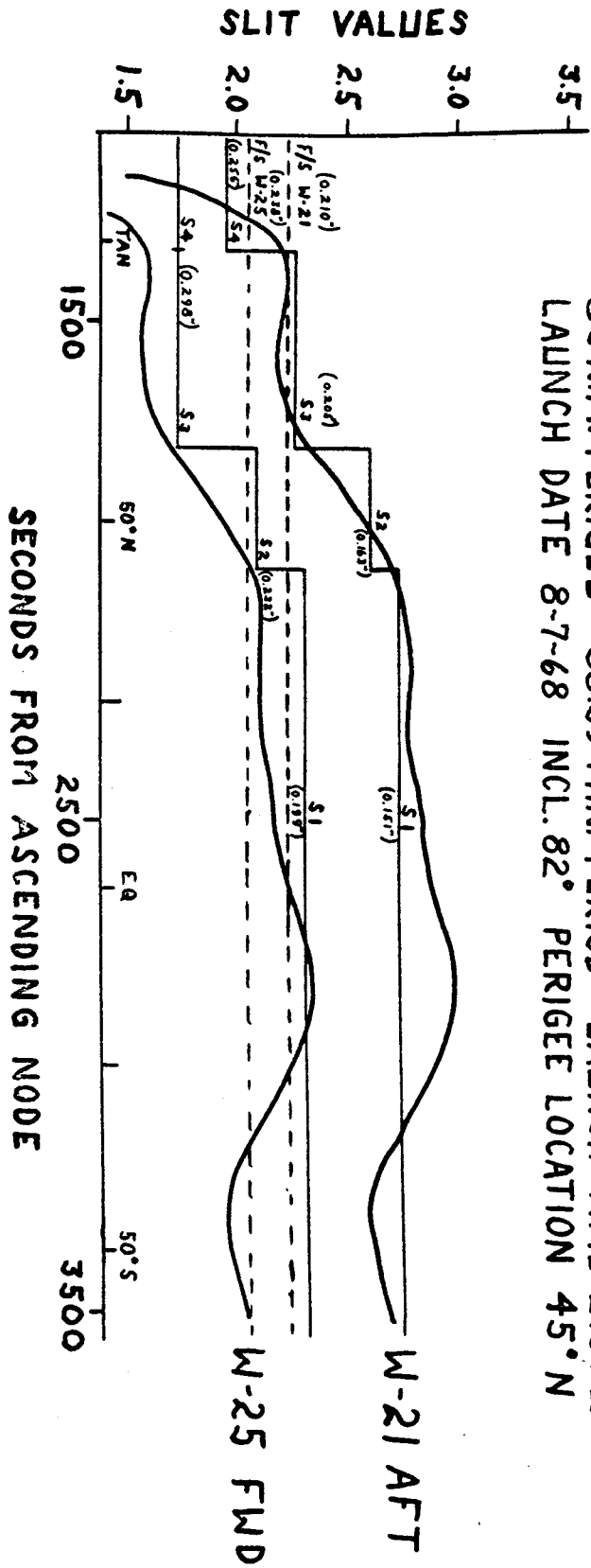
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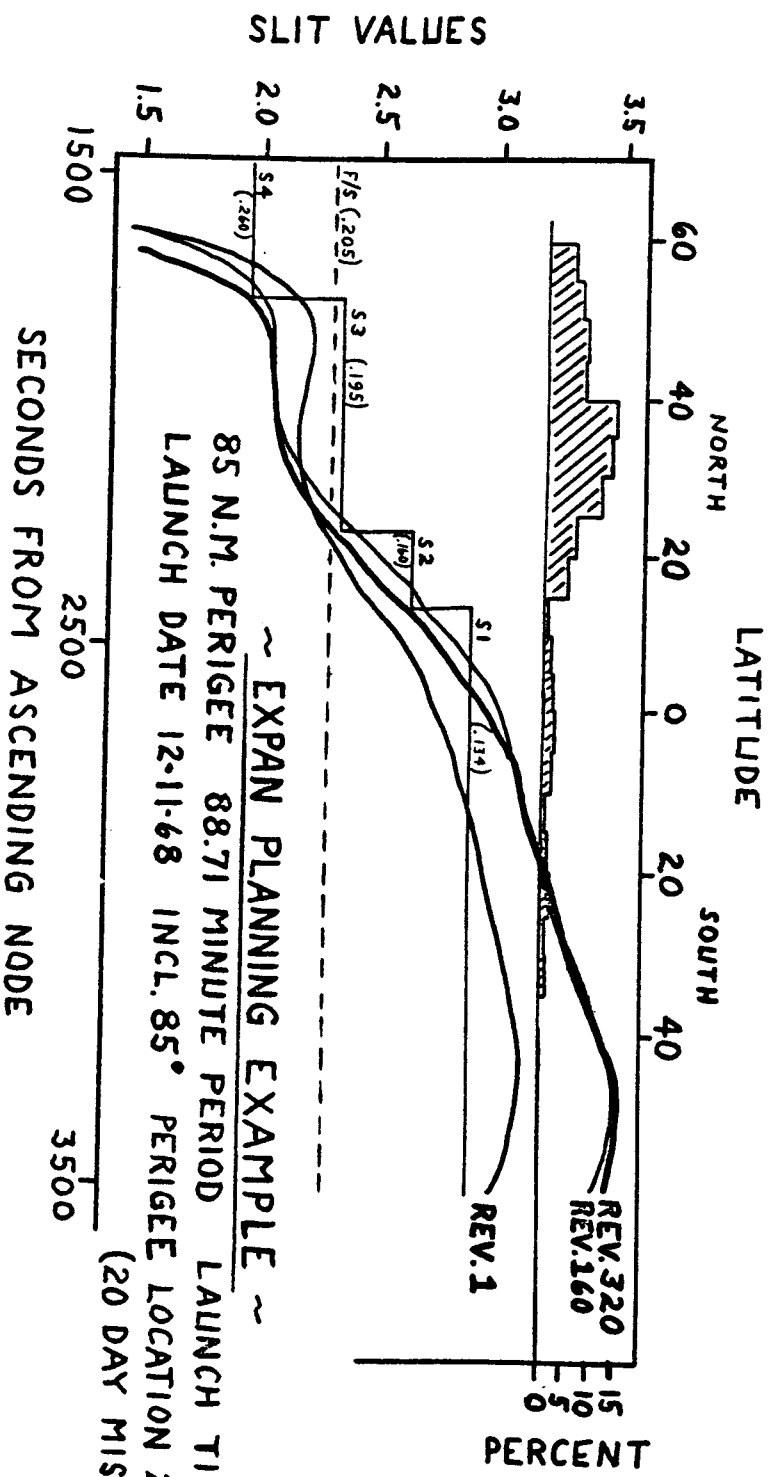
EXPOSURE CONTROL ACCURACY (Continued)

- CONTROL SYSTEM PRECISION TO FUNCTION MATCH ACCURACY (Continued)
 - NORMAL SLIT VALUE STEPS \approx .3 F STOP
 - SLIT COMMAND OPTIONS ARE LIMITED
- ESTIMATED FUNCTION TO FUNCTION MATCH ACCURACY
 - MAXIMUM ERROR \approx .6 F STOP
 - AVERAGE ERROR \approx .2 F STOP

SECRET

MISSION 1104 EXPOSURE ~ REV. 200
83 N.M. PERIGEE 88.59 MIN. PERIOD LAUNCH TIME 2137Z
LAUNCH DATE 8-7-68 INCL. 82° PERIGEE LOCATION 45° N





SLIT VALUES

LATITUDE
NORTH SOUTH

3.5
3.0
2.5
2.0
1.5
1500
2500
3500

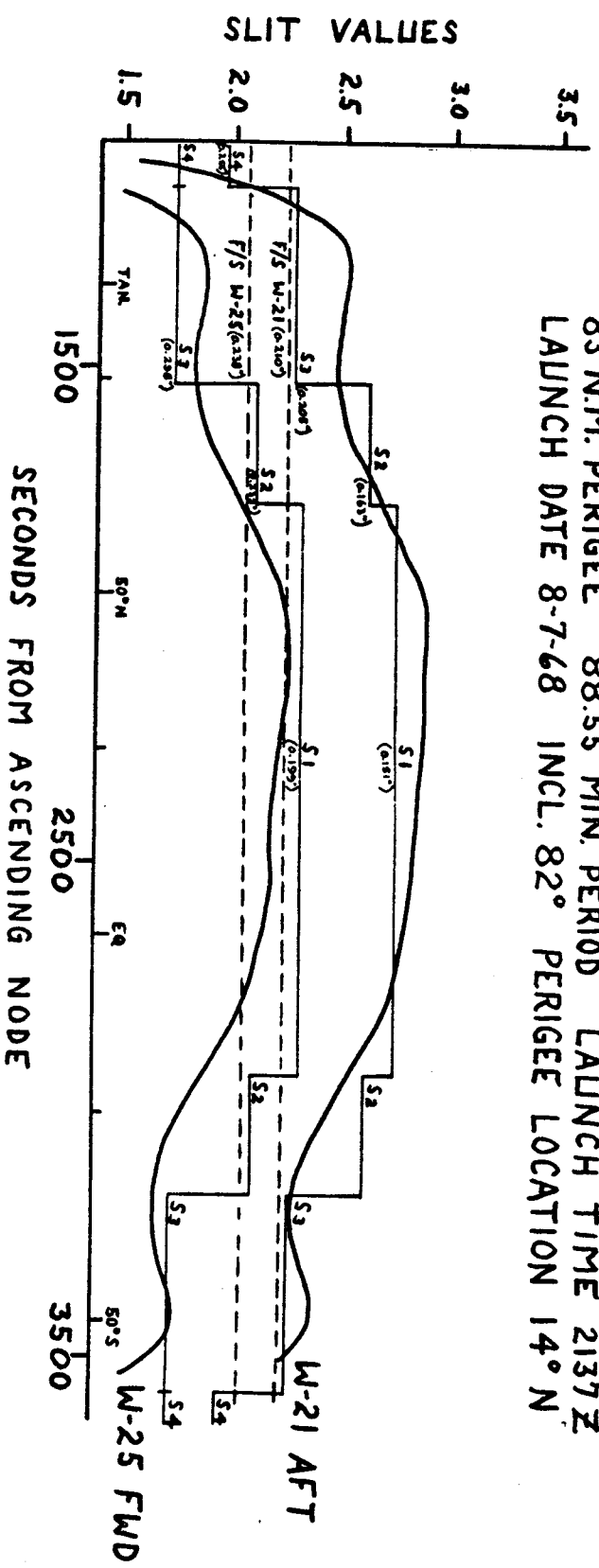
SECONDS FROM ASCENDING NODE

REV. 320
REV. 160
REV. 1
PERCENT
15
10
5
0

~ EXPAN PLANNING EXAMPLE ~
85 N.M. PERIGEE 88.71 MINUTE PERIOD LAUNCH TIME 2100
LAUNCH DATE 12-11-68 INCL. 85° PERIGEE LOCATION 22° N. DESC.
(20 DAY MISSION)

SECRET

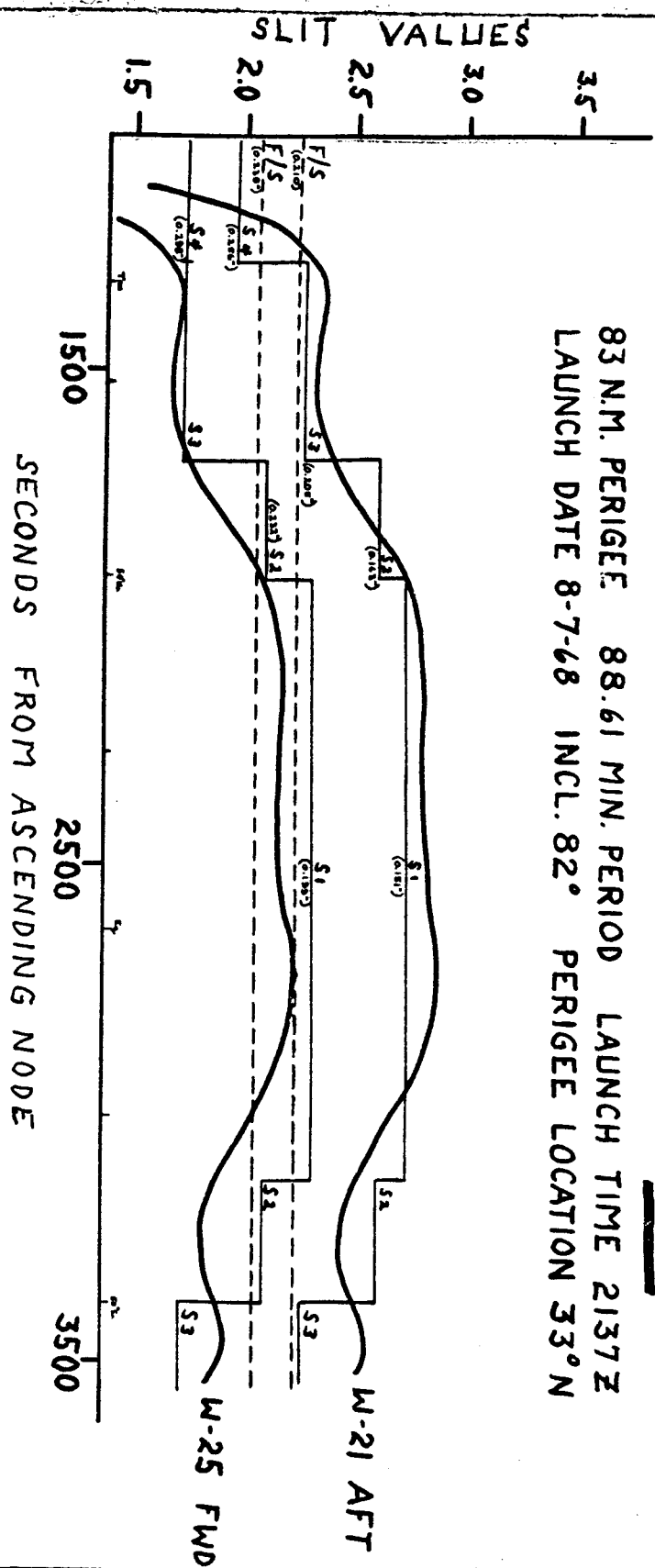
MISSION 1104 EXPOSURE ~ REV. 40
 83 N.M. PERIGEE 88.55 MIN. PERIOD LAUNCH TIME 2137Z
 LAUNCH DATE 8-7-68 INCL. 82° PERIGEE LOCATION 14° N



SMFT
W-21

ORBIT
SERIAL I

MISSION 1104 EXPOSURE ~ REV. 105
83 N.M. PERIGEE 88.61 MIN. PERIOD LAUNCH TIME 2137Z
LAUNCH DATE 8-7-68 INCL. 82° PERIGEE LOCATION 33°N



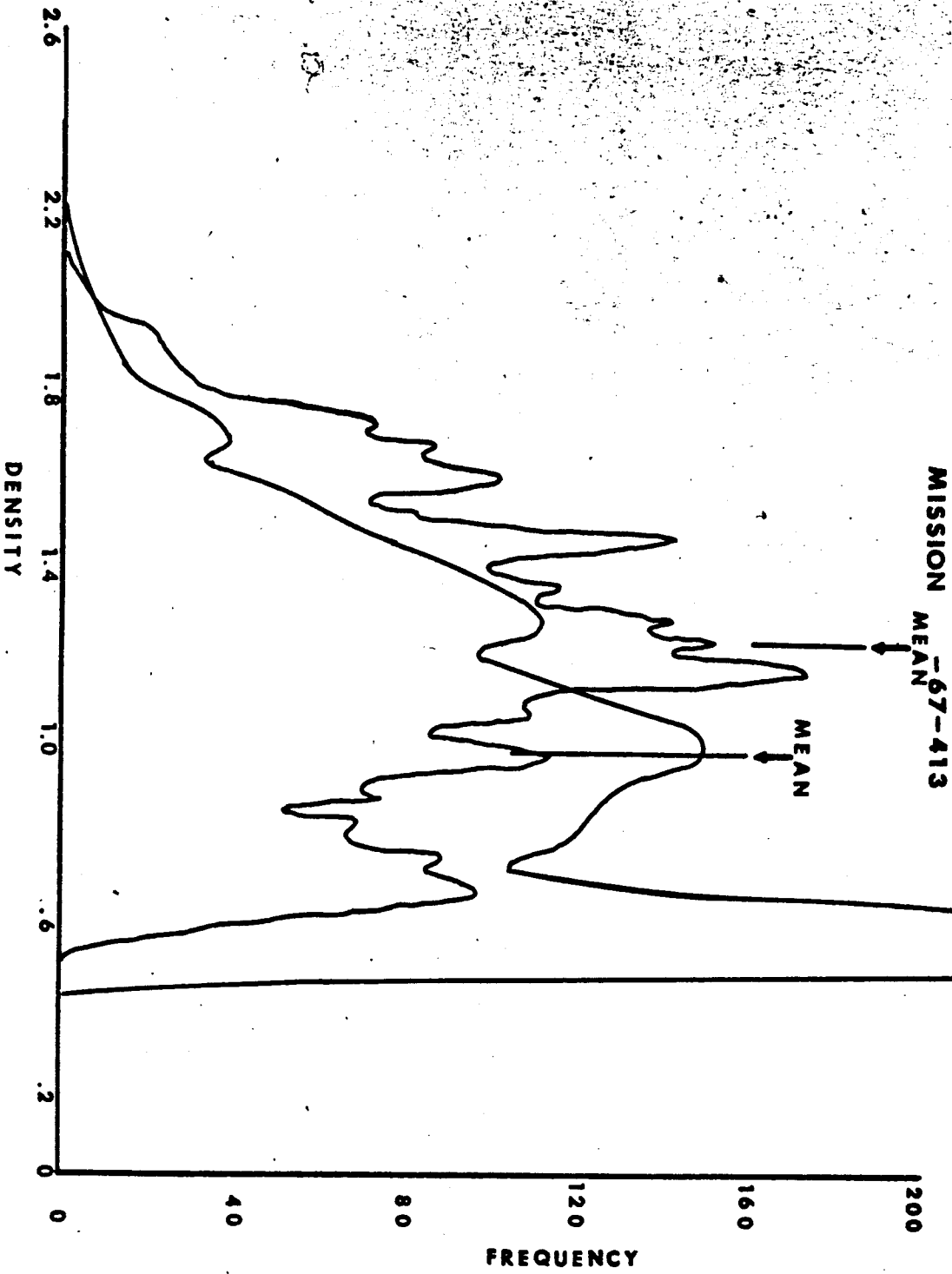
ORBIT
SERIAL I

CONCLUSIONS

- FLIGHT HARDWARE AND OPERATIONAL PROCEDURES ARE NOT SIGNIFICANTLY LIMITING CORONA EXPOSURE PERFORMANCE
 - IMPROVED RELIABILITY AND ACCURACY OF THE EXPOSURE CRITERIA IS DESIRABLE
 - SUNNY DATA VALIDATE FURTHER CRITERIA ADJUSTMENTS
- RECOMMENDATIONS
- USE THE INTERIM EXPOSURE CRITERIA BASED ON SUNNY DATA
 - CONTINUE SUNNY ANALYSIS TO MONITOR AND IMPROVE CRITERIA

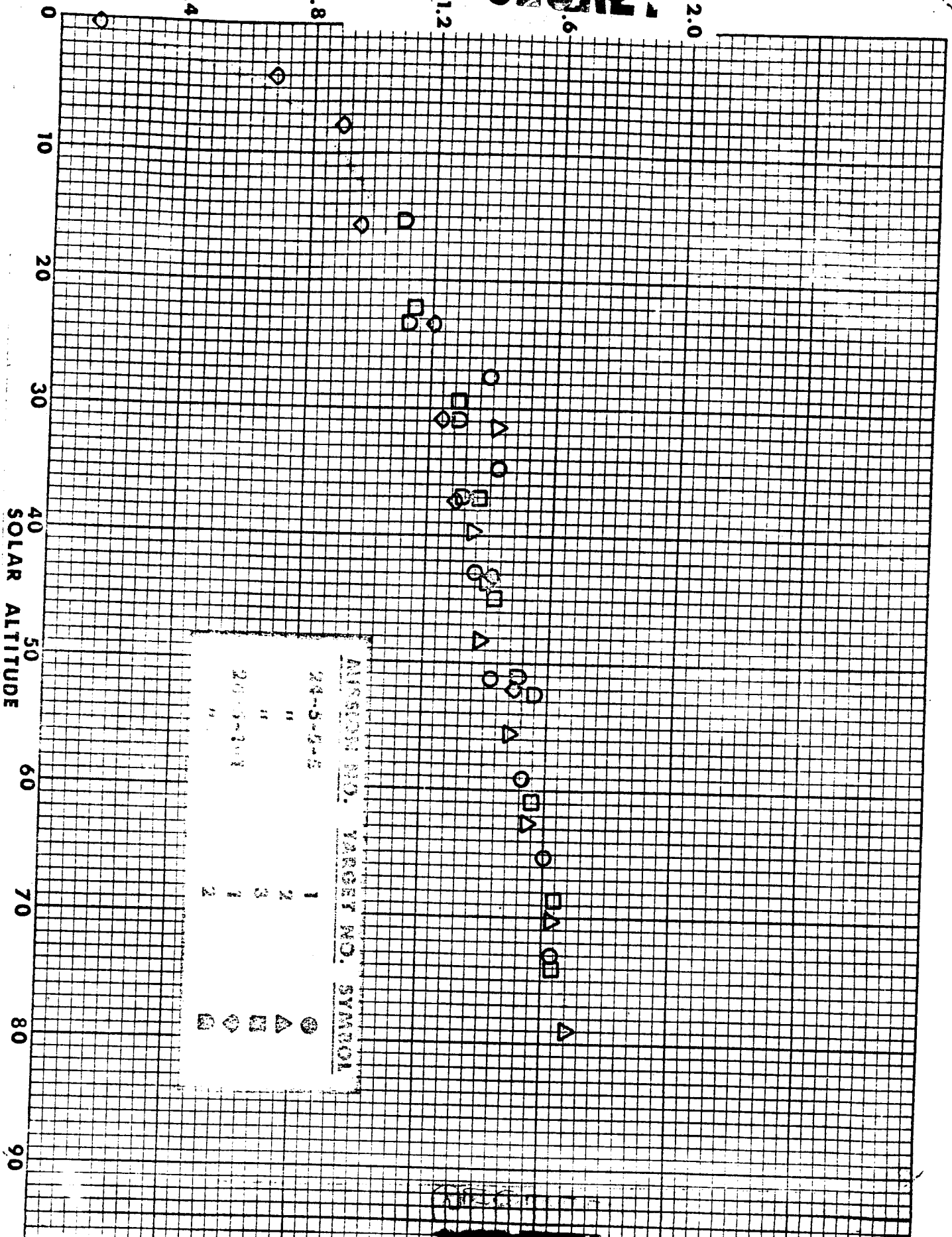
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DENSITY DISTRIBUTION

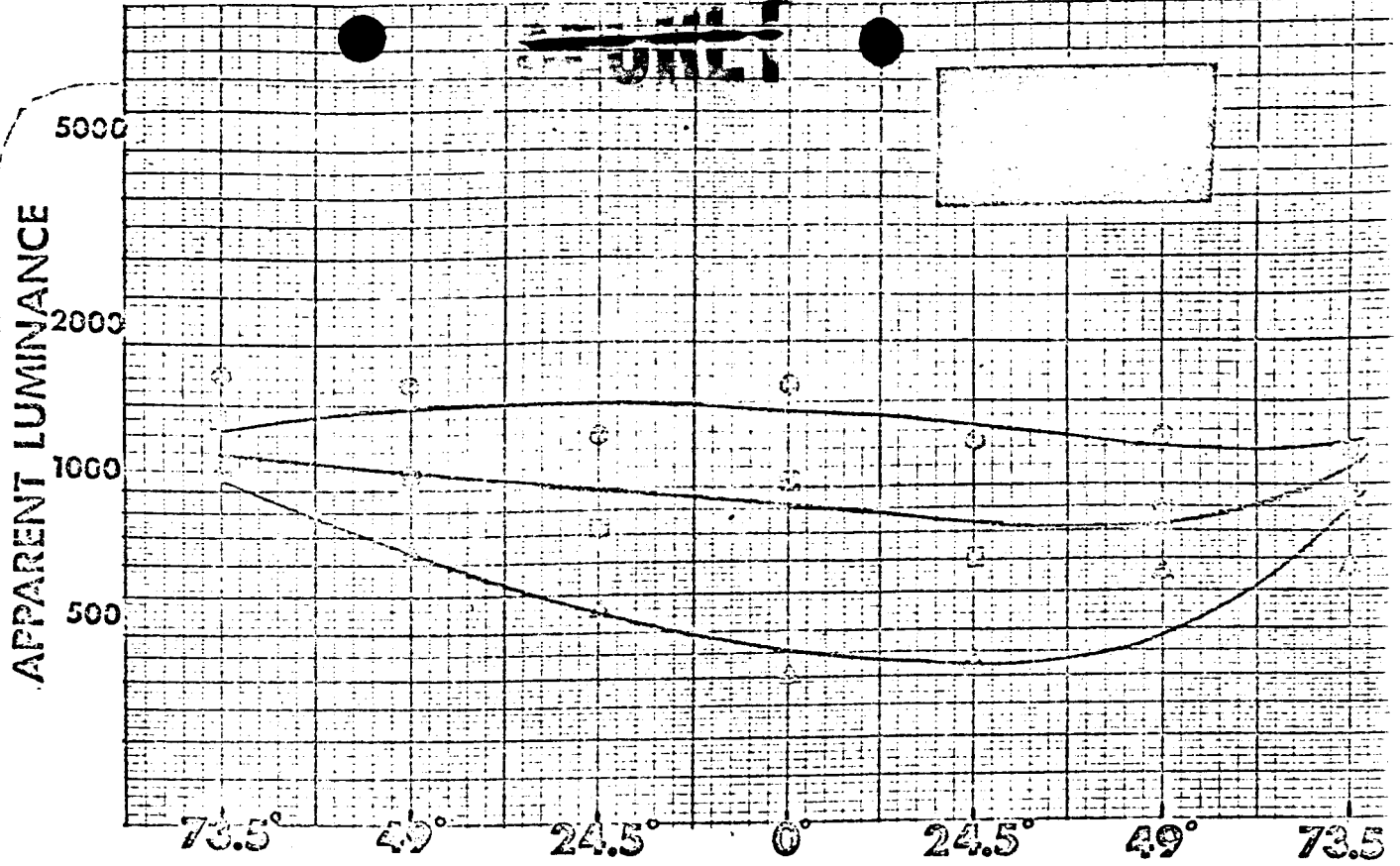


DELTA LOG B

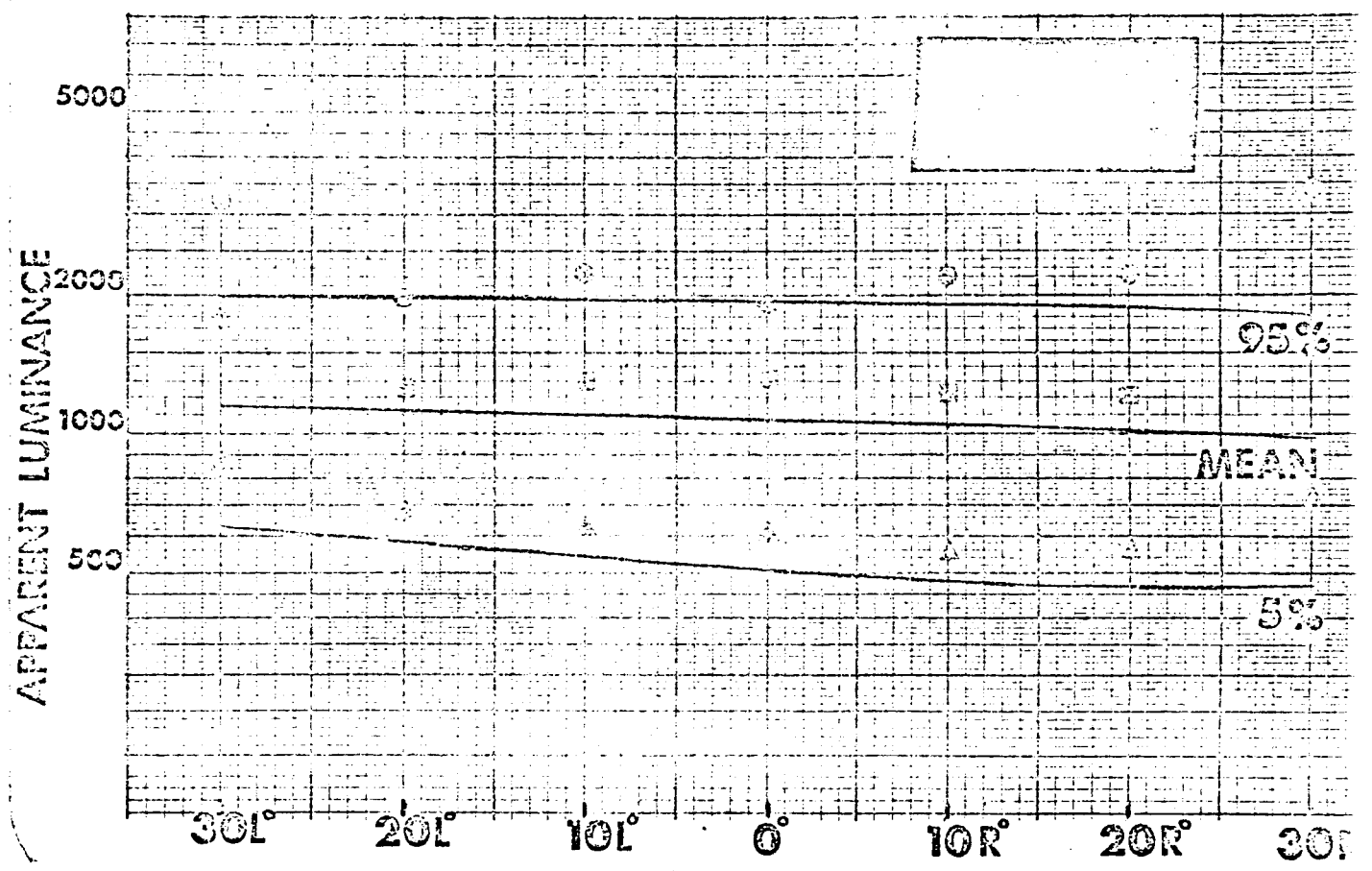
SECRET



SECRET



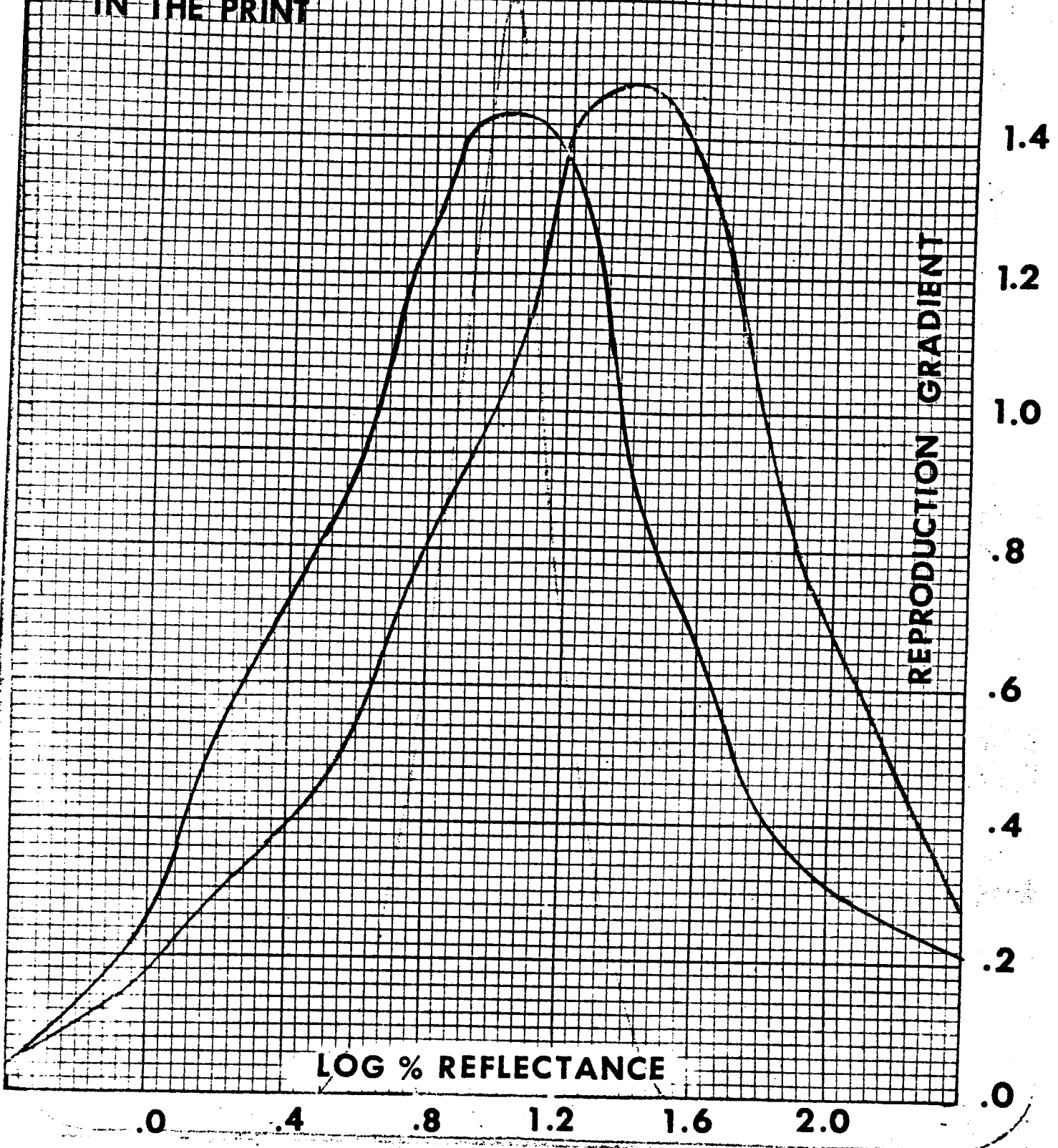
SCAN STATISTICS vs
CRYSTAL BALL PREDICTIONS



GEORGE
OPTICAL

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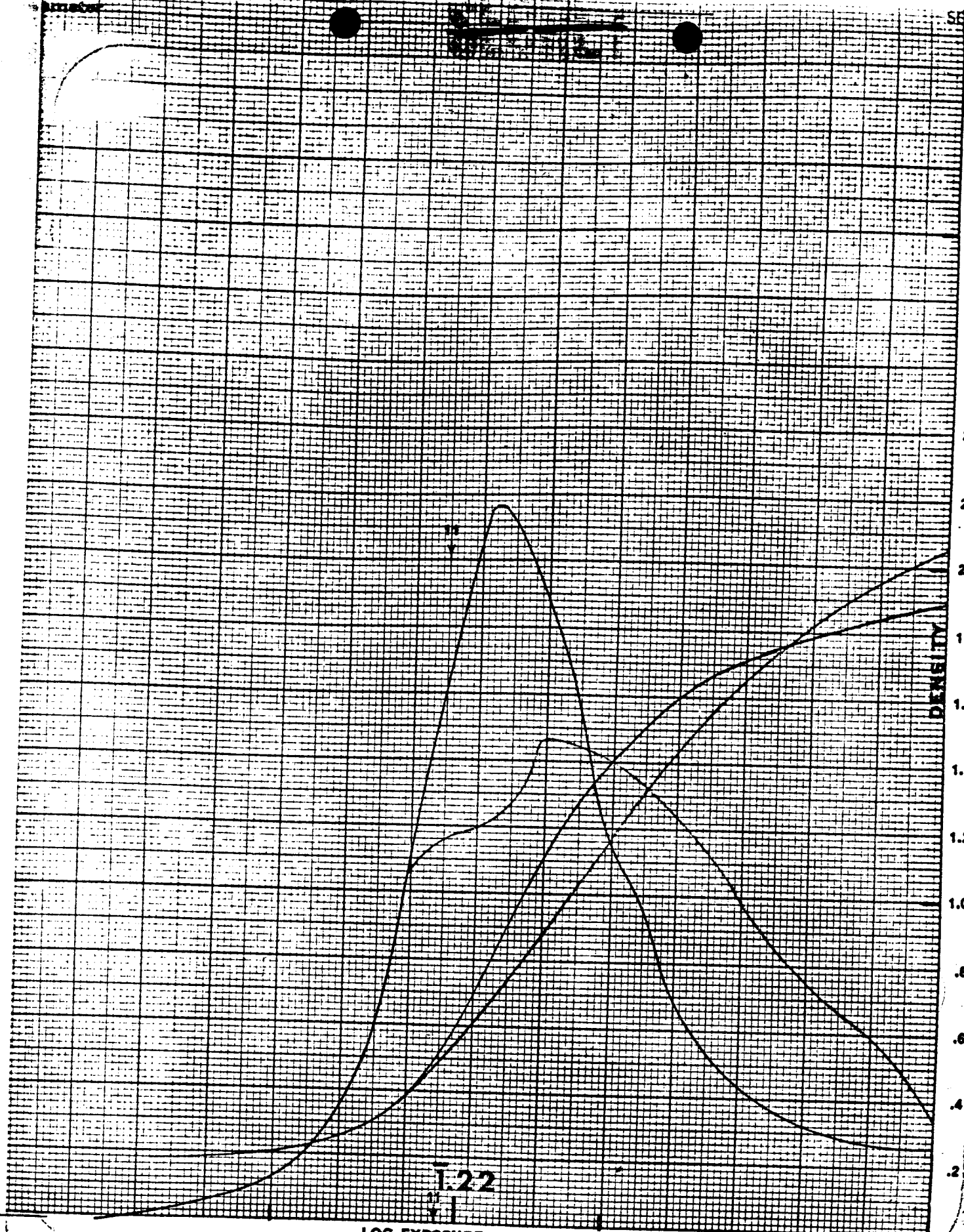
**OBJECT GRADIENTS
AS REPRODUCED
IN THE PRINT**



MASTER VIT

INFORMATION

~~SECRET~~



LOG EXPOSURE

1.22

~~SECRET~~

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METHODOLOGY

CONTENTS

SCENE

MATERIAL

1. MINIMUM B_a

TOE SPEED POINT

- a. GROSS SPOT
- b. OBJECT SHADOWS

2. LUMINANCE AND REFLECTANCE
FREQUENCY DISTRIBUTIONS

a. RESOLUTION VOLUME
b. PEAK RESOLUTION

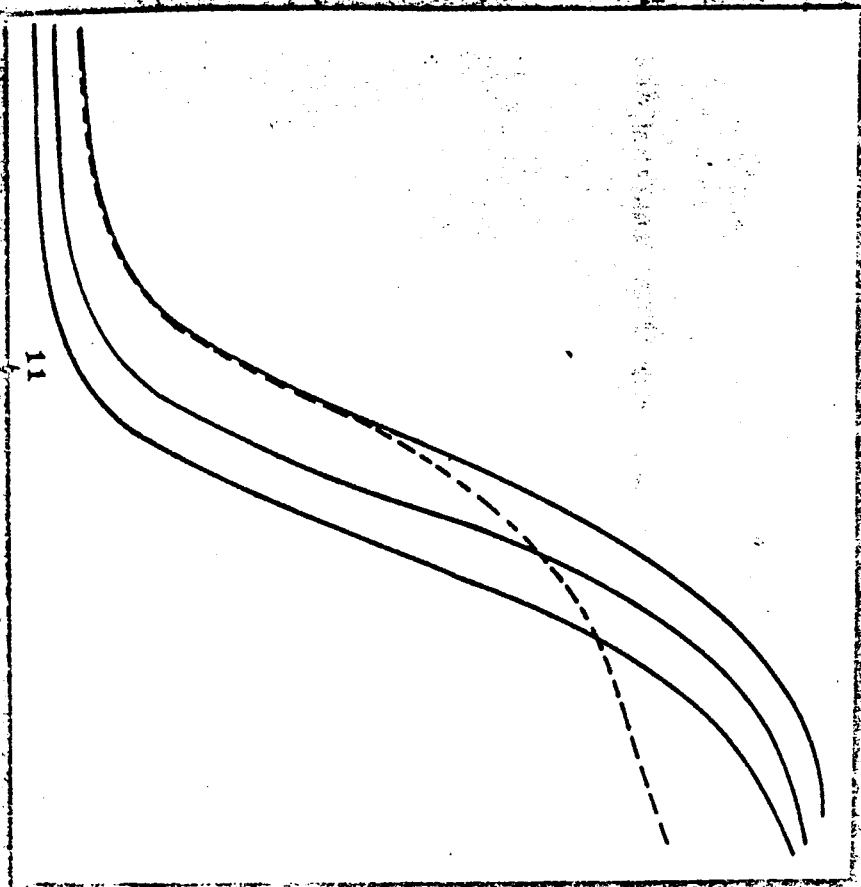
3. LUMINANCE OF SPECIFIC
TARGET ELEMENTS

PEAK RESOLUTION POINT

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ORIGINAL NEGATIVE PROCESSING SENSITOMETRY
FILM TYPES 3404/SO-380
Single Level Viscous (Dual Gamma) Vs. Interrupted Three Level



	P	I	F	Dual Gamma
Speed				
AFS	6.0	7.9	11.7	10.4
AEI	1.7	2.3	3.6	3.8
Gamma	2.36	2.45	2.26	2.00, .34
Fog	.10	.15	.25	.21
Latitude	.54	.67	.76	Extended



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SIGNIFICANT FINDINGS

- * SCENE LUMINANCE STATISTICS, AS SEEN FROM ORBITAL ALTITUDES, ARE NOW WELL KNOWN. (BASED ON LARGE AREA MIN-MAX, FOR ENTIRE FRAME)
- * THERE IS IMPORTANT GEOGRAPHICAL INFLUENCE ON SATELLITE EXPOSURE CURVES.
- * AS A GENERAL CRITERIA, THE MEAN SCENE LUMINANCE IS THE MOST INVARIANT STATISTIC, AND APPEARS TO BE ASSOCIATED WITH A 12 PERCENT REFLECTANCE.
- * A SENSITOMETRIC CURVE DESIGNED TO COMPENSATE FOR THE CONTRAST REDUCTION DUE TO THE ATMOSPHERE, PRODUCES AN IMAGE SUPERIOR TO THE CONVENTIONAL CURVE SHAPE.
- * THE EFFECTS OF ATMOSPHERIC HAZE CANNOT BE CORRECTED FOR, BY CHANGES IN CAMERA EXPOSURE.
- * VARIATIONS IN ATMOSPHERIC RADIANCE, AT A GIVEN SOLAR ALTITUDE, DO NOT APPEAR TO EXCEED A FACTOR OF 2.5:1.
- * IT MAY BE POSSIBLE TO DETERMINE THE HAZE LEVEL OF A DENIED AREA, BY EXAMINATION OF LUMINANCE FREQUENCY STATISTICS.

INITIAL TRANSPARENTS INCORPORATED

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- * THE PHOTOGRAPHIC MODEL CRYSTAL BALL APPEARS TO SIMULATE "THE REAL WORLD" REASONABLY WELL.
- * SPECIFIC TARGETS CAN BE ASSIGNED REFLECTANCES AND ORIENTATION CHARACTERISTICS FOR USE WITH CRYSTAL BALL MATH MODEL.
- * FUTURE EXPOSURE RECOMMENDATIONS SHOULD BE BASED ON TARGET AREA DATA WHENEVER POSSIBLE.



UNITED TRANSPARENCIES INCORPORATED

EXPOSURE EVALUATION IN ROUTINE 1000/1100 SERIES MISSION

PROCEDURES

SAMPLE EVERY 10TH FRAME

MEASURE PRINTING DMIN, DMAX

NO CLOUDS OR WATER

PLOT DENSITY FREQUENCY DISTRIBUTIONS

COMPUTE BMIN, BMAX

TABULATE FRAME BY-FRAME BASIS

SOLAR ALTITUDE SCATTERGRAM

BRIGHTNESS FREQUENCY DISTRIBUTION

DENSITY TOLERANCE ANALYSIS

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MINIMUM BRIGHTNESS STUDIES IN ORBITAL MISSIONS

BASIC APPROACH:

PLACE BMIN AT SPEED POINT

- DENSITY ANALYSIS OF ROUTINE MISSIONS
BASIS OF ALL PAST EXPOSURE RECOMMENDATIONS
- DENSITY ANALYSIS OF INDEX RECORDS
- ANALYSIS AND REPORTING OF EXPOSURE EXPERIMENTS
IN OPERATIONAL MISSIONS

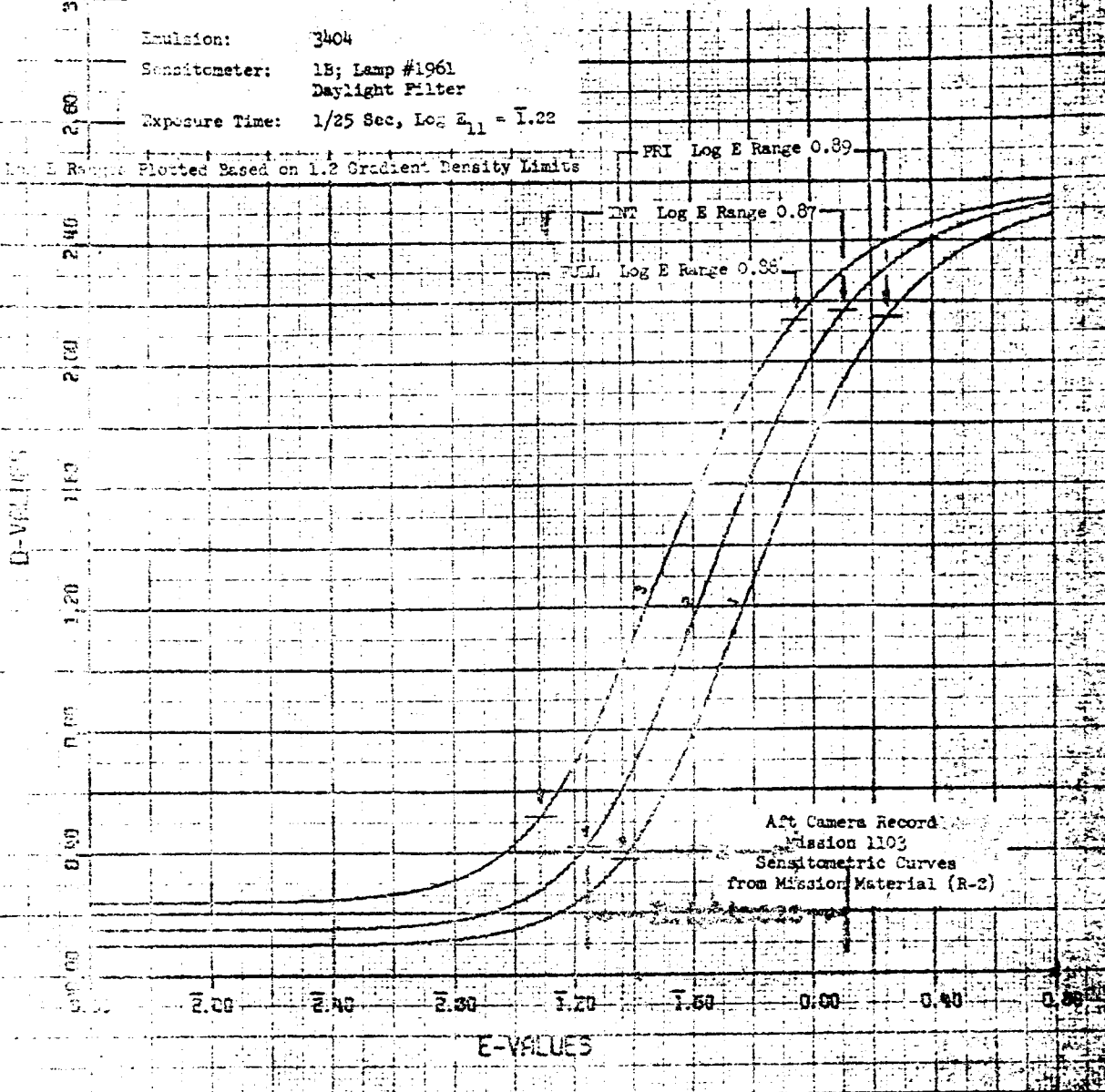
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1.2 Gradient

Process	Foc.	Gamma	0.68/Speed		Toe		Shoulder	
			Log E	Density	Log E	Density	Log E	Density
Full	.24	2.32	1.14	0.57	1.36	0.52	0.22	2.14
Int.	0.15	2.54	1.32	0.52	1.51	0.42	0.38	2.17
Pri.	0.10	2.51	1.43	0.46	1.65	0.38	0.54	2.15

Emulsion: 3404
 Sensitometer: 1B; Lamp #1961
 Daylight Filter
 Exposure Time: 1/25 Sec, Log $E_{11} = 1.22$

Results Plotted Based on 1.2 Gradient Density Limits

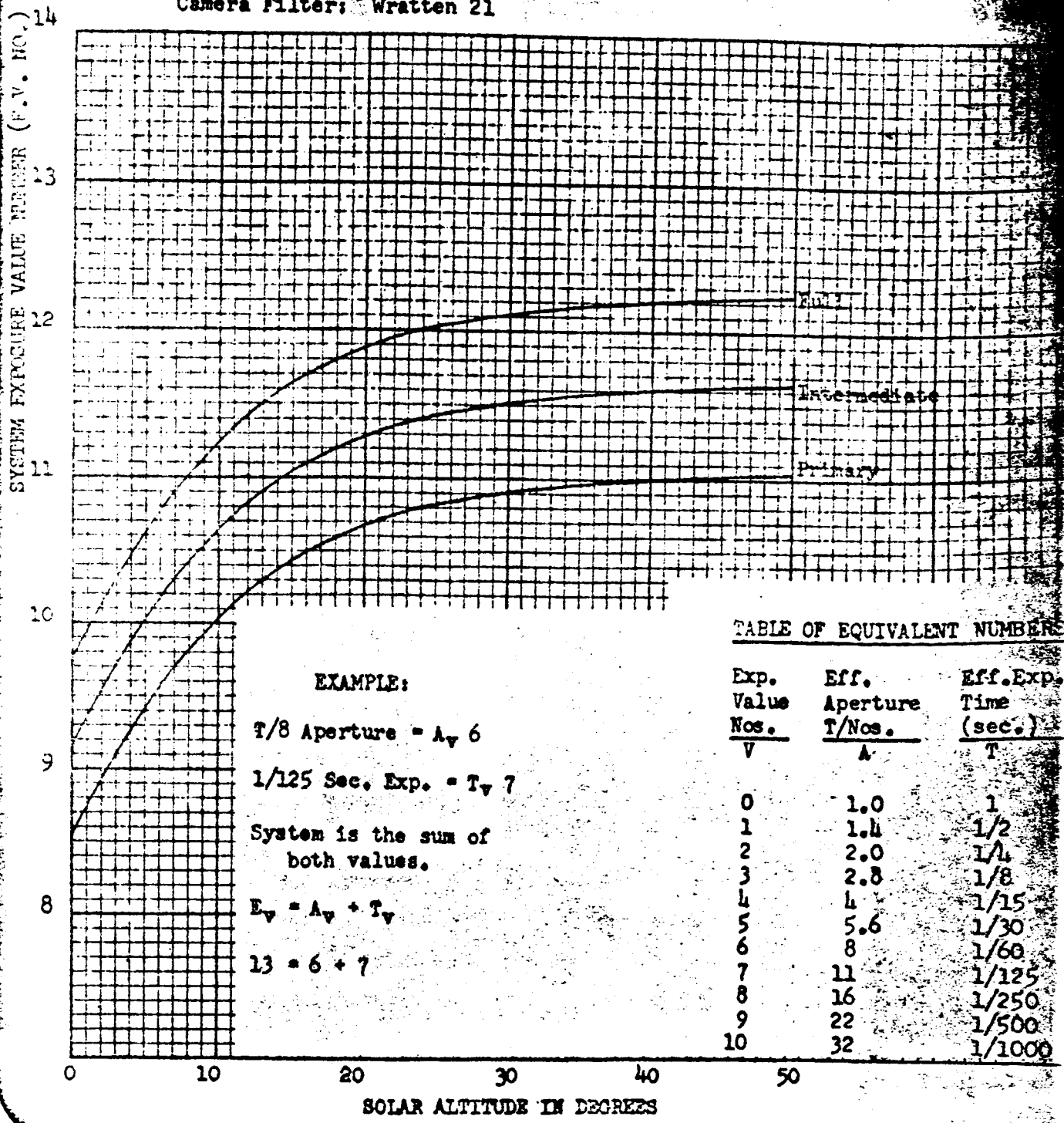


Aft Camera Record
 Mission 1103
 Sensitometric Curves
 from Mission Material (R-2)

MINIMUM EXPOSURE REQUIREMENTS FOR
AERIAL SCENES OF AVERAGE LUMINANCE
AS OF JANUARY, 1965

FOR SATELLITE PHOTOGRAPHY

Film: 4404
Camera Filter: Wratten 21

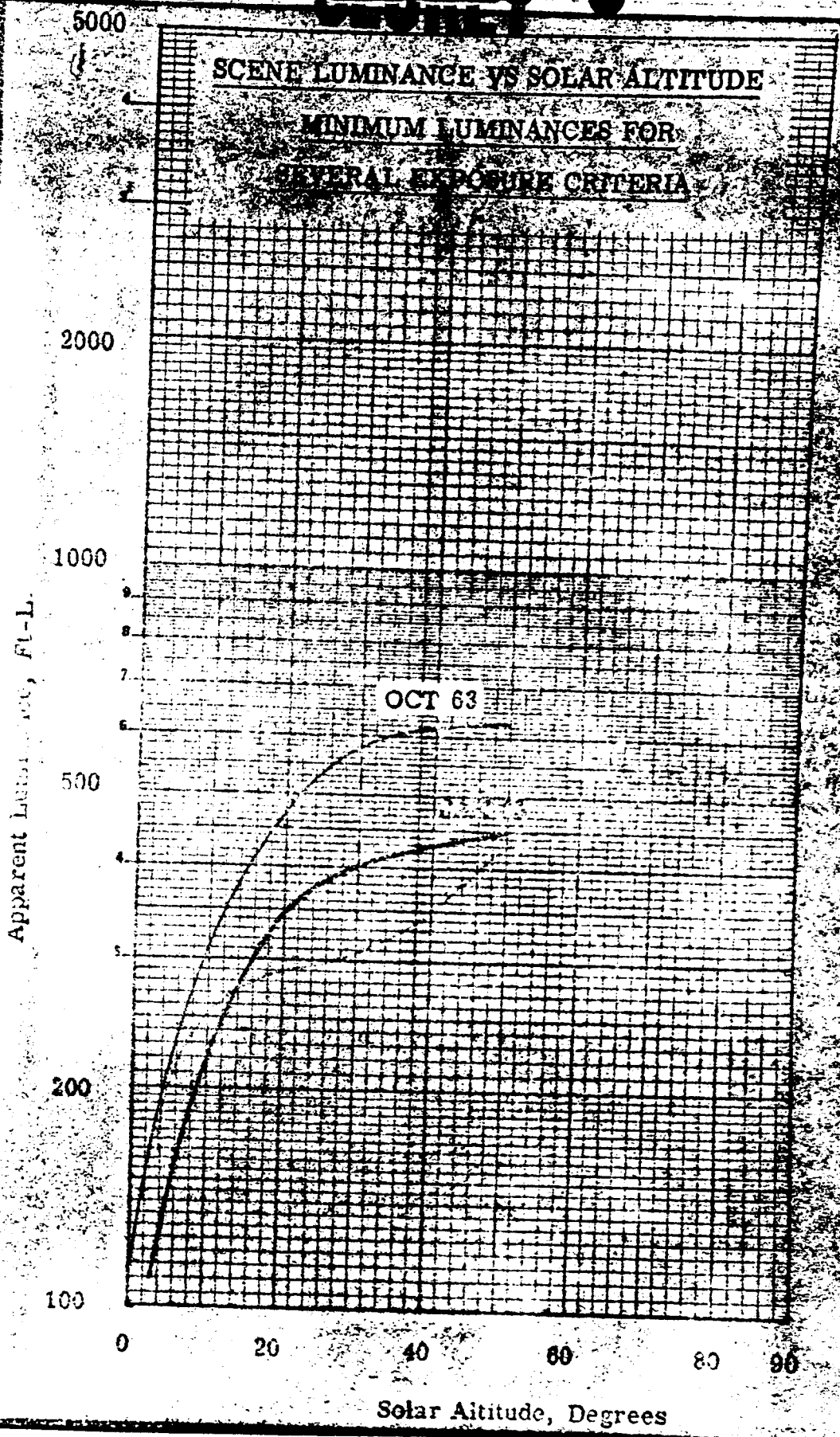


EXAMPLE:
 $f/8$ Aperture = A_v 6
 $1/125$ Sec. Exp. = T_v 7
 System is the sum of
 both values.
 $E_v = A_v + T_v$
 $13 = 6 + 7$

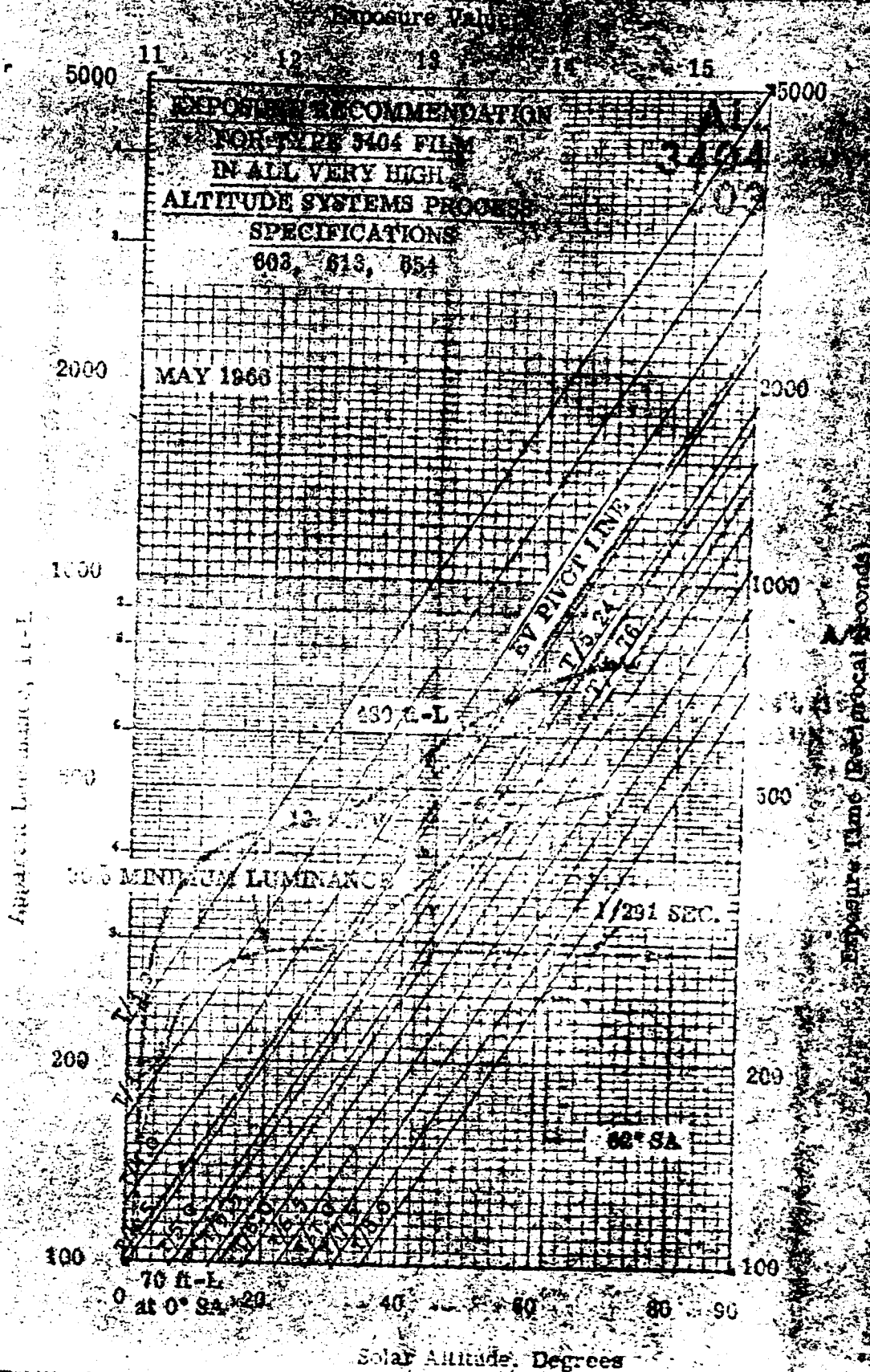
TABLE OF EQUIVALENT NUMBERS

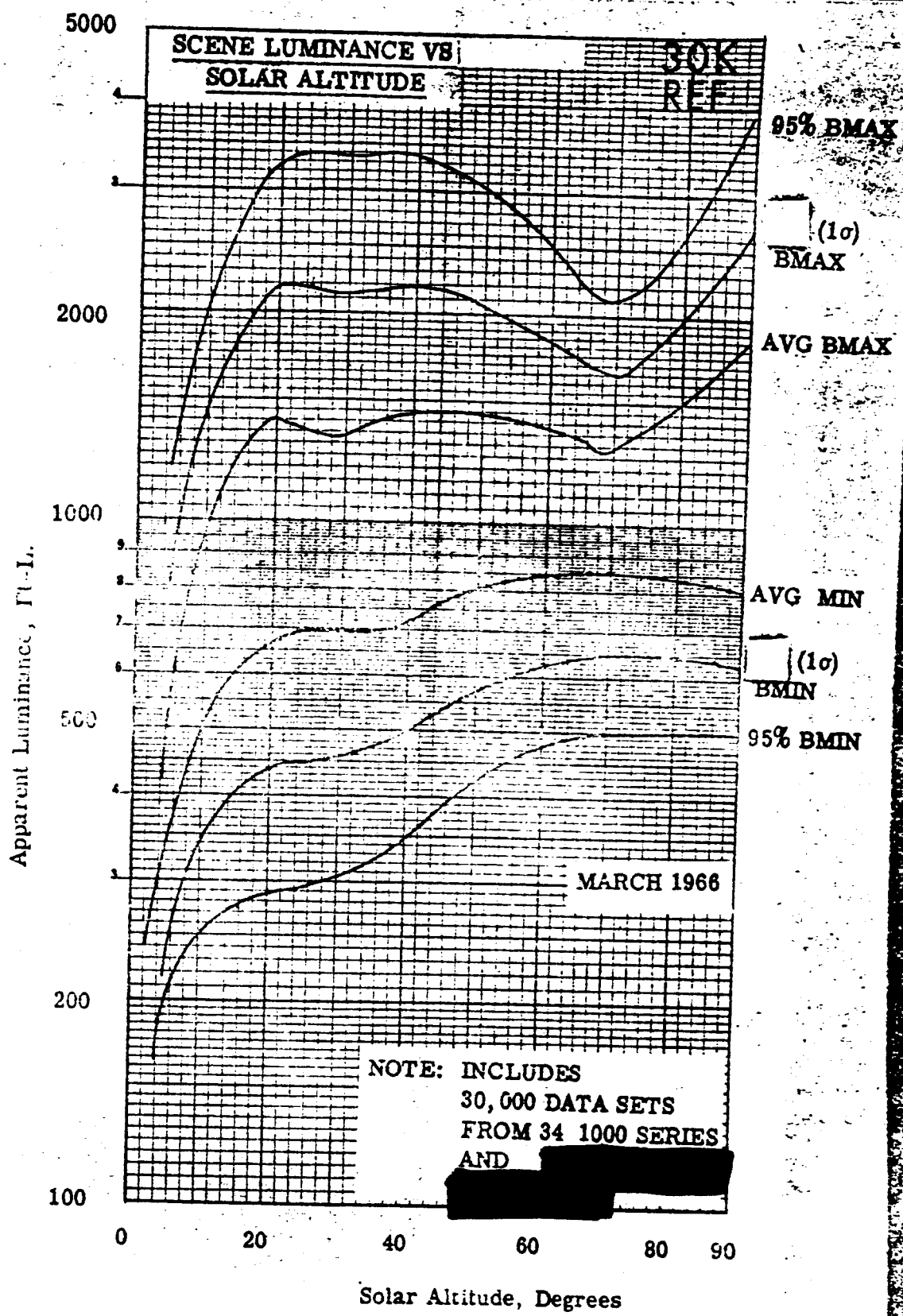
Exp. Value Nos.	Eff. Aperture T/Nos.	Eff. Exp. Time (sec.) T
0	1.0	1
1	1.4	1/2
2	2.0	1/4
3	2.8	1/8
4	4	1/15
5	5.6	1/30
6	8	1/60
7	11	1/125
8	16	1/250
9	22	1/500
10	32	1/1000

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DETAILED OUTPUT OF LUMINANCE COMPUTER PROGRAM

CM D R	E	SYS	S FR	SMLS	R	SD	II	IT	LN	INC	SA	UT DEN	FS P	ET	LUM	RKD
F 1007	680502	28596	70	40000	568489	60.3	548536	33.6	81.1	13.48	62.9	0	44 26 2	2.55	493.	24
F 1007	680502	28596	70	40000	548489	61.3	548536	33.6	81.1	13.48	62.9	0	44 26 2	2.55	2359.	24
F 1007	680502	28606	75	40000	567255	61.4	547355	32.9	83.2	13.46	63.2	0	56 26 2	2.55	651.	25
F 1007	680502	28616	80	40000	567255	61.4	547355	32.9	83.2	13.46	63.2	1	177 26 2	2.55	2592.	25
F 1007	680502	28616	80	40000	566021	62.5	546154	32.2	83.2	13.50	63.5	0	62 26 2	2.54	715.	26
F 1007	680502	28626	85	40000	566021	62.5	546154	32.2	83.2	13.50	63.5	3	43 26 2	2.54	2368.	26
F 1007	680502	28626	85	40000	564788	63.6	544963	31.6	83.3	13.50	63.8	1	162 26 2	2.54	462.	27
F 1007	680502	28636	90	40000	564788	64.7	543772	30.9	83.4	13.51	64.0	3	39 26 2	2.54	596.	27
F 1007	680502	28636	90	40000	563554	64.7	543772	30.9	83.4	13.51	64.0	1	51 26 2	2.53	403.	27
F 1007	680502	28636	90	40000	563554	64.7	543772	30.9	83.4	13.51	64.0	1	178 26 2	2.53	2687.	29
F 1007	680502	33556	5	0	624960	34.3	633008	57.8	55.8	13.04	45.9	0	46 27 2	2.83	466.	29
F 1007	680502	33556	5	0	624960	34.6	633008	57.8	55.8	13.04	45.9	1	185 27 2	2.83	2559.	30
F 1007	680502	33556	10	0	623059	34.6	631166	57.1	56.1	13.06	46.5	0	54 27 2	2.82	562.	30
F 1007	680502	33556	15	0	621159	35.0	599326	56.5	56.3	13.08	47.0	0	49 26 2	2.81	1818.	30
F 1007	680502	33576	5	0	571910	54.4	551819	36.9	38.1	13.42	61.3	0	45 26 2	2.57	1866.	31
F 1007	680502	39219	20	0	568330	57.7	548380	34.9	30.4	13.55	62.4	1	167 26 2	2.57	2287.	32
F 1007	680502	39228	25	0	567137	58.8	547234	34.2	38.4	13.46	62.7	0	193 16 1	2.55	1004.	33
F 1007	680502	39228	25	0	567137	58.8	547234	34.2	38.4	13.46	62.7	0	50 16 1	2.55	1653.	34
F 1007	680502	39238	30	0	565944	59.9	546088	33.5	38.5	13.47	63.0	1	171 15 1	2.55	801.	35
F 1007	680502	39248	35	0	564750	61.0	544942	32.9	38.6	13.48	63.3	0	168 16 1	2.54	880.	36
F 1007	680502	39248	35	0	564750	61.0	544942	32.9	38.6	13.48	63.3	0	50 26 2	2.54	3502.	36
F 1007	680502	45007	5	0	547825	120.5	528697	2.8	18.6	13.74	61.5	0	50 26 2	2.50	577.	37
F 1007	680502	45016	10	0	548408	121.4	529219	2.2	18.7	13.74	61.1	0	41 26 2	2.51	1450.	37
F 1007	680502	45026	15	0	548408	121.4	529219	2.2	18.7	13.74	61.1	1	99 26 2	2.51	437.	38
F 1007	680502	45035	20	0	548992	122.3	529741	1.5	18.7	13.75	60.7	0	45 26 2	2.51	501.	39
F 1007	680502	45045	25	0	549576	123.1	530343	0.9	18.7	13.75	60.3	0	44 26 2	2.51	1350.	39
F 1007	680502	45054	30	0	550160	124.0	530905	0.3	18.8	13.76	59.9	0	87 26 2	2.51	999.	40
F 1007	680502	45063	35	0	550743	124.9	531467	0.3	18.8	13.76	59.9	0	41 26 2	2.51	436.	41
F 1007	680502	45073	40	0	551327	125.8	532029	-0.4	18.8	13.77	59.5	0	170 26 2	2.51	1173.	41
F 1007	680502	45083	45	0	551911	126.6	532591	-1.7	18.9	13.78	59.6	0	41 26 2	2.52	466.	42
F 1007	680502	45093	50	0	552495	127.5	533153	-3.0	18.9	13.79	59.7	0	38 26 2	2.52	411.	42
F 1007	680502	45103	55	0	553079	128.4	533715	-4.3	18.9	13.80	59.8	0	35 26 2	2.52	465.	43
F 1007	680502	45113	60	0	553663	129.3	534277	-5.6	18.9	13.81	59.9	0	32 26 2	2.52	416.	43
F 1007	680502	45123	65	0	554247	130.2	534839	-6.9	18.9	13.82	59.9	0	29 26 2	2.52	466.	44
F 1007	680502	45133	70	0	554831	131.1	535401	-8.2	18.9	13.83	59.9	0	26 26 2	2.52	417.	44
F 1007	680502	45143	75	0	555415	132.0	535963	-9.5	18.9	13.84	59.9	0	23 26 2	2.52	467.	45
F 1007	680502	45153	80	0	555999	132.9	536525	-10.8	18.9	13.85	59.9	0	20 26 2	2.52	418.	45
F 1007	680502	45163	85	0	556583	133.8	537087	-12.1	18.9	13.86	59.9	0	17 26 2	2.52	468.	46
F 1007	680502	45173	90	0	557167	134.7	537649	-13.4	18.9	13.87	59.9	0	14 26 2	2.52	419.	46
F 1007	680502	45183	95	0	557751	135.6	538211	-14.7	18.9	13.88	59.9	0	11 26 2	2.52	470.	47
F 1007	680502	45193	100	0	558335	136.5	538773	-16.0	18.9	13.89	59.9	0	8 26 2	2.52	471.	47

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Table III

SECTION II - MISSION 1103
MAIN CAMERAS - FILM TYPES 3404/SO-380

DENSITY TOLERANCE ANALYSIS

	PERCENTAGE				TOTAL MISSION
	-1 FWD	-1 AFT	-2 FWD	-2 AFT	
I. SATISFACTORY EXPOSURE	47.5	63.8	31.2	44.0	46.6
A. Within Tolerance	43.3	59.8	25.1	39.4	41.9
B. Out-of-Tolerance					
1. Over-processed	0.0	0.0	0.0	0.0	0.0
2. Under-processed	4.2	4.0	6.1	4.6	4.7
II. UNSATISFACTORY EXPOSURE	52.0	36.2	65.8	56.0	52.5
A. Overexposure					
1. Best (Primary) Process	1.2	0.3	0.0	0.0	0.4
2. Over-processed	0.0	0.0	0.0	0.0	0.0
B. Underexposure					
1. Best (Full) Process	50.6	35.2	63.7	56.0	51.3
2. Under-processed	0.2	0.7	2.1	0.0	0.8
III. BEYOND SYSTEM CAPABILITY	0.5	0.0	3.0	0.0	0.9
A. Beyond System Latitude	0.5	0.0	2.6	0.0	0.8
B. Out-of-Phase	0.0	0.0	0.4	0.0	0.1
Number of Observations	409	298	510	241	1458

1458 sampled of 12425
exposed (12%)

DENSITY TOLERANCE LIMITS
CRITERIA USED FOR ANALYSIS: 1.2 GRADIENT
WRATTEN 25 FILTER (FWD SYSTEM)

PROCESS	LOWER DENSITY	UPPER DENSITY
PRI.	0.39	2.15
INT.	0.42	2.16
FULL	0.55	2.14

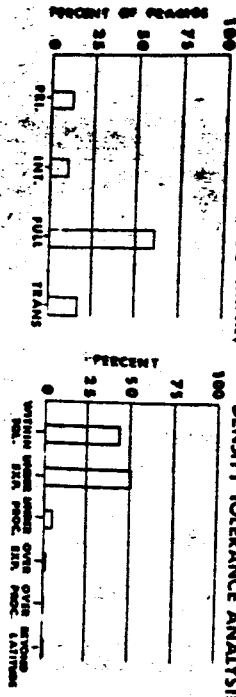
WRATTEN 21 FILTER (AFT SYSTEM)

PRI.	0.38	2.15
INT.	0.42	2.17
FULL	0.52	2.14

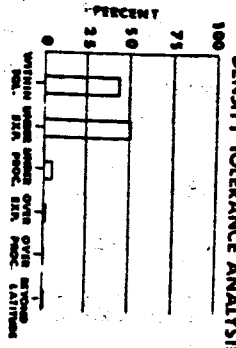
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PROCESSING SUMMARY



DENSITY TOLERANCE ANALYSIS

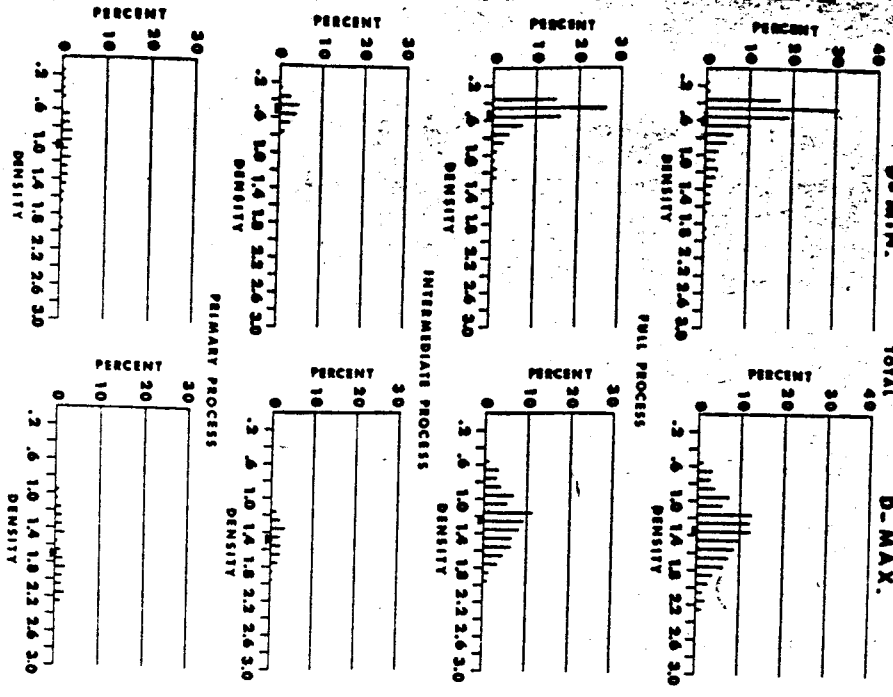


DENSITY SUMMARY

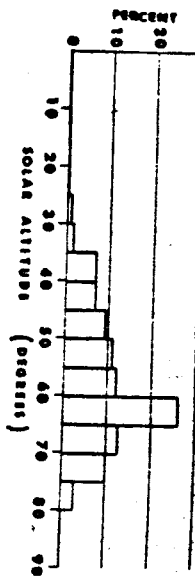
D-MIN.

TOTAL

D-MAX.



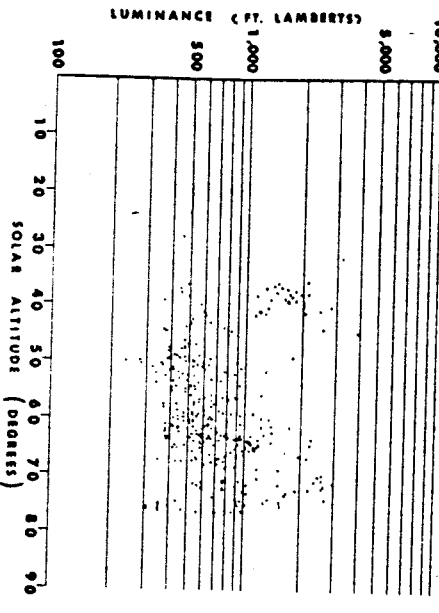
FREQUENCY VS SOLAR ALTITUDE



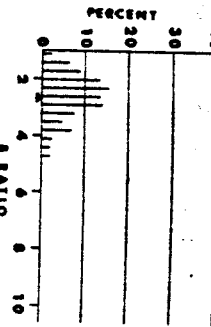
MAX. LUMINANCE VS SOLAR ALTITUDE



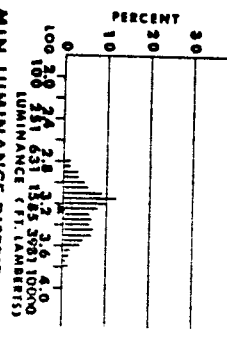
MIN. LUMINANCE VS SOLAR ALTITUDE



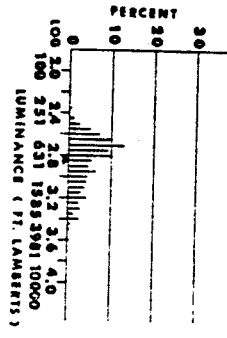
B-RATIO FOR FRAMES ABOVE 10° SA



MAX. LUMINANCE DISTRIBUTION



MIN. LUMINANCE DISTRIBUTION



MAIN CAMERA
DENSITY / LUMINANCE
 FRONT
 Launch Date 1 May 1968
 Filter No. WRATTEN 25
 No. Obs. 407 sampled of
 3865 exposed
 Strip Width 0.100 0.320
 (Inches)
 Pull Rate 0.195
 0.300
 % of frames Sampled 11
 Processor TRENTON
 Film Type 3404/50-380
 A=MEAN **1103**
 (KFD)

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Table II

Percentage of Film Type 3404/SO-380
Frames Considered Underexposed

Judgment Level	1103-1		1103-2	
	<u>Fwd</u>	<u>Aft</u>	<u>Fwd</u>	<u>Aft</u>
0.4	14.4	11.1	45.5	20.3
0.5	40.4	29.8	63.7	52.3
0.52*	--	36.1	--	56.1
0.55*	50.8	--	65.8	--

*1.2 gradient density level.

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**1100 SERIES
MAIN CAMERA
Cumulative Density Tolerance Analysis**

DENSITY TOLERANCE LIMITS
BASED ON 1:3 CONTRAST LEVEL

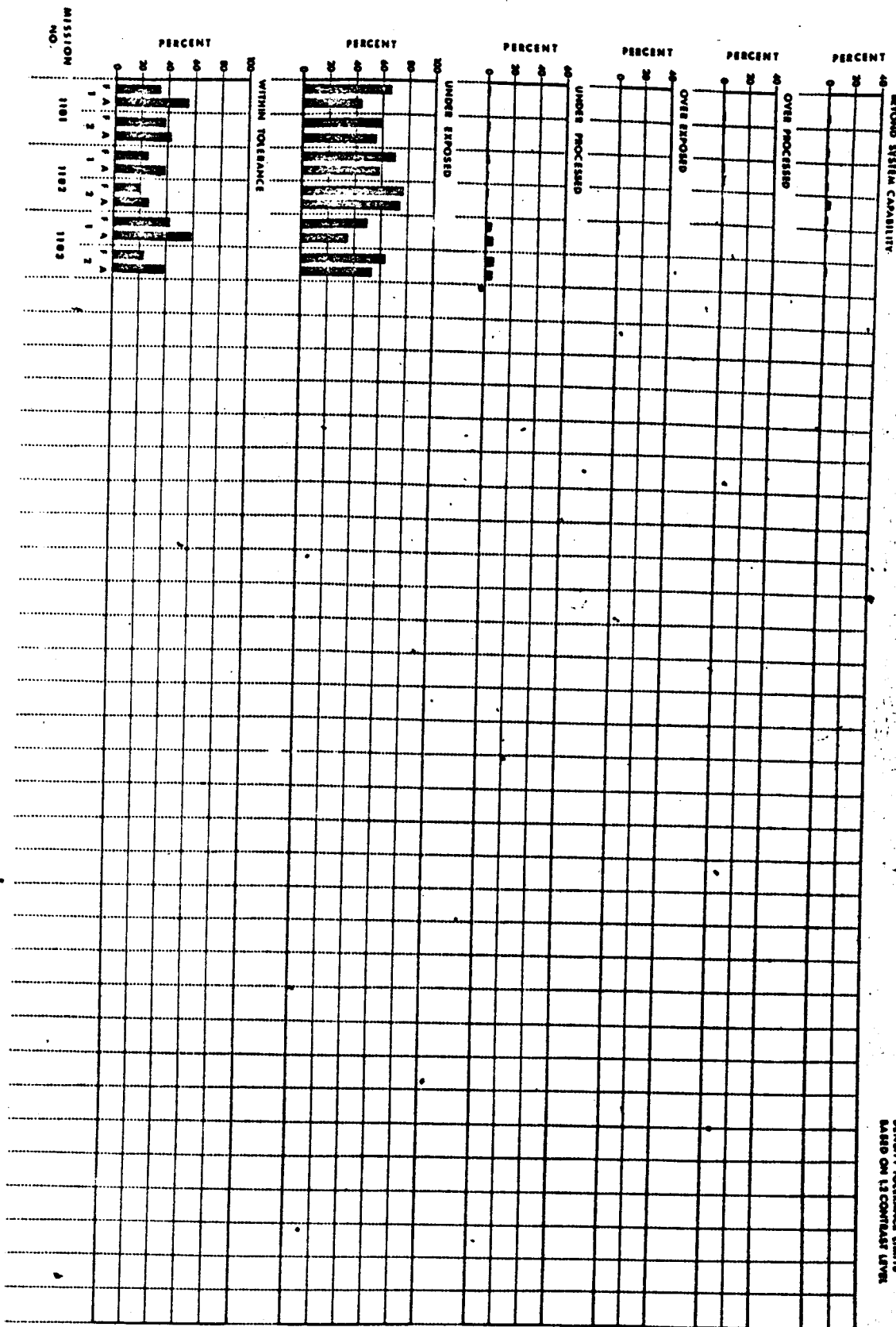


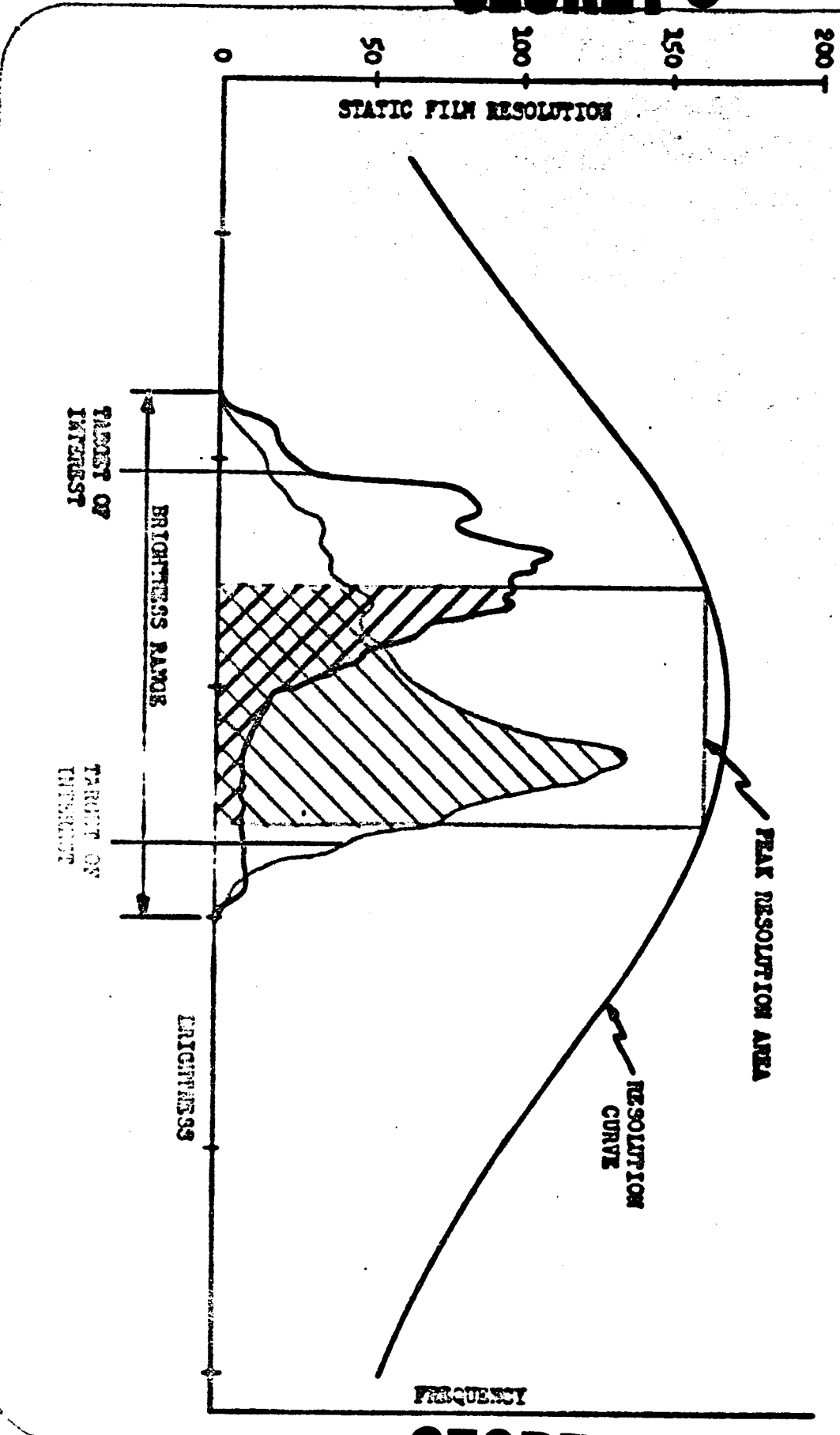
Figure 11



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FIGURE of MERIT APPROACH



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POSITIVE STUDIES CONSIDERING

SCENE BRIGHTNESS DISTRIBUTIONS

APPROACH PROPOSED BY "FIGURE OF MERIT" REPORT

(MAY, 1966)

CHANGE IN APPROACH TO DETERMINING EXPOSURE

CRITERIA

* BASIC APPROACH:

PLACE MOST IMPORTANT INFORMATION AT MAXIMUM
RESOLUTION

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TARGET BRIGHTNESS

STUDIES

PAR 24-7-65/R2

PROJECT SUNNY

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UNCLASSIFIED INFORMATION

OBJECTIVES

- + DETERMINE FEASIBILITY OF PROGRAMMING
EXPOSURE ON BASIS OF BRIGHTNESS CHARACTERISTICS OF SPECIFIC TARGETS
- + COMPARE EXPOSURE AND BRIGHTNESS DATA OF
TARGETS OF INTEREST WITH GENERAL MISSION
PHOTOGRAPHY

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APPROACH

THOROUGH LUMINANCE ANALYSIS
OF ALL ACQUISITIONS OF 31 SPECIFIC
TARGETS

+ OBJECTIVE

+ SUBJECTIVE

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GENERAL PROCEDURES

- + RECALL ORIGINAL NEGATIVES
- + MICRO - AND MACRO - DENSITOMETERS
- + ANALYSIS OF ACQUISITION
- + REPORTING
- + CORRELATION ANALYSIS

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PROJECT SUNNY

TARGET TYPES

- AIRFIELDS
- LAUNCH COMPLEXES
 - ICBM
 - SAM
- NAVAL FACILITIES
- RADAR INSTALLATIONS
- ARMY BARRACKS
- STORAGE AREAS
- MANUFACTURE & TEST SITES

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TARGET SELECTION

- + CROSS-SECTION OF TYPES
- + RANGE OF GEOGRAPHICAL LOCATIONS WITHIN LIST PROVIDED

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30° N LATITUDE

LONGITUDE SPREAD



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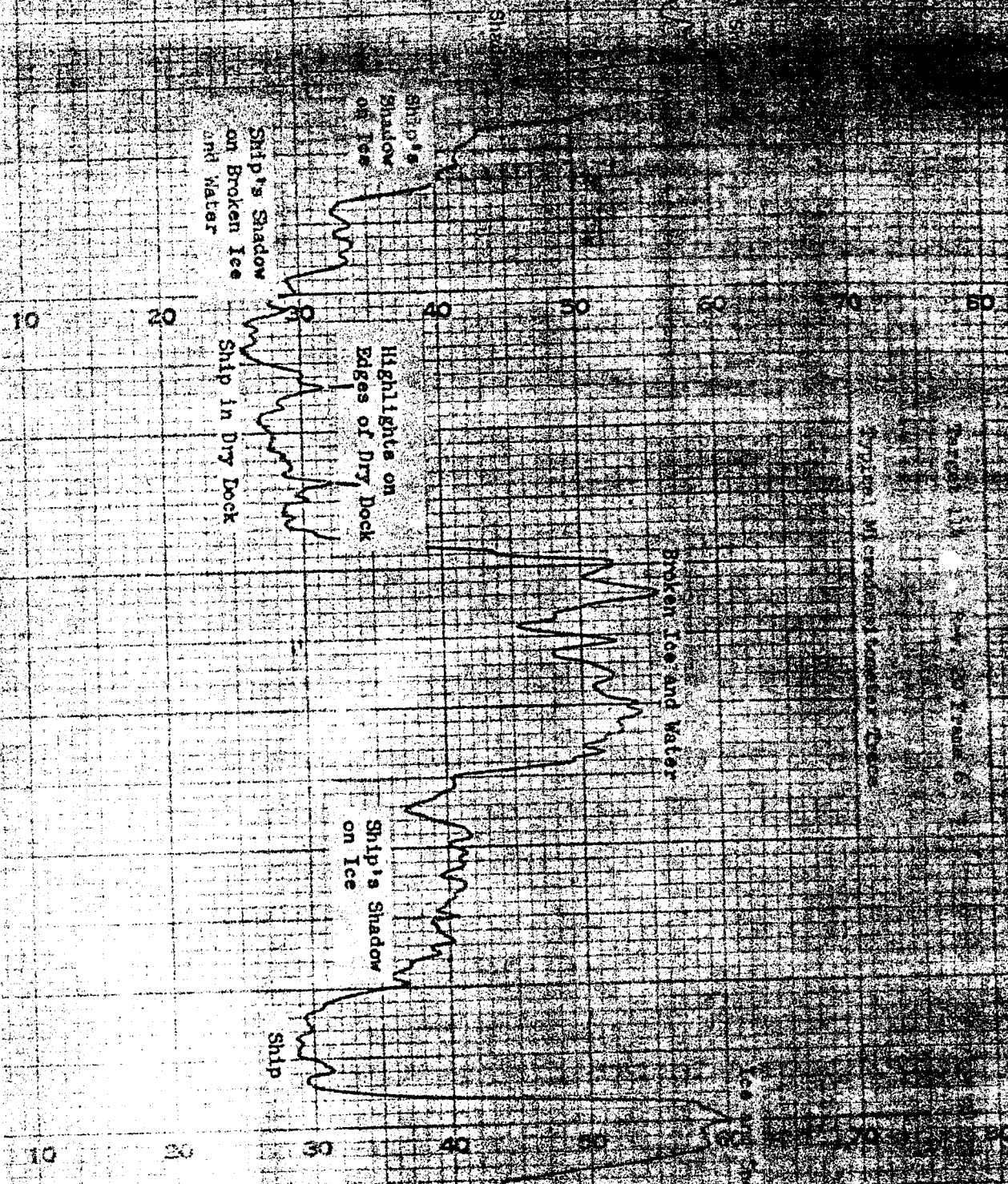
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PORTIONS OF PHOTOGRAPHY
BEING ANALYZED

- + SPECIFIC TARGET AREAS
- + SPECIFIC TARGET OBJECTS
(OF P. I. INTEREST)
- + FRAME AS A WHOLE

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*Target Ident. 114 *Trace Date _____ By _____

*Station Pass Frame _____ EXPY - 4.2 msec K - _____ Analysis Date _____ By _____

Acquisition Date 1-21-66 SA - 12.0 Site No. _____ Width - _____ T/no. - _____ Mode _____

*Index 1 X - 31.9 Y - 0.0 Spot Size - 1.0 microns Calib. Wedge A Calib. No. 3

TRACE OBJECT DESCRIPTION *CHT VALUE DENSITY LOG E E Ba

NO.	Printing Dmin	(Fog .22)	*CHT VALUE	DENSITY	LOG E	E	Ba
	Printing Dmax			1.81	7.19	.155	459
	Design Value				7.66	.724	2148
	Detail Contract	ON SHIP AND DRY DOCK	26	.43	7.04	.110	325
	→ 1.26		29	.54	7.14	.138	409
1	SHIP SHADOW ON ICE - MINIMUM		30	.57	7.16	.144	427
	- MAXIMUM		42	.99	7.39	.245	727
1	ICE AND SNOW - AVERAGE		57	1.52	7.63	.426	1264
2	SHIPS - MINIMUM		24.5	.38	3.98	.095	283
	P I F 0.6 Gamma ()				7.15	.141	1618
	Peak Resolution				7.30	.199	590
	August 1966 Recommendation						
	June 1967 Seasonal Recommendation						

Target Description (for TX): SHIPS SURROUNDED BY ICE AND SNOW

* Subjective Analysis: Target area in cloud shadow? Yes No Partially
 Target area under clouds? Yes No Partially
 Haze in target area? No Yes Medium Heavy
 Describe target area (incl. any other factors which might have affected exposure):
SNOW

Recommended Δ Exposure this Acquisition ±.70
 Res _____
 FOM _____

114

SAMPLE REPORT OF
ACQUISITION DATA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NBR	TGT	MSSN	DATE	SA	SLIT	EXPT	FMN	FMX	TMN	TMX	TDB	TDC	RELE	REST

1 114 [REDACTED] [REDACTED] 17 .0169 4.82 459 2146 283 727 365 1.26 +0.21 +0.70
 20-6F SHIPS SURROUNDED BY ICE AND SNOW

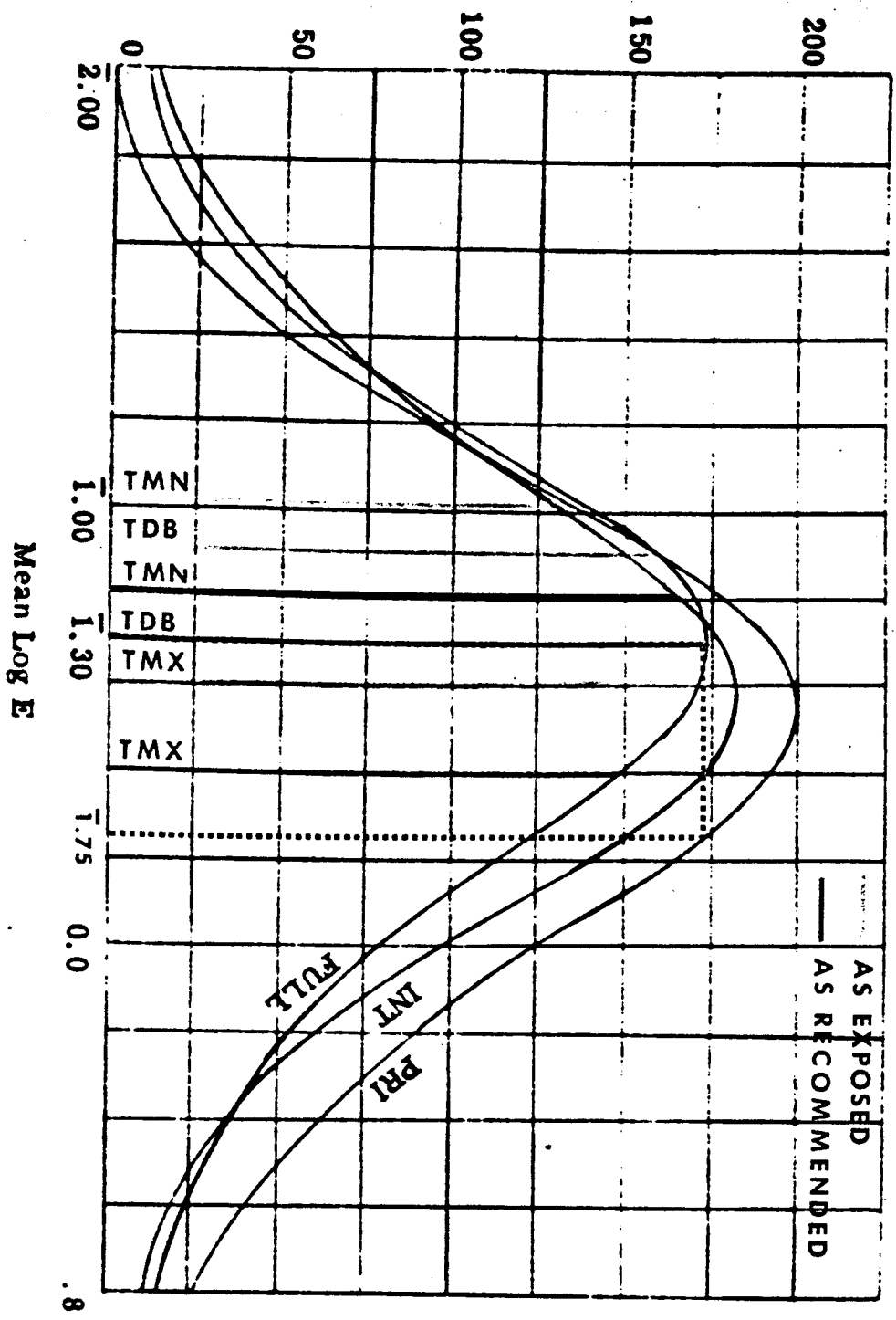
DEFINITION OF COLUMN HEADINGS

DATE	-	ACQUISITION DATE
SA	-	SOLAR ALTITUDE, DEG.
SLIT	-	SLIT WIDTH, IN.
EXPT	-	EXPOSURE TIME, MSEC.
FMN	-	FRAME MINIMUM APPARENT LUMINANCE
FMX	-	FRAME MAXIMUM APPARENT LUMINANCE
TMN	-	TARGET MINIMUM APPARENT LUMINANCE
TMX	-	TARGET MAXIMUM APPARENT LUMINANCE
TDB	-	TARGET DESIGN BRIGHTNESS
TDC	-	TARGET DETAIL CONTRAST
RELE	-	RECOMMENDED EXPOSURE CHANGE IN LOG E) THIS
REST	-	RECOMMENDED EXPOSURE CHANGE IN STOPS) ACQUISITION

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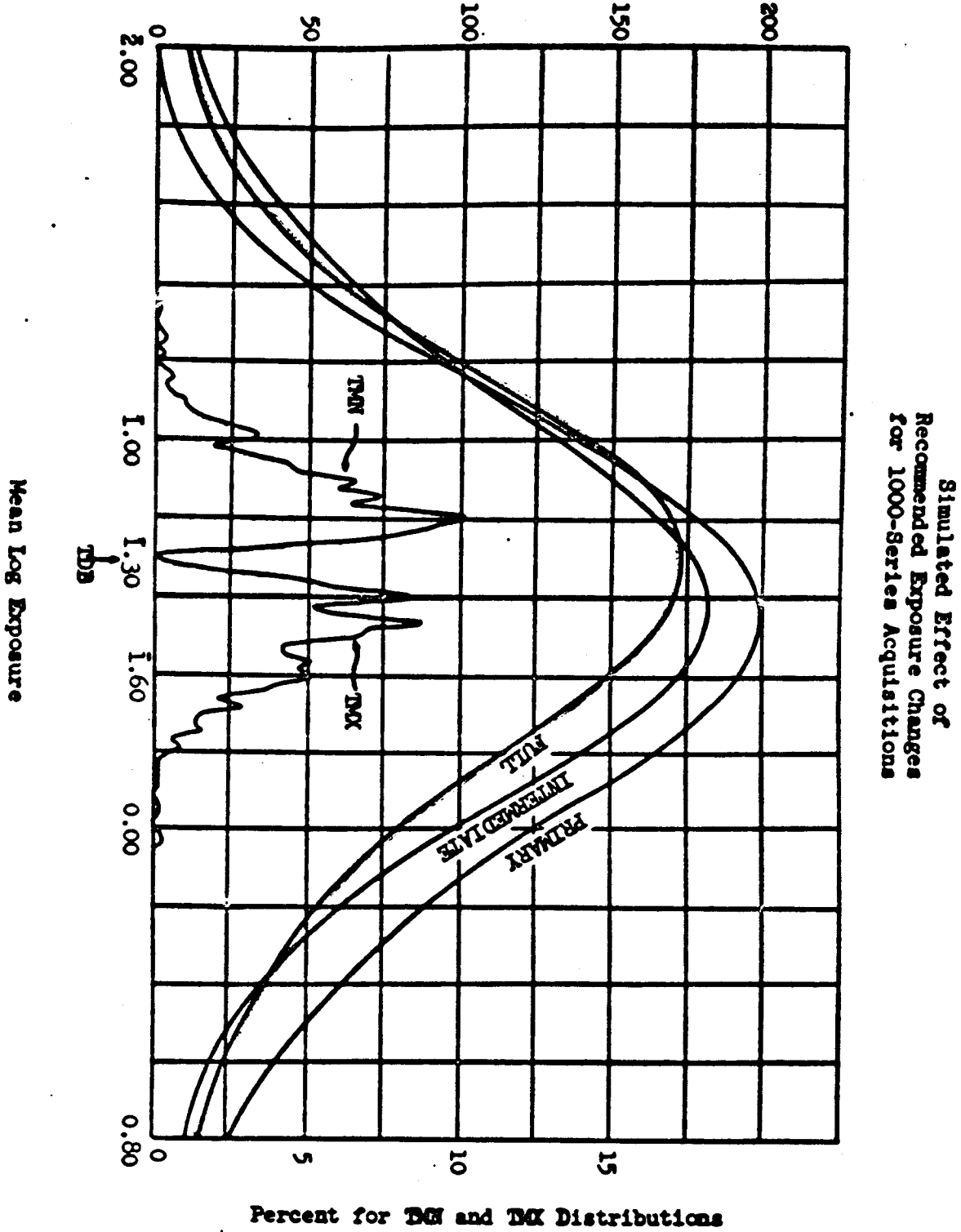
Resolution (cycles/mm)



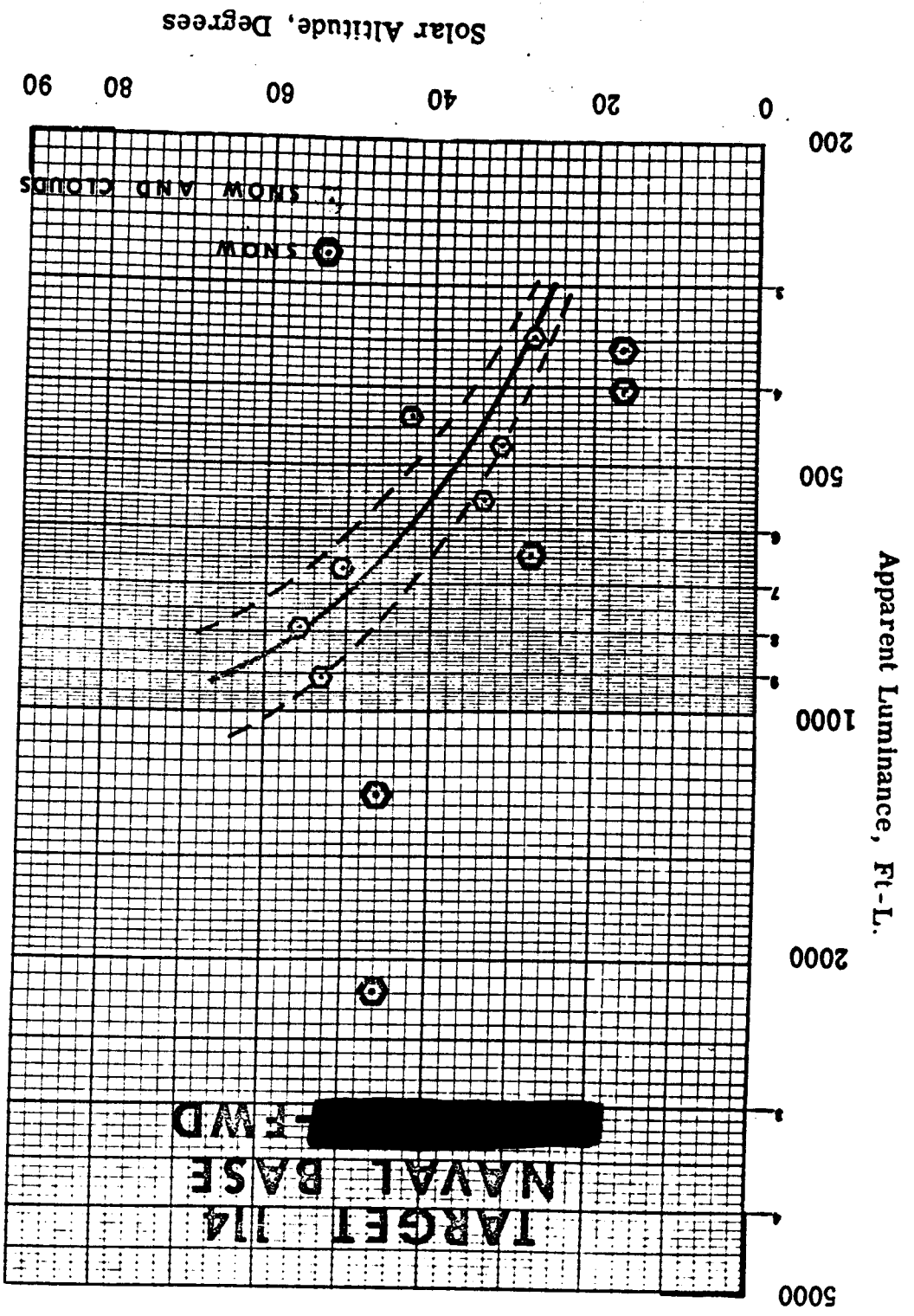
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Static Film Resolution (cycles/mm)



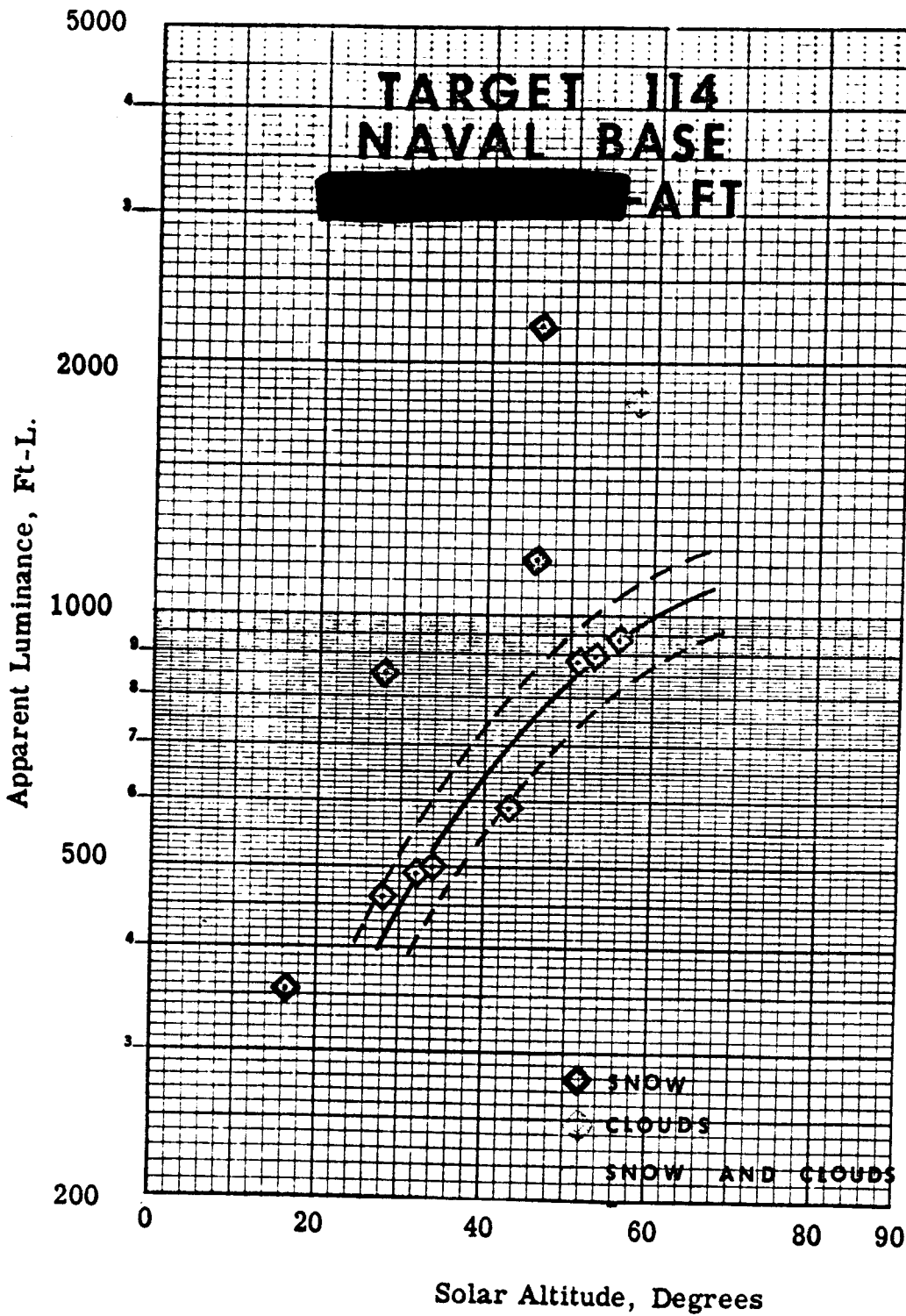
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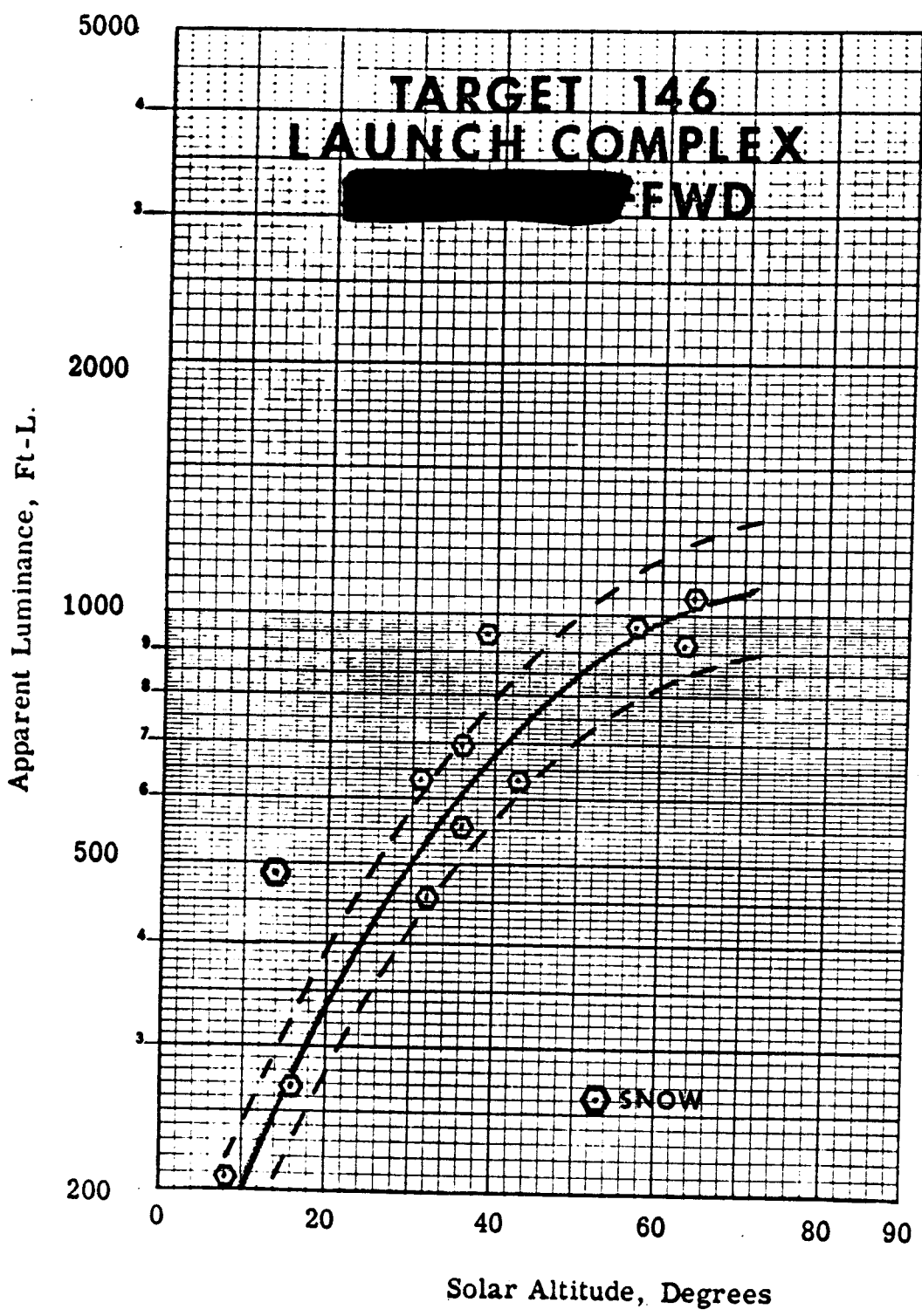
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30° 54' N

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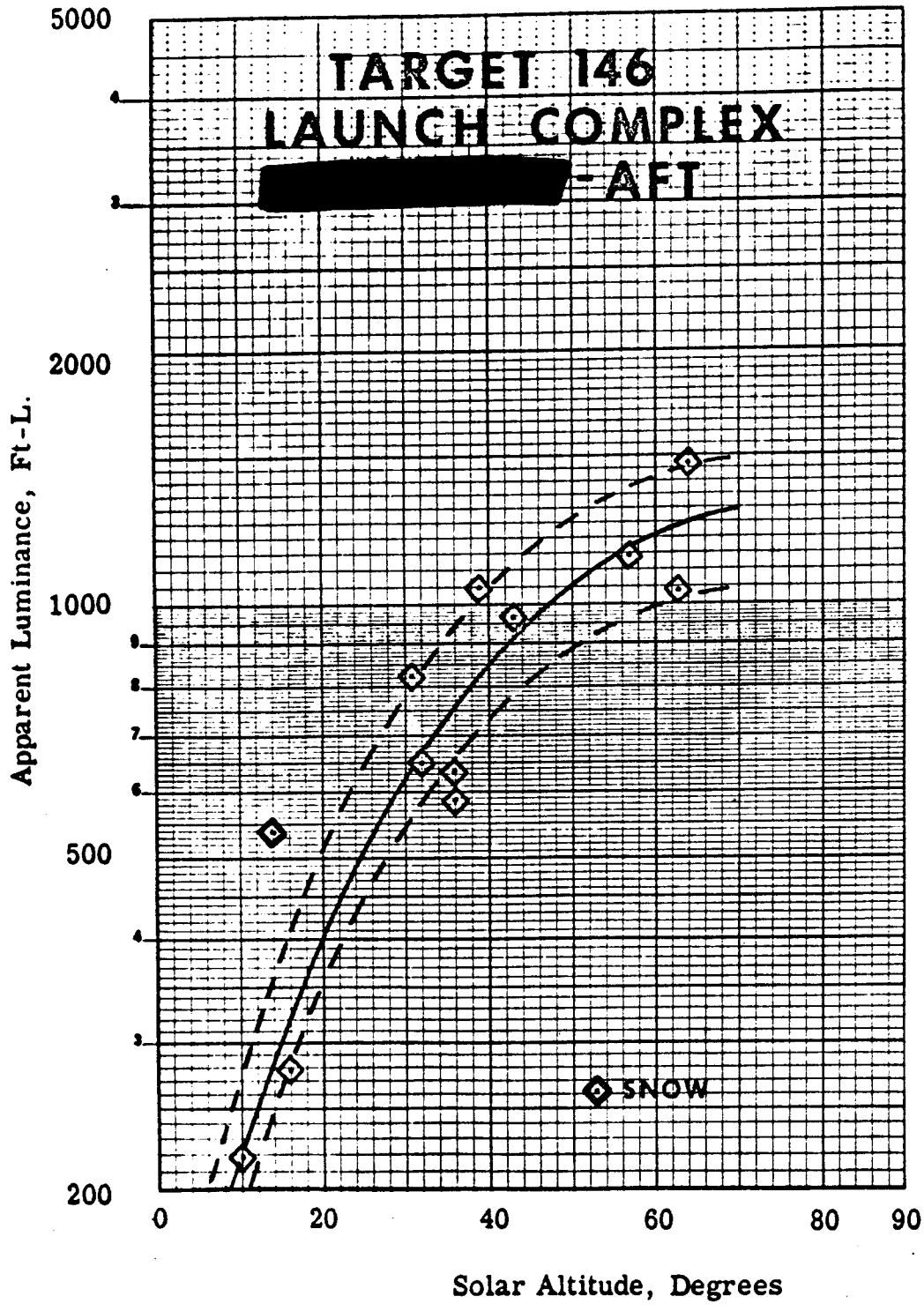
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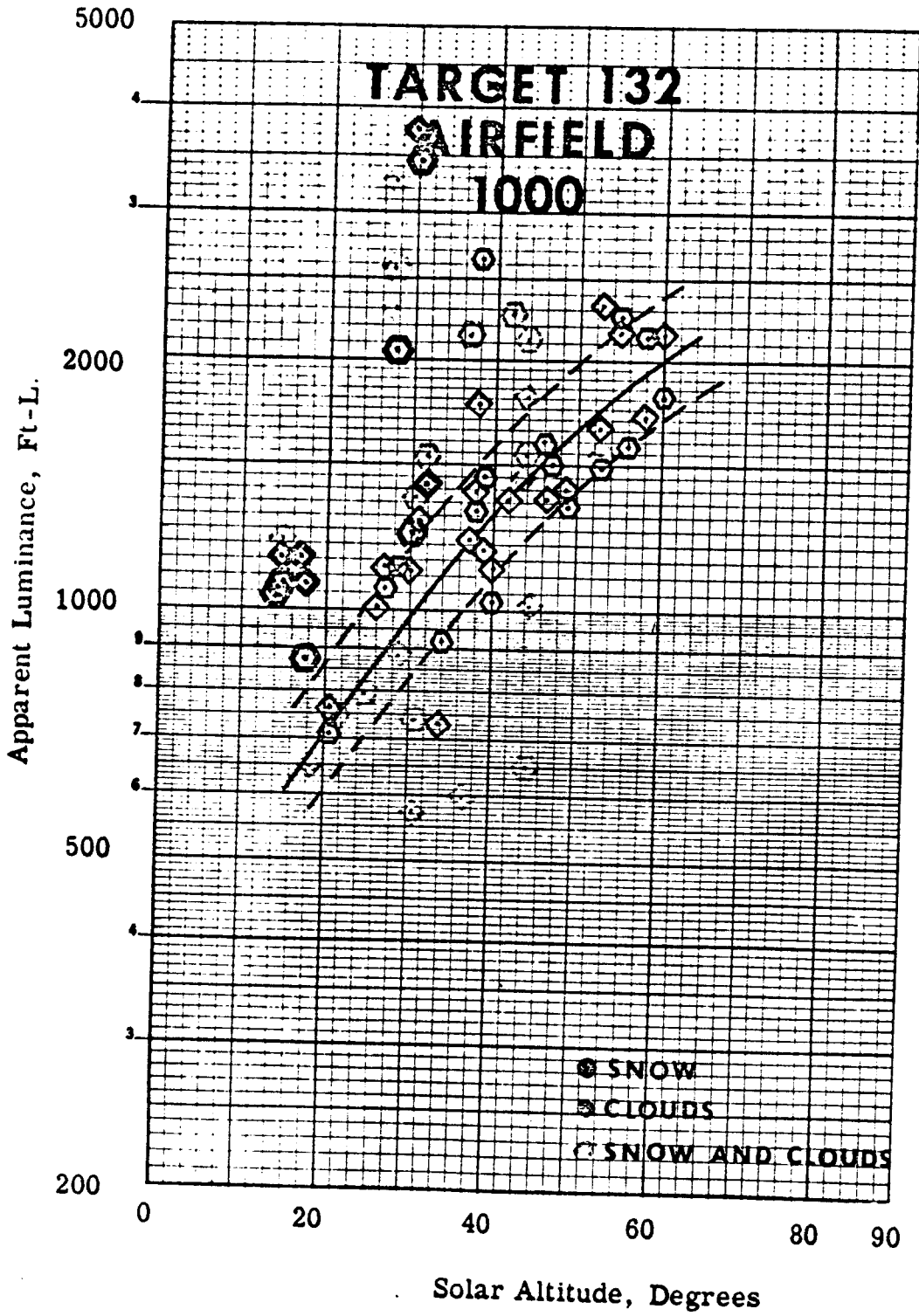


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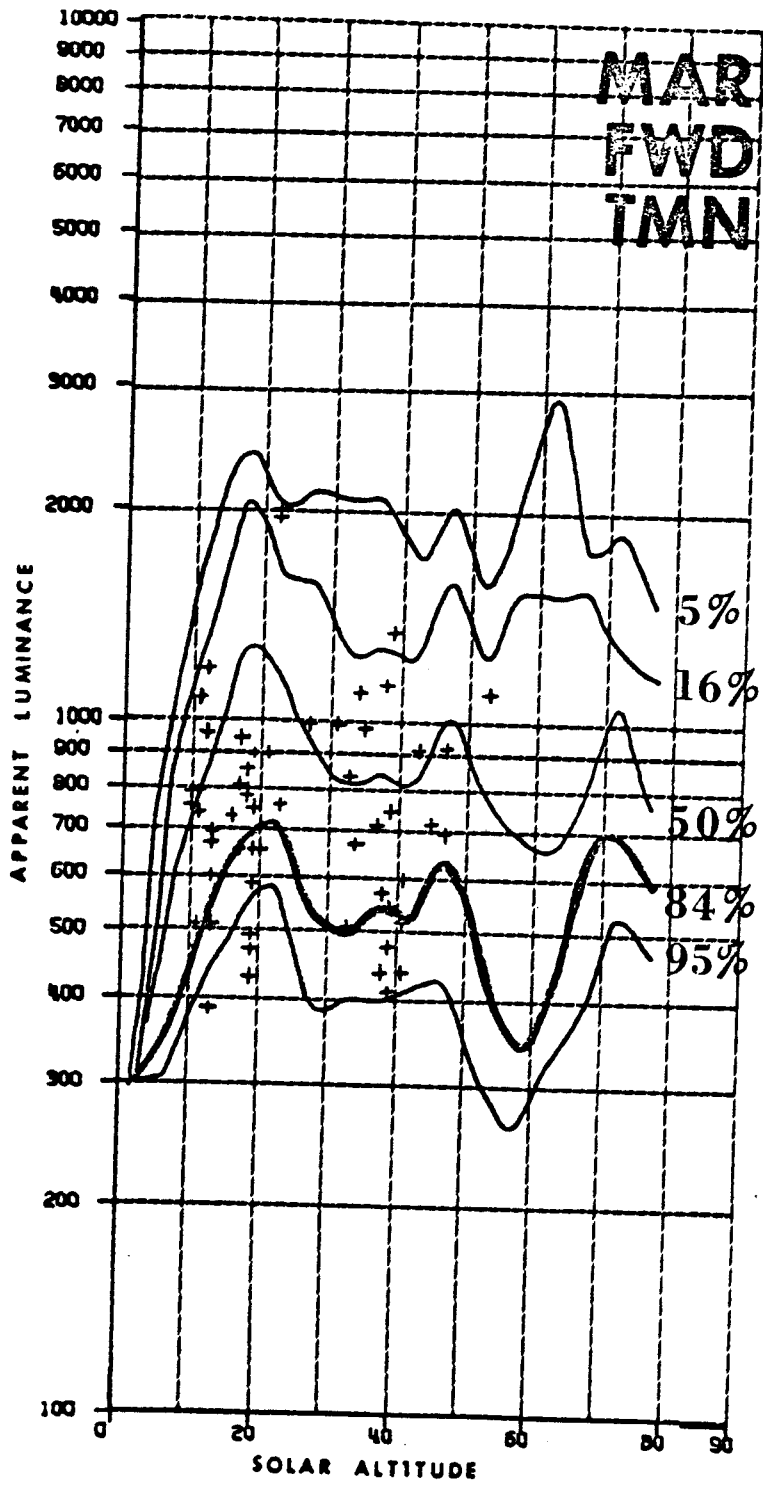


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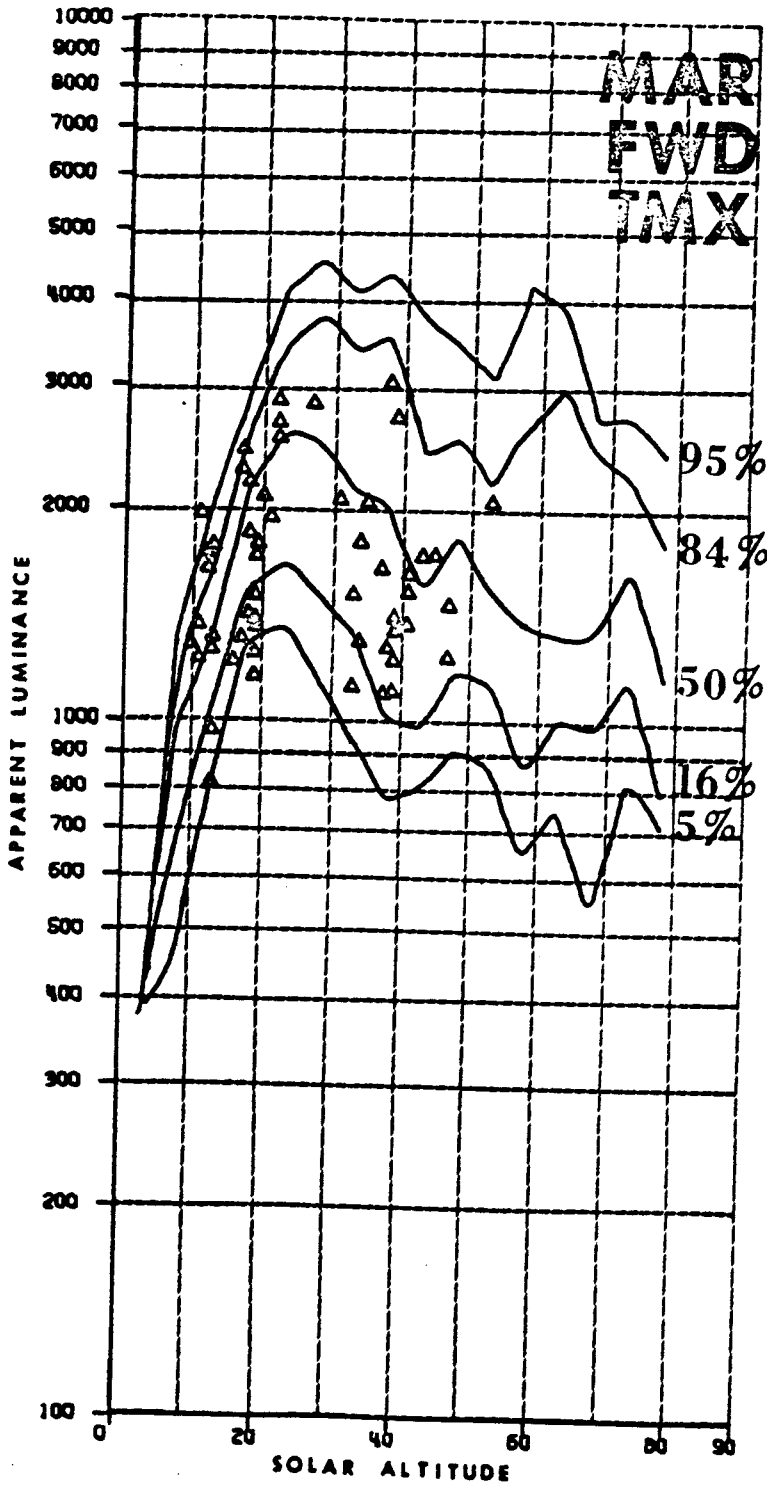


0° 29' N



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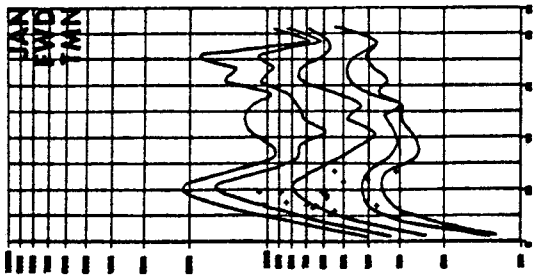
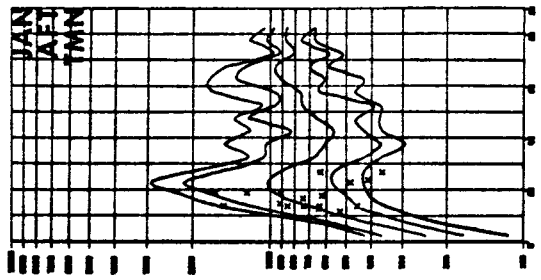
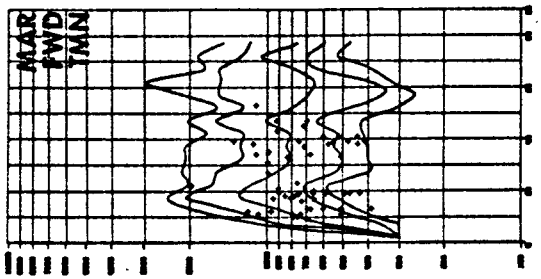
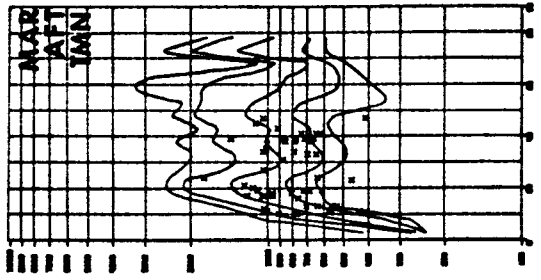
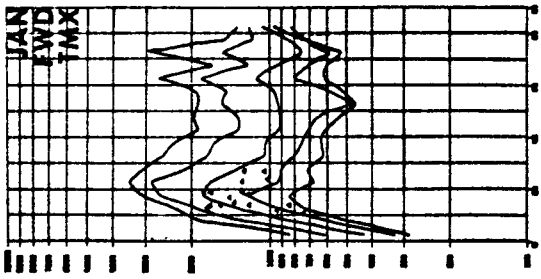
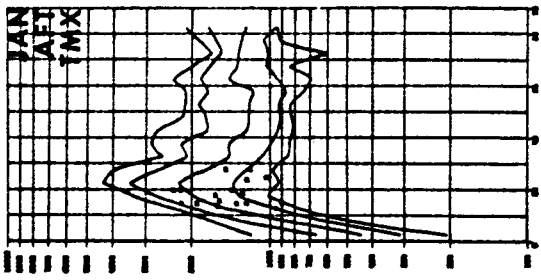
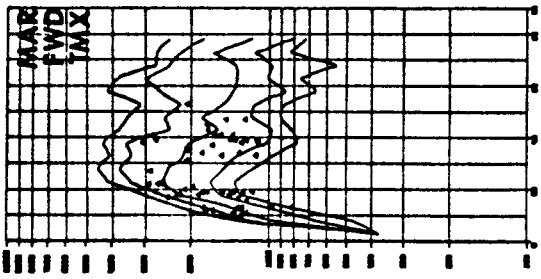
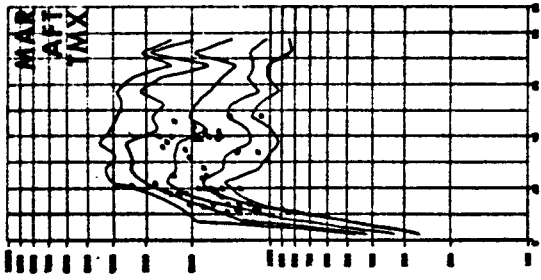
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J DATA COMPARED WITH SEASONAL DATA



APPARENT LUMINANCE, FT-1

SOLAR ALTITUDE

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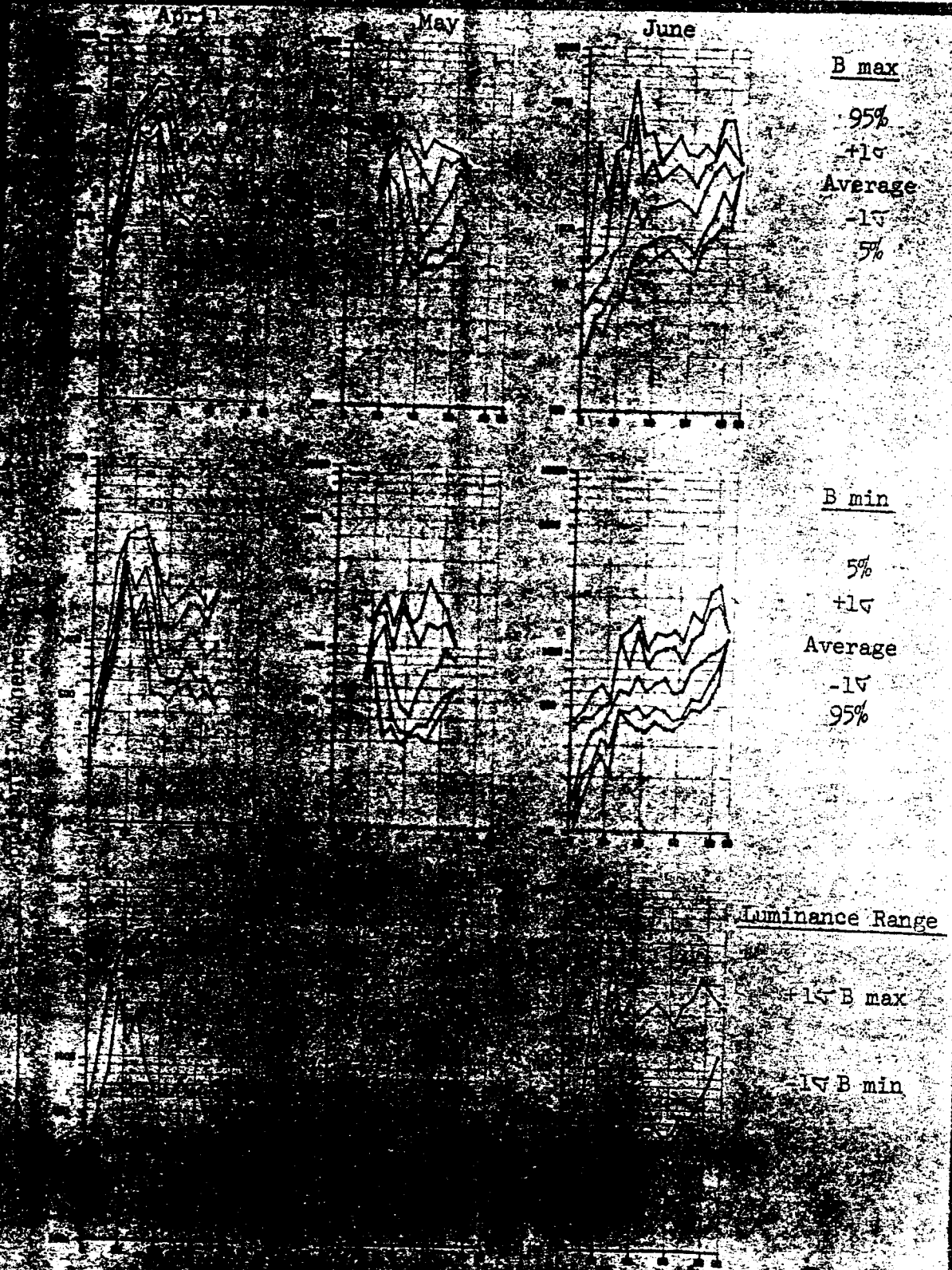


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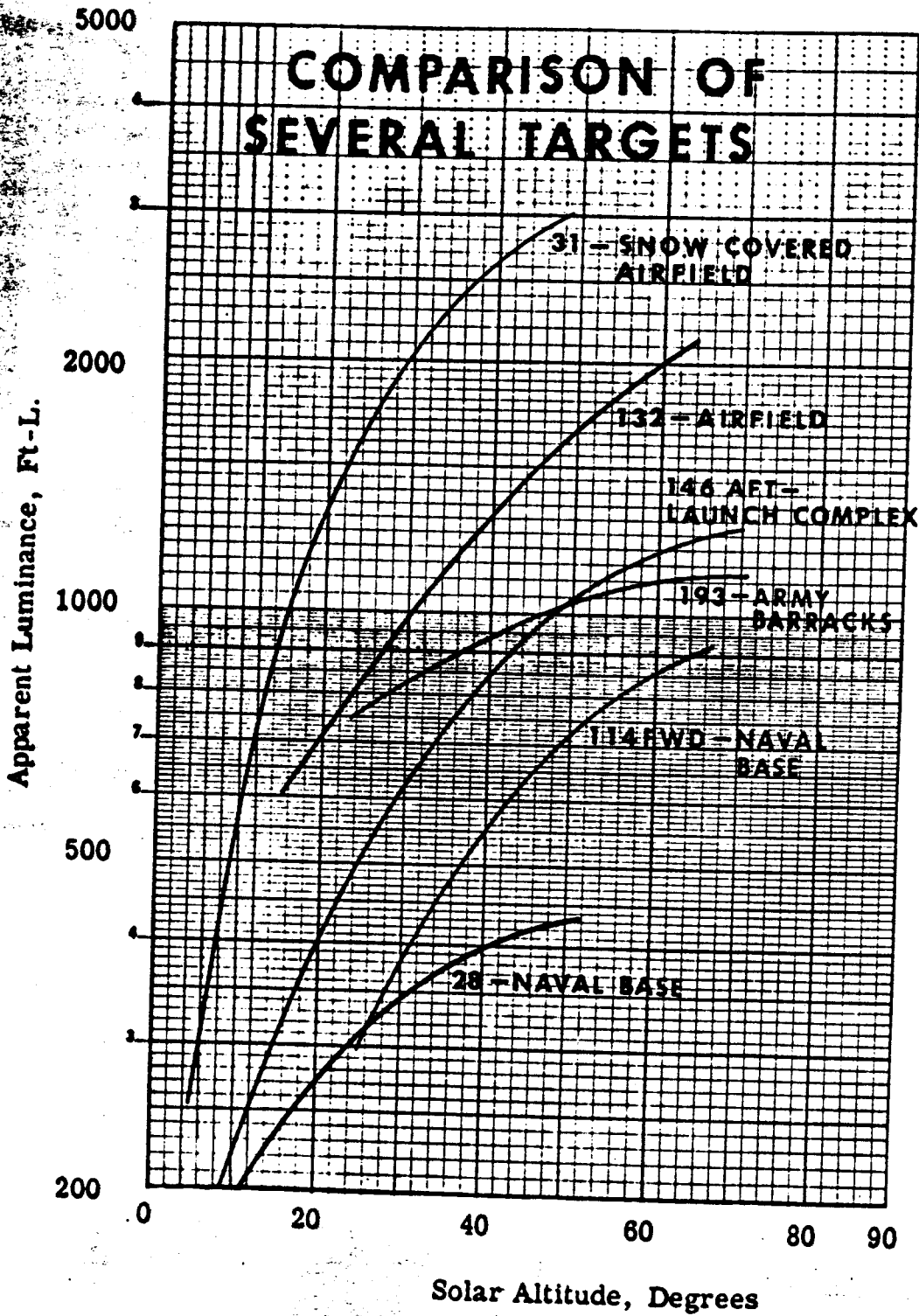
1000 Series Aft-Looking Camera: April - June



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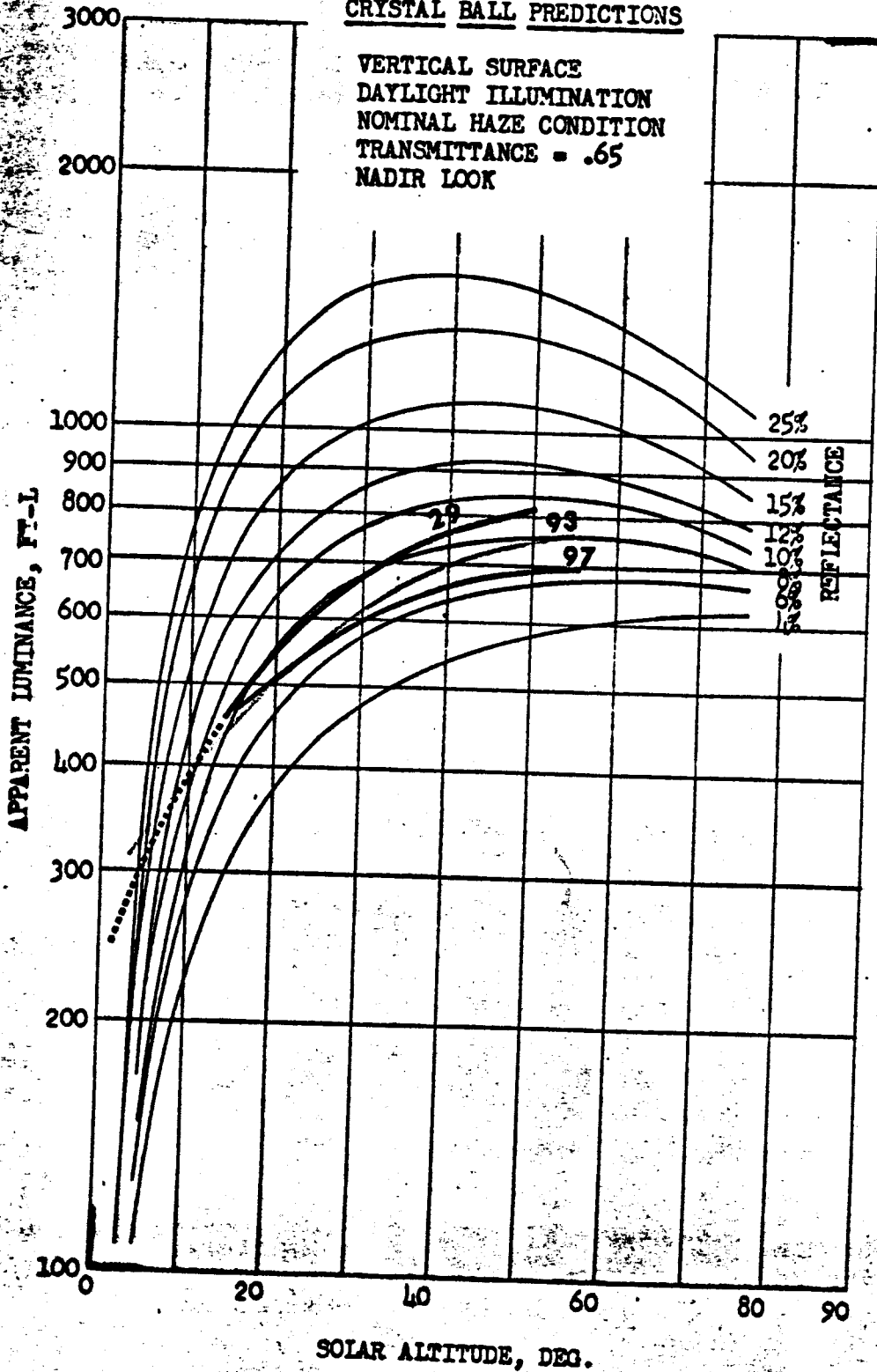
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CRYSTAL BALL PREDICTIONS

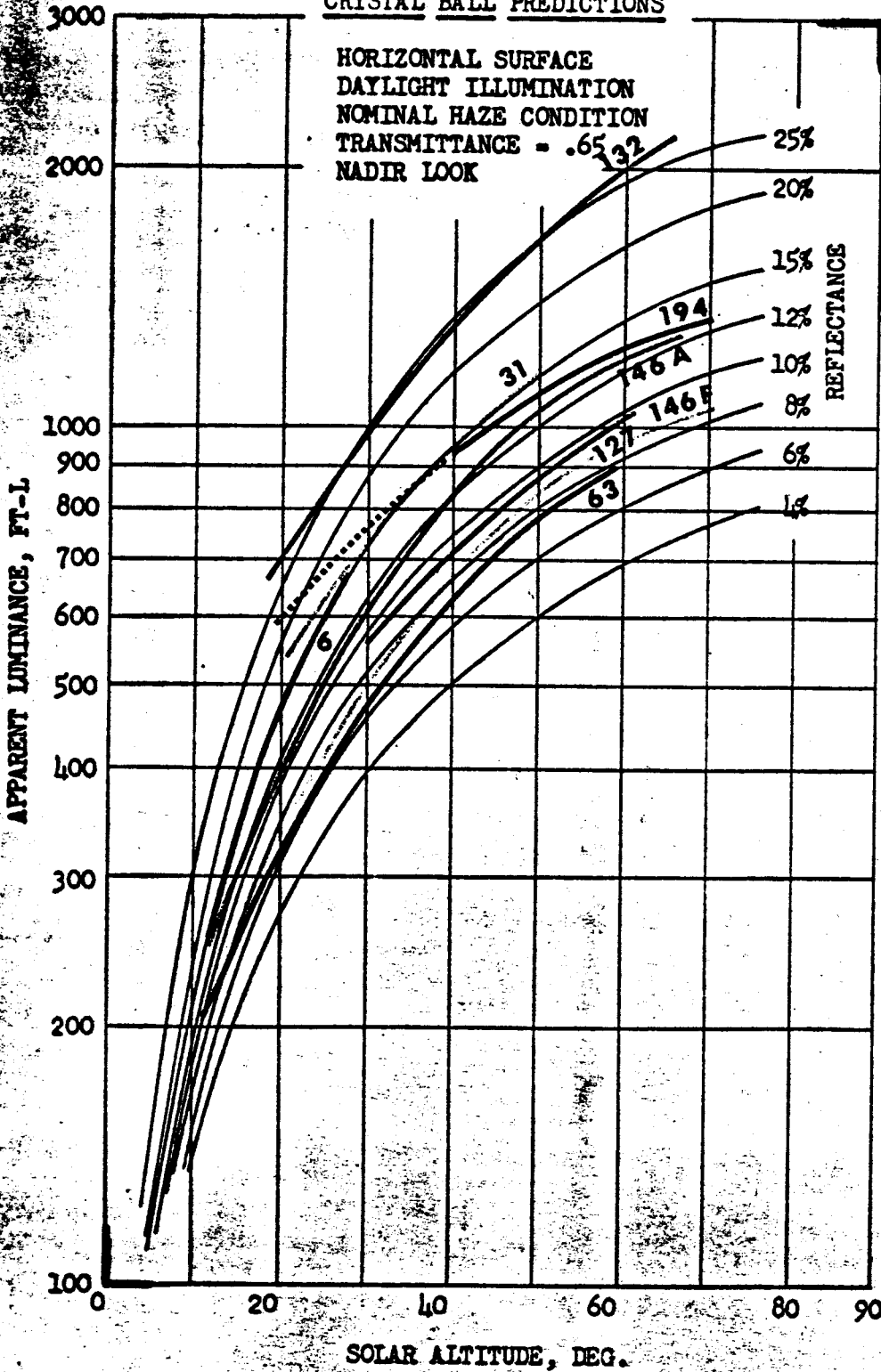
VERTICAL SURFACE
DAYLIGHT ILLUMINATION
NOMINAL HAZE CONDITION
TRANSMITTANCE = .65
NADIR LOOK



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CRYSTAL BALL PREDICTIONS



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KH-4 EXPOSURE ANALYSIS

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105-01

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PURPOSE

- EVALUATE CURRENT TECHNIQUE FOR ASSESSING ADEQUACY OF EXPOSURE WITH KH-4 SYSTEMS
- ASSESS THE IMPACT THAT A CHANGE IN EXPOSURE WOULD HAVE HAD ON OVER/UNDEREXPOSURE MEASUREMENTS AND SYSTEM RESOLUTION

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CURRENT EVALUATION CRITERIA

- MACRODENSITY TERRAIN READINGS
1/2 MM DIAMETER
- EQUIVALENT GROUND AREA MEASURED
≈ 500 FT DIAMETER
- SUMMATION OF RESULTS FROM MISSIONS 1024 TO 1044
33% UNDEREXPOSED
41% OVEREXPOSED

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TERRAIN / TARGET DENSITY COMPARISON

● MICRODENSITY TARGET READINGS (PROJECT SUMMARY)
10μ DIAMETER

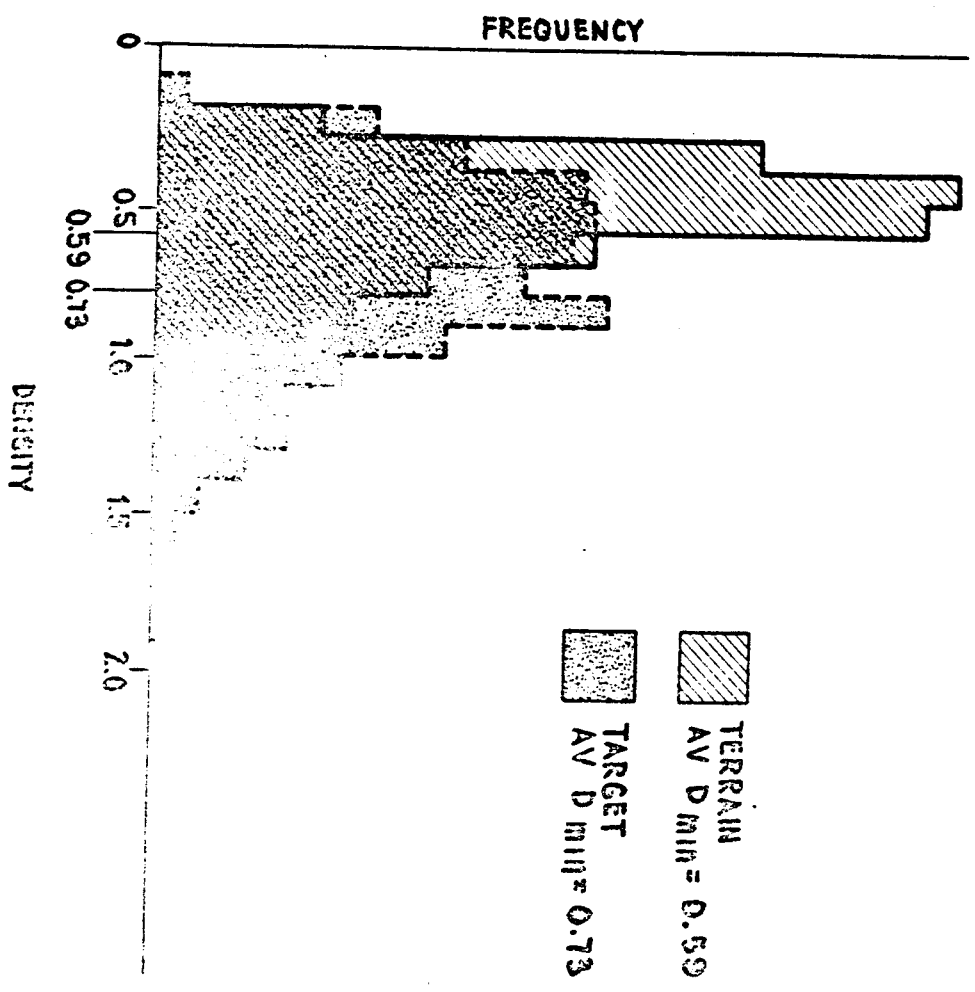
● EQUIVALENT GROUND AREA MEASURED
≈ 10 FT DIAMETER

● COMPARISON OF TERRAIN / TARGET DENSITIES
 \bar{D}_{MIN} TGT HIGHER BY .14 THAN \bar{D}_{MIN} TGR
 \bar{D}_{MAX} TGT HIGHER BY .13 THAN \bar{D}_{MAX} TGR

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TARGET AND TERRAIN DENSITIES FROM PROJECT SUMMARY

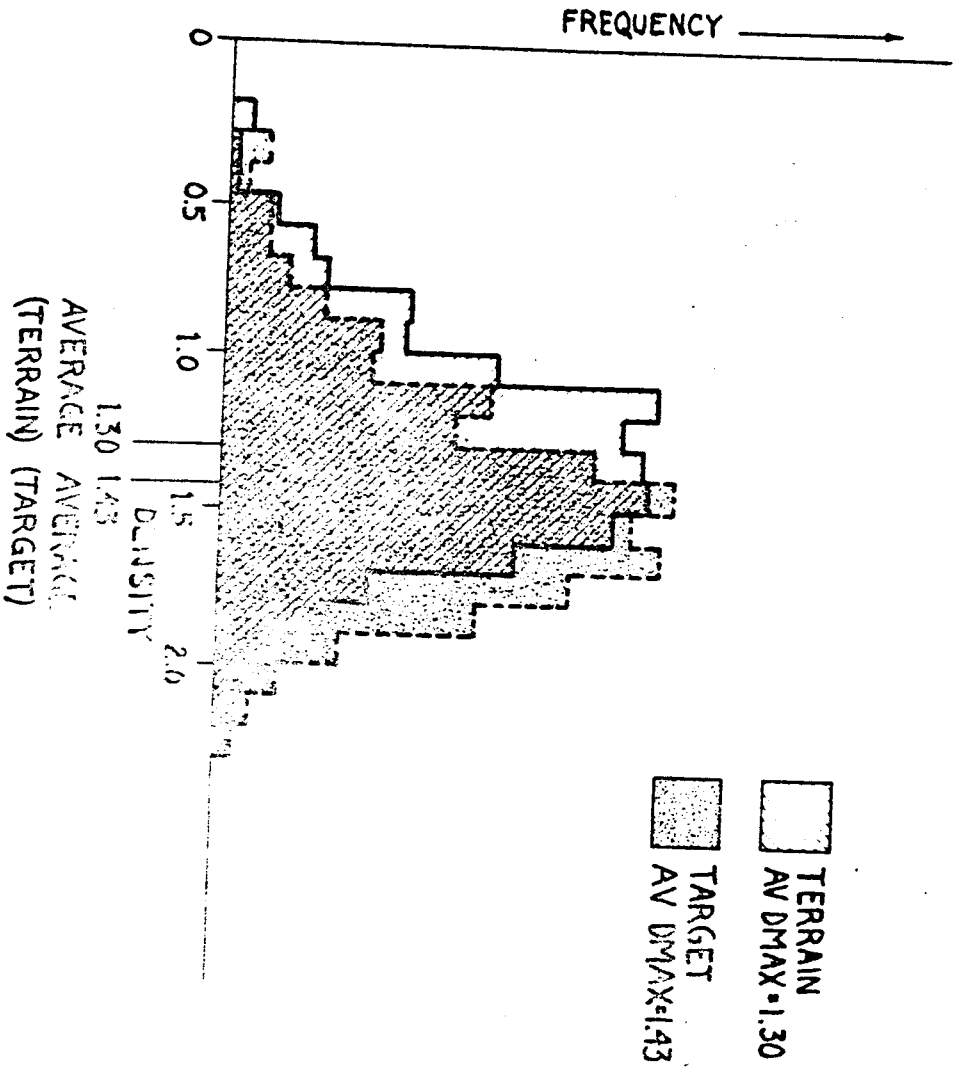


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TARGET AND TERRAIN DENSITY

FROM PROJECT COMPARISON



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CONCLUSIONS

- TARGET MIN AND MAX DENSITY READINGS ARE SIGNIFICANTLY HIGHER THAN CORRESPONDING TERRAIN MIN AND MAX DENSITY READINGS
- THEREFORE, TARGET DENSITY READINGS RATHER THAN TERRAIN SHOULD BE USED TO EVALUATE PICTURES OF TARGETS

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CRITERIA OF OVER/UNDER EXPOSURE FOR TARGETS

- OVEREXPOSED IF:

$$D_{min} > 0.8 \text{ OR } D_{max} > 2.0$$

- UNDEREXPOSED IF:

$$D_{min} < 0.4$$

- THEREFORE TARGETS WITH D_{min} 's OF 0.8 COULD HAVE RECEIVED A FULL STOP LESS EXPOSURE AND STILL NOT HAVE BEEN UNDEREXPOSED

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