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WHS-438
Copy 2 of 2
Pages: 31
7 September 1967

PSAC BRIEFINGS

29 August 1967

By

S. M. Tennant

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WHS-438
p. 2

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IMAGE VELOCITY SENSOR (IVS)

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WHS-438
p. 3

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MAJOR CONTRIBUTORS TO TOTAL RATE TRACKING INACCURACY

- NAVIGATION AND CONTROL
- VIBRATIONS OF OV AND EQUIPMENT
- CREW OR IMAGE VELOCITY SENSOR

[redacted]

- TOTAL (RSS)

[redacted]

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W.H5-438
p.4

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IVS PERFORMANCE REQUIREMENTS

POLARITY OUTPUT REQUIRED BETWEEN	[redacted]
SATURATION	
LINEARITY	
DYNAMIC RANGE	
NULL ACCURACY	

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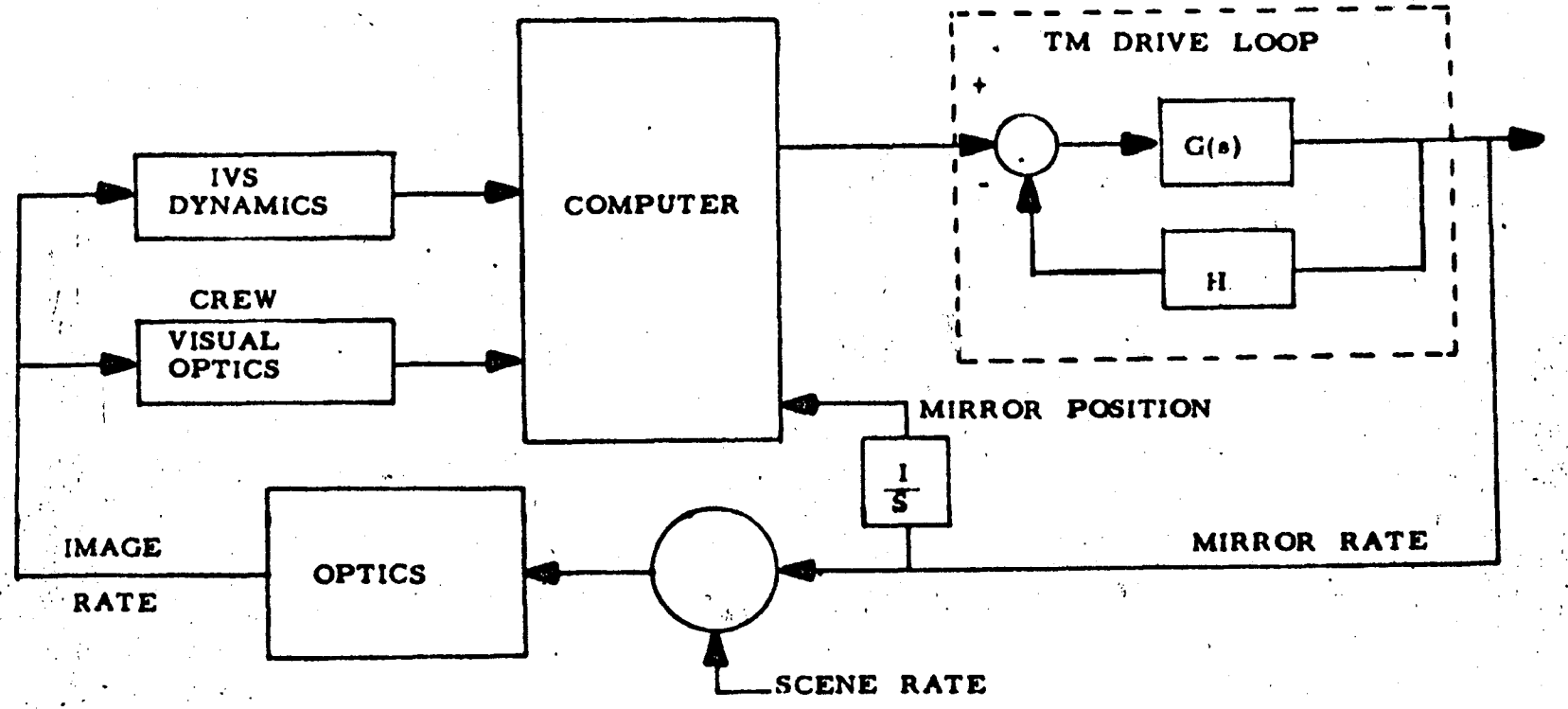
WHS-438
P.5

TRACKING MIRROR DRIVE CONTROL SYSTEM

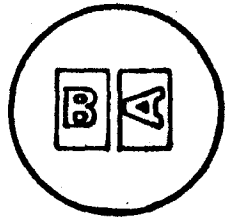


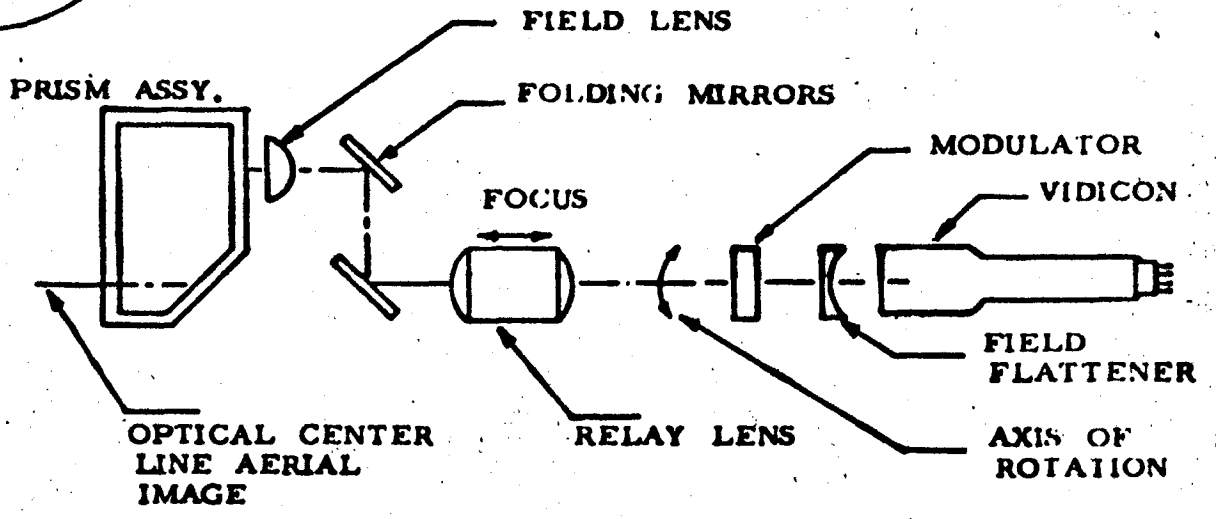
USING IVS OR CREW, SLEW AND SETTLE FOR PHOTOGRAPHY TO A RATE ERROR OF [redacted] (2σ) IN [ANGLE/6 + 4] SECONDS.

LEADS TO REQUIREMENT FOR IVS OR CREW TO AID TMD TO SETTLE FROM [redacted] IN LESS THAN 3 SECONDS.

B
A

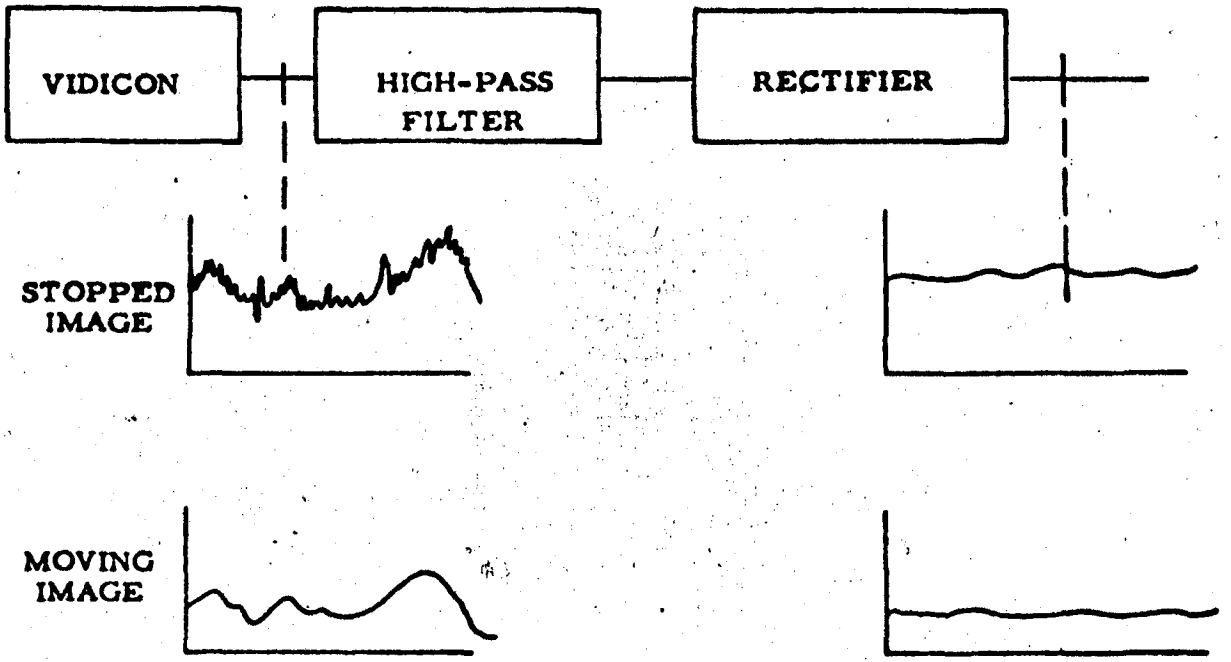
ITEK IVS SCHEMATIC





WHS-438
p. 7

ITEK
RUDIMENTARY SENSOR



LIMITATIONS

- SCENE SENSITIVE
- NO DIRECTIONAL INFORMATION

B-1

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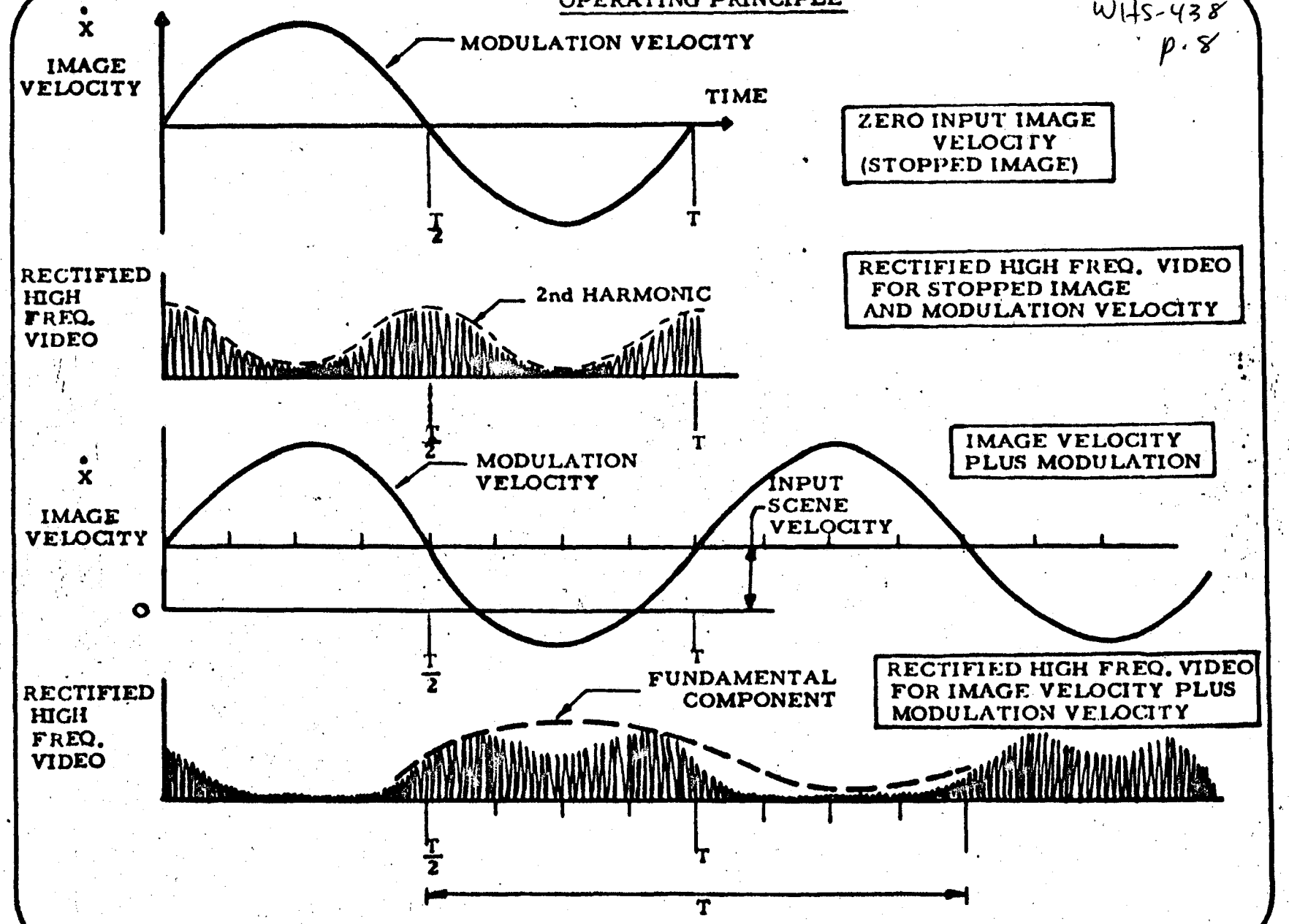
WHS-438
p. 8

OPERATING PRINCIPLE



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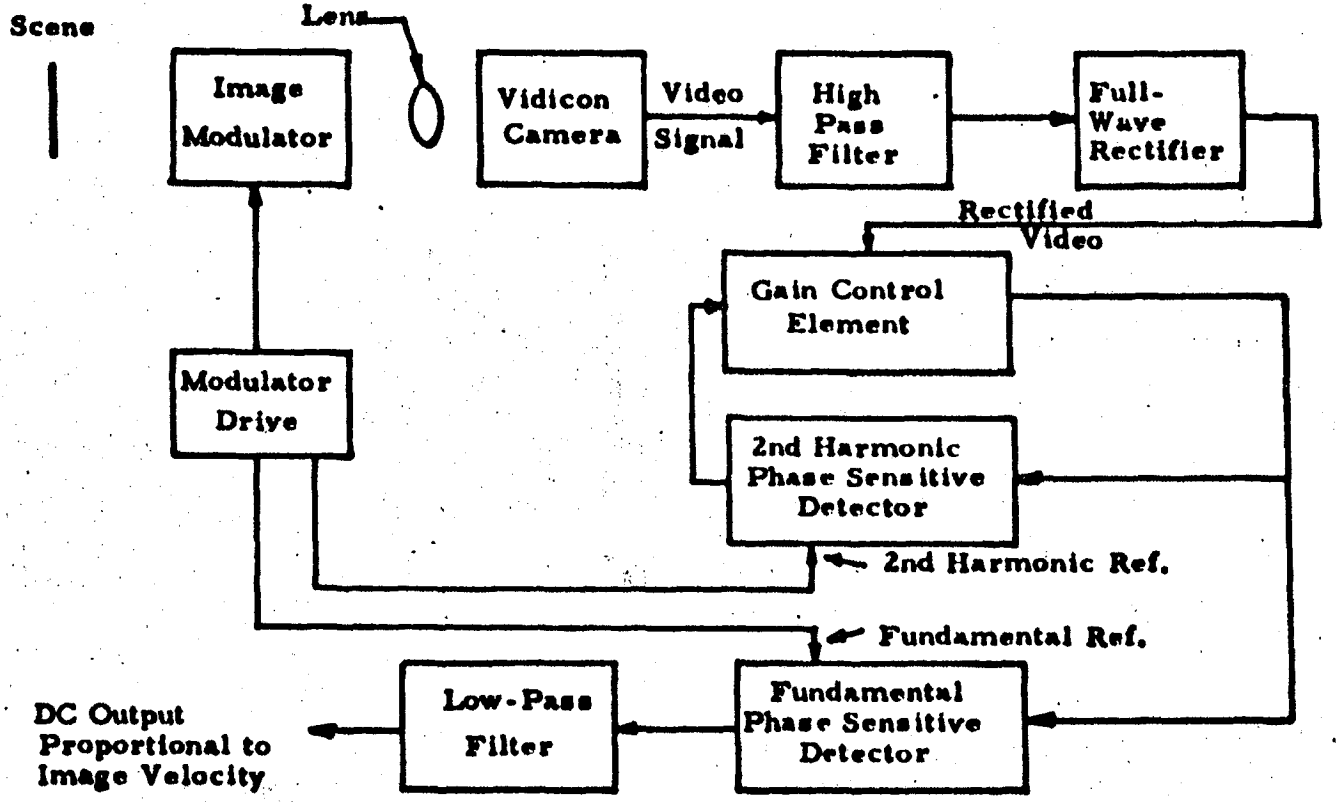
WHS-438
p.9

ITEK SINGLE AXIS BLOCK DIAGRAM



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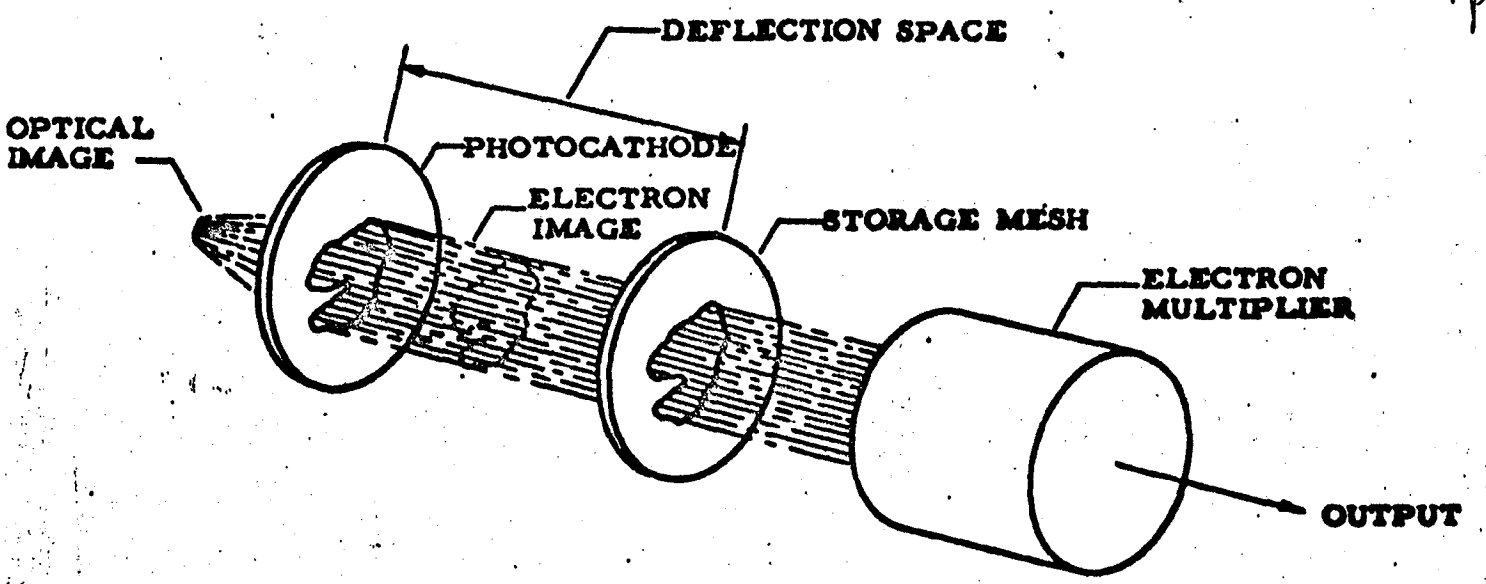
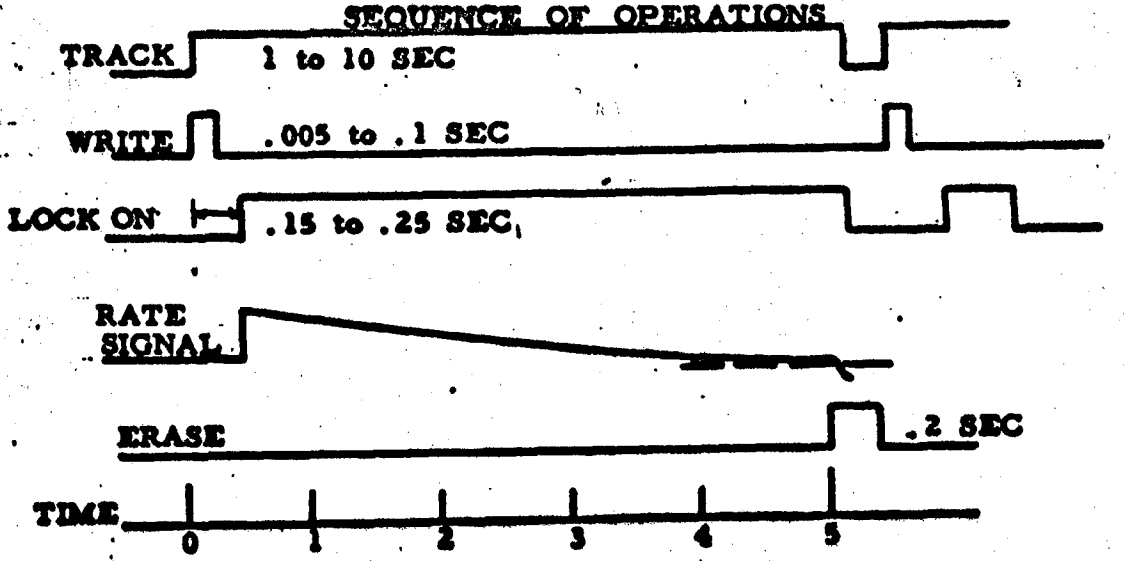
WHS-438
p. 10

GOODYEAR IVS (CORRELATRON)



SEQUENCE OF OPERATIONS



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WHS-438
p. 11

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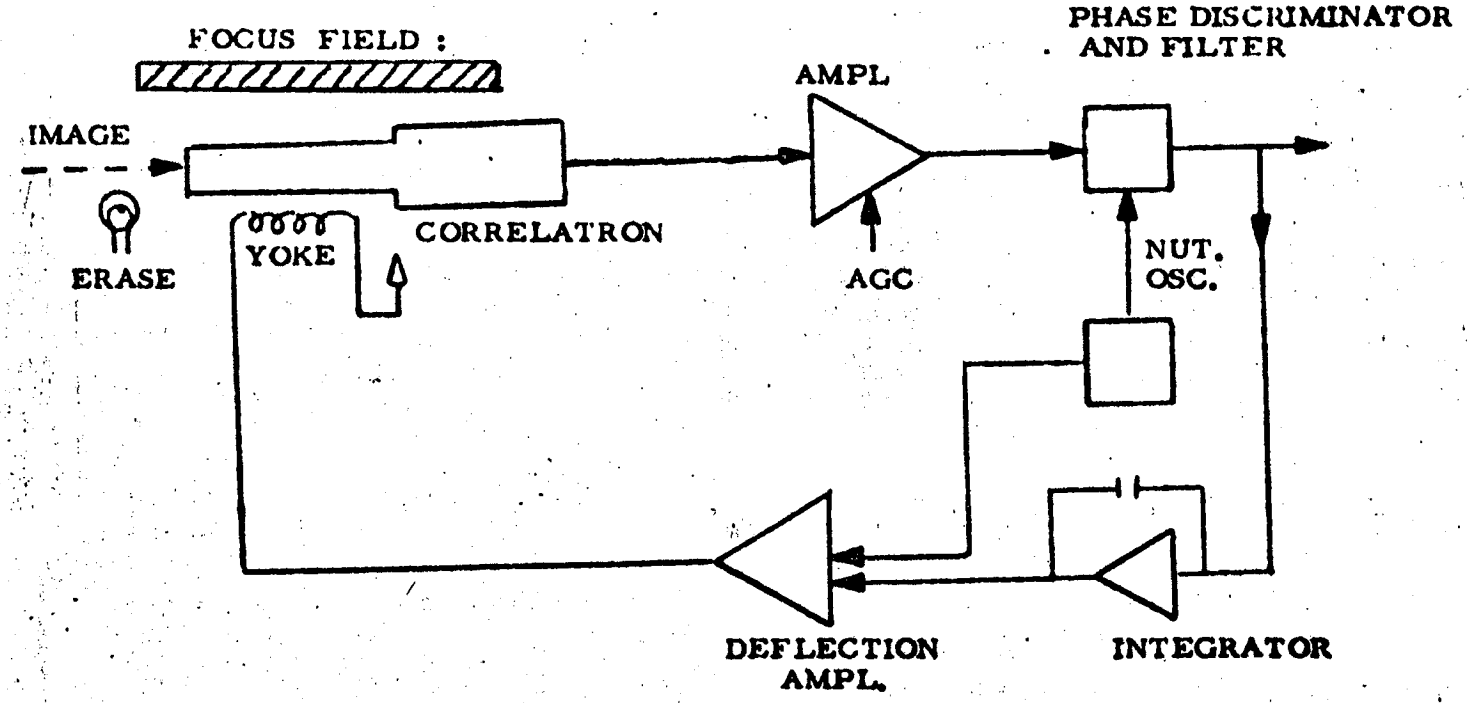
GOODYEAR SINGLE AXIS BLOCK DIAGRAM



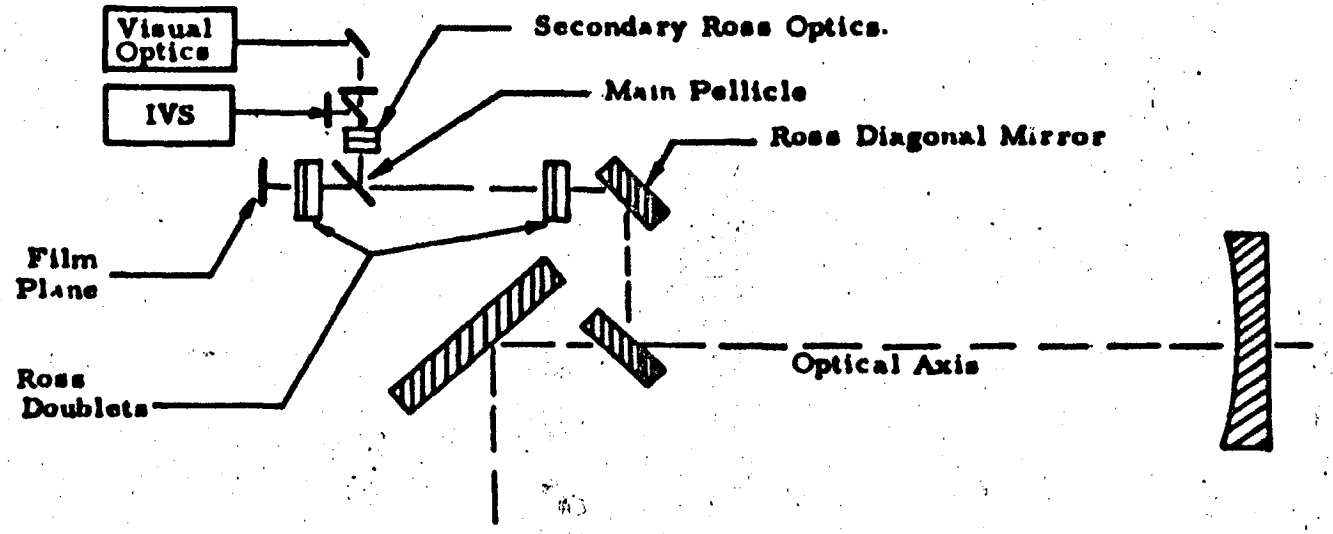
WHS-438
p. 12

PERFORMANCE COMPARISON

	GOODYEAR	ITEK
LIGHT LEVEL MIN. (FT. CANDLES)		
CONTRAST RATIO		
NULL ACCURACY μR/S		
DYNAMIC RANGE μR/S		
WEIGHT ESTIMATE (LB)		
MODULATION FREQUENCY (Hz)		
SPATIAL FREQUENCY RANGE		
MAXIMUM RESOLUTION (FT.)		
MINIMUM RESOLUTION (FT.)		
BREAK FREQUENCY (Hz) (MIN. SPEC.)		
PRACTICAL BREAK FREQUENCY		
FIELD OF VIEW		

WHS-438
p. 13

OPTICAL CONFIGURATION



Mirrors	59%
Pellicle	86%
Vignetting & Obscuration	56.8%
Total Transmittance*	29%

Total Transmittance to IVS

With Pellicle	1.2%
With Mirror	2.8%

* For 3404 Type Spectral Response

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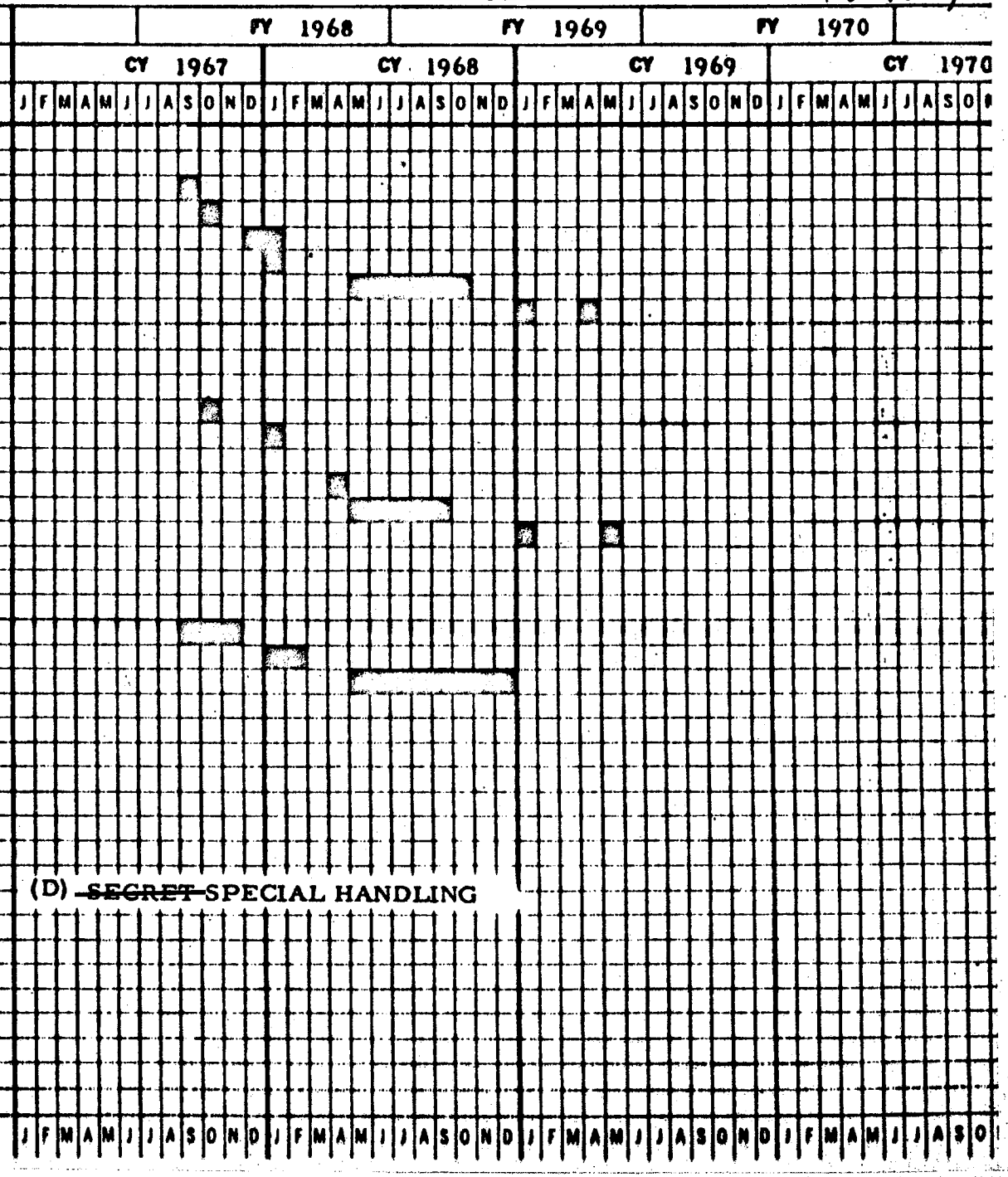
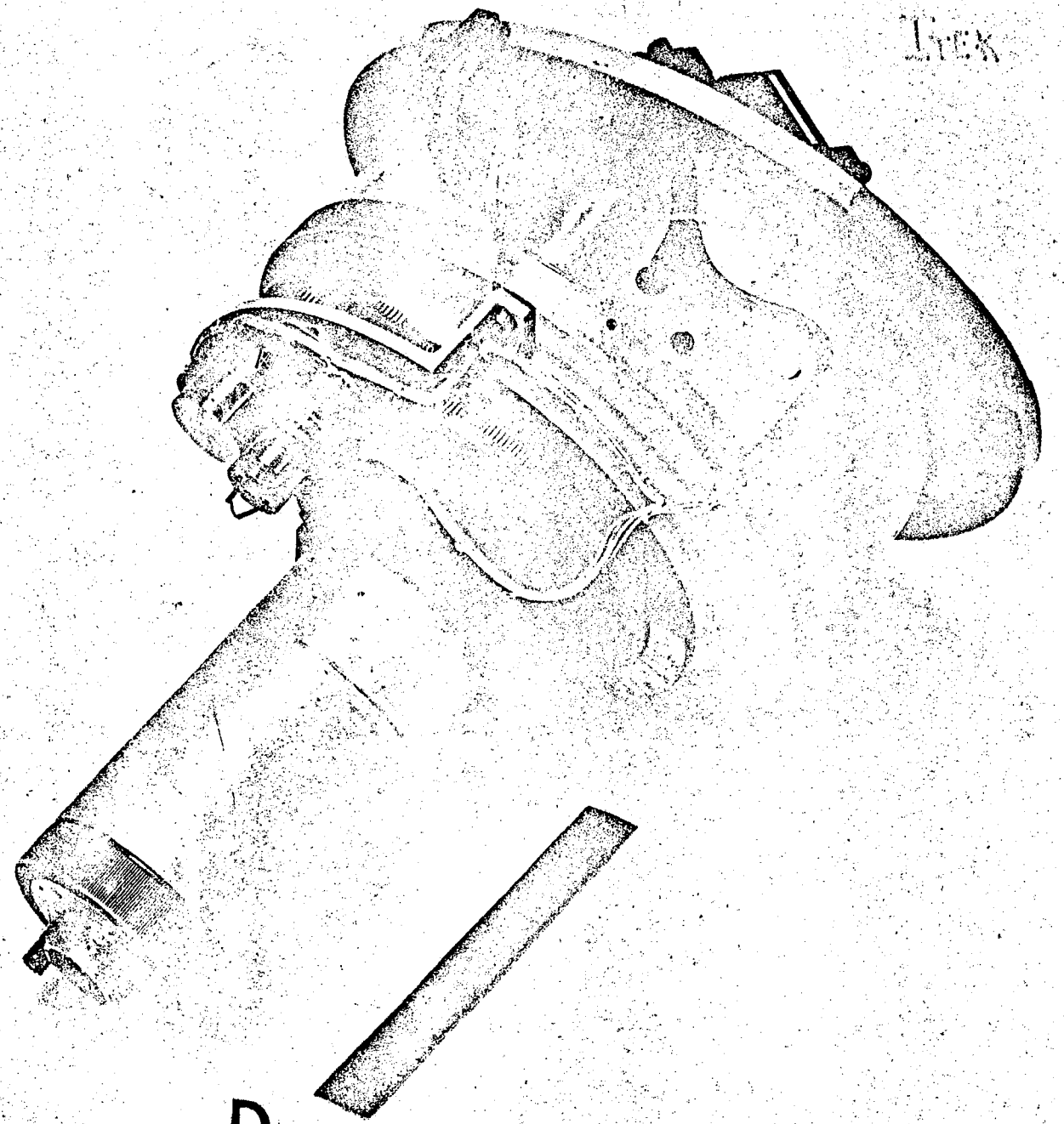
PROGRAM SCHEDULE

DEVELOPMENT AND TEST SCHEDULE

WHS-438 p.14





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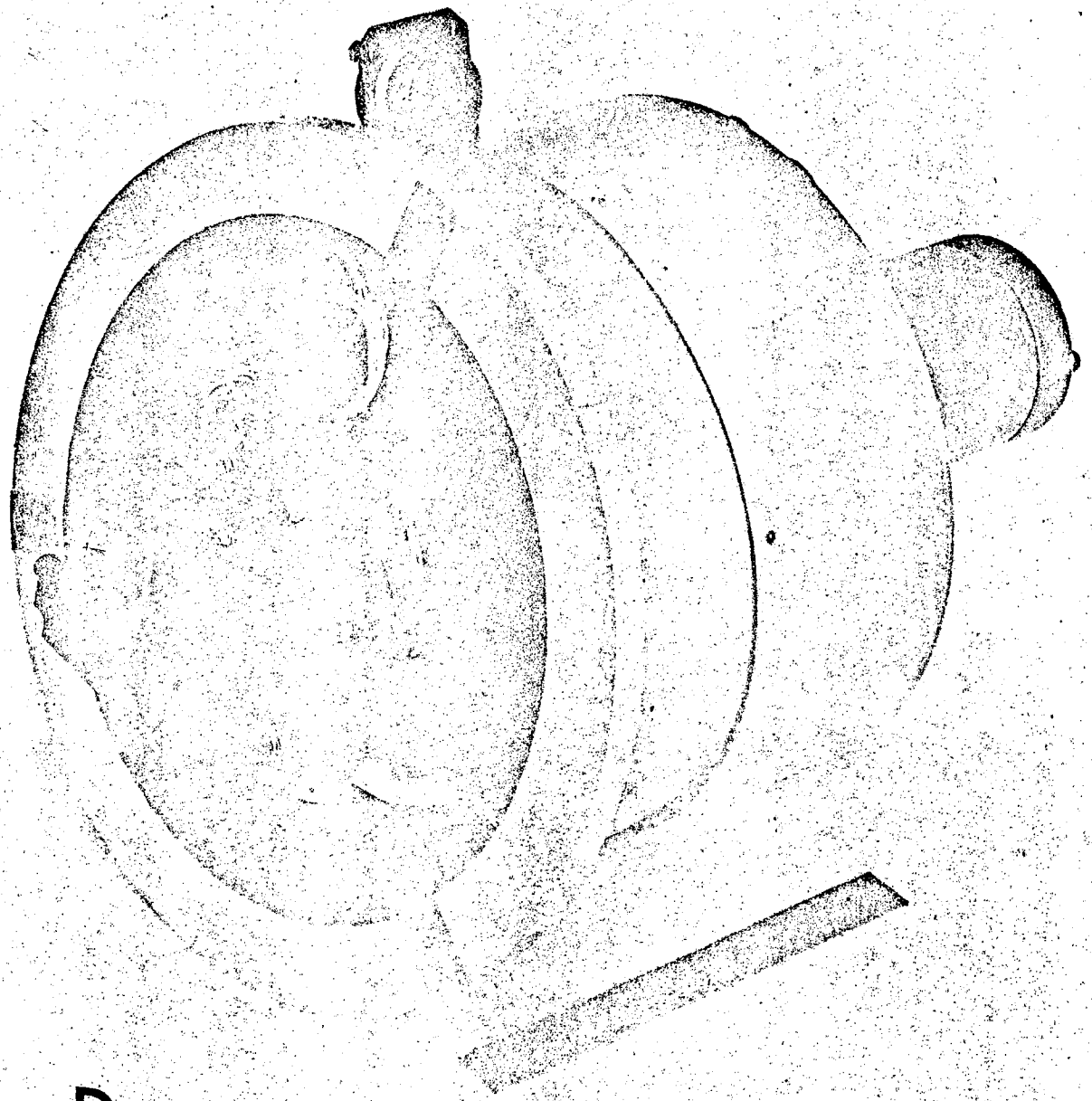
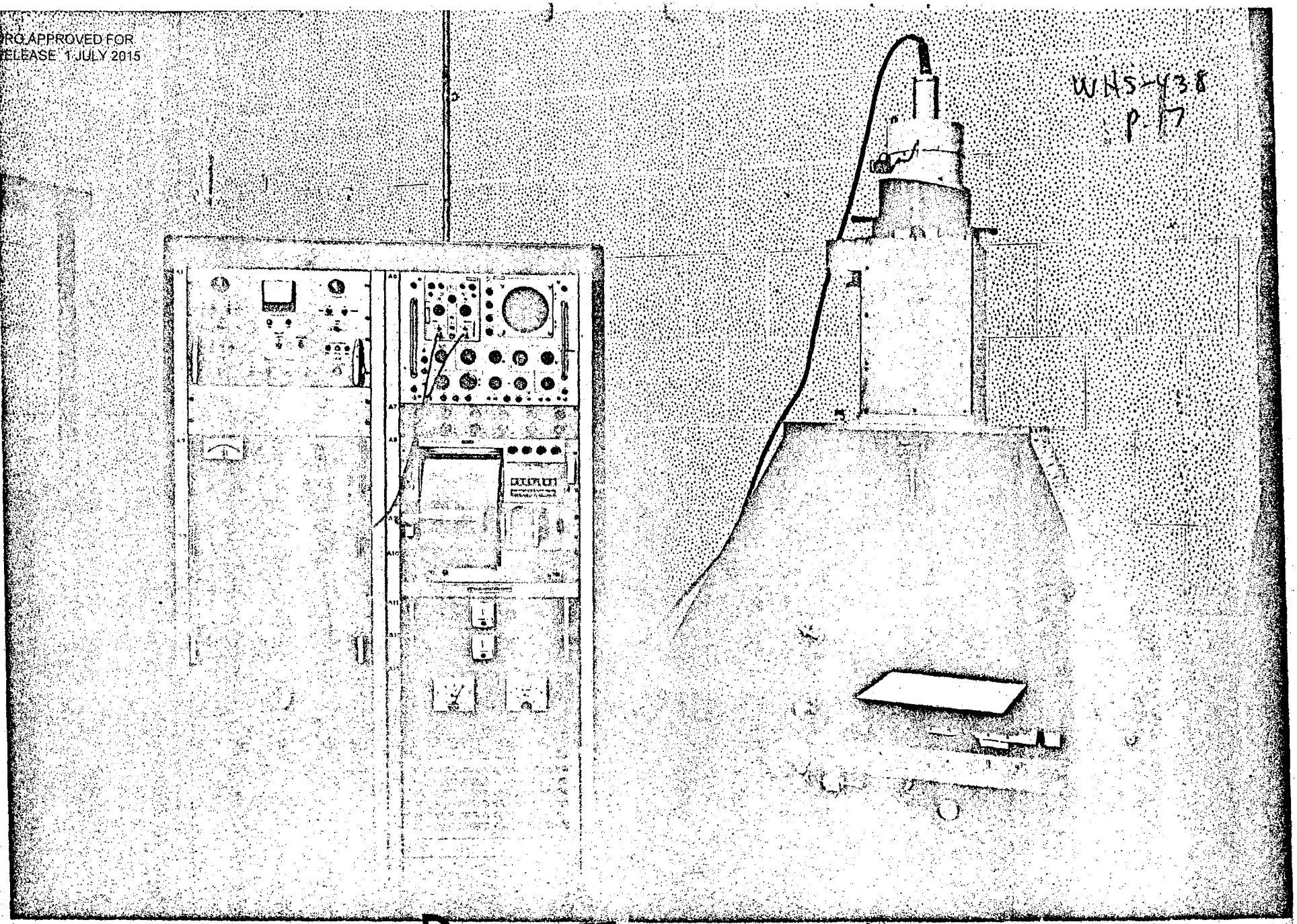
ITEK WHS-43Y
p.16



WHS-438
P-17



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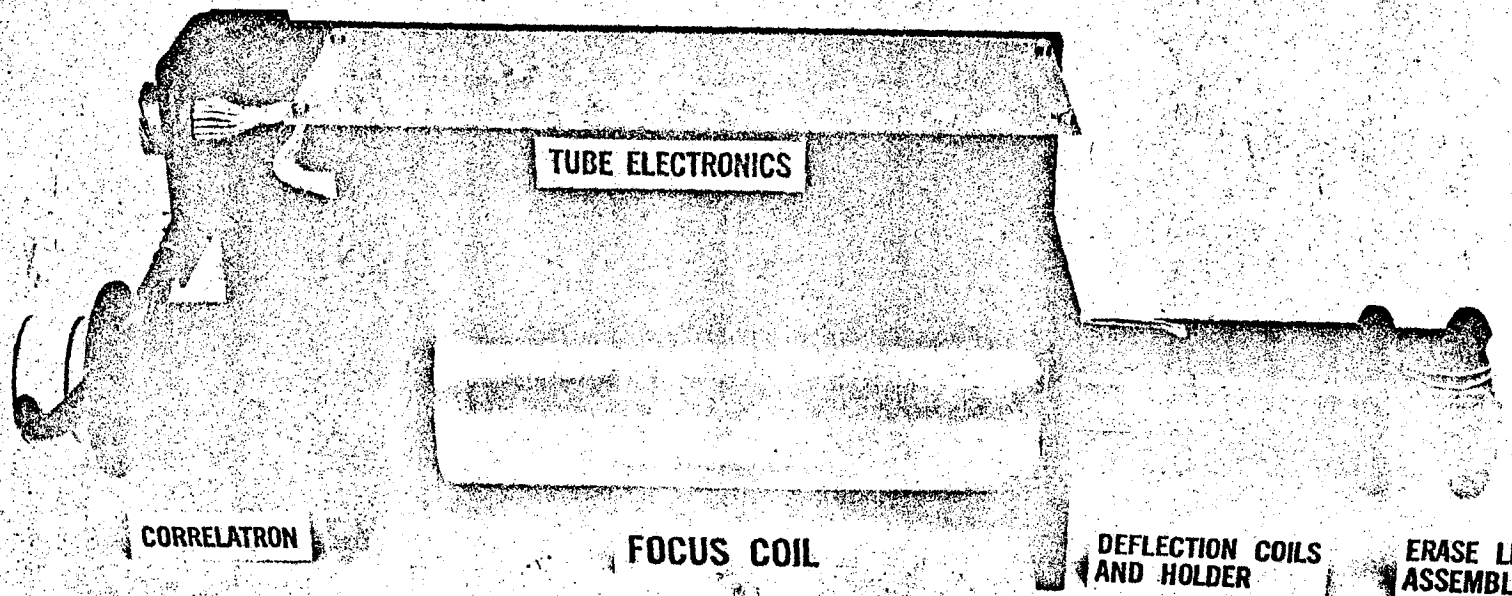
WHS-438
p. 18

GOODYEAR



TUBE ASSEMBLY

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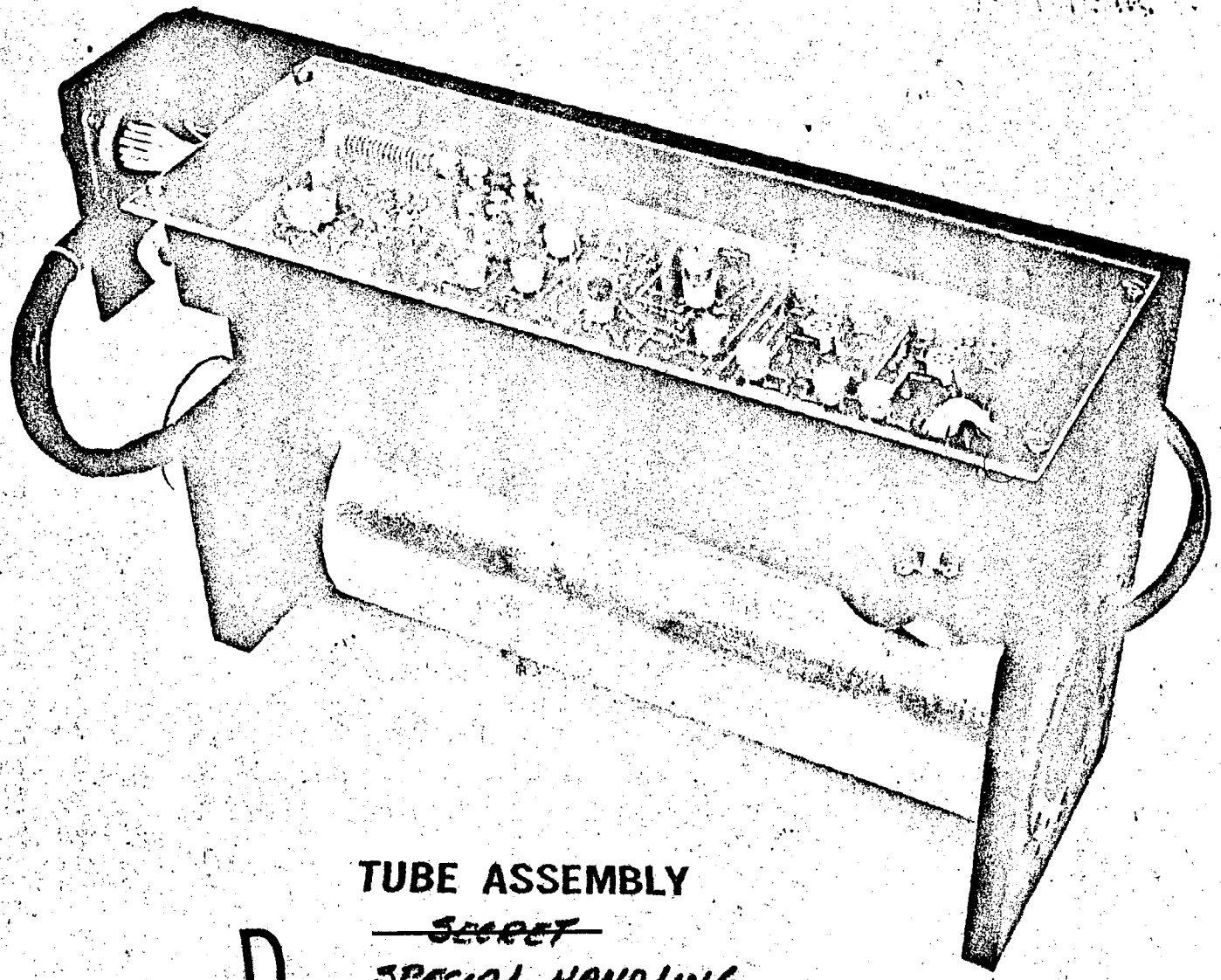

TUBE ASSEMBLY

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(1)

WHS-438
p. 20

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ACQUISITION AND TRACKING SYSTEM

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ATS REQUIREMENTS

FUNCTION

- TARGET ACTIVITY DETECTION
- ACQUISITION AND TRACKING
- SCAN WITHIN LIMITED AREA
- BACKUP NAVIGATION

DESIGN REQUIREMENTS

- 3-FOOT RESOLUTION FOR HIGH CONTRAST TARGETS
- 1° (1.5 N.M.) FOV FOR INITIAL ACTIVE INDICATOR ACQUISITION
- 4° (6 N.M.) FOV FOR NAVIGATION AND LIMITED SCAN
- SCAN ANGLE REQUIREMENTS
  - LATERALLY: $\pm 45^{\circ}$
  - LONGITUDINALLY: $+70$ TO -40°

WHS-438
p. 22

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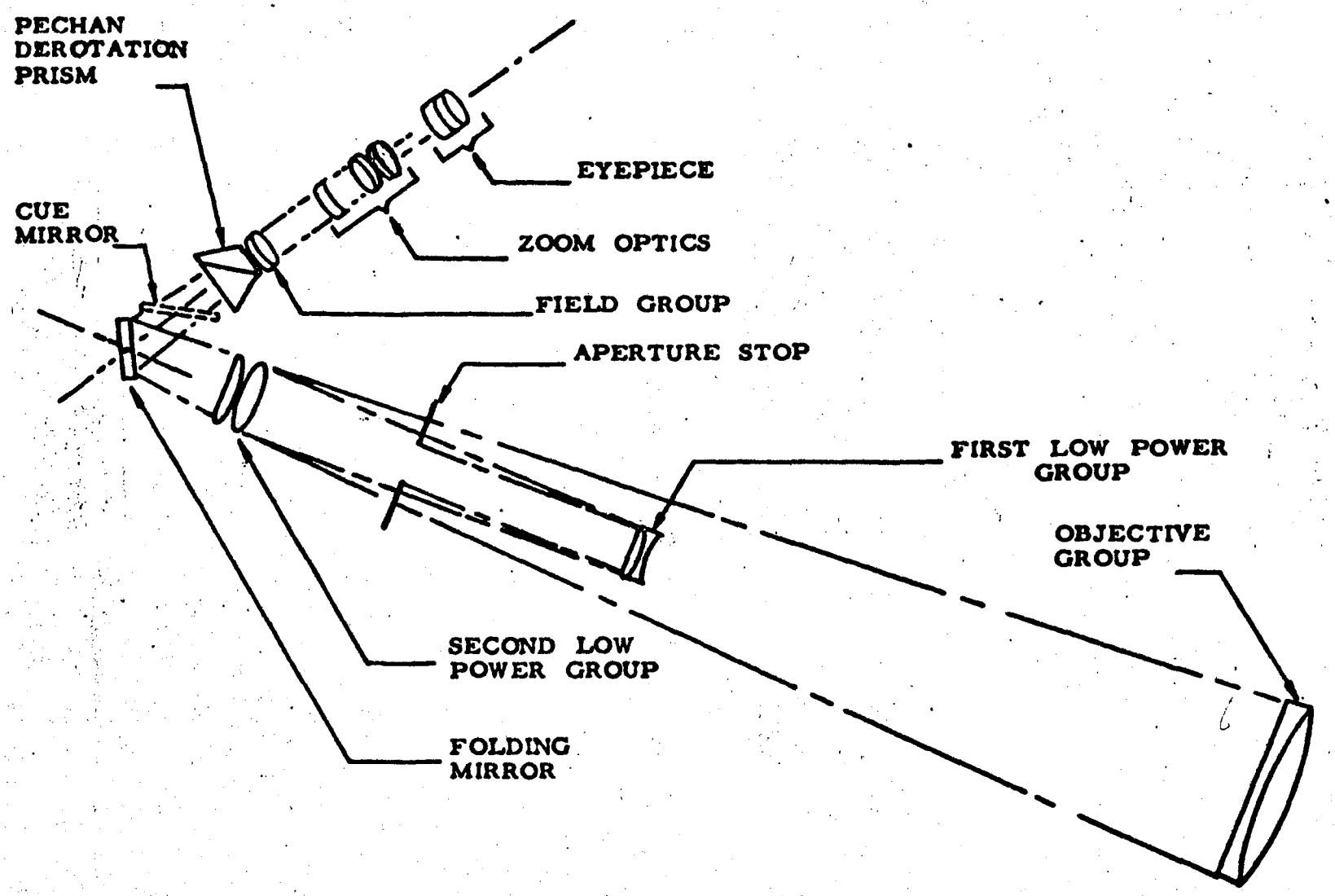
REFRACTIVE APPROACH



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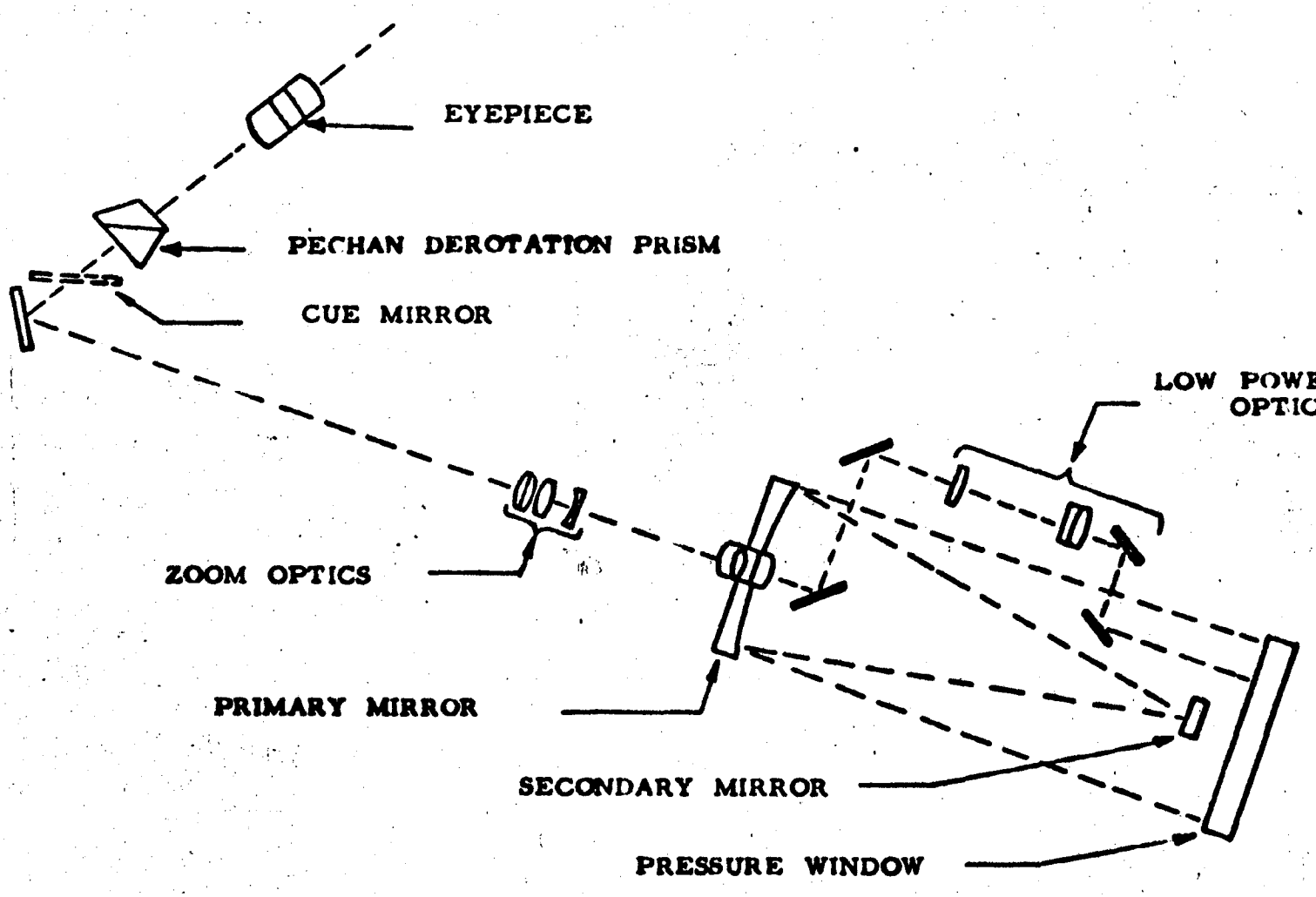
WHS-438
p. 23

BURIED CASSEGRAIN APPROACH



5

WHS-438
p. 24

CASSEGRAIN-REFRACTIVE TELESCOPE COMPARISONS

10-INCH APERATURE

	EXTERNAL CASSEGRAIN	BURIED CASSEGRAIN	REFRACTIVE
RESOLUTION FROM 80 N. MI. APERTURE 2:1 CONTRAST	4.0 FEET	4.0 FEET	3.6 FEET
ENVIRONMENT	SPACE	LAB	LAB
OBSCURATION AT EXIT PUPIL	PARTIAL	PARTIAL	NONE
OPTICAL RELAY TO RECON CONSOLE	YES	NO	NO
LAB MODULE PENETRATION	1 - 2 INCHES	10 INCHES	10 INCHES

CONCLUSION: REFRACTIVE SYSTEM SUPERIOR IN ALL RESPECTS EXCEPT SIZE OF LAB MODULE PENETRATION. THIS DISADVANTAGE IS OUT-WEIGHED BY LOCATING CRITICAL OPTICAL COMPONENTS IN THE LAB MODULE ENVIRONMENT.

(16)

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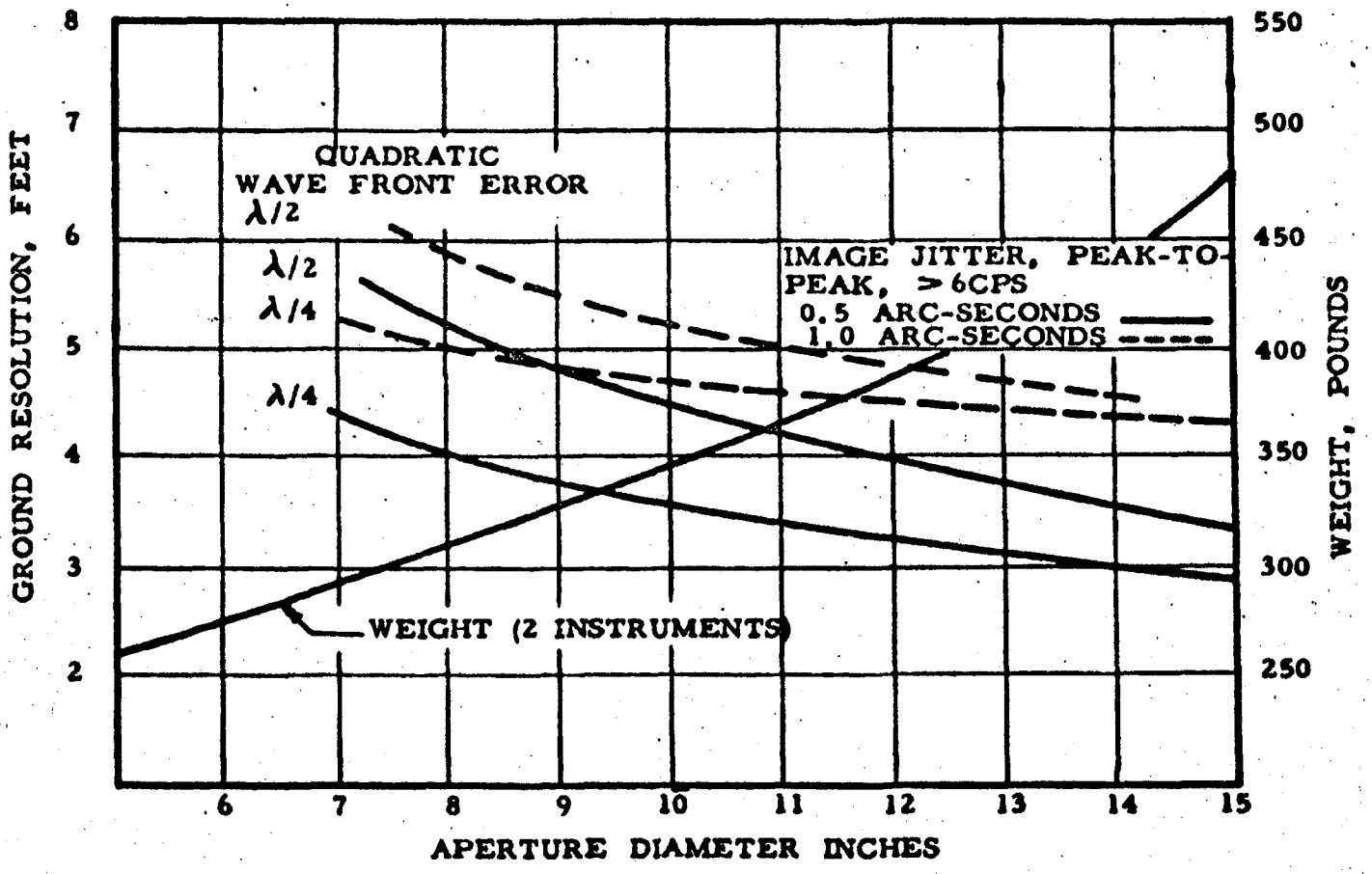
WHS-438
p. 25

ATS TELESCOPE
RESOLUTION AND POWER VS APERTURE DIAMETER

EXIT PUPIL: 2MM FIXED
RANGE: 80 N. MI. (NADIR)
CONTRAST AT APERTURE: 2:1



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7

WHS-438
p. 26

ATS TELESCOPE CHARACTERISTICS

OPTICAL PROPERTIES

- 10-INCH REFRACTIVE SYSTEM PLUS TRACKING AND FOLDING MIRRORS
- EYE-PIECE FIELD-OF-VIEW: 60°
- REAL FIELD-OF-VIEW: 2° TO 4° AND $1/2^{\circ}$ TO 1°
- MAGNIFICATION: CONTINUOUS ZOOM FROM 15 X TO 30 X AND 63.5 X TO 127 X
- OPTICAL TRANSMISSION: 33%
- EXIT PUPIL DIAMETER: 2 MM AT 30 X AND 127 X
  4 MM AT 15 X AND 63.5 X
- EYE-RELIEF: 0.4 INCH MINIMUM
- EYE-RELIEF VARIATION: $\pm$ .060 INCH MAXIMUM THROUGHOUT MAGNIFICATION RANGES
- LOW REFLECTANCE COATINGS ON REFRACTIVE SURFACES
- SCANNER REFLECTIVE SURFACES: CER-VIT

OPTICAL TOLERANCES

- REFRACTIVE SURFACES: $\pm \lambda/10$
- REFLECTIVE SURFACES: $\pm \lambda/20$
- QUADRATIC WAVE FRONT ERROR: $\pm \lambda/4$

WHS-438
p. 27

ATS TELESCOPE CHARACTERISTICS (CONT'D)

MISCELLANEOUS OPTICAL CHARACTERISTICS

- FOCUS RANGE: -2.5 TO +3 DIOPTERS
- FLIP MIRROR TO DISPLAY CUES IN EYE-PIECE
- DISPLAY AT PERIPHERY OF EYE-PIECE FOR DECISION-TIME, TARGET PRIORITY
- RETICLE: SINGLE CIRCLE TO SHOW FOV AT MAXIMUM ZOOM SETTING, OPEN CROSS-HAIRS
- FILTERS: FOUR COLOR OR NEUTRAL DENSITY INSERTABLE FILTERS
- IMAGE DEROTATION: PECHAN PRISM
- BLANKING SHUTTER AND SUN SENSORS TO PROTECT AGAINST SOLAR IMPINGEMENT

SERVO CHARACTERISTICS

- POINTING ACCURACY: $\pm$ 8 ARC-MINUTES
- JITTER: 0.5 ARC-SECONDS (PEAK-TO-PEAK, >6 CPS)

INSTRUMENT WEIGHT: 344 POUNDS (2 INSTRUMENTS)

TOTAL INSTALLATION: 485 POUNDS

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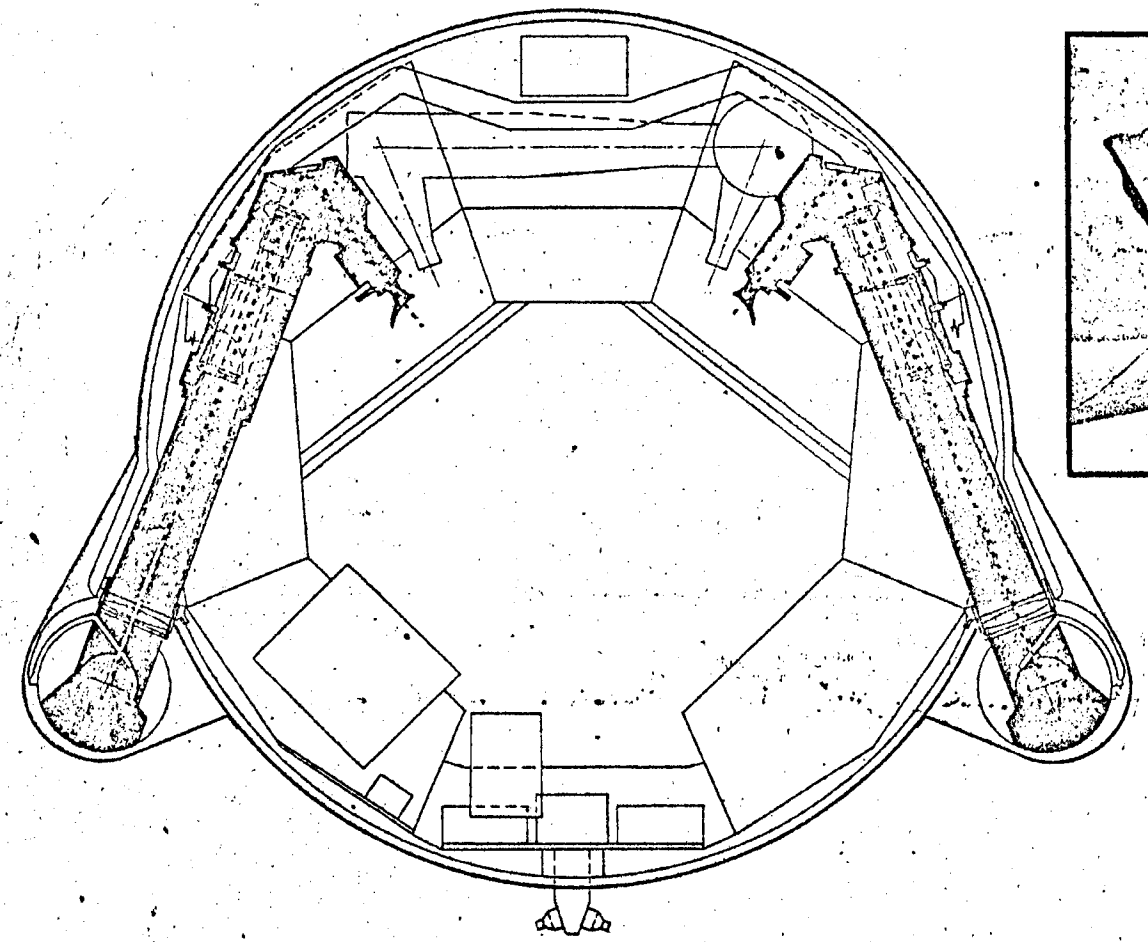
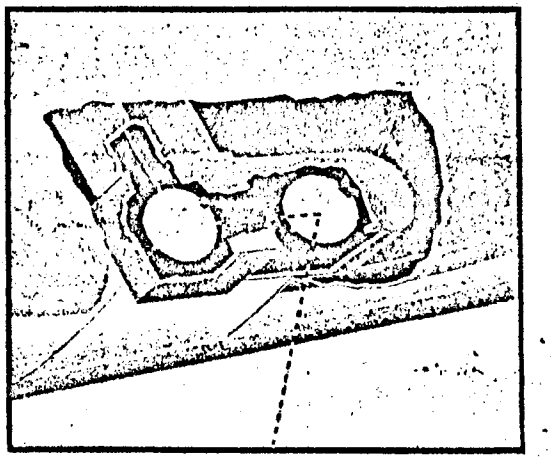
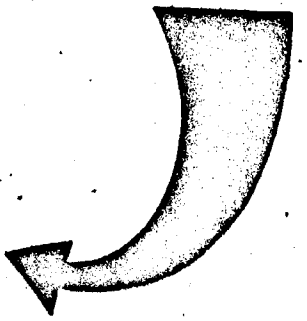
WHS-438
p. 28







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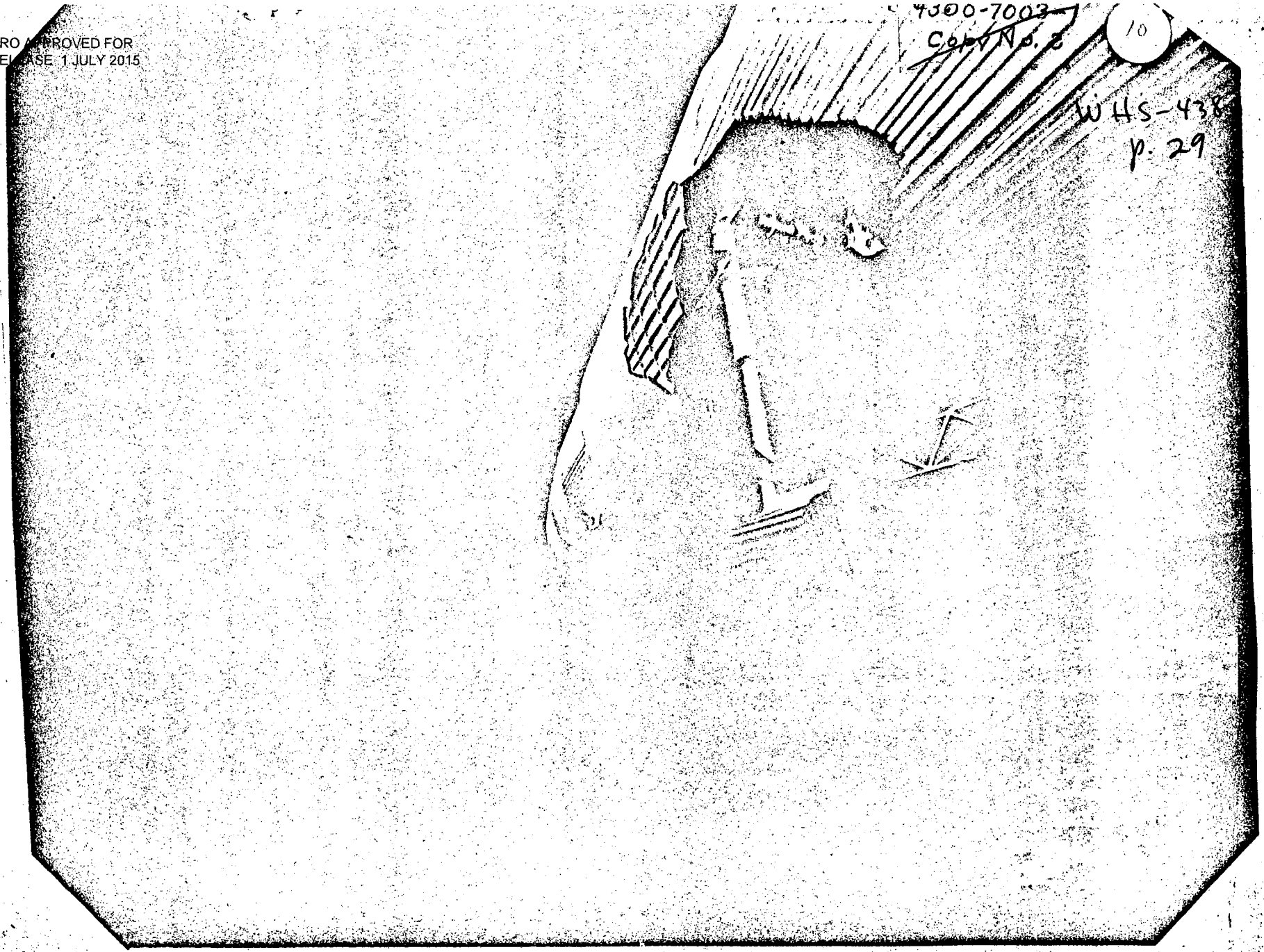

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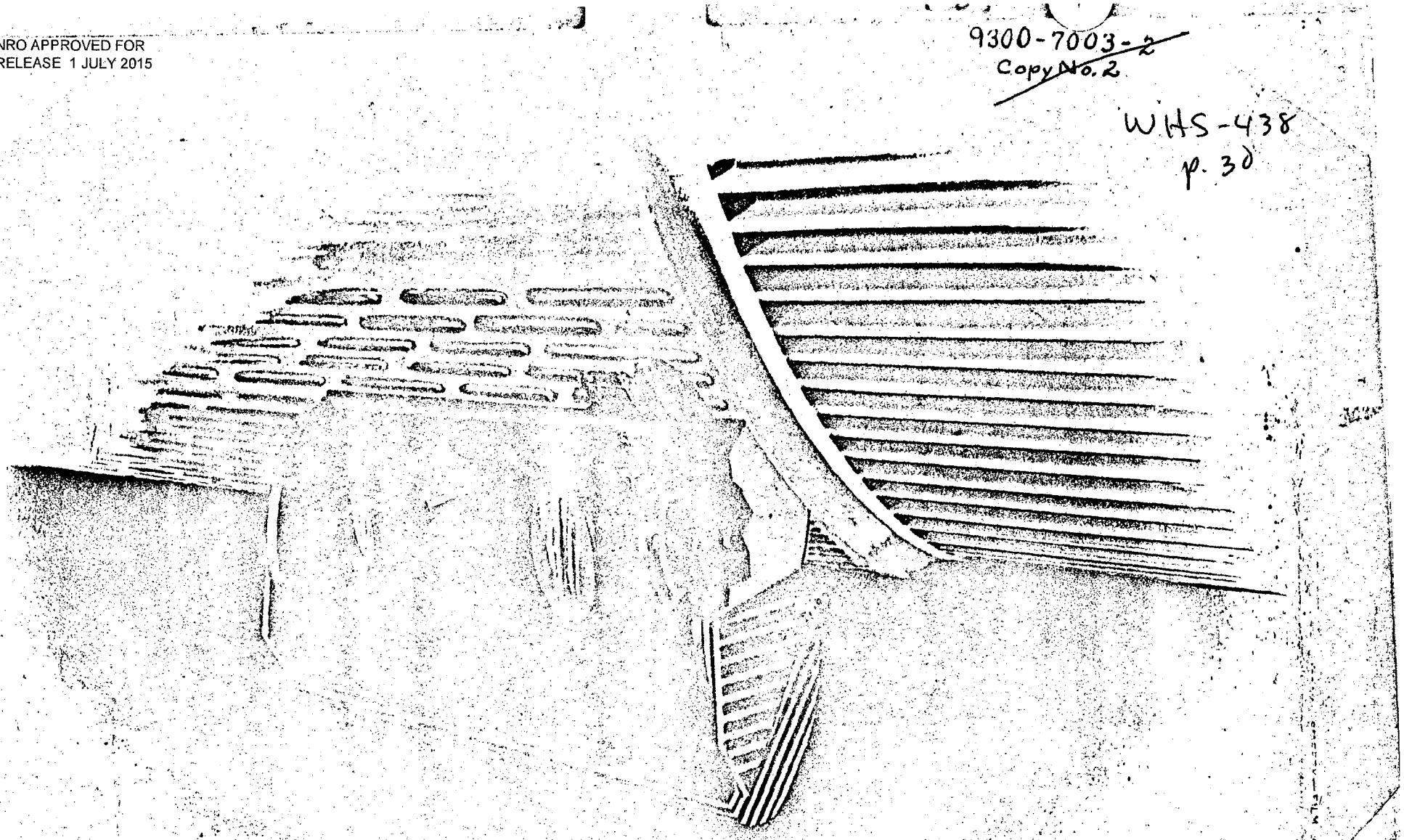
WHS-438
p. 30



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WHS-438 p. 31

ATS DEVELOPMENT SCHEDULE

AVE

- START PHASE II ENGINEERING
- BREADBOARD TESTING
- OPTICAL SYSTEMS
  - EYE-PIECE MODEL
  - ENGINEERING MODEL
  - QUAL TEST UNIT
  - FIRST FLIGHT UNIT
- DESIGN REVIEWS
  - PRELIMINARY
  - CRITICAL
- QUAL TESTING

SIMULATION (GE)

- ELEMENTAL DEVELOPMENT SIMULATOR (EDS) TESTING
- MISSION DEVELOPMENT SIMULATOR (MDS) DESIGN & DEVELOPMENT
- MDS FABRICATION & TESTING
- CONVERT EDS TO MDS
- MDS OPS WITH SIMULATED ATS