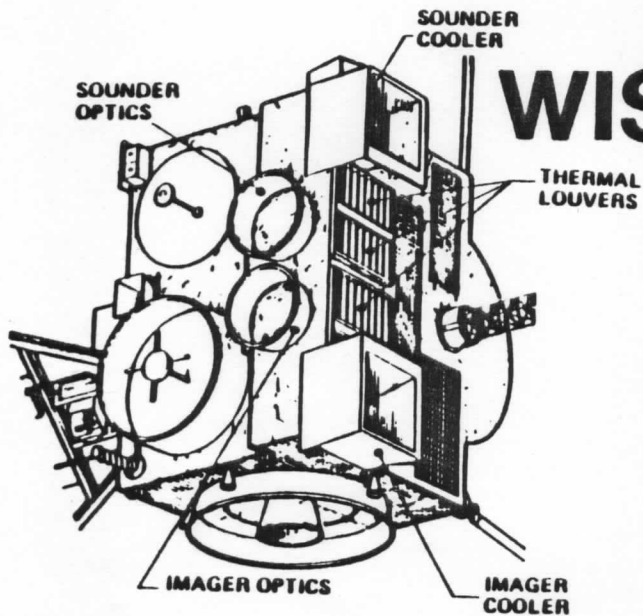


GOES

IMAGER AND SOUNDER

UNIVERSITY OF WISCONSIN (SSEC) REVIEW



JUNE 7, 1988

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GOES IMAGER AND SOUNDER REVIEW

JUNE 7, 1988

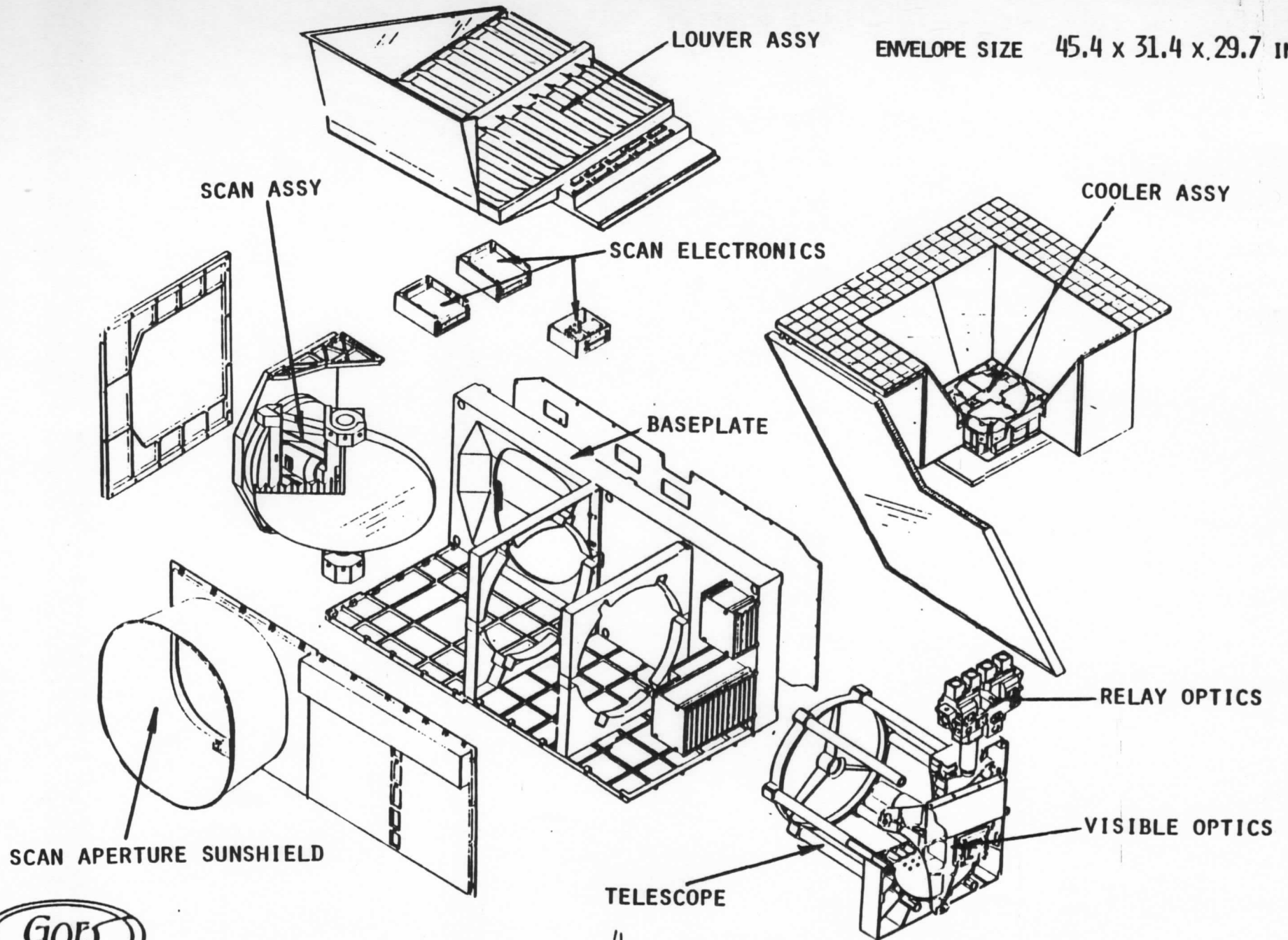
- 1.0 SYSTEM COMPONENTS**
- 2.0 IMAGER OPTICS**
- 3.0 SOUNDER OPTICS**
- 4.0 KEY FEATURES/PERFORMANCE**
- 5.0 THERMAL/INR**

SYSTEM COMPONENTS



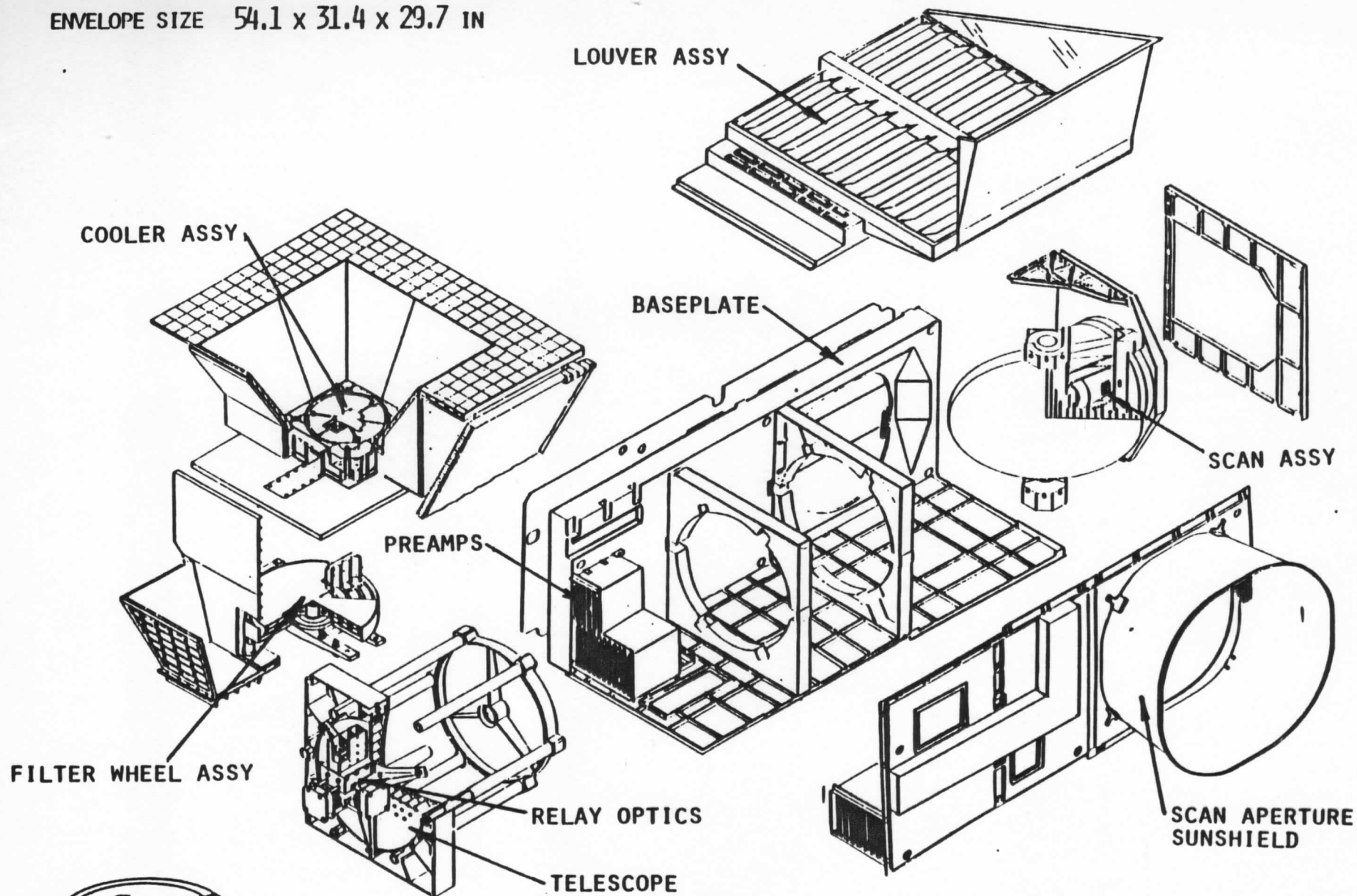
IMAGER SENSOR COMPONENTS

ENVELOPE SIZE 45.4 x 31.4 x 29.7 IN

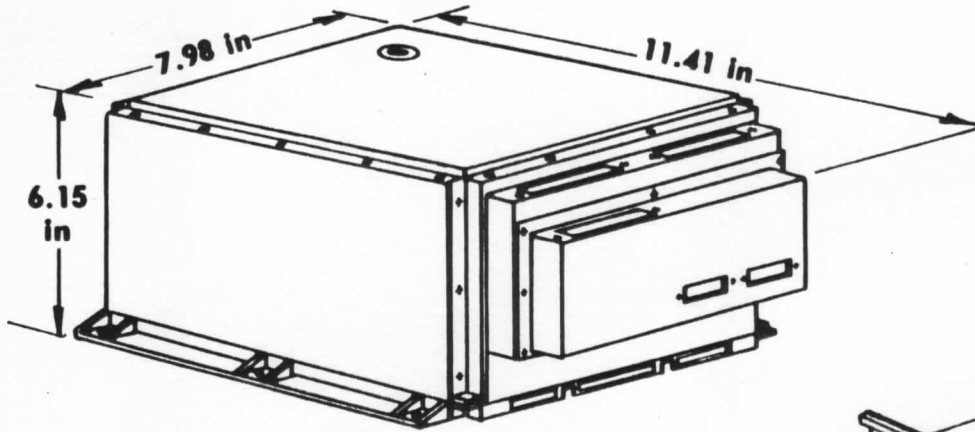


SOUNDER SENSOR COMPONENTS

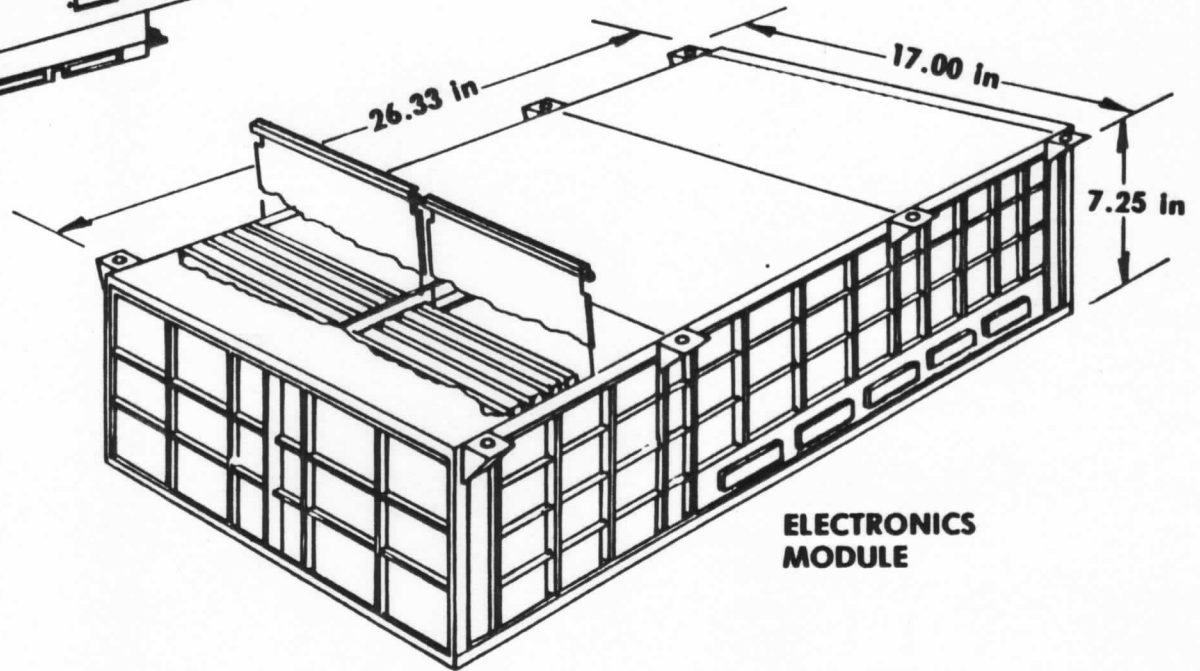
ENVELOPE SIZE 54.1 x 31.4 x 29.7 IN



IMAGER OR SOUNDER ELECTRONICS (IDENTICAL DIMENSIONALLY)



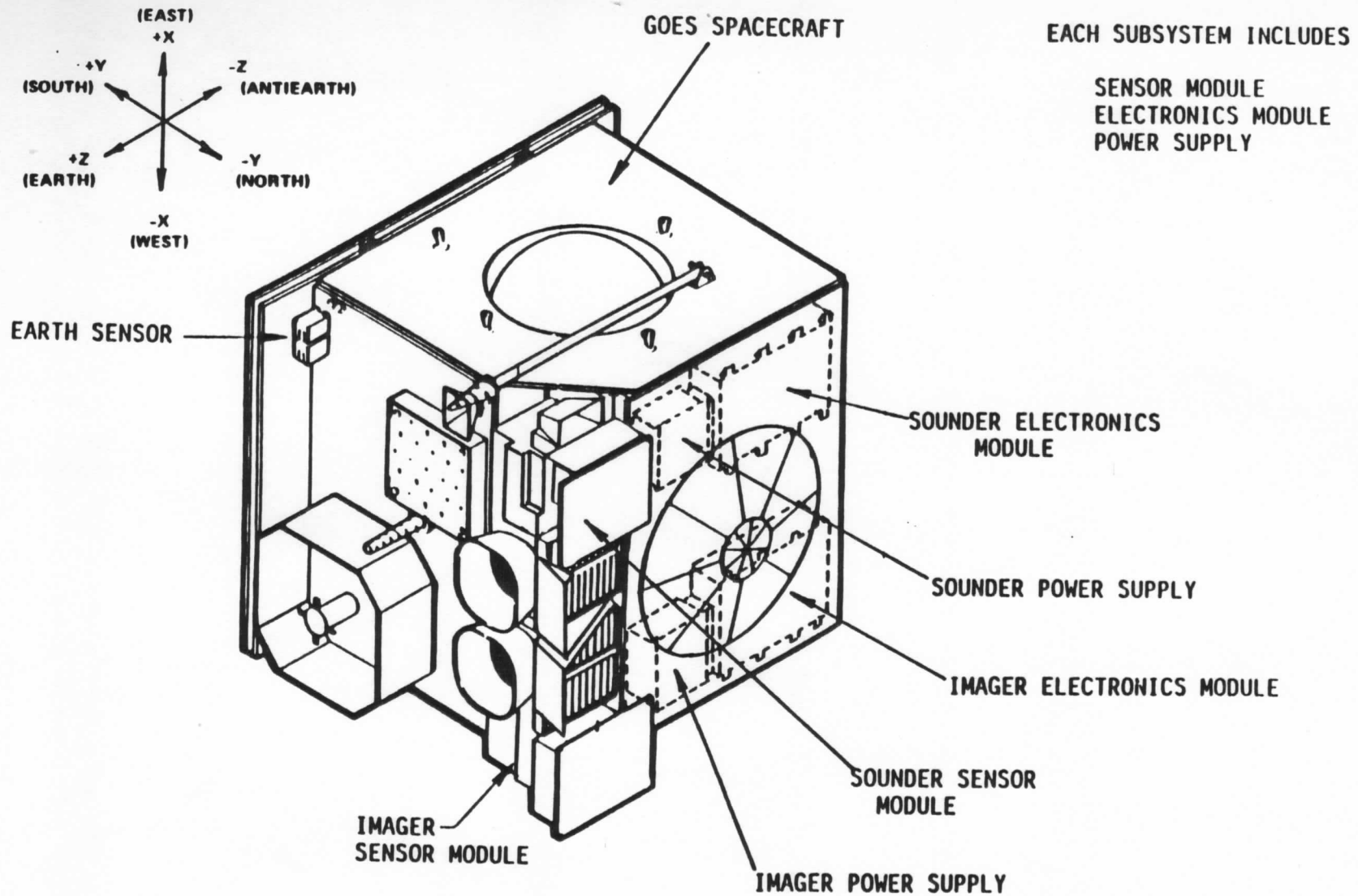
**POWER SUPPLY
MODULE**



**ELECTRONICS
MODULE**



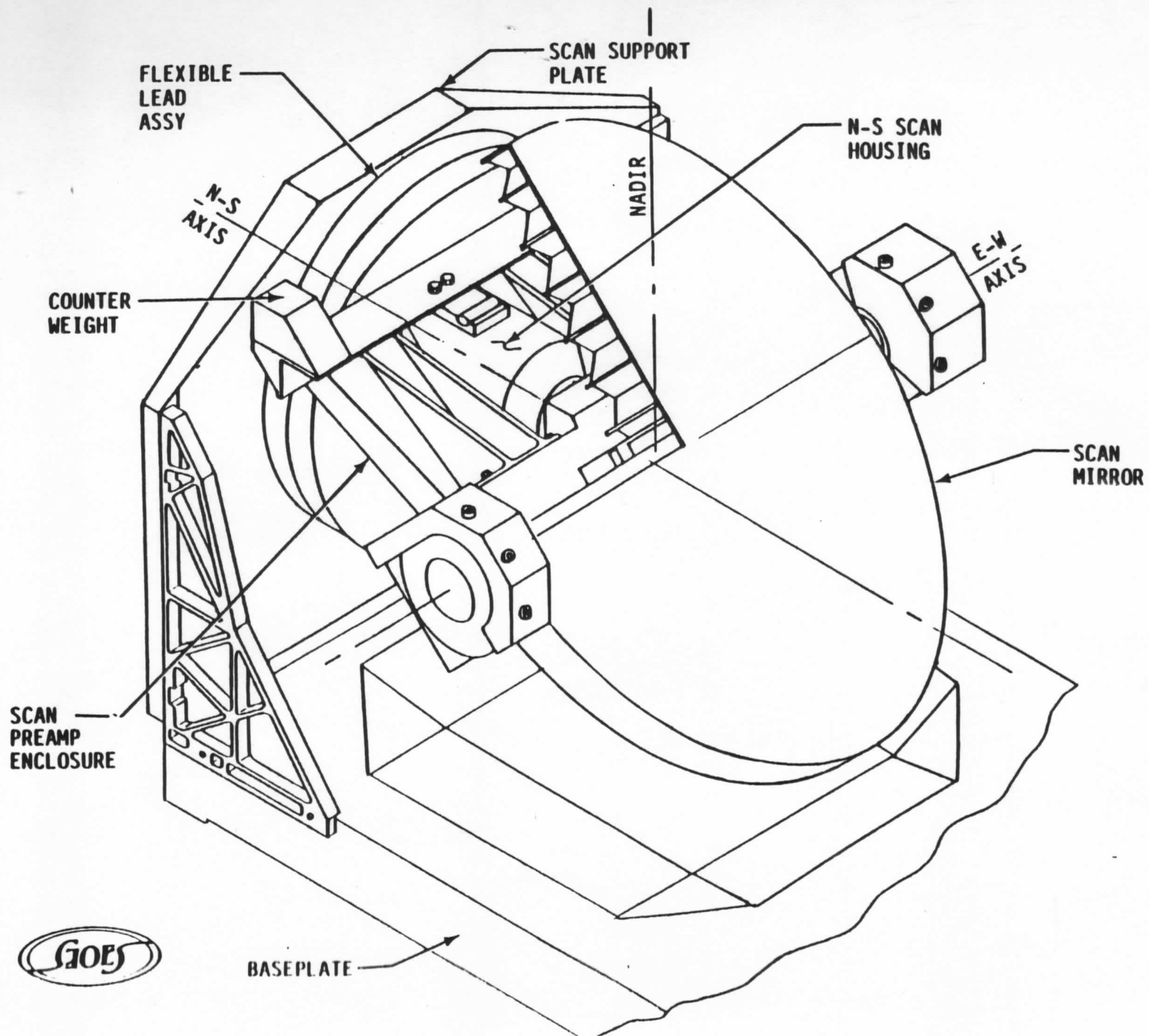
GOES IMAGER AND SOUNDER SUBSYSTEMS



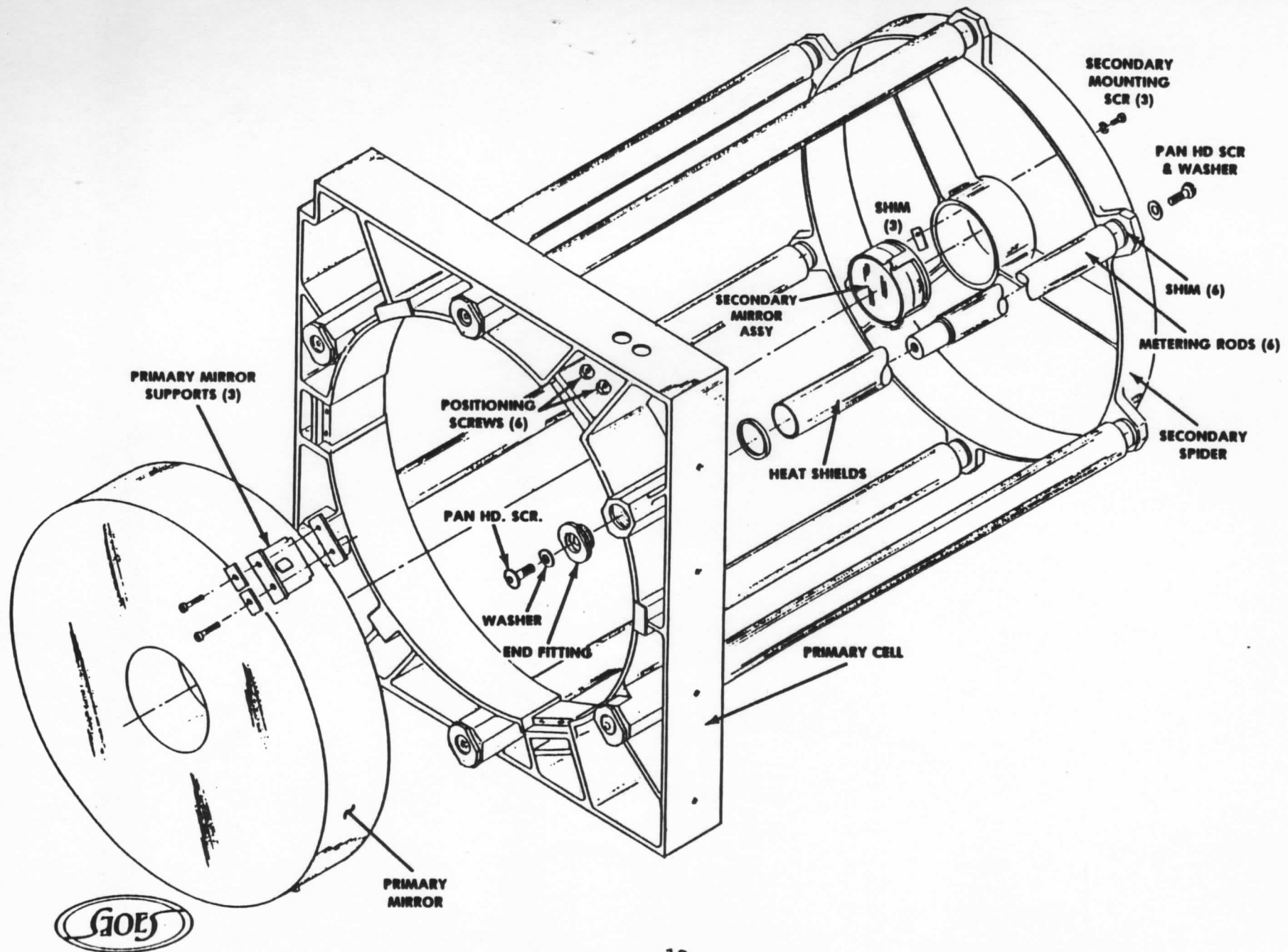
IMAGER OPTICS



GOES SCAN ASSEMBLY



IMAGER AND SOUNDER TELESCOPE



AFT OPTICS LAYOUT IMAGER

LEGEND:

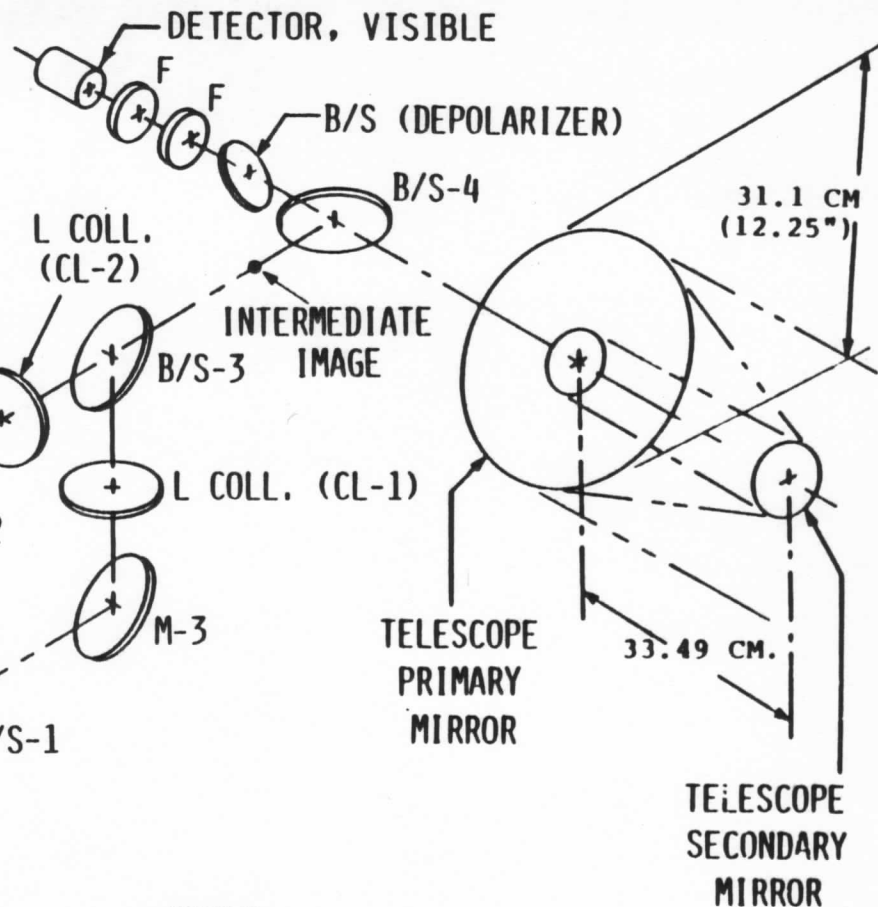
- M - MIRROR
- B/S - DICHOIC BEAMSPLITTER
- L - LENS
- CW - WINDOW, COOLER
- VW - WINDOW, VACUUM
- F - FILTER

DETECTORS
(10.2-11.2 μm)

DETECTORS
(11.5-12.5 μm)

DETECTORS
(6.5-7.0 μm)

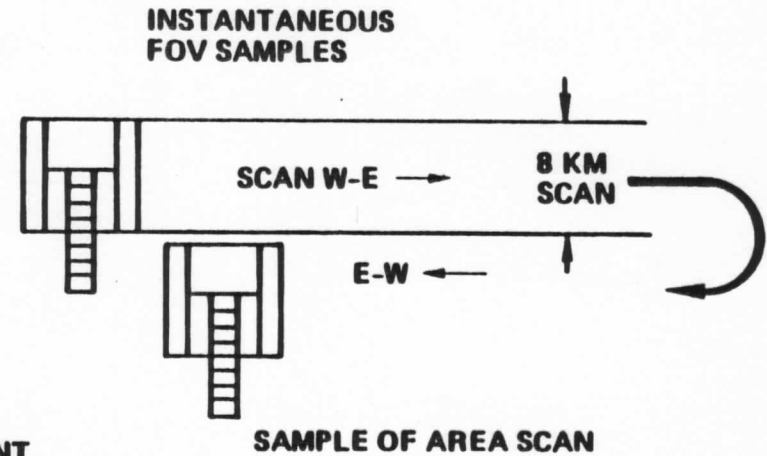
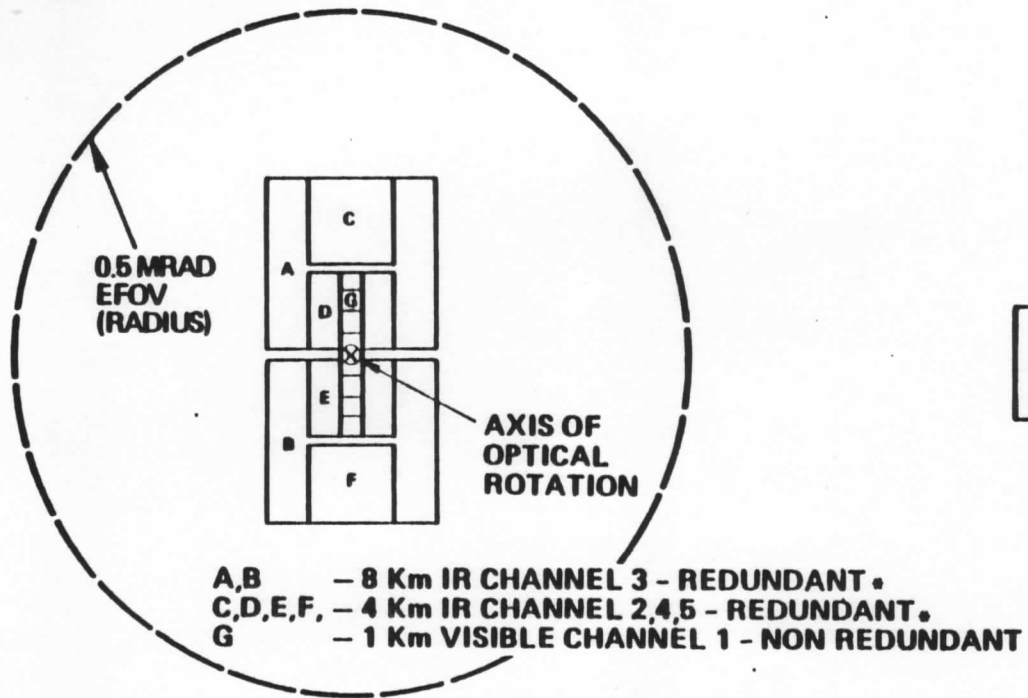
DETECTORS
(3.8-4.0 μm)



NOTES:

- 1) SCAN MIRROR NOT SHOWN
- 2) COMPONENTS AND SPACINGS ARE NOT TO SCALE

IMAGER DETECTOR CONFIGURATION



*A, C & D CHANNELIZED REDUNDANCY TO B, E & F



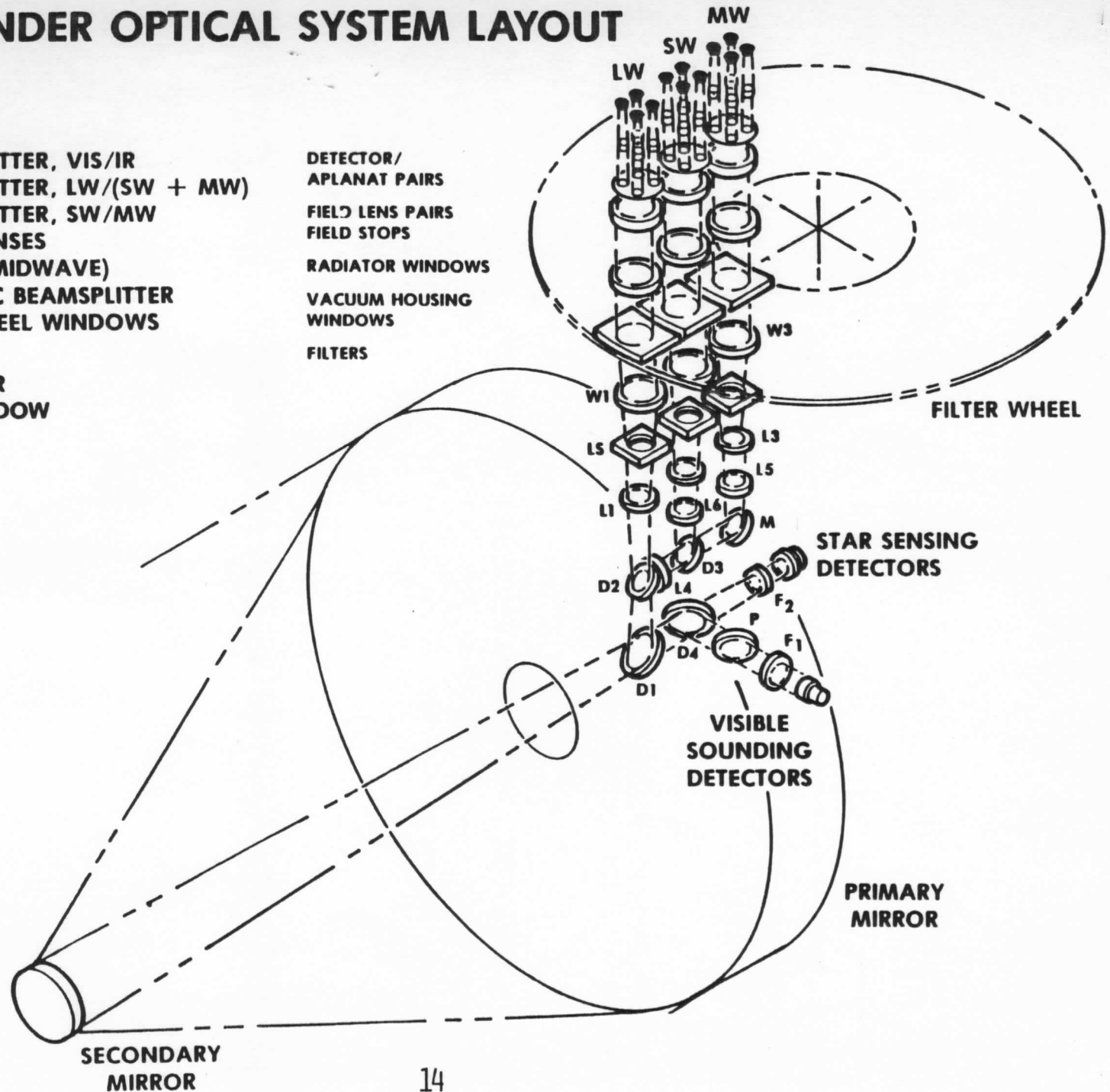
SOUNDER OPTICS



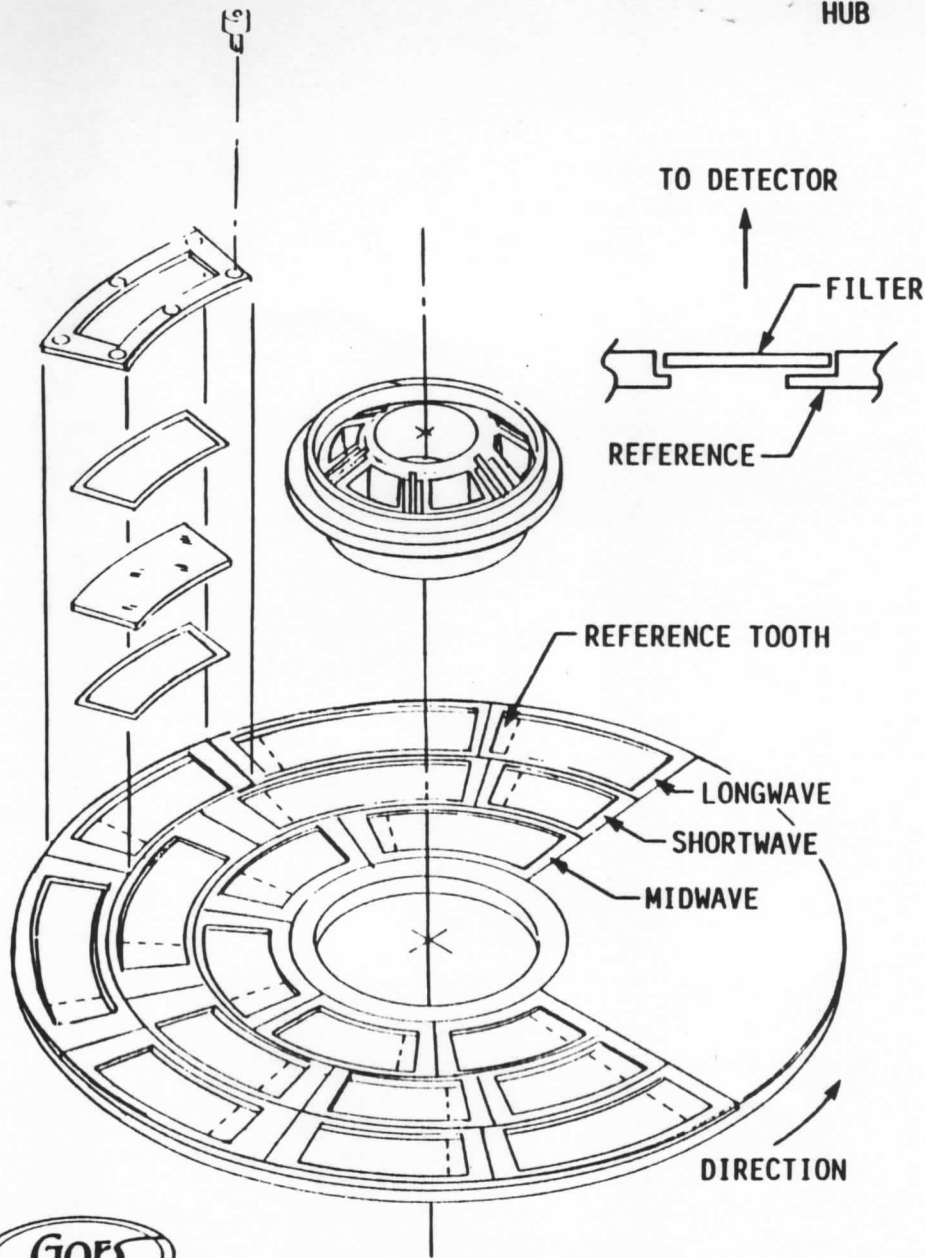
SOUNDER OPTICAL SYSTEM LAYOUT

- D1 = DICHOIC BEAMSPLITTER, VIS/IR
- D2 = DICHOIC BEAMSPLITTER, LW/(SW + MW)
- D3 = DICHOIC BEAMSPLITTER, SW/MW
- L1-L6 = INTERMEDIATE LENSES
- M = FOLDING MIRROR (MIDWAVE)
- D4 = STAR/VIS TRICHROIC BEAMSPLITTER
- W1, W2, W3 = FILTER WHEEL WINDOWS
- F₁ = VISIBLE FILTER
- F₂ = STAR SENSING FILTER
- P = DEPOLARIZING WINDOW
- LS = LYOT STOP

- DETECTOR/
APLANAT PAIRS
- FIELD LENS PAIRS
- FIELD STOPS
- RADIATOR WINDOWS
- VACUUM HOUSING
WINDOWS
- FILTERS



**FILTER WHEEL
AND
HUB**



MATERIALS:

WHEEL: 6061 T651 TYPE 200 ALUM

HUB: 6061 T651 ALUMINUM

HUB SPOKES: VESPEL SP-1 POLYIMID

**FILTER
CUSHION:** MP 1880 POLYURETHANE

SURFACE FINISH: CHEMGLAZE FLAT BLACK

OVERALL DIMENSIONS: 11.18 DIA x .400 THICK

TOTAL MASS: 2.6 LBS.

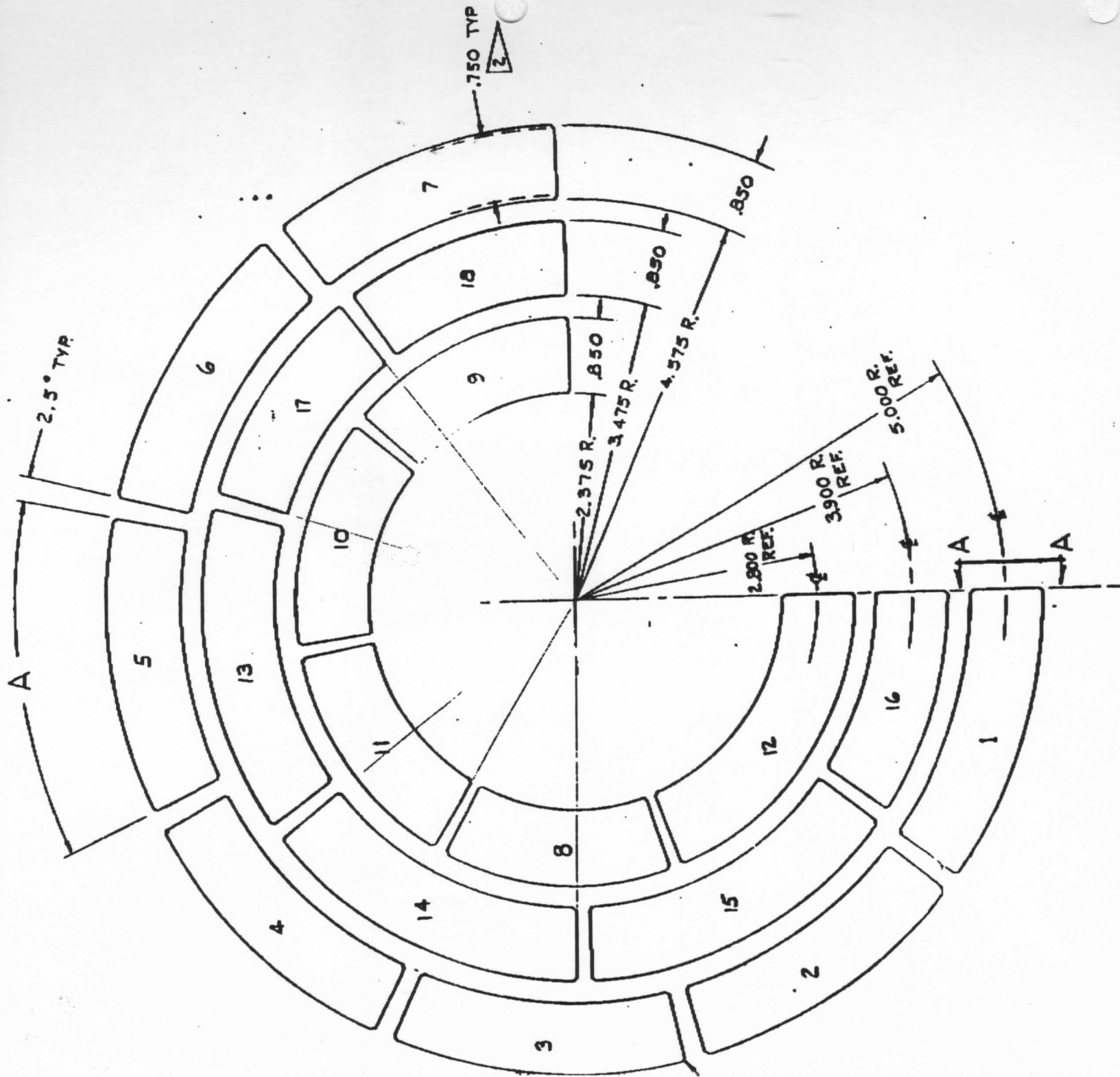
BALANCE REQUIREMENTS: .0025 oz.in @ 1000 RPM

STRUCTURAL DATA:

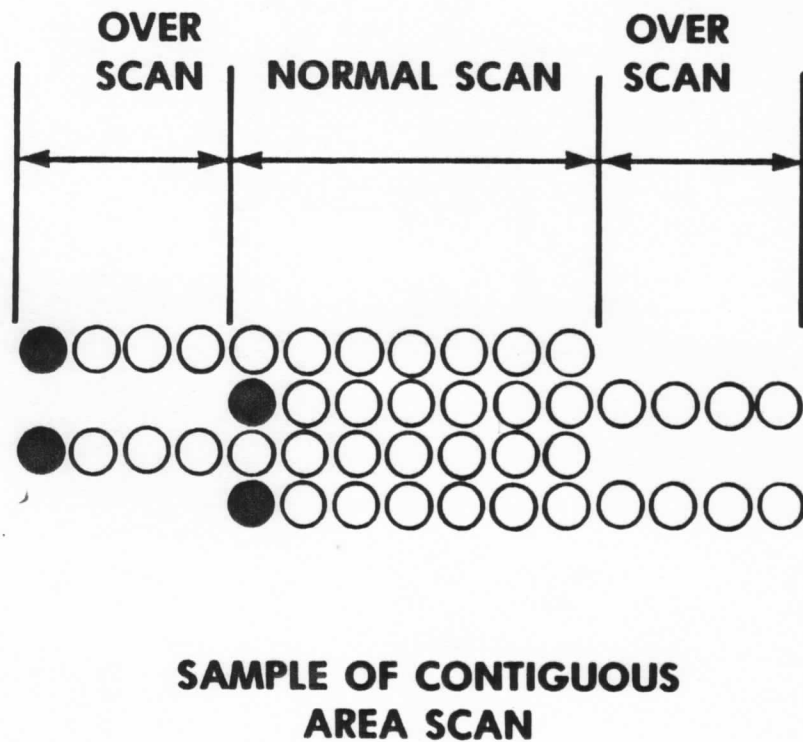
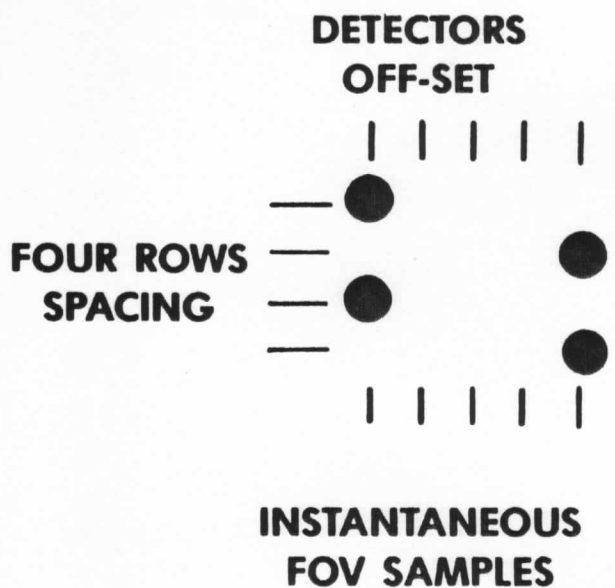
1st BENDING MODE: 290 Hz

1st TORSIONAL MODE: 50 Hz





SOUNDER SCAN PATTERN



KEY FEATURES



KEY FEATURES

FEATURE	IMAGER	SOUNDER
OPTICAL APERTURE	12.25 IN	12.25 IN
TOTAL STEP & SAMPLE TIME	NA	0.1 SEC (0.2 SEC & 0.4 SEC OPTIONAL)
METHOD OF SCAN	2-AXIS, STEP-SCAN FRAME	2-AXIS, E/W 280 μ R STEPS N/S 1120 μ R STEPS (OPTION 2240 μ R STEPS)
SCAN RATE	20°/SEC OPTICAL	40 SOUNDINGS/SEC
SLEW RATE	10°/SEC MECHANICAL	10°/SEC MECHANICAL

NOTE: 20°/SEC IS 349,000 MICRORADIANS/SEC



KEY FEATURES (CONTINUED)

FEATURE	IMAGER			SOUNDER
		CHAN	CHAN 3	
SPATIAL RESOLUTION	<u>VIS</u>	<u>2.4 & 5</u>	<u>CHAN 3</u>	<u>ALL CHANNELS</u>
	SPEC MAX	28 μ R	112 μ R	224 μ R
NOMINAL	27 μ R	96 μ R	196 μ R	242 μ R (ROUND)
SAMPLING	1.75/IGFOV VIS, 2,4 & 5 3.5/IGFOV CHANNEL 3			4 IGFOVs SAMPLED SIMULTANEOUSLY
SAMPLING RATE	183.3 μ S/PIXEL (IR) 45.8 μ S/PIXEL (VIS)			0.1 SEC
EARTH LOCATION ACCURACY*	± 21 μ R - 3 SIGMA (SPEC ALLOCATION)			± 21 μ R - 3 SIGMA (SPEC ALLOCATION)
PIXEL-TO-PIXEL* REGISTRATION ACCURACY (LINE-TO-LINE, ALONG A LINE, FRAME-TO-FRAME)	29.7 μ R - 3 SIGMA SPEC ALLOCATION			29.7 μ R - 3 SIGMA SPEC ALLOCATION

* FAC TO ITT ALLOCATION, TO BE REVISED



KEY FEATURES (CONTINUED)

FEATURE	IMAGER	SOUNDER
CHANNEL CO-REGISTRATION	14 μ R (SPEC)(OLD) ± 28 μ R (IR & VIS, Noon \pm 8 8hrs.) (IR only, midnight \pm 4	WITHIN 10 μ R OF CH 8 (SPEC)(OLD) ± 22 μ R (IR & VIS, Noon \pm 8 hrs.) * (IR only, midnight \pm 4 hrs.)
STAR SENSING	USES VISIBLE ARRAY; S/N 3 FOR 4TH MAG (400 SAMPLES)	USES SEPARATE VISIBLE ARRAY; S/N 3 FOR 4TH MAG (EACH SAMPLE)
DATA OUTPUT	10 BIT QUANTIZATION	13 BIT QUANTIZATION
DATA RATE	2.6208 Mb/SEC	40 KB/SEC
DATA FORMAT	NRZ-S, PN CODE	NRZ-S, PN CODE
PATCH TEMPERATURE	REGULATED TO 105K MARGIN @ 5 YRS - 5K WC BACKUP 110K	REGULATED TO 102K MARGIN @ 5 YRS - 2K WC BACKUP 107K

* DISCUSSION ON PROPOSED CHANGE

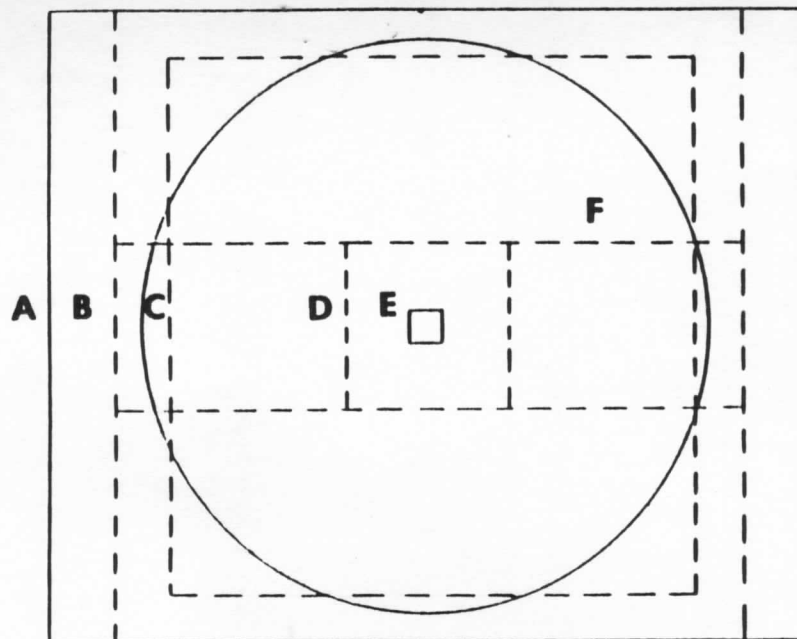


KEY FEATURES (CONTINUED)

FEATURE	IMAGER	SOUNDER
CALIBRATION	SPACE AND 290K BLACKBODY	SPACE AND 290K BLACKBODY
TIME BETWEEN SPACE LOOKS	2 MIN	2 MIN
TIME BETWEEN B/B CALIBRATIONS (NOMINAL)	10 MIN (CAN OVERRIDE OR INHIBIT)	20 MIN (CAN OVERRIDE OR INHIBIT)
PRIORITY FRAME SELECT	1 LEVEL NORMAL 2 LEVELS PRIORITY 1 LEVEL STAR SENSE	1 LEVEL NORMAL 2 LEVELS PRIORITY 1 LEVEL STAR SENSE



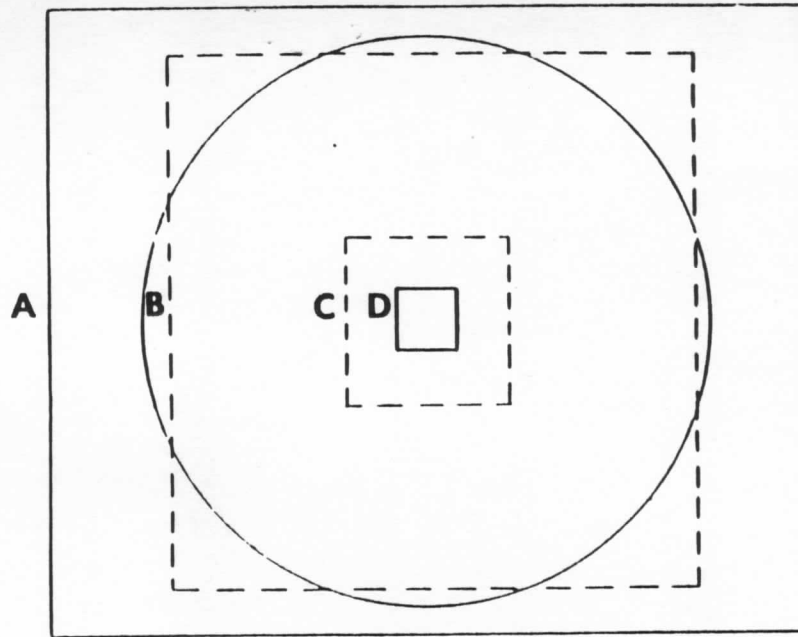
IMAGER SCAN FIELDS



- A MAXIMUM FRAME FIELD 19.2° E-W BY 19° N-S
MAXIMUM STAR FIELD 23° E-W BY 21° N-S
- B FULL EARTH LIMB SCAN IN 24.5 MINUTES (OVERSCAN AFTER SPACE
LOOK WILL INCREASE SCAN TIME TO 25 MINUTES)
- C REPEAT EARTH SCAN 60° E-W IN 22.0 MINUTES (22.5 MINUTES)
- D AREA SCAN 3000 KM BY 3000 KM IN 3.1 MINUTES (3.15 MINUTES)
(5 MIN REQUIRED)
- E SMALL AREA SCAN 1000 KM BY 1000 KM IN 40 SEC.
- F SECTOR SCAN FULL EARTH BY 3000 KM IN 7.6 MINUTES (7.7 MINUTES)



SOUNDING FIELDS



- A MAXIMUM FRAME FIELD 23° E-W BY 21° N-S (STAR SENSE ONLY)
- B FULL EARTH SOUNDING 60° N-S BY 60° E-W IN 444 MINUTES
- C AREA SOUNDING 3000 KM BY 3000 KM IN 41 MINUTES
(42 MIN REQUIRED)
- D SMALL AREA SOUNDING 1000 KM BY 1000 KM IN 4.7 MINUTES

STAR SENSING

OVERVIEW

- STAR LOCATION AND TIME PREDETERMINED BY GROUND COMPUTER
- SCAN SLEWS, SETTLES TO POSITION EAST OF STAR LOCATION
- SCAN STOPPED UNTIL STAR PASSES THRU 8 ELEMENT VIS ARRAY
- DATA TRANSMITTED DIRECT TO GROUND SYSTEM
- DETECT STARS OF VISUAL MAGNITUDE -1 TO +4
- TIME FOR SLEW, SETTLE AND RETURN: APPROXIMATELY 7 SEC
- TIME FOR STAR PASSAGE: APPROXIMATELY 5 SEC



IMAGER SYSTEM CHARACTERISTICS

CHANNEL BAND (μM)	3.8-4.0	6.5-7.0	10.2-11.2	11.5-12.5	0.55-0.75
$AD^{1/2}$ (CM)	0.00508	0.0102	0.00508	0.00508	0.010
TRANSMISSION (τ)	0.313	0.290	0.290	0.268	0.250
θ(μRAD)	98.0	196	98.0	98.0	26.6
Degradation Factor	1.1	1.5	1.3	1.3	1.0
(dN/dT) (WATT cm^{-2} sr^{-1} K^{-1})	6.35×10^{-7}	1.64×10^{-6}	1.47×10^{-5}	1.22×10^{-5}	100% ALB
NUMBER OF ACTIVE DETECTORS	2	1	2	2	8
NEAT (K) (CALCULATED)	.09	.34	.12	.15	(1) 428:1
NEAT (K) (SPECIFIED)	1.4	1.0	0.35	0.35	(2) >150
DESIGN MARGIN (NEAT)	15.7	2.9	2.9	2.3	(3) 2.9

* NEAT VALUES AT 300K EXCEPT 6.5 - 7.0 μM CHANNEL WHICH IS 230K

- (1) CALCULATED S/N RATIO
- (2) SPECIFIED S/N RATIO
- (3) CALCULATED (S/N): SPECIFIED (S/N)



SOUNDER SYSTEM PERFORMANCE

CHANNEL NO.	ν (cm^{-1})	λ (μm)	NE Δ N ($\text{mW}/\text{m}^{-2} \text{sr}^{-1} \text{cm}$)	
			CALCULATED*	SPECIFIED
1	680	14.71	.79	0.66
2	696	14.31	.67	0.58
3	711	14.06	.56	0.54
4	733	13.64	.49	0.45
5	748	13.37	.49	0.44
6	790	12.66	.29	0.25
7	832	12.02	.18	0.16
8	907	11.03	.13	0.16
9	1030	9.71	.21	0.33
10	1345	7.43	.13	0.16
11	1425	7.02	.10	0.12
12	1535	6.51	.14	0.15
13	2188	4.57	.0028	0.013
14	2210	4.52	.0028	0.013
15	2245	4.45	.0031	0.013
16	2420	4.13	.0015	0.0080
17	2513	3.98	.0015	0.0082
18	2671	3.74	.0007	0.0036
VISIBLE	14367	.696	.0057% Δ	.10%
STAR SENSE	9524 -18868	.530 -1.050	S/N=9	3.0

* CALCULATED WITH 1/F NOISE EFFECT AND MINIMUM DETECTOR SENSITIVITY (WORST CASE)



OTHER PERFORMANCE ISSUES

- 0 TELESCOPE DESIGN REQUIRES 10 MICRORADIAN BORESIGHT NON-REPEATABILITY ERROR**
- 0 ELECTRONIC/OPTICAL CROSSTALK IN THE IMAGER MAY NOT MEET SPECIFICATION**
- 0 SOUNDER CO-REGISTRATION FOR ALL CHANNELS**
- 0 SOUNDER IN-FLIGHT RADIOMETRIC CALIBRATION ACCURACY**
- 0 EARTH ALBEDO AND SOLAR SCATTER EFFECTS**
- 0 IMAGER AND SOUNDER TESTING LIMITATIONS AT ITT AND FAC**

THERMAL SECTION

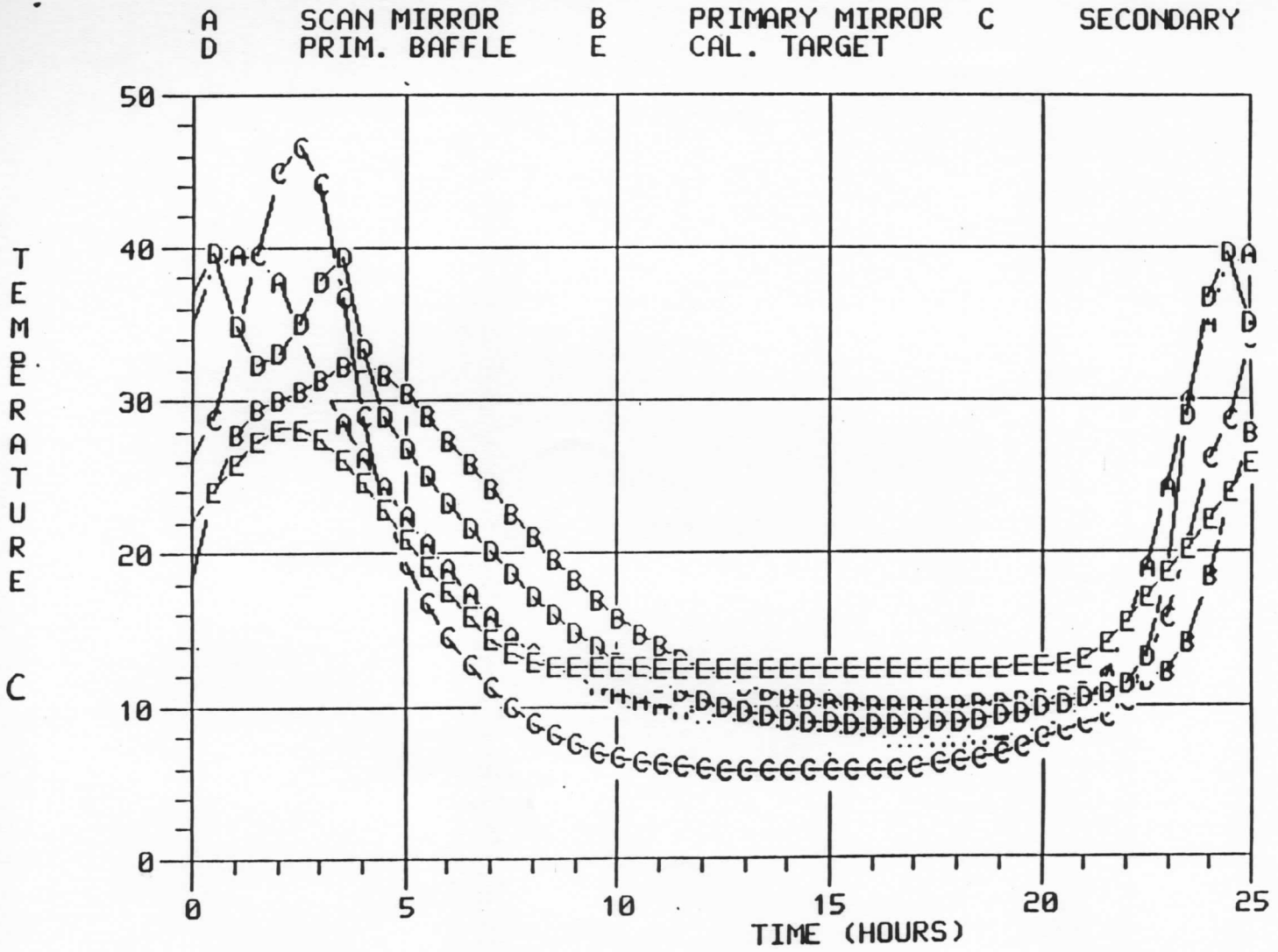


KEY THERMAL CONSIDERATIONS

- GRADIENT EFFECT ON LINE OF SIGHT MOTION
 - REDUCE GRADIENTS
- DISTORTION OF OPTIC ELEMENTS
 - REDUCE DIURNAL SWING OF BULK TEMP
- IMPACT ON RADIOMETRIC STABILITY BETWEEN CALIBRATIONS
 - REDUCE RATE OF CHANGE OF TEMP

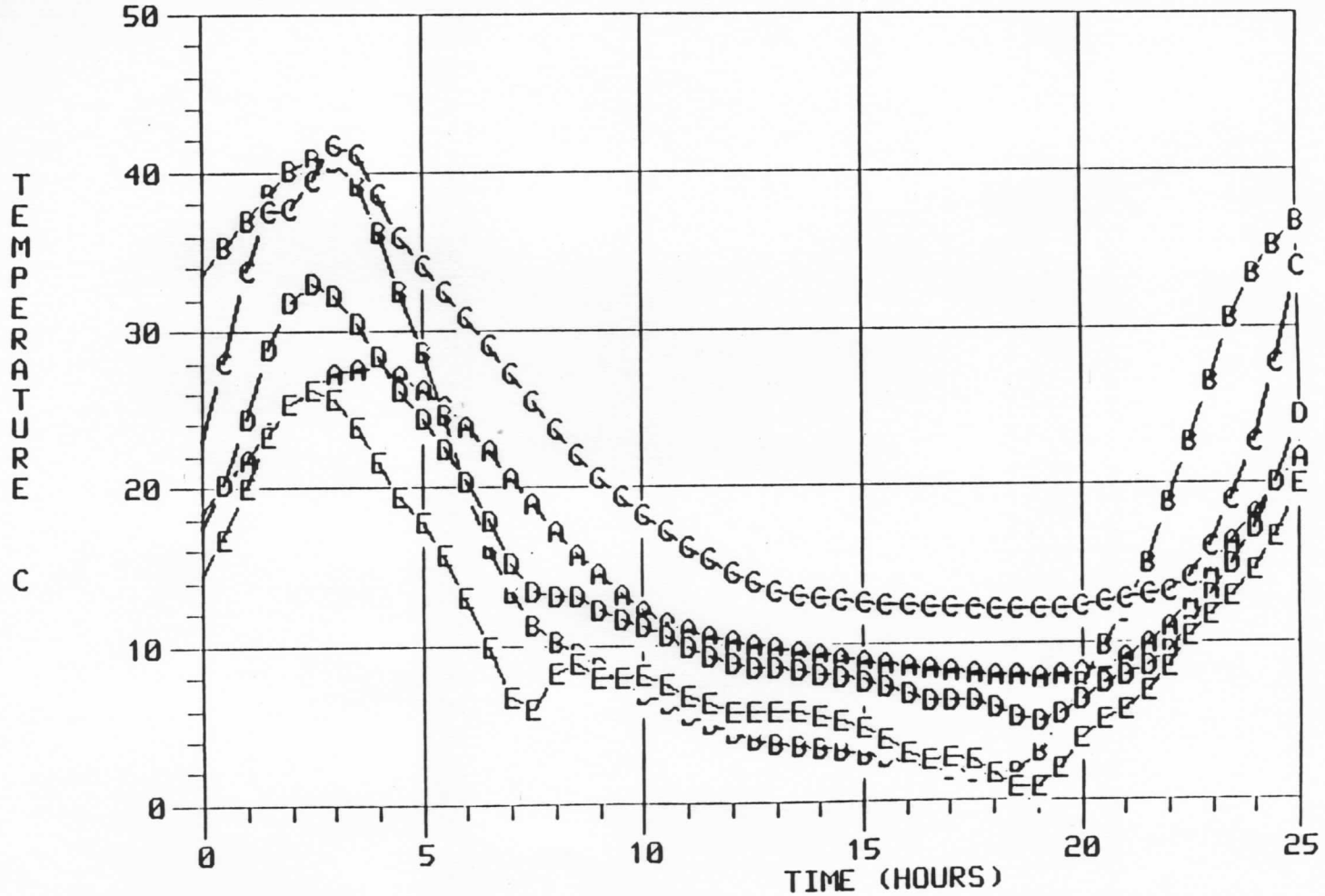


REPRESENTATIVE TRANSIENT TEMPERATURES FOR IMAGER (10° N OF EQUINOX)



TRANSIENT TEMPERATURES, MECHANICAL PARTS WITH LATEST SHIELDS.

A BACKPLATE B PORT C STRC BULK
 D LIMIT FRAME E LOUVER

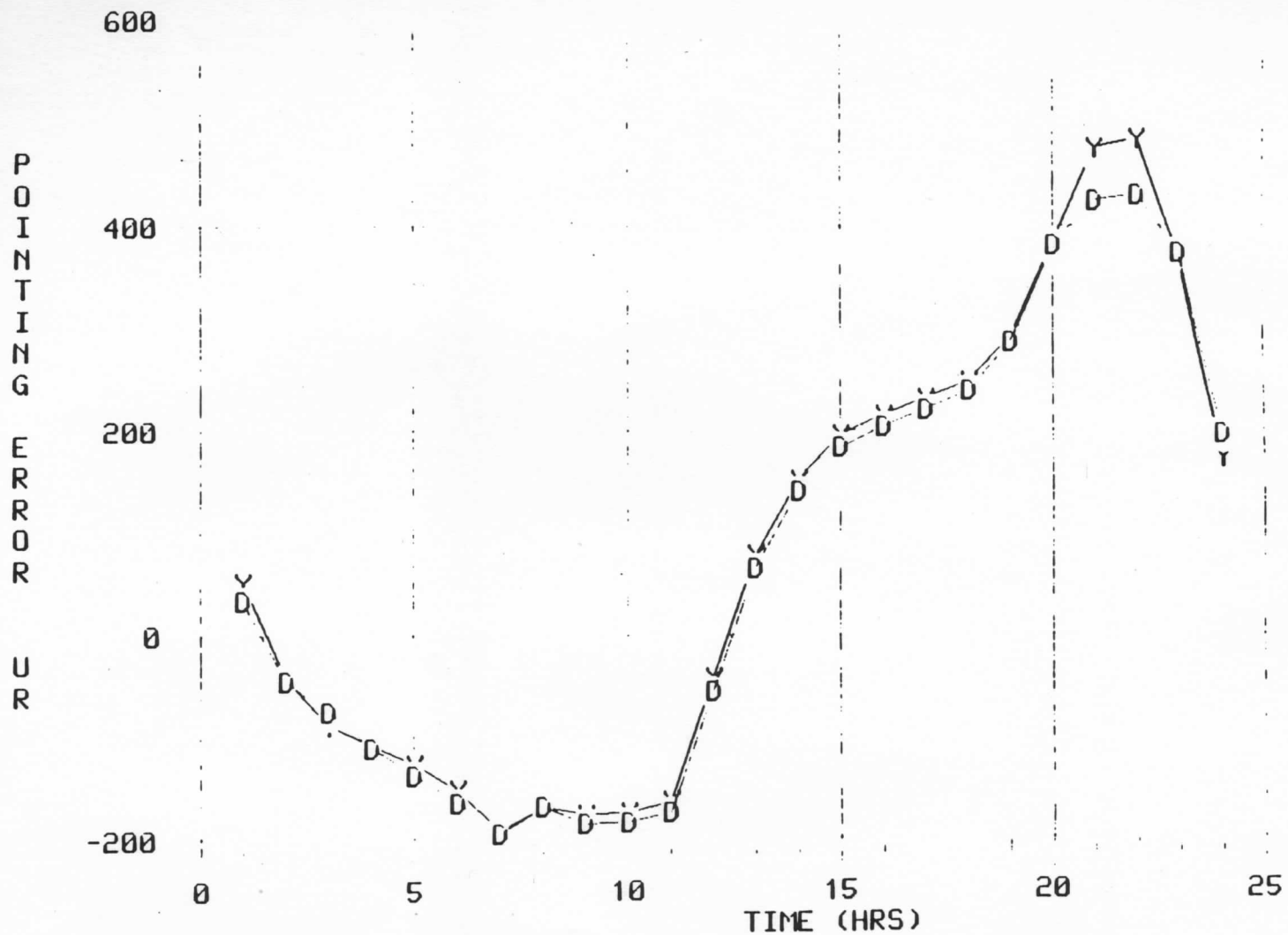


TEMPERATURE VS. TIME



POINTING ERROR (ROLL)

Y GOES 10 PASSIVE (CORRECTED STRUCTURE 11/07/1987) C5YRBETPA
D SHIELDED MODEL (C5YRBETPD)

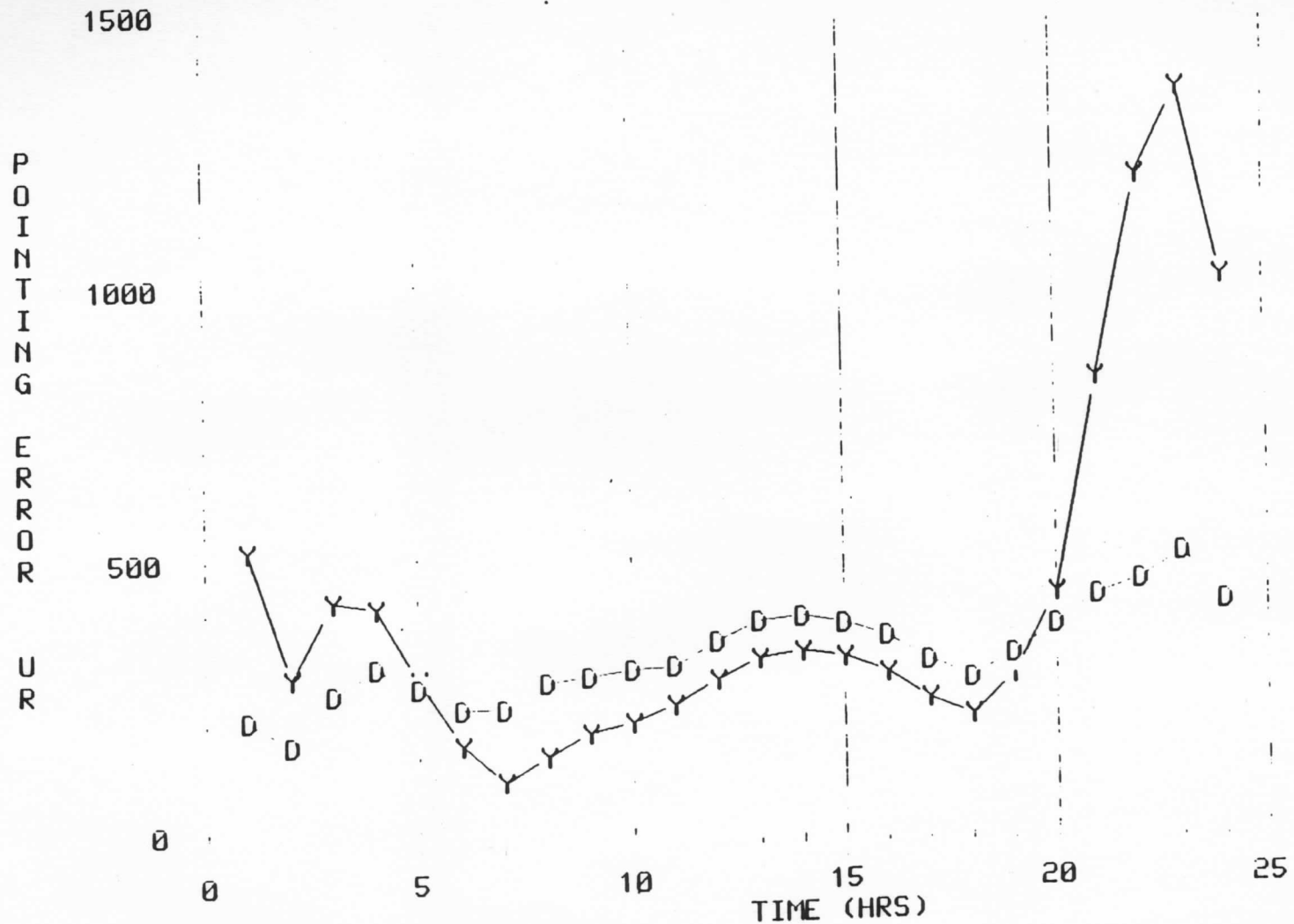


POINTING ERROR N/S (ROLL) VS. TIME
DIURNAL PROFILE



POINTING ERROR (PITCH)

Y GOES 10 PASSIVE (CORRECTED STRUCTURE 11/07/1987) C5YRBETPA
 D SHIELDED MODEL (C5YRBETPD)

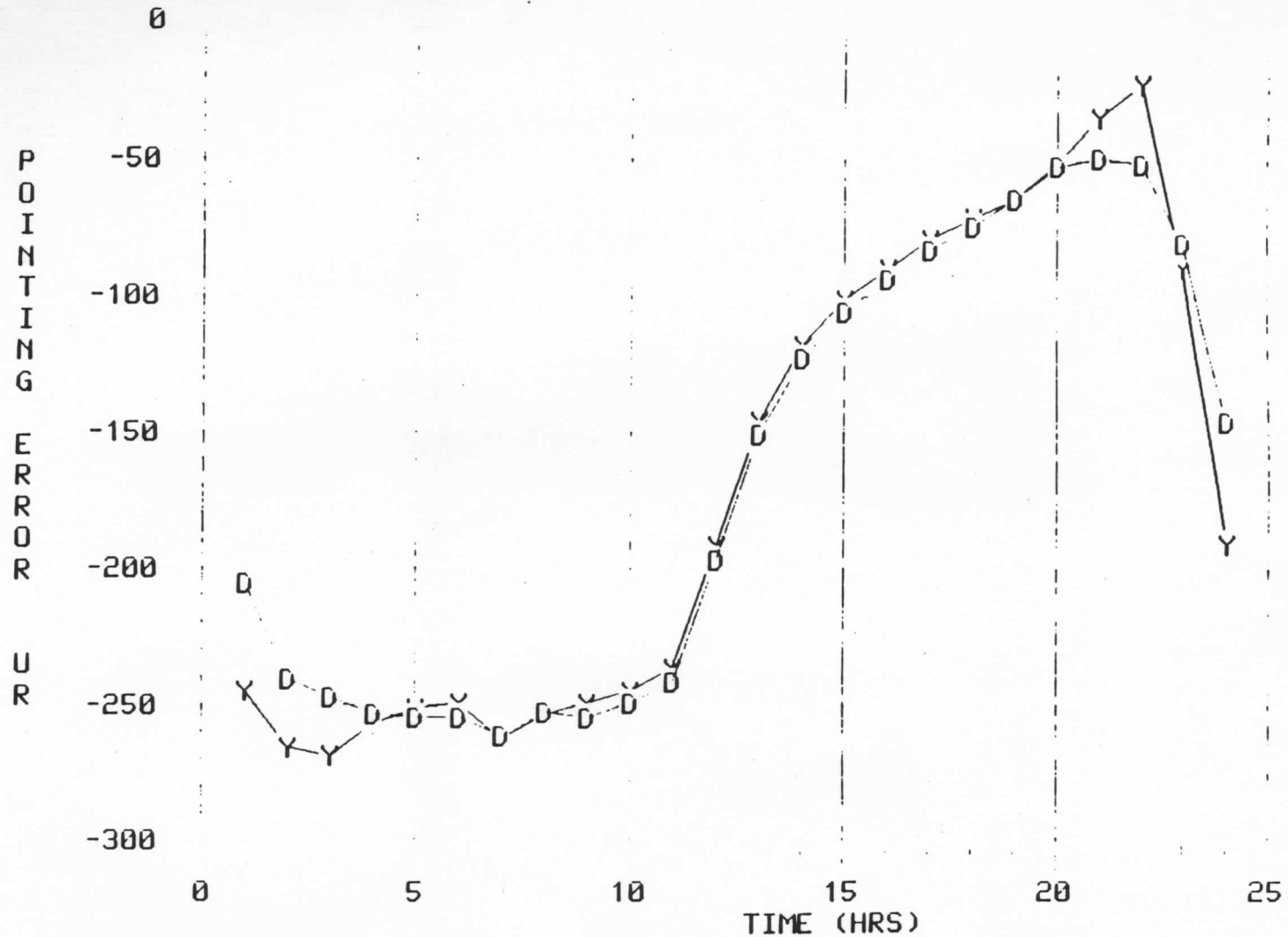


POINTING ERROR E/W (PITCH) VS. TIME
 DIURNAL PROFILE



POINTING ERROR (YAW)

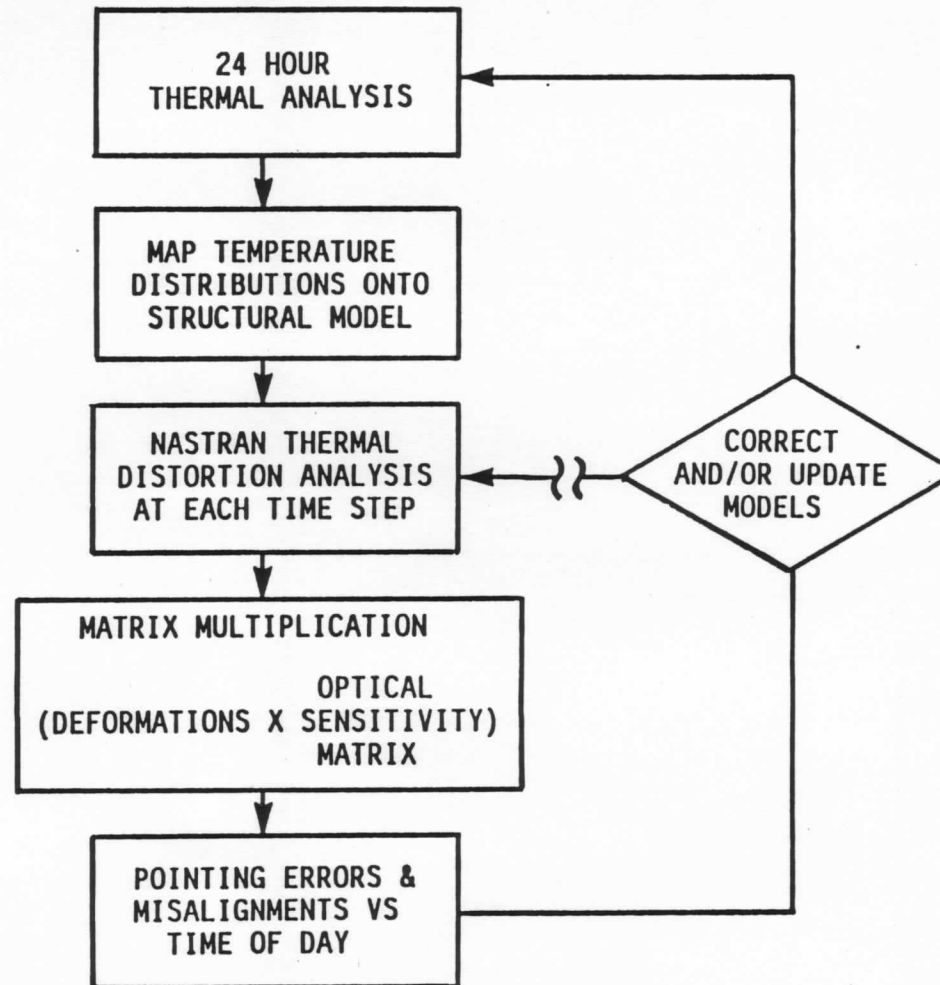
Y GOES 10 PASSIVE (CORRECTED STRUCTURE 11/07/1987) C5YRBETPA
D SHIELDED MODEL (C5YRBETPD)



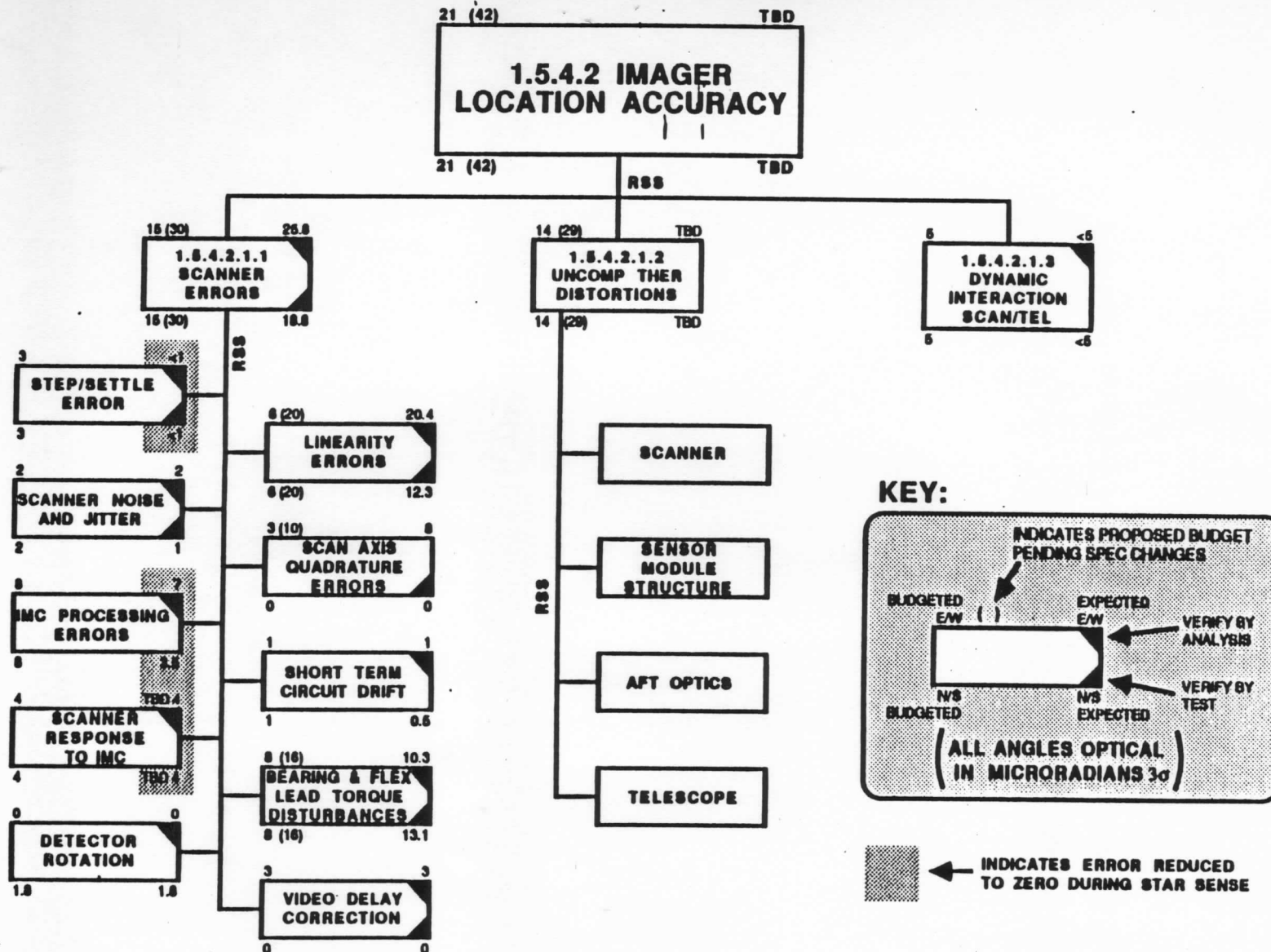
POINTING ERROR YAW VS. TIME
DIURNAL PROFILE



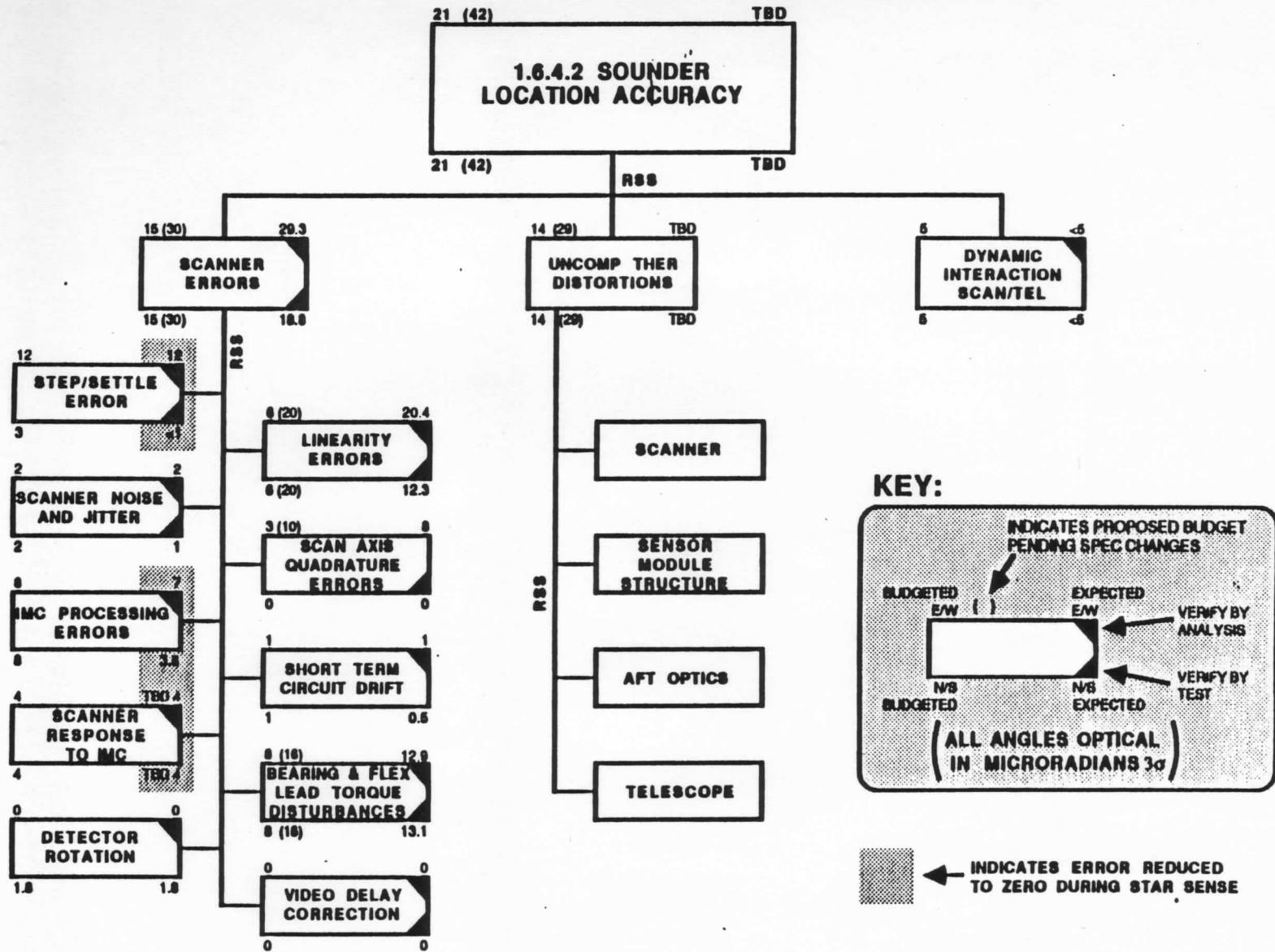
ANALYSIS FLOW PATTERN



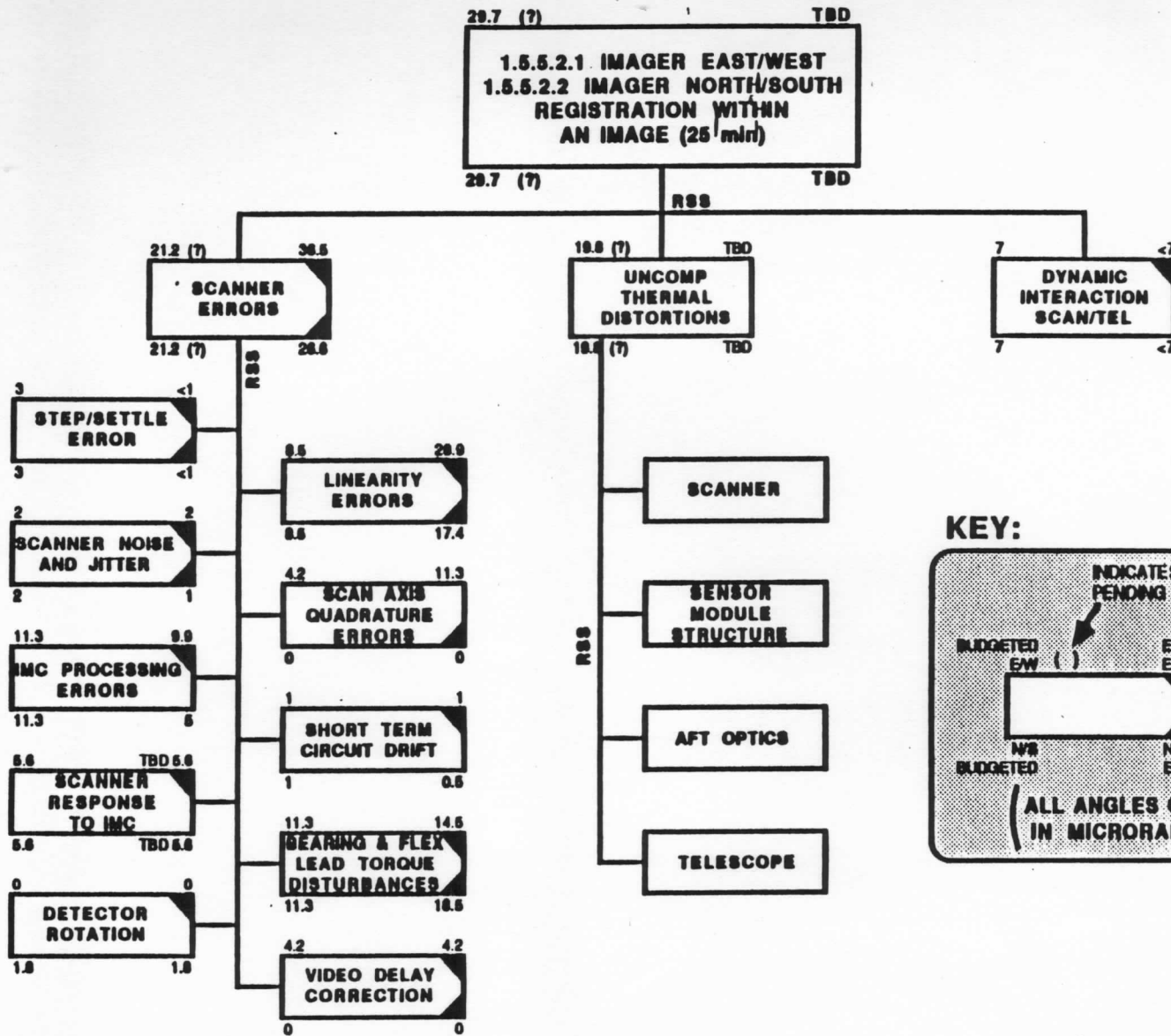
IMAGER LOCATION ACCURACY ALLOCATIONS VS PRESENT PERFORMANCE



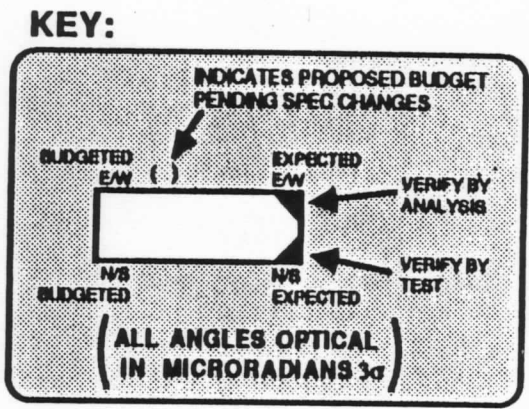
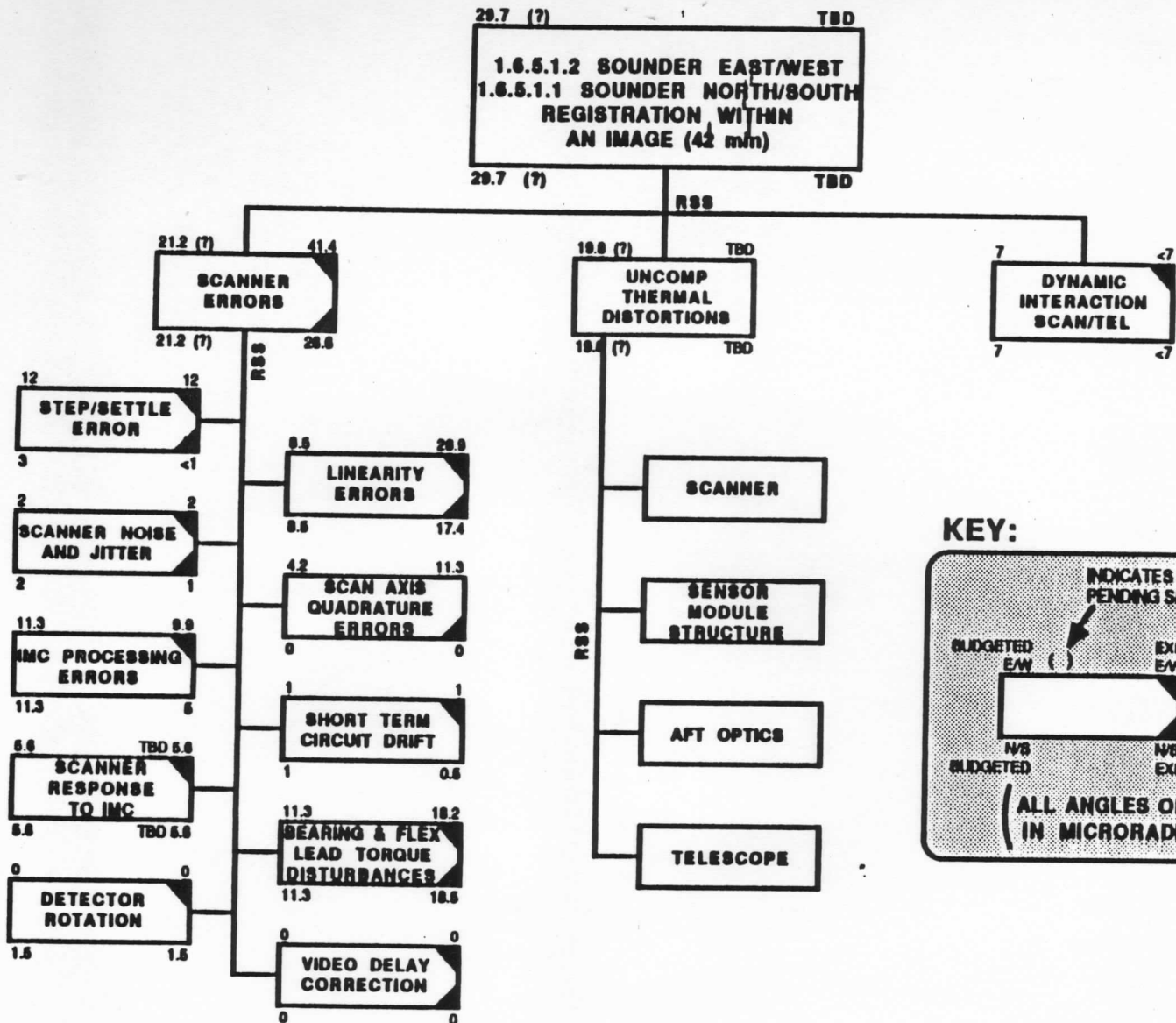
SOUNDER POINTING ACCURACY ALLOCATIONS VS PRESENT PERFORMANCE



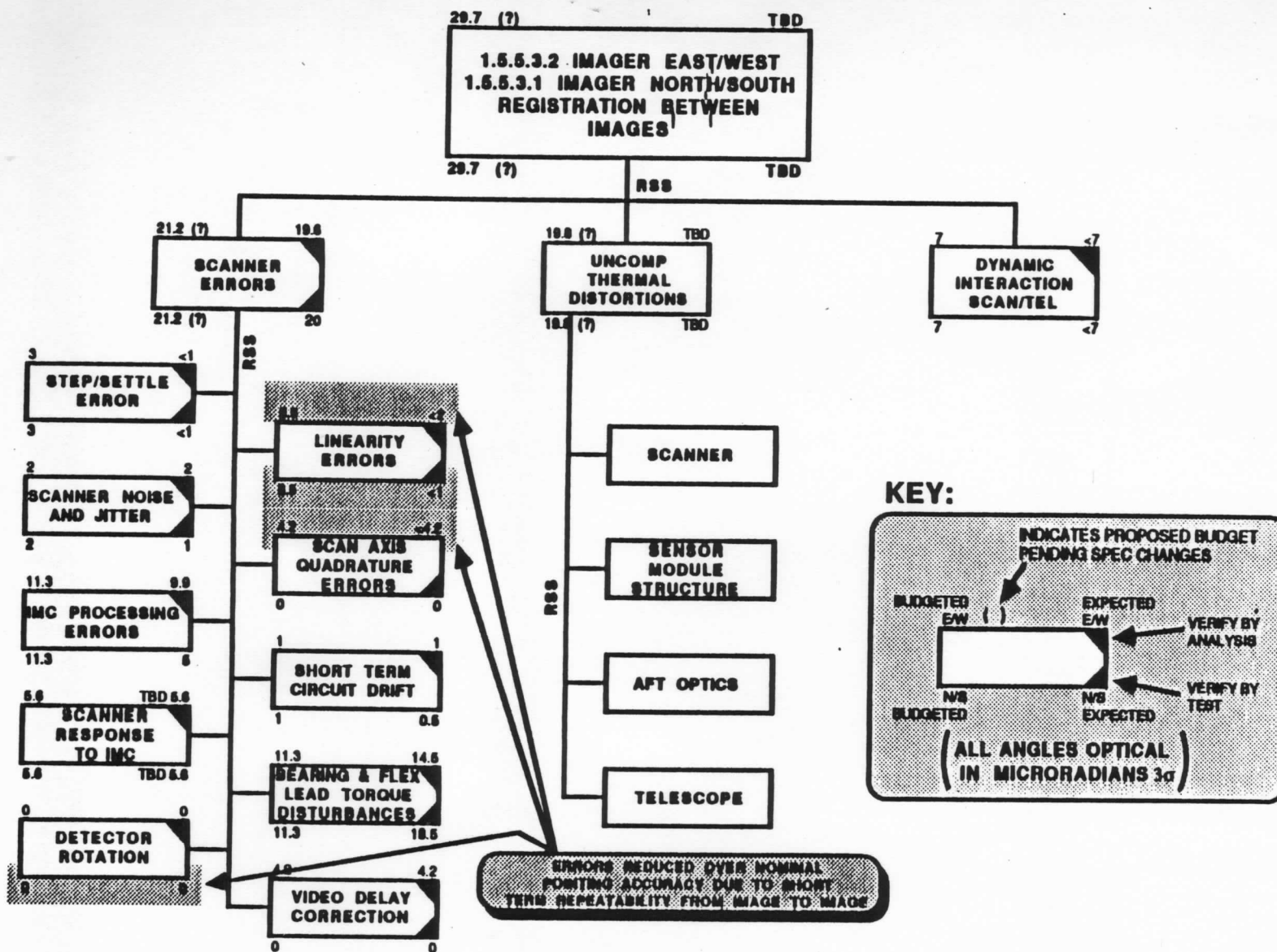
IMAGER REGISTRATION WITHIN AN IMAGE



SOUNDER REGISTRATION WITHIN AN IMAGE



IMAGER REGISTRATION BETWEEN IMAGES



SOUNDER REGISTRATION BETWEEN REPEATED SOUNDINGS

