

~~TOP SECRET~~

HANDLE VIA BYEMAN
CONTROL SYSTEM ONLY

BIF 007-0607-75

S³ PROGRAM HIGHLIGHTS

1. PROGRAM DEFINITION PHASE

- SYSTEM CONFIGURATION STUDIES
- OPTICAL DESIGN STUDIES
- TECHNICAL RISK EVALUATION PLANS
- EQUIPPED PHOTODETECTOR TEST LABORATORY
- ERROR BUDGET ANALYSIS

2. RISK EVALUATION PHASE

- INTERFACE MEETING WITH SBAC
- SV-9 ON-ORBIT CALIBRATION TESTS
- FRAME DEFORMATION TESTS
- MIDSECTION DEFORMATION TESTS
- FOCAL PLANE COOLER PERFORMANCE TESTS
- PHOTODETECTOR PERFORMANCE TESTS

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ENVIRONMENT EFFECTS (CONT'D)

4. CONCLUSION

- ENVIRONMENTAL ERRORS COMBINE AS FOLLOWS:

<u>ROLL</u>	<u>PITCH</u>	<u>YAW</u>
3.3 SEC	4.0 SEC	4.4 SEC

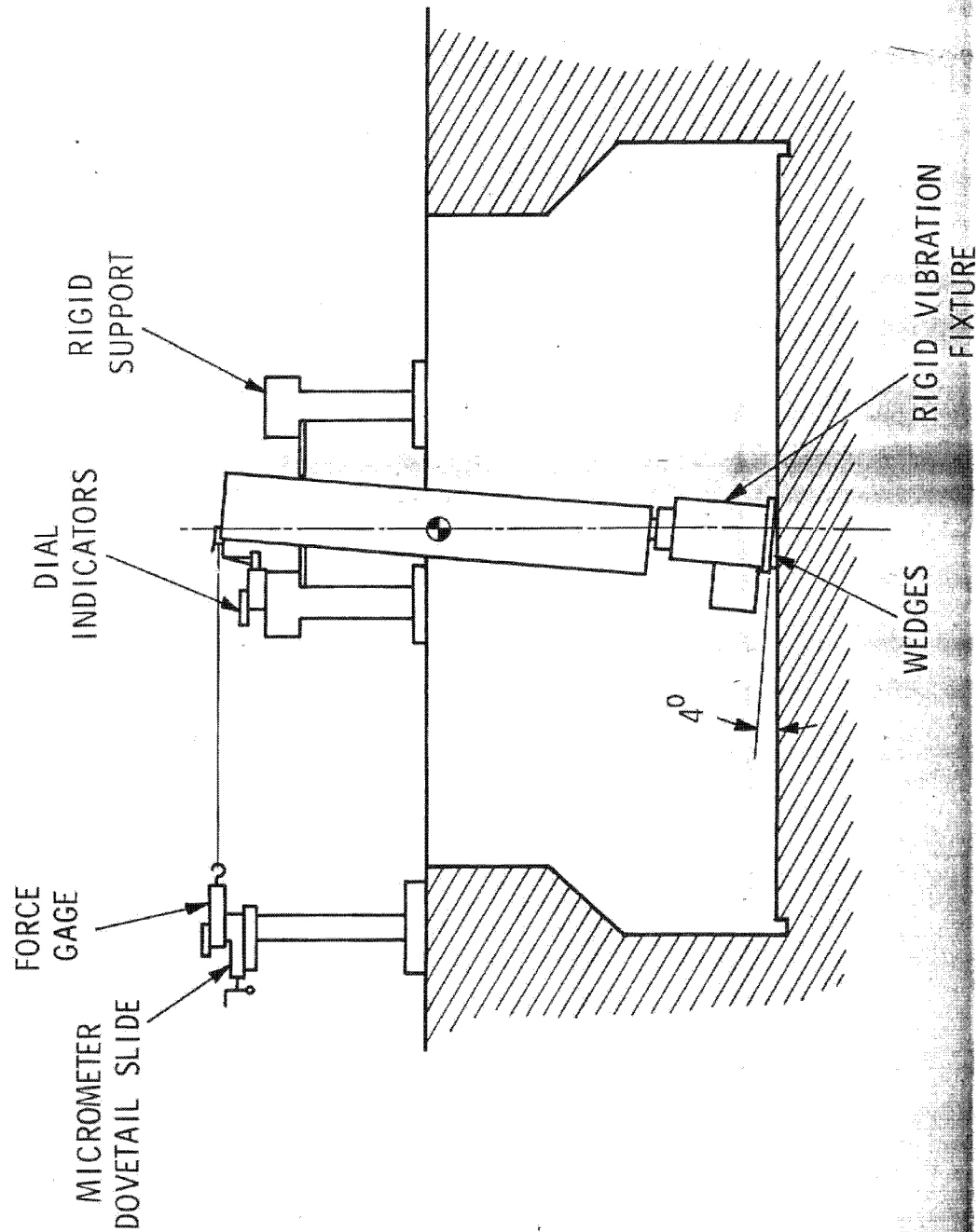
- ALL ERROR CATEGORIES COMBINE AS FOLLOWS:

	<u>ROLL</u>	<u>PITCH</u>	<u>YAW</u>
STELLAR SENSOR POINTING ERROR	1.4 SEC	1.8 SEC	1.3 SEC
INTERLOCK CALIBRATION ERROR	1.9 SEC	2.2 SEC	1.8 SEC
ENVIRONMENTAL STABILITY	3.3 SEC	4.0 SEC	4.4 SEC
	<u> </u>	<u> </u>	<u> </u>
RSS	4.1 SEC	4.9 SEC	4.9 SEC

- PRACTICAL SOLUTIONS HAVE BEEN FOUND.
- VERIFICATION TESTS SUPPORT ERROR BUDGET.

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TEST SETUP IN ENVIRONMENTAL LAB PIT



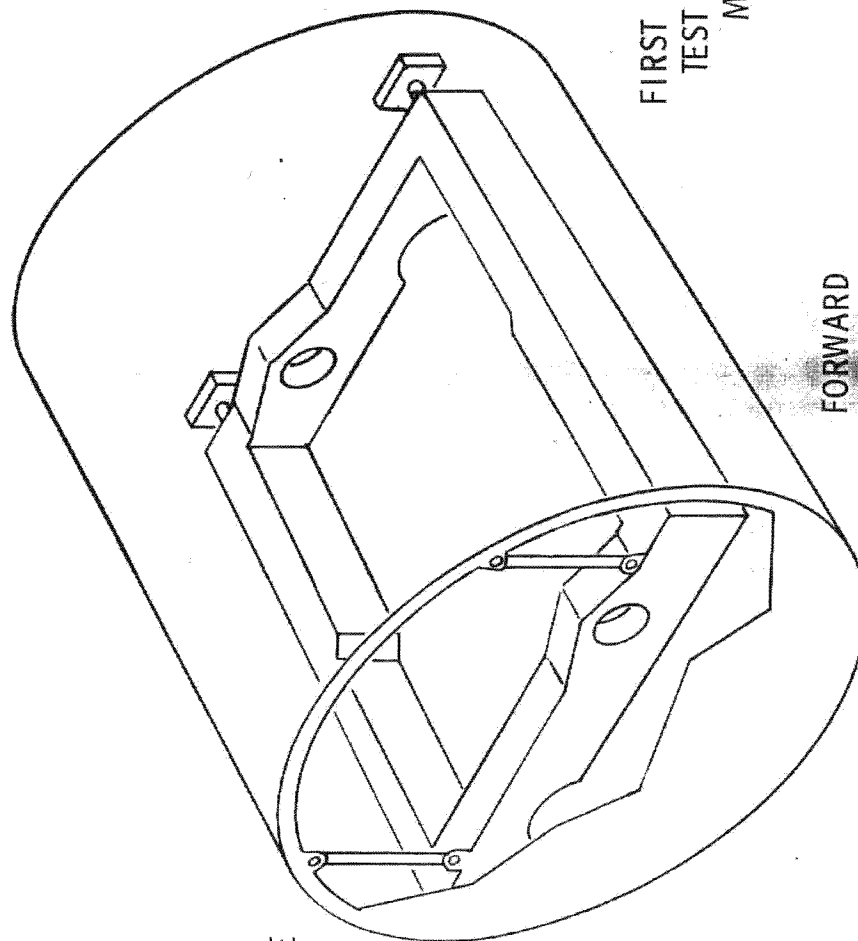
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ENVIRONMENT EFFECTS (CONT'D)

VEHICLE DISTORTION



TCA TWISTS
WHEN VEHICLE
TWISTS

FIRST CHAMBER A
TEST VERIFIED
MOTION

FORWARD
END

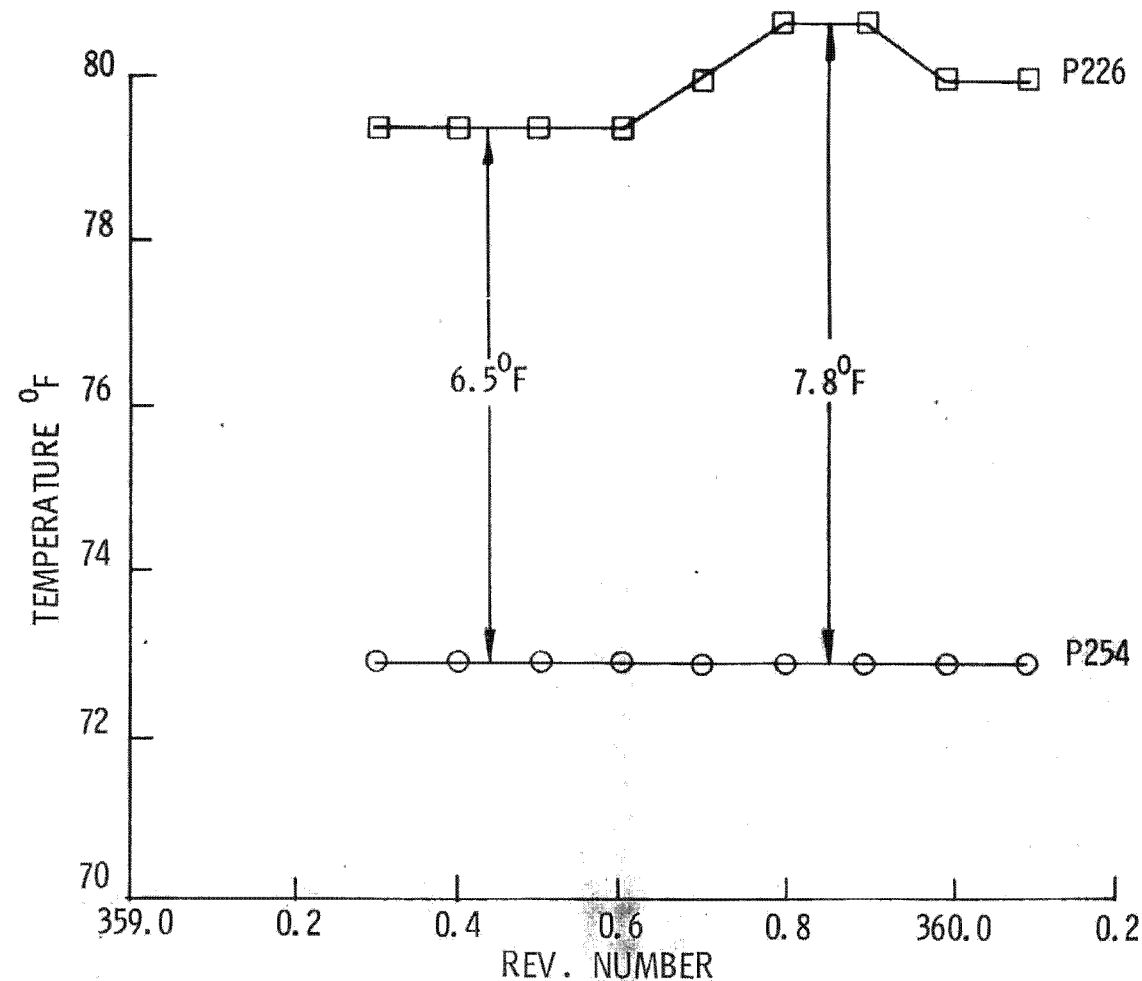
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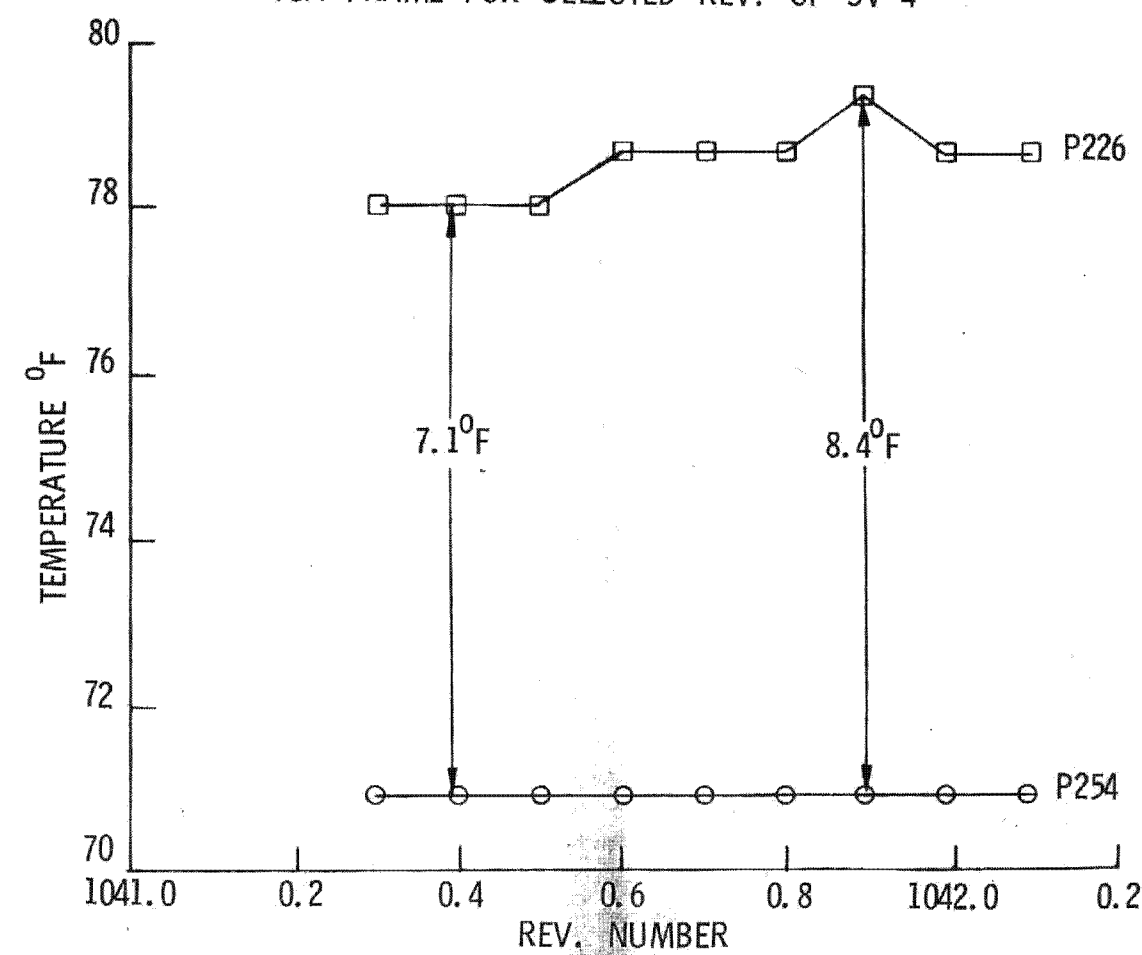
SIDE-TO-SIDE TEMPERATURE DIFFERENCE ON TCA FRAME FOR SELECTED REV. OF SV-4



REV. NUMBER 359 ($\beta = 31^{\circ}$)

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SIDE-TO-SIDE TEMPERATURE DIFFERENCE ON TCA FRAME FOR SELECTED REV. OF SV-4



REV. NUMBER 1041 ($\beta = 33^\circ$)

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POINTING ERRORS DUE TO ENVIRONMENT EFFECTS

<u>ERROR SOURCE</u>	<u>POINTING ERROR - ARC SECOND (1σ)</u>		
	<u>ROLL</u>	<u>PITCH</u>	<u>YAW</u>
ALIGNMENT CHANGE OF PAN CAMERA LOS TO S ³ SENSOR MTS. DUE TO THERMAL ENVIRONMENT			
SIDE TO SIDE GRADIENT IN TCA ($\Delta T = 2^{\circ}\text{F}$)	1.7	2.0	3.5
FRONT TO REAR GRADIENT IN TCA ($\Delta T = 3^{\circ}\text{F}$)	0.6	0.8	1.2
TOP TO BOTTOM GRADIENT IN TCA ($\Delta T = 0.2^{\circ}\text{F}$)	0.6	1.9	-
DEFORMATION IN TCA DUE TO VEHICLE DISTORTION	1.5	1.0	-
PRIMARY MIRROR TILT ($\Delta T = 0.5^{\circ}\text{F}$, METERING RODS)	0.4	0.4	-
FOLD FLAT TILT ($\Delta T = 2.0^{\circ}\text{F}$ in TEMP. LEVEL)	-	0.7	0.5
RSS ₁	2.5	3.1	3.7

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STELLAR SENSOR POINTING ERROR

ERROR SOURCE	POINTING ERROR - ARC-SECONDS* (1σ) (S ³ CAMERA COORDINATES)	
	Y _A	Z _A
CENTROIDING ERROR	2.0	2.0
DETECTOR LOCATION ERROR	1.6	1.6
RESIDUAL OPTICAL DISTORTION	1.6	1.6
FOCAL PLANE RESIDUAL THERMAL ERROR	1.0	1.0
STAR CATALOG UNCERTAINTY	0.5	0.5
POINTING ERROR/STAR	RSS	3.2
FOR 9 DETECTIONS/FIELD	$e = \frac{e_0}{\sqrt{N}}$	1.1
ATTITUDE CONTROL SYSTEM	1.2	1.2
S ³ POINTING ERROR	RSS	1.6
POINTING ERROR TRANSFERRED TO TCA COORD. SYSTEM USING 2-S ³ SENSORS:		
ROLL	1.4	ARC-SECONDS - 1σ
PITCH	1.8	
YAW	1.3	

* 253 mm F.L. : 1 micron ≈ 0.8 arc-second.

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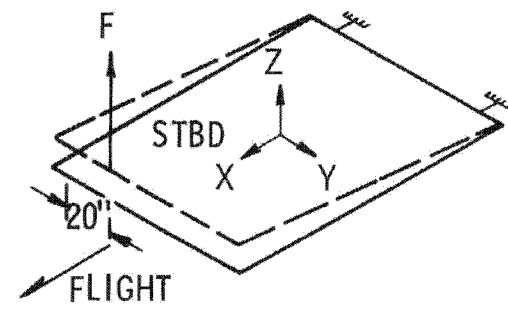
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INTERLOCK CALIBRATION ERROR
STELLAR/PAN CAMERAS

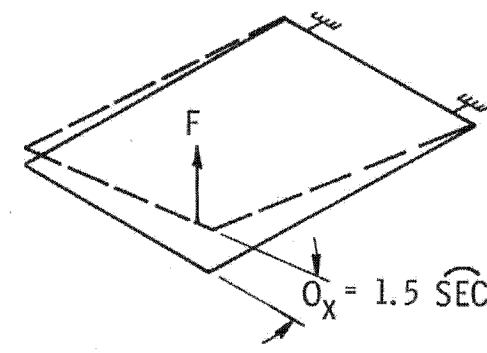
<u>ERROR SOURCE</u>	<u>POINTING ERROR - ARC SECONDS (1σ)</u>		
	<u>ROLL</u>	<u>PITCH</u>	<u>YAW</u>
STELLAR SENSOR POINTING ERROR	1.4	1.8	1.3
PAN PHOTO MENSURATION ERROR	0.8	0.9	1.0
ANGULAR VIBRATION OF TCA	1.0	1.0	1.0
SVT CORRELATION	-	<u>0.3</u>	-
RSS	1.9	2.2	1.9

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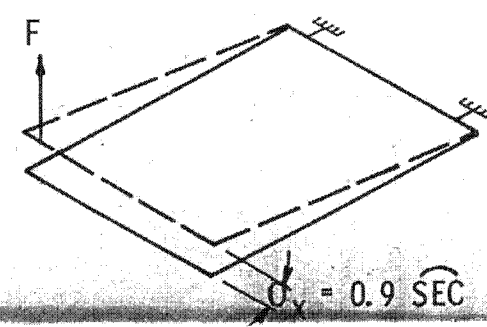
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CASE 2A - Z-AXIS DISPLACEMENT OF FORWARD FRAME MEMBER AT CENTER OF COMPLIANCE. (NO TWIST ABOUT THE X-AXIS.)



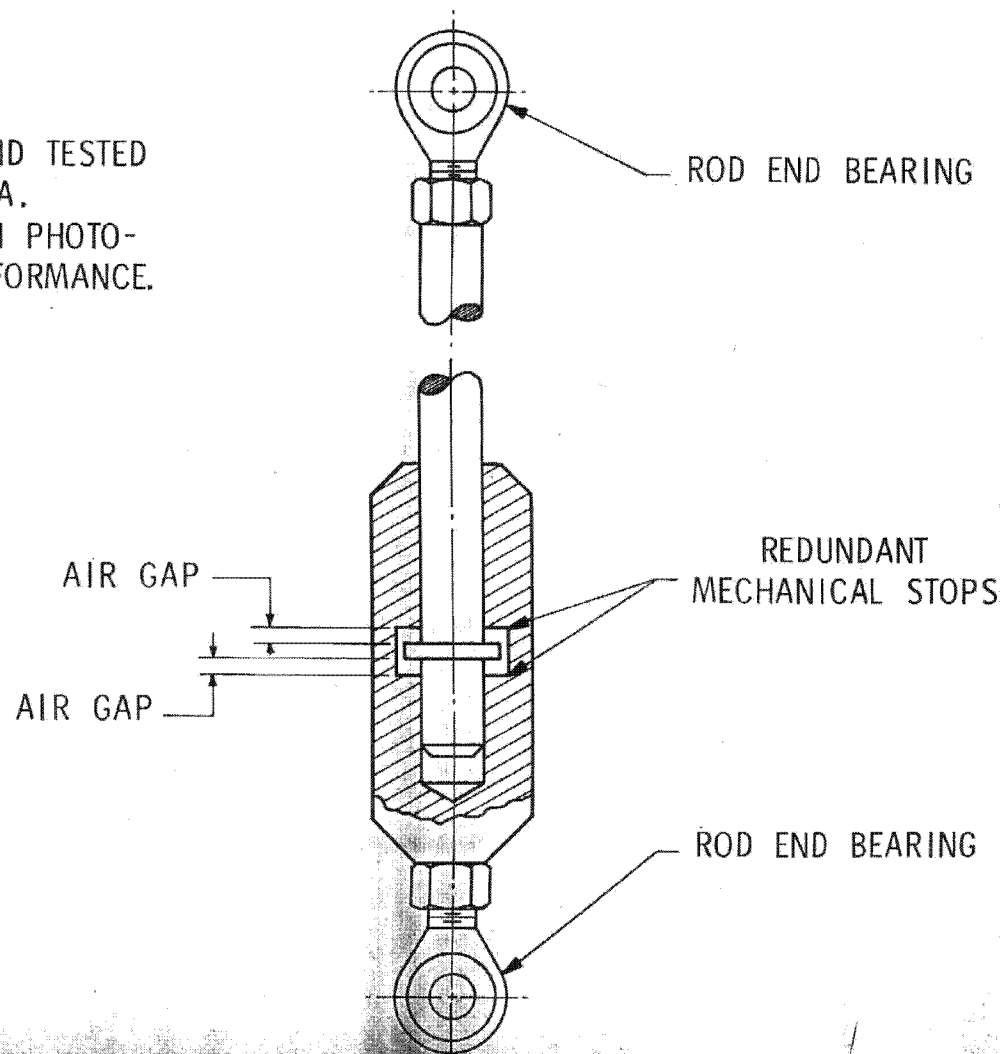
CASE 2B - Z-AXIS DISPLACEMENT OF 0.004 INCH AT PORT PITCH LINK ANCHOR. (CAUSES 1.5 SEC TWIST ABOUT X-AXIS.)



CASE 2C - Z-AXIS DISPLACEMENT OF 0.004 INCH AT STARBOARD PITCH LINK ANCHOR. (CAUSES 0.9 SEC TWIST ABOUT THE X-AXIS.)

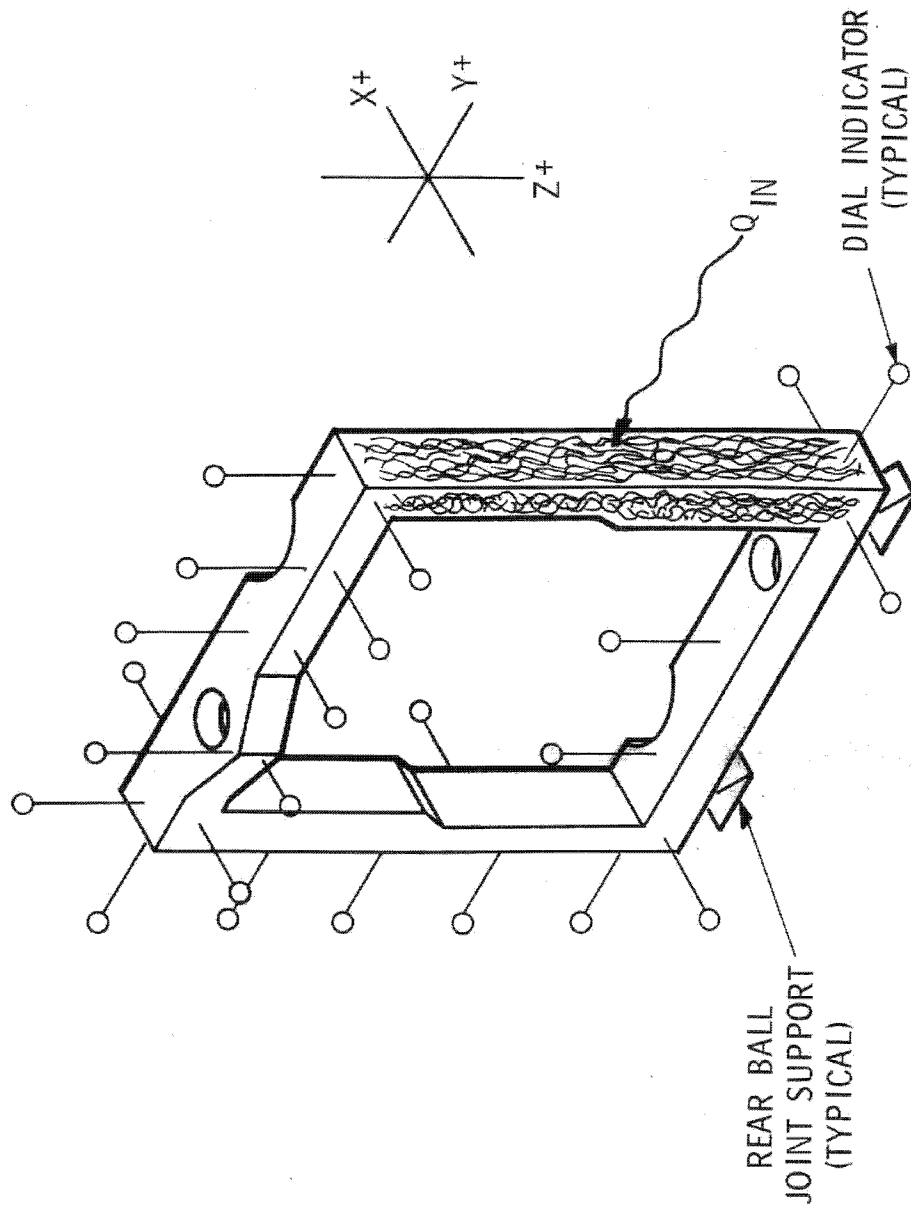
SCHEMATIC REPRESENTATION OF MODIFIED PITCH LINK

SIMULATED AND TESTED
IN CHAMBER A.
NO EFFECT ON PHOTO-
GRAPHIC PERFORMANCE.



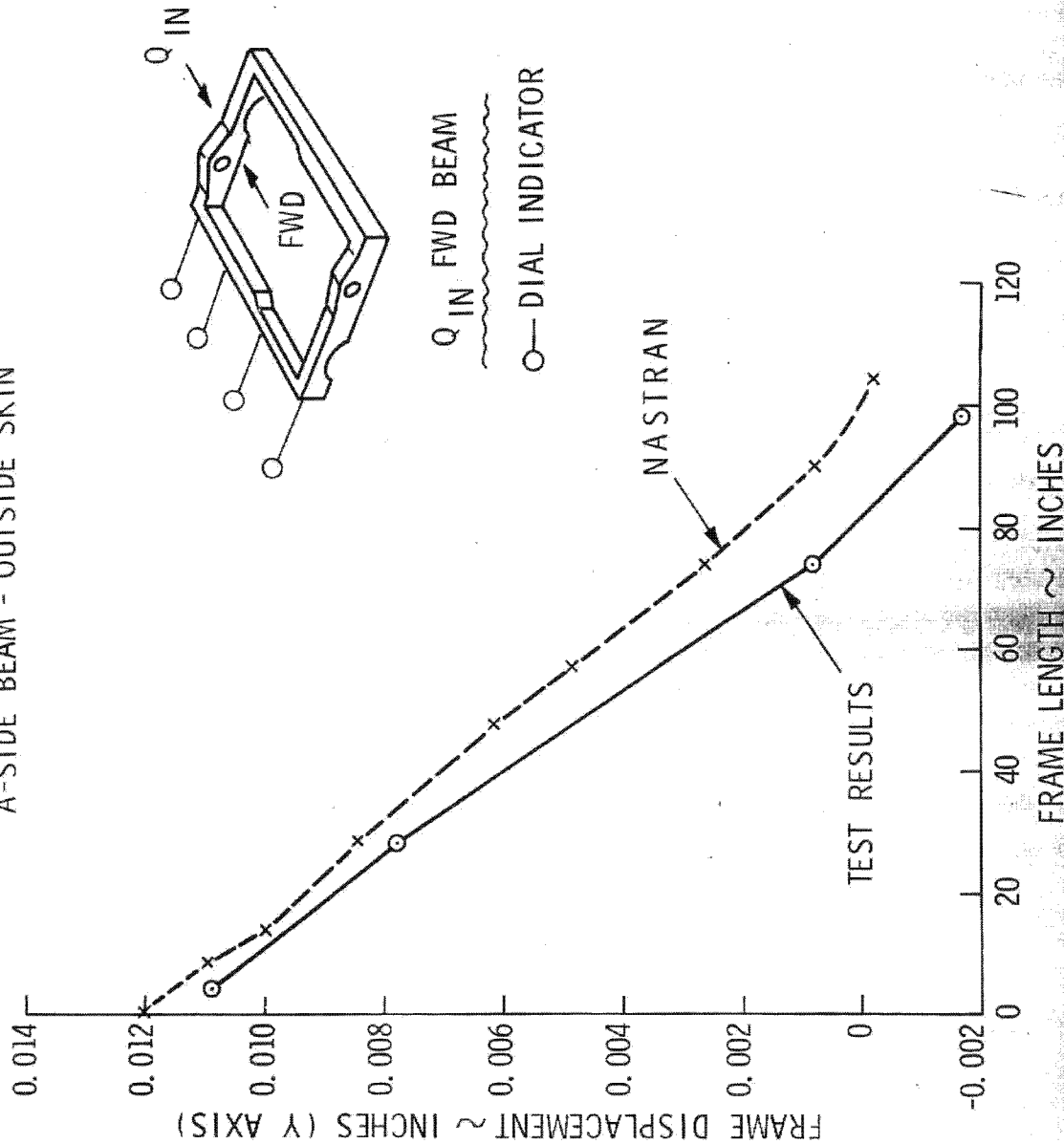
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FRAME BENDING TEST DIAL INDICATOR DATA
HEAT SYMMETRICALLY APPLIED INTO B-SIDE FRAME



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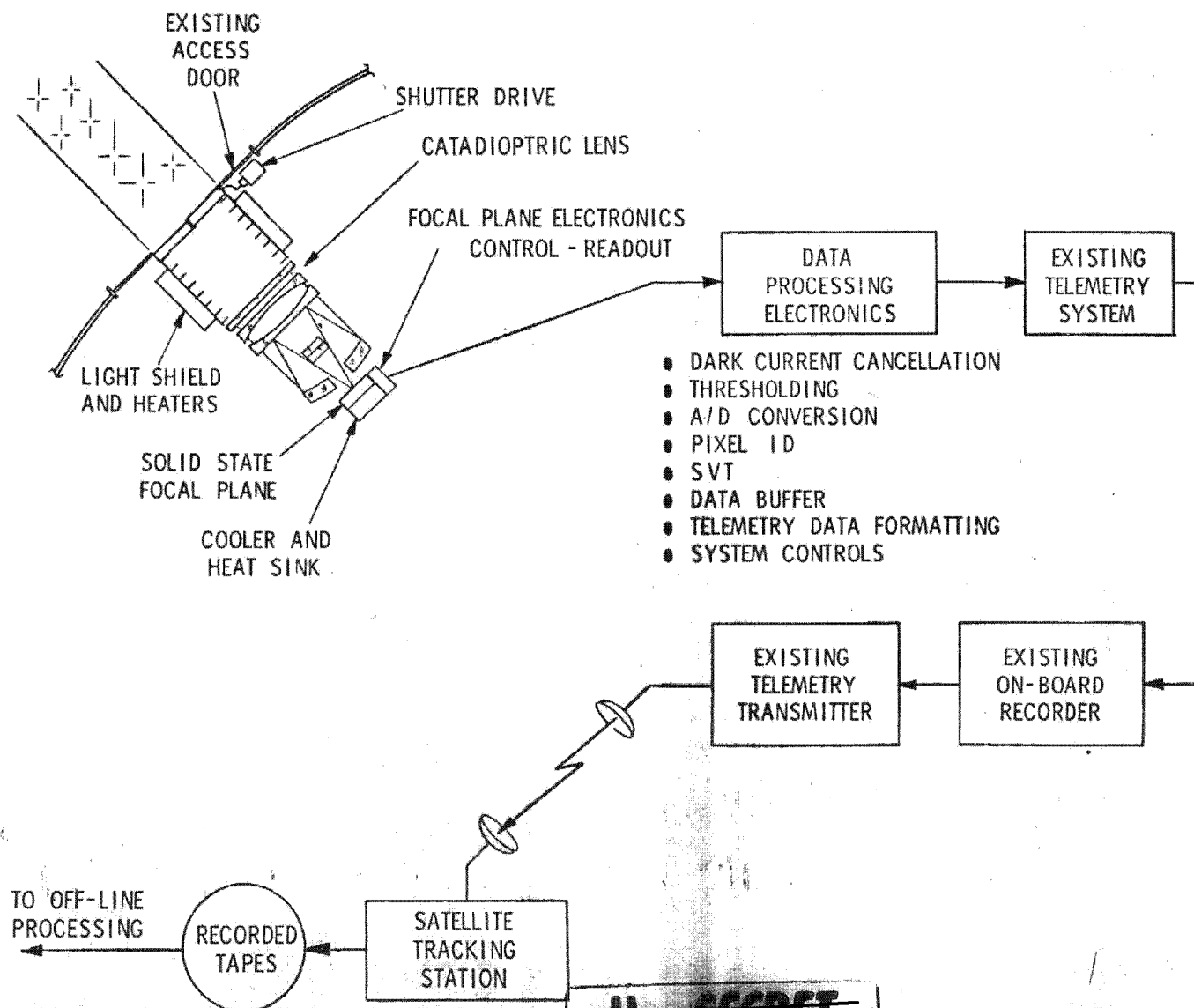
A-SIDE BEAM - OUTSIDE SKIN



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32002
C05127174

S³ CAMERA SYSTEM



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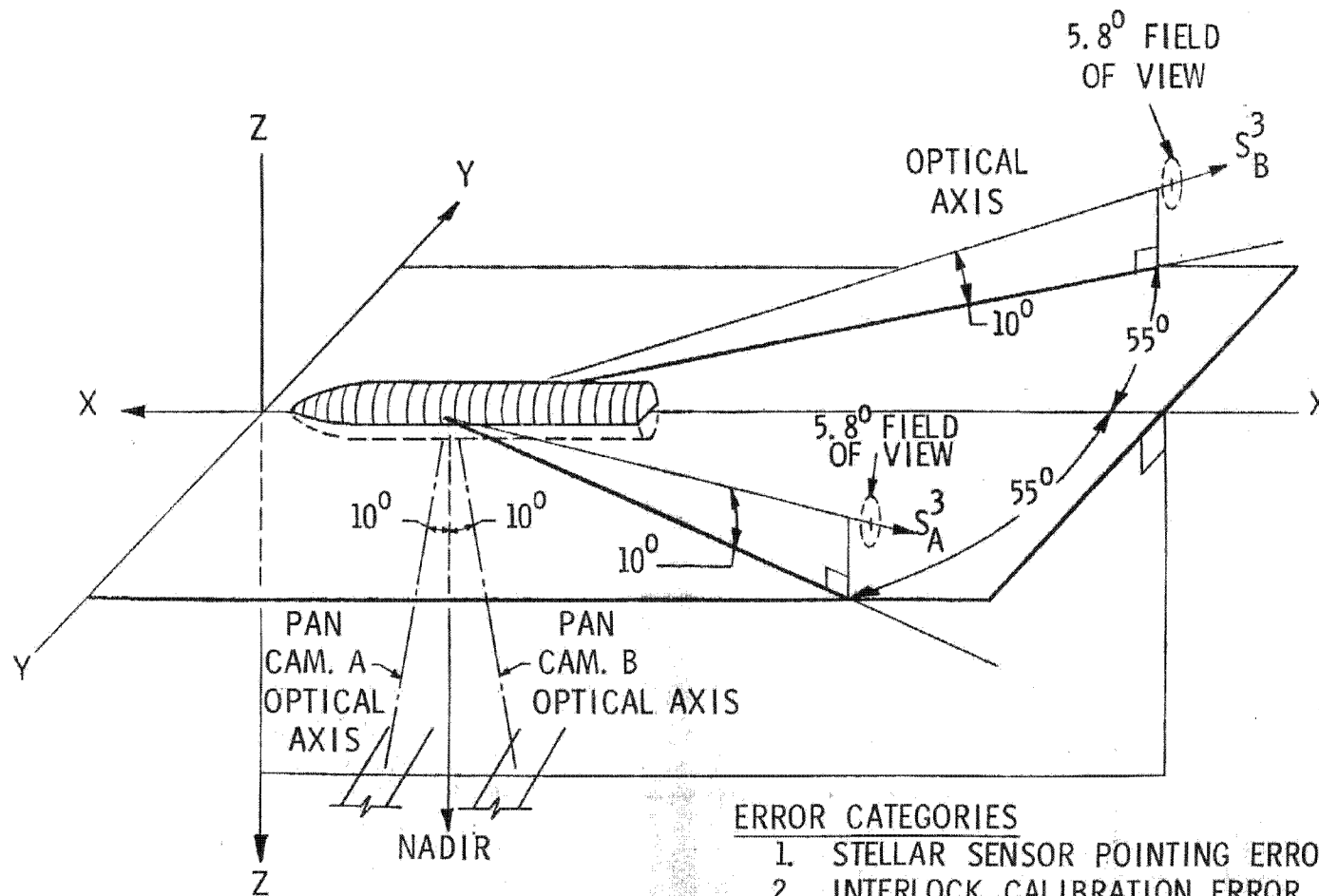
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S³ OPTICAL AXES



ERROR CATEGORIES

1. STELLAR SENSOR POINTING ERROR
2. INTERLOCK CALIBRATION ERROR
3. ENVIRONMENTAL STABILITY ERROR

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