

**ACIS Verification Summary Report**

<b>Specification:</b>	ACIS Contract End Item Specification
<b>Requirement Number/Title:</b>	3.2.2.5 Fiducial Lights (VRSD 3.2.2.5-1)
<b>Requirement Statement:</b> The instrument shall be equipped with GFE provided fiducial lights which are located as specified in paragraph 3.2.1.5.1 of the Observatory to Science Instrument ICD.	
<b>Verification Method:</b>	Measurement
<b>Procedure Number:</b>	N/A
<b>Configuration:</b>	Detector Housing
<b>Cycle Time:</b>	N/A
<b>Verification Discussion/Results:</b>	
<p>Pages 2 and 3 attached show the requirements  Pages 4 through 7 attached show the results of measurements and calculations. Since the Fid Lights are mounted in clearance hole and attached by screws through clearance holes, an effort was made during assembly to position the Fid Lights radially inward to the extent allowed by those clearances.</p>	

*Patric C. Zippin*  
ACIS Cognizant Engineer

5-1-97  
Date

### 3.2.1.5: Fiducial Light System

The Observatory shall provide fiducial lights and an optical system which can project the image of the fiducial lights mounted near the SI's focal plane onto the aspect sensor. Fiducial light configurations and interface characteristics are as shown in Interface Control Drawings 301330 and 822022 located in Appendix G.

#### 3.2.1.5.1: Location of Fiducial Lights

The locations of the fiducial lights on ACIS and HRC shall be as shown in Interface Control Drawing 301438 located in Appendix G.

Each FPSI shall maintain the mounting interface plane for each fiducial light perpendicular to the HRMA optical axis (assuming a perfect Observatory) to within  $\pm 7.0$  arcminutes. This tolerance is an on-orbit, 'not to exceed' number, and encompasses both static and dynamic effects. This requirement shall apply to the final FPSI assembly.

The tilt angle and beam angular size are shown for each ACIS and HRC fiducial light in Tables 3.2-1 and 3.2-2, respectively. The tolerances are as indicated in the footnotes to these tables.

The fid light clocking angle (pointing direction in the Y-Z plane) is shown for each fid light on Interface Control Drawing 301438 (Appendix G). The tolerance on the clocking angle is  $\pm 5^\circ$  for HRC ( $\pm 2^\circ$  for the instrument and  $\pm 3^\circ$  for the fid light) and  $\pm 4.5^\circ$  for ACIS ( $\pm 1.5^\circ$  for the instrument and  $\pm 3^\circ$  for the fid light). For both HRC and ACIS, the clocking error due to clearance between the #2-56 mounting screws and the fid light clearance holes is considered part of the  $\pm 3^\circ$  fid light tolerance.

The SI shall provide a clear field of view of the fiducial lights for the fiducial transfer optics located at the HRMA nodal point

#### 3.2.1.5.2: Fiducial Light Characteristics

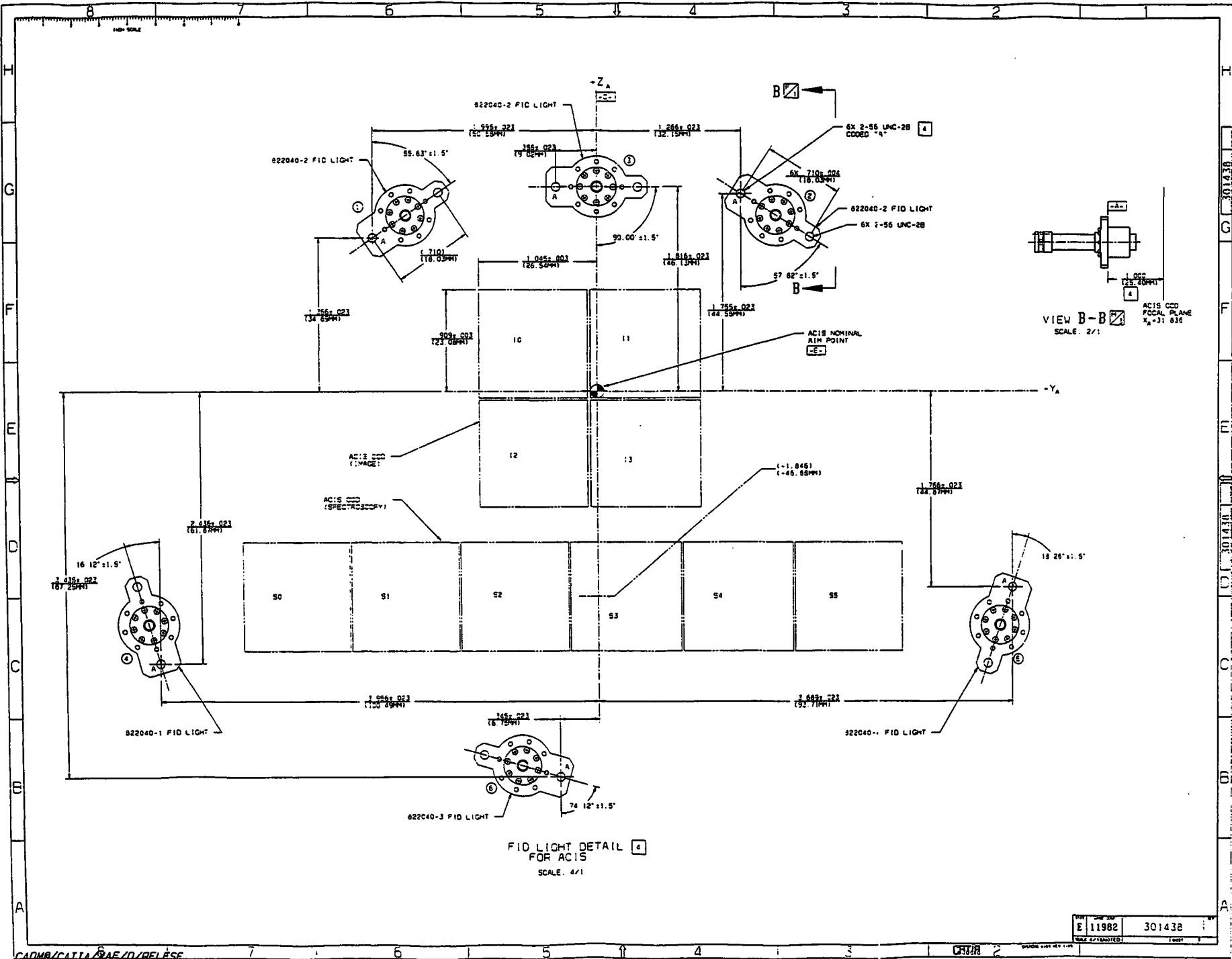
The fiducial lights are CFE by the AXAF-I contractor to the SI developer. The fiducial lights shall be compatible with the SI vacuum and contamination requirements.

For information purposes, the output radiant intensity of each fiducial light as a function of angle is specified in the Spacecraft to Telescope ICD (IF1-29). The spectral distribution peak is a function of temperature. At  $20^\circ\text{C}$ , the peak is at  $635 \pm 20$  nm. At  $-60^\circ\text{C}$ , the peak is at  $626 \pm 20$  nm. The half-power points will be within 40 nm of the peak position.

The maximum power dissipation of each fiducial light is specified in section 3.10 of this document.

The fiducial lights shall be capable of operating within the temperature ranges of their respective support structures, (i.e.: Camera Housing for ACIS fiducial lights and the Detector Assembly for the HRC fiducial lights), as specified in paragraph 3.3.2 of this document.

The fiducial lights shall be capable of operating to performance requirements following exposure to the random vibrations as specified in paragraph 3.4.1.2.2.2 of this document.



REV	DATE	BY	APP'D
E	11982		301438
SCALE 4/1 (INDICATED)		UNIT	

# LOCKHEED MARTIN

## Memorandum

TO: Pete Tappan ACIS-96-51  
July 24, 1996

FROM: Neil Tice

CC: L. Oldham, E. Sedivy, B. Mayer, R. Foster

SUBJECT: Action Item 3-19--Fiducial Light Mounting Surface Relative to Focal Plane

This memo documents the completion of the measurement of the distance from the focal plane to the fiducial light mounting surfaces. A Zeiss 3 axis coordinate measuring machine was used to perform the measurements. In the test, the detector housing (i.e. the back surface of the paddle) was set onto 3 gage blocks which were established as the zero point for the x axis. This surface will be approximately  $14.600 \pm 0.002$  inches away from the translation table during flight. Using a 13 inch extension on the Zeiss head, nine different locations were probed on the fiducial light mounting surfaces which will be  $13.005 \pm 0.002$  inches from the translation table during flight. Since the door, snoot, and Alignment Reference Mirrors (ARMs) were still installed and since the outer diameter of the probe extension was 1 inch, we were limited to the number of locations where we could make accurate measurements. However, statistically the data looks very good.

The data was very repeatable with an average distance from the back of the paddle to the fid light mounting surface of 1.60061 inches (1.600 inches expected nominal dimension at room temp.). The minimum to maximum measured distance was 1.60032 to 1.60093 with a spread of 0.00061. The standard deviation for the data was 0.000183 inches. If a normal distribution is assumed, then the 3 sigma deviation from the nominal measurement would be  $\pm 0.00055$  inches over the entire surface or from 1.60006 to 1.60116 inches. The raw data is shown in the approximate measurement location in Figure 1. Unfortunately, in the assembled state the fiducial light mounting flange locations were very difficult to measure and angles were not determined. I hope this gives you sufficient data to complete the alignment tolerance analysis. If not maybe you can get more data when you perform the alignment transfer to the ARMs

If you have any questions regarding this memo, please feel free to contact me.

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Post-It™ brand fax transmittal memo 7671		# of pages ▶ 5
To <i>Pete Tappan</i>	From <i>Neil Tice</i>	
Co.	Co.	
Dept.	Phone #	
Fax #	Fax #	

X Location in Memo YZ attached.

<b>Nominal Locations of Fid Lights Taken off Prints</b>										
Fid Light #	Center Y location (inches)	Center Z location (inches)	Angle (degrees)	-Y Bolt Y location (inches)	-Y Bolt Z location (inches)	+Y Bolt Angle (degrees)	+Y Bolt Y location (inches)	+Y Bolt Z location (inches)	dist. between bolts (inches)	Angle Recalc. (Bolt Angles) (degrees)
1	3.2200	6.3700	-145.6300	2.9270	6.1696	-145.6300	3.5130	6.5704	0.7100	-145.6299
2	6.4880	6.3700	147.8200	6.1875	6.5591	147.8200	6.7885	6.1809	0.7100	147.8198
3	4.9220	6.6200	0.0000	5.2770	6.6200	0.0000	4.5670	6.6200	0.7100	0.0000
4	0.8870	2.7090	-73.8800	0.9856	2.9880	-73.8800	0.7684	3.0500	0.7100	-73.8800
5	8.5000	2.7000	71.7400	8.6112	3.0371	71.7400	8.3888	2.3629	0.7100	71.7400
6	4.2360	1.4660	-15.8800	4.5775	1.3689	-15.8800	3.8345	1.5631	0.7100	-15.8600
<b>Dimensional Measurements From Flight Housing</b>										
Fid Light #	Center Y location (inches)	Center Z location (inches)	Angle (degrees)	-Y Bolt Y location (inches)	-Y Bolt Z location (inches)	+Y Bolt Angle (degrees)	+Y Bolt Y location (inches)	+Y Bolt Z location (inches)	dist. between bolts (inches)	Angle Recalc. (Bolt Angles) (degrees)
1	3.2200	6.3689	-145.6941	2.9246	6.1674	-145.4998	3.5101	6.5683	0.7096	-145.5976
2	6.4877	6.3687	147.8362	6.1882	6.5570	147.7878	6.7892	6.1787	0.7102	147.8118
3	4.9222	6.6186	0.2717	5.2807	6.6203	-0.0162	4.5637	6.6187	0.7170	-0.1277
4	0.8870	2.7090	-73.7021	0.9664	2.3689	-74.1058	0.7697	3.0507	0.7096	-73.9042
5	8.4994	2.6992	71.5640	8.6126	3.0389	71.7400	8.3893	2.3656	0.7094	71.6512
6	4.2353	1.4653	-15.4943	4.5789	1.3701	-16.2525	3.8920	1.5654	0.7141	-15.8740
<b>Distance and Angles from Nominal Print Dimensions</b>										
Fid Light #	Center Y location (inches)	Center Z location (inches)	Angle (degrees)	-Y Bolt Y location (inches)	-Y Bolt Z location (inches)	+Y Bolt Angle (degrees)	+Y Bolt Y location (inches)	+Y Bolt Z location (inches)	dist. between bolts (inches)	Angle Recalc. (Bolt Angles) (degrees)
1	0.0000	0.0011	0.0641	0.0024	0.0022	-0.1302	0.0029	0.0021	0.0004	-0.0323
2	0.0003	0.0013	-0.0162	-0.0007	0.0020	0.0322	-0.0008	0.0022	-0.0002	0.0081
3	-0.0002	0.0014	-0.2717	-0.0037	-0.0003	0.0162	0.0093	0.0013	-0.0070	0.1277
4	0.0000	0.0000	-0.1779	-0.0009	-0.0010	0.2258	-0.0013	-0.0007	0.0004	0.0242
5	0.0006	0.0008	0.1760	-0.0014	-0.0018	0.0000	-0.0006	-0.0027	0.0006	0.0888
6	0.0007	0.0007	-0.3857	-0.0014	-0.0012	0.3725	0.0026	-0.0022	-0.0041	-0.0060
Max	0.0007	0.0014	0.1760	0.0024	0.0022	0.3725	0.0033	0.0022	0.0006	0.1277
Min	-0.0002	0.0000	-0.3857	-0.0037	-0.0018	-0.1302	-0.0013	-0.0027	-0.0070	-0.0323

<b>Focal Plane Standoff Locations</b>											
Standoff #	Y Location	Z location	Y Location	Z location	Delta Y	Delta Z	Angle around Z				
	Design Nom.	Design Nom.	Measured	Measured	Mea.-Nom.	Mea.-Nom.					
	(inches)	(inches)	(inches)	(inches)	(inches)	(inches)	(degrees)				
1	-Y, +Z	1.4810	6.0760	1.4806	6.0758	-0.0004	-0.0002				
2	+Y,+Z	6.1720	6.0760	6.1713	6.0756	-0.0007	-0.0004	-0.0017	2 rel. to 1		
3	-Y, -Z	1.0900	1.3630	1.0896	1.3632	-0.0004	0.0002				
4	+Y,-Z	6.6180	1.3630	6.6173	1.3629	-0.0007	-0.0001	-0.0026	4 rel to 1		
	Max					-0.0004	0.0002	-0.0017			
	Min					-0.0007	-0.0004	-0.0026			
	Average					-0.0006	-0.0001	-0.0021			
<b>Distance and Angles from Nominal Relative to Focal Plane Standoffs</b>											
Fid Light #	Center	Center	-Y Bolt	-Y Bolt	-Y Bolt	+Y Bolt	+Y Bolt	+Y Bolt	dist. between	Angle Recalc.	
	Y location	Z location	Angle	Y location	Z location	Angle	Y location	Z location	bolts	(Bolt Angles)	
	(inches)	(inches)	(degrees)	(inches)	(inches)	(degrees)	(inches)	(inches)	(inches)	(degrees)	
1	0.0006	0.0012	0.0662	0.0029	0.0024	-0.1281	0.0035	0.0023	0.0004	-0.0302	
2	0.0009	0.0014	-0.0141	-0.0001	0.0021	0.0343	-0.0002	0.0023	-0.0002	0.0102	
3	0.0003	0.0015	-0.2696	-0.0031	-0.0002	0.0183	0.0039	0.0014	-0.0070	0.1299	
4	0.0006	0.0001	-0.1757	-0.0003	-0.0009	0.2279	-0.0007	-0.0006	0.0004	0.0264	
5	0.0012	0.0009	0.1781	-0.0009	-0.0017	0.0021	0.0000	-0.0026	0.0006	0.0910	
6	0.0019	0.0008	-0.3836	-0.0008	-0.0011	0.3746	0.0031	-0.0021	-0.0041	-0.0039	
	Max	0.0013	0.0015	0.1781	0.0029	0.0024	0.3746	0.0039	0.0023	0.0006	0.1299
	Min	0.0003	0.0001	-0.3836	-0.0031	-0.0017	-0.1281	-0.0007	-0.0026	-0.0070	-0.0302

