36-01510.058

ACIS Verification Summary Report

Specification:	ACIS Contract End Item Specification
Requirement Number/Title:	3.2.2.2 Center of Gravity (VRSD 3.2.2.2)

Requirement Statement: The instrument configuration shall be designed so as to be consistent with CG constraints specified in the Observatory to Science Instrument ICD Table 3.2-3.

Verification Method:	Calculation

Procedure Number: N/A

Configuration: Individual assemblies

Cycle Time: N/A

Verification Discussion/Results:

Table 3.2-3 (attached) shows the CG constraints. The attached spread sheet shows the results of the CG calculations. They are identical except as follows:

Support Assembly	Table 3.2-3	Calculated
X_{cg}	3.32 ± 1.00	3.44
Y_{cg}	$1.13 \pm .50$	.55
Z_{cg}	$.23 \pm .50$	.26

The Y_{cg} exceeds the requirement by .13 inches.

ACIS as an assembly meets the requirements.

Peter C. Zhan 4-29-97

ACIS Cognizant Engineer Date

TABLE 3.2-3: ACIS EQUIPMENT CONTROL WEIGHTS AND MOMENTS

Component Name	Maximum Control Wt. (1,2) (lbs)		Center of Mass (in.) (3)			Moments of Inertia ($lb \cdot sec^2 \cdot in$) (3)		
			Xcg	Ycg	Zcg	Ixx	Iyy	Izz
Detector Assembly ACIS Total	37.7		3.84	0.57	0.21			
CFE Fiducial Light System	1.00							
CFE Trim & Survival Heater Sys.	0.90							
CFE Mounting Hardware	0.50							
Detector Assembly Total		40.10						
Vent Valve less Vent Tube	5.10		12.73	13.64	-0.07			
CFE Mounting Hardware	0.30							
Vent Valve less Vent Tube Total		5.40						
Vent Mechanical Interface	2.20		12.73	19.98	3.50			
CFE Mounting Hardware	0.10							
Vent Mechanical Interface Total		2.30						
Vent Electrical I/F	0.50		12.85	20.18	-3.94			
CFE Mounting Hardware	0.10							
Vent Electrical I/F Total		0.60						
Support Assy ACIS Total	133.80		3.32	1.13	0.23	64.80	15.90	68.90
CFE Trim & Survival Heater Sys	4.20							
CFE Mounting Hardware	1.00							
Support Assy Total		139.00						
Radiators (5)	13.50		3.23	-0.02	8.83	2.49	0.74	3.20
CFE Mounting Hardware	0.12							
Radiators Total		13.62						
Sun Shade	8.50		-5.34	-0.52	19.64			
CFE Mounting Hardware	0.10							
Sun Shade Total		8.60						
Telescope Shade & Posts	7.60		13.67	-0.63	20.39			
CFE Mounting Hardware	0.50							
Telescope Shade & Posts Total		8.10						
PSMC	32.90		6.00	12.00	-32.50			
CFE Mounting Hardware	1.10							
CFE Trim & Survival Heater Sys	1.00							
PSMC Total		35.00						
PSMC Cable Less Ends	6.10		—	—	—			
CFE Cable Clamps & Hardware	1.00							
PSMC Cable Total		7.10						
SIM Mounted Calibration Source	4.20		20.75	0.00	16.88			
CFE O-Ring and Hardware	0.20							
SIM Mounted Cal. Source Total		4.40						

ACIS Control Weight (1)	252.20
CFE Subtotal	12.12
Total Control Weight (2)	264.32

See next page for Table Notes

IS

NOTES FOR TABLE 3.2-1:

1. Maximum Control Weights include contingency and are specified by component for SIM interface design purposes. Actual weights of the components may be less. The maximum control weight of the ACIS instrument assembly is **253** lbs ~~even though the individual control weights shown in this table exceed that number~~.

2. Weights do not include RCTU Cables and cable clamps, Fiducial Light Controller Assembly, cables and connectors, or Light Seal..

3. Coordinate system for the Center of Mass is the ISIM system with ACIS in the launch locked position. Moments of Inertia are with respect to the unit Center of Mass.

4. Tolerance for CM is ± 1 inch along the X axis and ± 0.5 inch along the Y and Z axes.

5. Includes ~ 0.9 lbs distributed weight for +Z Panel MLI blanket.

ACIS MASS PROPERTIES				30-Apr-97			P. C. Tappan			
/amd/snebulos/h2/pct/acis/mass_prop3.xs3		Coordinate system is the ISIM system with ACIS in the launch lock position.								
		RCTU Cables, Fudical Lights, Light Seal, Mounting Hardware,								
		Survival and Trim Heater System weights are not included.								
Description	Basic Weight	Percent Measured	Contingency		Reserve	Current Weight	Prior Basic Weight	Basic Weight Change	Prior Current Weight	Current Weight Change
	(Lbs)		%	(Lbs)	(Lbs)	(Lbs)	(Lbs)	(Lbs)	(Lbs)	(Lbs)
Detector Assembly	27.5	99%	0%	0.0	0.0	27.5	28.4	-0.9	29.1	-1.6
Proton Shield	3.8	100%	0%	0.0	0.0	3.8	3.8	-0.0	3.8	-0.0
MLI, Thermal Straps (.33)	2.3	100%	0%	0.0	0.0	2.3	2.3	-0.0	2.3	-0.0
DA to DEA Cabling (.3)	0.7	100%	0%	0.0	0.0	0.7	0.7	-0.0	0.7	-0.0
PSMC Cabling (.091)	0.8	100%	0%	0.0	0.0	0.8	0.8	0.0	0.8	0.0
Vent Tube	1.0	100%	0%	0.0	0.0	1.0	1.0	0.0	1.0	0.0
DETECTOR ASSEMBLY TOTAL	36.1	99%	0%	0.0	0.0	36.1	37.0	-0.9	37.7	-1.6
VENT VALVE less Vent Tube	5.1	100%	0%	0.0	0.0	5.1	5.0	0.1	5.1	0.0
VENT MECH. INTERFACE	2.2	100%	0%	0.0	0.0	2.2	2.2	0.0	2.2	0.0
VENT ELECT. INTERFACE	0.5	100%	0%	0.0	0.0	0.5	0.5	0.0	0.5	0.0
Support Structure	25.5	100%	0%	0.0	0.0	25.5	25.5	0.0	29.9	-4.4
DEA	47.1	100%	0%	0.0	0.0	47.1	47.1	0.0	52.5	-5.4
DPA	43.1	100%	0%	0.0	0.0	43.1	43.1	0.0	48.5	-5.4
DA to DEA Cabling (.7)	1.6	100%	0%	0.0	0.0	1.6	1.6	0.0	1.6	0.0
DEA to DPA Cabling	3.1	100%	0%	0.0	0.0	3.1	3.1	0.0	3.1	0.0
PSMC Cabling (.127)	1.2	100%	0%	0.0	0.0	1.2	1.2	-0.0	1.2	-0.0
SUPPORT ASSEMBLY	121.6	100%	0%	0.0	0.0	121.6	121.6	-0.0	133.8	-12.2
Radiators	10.2	100%	0%	0.0	0.0	10.2	10.2	0.0	10.3	-0.1
MLI, Thermal Straps (.67)	3.2	100%	0%	0.0	0.0	3.2	3.2	0.0	3.2	0.0
RADIATORS	13.4	100%	0%	0.0	0.0	13.4	13.4	0.0	13.5	-0.1
SUN SHADE	8.5	100%	0%	0.0	0.0	8.5	8.4	0.1	8.5	0.0
TELESCOPE SHADE & POSTS	7.6	100%	0%	0.0	0.0	7.6	7.6	0.0	7.6	0.0
PSMC	32.9	100%	0%	0.0	0.0	32.9	31.7	1.2	31.9	1.0
PSMC Cabling (.109)	1.0	100%	0%	0.0	0.0	1.0	1.0	0.0	1.0	0.0
PSMC TOTAL	33.9	100%	0%	0.0	0.0	33.9	32.7	1.2	32.9	1.0
PSMC CABLES Less Ends	6.2	100%	0%	0.0	0.0	6.2	6.1	0.1	6.1	0.1
SIM MOUNTED CALIBRATION SOURCE	4.1	98%	2%	0.1	0.0	4.2	4.1	0.0	4.2	0.0
	----	----	----	----	----	----	----	----	----	----
TOTAL	239.2	100%	0%	0.1	0.0	239.3	238.6	0.6	252.1	-12.8

Description	Current Weight	Center of Mass			Moment of Inertia about Unit C. M.			Products of Inertia		
	(Lbs)	Xcg (in.)	Ycg (in.)	Zcg (in.)	Ixx in-lb-s^2	Iyy in-lb-s^2	Izz in-lb-s^2	Pxy in-lb-s^2	Pxz in-lb-s^2	Pyz in-lb-s^2
DETECTOR ASSEMBLY TOTAL	36.1	3.84	0.57	0.21	1.75	3.93	4.21	-0.14	-0.20	0.04
VENT VALVE less Vent Tube	5.1	12.73	13.64	-0.07	0.17	0.13	0.06	0.00	0.00	0.00
VENT MECH. INTERFACE	2.2	12.73	19.98	3.50	0.03	0.01	0.02	0.00	0.00	0.00
VENT ELECT. INTERFACE	0.5	12.85	20.18	-3.94	0.00	0.00	0.00	0.00	0.00	0.00
SUPPORT ASSEMBLY	121.6	3.44	0.55	0.26	50.5	12.5	54.0			
RADIATORS	13.4	3.70	-0.16	9.00	2.49	0.74	3.20	0.00	0.00	-0.02
SUN SHADE	8.5	-5.34	-0.52	19.64	4.92	1.36	3.57	0.00	0.00	0.25
TELESCOPE SHADE & POSTS	7.6	13.67	-0.63	20.39	3.89	1.14	3.04	-0.01	0.07	-0.26
PSMC	33.9	6.00	12.00	-32.50	1.21	0.97	1.27	-0.11	-0.01	0.00
PSMC CABLES Less Ends	6.2									
SIM MOUNTED CALIBRATION SOURCE	4.2	20.75	0.00	16.88						
	----	----	----	----	----	----	----			
TOTAL	239.3									

AXAF-I Verification Requirement Compliance Data Submittal

Element: ACIS

Requirement Number: 3.2.2.2

Verification Item: 3.2.2.2-1

Evaluators: CHE

Type of Review:
- ☒ Verification Item Closure
- ☐ Requirement Closure

Requirement Title: Center of Gravity

Compliance Data/Location:
MA-22/600-A-21VR/Rm 522 Bldg 4200
MA-27/36.01510.058/Bldg 4200 Rm 522 (MIT Closure Report)

Verification Method: Analysis

Comments:
The MIT data submittal shows that all CG requirements specified in Table 3.2-3 of the SI-to-Observatory ICD are met with the exception that Y-CG for the Support Assembly was exceeded by 0.08 inches.

~~Waiver~~ Input to PIRN provided to MSFC on Aug 4.

William Mayer

Status: Open 5/9/97 due 6/6/97

Recommendation:
- ☒ Approve
- ☐ Disapprove
- ☐ Other (Explain)

Action Required for Closure:

MSFC Evaluator:	Date:	Organzation:	Phone Number:
Ken Reed	6/25/97	EJ32	4-6560

Disposition:
- ☐ Approve
- ☒ Disapprove
- ☐ Other (Explain)

Action Required for Closure: Need a waiver or a PIRN to the req't for the Support Structure. Everything else is ok.

Chief Engineer:	Date:
Anthony R. Lavoie	6/25/97

36-01510, 0057

AXAF-I CCD Imaging Spectrometer (ACIS)

Verification Assessment Report -Power and Thermal-Control Structure- -Mass Properties Analysis Report-

Document No. ACIS-600-A-21VR

DPD 727 DR SVR04

Contract # NAS8-37716

March 28, 1997

Submitted to:
Massachusetts Institute of Technology
Center for Space Research
77 Massachusetts Avenue
Cambridge, MA 02139

Submitted By:
Lockheed Martin Astronautics
P.O. Box 179
Denver, CO 80201

Prepared By:

Neil W. Tice
Program Thermal Design Engineer
Lockheed Martin Astronautics

Approvals:

Donald C. Larson
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Lockheed Martin Astronautics

Lloyd P. Oldham
Program Manager
Lockheed Martin Astronautics

CHANGE/REVISION RECORD

Number	Date	Description	Page	
			Rev.	Added
New	28 March 1997	Initial Release	All	

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Scope

This document provides a collection of information which results from the implementation of the ACIS Verification Plan, 36-01203. It is intended to show that the delivered instrument meets a specific set of requirements from the ACIS Power and Thermal-Control Structure (PTS) Specification, ACIS-36-02101.

In particular, this report provides the analytical data to support the verification of specific PTS Specification requirements. These requirements were assessed to be best verified by a analysis. The method selected in the verification of each specific requirement is the method which provides the assurance to the program that the requirements have been verified.

The Verification Cross Reference Matrix contained in the ACIS PTS Specification shows how each contractual requirement will be verified. The requirements documented herein have been designated to be verified by analysis and/or a combination of other verification methods.

1.2 Applicable Documents

ACIS Project Documents

36-02101	ACIS Power and Thermal-Control Structure (PTS) Specification
36-01203	ACIS Verification and Calibration Plan

2. METHODOLOGY

2.1 Requirements & Specifications

Verification methods to be used are defined in the verification matrix, compiled as an appendix to the ACIS Power and Thermal-Control Structure Specification, 36-02101.

2.2 Verification Descriptions

Summary level descriptions of each verification activity are located in the ACIS Verification Plan, 36-01203 and the ACIS Power and Thermal-Control Structure Specification, 36-02101. The specific definitions for this report are as follows:

2.2.1 Analysis Definition

Analysis is a method of verification, taking the form of the processing and accumulated results and conclusions, intended to provide proof that verification of a requirement(s) has been accomplished. The analytical results may be based on engineering study, compilation or interpretation of existing information, similarity to previously verified requirements, or derived from lower level examinations, tests, demonstrations, or analyses. Verification by analysis is a process used in lieu of or in addition to testing to verify compliance with specification requirements. The selected techniques may include systems engineering analysis, statistics and qualitative analysis, computer and hardware simulations, and analog modeling. Analytical techniques may be used in lieu of tests for such things as life, storage, failure analysis, safety, interchangeability, and some other performance requirements which cannot be verified by test.

2.2.2 Mass Properties Analysis Definition

Mass property analysis determines the Weight, Center of Gravity and Moment of Inertia characteristics for individual items leading to subassemblies and the ACIS as a whole. Weight analysis is required for those items that are built and installed in situ (e.g., cabling) or those items of sufficient complexity or impracticality (e.g., shims, fasteners, etc.) that an accurate weight cannot be easily measured. Center of Gravity and Moment of Inertia characteristics are determined analytically due to the impracticality in obtaining detailed measurements for many items.

3. ANALYSIS

3.1 Applicable Requirements

Requirement Reference — Requirement

1. 3.2.2.2a — Weight
   The Power and Thermal-Control Structure weight shall not exceed 130 pounds.

2. 3.2.2.2b — Weight
   The Power and Thermal-Control Structure component weights shall not exceed the values specified in Table 3.2.2.2-1.

Table 3.2.2.2-1 PTS Weights and Centers of Gravity

Description	Weight (lbs)	Center of Gravity (inches)		
		Xcg	Ycg	Zcg
Detector Assembly	31.6	2.60	0.39	-0.06
Detector Housing - Less FP, OBFs, Backplate, Internal Cabling and Connectors, DH Door Cal Source	26.0	2.10	0.39	-0.06
Venting Subsystem	10.0	12.00	14.00	0.00
Thermal Control & Isolation	9.0	N/A	N/A	N/A
Radiators	12.0	5.10	0.00	8.76
Sun & Telescope Shades	18.00	2.56	-0.67	19.44
Power Supply & Mechanisms Controller	32.0	7.70	11.53	-32.40
Cables and Connectors	13.0	N/A	N/A	N/A
Total (+ 10 lbs contingency)	130.0	N/A	N/A	N/A

3. 3.2.2.3 Center of Gravity
   The Power and Thermal-Control Structure components centers of gravity shall be within the dimensional values specified in Table 3.2.2.2-1 ± 1 inch.

3.2 Analytical Discussion

The Power and Thermal-Control Structure mass property analyses are provided for review and comment per contractual data requirement SSE03. The current mass properties report which was submitted for February is attached in appendix A.

	Requirement Reference	Requirement
1.	3.2.2.2a	Weight

The Power and Thermal-Control Structure weight shall not exceed 130 pounds.

DISCUSSION

The Power and Thermal-Control Structure components have been designed to minimize weight while meeting performance and structural requirements. The total weight has been provided previously per SSE03 data submittals and has been documented in the Monthly report submittals for the duration of the program. The PTS total weight is less than 130 pounds as verified in the table below. The total weight was 103.8 pounds which is 26.2 pounds less than the control weight of 130 pounds. This discussion verifies compliance with paragraph 3.2.2.2a of the PTS Specification, no further action is required.

Description	Weight (lbs)	Center of Gravity (inches)		
		Xcg	Ycg	Zcg
Detector Housing - Less FP, OBFs, Backplate, Internal Cabling and Connectors, DH Door Cal Source	**21.0** (26.0)	**2.60** (2.10)	**0.57** (0.39)	**0.21**(-0.06)
Venting Subsystem	**8.8** (10.0)	**12.7**(12.00)	**16.0** (14.0)	**1.30** (0.00)
Thermal Control & Isolation	**5.5** (9.0)	N/A	N/A	N/A
Radiators	**10.2** (12.0)	**3.70** (5.10)	**-0.16** (0.0)	**9.0** (8.76)
Sun & Telescope Shades	**16.1**(18.0)	**3.6** (2.6)	**-0.6**(-0.67)	**20.0**(19.44)
Power Supply & Mechanisms Controller	**32.9**(32.0)	**6.0** (7.70)	**12.0**(11.53)	**-32.5**(-32.4)
Cables and Connectors	**9.2**(13.0)	N/A	N/A	N/A
Total (+ 10 lbs contingency)	**103.8**(130.)	N/A	N/A	N/A

Actual Weights in Bold compared to requirements in parentheses.

2.	3.2.2.2b	Weight

The Power and Thermal-Control Structure component weights shall not exceed the values specified in Table 3.2.2.2-1.

DISCUSSION

The Power and Thermal-Control Structure components have been designed to minimize weight while meeting performance and structural requirements. All components have be weighed and the weights have been submitted as part of the SSE03 data submittals in the ACIS monthly progress report. All components meet the initial weight goals specified in the table above with significant margin except the PSMC. However, the weight of the PSMC was allowed to increase because of a MSFC directed change to redesign the PSMC baseplate to mount on flexures. This required an additional 1.5 pounds for baseplate stiffening and thus the new control weight should be 33.5 pounds which we meet with 0.6

pounds of margin. This discussion verifies compliance with paragraph 3.2.2.2b of the PTS Specification, no further action is required.

3. 3.2.2.3 Center of Gravity
The Power and Thermal-Control Structure components centers of gravity shall be within the dimensional values specified in Table 3.2.2.2-1 ± 1 inch.

DISCUSSION
The Power and Thermal-Control Structure components have been designed to meet the specified center(s) of gravity while meeting performance and structural requirements. All components have been analyzed and the data has been submitted in the SSE03 data submittals which are part of the ACIS monthly progress report. The above shows the current predictions for CGs for each piece of PTS hardware. In some cases, we did not meet the +/- 1 inch requirements specified in the PTS spec. However, there are good justifications for each exceedence since new requirements have been imposed which have changed the CGs and more detailed analyses have been performed which account for the actual hardware locations on the SIM. In the case of the venting subsystem, the CG moved slightly in Y and Z with the addition of a light shade on the exhaust of the vent tube and re-allocation of some of the vent tube weight to the detector assembly. The X axis CG of the radiator changed slightly with allocation of the warm and cold strap weight to the radiators. Lastly, the PSMC X axis CG changed because of a MSFC directed change which put the PSMC on flexures. The flexures move the PSMC 2 inches in the -X direction which would put the new CG within specifications. The current ACIS mass properties can be found in Appendix A. This discussion verifies compliance with paragraph 3.2.2.3 of the PTS Specification, no further action is required.

Appendix A

PTS/DPS Mass Properties Report for

February 1997

DOCUMENT NO. ACIS-MPR-48

Contract # SC-A-124624

AXAF CCD Imaging Spectrometer (ACIS)

CDRL SMA03

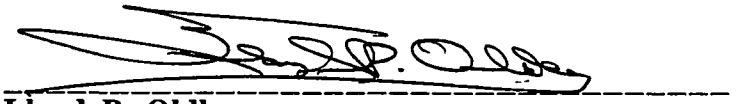
Monthly Progress Report

January 1997

Prepared For:
Massachusetts Institute of Technology
Center For Space Research
77 Massachusetts Avenue
Cambridge, Ma 02139

Prepared By:
Lockheed Martin Astronautics
Flight Systems
P. O. Box 179
Denver, CO 80201

Approval:



Lloyd P. Oldham
LMA ACIS Program Manager

opening operation has virtually no-load, it occurs faster. Bus voltage is a big variable since the power in the actuator heaters varies with the square of the voltage. The new bonding adhesive and the parallel resistor across the thermistors has provided the confidence that this situation will not occur again. Conclusion: Be more patient and watch the temperature of the actuators and not the duration of the operation in deciding whether or not to remove power from the actuators.

TCS Fabrication/Test Status

All TCS hardware, with the exception of some of the MLI blankets, has been NASA-SPEC-1238 certified and is in storage. The flight radiators, straps, and test MLI will be delivered to MIT as required for use in the Lincoln Labs Thermal Vacuum Test in early February.

Stress/Dynamic Analysis

Stress analysis updates have continued with a promised completion in early February. The analysis completed to date has been water-falled to MSFC as it is completed to enable timely review. The fracture analysis will continue into March on a part time basis and supports Acceptance Data Package delivery dates.

Science Instrument Module Simulator (SIM Sim) Status

The SIM Sim was pre-baked at 60°C and passed 1238 certification in preparation for the Lincoln Labs thermal vacuum test.

OBF Test Status

All flight Optical Blocking Filters passed 1238 certification and have been shipped back to MIT.

WEIGHT SUMMARY

PTS Weight Summary is shown in Table 1. Values are the measured weights of all LMA supplied components. Uncertainty margins have been reduced as the measured data became available.

Table 1 PTS Current Estimated Weight Summary

Assembly	Weight, lb.	Uncertainty, lb.
Detector Housing	**20.8**	**+0.2**
Venting Subsystem	**8.7**	**+0.1**
Thermal Control & Isolation	**5.4**	**+0.1**
Radiators	**10.2**	**+0.1**
Sun & Telescope Shades	**16.0**	**+0.1**
Power Supply & Mechanisms Controller	**32.7****	**+0.2**
Cables & Connectors	**9.1**	**+0.1**
Total Basic Weight	**102.9**	**+0.9 -0.0**

** Includes Survival Heaters, Thermistors, connectors, and bracket which are not part of ACIS budget. Mark Kilpatrick's (BECD) worksheet dated 12/8/95 assumed 1 pound for these components. LMA does not have the actual breakdown.

National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

Reply to Attn of: TA01CM (497)

August 11, 1997

TO: Distribution

FROM: Marshall Space Flight Center
TA01CM/Observatory Projects Configuration Management Office

SUBJECT: **AXAF CHANGE EVALUATION REQUEST**

You are requested to review the enclosed change action(s) and provide your response to this office no later than the suspense date indicated. Your response should be in the form of a Record Engineering Change Proposal (RECP), for concurrence as written, or, an Engineering Change Proposal (ECP) should you have impacts and/or changes.

CHANGE NO.	*SUBJECT/DESCRIPTION*	*SUSPENSE*
ECR EJ32-97-S010 (AX000497)	ACIS Support Structure CG/Weight (ICD IF1-20/PIRN 20-0054)	*2 SEPT 97*

Questions and/or comments relative to the technical nature of this change(s) should be directed to the Change Package Engineer (CPE), Melinda Self, Mail Code EJ32, (205) 544-9597, Fax (205) 544-5847.

William T. Anglin
Observatory Projects Configuration Management

Dave

Enclosures

cc:
EJ32/M. Self (CPE)
EJ32/T. Lavoie
TA61/M. Rosenthal
TA01CM/Obsv Proj CM Ofc
PWI/AXAF Receipt Desk

8/11/97

Tony,
This is okay with ACIS. In fact, we generated the PIRN.

Bill Mayer

TA01CM (497), dated August 11, 1997
Subject: AXAF Change Evaluation Request

Distribution:

TRW Space & Electronics Group
One Space Park
ATTN: R9/1809 Dave Deboe
Redondo Beach, CA 90278

Massachusetts Institute of Technology
Center for Space Research
77 Massachusetts Avenue
ATTN: W. Mayer
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Cambridge, MA 02138

Space Research Organization Netherlands
Space Research Utrecht
ATTN: T. Gunsing
Sorbonnelaan 2
3584 CA Utrecht
THE NETHERLANDS

1. NUMBER	2. PCN:	MSFC	3. DATE:	4. PAGE
EJ32-97-5010	AX000497	**ENGINEERING CHANGE REQUEST**	8 Aug 97	1 of 1

5. TO:	6. THRU:	7. FROM:
Obsv Projects Level II CCB		EJ32/Melinda Self

8. TITLE OF CHANGE: ACIS SUPPORT STRUCTURE CG/WEIGHT

9. RECOMMENDED PRIORITY:	10. NEED DATE:
☐ Emergency ☐ Urgent ■ Routine	ASAP
11. PROGRAM(S)/PROJECT(S) AFFECTED: 454, AXAF	12. END ITEM(S) AFFECTED BY NOMENCLATURE: AXAF
13. RECOMMENDED EFFECTIVITY: AXO1	14. BASELINE DOCUMENT AFFECTED (SPECS., ICD, etc.): ICD IF1-20: Observatory-to-Science Instruments ICD

15. RELATED CHANGES (ECR, ECP, CR, etc.) BY NUMBER:

16. JUSTIFICATION FOR CHANGE: (Continue on MSFC Form 2327-1):

Based on final calculated CG positions for the DEA/DPA/Support Structure, the Ycg was out of spec by 0.08 inches, if tolerances listed in the ICD are considered. The DEA/DPA/SS came in under weight by about 10 pounds and most of this savings was in the DEA. Therefore, the CG shifted from the DEA side toward the geometrical center.

17. EFFECTS ON:

■ Hardware ☐ Facility ☐ Schedule (See Enclosure _____) ☐ Other
☐ Software ☐ Requirements Documentation ☐ Cost (Estimated cost included in Enclosure _____)

18. DESCRIPTION OF CHANGE (Continue on MSFC Form 2327-1):

1. CHANGE ICD IF1-20 in accordance with PIRN 20-0054, attached hereto.

19. SIGNATURE OF ORIGINATOR:	DATE:	TELEPHONE NUMBER:	OFFICE SYMBOL:
Melinda K. Self *Melinda K Self*	8/8/97	(205) 544-9597	EJ32

20. CONCURRENCE

SIGNATURE & ORGANIZATION	DATE	SIGNATURE & ORGANIZATION	DATE

21. TECHNICAL APPROVAL

SIGNATURE & ORGANIZATION	DATE	SIGNATURE & ORGANIZATION	DATE

36-01510.058

ACIS Verification Summary Report

Specification:	ACIS Contract End Item Specification
Requirement Number/Title:	3.2.2.2 Center of Gravity (VRSD 3.2.2.2)

Requirement Statement: The instrument configuration shall be designed so as to be consistent with CG constraints specified in the Observatory to Science Instrument ICD Table 3.2-3.

Verification Method:	Calculation

Procedure Number: N/A

Configuration: Individual assemblies

Cycle Time: N/A

Verification Discussion/Results:

Table 3.2-3 (attached) shows the CG constraints. The attached spread sheet shows the results of the CG calculations. They are identical except as follows:

Support Assembly	Table 3.2-3	Calculated
X_{cg}	3.32 ± 1.00	3.44
Y_{cg}	$1.13 \pm .50$	.55
Z_{cg}	$.23 \pm .50$	.26

The Y_{cg} exceeds the requirement by $0.08 \pm .3$ inches.

ACIS as an assembly meets the requirements.

Peter C. Zhao 4-29-97

ACIS Cognizant Engineer Date

Interface Revision Notice

1. AFFECTED ICD NO. & REV.:	2. PIRN NO.:	3. IRN NO.:	4. SHEET 1 of 3
IF1-20, Revision B	20-0054		
5. PROGRAM:		6. PCN:	7. PANEL AFFECTED:
AXAF		AX000497	
8. ICD TITLE:			
Observatory-to-Science Instruments			
9. EFFECTIVITY(IES):		10. REASON FOR CHANGE:	
		ACIS Support Structure CG/Weight	
CHANGE ICD EFFECTIVITY	11. TO:	12. FROM:	
13. IRN NO.:	14. NEW IRN EFFECTIVITY:	15. PREVIOUS IRN EFFECTIVITY:	

16. DESCRIPTION OF CHANGE:

1. CHANGE Table 3.2-3, ACIS Equipment Control Weights and Moments, in accordance with "Was/Is" Pages, attached hereto.

17. PREPARED BY:	18. ORG:	19. DATE:	20. CONCURRENCE:
Melinda K. Self Melinda K Self	MSFC/EJ32	8 Aug 97	

21.

	ORG	DATE	SIGNATURE	ORG	DATE

22.

		DATE	APPROVAL & ACTIVITY	DATE	APPROVAL & ACTIVITY	DATE
ORG.						
CCBD NO.						

PIRN 20-0054

WAS

IF1-20 B
TRW-CM07A 02 May 1997

TABLE 3.2-3: ACIS EQUIPMENT CONTROL WEIGHTS AND MOMENTS

Component Name	Maximum Control Wt. (1,2) (lbs)		Center of Mass (in.) (3)			Moments of Inertia (lb-sec²-in) (3)		
			Xcg	Ycg	Zcg	Ixx	Iyy	Izz
Detector Assembly ACIS Total	37.7		3.84	0.57	0.21			
CFE Fiducial Light System	1.00							
CFE Trim & Survival Heater Sys.	0.90							
CFE Mounting Hardware	0.50							
Detector Assembly Total		40.10						
Vent Valve less Vent Tube	5.10		12.73	13.64	-0.07			
CFE Mounting Hardware	0.30							
Vent Valve less Vent Tube Total		5.40						
Vent Mechanical Interface	2.20		12.73	19.98	3.50			
CFE Mounting Hardware	0.10							
Vent Mechanical Interface Total		2.30						
Vent Electrical I/F	0.50		12.85	20.18	-3.94			
CFE Mounting Hardware	0.10							
Vent Electrical I/F Total		0.60						
Support Assy ACIS Total	133.80		3.32	1.13	0.23	64.80	15.90	68.90
CFE Trim & Survival Heater Sys	4.20							
CFE Mounting Hardware	1.00							
Support Assy Total		139.00						
Radiators (5)	13.50		3.23	-0.02	8.83	2.49	0.74	3.20
CFE Mounting Hardware	0.12							
Radiators Total		13.62						
Sun Shade	8.50		-5.34	-0.52	19.64			
CFE Mounting Hardware	0.10							
Sun Shade Total		8.60						
Telescope Shade & Posts	7.60		13.67	-0.63	20.39			
CFE Mounting Hardware	0.50							
Telescope Shade & Posts Total		8.10						
PSMC	32.90		6.00	12.00	-32.50			
CFE Mounting Hardware	1.10							
CFE Trim & Survival Heater Sys	1.00							
PSMC Total		35.00						
PSMC Cable Less Ends	6.10		—	—	—			
CFE Cable Clamps & Hardware	1.00							
PSMC Cable Total		7.10						
SIM Mounted Calibration Source	4.20		20.75	0.00	16.88			
CFE O-Ring and Hardware	0.20							
SIM Mounted Cal. Source Total		4.40						

ACIS Control Weight (1)	252.20
CFE Subtotal	12.12
Total Control Weight (2)	264.32

See next page for Table Notes

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20-004
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PAGE

PIRN 20-0054

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IF1-20 B
TRW-CM07A 02 May 1997

TABLE 3.2-3: ACIS EQUIPMENT CONTROL WEIGHTS AND MOMENTS

Component Name	Maximum Control Wt. (1,2) (lbs)		Center of Mass (in.) (3)			Moments of Inertia (lb-sec²-in) (3)		
			Xcg	Ycg	Zcg	Ixx	Iyy	Izz
Detector Assembly ACIS Total	37.7		3.84	0.57	0.21			
CFE Fiducial Light System	1.00							
CFE Trim & Survival Heater Sys.	0.90							
CFE Mounting Hardware	0.50							
Detector Assembly Total		40.10						
Vent Valve less Vent Tube	5.10		12.73	13.64	-0.07			
CFE Mounting Hardware	0.30							
Vent Valve less Vent Tube Total		5.40						
Vent Mechanical Interface	2.20		12.73	19.98	3.50			
CFE Mounting Hardware	0.10							
Vent Mechanical Interface Total		2.30						
Vent Electrical I/F	0.50		12.85	20.18	-3.94			
CFE Mounting Hardware	0.10							
Vent Electrical I/F Total	~~123.80~~	0.60						
Support Assy ACIS Total	~~133.80~~		~~3.32~~	~~1.15~~	~~-0.23~~	64.80	15.90	68.90
CFE Trim & Survival Heater Sys	4.20		3.44	0.55	0.26			
CFE Mounting Hardware	1.00							
Support Assy Total		139.00						
Radiators (5)	13.50		3.23	-0.02	8.83	2.49	0.74	3.20
CFE Mounting Hardware	0.12							
Radiators Total		13.62						
Sun Shade	8.50		-5.34	-0.52	19.64			
CFE Mounting Hardware	0.10							
Sun Shade Total		8.60						
Telescope Shade & Posts	7.60		13.67	-0.63	20.39			
CFE Mounting Hardware	0.50							
Telescope Shade & Posts Total		8.10						
PSMC	32.90		6.00	12.00	-32.50			
CFE Mounting Hardware	1.10							
CFE Trim & Survival Heater Sys	1.00							
PSMC Total		35.00						
PSMC Cable Less Ends	6.10		—	—	—			
CFE Cable Clamps & Hardware	1.00							
PSMC Cable Total		7.10						
SIM Mounted Calibration Source	4.20		20.75	0.00	16.88			
CFE O-Ring and Hardware	0.20							
SIM Mounted Cal. Source Total		4.40						

PIRN 20-0054

ACIS Control Weight (1)	242.20 ~~252.20~~
CFE Subtotal	12.12
Total Control Weight (2)	~~264.32~~ 254.32

PIRN 20-0054

See next page for Table Notes