SMITHSONIAN ASTROPHYSICAL OBSERVATORY

Progress Report No. 9

# The Design, Development, Testing, Fabrication, Calibration and Integration of a High Resolution Imager (HRI) for the Roentgen Satellite (ROSAT)

Contract NASW-3722

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## 1.0 Reporting Period: December 1, 1984 - February 28, 1985

## 2.0 Activity During Reporting Period

### 2.1 General

The HRI EM was returned to SAO upon completion of the first I&T at MPE. A re-test to verify the mechanical interfaces and to operate with the final MPE EGSE configuration was scheduled for February. Problems encountered with the HRI ion pump after T/V caused a slip of the re-test schedule to March, 1985. Fabrication of the HRI FM was completed at AS&E and the unit transferred to SAO on January 15, 1985. Preparations are now underway to close out the base contract with AS&E. Any repair and/or re-work required will be accomplished via purchase orders for the specific work tasks required. It is estimated 50K will be adequate for this work; the GSFC project office has concurred in this procedure for handling post-delivery repairs to the EM and FM.

### 2.2 Engineering Model

The EM survived its' return to the U.S. with no damage, and plans were made to finish the environmental testing started the previous reporting period.

A centrifuge facility was located in the area (Draper Laboratories) and tests with the mass model started on January 21. Following uneventful mass model tests, the EM was subjected to loads of 26, 27, and 28g, for the X, Y, and Z axes respectively. No visible damage was noted, and the unit was then run through a functional test which also disclosed no degradation in performance. This test completes the required static loads testing of the HRI which was not possible earlier because of the limited-capability vibration facility at Itek.

After static load testing, the EM was moved to Acton Labs for a two-week thermal vacuum (T/V) test. Since the S-120 was left at MPE after the first I&T period, the S-140 was moved to Acton to support the T/V test. T/V tests started late January and completed early February. The S-140 crashed once causing some delay in schedule; after replacement of a disk controller board by the DG Service Rep, testing continued with no problems surfacing until the chamber was brought up to ambient after completing the planned number of thermal cycles. The ion pump failed to start with the chamber pressure at ambient. The chamber was pumped down and the DA door opened. The ion pump was turned on and operated erratically. The door was then closed, the chamber brought to ambient, and the DA ion pump connected to the back-up Varian high voltage supply. The high voltage cable failed and the ion pump therefore could not be used to maintain vacuum.

Subsequent tests disclosed a leak in one of the three fiducial light windows; cause is assumed to be mechanical stress induced by the high temp cycle of the T/V test. All three windows were re-sealed and the DA pumped down on the pumping station in preparation for the second I&T at MPE.

## 2.3 Equalization Valve

The quotation for equalization valves was finally received from Parker-Hannefin late in December. The quoted price was about 30K higher than estimated (primarily because of high set-up costs) and no delivery date was specified. A delivery schedule was received on 18 January, showing earliest delivery 52 weeks ARO. Discussions with GSFC project resulted in a decision to proceed with valve procurement at the higher cost and late delivery, based upon a SAO statement that valve retrofit could readily be accomplished after delivery of the FM to MPE by providing a plugged hole (for later installation of the valve) in the DA prior to shipment.

This is the current plan pending contractual approval from GSFC to proceed with the P-H procurement.

## 2.4 Fiducial Lights

The tolerance of HRI fiducial light placement was requested by Dornier (through Hartmann). Apparently this information is necessary for the fid light periscope design activity presently underway. The actual positions of the fiducial lights on the FM were measured and the information forwarded to DFVLR via GSFC. A copy of the memo documenting the as-built configuration of the EM fiducial light assembly is provided as Appendix I.

It is not known whether the optical relay system can accommodate the HRI fiducial light positions since the periscope design is incomplete. Spare fiducial light boards have been procured however, and are available should DFVLR/MPE require alternate placement of HRI fiducial lights.

## 2.5 Software

EGSE software modifications have been completed and tested in preparation for the re-integration of the EM in March. Software has been placed under configuration control to assure only approved modifications are made and to keep mods to the minimum required for the remainder of the EM and FM test activity.

## 2.6 Data Processing Software

The following Data Items have been completed and delivered during this reporting period:

DI#24, Executive Program Systems Requirement
DI#25, DBMS Requirements Document
DI#29, System Specification Model
DI#30, Preliminary Users' Manual

The design of the processing system is rapidly approaching completion, and coding is scheduled to begin in May. In order for SAO to maintain schedule, MPE must initiate delivery of overdue specification, requirements, software sub-system design data, etc. A meeting is planned for March at MPE to discuss in detail those items which will soon become schedule drivers.

2.7 Flight Model (FM)

As noted above, the FM was delivered to SAO in January. It is being prepared for environmental testing, scheduled to begin shortly after the pre-environmental review. GSFC has requested T/V and EMI be performed on the FM, as well as a random vibration test at loads yet to be specified. Since delivery of the FM to MPE is tentatively specified as September-October 1985, it is anticipated the FM will be placed in storage upon completion of the environmental test program.

2.8 Microchannel Plates (MCP)

A preliminary recommendation has been made to use Cesium Iodide coatings on the MCP's rather than Mag Fluoride as was used on HEAO. A data package is in preparation for submission to the GSFC ROSAT Project Office; a formal recommendation to use Cesium Iodide coatings, and a request for approval will accompany the scientific justification and risk assessment provided in the data package.

2.9 AS&E (Status through January 31, 1985)

2.9.1 Progress through November, 1984

Summary

Activities on the program have slowed considerably. Delivery of the Flight Model is delayed by the fact that SAO support is required for most of the remaining assembly operations, and cannot be provided until interface incompatibilities discovered during spacecraft integration testing have become resolved. Assuming that design changes necessitated by these incompatibilities are received from SAO, delivery of the Flight Model is expected before the end of the next reporting period. Limited additional post-delivery support may be required for installation of trim components.

Reliability and Quality Assurance

Replacement parts for the epoxy microcircuits inadvertently installed in the Engineering and Flight Models were received and sent out for rescreening.

A damaged module flexprint was inspected. The damage was found to be in an area where it does not affect system operation or reliability, and therefore the nonconformance was dispositioned "Use As Is" with SAO concurrence/

An alleged problem with the potting of the Forward Assembly was investigated and found to be within normal manufacturing tolerances.

Mechanical Fabrication

Fabrication of the Flight Model is proceeding slowly for reasons stated above.

The Low Voltage Power Supply was received from SAO on 22 November and was installed in the Flight Model.

Some sheet model parts for the CDEA have still not been returned from a vendor for final assembly into the unit.

Flight Model Status

Aft Assembly completed.

All CDEA modules tested.

Fabrication of mechanical and electrical CDEA parts and subassemblies is complete but some vendor processing remains to be completed. Final assembly is still not complete.

Mechanical assembly of Forward Assembly is still not complete. Wiring is still in process.

2.9.2 Progress through December, 1984

Summary

Activities on the program continue at a very low level. Delivery of the Flight Model has still not taken place. A request for quotation was received from SAO to incorporate the modifications required by the spacecraft interface incompatibilities reported in the previous report, and for other additional work. A response is being prepared. Delivery of the Flight Model is now projected for January 1985. Limited additional post-delivery support may be required for installation of trim components and other tasks.

Reliability and Quality Assurance

A defective Vishay precision resistor, found in the Flight Model, was analyzed. It appears that this device is a genuine "random failure".

A defective connection was found in one of the Deutsch interconnection blocks. It appears that this connection was not mated properly during assembly due to excessively tight part tolerances. It was found that it was possible to establish a proper and reliable connection by following a special procedure.

A Ratiometric ADC module was found to be defective after CDEA testing at SAO. Failure analysis revealed that the failure was caused by an overstressed microcircuit (AD7510).

Additional weld samples were sent out for fracture control stress testing. These samples were subjected to X-ray inspection before testing and completed the required test of 100,000 cycles successfully. A Final Fracture Control Report is being prepared and will be submitted during the next reporting period.

A defect was found in the UV Calibration Mask. SAO will make a determination at a later date whether the defect will inhibit proper system operation or not. If so, the UV Calibration Mask in the Engineering Model will be used as a spare.

An updated materials list is being prepared.

Mechanical Fabrication

Fabrication of the Flight Model is still proceeding slowly.

Some sheet metal parts for the CDEA have still not been returned from a vendor for final assembly of the unit.

Flight Model Status

Aft Assembly completed.

All CDEA modules tested.

Fabrication of mechanical and electrical CDEA parts and subassemblies is complete except for some vendor processing. Final assembly is still not complete.

Mechanical assembly of the Forward Assembly is still not complete. Wiring is still in process.

2.9.3 Progress through January, 1985

Summary

The hardware phase of the program has been essentially concluded. The Flight Model has been delivered to SAO. Only two hardware tasks need further activity:

1. Fabrication of spare fiducial light boards in accordance with addendum number 4.

2. Replacement of pyrotechnic devices in the Flight Model following testing at SAO.

Completion of these items is planned for the next reporting period.

Delivery of the program data package is scheduled for February.

Design

The following Data Items were received from SAO and incorporated into the design documentation:

ECO Numbers 10305 through 10308 and 10311 through 10317

The Top Assembly drawing (E206-0500) was released.

Reliability and Quality Assurance

A dowel pin used in the Flight Model was found to have been made from material of non-traceable origin. The material from which this dowel pin was made has been analyzed and found to be SS 416, a suitable material for the program.

Electrical Fabrication and Test

Electrical fabrication of the Flight Unit is complete except for replacement of the pyrotechnic devices after testing at SAO, and fabrication of spare fiducial light boards.

Flight Model Status

Delivered

Documentation Status

Design drafting is complete except for incorporation of changes reflecting "As Run" module tests (Ref. ECO's 10318 through 10320).

The deliverable documentation package is being assembled for delivery during the next reporting period.

Work Accomplished During Reporting Period

The Flight Model has been delivered to SAO.

Hardware activities have been concluded.

Deliverable documentation is being assembled and checked.

3.0 CURRENT PROBLEMS

Continuing attempts to obtain a realistic and comprehensive EM test schedule have proved unsuccessful. The next scheduled I&T activity is scheduled for March 8-15; hardware was shipped on February 28 and is to arrive for set-up at MPE on March 1.

There is still no clear statement from MPE acknowledging the need for MPE personnel training in order to permit HRI EM and FM limited operation without SAO personnel present.

GSFC has agreed to have SAO provide to MPE suitably screened and tested LED's for the PSPC fiducial lights. No action has been taken on this direction pending receipt of LED specifications from Dornier.

Some difficulty still exists in specifying the loads to which the FM will be tested. It is anticipated GSFC will soon resolve the disparity between Dornier and GSFC analysis results, and provide timely direction to SAO for FM random vibration tests.

## 4.0 WORK TO BE ACCOMPLISHED NEXT PERIOD

A) Return EM to MPE for completion of I&T (with the EM FI structure).

B) Prepare and distribute Data Package for pre-environmental review.

C) Complete and submit recommendation for selection of MCP coating.

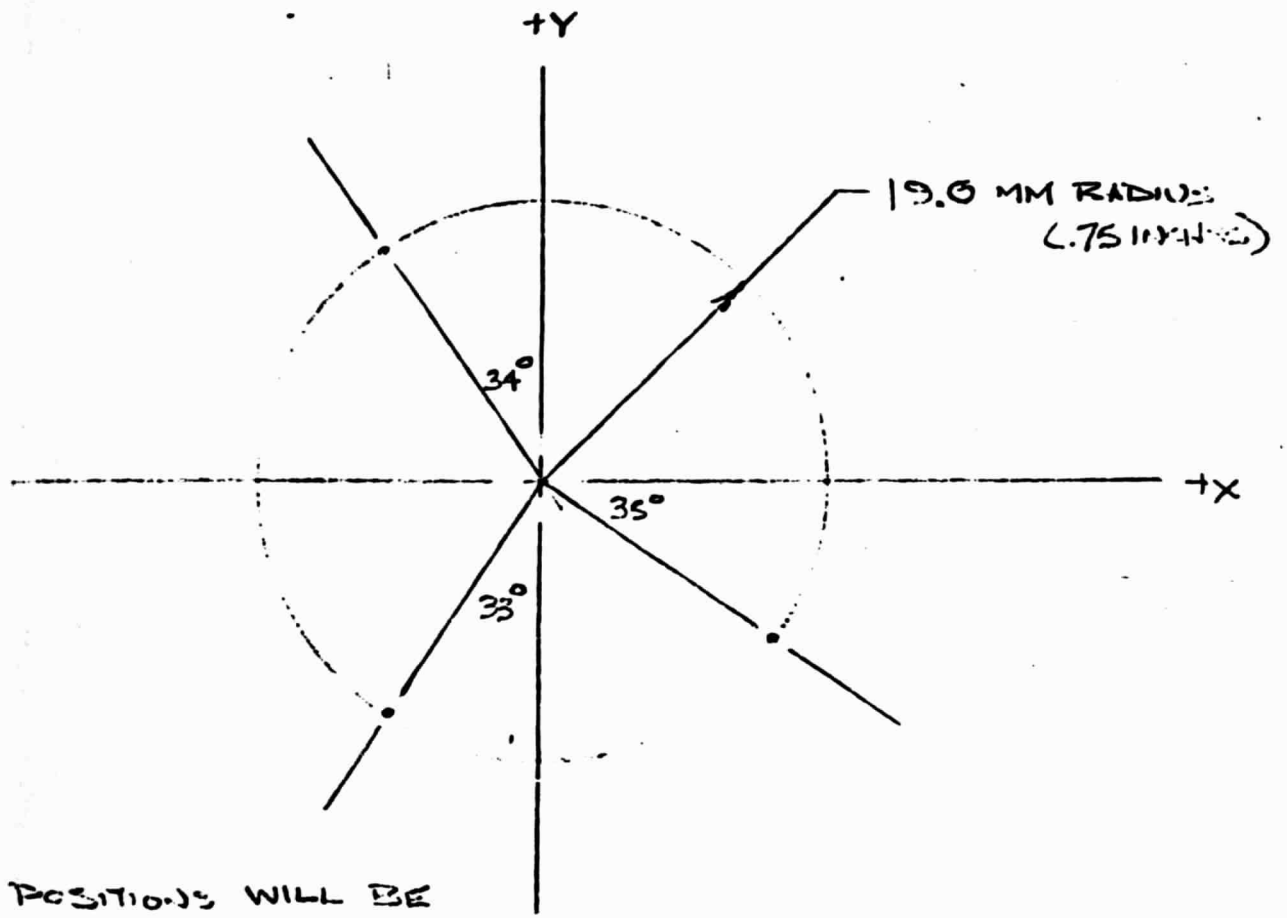
D) Initiate design of equalization valve mounting flange.

E) Prepare and submit SAO evaluation of the random vibration test data from the HRI EM vibration test.

F) Assess GSFC proposed random test spectrum for the HRI FM.

G) Support the loads meeting at GSFC on March 27, 1985.

# NOMINAL POSITIONS OF NRL FIDUCIAL LIGHTS.




ACTUAL POSITIONS WILL BE
±1 MM MAX FROM NOMINAL

G.K. AUSTIN
28 NOV 83
REVISED 18 JAN 84