IMAGE FUV Environmental Test Plan

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1. Introduction

The IMAGE FUV instrument consists of four deliverable packages which will be flown on the IMAGE spacecraft:

1) The Spectrographic Imager,
2) The Wideband Imaging Camera,
3) The Geocoronal Detector, and
4) The Main Electronics Package.

Drawing number 8110-A4 shows the integration and testing flow plan for the development of the FUV instrument. The drawing shows major fabrication and functional testing steps as well as the calibration of the different parts of the instrument and the environmental testing.

This plan defines the environmental tests which demonstrate that the design and fabrication of the FUV instrument are such that the instrument will survive launch and operation on orbit.

2. Main Electronics Package (MEP)

This package contains all instrument electronics except that which has to be mounted directly adjacent to the detectors for considerations of noise or interference. The design includes an external structure of .200" aluminum to provide radiation shielding for the electronic parts. Heritage construction techniques are used to mount part to the boards to resist vibration loads. Heat dissipating parts are mounted in heatsinks which are attached to the lower part of the frame to provide a short heat path to the spacecraft deck plate.

The design will be proven by performing a qualification level vibration test (8115-W7) on the ETU MEP unit. Proper fabrication of the flight unit will be demonstrated by performing a vibration of the flight unit to acceptance levels (8116-W7).

Proper operation over the full temperature range will be demonstrated by performing a thermal vacuum test on the flight unit (8310-W7). A functional test (8311-W7) will be performed at selected temperature dwells to demonstrate proper operation. Eight cycles will be performed to show no failure or degradation of the unit due to temperature cycling.

3. Geocoronal Detector

This unit consists of three sealed tube detectors containing oxygen cells and channel electron multipliers, along with the front end electronics and the a single high voltage power supply which power all three detectors. Interface to the MEP is by three digital lines.

The design will be proven by performing a qualification level vibration test (8113-W7) on the ETU unit. Proper fabrication of the flight unit will be demonstrated by performing a vibration of the flight unit to acceptance levels (8114-W7).

Proper operation over the full temperature range will be demonstrated by performing a thermal vacuum test on the flight unit (8305-W7). A functional test (8306-W7) will be performed at selected

temperature dwells to demonstrate proper operation. Eight cycles will be performed to show no failure or degradation of the unit due to temperature cycling.

3. Wideband Imaging Camera

This instrument is constructed from a telescope and optics which was developed for the Freija spacecraft, along with an MCP and phosphor screen detector assembly which is being designed and fabricated at the UCB, and a CCD and electronics assembly which is being developed at the Lockheed Martin Missiles and Space Corporation. A front cover assembly which is being developed at the Marshall Space Flight Center completes the instrument.

Since the telescope and optics system is identical to that which was successfully flown on the Freija spacecraft, the design of that portion of the instrument is considered to be qualified.

The UCB supplied detector and the LMMS supplied CCD camera assembly is a new design and so it will be vibrated to qualification levels using an ETU detector and CCD assembly which will be mated to a mock-up of the telescope and optics (8112-W7). This test will qualify the design of the UCB detector and middle housing assembly and the CCD camera and front end electronics assembly.

The front cover is mechanically isolated from the rest of the instrument (it has an independent mount to the spacecraft deck), and so it will be qualified independently by Marshall Space Flight Center.

Following the qualification of the separate components, the flight unit will be assembled and focused, and the entire flight unit will be vibrated to acceptance levels (msfc96M64244). A late addition EMI shield (which also has no connection to the WIC structure, but rather mounts only to the spacecraft deck, will be included in the acceptance vibration test. We believe that this is acceptable since this is a light, stiff structure which can be readily analyzed.

A thermal vacuum test will be done on the completed flight unit (msfc96M64245). Proper operation over the full temperature range will be demonstrated. A functional test (8307-W7) will be performed at selected temperature dwells to demonstrate proper operation. Eight cycles will be performed to show no failure or degradation of the unit due to temperature cycling.

4. Spectrographic Imager

The Spectrographic Imager is an imaging spectrograph which is designed to create an image at 1218 Angstroms while strongly rejecting light at 1216 Angstroms. A separate set of optics with an associated detector system also generates an image at 1356 Angstroms.

The spectrograph and optics system is being designed and fabricated by international science collaborators at the Central Spatial de Leige in Belgium, while the MCP detectors, the XDL anodes, and the electronics is being designed and fabricated at the UCB. The UCB is also providing a front cove assembly.

The flight unit spectrograph and camera assembly, along with the flight front cover and the ETU detector assemblies were vibrated to qualification levels at the CSL to both qualify the entire design and to verify the proper fabrication of the flight spectrograph and the front cover.

A thermal vacuum test was then done on that assembly to demonstrate proper operation of the system over the full temperature range, including verification that neither the resolution nor the 1216 rejection is degraded.

In parallel with this activity, the flight detectors are undergoing development at the UCB. This activity has included a qualification vibration test (8117-W7) on the ETU detectors which will be followed by an acceptance level vibration test on the fully assembled flight detector and electronics assemblies.

Following the vibration test, a thermal vacuum test including 8 thermal cycles (8309-W7) will be done on the flight detector assemblies with their electronics. Correct operation of the detectors will be verified by performing a full detector functional test (8304-T1) at selected thermal dwells.