THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

FINAL REPORT

"Seal Sample Fixtures"

Submitted to:

NASA
Marshall Space Flight Center
Huntsville, Alabama

For:

Contract: NAS8-38609, D.O. 133

Submitted by:

Edwin White
James B. Hadaway
Center for Applied Optics

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1. Introduction:

This report summarizes work performed by the Center for Applied Optics (CAO) at the University of Alabama in Huntsville (UAH) on the contract entitled "Seal Sample Fixtures" for NASA's Marshall Space Flight Center (contract NAS8-38609, Delivery Order 133).

The development of the International Space Station is critically dependent upon development and testing of materials that will require exposure to the space environment. The seals between the modules are one of the more important examples. The choice of seals depends upon the seal materials' susceptibility to atomic oxygen, UV radiation, and the combined external space environment. Also, the choice of thermal control materials depends on their susceptibility to the space environment. The Space Environmental Effects Branch at MSFC developed a flight experiment to provide information on the effects of the space environment on seal and thermal control materials. The experiment, called the Passive Optical Sample Array (POSA), involved exposing several different material samples to the atomic oxygen, UV radiation, and combined effects of the space environment. The POSA experiment is currently flying on the Russian Mir space station. It was necessary during the assembly of POSA to develop an understanding of available fabrication and metrology techniques in order to develop several monitoring systems for the experiment. UAH provided this understanding.

2. Technical Approach:

The work performed under this effort consisted of applied research related to the space environmental effects on spacecraft structural materials. The specific tasks to be associated with this effort were:

Task 1. UAH was to prepare ground test hardware and POSA flight hardware for the seals by cutting, milling, grinding and etching as required for investigations of materials effects associated with the exposure of the samples to the space environment. This effort was to be accomplished using equipment located in the Space Environmental Effects Branch at MSFC.

Task 2. UAH was to perform metrology on additional hardware as required and develop proper metrology and fabrication techniques and tooling necessary to perform the required tasks.

Task 3. UAH was to perform metrology tasks related to the fabrication of the POSA Vacuum Ultraviolet Sensor. The task would involve the development of detailed fabrication and calibration procedures as well as the production and testing of flight fixtures.

Task 4. UAH was to conduct laboratory investigations of atomic oxygen effects related to the re-flight of the Tethered Satellite System (TSS-1R). The focus of this task was to be

electrically conductive thermal coatings, particularly RM400 paint. Research under this task was to include suggested alternatives for the mitigation of the effects of atomic oxygen on the electrical and optical properties of RM400.

3. Work Summary:

Mr. Edwin White of UAH worked on-site within the Space Environmental Effects Branch at MSFC performing the tasks as described above. He reported his work directly to the NASA scientists involved in the project at the time. The results of his work are simply summarized here.

All of the aluminum flight parts were machined for the POSA Pinhole Camera for measuring atomic oxygen flux and direction. Polyethylene gaskets for the flight assembly were also machined. Mass equivalent models of the camera assembly were also manufactured for use in vibration testing.

All of the aluminum parts for the diode housing, Teflon gaskets, and glass filters for the Ultraviolet Radiation Sensor flight assembly were machined. Mass equivalent models of the diode housing were also made. Lastly, the electronics box for this part of the experiment was made.

24 Vacuum UV Carousel Assemblies were machined. Each assembly consisted of a sample carrier, retainer plate, base plate, and cover plate, all match-drilled and precision machined.

Numerous 1" diameter aluminum shims were made as substrates for paint samples.

Proper fabrication as well as metrology techniques and tooling required to perform the above tasks were developed as needed.

4. Conclusion:

All required tasks were completed on schedule. The POSA assemblies went together well. It will be interesting to see how the parts held up after return from the MIR station.

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Edwin White & James B. Hadaway

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