Large Optic Coating Facility

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The Optics and Radio Frequency Division here at Marshall is in the process of converting a fully operational thermal vacuum test chamber, (fig. 106), into a multipurpose large optic coating facility. During the 1996 fiscal year, the thermal vacuum test chamber here at MSFC has become a lifesaver for two major projects—the Advanced X-Ray Astrophysics Facility (AXAF) and Space Station Alpha. It has contributed greatly by serving a dual role as a preliminary and certified bakeout chamber for AXAF, and as a test facility for the Space Station nonpropulsive vent test. In the near future, resistive and electron beam coating sources will be installed in this 18-ft-diameter chamber. This will give NASA the capability to coat large mandrels for replicated optics, large segmented and nonsegmented optics, and large polymer film type optics.

The large optic coating facility houses the thermal vacuum test chamber which will be converted into a large optic coating chamber. The vacuum chamber has a usable inner diameter of 15 ft and total outside length of 16 ft. On the chamber there are a multitude of ports for feedthroughs and fixturing. The chamber is housed in a class 10,000 cleanroom that has a 26-ft ceiling, two-piece monorail with a 1-ton crane, and 24-ft doors that allow entrance for large apparatus. The control center displays all the functions of the system, and has a 486 computer to monitor the interior temperature. The supporting crew of the chamber consists of four roughing pumps and blowers, two 48-in cryopumps, two 48-in gatevalves, and one 13,000-gal liquid nitrogen tank. The conversion from bakeout chamber into a large optic coating chamber is presently in progress.

The Fixture Design Branch here at MSFC is performing preliminary design, design and detailing to complete the conversion modifications. Equipment to be designed includes a protected shroud/liner, scaffolding to support evaporation sources, 12-ft-diameter optic support structure, and a replicated optic support structure. The optic support structures will contain rotary motion capability. Once the designs are completed the fabrication will begin. New equipment is being procured which will give this vacuum chamber the capability to perform thermal, electron beam and eventually sputtered coatings. The various types of coatings will include aluminum, gold, and magnesium fluoride just to name a few. The completion date for this large optic coating chamber is approximately June 1997.

The Optics and Radio Frequency Division plans to transform the large optic coating chamber into a world-class coating facility. This will allow NASA to achieve great accomplishments and benefit the corporate sector. Tasks we are pursuing include coating of large mandrels, segmented and nonsegmented optics, and large polymer film-type optics. A future objective for this vacuum chamber, should additional support become available, will be to perform multilayer dielectric coatings or perhaps multilayer x-ray coatings with "depth-graded d-spacing."[1] The coating possibilities for this large optic vacuum chamber are limited only by one's imagination.

[1]Joensen, K.P.; Hoghoj, P.; Christensen, F.; Gorenstein, P.; Susini, J.; Zeigler, E.; Freund, A.; and Wood, J.: "Multilayered Supermirror Structures for Hard X-ray Synchrotron and Astrophysics Instrumentation." Harvard-Smithsonian Center for Astrophysics, Reprint Series, no. 3732, 1993.

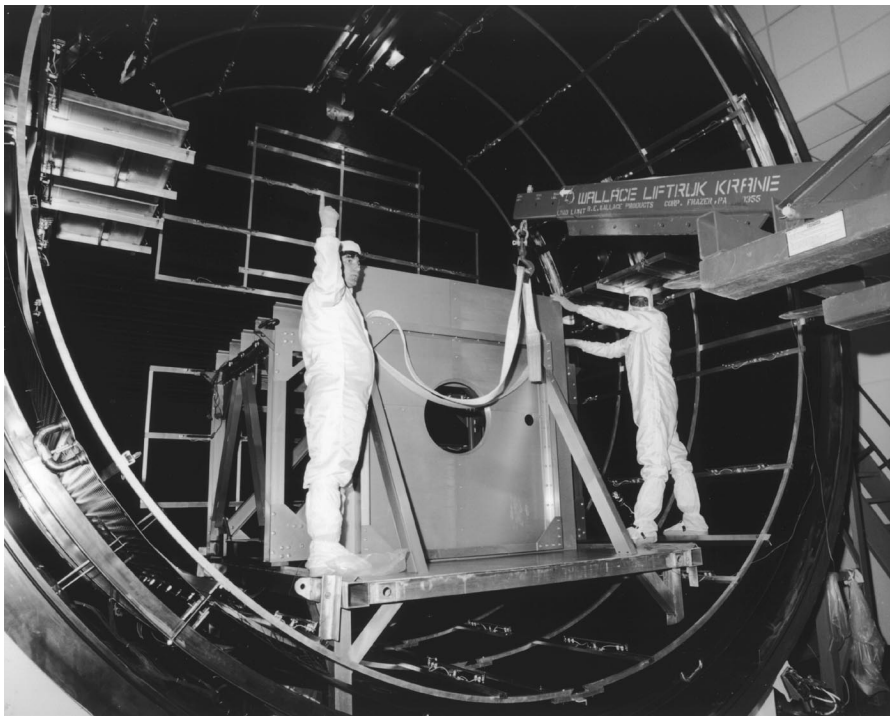

Figure 106.—Large optic coating chamber interior. NAS, Inc. personnel are shown removing an AXAF support structure.

Sponsors: Solar Thermal Upper Stage Flight Experiment (STUS); AXAF; *International Space Station*

Biographical sketch: Tommy Thompson is an optical physicist in the Optics and Radio Frequency Division at MSFC's Astronics Laboratory. He conducts scientific research on thin film deposition, surface roughness, optical phase conjugation, and x-ray coded masks. He earned a B.S. degree in applied physics from Alabama A&M University , and is pursuing an M.S. in thin film deposition from A&M. Thompson has been employed at MSFC since 1988.