Fact Sheets

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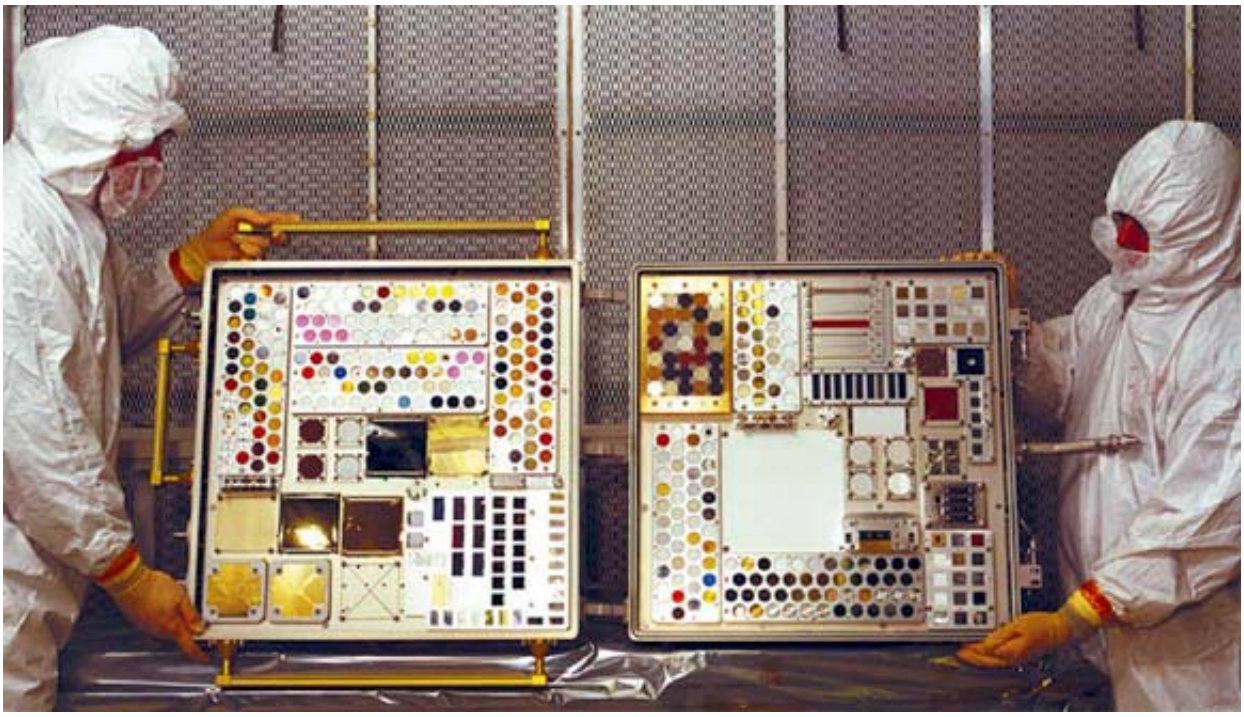
MISSE: Testing materials in space



MISSE project specimens are placed onto trays and inserted into Passive Experiment Containers (PECs).

The Materials International Space Station Experiment (MISSE), the first experiment mounted externally on the International Space Station (ISS), will investigate the effects of long-term exposure of materials to the harsh space environment. MISSE will evaluate the performance, stability, and long-term survivability of materials and components planned for use by NASA, commercial companies and the Department of Defense (DOD) on future Low Earth Orbit (LEO), synchronous orbit, and interplanetary space missions. The Long Duration Exposure Facility (LDEF), which was retrieved in 1990 after spending 69 months in LEO, revealed that space environments are very hostile to many spacecraft materials and components. Atomic oxygen, which is the most prevalent atomic species encountered in LEO, is highly reactive with plastics and some metals causing severe erosion. There is also extreme ultraviolet radiation due to the lack of an atmospheric filter. This radiation deteriorates and darkens many plastics and coatings. The vacuum in space also alters the physical properties of many materials. Impacts of meteoroids and orbiting man-made debris can damage all materials exposed in space. The combined effects of all of these environments on spacecraft can only be investigated in space. On Earth, a material can only be subjected to one environment at a time. MISSE will evaluate materials currently being used and those planned for use in future space missions.

Materials Tested

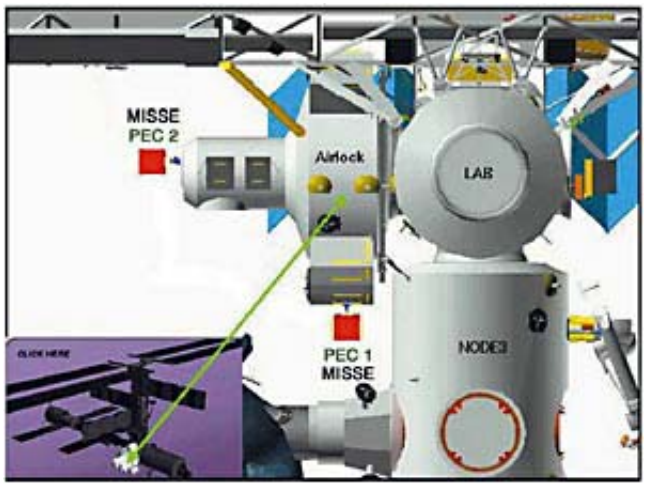
There are about 1,500 samples being tested on the MISSE project. Samples range from components such as switches, sensors, and mirrors to materials like polymers, coatings, and composites. There are also biological materials such as seeds, spores, and various types of bacteria being evaluated. Each material on the mission had to be individually tested in the laboratory prior to being selected. The ultimate test for the materials is when they are exposed to the space environment. In the laboratory, each material can only be exposed to one particular simulated environment at a time. In

space, they are exposed to all of the environments at once. Besides testing new materials, MISSE will also be addressing questions concerning current materials, such as those being used in communication satellites which are being plagued with premature failures of the solar cell power arrays. New generations of solar cells with longer expected lifetimes will also be tested.

MISSE will also be testing coatings used to control heat absorption and emission temperatures of satellites. The hostile environment of space limits the useful life of currently used coatings. New coatings, which are expected to be much more stable in space and therefore have longer useful lives, will be tested. MISSE will also address a major problem for a manned exploration of Mars: shielding the crew from the very energetic cosmic rays found in interplanetary space. New concepts for lightweight shields will be tested on MISSE. Ultra-light membrane structures are planned for solar sails, large inflatable mirrors and lenses. The effects of micrometeoroid impacts on these materials will also be investigated.

Langley Materials

Some of the space polymers to be tested on MISSE such as Triton Oxygen Resistant were developed by John W. Connell of Langley's Advanced Materials and Processing Branch. Colorless polyimide films known as CP1 and CP2, created by former Langley employee Anne K. St. Clair, are also being tested on MISSE. Langley is world famous for the development of space-tailored polymers. Before polymers can be used in space, they must be tested in space.



PECs will be attached to the International Space Station using clamps which lock onto handrails outside ISS.

Deploying MISSE

The materials selected for the mission are placed into four suitcase-like Passive Experiment Containers (PECs). The PECs are used for transporting experiments to and from ISS. During the STS-105 mission, astronauts Daniel T. Barry and Patrick G. Forrester will conduct a spacewalk to attach MISSE to handrails located on the airlock and high-pressure gas tanks. Once attached, the astronauts will open the cases and expose MISSE's materials to the space environment.

After a year of exposure in space, MISSE will be retrieved in the same manner it was deployed. Tests will be conducted to determine the effects of its exposure. These tests will determine which materials are strong enough to survive in space. MISSE will provide significant new materials and component technologies to help the U.S. maintain its space superiority.

Participants in MISSE

The MISSE Project is a cooperative endeavor managed by NASA Langley Research Center. Participants include: Johnson Space Center, Marshall Space Flight Center, Glenn Research Center, the Materials Laboratory at the Air Force Research Laboratory, and the Boeing Phantom Works. Shuttle/ISS MISSE integration is performed by the USAF's DoD Space Shuttle and ISS Payload Integration Directorate.

For more information on MISSE, visit <http://misse1.larc.nasa.gov/> on the Internet or contact NASA Langley Research Center Office of Public Affairs, Mail Stop 115, Hampton, VA 23681-21999, 757-864-5036.

Find this article at:

http://www.nasa.gov/centers/langley/news/factsheets/MISSE.html