

An example of Air Force supported SBIR/STTR technology that has been transitioned into an Air Force or other DoD system or subsystem or used by Air Force test ranges and facilities or maintenance depots.

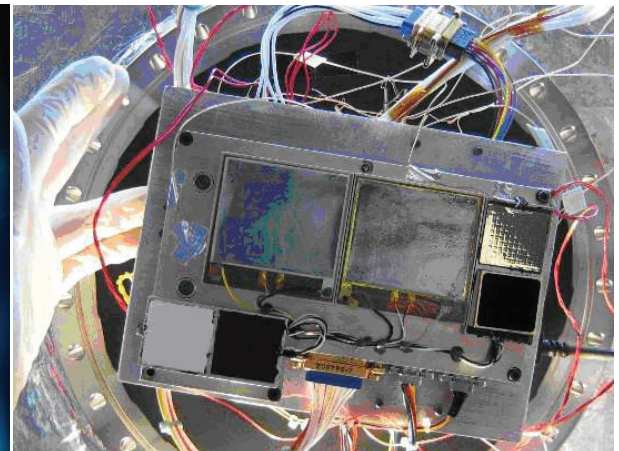
SBIR Topic Number:
 AF04-147

SBIR Title:
 Active Calorimetry
 Development for
 Testing of Active
 Thermal Control
 Coatings and Devices

Contract Number:
 FA8650-05-C-5045

SBIR Company Name:
 Advanced Thermal and
 Environmental
 Concepts, Inc. (ATEC)
 College Park, MD

Technical Project Office:
 AFRL Materials &
 Manufacturing
 Directorate, Wright-
 Patterson AFB, OH



Left: Graphic showing location of the Materials on the International Space Station Experiment-6 (MISSE-6) experiments on the exterior of the International Space Station. Right: MISSE-6 tray that includes ATEC's heat-flux based emissivity (HFBE) module after all the experiments were attached.

Heat Flux Based Emissivity Measuring Method Breakthrough

- The Air Force needs a space-ready instrument that can accurately measure the emissivities, absorptivities, and long-term stabilities of passive and active coatings and thermal structures
- Under a SBIR project, ATEC developed a heat flux based emissivity (HFBE) measuring method that provides direct measurements of the heat flows through the emitting surfaces of several coatings or surfaces simultaneously
- The Air Force Research Laboratory paired the HFBE technology with another separate SBIR-developed technology (Sensortex Inc.'s electrostatic radiator device) to develop an integrated thermal emission management system
- The integrated device was installed in the MISSE-6 package at NASA Langley and deployed on the exterior of the International Space Station in 2008

Commercialization Pilot
 Program Series

RX2008-104

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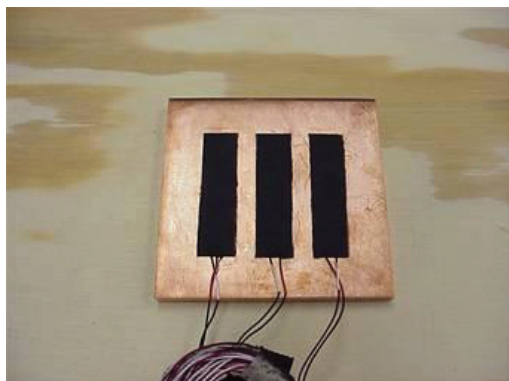
Air Force Requirement

The space environment is a harsh one that includes radiation, atomic oxygen, and rapid changes in temperature that can be harmful to satellites and spacecraft. To ensure that a satellite functions properly, its temperature must be controlled.

The Air Force needs a space-ready instrument that can accurately measure the emissivities, absorptivities, and long-term stabilities of several passive and active coatings or thermal structures simultaneously.

SBIR Technology

Under an Air Force Small Business Innovation Research (SBIR) project, Advanced Thermal and Environmental Concepts, Inc. (ATEC) developed a heat flux based emissivity (HFBE) measuring method that provides a direct measurement of the heat flow through the emitting surface. The heat flux passing through the surface, the surface temperature, and the ambient temperature are the only information needed to calculate the surface emissivity. There is no need for heaters and their control systems. The method allows for emissivity values of multiple surfaces to be measured at the same time.



Three heat flux sensors attached to a copper plate

Application and operation of this method is much simpler than calorimetric methods because it does not require careful thermal insulation of the substrate from the surroundings. This technique allows emissivity measurements of the newly developed variable emissivity surfaces with significantly lighter and more energy-efficient measurement equipment that can operate for long term space missions and allows emissivity measurement of more than one surface simultaneously on the same test substrate.

Transition Impact

By pairing the ATEC HFBE technology with another separately SBIR-developed technology – Sensortex Inc.'s (Kennett Square, PA) electrostatic radiator (ESR) device – the Air Force Research Laboratory (AFRL) was able to successfully integrate technologies to develop a thermal emission management system suitable for use in space. The management system requires very little power (<2 milliwatt), is lightweight and compact, and has a very fast response time.

The ATEC-Sensortex integrated device was tested in a simulated space environment where the device was mounted on the inside of a large vacuum chamber. Once a steady-state temperature was obtained, a voltage was supplied to one side of the ESR structure, and the membrane was drawn down to contact the rigid surface of the ESR structure. The heat flux sensor had a very fast response time, so the scientists were able to monitor the emissivity of the hybrid device as its temperature was changing. The results from the ESR structures demonstrated a large difference in emissivity values, which is required to allow for a wide range of active thermal control.

As a result of these successful tests, the device was installed in the MISSE-6 (Materials on the International Space Station Experiment-6) package and deployed on the exterior of the International Space Station in 2008.

Company Impact

Dr. John Lawler, President of ATEC, stated, "The Air Force SBIR program, and especially the AFRL-led initiative to pair our HFBE technology with Sensortex's ESR application, provided a significant opportunity for both firms. We look forward to using the HFBE capability in other military and commercial areas. In the short term, we will soon use our HFBE technology to study another company's electrochromic variable emissivity surfaces."

ATEC provides cost-effective contract engineering and R&D services that help engineering and technology companies solve their advanced thermal management problems.



SBIR/STTR

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