

High-Tech, Low-Temp Insulation

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The fiery reentry of future reusable space planes can receive a cool reception as they slam into the Earth's atmosphere by using a new lightweight metal insulation. That same technology has been applied to the creation of emergency rescue blankets and mittens capable of thwarting extremely cold weather.

S.D. Miller & Associates of Flagstaff, Arizona has received Small Business Innovation Research (SBIR) contracts through the Ames Research Center. The company is operated by Steve Miller, who has served as the principal investigator on several NASA SBIR awards over the past 11 years. The SBIR work has launched an investigation into a unique flexible insulation blanket suitable for the thermal protection systems of future spacecraft during atmospheric entry. A low-density, honeycomb-like material was fabricated, capable of inhibiting convective and radiative heat transfer. This advanced, but lightweight, insulation was made from

special metal alloys and ceramics. Shaving off any weight from a reusable launch vehicle means a decrease in fuel and frame weight and, ultimately, lowers the cost of hurling each pound of payload into space.

Spacecraft are not only vehicles to benefit from using the improved lightweight, multi-layer thermal insulation. Current aircraft designs can be made more efficient by reducing the weight of the insulation system, such as that used in certain areas of a jet engine. The cloth-like honeycomb material can withstand temperatures as high as 2,200 degrees Fahrenheit. An outstanding characteristic of the fabrication process is that a broad range of materials can be used to form the honeycomb to match the temperature range of the application.

Miller's group saw several potential spinoff applications using the same honeycomb concept. Collaborating with NASA scientists, the team made a lightweight plastic insulation for blankets and clothing that has properties better than wool fibers or polyester fleece. Better yet, the honeycomb structure can even be made from recycled milk containers - an excellent use of refuse.

Utilized in blankets, the plastic honeycomb material keeps a person four times warmer than wool, even when subjected to cold and wet conditions. Blankets made from the plastic insulation are also non-allergenic, and dry five times faster than blankets made of wool. Thermalon Industries, Ltd. in El Segundo, California, is commercializing the technology in various products including blankets and mittens. "Our first production run of mittens was sold out before New Year's. We believe they were bought mostly by extreme skiers and ice climbers through word of mouth advertising," says Miller, who is a principal stockholder in Thermalon.

Eventually, about 70,000 emergency blankets that use the new insulation technology are expected to be distributed annually by Thermalon Industries. A program to demonstrate the unique attributes of the blanket was begun with NASA Ames' Disaster Assistance and Rescue Team. Also planned is a full evaluation of the blankets in concert with ambulance companies and American Red Cross chapters.

Yet another commercial product is emerging from the space program work. Mittens are now in production which are warmer than wool and made from recycled plastic. The mittens are designed for people in extreme cold weather, including recreational, industrial, and military users. Informal field testing of the mittens has been carried out in the frozen climes of Antarctica, Miller reports.

Silk is used as a glove lining for greater breathability and extra comfort. A waterproof/breathable shell on the outside of the product facilitates faster drying. Glove palms use a rubberized material for better grip.

Since hands perspire more than other parts of the body, handwear often gets damp and this moisture greatly increases heat loss from the hands. "Our honeycomb insulation doesn't trap moisture, so hands stay warmer," Miller says. "Active people from snowboarders to driveway shovelers will benefit since perspiration increases with greater activity," he adds.

Other spinoff insulations are also deemed feasible. The Whirlpool Corporation is evaluating the material as a moisture-tolerant alternative to chlorofluorocarbon (CFC)-blown foam that would make their refrigerators even more efficient. Units that hold and maintain super-cold fluids, and other industrial applications would also benefit from the technology's unique advantages.