

Laboratory Develops Biofuel-Powered Heated Vest

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Around the world, military members from Alaska to Afghanistan work in harsh, frigid environments. Temperatures in the Afghani Mountains have been recorded as low as minus 51 degrees Farenheit, while Elmendorf Air Force Base, Alaska, sees up to 69 inches of snowfall each year.

Military personnel must have user-friendly, affordable and enduring protection from inclement weather conditions as a result.

In searching for a solution, scientists at Air Force Research Laboratory's Materials and Manufacturing Directorate evaluated several methods to maintain a healthy body temperature in these colder climates by conducting market research and consulting with Air Force Research Laboratory's Propulsion Directorate, the Army Natick Soldier Center, OnPoint Technologies and the Air Force's Force Protection Battlelab.

Vacca Incorporated's biofuel-powered flameless catalytic heaters showed significant promise in meeting military member's cold-weather needs.

Through the Company Grade Officer Initiative, the directorate funded the integration of the heaters into a vest.

The lightweight, easy-to-use prototype combines a standard work vest with two of Vacca Inc.'s biofuel-powered heaters in the two front panels of the vest.

Using fuel cell concepts developed at Los Alamos National Laboratories, Vacca Inc. developed heaters that work by passing methanol or ethanol across a catalyst membrane. The reaction byproducts are heat, carbon dioxide, and small traces of water.

The prototype weighs dramatically less, at only 12 ounces, than the 1.7-pound commercial products on the market today and has the potential to weigh eight ounces in future designs.

The prototype provides enduring heat and comfort over existing approaches. The 15-piece cold weather uniform, currently worn by military members, can be bulky and cumbersome to wear and carry.

Additionally, these individuals are at greater risk when they must take off body armor to add or remove layers of clothes.

Commercially-introduced lithium ion heated jackets provide heat for two and a half to three hours before recharging the battery.

In contrast, Vacca Inc.'s prototype, can last 22 hours with 100 cubic centimeters of fuel in low heat mode (22 Watt) and 12 hours in high heat mode (42 Watt) according to the company's final report.

The vest's internal fuel supply has high/low/off settings for increased control.

Both the vest and fuel are much more affordable to the Department of the Defense compared to the available commercial products.

Current commercial products cost more than \$500 per unit, while the full-scale version of Vacca Inc.'s technology will cost \$150-\$250. Market rates for methanol fuel are between \$3 and \$5 per gallon.

The prototypes purchased by Air Force Research Laboratory's Materials and Manufacturing Directorate are currently used to demonstrate the feasibility of the technology.

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