Designers to the stars: TEES engineers CRAVE redesign of out-of-date space suits

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Astronauts don't care much about fashion: They've been wearing essentially the same space suit for almost 40 years. But they care a lot about the technology in the suit that keeps them alive.

That vintage technology may be getting a 21st Century update, thanks to engineers in the Texas Engineering Experiment Station (TEES). TEES is the engineering research agency of the State of Texas and a member of The Texas A&M University System.

"The current life support system was designed for the Apollo moon flights," said Michael Schuller, an associate research engineer in the TEES Center for Space Power (CSP) and lead engineer for the life

support system project. "That was pre-1969. It hasn't changed much since."

Updating the space suit life support system is the first undertaking of the Crew, Robotics And Vehicle Equipment (CRAVE) project. CRAVE is a five-year, $48 million NASA-funded project intended to design and develop equipment for future human spaceflight programs.

TEES, the University of Alabama-Birmingham and Houston engineering firms Oceaneering and Hamilton-Sunstrand are designing, analyzing, prototyping and developing new hardware for the CRAVE project.

TEES engineers are working with space flight experts at NASA's Johnson Space Center (JSC) in Houston to put up-to-date technology to work in the suits' life support systems.

The TEES engineers carried out a "functional decomposition" of the life support system. This process examined each individual function the system performs and broke it down to its most basic components.

"This is what automakers do when they create a new car or update an existing model," Schuller said. "They break down every function to its smallest piece. We did the same thing for the life support system."

By late May 2005, the TEES researchers had completed the function structure. The list of functions guided an intensive brainstorming session by A&M engineering and science faculty and student researchers and space flight experts from JSC. The brainstorming participants came up with a list of design concepts that was refined during June and July.

"We put them through a go-no go screen: can the concept be ready in time to use it; is it safe; does it fit into the backpack concept," Schuller said.

Ultimately, the TEES researchers sent 25 conceptual designs to JSC. After another NASA contractor analyzes the designs, the team will perform more detailed designs.

The TEES design proposals range from more efficient ways to keep the suits -- and the astronauts wearing them -- cool while outside a spacecraft to more compact ways to carry oxygen for astronauts to breathe and new methods of removing carbon dioxide from the suit's atmosphere.

"Because we have particular expertise in thermal and energy management, we came up with some ideas NASA hadn't thought of yet," Schuller said.

The oxygen system design, for instance, would replace the tanks of compressed oxygen used in the current life support system with smaller tanks of liquid oxygen. This approach would provide more oxygen in smaller tanks, Schuller said.

The size and weight of the life support system will be important issues as NASA plans for future exploration of Mars.

"In a microgravity environment, the mass of the suit and backpack isn't that important," Schuller said. "But a suit and backpack that weighs 300 pounds on Earth weighs 50 pounds on the moon; 120 pounds on Mars. That weight becomes significant pretty quickly."

An Earth weight of less than 70 pounds for both suit and backpack would be ideal, Schuller said.

The CRAVE research team includes students and faculty from TEES, the Dwight Look College of Engineering at Texas A&M University and Texas A&M University-Kingsville. Raymond Askew, a distinguished

research scientist in TEES's Center for Space Power, is the project manager.

Source: TEES