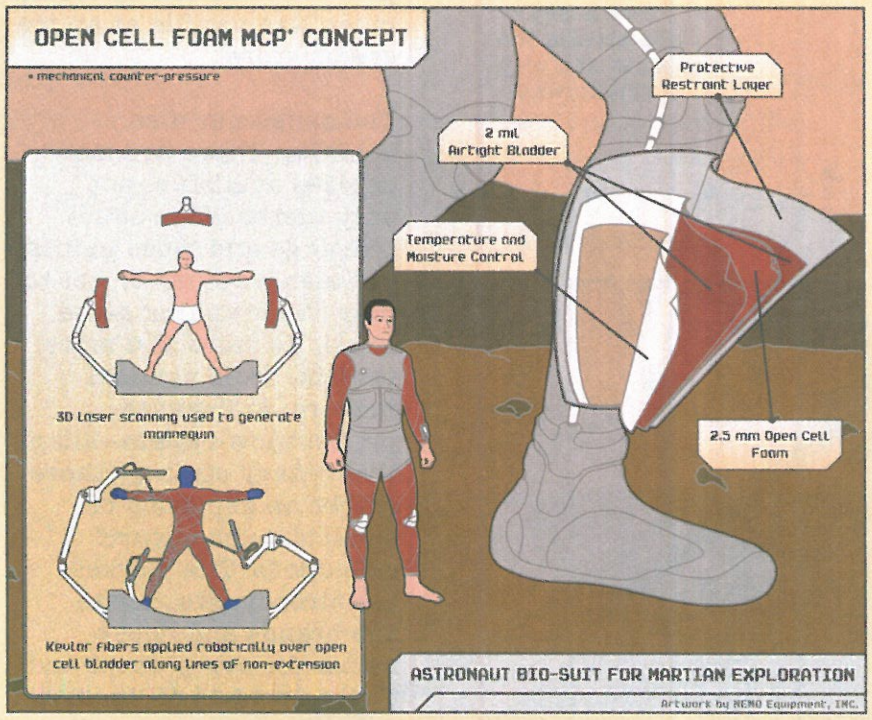
Research at the Massachusetts Institute of Technology Advances Wearable Outer Space Gear. By Kathlyn Swantko

A BioSuit Takes Shape



Out There: High performance construction and materials are used in the new BioSuit for space activity.

"The USA was an inspiration to the world in space travel during the 60s and 70s. NASA needs to recover this inspiration, if our nation is to be exceptional again!" says Buzz Aldrin, a member of NASA's Space Team and one of a few astronauts to walk on the moon, who believes Mars is the future for the U.S. Space Program. "We are going to take transportation to the surface of Mars, and lead the world in putting humans on Mars!"

MIT is taking a lead in helping Aldrin reach his goal. Under the direction of Dava Newman, professor of aeronautics and astronautics and engineering systems, MIT has been pursuing the development of a spacesuit for a Mars mission.

Early research on a space activity suit (SAS) dates back to the 50s and 60s. MIT's recent program has advanced the SAS development. For over a decade, Newman and others from around the world have been researching wearable outer space gear. MIT has worked with researchers from the European Space Agency's (ESA) Space Medicine Office, Kings College, and the University College in London to test various "skinsuit" prototypes.

"We perform stress, strain, thermal, and fatigue material tests. We also perform testing in a vacuum chamber, since we need realistic representation of the space environment. It gets complicated when we perform the analysis for a 3D body, since the shapes, tissues, and musculoskeletal system is so complex," says Dr. Newman.

A Design Fit for Spiderman

MIT's tight fitting Spiderman-like BioSuit is an experimental space activity suit, incorporating advancements in engineering and calculating measurements that produce a more simplified SAS prototype. The sleek design allows the suit to be pressurized close to the skin, made possible by the BioSuit's tension lines.

"Our BioSuit design criteria includes achieving 30 KPa (Kilo Pascal) pressure, or 4.3 psi, to keep an astronaut alive in the vacuum space," explains Dr. Newman. "In addition, our materials research and technology demonstrations have led us to our current prototypes that can achieve our desired pressure (~30 KPa) directly on the body (mechanical counter pressure) using passive elastic materials, in conjunction with active materials."

According to Newman, the BioSuit's patented design mimics the Spiderman suit, giving the astronauts more freedom of movement through the use of tension lines that don't break when the astronauts bend their arms and knees. Newman notes, "We have calculated the minimum extension, tension and compression over the body surface, which the astronauts need to safeguard their flexibility."

The BioSuit features a bi-directional weave that hugs the astronaut's body from the neckline to the feet, and is designed to neutralize the lack of Earth's gravity felt in space. Dr. Newman and Brad Holshcuh, an MIT graduate student, have achieved breakthrough results, inventing shape memory alloy (SMA) coils for compression garment use. Active materials like nickel-titanium SMAs allow the nylon and spandex suit to be shrink-wrapped, making the BioSuit skin even more close-fitting.

Dr. Newman is also looking beyond space for new applications of her BioSuit technology. "I'm passionate about the application of compression suits for cerebral palsy (CP)," she states. It could assist in CP by improving muscle tone, range of motion and hopefully, augmented locomotion. ●

Kathlyn Swantko is the president of the FabricLink Network.

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