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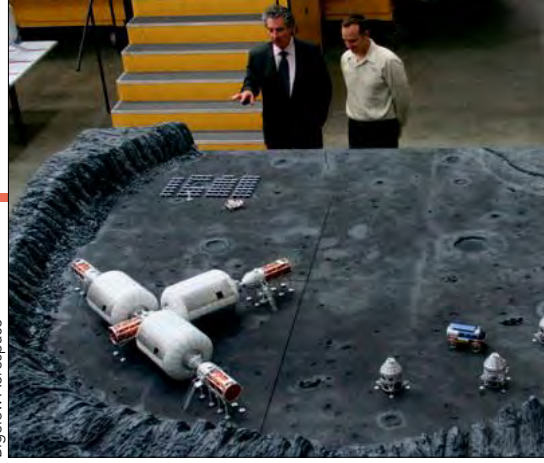

Bigelow Aerospace

Bigelow Aerospace wants to put expandable habitation modules on the Moon for scientific exploration and commercial enterprise.

Inflatable modules aim for room in space habitats

NASA/Stephanie Schierholz

William Gerstenmaier, NASA's associate administrator for human exploration and operations (left), views the Bigelow Expandable Activity Module at the Bigelow Aerospace facility in Las Vegas.

What will the space habitats of the future look like? The answer could be something like the privately-built and NASA-funded Bigelow Expandable Activity Module, or BEAM, scheduled for delivery to the International Space Station in September by a Dragon cargo module.

BEAM is made by Bigelow Aerospace out of a flexible Kevlar-like weave material that will be tucked unpressurized inside Dragon. Outside the space station, BEAM will be removed from the unpressurized pallet of the Dragon by an astronaut operating the station's Canadian-built robotic arm. The arm will hold BEAM while a built-in pressurization system inflates the structure with air carried to space in pressure canisters. The arm will steer BEAM to berth at the station's Tranquility module.

NASA wants astronauts to hang out inside BEAM and inspect it periodically so the agency can assess whether to incorporate the technology in its long-term plans for human exploration of asteroids and Mars. Greater safety will be one of the key advantages of inflatable technology over rigid structures, according to Bigelow Aerospace.

"In a broad sense, the same kind of materials that are used for the BEAM are used in bulletproof vests, which is why expandable habitats are so much safer than traditional metallic structures," says Michael Gold, director of D.C. operations and business growth for Bigelow. "If you were getting shot at, what would you rather have for protection: a Kevlar vest or a piece of aluminum? I'll take the Kevlar vest."

The Kevlar-like material also will be covered by a micrometeoroid and orbital debris protection layer.

BEAM is scheduled to remain attached to the space station for at least two years, but Gold hopes it will stay much longer than that. When and if NASA decides to eject BEAM from the space station, it will burn up on reentry into the atmosphere.

BEAM's makers also say the technology promises larger volumes with less cost and weight.

Gold says Bigelow is withholding some technical details for BEAM, both because of proprietary concerns and export-control reform issues. Sharing technical information related to most space systems requires a license from the U.S. Department of Commerce or the U.S. Department of State, and in many cases the information cannot be made public without violating federal export-control laws.

BEAM is the creation of Robert Bigelow, an entrepreneur who made his wealth in real estate and construction. In 1999, he founded Bigelow Aerospace in a cluster of facilities on a 50-acre site in North Las Vegas.

From the start, Bigelow viewed expandable habitat technology as the anchor for private-sector space commerce in low Earth orbit and deep space exploration. To that end, Bigelow Aerospace underwrote the fabrication and testing in orbit of two subscale pathfinder expandable spacecraft, Genesis 1 and Genesis 2 in 2006 and 2007. Both were boosted into orbit from ISC Kosmotras Space and Missile Complex near Yasny, Russia, aboard converted Russian intercontinental ballistic missiles. With 406 cubic feet of usable volume, the Genesis modules tested technologies for Bigelow's larger expandable structures.

In 2013, NASA awarded a $17.8 million contract to Bigelow to provide BEAM for attachment to the space station in 2015.

The inflated structure will add 565 cubic feet of volume — about the size of a large family camping tent. The space station crew will periodically float into BEAM to inspect the module and collect performance data.

Bigelow has set its sights beyond just the space station. The company is developing a full-scale system, the BA 330, a larger expandable structure that would yield roughly 12,000 cubic feet of internal space for up to six crew members. Bigelow intends BA 330s to support zero-gravity research including scientific missions and manufacturing processes An even larger spacecraft, the Olympus, is in planning stages that would provide 2,250 cubic meters of internal volume.

"We have done conceptual work and have even constructed a full-scale model of Olympus," Gold says.

Once BEAM proves itself on board the space station, Gold says, the intent is to someday deploy the larger volume Bigelow space modules in Earth orbit, eventually setting the stage for their use on the moon, Mars and other deep space destinations.

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