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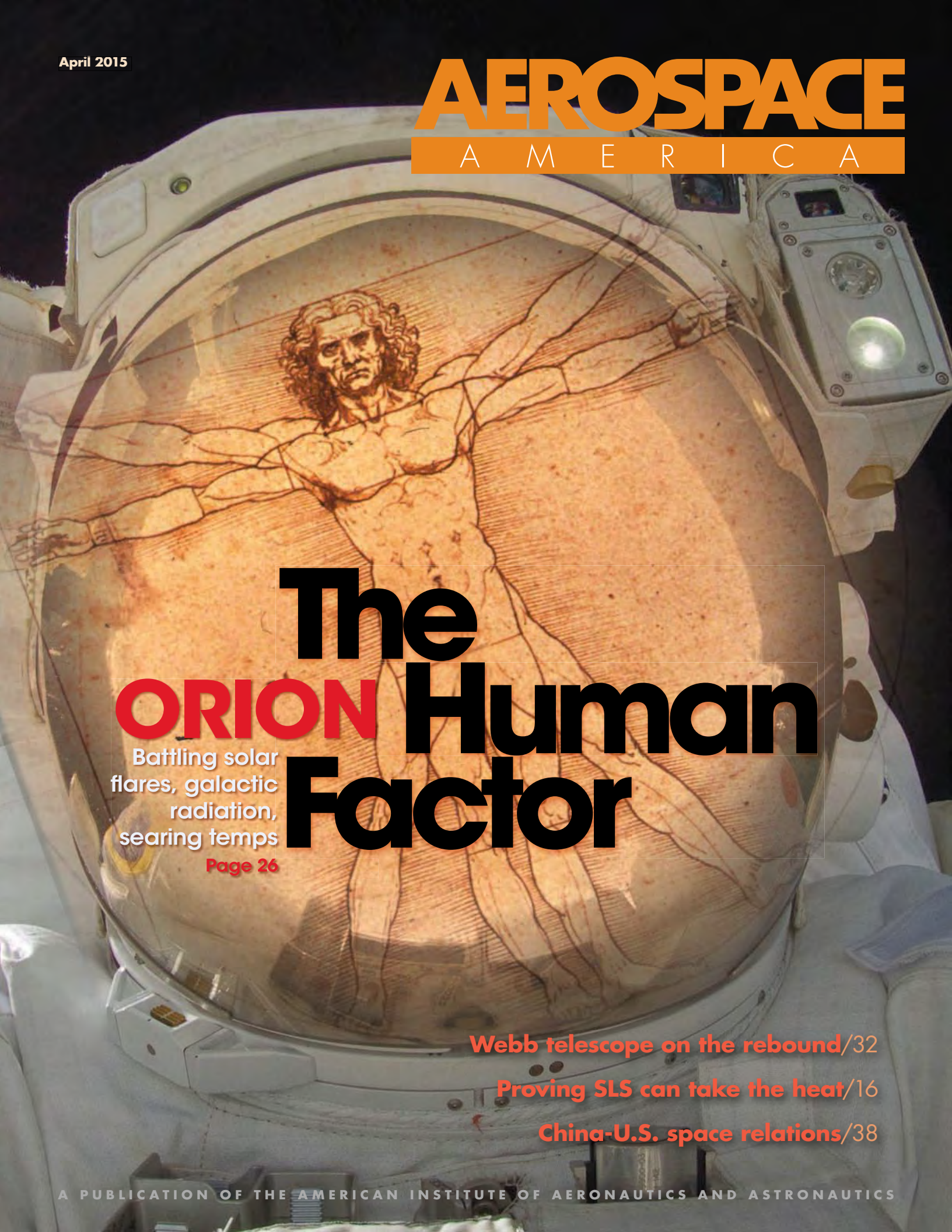

The ORION Human Factor

Battling solar flares, galactic radiation, searing temps

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Keeping Mars pristine

If scientists ever find microbes on Mars, they'll want to be sure the organisms didn't get there by stowing away on a robotic rover or lander during their time in the factory.

NASA maintains a library of microbes known to stubbornly inhabit spacecraft clean rooms. Scientists know that if they find any of those on Mars, it's likely the microbes weren't native to the planet. Better would be to know whether any of those could survive in the Martian environment at all and, if so, for how long. To find out, NASA has begun a series of high-altitude balloon flights called E-MIST, short for Exposing Microorganisms in the Stratosphere.

"We are taking up terrestrial microbes [by balloon] to see how they respond to that environment," said David J. Smith, the E-MIST principal investigator at NASA's Ames Space Biosciences Division in California. "By sending micro-organisms into the stratosphere, it is analogous to the Martian surface. We want to know what happens in that environment. Can they survive and to what extent are they dying off?"

Microbes are loaded into a 36-kilogram (80-pound) carrier built at Kennedy Space Center's Prototype Development Lab. Four doors open at stratospheric altitude to expose the microbe samples for predetermined amounts of time.

The next flight of this setup over the New Mexico desert could be later this year — perhaps in August or September.

On E-MIST's first mission — a five-hour journey to 125,000 feet last August from Fort Sumner, New Mexico — the carrier contained bacillus pumilus, a highly resilient spore-forming bacteria strain originally isolated from NASA's Odyssey spacecraft being prepared for a Mars sendoff. Spore-forming is a survival strategy for certain bacteria that enables them to persist in extreme conditions, including space and perhaps on Mars.

The environment at 125,000 feet is super dry, irradiated and hypobaric, meaning the air pressure is lower than at the surface, Smith said. Those are conditions that mimic Mars. The flight was a shakeout mission, Smith said last August.

A high-altitude balloon designed to test how to avoid microbial contamination on Mars lifts off from New Mexico.

NASA

"We only tested the hardware on the first flight. The exposure was 2 seconds long, so all the microbes survived just as we would expect them to," Smith added.

On a future flight, the exposure will be longer, perhaps up to 8 hours. Ground simulations with another bacillus species indicate that 99.9 percent of sunlight samples in the stratosphere will be killed within 6 hours. However, bacillus pumilus is much more radiation resistant than the previous species tested on the ground. "We don't know what the stratosphere tolerance will be; this kind of experiment has never been conducted before," Smith said.

The E-MIST effort is focusing on ways to have a say in the development of procedures for preventing the microbial contamination of Mars by robotic spacecraft.

The E-MIST hardware was built through funding from Rocket University, which is a training program paid for by the NASA Office of the Chief Engineer. Funding also comes via a research grant from the Kennedy Space Center.

While the NASA library of spacecraft facility microbes is huge, the intent is to start with some of the hardiest known microbes from the archive.

While E-MIST can house spore-forming bacteria that have remarkable resistance to atmospheric extremes, non-spore-forming bacteria, archaea, fungi, algae, and viruses can also be examined.

Casting an eye to the future of human explorers stepping onto the Red Planet, Smith said: "We need to keep Mars as pristine as possible, for as long as possible, before astronauts get there."

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