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Anti-radiation vest eyed for Orion crew

StemRad of Tel Aviv is working with Lockheed Martin Space Systems to determine whether StemRad's radiation shielding vest, which is designed for first-responders on Earth, can be adapted for astronauts on Orion deep-space missions.

The two-year initial collaboration is partly funded by Space Florida, the state's aerospace economic development agency, and Israel's Matimop agency, which fosters international research and development programs involving Israeli technology.

Space radiation, particularly an extreme solar particle event, or SPE, is a known hazard for astronauts. High doses can lead to acute radiation syndrome, commonly known as radiation sickness. Depending on the severity of the event, the solutions for astronauts on the International Space Station range from sheltering in a protected part of the station to heading for the emergency return capsule. For crews en route to Mars in NASA's next-generation space capsule, Orion, the return option won't be available.

Orion is "designed to be a safe haven, so the probability of an astronaut getting ARS while inside the spacecraft is not likely," says Razvan Gaza, Lockheed Martin's lead for Orion radiation protection. But since extreme solar particle events can potentially last for days, astronauts may need to "leave the confines of the Orion storm shelter briefly to perform other tasks — in a docked habitat, for example" Gaza adds.

If a solar event were detected, the Orion crew members might don the proposed space vest, called AstroRad, over their clothing. The contoured ra-



Oren Milstein, StemRad CEO, next to a manikin wearing a preliminary concept of the AstroRad vest for use in deep space. It is based on the StemRad 360 Gamma radiation vest worn by Milstein and by first responders on Earth.

diation vest aims to minimize the probability of radiation-induced cancer by selectively protecting the lungs and bone marrow, which are especially prone to radiation damage, explains StemRad CEO Oren Milstein.

AstroRad focuses its protection on stem cell concentrations within those organs, Milstein says, because radiation-induced mutation produces "thousands of mutated daughter cells, exponentially increasing the likelihood of cancer." He calls the strategy "smart shielding."

Because AstroRad is intended for temporary use inside a spacecraft, it is not designed to be integrated with current spacesuits. But if it proves effective in its primary role, it could be studied for extravehicular activities, Milstein says.

Francis Cucinotta, a radiation expert and professor in the University of Nevada's Department of Health

Physics who is not involved with AstroRad, suggests that there could be lunar applications, too.

"Although the main protection on the moon is active dosimetry to alert astronauts to take shelter inside a vehicle," he says, AstroRad could "buy more time to get to a shelter before the cumulative dose from an SPE becomes unsafe."

NASA has options beyond AstroRad to explore, too. Charles Limoli, a researcher in the Department of Radiation Oncology at the University of California, Irvine, while not familiar with the AstroRad system, notes that "biological countermeasures are under development [to protect] various tissues depending on radiation dose."

In other words, astronauts could take medication rather than don vests. However, Limoli cautions, protecting the brain and central nervous system is problematic "due to the protective blood-brain barrier that limits the diffusion of many potential mitigating agents into the brain."

Dave Murrow, business development manager at Lockheed Martin, says that AstroRad is "promising in that it blends the latest in stem cell research with the latest in materials capability."

If its development is successful and "reaches an acceptable technical readiness level," Murrow says, "the decision to fly AstroRad on Orion missions would be determined by a trade" between the benefit to astronauts and "the penalty of the shield's mass," alongside the usual safety reviews and space qualification procedures.

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