

GUNS GONE

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Bozeman-built computer to test limits of lunar radiation on NASA mission



ADRIAN SANCHEZ-GONZALEZ

Brock LaMeres' RadPC space computer is scheduled to be on the surface of the moon by mid-March.

SKIP ANDERSON
MSU News Service

BOZEMAN — When NASA's unmanned lunar lander launches from Florida next week, it will carry with it a radiation-tolerant computer developed at Montana State University. The computer was created by MSU faculty member Brock LaMeres. LaMeres is a professor in MSU's Department of Electrical and Computer Engineering, which is part of MSU's Norm Asbjornson College of Engineering.

The launch of the lander, named Blue Ghost, is scheduled to launch Tuesday, Jan. 14 at 11:11 p.m. Mountain Standard Time atop a SpaceX Falcon 9 rocket from the Kennedy Space Center in Florida. The lander will then orbit Earth for 25 days before taking a

four-day journey to the moon, where it will orbit for 16 days. Blue Ghost is expected to set down near a volcanic feature called Mons Latreille, which is located within a 300-mile-wide basin in the upper-right quadrant of the Earth-facing side of the moon. Once on the lunar surface, the lander and 10 onboard science and technology instruments are expected to operate for one lunar day — or around 14 Earth days — plus a few hours into the darkness of the lunar night.

"Brock LaMeres is a decorated faculty member at MSU, receiving recognition for teaching and research in addition to innovation in technology," said Alison Harmon, MSU's vice president for research and economic development. "He is among our most entrepreneurial researchers who has spun out a company and perseveres to

ensure that his inventions deliver economic impact through commercialization. It is gratifying to see his radiation-tolerant computer be tested on this upcoming space mission."

According to LaMeres, the computer, called RadPC, is three times as stable as the current state-of-the-art satellite computers due to its ability to withstand potentially crippling radiation emitted by the sun and other celestial bodies. RadPC prototypes have been tested in space seven times, including on board the International Space Station and in self-contained satellites orbiting Earth. One of the biggest challenges for the space computer will test its ability to withstand radiation after it passes through Earth's radiation belts while in transit to the moon and on the lunar surface.

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"This will be the first time our computer will go through the radiation belts," LaMeres said. "Once outside the belts, there is no protection from radiation whatsoever. So, we'll get bombarded from all the sun's radiation in addition to that from other stars."

The mission, called Ghost Riders in the Sky, is part of NASA's Artemis lunar-surface space campaigns. According to LaMeres, the Ghost Riders mission could subject the computer to intense levels of radiation even on the surface of the moon.

"When the Earth is between the moon and sun, the Earth blocks radiation," he said. "However, if a strong solar wind occurs, it can actually bend and extend the Earth's magnetic fields. If the fields extend so far that they encompass the moon, it could lead to extreme radiation on the surface."

Measuring 4 inches square and 0.5 inches thick, RadPC is about the size of a slice of bread. Like most space computers, it has underwhelming processor speeds by off-the-shelf PC standards and RAM that's measured in kilobytes, not the gigabytes of a home PC. That's not to say RadPC doesn't pack computing punch in order to meet NASA's stringent expectations while operating in the harsh environment of space. But computers engineered for space, LaMeres explained, are designed to perform hyper-specific jobs. RadPC relies on four redundant computers mounted on the same chip to endure inevitable radiation strikes while in space. It accomplishes this feat by having each chip run software to check that the others haven't had their identical coding disrupted by radiation.

This patented radiation-tolerant technology is being commercialized by an MSU spinoff company called Resilient Computing, based in Bozeman. Idaho National Laboratory, NASA, Raytheon and the U.S. Special Operations Command provided funding for RadPC, which cost around \$10 million to develop over 15 years.

More than 100 MSU undergraduate students and 20 MSU graduate students have worked on this high-profile project, as well as nearly a dozen faculty. Staff engineers from the Space Science and Engineering Laboratory, housed in the Department of Physics in MSU's College of Letters and Science, were critical to building the payload to carry RadPC on the ongoing project.

"MSU students have contributed significantly to the development of RadPC," LaMeres said. "And they have developed skills along the way that will help them as they become computer scientists and engineers."

The Ghost Riders mission will help prepare for future human missions to the lunar surface as part of NASA's Moon to Mars exploration approach. The Blue Ghost lunar lander was developed by Firefly Aerospace as part of NASA's Commercial Lunar Payload Services initiative, which contracts private companies to transport science and technology payloads to the moon to support future human exploration.