BOZEMAN DAILY CHRONICLE

BIG SKY

CITY DESK: 587-4491 | CITYDESK@DAILYCHRONICLE.COM

SECTION C | SATURDAY, SEPTEMBER 21, 2013

ROADWORK AHEAD

Colorado rushes to repair mountain roads before winter weather grips state | PAGE C3

Police reports, obituaries PAGE C2

NASA taps MSU professor for next phase of space computer technology

By SEPP JANNOTTA
MSU News Service

Montana State University engineering professor Brock LaMeres has received a two-year grant for $200,000 from NASA to continue building a radiation-tolerant computer system that is rocket ready.

The funding is a third boost from NASA for LaMeres' work on a radiation-hardened computing platform.

LaMeres, an associate professor in MSU's Electrical and Computer Engineering Department, and his two doctoral students, Justin Hogan and Raymond Weber, successfully flew their computer on a NASA high-altitude balloon and ran it without failures for 10 hours.

Their second major test comes in March 2014 when their computer system will fly on a rocket that will take it 73 miles into space and return to Earth 15 minutes after launch. For that phase of work, MSU received $100,000 from NASA.

Work on the project began in 2010 with a three-year, $750,000 grant LaMeres received from NASA's Experimental Program to Stimulate Competitive Research, or EPSCoR. This latest nod from NASA is a lesser grant amount, but it comes with the ultimate carrot, LaMeres said.

If the "environmentally aware" computer LaMeres and his students are developing performs during on-the-ground vacuum-chamber and thermal tests in 2015, LaMeres said the MSU team would be invited to submit an application for their work to be carried on one of the space agency's CubeSat launch vehicles, which put small research satellites into orbit.

"It's a great thing for us because we've matured the architecture of this computer all the way from drawing it up on a whiteboard to where it's pretty close to being flight-ready," LaMeres said.

MSU SPACE SCIENCE AND ENGINEERING LABORATORY/ ILLUSTRATION

Launched in 2011, MSU's student-built satellite, HRBE, is still orbiting Earth. Having received three separate grants from NASA, a team from the MSU College of Engineering is hoping they will have a chance to launch a research satellite to study a radiation-tolerant computer they're building.

Once aboard a satellite, the real test of the technology would finally begin.

"Out there in the extreme radiation environment of space, things can turn hostile in a hurry," LaMeres said. "The computers we use on the surface of the earth are protected from radiation by our atmosphere and magnetosphere. But out in space, radiation can wreak havoc."

While most of the radioactive particles streaming through space are not likely to damage a computer, there are certain widely dispersed particles that pack particularly high energy and can pass right through a space vehicle and traverse an entire computer chip, LaMeres said.

These radiation hits, called single-event effects, don't come as a continual bombardment, and a satellite might only encounter one or two of these during a typical pass through orbit. The problem is that no amount of shielding can stop these high-energy particles, so a computer crash using modern parts is imminent. The question is how to handle it.

More MSU | C2

MSU/from C1

Built exclusively from off-the-shelf materials, the system LaMeres and his students have designed can overcome single-event effects. Using nine reprogrammable processors and radiation-sensing devices, the system can detect when a powerful stray particle compromises one of the processors.

In MSU's approach, three of the processors work in parallel and compare their results to ensure a failure hasn't occurred. The other six processors are held in reserve. In the event of a radiation strike, the damaged processor gets replaced with a spare and normal operation continues.

Rather than rebooting the entire system, once the computer senses a radiation strike, a malfunctioning processor is automatically reprogrammed to its original state and readied to provide back up in the case of another failure, LaMeres said.

Faster and far cheaper to build, LaMeres said their system overcomes some of the shortcomings common to existing shielded, custom-built processors typically used on space flights.

Because the computer system is environmentally aware and can repair itself, astronauts and satellites would not have to stop other tasks to fix computer malfunctions.

The group's research is being done in collaboration with MSU Space Science and Engineering Laboratory.