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The Eclectic Engineer

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Mechanical engineering professor Darrell Pepper was the 2010 winner of the Harry Reid Silver State Research Award, the university's top research honor.

The Eclectic Engineer

An open mind and an eclectic orientation have led UNLV engineering professor Darrell Pepper to pursue widely varying and innovative research. What will the Harry Reid Silver State Research Award winner think of next?

STORY BY DIANE RUSSELL

PHOTOGRAPHY BY R. MARSH STARKS

Darrell Pepper's research impacts Nevada, but many of his research interests reach far beyond the state's borders.

In fact, some even reach beyond our planet.

From solar power to wind energy to building a habitat on Mars, the research subjects that interest the longtime mechanical engineering professor seem endless. He acknowledges that he finds few limits when it comes to his research pursuits.

Pepper received the 2010 Harry Reid Silver State Research Award, which was established in 2001 to honor the U.S. senator for his support of UNLV and to recognize research that is both highly regarded and responsive to the needs of the community and state. As part of the award, he received a $10,000 stipend, funded with private donations from the UNLV Foundation.

"I'm honored to receive this award," says Pepper, who joined the UNLV engineering faculty 18 years ago. The director of the Nevada Center for Advanced Computational Methods and a previous interim dean of the Howard R. Hughes College of Engineering, Pepper has several areas of expertise, including computational fluid dynamics and heat transfer. He has channeled his expertise into a number of innovative projects.

One is a small prototype of a solar-powered airplane. At only 15 pounds, it has flown successfully, powered solely by extremely thin solar panels attached to its exterior. The thin-film panels serve as the skin of the upper part of the wing surface. The airplane is small, but its solar panels, if perfected, have the potential to be installed in any number of places, including cars, home roofs, and even airplanes, he says.

One characteristic that makes the plane project different from many solar-powered projects is that the panels on the plane do not have to have a direct, 90-degree orientation to the sun. As long as the panels receive some amount of solar radiation, they will absorb energy from the sun.

Another of his alternative energy projects involves the conversion of wind power to electricity, an area he has been studying for years.

"Some years ago, I conducted the first wind assessment in Nevada using meteorological data from the Nevada Test Site," he says, noting that he is currently assessing the potential for wind energy in other locations in Nevada and northern Arizona. "I've been working on wind energy projects for Nevada since the mid-'90s. Nobody was interested back then. Turns out I'm getting more than I can handle now. Recently, I've been assessing the viability of small vertical axis wind turbines that individuals could use to produce their own electricity."

One of his other interests is how to build lunar and Mars habitats. In conjunction with engineering professor Nader Ghafoori, who is an expert in concrete, Pepper is working toward creating habitats that can be built from regolith (more commonly known as moon or lunar dust) and from dust on Mars. The idea is that someday astronauts may be able to build and live in these shelters.

The regolith can be poured into aluminum forms. Once the material is compressed and vibrated inside the forms, it will become rigid, producing walls that can stand vertically without support. Because of the consistency of the regolith, compacting the material into the forms will result in strong, easily produced walls that astronauts can then fashion into a dome. In order to conduct research on this subject here on Earth, basalt that has been ground into dust is substituted for regolith because its consistency is similar.

This research is being put to use in post-earthquake Haiti, where concrete is substituted for the regolith and basalt, Pepper says. He explains that by pouring the cement and water mixture into the forms and compressing the forms, walls can be produced much more quickly than they can be made by traditional means, thus facilitating a faster rebuilding process.

Asked how he has come up with such unusual and innovative research projects, Pepper says they are often just dropped in his lap, and he finds himself saying, "That's interesting; let's see what we can do.

"A good idea is always a good idea. It's just a question of timing as to whether it will catch on."

Pepper will have an opportunity to share his ideas with a different group of students soon. He was recently appointed distinguished visiting professor at the U.S. Air Force Academy and will serve there for 10 months in the engineering mechanics department beginning this summer. He was also recently nominated for the international ENI Award for his work on wind energy modeling.