To widen path to outer space, UF engineers build small satellite

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It's not much bigger than a softball and weighs just 2 pounds. But the "pico satellite" being designed and built in a University of Florida aerospace engineering laboratory may hold a key to a future of easy access to outer space — one where sending satellites into orbit is as routine and inexpensive as shipping goods around the world.

"Right now, the way satellites are built, they're all large, one-of-a-kind and very expensive," says Norman Fitz-Coy, an associate professor of mechanical and aerospace engineering and the lead investigator on the project. "Our idea is that you could mass produce these small satellites and launch 10 or 20 from a single launch vehicle."

The satellite is the first ever built at UF and may be the first orbiting spacecraft to be built in Florida, said Peggy Evanich, director of space research programs at UF.

Fifty-one years ago, the former Soviet Union inaugurated the space race with the launch of Sputnik. Since then, satellites have transformed communications, navigation and climatology, as well as science and the military. But satellites remain large, ranging in size from basketball to school bus proportions; expensive, with costs typically in the hundreds of millions to billions of dollars; and slowly hand-built as one-of-a-kind devices, rather than speedily mass produced, Fitz-Coy said.

Scientists and engineers now hope to change that legacy.

"There is a national push to make satellites smaller so that you can provide cheaper and more frequent access to space," he said.

As part of that push, the National Science Foundation this fall created the Advanced Space Technologies Research and Engineering Center at the UF College of Engineering. Headed by Fitz-Coy, the center will seek to develop "pico- and nano-class small satellites" that can be built and launched for as little as $100,000 to $500,000, according to the NSF. The UF center will receive NSF funding for five years for the research.

Fitz-Coy said small satellites are not anticipated to totally replace larger ones, but rather to complement them by adding new capabilities. For example, he said, "swarms" of small satellites could take multiple, distributed measurements or observations of weather phenomena, or the Earth's magnetic fields, providing a more comprehensive assessment than is possible with a single satellite.

"People are looking toward these to not totally replace the big satellites but to supplement what the big satellites are doing," he said.

He said the main impediment to designing small satellites is control: The smaller the satellite, the harder it is to manage its flight path and attitude, or orientation in space – for example, which directions its instruments point, a critical parameter in spacecraft design.

"It's similar to you driving an SUV down the road or a sub-compact," Fitz-Coy said, explaining that while inertia helps large satellites, it is not enough to keep small satellites on track and properly oriented. "The SUV is a lot more stable than the sub-compact."

The goal of the UF satellite, nicknamed SwampSAT, is to test a new system designed to improve small satellites' attitude control. Having precise control is particularly important for such satellites because they

have to fly relatively close to Earth so that their weak communications signals can reach their targets, he said. Because of their proximity to Earth, their instruments must be precisely aimed.

"They need to be able to control their orientation and re-orient rapidly," he said.

Fitz-Coy and about 12 undergraduate and graduate students began the project last year and hope to complete SwampSAT late this year or early next year, he said.

The cost is anticipated to be about $100,000, with a launch in 2009 – likely aboard an unmanned NASA rocket carrying other payloads as well. The satellite will fly at an altitude of between 600 and 650 kilometers, or from 373 to 404 miles, and will remain in orbit for several years, Fitz-Coy said.

A container that could be standardized for use in transporting the small satellites aboard the rocket also is being developed. As with the satellites themselves, the goal is mass production – to be able to transport satellites to outer space much the same way that ships and trucks transport goods around the terrestrial world now, Fitz-Coy said.

Source: University of Florida