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## COMMENTARY

# Going for Gojett

## Speed record drives supersonic UAV project

Researchers are all too familiar with the huge costs, high risks and frustratingly slow pace of high-speed flight testing, not to mention the scarcity of opportunities.

Now a Colorado-based team is developing a small supersonic UAV (below) for low-risk testing at a fraction of the cost of existing systems. Dubbed the Gojett (graduate organization jet engine technology team), the ambitious project is aimed at breaking the supersonic test paradigm and filling part of the void left by retirement of reusable flying testbeds like the legendary X-15.



UNIVERSITY OF COLORADO/BOULDER CONCEPT

The development stems from work begun three years ago—which later grew to include a supersonic vehicle—at the University of Colorado (CU) Boulder to develop improved small turbojets. The project has now morphed into a bid to build the world's fastest small UAV, and is being carried forward by Starkey Aerospace Corp. (Starcor), a new company set up to transfer the technology out of CU for commercialization. Starcor was recently incubated by eSpace, a joint venture between the university and Sierra Nevada's Space Systems Group.

Led by CU assistant professor and Starcor CEO Ryan Starkey, the mini-UAV is designed to appeal to a research community that has been "disenfranchised with \$100 million programs that stop and start." Instead, for \$50,000 to \$100,000, Starkey says the industry can have an affordable, test

asset that "won't end your program if you lose it." Gojett was developed "in the spirit of the X-15," and is aimed at rekindling the can-do spirit of the 1950s and 1960s when fast-paced progress was built on repeatable cycles of design, test, learn and re-test.

The initial vehicle is targeted at Mach 1.4 "because we think we can get there," says Starkey, who adds that the eventual aim is a UAV capable of Mach 1.6-1.7. Measuring 1.76 meters (5.8 ft.) in length, the vehicle is configured with a 1.27-meter-span cranked delta wing. Flight-control surfaces consist of elevons and a fluidic-injection thrust-vectoring system.

A pitot inlet feeds air to a custom afterburning 200-lb.-thrust turbojet, which is also under development.

"The biggest problem we have with UAVs is that small engines are inefficient," says Starkey. This is mostly

because powerplants in this thrust class emerged from the hobby-shop world rather than the propulsion industry, he adds. The Gojett project was initiated to develop a competitive turbojet by modifying an off-the-shelf U.S. Microjet AT-450 to increase its thrust-to-weight ratio and enable operation on a biofuel analog called SPK. Engine power is increased by several component changes including the addition of a variable-area nozzle and an afterburner. Current work is focused on test and development of the nozzle and the fluidic-control thrust-vectoring system.

The modified AT-450 will be used for low-speed tests but has insufficient thrust to power the vehicle through the transonic region. For higher speeds, and the supersonic test, the afterburner and nozzle will be adapted to a more powerful AMT Titan engine.

To help stimulate interest and drive the design, the UAV team aims to pursue a world speed record for a vehicle weighing less than 50 kg (110 lb.). Equipped with retractable landing gear, the aircraft will take off from a runway and fly twice around a course including a 15-25-km straight, level section. Starkey says the attempt will have to be flown at Edwards AFB, Calif., as this is the only suitable site with a supersonic corridor. The UAV could also be rail-launched, but this is not currently planned as "we just don't have that kind of asset on our hands," he adds.

The vehicle will have a guidance, navigation and control system incorporating sensors and a flight computer that will also control the fuel flow into the engine. Ground tests of the electronics are planned for early this year, with a critical design review set for May. Validation of thermal and control systems are planned by mid-2012, with engine tests by December. Flight tests are expected to be underway by spring 2013, with the supersonic attempt anticipated in mid-2013.

Beyond world speed records and supersonic research, Starkey says the UAV has potential military roles and the U.S. Navy is interested in exploring several. "We can imagine a wide range of missions. We've just scratched the surface." ☺