NASA deploys record-breaking 29 small satellites into orbit

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The Minotaur 1 four-stage rocket carrying the Air Force's Space Test Program Satellite-3 and 28 other CubeSats also carried a compact Autonomous Flight Safety System unit that operated in "shadow mode" to track the rocket's path as it lifted off the gantry and streaked across the horizon. Credit: Chris Perry/NASA Wallops

(Phys.org) —A spectacular launch from Virginia's eastern shore recently

resulted in the successful deployment of a record-breaking 29 small satellites into orbit, but that wasn't the only first for the mission or the bustling spaceport at NASA's Wallops Flight Facility in Wallops Island, Va.

Range safety officers also used the ORS-3 mission, run by the U.S. military's Operationally Responsive Space Office, to carry out the first of three planned certification tests of a new technology that promises to eventually eliminate the need for expensive down-range tracking and command infrastructure to manually terminate rockets if they veer off course.

According to Barton Bull, the chief engineer of the Wallops Research Range, the Minotaur 1 four-stage rocket carrying the Air Force's Space Test Program Satellite-3 (STPSat-3) and 28 other so-called CubeSats also carried a compact Autonomous Flight Safety System (AFSS) unit that integrated GPS, an inertial measurement unit and Wallops-developed algorithms to track the rocket's path as it lifted off the gantry and streaked across the horizon.

Developed by ATK, a supplier of aerospace and defense products from its location in Plymouth, Minn., the shoe box-size unit worked in shadow mode during its first certification test. As part of that test, range officers programmed the unit to respond to a simulated signal indicating that the rocket had gone off course and to send a self-destruct or detonate command at the appropriate time.

Initial Data 'Positive'

"We're still looking at the data, but initial indications are pretty positive," said Bull, whose organization created the unit's software. "Preliminary data indicate that the unit sent the simulated termination command at the right time."

Traditionally, range-safety officials use radar from ground stations operating in the Outer Banks of North Carolina, Bermuda and Antigua to track flight vehicles and a ground-based command system to terminate rockets that deviate from their flight plans. Due to increasing costs to maintain and staff these systems, NASA and the military launched a program several years ago to develop an autonomous system that would migrate flight-safety functions onto the rocket itself.

"All these systems need to be tied together and that costs money and time," Bull said. "Our objective is to save money and allow faster decision-making."

Initial testing of AFSS began more than three years ago. However, in those flight demonstrations the team used a system cobbled together with commercial, off-the-shelf components married to the Wallops-developed software. The test during ORS-3, however, employed the actual unit that ATK built under contract.

As a result of the unit's successful function test, the AFSS team plans to execute another test during a rocket launch from the Pacific Missile Range Facility in Kauai, Hawaii, in the coming months. A launch date has not been set. Once the team finishes the certification, it believes AFSS will become fully operational in a couple years.

New Mission Graphics System Debuts

In addition to carrying out the first AFSS test toward certification, the mission debuted and tested a new, user-friendly mission-graphics system that updates radar and other data on a computer screen, Bull said. "It takes an enormous amount of time to set up these systems" and make sure all the data, which typically arrive in different formats, are easily displayed, he added. The new system is more configurable and faster to set up.

"This was a mission of firsts on many different levels," Bull said. The team deployed a record-breaking 29 CubeSats, including, among others, Firefly (developed at NASA's Goddard Space Flight Center in Greenbelt, Md.), which is studying lightening and its possible connection to incredibly powerful bursts called terrestrial gamma-ray flashes, or TGFs, just miles off the ground. Also aboard were NASA's so-called "PhoneSat," which is testing a smartphone's capability as a communication technology for nanosatellites, and 11 student-developed research satellites. A student team from a high school in Alexandria, Va., provided one of the 11, also a first. "I think we were all pleased with the results," Bull said.

Provided by NASA