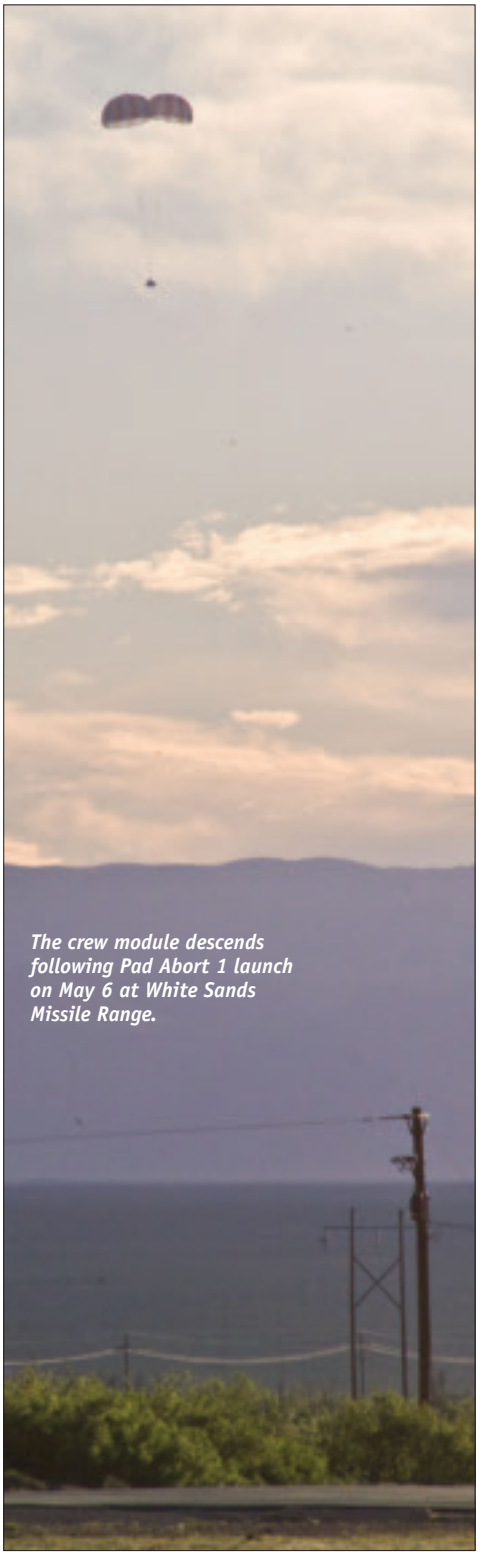
Aerodynamic decelerators



The crew module descends following Pad Abort 1 launch on May 6 at White Sands Missile Range.

by **Elsa Hennings**

This was an extremely busy year for parachute development, both for space applications and for precision aerial delivery. NASA's Orion crew exploration vehicle parachute assembly system (CPAS) was successfully demonstrated in May at White Sands Missile Range as part of a launch abort system test. CPAS consists of two mortar-deployed drogue parachutes, which slow the crew module during reentry into the Earth's atmosphere, followed by three mortar-deployed pilot parachutes that in turn deploy three 116-ft final descent main parachutes. The CPAS team has been performing component and subsystem tests since 2006, but the recently conducted Pad Abort 1 test marked a significant milestone in the demonstration of the complete recovery system, which functioned flawlessly.

SpaceX recently completed its first Dragon spacecraft drop test. The purpose was to test the deployment of the Dragon recovery system as well as recovery operations ahead of the first scheduled launch later this year. The recovery system includes two drogue parachutes to begin deceleration and stabilization of the spacecraft, followed by three main parachutes that reduce the capsule's speed to the desired landing descent rate. This test, conducted in August off the coast of California, was a complete success.

Alliant Techsystems, together with NASA, the Army, and United Space Alliance, broke the record for the largest single load extracted from a C-17 aircraft as they successfully tested an Ares I drogue parachute. In this test, conducted at the Yuma Proving Grounds, a record weight of 78,000 lb was deployed. Following release, the test article was allowed to accelerate to a predetermined velocity before the 68-ft-diam drogue parachute was deployed. This parachute is designed to reorient and decelerate the first-stage booster to an acceptable speed before the three main parachutes are deployed. The test exercised the drogue parachute to its intended 450,000-lb design load for the Ares I first stage.

Pioneer Aerospace began an effort to design, build, and test the descent system for ESA's intermediate experimental vehicle (IXV). The IXV project is part of the ESA Future Launchers Preparatory Program. The IXV reentry system is a technology platform to verify in-flight performance of critical reentry technologies. The lifting-body-shaped IXV weighs approximately 1,900 kg and is 5 m long and 2 m wide. The IXV descent system consists of a mortar-deployed pilot, a supersonic ribbon drogue, subsonic ribbon drogue, and ringsail main parachute. The IXV launch, reentry, and final 6-m/sec water landing is planned for 2013.

A Blizzard autonomous networked aerial delivery system (ADS) was developed by the Aerodynamic Decelerator Systems Center at the Naval Postgraduate School. Because of its smart guidance and control algorithms, even with strong winds this ultralightweight ADS proved quite reliable and exhibited a superb performance of 40 m circular error probable. Such performance allows the development team to proceed with the demonstration of unique applications for aerial delivery, such as precise delivery of an autonomous ground robot, landing on a moving platform, and deployment from the stratosphere.

In Europe, the FASTWing CL Project, largely funded by the European Commission and conducted by a consortium of eight European companies and institutions, was completed successfully, with a total of 21 drop tests of payloads weighing between 6,500 and 13,000 lb. Using a 3,225-ft^2 tapered parafoil and ultracapacitor-powered actuators, the system navigated autonomously to the target, showing an average glide ratio of 4:1.

The SPADES 1000 Mk2 system, developed by NLR and Dutch Space in the Netherlands, has been sold to the Netherlands Defense Forces and is presently undergoing system qualification.

For more information, go to: https://info.aiaa.org/tac/AASG/ADSTC/default.aspx.