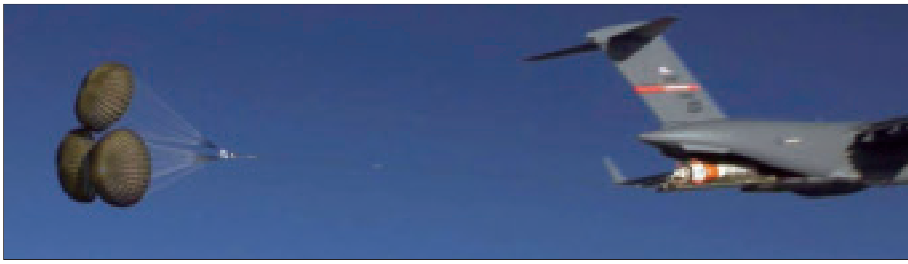
Aerodynamic decelerator systems



An Ares main parachute was successfully extracted from a C-17 at an altitude of 25,000 ft.

The field of aerodynamic decelerator systems has seen many exciting advancements this year. Aerial delivery remains an increasingly critical and successful method of delivering supplies safely, accurately, and rapidly to NATO forces. Airdrops in Afghanistan are projected to top 100 million lb by year's end. These resupply missions often support otherwise inaccessible locations. DOD leaders continue to support improvements in current airdrop capabilities and new airdrop technologies. The ongoing focus is to reduce system costs, increase accuracy, and expand the range of deployment conditions.

Two drop tests of the capsule parachute assembly system (CPAS) for the multipurpose crew vehicle (MPCV) were conducted to assess the performance of higher porosity main canopies. A third drop test in September included a representative parachute compartment. A series of full-scale CPAS ground tests also took place. JPL conducted a CPAS drogue parachute test program at the Texas A&M low-speed wind tunnel. The team flew 10%-scale conical ribbon parachutes in the wake of a scaled MPCV. High-speed video, time-resolved drag, and particle image velocimetry measurements were made to explore the coupling of the MPCV wake to parachute performance.

The Mars Science Laboratory parachute mortar system completed qualification testing. The flight mortars were delivered to Pioneer Aerospace for final assembly with the parachute packs. Following extensive reviews of the build and test data, the systems were approved by NASA JPL and the flight unit was shipped to Kennedy Space Center for integration and installation several months before the spacecraft's November launch.

A single 150-ft-diam. Ares main parachute was successfully tested at the Army's Yuma Proving Ground. The 72,000-lb jumbo drop test vehicle (JDTV) was extracted from a USAF C-17 aircraft at an altitude of 25,000 ft. The JDTV descended under a programmer chute until main parachute deployment. The total extracted weight was 85,000 lb, a record for C-17 single payload extraction.

Researchers from the Georgia Institute of Technology created a new canopy bleed air parafoil control mechanism for lateral and longitudinal control of autonomous airdrop systems. Flight test results indicate changes in glide slope from 3.0 to 1.0 and good turn rate control authority. At the University of Alabama at Huntsville, researchers have integrated multiple miniature wireless inertial sensors into a parafoil canopy and payload. Both rigid body and flexible canopy dynamics modes were identified using these sensors.

New commercial software and faster computing platforms have enabled the use of CFD, CSD, and FSI (fluid-structure interactions) simulations in parachute problems that until recently were deemed too complex and too computationally intensive for short-term efficient solutions. This year saw the first simulations of unsteady behavior, such as parachute inflation and landing speed reduction using pneumatic muscle contraction, by Airborne Systems, Saint Louis University, and DGA Aeronautical systems in France. Simulations of a cluster system showing the overall response and individual canopy motion were performed by Natick Soldier Research Center, Rice University, Bethel College, and the Universities of Connecticut and Texas-El Paso.

A NASA and industry team is working toward a 2012 launch date for the inflatable reentry vehicle experiment-3. The hypersonic inflatable aerodynamic decelerator (HIAD) consists of a cone-shaped configuration of seven braided inflatable tori, with a flexible thermal protection system to shield against the heat of reentry. The centerbody will provide inflation gas, telemetry, and a center of gravity offset system to generate lift. A HIAD can be used to deliver a larger payload than a traditional rigid heat shield, since its size is not limited by the booster shroud diameter. When launched, IRVE-3 will reach an altitude of 450 km and then reenter Earth's atmosphere at Mach 10.

For more information on the AIAA Aerodynamic Decelerator Technical Committee, please visit https://info.aiaa.org/tac/AASG/ADSTC/default.aspx.

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