MSL parachute tests were conducted in the NASA Glenn Unitary wind tunnel.

Aerodynamic decelerators

The aerodynamic decelerator systems community has been particularly busy during the past 12 months, touching a broad range of disciplines and achieving some major milestones.

The DOD continues to invest in and utilize a wide range of advanced aerial delivery capabilities. Of note this year are the Joint Precision Airdrop System (JPADS) air vehicles, JPADS mission planner, and a rapidly fielded low-cost low-altitude capability, all of which continue to save lives in Afghanistan and have an enormous impact on International Security Assistance Force operations.

Investments in JPADS capabilities include a push for a wider payload weight range (currently a 700-2,200-lb and a 5,000-10,000-lb capability are formal programs of record) and for significantly increased accuracy, higher reliability, and lower cost systems for an expanding range of military applications.

As of this September well over 19 million lb of supplies have been airdropped into Afghanistan without any Air Force aircraft being hit by small arms fire. JPADS airdrops have been associated with saving warfighters' lives in emergency resupply missions and reducing the number of convoys and helicopter resupply missions. Such airdrops are being used at a rate of approximately 1 million lb a month in current operations.

This year saw a change in direction for the Orion crew module landing system. Initially conceived and designed as a parachute and airbag combination, the system would enable landing on land, allowing reuse of the major spacecraft components. The current landing system architecture reverts to the Apollo Earth landing system approach—parachuting to a water-based landing. However, the requirement to provide a crew survivable landing for all emergency/contingency landings is currently beyond this landing system architecture. An emergency or contingency landing may include a pad abort scenario that could see the crew module drift back over land under the parachutes, or myriad high-altitude or orbital returns that can result in land landings.

The Orion crew module landing system advanced development program has tasked a team with developing a contingency airbag landing system. A conceptual design has been developed and incorporates two independent airbag assemblies that are deployed from the backshell and wrap around the leading edge of the crew module. This design is currently undergoing optimization and prototype testing.

The Mars Science Laboratory (MSL) mission is scheduled for launch in the fall of 2009. MSL is NASA's next robotic explorer to Mars with a mission to look for organic compounds and environmental conditions that could have supported microbial life in the past. The mission is unique in that it will use precision landing techniques to guide the entry vehicle containing the rover to previously inaccessible terrain with potential for unique science return.

The parachute decelerator system is a critical part of the entry, descent, and landing phase of the mission, slowing the entry vehicle from supersonic to subsonic speeds. The parachute development and qualification program continued this year under the direction of JPL, as part of the overall spacecraft development. It will be the largest, highest Mach, and highest opening load deployment of an extraterrestrial aerodynamic decelerator in history. This year's primary accomplishments were completion of the flight parachute design, cyclic strength testing of the full-scale parachute, and supersonic testing of 4%-scale parachutes.

The supersonic test program was conducted at the NASA Glenn 10 x 10 Unitary tunnel. Parachutes at 4% scale were tested to investigate the drag and stability performance from Mach 2 to Mach 2.5. The tests provided insight into the aerodynamic phenomenon that drives the supersonic instability referred to as "area oscillations." The flight parachute system will be installed in the spacecraft in the spring of 2009. ▲

The Firefly Precision Aerial Delivery System was developed for the Army JPADS program.

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