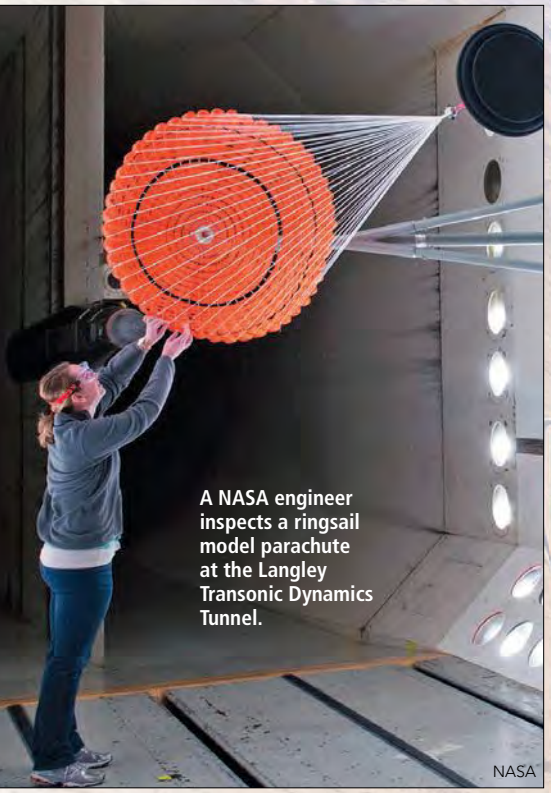
Balloons, parachutes and ballutes

by Ben Tutt

*The **Aerodynamic Decelerator Systems Technical Committee** focuses on development and application of aerodynamic decelerator systems and lifting parachutes, pararotators, and inflatables for deceleration, sustentation and landing of manned and unmanned vehicles.*

The U.S. Army **Natick Soldier Research Development and Engineering Center** has focused on Precision Airdrop Enhancements for autonomously guided cargo airdrops. One enhancement is bleed-air actuators that control airflow through vents in the top skin of a guided Joint Precision Aerial Delivery Systems parafoil. These small actuators use roughly 1/100th of the force required by conventional trailing edge deflection, provide an improved system response, enable an additional degree of freedom through longitudinal control, have demonstrated increased accuracy, and weigh significantly less than standard actuators and batteries. It is envisioned that bleed-air actuators could be inserted into existing parafoil-based systems, eliminating the need for warfighters to recover airborne guidance units now in use.



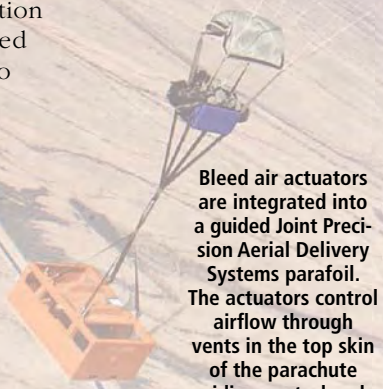
A NASA engineer inspects a ringsail model parachute at the Langley Transonic Dynamics Tunnel.

NASA

Airborne Systems and Near Space Corp., as part of the Flight Opportunities program in the **NASA Space Technology Mission Directorate**, completed two high-altitude flight tests in August of an autonomously guided parafoil parachute recovery system. In each test, a payload weighing 100 kilograms was released from a balloon at an altitude of 18,600 meters. In the first test, the autonomous onboard navigation system guided the payload to a location just 70 meters from its predetermined landing coordinates. In the second test, the payload landed just 33 meters away from its target coordinates. These flights demonstrated a more challenging dynamic deployment of the parachute system than a predecessor test. Each payload fell for 10 seconds under a drogue to build up speed before the semi-elliptical parafoil parachute system was deployed. Customized GPS-based navigation showed the ability to autonomously acquire and maintain desired headings at higher altitudes than previously demonstrated. These tests are a major milestone in showcasing parafoil parachute systems that can be employed above conventional military cargo airdrop altitudes, enabling significant increases in the cross range capability of the recovery system.

A **wind tunnel test of subscale parachutes** was conducted at the NASA Langley Research Center's Transonic Dynamics Tunnel in Virginia. This test supported the ringsail parachute development being undertaken by NASA's Low-Density Supersonic Decelerator project. The test's main objective was to generate a database suitable for modeling the aerodynamic characteristics of ringsail parachutes during flight at Mars. A Disk-Gap-Band parachute was also tested in order to provide data for a direct comparison of aerodynamic performance between ringsail and the parachutes.

Also as part of the **Low-Density Supersonic Decelerator project**, the Jet Propulsion Laboratory conducted a second supersonic flight test with the next generation of aerodynamic decelerators for future Mars missions. A 4.7 meter diameter blunt-body aeroshell was lifted to an altitude above 30 kilometers by a balloon with a volume of 1.12 million cubic meters. The test vehicle was released from the balloon and accelerated to above Mach 4 and an altitude of 54 kilometers where a 6 meter diameter Supersonic Inflatable Aerodynamic Decelerator was deployed to slow the vehicle. The flight also saw the deployment and inflation of a large, 4.4-meter-diameter trailing ballute. A supersonic parachute was also deployed but was severely damaged during supersonic inflation.



Bleed air actuators are integrated into a guided Joint Precision Aerial Delivery Systems parafoil. The actuators control airflow through vents in the top skin of the parachute aiding control and accuracy.

U.S. Army RDECOM

The **Beagle 2 Team** was awarded a 2015 Sir Arthur Clarke Award. Eleven years after its landing attempt on December 25, 2003, Beagle 2 was found on the Martian surface in January 2015 by NASA's Mars Reconnaissance Orbiter. Data showed that Beagle 2 had landed but a number of the solar panels had failed to open completely, preventing the lander from communicating back to Earth.