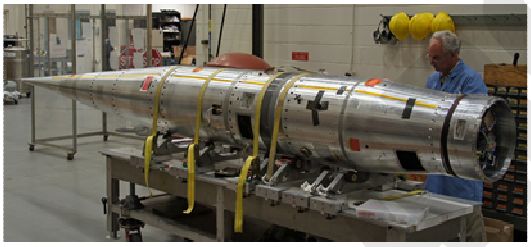
NASA Facts

National Aeronautics and Space Administration

Space Technology Program

NASA Successfully Demonstrates Inflatable Heat Shield

NASA's Space Technology Program successfully conducted a flight test to further demonstrate the feasibility of inflatable heat shields, or Hypersonic Inflatable Aerodynamic Decelerators (HIAD). This technology could change the way we explore other worlds by accommodating larger payloads allowing for delivery of more science instruments and tools for exploration.



The Inflatable Reentry Vehicle Experiment-3 (IRVE-3) successfully launched the HIAD system from a sounding rocket at 7:01 a.m. from the NASA's Wallops Flight Facility in Wallops Island, Va on July 23, 2012, soaring through Earth's atmosphere, and re-entering the atmosphere at hypersonic speeds up to 2.7 km/s (6000 mph).

The launch was the third in a series of suborbital flight tests to provide foundational data for NASA's efforts to develop and integrate HIAD technology into future missions. Technicians vacuum packed the uninflated, three meter diameter cone of high-tech inner tubes into a 0.5 meter diameter, three-stage Black Brant XI sounding rocket.

During the flight test, an on-board inflation system (similar to air tanks used by scuba divers) pumped the inner tubes full of nitrogen, stretching a thermal blanket over them to create a heat shield or aeroshell. That heat shield protected a payload that consisted of four segments including the inflation system, steering mechanisms, telemetry equipment and camera gear.

The rocket took about six minutes to climb approximately 450km (280 miles) into the skies over the Atlantic Ocean. The 308 kg/680 pound IRVE-3 separated from the rocket, traveled at Mach 10, experienced peak loads of about 20 g's and heating of 15 W/cm^2, with its heat shield temperature reaching up to 400℃ (750℉) as it returned to Earth.

Image 1: IRVE-3 launching from the Wallops Flight Facility
Image 2: IRVE-3 following compression into the nose cone of the sounding rocket
Image 3: Prior to launch, a Complete System Test was conducted at NASA's Transonic Dynamics Facility.

Four video cameras transmitted images to the Wallops control room to confirm that the IRVE-3 successfully inflated, reconfigured to generate lift prior to atmospheric entry, and demonstrated re-entry steering capability. The inflated heat shield and payload plummeted back through Earth's atmosphere, splashing down in the Atlantic Ocean about 20 minutes after launch and 560 kilometers (350 miles) down range from Wallops.

Engineers at NASA's Langley Research Center in Hampton, Va. have spent the last three years preparing for the test of this Hypersonic Inflatable Aerodynamic Decelerator. Researchers and technicians studied designs, assessed materials in laboratories and wind tunnels and subjected hardware to thermal and pressure loads beyond what it should face in flight.

NASA began researching inflatable spacecraft because rigid spacecraft structures are limited by the size of the launch vehicle shroud. This, in turn, limits the size of the payload that can be carried through planetary atmospheres. NASA is investigating HIAD technology as a potential enabler for delivering larger mass on future missions, or accessing higher elevations on Mars. IRVE-3 is one of the Space Technology Program's many research efforts to develop new technologies to advance space travel and open up new capacity for exploration within both scientific and human missions.

For more information on the Space Technology HIAD project visit: http://www.nasa.gov/HIAD

Image 4: Cameras captured the IRVE-3 shape during entry.

Project Partners:

NASA Langley	Hampton, Va	Project Management and HIAD engineering
NASA Wallops Flight Facility	Wallops Island, Va	Payload integration and launch operations
Airborne Systems/ HDT Global	Santa Ana, Ca	Inflatable Structure
Oceaneering	Houston, Tx	Thermal Protection Systems
Bristol Aerospace	Manitoba, Ontario	Black Brant Sounding Rocket