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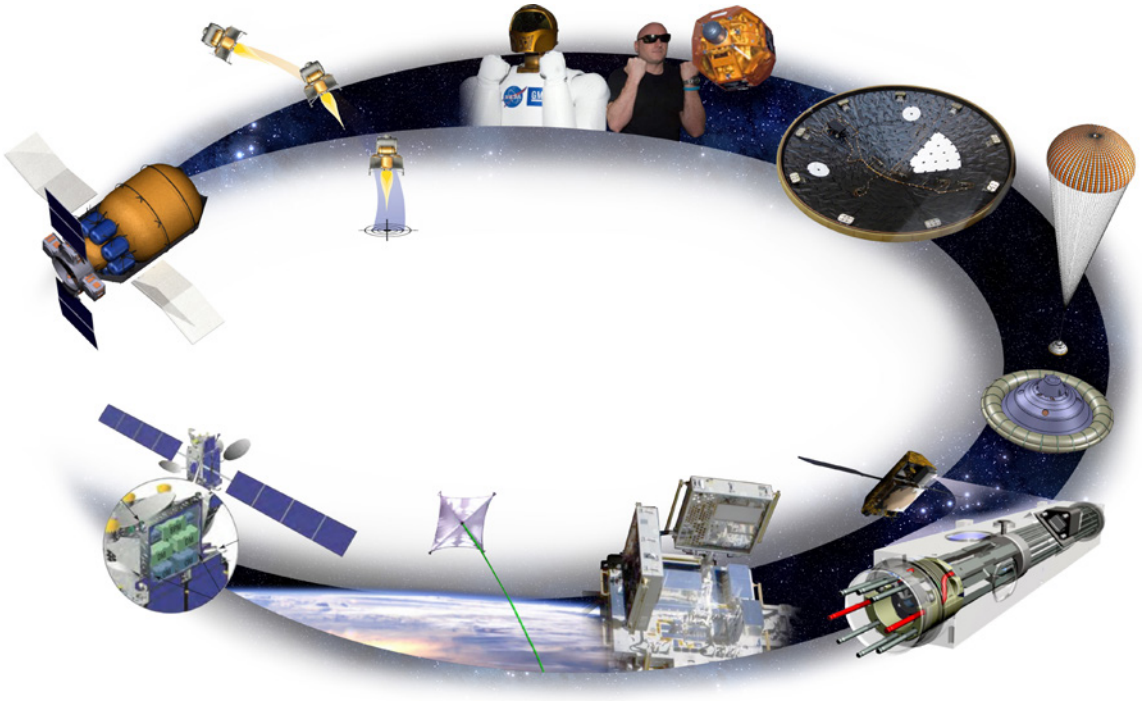
Technology Demonstration Missions—Bridging the Technology Gap

Technology development progresses through stages that fall into distinct categories: idea inception and initial formulation; proof of concept and experimental testing; demonstration of mature technologies in relevant environments; and infusion of the technology into objective missions.

The Technology Demonstration Program bridges the gap between proof of concept and experimental testing stage and the final infusion of the technologies into NASA missions. Charged with proving revolutionary, crosscutting technologies — ones that could radically advance NASA's mission in space and reap untold benefits for science and industry here on Earth. The Technology Demonstration Program provides needed flight demonstration in relevant environments to mature laboratory-proven technologies to flight-ready status.

The Technology Demonstration Missions Program focuses on technologies with strong customer interest that meet the needs of NASA and industry by enabling new missions or greatly enhancing existing missions. The chosen technologies will have access to relevant demonstration environments such as Earth's orbit — where they will gain operational heritage, reducing the risk of their use in future missions and continue NASA's long history as a technological innovator. They will allow future NASA missions to pursue bolder science, allow safer and more rewarding human missions and enable new approaches to U.S. space missions in the government and commercial sectors.

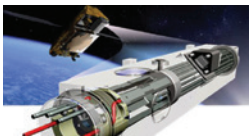
The Technology Development Missions Program Office at NASA's Marshall Space Flight Center in Huntsville, Ala., is overseeing nine Technology Demonstration Mission demonstrations that have the potential to transform the way we live and work in space.



Cryogenic Propellant Storage & Transfer (CPST)

CPST will demonstrate the capability to safely and efficiently store, transfer and measure cryogenic propellants — liquefied and supercooled fuels and oxidizers — on-orbit, thus enabling next-generation space transportation systems capable of managing and handling large propellant volumes over long time periods necessary for deep space travel. The demonstration is slated to launch in fiscal year 2016 with NASA's Human Exploration and Operations Mission Directorate as a primary customer.

Deep Space Atomic Clock (DSAC)



DSAC will validate a miniaturized, ultra-precise mercury-ion atomic clock that is 100 times more stable and accurate than today's best navigation clocks. This technology promises to increase mission data quality and enable more mission and science data flow. The technology also will free up precious communications bandwidth currently reserved for navigation purposes and enable further development of deep-space autonomous radio navigation.") A launch into low-Earth orbit is planned in fiscal year 2015 with NASA's Space Communications and Navigation organization as a partner.

Laser Communications Relay Demonstration (LCRD)

LCRD will fly and validate a reliable, capable and cost-effective optical communications technology to enable a variety of robust future science and exploration missions. Lasers will be used to encode and transmit data at rates 10 to 100 times faster than current radio frequency based space communication systems. The project will help mature concepts and deliver technologies applicable to both near-Earth and deep-space communication systems. Flight testing is expected to begin in fiscal year 2014 with NASA's Space Communications and Navigation organization as a partner.

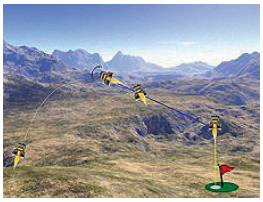
Low-Density Supersonic Decelerator (LDSD)

LDSD will demonstrate the use of inflated structures and advanced parachutes that operate at supersonic speeds to effectively slow down a spacecraft as it navigates through a planet's atmosphere prior to landing. These new inflatable and parachute decelerators will increase landed payload masses, decelerating spacecraft at higher altitudes improving targeting of safe landing-sites. These new devices represent the first steps on the technology pathway to land humans, habitats and return rockets safely on Mars. Flight testing is planned in fiscal year 2014 with customers that include both NASA's Mars Exploration Program and NASA's Human Exploration and Operations Mission Directorate.

Solar Sail Demonstration (SSD)

SSD will demonstrate an inventive alternative to conventional propellant-based spaceflight. This small-satellite project will deploy and operate a nearly 13,000-square-foot sail propelled by sunlight, offering a variety of propellantless spaceflight solutions, including station keeping, orbital transfers and polar satellite services. Once proven, this technology will enable a host of space missions not possible today. Deployment, flight and navigation of a solar sail demonstation is planned as early as fiscal year 2014 with National Oceanagraphic and Atmospheric Agency (NOAA) as a partner.

Autonomous Landing Hazard Avoidance Technology (ALHAT)



NASA researchers and their partners are working to equip a new generation of hardy planetary landers with the ability to automatically recognize their desired landing site, assess any potential landing hazards and adjust accordingly as they descend to the surface. Once proven, this technology could dramatically improve the safety and versatility of future robotic, cargo and crewed planetary descent vehicles. A full closed-loop flight demonstration is planned in fiscal year 2013 with customers that include NASA's Human Exploration and Operations Mission Directorate.

Human Exploration Telerobotics (HET)

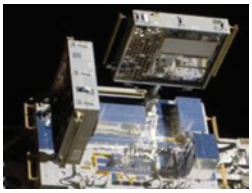
HET is demonstrating how a variety of robotic elements including robonauts (robotic astronauts), rovers and other remotely controlled devices can accomplish routine, highly repetitive and dangerous space tasks traditionally performed by astronauts. The goal is to improve the capabilities of human exploration missions, provide for a greater degree of autonomy and hasten the start of human space exploration missions to new destinations as robots team with astronauts in space. Two of these robots — Robonaut 2 and SPHERES — the Synchronized Position Hold, Engage, Reorient Experimental Satellites — have been activated and have demonstrated

survey and monitoring capabilities aboard the International Space Station and others operate at NASA field centers.

Mars Science Laboratory Entry, Descent and Landing Instrumentation (MEDLI)

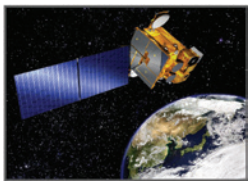
MEDLI is a set of sensors embedded in the Mars Science Laboratory's heat shield. The sensors measure the heat and pressure the heat shield is subjected to during atmospheric entry and descent at Mars. This data will be used to refine the design of future heat shields, improving performance and minimizing weight. The Mars Science Laboratory, or MSL, launched Nov. 26, 2011, with the MEDLI sensors aboard. The vehicle is expected to enter the Mars atmosphere in August 2012. After landing, MEDLI will transmit to Earth important engineering data concerning the atmospheric entry conditions and heat shield performance.

Materials International Space Station Experiment-X (MISSE-X)



Since 2001, NASA has tested some 4,000 material samples and specimens on a platform affixed to the exterior of the International Space Station to demonstrate their durability in the punishing space environment. NASA's new Materials International Space Station Experiment, or MISSE-X, is an evolution of this effort and will host replaceable experiments that will be used to develop and space qualify new space materials and devices critical to future space exploration missions. Launch of the MISSE-X facility is planned in fiscal year 2016.

Green Propellant Technology Demonstrations



The Technology Development Missions Program is seeking technology demonstration solutions to replace highly toxic hydrazine fuel with environmental propellant alternatives. As NASA works with American companies to open a new era of access to space, the Agency is pursuing development of innovative and transformative fuels that are less toxic for operations, less hazardous for handling and less harmful to the environment. NASA anticipates awarding green technology alternative propellant contracts in August 2012.

The Technology Demonstration Missions program is sponsored by NASA's Office of the Chief Technologist and supported by NASA field centers and partner facilities around the nation.

National Aeronautics and Space Administration

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