National Aeronautics and Space Administration

NASA**facts**

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 testing; demonstration of mature technologies in relevant environments; and infusion of the technology into target missions.

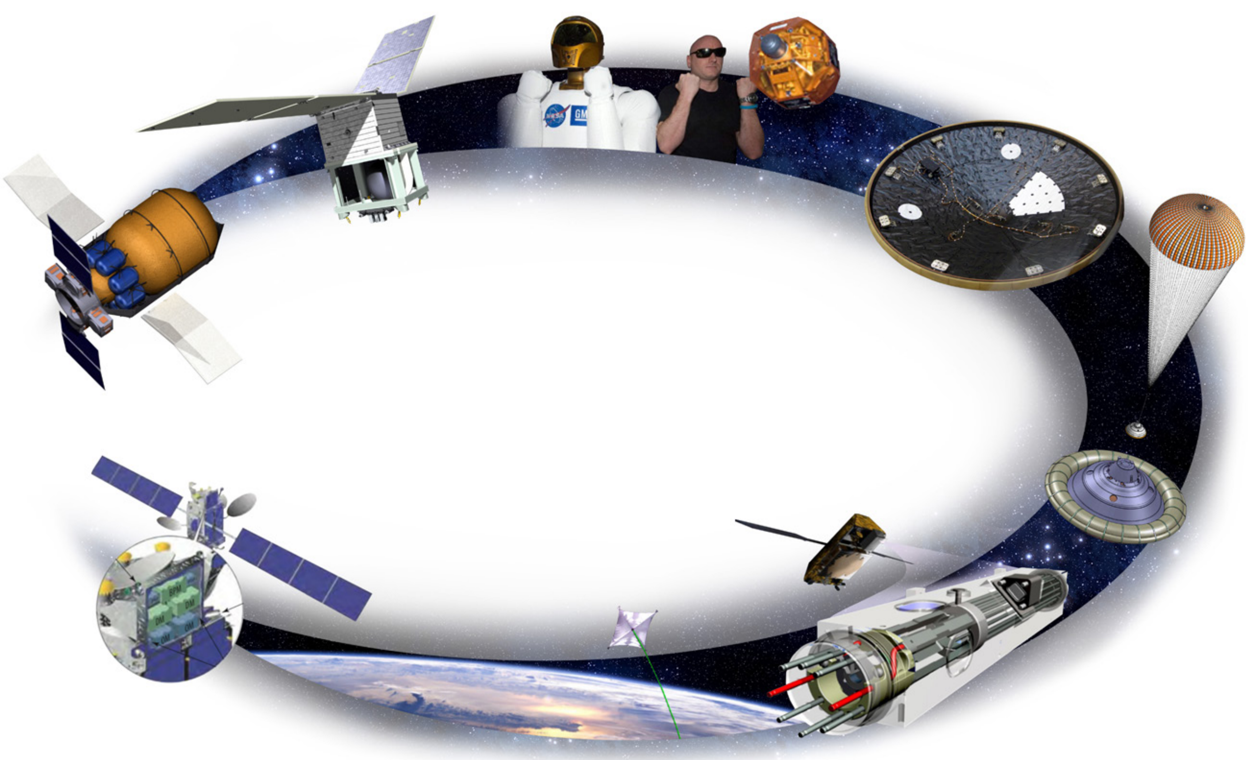
NASA's Technology Demonstration Missions Program, or TDM, bridges the gap between early proof-of-concept tests and the final infusion of cost-effective, revolutionary new technologies into robust NASA, government and commercial space missions.

The Technology Demonstration Missions Program Office at NASA's Marshall Space Flight Center in Huntsville, Ala., is overseeing a portfolio of technology demonstration flight projects led by NASA centers and industry partners across the country. The program is part of NASA's Space Technology Mission Directorate in Washington.

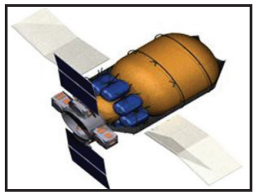
The TDM program focuses on crosscutting technologies with strong customer interest that meet the needs of NASA and industry by enabling new missions or greatly enhancing existing ones. Chosen technologies will be thoroughly ground-tested and flight-tested — reducing risks to future flight missions, gaining operational heritage and continuing NASA's long history as a technological leader. These newly proven technologies will enable future NASA missions to pursue bolder goals; make human missions safer and more rewarding; and enable new expansion of space industry in the government and commercial sectors.

Cryogenic Propellant Storage and Transfer (CPST)

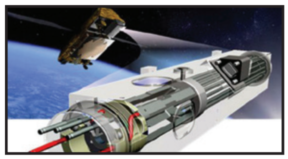
The Cryogenic Propellant Storage and Transfer project will demonstrate in space the capability to safely and efficiently store, transfer and measure cryogenic propellants, including



liquefied and super-cooled fuels and oxidizers. These advances will lead to development of next-generation space transportation systems capable of managing large propellant volumes over long time periods necessary for deep space travel. The demonstration is slated to launch in fiscal year 2017, with NASA's Human Exploration and Operations Mission Directorate as a primary customer and new opportunities to follow for the agency's industry partners.

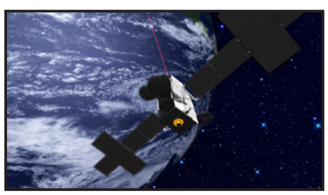


Deep Space Atomic Clock (DSAC)



The Deep Space Atomic Clock project will demonstrate in space a small, ultra-precise, mercury-ion atomic clock 100 times more accurate than today's best navigation clocks. It will provide the timekeeping stability needed for the next generation of Global Positioning Satellites and deep-space navigation and radio science missions. This technology promises to improve the quality and flow of mission data by enabling a shift to a more flexible radio navigation architecture, freeing precious communications bandwidth currently reserved for navigation. Launch to low-Earth orbit as a hosted payload is planned for 2015 in partnership with NASA's Space Communications and Navigation (SCaN) Program.

Laser Communications Relay Demonstration (LCRD)

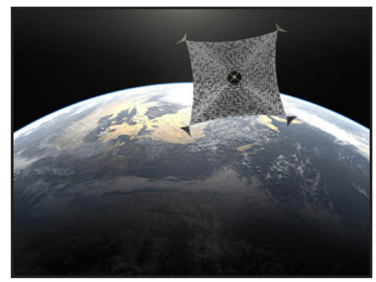


The Laser Communications Relay Demonstration project will advance optical communications technology, expanding industry's capability to produce competitive, high-value optical communications systems and components. A hosted payload with two optical-communications space terminals and associated electronics will fly to geosynchronous Earth orbit on a commercial spacecraft, where it will communicate with two separate ground stations. The technology also will enable communications with other spacecraft in low-Earth orbit. Launch is planned for 2017 in partnership with NASA's Space Communications and Navigation (SCaN) Program, with expectations to implement the LCRD technology and concepts in next-generation space communication relays.

Low-Density Supersonic Decelerator (LDSD)

The Low-Density Supersonic Decelerator project will demonstrate the use of inflatable structures and advanced parachutes that operate at supersonic speeds to more efficiently slow down a spacecraft navigating through planetary atmosphere prior to landing. These new supersonic inflatable and parachute decelerators will increase landed payload masses. They also will allow for higher-altitude landings and access to a larger portion of a planet's surface, and will enable improved targeting of safe landing sites. These new devices will be suitable for infusion into landed Mars missions, greatly extending performance capabilities. Flight testing is planned through 2015. Infusion customers include NASA's Science Mission Directorate and NASA's Human Exploration and Operations Mission Directorate.

Solar Sail Demonstration (SSD)

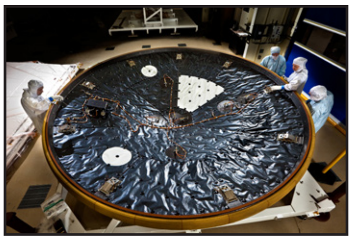


The Solar Sail Demonstration project will demonstrate an alternative to conventional propellant-based spaceflight. Dubbed "Sunjammer" by designers — in honor of the 1964 Arthur C. Clarke story of that name, in which he coined the term "solar sailing" — the demonstrator will deploy and operate a sail of approximately 13,000 square feet. When collapsed, it is the size of a dishwasher and weighs just 70 pounds. Attached to a 175-pound disposable support module, the Sunjammer will fly to space as a secondary rocket payload. There, it will offer a variety of solutions to enable high-energy, long-duration missions such as those to artificial Lagrange orbits sunward of the Sun/Earth L1 point and "pole sitters" which could provide enhanced warning of geomagnetic activity. Launch is planned for 2014, in partnership with the National Oceanic and Atmospheric Administration (NOAA), with deployment, flight and navigation of the solar sail planned through 2015.

Human Exploration Telerobotics (HET)

The Human Exploration Telerobotics project is demon-strating how a variety of robotic elements including dexterous humanoid robots, freeflying “smartbots,” rovers and other remotely controlled devices can accomplish routine, highly repetitive or dangerous tasks traditionally performed by astronauts. The goal is to improve human exploration capabilities, provide for greater autonomy and hasten the start of human space exploration missions to new destinations. Two such robots — Robonaut 2 and SmartSPHERES, or the Synchronized Position Hold, Engage, Reorient Experimental Satellites — have demonstrated survey and monitoring capabilities aboard the International Space Station. Others are being developed and tested at NASA facilities including Ames Research Center in Moffatt Field, Calif., and the Jet Propulsion Laboratory in Pasadena, Calif.

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



The Mars Science Laboratory Entry, Descent and Landing Instrumentation suite is a series of sensors embedded in the heat shield of the Mars Science Laboratory, which was launched Nov. 26, 2011, and successfully entered the Mars atmosphere Aug. 6, 2012. The MEDLI sensors successfully measured the temperature and pressure endured by the heat shield during atmospheric entry and descent at Mars. MEDLI transmitted to Earth important engineering data concerning the atmospheric entry conditions and heat shield performance. The data is being used to refine the design of future heat shields, minimizing weight and improving performance. Infusion customers include NASA’s Mars Exploration Program and NASA’s Human Exploration and Operations Mission Directorate.

Green Propellant Infusion Mission (GPIM)

The Green Propellant Infusion Mission project is the nation’s first spacecraft demonstration of a high-performance fuel and propulsion system — a more environmentally “green” alternative to the more toxic conventional fuel hydrazine. This technology promises improved performance for future satellites and other space missions by providing for longer mission durations, increased payload space and safer, simplified pre-launch spacecraft processing and safer handling and transfer of propellants. Launch to low-Earth orbit is planned for 2015.

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