# NASA Facts

National Aeronautics and
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**Marshall Space Flight Center**
Huntsville, Alabama 35812

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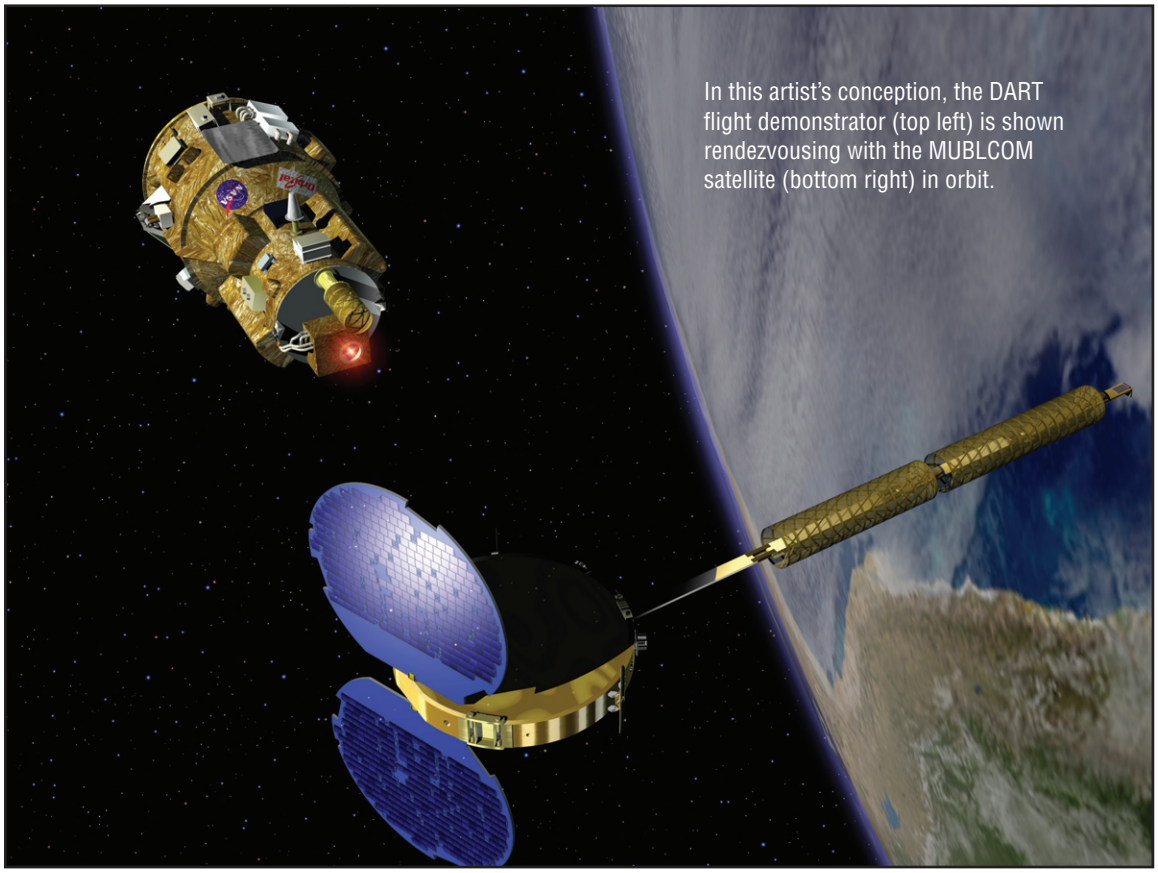
## DART Demonstrator To Test Future Autonomous Rendezvous Technologies in Orbit



In this artist's conception, the DART flight demonstrator (top left) is shown rendezvousing with the MUBLCOM satellite (bottom right) in orbit.

The Demonstration of Autonomous Rendezvous Technology (DART) is a flight demonstrator that provides a key step in establishing autonomous rendezvous capabilities for the U.S. space program. While previous rendezvous and docking efforts have been piloted by astronauts, the unmanned DART spacecraft will have computers and sensors to perform all of its rendezvous functions.

Future applications of technologies developed by the DART project will benefit the nation in future space systems development requiring in-space assembly, services, or other autonomous rendezvous operations.

DART is designed to demonstrate technologies required for a spacecraft to locate and rendezvous, or maneuver close to, other craft in space. Developed by Orbital Sciences Corporation of Dulles, Va., the DART spacecraft will be launched on a Pegasus vehicle from its Stargazer L-1011 aircraft. At approximately 40,000 feet over the Pacific Ocean, the Pegasus vehicle will be released with

the DART spacecraft. The vehicle will then boost the DART spacecraft into approximately a 472-by-479-mile polar orbit.

Once on orbit, DART will travel around the Earth to rendezvous with the target satellite, the Multiple Paths, Beyond-Line-of-Site Communications (MUBLCOM) satellite, also built by Orbital Sciences. Launched in May 1999, the MUBLCOM satellite was used by the Department of Defense as an experimental communications satellite and was outfitted with optical retro reflectors designed for future use with a video guidance system such as the Advanced Video Guidance Sensor (AVGS) onboard DART.

The AVGS is an advanced version of the Video Guidance Sensor developed by the Marshall Space Flight Center in Huntsville, Ala., for NASA's Automated Rendezvous and Capture Project, which demonstrated these automated capabilities in the mid-1990s -- including two successful flight tests on board the Space Shuttle. The next-generation AVGS incorporates advanced optics and electronics and allows DART to communicate with and track the MUBLCOM satellite within a range of 5 to 250-plus meters.

Once DART reaches the MUBLCOM satellite, it will perform several autonomous rendezvous and close proximity operations, such as moving toward and away from the satellite using navigation data provided by the AVGS and Global Positioning System (GPS) based information.

The Autonomous Rendezvous and Proximity Operations software on DART will test additional algorithms by calculating and executing collision avoidance maneuvers and circumnavigation -- navigating around the MUBLCOM satellite. To conclude the mission, DART will fly away from the MUBLCOM satellite. The entire 24-hour mission will be accomplished without human intervention.

The fourth stage of the Pegasus vehicle is an integral part of the DART spacecraft, sharing avionics and propulsion components while in orbit. The auxiliary propulsion system includes three hydrazine-fueled thrusters, and the reaction control system includes six nitrogen-fueled thrusters. DART also uses 16 nitrogen-fueled thrusters for proximity operations.

The DART spacecraft is about 6 feet long, with a diameter of 3 feet, and weighs approximately 800 pounds with fuel.

In June 2001, Orbital Sciences Corporation was awarded contracts to design and develop the DART flight demonstrator, including orbital flight test and integration and launch with a Pegasus vehicle. Software and hardware testing was completed in 2004, followed by assembly and integration of the DART spacecraft. Launch is scheduled for fall 2004. The DART budget including launch services is approximately $95 million.

Flight demonstrators, like DART, have a critical role in demonstrating technologies that cannot be validated on the ground. DART will help lay groundwork for future reusable manned and unmanned launch vehicle missions using autonomous rendezvous operations. Future technology applications may aid in cargo delivery, servicing missions for the International Space Station and other on-orbit activities, such as satellite retrieval or servicing to enable future civil, defense and commercial space transportation. NASA is pursuing technologies that will enable the Agency to achieve its goals of establishing safe, reliable, affordable access to space.

The DART project is funded by NASA's Exploration Systems Mission Directorate and managed by the Marshall Space Flight Center. The Kennedy Space Center has oversight responsibilities for launch integration and launch services.

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For more information on the DART project, including electronic images and animation, visit:
**http://www.msfc.nasa.gov/news/dart/**


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