NASA team successfully deploys two solar sail systems

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NASA's

Solar Sail Propulsion Team and industry partners have successfully deployed two 10-meter solar sails in a vacuum environment - a critical milestone in

development of the unique propulsion technology that could enable future deep space missions. Solar sail propulsion uses the Sun's energy to travel through space. The work is led by the In-Space Propulsion Technology Projects Office at the Marshall Center.

NASA engineers and their industry partners have successfully deployed two solar sails — each nearly 33 feet in length along one side — reaching a critical milestone in the development of a unique propulsion technology that could enable future deep space missions.

Solar sail propulsion uses the Sun's energy to travel through space, much the way wind pushes sailboats across water. The technology bounces a stream of solar energy particles called photons off giant, reflective sails made of lightweight material 40 to 100 times thinner than a piece of writing paper. The continuous pressure provides sufficient thrust to perform maneuvers, such as hovering at a point in space and rotating the space vehicle's plane of orbit, which would require too much propellant for conventional rocket systems. Because the Sun provides the necessary propulsive energy, solar sails also require no onboard propellant, thus reducing payload mass.

In July, L'Garde, Inc., of Tustin, Calif., successfully deployed a solar sail technology system. Earlier this year, Able Engineering of Goleta, Calif., successfully completed testing of its own solar sail design. The work of both contractors is led by the In-Space Propulsion Technology Projects Office at NASA's Marshall Space Flight Center in Huntsville, Ala.

"We are making the stuff of science fiction into reality," said Les Johnson, manager of the In-Space Propulsion Technology Projects Office at the Marshall Center. "It has been a tremendous engineering challenge, and I'm pleased and proud of the teams that have made it happen."

L'Garde's sail deployment was conducted in a 100-foot-diameter vacuum chamber at NASA's Glenn Research Center Plum Brook Station in Sandusky, Ohio. The tests included temperatures as cold as minus 112 degrees Fahrenheit to simulate the conditions of open space.

The sail technology used an inflatable, thermally rigidized boom system, which inflates and becomes stiff in space environment conditions. The boom is the core of the support structure for the thin, reflective solar sail itself — merely a fraction of the thickness of a human hair -- and includes a stowage structure and built-in deployment mechanism. Engineers used a computer-controlled boom pressurization system to initiate deployment of the boom and sail system.

In May, Able Engineering also successfully completed testing of a solar sail design at NASA's Langley Research Center in Hampton, Va. This sail employed a "coilable" graphite boom, which is extended or uncoiled via remote control — much the way a screw is rotated to remove it from an object. The boom supports the lightweight sail, which is made of an aluminized, temperature-resistant material called CP-1. Named NASA's 1999 Invention of the Year, CP-1 was invented by the Langley Research Center and is produced under exclusive license by SRS Technologies of

Huntsville. The boom system also includes a central stowage structure and deployment mechanism.

Tests of the coilable boom were conducted in a 50-foot-diameter vacuum chamber. Engineers remotely initiated deployment of the boom and sail in April, then spent the next five weeks studying its shape and system dynamics — or how the solar sail functions in relation to force, weight and tension.

Data from both tests will be used to make improvements to future solar sail design and modeling. In March 2005, NASA plans a laboratory deployment of a sail more than 65 feet in length.

Solar sail technology was selected for development in August 2002 by NASA's Office of Space Science in Washington. Along with the sail system design projects by L'Garde and Able Engineering, NASA's Jet Propulsion Laboratory in Pasadena, Calif., was tapped to develop an integrated set of computer-based solar sail simulation tools. These are just three of a number of efforts undertaken by NASA Centers, industry and academia to develop solar sail technology.

Solar sail technology is being developed by the In-Space Propulsion Technologies Program, managed by NASA's Office of Space Science and implemented by the In-Space Propulsion Technology Projects Office at Marshall. The program's objective is to develop in-space propulsion technologies that can enable or benefit near and mid-term NASA space science missions by significantly reducing cost, mass and travel times.

For more information about solar sails, visit: http://www.inspacepropulsion.com/

Source: NASA