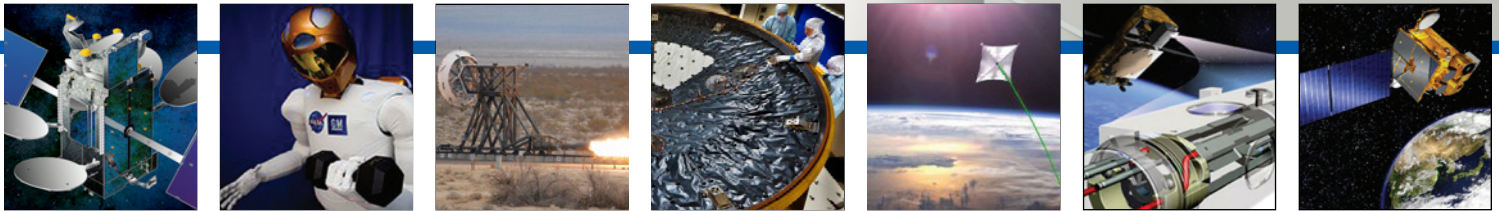




Technology Demonstration Mission Program

The Bridge

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Laser Communications Relay Demonstration Project Completes Key Milestone

NASA's [Laser Communications Relay Demonstration](#), or LCRD, project has successfully completed its Systems Requirements Review — a major milestone for the agency's first, long-duration optical communications mission.

The review ensures all project requirements are properly formulated and correlated with strategic objectives set by NASA's [Space Technology Mission Directorate](#) in Washington for the building, launch and operations of the space communications laser system.

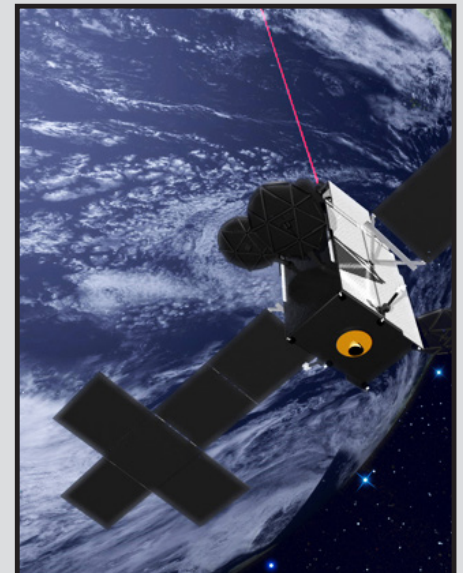
Part of NASA's [Technology Demonstration Missions Program](#), the LCRD project will use lasers to encode and transmit data at rates 10 times to 100 times faster than conventional radio systems, helping to revolutionize near-Earth and deep-space communications. It is scheduled to fly to space in 2017 as a payload on a commercial satellite. It will be positioned in orbit above the equator — a prime location for line-of-sight communications with other orbiting satellites and ground stations.

"LCRD will demonstrate the feasibility of future optical relay systems," said

project manager Michael Weiss at NASA's [Goddard Space Flight Center](#) in Greenbelt, Md. "It will help us understand the system's performance over an extended period of time and confirm its ability on orbit, enabling an affordable optical communication systems in the future."

The LCRD project is led by Goddard, which hosted the two-day Systems Requirement Review in March. NASA's Standing Review Board, consisting of members from various technical disciplines, evaluated the requirements for a successful mission and confirmed all NASA and center-level requirements. The board commended the "very capable" team on its progress since completing a Mission Concept Review in September 2012.

The LCRD team at Goddard receives significant support on the project from NASA's [Jet Propulsion Laboratory](#) in Pasadena, Calif.; MIT Lincoln Laboratory of Cambridge, Mass.; and Space Systems/Loral LLC of Palo Alto, Calif. The latter will host the project payload on one of its satellites — the first American-made, commercial communications satellite ever to carry a NASA payload. The LCRD project will be a pathfinder for developing



An artist's rendering of the Laser Communications Relay Demonstration payload in orbit. (NASA/GSFC)

and flying future hosted payloads, with both partners fully committed to mission success.

The Laser Communications Relay Demonstration mission and other crosscutting flight demonstration projects are helping NASA and its industry partners forge a cost-effective path for delivering critical technology innovations for a variety of future government and commercial space activities. Learn more about the LCRD project [here](#).

CPST Project Team Hosts Technology Maturation Workshop

In April, the [Cryogenic Propellant Storage and Transfer](#), or CPST, project marked 15 months of successful technology maturation efforts, sharing results with executives and managers from the [Space Technology Mission Directorate](#), the [Technology Demonstration Missions Program](#) and other NASA organizations at an internal workshop at NASA's [Glenn Research Center](#) in Cleveland.

Members of the CPST technology demonstration team from Glenn, NASA's [Marshall Space Flight Center](#) in Huntsville, Ala., and NASA's [Kennedy Space Center](#), Fla., shared results from four major cryogenic fluid test activities. These tests addressed technologies for passive and active thermal control, liquid acquisition in microgravity and chilldown of transfer lines — all key tests to advance NASA's ability to safely and cost-effectively

store and transfer advanced, cryogenic propellants required to power the nation's future space vehicles.

The work also included analytical studies to confirm scalability of planned technologies to very large vehicle tank systems; extensive performance model development activities, including a computational fluid dynamics benchmarking agreement with the French space agency, Centre National d'Etudes Spatiales, or CNES; and radio frequency-based technology for propellant mass gauging in microgravity.

The Space Technology Mission Directorate recognized the successful completion of the task, and hailed the team's outstanding efforts in summarizing an extremely large

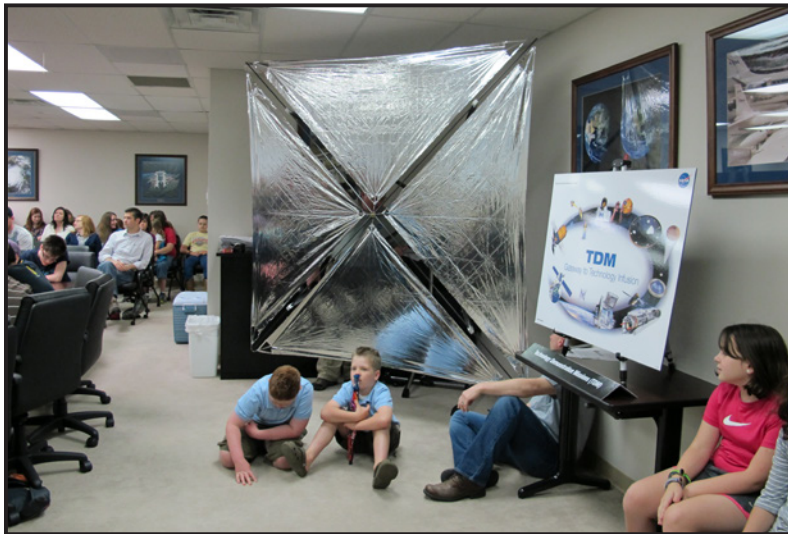
amount of work, and its succinct approach to assessing the project's technology readiness level.

As part of the project's infusion plan, [a series of CPST industry workshops](#) was planned for late spring and summer 2013. The first workshop was held the week of May 20. Each is focused on a particular technology area and provides attendees with detailed data and results. Attendees included representatives from government and industry partners. Workshop details are available at the hotlink above, or contact [Susan Motil](#), CPST project manager at Glenn, for more information.

Workers in the Small Multipurpose Research Facility, or SMiRF, at Glenn conduct liquid hydrogen reduced boiloff testing — key research in the agency's Cryogenic Propellant Storage and Transfer project. (NASA/GRC)



TDM Program Office Welcomes Homeschoolers



This spring, the Technology Demonstration Missions Program Office invited home-school networks in North Alabama to participate in a “Homeschool Day” at the [National Space Science & Technology Center](#) in Huntsville, where the program office resides.

Approximately 90 visitors — home-school students and their parents — participated. The informative, day-long session included speakers from the TDM Program Office and other organizations at NASA’s Marshall Space Flight Center in Huntsville, and provided hands-on activities that highlighted some of NASA’s current projects.

Ray French, TDM deputy manager at Marshall, welcomed the group. Ron Unger, mission manager for the [Solar Sail Demonstrator](#) project, explained details of that exciting TDM undertaking. Other Marshall team members supporting the [Space Launch System](#) Program showed the students launch animations and talked about the design and capabilities of NASA’s new heavy-lift exploration vehicle.



The students, ranging from kindergarten to 12th grade, assembled straw rockets and mini-robots. They were assisted by Marshall educators and engineers, who discussed how robots work with and assist humans in missions in space — as demonstrated by NASA’s [Human Exploration Telerobotics](#) project, also a key part of TDM.



Dozens of homeschooled students and their parents took part in the first TDM “Homeschool Day” at the National Space Science & Technology Center in Huntsville, where, from top, they examined a mockup of a solar sail; did a variety of hands-on experiments related to NASA science and engineering activities; and even got to build small rockets and robots with help from engineers and educators at the Marshall Center. (NASA/MSFC)

NASA Exhibits at 'SXSW' Festival Include TDM Projects

Thousands of concert goers at this year's South by Southwest, or SXSW, Interactive Festival—held in March in Austin, Texas—visited exhibits showcasing NASA's current missions and projects. Among these were two Technology Demonstration Missions: a hands-on look at the [Laser Communications Relay Demonstration](#) project via an augmented-reality app for users' phones, and a chance to train [Robonaut 2](#), one of the key automats demonstrating the future of [Human Exploration Telerobotics](#). Among those tackling the R2 training experience were editors of Mashable.com, a leading source of news for the social media generation. You can read their April 2013 spotlight story about Robonaut 2 [here](#).



Carolyn Keene, a project support specialist at Goddard, helps a visitor to NASA's SXSW booth try out the augmented reality app for the Laser Communications Relay Demonstration project—a key TDM initiative intended to revolutionize near-Earth and deep-space communications. (NASA/GSFC)



NASA engineer Ron Unger, second from right, mission manager for the Solar Sail Demonstrator project, lends a hand to K-8 educators assessing new TDM-themed classroom activities during a teacher workshop at the Marshall Center in March. (NASA/MSFC)

TDM to Become Part of 'NASA's BEST' Curriculum

Educational activities tied to projects in the Technology Demonstration Missions Program are set to be integrated into [NASA's Beginning Engineering, Science and Technology program](#), better known as "NASA's BEST." The program develops educational curricula and learning tools based on the principles of the engineering design process, and provides in-depth study guides and a wealth of hands-on learning activities for students in grades K–8.

The new TDM initiative was on view during an educator workshop hosted by NASA's [Marshall Space Flight Center](#) in Huntsville, Ala., in March. Designed to showcase new BEST projects and guides and create new partnership opportunities between NASA and educational institutions, the workshop included participation by NASA education leads from Marshall;

[Goddard Space Flight Center](#) in Greenbelt, Md.; [Glenn Research Center](#) in Cleveland, Ohio; and [Dryden Flight Research Center](#) at Edwards Air Force Base, Calif.

Kat Balch, an education curriculum specialist supporting NASA's BEST at the Marshall Center, presented the variety of TDM-themed education activities she is developing and asked educators to review her curriculum. Attendees broke into teams to assess new classroom activities tied to the [Solar Sail Demonstrator](#); the Mars Science Laboratory Entry, Descent and Landing Instrumentation (MEDLI) project; and the [Low Density Supersonic Decelerator](#) project. Once completed, the new TDM curriculum will be part of available classroom learning modules and activities on the [NASA's BEST Web presence](#).

<http://www.nasa.gov/oct>

Why We Do What We Do

From the TDM Program
Manager

By John McDougal



McDougal manages
the TDM Program Office
at the Marshall Center.

Our program has definitely seen its share of challenges over the last year or so—as has all of NASA, especially within our budgets. I think all of us at one point in our careers have asked why we do what we do. Not only what's in it for us—but what's in it for the greater good.

Sometimes all it takes is one little thing to pop up and remind us why our jobs are important and why we work so hard. For me, it happened as I was reviewing materials for this newsletter. I was reminded how our office had invited homeschool networks from across North Alabama to come in and participate in hands-on activities highlighting TDM projects. We also began our new initiative with NASA's Beginning Engineering, Science and Technology program, which develops

educational materials for kids in elementary and middle school. Once the TDM curriculum is completed, teachers will have access to learning materials on projects such as the Solar Sail Demonstrator and MEDLI.

I also read in this issue about Michelle Munk and her work on MEDLI. Two sentences in her story really stand out in my mind: "We can help them reduce their risk, and maybe their cost. That is the payoff we are so excited to see."

And there it is—why we do what we do. This is why, when faced with budget and other challenges, we don't quit. We look for better ways of doing things so we can continue bringing in students and their teachers to tell them about solar sails, to show them alternative technologies that might one

day enable them to travel to space. We come up with new ways of using data from our projects to help other missions, enabling them to find better, more efficient ways of designing their hardware.

Our program is charged with taking technologies once thought to be so far-fetched they were unattainable, and making them so real, so attainable that a 4th-grader can see her future as an astronaut when she looks at a model solar sail.

Our work is important, it's rewarding and it will change how future generations are able to work and live in space.

Thank ALL of you for doing what you do—every day.



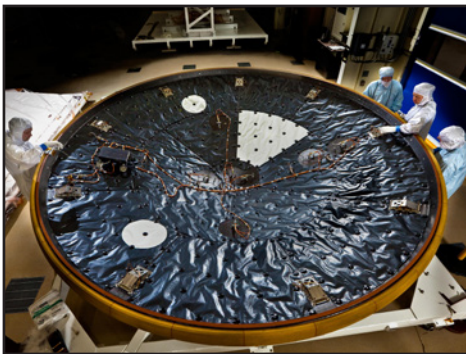
Seeing 'Green' at National Space Symposium

A 1:2 scale model of NASA's Green Propellant Infusion Mission project, or GPIM, payload made its debut in April at the National Space Symposium in Colorado Springs, Colo. The mockup was part of the booth hosted by Ball Aerospace & Technologies Corp. of Boulder, Colo., which leads the GPIM project for NASA. (Ball Aerospace)



Michelle Munk —
NASA engineer
and MEDLI deputy
manager

Editor's Note: TDM Bridge Builders are team members at various NASA centers and partner organizations who are helping bridge the gap, bringing one of our cutting-edge technologies to flight readiness. Got a suggestion for a team member worthy of a place in the limelight? Email richard.l.smith@nasa.gov.



Lockheed Martin engineers install the MEDLI instrumentation suite on the back of the Mars Science Laboratory's heat shield. (Lockheed Martin)

Michelle Munk is a NASA engineer supporting the [Mars Science Laboratory Entry, Descent & Landing Instrumentation](#) project, or MEDLI, at NASA's [Langley Research Center](#) in Hampton, Va. She earned a bachelor's degree in aerospace engineering from Virginia Polytechnic Institute in Blacksburg, Va., in 1991. Munk recently took time out from her MEDLI data review work to update "The Bridge" on the project, which was launched in 2011 aboard the [Mars Science Laboratory](#) and successfully tested during the lander's entry and descent at the red planet Aug. 6, 2012.

What are your responsibilities on MEDLI?

As the deputy project manager and the subsystem lead for pressure measurements [taken by MEDLI sensors embedded in the lander's heat shield], I get to help make sure the team can properly analyze and document the great data we got from Mars. As we were getting ready to launch, I was working on details of the pressure transducer manufacturing and testing. I was really lucky to get that hands-on experience, following the project from beginning to end. At Langley, I usually work at a higher level, managing technology development for [planetary] entry, descent and landing systems.

How do you hope your work will impact NASA's TDM goals?

I hope MEDLI is the pathfinder that leads to every NASA entry mission being instrumented. We have learned an enormous amount from the experience of developing and flying MEDLI to Mars, and from the wealth of data it returned. Our goal is to apply all we've learned to future entry vehicles so we can improve our computer models and more accurately predict what a spacecraft will encounter and how it will behave when it enters an atmosphere. Only by obtaining this detailed knowledge for every entry will we be able to effectively design larger, more capable vehicles — like those that might carry humans to Mars someday.

What's the latest MEDLI news? What do you next hope to accomplish?

The MEDLI data has been analyzed and our findings have been published over the past six months. We also are contributing to a special journal issue with all the MSL entry performance results, and we're making sure we've captured everything in internal NASA documents. We're very close to releasing the raw data to the broader community.

The thing we've claimed from the beginning — that MEDLI data will help other missions — is happening. Our engineers analyzing the vehicle's thermal data and material performance are sharing their findings with the next American Mars entry mission, [InSight](#). Even though the InSight heat shield is made of a different material than that of the Mars Science Laboratory, the InSight team can still take what we learned about predicting the heating and apply it to their mission. We can help them reduce their risk, and maybe their cost. That is the payoff we are so excited to see!

What was your first job for NASA?

I joined NASA in 1987 as a co-op student, which means I was still a sophomore in college when I started working at NASA's [Johnson Space Center](#) in Houston every other semester. My very first job was helping design the personal hygiene area for the International Space Station! We were encouraged to move around during subsequent semesters, and during my third tour, I found my niche in interplanetary trajectory design. I learned to compute the trip times for sending humans to Mars and back — something we're still doing today.

What's one thing most people would be surprised to learn about you?

People are usually surprised to learn that I grew up in Ocean City, Md., which is a beach resort. I still love to boogie board, and I return to Ocean City every year to enjoy the sun, sand and surf with my husband and two daughters.

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