National Aeronautics and Space Administration

Space Technology
Game Changing Development
Monthly Highlights

July 2013

Space Technology Highlighted on the Hill

By Ryan Ligon, LARSS Intern
Photos by Joey Donatelli, LARSS Intern

Around 500 congressional staffers and 15 congressional Representatives converged on the foyer of the Rayburn House Office Building Tuesday, July 23 for NASA Technology Day on the Hill. The Congressmen and their staffers engaged with NASA and its industry partners who are building the frontier of space technology. The annual event illustrated how investments in space technology made by NASA, industry and academia directly benefit our nation's innovation-driven economy. These technologies help America maintain the global technological high ground and enable NASA's current and future missions of exploration and discovery. Notable attendees included NASA Administrator Charles Bolden, NASA Chief Technologist Mason Peck, and NASA Associate Administrator for the Space Technology Mission Directorate Michael Gazarik.

NASA Administrator Charles Bolden (left) made the rounds at NASA's Tech Day on the Hill. Pictured at center is Composite Cryotank Project Manager John Vickers.

Robonaut 2, the twin of the humanoid robot currently on ISS, greeted visitors at the door and was one of numerous exhibits at the event. The premise of the event dates back to NASA's founding through the National Aeronautics and Space Act of 1958 in which the agency was commissioned to transfer as much of its technology as possible to uses in public industry. The event, held each year on Capitol Hill, included exhibits and demonstrations from various NASA centers, contractors, and industry partners from both public and private industry.

3D printing technology, a current hot topic in the tech world, was showcased by Made in Space, the company that recently shipped off the first 3D printer to be taken to space aboard the International Space Station. Printers such as this

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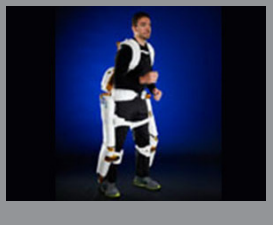

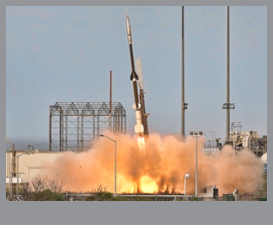

Space Technology on the Hill

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have tremendous potential to aid in repair and production of parts in space, reducing a spacecraft's dependence on ground support for repair and maintenance.

Two solar panel manufacturers involved in the newly unveiled Asteroid Retrieval Mission were also in attendance. Alliant Techsystems Inc. (ATK) demonstrated its MegaFlex circular, radial foldout array with a 6-foot diameter floor model. Deployable Space Systems (DSS) did the same with its spring-loaded, rectangular, rollout array. Both companies are in the running to provide power for the Asteroid Retrieval Mission's solar electric propulsion "tug" spacecraft and the manned Orion module.

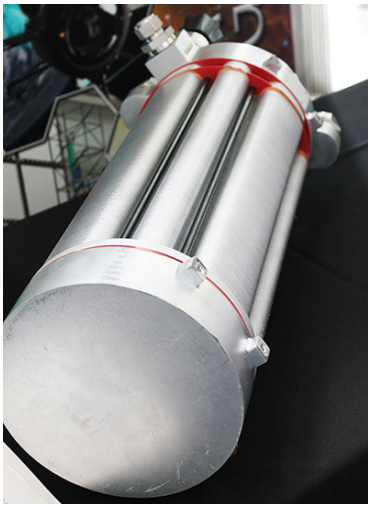
Final Frontier Design brought out its next generation Internal Vehicular Activity (IVA) flight suit as well as several models of next-gen astronaut gloves. Final Frontier Design's flight suit is a significant improvement over current IVA flight suits because of its lighter weight, single layer design as opposed to the traditional, and somewhat motion-restrictive, two-layer design. PURETi, an environmental company, was also among the attendees. PURETi's clear, water-based spray can be applied to any surface to reduce cleaning time and frequency, improve indoor air quality, and actively reduce smog when applied to outdoor surfaces.

Also on display was a NASA Space Communication demonstration. Since its inception, NASA has communicated with its spacecraft via radio frequency devices. These radios are excellent and reliable for near-Earth missions; however, for deeper, manned space missions, time delays between the initial transmission and reception of messages becomes significant. To solve this issue, NASA is developing laser communication devices to more quickly transfer messages from spacecraft to the ground.

L'Garde's large solar sail display — a NASA Technology Demonstration Mission — was another notable feature in the Rayburn building's foyer. The large square of silvery Mylar is being targeted for use in an early warning system to help NOAA track solar flares. NASA is looking at solar sails to provide propellantless station keeping and transportation and unmanned satellites. Eliminating or drastically reducing fuel needs gives spaceflight missions the ability to carry more instruments and mass that would usually have been taken up by engines and propellant.

L'Garde's large solar sail display.

Final Frontier Design's next-gen astronaut gloves.



Fuel cell technology on display.

A significant, terrestrial based application of NASA technology was demonstrated by Vecna Technologies, whose QC Bot sees applications in aiding hospital staff. The box-looking robot is capable of augmenting hospital staff capabilities by transporting medication and materials, aiding in patient check-in, and enabling video conferencing with other doctors or nurses in other buildings or rooms.

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NASA, Industry Test "3D Printed" Rocket Engine Injector

Excerpt from NASA news release

NASA and Aerojet Rocketdyne recently finished testing a rocket engine injector made through additive manufacturing, or 3-D printing. This space technology demonstration may lead to more efficient manufacturing of rocket engines, saving American companies time and money.

The tests were conducted at NASA's Glenn Research Center in Cleveland. The series of tests demonstrated the ability to design, manufacture and test a critical rocket engine component using selective laser melting manufacturing technology — a method that employs high-powered laser beams to melt and fuse fine metallic powders into three dimensional structures.

"NASA recognizes that on Earth and potentially in space, additive manufacturing can be game changing for new mission opportunities, significantly reducing production time and cost by 'printing' tools, engine parts or even entire spacecraft," said Michael Gazarik, NASA's associate administrator for space technology in Washington. "3-D manufacturing offers opportunities to optimize the fit, form and delivery systems of materials that will enable our space missions while directly benefiting American businesses here on Earth."

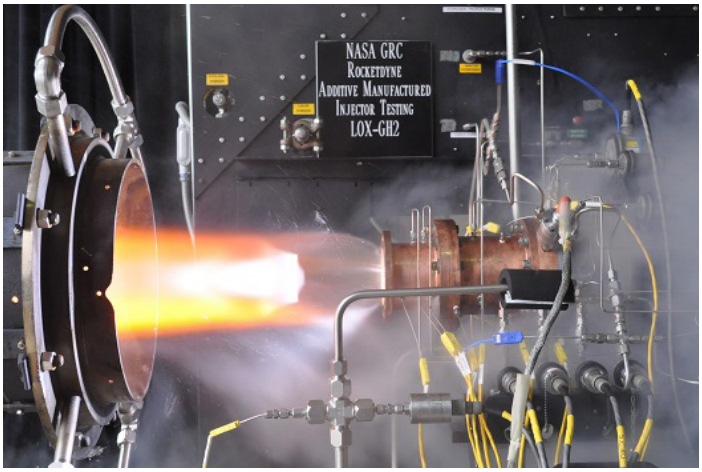

Image Credit: NASA Glenn Research Center

Liquid oxygen/gaseous hydrogen rocket injector assembly built using additive manufacturing technology is hot-fire tested at NASA Glenn.

Image Credit: NASA Glenn Research Center

Task lead Tyler Hickman, on the right, and technicians inspect the rocket injector assembly as it's installed in the Rocket Combustion Laboratory at NASA Glenn.

This type of injector manufactured with traditional processes would take more than a year to make, but with these new processes it can be produced in less than four months, with a 70 percent reduction in cost.

The project is supported by the Game Changing Development Program in NASA's Space Technology Mission Directorate, which is innovating, developing, testing and flying hardware for use in NASA's future missions.

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Among the other technologies represented was NASA's Game Changing Development Program's Composite Cryotank project, which features a lightweight, composite cryogenic fuel tank built by Boeing — as well as fuel cell technology, Woven TPS and a human grasp-assist glove built by a joint partnership of GM and NASA using technology from Robonaut 2.

NASA's partnership with industry and potential for consumer-ready products was on full display Tuesday. The energetic and talkative crowd filled the room for the duration of the 4-hour event and demonstrated a strong popular interest in NASA technology shared by many. NASA is innovating, developing, testing and flying hardware for use in NASA's future missions that have real-world benefits here on Earth, today.

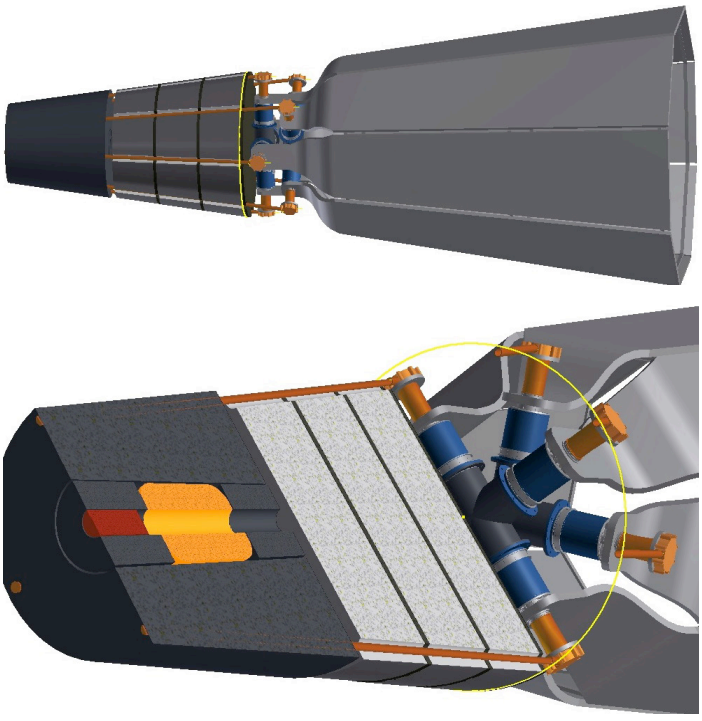
Game Changing Technologies Among R&D Magazine's Top 100 of the Year

Two game changing technologies were selected as R&D Magazine's Top 100 technologies of the year. Also known as the "Oscars of Innovation," the R&D 100 Awards celebrates the top 100 significant technology products from all sectors.

Both the Robo-Glove — or Human Grasp Assist device — and the Kilopower Space Fission Power System technology were recognized.

The Kilopower power formulation activity under the Nuclear Systems project was a codeveloper of the Kilopower Space Fission Power Systems technology. The team comprised engineers from Los Alamos National Laboratory, NASA's Glenn Research Center, and National Security Technologies LLC.

Kilopower is a concept for a small space-fission power system that uses solid cast uranium-235 fuel and sodium heat pipes coupled to advanced Stirling converters to produce about 1 kilowatt of electrical power. An experimental proof-of-concept was completed by the team in 2012 at the Nevada National Security Site where an existing U-235 reactor, called Flattop, transferred thermal power through a heat pipe to a pair of small Stirling converters that produced 24 watts of electricity. The test marks the first use of a heat pipe to extract thermal power from a reactor as well as the first use of a Stirling converter to produce electric power with a fission heat source. The results demonstrate the feasibility of a small heat pipe reactor for space applications enabling future space science missions that might not be possible with current technology.



Small Stirling converter reactor (top) with cutaway view (bottom).

Photo by Joey Donatelli

NASA's Robo-Glove.

The Robo-Glove was built through the continuing partnership between NASA and General Motors. It uses Robonaut 2 technology to increase the strength of a human's grasp. The glove would help autoworkers and astronauts do their respective jobs better while potentially reducing the risk of repetitive stress.

The Robo-Glove is game changing because it uses leading-edge sensors, actuators and tendons comparable to the nerves, muscles and tendons in a human hand, which gives it unprecedented dexterity.

Gazarik Introduces Bright Minds to Space Tech

By Joey Donatelli, LARSS Intern

At NASA's Langley Research Center, Mike Gazarik, associate administrator for NASA's Space Technology Mission Directorate (STMD), reminded nearly 200 summer interns of the important role they play in space technology.

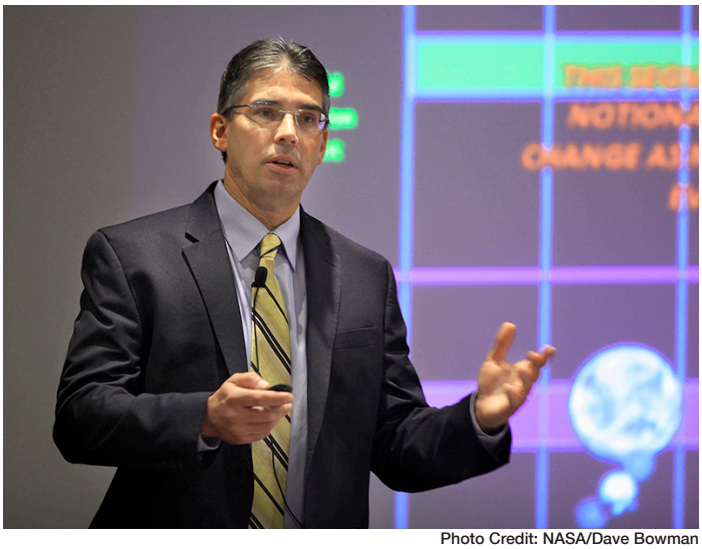


Photo Credit: NASA/Dave Bowman

AA for STMD Mike Gazarik speaks to interns at NASA Langley.

"Space tech is about building a community of people," Gazarik said, "especially those in college…tapping into the brightest minds, and yes, you are the nation's brightest minds, you're going to be called that a lot in the years as you come out of college."

Gazarik provided an overview of STMD and highlighted some challenges within the agency that space tech will address.

Gazarik said that STMD is about getting back into the labs, "building, testing and flying." Then, solutions follow.

"You've all heard the phrase 'failure is not an option', and in human spaceflight that's absolutely true. But it turns out, in the technology world, that's not the greatest approach to take," Gazarik said. "Failure needs to be an option. If you don't try new technologies or approaches in the lab then that's when you're guaranteed to fail; it won't result in any breakthroughs."

For the full article, visit http://www.nasa.gov/larc/gazarik-introduces-bright-minds-to-space-tech/#.Uhtt1oKJS0o

Mike Gazarik, the associate administrator for NASA's Space Technology Mission Directorate, visited the Goddard Space Flight Center Monday, July 29 to get a first-hand look at emerging technologies, including an experiment that Goddard scientist Keith Gendreau (pictured, left) is building that will both gather information about neutron stars and demonstrate pulsar-based navigation. Here, NASA's Game Changing Development Program Executive Tibor Balint listens as Gandreau discusses the technology.

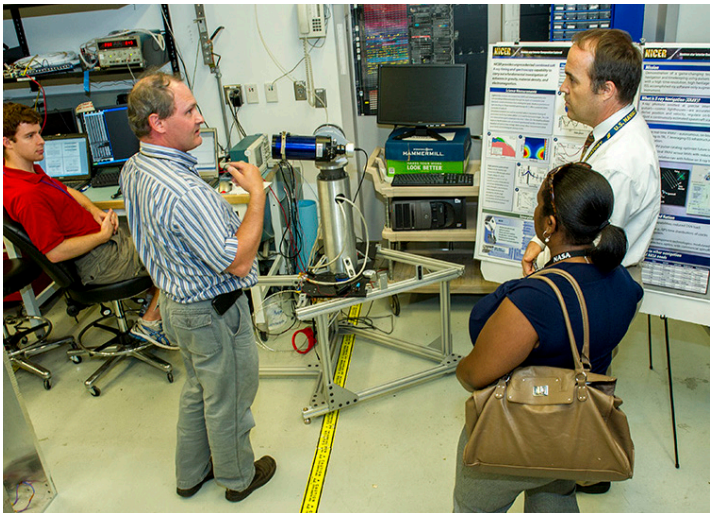


Photo Credit: Bill Hrybyk

Game On!

http://gameon.nasa.gov

For more information, contact
Amy McCluskey
Communications Manager
Game Changing Development Program Office
NASA Langley Research Center
757-864-7022
amy.leigh.mccluskey@nasa.gov