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MARSHALL STAR

In This Week's Star

Marshall Celebrates 'People, Progress and Partnerships' at Annual Director's Breakfast

By Bill Hubscher and Sanda Martel

Elected officials, business and community leaders from across North Alabama gathered May 17 in the Davidson Center for Space Exploration at the U.S. Space & Rocket Center in Huntsville to celebrate accomplishments and better understand the future direction of the Marshall Space Flight Center at the annual Center Director's Breakfast.

Image right: Goldman speaks to elected officials, business and community leaders at the annual Marshall Center Director's Breakfast May 17. (NASA/MSFC/Emmett Given)

Acting Center Director Gene Goldman updated attendees on the status of major programs and projects and recognized the workforce that helped lead to the success of the center. The theme of this year's event was "People, Progress,

Partnerships."

"Our theme this year is very appropriate," said Goldman. "Our people and their skills make us unique, and these same people help the agency make progress towards our scientific and exploration goals. Plus, we are here today to honor the great partnerships between NASA and the space exploration industry."

Goldman presented three companies with 2011 Marshall Center Contractor Excellence Awards for significant contributions to the Marshall Center's mission. Recipients included Pratt & Whitney Rocketdyne of Canoga Park, Calif.; SAIC of Huntsville; and HPM Corp. of Kennewick, Wash.

Eligible contractor companies were evaluated for the award on the following criteria: contract technical performance; schedule and cost performance; leadership and quality improvements; customer satisfaction; innovation; and a category that included safety, diversity and outreach.

Pratt & Whitney Rocketdyne was honored in the "Large Business – Product" category for providing propulsion products to NASA, including the space shuttle main engines and propulsion systems for the United Launch Alliance Atlas and Delta expendable launch vehicles. The company specializes in the design, manufacture and service of aircraft engines, space propulsion systems and industrial gas turbines.

SAIC was honored in the "Large Business – Service" category. The company provides a wide spectrum of Information Technology services for Marshall and the agency. This includes software development and maintenance, mission-critical IT implementation, operations and maintenance, and telecommunications and network management.

HPM Corp. was honored in the "Small Business – Service" category. The woman-owned company operates and manages occupational health services for the Marshall Center. This includes occupational medicine, emergency medical response, industrial hygiene and respiratory protection.

Recipients of the Marshall Center's Contractor Excellence Award may become nominees for NASA's George M. Low Award. Named for the former NASA deputy administrator who served from 1969 to 1976, the Low Award is the agency's oldest and most prestigious award for quality and performance in the aerospace industry.

Hubscher and Martel are AI Signal Research Inc. employees supporting the Office of Strategic Analysis & Communications.

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SpaceX Launches NASA Demonstration Mission to Space Station
NASA news release

The second demonstration mission for NASA's Commercial Orbital Transportation Services, or COTS, program is under way as SpaceX's Falcon 9 rocket and Dragon spacecraft lifted off May 22 from Cape Canaveral Air Force Station in Florida at 2:44 a.m. CDT.

Image left: The SpaceX Falcon 9 rocket lifts off from Space Launch Complex-40 at Cape Canaveral Air Force Station, Fla., to begin a demonstration flight. (NASA TV)

"I want to congratulate SpaceX for its successful launch and salute the NASA team that worked alongside them to make it happen," NASA Administrator Charles Bolden said. "Today marks the beginning of a new era in exploration; a private company has launched a spacecraft to the International Space Station that will attempt to dock there for the first time. And while there is a lot of work ahead to successfully complete this mission, we are certainly off to good start. Under President Obama's leadership, the nation is embarking upon an ambitious exploration program that will take us farther into space than we have ever traveled before, while helping create good-paying jobs right here in the United States of America."

The Dragon capsule will conduct a series of checkout procedures to test and prove its systems, including the capability to rendezvous and berth with the International Space Station. On May 24, Dragon will perform a flyby of the space station at a distance of approximately 1.5 miles to validate the operation of sensors and flight systems necessary for a safe rendezvous and approach. Live NASA TV coverage will begin at 1:30 a.m.

Following analysis of the flyby by NASA and SpaceX managers, the Dragon capsule will be cleared to rendezvous and berth with the space station May 25, marking the first time a commercial company has attempted this feat. The Expedition 31 crew on board the station will use the orbiting complex's robotic arm to capture Dragon and install it on the bottom side of the Harmony node. NASA TV will provide live coverage beginning at 1 a.m.

"This flight is an important milestone as NASA and SpaceX develop the next generation of U.S. spacecraft to carry the critically important experiments, payloads and supplies to our remarkable laboratory in space," said William Gerstenmaier, associate administrator for NASA's Human Exploration Operations Directorate at the agency's Headquarters in Washington.

SpaceX and Orbital Sciences, which will perform its own test flight later this year, have been working under NASA's COTS program, which provides investments to stimulate the commercial space industry in America. Once the companies have successfully completed their test flights, they will begin delivering regular cargo shipments to the station.

"NASA is working with private industry in an unprecedented way, cultivating innovation on the path toward maintaining America's leadership in space exploration," said Philip McAlister, director for NASA's Commercial Spaceflight Development.

In parallel to COTS, NASA's Commercial Crew Program is helping spur innovation and development of new spacecraft and launch vehicles from the commercial industry to develop safe, reliable and cost-effective capabilities to transport astronauts to low-Earth orbit and the space station.

NASA also is developing the Orion spacecraft and Space Launch System, a crew capsule and heavy-lift rocket that will provide an entirely new capability for human exploration beyond low-Earth orbit. Designed to be flexible for launching spacecraft for crew and cargo missions, SLS and Orion will expand human presence beyond low-Earth orbit and enable new missions of exploration across the solar system.

For up-to-date SpaceX mission information and a schedule of NASA TV coverage, visit http://www.nasa.gov/spacex.

For NASA TV downlink information, schedules and links to streaming video, visit http://www.nasa.gov/ntv.

For more information about NASA's commercial space programs, visit http://www.nasa.gov/exploration/commercial.

For an interactive overview of NASA's commercial space programs, visit http://www.nasa.gov/externalflash/commercializingspace.

For an interactive overview of the future of American human spaceflight, visit http://www.nasa.gov/externalflash/human_space.

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Marshall's Virtual Environments Laboratory: Where Virtual Reality Meets Space Essentiality

By Jessica Eagan

Virtual worlds. Tracking movements. Avatars. Sounds like what one would need for a fun video game with a lifelike experience.

Image right: Marshall engineer Peter Ma, in the Marshall Virtual Environment Laboratory, wears a suit covered with spherical reflectors. This gear enables his body positions to be captured by a motion-tracking system, creating a model that is performing the same tasks in the virtual world that he is performing in the physical world. The human model in red on the screen represents the system-generated image of Ma's position, while the human model in light blue is a system-generated image of Kennedy Space Center engineer Jim Bolton, who is in Kennedy's Human Engineering Modeling and Performance laboratory. In this simulation, the two virtual humans picked up the models of the boxes shown on the floor and passed them back and forth. (NASA/MSFC/Emmett Given)

While the Marshall Space Flight Center's Virtual Environments Laboratory doesn't keep score and there isn't a winner, the work performed there is similar to the gaming world. Its mission: to assure that human factors engineering practices -- the study of how people interact with product designs -- are incorporated into space system designs.

Located in Building 4649, this lab is currently a 6-foot-by-6-foot work area surrounded by two big-screen monitors and 12 motion-tracking infrared cameras that follow the movements of up to two people -- called evaluation talents. The talents are dressed in black and blue suits, head-mounted displays and cyber gloves, all covered with white spherical reflectors. The cameras send infrared beams to track the reflectors and determine where they are in this six-dimensional space, creating an avatar. A software program called Cortex translates the camera data into where the dots are on the virtual human. The information is then fed into a program called Bones, which recognizes the "human" and places a skeleton-like figure around the avatar. Once that has been established, the data is sent to the human factors analysis program called Jack, which allows engineers to tie the avatar to the actual virtual human. The talent's movements can then be captured in the software

and evaluated by the Human Factors Engineering Team here at the center.

"We have the ability to 'see' and study movement to determine if an astronaut can perform work tasks that will allow them to live in a future deep space environment," said Don Krupp, branch chief in the Systems Analysis Branch of the Engineering Directorate. "Basically we develop a space habitat in a three-dimensional Computer-Aided Design, known as CAD, program and we place a virtual human in that area. We then use our laboratory to evaluate how well the person is going to perform in those quarters. The great thing about our technology is we can do a lot of things virtually before we actually cut the metal or build the final design. If the person needs to lift a box of supplies, is it going to be too heavy to lift alone, or does another person need to help? And if that person helps, is there going to be enough room for both of them to safely maneuver? Is more space needed? If the person needs to change out a battery or a flight computer, can it be done within reach or does it need to be relocated? Where do we need to put handholds? These are some of the questions we ask ourselves and we adjust designs based on how we see the virtual person interacting in the virtual world."

When evaluation talents are used, engineers measure them to make sure they create an avatar that matches physical dimensions so they can accurately see their movements, giving the designers a feel for where to place equipment and how the humans are going to interact.

"If the talent is trying to put a washer and a nut around a bolt, we can get the level of fidelity," said Krupp. "If he or she is holding a tool, we can see the stress and strains on the fingers and the muscles in the hands and the wrists to get that data. These are the kinds of things we're looking at. We're worried not only about the human being safe, but if somebody tried picking up a 75-pound box and strained their back, they're likely to drop that box, so now we've also damaged that piece of equipment."

The lab is funded by the Engineering Directorate and its primary customer is the Advanced Exploration Systems, or AES, Habitation Systems Project in the Human Exploration and Operations Mission Directorate at NASA Headquarters. The project is developing concepts and prototype subsystems for a habitat that will allow the crew to live and work safely in deep space for extended periods of time. The team is located at several NASA centers including Marshall, Johnson Space Center, Kennedy Space Center, Goddard Space Flight Center, Langley Research Center, Jet Propulsion Laboratory, Glenn Research Center and Ames Research Center. "We are in the concept development phase right now with AES," said Krupp.

"We're getting the CAD models of what the configuration of the Deep Space Habitat might look like, and our talents will evaluate the design to see if that space will work. As the design matures in the virtual world, we're also going to build a real model here in Building 4649. We'll then anchor our virtual model with the physical model to make sure that we have a good correlation between the virtual and physical world."

The Habitat Systems Project will define and mature habitat architectures that enable human exploration of the range of destinations outlined in NASA's Capability Driven Framework. The plans for FY12 include developing a low-to-medium fidelity concept demonstrator using rapid prototyping techniques to evaluate alternative configurations, and perform volumetric and usability studies.

Krupp anticipates that in the next few years, other NASA and industrial collaborator sites will be brought into the simulation, and each will contribute CAD models of their design, enabling virtual "fit checks" many months before the hardware is built, ensuring components will match up when hardware is delivered at the launch site or wherever the equipment is needed.

This technology could also be used in preparation for evaluation of worksites for the Space Launch System vehicle -- NASA's new heavy-lift launch vehicle.

"We could use it to look at the things technicians will need to do to actually service the vehicle when it arrives at Kennedy," said Krupp. "We could use the virtual lab to figure out where the work platforms had to go, make sure that the ground support equipment could put the human in its proper place to change batteries and repair and replace units, and they could put fluid lines safely together with their hands."

Collaboration demonstration

The virtual lab also can collaborate with other centers that have a similar environment. Marshall teamed with Kennedy's United Space Alliance's Human Engineering Modeling and Performance laboratory to demonstrate this capability to Japan Aerospace Exploration Agency personnel who recently visited the Space Coast. Marshall engineer Peter Ma entered the virtual world from Building 4649 while Kennedy engineer Jim Bolton entered the same world from Florida.

"In this simulation, the two virtual humans picked up virtual boxes and passed them back and forth," said Krupp. "And we actually had them do a virtual high five. Our software has the capability to detect collisions, so if the person ran into a wall with their shoulder, we would see the shoulder flash and change different colors. When they high-fived, we saw the avatar's hands turn yellow and they actually 'touched' in the virtual world."

This collaboration establishes the capability for geographically distributed designers to enter the same virtual space to resolve design issues together.

How it all began and where it's going

Krupp said the precursor to this project was the upper stage development of the Ares I crew launch vehicle.

"We were looking at bringing human factors early on into the program as the designers were figuring out where to place various components," said Krupp. "We didn't have motion-tracking cameras then, but we would program avatars and place them in a virtual worksite and analyze their motions, allowing us to make recommendations on what we saw. Sometimes the piece of equipment was too heavy for one person to safely lift, so we gave recommendations on where to put the equipment so people could go in and do what they needed to do. We could see on the computer if an avatar's back was strained."

While engineers gained a lot of information based on the avatar's reactions in the software, Krupp said the problem was the avatar would move the equipment the same exact way every time, doing only what the programmer would tell it to do. "What we found was when we put actual humans in there to do the physical task with equipment mockups, we saw additional behavior such as needing to catch their balance on handholds or tiredness," said Krupp. "So over the past few years, we've been working with the Engineering Directorate to invest in more technologies to advance this lab even further. Right now, we only have a small footprint to work in, but as money allows, we're purchasing more trusses to raise the cameras up and out. This will increase our workspace.

"We're also going to eventually get more cameras," he added. "This will allow for more people to enter the virtual world simultaneously. We'd like to put some cameras fairly low on the truss so we can better triangulate the feet. Eventually, we'd also like to purchase more props. Right now, we have wire-framed boxes that weigh very little. In our software, we can actually put pounds on them, allowing us to see how much stress is on their back. The only problem is since the wire-framed boxes don't have any weight, the talents will pick them up differently as opposed to a 30-pound box. So we're not catching that little nuance. Later on, we'll purchase heavier boxes to capture more accurate results. These are some of the things that we're looking at in the future as we begin to use this lab more."

For more information about the lab and to join in on discussions, team members can visit the lab's ExplorNet site at https://explornet.msfc.nasa.gov/groups/virtual-environments-laboratory or the Human Factors Engineering Team's site at https://explornet.msfc.nasa.gov/groups/msfc-human-factors-team.

Eagan, an AI Signal Research Inc. employee and the Marshall Star editor, supports the Office of Strategic Analysis & Communications.

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Proven Friction Stir Welding Technology Brings Together Reliability and Affordability for NASA's Space Launch

System

By Amie Cotton

NASA's next heavy-lift launch vehicle, the Space Launch System, is moving further in development faster thanks to proven advanced technologies like friction stir welding.

Image left: Four aluminum domes, each created using innovative friction stir welding processes, are seen in this overhead view of the Marshall Center's Advanced Welding and Manufacturing Facility. In this cutting-edge facility, a team of NASA and contractor engineers and technicians develops complex manufacturing processes aimed at achieving high-strength, defect free, uniformly bonded aluminum structures -- a vital requirement for next-generation launch vehicles and hardware designed for long-term space travel. (NASA/MSFC)

Friction stir welding uses frictional heating combined with forging pressure to produce high-strength bonds virtually free of defects. The welding process transforms metals from a solid state into a "plastic-like" state, and uses a rotating pin tool to soften, stir and forge a bond between two metal plates to form a uniform welded joint -- a vital requirement of next-generation space hardware.

"NASA is leveraging key technologies like friction stir welding from the Space Shuttle Program to design and manufacture the Space Launch System," said Todd May, SLS program manager at the Marshall Space Flight Center. "NASA's advancements in friction stir welding techniques used to manufacture the space shuttle external tanks give SLS a head start in development while reducing program cost, increasing reliability and creating hardware with superior mechanical properties. This technology directly supports SLS' program tenets of safety, reliability and sustainability."

In the mid 1990s, following use of a new lightweight aluminum lithium alloy created to reduce the weight of the external tanks, Marshall engineers found the new alloy difficult, complex and costly to weld. Engineers researched and adapted the innovative friction stir welding process for use on the 153.8-feet-tall orange space shuttle external tanks used to hold propellant for the space shuttle main engines. The process reduced manufacturing costs, increased reliability and significantly lowered the number of defects to yield a nearly perfect weld.

The Space Shuttle Program implemented the new weld technique in its manufacturing process of the external tank in 2001. The first friction stir welded tank flew in 2009. Since then, NASA has developed multiple tools and advanced processes to enhance its welding capabilities on aerospace hardware.

"State-of-the-art friction stir welding will continue to be a critical technology as we continue to learn how to build more efficient space vehicles with less expensive materials," said Jon Street, welding and manufacturing lead in the Material & Processes Laboratory at the Marshall Center. "Friction stir welding yields higher strength metals with higher reliability and predictability. It also increases efficiency by reducing the number of weld passes that traditional fusion arc welding requires. In addition, it offers safer, more environmentally friendly operations than traditional welding by not creating hazards such as welding fumes, radiation or high voltage. SLS will benefit from all of these advancements."

Today, the Boeing Company of Huntsville is developing the SLS core and upper stage using the friction stir welding process.

The core stage will stand more than 200 feet tall with a diameter of 27.5 feet and store cryogenic liquid hydrogen and liquid oxygen to feed RS-25 engines. The upper stage, powered by J-2X engines, will be used on the evolved SLS and share common attributes with the core stage such as its outer diameter, material composition, subsystem components and tooling. Both stages will be built at the Michoud Assembly Facility with state-of-the-art manufacturing equipment and tooling -- including one of the largest robotic friction stir welding systems in the world.

"NASA's strategy to affordably achieve a 2017 first flight for its new launch vehicle depends a great deal on the ability to leverage existing technologies and expertise, while taking advantage of the new science and innovations necessary to achieve extended flights of discovery," said Jim Chilton, Boeing Exploration Launch Systems vice president. "Friction stir welding technology meets all of those challenges."

Cotton, an AI Signal Research Inc. employee, supports the Office of Strategic Analysis & Communications.

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NASA Conducts Tests on Orion Service Module

Engineers at the Marshall Space Flight Center are testing parts of the Orion service module to ensure the spacecraft can withstand the harsh realities of deep space missions.

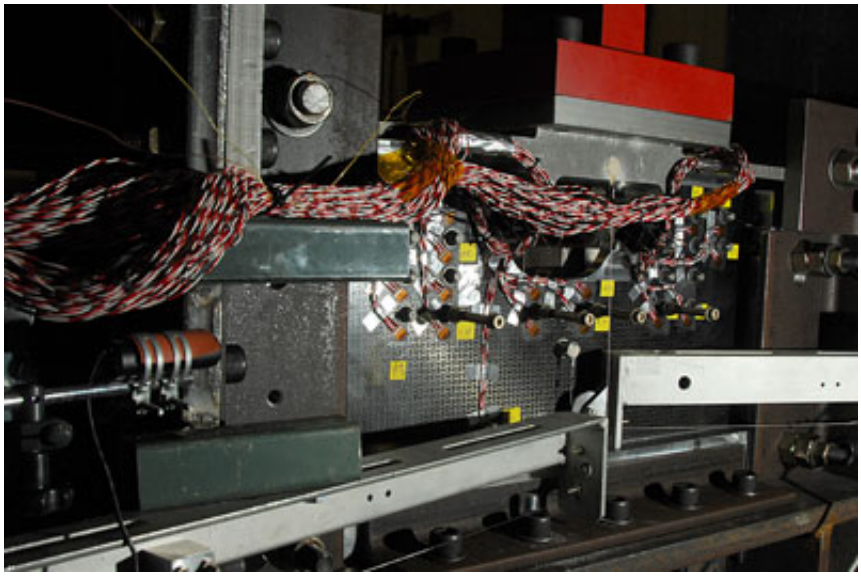

Image right: Load-withstanding capabilities of the Orion service module's conical adapter joint are tested at Marshall's Material Environment Test Complex facility. The test was successfully completed in March. (NASA/MSFC)

To date, Marshall has completed two structural loads tests, and another is under way. Structural loads tests prove the structural performance or material behavior of a design as weight is applied to it. Most of the time, the allowable weight is exceeded to test the material at extreme conditions to verify the tolerance of the material or design.

"Marshall was called upon to assist since we had the necessary test facilities and experienced team that could move out quickly to take on these very complex tests," said Scott Chartier, a test engineer in Marshall's Propulsion Systems Test Branch. "We were able to save time and budget since we had the facilities Orion needed, and they didn't have to build a duplicate test facility."

To date, development tests have been performed on key structural pieces of the Orion spacecraft, called the shear panel and the conical adapter. Both of these pieces can be thought of as the skeleton of the Orion vehicle. These tests validated the design and manufacturing processes that will be used for Orion's service module and verified the load-bearing capabilities of the components.

Image left: From left, Jeremy Kelly, Wes Lawler and Dani Davis, all Lockheed Martin Corp. test personnel, perform tests on the Orion manufacturing development article shear panel. (NASA/MSFC)

"The shear panel and conical adapter joint achieved all load conditions, and no permanent or visual damage was observed after the tests," said Chartier. "In addition, the conical adapter was successfully taken to the maximum capability, which concluded the test series."

The next set of tests will provide data that will be used for acceptance of the design and incorporated into the Orion Exploration Flight Test 1, or EFT-1. The results from these tests will be used to assess the materials and workmanship of the Orion service module's shear panels. The acceptance test is laying the groundwork for EFT-1, planned for 2014 that will launch an uncrewed Orion spacecraft on a Delta IV Heavy to an altitude of 3,600 statute miles above Earth -- a distance that has not been achieved by a craft intended for human flight since the Apollo missions. This test will ensure that several of Orion's systems, including the heat shield, can withstand a return to Earth from a deep space mission.

"We are excited to have the opportunity to do these structural tests at Marshall to help with NASA's Orion program," Chartier said. "It will help us get Orion to that first test flight."

Image right: The Orion Ground Test Vehicle shows the Orion "skeleton" used for pathfinding operations in preparation for the Orion spaceflight test vehicle slated for NASA's Exploration Flight Test, or EFT-1, in 2014. (NASA)

The Orion spacecraft, managed by the Johnson Space Center, will be launched on missions by NASA's Space Launch System -- a heavy-lift launch vehicle that will provide an entirely new capability for human exploration beyond low-Earth orbit. Designed to be flexible for launching spacecraft for crew and cargo missions, SLS will expand human presence beyond low-Earth orbit and enable new missions of exploration across the solar system. SLS is managed by the Marshall Center.

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NASA $1.5 Million Robot Competition Rolls Onto WPI Campus June 14-17
NASA news release

Autonomous robots created by 11 teams of engineers from across the country will compete for a NASA prize purse of $1.5 million on the campus of Worcester Polytechnic Institute, or WPI, in Worcester, Mass., June 14 -17. The challenge: design and develop the next generation of robots to explore the landscapes of other worlds.

The NASA-WPI Sample Return Robot Challenge requires the competing teams to design and build an autonomous robotic system that will locate and collect a set of specific objects from a large area and return the "planetary samples" to the starting zone.

The innovative technologies the teams bring forward can help NASA in future exploration of distant planets while also potentially benefiting life here on Earth. Earthly benefits could include areas such as disaster recovery and mitigation, and remote exploration and mapping of hazardous terrains.

The NASA-WPI Sample Return Robot goals are to discover innovative new technologies to advance robot navigation and sample collection without human control, and demonstrate robotic transportation over varied terrain without the aid of GPS or other Earth-based systems. The competition also will empower educators and people of all ages by introducing robotics and how they work, where they work, and real-world applications of how robots will be used in the future.

The competition's roving area includes open rolling terrain, soft soils, a variety of rocks and immovable obstacles such as trees, large rocks and water hazards. Teams will be given maps with appropriate orbital resolution, including the location of the starting position and a pre-cached sample, but will have no control of the robots during the competition.

Robots will have to identify and collect samples and return them to their starting point. Samples will have different point values. Prizes will be determined based on the scores for the number and point value of samples collected and returned to the starting location.

During the first phase of the competition, a robot must autonomously navigate and retrieve a pre-cached sample within 15 minutes. Teams will compete for portions of a $50,000 total prize purse, with a maximum winning value of $5,000 per team.

In the second phase, a robot must autonomously navigate and retrieve pre-cached samples as well as other, more difficult samples distributed over the roving area within two hours. Teams will compete for up to $1.5 million during this phase, with awards depending on the amount of points scored and number of successful competing finalists.

WPI is the first university selected as host and manager for one of NASA's Centennial Challenges Programs, which promotes technical innovation through novel prize competitions. NASA chose WPI to run this Centennial Challenge because of its proven experience managing robotics competitions, its academic expertise in robotics engineering, and its leadership in science, technology, engineering and mathematic education.

NASA uses prize competitions to establish important technical challenges without having to specify the approach that is most likely to succeed, while only paying for successful results. These competitions increase the number and diversity of individuals, organizations and teams that are addressing a particular problem or challenge of national or international significance. These challenges stimulate private sector investment many times greater than the cash value of the prize.

The Centennial Challenges are part of NASA's Space Technology Program. For more information, visit http://www.nasa.gov/challenges.

For more information about WPI, visit http://www.wpi.edu and http://touchtomorrow.wpi.edu.

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NASA Celebrates Small Business Week May 21-25

By Jessica Eagan

This week, each NASA center is honoring the contributions of small businesses to the economic well being of the United States following President Barack Obama's proclamation of National Small Business Week.

In celebration, the Marshall Space Flight Center is airing a video of NASA Administrator Charles Bolden thanking the many small businesses that support the agency. The video can be viewed throughout the week in the Building 4200 lobby. Team members also can read posters around the center that acknowledge the hard work done by the country's entrepreneurs.

"America's Small Business Program is the economic engine in the U.S. economy that drives innovation and creates jobs for many Americans," said David Brock, the Marshall Center's small business specialist in the Office of Procurement. "Today there are more than 23 million small businesses employing more than 60 percent of the U.S. workforce while contributing to more than 50 percent of the U.S. Gross National Product. Small businesses also lead the way in innovation, with more than 50 percent of all new inventions developed by small businesses. Since 1980, approximately 99 percent of all new jobs were created by small businesses. If America is to remain a world leader in the global marketplace, small businesses will no doubt play a key role in our future successes."

Small businesses received approximately $213 million in direct dollars in FY2011, and approximately $300 million in subcontract dollars by Marshall prime contractors.

President John F. Kennedy was the first president to sign the proclamation in 1963.

To learn more about Marshall's Small Business Program, visit here. To read the president's proclamation, visit here.

Eagan, an AI Signal Research Inc. employee and the Marshall Star editor, supports the Office of Strategic Analysis & Communications.

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Marshall Retirees Association to Host Space Shuttle Reunion Social June 14; RSVP Due June 6

The Marshall Space Flight Center Retirees Association is hosting a Space Shuttle Reunion social from 6-8 p.m., June 14, at the Huntsville Country Club, 2601 Oakwood Ave.

Everyone who had a part in the success of the program is invited to attend. Gene Goldman, Marshall's acting director, and Bill Lucas, former center director from 1974-1986, will share a few words.

The cost is $10 and cash is due at the door. Heavy hors d'oeuvres will be served and there will be an open bar. Please RSVP by June 6 to Linda Posey, the association president, at linda.m.posey@nasa.gov, or to Betty Hughes, association secretary, at bth7777@comcast.net, or call 256-883-2047 and leave a message.

Dress is business casual. Membership is not required.

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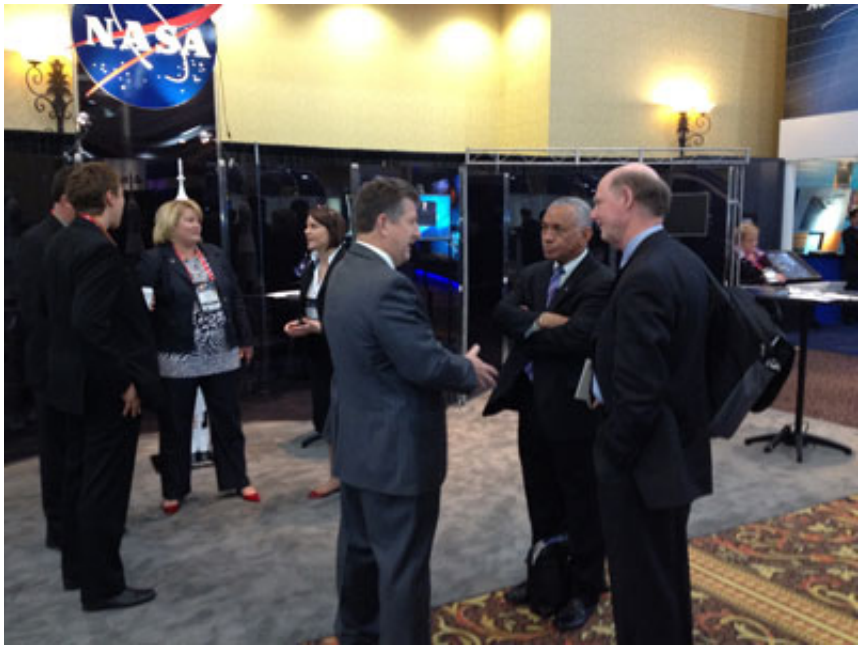
NASA Takes Part in 28th Annual National Space Symposium

NASA Administrator Charles Bolden, in the center foreground, talks with participants visiting the OneNASA exhibit at 28th annual National Space Symposium. Held April 16-19 in Colorado Springs, Colo., the event brings together space leaders from around the world to discuss the future of space. Representatives from several NASA centers, including the Marshall Space Flight Center, answered questions and provided information on NASA programs and projects at the exhibit. More than 9,000 people attended the symposium. (Special to the Star)



A group of students learns about NASA's new heavy-lift launch vehicle at the National Space Symposium. Fielding students' questions is Shannon Raleigh, right, a Schafer Corp. employee in the Office of Strategic Analysis and Communications, supporting the Marshall Center's Space Launch System Program Office. The Space Launch System will provide an entirely new capability for human exploration beyond Earth orbit. It also will back up commercial and international partner transportation services to the International Space Station. For more information on SLS, visit http://www.nasa.gov/sls. (Special to the Star)

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Marshall Center Celebrates Asian-Pacific American Heritage Month

Dr. Jeremy Hon, left, addresses Marshall Space Flight Center employees at his presentation for Asian-Pacific American Heritage Month on May 17. The Hong Kong native talked about his personal and professional journey as a "cultural hybrid." Hon is an oncology specialist at the Clearview Cancer Institute in Huntsville. The Asian-Pacific American Heritage Month event was sponsored by Marshall's Office of Diversity & Equal Opportunity. (NASA/Fred Deaton)

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The Weather Channel to Air Series on April 2011 Tornadoes This Week

This week, The Weather Channel is airing a series of programs on the April 27, 2011, tornadoes and NASA's involvement in the recovery efforts. Tune in May 23 at 7:40 p.m., and May 28 and May 30 at 9:50 a.m., 11:50 a.m., 12:50 p.m. and 7:40 p.m.

For more information about the Marshall Space Flight Center's response to the tornadoes, read this article in the April 25 Marshall Star.

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Marshall's Dr. Gerald Fishman to Speak About High-Energy Astronomy May 30 at UAH

On May 30, Dr. Gerald Fishman, an astrophysicist at the Marshall Space Flight Center's Science & Technology Office, will provide an overview during the Distinguished Lecturer Series about the history of high-energy astronomy and his current work in this field, with an emphasis on the research performed by scientists in Huntsville. High-energy astronomy is the study of the most energetic objects and regions of the universe.

The event will be held in the University of Alabama in Huntsville's Chan Auditorium in the Administrative Science Building on Ben Graves Drive at 7:30 p.m. Refreshments will be served following the lecture. All Marshall team members are invited to attend.