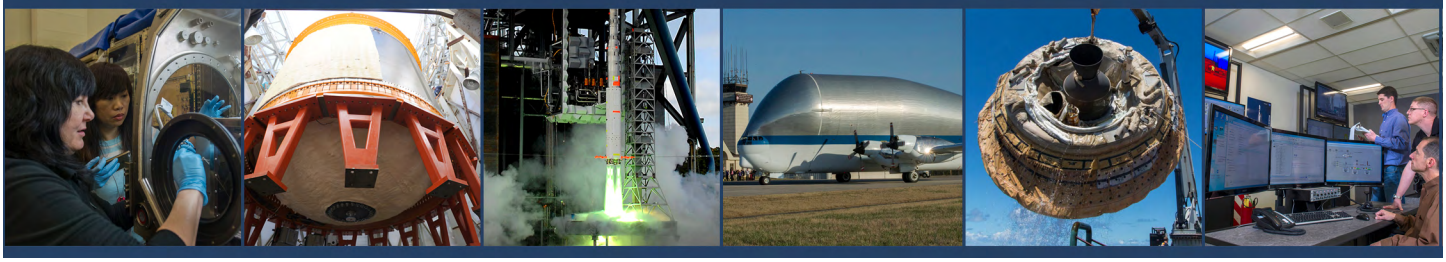
# MARSHALL 2014 Year In Review



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## Director's Corner

Happy 2015! I hope your holidays were joyous and rejuvenating.

During 2014, we advanced significantly along numerous fronts. The list is long and even the highlights below fall short of describing all the progress.

Fresh on our minds, of course, is the successful Exploration Flight Test-1 of the Orion spacecraft on Dec. 5. This is not just significant; it is historic. You played a major role in this memorable achievement.

All elements of the Space Launch System Program are now producing hardware. We held the ribbon cutting for the Vertical Assembly Center at Michoud Assembly Facility. The Agency Program Management Council approved SLS for completion of Key Decision Point C -- the formal go-ahead to Critical Design Review. Plus, both the Solid Rocket Booster and Core Stage successfully completed Critical Design Reviews.

*Patrick Scheuermann (NASA/MSFC)*

NASA's New Horizons spacecraft came out of hibernation for the final time to ready itself for its historic encounter with Pluto in July.

We completed a complex series of tests on the 5.5 meter diameter composite cryotank. Michael Gazarik, associate administrator, Space Technology Mission Directorate, said, "This is one of NASA's major technology accomplishments for 2014."

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## Director's Corner *Continued from page 1*

Tests of the Low-Density Supersonic Decelerator worked beautifully and we met all of our flight objectives, helping us evaluate new landing technologies for future Mars missions.

The Near Earth Asteroid Scout spacecraft and solar sail propulsion system project successfully completed Mission Concept Review and System Requirements Review.

We shared our technological knowhow at the first-ever Marshall Technology Exposition at the U.S. Space & Rocket Center, an outstanding event attended by more than 500 people, and held our first NASA on the Square, an open house-style event on Huntsville's Courthouse Square attracting children, retirees and families.

We partnered to deliver the first zero-g 3D printer to the International Space Station, ushering in the era of off-world manufacturing. Marshall is leading the discussion on how we will test, qualify and certify additively manufactured parts in sensitive civil and defense applications.

The Chandra X-ray Observatory celebrated its 15th anniversary and continues to revolutionize our understanding of the universe.

Robert Lightfoot, associate administrator for NASA, came to Marshall to recognize the multi-year superior performance of our X-Ray and Cryogenic Facility James Webb Space Telescope Test Team.

We -- and Headquarters -- contributed substantially to the 7th Annual Wernher von Braun Memorial Symposium sponsored by the American Astronautical Society and hosted at the University of Alabama in Huntsville.

Tools for Analysis of Surface Cracks won a NASA 2014 Software of the Year award, and a Marshall partnership project for the Lightweight Integrated Solar Array and Transceiver was an Early Career Initiative proposal winner.

We celebrated completion of Building 4220 as a Leadership in Environmental Engineering and Design Silver repair-by-replacement building, another milestone in achieving our 20-year Center Master Plan.

We met or exceeded a number of Executive Order sustainability goals, including better than expected reduction in energy intensity, improved use of alternative fuels, and more efficient use of water.

We exceeded all Small Business direct goals. Small Disadvantaged Business; HUBZone; Woman-Owned Small Business; and Small, Disadvantaged Veteran-Owned Small Business all exceeded expectations.

Our economic impact study showed that we have a $2.5B impact locally and $6.7B nationally, creating 14,000 jobs and 40,000 jobs, respectively.

In educational outreach, we initiated the Human Exploration Rover Challenge; and coordinated with the city of Cullman, Alabama, which hosted an entire NASA Week featuring talks by Speakers Bureau volunteers with hundreds of middle and high school students.

Throughout all of these accomplishments, I see a team achieving NASA goals and Marshall objectives, from developing and operating integrated vehicles and systems that enable human space activities, to sharing our knowledge with the public, educators and students.

No wonder NASA has been named the Best Place to Work in government in the large agency category for the third year in a row. This year's score was even higher than last year's.

Looking ahead to 2015, we're inviting everyone to continue to Join Us On The Journey. Numerous activities will march us tangibly closer to SLS launch, which the American public, the U.S. Congress and many around the globe are eager to see happen.

Thank you for your dedication and achievements this past year. While we should never become overconfident or complacent, I brag on you everywhere I go -- especially in Washington, where your consistent successes energize continued support.

Together, let's continue to build, explore, and discover in 2015.

Patrick

# January

## Bolden Visits Michoud Assembly Facility

NASA Administrator Charles Bolden visited the Michoud Assembly Facility in New Orleans on Jan. 13 with Louisiana Sen. David Vitter and other officials. They toured construction of Michoud's Vertical Assembly Center and advanced welding facilities, where 27.5-foot diameter cylinders, domes, rings and more are being brought together to form the fuel tanks and core stage of NASA's Space Launch System. (NASA)

## SLS Avionics System Sees 'First' Light

From left, Wayne Arrington, Gerald Clayton and Ryan MacKrell, all of The Boeing Co., work on setting up the avionics system in flight configuration in the Systems Integration and Test Facility at the Marshall Center. Hardware, software and operating systems for the Space Launch System were integrated and powered up in early January for an inaugural run -- referred to as "first light." SLS will be the most powerful rocket ever built for deep space missions, including to an asteroid and ultimately Mars. (Boeing)

## NASA Ramps Up SLS Sound Suppression Testing

A 5-percent scale model of the SLS is ignited for five seconds to measure the effect acoustic noise and pressure have on the vehicle at liftoff. The test series began Jan. 16 and was completed Dec. 4. (NASA/MSFC/David Olive)

*See **January** on page 4*

## January *Continued from page 3*

# Orion Stage Adapter Aces Structural Loads Testing

A test article of the stage adapter aced structural loads testing Jan. 30. The adapter -- designed, built and tested at the Marshall Center -- connected the Orion spacecraft to a United Launch Alliance Delta IV rocket for Orion's first test flight. The same adapter technology will later connect Orion to the SLS. (NASA/MSFC/David Olive)

# Marshall Center Instagram Account Launches with a 'Legacy to Inspire'

Marshall Center's Instagram account launched in late January 2014 and continued its growth throughout the year. The initial campaign kicking off the new account was titled 'Legacy to Inspire' and featured images that were inspiring to Marshall team members. This image is from the Chandra Observatory Telescope, managed by the Marshall Center. (NASA/MSFC)

## February

# Marshall Team Celebrates Work on Orion's First Test Flight

Marshall Center and Orion team members, industry partners and other special guests celebrated the contributions the center made toward Orion's first mission to space. John Casper, Orion special assistant for program integration and a former astronaut; Larry Gagliano, Marshall's deputy project manager for the Orion Launch Abort System; and Brent Gaddes, Spacecraft & Payload Integration Adapter Subsystem manager at Marshall, attended the event and took a final look at the completed adapter for Orion's first test flight on Dec. 5. (NASA/MSFC/Emmett Given)

*See **February** on page 5*

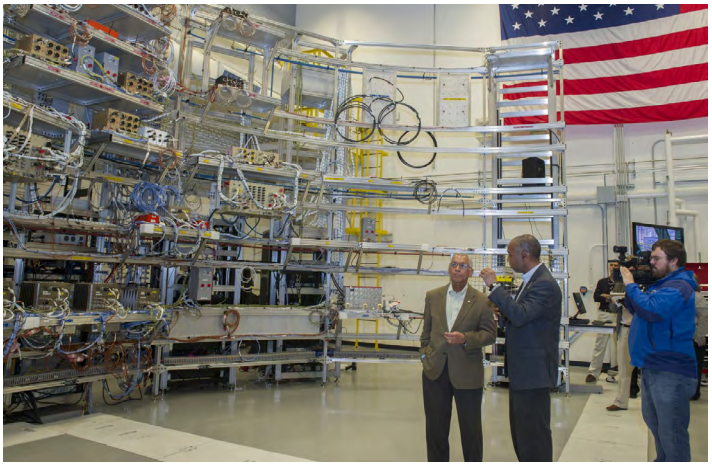
## February *Continued from page 4*

# Dome Passes Confidence Test at Michoud

The second Space Launch System core stage forward liquid oxygen tank dome was completed on the Circumferential Dome Weld Tool at NASA's Michoud Assembly Facility. The dome was welded as a "confidence" article to ensure that the weld tool can produce the qualification and flight domes. The SLS core stage liquid hydrogen and liquid oxygen tanks will each have two domes similar to the confidence article. The dome will be used to develop inspection techniques for the flight articles. It also will be used for future confidence welding on the Vertical Assembly Center -- one of the world's largest welding tools completed in 2014. (NASA/Michoud)

## March

# Bolden Tours Marshall



During his March 14 visit to the Marshall Center, NASA Administrator Charles Bolden left, spoke with Kurt Jackson, SLS integrated avionics and software discipline lead engineer, about progress on the SLS avionics system. Bolden toured the System Integration Laboratory, where the avionics units are arranged in flight configuration, along with booster hardware. He also watched flight software simulations of how the SLS will perform during launch. After the tour, he also held an all-hands meeting and question-and-answer session with Marshall team members and took a "selfie" with the center's social media team. (NASA/MSFC/Emmett Given)

# Marshall Director Outlines FY15 Budget Proposal

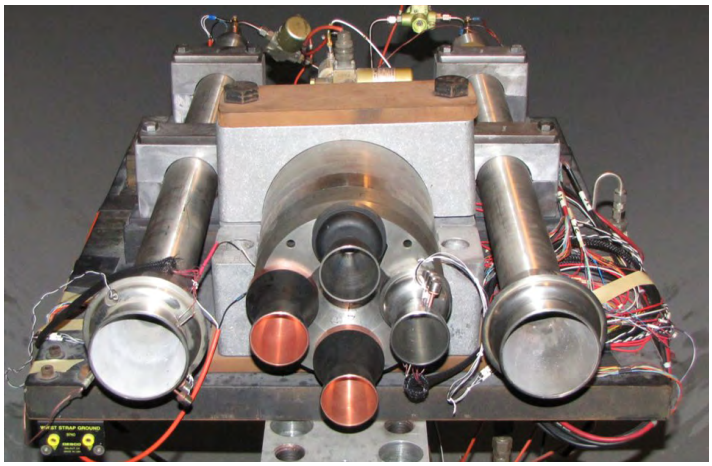
Marshall Center Director Patrick Scheuermann briefed Huntsville media about the fiscal year 2015 budget proposal during rollout events on March 4. He also met with Marshall team members to outline the $2.15 billion proposal, which included $71 million funding for center construction, revitalization and environmental improvements. (NASA/MSFC/Bill Hubscher)

*See **March** on page 6*

## March *Continued from page 5*

# Mini Rocket Models to be used in a Big Way for SLS Base Heating Test

Two-percent scale models of the SLS solid rocket boosters and core stage RS-25 engines have been designed and built ahead of base heating testing. The replicas will provide data on the convective heating environments that the base of the vehicle will experience during ascent. (NASA/MSFC)



# NASA's Super Guppy Delivers Composite Rocket Fuel Tank

NASA's Super Guppy, a wide-bodied cargo aircraft, delivered an innovative composite rocket fuel tank for testing at Marshall. (NASA/MSFC/Emmett Given)

## April

# Marshall Honored at Alabama Aerospace Day in Montgomery

Marshall Center Director Patrick Scheuermann, right, talks with Alabama Gov. Robert Bentley as astronaut Stephanie Wilson signs a photo for the governor during NASA Alabama Aerospace Day on April 3 at the Capitol in Montgomery. Wilson also spoke on the floors of the Alabama House and Senate, where resolutions honoring NASA and the center were presented. Dozens of NASA exhibits were placed in and around the Capitol building for the event, for which the theme was "Together We Make Bold Things Happen." Marshall representatives also made visits to schools and nonprofit organizations in the Montgomery area. (NASA/MSFC/Emmett Given)

*See **April** on page 7*

## April *Continued from page 6*

# Center Economic, Technological Impact Presented at 'Marshall 2014 Update'

Marshall Center Director Patrick Scheuermann and Dr. Lisa Watson-Morgan talk to news media at the April 17 Marshall 2014 Update. Watson-Morgan, the first woman to be named Marshall's manager, Office of Chief Engineer, answered questions about progress on the Space Launch System and other projects, and spoke about the importance of attracting young people to science, technology, engineering and mathematics education to maintain a "pipeline" of future engineers. Scheuermann and other Marshall leaders also updated the crowd at the U.S. Space and Rocket Center about budget plans, improvements to Marshall facilities, upgrades to the International Space Station Payload Operations Integration Center, work on science missions and more. (NASA/MSFC/ Emmett Given)

# Active Shooter Exercise: Training to Live

Marshall Center Director Patrick Scheuermann and emergency response team members discuss actions taken during a full-scale active shooter emergency exercise at the center on April 17. The exercise was designed for training but the scenario was very real. A designated gunman was recruited from the Army's Criminal Investigation Command Headquarters on Redstone Arsenal to conduct the exercise by firing blank rounds from outside and inside Building 4494. Seven Marshall team members volunteered to be victims. (NASA/MSFC/Fred Deaton)

# Marshall Center Launches 'I Love Earth' Social Media Image Campaign

The Marshall Center social media team hosted a month-long campaign, "I Love Earth," to celebrate Earth Day on April 22. The campaign featured images of Earth taken from space with an emphasis on images taken from the International Space Station. This photo of Huntsville was one of many posted during the campaign. It was photographed by the International Space Station SERVIR Environmental Research and Visualization System camera. ISERV captures images of Earth for disaster monitoring and assessment, environmental decision-making and other research activities. (ISERV)

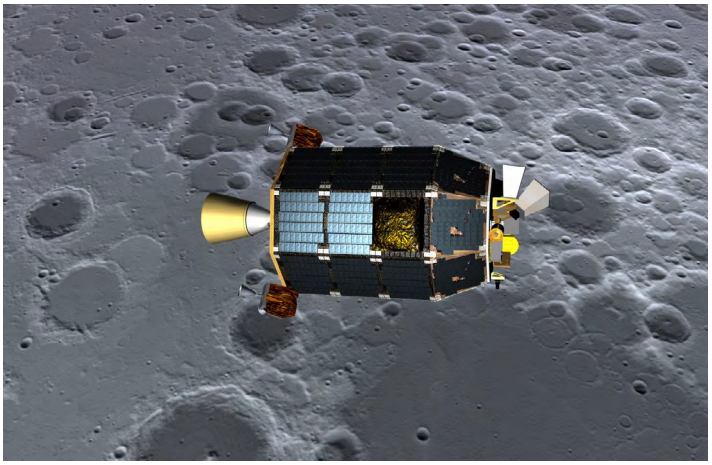
*See **April** on page 8*

# April *Continued from page 7*

## NASA Celebrates Earth Day with 'Global Selfie'

NASA invited people from all around the world to step outside on Earth Day to take a "selfie" and share it with the world on social media. The Marshall Center had many team members participate including Earth scientists Patrick Gatlin and Timothy Lang. (NASA/MSFC/Gatlin/Lang)

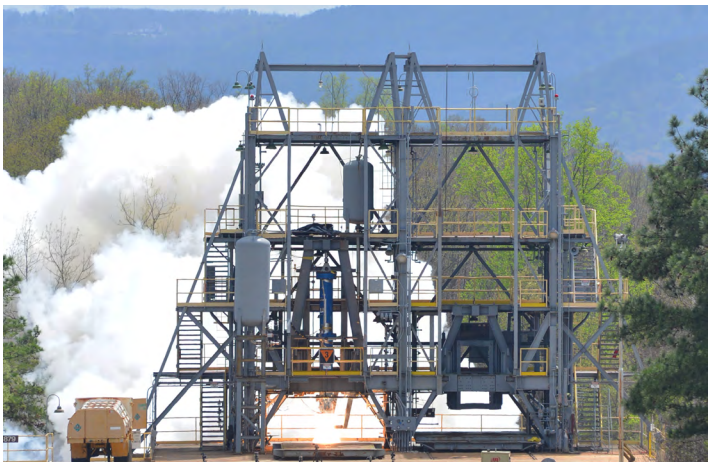
## NASA Completes LADEE Mission



NASA's Lunar Atmosphere and Dust Environment Explorer impacted the surface of the moon, as planned, on April 17. The Marshall Center managed LADEE within the Lunar Quest Program Office. LADEE gathered detailed scientific information about the moon's atmosphere through several scientific instruments located on the spacecraft and hosted the Lunar Laser Communication Demonstration. (NASA/Ames/Dana Berry)

## NASA and Redstone Test Center Collaborate on Solid Rocket Motor Firing

A subscale solid rocket motor blazed to life producing 50,000 pounds of thrust during a vertical test firing at the Redstone Test Center's Test Area 5 on Redstone Arsenal. Marshall engineers conducted the test at Redstone so that the subscale solid rocket motor could be fired in a vertical position similar to the orientation of solid rocket boosters on a launch pad. (Redstone Test Center)



*See **April** on page 9*

## April *Continued from page 8*

# NASA Human Exploration Rover Challenge debuts in April

The 20-year-old NASA Great Moonbuggy Race evolved in 2013-14 into the NASA Human Exploration Rover Challenge, and more than 70 teams participated in the first-ever event April 11-12 at the U.S. Space & Rocket Center in Huntsville. Student racers from the Academy of Arts, Careers and Technology in Reno, Nevada, claimed first place in the high school division, and a team from the University of Puerto Rico at Humacao won the top prize in the college division. Hundreds of race fans came out to watch, and some 50,000 more followed live, real-time coverage via the NASA Human Exploration Rover Challenge Facebook page, Marshall's Rover Challenge Twitter feed and other social media outlets. Nearly 45,000 viewers watched continuous, live coverage of the race via UStream and NASA TV. (NASA/MSFC/Emmett Given)

## May

# Marshall-Built Adapter Arrives at Cape for Orion's First Flight Test

The port booster, stage adapter and the second stage of the Delta IV rocket for Orion's first flight test arrived by barge in early May to Cape Canaveral, Florida, from United Launch Alliance in Decatur. (NASA/KSC)

# Engineers Test NASA's SLS Booster Forward Skirt to the Limits

NASA and ATK engineers complete structural loads testing May 20 on the SLS booster forward skirt at ATK's facility in Promontory, Utah. Structural loads tests are performed to ensure each piece of hardware can endure loads without any adverse effects to the vehicle, or most importantly, to the crew. (ATK)

*See **May** on page 10*

## May *Continued from page 9*

# NASA's Michoud Assembly Facility, Louisiana Aerospace Industry Honored by Louisiana Legislature

Astronaut Jeanette Epps addressed the Louisiana House of Representatives -- a rare privilege that was part of NASA Louisiana Aerospace Day events in Baton Rouge on May 7. Proclamations were presented in the state House and Senate honoring the many contributions of NASA and the Michoud Assembly Facility to the state's economy and educational system. (NASA/Michoud Assembly Facility/Eric Bordelon)

# NASA Student Launch Rocketry Challenge Moves to Utah For 2014

In May, student-built rockets soared over the high desert of Utah as the annual NASA Student Launch rocketry challenge raised stakes and moved from its long-time North Alabama home to Salt Lake City and the Bonneville Salt Flats. For the second year in a row, the top trophy went to student rocketeers from Vanderbilt University in Nashville, Tennessee, whose fiery creation beat out 20 other college and university teams during the May 17 "launchfest." More than 21,000 unique viewers tuned in for live launch coverage -- including interviews with student teams, event organizers and veteran NASA astronauts Charlie Precourt and Kent Rominger -- via NASA's official UStream channel alone, and thousands more watched on NASA-TV. (NASA/MSFC)

## June

# New ISERV Tool Enables Rapid View of Earth Images from Space

One of NASA's newest tools for effective Earth observation has been orbiting our planet for more than 15 years. The International Space Station provides a constant, reliable perspective from which to record changes on the surface of Earth. A new user-friendly online resource will provide images from a space station camera with nearly two years of images to share. The interface is a world map that links to thousands of images made by the ISERV camera: the International Space Station SERVIR Environmental Research and Visualization System. With the click of a mouse using the ISERV Viewer, the public can view and download specific ISERV captures from a collection of more than 4,000 Earth images. ISERV scientists should expand the database to about 60,000 by summer 2015.

*See **June** on page 11*

## NASA on the Square

Six-year-old Owen Dean proudly displays his homemade jetpack during the very first "NASA on the Square" held June 21 in downtown Huntsville, and gives a big "thumbs up!" with, from left, Marshall Director Patrick Scheuermann, Space Launch System Program Manager Todd May and Michoud Assembly Facility Deputy Director Mike Kynard. Marshall partnered with Downtown Huntsville Inc. for the event -- a center "open house" on the streets and sidewalks around the Madison County Courthouse. Thousands came downtown to enjoy the dozens of exhibits, demonstrations, talks by center researchers and former astronauts, bands featuring Marshall musicians, educational activities and games for all ages. (NASA/MSFC/Emmett Given)

## All Systems are 'Go' for Modern Control and Data Center at Marshall's Test Facilities

Smoke and fire might be the first things people envision when they think about rocket testing, but information technology systems are just as important to the success of a test. To create a facility worthy of important NASA testing, a landmark building in the East Test Area at Marshall has been transformed into a bustling information and control hub for test operations. The new control and data acquisition hardware located in Building 4583 was used for the first time in 2014 for tests of one of the largest composite fuel tanks ever built. It also was used for SLS tests. Centralized operations lower the amount of energy that goes into powering network infrastructure at multiple locations and the associated systems for securing, cooling and maintaining them. New state-of-the-art data acquisition systems increase the amount and quality of test data collected. (NASA/MSFC/Emmett Given)

## Small Business Office Hosts HUBZone Industry Day

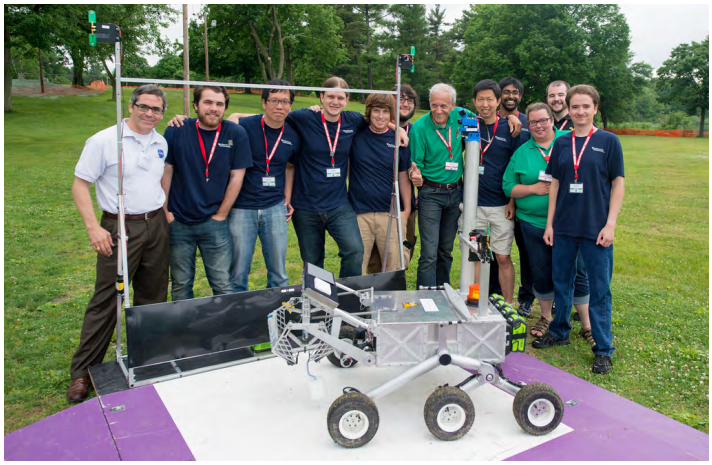
Marshall's Small Business Office, part of Marshall's Office of Procurement, hosted a NASA HUBZone Industry Day June 10, designed to help small businesses in certified Historically Underutilized Business Zones network with NASA prime contractors and agency spokespersons about pursuing NASA business endeavors. Glenn Delgado, associate administrator for NASA Office of Small Business Programs at NASA Headquarters, was among the speakers at the event. A highlight of the event was the signing of a new NASA Mentor-Protégé Agreement between Teledyne Brown Engineering of Huntsville and MartinFederal Consulting, a disabled-veteran-owned small business headquartered in Auburn, Alabama. (NASA/MSFC/Fred Deaton)

*See **June** on page 12*

## June *Continued from page 11*

# 17 Teams Take On $1.5M Autonomous Robot Challenge

NASA awarded $5,000 to the Mountaineers, first-time competitors from West Virginia University, Morgantown, for completing Level 1 of the Sample Return Robot Challenge, a part of NASA's Centennial Challenges prize program. Robotics teams from the United States, Canada, Mexico and Estonia competed for $1.5 million in prize money at the 2014 NASA Centennial Challenges Sample Return Robot competition this June. Seventeen teams arrived to compete, 14 passed inspection and took to the challenge field on the Worcester Polytechnic Institute's (WPI) campus in Worcester, Massachusetts. (NASA/HQ/Joel Kowsky)



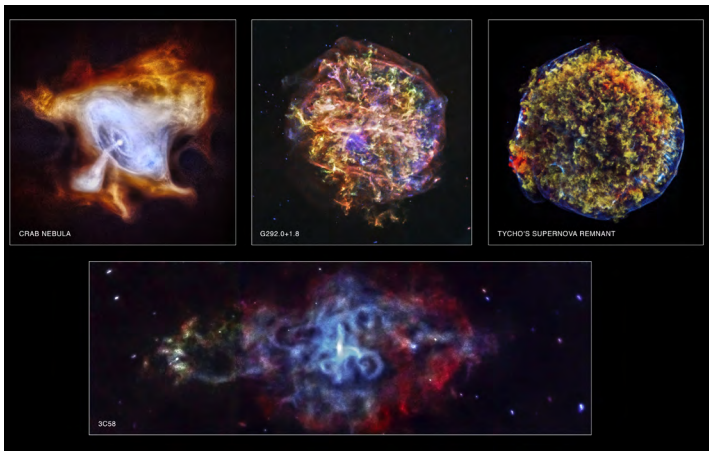
# First LDSD Test Flight a Success

NASA's Low-Density Supersonic Decelerator successfully completed its near-space test flight on June 28 off the coast of the U.S. Navy's Pacific Missile Range Facility in Kauai, Hawaii. Hours after the test of LDSD over the missile range, the saucer-shaped test vehicle was lifted aboard the Kahana recovery vessel. NASA's Space Technology Mission Directorate funds the LDSD mission, a cooperative effort led by NASA's Jet Propulsion Laboratory. NASA's Technology Demonstration Mission program manages LDSD at Marshall. (NASA/JPL-Caltech)

## July

# NASA's Chandra X-ray Observatory Celebrates 15th Anniversary

In commemoration of the 15th anniversary of NASA's Chandra X-ray Observatory, four processed images of supernova remnants dramatically illustrate Chandra's unique ability to explore high-energy processes in the cosmos. The images of the Tycho and G292.0+1.8 supernova remnants show how Chandra can trace the expanding debris of an exploded star and the associated shock waves that rumble through interstellar space at speeds of millions of miles per hour. The images of the Crab Nebula and 3C 58 show how extremely dense, rapidly rotating neutron stars produced when a massive star explodes can create clouds of high-energy particles light years across that glow brightly in X-rays. (NASA/CXC/SAO)

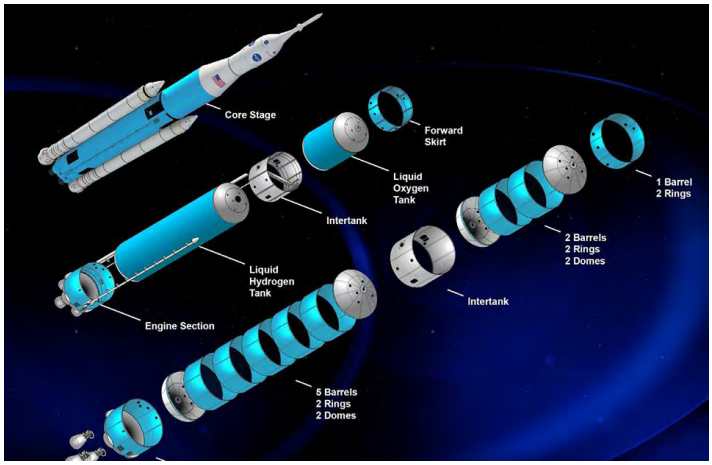



*See **July** on page 13*

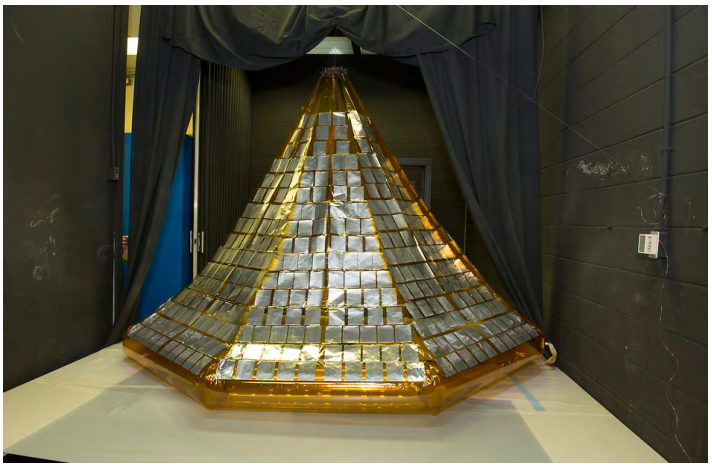
## July *Continued from page 12*

# SLS Core Stage Passes Critical Design Review

On July 1, the SLS core stage passed its Critical Design Review. The review is a major milestone for the program, proving the first new design for America's next great rocket is mature enough for production. (NASA/MSFC)




# Inflatable Solar Array Technology Packs Incredible Power in Small Package



Working with industry partners, NASA engineers from the Engineering Directorate's Advanced Concepts Office at Marshall built and tested a large, inflatable solar array with the potential to provide affordable, lightweight power for both large and small spacecraft. (NASA/MSFC/Fred Deaton)

## August

# SLS Boosters Complete Critical Design Review

The SLS Boosters Office successfully completed its critical design review Aug. 6. This milestone verifies the boosters are ready to move forward with qualification testing. (NASA)

*See **August** on page 14*

## August *Continued from page 13*

# No Geysers Allowed: NASA Engineers Begin Testing for SLS Liquid Oxygen Feed System

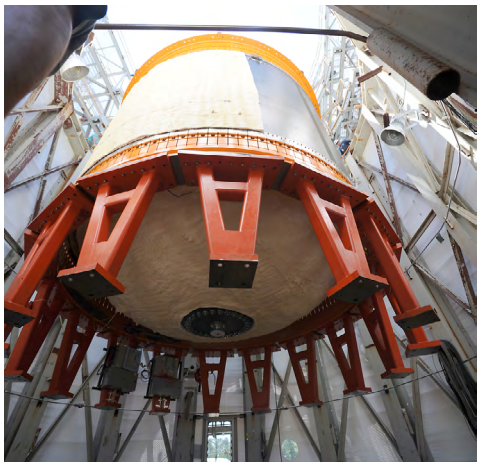
A full-scale replica of the SLS liquid oxygen tank feed system -- which will be housed in the rocket's core stage -- is set up on one of Marshall's test stands to show that proven procedures will keep the tank's thousands of gallons of oxidizer from geysering. Oxidizer is a type of chemical that fuels require to burn. Testing began Aug. 5 and is scheduled to be completed in early 2015. (NASA/MSFC/David Olive)

# NASA Completes Key Review of SLS in Support of Journey to Mars

NASA officials announced Aug. 27 that they completed a rigorous review of the SLS and approved the program's progression from formulation to development -- something no other exploration class vehicle has achieved since the agency built the space shuttle. "We are on a journey of scientific and human exploration that leads to Mars," said NASA Administrator Charles Bolden. "And we're firmly committed to building the launch vehicle and other supporting systems that will take us on that journey." (NASA)

# NASA Completed Battery of Tests on Composite Cryotank

Engineers completed a series of tests on one of the largest composite cryotanks ever built. The 18-foot-diameter (5.5-meter) cylinder-shaped rocket fuel tank was lowered into a structural test stand at the Marshall Center. (NASA/MSFC/David Olive)



*See **August** on page 15*

## Sparks Fly as NASA Pushes the Limits of 3-D Printing Technology

As part of a plan to gather data on the use of additive manufacturing to make rocket parts, Marshall engineers completed hot-fire tests with two 3-D printed rocket injectors. (NASA/MSFC/David Olive)

## Marshall, State Leaders Cut Grand Opening Ribbon to Building 4220

NASA and Marshall Center leaders joined members of the Alabama congressional delegation Aug. 13 to cut a symbolic ribbon and officially mark the grand opening of Building 4220. Marshall Center Director Patrick Scheuermann, Deputy Director Teresa Vanhooser, U.S. Sen. Jeff Sessions of Alabama, U.S. Rep. Mo Brooks of Alabama's 5th District and other leaders declared the new facility open for business. Designed and built to federally mandated standards of energy and water efficiency, the facility earned LEED® Silver Certification from the U.S. Green Building Council for Leadership in Energy and Environmental Design, the national standard for the development of high-performance, sustainable structures. Building 4220 primarily is home to workers developing and constructing key elements of the Space Launch System, set in coming decades to enable exploration missions across our solar system. (NASA/MSFC/Emmett Given)

## Marshall Hosts 2014 Honor Awards Aug. 19

On Aug. 19, the Marshall Center recognized more than 300 employees and contractors during its annual NASA/MSFC Honor Awards ceremonies in Morris Auditorium. NASA Associate Administrator Robert Lightfoot was the keynote speaker, and assisted Marshall Center Director Patrick Scheuermann in presenting awards to the honorees. Complete lists of NASA Honor Award recipients and Marshall Honor Award recipients are available. (NASA/MSFC/Fred Deaton)

## September

# U.S. Secretary of Education Brings Back-To-School Bus Tour To Rocket City, U.S.A.

On Sept 9, the U.S. Department of Education brought their traveling Back-To-School bus tour to Huntsville to allow Secretary of Education Arne Duncan to participate in a town-hall meeting. The tour -- called "Partners in Progress" -- was part of a three-day bus tour, making stops in Georgia, Tennessee and Alabama to encourage students to make the most of their educational opportunities. Duncan got a first-hand look at the unique student opportunities provided by the Marshall Center and its official visitor center, the U.S. Space & Rocket Center. (NASA/MSFC/Emmett Given)

# Marshall Hosts Minority Partnerships Meeting with White House Associate Director for HBCUs

On Sept. 17, the Marshall Center hosted a NASA Partnerships Meeting for Historically Black Colleges & Universities and Minority Serving Institutions, sponsored by NASA's Office of Small Business Programs and NASA's Office of Education. Ronald E. Blakely, associate director for the White House Initiative on HBCUs, talked about the importance of potential subcontracting opportunities with NASA and many of its large business prime contractors. The event sought to create and sustain working relationships between NASA and its prime contractors with numerous colleges and universities serving minority students. (NASA/MSFC/Emmett Given)

# International Observe the Moon Night Draws Astronomers of All Ages

Caroline Springfield got an up-close look at the lunar surface from one of the many high-powered telescopes on-hand Sept. 6 at Marshall's International Observe the Moon Night event at NASA's Education Training Facility, adjacent to the U.S. Space & Rocket Center. The event, sponsored by Marshall's Discovery and New Frontiers Program, was designed to encourage educators and moon enthusiasts around the globe to gather together to learn more about Earth's moon. (NASA/MSFC/Emmett Given)

*See **September** on page 17*

## September *Continued from page 16*

# NASA Unveils World's Largest Spacecraft Welding Tool for Space Launch System

The largest spacecraft welding tool in the world, the Vertical Assembly Center, officially opened for business at NASA's Michoud Assembly Facility Sept. 12. The 170-foot-tall, 78-foot-wide giant completes a world-class welding toolkit that will be used to build the core stage of America's next great rocket, the Space Launch System. The Vertical Assembly Center, which qualifies as a skyscraper, will join domes, rings and barrels to complete the tanks or dry structure assemblies. (NASA/MAF/Eric Bordelon)

## October

# Marshall Software is Co-winner of 2014 Software of the Year Award

The Tool for Analysis of Surface Cracks was developed by Phillip Allen, center, a materials engineer and structural analyst at Marshall, who was selected as a co-winner of the Software of the Year Award. The award competition allows the agency to recognize NASA team members who set high standards for significant software that is creative, usable, transferable and possesses inherent quality. This is the second time a Marshall team member has received the award. TASC software provides a more thorough understanding of surface crack material fracture toughness – essential to prevent failures – for safer aerospace vehicles and structures. Since its release in January 2014, TASC has been downloaded more than 500 times and is in use by multiple NASA centers, government contractors, aerospace industries and universities. (NASA/MSFC/Emmett Given)

# Marshall Center, North Alabama Companies Play Big Part in Orion's First Flight

The Orion spacecraft undergoes assembly operations in early October inside the Launch Abort System Facility at NASA's Kennedy Space Center. The Marshall Center, Lockheed Martin and other North Alabama companies provided critical support on the launch abort system and other key components of the spacecraft, as well as the stage adapter, ahead of Orion's first flight. (NASA)

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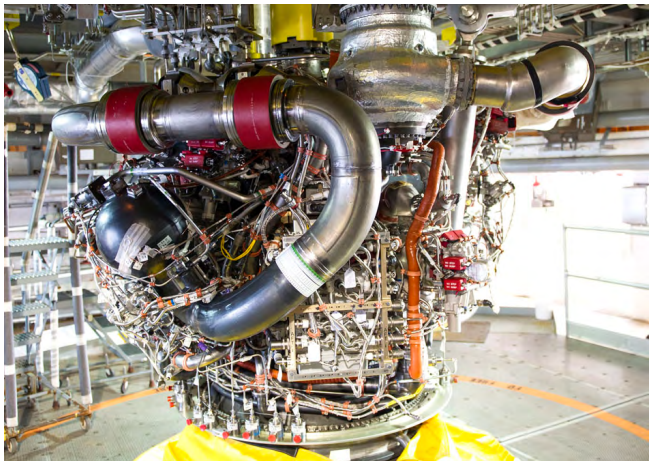
# October *Continued from page 17*

## Construction Underway on SLS Test Stand at Marshall

Crews pour concrete and embed anchor rods Oct. 17 to stabilize a new, 215-foot test stand at the Marshall Center. Test Stand 4693 will be used for structural loads testing on the liquid hydrogen tank for the SLS core stage. A second test stand also is under construction at Marshall and will be used to test the liquid oxygen tank. The stands are on track for completion in 2015. (NASA/MSFC)

## SLS RS-25 Engine and 'Brain' Get Ready for Testing



The RS-25 engine with its new "brain" -- the engine controller unit -- was installed Oct. 24 on the A-1 Test Stand at NASA's Stennis Space Center. Four RS-25 engines will power the SLS core stage, which will store cryogenic liquid hydrogen and liquid oxygen that will feed the vehicle's RS-25 engines. Testing is scheduled to begin in 2015. Read more about the engine controller unit here. (NASA/Stennis)

## Orion's First Crew Module Complete

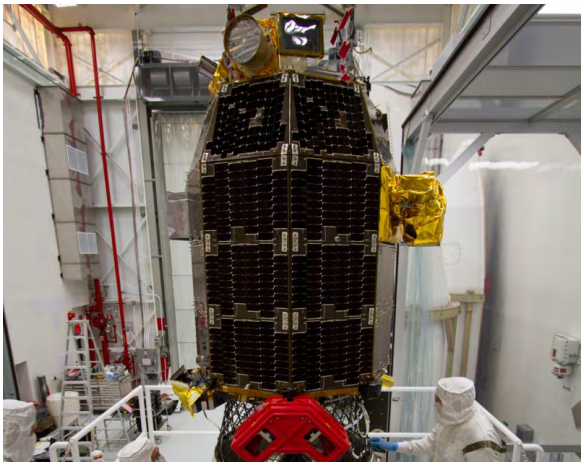
The Orion spacecraft crew module was covered by protective foil as it and the service module were lifted for the installation of the Orion-to-stage adapter ring at the Neil Armstrong Operations and Checkout Facility at NASA's Kennedy Space Center. The adapter, designed and built at Marshall, connected the Orion to a Delta IV heavy rocket for Orion's first test flight. The Marshall Center provided critical support to the flight, including the fabrication of more than 975 pieces of Orion flight hardware, conducted structural testing of the service module and crew module elements, and management oversight of the launch abort system propulsion elements.

*See **October** on page 19*

## October *Continued from page 18*

# NASA Lunar Mission Wins 2014 Popular Mechanics Breakthrough Award

NASA's Lunar Atmosphere and Dust Environment Explorer mission received the Popular Mechanics 2014 Breakthrough Award for innovation in science and technology. Breakthrough Awards recognize innovators, engineers and scientists responsible for changing our world. The award acknowledged LADEE's modular flexible construction and laser data transfer capability, which can send and receive data more than six times faster than the quickest space-based radio signals. The Marshall Center managed LADEE within the Lunar Quest Program Office. "We are extremely proud of the LADEE team and are honored to have been involved in the incredible success of this mission," said Danny Harris, Marshall's Lunar Quest Program mission manager for LADEE. (NASA/LADEE Integration and Test Team)

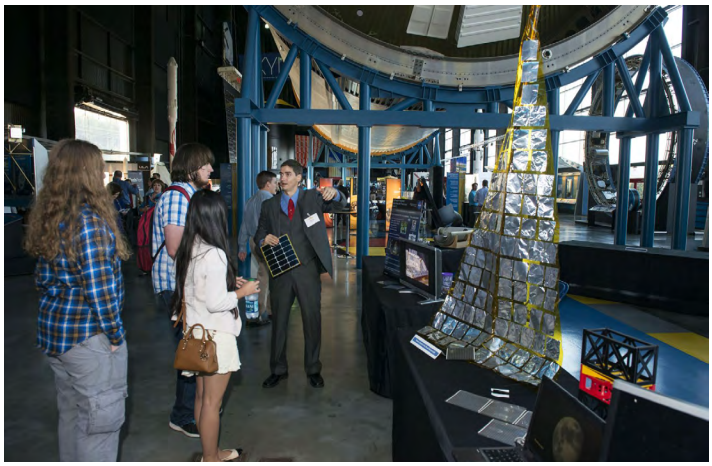


# NASA Administrator Charles Bolden Calls Astronauts on the International Space Station

On Oct. 28, NASA Administrator Charles Bolden called astronauts on the International Space Station from the Payload Operations Integration Center at Marshall. The Payload Operations Integration Center is the command post for science on the space station. The payload operations team works with the crew in space to conduct experiments around the clock, 365 days a year. The Destination Station: ISS Technology Forum was held in Huntsville the previous day and featured Marshall's work on the space station 3-D printer and the environmental control and life support system. (NASA/MSFC/ Emmett Given)

# Marshall Technology Exposition Showcases Emerging Technologies, World-class Capabilities of Center, Agency

The Marshall Technology Expo, held at the Davidson Center for Space Exploration, showcased emerging technologies and in-house capabilities of the Marshall Center. The event featured more than 40 exhibits, many panel discussions and guest speakers, including the Destination Station: ISS Technology Forum -- one in a series of live discussions about the International Space Station. Expo participants included NASA team members, along with aerospace professionals from government, industry and academia, all interested in advancements with propulsion, avionics, advanced manufacturing and more. (NASA/MSFC/Fred Deaton)



# November

## SLS Engine Section Barrel Hot off the Vertical Weld Center at Michoud

The barrel for the engine section of the SLS is taken off the Vertical Weld Center in early November at NASA's Michoud Assembly Facility. The barrel is flight hardware to be used on the first uncrewed test flight of the 70-metric-ton configuration of the rocket. The engine section, made up of the barrel and a ring -- also welded at Michoud -- will hold four RS-25 engines that will power the core stage of the SLS. (NASA/Michoud)

## It's Anchors Aweigh on Modifications to NASA's Pegasus Barge

NASA's Pegasus barge began undergoing major modifications required to carry the core stage of the SLS for testing and launch. Conrad Shipyard LLC in Morgan City, Louisiana, is performing modifications and refurbishments to ensure the restored vessel meets American Bureau of Shipping standards, including load line certification, or verification of the barge's legal loading limit to safely maintain buoyancy during water travel. Crews at Conrad are building a new, 165-foot section for the Pegasus barge, which will lengthen the vessel from 260 feet to 310 feet. (NASA)

## 3-D Printer Creates First Object in Space on International Space Station

The International Space Station's 3-D printer tested at Marshall manufactured the first 3-D printed object in space, paving the way to future long-term space expeditions. (NASA/MSFC/ Emmett Given)

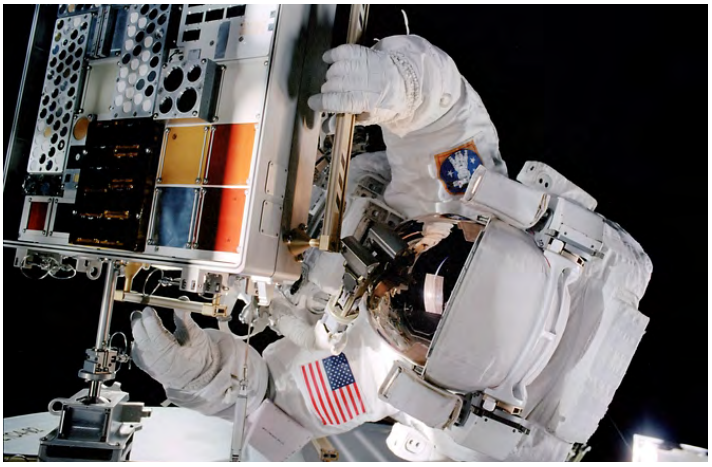
*See **November** on page 21*

## November *Continued from page 20*

# NASA Brings Unprecedented 3-D Views from Space to Your Computer

Rodney Grubbs, program manager for NASA's Imagery Experts Program at Marshall, is testing new cameras in space and released the first 3-D videos made on the International Space Station to a new YouTube channel. These videos have been viewed more than 2 million times on YouTube. (NASA/MSFC/ Emmett Given)

# NASA Launches Comprehensive Database of Materials Tested on International Space Station



Since the International Space Station's early days, the Materials International Space Station Experiment has exposed almost 4,000 material samples to the space environment. Data from MISSE can now be easily accessed with a new online tool developed at Marshall where many of the samples have been analyzed after years on the space station. (NASA)

## December

# NASA's New Orion Spacecraft Completes First Spaceflight Test

NASA marked a major milestone on its journey to Mars as the Orion spacecraft completed its first voyage to space, traveling farther than any spacecraft designed for astronauts has been in more than 40 years. The United Launch Alliance Delta IV Heavy rocket with NASA's Orion spacecraft mounted atop, lifted off Dec. 5 from Cape Canaveral Air Force Station's Space Launch Complex 37. A team of NASA, U.S. Navy and Lockheed Martin personnel aboard the USS Anchorage recovered Orion and returned it Dec. 9 to U.S. Naval Base San Diego. Orion was delivered Dec. 18 to NASA's Kennedy Space Center, where it will be processed. The crew module will be refurbished for use in Ascent Abort-2 in 2018, a test of Orion's launch abort system. (NASA/Bill Ingalls)

*See **December** on page 22*

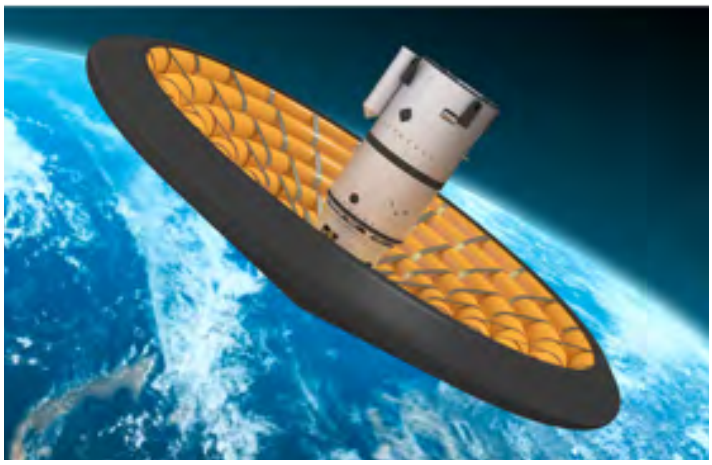
## December *Continued from page 21*

# Multi-Center NASA Social Joined Orion's First Flight Activities

For the first time, all 10 NASA field centers participated in a multi-center NASA Social event Dec. 3, previewing the Dec. 5 first flight of Orion. Marshall Center invited social media users from all over the country to get a unique, behind-the-scenes look at the diverse work at the center. Each center was connected to NASA's Kennedy Space Center via a multi-center NASA Television simulcast. Along with discussing Orion and NASA's Journey to Mars, participants experienced the Marshall Center through tours and presentations with scientists, engineers and managers. Marshall team members and the public followed the Marshall NASA Social on the center social accounts: Twitter, Facebook and Instagram.

# Marshall Oversees Second Mentor-Protégé Agreement in 2014

Marshall's Small Business Office oversaw a NASA Mentor-Protégé Agreement between NASA prime contractor Jacobs and Linc Research Inc., both of Huntsville. Only the second agreement of its kind overseen by the Marshall Center, the partnership is designed to help Linc Research -- a certified Historically Underutilized Business Zone small business -- establish long-term relationships and successfully compete for larger, more complex prime contract and subcontract awards. The Mentor-Protégé program, established in 2008 by NASA's Office of Small Business Programs, promotes job growth, capital investment and economic development for small businesses in economically challenged communities.

# Technology Demonstration Mission Program Adds Cutting-edge Projects

The NASA Technology Demonstration Mission Program, managed for the agency by the Marshall Center, added three new projects in 2014, including the Solar Electric Propulsion project, the Terrestrial HIAD Orbital Reentry project and the Composites in Exploration Upper Stage. The projects are managed for the agency by NASA's Glenn Research Center, Langley Research Center and the Marshall Center, respectively. The projects seek to deliver critical spaceflight technologies to enable cost-effective new trips to Mars, asteroids and other solar-system destinations.