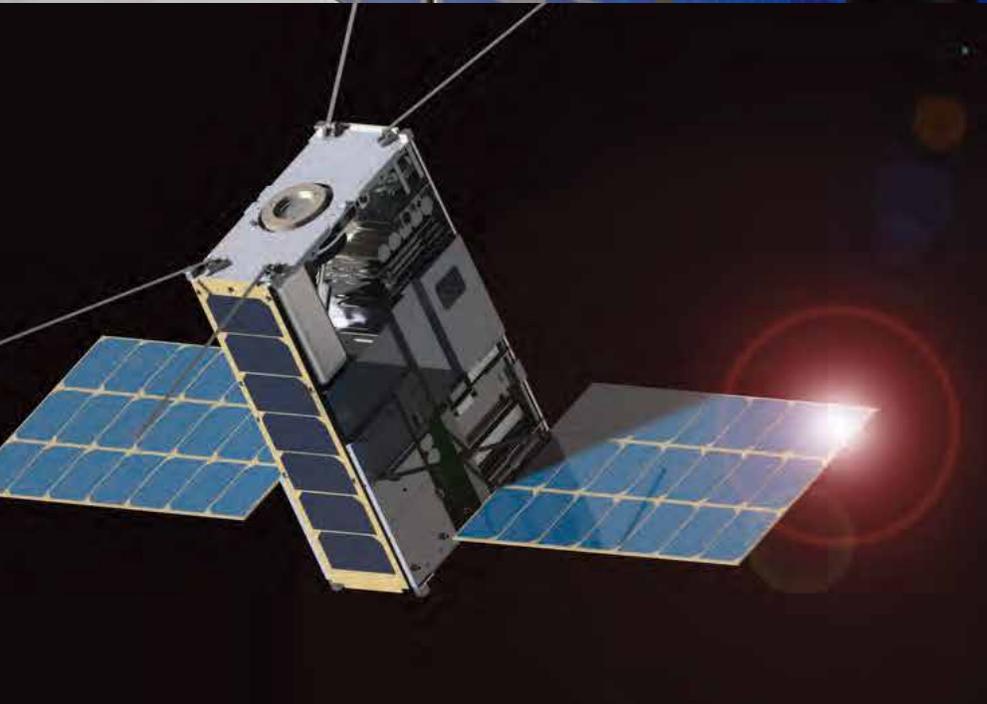




ESD

Exploration Systems Development

Combined Monthly Report February 2016



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National Aeronautics and
Space Administration



ORION

FEBRUARY 2016

ORION EXTENDS ITS REACH



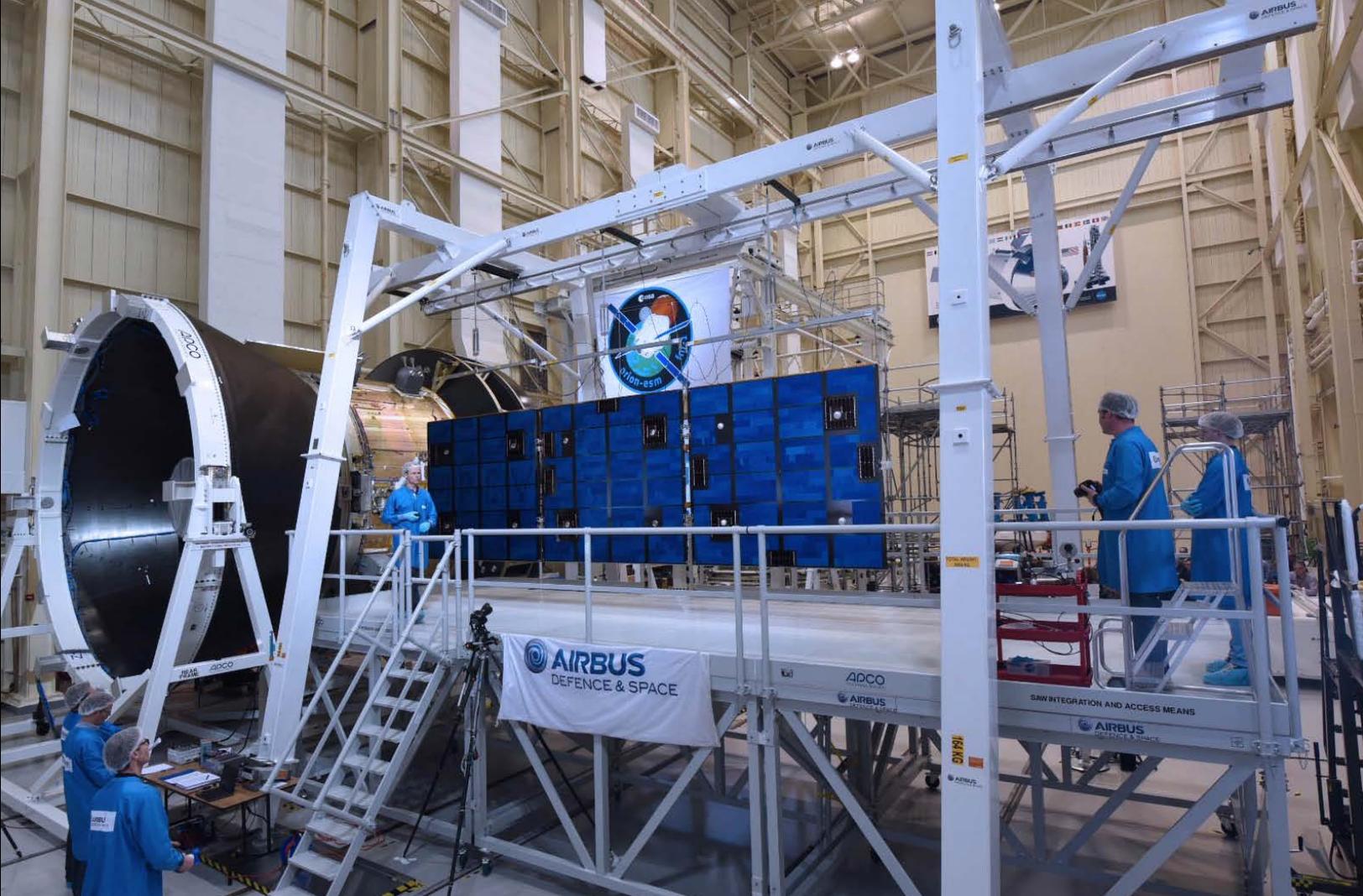
Engineers examine one of Orion's solar array wings after a test at NASA Glenn's Plum Brook Station.



ORION SOLAR ARRAY SUCCESSFULLY DEPLOYED



A representative structure of Orion's service module, which is being tested at Plum Brook Station in Sandusky, Ohio, was tilted to a 90-degree angle in preparation for the solar array deployment test.



An international team of engineers successfully deployed an Orion solar array wing inside the Space Power Facility (SPF) at NASA Glenn Research Center's Plum Brook Station in Sandusky, Ohio, on Feb. 29.

The deployment of the 24-foot wing qualification model was an important first step to verify Orion's power system for the spacecraft's first flight atop the agency's Space Launch System (SLS) rocket.

When deployed on orbit, Orion's four solar array wings will span across 63 feet and resemble the ESA (European Space Agency) Automated Transfer Vehicle's X-shaped array. The four panels combined will generate 11 thousand watts, enough power to light up an entire street of homes on Earth. The array is a component of Orion's service module, which is being provided by ESA and built by Airbus Defence and Space to supply Orion's power, propulsion, air and water.

The successful deployment was the first in a series of crucial tests being performed at SPF to verify the Orion service module can withstand the harsh conditions of launch and ascent into deep space. SPF is the only place in the world that can

subject the full-scale, flight-like test article to the conditions of launch and ascent. It is home to the world's largest mechanical vibration table and most powerful acoustic chamber.

Throughout spring and fall, engineers will use those facilities to mimic the shaking and noise the service module will experience during its ascent into space. They also will use pyrotechnics to simulate the shock the service module will experience during separation from the SLS rocket. In early fall, the team will conclude the campaign with another solar array wing deployment test.

With the first solar array wing test complete, engineers will waste no time preparing for the next test. They will soon begin stacking the Orion crew module and launch abort system mass simulator on top of the test article and attaching the outer fairings in preparation for acoustic tests to begin this spring.

► [Read the full story](#)

SIMULATIONS ARE THE REAL DEAL FOR ORION MISSION OPERATIONS TEAM

In early February, flight controllers and astronauts took part in a joint simulation to evaluate the prototype Orion crew display and control system, advanced caution and warning system for flight controllers, and communication protocols. The test was conducted in the Rapid Prototyping Lab (RPL) at NASA's Johnson Space Center in Houston where engineers are creating and evaluating the display and control systems that Orion's crew will use to navigate and operate the spacecraft.

The simulation involved two astronauts and several flight controllers, including a flight director, capsule communicator (CAPCOM) to communicate with the crew, and controllers who manage electrical power subsystems and environmental control and life support elements. Together they worked through a failure scenario in which part of Orion's power system failed. This scenario required troubleshooting to get pumps and other systems back up and running to support the systems the crew needs to survive. Evaluating extreme failure scenarios is a routine part of training for missions in space.

As the RPL continues to build and evaluate the displays for crew, it also is providing hands-on engineering experience for students in Texas. Mechanical engineering students at the University of Texas at Tyler (shown at right), have designed and built a mount to attach the cursor control device that serves as one way to operate Orion's displays. The students delivered their hardware to NASA in February.

As engineers continue to develop Orion's display, controls and software for crewed flights, teams will conduct additional simulations. The RPL will also continue to look for potential ways to include student ingenuity in the lab.

► [Read the full story](#)





NASA ROLLS OUT STATE OF THE AGENCY

On Feb. 9, as part of the rollout of President Barack Obama's Fiscal Year 2017 budget proposal for NASA, Administrator Charles Bolden delivered a "State of NASA" speech at the agency's Langley Research Center in Hampton, Virginia, in front of the Orion Ground Test Article. During the speech, Bolden highlighted key work and advancements by the agency during the last few years and discussed some of the future goals the agency continues to work toward, including exploration of Mars and elsewhere in our solar system and beyond, aeronautics research, development of technology to enable humans to explore deep space and research aboard the International Space Station for the benefit of life on Earth and for astronauts on long-duration space missions.

► [Watch the 'State of NASA'](#)

BLACKWELL-THOMPSON TO LAUNCH NASA'S NEXT STEP IN SPACE EXPLORATION

The first flight of a Space Launch System, or SLS, rocket carrying the Orion spacecraft on an uncrewed mission to lunar orbit and back now has its launch director. Veteran spaceflight engineer Charlie Blackwell-Thompson will helm the launch team at NASA's Kennedy Space Center in Florida for Exploration Mission-1 (EM-1). Her selection as launch director means she will be the first woman to oversee a NASA liftoff and launch team.

As work for the mission progresses on Orion, SLS and the ground systems and mission support needed to launch them, NASA will identify additional key personnel who will lead and oversee the launch and execution of the mission from different NASA centers. Blackwell-Thompson will be responsible for launching the EM-1 mission from Firing Room 1 at Kennedy's Launch Control Center, while a team of flight directors at NASA's Johnson Space Center in Houston will manage Orion's mission as it ventures beyond the far side of the moon and returns to Earth.

► [Read more about Charlie Blackwell-Thompson](#)



BREVARD SCHOOLS RECEIVE FLOWN FLAG FROM ORION'S FIRST SPACE FLIGHT

Lockheed Martin presented a U.S. flag flown on Exploration Flight Test (EFT)-1 to Brevard Schools in Florida this month. Included in the presentation frame were flown mission pins and patches. EFT-1 was launched from Cape Canaveral Air Force Station on Dec. 5, 2014.

The presentation was held at Apollo Elementary School in Titusville where fifth grade students participated in the county's first space school. Students were provided with science, technology, engineering and math (STEM) hands on learning with astronauts and space professionals.



Joe Mayer, Lockheed Martin Director of Government Relations (second from right) presents EFT-1 flown items to Dr. Desmond Blackburn, Superintendent of Brevard Schools (holding presentation). Also shown are Lorna Kesner, assistant principal (far left) and Frank Miller O'Leary, principal (far left).



ORION TANKS ARRIVE IN SWEDEN

Orion's propulsion qualification module, which will ensure the spacecraft's thrusters and fuel system work and is used to orient the spacecraft and send it back to Earth, arrived in Stockholm, Sweden. OHB Sweden and Airbus Defence & Space will do the final integration of this part of the spacecraft test module before shipping it to NASA's White Sands Test Facility in New Mexico in July for hot fire testing to occur in September.

Left: The fuel tanks that will hold mixed oxides of nitrogen and monomethyl hydrazine were built in Bremen, Germany, and delivered to Sweden to be placed in the propulsion qualification module.

MEDIA GET THE SCOOP ON ORION PROGRESS AT KSC

The Orion crew module pressure vessel arrived at NASA's Kennedy Space Center in Florida on Feb. 1 via the Super Guppy cargo aircraft and was moved into the birdcage tool at the Neil Armstrong Operations and Checkout (O&C) Building. A media event was held at the O&C on Feb. 3 for the crew module arrival with NASA Johnson Space Center Deputy Director Mark Geyer, Astronaut Stan Love, NASA Orion Production Operations Manager Scott Wilson, and Lockheed Martin Orion Program Manager Mike Hawes.



ORION TEAM PAVES THE WAY FOR FUTURE ENGINEERS



Debbie Korth and Susan Baggerman of the Orion Program spoke with potential future engineers during Project Lead the Way at Clear Lake High School in Houston on Feb. 4. During the event, engineers from different industries met with students in Grades 6 through 12 to let them know more about jobs in engineering.



Lockheed Martin Orion engineer Dustin Neill puts things (or planets) into perspective for students when answering a question during a Feb. 23 NASA Exploration Systems Web Chat with Imagination Station in Toledo, Ohio. Neill grew up in the Toledo area and enjoyed talking with fifth graders from his hometown during this national Engineer's Week STEM outreach event.



ASRC Federal hosted several STEM-related events in February and during Engineers Week. As part of the company's ongoing Apprenticeship Program partnership with Eastern State College, ASRC sponsored the college's annual Aerospace Maintenance Competition. In addition, ASRC sponsored several FIRST Robotics Competitions including the Rocket City Regional in Alabama; the 2016 FIRST Chesapeake District Championship in College Park, Maryland; and the Orlando FIRST Robotics Regional at University of Central Florida. Pictured above: ASRC's Joe Velez and Scott Altman host students from Eastern State College to attend the National Space Club luncheon in Florida.



K-12 educators attending the Space Exploration Educators Conference (SEEC) in Houston, Texas, experienced several days of complete immersion in an out-of-this-world adventure of space exploration on Feb. 4 & 5. Orion team members briefed educators touring the JSC Space Vehicle Mockup Facility and staffed an Exploration Systems Development display booth at the Space Center Houston exhibition.

INDUSTRY SUPPLIERS CONVENE IN THE SPIRIT OF SPACE EXPLORATION

More than 200 Orion, SLS and GSDO suppliers from 30 states gathered in Washington to get the latest updates from program managers and hear briefings from NASA leadership including NASA Administrator Charles Bolden. In addition, the suppliers conducted more than 175 meetings with their respective Congressional and Senatorial representatives to provide them updates on program progress toward Exploration Mission-1.



Moving from left to right: Rick Brown (General Plastics), Jonathan Beaudoin (Systima), Robert Emmett (Orbital ATK), Lauren Anderson (Kimble's Fuel Logistics), JC Hall (Esterline), Jerry Berg (Systima)



Patty Stratton of Abacus Technology and NASA Fellow Denton Gibson visit with Mary Lynne Dittmar, NASA's Tom Whitmeyer, and Orbital ATK's Sandy Coleman.



Tom Culligan, (left) conference coordinator, visits with SLS Program's Kimberly Robinson and Charlie Precourt of Orbital ATK.



Orion Program Managers Mark Kirasich (left, NASA) and Mike Hawes (right, Lockheed Martin) are pictured with astronaut Cady Coleman. The human spaceflight veterans spoke to the suppliers about the importance of flawless performance and crew safety for deep space exploration.



NASA Administrator Charles Bolden addressed industry suppliers to provide them an overview of NASA's Journey to Mars exploration plans and thank them for all their hard work in building the spacecraft and systems needed for America's space program.



EM-1 Mission Manager Mike Sarafin provided the supplier team with a detailed overview of Orion's next spaceflight that will launch atop the new Space Launch System and travel 40,000 miles beyond the moon during a three-week mission in 2018.

LAST MAN ON THE MOON TALKS ABOUT AMERICA'S NEXT GIANT LEAP

The Orion and SLS industry team sponsored the U.S. release of Gene Cernan's film *The Last Man on the Moon*, an inspiring documentary about America's Apollo Program and its legacy that continues with today's space exploration endeavors. In a brief interview following the film, Captain Cernan talks about the future of human space exploration with Orion and SLS.

► **Watch Cernan video**

The film was released in theaters nationwide and through On Demand platforms on Feb. 26.

► **For more information**



Former astronauts reunited at the Washington premiere for *The Last Man on the Moon*. Pictured from left to right are astronauts Tony Antonelli, Bill Readdy, Cady Coleman with film producer Mark Stewart, film director Mark Craig, astronauts Gene Cernan, Jan Davis, Michael Lopez-Alegria and Charlie Precourt.



TTTECH HOSTS VIP TOUR FOR NASA EXECUTIVE VISIT

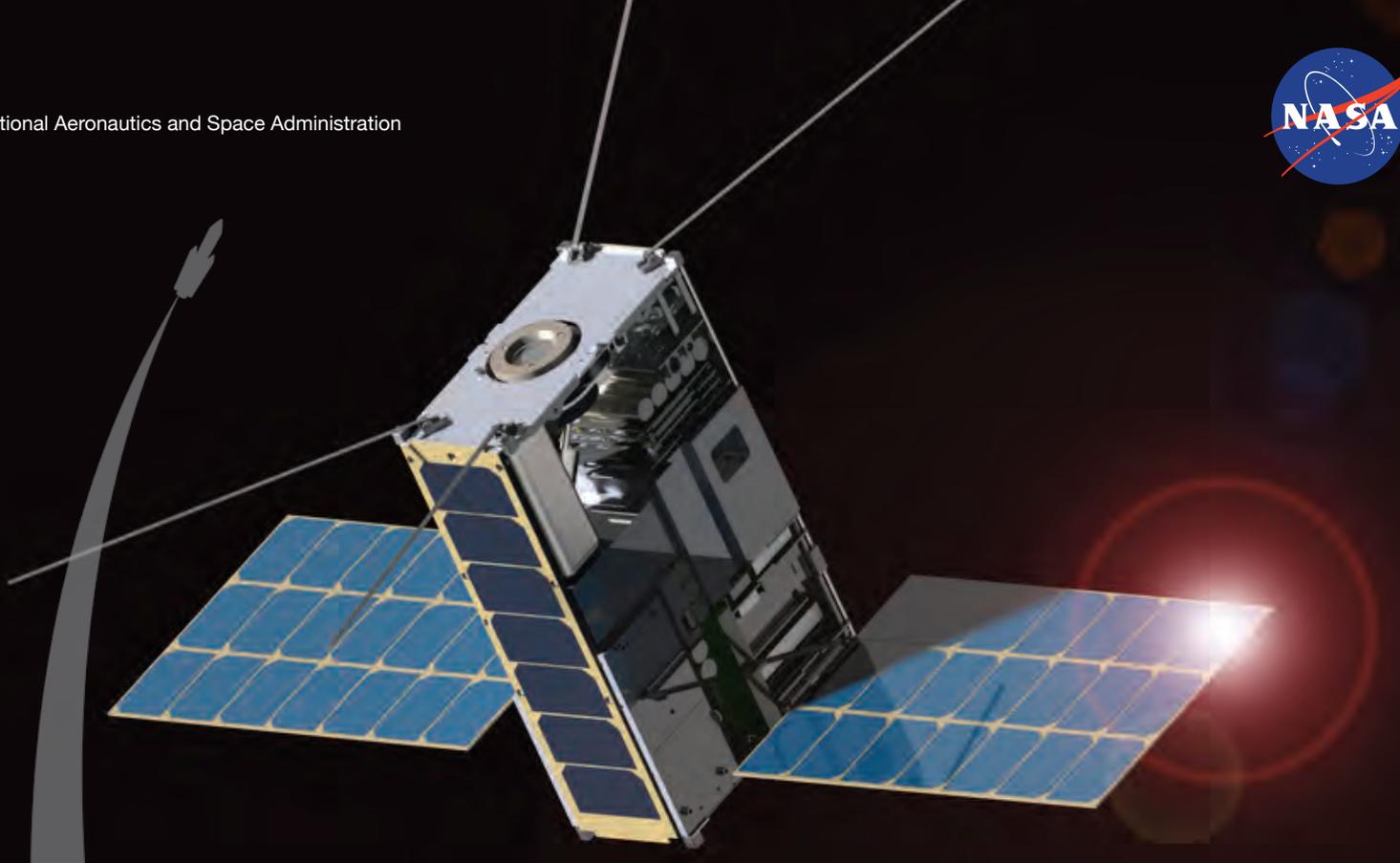
NASA's Associate Administrator for Human Exploration and Operations Bill Gerstenmaier (center) visited Orion supplier TTTech at its headquarters in Vienna, Austria, on Feb. 23. TTTech, a sub-contractor to Honeywell Aerospace, supplies the ethernet for the Orion avionics architecture. TTTech has been working with NASA since 2000 on various projects.

FOLLOW THE PROGRESS OF NASA'S NEW SPACECRAFT FOR HUMAN EXPLORATION:

- NASA's Orion Blog..... Blogs.NASA.gov/Orion
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MARCH:

- Orion Acoustic Testing in Waterton
- Orion Crew Module Progress at KSC
- Orion All Hands
- ECLSS Test Bed Arrives at JSC



FEBRUARY 2016

SPACE LAUNCH SYSTEM HIGHLIGHTS

LUCKY 13

CubeSats selected for first flight of SLS



NASA SLS SAVING SEATS ON FIRST FLIGHT FOR SCI-TECH SATELLITES

The first flight of SLS will carry 13 CubeSats to test innovative ideas along with an uncrewed Orion spacecraft in 2018. These small satellite secondary payloads will carry science and technology investigations to help pave the way for future human exploration in deep space, including the journey to Mars. SLS' first flight, referred to as Exploration Mission-1 (EM-1), provides the rare opportunity for these small experiments to reach deep space destinations, as most launch opportunities for CubeSats are limited to low-Earth orbit.

The secondary payloads were selected through a series of announcements of flight opportunities, a NASA challenge and negotiations with NASA's international partners. NASA made the announcement Feb. 2 during a live press conference at the Marshall Space Flight Center in Huntsville, Alabama. Stories on the payloads appeared in a number of news outlets, including [Popular Science](#), [The Verge](#) and [The Christian Science Monitor](#).



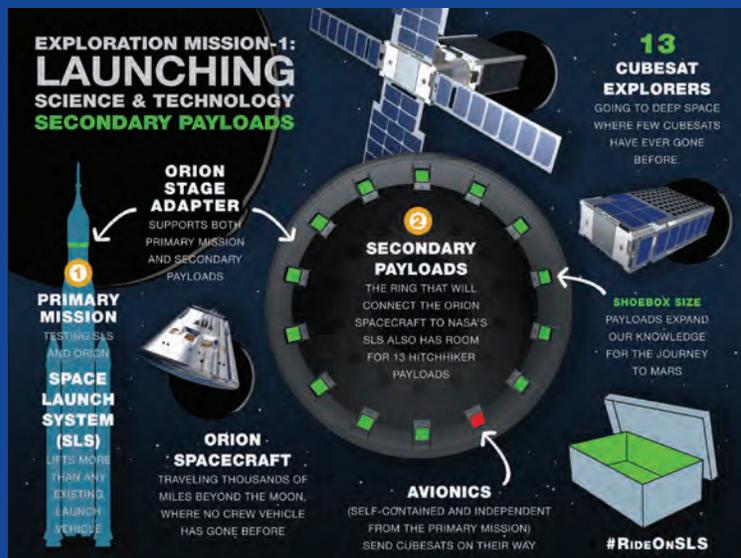
NASA Deputy Administrator Dava Newman at Marshall's secondary payloads media event.



Participating on the secondary payloads panel are, from left, Dava Newman, NASA Deputy Administrator; Bill Hill, deputy associate administrator of Exploration Systems Development; Michael Seabloom, chief technologist for NASA's Science Mission Directorate; Jim Cockrell, Cube Quest program administrator in NASA's Space Technology Mission Directorate; and Jitendra Joshi, technology integration lead for NASA's Advanced Exploration Systems Division.

The 13 CubeSats that will fly to deep space as secondary payloads aboard SLS on EM-1 showcase the intersection of science and technology, and advance our journey to Mars.

— Dava Newman



Click [here](#) for a larger version of the infographic.



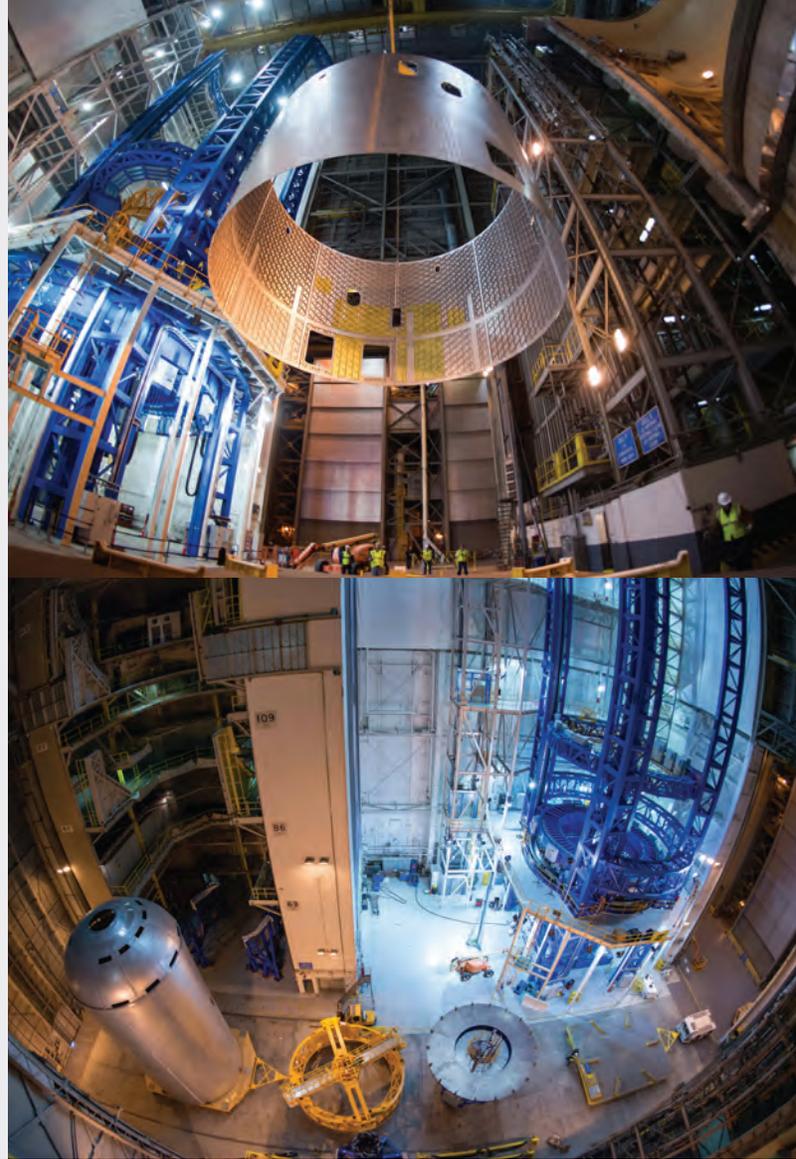
Chris Crumbly, manager of the SLS Spacecraft/Payload Integration and Evolution Office, explains how the Orion stage adapter will carry the 13 CubeSats to space.

TOOLS AND TALENT AT MICHLOUD TO COMPLETE SLS CORE STAGE WELDING IN 2016

This will be a pinnacle year for NASA's Michoud Assembly Facility in New Orleans, as all welding for the structural backbone of SLS, the core stage, will be completed this summer in preparation for its first flight in 2018. The hardware being welded at Michoud will include confidence, qualification and flight components of the core stage. "Completing all core stage welding will be a huge milestone for our team," said Pat Whipps, SLS resident manager at Michoud. "It is something we've been working hard toward here at Michoud, and we are excited to move on to integration and other next steps in building the core stage to be ready for the first flight of SLS." Read the full [story](#).

TOP-RIGHT: An engine section weld confidence article is taken off the Vertical Assembly Center at Michoud.

BOTTOM-RIGHT: A liquid hydrogen tank weld confidence article, left, for the SLS core stage recently [was completed](#) on the Vertical Assembly Center at Michoud.



SPACEFLIGHT PARTNERS: PARKER HANNIFIN

EDITOR'S NOTE: Every month, SLS Highlights turns the spotlight on one of the many industry partners helping to create the world's most powerful rocket ever built for human space exploration. In this issue, we profile Parker Hannifin of Cleveland.

For more than 25 years, the Parker Hannifin O-Ring Division has worked with Orbital ATK and NASA to consistently supply quality O-rings, meeting stringent aerospace and design requirements.



NASA is currently developing the SLS heavy-lift vehicle, which will launch the Orion spacecraft and cargo on missions requiring unprecedented lift capability. SLS will enable astronauts to travel and explore deeper into our solar system, reaching destinations farther than humans have ever gone.

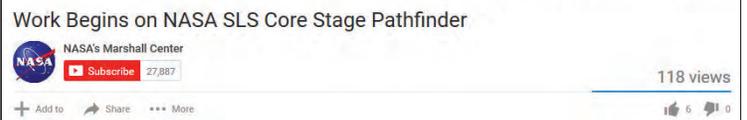
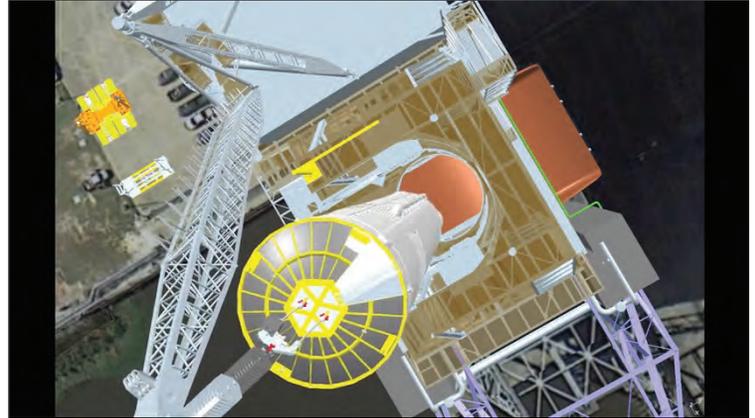
Parker O-Ring Division supplies large O-rings to Orbital ATK for the SLS boosters, in addition to numerous O-rings for the Orion launch abort system.

Parker O-Ring Division manufactured and supplied O-rings for the first three SLS demonstration motors, as well as the two booster qualification motors, known as QM-1 and QM-2. QM-1 was successfully test fired earlier this year, and QM-2 is on track for its ground test this summer.

THE MAKING OF A MOCKUP: WORK BEGINS ON NASA SLS CORE STAGE PATHFINDER

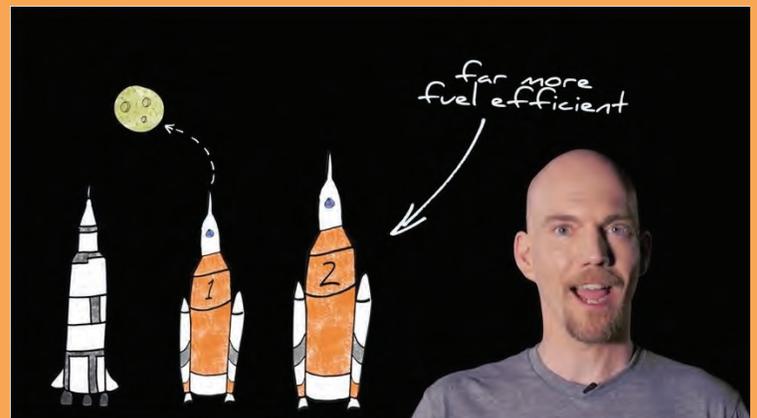


Major work is beginning in three Alabama communities on a 213-foot, 230,000-pound simulation of the core stage of the SLS. The steel mockup, designed by engineers at the Marshall Center, will demonstrate core stage operations and transportation, including routes for testing, assembly and launch. “This hardware is an excellent proving ground for the core stage -- from manufacturing and assembly to the launch site,” said Shane Carpenter, engineering lead on the core stage pathfinder project at Marshall. “We don’t want the first time we transport the core stage to be with flight hardware. That’s why having a pathfinder is critical to the program.” Read the full [story](#).



Watch an [animation](#) showing how the pathfinder will be placed vertically in the B-2 test stand at NASA’s Stennis Space Center near Bay St. Louis, Mississippi. The test stand is being completely refurbished for core stage testing in 2017, and the pathfinder will be used to ensure all modifications made to that test stand meet SLS core stage specifications.

NO SMALL STEPS EPISODE 2: A FOUNDATION FOR MARS



The [second installment](#) of this video series discusses how SLS builds on the foundation of the Saturn V and the space shuttle, and uses that foundation to create a rocket that will send humans to the Red Planet. Host Stephen Granade continues to explore how this rocket will be the most capable ever built for deep space destinations. Miss the first episode on getting to Mars? Watch it [here](#).

MEDIA, SOCIAL MEDIA USERS TAKE PART IN 'STATE OF NASA' AT MARSHALL

Members of the news media and 20 social media users visited the Marshall Center on Feb. 9 for "State of NASA" events, which were held across NASA's 10 field centers to discuss what the FY17 budget proposal means to the agency and highlight cutting-edge work happening in support of SLS, the journey to Mars, and other agency missions and programs. The NASA Social group "tweeted" and "shared" their experiences while on a tour of several Marshall facilities, where critical work is taking place in building the SLS rocket. Read NASA Administrator Charles Bolden's "State of NASA" [address](#).

TOP-RIGHT: The social group learns more about the lab where the SLS avionics system is tested at Marshall.

MIDDLE-RIGHT: Flight simulations in action for SLS.

BOTTOM-RIGHT: The NASA social group taking in the view from a Saturn V test stand, with one of the new SLS test stands under construction on the horizon.



'STATE OF NASA' SOCIAL SNAPSHOT

#StateOfNASA trended throughout the day in the United States on Twitter.





U.S. SEN. BILL NELSON VIEWS SLS PROGRESS AT MARSHALL

U.S. Sen. Bill Nelson of Florida, right, listens as Andy Schorr, assistant manager for Spacecraft/Payload Integration and Evolution, explains the progress on SLS during a visit to the Marshall Center on Feb. 12. The senator was given a detailed description of how the Marshall team tests avionics systems, flight software and hardware. No stranger to human spaceflight, Nelson flew as a payload specialist aboard space shuttle Columbia during the STS-61C mission in 1986.

‘ENGINEERING CAN BE FUN!’

“Engineering can be fun!” said SLS’s Kimberly Robinson to a group of high school girls attending the Tennessee Women in Science, Technology, Engineering & Research (TWISTER) event Feb. 13 at the Adventure Science Center in Nashville. Throughout the day, the girls participated in sessions on different science, technology, engineering and math (STEM) topics, presented by women, like Robinson, working in STEM professions.



FOLLOW THE PROGRESS OF NASA’S NEW LAUNCH VEHICLE FOR DEEP SPACE:

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COMING IN MARCH:

- RS-25 flight engine test
- EM-1 booster aft segment cast
- South by Southwest



GSDO
GROUND SYSTEMS
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EXPLORATION BEGINS HERE



PROGRAM HIGHLIGHTS • FEBRUARY 2016

At NASA's Kennedy Space Center in Florida, the Ground Systems Development and Operations (GSDO) Program Office is leading the center's transformation from a historically government-only launch complex to a spaceport bustling with activity involving government and commercial vehicles alike. GSDO is tasked with developing and using the complex equipment required to safely handle a variety of rockets and spacecraft during assembly, transport and launch. For more information about GSDO accomplishments happening around the center, visit <http://www.nasa.gov/groundsystems>.

Blackwell-Thompson Named Launch Director

The first flight of a Space Launch System, or SLS, rocket carrying the Orion spacecraft on an uncrewed mission to lunar orbit and back now has its launch director. Veteran spaceflight engineer Charlie Blackwell-Thompson will helm the launch team at NASA's Kennedy Space Center for the first flight test of a space system designed to carry astronauts into deep space before making a landmark journey to Mars.

Her selection as launch director means she will be the first woman to oversee a NASA liftoff and launch team.

"A couple of firsts here all make me smile," Blackwell-Thompson said. "First launch director for the world's most powerful rocket -- that's humbling. And I am honored to be the first female launch director at Kennedy Space Center. So many amazing women that have contributed to human spaceflight, and they blazed the trail for all of us. I feel extremely blessed. I also know being the launch director comes with a whole lot of responsibility. I have a healthy respect for just how important this job is."

That first flight, known as Exploration Mission-1, or EM-1, will be an important flight test before carrying astronauts, and Blackwell-Thompson said there is no shortage of planning, simulations and adaptations ahead in the next three



years as the American space agency gets ready to launch the first rocket powerful enough to enable human exploration into deep space.

"I remember when I walked into Firing Room 1 during a tour before I was hired many years ago, and one of the guys said if you take this job you will sit here at this console," Blackwell-Thompson said. "I was amazed at even being in the firing room, and the thought of being on the launch team then was unbelievable. So take that feeling and fast forward to getting the opportunity to walk into Firing Room 1 as the launch director for the SLS/Orion vehicle; that is something very special."

That tour led to a post with The Boeing Company as a payload flight software engineer that saw Blackwell-Thompson lead test and avionics checkouts for numerous spacecraft and systems that were later launched on the space shuttle. She joined NASA as a test director in 2004 and oversaw different aspects of the launch countdown for launches from 2005 until the shuttle fleet was retired in 2011.

A holder of numerous patents, Blackwell-Thompson has worked in NASA's Ground Systems Development and Operations Program as launch and countdown planning has developed for the SLS and Orion systems.

To read the complete story, visit <http://go.nasa.gov/1KV1Vv9>.

GSDO: OUTreach and ABOUT



NASCAR driver Carl Edwards gets settled behind the wheel of a Mine-Resistant Ambush-Protected vehicle Feb. 11 at Launch Pad 39B at Kennedy Space Center in Florida. Edwards toured the space center to promote the Feb. 21 Daytona 500 race in which he was driving. Photo credit: NASA/Bill White



In the Space Shuttle Atlantis exhibit facility March 1 at the Kennedy Space Center Visitor Complex, a guest is briefed on work taking place in the Florida spaceport's Ground Systems Development and Operations Program. This followed a presentation by Center Director Bob Cabana who updated community leaders on current and future activities at the space center. Photo credit: NASA/Kim Shiflett



A United States flag and a poem by Dr. Maya Angelou went on display at various locations around Kennedy Space Center. In this photo, they are surrounded by NASA and contractor workers in the Vehicle Assembly Building. The U.S. flag was presented to NASA on behalf of the men and women of Lockheed Martin by Marilyn Hewson and Rick Ambrose. Along with the flag, the Angelou Family "Cage Foundation" gifted NASA a plaque of Dr. Angelou's writing, "A Brave and Startling Truth," which NASA Administrator Charlie Bolden accepted on behalf of the agency. Both the flag and the plaque were flown on the Orion Exploration Flight Test-1 on Dec. 5, 2014. The two items are a traveling exhibit that will spend a month at each NASA center. The flag and poem will remain on display in the main lobby of Kennedy's Headquarters Building until March 11.

View the ESD quarterly video: "Preparing America for Deep Space Exploration Episode 12: Built for Exploration" at: <http://www.nasa.gov/exploration/systems/ground/index.html>



Industry Spotlight: L&H Industrial

L&H Industrial is a 52-year-old company headquartered in Gillette, Wyoming, with offices on five continents. The company's main focus is on mining equipment. However, it also is involved in oil and gas, railroads, power generation, and special projects for related industries.

At Kennedy Space Center, L&H completed two major renovations on crawler-transporter 2 (CT-2) in the Vehicle Assembly Building (VAB).

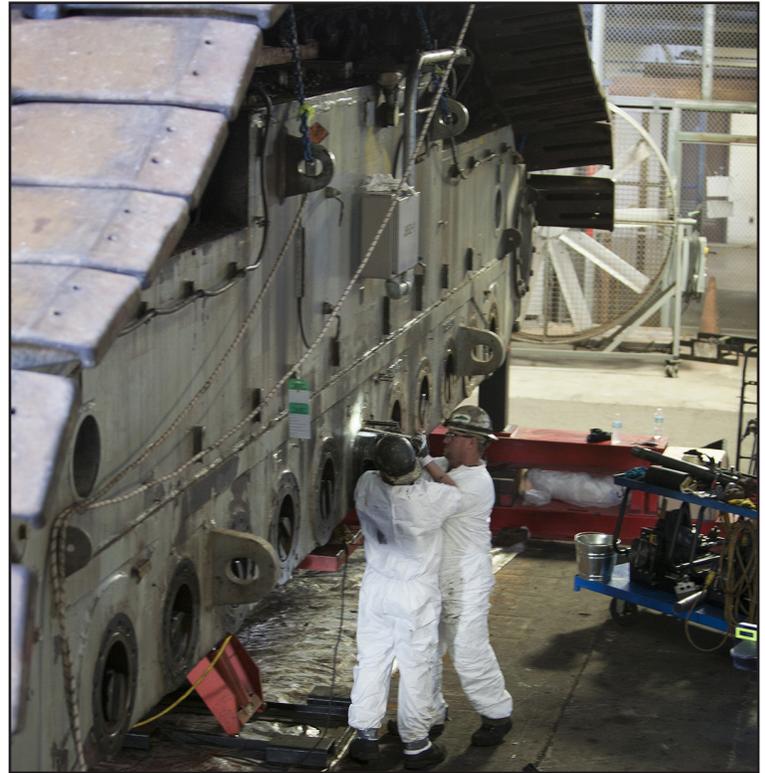
"We are very excited about being a major part of two crawler-transporter projects that needed to be completed in order to support NASA's Space Launch System rocket," said Bill Schroyer, P.E., L&H engineering manager.

The first project was the traction roller assembly upgrade. The contract was awarded in October 2012, and the company completed the work in May 2014.

The CT traction roller assemblies (TRAs) are the parts in the track system that hold the weight of the entire machine. The 11-rollers-per-side frame are supported in the base of the side frame and ride on top of the crawler's track shoes. There are 22 rollers per truck, which includes two side frames.

The TRAs needed to be replaced with a new modified TRA designed by NASA's Ames Research Center in Moffett Field, California, to be able to handle the additional weight of the Space Launch System rocket. L&H manufactured the components for the new TRAs and pieces to modify the side frames. While manufacturing was underway, L&H removed half of the original 88 TRAs from CT-2. The side frames were modified, and the bores were all field machined to new exacting tolerances. Dimensional audits were performed on all of the field machining prior to installation of the newly manufactured TRA components.

After the first 44 TRAs were installed, CT-2 was tested to



L&H field service workers Mike Kretschmar and Josh Martin remove the outer shaft adapter from the traction roller assembly on crawler-transporter 2 inside the Vehicle Assembly Building at Kennedy Space Center. There are 88 traction roller assemblies on the crawler-transporter. Photo credit: NASA

verify that all of the components were functioning as designed. The crawler was driven along the crawlerway, around two maximum angle turns, and then returned to VAB High Bay 2. Identical work was completed on the remaining 44 TRAs. This entire process took about 1.5 years from the time manufacturing began.

The second CT-2 project involved Propel transmission work and was completed in 2015. NASA's TOSC contractor, Jacobs Engineering, removed the transmission shaft assemblies and input housings with bevel gears from the crawler and sent them to L&H Industrial in Wyoming, where the assemblies were rebuilt. The process included disassembly, cleaning and removing contamination, non-destructive inspection, measurement inspection, corrosion protection, reassembly, and final inspection prior to shipment back to Kennedy.

While this work was completed, a small crew of L&H workers arrived at Kennedy to audit the bores in the transmission housings. The company provided on-site repairs of the bores, if they were deemed out of compliance, by a team of Vencore, L&H and NASA engineers and technicians.

About 14 L&H workers were on-site performing the field work on the crawler, while more than 50 workers manufactured components in Wyoming.

"Walking into the Vehicle Assembly Building each day felt very humbling," Schroyer said. "It was a great honor for all of us to work in a place and with people that are a major part of past and future space travel."



L&H field service mechanic Josh Martin crouches to remove the inner cover from the traction roller assembly on crawler-transporter 2 on June 19, 2013. L&H field service mechanic John Robertson directs the forklift that is coming in with a fixture to bolt the cover and support its weight for removal. Photo credit: L&H/Bill Schroyer

Ground Systems Team Spotlight

Tiffany Osborne is a section chief with Jacobs Engineering on the Test and Operations Support Contract at Kennedy Space Center. Her responsibilities include overseeing the system engineers and technicians within her department that handle operations and maintenance of cranes, doors, platforms and logistics



equipment.

Osborne's group supports the Ground Systems Development and Operations Program in several ways.

"We currently are providing operational support in the Vehicle Assembly Building (VAB) for one of the 325-ton cranes, to assist with installation of the new work platforms for NASA's Space Launch System," Osborne said.

Osborne's group also operates all of the VAB doors and will provide crane operational support for Exploration Mission-1 processing activities in the VAB and the Rotation, Processing and Surge Facility (RPSF).

They also will handle booster stacking, core stage mating and Orion mating to the SLS rocket in the VAB and provide all of the SLS platform operational support.

One of the accomplishments Osborne is most proud of is returning to college to obtain her bachelor's degree in organizational management from Warner Univer-

sity in Lake Wales, Florida, while working full time and raising a family.

She has worked at Kennedy for 15 years. Her previous employer was United Space Alliance, where she started as an administrative assistant and held several different positions in planning and scheduling before joining the cranes, doors and platforms department.

Osborne's hometown is Titusville. Her first car was a 1980 silver Honda Accord.

She is married to her husband, Gary Osborne, who also works for Jacobs. They have three daughters, Hanna, 20, Jessica, 19, and Rebekah, 18. Two mixed-breed dogs, named Bella and Lady, keep them company.

Her hobbies include watching sports, especially collegiate sports, with football and softball being her favorites. She also enjoys outdoor activities and is interested in traveling now that her children are grown.

Lorena Secrease is a mechanical design engineer with Nelson Engineering Company on the Engineering Services Contract (ESC) at Kennedy Space Center.

Her group's work to support the Ground Systems Development and Operations Program includes design, development, testing and integration of the Space Launch System's (SLS) launch accessories, such as umbilical arms and stabilizers.

Until recently, Secrease was the ESC lead mechanical design engineer for the SLS vehicle stabilizer system. Her primary responsibilities included integrating the multidiscipline design elements that make up the vehicle stabilizer system.

"I had the privilege of working with a talented team of designers and engineers that were tasked with taking the Space Launch System stabilizer system design from concept through detail design and into fabrication," Secrease said.

She is very proud of seeing designs of mechanical systems that she has worked on in support of the space program come to life.

"There are no words to explain the feeling I experience when hardware starts leaping off the computer monitor and drawings and becomes reality,"

Secrease said. "I'm looking forward to seeing our designs center stage with the SLS vehicle at the 2018 launch."

Secrease began her engineering career at Kennedy with United Space Alliance in 2005. She also worked for ASRC supporting the university-affiliated Spaceport Technology Development Contract. She also supported the Constellation Program as a mechanical design engineer for ground support equipment.

Secrease's hometown is Union City, New Jersey. Her parents moved to Orlando, Florida, when she was 16. She has planted roots in Central Florida ever since.

Secrease earned a Bachelor of Science in aerospace engineering from



the University of Central Florida in Orlando in 2005.

Her first car was a 1997 Ford Explorer in a "fun" purple color.

Secrease has been married for nine years to her husband, Jeff. They have a son, Evan, 5, and they are expecting another baby in about three months.

Her hobbies include sewing, bike riding and attending baseball games. "Go Rays!"

Employee Spotlight - Lauren Price

Lauren Price is a ground systems mechanical engineer in the Engineering Directorate at Kennedy Space Center. She oversees the operations, maintenance and new designs of large, ground system-type equipment, including cranes, heavy equipment, access platforms, powered doors and temporary scaffolding systems for the Ground Systems Development and Operations Program.

Price started working at Kennedy as a cooperative education student in January 2001. She started in the Shuttle Processing Directorate working on ground systems, including cranes, doors and platforms.

“The coolest part of my job is being able to see the Vehicle Assembly Building every day, and go into that building whenever I want to,” Price said. “It’s such an icon of NASA and of human spaceflight. And there’s so much history associated with it. It’s really a special place.”

Price said the achievement she’s most proud of in supporting GSDO is that she gets to work with a really cool team that provides temporary access to spacecraft and launch vehicles for their processing, and for the Exploration Flight Test-1 mission that launched in December 2014. Her team provided access to the Orion spacecraft for its processing, with planning for it starting about a year in advance.



Price originally is from Louisville, Kentucky. She earned a Bachelor of Science and Master of Engineering in mechanical engineering.

“NASA’s journey to Mars is really exciting,”

Price said. “We’ve been to low-Earth orbit a lot and I think it’s time to start looking beyond that. It will be amazing seeing launches of people from Kennedy. It’s going to be wonderful again.”

Price’s first car was a 1997 black Toyota Celica GT convertible. She hated it at first because it had manual transmission. But once she

got used to it she loved it and has gone out of her way ever since to purchase only manual cars.

Her parents live in Louisville, while a younger sister lives in Lexington. Her hobbies include running, working out, and traveling to ride roller coasters. She has a cat named Babalu.

Her fiancé Cory and she are planning a February 2017 wedding in Orlando.



Inside the Rotation, Processing and Surge Facility high bay at Kennedy Space Center in Florida, two cranes are used in tandem to lift the first pathfinder, or test version, of a solid rocket booster segment for NASA’s Space Launch System (SLS) rocket and move it away from the railcar Feb. 25. The booster segment will be lifted into the vertical position and secured on a test stand. The Ground Systems Development and Operations Program and Jacobs Engineering, on the Test and Operations Support Contract, will conduct a series of lifts, moves and stacking operations using the booster segments, which are inert, to prepare for the first flight of Orion atop the SLS rocket. The pathfinder boosters arrived at Kennedy from Orbital ATK in Utah aboard an Iowa Northern train contracted by Goodloe Transportation of Chicago. Photo credit: NASA/Ben Smegelsky