



# ESD

## Exploration Systems Development

Combined Monthly Report January 2016



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# Deep Space Exploration *Systems*

National Aeronautics and  
Space Administration

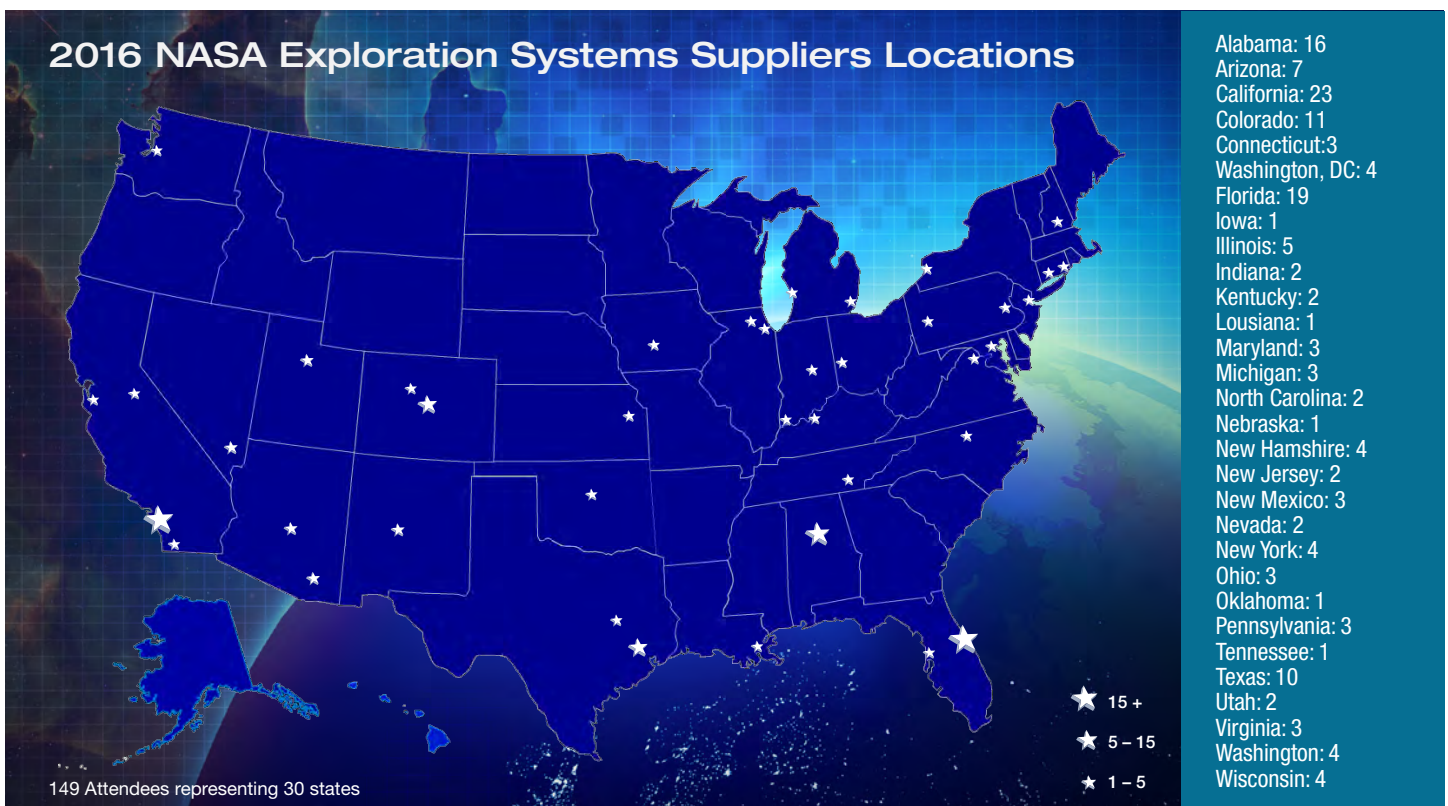


## Exploration Systems Suppliers Conference

The 4th annual NASA Exploration Systems Suppliers Conference (February 23–25) took the complex models of the Space Launch System (SLS), Orion crew capsule, and Ground Systems Development and Operations (GSDO) and briefly narrated its intricate plans to an audience with direct influence on the program’s success. Opening with remarks by NASA Administrator Charles Bolden and including participation by senior program and Headquarters leadership, nearly 240 supplier representatives of 29 suppliers were warmly welcomed and given significant information to consider as they continue to support such a remarkable mission.

The growing number of supplier locations represent 49 of 50 U.S. states and are an enormous grassroots influence for NASA. Throughout the conference, NASA leaders exhibited multimedia presentations and status updates of the EM-1 mission to illustrate how it will impact not only the suppliers, but its workforce and the general public. NASA leaders reiterated the importance of manufacturing, assembly, and launch objectives with great care to ensure complete understanding of the goals and values of NASA’s EM-1 mission.

In addition to the speakers, the conference attendees were incentivized with a visit from both Republican and Democratic representatives from House and Senate Appropriations Subcommittees, who assured continued bipartisan support for exploration. Apollo astronaut Gene Cernan attended a mid-conference reception at the Rayburn building. Astronaut Cady Coleman was also in the audience to give her support. On the conference’s second day, suppliers visited more than 170 Congressional offices on Capitol Hill.







# ORION'S PRESSURE VESSEL NOW IN FINAL ASSEMBLY AND TESTING FOR EXPLORATION MISSION-1

NASA's Orion spacecraft is another step closer to launching on its first mission to deep space atop the agency's Space Launch System rocket. On Jan. 13, Lockheed Martin engineers at NASA's Michoud Assembly Facility in New Orleans finished welding together the primary structure of the Orion spacecraft destined for deep space, marking another important step on the journey to Mars.

Welding Orion's seven large aluminum pieces, which began in Sept. 2015, involved a meticulous process. Engineers prepared and outfitted each element with strain gauges and wiring to monitor the metal during the process. The pieces were joined using a state-of-the-art process called friction-stir welding, which produces incredibly strong bonds by transforming metals from a solid into a plastic-like state, and then using a rotating pin tool to soften, stir and forge a bond between two metal components to form a uniform welded joint, a vital requirement of next-generation space hardware.

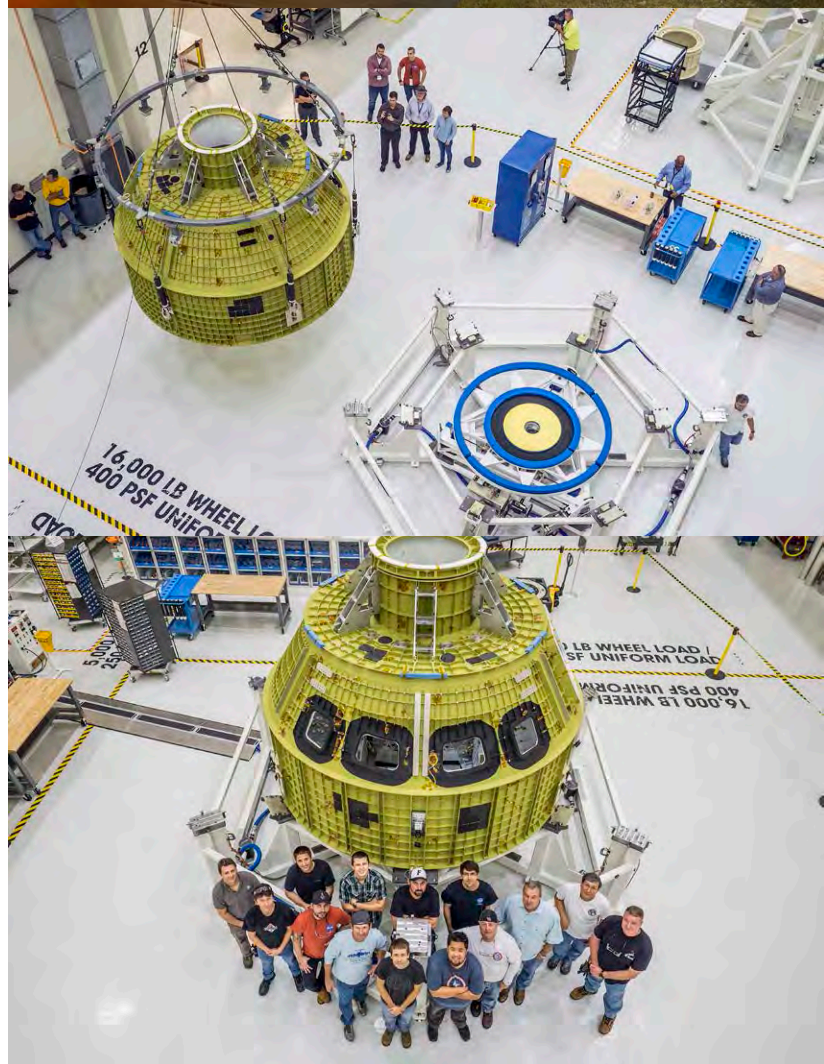
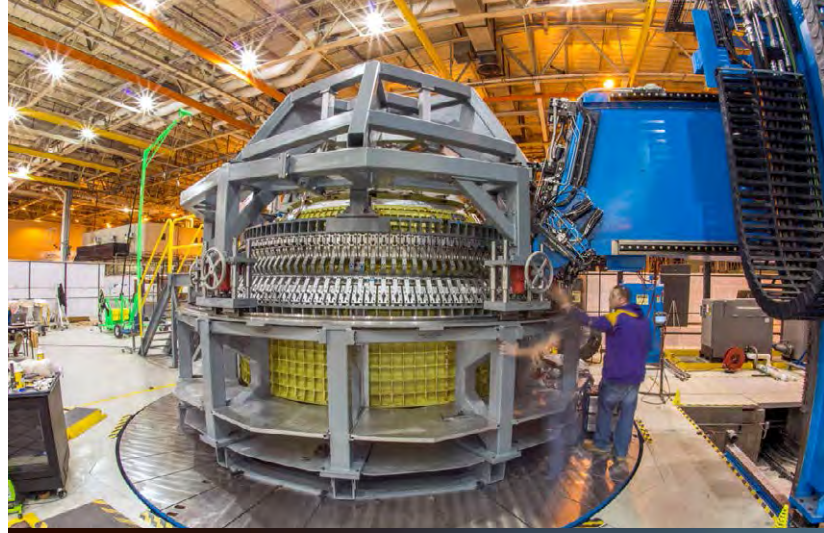
**1:** *The Orion pressure vessel is encased in a structural tool that secures the spacecraft in place during welding operations at Michoud Assembly Facility.*

**2:** *Packaged for travel, Orion's pressure vessel is moved by truck to the airfield in New Orleans where it was loaded onto NASA's Super Guppy airplane for transfer to Kennedy Space Center.*

**3:** *Engineers load the Orion pressure vessel onto a work stand in the Neil Armstrong Operations & Checkout Building at Kennedy on Feb. 2.*

**4:** *The Orion team surrounds the pressure vessel on the floor of the Operations and Checkout Building high bay.*

**On the cover:** *The Orion crew module pressure vessel, or underlying structure, was shipped from NASA's Michoud Assembly Facility in New Orleans to NASA's Kennedy Space Center in Florida on board the Super Guppy cargo aircraft on Feb. 1.*



A large, green, dome-shaped heat shield is being tested in a facility. The heat shield is mounted on a white base and is surrounded by various cables and equipment. A blue sign with a yellow diamond in the center and the text "Foreign Object Debris FOD AWARENESS AREA" is attached to the heat shield. The background shows a large industrial building with orange overhead cranes and a person in a suit standing to the left.

Orion's Ground Test Article and Exploration Flight Test-1 Heat Shield ready for water drop tests at NASA Langley Research Center in Virginia.

# ORION MILESTONES TO TRACK IN 2016

Throughout 2016, engineers and technicians will continue refining, assembling and testing the Orion spacecraft that will send astronauts to deep-space destinations on NASA's journey to Mars.

In Colorado, Lockheed Martin engineers will evaluate a new acoustic technology called Direct Field Acoustic Testing. The test will use customized, high-energy speakers configured in a circle around the crew module flown in space in 2014 to control how much energy reaches the vehicle. The evaluation of the acoustic testing will determine if the method can produce enough energy to simulate the acoustic loads Orion will experience during launch and ascent on the SLS rocket. In 2016, Engineers at NASA Glenn Research Center's Plum Brook Station will put a structural representation of the Orion service module provided by ESA (European Space Agency) and built by Airbus through a series of crucial tests to verify the structural integrity and ability to withstand the dynamic launch environment atop the SLS rocket.

In the spring, tests at NASA Langley Research Center's Hydro Impact Basin, will mimic some of the most stressful water landing conditions Orion could experience with it returns from deep space and splashes down in the Pacific Ocean. Engineers outfitted a test version of the crew module with Orion's heat shield that flew in space and two test dummies strapped inside to evaluate loads the crew may experience during real missions.

The tests highlighted in 2016 are only part of the overall test plan for Orion and SLS in preparation for their first exploration mission. With the progress made so far, and tests planned at Kennedy in 2017 and 2018 when the rocket and ground systems are ready, NASA is on a path to be ready to launch Exploration Mission-1 in 2018.

► [Read the full story](#)

# FASTER, LIGHTER, BETTER

NASA engineers recently tested new parachute designs for the Orion spacecraft with lighter materials that can safely deploy at faster descent velocities.

A dart-shaped test vehicle descended from the skies above the Arizona desert under Orion's parachutes Wednesday, Jan. 13, successfully completing the final development test of the parachute system. NASA engineers evaluated modifications to the system for the last time before the start of qualification testing for Orion missions with astronauts.

During the test, engineers demonstrated that when the spacecraft is traveling faster during descent than in previous tests, Orion's parachutes can properly deploy and withstand high-inflation loads. The dart-shaped vehicle allows engineers to simulate faster descent conditions than the capsule-shaped test article that has been used in many previous evaluations. The test also evaluated new, lighter-weight suspension line material for the parachutes saving a significant amount of mass.

The test was the seventeenth in the developmental series. In July, engineers will begin qualifying Orion's parachute system for flights with astronauts. The series will encompass eight drop tests over a three year-period.

► [Read the full story](#)



# ORION'S CREW & SERVICE MODULES GET HITCHED



The Orion team at NASA Glenn Research Center's Plum Brook station in Sandusky, Ohio, successfully tested mating operations that will connect the spacecraft's service module to the crew module adapter.

The European service module structural test article (E-STA) is used for testing purposes before installing the real thing. It is as close to the flight version as possible while keeping costs and development time manageable. The structure and weight are the same, while mass equivalents stand in for electronics boxes not needed for the series of tests.

The test article was installed under a test version of the crew module adapter, and sits on the spacecraft adapter that

will attach Orion to its launch vehicle. This test marked the first time the European-built hardware has been physically connected to NASA's elements.

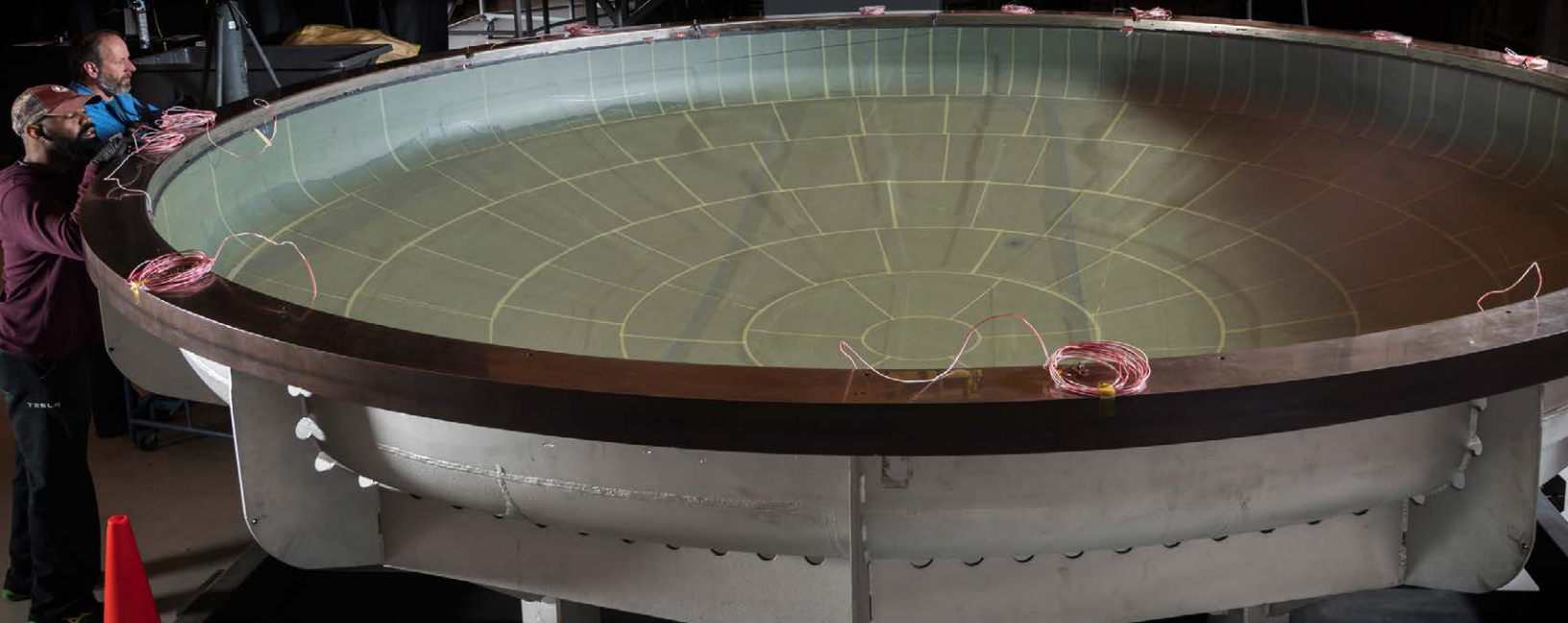
The service module will soon be vigorously shaken on the vibration table at Plum Brook's Space Power Facility to recreate the vibrations of launch. The spacecraft test structure will also be subjected to acoustic and shock environments. Built by European Space Agency and Airbus, the European service module will provide electricity, water, oxygen and nitrogen, and thermal control as well as propulsion for the spacecraft.

► [Read about the Service Module on ESA blog](#)



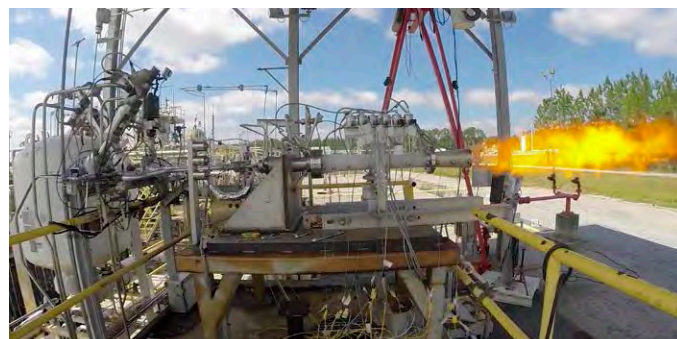
# THE HEAT IS ON

NASA's Super Guppy aircraft arrived at Moffett Field in California on Jan. 7, carrying the Orion Exploration Mission-1 heat shield skin. The heat shield is primarily being built at Lockheed Martin's Littleton, Colorado, facility, and was temporarily sent to Lockheed Martin's Sunnyvale, California, facility for an autoclave cure (shown here). The heat shield has a stiffened skin design, and this cure process is the last step prior to attaching titanium stiffeners to the interior surface. Once the skin and stiffeners are attached, it will be sent to Kennedy where ablative material will be applied to the exterior.



## STENNIS PROPULSION TEAM FIRES UP ORION TESTING

It is widely known that rocket engines tested at NASA's Stennis Space Center near Bay St. Louis, Mississippi, will launch NASA's new Space Launch System on its missions. What is not so widely known is that the south Mississippi center also contributes to the propulsion system that will power the Orion crew vehicle once it leaves Earth's atmosphere and separates from the SLS.



In late 2015, Stennis engineers completed a series of tests on a subscale diffuser system, providing valuable data for the final development testing of the engines that will provide the power Orion needs for deep-space missions.

Stennis engineers also concluded a subscale diffuser test series that recorded 38 hot fires for a total of 172.46 seconds. Data gathered from the testing of the subscale configurations now will be used to build a full-scale diffuser chamber at NASA's White Sands Test Facility near Las Cruces, New Mexico, which will be used to provide a simulated space environment during an actual hot fire test series of the Orion service module propulsion system.

► [Read the full story](#)

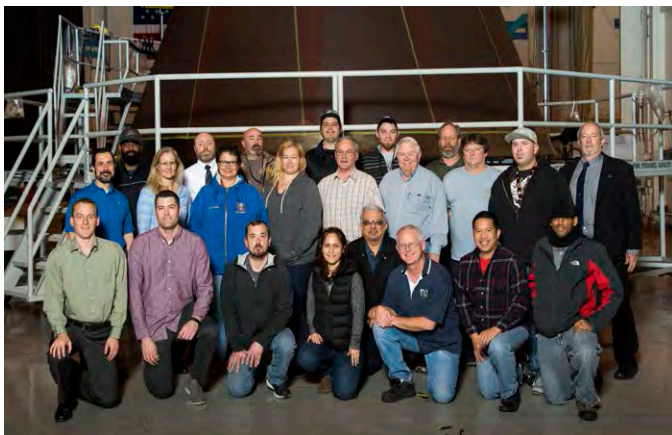
# QUALIFYING FOR QUALITY

Orbital ATK team members stand proud in front of an Orion launch abort motor.



Orbital ATK conducted a successful structural qualification test Jan. 26 on its abort motor case that is being manufactured for use on NASA's Orion crew module. Orbital ATK's launch abort motor is integral to Orion's Launch Abort System, which is designed to ensure the safety of the astronauts inside the spacecraft that fly atop NASA's Space Launch System.

The successful test of the Motor Structural Test case represents a significant milestone on the path to qualifying the abort motor production design. Motor qualification tests demonstrate the abort motor design is capable of performing under the extreme temperatures, G-forces and speed of a crew rescue.



## LOCKHEED MARTIN'S SUNNYVALE ORION TEAM RECOGNIZED FOR SUCCESS

The Orion management team hosted a recognition event at Lockheed Martin's facility in Sunnyvale, California, for the build teams' completion and delivery of the Exploration Mission-1 spacecraft adaptor cone and the successful test for Orion's first two jettisonable panels. Pictured left is the Service Module Spacecraft Adaptor Cone & Fairing Panel Build Team in front of the structural test article cone.

## SPACE CAUCUS MEMBERS TOUR NASA

Texas Representative Dennis Paul, co-chairman of the Texas Legislative Space Caucus, invited Caucus members to the legislative district in which NASA's Johnson Space Center in Houston is located, to share information about commercial and government-led aerospace activities in the area, and to learn about their contributions to Texas. Members toured the Neutral Buoyancy Laboratory, the Boeing Company, Ellington Spaceport,

and Johnson. Lockheed Martin hosted a luncheon for the group during which Lockheed's Orion Deputy Program Manager Larry Price provided an Orion program update and Exploration Mission-1 mission overview. The representatives also toured the Orion mockup in the Space Vehicle Mockup Facility at Johnson with Orion engineer Stu McClung.

# THANKS MICHLOUD TEAM FOR JOB WELL DONE



On Jan. 26, a VIP event, All Hands employee meeting and media event focusing on the Orion crew module pressure vessel took place at NASA's Michoud Assembly Facility in New Orleans. NASA participants included Bobby Watkins, Michoud Assembly Facility director; Ellen Ochoa, Johnson Space Center director; Bill Hill, deputy associate administrator for exploration systems development; Mark Kirasich, Orion program manager; Mike Bolger, Ground System Development and Operations manager; and Steve Doering, SLS core stage manager. Representing Lockheed Martin were Mike Hawes, Orion program manager and Jim Bray, Orion crew module manager. Attendees heard overviews on the Orion spacecraft production and Exploration Mission-1 progress.

Read more about Michoud Assembly Facility in the news:

- ▶ Fox TV
- ▶ ABC TV
- ▶ The Times-Picayune
- ▶ Space News

The following employees at Michoud were recognized during the All Hands event with program manager commendations from NASA: Terri Ryan, Ryan Dardar, John Desforges, Jose Bueiz, Frank Middleton, Chris Bollinger, Rogan Bernard, Raymond Zibilich, Matthew Jackson, Linda Savage-Regan, Tom Kilroy, Gene Flores, James (JD) Dunn, Jason Amato and Steven Seipel.

Prior to the events at Michoud, NASA astronaut Rick Mastracchio also spoke with aspiring astronauts and engineers from Fannie C. Williams Charter School and Schaumburg Elementary School in New Orleans during the visit.





## ORION BACKSTAGE

Even engineers like to shake things up now and then. Anthony Thirkettle is a Principal Mechanical Engineer working on the Orion spacecraft European service module and explains structural testing that is now underway at NASA Glenn Research Center's Plum Brook Station in Sandusky, Ohio. The service module elements are being built by ESA and Airbus Defence & Space for NASA's Orion spacecraft, which will launch in 2018.

► [View the video](#)



## SPACE STATION LIVE: ORION

John McCullough, NASA's Orion vehicle integration manager, talks about the progress of preparing the Orion spacecraft in this edition of Space Station Live.

► [View the video](#)

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

**NASA's Orion Blog**..... [Blogs.NASA.gov/Orion](https://blogs.nasa.gov/Orion)

**Twitter** ..... [Twitter.com/NASA\\_Orion](https://twitter.com/NASA_Orion)

**Facebook** ..... [Facebook.com/NASAOrion](https://facebook.com/NASAOrion)

**Flickr** ..... [Flickr.com/NASAOrion](https://flickr.com/NASAOrion)

**Google+** ..... [Plus.Google.com/+NASAOrion](https://plus.google.com/+NASAOrion)

## ORION TEAM MEMBERS INSPIRE FUTURE GENERATIONS



Raquel Redhouse in Orion's Vehicle and Integration Office recently gave a presentation to Fremont Junior High students in Mesa, Arizona, for the American Indian Science & Engineering Society's National Conference. ► [View the video](#)



Barry Bohnsack, Lockheed Martin Orion engineer, was involved in several FIRST Robotics Competition activities taking place in Florida. Jan. 8-11, Bohnsack participated in the "Robot in 3 Days" webcast, a rapid robot-build video, and presented an Orion overview to high school students in Ocala, Florida. He presented about Orion again on Jan. 16 and helped lead 300 students at the FIRST Tech Challenge Team Championship in Orlando. ► [View the video](#)

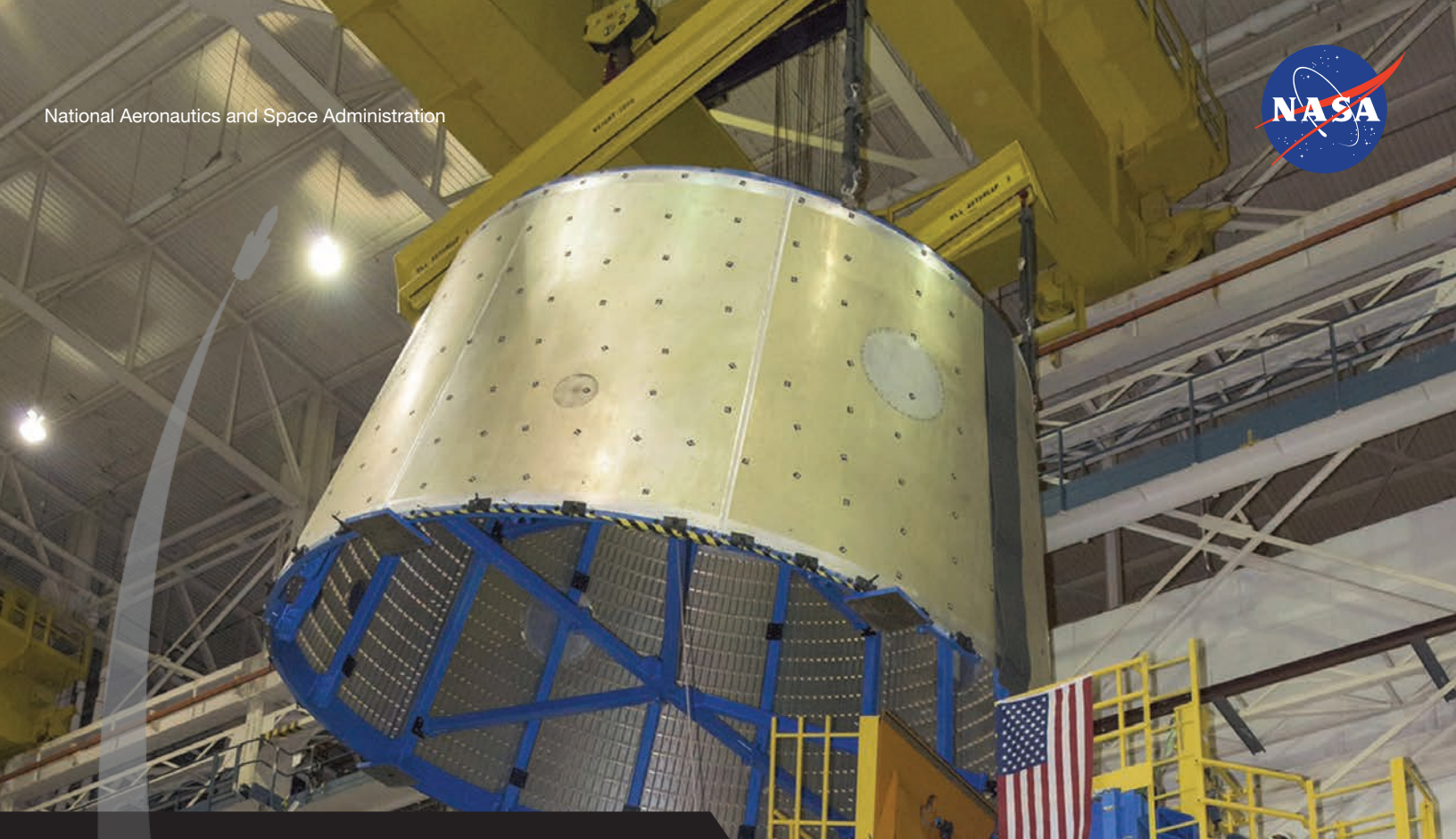
## FEBRUARY:

**Orion assembly and testing continues at Kennedy**

**NASA State of the Agency address**

**Orion/SLS Suppliers Conference in Washington, D.C.**

**Solar array deployment test at Plum Brook Station**

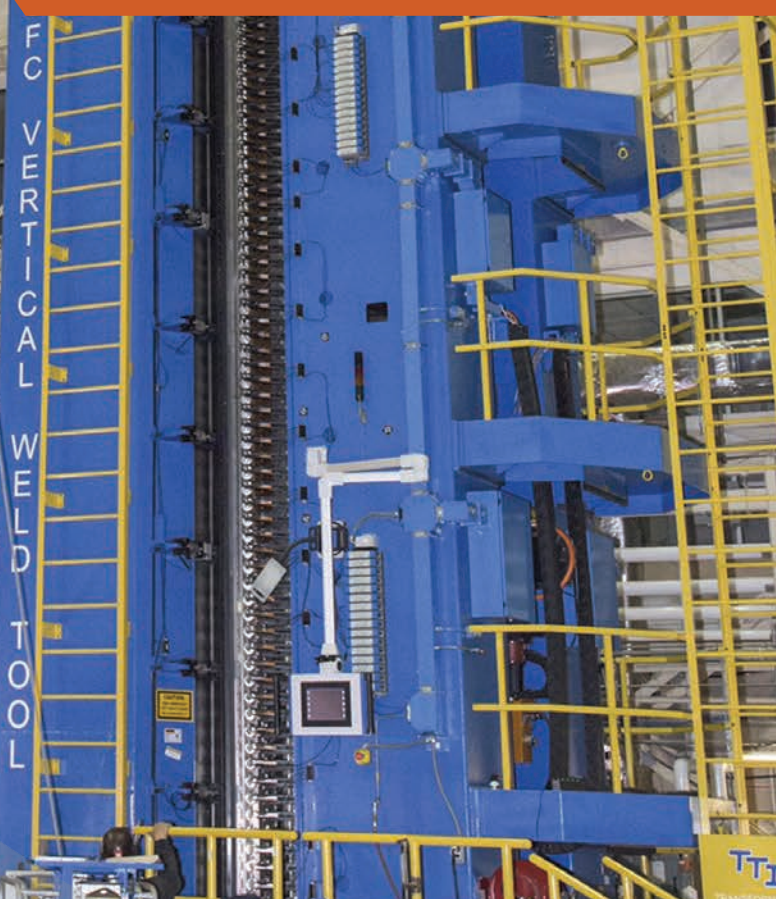


JANUARY 2016

# SPACE LAUNCH SYSTEM HIGHLIGHTS



**FINAL WELDING  
BEGINS FOR  
SLS LAUNCH VEHICLE  
STAGE ADAPTER**



The aft cone, or bottom portion, of a test version of the [launch vehicle stage adapter](#) (LVSA) for SLS is moved out of a weld tool after undergoing its final vertical weld at the agency's Marshall Space Flight Center in Huntsville, Alabama. The LVSA will connect two major sections of the SLS -- the [core stage](#) and the [interim cryogenic propulsion stage](#) (ICPS). Marshall and Teledyne Brown Engineering -- prime contractor on the LVSA work -- have two more major welds to finish the structural test article. When completed, the test hardware will be stacked with other structural test articles of the upper part of the rocket and tested in late 2016 at Marshall. Testing will verify the integrity of the hardware and ensure it can withstand the loads it may experience during flight.





## SECOND SLS TEST STAND BEGINS RISE AT NASA MARSHALL

A crane moves the first steel tier to be bolted into place Jan. 6 for welding of a second new structural test stand at the Marshall Center -- critical to development of SLS. When completed this summer, the 85-foot-tall test stand 4697 will use hydraulic cylinders to subject the liquid oxygen tank and related hardware of the massive SLS core stage to the same loads and stresses it will endure during launch. The stand is rising in Marshall's West Test Area, where work is also underway on the 215-foot-tall towers of test stand 4693, where similar structural tests will be conducted on the SLS core stage's liquid hydrogen tank.



## JERRY COOK NAMED DEPUTY DIRECTOR OF SLS PROGRAM

Jerry Cook has been named deputy director of the SLS Program at the Marshall Center. Appointed to the position in December 2015, he shares responsibility for all facets of the SLS Program, including programmatic and technical planning, procurement, development, testing, evaluation, production, and operation of the integrated SLS. Cook has more than 30 years of experience in both an operational and developmental environment of strategic planning, program management, and program execution.

# SLS, ORION ANOTHER STEP CLOSER TO FLIGHT

On Jan. 26, SLS had an opportunity to showcase progress as part of a media viewing and tour of the Orion spacecraft's recently completed pressure vessel at the Michoud Assembly Facility in New Orleans. NASA shipped the pressure vessel -- the underlying structure of the crew module -- in early February to NASA's Kennedy Space Center in Florida for outfitting with the spacecraft's systems and subsystems. Engineers will then process the vessel and later integrate with the SLS ahead of their first joint mission, Exploration Mission-1 (EM-1).



*The completed Orion pressure vessel*



*Mark Kirasich, Orion program manager at Johnson Space Center, talks about the work that went into the spacecraft's completed pressure vessel.*



*While on a tour of Michoud, guests get a chance to see the engine section weld confidence article in the world's largest welding tool, the Vertical Assembly Center.*





Where better for the world's largest rocket in the world to go than the world's largest technical trade show? That's just what SLS did as first-time participants of the Consumer Electronics Show in Las Vegas. NASA showcased SLS, Orion, and Ground Systems, as well as future missions and the latest technologies. Attendees enjoyed interactive activities, such as a virtual experience of SLS and Mars, and interacting with a Mars rover. Former NASA Astronaut Don Thomas also made a special appearance, signing autographs and posing in pictures with guests. The event drew more than 170,000 industry professionals. While in Nevada, SLS and Thomas visited several local schools and Boys & Girls Clubs to talk about the rocket and NASA's missions.

**ABOVE:** NASA's booth at the Consumer Electronics Show was featured in [Fortune](#) and [EDN Network](#).

**MIDDLE-RIGHT:** Inspiring the next generation of explorers as they learn more about SLS.

**BOTTOM:** Former NASA astronaut Don Thomas signs autographs and meets fans.





NASA has begun the journey to Mars with SLS -- and the SLS blog, “*Rocketology*” is telling the story.

*Rocketology* provides a glimpse of the SLS rocket before it reaches the launch pad -- a rare, once-in-a-generation behind-the-scenes look at how NASA designs, builds and tests a massive launch vehicle like none other in the world. *Rocketology* also pulls back the curtain on the real-world rocket science -- and rocket scientists – that will make possible the first human footsteps on another planet.

Follow along [here](#). Comments and questions will be addressed on the SLS [Facebook page](#).

## SPACEFLIGHT PARTNERS: MEGGITT (ORANGE COUNTY) INC.

- Where is Meggitt located? **Irvine, California**
- How many employees do you have? **450**
- What are you working on for SLS? **We are supplying flight instrumentation sensors to measure things on the rocket like acoustics, acceleration, and pressure.**
- Why do you like doing this work? **It is rewarding to have our sensors on such an important and high-visibility program.**
- How do you feel about working on the world’s most powerful rocket? **It is exciting to be a part of history and helping NASA conquer new space frontiers.**



*Meggitt employees and their children talk to NASA astronaut Ricky Arnold during a Feb. 4 Boeing supplier visit. Meggitt is part of the Boeing team responsible for the SLS core stage and avionics.*

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

- NASA SLS Rocketology Blog.... [blogs.nasa.gov/Rocketology](http://blogs.nasa.gov/Rocketology)
- Twitter..... [Twitter.com/NASA\\_SLS](https://twitter.com/NASA_SLS)
- Facebook..... [Facebook.com/NASASLS](https://facebook.com/NASASLS)
- Flickr..... [Flickr.com/NASASLS](https://flickr.com/NASASLS)
- Google+..... [Plus.Google.com/+NASASLS](https://plus.google.com/+NASASLS)
- Tumblr..... [nasasls.tumblr.com](https://nasasls.tumblr.com)

## COMING IN FEBRUARY:

**Start of interim cryogenic propulsion stage (ICPS) assembly**

**Secondary payloads**



**GSDO**  
GROUND SYSTEMS  
DEVELOPMENT & OPERATIONS

EXPLORATION BEGINS HERE



PROGRAM HIGHLIGHTS • JANUARY 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>.

## 2015 a Busy and Productive Year for GSDO

The year 2015 could be described as a very busy and productive year for the Ground Systems Development and Operations (GSDO) Program at Kennedy Space Center. The team was focused on continuing to prepare our launch infrastructure, facilities, ground systems and operational processes that will become the springboard for our journey to Mars.

We completed the structural modifications to the mobile launcher that provides the platform and launch tower for NASA's Space Launch System rocket and the Orion spacecraft.

Three of 10 levels of work platforms for the Vehicle Assembly Building, K, J and H, arrived at the center. The first half of the K-level work platforms was installed in High Bay 3.

Several of the umbilical lines that will connect from the mobile launcher tower to the rocket and spacecraft are being tested at the Launch Equipment Test Facility.



We are developing a state-of-the-art command and control system for Firing Room 1 in the Launch Control Center. Modifications and installation of ground support equipment are nearly complete in the Multi-Payload Processing Facility where we will service and de-service the Orion spacecraft.

Work began to tune up the massive crawler-transporter that will carry the Space Launch System and Orion spacecraft atop the mobile launcher to Launch Pad 39B for Exploration Mission-1.

We have a busy year ahead with many more milestones to complete. And we have to be ready because, in less than two years, the most powerful rocket in the history of the world is going to show up here on our doorstep.

"Exploration begins here" are more than just words. They are a reality at Kennedy Space Center. And GSDO is "go."

-- Mike Bolger  
GSDO Program Manager



# First Work Platform Installed in Vehicle Assembly Building

The first of 10 work platforms that will provide access to NASA's Space Launch System (SLS) rocket has been installed inside the Vehicle Assembly Building (VAB) at NASA's Kennedy Space Center in Florida. When the SLS arrives at Kennedy for processing prior to launch, it will be housed in the VAB atop the mobile launcher and will stand more than 350 feet above the ground. Engineers are installing platforms at key points along the body of the rocket to provide access needed for launch preparations.

An overhead crane that can hold as much as 325 tons was used to lift the first half of the K-level work platforms from High Bay 4 through an opening in the divider between the bays approximately 19 stories up, across the transfer aisle, and then lowered it into High Bay 3.

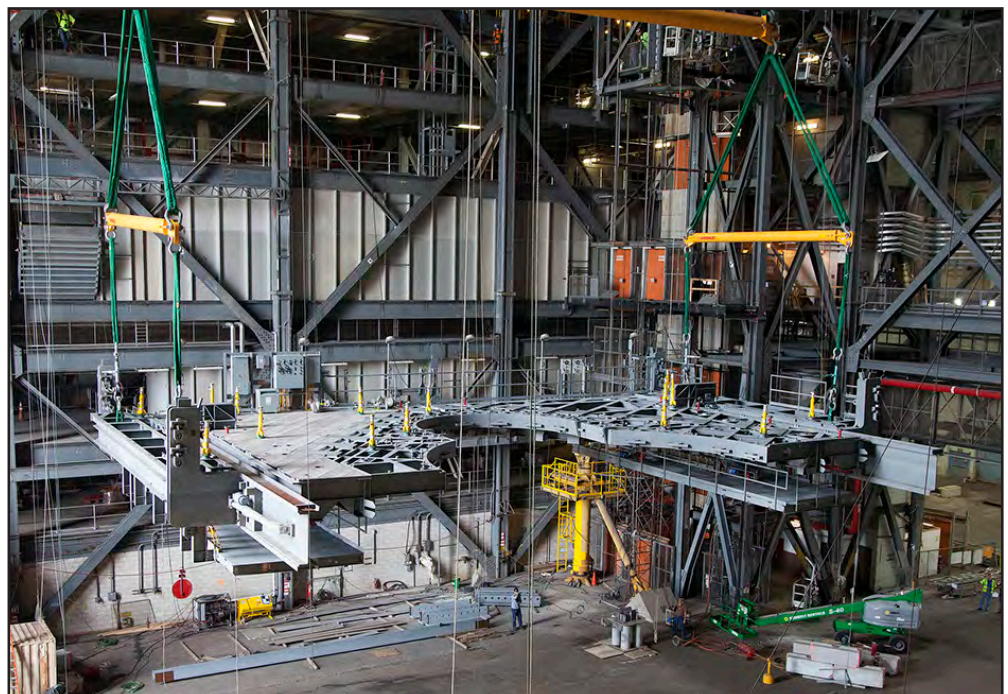
The platform was secured into position, about 86 feet above the VAB floor, or nearly nine stories high. The K-level work platform halves will provide access to the SLS core stage and solid rocket boosters during processing and stacking operations on the mobile launcher.

A total of 10 levels of new platforms -- 20 platform halves altogether -- will surround the SLS rocket and Orion spacecraft and provide access for testing and processing. The giant steel platforms, each measuring 38 feet long and 62 feet wide, will be attached to rail beams that will provide structural support and contain the drive mechanisms to move them in and out or up and down as needed.

The Ground Systems Development and Operations Program is overseeing upgrades and modifications to the VAB, including installation of the new work platforms, marking preparations for the agency's journey to Mars.



Inside the Vehicle Assembly Building at Kennedy Space Center, a 325-ton crane lifts the first half of the K-level work platforms up for installation in High Bay 3 on Dec. 22. The platform was secured into position on tower E, about 86 feet above the floor. Photo credit: NASA/Ben Smegelsky



A 325-ton crane is used to lift the first half of the K-level work platforms for NASA's Space Launch System (SLS) into position in High Bay 3 on Dec. 22. Photo credit: NASA/Glen Benson

View a video of the platform installation at [https://www.youtube.com/watch?v=Yn7\\_4GRqt0k](https://www.youtube.com/watch?v=Yn7_4GRqt0k)

# Critical Design Review Marks Progress for Journey to Mars

NASA's Ground Systems Development and Operations Program (GSDO) has successfully completed its critical design review, on the path to preparing for the agency's journey to Mars.

Members of the review board completed their in-depth assessment of the plans for the facilities and ground support systems at Kennedy Space Center in Florida that will be needed to process NASA's Space Launch System (SLS) rocket and Orion spacecraft for deep-space exploration missions. A Standing Review Board composed of aerospace experts from NASA and industry also will provide an independent assessment. Results of the review process will be briefed to senior agency officials in the coming months as the last step in the process.

"The completion of this review represents a critical milestone for the GSDO team that clearly demonstrates we are on track with the launch site upgrades required to support SLS and Orion test, checkout and launch in 2018," said Mike Bolger, GSDO program manager.

The SLS will be the most powerful rocket in the world and will launch astronauts in the agency's Orion spacecraft to destinations beyond Earth's orbit. Key elements of Kennedy's launch infrastructure will support a new era of human exploration on the journey to Mars.

Progress already can be seen around the center with work currently underway to prepare for the arrival of SLS and Orion.

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



An artist illustration of NASA's Space Launch System rocket and Orion spacecraft on the mobile launcher at Launch Pad 39B at Kennedy Space Center. Image credit: NASA



Technicians assist as an oversized, heavy transport trailer, carrying the first half of the "G" level work platforms, proceeds toward the west side parking area of the Vehicle Assembly Building at NASA's Kennedy Space Center in Florida. The platform was transported Jan. 6, from Sauer Co. in Oak Hill, Florida. The Ground Systems Development and Operations Program is overseeing upgrades and modifications to High Bay 3 to support processing of NASA's Space Launch System and Orion spacecraft, and other exploration vehicles. Photo credit: NASA/Ben Smegelsky

# New Tracking Station for Space Launch System Rocket Launches

Assembly of an advanced tracking antenna is nearing completion at NASA's Kennedy Space Center in Florida. It is both an important step toward the center's role as a 21st century multi-user spaceport and a crucial milestone in preparing to launch the agency's Space Launch System (SLS) rocket and Orion spacecraft.

The antenna is part of a new S-band ground tracking system, known as the Kennedy Uplink Station, located in the space center's industrial area. The new facility, along with a refurbished, identical counterpart north of Kennedy and other enhancements to existing Florida spaceport infrastructure, will form an integrated ground system providing crucial launch communications capabilities. In addition to SLS and Orion, the new ground system will support future civilian, military and commercial launches from Kennedy and Cape Canaveral Air Force Station.

While the NASA ground stations are located at and near Kennedy to support launches from the Florida spaceport, they will be operated remotely from the Wallops Flight Facility in Virginia as part of the agency's Near Earth Network. To meet all SLS and Orion requirements, the project also will deliver upgraded electronics to two Air Force stations and a down-range tracking site in Bermuda.

The crucial elements of the new



*A crane lowers a radome Dec. 10 to cover an S-band antenna at Kennedy Space Center. The antenna is designed to provide a crucial tracking capability following liftoff of NASA's Space Launch System rocket. A radome is a weatherproof structural enclosure designed to protect an antenna or radar system and is constructed of material that interferes minimally with the electromagnetic signal transmitted or received. The S-band portion of the microwave spectrum combines voice, television, telemetry, command, tracking and ranging into a single system. Photo credit: NASA/Dimitri Gerondidakis*

system will allow uninterrupted transmission of communications between the rocket-spacecraft combination and controllers at Kennedy, the Cape, Goddard Space Flight Center, the Johnson Space Center in Houston and the Marshall Space Flight Center in Huntsville, Alabama.

The new network, designed for launch support, includes the new S-band antenna site at Kennedy, as well

as an identical station at the Ponce De Leon Inlet Tracking Annex. The twin station is located in New Smyrna Beach, Florida, 35 miles north of Kennedy. The facility is being refurbished and modernized with an antenna system identical to the one at Kennedy, and will provide a crucial tracking capability following liftoff of the SLS.

To read the complete story, visit <http://go.nasa.gov/1mLqR2A>.



*An aft skirt similar to one that will be used on a solid rocket booster (SRB) for NASA's Space Launch System rocket, was transported by NASA and Jacobs engineers and technicians on the Test and Operations Support Contract on Jan. 20, to the Rotation, Processing and Surge Facility (RPSF) at NASA's Kennedy Space Center in Florida. At the RPSF, the aft skirt will be inspected and undergo limited processing to prepare for SRB pathfinder operations. The pathfinder operations will help to test recent upgrades to the RPSF facility as the center prepares for Exploration Mission-1, deep-space missions, and the journey to Mars. Photo credit: NASA/Bill White*

**Look for a feature on the SRB pathfinder operations in the RPSF in the next issue of GSDO Program Highlights.**

# Ground Systems Team Spotlight



**Lisa Waters** is the group manager for the Safety, Health and Environment (SH&E) organization with Jacobs on the Test and Operations Support Contract at Kennedy Space Center. Her main responsibilities include implementing and executing safety and environmental management systems for Jacobs, and providing support to SH&E customers.

Her team supports the Ground Systems Development and Operations Program at various sites around the center, including the Vehicle Assembly Building; Launch

Control Center; Launch Pad 39B; the Rotation, Processing and Surge Facility; and the Multi-Payload Processing Facility. They provide design, operations and engineering support, safety and environmental teams, recommendations, inputs and plans, product risk assessments, hazard report reviews, safety requirement document release, training and certification, and environmental reports.

"We interface with technicians, engineers, operations and management daily on real-time topics ranging from spider issues in facilities to visualization lab reviews of future operations in the Vehicle Assembly Building," Waters said.

Waters said the coolest part of her job is the people she works with.

"It's an honor and privilege to work with so many passionate, professional and dedicated individuals, all working toward the launch of Exploration Mission-1 and future human missions," Waters said.

Waters has worked at the center for 25 years, starting in 1990 with Lockheed Space Operations Company as part of safety operations for orbiter processing.

Her hometown is Benton, Kentucky, a small town in the western part of the state. She moved to Titusville in 1990.

Waters earned a Bachelor of Science in occupational safety and health in 1987 from Murray State University in Murray, Kentucky. She is just two courses away from obtaining her master's, also from Murray.

"We're never too old to learn new things," Waters said.

Her first car was a 1979 yellow Pontiac Firebird. Her hobbies include traveling and reading fiction and non-fiction books with a focus on history. One of her favorite trips was to Washington, D.C., where she visited the museums and historical sites.

She has been married to her husband, Dwayne, for 22 years. They have two sons, Joshua, 21, and Caleb, 19.

Their pets include Georgia, a two-year-old rescued Border collie and golden retriever mix, and Mac, a six-month-old rescued Siamese kitten with blue eyes.

**Randy Lane** is the technical lead for the Application Services Framework with Vencore on the Engineering Services Contract at Kennedy Space Center. His responsibilities include developing software that allows engineers to quickly develop complex scripts that monitor and command ground support equipment and eventually the Space Launch System rocket and Orion spacecraft.

"The coolest part of my job is getting to write the programs that will be used to launch the Space Launch System," Lane said.

He became interested in space while growing up on Merritt Island and watching rockets launch. His favorite memory is when he was five and his dad woke him up in the middle of the night to watch television. Even though he wanted to go back to sleep, his dad kept him up because it was the Apollo 11 moon landing, and Neil Armstrong was just about to walk on the moon.

"I thank my dad for the memory every chance I get," Lane said.

He has worked at Kennedy or at the Cape Canaveral Air Force Station since 1987. He interned for Computer Sciences Corp. in 1982, during the summer between high school and college. He has worked in various positions for Grumman, Rockwell, Boeing and United Launch Alliance (ULA).

In 2011, he left ULA to work for QinetiQ (which became Vencore).

Lane has always lived in Brevard County. He attended local schools, including Merritt Island High School. He earned a Bachelor of Science in computer science from the University of Central Florida in Orlando in 1986. In 1990, he received a master's in computer graphics from Florida Technological University in Melbourne, Florida.

Lane's first car was a 1987 blue Chevrolet Camaro with a stick shift. Years later, he traded it in for a pickup truck to help transport his windsurfer.

His hobbies include windsurfing and scuba diving. He also volunteers as a mentor for the FIRST robotics teams Horsepower 801, The Pink Team 233, and has worked at the Florida Regional competition. Other hobbies include reading and computer games.

"I am a computer nerd after all," Lane said.

He has been married to his wife, Jean, for 23 years. They have two daughters, Christine, 22, and Heather, 21. Lane and his wife met at the space center where they both worked in the Vehicle Assembly Building for different companies.

They have a dog named Scooter, who may be a Labrador, terrier and German shepherd mix.

"I cannot believe the amount of hair he sheds," Lane said. "He loves our pool more than we do so we think he may be part seal, too."



