



ESD

EXPLORATION SYSTEMS DEVELOPMENT

COMBINED MONTHLY HIGHLIGHTS

January 2014

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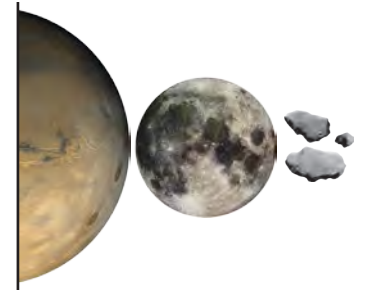
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ORION

SPACE LAUNCH SYSTEM

GROUND SYSTEMS



At Your Service: Orion Team Completes Exploration Flight Test-1 Service Module



The second of three major parts of the Orion spacecraft that will launch into orbit on Exploration Flight Test-1 (EFT-1) is complete. The Orion spacecraft consists of three components: crew module, service module, and launch abort system. This month's completion on the service module marks another major accomplishment as progress continues toward the EFT-1 Orion's first high-altitude orbital flight set for this fall.

Orion's service module sits between the crew module and the rocket that will launch Orion into space. The recently completed EFT-1 service module contains all the structural elements, spacecraft adapter, payload fairings and crew module separation systems. The Exploration Mission-1 (EM-1) service module will also provide power, heat rejection, and propulsion for maneuvering in space. Orion's service module is also responsible for housing water, oxygen and

nitrogen for the Deep Space missions. Since Orion's first mission will be a four-hour-long, uncrewed flight test, many of those systems aren't needed for EFT-1. Instead, this first service module will primarily be responsible for providing the structural support involved in carrying the crew module and launch abort system as they launch into space.

Since the crew module and launch abort system together weigh more than 37,000 pounds at liftoff, Orion's structural integrity must be put to the test prior to flight. To ensure that the service module and its protective panels, called fairings, are up to the challenge, it will spend two weeks in February undergoing tests. Engineers will carefully apply small amounts of stress to the structure to test its stiffness and verify it reacts as predicted. If it does, they'll up the ante, pushing and twisting it from multiple directions. If it can withstand the strain, the engineers will know the spacecraft is ready for flight.



Marshall Team Celebrates Work on Orion's First Mission

From left, John Casper, Orion special assistant for program integration and a former astronaut; Larry Gagliano, Marshall Center deputy project manager for the Orion Launch Abort System (LAS); and Brent Gaddes, Spacecraft and Payload Integration Adapter Subsystem manager at Marshall, take a look at the completed adapter for Orion's first mission scheduled for this fall. This spacecraft adapter will be the first of the Space Launch System (SLS) hardware tested in flight. At an event at

Marshall on Jan. 30, more than 150 Marshall and Orion team members, industry partners and other special guests celebrated the contributions the center has made toward the mission. Along with the adapter work, the Flight Programs and Partnerships Office at Marshall provided support to the mission and the Orion program by fabricating more than 300 pieces flight hardware and conducting testing of the LAS thermal production material.



On Jan 22, producers from the PBS Series "MAKERS: Women Who Make America" were at the Operations & Checkout facility interviewing Orion's very own Marleen Martinez, a Lockheed Martin test engineer for the program. Along with special episodes about comedy, politics, war, business and Hollywood, the show will feature a one-hour documentary on America's Space Program — most likely to air in July.

<http://www.pbs.org/makers/home/>



Read about Julie Kramer White, Orion's Chief Engineer:
<http://on.fb.me/1cZHnUL>



Orion Parachute System Passes Complex Test

This month saw the successful completion of the most complicated parachute system test to date for NASA's Orion spacecraft. This time, in addition to parachute deployment, the system responsible for jettisoning Orion's forward bay cover was included in the test.

Engineers collected in-air data on the performance of the forward bay cover, which is a shell that fits over Orion's crew module to protect the spacecraft during launch, orbital flight and reentry into Earth's atmosphere. A successful jettison of the forward bay cover is a mission-critical event because the cover must come off before the spacecraft's parachutes can deploy. A thruster separation system built by Systima Technologies of Bothell, Wash., helps to discard the cover. "This was a tough one," said Mark Geyer, NASA Orion program manager.

"We'd done our homework, of course, but there were elements here that could only be tested in the air, with the entire system

working together. It's one of the most complicated tests that we'll do, so we were all excited to see it work just as it was meant to."

Previous parachute system tests at the U.S. Army's Yuma Proving Grounds in Arizona were conducted without a forward bay cover. Since this test included the cover and its jettison, along with the deployment of three additional parachutes to pull the cover away from the crew module and lower it to the ground, this run-through was much more complex.

"The parachute deployment and forward bay cover jettisons are two of the most difficult things for us to model on computers," said Chris Johnson, NASA project manager for the parachutes. "That's why we test them so extensively ... And every bit of data we can gather in tests like these helps us improve our models."

Video of drop test: <http://bit.ly/1I05tAt>

Orion's propulsion system, Environmental Control & Life Support System (ECLSS), wiring and avionics have been successfully installed on the crew module, and the team recently began proof pressure and leak testing to qualify those systems for flight. As part of the process to qualify the spacecraft for flight, and to verify workmanship, these systems are pressurized, and the welds are checked for leaks (image on right). Once proof testing is complete, the crew module avionics system will undergo functional testing. During these tests, every piece of the avionics system will be powered on and sent commands. This functional testing expands on the initial power on test, by activating the entire avionics system.



California Small Businesses Make Big Contributions To Space

The NASA Orion and Space Launch System (SLS) team conducted supplier and outreach events in the greater Los Angeles area the week of Jan. 27, to say thanks to the workforce helping to build America's next generation spacecraft.

Representatives from Lockheed Martin, NASA, Boeing, and Alliant Techsystems participated collaboratively in the events, which included visits to a handful of the more than 200 California suppliers who have contributed to the Orion and SLS spacecraft production to date. They provided the companies with an update on program progress toward Orion's first mission this fall and the follow-on Exploration Mission-1 in 2017.

The program teams met with employees at Aero-Pacific Corp., Southern California Braiding, Coast Aerospace, Hurlen Corporation, GlenAir, Hi-Rel, and the California Science Center. In addition, program managers provided Orion/SLS briefings to more than 100 members of the AIAA student chapter at California State Polytechnic University, and participated in an event at AMRO Fabricating Corp., celebrating a protégé-mentorship announcement for the family-owned business.

"Cooperation among companies, agencies and nations is required to make Deep Space exploration possible," said Paul Anderson, Lockheed Martin Orion Avionics Integrated Product Team director. "Orion and SLS are being built by virtual teams with members all across the country to ensure we have the right skilled technicians with the level of expertise we need to accomplish that goal. It's been a great honor and privilege to meet some of these people in person and thank them for their hard work and commitment to the future of human space exploration."



Coast Aerospace Team



Lockheed Martin's Jon TenEyck and Paul Anderson, and NASA Sharon Cobb and Paul Marshall tour the Southern California Braiding facility with President Craig Phefferman.

Coming up in February

- Underway recovery test in San Diego
- Service module structural loads testing
- First Delta IV heavy booster ships to Kennedy Space Center
- Crew module multi point random vibration test

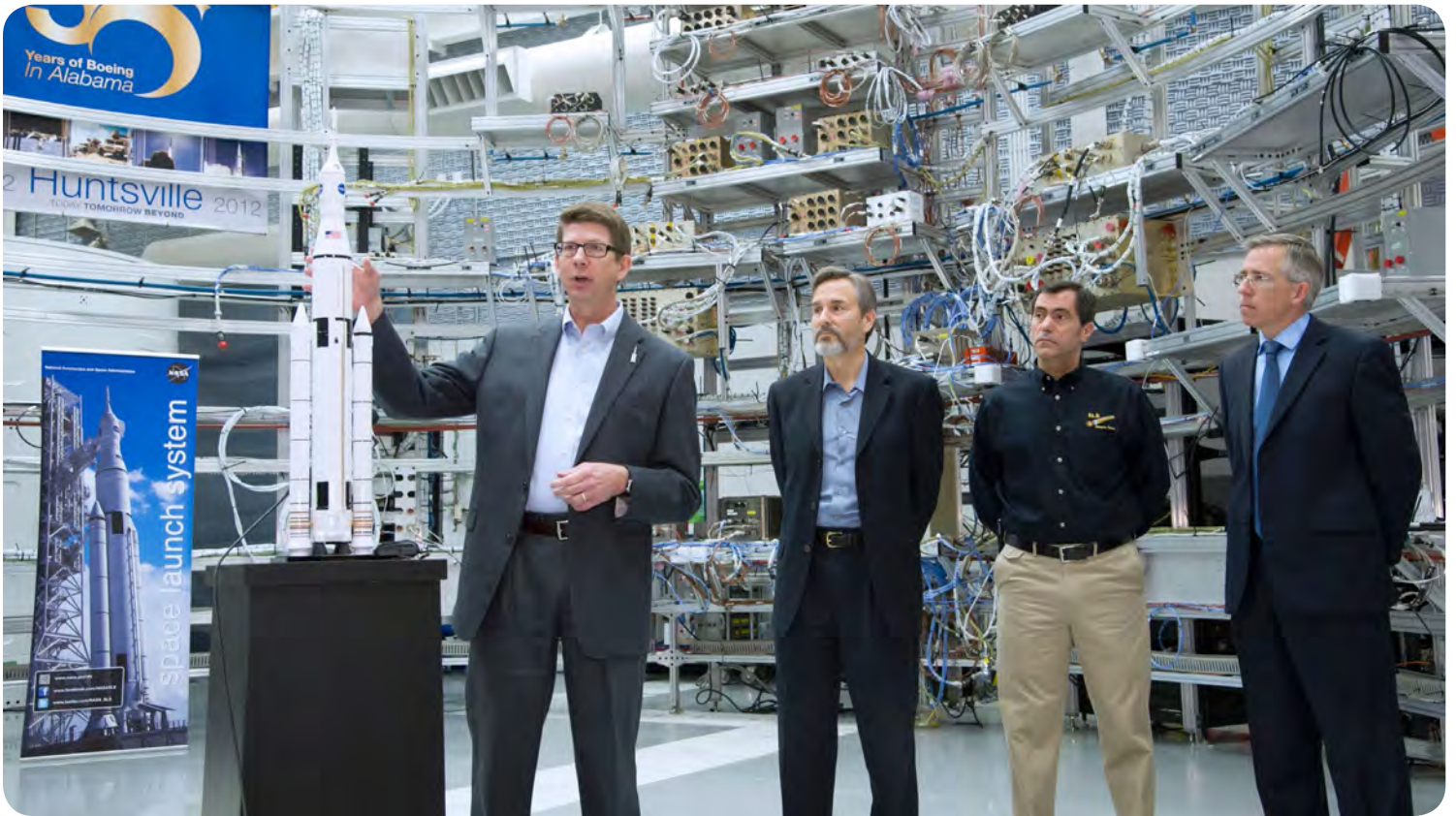
Space Launch System

Highlights

January 2014



SLS Avionics System Sees the (First) Light



Dan Mitchell, at podium, SLS Integrated Avionics and Software lead engineer at NASA's Marshall Space Flight Center in Huntsville, Ala., explains during a media event how the hardware, software and operating systems for the SLS recently were integrated and powered up for an inaugural run—referred to as “first light.” The avionics hardware units are arranged in flight configuration at the Systems Integration and Test Facility at Marshall and will replicate what will actually fly the rocket. NASA and Boeing engineers will test the system and run flight simulations to see how the SLS will perform during launch. In the background, from left, are Charles Dutch, Boeing avionics manager; Tony Lavoie, manager of the Stages Office at Marshall; and Frank McCall, Boeing deputy program manager. For the full story on first light, [click here](#). (Boeing)

Spaceflight Partners: ESAB Welding & Cutting Products

EDITOR'S NOTE: Every month, SLS Highlights turns the spotlight on one of the industry partners helping to create the largest rocket ever built for human space exploration. In this issue, we profile ESAB Welding & Cutting Products of Laxa, Sweden.

The Boeing Co. selected ESAB Welding & Cutting Products as a partner in the manufacturing of fuel tank structures for the SLS. Engineers and experts from ESAB have worked with Boeing and NASA for more than a year to develop the new Vertical Assembly Center (VAC) at the agency's Michoud Assembly Facility (MAF) in New Orleans. The VAC is a giant orbital welding system that is capable of supporting the huge rocket fuel tank, while circumferentially welding its sections together with the friction-stir process. The VAC will be the largest welding machine of its type in history.

The VAC is being designed, engineered and built at the ESAB facility in Laxa, Sweden, and is supported by ESAB's North American Automation Division. The vertical tower assembly is being built in the United States using U.S. steel and component materials. For more information, visit www.esabna.com.



Artist illustration of the Vertical Assembly Center. (NASA/MAF)

Marshall Team Celebrates Work on Orion's First Mission



From left, John Casper, Orion special assistant for program integration and a former astronaut; Larry Gagliano, Marshall Center deputy project manager for the Orion Launch Abort System (LAS); and Brent Gaddes, Spacecraft & Payload Integration Adapter Subsystem manager at Marshall, take a look at the completed adapter for Orion's first mission, Exploration Flight Test-1 (EFT-1), in September. At an event at Marshall on Jan. 30, more than 300 Marshall and Orion team members, industry partners and other special guests celebrated the contributions the center has made toward Orion's first test flight. Along with the adapter work, the Flight Programs & Partnerships Office at Marshall provided support to the Orion program by fabricating more than 300 pieces of EFT-1 flight hardware and conducting testing of the LAS thermal protection material. (NASA/MSFC)

(continued on page 3)

NASA Administrator Tours Facility Where New Deep Space Rocket is Being Built



NASA Administrator Charles Bolden, center, talks about progress on the Core Stage with SLS Program Manager Todd May, right, and Michoud Assembly Facility Director Roy Malone during a tour of Michoud in New Orleans Jan. 13. (NASA/MAF)



With the SLS hardware in the background, NASA Administrator Charles Bolden talks to Michoud employees during a visit to the facility. Bolden was joined by U.S. Sen. David Vitter of Louisiana to observe progress made on the SLS. (NASA)

I am
building
SLS

Robert Hoffman
Team Lead Engineer



To find out more about the people who are building SLS, [click here](#).



Marshall Team

(continued from page 2)

Also on Jan. 30, structural loads testing was completed on the prototype flight adapter at Marshall's East Test Area. For the structural loads test, the prototype was attached with lines running in different directions on the hardware. Hydraulic pressure is added to those lines in increments, which pushes on the adapter to evaluate its integrity. Twenty-five loads cases were completed during testing. To watch a video of the adapter's journey to completion, [click here](#). (NASA/MSFC)

SLS Sound Suppression Testing Ramps Up at Marshall



▲ Engineers at the Marshall Space Flight Center began the first round of acoustic tests on a scale model of the SLS on Jan 16. Here, a 5-percent scale model of the SLS is ignited for five seconds to measure the affect acoustic noise and pressure have on the vehicle at liftoff. The green flame is a result of the ignition fluid that is burned along with the propellant during this short-duration test. For the full story on acoustic testing, [click here](#). (NASA/MSFC)

Michael Martin, an InfoPro Corp. employee supporting Marshall's Test Laboratory, installs a leak check fixture on one of the liquid oxygen (LOX)/hydrogen thrusters ahead of testing on the scale model. The thrusters simulate the four RS-25 engines that will power the core stage on the SLS. (NASA/MSFC) ▼



Adapter Gets Astronaut's Autograph



Expedition 36 flight engineer Chris Cassidy visited Marshall on Jan. 22 following a recent five-month tour aboard the International Space Station. While at Marshall, Cassidy signed the adapter that will connect Orion to a Delta IV rocket for Orion's first mission later this year. (NASA/MSFC)

SLS On the Road...

SLS Assistant Program Manager Sharon Cobb, second from left, takes a tour of Southern California Braiding in Bell Gardens, Calif. The company provides cable assemblies for SLS and the Orion spacecraft. The tour was part of a Jan. 29-31 trip to the southern California area by members of the SLS and Orion programs to visit institutions and companies in the area that are providing support for the vehicles. The teams also talked to students at California State Polytechnic University about SLS. (NASA/MSFC)



On Jan. 31, NASA hosted a Mentor-Protégé signing agreement between The Boeing Co. and AMRO Fabricating Corp. of South El Monte, Calif., to work together in support of SLS. AMRO currently supports Boeing by manufacturing the aluminum alloy panels that make up the large barrels of the SLS core stage. The NASA Mentor-Protégé Program pairs large companies with eligible small businesses to enhance capabilities and enable them to successfully compete for larger, more complex prime contract and subcontract awards. SLS representatives taking part in the signing are Boeing SLS Vice President and Program Manager Ginger Barnes, seated second from left; SLS Assistant Program Manager Sharon Cobb, seated second from right; and David Brock, small business specialist, seated at right. (NASA/MSFC)



SLS Program Manager Todd May served as keynote speaker at the first Downtown Huntsville Inc. annual meeting and awards ceremony Jan. 10 at the Von Braun Center. Local organizations and individuals were honored at the event for their impact on downtown Huntsville. (NASA/MSFC)



For more SLS news, updates and resources, visit www.nasa.gov/sls

Follow SLS on:



SLS on Deck:

- SLS at Clark Planetarium
- AUSA Winter Symposium
- SMAT testing continues



GSDO

GROUND SYSTEMS
DEVELOPMENT & OPERATIONS

EXPLORATION BEGINS HERE



PROGRAM HIGHLIGHTS • JANUARY 2013

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://go.nasa.gov/groundsystems>.

GSDO 2013 Review: A Year of Progress

During 2013, the Ground Systems Development and Operations (GSDO) Program at Kennedy Space Center in Florida continued to upgrade or modify several facilities and ground support equipment to be ready to support the processing and launch of NASA's Exploration Flight Test-1 in 2014 and the agency's Space Launch System (SLS) with the Orion spacecraft atop it in 2017.

At Launch Pad 39B, construction crews have removed the space shuttle-era flame deflector and Apollo-era brick walls from the flame trench that sits below and between the crawler tracks to make way for a new flame deflector and brick walls. On the surface of the pad, a new elevator has been constructed. All of the crawler track panels were removed so the concrete surface below and the catacomb roof can be inspected and repaired. New crawler track panels will be installed this year.

Upgrades, including new roller shaft bearings, were installed on crawler-transporter 2 so it can support the added weight of the mobile launcher and SLS on its journey to Pad 39B. Crawler-transporter 1 (CT-1) received new jacking, equalizing and leveling, or JEL, hydraulic cylinders and was taken for a test ride to Launch Pad 39A to undergo a leveling and turning test. CT-1 continues to be modernized so that it is available to carry a variety of



An aerial view of Launch Pad 39B with the Vehicle Assembly Building in the background.

launch vehicles to the pad.

The crawlerway leading to pads A and B was upgraded to improve the foundation and prepare it to support the weight of the SLS and mobile launcher on the crawler-transporter during rollout. Workers removed the original Alabama river rock and restored the layer of lime rock below to its original depth of 3 feet. New river rock was added on top.

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The Multi-Payload Processing Facility is undergoing extensive upgrades and modernizations to support processing of the Orion spacecraft. The building, originally constructed in 1995, primarily will be used for Orion hypergolic fueling, ammonia servicing and high-pressure gas servicing and checkout. Upgrades include installing new pneumatics systems, hypergolic systems and a ground cooling system.

With crewed launches on the SLS and Orion spacecraft beginning in 2017, GSDO led the effort to select an emergency egress vehicle that future astronauts could use to quickly leave the Launch Complex 39 area in case of an emergency. The first of four refurbished Mine-Resistant Ambush-Protected (MRAP) vehicles was shipped from the U.S. Army Red River Depot in Texarkana, Texas, and arrived at the Kennedy Dec. 5. They will be modified to meet NASA's emergency egress requirements.



A road grader resurfaces a section of the crawlerway leading from the Vehicle Assembly Building to the launch pads.

GSDO Preliminary Design Review Begins

NASA kicked off the preliminary design review (PDR) for its Ground Systems Development and Operations (GSDO) Program on Jan. 15. This major program milestone provides an assessment of the preliminary designs, and upon successful completion, will allow development of the ground systems to proceed to detailed design.

"The preliminary design review is incredibly important, as it must demonstrate that the ground systems designs meet all requirements within cost, schedule and risk constraints," said Mike Bolger, GSDO program manager. "This review also will help ensure that GSDO stays on track to process and launch the Space Launch System (SLS) and the Orion spacecraft in 2017 at the Kennedy Space Center."

The SLS is larger than the Saturn V rocket and will be the most powerful rocket ever built. Orion will transport astronauts to destinations beyond Earth orbit and will



GSDO Program Manager Mike Bolger kicks off the preliminary design review Jan. 15.



NASA and contractor workers attend the kickoff of the GSDO preliminary design review Jan. 15

return them safely to earth. Representatives from NASA, its contractor partners and experts from across the aerospace industry will validate the ground systems to ensure they can be safely and successfully integrated with the rocket and spacecraft.

A variety of buildings will be needed to process specific elements of the agency's next deep space booster and spacecraft. The PDR is a technical milestone that will ensure these structures are suited for their vital roles in developing and building the spacecraft and rocket NASA needs to carry out its deep-space missions.

The review process will take several weeks and is expected to conclude in the spring.

Employee Spotlight – Sasha Sims

Sasha Sims is the Business Management and Analysis Branch chief for GSDO at Kennedy Space Center. Her primary role is to manage the development and administration of the program's budget.

She leads a team of program analysts who work with technical counterparts to identify resource requirements and prioritize allocation of funding.

"We also are responsible for ensuring that financial decisions are in line with the program's technical baseline and support the schedule baseline," Sims said.

Sims is originally from Camuy, Puerto Rico. She graduated from the University of Puerto Rico, Mayaguez Campus, with a bachelor's degree in industrial engineering in 2002. She earned a master's in engineering management from the Florida Institute of Technology in Melbourne in 2007.

Her interest in space began during her sophomore year in college after completing a course in physics. She joined NASA in January 2003, just three days before the launch of Columbia on the STS-107 mission.

Sims worked as a logistics engineer in the Cape Canaveral Spaceport Management Office until 2006. She then moved to the Constellation Program and worked as a mission operations engineer for five years. Sims has worked in the GSDO Program since its formulation in 2011 and 2012.

Sims is fascinated with photography and spends some of her time capturing memorable moments in photographs. She likes to travel and has a goal of traveling



to a part of the world she has never been to every year.

Her first car was a 1997 Toyota Rav-4. She didn't get a car until her fourth year of college, so she spent most of her student life walking everywhere.

Sims and her husband, Michael, have been married for nearly eight years. They have one son, Lucas, who is almost five years old.



GSDO hosted a media day Jan. 21 at various locations around the center. Managers provided progress updates on the work being done to the Mobile Launcher (ML), crawler-transporter 2 (CT-2) and Launch Pad 39B. At left is Mary Hanna, crawler-transporter project manager, talking to reporters about CT-2 inside the Vehicle Assembly Building. At right is Mike Canicatti, ML construction manager, talking to reporters near the Mobile Launcher.

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EXPLORATION SYSTEMS DEVELOPMENT



*An aerial view shows construction progress at Launch Pad 39B
at NASA's Kennedy Space Center in Florida on May 6, 2013*