

**MONTHLY  
ACCOMPLISHMENTS**  
June 2013

# orion



## Orion EFT-1 Crew and Service Modules now in full production at KSC's O&C facility

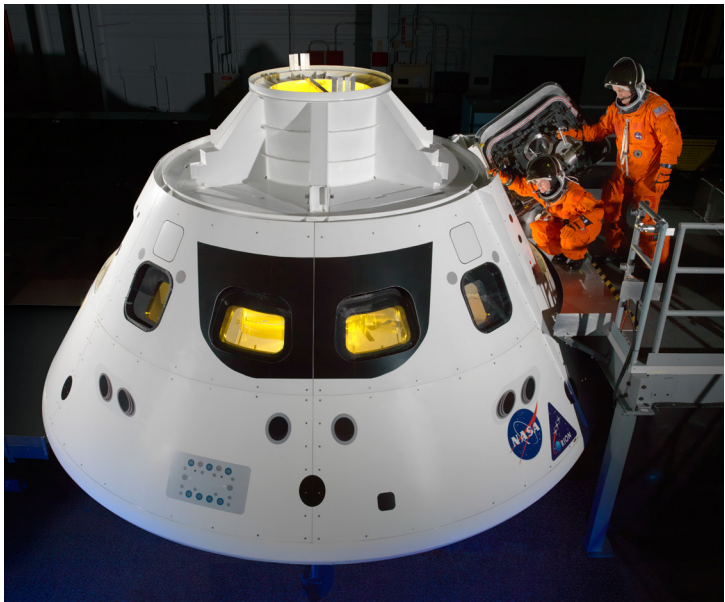


Orion's assembly, integration and production phase officially commenced in June with the arrival of the last of the ECLSS (Environmental Controls & Life Support Systems) elements. In addition, more and more components for all 14 of the spacecraft's subsystems continue to arrive on dock at Kennedy Space Center's Operations and Checkout facility in Florida every day.

The manufacturing and assembly team has been extremely busy getting the Orion crew and service modules ready for power up and testing later this fall. Welding and testing tubes and components for the spacecraft's fluid systems,

testing and installing pyrotechnic components, and validating the vehicle's uprighting system were many of the activities conducted in June.

With the primary and secondary structures now completed, Orion technicians are now also working on fabrication and installation of the spacecraft's thermal protection systems. The first set of backshell panels have been received and will undergo thermal protection system installation over the next few weeks. Wire harnesses and multilayer insulation blankets are also in fabrication at the Operations and Checkout facility.



## Orion cockpit egress evaluations at JSC

Engineers and astronauts suited up for the Crew Impact Attenuation System removal test runs that took place this month in the Orion low-fidelity mock-up at the Space Vehicle Mock-up Facility at Johnson Space Center in Houston. The fully suited evaluations are being conducted to gain better understanding of any impacts of the pallet removal on seat ingress and egress.

NASA Public Affairs Officer Dan Huot talked with Orion Cockpit Lead Engineer Jeff Fox (<http://bit.ly/1ahw1I3>) and Orion Crew Survival Systems Manager Dustin Gohmert (<http://bit.ly/139DCIA>) about the egress evaluations with a fully-suited crew.

## Adapter, Delta IV rocket test article successfully connected for Exploration Flight Test-1



It was a good fit for a spacecraft adapter and a Delta IV test article, as two critical elements of Exploration Flight Test (EFT-1) were successfully connected during a fit check June 26 at NASA's Marshall Space Flight Center in Huntsville, Ala. The adapter weighs about 1,000 pounds and is being designed and built at Marshall. The adapter will join the Orion spacecraft to a United Launch Alliance (ULA) Delta IV rocket, which is being constructed at ULA's facility in Decatur, Ala., and will launch Orion on the 2014 flight test.

NASA Orion Program Manager Mark Geyer visited Marshall to observe the fit check, as well as speak with the Space Launch System team and give out a Program Manager Commendation award to the EFT-1 crew module repair team.

While there, he conducted interviews with WAFF-TV Ch. 48, The Huntsville Times and the Huntsville Newswire. He also attended an event at ULA to see the Delta IV rocket in production for EFT-1. At ULA, Geyer was interviewed by The Decatur Daily and WAAY-TV Ch. 31.

# Exploration systems, employees recognized at Michoud

NASA Exploration System Development and Boeing team members participated in a media day at NASA's Michoud Assembly Facility in New Orleans, on June 21. The event consisted of an employee town hall and recognition event, a Space Launch System Vertical Weld Center ribbon cutting ceremony, and a media opportunity. NASA Associate Administrator for Human Exploration and Operations William Gerstenmaier gave remarks and answered media questions.

During the recognition event, a Silver Snoopy award was presented by Astronaut Ricky Arnold to Don Regan with Lockheed Martin Space Systems for his outstanding technical performance and leadership in support of the fabrication and delivery of the Orion Exploration Flight Test-1 (EFT-1) launch abort system fairing assembly. Also, the launch abort systems fairing manufacturing team received a Space Flight Awareness team award that was accepted on behalf of the team by Lockheed Martin's Jay Layton.



## Fit check sets stage for Orion spacecraft recovery test

Engineers and technicians at Kennedy Space Center in Florida, Langley Research Center in Virginia and Lockheed Martin Space Operations in Denver, Colo., prepared unique hardware that was used in a fit check of equipment that will be used to recover Orion upon splashdown in the Pacific Ocean. The recovery operations were led by the Ground Systems Development and Operations Program at Kennedy.

A test of the recovery equipment and procedures will take place in August at the Naval Station Norfolk port facility in Norfolk, Va. To be ready for that test, a fit check of the hardware was conducted near Langley on June 25-28.

For the first time, the crew module recovery cradle, the boilerplate handling fixture bumper assembly, and the Orion boilerplate test article – a life-size test version of the spacecraft – was assembled and tested in one place. The fit check also gave the team the opportunity to see how NASA procedures and hardware mesh with procedures and hardware developed by the U.S. Navy.





## Testing begins on flight hardware designed to protect Orion on ascent

Testing has begun on NASA's launch abort system (LAS) fairing assembly, which will be used to cover and protect the Orion crew module during ascent on Exploration Flight Test-1 (EFT-1).

Lockheed Martin, the prime contractor for Orion, is conducting the hardware tests at the company's Sunnyvale, Calif., facility, as well as several other tests on Orion components that will be conducted throughout the summer. The actual flight hardware will be exposed to loads and pressures greater than those expected during launch.

During static loads testing of the LAS fairing, the structure is placed into a large steel frame and loaded by 10 hydraulic actuators, simulating aerodynamic pressures and bending loads experienced during flight. Approximately 36 strain gauges and 26 displacement sensors are placed on the structure to measure the way it handles various loads and stresses. Testing makes certain that the structure will work during flight and helps to better understand how well the engineering analysis predicts real-flight vehicle behavior.

If an emergency were to occur on the pad or during initial ascent the LAS would propel the crew module to a safe distance away from the launch vehicle.



## Navy divers learn about Orion rescue and recovery operations at JSC

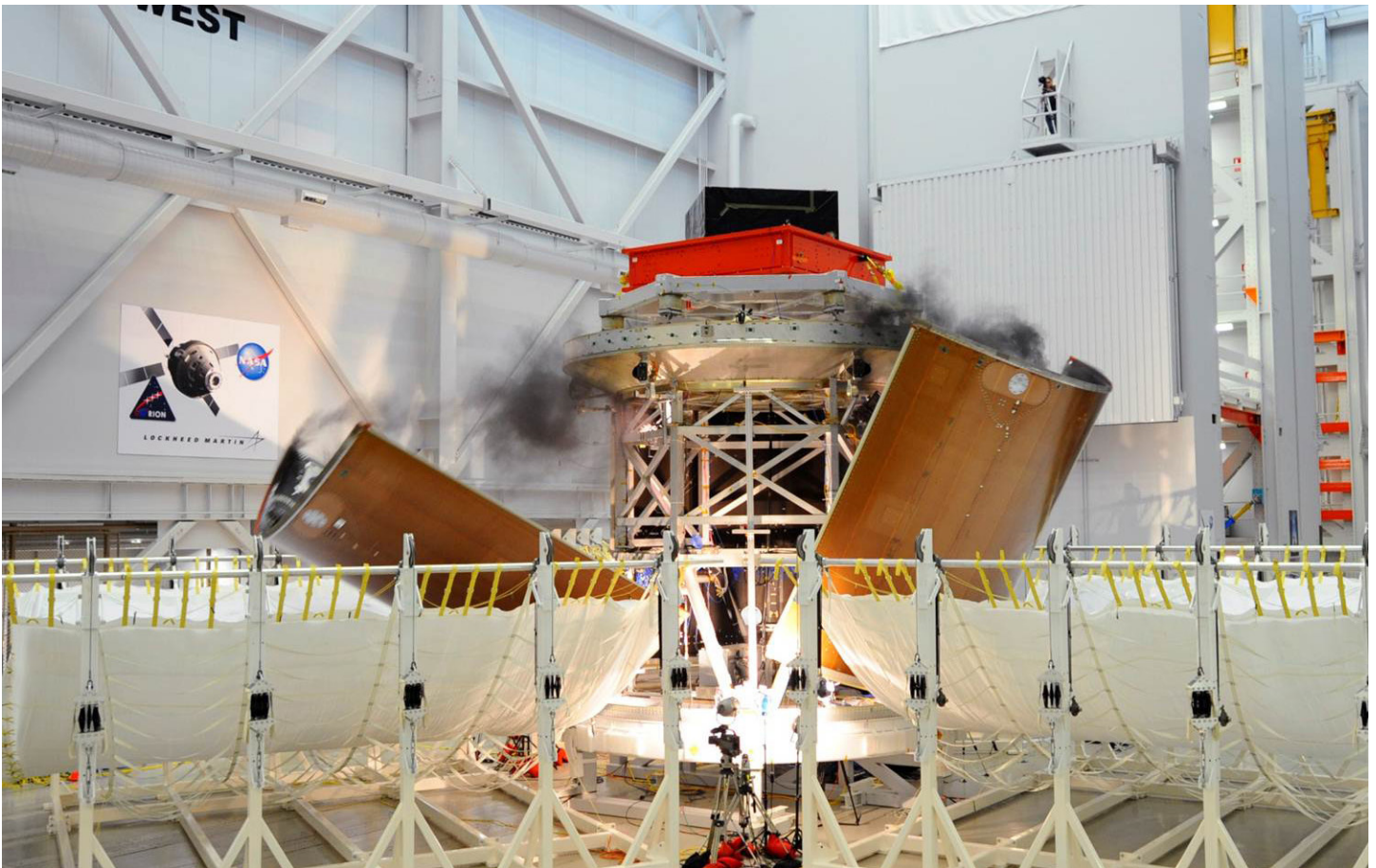
NASA engineers have been working closely with the U.S. Navy to develop the procedures their divers will use when recovering the Orion spacecraft following splashdown after the first orbital flight test in 2014 – Exploration Flight Test (EFT-1). These procedures are being tested in the 40-foot-deep Neutral Buoyancy Laboratory at Johnson Space Center in Houston. The dive team is learning how to safely approach, capture and recover the Orion spacecraft and associated hardware. The Orion capsule will be recovered by the U.S. Navy when it lands off the coast of Baja, Calif., next year during the EFT-1 mission.



## NASA pays tribute to shuttle program and launches new era of exploration at Kennedy Space Center

At the unveiling of the new space shuttle Atlantis exhibit at Kennedy Space Center's Visitor Center, Lockheed Martin displayed the Orion Ground Test Article (GTA) along with a quarter-scale model of the Orion spacecraft. Orion subject matter experts conducted impromptu group presentations for visitors. In addition, NASA Orion volunteers spoke with visitors at a display inside the visitor's center, as well as in front of full-sized mock-ups of Orion's crew module, service module and launch abort system. NASA Administrator Charles Bolden, Kennedy Space Center Director Robert Cabana and officials from the state of Florida discussed NASA's future spaceflight program in a press conference in front of the GTA during the event.

# First fairing separation test provides data to validate design



At the Lockheed Martin facility in Sunnyvale, Calif., the team conducted the first in a series of tests to determine if the Orion spacecraft can successfully jettison its protective fairings, or covers, during its ride to space. During the first of these tests, two of the three fairing panels separated as planned, but a third did not.

The fairings are panels that will protect Orion's service module from the environment around it. The testing is designed to demonstrate the fairing system's separation sequence before Orion launches on Exploration Flight Test-1. The test series will allow engineers on the ground to evaluate Orion's design before humans take their first flight aboard the spacecraft.

During the test, all pyrotechnic mechanisms and bolts separated as planned, but the third fairing panel did not completely detach. Initial observations point to a potential contact interference. Engineers continue to evaluate the test data, which will be compared with engineering models of the

jettison to validate engineers' expectations and, if necessary, improve the fairings' design before the flight test.

The three fairing panels, each 14 feet high and 13 feet wide, will surround and protect the service module during ascent. Unlike conventional rocket fairings, Orion's are designed to support half of the weight of the crew module and launch abort system during launch and ascent, which will maximize the size and capability of the spacecraft that can be delivered to orbit.

A second test is set to take place later this year and will add the expected thermal loads to the mix by heating one panel to 200 degrees Fahrenheit. This will cause it to expand and could change its performance. The final fairing separation test will be performed next year.