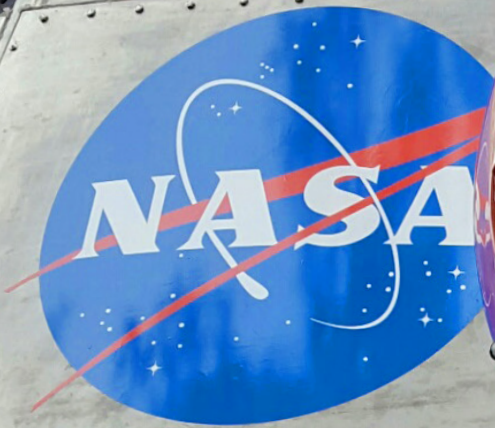
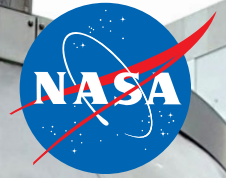


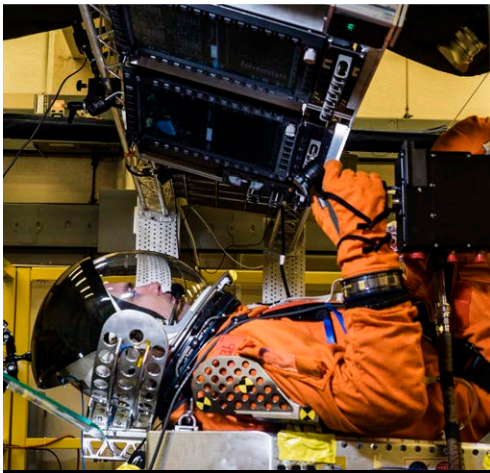
National Aeronautics and  
Space Administration



# ORION

JANUARY 2017

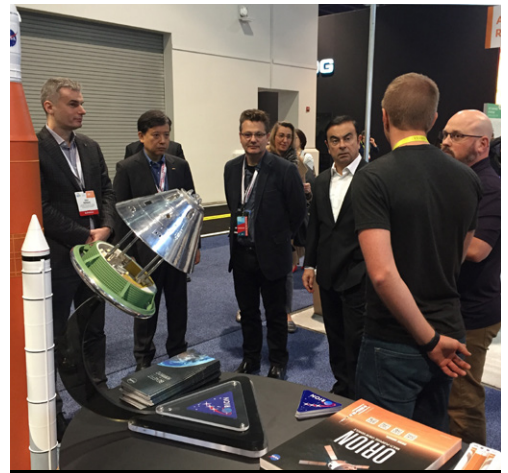
# ORION'S MONTHLY HIGHLIGHTS



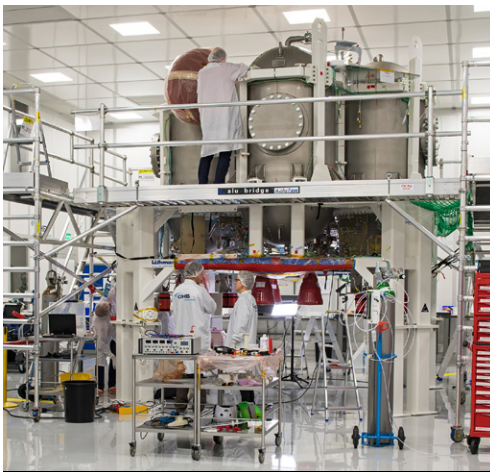
**3** | ORION LAUNCH OPERATIONS SIM SHAKES THINGS UP FOR CREW



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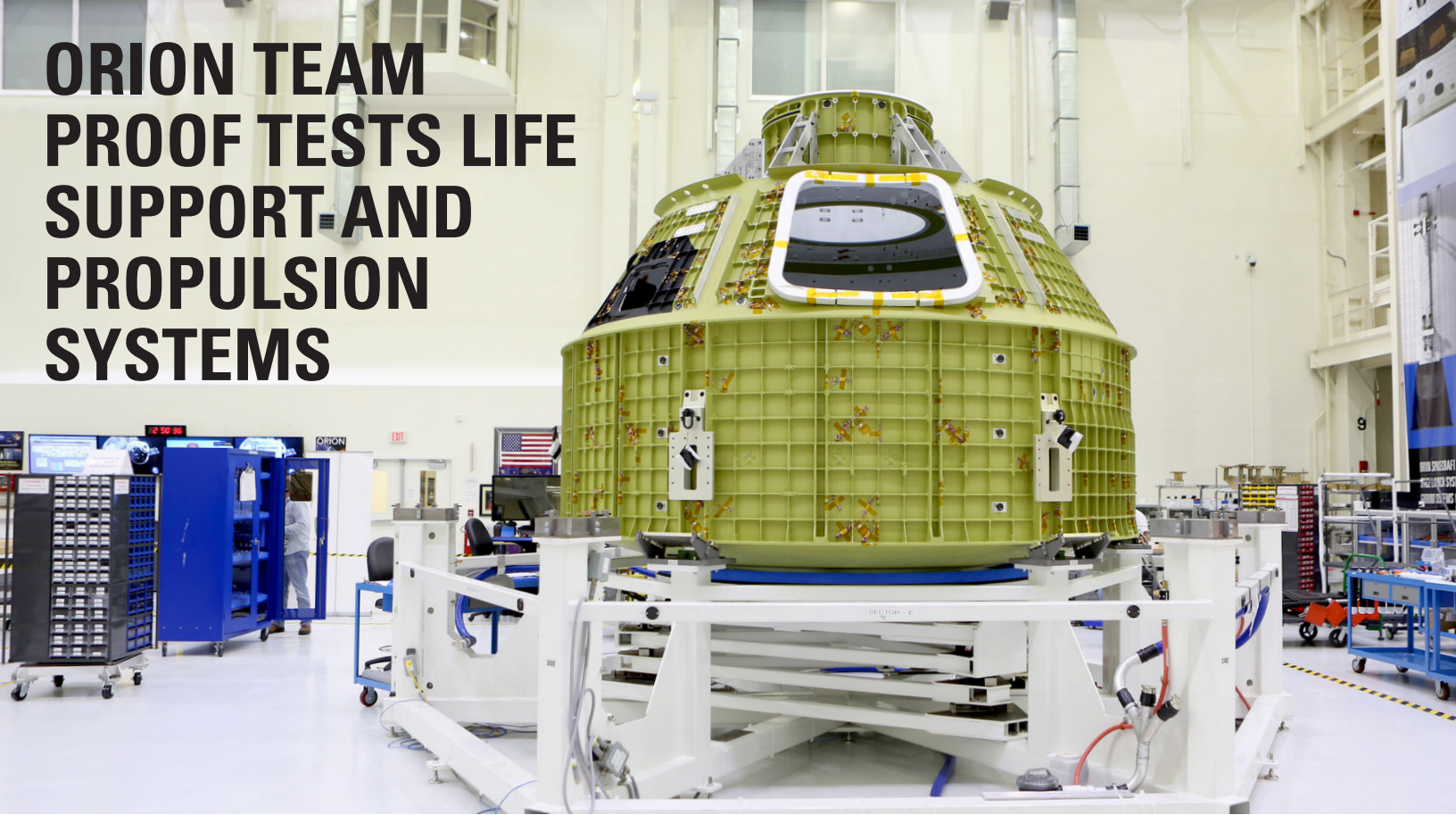
# ORION LAUNCH OPERATIONS SIM SHAKES THINGS UP FOR CREW

In a lab at NASA's Johnson Space Center in Houston, engineers simulated conditions that astronauts in space suits would experience when the Orion spacecraft is vibrating during launch atop the agency's powerful Space Launch System rocket on its way to deep space destinations. A series of tests occurring at Johnson will help human factors engineers assess how well the crew can interact with the displays and controls they will use to monitor Orion's systems and operate the spacecraft.

Test subjects wore modified advanced crew escape suits that are being developed for astronauts in Orion, and sat in the latest design of the seat atop the crew impact attenuation system. This was the first time this key hardware was brought together to evaluate how launch vibrations may impact the astronaut's ability to view the displays and controls. Engineers are hard at work performing all the necessary evaluations to make sure the spacecraft is ready for crewed missions.

Houston Chronicle article:  
[http://bit.ly/NASA\\_VibeCrew](http://bit.ly/NASA_VibeCrew)

# ORION TEAM PROOF TESTS LIFE SUPPORT AND PROPULSION SYSTEMS



Engineers and technicians with NASA and Orion manufacturer Lockheed Martin are preparing the Exploration Mission-1 crew module for a series of proof pressure and leak tests to confirm the welded joints of the propulsion and Environmental Control and Life Support Systems (ECLSS) tubing are solid and capable of withstanding launch, re-entry and landing. The work test series will take place at the Neil Armstrong Operations and Checkout Building at NASA's Kennedy Space Center in Florida.

The Orion propulsion system includes the propellant and thrusters which support deorbit and re-entry of the spacecraft from deep space while the ECLSS provides cooling for interior and exterior components on the crew module throughout a long-duration mission.

For its uncrewed flight test, Orion will be outfitted with most of the systems needed for a crewed mission during its first flight atop the agency's Space Launch System rocket from Launch Pad 39B at Kennedy.



## ORION AND SPACE LAUNCH SYSTEM EXHIBIT FEATURED AT CES 2017

NASA hosted a booth at the Consumer Electronics Show in Las Vegas on Jan. 5-8. NASA's Bob Floyd and Jared Daum participated as Orion subject matter experts, talking with visitors about the latest progress on the Orion spacecraft during this event, which drew more than 175,000 industry professionals.

# ORION'S EUROPEAN SERVICE MODULE TEAM MARKS MAJOR MILESTONES

**Avionics Acceptance Testing:** The first set of the European Service Module (ESM) avionics equipment was shipped to the Lockheed Martin Integrated Test Lab (ITL) in Littleton, Colorado on Jan. 4. This initial delivery of avionics controllers and electrical support equipment have completed their development and integrated testing at the Airbus Defence & Space facility in Les Mureaux, France. These components will be installed in the ITL, and once the post-ship checkouts are completed, an Acceptance Review will be held. After acceptance by ESA (European Space Agency) and NASA, Lockheed Martin will begin integration and testing with U.S. equipment. Once all components are fully integrated, the ITL will be able to emulate ESM spacecraft functionality, and enable integrated Command-Service Module subsystem and mission testing.



**PQM Final Assembly:** The European Service Module Propulsion Qualification Module (PQM) underwent final assembly at OHB Sweden prior to being shipped to NASA's White Sands Test Facility in New Mexico for propulsion testing. The PQM is expected to arrive to White Sands in mid-February.



**E-STA Hardware Handover:** ESA Airbus Defense and Space, NASA and Lockheed Martin have successfully completed the formal handover of the European Service Module Structural Test Article (E-STA), transferring ownership of the Airbus built hardware from ESA to NASA.

The test article was built in Turin, Italy, and shipped to the U.S. in November 2015 for a comprehensive series of rigorous tests at NASA Glenn Research Center's Plum Brook Station in Sandusky, Ohio. A little over five meters in diameter and four meters high, the service module weighs 13.5 tons. Over the last year, the item has been shaken to reproduce the vibrations of launch and put in the acoustic chamber to verify it can withstand the extreme sounds of a rocket launch.



The review board, led by NASA European Integration Office Manager Susan Motil, approved the Acceptance Data Package and agreed to accept the test article. Ownership was then passed to Lockheed Martin. Lockheed Martin will utilize the E-STA in further Orion vehicle testing, including a Direct Field Acoustic test at NASA Glenn Research Center's Plum Brook Station and the Orion Structural Test Article tests after assembly at NASA's Kennedy Space Center.

Read the ESA story: [http://bit.ly/ESA\\_SMTestComplete](http://bit.ly/ESA_SMTestComplete)

Read the Spaceflight Insider story: [http://bit.ly/SM\\_TestComplete](http://bit.ly/SM_TestComplete)

Anthony Byers, Lockheed Martin ESA Service Module Integration Manager; Scott Numbers, Glenn Research Center Safety and Mission Assurance; Susan Motil, and Philippe Deloo, ESA Service Module Project Manager.



Photo Credit: collectSPACE.com/Robert Pearlman

# NASA, PARTNERS HOST FUTURE FLIGHT FAN EXPERIENCE AT SUPER BOWL LIVE

NASA, in collaboration with the Houston Super Bowl Host Committee and six aerospace partners (Lockheed Martin, Aerojet Rocketdyne, Orbital ATK, Raytheon Company and Northrop Grumman Corporation), hosted a space-themed Future Flight fan experience sharing NASA's vision for the incredible journey to Mars and beyond.

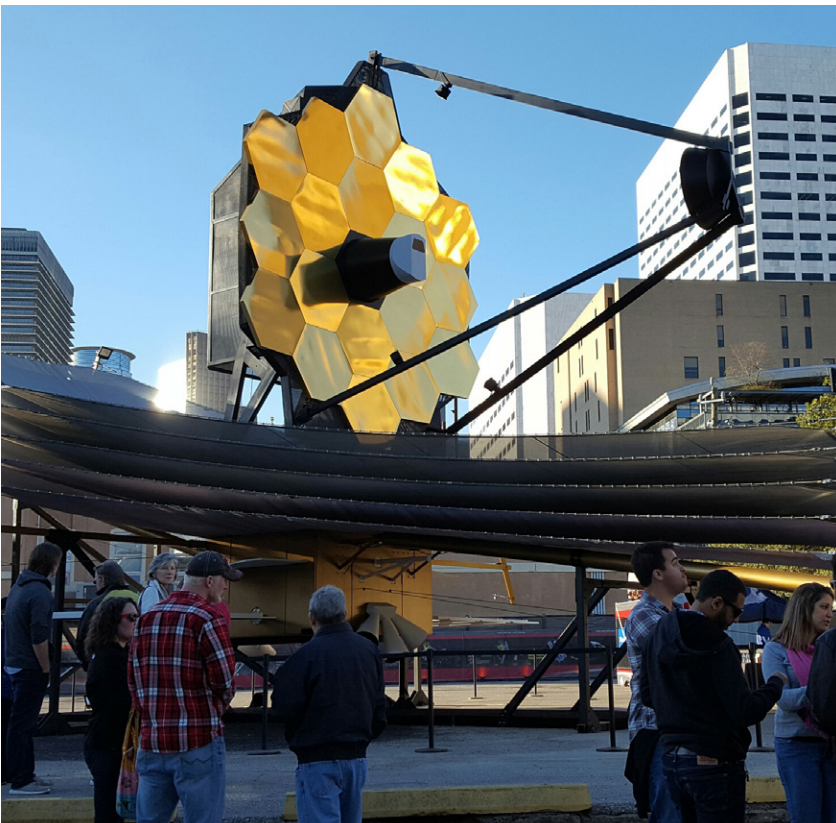
Future Flight was part of the 2017 Super Bowl LIVE fan festival and featured an out-of-this-world virtual reality ride that allowed fans to experience a launch to Mars and a landing back on the Super Bowl LI 50-yard-line on Earth, plus numerous hands-on, space-related exhibits, including the Post-Landing Orion Recovery Test, or PORT mockup, interactive rocket launchers, an RS-25 and RL10 engine and a virtual-reality Mars bus that replicated the Martian terrain and gave riders an interactive adventure simulating a drive on the surface of Mars.

Continued on pages 7 and 8



Learn more about the event with the links below:

- [http://bit.ly/NASA\\_PregameClip](http://bit.ly/NASA_PregameClip)
- [http://bit.ly/NASA\\_ChronicleSuperBowl](http://bit.ly/NASA_ChronicleSuperBowl)
- [http://bit.ly/Marvin\\_SBReplay](http://bit.ly/Marvin_SBReplay)
- [http://bit.ly/NASA\\_CollectSpace](http://bit.ly/NASA_CollectSpace)









# ORION AND SLS TAKE CENTER STAGE AT NEW MISSION MARS EXHIBIT

NASA center directors Ellen Ochoa (Johnson Space Center) and Todd May (Marshall Space Flight Center) received a sneak peek preview of the new Mission Mars exhibit during a VIP event at Space Center Houston on Jan. 20. The event was the kickoff to a year-long celebration of the visitor center's 25th anniversary. Mission Mars is an interactive exhibit in which guests experience what it takes to travel to Mars, see the spacecraft that will transport humans to the fourth planet in our solar system, and learn how humans will live on the red planet. KHOU-TV personality Deborah Duncan moderated the event.

<https://spacecenter.org/attractions/mission-mars/>



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

- NASA's Orion Blog . . . . . [Blogs.NASA.gov/Orion](https://blogs.nasa.gov/orion)
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- Google+ . . . . . [Plus.Google.com/+NASAO Orion](https://plus.google.com/+NASAO Orion)

# FEBRUARY

- ESA Propulsion Qualification Module Arrives at White Sands
- Contract Signing at Airbus for Second Service Module
- Suppliers Conference in Washington, DC