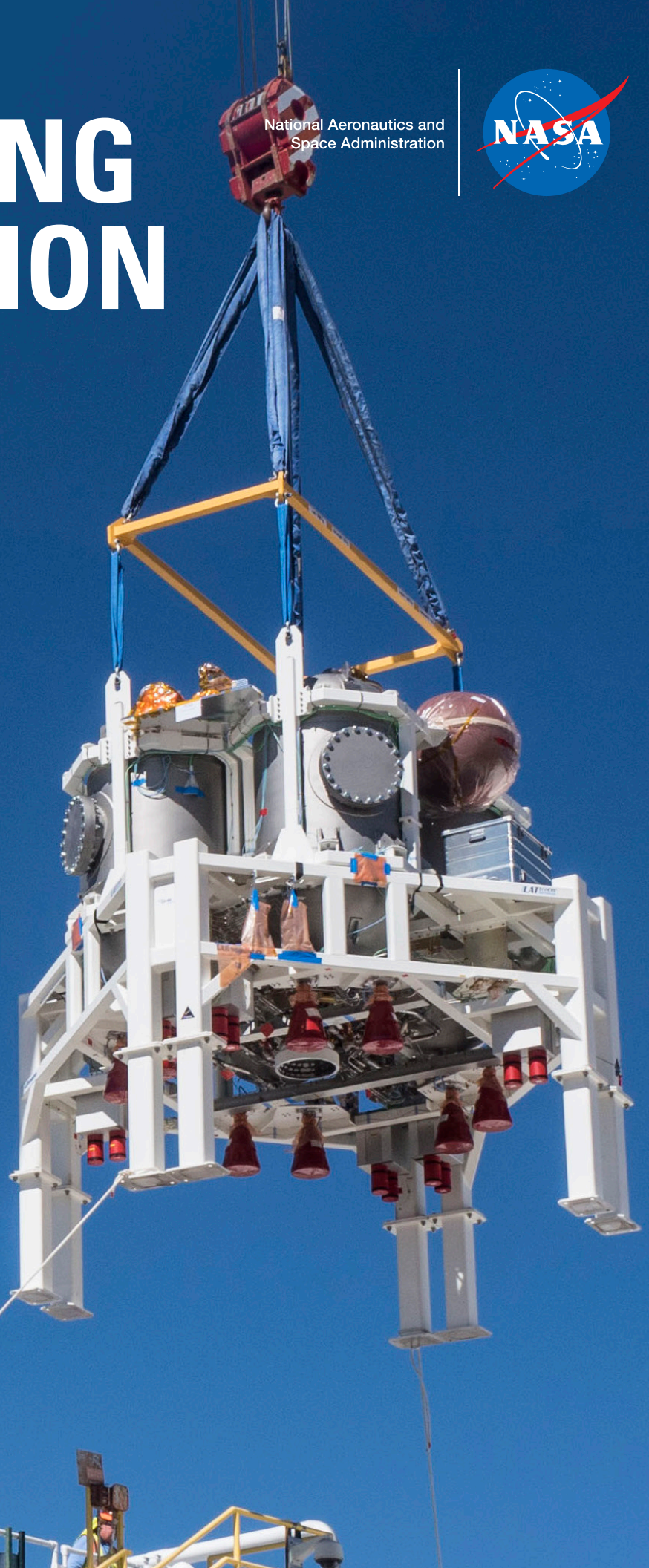


PERFECTING PROPULSION

National Aeronautics and
Space Administration



ORION

FEBRUARY 2017



ORION'S MONTHLY HIGHLIGHTS



SERVICE MODULE QUALIFICATION TESTING UNDERWAY AT WSTF



NASA KICKS OFF STUDY TO ADD CREW TO FIRST FLIGHT OF ORION, SLS



KEY MILESTONE COMPLETED TO ENSURE ASTRONAUT SAFETY



ESA TO PROVIDE SERVICE MODULE FOR FIRST ASTRONAUT MISSION



SEN. TAYLOR NAMED 2017 QUASAR HONOREE

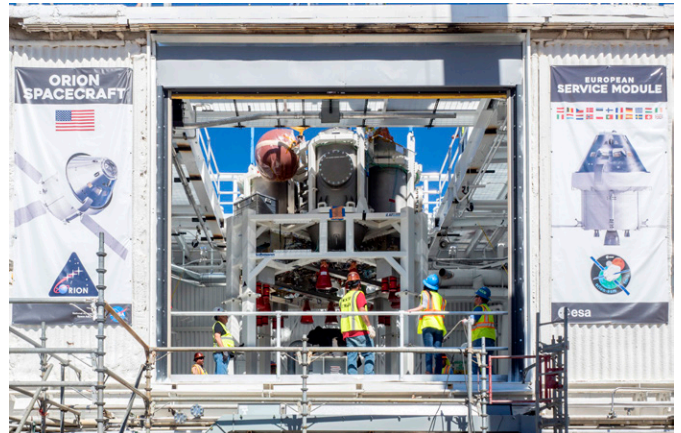


LARGEST SUPPLIERS CONFERENCE EVER!



SERVICE MODULE QUALIFICATION TESTING UNDERWAY AT WSTF

On Feb. 22, engineers successfully installed Orion's European Service Module Propulsion Qualification Module (PQM) at NASA's White Sands Test Facility in New Mexico that was delivered by Airbus – the prime contractor to ESA (European Space Agency) for the Service Module. The module will be equipped with a total of 21 engines to support NASA's Orion spacecraft: one U.S. Space Shuttle Orbital Maneuvering System (OMS) engine, eight auxiliary thrusters and 12 smaller thrusters produced by Airbus Safran Launchers in Germany. The all-steel PQM structure is used to test the propulsion systems on Orion, including "hot firing" of the OMS engine and thrusters.



A detailed view of the Orion spacecraft's interior, showing the circular cabin with several illuminated yellow rectangular lights. The spacecraft is set against a dark background of space with stars and parts of the SLS rocket structure visible.

NASA KICKS OFF STUDY TO ADD CREW TO FIRST FLIGHT OF ORION, SLS

NASA is assessing the feasibility of adding a crew to the first integrated flight of the agency's Space Launch System (SLS) rocket and Orion spacecraft, Exploration Mission-1 (EM-1).

Acting Administrator Robert Lightfoot announced Feb. 15 that he asked William Gerstenmaier, associate administrator for NASA's Human Exploration and Operations Mission Directorate in Washington to conduct the study, which is now underway. NASA expects it to be completed in early spring.

The assessment will review the technical feasibility, risks, benefits, additional work required, resources needed and any associated schedule impacts to add crew to the first mission. It will assume launching two crew members in mid-2019, and consider adjustments to the current EM-1 mission profile.

During the first mission of SLS and Orion, NASA plans to send the spacecraft into a distant lunar retrograde orbit, which will require additional propulsion moves, a flyby

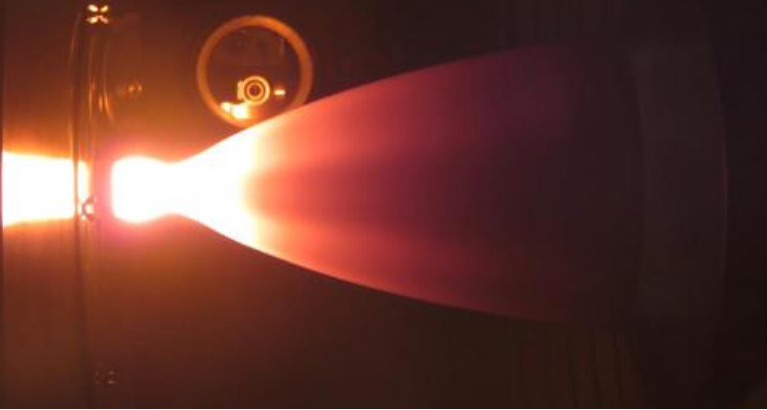
of the moon and return trajectory burns. If the agency decides to put crew on the first flight, the mission profile for Exploration Mission-2 would likely replace it, which is an approximately eight-day mission with a multi-translunar injection with a free return trajectory.

NASA is investigating hardware changes associated with the system that will be needed if crew are to be added to EM-1. As a starting condition, NASA would maintain the Interim Cryogenic Propulsion stage for the first flight. The agency will also consider moving up the ascent abort test for Orion before the mission.

Regardless of the outcome for the study, the feasibility assessment does not conflict with NASA's ongoing work schedules for the first two missions. NASA is leveraging the very best the country has to offer on its deep space exploration plans, and its advancing the national economy.

Read the full story at: http://bit.ly/EM1_CrewStudy

The auxiliary engine for Orion's European Service Module demonstrates long-duration firing in ground acceptance test.



KEY MILESTONE COMPLETED TO ENSURE ASTRONAUT SAFETY

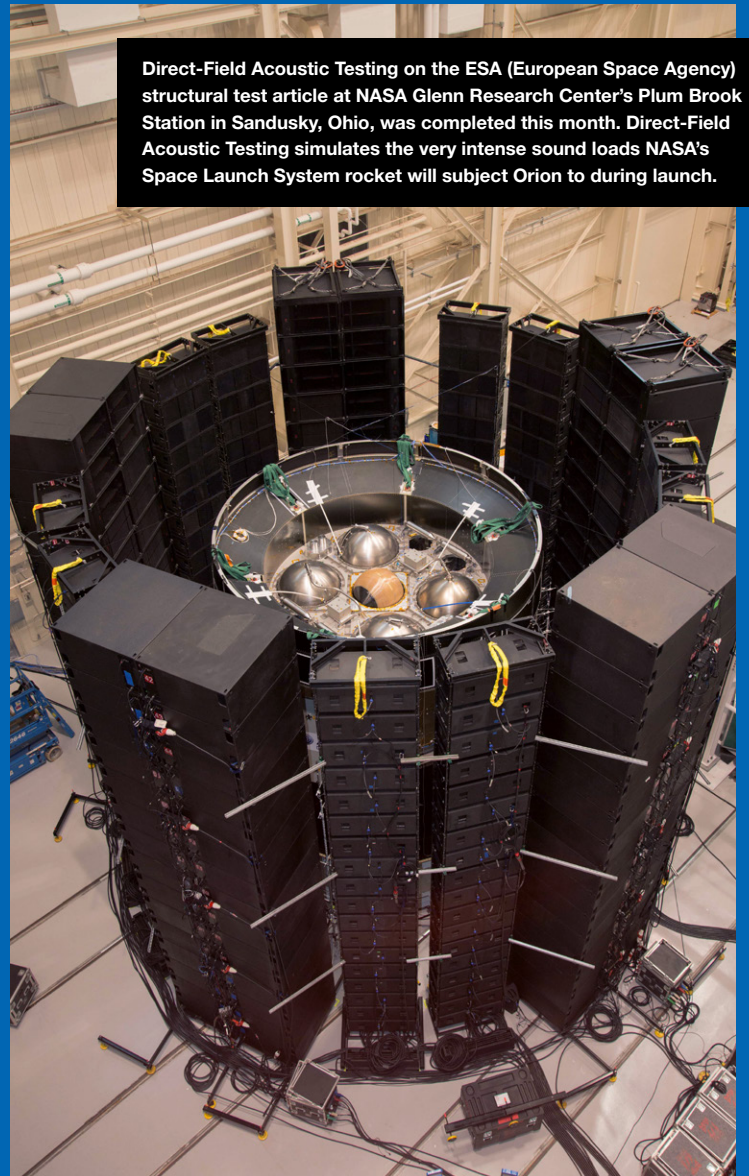
Aerojet Rocketdyne recently completed hot-fire acceptance testing of eight auxiliary engines that will be used on the first flight of NASA's Orion spacecraft with the Space Launch System rocket, slated to launch in 2018.

Orion's European Service Module (ESM), which remains connected to the spacecraft throughout the mission until just prior to Orion's re-entry to Earth's atmosphere, provides propulsion, power, temperature control, air, and water for crew members. ESA (European Space Agency) is providing the ESM to NASA. Aerojet Rocketdyne is responsible for the ESM's eight auxiliary engines and is assisting Lockheed Martin in the refurbishment of the Orbital Maneuvering Subsystem (OMS) engine that Aerojet Rocketdyne originally manufactured for the space shuttle and will now be used as the main propulsion for ESM.

The auxiliary engines, which will be located in four pairs on the outside of the ESM, work in concert with the main OMS engine and are critical to ensuring astronaut safety.

In addition to providing propulsion for the ESM, Aerojet Rocketdyne also supplies twelve 160-pound-thrust monopropellant engines for the Orion crew module's reaction control system and the jettison motor that is instrumental in separating the launch abort system from the crew module to keep astronauts safe should a problem arise during launch.

Read the full article at: http://bit.ly/EM1_HotFire



Direct-Field Acoustic Testing on the ESA (European Space Agency) structural test article at NASA Glenn Research Center's Plum Brook Station in Sandusky, Ohio, was completed this month. Direct-Field Acoustic Testing simulates the very intense sound loads NASA's Space Launch System rocket will subject Orion to during launch.

ESA TO PROVIDE SERVICE MODULE FOR FIRST ASTRONAUT MISSION

On Feb. 16, ESA (European Space Agency) hosted a press conference to highlight a contract signing between ESA and Airbus Defence and Space to build the second European Service Module (ESM) for NASA's Orion spacecraft. The agreement is a further extension of ESA and NASA's collaboration in human spaceflight continuing from the International Space Station. The event took place at an Airbus facility in Bremen, Germany. NASA's Jim Free, deputy associate administrator for technical in the Human Exploration and Operations Mission Directorate at Headquarters, was one of the speakers at the event. Other participants included Dr. Carsten Sieling, Bremen Mayor; David Parker, ESA Director of Human Spaceflight and Robotic Exploration; Oliver Juckenhoefel, Head of On-Orbit Services and Exploration, Airbus Defence and Space and Matthias Maurer, ESA Astronaut.



LARGEST SUPPLIERS CONFERENCE EVER!

U.S. companies that support the Orion, Space Launch System and Ground Systems Development & Operations programs gathered in Washington, D.C. for the fifth annual suppliers' conference. More than 250 participants representing over 100 companies and small businesses from 30 states met with Congressional representatives and staffers to talk about their home state's contributions to building the nation's next human exploration systems that will take astronauts to the moon, Mars, and beyond—farther into deep space than ever before.

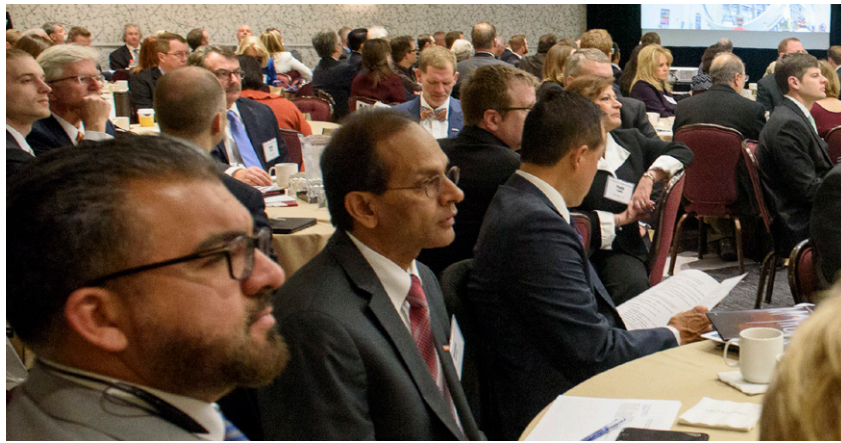
In addition to meeting with state leadership, the supplier representatives heard presentations and had the opportunity to network with NASA leadership, program managers, and spaceflight legends Bob Crippen and Tom Stafford.

Teams across the United States are making steady progress toward Exploration Mission-1, the first integrated test flight of SLS and Orion, which is currently slated for 2018. To date, workers in 49 states and Puerto Rico have provided support to the nation's deep space exploration programs through engineering design, skilled manufacturing, testing and analyses, software development and professional services.

The hard-working employees at these companies are helping NASA reach the goal of sending humans to the moon and on to Mars, and at the same time advancing American manufacturing, technology and innovation, and helping to inspire the next generation of explorers and engineers.



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SEN. TAYLOR NAMED 2017 QUASAR HONOREE

Lockheed Martin Vice President and Orion Program Manager Mike Hawes (right) presents a U.S. flag flown aboard Orion's first space flight to Texas Senator Larry Taylor who was honored as the Bay Area Houston Economic Partnership's 2017 Quasar Award honoree at the annual banquet in February. Hawes thanked Sen. Taylor for his leadership on the Texas Legislative Space Caucus and his support of NASA's space exploration missions. Sen. Taylor also serves as the chairman of the Senate Public Education Committee and as a member of the Senate Finance, Business and Commerce and Intergovernmental Relations Committees.

The Quasar Award honors an outstanding elected official or business leader who, through his or her actions and leadership, has demonstrated a strong and continual effort to support the business foundations of the greater Bay Area Houston communities. The recipient's actions must have gone above and beyond to promote the economic development of the region and the fulfillment of the Bay Area Houston Economic Partnership's objectives to recruit, retain and expand primary jobs in the region.



U.S. REPRESENTATIVE CRIST VISITS ORION PROGRAM AT KENNEDY

U.S. Rep. Charlie Crist (D-FL-13) visited NASA and Lockheed Martin at the Neil Armstrong Operations & Checkout facility at NASA's Kennedy Space Center in Florida on Feb. 24 for a tour and program update on the Orion spacecraft. Crist is a member of the House Space Subcommittee.

Rep. Crist (white shirt); NASA Kennedy Space Center Director Bob Cabana (back to camera), Lockheed Martin Florida Government Relations Joe Mayer (blue shirt) and NASA Orion Program Scott Wilson (dark suit).



Mike Hawes (right) stands in front of the Orion spacecraft alongside NASA astronaut Stan Love.

Read how Lockheed Martin Orion Program Manager Mike Hawes is helping lead our march to Mars in the article: From Greenville...To the Red Planet. http://bit.ly/LM_MarchToMars

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MARCH

- Parachute drop test in Yuma, Arizona
- Texas Space Day in Austin
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- NASA at South By Southwest