National Aeronautics and Space Administration

ORION

APRIL 2016

SPLISH SPLASH!

ORION SPLASHDOWN TEST SERIES UNDERWAY

Engineers at NASA's Langley Research Center in Hampton, Virginia, launched a series of nine drop tests with a full-scale Orion crew capsule outfitted with crash test dummies inside to understand what the spacecraft and astronauts may experience when landing in the Pacific Ocean after deep-space missions. The high-fidelity capsule, coupled with the heat shield from Orion's first flight in space, was hoisted approximately 16 feet above the water and vertically dropped into Langley's 20-foot-deep Hydro Impact Basin during the inaugural test on April 6. The crash test dummies were instrumented to provide data and secured inside the capsule to help provide information engineers need to ensure astronauts will be protected from injury during splashdown. Each test in the series simulates different scenarios for Orion's parachute-assisted landings, wind conditions, velocities and wave heights the spacecraft may experience when touching down in the ocean.

Water-impact testing will help NASA evaluate how the spacecraft may behave when landing under its parachutes in different wind conditions and wave heights. Langley has already conducted dozens of splash tests with a less sophisticated capsule mockup, but this is the first time it will assess the higher fidelity Orion ground test article.

▶ Watch video of the first drop test in the series

THESE DUMMIES ARE SMARTER THAN YOU THINK!

Dummies can actually teach engineers a thing or two. When outfitted with tiny sensors, these mannequins are able to collect data to help Orion engineers better understand and prepare crew members for various splashdown scenarios.

Two test dummies – one representing a 105-pound woman and the other a 220-pound man to assess the impact on different-sized people – were installed in the crew seats of the Orion crew module mockup.

For the initial round of tests, the dummies were not equipped with suits and helmets. After the third test, the dummies were outfitted with spacesuits and helmets to simulate fully suited crew members returning from a deep-space mission. After four vertical drop tests are completed, the capsule will undergo a series of five swing tests with the mock crew.

Collecting data on the dummies with and without suits allows engineers to make comparisons, which will aid in the computer modeling of Orion's splashdown.

Water-impact testing is one of many steps required to ensure Orion will meet the demands of sending humans to deep space for the first time and in the future on the journey to Mars.

▶ Read the full story

ORION'S SOUND CHECK GETS INTENSE

Orion engineers blasted an Orion service module test article with forceful sound and pressure in the Reverberant Acoustic Test Facility (RATF) at NASA Glenn Research Center's Plum Brook Station in Sandusky, Ohio, during a series of acoustic tests that began in April.

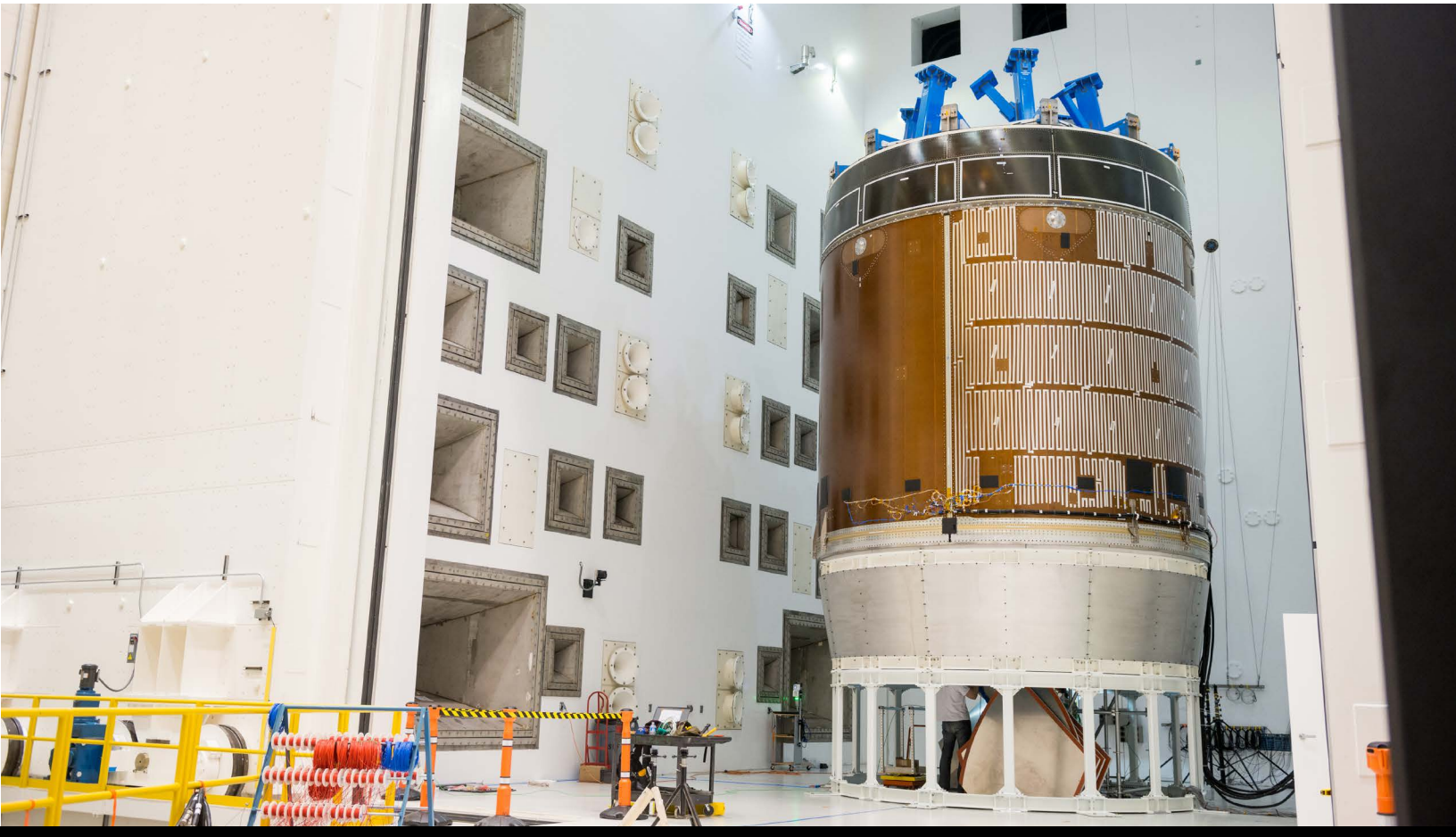
The test article was lambasted with more than 150 decibels and 20-10,000 hertz of sound pressure and vibration to simulate the intense sounds the Orion service module will be subjected to during launch and ascent into space atop the agency's Space Launch System (SLS) rocket. This series of tests will verify the structural integrity of Orion's service module for Exploration Mission-1, the spacecraft's first flight atop SLS that will venture to the far side of the moon and back to Earth during a three-week, uncrewed mission in 2018.

Provided by ESA (European Space Agency) and built by Airbus Defence and Space, the service module will power, propel and cool the spacecraft and also supply Orion's crew with air and water. The first crewed mission for Orion and SLS is scheduled to launch as early as 2021.

The Orion service module for EM-1 was delivered by Thales Alenia Space to the Airbus Defence and Space facility in Bremen, Germany, for final assembly and integration work. It will be shipped to the United States for further integration with the other elements that make up Orion at the beginning of next year.

Media coverage of the testing included:

- ▶ **Sandusky Register**
- ▶ **SpaceFlight Insider**
- ▶ **ESA Blog**



Pictured above: The service module test article sits in the RATF at Glenn's Plum Brook Station ahead of testing. The blue structure sitting on top of the test article is a mass simulator that represents the Orion crew module.

ORION'S NEW YORK STATE OF MINDS

Students of all ages shared their excitement and enthusiasm for space exploration at a variety of schools and events where they were able to meet astronauts and engineers working on the Orion spacecraft. The Orion team representatives also met with regional suppliers as well as the New York Legislature while visiting the Empire State in mid-April. Nearly 100 companies across the state have contributed to the future of deep-space exploration by providing critical elements for NASA's Orion and Space Launch System programs.
Media covering the visit included: ▶ Utica OD ▶ Times Telegram

Astronaut Lee Morin is presented with photos from two student winners in a Herkimer County Schools district-wide art competition, Aiden Davies and Brynn Shepardson. Nancy Wilson, also pictured, oversaw the art competition.

Orion's Scott Wilson and Astronaut Lee Morin (pictured here) presented to the Herkimer County, New York, legislature.

Scott Wilson with students from Gregory B. Jarvis Middle School in Frankfort, New York.

NASA's Scott Wilson and Bob Ess, along with members of the Orion communications team visited with girls from the Emma Willard School in Troy, New York.

NASA's Scott Wilson speaks at his former alma mater, Frankfort Schuyler Central High School in Frankfort, New York. Shown with Scott are (left to right)- Craig Ferretti, Camden Elementary principal; Nicholas Ferretti; Joseph Cantales, instructor; Scott Scherer, Herkimer County undersheriff; Christopher Farber, Herkimer sheriff; and Michael Stalteri, Frankfort Schuyler Central High School principal

Lockheed Martin's Paul Anderson and NASA's Bob Ess pose with students from St. Martin de Porres Marianist School, following a presentation at Cradle of Aviation Museum in Plainview, New York.

ORION PROGRAM APPLAUDS NEW YORK SUPPLIERS

Key members of NASA's Orion team came together on April 11 to thank employees of Cobham Semiconductor Solutions for their support of the program that will eventually carry a crew to deep space and back. Cobham is a key supplier of microelectronics, motion control and valve systems used by Honeywell Aerospace, which is a member of the avionics integrated product team led by Lockheed Martin. Honeywell is handling Orion navigation hardware and software design and development, as well as production of the navigation avionics and the command and data handling system.

More than 120 Cobham employees attended a meeting to hear about the latest program progress from NASA's Bob Ess, Orion avionics, power and software manager; Astronaut Lee Morin; Paul Anderson, Lockheed Martin Orion avionics director; and Steve Mayers, Honeywell's Orion lead engineer. The event was hosted at the company's Plainview, New York, facility.

The speakers recognized the Cobham team's contributions to the successful Exploration Test Flight-1 mission in December 2014 and for their continuing work as NASA prepares for Exploration Mission-1 in 2018.

ORION STARS SHINE AT RNASA STELLAR AWARDS

The Orion team made a stellar showing at the 30th annual Rotary National Award for Space Achievement (RNASA) awards. The winners were announced at the RNASA banquet held April 29, at the Houston Hyatt Regency hotel in downtown Houston.

RNASA recognized 137 Stellar Award nominees from 16 states for their outstanding contributions to advance space exploration toward the future and honored 23 individuals and seven teams with Stellar Awards. The government and corporate nominations were evaluated by the RNASA 2016 evaluation panel comprised of aerospace legends Dr. Glynn S. Lunney, Colonel Eileen Collins, Arnold D. Aldrich and former Johnson Space Center Director Michael Coats. The 2016 Stellar Awards were presented by Astronauts Stephanie Wilson and Rex Walheim. This year's Orion individuals and teams recognized included:

Larry Price, Lockheed Martin, for outstanding leadership and international collaboration to take the Orion Program from development to spaceflight vehicles for NASA's human explorations missions.

Bruce Sommer, Lockheed Martin, for outstanding human spaceflight contributions for improving crew safety and ensuring mission success for the International Space Station and Orion spacecraft.

Judith C. "Charlie" Blackwell-Thompson, NASA Kennedy Space Center's EM-1 Launch Director, for exemplary and sustained contributions to manned spaceflight launch planning and execution.

Orion EM-1 Critical Design Review Team, Lockheed Martin, for excellence in preparation, execution and follow through of the Orion Exploration Mission Critical Design Review that resulted in NASA's authorization to proceed to spacecraft production. Brian Jones accepted for the team.

Orion EFT-1 Propulsion Team, Aerojet Rocketdyne, for outstanding team dedication and attention to detail during development, production, flight readiness and flight, resulting in significant achievement on Orion EFT-1 and paving the way for advanced future space activities. Janine Cuevas accepted for the team.

Pendulum Test Team, NASA Johnson Space Center, for outstanding team effort in mitigating the Orion pendulum motion anomaly. Yasmin Ali accepted for the team.

▶ More information about other Stellar Award nominees from Orion

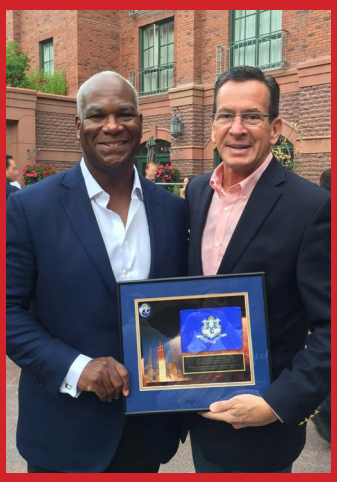
Pictured left to right: Rex Walheim (presenting), Andrew Zarechnak (OA-4 Return to Flight Team of Orbital ATK), Seth Lacy, Corey Duncan (Automated Navigation and Guidance Experiment for Local Space Program Team), Debbie Sharp (ISS Hardware Recovery Team), Carolyn Gernux (Fan/Pump/Separator Bearing Corrosion Anomaly Resolution Team), Yasmin Ali (Pendulum Team), Janine Cuevas (EFT-1/Orion Aerojet Rocketdyne Propulsion Team), Brian Jones (Orion EM-1 Critical Design Review Team), Stephanie Wilson (presenting)

HIGH FLYIN' FLAGS EARN SPECIAL PLACE BACK ON EARTH

As Orion development and progress continues with full steam toward Exploration Mission-1, the story of our Journey to Mars has continued to be told through special recognition events, news features and presentations to many of the suppliers, business partners and community leaders who support the future of space exploration. Several states where many Orion engineers and technicians work have been presented with their respective state flags that flew in space aboard Orion during its first flight in 2014. The presentation items will be proudly displayed in state capitol buildings across the country. Eventually, all the state and U.S. territory flags flown aboard Orion will reside back in their home states.

Lockheed Martin's Joe Rice (left) and Amber Gell presented the Arizona state flag to Governor Doug Ducey and Senator Andrew Sherwood (right) at the State Capitol in Phoenix.

Lockheed Martin and Bay Area Houston Economic Partnership representatives presented the Texas state flag to Governor Greg Abbott at the State Capitol in Austin. Pictured on the front row are Larry Price, Governor Greg Abbott and Linda Singleton; on the back row are Joe Mayer, Bob Mitchell and Texas Rep. Charles "Doc" Anderson.



Lockheed Martin's Larry Duncan presents the state flags flown in space to Connecticut Governor Dannel Malloy (left) and Colorado Governor John Hickenlooper.

Right: Lockheed Martin's Joe Rice presents state flags to Wisconsin and Ohio state delegations.

APRIL FESTIVALS INSPIRE THE MARS GENERATION

The weekend of April 16 brought the excitement of Mars exploration to thousands of visitors at the Washington, D.C. Convention Center. At the U.S.A. Science and Engineering Festival Lockheed Martin unveiled the company's Generation Beyond campaign—a STEM initiative that brings deep space exploration to classrooms across America.

During the next weekend, on April 23, Smithsonian Magazine's The Future is Here Festival™ in Washington, D.C. brought out a great selection of innovative futurists. Lockheed Martin's Chief Technologist of Exploration Systems, Tony Antonelli, spoke on paving the way for human exploration of deep space and the Journey to Mars.

THE MAKING OF A MARS GENERATION

In addition to building spacecraft that will travel farther into space than ever before, the Orion team volunteers a great deal of their time inspiring future generations of scientists, explorers, engineers, technicians and designers who will continue to build and support the Journey to Mars and beyond for generations to come.

Aimee Crane, Orion Program communications team member and 2005 Fredericktown High School graduate, visited Fredericktown Elementary School in Ohio to talk with 600 K-5 students of the Mars generation about the future of NASA. In the evening, Crane visited with the Fredericktown Cub Scout Pack 350 as well as members of the Knox County Eclipse Space Balloon Project. Following Crane's presentation, the pack launched rockets made from large pop bottles fueled by compressed air and water.

▶ Read the full story

CNN'S RACHEL CRANE TAKES US WAY UP THERE

CNN's Rachel Crane examined the future of space exploration in a seven-part series which included a look at NASA's deep space exploration efforts.

Series Teaser/Overview:

▶ CNN space series explores the future of space travel

▶ All seven episodes here

The Orion/SLS piece is titled, *How will humans get to deep space?* Image credit: CNN

MAKING SPACE

Meet musician and acoustic engineer Aron Hozman. Aron is part of the team at NASA Glenn Research Center's Plum Brook Station in Ohio that gives Orion a thorough sound check. He is in charge of blasting Orion with more than 150 dB of sound, louder than an AC/DC concert, so engineers can fine tune the spacecraft's structural integrity to keep astronauts safe during deep-space exploration missions throughout our solar system. The series of acoustics tests are conducted to make sure Orion can withstand the trip to space atop NASA's powerful Space Launch System rocket before its next mission beyond the moon in 2018. Aron is one of many dedicated rocket scientists and engineers across the country who are making space exploration of the future possible today.

▶ Watch the video

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

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MAY:

Crew Module Proof Pressure Testing at KSC

EM-1 Flight Structure Arrival in Bremen

National Space Day, May 6th

Glenn Research Center's 75th Anniversary