

# ORION



APRIL 2018



## Booster Fired Up for AA-2

SR 118 rocket to be used in Ascent Abort-2 test undergoes successful testing in Promontory, Utah.

# BOOSTER FIRED UP FOR AA-2



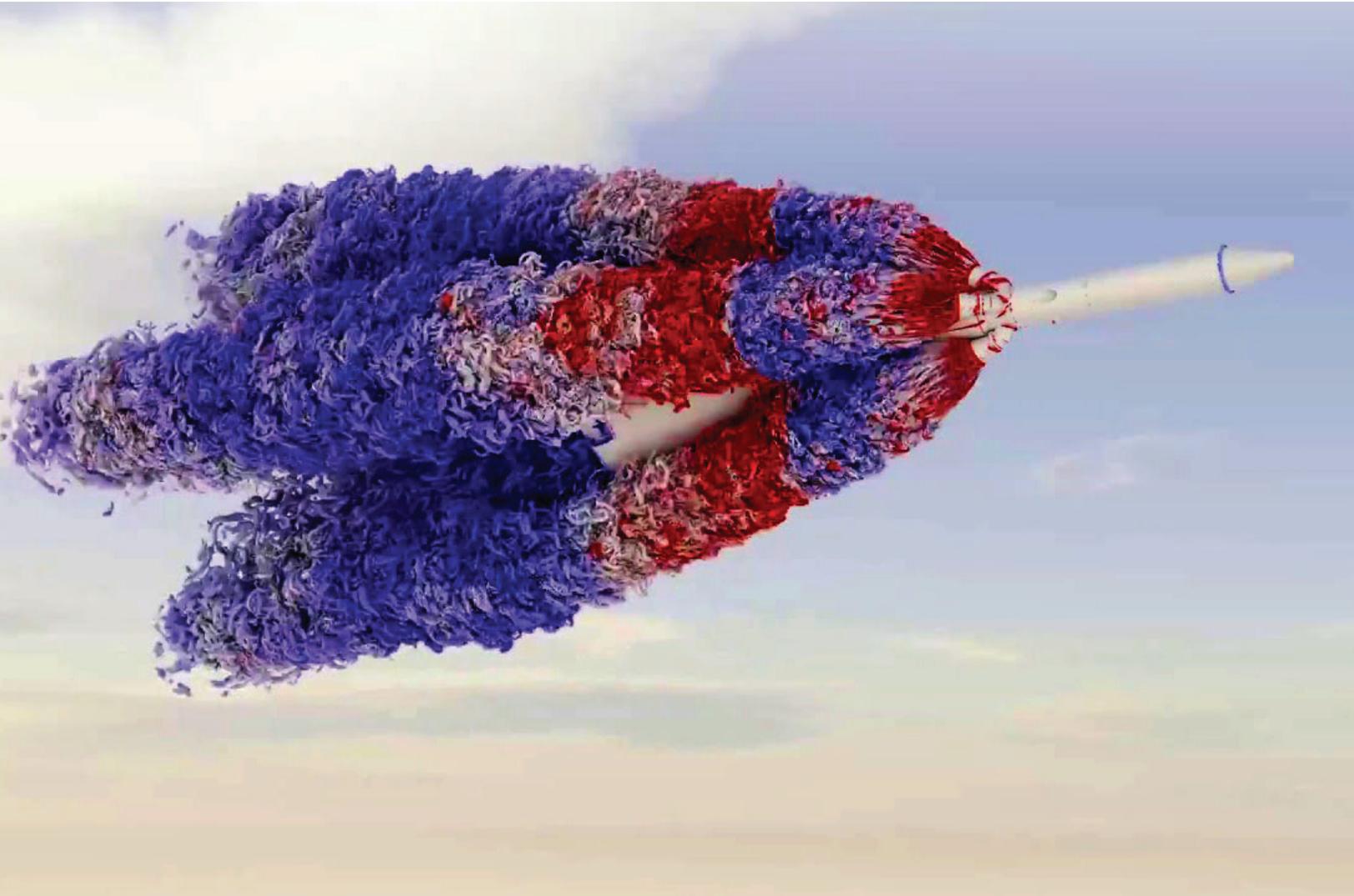
Orbital ATK successfully tested an SR 118 rocket motor at the company's Promontory, Utah, facility on March 29. Witnessing a rocket test or launch is exciting, and this one was no exception, as this ground test produced just the right amount of smoke and fire. NASA and Lockheed Martin will use an SR 118 rocket motor to launch an Orion test article to evaluate its Launch Abort System (LAS) in a test known as Ascent Abort-2, prior to launching a crewed Orion aboard NASA's Space Launch System.

The SR 118 was originally designed, qualified and manufactured by Orbital ATK in Promontory, Utah, for the Air Force as the first stage of the Peacekeeper InterContinental Ballistic Missile deployed by the United States in 1986. Today, SR118 rocket motors are used for commercial purposes such as launching payloads into orbit. Static firing individual rocket motors ensures those motors are safe and reliable to fly when needed.

The SR 118 motor major assembly consists of a composite motor case, solid propellant, an igniter, a thrust vector system and nozzle, internal and external insulation, external protective material and forward and aft skirts.

During the test, the rocket will launch from Space Launch Complex 46 (SLC-46) at Cape Canaveral Air Force Station in Florida, carrying a fully functional LAS and a 22,000-pound Orion test vehicle to an altitude of 31,000 feet at Mach 1.3 (over 1,000 mph). At that point, the LAS' powerful reverse-flow abort motor will fire 400,000 pounds of thrust, propelling the Orion test vehicle to a safe distance away from the rocket. The test will demonstrate the LAS can safely send Orion a safe distance from a failing rocket if an emergency arises during launch.

# VERIFYING SAFETY THROUGH VISUALIZATION



NASA Advanced Supercomputing research scientists at the agency's Ames Research Center in California's Silicon Valley are producing highly detailed simulations and visualizations to learn how to best protect astronauts during spaceflight. The dynamic liftoff conditions of NASA's Orion spacecraft atop the powerful Space Launch System rocket will be more intense than ever as we send humans to the Moon and other destinations throughout the solar system.

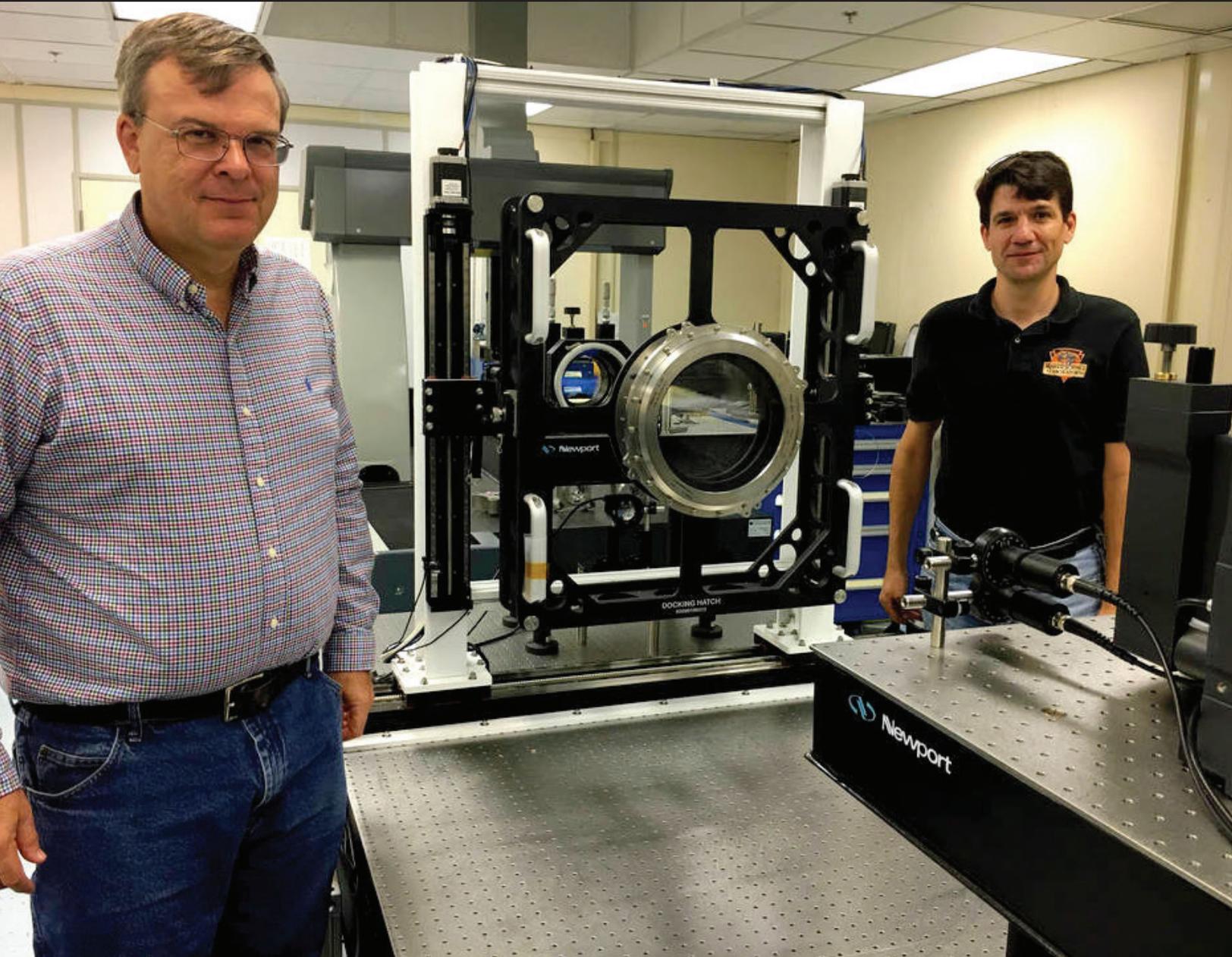
The advanced simulation techniques are being used to predict vibrations on the Orion spacecraft's Launch Abort Vehicle (LAV). The LAV is the combined configuration of the Orion launch abort system and crew module. The LAV

is designed to pull the crew module away from peril if an emergency occurs on the launch pad or during the first two minutes of flight.

This visualization supports the Orion LAV motor design effort, a collaboration between NASA and Orion prime contractor Lockheed Martin. The simulations of Orion's pad abort and ascent abort scenarios, run on the Pleiades supercomputer, directly inform the spacecraft's design to increase astronaut safety while reducing mission risk, cost and launch abort vehicle weight.

Learn more and see the flow: [go.nasa.gov/2rsfOiR](https://go.nasa.gov/2rsfOiR)

# A WINDOW TO SPACE



A few multi-layer windows on NASA's Orion spacecraft provide astronauts the view they may need for navigating space and carrying out their exploration mission with visual data. NASA is working to improve the durability of those windows with less cost and weight, while maintaining the clarity astronauts need to carry out their tasks and observe the Earth and other destinations as they travel farther into the solar system.

Recently, a team from Kennedy Space Center's Exploration Research and Technology Programs performed the first optical quality testing on a window that is ready for installation in Orion's docking hatch. These window tests are another step towards completion of Orion as the spacecraft is being prepared to take humans farther into space than ever before.

Learn more: [bit.ly/Window2Space](https://bit.ly/Window2Space)

# EUROPEAN SERVICE MODULE PROGRESS



The European service module that will provide power, water, air, thermal control and electricity to NASA's Orion crew module has taken a large step closer to completion with the installation of its fuel tanks and testing of its solar array wings.

Orion will eventually fly beyond the Moon with astronauts. The first mission – without astronauts – is getting ready for launch at the end of 2019. The large tanks that will provide propellant for the spacecraft are now snug inside the spacecraft at the Airbus assembly hall in Bremen, Germany.

The four tanks-- two sets of tanks connected by intricate pipelines to 33 engines-- each contain about 2000 liters of propellant. In the vacuum of space there is no air to burn so spacecraft fuel tanks include oxidizer and fuel that are mixed to ignite and provide thrust.

The European service module is a small but complex spacecraft packed with equipment. The large tanks are installed as one of the last components to allow technicians more room to work.

Meanwhile the solar arrays Orion will use to produce

electricity are being tested at ESA (European Space Agency) in the Netherlands. Folded for launch, the fragile solar panels need to survive the rumbling into space aboard the most powerful rocket ever built, NASA's Space Launch System.

Orion's solar panels will be folded inside the rocket fairing on the first leg of the trip around the Moon. Once released from the rocket, they will unfold and rotate towards the Sun to start delivering power.

To ensure the solar panels will work after the intense launch, ESA engineers are putting them through rigorous tests that exceed what they will experience on launch day. This includes vibrating them on a shaking table and placing them in front of enormous speakers that recreate the harsh launch conditions.

Once successfully tested, the solar panels will be sent to Bremen for attachment on the service module. The service module is set to ship to the U.S. this summer for further tests and integration with the crew module adaptor as the Orion spacecraft elements come together at Kennedy Space Center for the EM-1 launch.

# JSC SHOWCASES DEEP SPACE EXPLORATION EXPERTISE



Media was invited to see how engineers and scientists are helping make NASA's deep space human exploration plans a reality at the agency's Johnson Space Center in Houston.

Media had the opportunity to hear from experts who provide updates on work to build the Orion spacecraft for its upcoming missions, exploration integration efforts, as well as JSC work on the crew module test article that will be used in Orion's Ascent Abort-2 flight test in April 2019. Media also toured areas where astronauts train and engineers are constructing the spacecraft that will get crew back to the Moon and other deep-space destinations.

Space industry suppliers from across Texas met with NASA and prime contractor leadership to hear program updates and better understand how their work contributes to the future of human spaceflight. Suppliers were also able to get a first-hand look at the Orion mockup and AA-2 crew module, as well as the future Orion mission control room.

Learn more about Johnson's contributions:  
[bit.ly/Chron\\_JSCApr18](https://bit.ly/Chron_JSCApr18)

Watch the exploration progress panel discussion:  
[bit.ly/AA2panelApr18](https://bit.ly/AA2panelApr18)



# VP PENCE SWEARS IN NEW NASA ADMINISTRATOR BRIDENSTINE



Jim Bridenstine officially took office as the 13th administrator of NASA after he was given the oath of office by Vice President Mike Pence at the agency's headquarters in Washington on April 30.

In his new role at NASA, Bridenstine takes over an agency critical to the nation's economy, security and technological preeminence.

As part of the swearing-in ceremony, Vice President Pence and Administrator Bridenstine spoke live with NASA astronauts Scott Tingle, Drew Feustel and Ricky Arnold, who currently are living and working 250 miles above Earth aboard

the International Space Station. The astronauts offered congratulations and shared stories of their experiences on the orbiting laboratory.

Bridenstine was confirmed by the U.S. Senate on April 19, to serve as the agency's administrator. Prior to this position, he served in the U.S. House of Representatives for the state of Oklahoma, where he held positions on the House Armed Services Committee and the Science, Space and Technology Committee. Bridenstine also is a pilot in the U.S. Navy Reserve and the former executive director of the Tulsa Air and Space Museum and Planetarium.

## 34TH ANNUAL SPACE SYMPOSIUM

At the 34th annual Space Symposium held in Colorado Springs, Colorado, space leaders from around the world came together to discuss and plan for the future of space exploration. Companies large and small brought top forward-thinkers to show off their new concepts, learn from other industry partners, and discuss what they can do to impact the future of space. Vice President Mike Pence attended and spoke about how NASA is leading the way into deep space

and shaping space policy. Orion leaders from NASA and Lockheed Martin shared innovations that have contributed to Orion progress and what is planned for future missions back to the Moon and on toward Mars.

Listen to Vice President Pence talk space policy: [cnb.cx/2FUr250](https://cnb.cx/2FUr250)

# USA SCIENCE AND ENGINEERING FESTIVAL

Every two years, in Washington D.C., leaders from the fields of Science, Technology, Engineering and Math (STEM) gather to inspire students and challenge them to think about where “STEM Can Take You.”

Industry leaders from around the country, universities and small businesses participate in sharing information through booths, presentations, a STEM career fair, and a STEM symposium, all aimed to inspire students to pursue careers in STEM fields.

NASA had a big presence at this year’s festival, which included activities and information for students on how the agency’s Orion, Space Launch System (SLS), and Exploration Ground

Systems programs are leading the way to deep space exploration. Students were able to learn how parachutes are used to land crew safely back to Earth, explore a virtual reality simulation of the Exploration Mission-2 launch, learn what makes SLS the most powerful rocket ever built, and even experience what astronauts may see when they get to Mars.

By interacting with different activities that enabled them to learn more about NASA’s accomplishments on Earth and in space, participants learned about future careers in which they could help build the rockets, systems and spacecraft needed for traveling into deep space.



# FIRST UP: ORION ENGINEERS HELP ROBOTICS TEAMS

The FIRST Robotics Competition championship and three junior-level championships were held in Houston in April, culminating with the final Einstein Matches at Minute Maid Park. Lockheed Martin Orion engineers Barry Bohnsack and Dustin Neill were among the many volunteers helping with the events, with over 55,000 attendees and 1,288 teams of students from more than 56 countries around the world. One notable example was seen at the team pit of the SciBorgs from Pullman, Washington (pictured). The pit caught the attention of a younger group of competitors, so the SciBorgs team took time out for a mentoring session to explain the basics of the robot and its functions. Next year's theme for FIRST teams to explore with their research projects and robotic tasks will focus on deep space.



## AMRO FABRICATING CORP. VP VISITS JSC

Steve Riley, vice president of AMRO Fabricating Corporation, toured NASA's Johnson Space Center to see the Orion mockup and the Ascent Abort-2 Crew Module on April 13. Paul Marshall, assistant program manager for Orion, met with them to share an update on the Orion program and Johnson activities which support deep space exploration. AMRO is a third generation, family owned, small business manufacturer that specializes in building metallic structures for spacecraft and launch vehicles that serve NASA – including the Space Launch System rocket and Orion spacecraft. Based in El Monte and Riverside, California, AMRO employs more than 200 people and is a key contributor to the state's historic aerospace industrial base serving the American space program, national security and commercial aerospace providers.

## DOCKING HATCH TEAM COMMENDED

The Docking Hatch team at NASA's Johnson Space Center completed the design work and development testing of the Orion docking hatch. The NASA team led the design and development effort through the Critical Design Review, working closely with Lockheed Martin. At the conclusion of the design and development effort, the docking hatch design was handed over to Lockheed Martin for manufacturing of the flight hatch. The joint NASA/Lockheed Martin team was recognized by Program Manager Mark Kirasich for their innovative approach to working together, which allowed for seamless integration of the design as well as cost and schedule efficiencies.



# SUPPLIER SPOTLIGHT

## SAFE INC.



Safe, Inc. is a veteran owned small business in Tempe, Arizona. Since 2002, Safe's 11 employees have made instrumental contributions to the defense sector and to the Orion program. An accomplished innovator of aircraft, ground vehicle, and personnel safety systems, Safe designed and developed the Crew Impact Attenuation System (CIAS) for Orion. The purpose of the CIAS is to protect the astronauts

from serious injury in the event of higher-than-expected deceleration conditions during landing. The CIAS helps cushion landing forces from the astronauts by reducing the flux of energy specific to the mass of each crew member. The system is installed between each of the occupied seats and the spacecraft's secondary structure.

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

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## MAY 2018

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