National Aeronautics and
Space Administration

NASA

ORION

ORION 2 TAKES SHAPE

AUGUST 2017

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ORION'S ASTRONAUT WINDOW PANEL SHIPS OUT

When the first crew of astronauts flies aboard the Orion spacecraft, they will be able to look through a window and view the moon and Earth from their deep-space vantage point. The window panel that will provide that view is ready for shipment to NASA. AMRO Fabricating Corp., of South El Monte, California, has completed a section of the Orion pressure vessel, or underlying structure of the spacecraft that will send astronauts farther than humans have ever traveled before on Exploration Mission-2.

Orion's four windows are contained in one of three cone panels that AMRO is manufacturing for NASA and Orion prime contractor, Lockheed Martin. The spacecraft's pressure vessel has seven structural elements, including the three cone panels. AMRO shipped the panel to NASA's Michoud Assembly Facility in New Orleans at the end of August, where it will be outfitted with strain gauges and wiring for monitoring purposes and joined together with other pieces of the pressure vessel scheduled to arrive at Michoud in the coming months.

The pressure vessel forms the sealed environment inside where astronauts will live and the structure upon which all the other elements of the spacecraft are built and integrated. The components of Orion's pressure vessel are joined using the friction-stir welding process, which bonds the pieces by transforming metals from a solid into a plastic-like state and then forging a bond between the two metal components. Once all pressure vessel elements are welded together, the spacecraft will be sent to NASA's Kennedy Space Center in Florida for outfitting, processing and launch.

Other than several small changes to allow for interfaces with crew equipment or mounting of hardware specific to EM-2, the overall structure, manufacturing process and mass of the pressure vessel is the same as it is for the structure that will fly on the first mission of Orion and SLS, now that engineers have optimized the design of Orion's structure. Engineers are making progress on the EM-1 spacecraft, currently being assembled at Kennedy ahead of its 2019 launch.

Family owned AMRO Fabricating Corp. celebrated the completion of the Exploration Mission-2 crew module window panel at their Made In America themed event on August 9.

Read more: **bit.ly/DailyNewsAMRO**

NNASA Astronaut Lee Morin, NASA and Lockheed representatives and VIP guests joined more than 100 AMRO employees on the factory floor for this milestone event complete with American flags, apple pie and ice cream. Representatives from the offices of Sens. Diane Feinstein and Kamala Harris attended along with South El Monte Mayor Gloria Olmos and City Council Member Richard Angel. NASA Associate Administrator for Small Business Programs Glenn Delgado also attended the event with small business representatives for NASA centers from across the country.

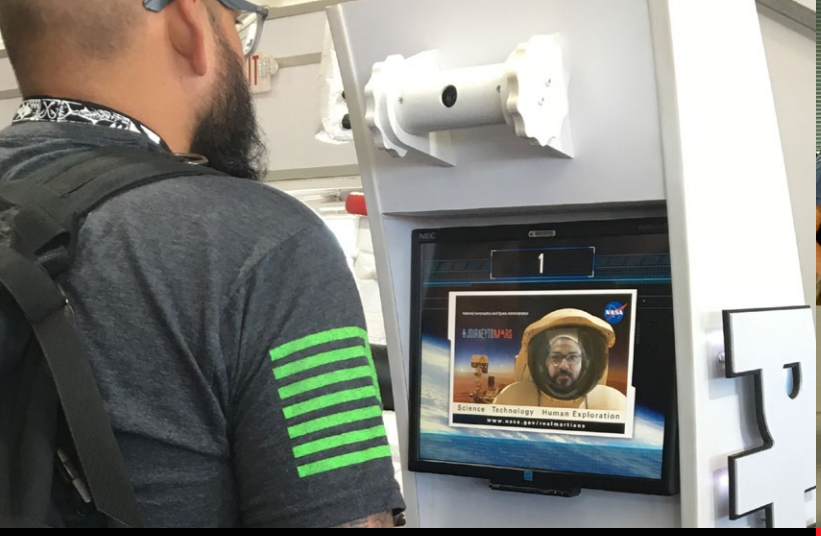
ORION EM-1 SPACECRAFT **POWERS UP**

Hurtling beyond the moon at a speedy 25,000 mph for a three-week mission requires a space processor capable of operating with guaranteed reliability, in a high radiation environment tens of thousands of miles in deep space, at 480,000,000 instructions per second to execute thousands of commands and sequences for controlling the hundreds of spacecraft systems and components to ensure crew safety and mission success.

To ensure everything performs as planned, the Orion spacecraft destined for Exploration Mission-1 was successfully powered up for the first time in August in Orion's spacecraft factory, the Neil Armstrong Operations and Checkout Building at NASA's Kennedy Space Center in Florida.

During the initial power-on tests, engineers and technicians connected the vehicle management computers to Orion's power and data units to ensure the systems communicate precisely with one another to accurately route power and functional commands throughout the spacecraft for the duration of a deep-space exploration mission. In spaceflight, Orion will generate power through its four solar array wings which collectively hold about 15,000 solar cells that can harness enough electricity to power eight three-bedroom homes. The power and data units then distribute that power as needed throughout the spacecraft.

Learn more: **bit.ly/LMOrionIPO**



ORION SHARES JOURNEY TO MARS AT OSHKOSH

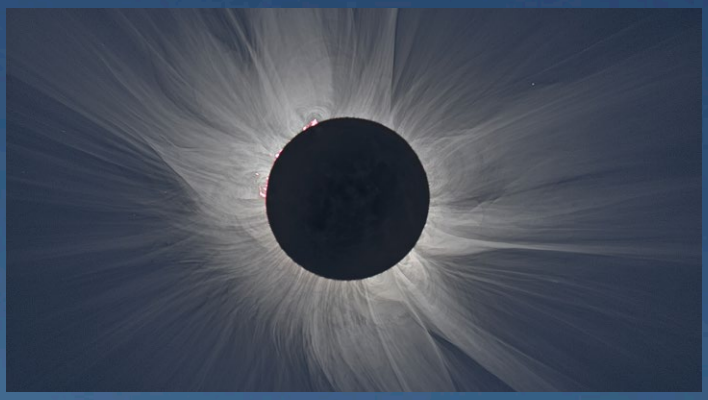
The Orion and Space Launch System (SLS) programs had a big presence at the recent EAA AirVenture Oshkosh Air Show in Oshkosh, Wisconsin. Prime contractors helping to build Orion and SLS around the country such as Orbital ATK, Aerojet Rocketdyne, Lockheed Martin and Boeing shared the story of NASA's deep space exploration efforts with more than 550,000 guests who attended the air show. Their exhibit included an Oculus Rift Mars virtual experience, a photo booth and several panel presentations, including a Women in Space panel which featured Astronaut Janet Kavandi and four other women with jobs dedicated to space and aerospace.

Read more about the Oshkosh Women in Space Panel:
bit.ly/FoxCitiesOshKosh

ORION VISITS THE BIG APPLE

Members of the Orion Program participated in the 2017 Intrepid Science and Space Festival held in New York City on Aug. 3-6. The festival is a four-day celebration of science and space that takes place annually in mid-summer at the Intrepid Sea, Air and Space Museum which is housed on a WWII-era aircraft carrier on Pier 86 in mid-town Manhattan. Throughout the event, more than 15,000 people had the opportunity to participate in featured lectures, presentations, hands-on activities, special exhibitions and a variety of other experiences for all ages. The event provides opportunities for a large and diverse audience to positively engage with NASA and other informal education groups to enhance science, engineering, technology and math. NASA Orion Program Manager Mark Kirasich also conducted interviews with several media outlets while at the event.

Read interview with Orion Program Manager Mark Kirasich:
bit.ly/SpaceFlightIntrepid



CATCH A GLIMPSE OF THE SOLAR ECLIPSE

See pictures from around the country: www.flickr.com/groups/nasa-eclipse2017/pool/

Just as the moon lined up with the sun for the solar eclipse that was seen across the United States, in the future, NASA will monitor the alignment of Earth and Mars to ensure the best path is taken as Orion journeys through deep space. Whether viewers were in the path of total eclipse, or were only able to see part of the sun blocked out by the moon, Americans shared their views and memories of the event.

SUPPLIER SPOTLIGHT

DEEP SPACE SYSTEMS INC.

Located in Littleton, Colorado, Deep Space Systems Inc. (DSSI) is an engineering services contractor and vendor for the Orion engineering camera system. DSSI has 15 employees who work on systems, electrical, mechanical software and test engineering for Orion. The camera system captures all important mission events both inside and outside the spacecraft.

DSSI provides Orion with 11 cameras and two camera controllers. During missions, they will document separations, jettisons and deployments, even placing cameras on the tips of the spacecraft's solar arrays. The team said, "Orion represents the very best of the aspirations and intentions of the people of the United States. We are all inspired by a shared national vision to boldly explore the space frontier and the limits of what we as a people and a species are capable of doing." DSSI is also developing compact, high performance cameras for government and commercial applications.

BUILDING ORION
AIRBUS DEFENCE AND SPACE

Airbus Defence and Space is managing the development and construction of the Orion service module for the European Space Agency. More than 20,000 parts and components will be installed in the space flight model, from electrical equipment to rocket engines, solar panels, fuel tanks and life support materials, as well as 11 km of cables and tubes. The integration of the first flight model is currently underway and the start of the integration of the second flight model is planned for 2018.

In this video, meet some of the engineers and technicians at their Bremen facility, where all the service module integration and testing takes place, as they bring together the expertise and components from their partners and suppliers from all across Europe.

Heike Nupnau, Electrician in the cleanroom, ArianeGroup
Dragos Alexandru Paun, Orion-ESM Propulsion Engineer
Marcel Petke, Team Lead Space Vehicles Integration, ArianeGroup
Hend Kamoun-Rosenko, Propulsion Engineer ArianeGroup
Henning Schoenbeck , Head Design Engineer for Orion-ESM

Watch the video: **bit.ly/2wlCxO5**

Sharing information prior to their AMA are interns Sam Goldman, Abbey Johnson, Bailey Sikorski and Cong Bui.

WHAT IT TAKES TO BE AN ORION INTERN

Four interns at Lockheed Martin near Denver, Colorado, who spent the summer working on Orion technology, recently participated in a Reddit AMA. During their summer term they worked on various projects involved with Orion's integration and testing, flight software and software integration. After learning what it takes to intern at a large company, and what goes into developing a spacecraft as innovative as Orion, they answered questions to show what their experiences taught them.

See their responses:
bit.ly/InternAMA17

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

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SEPTEMBER

Testing Orion's structure in Colorado

Parachute test in Arizona

Supplier Conference in Indiana

Hurricane Helpers in Action