



Exploration Systems Development

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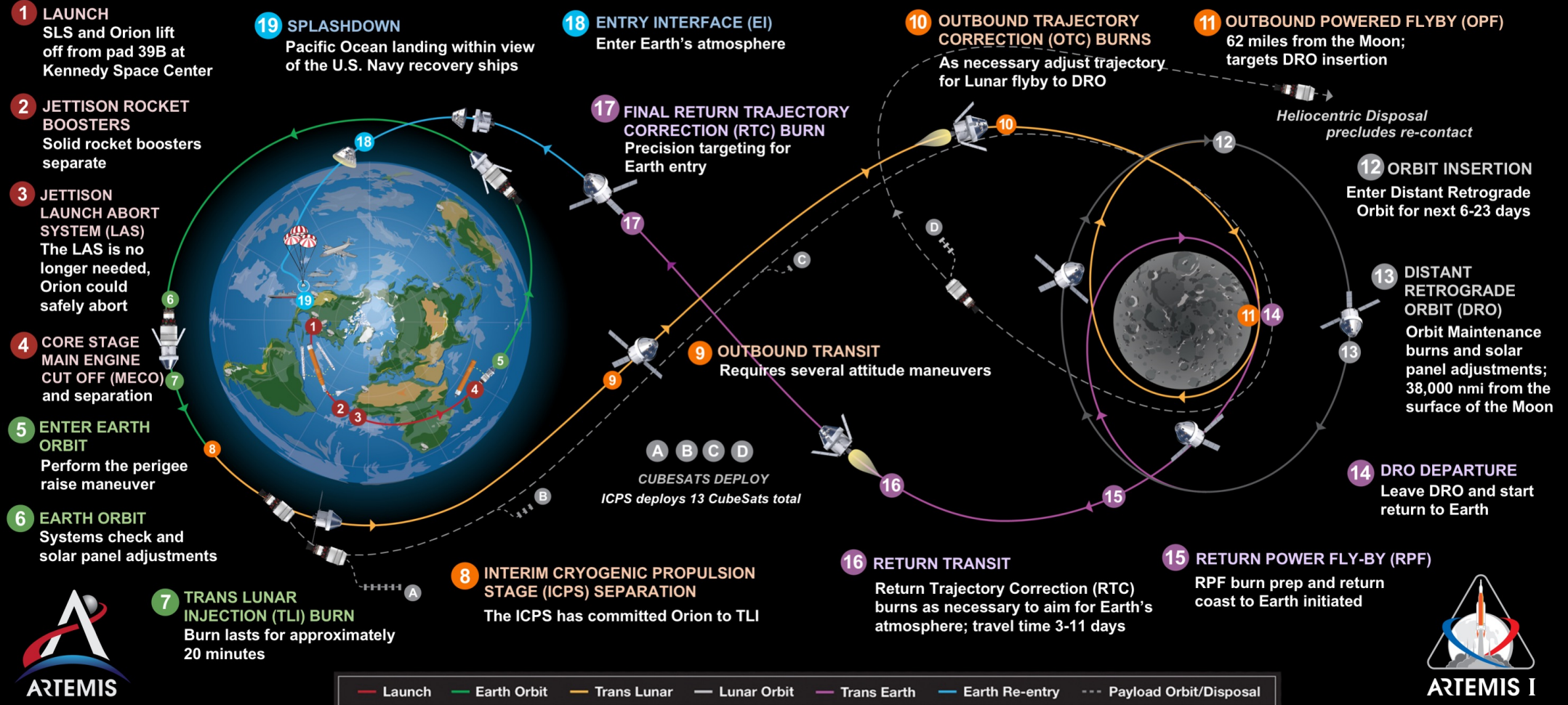


Artemis I



ARTEMIS I

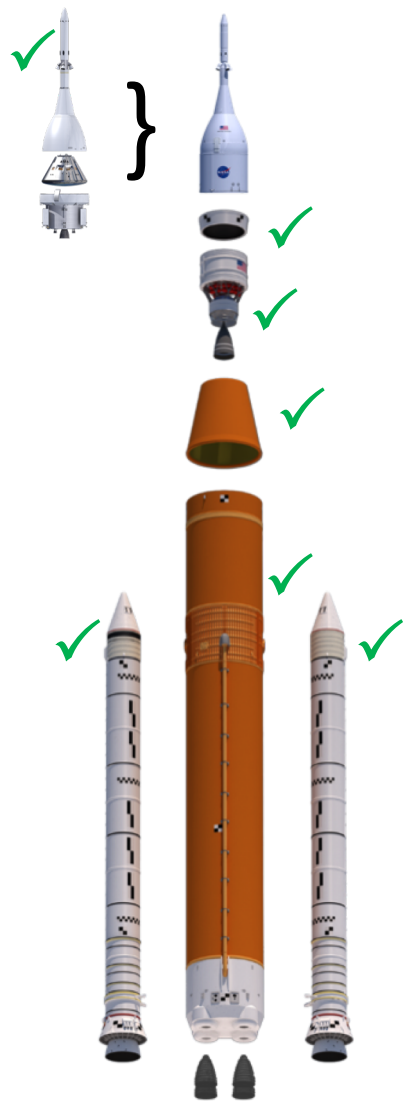
The first uncrewed, integrated flight test of NASA's Orion spacecraft and Space Launch System rocket, launching from a modernized Kennedy spaceport



Total distance traveled: 1.3 million miles – Mission duration: 26-42 days – Re-entry speed: 24,500 mph (Mach 32) – 13 CubeSats deployed



Building to Artemis I



✓ 4 Artemis I Engines





Artemis I Status



- ✓ European Service Module Critical Design Review
- ✓ Crew Module Pressure Proof Test
- ✓ Booster Qualification Motor 2 Test
- ✓ Crew Module Propellant Pressure Proof Test
- ✓ VAB Verification & Validation Complete
- ✓ RS-25 Flight Engines Complete
- ✓ ICPS Delivered to KSC
- ✓ Crew Module Initial Power On
- ✓ VAB High Bay Construction Complete
- ✓ Multi-Payload Processing Facility Construction
- ✓ LVSA Manufacturing Complete
- ✓ Mobile Launcher (ML) Umbilicals Installed
- ✓ VAC Welding Complete on Core Stage
- ✓ Launch Pad Flame Trench Construction Complete
- ✓ Parachute Tests Complete
- ✓ European Service Module Delivered to KSC
- ✓ Crew Module and Service Module Mate
- ✓ ML Tests at Pad Complete
- ✓ Core Stage Integration at MAF Complete
- ✓ Core Stage Delivered to SSC
- ✓ Orion Delivered to Plum Brook Station
- ✓ Orion Thermal Vac Tests Complete

- Core Stage Green Run Hot Fire Test Complete
- Orion Delivery to EGS
- Ground Flight Application Software Complete
- Booster Stacking in VAB
- Core Stage Arrival at KSC
- Core Stage Stacking with Boosters in VAB
- Orion Mating with Launch Abort System
- Orion Mating with SLS in VAB
- Wet Dress Rehearsal at Launch Pad
- Roll-out for Launch





Artemis I Progress



Nov. 2019 - Orion was loaded into the agency's Super Guppy aircraft to be transported the following day to NASA's Plum Brook Station in Sandusky, Ohio for environmental testing.



All four RS-25 engines were structurally mated to the core stage for NASA's SLS rocket for Artemis I.



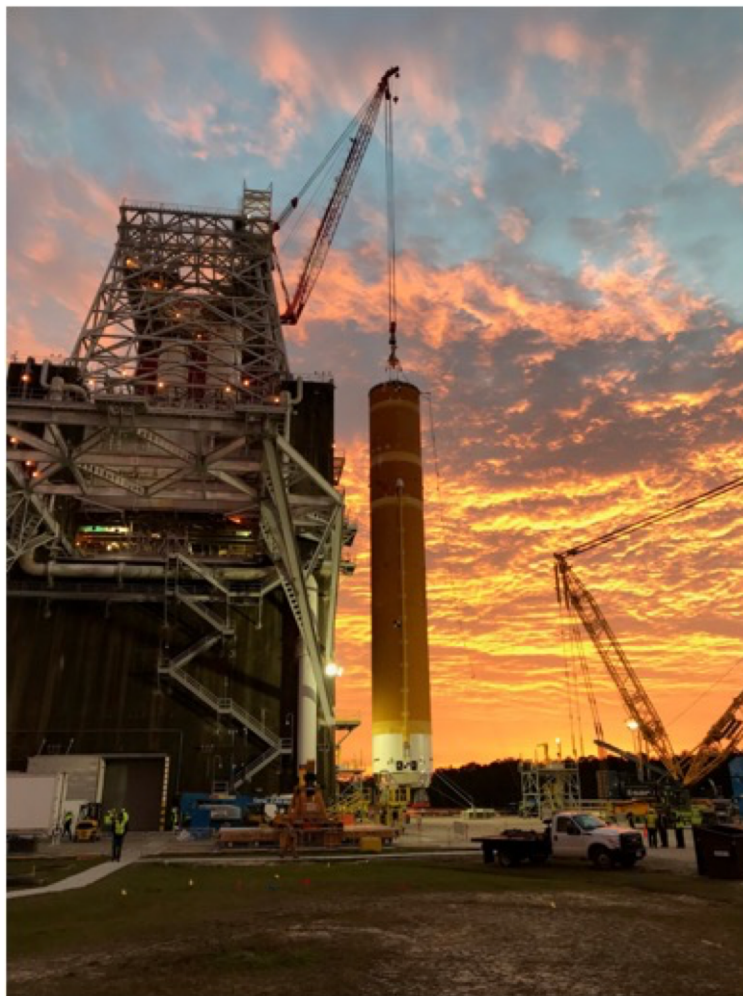
Dec. 2019 - NASA Administrator Jim Bridenstine showed off the Space Launch System liquid-fueled rocket stage that will send the first Artemis mission to space.



Artemis I Progress



Jan. 2020 - After closeout work to connect wiring, piping, ductwork, check avionics, etc., the completed SLS core stage shipped to Stennis Space Center for "green run" testing.



Jan. 2020 – The core stage was lifted into the B-2 Test Stand at Stennis.



Jan. 2020 – In High Bay 4 of the Vehicle Assembly Building at NASA's Kennedy Space Center, a team of EGS engineers and contractor Jacobs participated in SLS solid rocket booster pathfinder stacking during a training exercise.



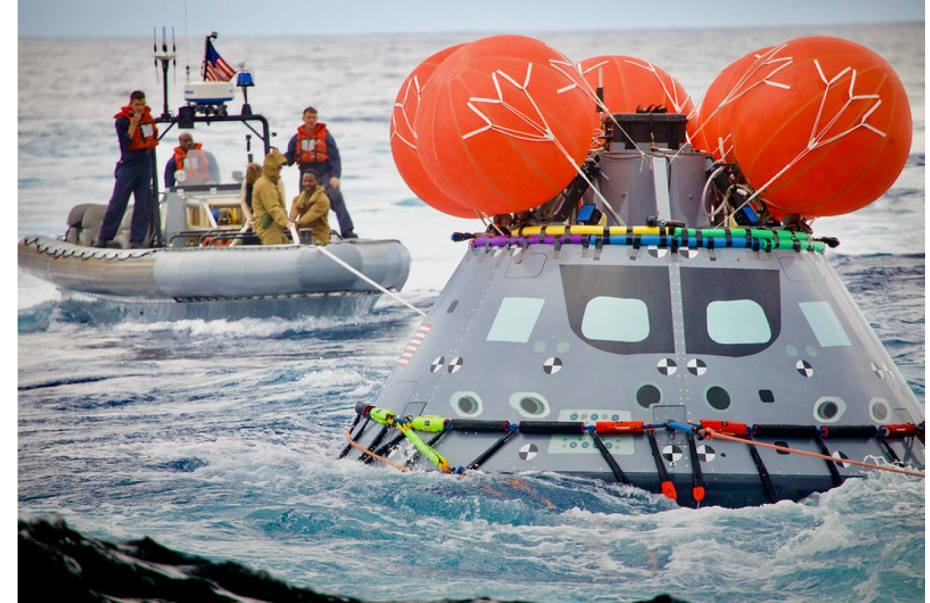
Artemis I Progress



Feb. 3, 2020 - Inside the Launch Control Center's Firing Room 1, a team of nearly 100 engineers from Orion, SLS, and EGS came together to work through a series of simulated challenges, as well as a final countdown procedure, in preparation for the Artemis I launch.



Mar. 2020 - Artemis I Orion spacecraft completed its final set of environmental and thermal tests at NASA Glenn Research Center Plum Brook Station in Sandusky, Ohio.



Mar. 2020 - NASA's Landing and Recovery team, composed of members from the Department of Defense, NASA, and contractor Jacobs, practiced securing a test version of Orion into the well deck of a ship.



Artemis I Progress



Mar. 2020 - The Orion spacecraft was moved to the Final Assembly and Systems Test cell at Kennedy Space Center. The spacecraft returned from Ohio after a successful series of environmental tests at Glenn Research Center's Plum Brook Station.



April 2020 - Two forward assemblies for Artemis I, now successfully through their Acceptance Check Out tests.



Major Milestones Remaining to Artemis Launch



- Booster Motor Segment Delivery to EGS
- Booster Aft Skirts Delivery to EGS
- Launch Vehicle Stage Adapter Delivery to EGS
- Artemis I Launch Abort System Delivery to EGS
- Orion Final Testing and Assembly Complete
- EGS Ground/Flight Application Software Integrated Test and Checkout Ready
- Booster Forward Assembly Complete
- Core Stage Green Run Hot Fire Test
- Booster Forward/Center/Aft Booster Segments Delivery to EGS
- Core Stage Arrival at EGS
- Orion Delivery to LASF Launch Abort System Facility
- Booster Integration
- Core Stage Integration
- Launch Vehicle Stage Adapter and Interim Cryogenic Propulsion Stage Integration
- Crew Service Module/Launch Abort System Integration
- Orion Move to Vehicle Assembly Building
- Orion Integration and Roll to Pad
- Wet Dress Rehearsal
- Roll-back and Final Ordnance Installation
- Roll-out for Launch
- Agency Flight Readiness Review



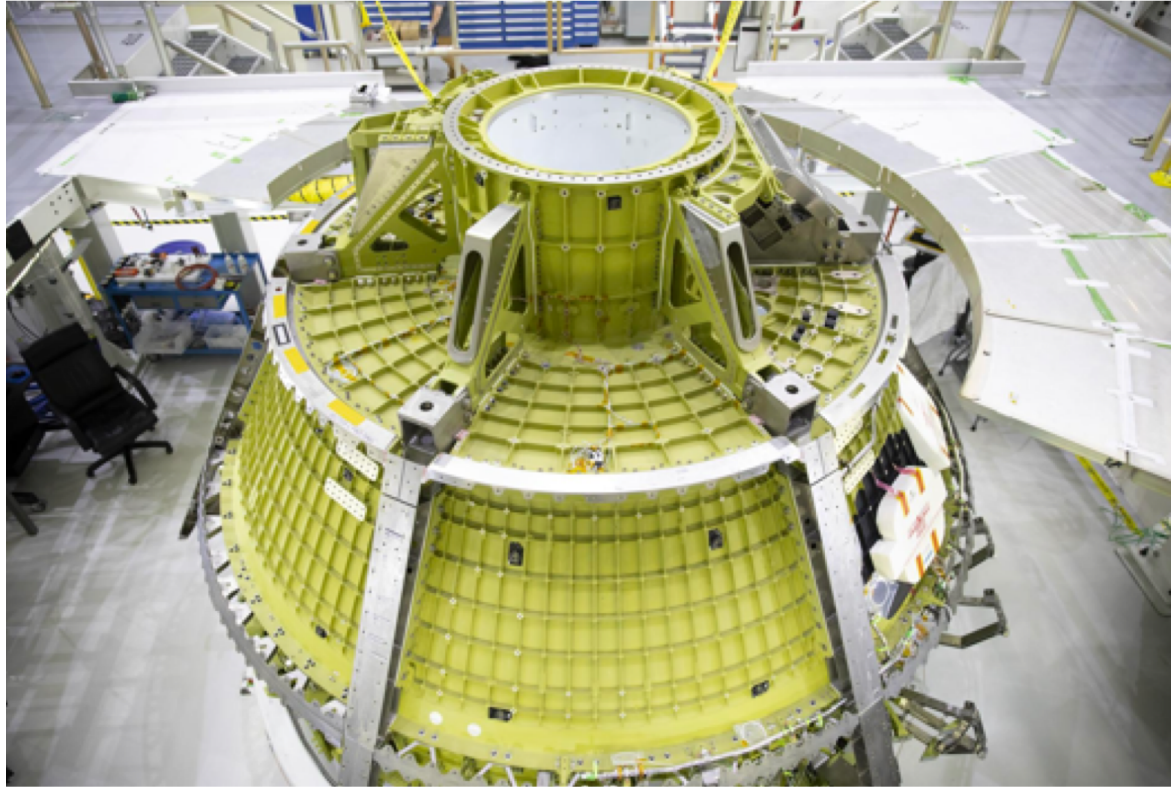
The Orion spacecraft, secured atop a transporter in its shipping container, is carried to the Neil Armstrong Operations and Checkout Building at NASA's Kennedy Space Center in Florida on March 25, 2020.

A stylized graphic of a rocket ship, depicted as a black horizontal bar with a white nose cone on the left. The interior of the bar is black and filled with numerous small white stars. On the right side, there are vertical red and blue stripes, each topped with a small circle (red and white, blue and white).

Artemis II and Beyond



Artemis II Progress



The Orion pressure vessel for NASA's Artemis II mission is in view in a processing stand inside the Neil Armstrong Operations and Checkout Building high bay.



NASA and Northrop Grumman technicians in Promontory, Utah, completed casting, or filling with propellant, all 10 of the booster motor segments for the second flight of NASA's Space Launch System rocket.



Artemis II Progress



The Artemis II Intertank has completed thermal protection application and is in mechanical assembly, and the engine section is undergoing mechanical integration and orbital welding.



Build-up of a new liquid hydrogen (LH2) storage tank is in progress at Launch Complex 39B at NASA's Kennedy Space Center in Florida.



Artemis II Progress



Jan. 2020 - The liquid hydrogen tank for the Artemis II mission, the first crewed mission of NASA's SLS and Orion spacecraft, completed welding and is in testing to evaluate weld strength and structural soundness.



Feb. 2020 - NASA successfully tested the attitude control motor (ACM) at the Northrop Grumman facility in Elkton, Maryland. The 30-second hot fire was the third and final test to qualify the motor for human missions, beginning with Artemis II.



Mar. 2020 - Technicians are completing the work on the heat shield for NASA's Artemis II mission inside the Neil Armstrong Operations and Checkout Building at the agency's Kennedy Space Center.



Artemis II Progress



April 2020 - The launch abort motor for Orion's launch abort system for Artemis II, enclosed in its shipping container, arrived at NASA's Kennedy Space Center in Florida on April 13, 2020.



April 2020 - At the AMRO Fabricating Corporation in southern California, the Motor Adapter Cone for NASA's Orion spacecraft is undergoing final machining.



Artemis II Progress



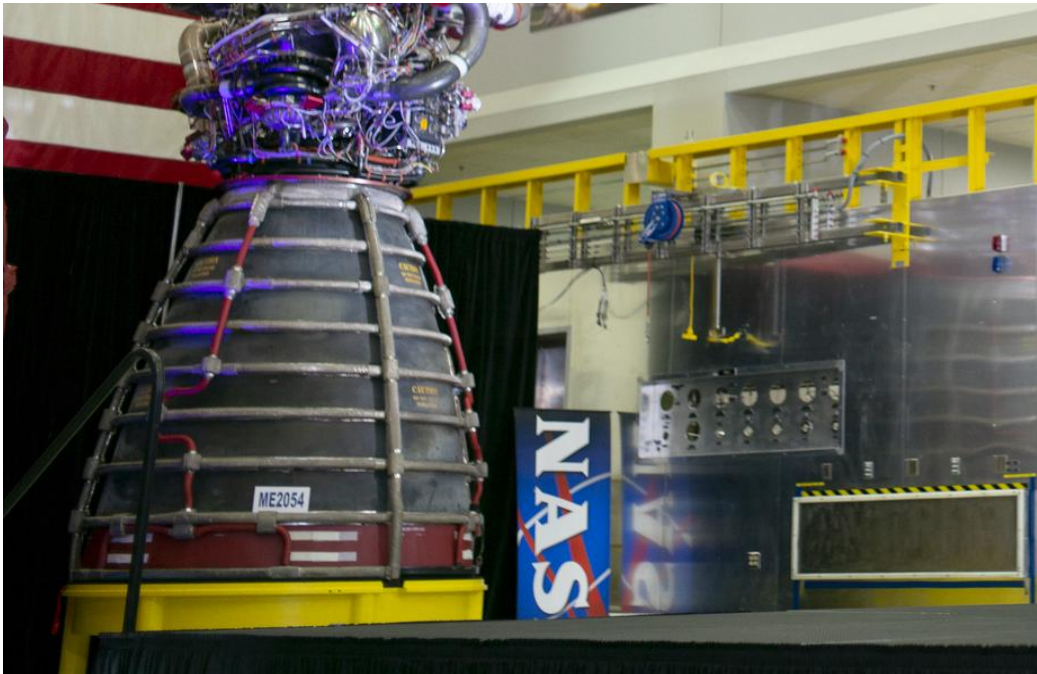
April 2020 - The launch abort motor was integrated with the jettison motor for Orion's launch abort system for Artemis II, inside the Launch Abort System Facility at NASA's Kennedy Space Center.



April 2020 - Artemis II crew module adapter outboard walls are in work at NASA's Kennedy Space Center.



Artemis III Progress



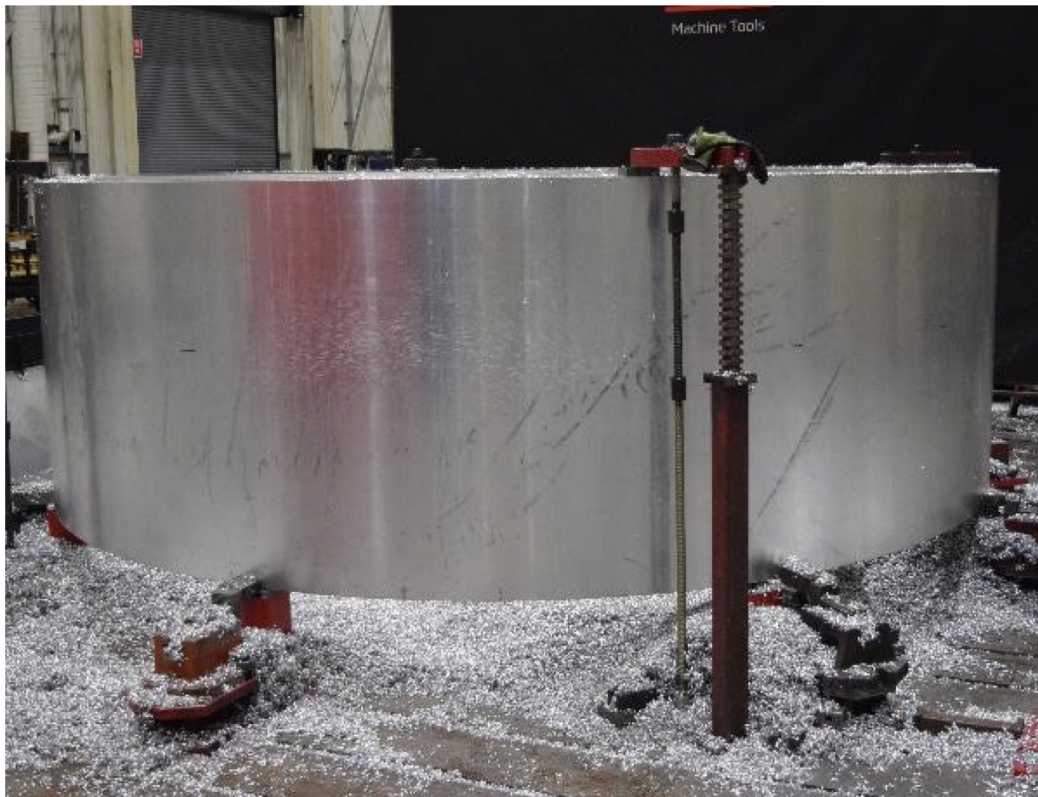
Artemis III RS-25 Engine



Payload adapter manufacturing work at Marshall Space Flight Center



Artemis III Progress



Artemis III crew module barrel being machined at Ingersoll in Illinois



Artemis III European Space Module being assembled at TASI in Turin, Italy



Artemis III Progress



April 2020 - A large aluminum alloy panel for the Artemis III Orion spacecraft is being manufactured by AMRO Fabricating Corporation. The cone panel is one of three segments that make up the upper half of the pressure vessel capsule of the spacecraft.



The liquid hydrogen tank for the third SLS core stage is in production at Michoud Assembly Facility.



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