



## Orion Facilities

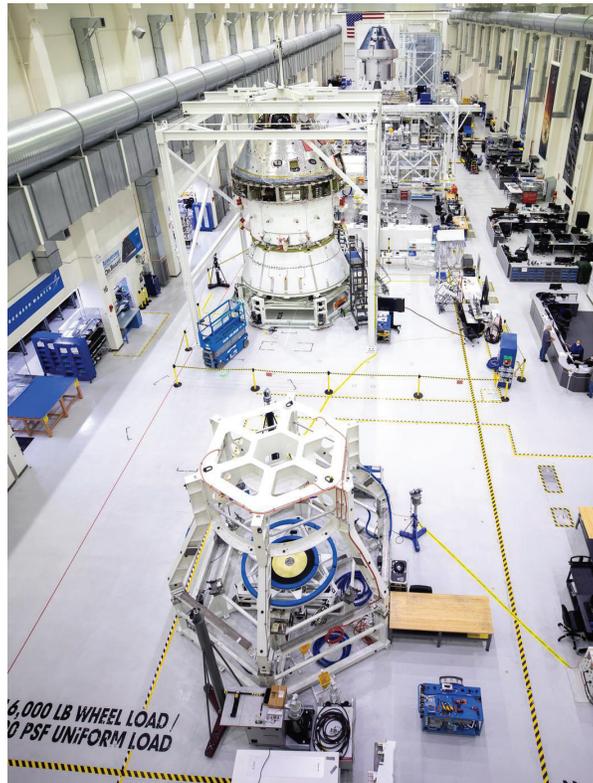
NASA's Kennedy Space Center in Florida uses several facilities to prepare the agency's Orion spacecraft for flight and to process the spacecraft after its return from deep space in support of NASA's Artemis missions.

Kennedy's facilities support the factory assembly of the spacecraft, launch operations, and hazardous processing before and after missions. Most facilities overseen by NASA's Orion and Exploration Ground Systems (EGS) Programs have been modernized and now provide Kennedy with an end-to-end capability the center has not had before. Previously, the spacecraft arrived at Kennedy fully assembled and the center's job was to put on the finishing touches and launch the mission.

### Neil Armstrong Operations & Checkout Building High Bay

Orion crew modules arrive at Kennedy following initial manufacturing at NASA's Michoud Assembly Facility in New Orleans and are delivered to the Neil Armstrong Operations & Checkout Building (O&C). The building contains a large room, called a high bay, that operates as a state-of-the-art factory, where workers assemble spacecraft and ready them for Artemis missions to the Moon and deep space destinations. The high bay includes unique tooling stations, test fixtures, chambers, and clean rooms for the build-up and testing of the spacecraft. The facility is capable of processing multiple spacecraft in varying production phases. Orion spacecraft for Exploration Flight Test-1 and Artemis I have been completed in the O&C with assembly of spacecraft for future Artemis missions well underway.

Orion assembly includes joining the crew module, crew module adapter, and the European service module. The service module, provided by ESA (European Space Agency), will carry consumables, like air and water, and provide power and fuel to support the crew module and astronauts' needs for deep space missions. Assembly also includes installation of the service module's four solar array wings, which provide electrical power to the service module, and three spacecraft adapter jettison fairings, which protect the service module during ascent. The facility was vital



*Installation of the spacecraft adapter cone to the Artemis I Orion spacecraft was in progress inside the Neil Armstrong Operations and Checkout Building at NASA's Kennedy Space Center on Aug. 10, 2020. This is one of the final major hardware operations the spacecraft undergoes during closeout processing prior to being integrated with the Space Launch System rocket in preparation for the first Artemis mission. Photo credit: NASA/ Frank Michaux*

in the assembly of the prototype vehicles as well as a test version of Orion that launched atop a United Launch Alliance Delta IV rocket on Exploration Flight Test-1 in 2014.

The O&C, previously known as the Manned Spacecraft Operations Building, has played a major role in NASA's spaceflight history. It was the first building finished at Kennedy and has housed the Astronaut Crew Quarters since the mid-1960s, where the Gemini astronauts stayed prior to launch. The facility, once used to process spacecraft in the Apollo era, underwent an extensive, two-year renovation starting in 2007 to outfit the facility for assembly of the Orion spacecraft. Space Florida and NASA



*The Space Launch System rocket's interim cryogenic propulsion stage moved into the Multi-Payload Processing Facility on Feb. 18, 2021, at NASA's Kennedy Space Center, alongside one of its flight partners for the Artemis I mission, the Orion spacecraft. Photo credit: NASA/Glenn Benson*

provided the funds for a full refurbishment that involved everything from replacing the entire facility support infrastructure to new overhead cranes to complete manufacturing and assembly work. The building now serves as the final assembly facility for Orion in support of NASA's Artemis program.

## Multi-Payload Processing Facility

The next step for the Orion spacecraft is the Multi-Payload Processing Facility (MPPF). In the MPPF, technicians fuel and service spacecraft and some flight hardware, including the ICPS shown in the photo above. The MPPF is equipped to fuel the Orion spacecraft with hazardous propellants and other fluids and gases the spacecraft and astronauts will need for the journey around the Moon and during deep space missions.

When Orion returns to Earth after its mission, workers transport it to the MPPF, where they use specialized equipment to remove unused hazardous propellants, fluids, and gases from its tanks during postflight processing.

## Launch Abort System Facility

The Launch Abort System facility houses the launch abort system for the Orion spacecraft. After fueling in the MPPF, the Orion spacecraft moves to the Launch Abort System Facility (LASF). Teams then position the 44-foot-tall Launch Abort System on top of Orion for launch and ascent into orbit. The LAS has a solid-fueled rocket system that activates in the unlikely case that an emergency occurs during launch or ascent. In that

case, the LAS ignites and lifts the crew module and its crew away from the rocket with more thrust than the Atlas booster that launched John Glenn into orbit in 1962. The crew module would then parachute safely back into the ocean for recovery.

Workers assemble the LAS horizontally inside the LASF and then move it into a vertical position for stacking with Orion. The facility is taller than many processing facilities at Kennedy to allow clearance for vertical assembly of the Orion spacecraft with the LAS. The LASF has cranes and other equipment needed to integrate the system during launch processing. After integrating the LAS with Orion, teams move the entire stack to High Bay 3 in the Vehicle Assembly Building where they lift and secure it atop NASA's Space Launch System rocket on the mobile launcher. The LAS for the Ascent-Abort-2 flight test aboard a Northrop Grumman booster in 2019, was assembled at Kennedy's LASF and successfully demonstrated its capabilities.

Workers then transport the integrated stack of the SLS rocket and Orion spacecraft atop the mobile launcher on crawler-transporter-2 to Launch Pad 39B for liftoff to deep space missions, including to the Moon and Mars.

These unique facilities at Kennedy will continue to play a significant role in processing the Orion spacecraft for ambitious Artemis missions.



*The last of three motors required to assemble the Launch Abort System (LAS) for NASA's Artemis II mission, the attitude control motor (ACM), arrived at Kennedy Space Center on Aug. 28, 2020, and was delivered to the Launch Abort System Facility. During launch of Orion atop the agency's Space Launch System rocket, the LAS motors work together to separate the spacecraft from the rocket in the unlikely event of an emergency during launch. The ACM operates to keep Orion's crew module on a controlled flight path in the event it needs to jettison and steer away from the rocket. Photo credit: NASA/Ben Smegelsky*

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