NASAfacts

Mobile Launcher 1

The mobile launcher 1 (ML1) is the ground structure used to assemble, process, and launch NASA's Space Launch System (SLS) rocket (Block 1 configuration) and Orion spacecraft from Launch Pad 39B at the agency's Kennedy Space Center in Florida for missions to deep space destinations such as the Moon, Mars, and beyond. ML1 will launch the first three Artemis missions, including the mission that returns humans to the lunar surface.

During preparations for launch, the crawler-transporter picks up and moves ML1 into High Bay 3 in the Vehicle Assembly Building (VAB). The Mobile Launcher is structurally supported at the VAB and Launch pad atop support posts, called mount mechanisms. The Crawler Transporter (CT) fits within the space above the ground surface and beneath the bottom of ML1 to lift and lower ML1 onto the mount mechanisms before and after transportation. The Orion spacecraft is stacked atop the SLS rocket and processed on the mobile launcher. The launcher is designed to support the assembly, testing, checkout, and servicing of the rocket, as well as transfer it to the pad and serve as the structural platform from which it launches.

With NASA's Moon rocket atop, the mobile launcher is on the move at the agency's Kennedy Space Center in Florida, rolling out of the Vehicle Assembly Building for a 4.2-mile journey to Launch Complex 39B on March 17, 2022. Carried atop the crawler-transporter 2, the Space Launch System rocket and Orion spacecraft are venturing to the pad for a wet dress rehearsal ahead of the uncrewed Artemis I launch. Photo credit: NASA/Kim Shiflett

ML1 consists of a two-story base that is the platform for the rocket and a tower that is equipped with a number of connection lines, called umbilicals, and launch accessories that provide SLS and Orion with power, communications, coolant, fuel, and stabilization prior to launch. The tower also contains a walkway for personnel, equipment, and astronauts entering the crew module during launch preparations, called the Crew Access Arm (CAA).

The launcher rolls out to the pad for launch on top of the crawler-transporter, carrying SLS and Orion. After the crawler-transporter makes its eight-hour trek to the pad just over four miles away, engineers lower the launcher

onto the pad and remove the crawler-transporter. During launch, each umbilical and launch accessory releases from its connection point, allowing the rocket and spacecraft to lift off safely from the launch pad.

By the Numbers

- Total height above ground: ~400 feet
- Two-story base: 25 feet high, 165 feet long, and 135 feet wide
- Sits 22 feet off the ground, "0" deck is 47 feet off the ground
- Height of six steel mount mechanisms: 22 feet (in VAB or on launch pad)
- Height above the ground of mobile launcher deck when positioned on six steel mounts: 47 feet (in VAB or on launch pad)
- The booster aft skirt sits on Vehicle Support Posts (VSPs): Eight to support the vehicle (four per booster) on mobile launcher platform during transfer to pad and at liftoff
- Tower: 40 feet square, about 345 feet tall
- Tower floor levels: every 20 feet for personnel access to vehicle and ground support equipment
- Approximate ML1 weight: ~11.5 million pounds

Prior to the Artemis I mission, the ML1 structure was modified by NASA's Exploration Ground Systems (EGS) Program. Hensel Phelps constructed the structure and facility support systems during the first phase of development. The design and prototyping of the necessary ground support equipment subsystems was performed by Vencore and Jacobs Test and Operations Support Contract (TOSC). JP Donovan Construction Inc. performed the work to widen the flame hole opening on the base of the launcher from approximately 22x22 feet to 34x64 feet to accommodate the SLS configuration of the core stage and its twin solid rocket boosters.

JP Donovan Construction Inc. installed and integrated ground support equipment systems onto ML1, modifying the structure with the systems necessary to assemble, process, and launch NASA's SLS rocket and Orion spacecraft. The scope of work included installing more than 800 mechanical, electrical, and fluid panels, 400,000-plus feet of cabling, and miles of tubing and piping to support the SLS rocket. Reynold Smith and Hills (RS&H) completed the majority of the structural design and facility design modifications.

Following the successful liftoff of the uncrewed Artemis I mission from NASA's Kennedy Space Center, the mobile launcher endured the blast exceptionally well and received isolated, local damage on specific subsystems. Teams immediately worked on repairing and modifying the damage sustained on mobile launcher 1. This included repairing the elevators and pneumatics systems which sustained damage during launch by hardening them and strengthening the blast protection. Technicians also refurbished the platform's blast plates that surround the mobile launcher's flame hole to protect it against the powerful exhaust plume from the rocket's engines.

To prepare for crewed missions starting with Artemis II, engineers added an emergency egress system on mobile launcher 1. This system allows personnel to safely depart from the mobile launcher (or tower) in the unlikely event of an emergency while at the launch pad. Personnel will ride down emergency egress baskets, similar to gondolas at ski lifts, and head to the launch pad perimeter, or the pad terminus area where armored emergency response vehicles are stationed to take personnel safely away to a safe haven location.

The nearly 400-foot-tall mobile launcher, atop crawler-transporter 2, with NASA's Space Launch System rocket and Orion spacecraft atop, rolls out of the Vehicle Assembly Building's High Bay 3 to begin its journey to Kennedy's Launch Pad 39B ahead of the Artemis I mission on Nov. 4, 2022. The first in a series of increasingly complex missions, Artemis I was the first integrated test of the agency's deep space exploration systems. Through Artemis missions, NASA will establish a long-term lunar presence for scientific discovery and prepare for human missions to Mars. NASA/Isaac Watson

Find out more about **Exploration Ground Systems** and NASA's deep space exploration, including the Moon, Mars and beyond at **https://www.nasa.gov/exploration/systems/ground/index.html**

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FS-2024-11-997-KSC