NASAfacts

Mobile Launcher 2

NASA's mobile launcher 2 (ML2) is the ground platform structure that will launch Space Launch System (SLS) Block 1B and Block 2 configurations to the Moon, allowing the agency to send astronauts and heavy cargo to the lunar surface as part of NASA's Artemis program. ML2 is the primary interface between the ground launch control system and the SLS rocket and Orion spacecraft flight hardware.

It serves as the platform for all SLS and Orion integrated stacking operations, as well as structurally supporting the stack during prelaunch preparations, its roll to the launch pad, and during the launch countdown. ML2 is capable of withstanding severe launch blast environments, and at the time of launch, will help stabilize the rocket and spacecraft – approximately 6 million pounds gross liftoff weight – once loaded with liquid hydrogen (LH2) and liquid oxygen (LOX).

Multiple umbilicals, or swing arms, on the ML2 tower will provide the power, data, remote monitoring and control, propellants, fluids, gases, sound suppression, imagery and communications necessary for launch. The launch team, sitting in the Launch Control Center's Firing Room 1, will send remote commands to the tower's umbilicals, which in turn get communicated to SLS and Orion.

Bechtel National, Inc. is the prime contractor building the approximately 355-foot-tall, 11.3-million-pound structure, and the agency's Exploration Ground Systems is overseeing the build. The contract was

An artist rendering of crawler-transporter 2, with the mobile launcher 2 and Space Launch System (SLS) Block 1B atop, as it makes its way to Launch Pad 39B in preparation for liftoff. The SLS Block 1B configuration will be used to send cargo to the Moon under NASA's Artemis program. Photo credit: NASA/David Zeiters

awarded in July 2019 and is aligned to support the first launch of a Block 1B, scheduled for Artemis IV. The ML2 structural design will incorporate many lessons learned and modifications from ML1, which will support the agency's Artemis I, II, and III launches – test flights that will validate SLS and Orion as an integrated system and, ultimately, land the first woman and next man on the Moon.

The SLS Block 1B configuration introduces the new Exploration Upper Stage (EUS), which will replace the Interim Cryogenic Propulsion Stage as the rocket's upper stage, allowing NASA to send more cargo to the Moon in a single launch. The EUS also is planned for use in SLS Block 2 configurations. This presents significantly different interfaces than with ML1; hence, NASA's need for ML2. The EUS and structural adapters extend the SLS by 40 feet, so the critical swing arms for ML2 must be located at different elevations. The EUS also requires two new swing arms be added to ML2. Additionally, because the Block 1B and Block 2 are taller, wind will have a greater effect on the rocket, which will impart higher loads on ML2. The structural design of the tower and the base are somewhat different than ML1, but essentially maintain the same physical outer dimensions in order to fit in the Vehicle Assembly Building (VAB) and on Launch Pad 39B.

Although the SLS Block 1B will be about 40 feet taller, the ML2 tower is only planned to be about seven feet taller than ML1. The major differences for the flight vehicle and ML towers are located above the Core Stage Forward Skirt Umbilical. The ML2 base's backbone, or truss structure, has been redesigned to support the larger, more powerful rocket.

The ML2 base is 133 feet wide x 158 feet long x 25 feet tall, and it is supported by six 25-foot-tall pedestals (mount mechanisms) located at each site – the VAB, Launch Pad 39B, and the ML Park Site.

The overall purpose, functionality, and crew interfaces of the Crew Access Arm (CAA) and Emergency Egress System (EES) are the same on ML1 and ML2, as well as the physical interfaces required for the core stage. The CAA design is the same for both MLs, but its location on the ML2 tower will be different to accommodate the height increase of Block 1B. The purpose of the EES is to provide an escape path for the astronauts and ground crew in the unlikely event of an extremely hazardous situation at the CAA elevation, or 317-foot-level, of the ML2 tower. The EES architecture was similarly used for the space shuttles and has incorporated many lessons learned from the program.

The EES design contains four large baskets that can each hold five people. These baskets slide down four large cables between the tower and the landing area, where Mine Resistant Ambush Protected (MRAP) vehicles will be staged for escape from the pad area. The big challenge, as compared to the space shuttle configuration, is that the tower is not permanently located at the pad; therefore, the EES must be assembled and disassembled for every launch. The ongoing EES design for ML1 is being integrated into the ML2 design in parallel. While the EES baskets are located at a higher elevation on the ML2 tower, the ML2 EES will be fully compatible with the same landing area, located near the west side of the Pad B perimeter.

An artist rendering of the Space Launch System (SLS) Block 1B atop the mobile launcher 2 at Kennedy Space Center's Launch Pad 39B in Florida. The SLS Block 1B configuration will be used to send cargo to the Moon under NASA's Artemis program. Photo credit: NASA/David Zeiters

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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