

Mobile Launcher Tower Umbilicals and Accessories

NASA's [Space Launch System](#) rocket, or SLS, will be the most powerful rocket in the world, with the capability to launch humans beyond Earth's orbit on [Artemis](#) missions. The SLS rocket, powered by four RS-25 core stage engines and two solid rocket boosters, along with an RL10 in-space propulsion engine, provides the energy necessary to launch the [Orion](#) spacecraft to the Moon or beyond.

Prior to rollout and launch, teams stack the Orion spacecraft atop the SLS rocket and process it on the [mobile launcher](#) inside High Bay 3 of the [Vehicle Assembly Building](#) (VAB) at NASA's Kennedy Space Center in Florida. The tower on the mobile launcher is equipped with several connections, called launch accessories and umbilicals, which attach to the SLS's core stage and twin solid rocket boosters, as well as the interim cryogenic propulsion stage (ICPS) and the Orion spacecraft.

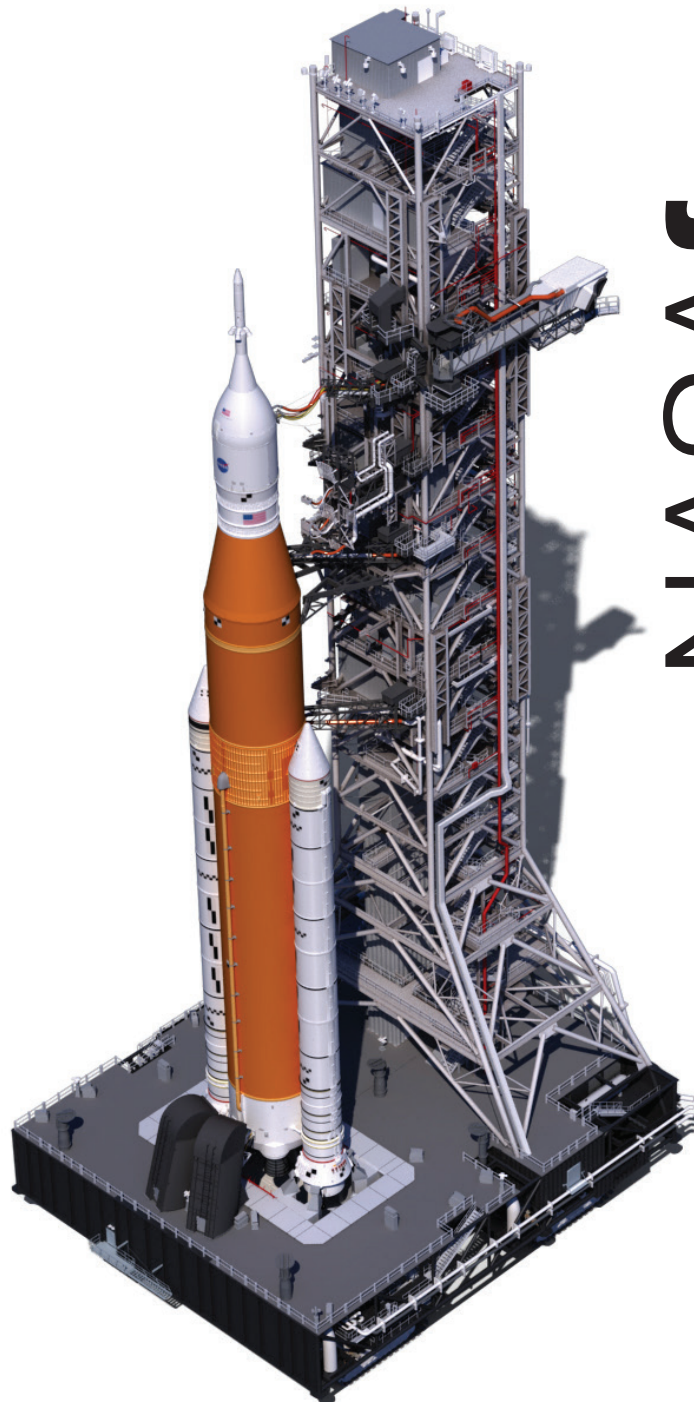
These umbilicals provide power, communications, coolant, and fuel. Additional accessories provide access and stabilize the rocket and spacecraft. During launch, each accessory releases from its connection point, allowing the rocket and spacecraft to lift off safely from the launch pad.

Aft Skirt Electrical Umbilicals

Two aft skirt electrical umbilicals connect to the SLS rocket at the bottom outer edge of each booster and provide electrical power and data connections to the SLS rocket until it lifts off from the launch pad. These umbilicals act like a telephone line, carrying a signal to another subsystem on the mobile launcher called the Launch Release System. This system distributes the launch signal to the rest of the launch accessories and the SLS boosters, and it initiates the launch release command.

Aft Skirt Purge Umbilicals

Two aft skirt purge umbilicals also connect to the SLS rocket at the bottom outer edge of each booster to remove potentially hazardous gases and maintain components within acceptable temperature ranges



An artist illustration of the mobile launcher with umbilical lines installed on the tower and attached to NASA's Space Launch System rocket and Orion spacecraft. Image credit: NASA

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through a heated gaseous nitrogen purge to the cavity of each booster's aft skirt. Teams connect these umbilicals during pad operations, and they remain connected until released during liftoff.

Tail Service Mast Umbilicals

Two tail service mast umbilicals connect from the zero-level deck on the mobile launcher to the SLS rocket core stage aft section. These umbilicals are about 33 feet tall. They provide liquid oxygen and liquid hydrogen fluid lines and electrical cable connections to the SLS core stage engine section to support propellant handling during prelaunch operations. The umbilicals tilt back before launch to ensure all hardware safely and reliably disconnects and retracts from the rocket during liftoff.

Core Stage Intertank Umbilical

The core stage intertank umbilical is a swing arm umbilical that connects to the SLS [core stage](#) intertank, which sits between the rocket's liquid hydrogen and liquid oxygen tanks. The intertank umbilical's main function is to vent gaseous hydrogen, which is boil off from the extremely cold liquid hydrogen fuel, from the core stage. The arm also provides conditioned air, pressurized gases, and power and data connections to the core stage. This umbilical, located at the 140-foot level on the mobile launcher tower, swings away at launch.

Core Stage Forward Skirt Umbilical

The core stage forward skirt umbilical is located at the 180-foot level on the mobile launcher tower, above the liquid oxygen tank. This umbilical connects to the core stage forward skirt of the SLS rocket and then swings away at launch. Its main purpose is to provide conditioned air and nitrogen gas to the SLS core stage forward skirt cavity.

Orion Service Module Umbilical

The Orion service module umbilical connects from the mobile launcher tower to the Orion service module. The umbilical is located at the 280-foot level of the tower and, prior to launch, transfers liquid coolant and air for the electronics, as well as purge air and nitrogen gas for the environmental control system to support the spacecraft and the Launch Abort System. The umbilical tilts back at launch.

Interim Cryogenic Propulsion Stage Umbilical

The interim cryogenic propulsion stage umbilical is located at about the 240-foot level on the mobile launcher tower. This um-

bilical supplies fuel, oxidizer, purge air, gaseous nitrogen and helium, and electrical connections to the interim cryogenic propulsion stage of the SLS rocket. The engine, just like the core stage engines, uses fuel (hydrogen) and oxidizer (oxygen) to create thrust. The umbilical also provides hazardous gas leak detection and swings away at launch.

Launch Accessories

Crew Access Arm

The crew access arm is located at the 274-foot level on the mobile launcher tower. The arm rotates from its retracted position and interfaces with the SLS rocket at the Orion crew hatch location to provide entry and exit for the Orion crew module during operations in the VAB and at the launch pad. The access arm provides a clean and controlled work area for people and equipment entering the crew module, an emergency egress path during emergency conditions, and access to servicing panels for the Orion crew module and service module. On human missions, the access arm also provides entry and exit for astronauts. The arm retracts from the Orion spacecraft before launch.

Vehicle Stabilizer System

The vehicle stabilizer system is located at the 200-foot level of the mobile launcher tower, and provides a structural interface to the SLS core stage. The system helps reduce core stage motion during rollout to the launch pad, processing operations, high wind events at the pad, and the launch countdown. The stabilizer drops down and away from the SLS at launch.

Vehicle Support Posts

Eight posts support the load of the solid rocket boosters, with four posts for each booster. The support posts, made of cast steel, are five feet tall and each weigh about 10,000 pounds. They are located on the deck of the mobile launcher and are instrumented with strain gauges to measure loads during stacking, integration, rollout, and launch operations. The posts will structurally support the SLS rocket through T-0 and liftoff.

The center's Engineering Directorate and Exploration Ground Systems tested the launch umbilicals and accessories at Kennedy's [Launch Equipment Test Facility](#). After testing, teams transported the launch accessories to the [Launch Complex 39B](#) area and installed them on the mobile launcher tower. The umbilicals will be mated to the SLS for testing to ensure proper release and retract from the rocket. Following this test, the umbilicals will be remated for launch.

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