Launch Control Center

NASAfacts

An overall view of Firing Room 1 at Kennedy Space Center's Launch Control Center shows the launch team at work during a terminal countdown demonstration for Artemis I on Dec. 14, 2018. Photo credit: NASA/Kim Shiflett

The Launch Control Center (LCC) was built in 1967 in support of NASA's Apollo Program. It subsequently supported NASA's Space Shuttle Program and now is being updated and renovated in support of NASA's Artemis Program. NASA's Exploration Ground Systems (EGS) will operate, monitor, and coordinate the ground equipment for launch of the Space Launch System (SLS) rocket and Orion spacecraft; the LCC is a vital part of EGS's infrastructure needed to support the Artemis Program. The LCC comprises a suite of complex software, which links the launch team operators in Firing Room 1, located inside the LCC at NASA's Kennedy Space Center in Florida, to the SLS rocket and Orion spacecraft in processing areas such as the Vehicle Assembly Building (VAB), mobile launcher, and at Launch Complex 39B. It also will allow controllers at Kennedy to communicate with astronauts inside Orion, controllers at the Air Force Eastern Range, and other NASA control centers.

The Launch Control Center will use new processing and launch software called the Launch Control System (LCS). The LCS software is the first new software to be developed for NASA since the Space Shuttle Program was retired in 2011. It represents a suite of advanced software tailored to the unique needs of both the SLS rocket and Orion spacecraft. The new software is designed to take advantage of modern computers, servers, and information technology to provide a faster, safer, and more reliable network than what has been used in the past. The software is also designed to be upgradable and adaptable to the launcher and spacecraft as they are flown in different configurations and in increasingly advanced versions.

The LCS offers significant improvement over previous processing and launch software in that it gives controllers unprecedented insight into vehicle and systems testing throughout the processing of the SLS and Orion. In addition, it offers precise control over operations at the launch pad during the countdown and liftoff of the largest rocket ever built, along with the first spacecraft since Apollo designed to carry astronauts into deep space.

Personnel with NASA's Exploration Ground Systems and Jacobs Test and Operations Contract monitor activities during a formal Artemis I terminal countdown simulation in Firing Room 1. Photo credit: NASA/Kim Shiflett

The LCS software is installed throughout Firing Room 1, also known as the Young-Crippen Firing Room. The upgraded software is the final step of a modernization effort that began with the removal of outdated computer systems – some dating back to Apollo – from the firing room and replacing them with updated computing hardware. These upgrades will provide controllers with more precision and flexibility during processing and launch operations. The software system also takes advantage of a refurbishment of the cable and wiring networks inside the VAB and leading out to Launch Complex 39B.

The LCS software, SLS rocket, and Orion spacecraft will come together for the first time for the launch of Artemis I. Artemis I is an uncrewed mission in which the massive SLS rocket will launch the Orion spacecraft on an excursion to lunar orbit, lasting approximately three weeks. The Artemis I mission will end with Orion returning to Earth with a splashdown off the coast of California.

A member of the Artemis I launch team participates in validation testing inside Firing Room 1 on July 11, 2019. The team includes personnel with NASA's Exploration Ground Systems and Jacobs Test and Operations Contract. Photo credit: NASA/Kim Shiflett

Firing Rooms

After 30 years of serving as the "brain" behind space shuttle processing and launches, the firing rooms in the Launch Control Center have been modified to oversee preparations and launches of the new generation of rockets and spacecraft. The upgrades to the firing rooms are in line with the many upgrades being performed across the space center to refurbish launch systems and facilities, many of which have been in place since the Apollo Program.

The four firing rooms are the heart of the LCC. All the activities necessary to prepare rockets, spacecraft, and payloads for space can be controlled by engineers sitting at computer terminals in the firing rooms. Likewise, all activities at the launch pads can be run from a firing room.

New launch systems, including NASA's Orion spacecraft and SLS rocket, are not expected to require as many controllers as was needed in the shuttle program. Instead, advances in computer and software systems will allow greater situational awareness by the launch controllers.

Significant updates have occurred throughout the Launch Control Center, which last underwent major modification ahead of the launch of the first space shuttle mission in 1981. The up-

On July 16, 2019, the 50th anniversary of the Apollo 11 launch to the Moon, launch team members from Apollo 11 and Artemis I mingled in Launch Control Center Firing Room 1. From left are John Tribe, Apollo 11 launch team member; Kennedy Space Center Director Bob Cabana; Artemis I Launch Director Charlie Blackwell-Thompson; Harrison Schmitt, Apollo 17 astronaut; Apollo 11 astronaut Michael Collins, with his daughters Ann (left) and Kate (right); and Kelvin Manning, associate director, technical. Photo credit: NASA/Kim Shiflett

grades focused on replacing obsolete and degraded cables, wiring, and pipes, along with making the control center flexible to the needs of a new generation of launchers, payloads, and spacecraft. Some of the most dramatic modernization has taken place in the Young-Crippen Firing Room, commonly referred to as Firing Room 1. This Firing Room oversaw launches ranging from the first Apollo missions to the first space shuttle mission. Firing Room 1 was last used for the liftoff of the Ares I-X flight test in October 2009.

Firing Room 4, which was used as a large conference room when the LCC was built, was extensively remodeled in 2006 and used for processing and launch of the final shuttle missions. Firing Room 4 is now designated as a KSC Multi-user Spaceport Control Room and is used by commercial and government programs. Firing Rooms 2 and 3 have also undergone extensive modifications, including removing computer terminals that were installed in the 1970s. Both control rooms were used as the primary control rooms throughout the Apollo and shuttle programs and were used by controllers to track the myriad of ground systems during launch countdowns.

The modernization of the firing rooms also extends to the way individual workstations are configured and used. Previously, a console was connected to an exclusive set of hardware and software, tailoring it for a single use. For instance, an engineer overseeing the space shuttle main engines could perform that role only at a specific console. The upgrades make it possible for controllers and engineers to sit at any console located in the firing room and access their desired networks.

With modern cables, including fiber-optics, making these changes does not require more room for equipment. In fact, it requires much less. A fist-sized set of copper cables that were used to transmit a single camera's data from the launch pad to the firing room has been replaced with a pinky-sized cable that carries the signals from all the video cameras at the launch pad at once.

The changes that have taken place in the firing rooms will allow the Launch Control Center to continue its significant role in the processing and operations of future rockets and spacecraft for NASA and private companies as new strides are made into space.

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