



Beyond an eight-ton blast door is a suspended walkway and then the LCC, where missileers pull 24-hour alerts. (Photo: Dan Sagalyn/PBS News Hour)

### ICBM flight testing builds confidence

Minuteman III missiles are periodically launched (without their nuclear warheads, of course) from Vandenberg Air Force Base on the southern coast of California. These launches test missile capabilities and boost the confidence of U.S. allies—and the missileers.

Testing is increasingly necessary as Minutemen III age. Currently in their 40s, these missiles will be 60 years old by the time they are scheduled to be replaced in 2030. Components deteriorate every year, and since 2007, the Pentagon has spent more than \$7 billion to keep them up to date. Aging guidance systems have been replaced, solid-propellant rocket motors have been remanufactured, standby power systems have been swapped out, launch facilities have been repaired, and updated communications equipment has been installed. Test launches are a good way to demonstrate that all the new and updated parts work.

“While ICBM launches from Vandenberg Air Force Base almost seem routine, each one requires a tremendous amount of effort and absolute attention to detail in order to ensure a safe and successful launch,” says Col. J. Christopher Moss, who was the launch decision authority on five missiles that were tested in February 2016. “The data from these launches allows us to maintain a high readiness capability and ensures operational effectiveness of the most powerful weapons in the nation’s arsenal.”

Test launches from Vandenberg typically reenter—come back to Earth—off the coast of Kwajalein Atoll in the Pacific Ocean. In almost a blink of an eye, a glowing orange streak on its ballistic path hits the water and disintegrates. ✦



7 The nuclear weapon hits its target.

## The W78 Lives On

### Joint Test Assembly flight tests evaluate the Minuteman III’s aging warhead.

The W78 warhead, which was designed by Los Alamos and is one of the two types used to arm Minuteman III ICBMs, will turn 40 in 2019.

One way to evaluate the health of the aging W78 is by Joint Test Assembly (JTA) flight tests. These joint Department of Energy-Department of Defense tests gather key data from the sophisticated sensors inside the missile, the reentry vehicle (RV), and the W78 warhead tucked inside the RV. These data provide weapons scientists and engineers a way to assess the warhead’s ability to survive and function while traveling through multiple severe environments: the extreme violence of launching; accelerating within seconds to Mach 23 (about 18,000 miles per hour); entering the frigid vacuum of space; then reentering the atmosphere at speeds that threaten to break up or burn up the reentry vehicle and its warhead.

The key to a JTA, however, is that it uses a mock nuclear warhead: surrogate materials have replaced all of the nuclear materials inside. For example, the W78’s plutonium pit is replaced with a pit of non-nuclear material, making this mock-warhead incapable of generating any nuclear yield. The mock warhead is otherwise all but identical to a real warhead.

All types of nuclear warheads are flight-tested using JTAs. Because Los Alamos designed the W78 (and the W88, W76, and B61 warheads), it provides the mock warheads for those JTA flight-tests.

Although the mock warhead is technically a “dud,” JTAs are still one of the best ways to provide confidence that the W78 remains safe, secure, and reliable. ✦

