TITAN MISSILE MUSEUM

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Introduction

The Titan Missile Museum is operated by the Arizona Aerospace Foundation. It is a unique facility that is comprised of two parts: The Count Ferdinand von Galen Titan Missile Museum Education and Research Center, and the Titan Missile National Historic Landmark. The Education and Research Center opened in November of 2003. It houses the Click Family Exhibits Gallery, the Jim and Maxine Greenwood Aerospace Education Center, and a state-of-the art archival area devoted to the historical documents and artifacts of the Titan II Intercontinental Ballistic Missile (ICBM) program.

The Titan Missile National Historic Landmark is Air Force Missile Site 8, most commonly known by its local designation as Titan II launch complex 571-7. This former operational missile site was originally part of the 571st Strategic Missile Squadron, 390th Strategic Missile Wing, Davis-Monthan AFB, Arizona. It is the sole remaining Titan II ICBM complex of the 54 that were "on alert" during the Cold War between 1963 and 1987. The site was designated a National Historic Landmark in April of 1994, in recognition of the important role that the Titan II played in American history. National Historic Landmarks are nationally significant historic places designated by the Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States. There are just over 2,500 historic places that bear this national distinction, and this status is rarely conferred on sites that are less than 50 years old. Launch complex 571-7 was just 31 years old when it achieved its landmark status. It is further distinguished by the fact that it is one of only two ICBM sites in the entire world that have been preserved for the benefit of the public.

The Titan Missile Museum's mission is to preserve and illustrate the history and significance of the Titan II and its role in the peaceful conclusion of the Cold War, to provide stewardship for the Titan Missile National Historic Landmark, and to provide a framework for public discussion on nuclear proliferation and disarmament.

The Titan Missile Museum

The Director of the museum is Yvonne C. Morris, a former Titan II Missile Combat Crew Commander. Ms. Morris was assigned to the 390th Strategic Missile Wing from 1980 to 1984. She pulled alerts at all the Titan II sites around Tucson, including site 571-7.

Launch complex 571-7 came off alert on November 11, 1982. The Air Force retains ownership of the site, but leases it to Pima County. Pima County, in turn, subleases the site to the Arizona Aerospace Foundation for the purpose of operating the Titan Missile Museum.

The missile on display in the launch duct at the museum is N-10, the tenth Titan II missile to come off the production line. N-10 was the training missile for the Titan II program. From the production line, it was transferred directly to Sheppard AFB in Texas, where each of its stages were displayed on a missile handling trailer. Everyone who served in the Titan II system trained on this missile. N-10 was never loaded with propellant, so it is safe to display it in the confines of the launch duct.

Before the Foundation could open the Titan Missile Museum, several modifications had to be made to the missile site. All of these modifications were made for the purpose of demonstrating that launch complex 571-7 is no longer an operational missile site. For example, before missile N-10 could go on display in the launch duct, holes were cut in each of its propellant tanks and in the heat shield of the Reentry Vehicle. Then the missile was displayed on the surface of the site for 30 days to allow satellites to confirm that it was no longer operational. After the missile was installed in the launch duct, the silo closure door was permanently placed in the half-open position (six huge concrete blocks prevent it from opening any further) and a large window was placed over the open portion of the launch duct to facilitate visitor and satellite viewing.

The Titan Missile Museum opened its doors to the public on May 21, 1986. Since then, the museum has hosted close to 1.5 million visitors from around the world. Average yearly attendance is approximately 55,000 visitors.

At the Titan Missile Museum, visitors stand on the historic front line of the Cold War. Daily guided tours include a close-up view of the seven-story missile in the silo, a visit to the underground launch control center, and a simulated launch of the Titan II. Nowhere in the United States is such a facility so completely open for public inspection and education. A visit to the Titan Missile Museum represents a rare opportunity to learn about the much-feared prospects of the conduct of nuclear war and the efforts of the United States to deter it.

Filmography

The Titan Missile Museum was featured on the History Channel in two separate series in August of 2007: ***Lost Worlds: Secret A-Bomb Factories;*** and ***Mega Movers: Army Mega Moves.*** In 2012 it was featured in the reality TV show ***The Great Escape*** on TNT. The museum was also featured in a short documentary on nuclear tourism by ***National Geographic*** (see the link below), and in two documentaries that appeared on PBS as part of the American Experience series: *Uranium, Twisting the Dragon's Tail* (http://sploid.gizmodo.com/the-process-of-launching-a-nuclear-missile-is-completel-1720483308) and *Command and Control.* Finally, the museum was featured twice on the Travel Channel's ***Mysteries at the Museum*** series, most recently in a segment entitled *The Man Who Saved the World*, the story of Stanislav Petrov, the Soviet officer who may have prevented WWIII. See the following links for stories on the museum:

National Geographic, Inside a Nuclear Launch Pad: What Could Have Been WWIII
http://video.nationalgeographic.com/video/news/140915-nuclear-tourism-vin

Read an interview for *BBC Future* with Yvonne Morris, the Director of the Titan Missile Museum and a former Titan II Missile Combat Crew Commander:
http://www.bbc.com/future/story/20160729-the-hidden-base-that-could-have-ended-the-world

Tour the Titan Missile Museum with Rajan Datar of *The BBC Travel Show* and Yvonne Morris, Director of the Titan Missile Museum and a former Titan II Missile Combat Crew Commander:
http://www.bbc.co.uk/programmes/p041fdj2

Listen to a story about the Titan Missile Museum on NPR:
http://www.npr.org/templates/story/story.php?storyId=7284003

Read about the Titan Missile Museum in the New York Times:
http://travel.nytimes.com/2007/01/05/travel/escapes/05atomic.html

http://www.nytimes.com/packages/html/travel/20070105_ATOMIC_FEATURE/index.html

Directions:

The Titan Missile Museum is located approximately 25 miles south of Tucson, Arizona, at 1580 W. Duval Mine Rd., Sahuarita, Arizona.

From Tucson, take I-l9 south toward Green Valley and Nogales.

Exit I-19 at Duval Mine Road (exit 69).

Turn west on Duval Mine Road. Follow the signs to the Titan Missile National Historic Landmark. The entrance to the museum is on the north side of the road approximately l/l0 mile past the intersection of La Canada and Duval Mine Road.

Hours:

The museum is open every day of the year except for Thanksgiving and Christmas.

Winter Hours (November- April)

9:45 AM - 5:00 PM Sunday-Friday
The first tour of the day begins at 10:00 AM and the last tour of the day begins at 3:45 PM.

8:45am – 5:00 PM Saturday
The first tour of the day begins at 9:00 AM and the last tour of the day begins at 3:45 PM.

Summer Hours (May-October)

9:45 AM - 4:00 PM Sunday-Friday
The first tour of the day begins at 10:00 AM and the last tour of the day begins at 2:45 PM.

8:45am – 5:00 PM Saturday
The first tour of the day begins at 9:00 AM and the last tour of the day begins at 3:45 PM.

Admission:

Adult (13+)	$10.50
Seniors (65+), Military, Pima County Residents, Groups	$9.50
Children ages 5-12	$7.00
Children 4 and Under and School/Youth Groups	FREE

Planning a Visit:

- One-Hour guided tours of the missile site are offered at least once an hour beginning at 10:00 am Sunday-Friday and 9:00 am on Saturday. During the winter months, tours will generally run every 30 minutes.
- Groups are welcome on a first come, first served basis. Reservations are required for general admission group tours (10 or more paid visitors paying in one transaction). Please call the visitor reservations line at (520) 625-4598. For school groups and educational programs, please see the Education section of our web site.
- Daily guided tours include a visit to the underground launch control center, and a simulated missile launch. After the tour, visitors can stand on top of the launch duct and look at the 7-story missile from above.
- Walking shoes are required (no heels please).
- Strollers are prohibited on all guided tours.
- Weapons are prohibited. Gun storage is available.
- Large purses, backpacks, cinch sacks, camera bags and diaper bags are prohibited on the guided tours.
- Food and beverages, except bottled water, are prohibited.
- Smoking is not permitted inside museum buildings or while on the guided tour.
- The underground portion of the missile site is accessed by a flight of 55 steps in the Access Portal.
- The Titan Missile Museum is an ADA compliant facility. All restrooms are wheelchair accessible and handicapped parking is provided. An elevator is available to access the underground portion of the missile site for those who have limited mobility or who need special assistance.
- The Museum Store is open during regular Museum hours, and features top-quality museum, rocket and flight-related gifts, apparel, books, models, and educational toys. Museum admission is not required to shop in the Store, and sales proceeds support the mission of the Titan Missile Museum.
- Non-commercial photography and video recording are permitted. Commercial photography is not allowed without written permission. To arrange a commercial photo or video recording session, please contact the Museum at (520) 625-7736.
- Tours are limited to 25 visitors per tour. Taking the guided tour is the only way to see the missile site.

More information about the Titan Missile Museum and the Titan II ICBM can be found at the museum's web site at http://www.titanmissilemuseum.org/

Special Tours:

Beyond the Blastdoor Tours: 1st and 3rd Saturday mornings of every month, 9:30 AM-11:15 AM. Explore areas of the missile site generally closed to the public. Visit the missile crew quarters and see where the crews ate and slept. Then, descend more than 100 feet underground to level 7 of the missile silo. There, you will walk into the launch duct and stand directly underneath the missile.

Admission: $20/person

No discounts or coupons apply.

Sorry, but this tour cannot accommodate wheelchairs, scooters, walkers, crutches, or children under 10 years old.

Tours are limited to 20 people. **Reservations and advance payment are required,** and may be made by calling (520) 625-7736, or emailing info@titanmissilemuseum.org

Director's Tour: 1st Thursday of each month; 8:45-11am. Tour the missile site with Yvonne Morris, Director of the Titan Missile Museum and a former Titan II Missile Combat Crew Commander. Part of the tour takes place on level 2 of the launch duct, an area that has rarely been open to the public. While visitors stand just inches away from the largest land-based missile ever deployed by the US, Yvonne will share her unique perspective on the Titan II and its mission of peace through deterrence. No other tour brings visitors this close to the missile. This tour is limited to 6 people and is not accessible to visitors who use a wheelchair, walker, cane or crutches. You must be at least 12 years old to go on this tour. **Reservations and advance payment** are required and may be made by calling 625-7736.

Admission: $29.95/person (No discounts apply)

Titan Top-to-Bottom Tour: Email info@titanmissilemuseum.org **or visit** www.titanmissilemuseum.org **for dates.**
You'll explore all 8 levels of the museum's underground Titan II missile silo, from level 1 where you'll view the silo closure door opening mechanism, to level 8 more than 140 feet underground where you'll see the propellant pump rooms. Other stops include silo level 3 where you'll see the massive diesel generator, and silo level 7 where you'll enter the launch duct and stand directly underneath the missile.

You must be at least 16 years of age, able to climb up to seven 15-foot ladders in an emergency and fit through holes 2 feet in diameter to go on this tour. Sorry, but this tour cannot accommodate wheelchairs, scooters, walkers, crutches, or any other physical impairment. The tour is limited to 6 people and **reservations and advance payment are required**. For more information or to make a reservation, email info@titanmissilemuseum.org

Admission:

Members: $89.95
Non-Members: $99.95

The Titan II

The Titan II was a second-generation, 2-stage, silo-stored, silo-launched, liquid propelled ICBM. It was stored in a hardened underground silo with its liquid propellant on board, so that it was ready to launch at all times. An ICBM is a missile specifically designed to carry a nuclear warhead from one continent to another. These missiles are ballistic because, like the shell from a gun, they receive a brief but powerful initial push from a rocket motor, then follow a ballistic free-flight trajectory to the target.

While the Titan II was designed for the purpose of carrying a nuclear warhead from the United States to another continent, it was built for another purpose altogether. And that purpose was that the Titan II would never launch at all. The primary mission of the Titan II was "Peace Through Deterrence." America's strategy in deploying the Titan II was to prevent other countries from ever attacking it with nuclear weapons by demonstrating that it had the ability to retaliate against a nuclear strike to such a degree that the attacking country would be virtually destroyed, even if that country launched its weapons first. For 24 years, nearly a quarter of a century, Titan II missiles stood guard over America, fulfilling this mission.

The Martin Company first proposed the development of the Titan II in 1958, and the Air Force approved the program in October of 1959. Construction of the launch complexes began in December of 1960. The first missile was installed in December of 1962, and the first unit was turned over to the Strategic Air Command (SAC) on March 31, 1963. Four important changes distinguished the Titan II from its predecessors, the Atlas F and the Titan I. First, the Titan II used nitrogen tetroxide (oxidizer) and unsymmetrical dimethyl hydrazine (fuel) as its propellants. These liquids are hypergolic, meaning that they ignite on contact. This increased the reliability of the Titan II, both at liftoff and when the Stage II engine ignited at high altitude. Second, nitrogen tetroxide is noncryogenic, so that both propellants could be stored on board the missile for indefinite periods of time. Third, the Titan II would also launch from its underground silo, reducing the launch time of the missile to just under a minute. Finally, the Titan II utilized an all-inertial guidance system, increasing its accuracy over the Titan I. Carrying the largest nuclear warhead ever deployed on an ICBM by the United States, and with a range of 5,500 miles, the Titan II was the ultimate liquid propellant ICBM.

Fifty-four Titan II ICBMs were deployed in groups of eighteen around three Air Force Bases, with the first units coming on alert in early 1963. All fifty-four missiles were on alert by December of that year. Davis-Monthan AFB, Arizona hosted the 390th Strategic Missile Wing which was comprised of the 570th and 571st Strategic Missile Squadrons. Little Rock AFB, Arkansas hosted the 308th Strategic Missile Wing which was comprised of the 373rd and 374th Strategic Missile Squadrons. And McConnell AFB, Kansas hosted the 381st Strategic Missile Wing which was comprised of the 532nd and 533rd Strategic Missile Squadrons.

Originally designed for a ten-year deployment, the Titan II program was extended by a series of modifications and upgrades. One such modification replaced the all-inertial guidance system with the Universal Space Guidance System (USGS) developed by MIT and Delco Electronics. In the end, the Titan II more than doubled its planned deployment. But in October of 1981, President Reagan announced the start of his Strategic Forces Improvement Program. As part of this program, the land based ICBM programs would be modernized, and the Titan II was identified for deactivation to make way for more advanced systems such as the MX Peacekeeper. Deactivation of the Titan IIs began in 1982 at the 390th SMW. The 381st SMW followed, and finally, in 1987, twenty-four years after its initial deployment, the Titan II program came to an end when the 308th SMW was deactivated.

Titan II Facts:

Length:	103 feet
Width:	10 feet in diameter
Weight at liftoff:	Approximately 330,000 pounds, depending on the propellant load
Warhead:	W-53
Yield:	Approximately 9 megatons (equivalent to 9 million tons of TNT)
Launch Sequence (key turn to liftoff):	58 seconds
Time to target (from liftoff to detonation):	25 to 30 minutes
Range:	Approximately 5500 nautical miles
Velocity:	Approximately 17,000 miles per hour
Underground Launch Duct:	146 feet deep, 26 feet in diameter
Cost to build (in 1963 dollars):	Each missile site: 8.3 million dollars Each missile: 2.2 million dollars
Annual Operating Cost (in 1984 dollars):	Approximately 1.964 million dollars

From liftoff to target, the flight time was 30 minutes. Only 5.5 minutes of that was powered flight. The other 24.5 minutes was ballistic free flight.

Each site consisted of a missile silo, a launch control facility and an access portal. The sites were staffed 24 hours per day, 365 days per year, by 4-person missile combat crews who deployed to the missile sites for 24-hour shifts, called alerts. Each crew pulled an average of 8 to 9 alerts a month, meaning they often worked the equivalent of 5 weeks in a 4-week month. Crew members consisted of two officers—the Missile Combat Crew Commander (MCCC) and the Deputy Missile Combat Crew Commander (DMCCC), and two enlisted personnel—the Ballistic Missile Analyst Technician (BMAT) and the Missile Facilities Technician (MFT).

Professional Bio of Yvonne C. Morris

Yvonne C. Morris, Director of the Titan Missile Museum since October 2004, brings a very personal perspective to her job. As an officer in the United States Air Force, she was one of the Missile Combat Crew Commanders responsible for missile site 571-7, which is now the Titan Missile Museum. When Yvonne talks about the missile museum, it is real. She lived it.

She was commissioned through the Air Force ROTC program at the University of Virginia (UVA). While in college, Yvonne was selected to be among the first group of women recruited by the Air Force in 1978 for duty in the Titan II system. She received a Bachelor of Arts Degree with Distinction in Speech and Communications in 1980 from UVA. In 1981, after graduating with distinction from Missile Launch Officer Training, Yvonne was assigned to the 390th Strategic Missile Wing (SMW) at Davis Monthan AFB, Tucson, Arizona. During her assignment with the 390th SMW, Yvonne served as a Missile Combat Crew Commander and instructor. Yvonne trained other crew commanders, managed combat crew training for the entire Wing, and served as an advisor to the Wing Commander and his Battle Staff. Among the launch facilities where Yvonne and her crew pulled alerts was missile site 571-7 at the Titan Missile Museum.

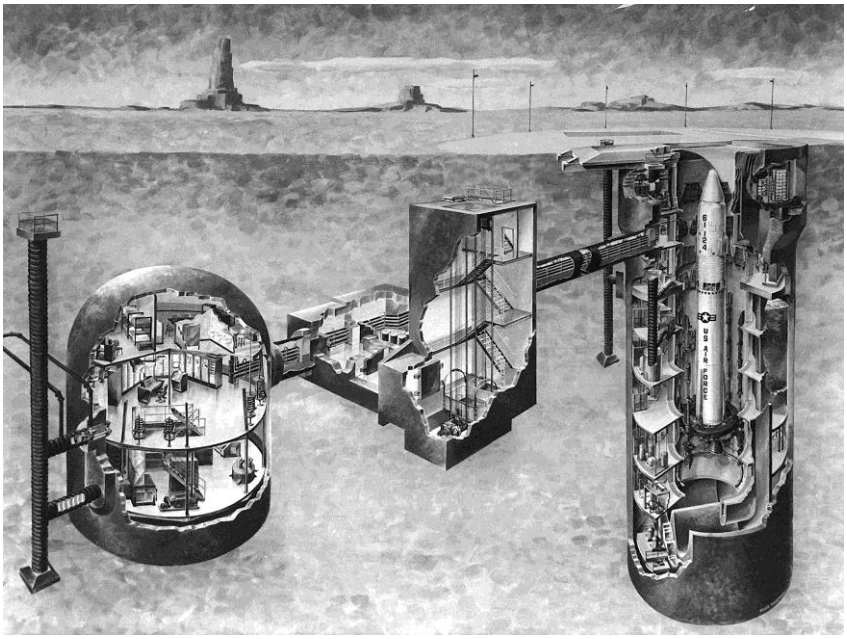
After she left the Air Force in 1985, Yvonne was a legal researcher for the Civil Division of the Pima County Attorney's Office where she wrote appellate briefs in civil rights cases for attorneys appearing before the Ninth Circuit Court of Appeals and the United States Supreme Court.

Putting her Air Force training to good use, she began volunteering as a Docent and Instructor at the Titan Missile Museum in 1998. In 2000, she was appointed to the Board of Trustees of the Arizona Aerospace Foundation. In 2002, she became the chair of the Foundation's Titan Missile Museum Committee which provided oversight for the design and construction of the Count Ferdinand von Galen Education and Research Center for the Titan Missile Museum. Two years later, she was appointed Director of the museum. Yvonne was appointed the Executive Director of the Arizona Aerospace Foundation in July of 2008 where she oversaw the Pima Air & Space Museum in addition to the Titan Missile Museum. She returned to the Titan Missile Museum as its fulltime Director in October of 2014.

Yvonne has appeared on several history and tourism themed television shows and documentaries, including *Inside a Nuclear Launch Pad: What Could Have Been WW III* by *National Geographic*, *Secret A-Bomb Factories* for the History Channel, *No Reservations* with Anthony Bourdain on the Travel Channel, *Mysteries at the Museum* on the Travel Channel, *Tracks Across America* with Billy Connolly, *The BBC Travel Show*, Arizona Highways, and California's Gold with Huell Howser. She

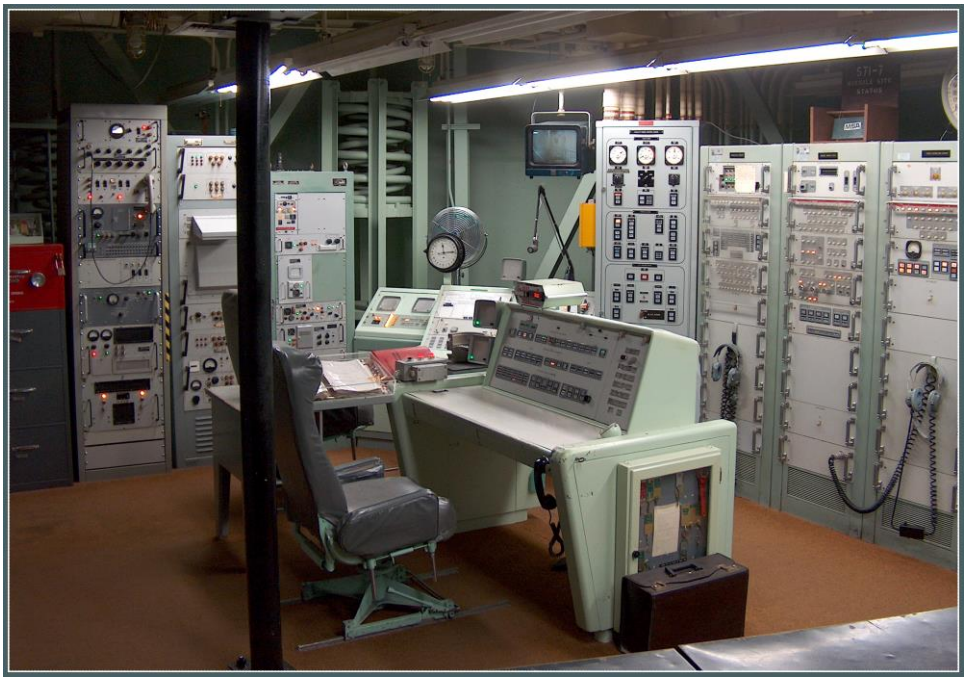
was also a featured speaker at the first Cold Culture Symposium, an international symposium on new approaches to Cold War research, education and expression at the Diefenbunker Museum in Ontario in 2008, and at the Mutual Concerns of Air and Space Museums Conference in 2011 where she spoke on the topic of interpreting the role of nuclear weapons in the Cold War.

The following images of the Titan Missile Museum are available for use with permission from the museum:



This is an artist's rendering of the underground complex. The center structure is the Access Portal which is the primary entry point for the underground complex. It consists of a flight of steps and a freight elevator that take you 35 feet underground. At that point you enter the hardened portion of the missile complex through the Blastlock Area. Once in the Blastlock Area you can turn left and enter the 3-story Control Center or turn right and head down the Long Cableway to the Missile Silo.

The Long Cableway.

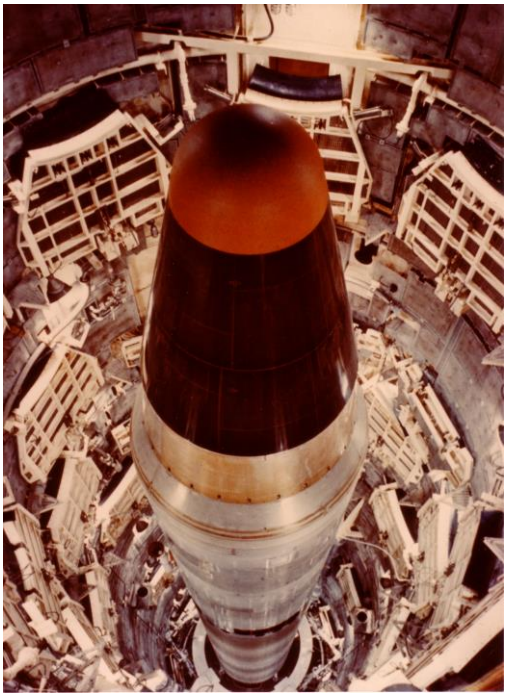


The Launch Control Center

Titan II Launch (test)

Yvonne C. Morris, Missile Combat Crew Commander, 1983

Titan II ICBM in the Launch Duct at the Titan Missile Museum



Operational Titan II on alert

Titan II ICBM Launch (test)