TITAN MISSILE MUSEUM

TOPSIDE TOUR GUIDE

The layout of the missile silos was the same for all 54 sites, with slight variations in antenna placements. It is important to note that the topside equipment at the Museum would not have been visible on a regular day; only the silo door and antenna poles would be there.

There were three **air shafts** that provided air circulation to the underground complex. Two were for fresh air intake, while one was for air exhaust. The shafts were made of corrugated metal pipe sections 3 feet (1 m) in diameter that opened to the surface; two are next to the silo door. One air intake shaft was built next to the Launch Control Center and provided the crew with fresh air. It was also used as an emergency exit. Now an AC unit sits on top of the hole.

A few **Bell UH-1 "Huey"** helicopters were used to transport crews to their assigned missile site when heavy summer rains would make the dirt roads inaccessible with regular vehicles.
In addition, the Huey's were used for airborne security, the critical maintenance crew and parts, and as a MedEvac helicopter in case of injuries on site.

Inside the fence, security was maintained with the **AN/TPS-39 radar surveillance security system**. Pairs of TPS (tipsie) units are located at each corner of the silo (short scoop poles) and also on each side of the Launch Control Center air intake shaft. These shorter poles on both sides of the air shaft would project a beam that would be triggered by motion. The TPS-39 sensors had their own battery backup; in case of total power failure they could stay on for a couple of hours.

There are many **antennas** in the site's yard, because there were four separate communication systems. They were used to stay in communication with higher headquarters, an aspect that was of extreme importance. The main communication system was made up of hard and soft antennas, the hard ones were backups. These "hard" backups could survive a nuclear blast because they would be stored in hardened silos and/or underground.

The biggest antenna used for communications was the **High Frequency Short Antenna**, or discage antenna. It is viewable in the parking lot of the Museum and resembles a Christmas tree. This antenna was "soft," meaning that it would not survive a nuclear blast. It is operational to this day.

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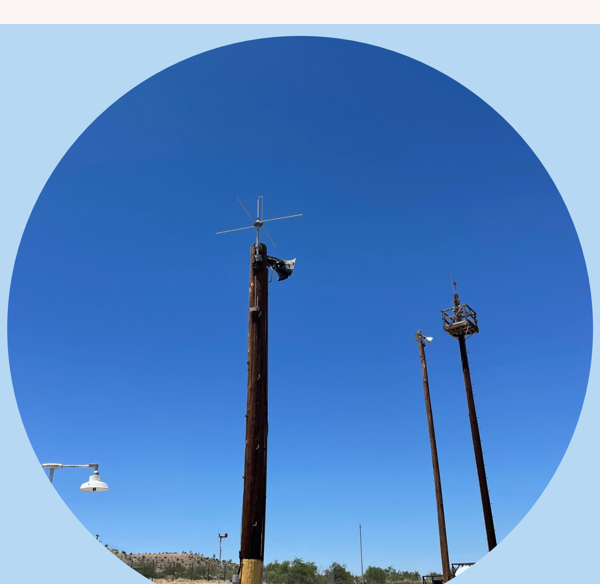
A semi-hardened, cone-shaped **Ultra High Frequency (UHF) Antenna** was used to communicate with helicopters and other aircraft. These aircraft would be linked to the Command Post and Strategic Air Command. The latter would be an airborne command post known as "Looking Glass," and commonly referred to as the "Doomsday Plane." This aircraft would give the orders to launch the missile.

Close to and outside the fence, on the right of the main access portal, you can see two other examples of soft and hard (pole-like) antennas. The one on the left, with the square base, is the soft **IRCS Antenna**. This antenna was designed for frequency diversity. This means that it could operate on many different frequencies at the same time. This antenna would deliver the order to launch, as it would be a direct link to Strategic Air Command (SAC) Headquarters.

The **IRCS antenna** was extremely important for the site and the crew. Because it was soft, two **backups** were built. These two antennas were hard, meaning that they could survive an attack. This is because the antennas would be stored in underground hardened silos, and would pop up and be operational in only 50 seconds.
Only one "pop-up" antenna would be used first, because the second served as the backup for the backup.

Behind the access portal, you can see a globe-like antenna. This is the **Survivable Low Frequency Communications System (SLFCS) Antenna**. It was installed in 1967 and buried underground. This antenna was not hard, but its underground placement increased the chances survival in case of a nuclear blast.
The system provided receive-only data communications, which would be printed on paper in the Launch Control Center.



The **Radio-Type Maintenance Network (RTMN) Antenna** can also be seen. It sits atop a pole close to the access portal. This pole is also equipped with the **Voice Signaling System (VSS)** speaker. This antenna had a more localized use, as it would allow communications between the crew and the maintenance teams working topside. The antenna could be disabled when not in use. The **VSS** would be used to make public announcements from the Launch Control Center to the topside crew.

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The 55-foot wooden **"Delta-T" pole** with the crows-nest on top was used together with an anemometer, which captured the speed of the wind and its direction. This was an important aspect, as weather conditions would need to be assessed before and during fueling and defueling the missiles' highly toxic propellants. The Delta-T pole was also fitted with sensors to gauge the atmospheric air pressure and temperature, as these two factors were critical in the fueling and defueling process.

Behind the Huey helicopter, you can see a **pole with 3 colored bulbs on top**. The colors were red, yellow, and green like a traffic light. Their job was to provide a visual indication of the status of the complex. The green and yellow lights were standard light bulbs, but the red light was a rotating beacon. If nothing distressing was happening, the green light would be on. The yellow light would indicate possible hazards, while the red light was for extreme scenarios.

Always behind the helicopter, you can see another pole. This one is equipped with a yellow speaker. This was an air-powered siren "**Thunderbolt"**, which was installed in 1981 after the Damascus, AR accident. When activated, this siren was extremely loud and could be heard more than a mile away. During the Cold War, all the major cities were equipped with these sirens. These sirens would be activated to warn the nearby population of imminent nuclear attacks or disasters. The siren would be activated from the Launch Control Center, and tested every Friday at noon.

To know its coordinates before launch, the missile had to be aligned with True North. To do so, the **Theodolite Station** would be used. It was a tripod, and its placement can be seen next to the silo door (northwest corner). A hatch next to it would also be opened to reveal a pipe that connected to the silo. That, together with two concrete monuments outside the fence were used to coordinate the Theodolite pole to True North. The **AAS Auto Collimator** in the silo would in turn align the missile's guidance system.

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A complex system **(PTS)** was used to load and unload the missile's propellants to minimize the venting of fuel and oxidizer vapors. After PTS operations were completed, it was necessary to clean the pipes involved. To do so, the pipes were cleaned with propane gas, and the vapors would exit from a burner (picture above) exposed to the atmosphere.
Tanks mounted on trailers would be used to supply propane. Its use neutralized the toxicity of the propellants.

The **silo door** is considered to be the most complex component of the sites. The door is 43 feet (12.5m) long, 64 feet (19.5m) wide, and 5 feet (1.5m) thick at the center. The silo door weighs anywhere from 699 to 749 tons. The door could open in only 20 seconds by rolling on 30in (76cm) wheels, which would slide on the two railroad tracks. The opening of the door exposed two large exhaust ducts on either side of the silo. These ducts were 150 feet (45.72m) deep and reached the bottom of the silo.

The **glass viewing dome** was installed when this site became a museum. The reason behind its installation lies in the terms of the **Strategic Arms Limitation Treaty (SALT II)**. The treaty was signed between the US and the Soviet Union, and limited the number of nuclear heads that both countries could have. The dome allows the Russian satellites to check that the missile is unarmed. If you look at the Re-Entry Vehicle, you will notice a hole that allows to verify the harmlessness of the missile.

The Titan II Missile was completely fueled while sitting in the silo. The fuel (**Aerozine-50**) and the oxidizer (**Nitrogen Tetroxide**) would need to be removed and put back into the tanks at certain maintenance intervals. To do so, several pieces of equipment were used. The **tanker trailers** for both propellants would be needed to pump the propellants into their respective **conditioning and holding trailers**. Throughout the entire process, the pressure and temperature of the propellants would be monitored inside the **command trailer**.

Next to the command trailer, where the chemicals' temperature and pressure would be monitored and manipulated, there was another trailer that contained the **equipment and the protective RFHCO suits** used by the crews to handle the toxic propellants.
A **fire suppression trailer** containing foam and water tanks was also on site in case a fire started. A **portable A/C electrical generator** was also used to give power to the trailers during transfer operations.

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The Titan II missile used a **two-stage engine**. The **first stage engine** (left photo) burned for 2.5 minutes and consumed around 25,500 gallons (96,500 l) of fuel and oxidizer - around 170 gallons (640 l) per second. **Stage two** would ignite after stage one ran out of fuel. Then, explosive bolts would separate the two stages. Stage two (picture above) would burn for 3 minutes and bring the missile to an altitude of 200 miles (320 km). Stage 2 would turn off when on course.

Between the silo door and the pole with the Thunderbolt siren you can see **two pits**. One is enclosed with a metal cover, while the other is open and surrounded by a handrail. The covered pit contained an **electric power transformer**. It was used to supply the complex with **480-volt** electricity and it was connected to a distribution center at Level 3. At Level 3, there was an emergency generator used to supply electricity to the complex in case of a blackout.

The open pit housed the **cooling tower**. A modification made only in Tucson replaced the original equipment with more **modern refrigerated coolers**. The original towers worked with the site's underground water chillers to regulate the temperature in the complex. This way they could maintain the launch duct at **60 degrees Fahrenheit (15 C)**, and the complex at **72 F (22 C)**. The modern coolers did not need the underground chillers to work.

On the truck, you can see the **Re-Entry Vehicle (RV)**. It was built by General Electric, and it housed the **W-53 9 Megaton thermonuclear bomb**. The RV's name refers the fact that the RV would exit and reenter Earth's atmosphere, traveling at 16,000 mph (25,000 km/h). The RV did not have a guidance system, but it had thrusters that would adjust the trajectory. The RV's shell would also erode upon reentry, protecting the W-53 bomb from damage.

The **adapter** section paired the RV with the missile and it contained **cylinders filled with metallic balls**. These cylinders would explode upon reentry into Earth's atmosphere and above the target. The metallic balls would then be ejected around the RV in an effort to create a **decoy**, and confuse the enemy radar. The decoy mechanism was abandoned in 1975 but the cylinders remained.