DYESS AIR FORCE BASE, ATLAS F MISSILE SITE S-8, LAUNCH FACILITY

HAER No. TX-25-B

Approximately 3 miles east of Winters,
500 feet southwest of Highway 1770, center of complex
Vicinity of Winters
Runnels County
Texas

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

HISTORIC AMERICAN ENGINEERING RECORD
Southwest System Support Office
National Park Service
P.O. Box 728
Santa Fe, New Mexico 87504

HISTORIC AMERICAN ENGINEERING RECORD

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Date of Construction:	1962
Engineer:	U.S. Army Corps of Engineers
Builder:	U.S. Army Corps of Engineers, H.B. Zachary and Brown & Root, Inc.
Present Owner:	
Present Use:	
Significance:	The threat posed by intercontinental ballistic missiles (ICBMs) lay at the heart of nearly all foreign policy decisions during the Cold War Era. The Atlas program produced the United States' first operational intercontinental ballistic missile and served as the template for the technological and organizational aspects of later ICBM programs. The Atlas F missile represents the culmination of this pioneering effort and the launch facility at Atlas F Missile Site S-8 at Winters, Texas is a representative example of a crucial facility at one the first operational ICBM launch complexes in the United States
Report Prepared by:	Sheila McCarthy, Roy McCullough, James Gorski, Tri-Services Cultural Resources Research Center U.S. Army Construction Engineering Research Laboratories 2902 Newmark Drive Champaign, Illinois 61826
Date:	February 1996

The Atlas F Missile Site S-8 Launch Facility [1]

Construction at the missile silo began on 28 June 1960. DW-20 scrapers, three dozers, and a grader were used for open cut excavation until reaching a "reference elevation" of 960.5 feet on 13 July 1960 (the top of the shaft is considered to be reference elevation of 1000). Silo shaft excavation began from this elevation on 23 July 1960. A type of front-end loader with a rear ripper teeth attachment, called a "taxcavator" began the process. A 40-ton crane with a clam bucket removed the excavated material from the shaft. As the excavation progressed, a hoist with a bucket and guide tracks was installed for earth removal. The excavation proceeded smoothly until reaching "reference elevation 88," at which point the material, composed of gypsum, limestone, and shale, became impenetrable using the current excavation method. The contractor deemed it necessary to "drill and shoot", using explosives to loosen the material. Three "shots" were drilled, each approximately 21 feet deep. Each individual shot was made up of 300 two inch holes. Approximately 3/4 pound of dynamite was used per cubic yard of excavated material. The result was a conical pile of debris with the shale and limestone broken down into pieces less than a foot in size. The "gypsum" did not fracture well and it was necessary to use cables to remove the larger blocks from the shaft.

As the excavation proceeded, shoring became necessary to resist the ever increasing pressures generated by the surrounding earth. This was accomplished by bolting together circular I-beam segments to form a continuous "ring beam" around the perimeter of the excavation. The space between the rings was filled with welded wire mesh and pneumatic concrete, and metal or wood shoring.

Once excavation was completed, the floor of the shaft was sealed with reinforced concrete. After the placement of the reinforcing rods, the concrete pour was made using a 2-ton

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[1]The following details on the construction process can be found in Leroy V. Ecklund and John L. Lee, "History of the Dyess Area Office, 18 April 1960-28 April 1962." This CEBMCO publication is deposited in the Corps of Engineers, Office of History Military Files Holdings at Fort Belvoir, Virginia, Series XVIII "Space and Missiles File," carton #16, Folder #3.

bucket lowered into the shaft by a truck crane. Upon completion of this operation, the installation of reinforcing steel for the silo walls began. Upon reaching a certain elevation,the installation of reinforcing steel was halted and a steel bridge system was erected. This system would suspend steel rods used to support and raise the "slip form." The slip form was a circular wooden device, 4 feet 6 inches high, consisting of two separate platforms. The top platform was designed to carry the concrete buggies that were used to pour the silo wall. The lower platform carried the concrete finishers. The steel rods supporting the slip form were raised with manually controlled pneumatic jacks capable of moving the slip form at a rate of 13 inches per hour. Once this initial concrete pour set, the installation of reinforcing steel for the higher elevations began and the entire process was repeated.

The erection of the octagonal steel crib began once the silo shaft walls were complete. In most cases, the crib was temporarily supported at the bottom of the silo, but erection does not proceed beyond the third level until after the spring hangers are installed.[2] When completed this crib will support the missile and eight work levels on which operating ground equipment (OGE) and missile launch equipment are situated. The crib is equipped with a facility elevator that descends to level eight, and spiral stairs that reach to level seven, from which a ladder is provided for access to level eight. The crib's overall length is 42 feet wide and 151 feet deep, and is hung from the concrete silo wall by a more elaborate version of the suspension system used in the Launch Control Center. A "rattle space" is provided between the crib and the silo wall to allow for some degree of movement.[3]

The crib suspension system provides isolation for the crib structure, the supporting equipment and, the missile, from the damaging effects of a ground shock. The system consists

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[2]Silo construction was standardized in many respects. The following discussion of crib assembly and equipment installation is taken from the "CEBMCO Historical Summary Report of Major ICBM Construction: Lincoln Area, Atlas 'F'." This report is deposited in the Corps of Engineers, Office of History Military Files Holdings at Fort Belvoir, Virginia, Series XVIII "Space and Missiles File," carton #17.

[3]579th Strategic Missile Squadron, "Operational Readiness Training: Atlas "F" Silo Familiarization," September 1962, Walker, AFB, 93.

of four silo wall brackets and the crib suspension shock struts. The silo wall brackets are mounted on the silo wall 90 degrees apart near the top of level two. These brackets are capable of mounting and supporting the crib suspension shock struts which in turn support the entire crib assembly. Each strut is 64 feet, 2.5 inches long and has seven decks of springs, three sets of springs per deck. Eight crib suspension shock struts are paired into four sets, each set mounted to a corresponding wall bracket.[4]

After crib assembly installation began, the tanks necessary for the Propellant Loading System were installed, including a 23,000 gallon capacity LO_2 tank and three GN2 tanks. Delivery of these vessels to Dyess, however, was delayed, thus necessitating certain minor modifications in the construction sequence.[5] To avoid lost time, the structural steel for level eight was left and a minimum of cross bracing was installed between levels seven and eight. The placement of the silo cap was postponed, but an 18 inch parapet wall was cast 9 feet around the perimeter of the silo to permit the completion of the backfill. Once the vessels were delivered to the site, a derrick lifted and lowered each vessel into place.

The installation of supporting mechanical and electrical equipment began after the installation of the crib assembly was substantially completed. Work was first performed on the floor grating, stairs and ladders, and handrails to provide a safe, accessible environment for the workers. Next, preassembled piping units, electrical equipment, and the mechanical units were installed. Various other specialized equipment such as the launch platform counterweights and drive mechanisms were also installed during this phase. Finally, the silo cap and doors were cast. The silo cap is a 9 feet thick reinforced concrete slab, while the steel doors themselves are 2.5 feet thick.

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[4]Ibid., 13.

[5]Details on this delay can be found in, "Progress Report-November 1960," RG 77, Acc. # 64A-2125, carton #10, "Military Construction Project Files, 1959-1961," Folder 285/53 "CEBMCO, Letters, CY 60."

Final inspection of all equipment and systems was completed once the silo cap was finished. The testing and validation process was performed by special teams for each system, comprised of Corp of Engineers, SATAF and contractor personnel. Each test contained a number of checklist items with the completed test signed and documented by all parties concerned. "Without this procedure and close coordination final sign-off of the completed complexes would have been virtually impossible."[6]

Launching Atlas missiles from underground silos required the raising of the missile above ground prior to the launch.[7] This was accomplished by an elevator-type structure known as the launch platform. This launch platform had to be constructed to prevent flames and missile exhaust gases from entering the silo during firing and to withstand angular misalignment forces, engine exhaust temperatures, and the effects of engine blast.[8] The platform had an overall height of 49 feet, was approximately 16 feet square, and weighed approximately 222,000 pounds (without the missile and OGE).[9] The platform was raised and lowered by a drive system equipped with electric motors, gear reducers, cable drums, steel cables and counterweights. The counterweight was sized to minimize power requirements during missile raising.[10]

Also within the silo there existed a system of work platforms designed to provide access for inspecting, servicing, and maintaining the missile when inside the silo. This system consisted of six platforms: four work platforms, an engine access platform, and a safety platform. The four work platforms, positioned on levels two, five, five-A, and six, extend and retract from the missile enclosure walls powered by hydraulic cylinders. They were positioned to provide access

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[6]Ecklund and Lee, 51.

[7]The first ICBM with an "in-silo" launch capability was the Titan II.

[8]Department of Missile and Space Training, Missile Launch/Missile Officer Student Study Guide, (Sheppard Air Force Base, Texas, 1964), 17.

[9]Ibid., 17.

[10]Hansen, 22.

to the reentry vehicle, the boil-off valve area, the umbilical attachments, the booster engine nacelle area, and the vernier engines. The safety platform was located at crib level one and was extended when the main missile doors were opened for an extended time. The platform was also used to receive equipment lowered into the silo area through the silo doors. A "stretch mechanism" was positioned on the first work platform. This mechanism supplied "two upward acting forces at diametrically opposite sides of the missile skin rendering the thin-walled cylinder section of the skin safe from collapsing under its own weight in case the cylinder loses its internal pressure."[11]

Two steel doors capped the launching silo. Their combined length was 33 feet. Each individual door was 22 feet wide, 2.5 feet thick, and weighed 150,000 pounds.[12] The silo door system operated by hydraulic cylinders. Nitrogen gas was pumped to a high pressure and stored in accumulators. The gas pressurized the hydraulic fluid which, in turn, powered the hydraulic cylinders.

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[11]"Silo Familiarization", 94.

[12]Missile Launch/Missile Officer Student Study Guide, 34.