National Park Service
U.S. Department of the Interior

Minuteman Missile National Historic Site

Press Kit

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Updated: August 2016

The Delta-01 safe box once held several sealed authenticators and launch keys for use in the event of a launch order. The safe boxes were secured by two separate combination locks. Each of the Launch Control Officers would have their own separate lock.

The safe box is a physical representation of the past, present and future history of America's national security.

Park Overview

Preserving elements of the Minuteman II intercontinental ballistic missile system, the park interprets the deterrent value of the land-based portion of America's nuclear defense during the Cold War era and commemorates the people and events associated with this recent period of American history. Resources feature the Delta-09 Launch Facility, where a Minuteman missile is housed in its underground silo, and the Delta-01 Launch Control Facility, where Air Force personnel controlled and maintained ten of the 150 nuclear missiles located in South Dakota.

Superintendent:
Eric Leonard

Base Operating Budget:
$724,000 (FY16)

Employees:
5 permanent; 13 temporary

Volunteers:
8 volunteers; 2,666 hours (FY15)

Location:
Minuteman Missile National Historic Site is located at three sites along a fifteen mile stretch of Interstate 90 in western South Dakota. The Visitor Center is located immediately north of I-90, exit 131. The two historic sites which make up the park are four miles (Launch Control Facility Delta-01) and 15 miles (Launch Facility Delta-09) from the Visitor Center.

Acreage:
43.80 acres total
(40.15 federal and 3.65 nonfederal)

Legislation
Enabling Legislation
Nov. 29, 1999, Public Law 106-115

Boundary Adjustment
Sept. 18, 2013, Public Law 113–36

Purpose
The purpose of Minuteman Missile National Historic Site is to preserve, protect, and interpret the Delta-01 Launch Control Facility and Delta-09 Launch Facility associated with the Minuteman II Intercontinental Ballistic Missile System, and interpret its role as a key component of America's strategic defense in the broader context of the Cold War.

Park Description
A visit to the park provides an opportunity to explore the Minuteman II system's role as a nuclear deterrent during the Cold War and visit sites rarely seen by civilians while in use, but that nevertheless loomed large on the geo-political landscape. Those with a special interest in the Cold War or nuclear weapons could spend a half day or more at Minuteman Missile National Historic Site.

Visitor Center
The visitor center serves as the primary orientation point for the park, with exhibits, a theater, and a bookstore. At the visitor center, park rangers answer questions, lead programs, and assist visitors with their visit.

Delta-01 Launch Control Center
Delta-01, the launch control facility, is where support personnel lived above ground and missile combat crews manned the underground capsule. The 6.35-acre site includes two buildings. One building was the living quarters for 8 to 10 personnel and various equipment rooms. The second building was a large garage for military vehicles. The living quarters connected via an elevator to the launch control center.

Delta-01 is open to the public for ranger-guided tours only. Tickets are required for these tours: http://go.nps.gov/delta-01tour

Park rangers lead tours to the Delta-01 Launch Control Center, connecting America's Cold War defenses to the present-day.

Delta-09 Launch Facility (missile silo)
The Delta-09 missile silo, contains the Minuteman II missile and its silo and underground utility support building. At this 1.5-acre site, visitors can look into the viewing enclosure to see the missile. Delta-09 is open daily for visitors. A cell phone tour which explains the silo components is available to augment the experience: http://go.nps.gov/delta-09tour

Museum Collection Summary
The museum collection at the park primarily contains the contents of Delta-01 Launch Control Facility as it was left by the United States Air Force in 1993. These contents include the furnishings, electronics, books and maintenance items that were typical to these sites during their occupation. The park also has a substantial archives transferred from the Civil Engineering Squadron at Ellsworth Air Force Base that includes the shop drawings, modification paperwork, and technical orders for the maintenance and upgrades of the missile system in South Dakota. Several small personal collections have also been acquired by the Site since its formation in 1999 including personal papers, photographs, insignia, and other personal mementos.
The largest object in the park is the park's namesake, a 57 foot tall Minuteman II missile displayed in the silo at Delta-09.
Collection Size: 161,098

Visitation
In the first decade of park operations, visitation was limited due in part to the small size of administrative and visitor facilities. Since the completion of the visitor center late in 2014, and the installation of exhibits in 2016, visitation has significantly increased. This increase is expected to continue in the coming years.

Annual Visitation

Year	Visits
2004	4,924
2005	7,800
2006	16,754
2007	24,566
2008	30,615
2009	36,777
2010	42,348
2011	59,389
2012	75,654
2013	76,261
2014	62,058
2015	100,488
2016	78,3777 *(Through July 31, 2016)*

More Information
More information on the park may be found at our website: http://www.nps.gov/mimi/

This press kit and other media resources including photographs are available at http://go.nps.gov/missilemedia

Significance

The following significance statements have been identified for Minuteman Missile National Historic Site. (Please note that the sequence of the statements does not reflect the level of significance.)

1. *Facilities, Technology, and Engineering*—The Minuteman II Intercontinental Ballistic Missile System facilities known as Delta-01 and Delta-09 are the best preserved examples of operational Cold War missile facilities, representing unparalleled engineering feats and collaboration between the military and civilian contractors to design, construct, and activate in a short period of time a complex and enduring system and support infrastructure for protection against nations of like power.

2. *Air Force Mission*—The Delta-01 and Delta-09 facilities are symbolic of the dedication, preparedness, values, training, and espirit de corps of the U.S. Air Force personnel who operated, maintained, and supported the missile systems throughout the upper Great Plains in remote and forbidding locations during the Cold War.

3. *Geopolitics*—Once top secret and restricted, the Delta-01 and Delta-09 facilities were the ultimate deterrent produced by the military industrial complex that rose to defend the United States during the Cold War and brought major changes to rural areas in the Great Plains. Minuteman Missile National Historic Site is an ideal place for considering the impacts and choices a nation, states, and communities may face in providing for a common defense.

4. *Resonance*—The Delta-01 and Delta-09 facilities provide unique public access and a rare opportunity to experience a pristine Cold War nuclear weapons system, and to consider its social, political, and cultural importance in the past, present, and into the future.

Open daily, the Delta-09 missile silo provides the public with a rare opportunity to view first-hand a nuclear missile in a silo; a representative of the Cold War arsenal of 1,000 Minuteman Missile spread across the United States.

No, it's not the barbeque grill. A code burner stands sentry in the yard at Delta-01, a reminder of the layers of secrecy which were a part of daily life in the missile fields.

Painted on to the Delta-01 blastdoor is a mural which employs a pizza company motto from the year it was painted (1990) in a classic example of Cold War gallows humor.

Site Descriptions

The pastoral setting of the farm and ranch land in Western South Dakota belies that area's pivotal role in the Cold War. Beneath the prairie, in an area encompassing 13,500 square miles, were 150 underground missile silos, ach equipped with a nuclear-armed Minuteman. Also underground were 15 launch control centers, where Minuteman missileers were on duty 24 hours a day.

The Delta One Launch Control Facility and the Delta Nine Launch Facility survive as excellent examples of this "underground" Air Force. Together, these two facilities offer visitors the full story of the Minuteman missile system. Visitors can tour the support facilities and see how Air Force personnel lived in the missile field, enter the underground launch control center and view a missile silo equipped with a disarmed Minuteman II missile.

Delta One

The Delta One Launch Control Facility occupies an open, grassy tract of land approximately 1. 7 miles north of Interstate 90 at Exit 127. A barbed-wire security fence encloses Delta One. Access is controlled through a remote-controlled, chain-link, sliding gate.

Launch Control Facility (LCF) Support Building
Located just inside the sliding gate, the LCF support building provided lodging and cooking facilities for Air Force personnel, served as the security control center for Delta Flight, and housed environmental and electrical systems equipment for the underground launch control center. Prior to the 1993 deactivation of Delta One, a ten-person crew continuously staffed the LCF. Two officers stood vigil in the underground launch control center, replaced each morning by a new missile combat crew dispatched from Ellsworth AFB. Eight topside support personnel, including two flight security controllers, two two-person armed response teams, a cook, and a facility manager, worked three-day shifts.

The support building's main entrance is on the south side. The door opens into a narrow hallway that leads to a spacious dayroom that personnel used during their off-time to read, watch television, and relax. A kitchen and small dining area adjoin the dayroom to the west. A doorway at the west end of the room pens into a long central hallway flanked by seven bedrooms, men's and women's restrooms, and a utility room.

A doorway on the east side of the main entrance hall opens directly into the security control center. This room served as headquarters for the security police who constantly monitored Delta Flight. From a console in this room, guards observed the main entrance, operated the gate, checked visitors' credentials, and monitored radio transmissions. When alarms indicated that a missile silo area may have been breached, the guards also dispatched and monitored the armed response teams.

Launch Control Center (LCC)
The Delta One LCC is 31 feet beneath the support building. This blast-hardened structure served as the command post for the ten dispersed missiles of Delta Flight. After going through security clearance, Delta One launch control officers entered the LCC via an elevator.

A short corridor leads from the elevator to the launch control center. A sign on the wall and a yellow line painted across the floor mark the beginning of the LCC's ultra-high-security, "no-lone zone." Anyone crossing that line had

The Delta-01 day room provided a common area for topside crews to eat meals and relax in "the comforts of home."

to be accompanied or observed by another person who could detect erratic behavior or sabotage attempts. Launch control officers carried sidearms and were authorized to shoot in order to guard against sabotage or an unauthorized launch.

The entrance to the underground LCC capsule is sealed by an eight-ton, blast-proof, steel-and-concrete door. Artwork on the door serves as a darkly humorous reminder of the LCC's ultimate purpose. Emblazoned on the door's outer face is a painted depiction of a red, white, and blue pizza delivery box labeled "Minuteman II." A hand-lettered legend reads:

> *"World-wide delivery in 30 minutes or less, or your next one is free."*

Like the crews who painted "nose art " on military aircraft during World War II, the Cold Wlr's missileers often decorated the blast doors of underground LCCs.

The LCC is a protective shell, shaped like an enormous capsule. The shell measures 29 feet in diameter and 54 feet in length (outside dimensions) , and is constructed of heavily reinforced concrete with four-foot-thick walls. The interior surface is lined with I /4-inch-thick steel plate. Suspended inside the shell is a boxlike acoustical enclosure containing the launch control consoles, communications and missilemonitoring equipment, and accommodations for the two-person launch crew.

The acoustical enclosure is rectangular in plan, measuring approximately 12 feet wide and 28 feet long. Each corner of the room is suspended by a large pneumatic cylinder called a "shock isolator," which would help the control room survive a near-hit from a nuclear weapon. Hanging from heavy chains attached to the ceiling of the shell, the shock isolators would allow the enclosure to bounce in any direction with only minimal damage.

The LCC contains two consoles. Each console has a swiveling, high-backed, aircraft seat fitted with seat belts and a shoulder harness. The LCC's "commander" console is at the east end, directly opposite the entrance. The instrnment panel allowed the commander to continually monitor the operational and security status of each of the ten missiles and launchers in Delta Flight. The communications control or "deputy commander" console contains radio, telephone, and decoding equipment that enabled communication with other LCFs, base headquarters, and the Strategic Air Command.

Each of the two consoles includes a small panel that contained a spring-loaded, key-operated launch switch. The launch keys were kept in a red, padlocked, steel box mounted above the deputy commander's console. The walls of the LCC are lined with cabinets filled with computer equipment, radio transmitters and receivers, a telephone relay system, and a power control panel. The LCC is also equipped with a latrine, a small refrigerator and microwave oven unit, and a curtained sleeping compartment.

The LCC ordinarily used commercial electrical power to run its motor-generator, and was provided clean and cooled air from air-conditioning equipment located in the support building. However, the LCC could operate for sustained periods without topside support. In the event of a nuclear attack, an automatic blast valve system would have sealed the capsule off from the surface. The LCC crew could then activate a hand-pumped oxygen regeneration unit. Storage batteries provided emergency electrical power, and an emergency air-conditioning unit would have prevented vital electronic equipment from overheating.

Launch control officers trapped in the LCC after an attack could reach the surface through an escape tube that angles upward from the east end of the capsule. The Air Force plugged the tube at its lower end, and filled it with sand to prevent collapse. To exit, crew members had to remove the plug, dig out the sand, and climb through the tube to the surface.

Vehicle Storage Building

The vehicle storage building is near the northwest comer of the LCF support building. Built in 1968, this structure provided a heated parking area for vehicles, including the front-end loader used for snow removal.

Antennas

Dispersed across the grassy compound on the south side of the support building are two hardened high-frequency (HF) antennas and one ultra-high-frequency (UHF) antenna, which could provide the LCC with an uninterrupted communications link during a nuclear attack. Buried in the ground was a Survivable Low Frequency Communication System antenna.

Sewage Lagoons

Two large sewage lagoons are just outside the security fence, approximately 240 feet southeast of the support building.

Helicopter Pad

Helicopters often transported personnel and equipment between the LCF and the main base at Ellsworth AFB. A large helicopter pad located outside the security fence south of the support building provided a safe landing area.

As seen from the interstate highway, the Delta-01 Launch Control Facility blends into the rural background, appearing as an inconspicuous ranch house.

Aerial view of Delta-09 in use, 1992 (Library of Congress).

Delta-09, present-day. A glass enclosure placed over the silo allows visitors to view the missile emplaced below.

Delta Nine

The Delta Nine Launch Facility is approximately 11 miles west-northwest of Delta One. The launch facility occupies part of an open, grassy, tract of land, 0.6 miles west and south of Interstate 90 Exit 116. The tract is roughly rectangular in plan and surrounded by a chain-link security fence with a double gate on the east side. A gravel access drive leads from the nearby county road to the gate.

The Air Force graded the area inside the enclosure to form a level, earthen platform that is elevated a few feet above the surrounding terrain. The platform, which has a gravel surface, provided maneuver space for the transporter-erector vehicles that hauled and emplaced the Minuteman missiles. A smaller rectangular area at the north end of the platform served as a helicopter pad . Flood lights illuminated the area for nighttime maintenance activities.

Missile Launcher

The missile launcher served as a temperature-and-humidity-controlled, long-term storage container, protective enclosure, support facility, and launch pad for a Minuteman missile. The launcher consists of an underground launch tube surrounded by two cylindrical equipment rooms, and covered by a hardened, ballistically-actuated closure door. Air Force personnel could enter the launcher through a heavilysecured hatchway connected to the equipment room.

The launch tube is a reinforced concrete cylinder, lined with 1/4-inch steel plate, 12 feet in diameter, and approximately 80 feet deep. An electrical surge arrestor room is on the southeast exterior wall of the tube's lower level. The surge arrestors would have prevented the electronic equipment inside the launcher from being damaged by the electromagnetic pulse waves of a nuclear explosion. The west half of the lower level contains electrical equipment, including a dozen large emergency batteries. On the outer wall of the upper level is a bench, calibrated with compass bearings. Part of a complex optical alignment system, the bench was the support for an autocollimator, which was used to align the Minuteman missile's guidance system. A porthole that looked up through the open access hatch was also part of the system.

Along the northwest side of the upper level are racks of electronic equipment used to monitor and troubleshoot the missile system, communicate with the LCC, and conduct the countdown.

A massive, reinforced-concrete roof slab covers the launch tube. Cast into the southern edge of the roof slab is a pocket-like opening for the launcher closure door. The hexagonal-shaped, reinforced-concrete, closure door is three and one-half feet thick and weighs more than 80 tons. Prior to launch, a ballistic actuator would have opened the door. If the missile had to be replaced, maintenance workers used a cogged rail in the middle of the track apron to slowly jack the door open.

A white, fiberglass, monopole antenna rises from the base of the roof slab on the east side of the closure-door opening. This antenna is part of a microprocessor-based surveillance system designed to detect intruders at the launch site.

Launch Facility Support Building

Adjacent to the launcher is the underground launch facility support building, which provided electrical power to the site, as well as chilled "brine" to the launcher equipment room air handler. The air handler provided the electronics racks and launcher with temperature- and-humidity-controlled air. The support building contains a diesel-fueled standby power generator, electrical switch gear, a brine chiller, a hydraulic pump for the launcher's personnel access hatch, a temperature-control air compressor, and panels for mechanical, security, and communications systems.

Antenna

The site's hardened UHF receiving antenna is a few feet northwest of the silo opening. The antenna linked Delta Nine with the Strategic Air Command's airborne control center.

Azimuth Markers

The azimuth markers are surveyors' benchmarks used in conjunction with the autocollimator to align the Minuteman missile guidance system. Delta Nine has two azimuth markers; located approximately 1,000 feet northwest and north-northeast of the launcher.

Located immediately north of Interstate 90 at exit 131, the visitor center's highly visible location takes advantage of existing visitor traffic to and from Badlands National Park.

Visitor Center

Located immediately north of exit 131, on Interstate 90, the visitor center provides a critical location for orientation to the story of the Cold War and as an introduction to the public lands in Western South Dakota.

Funded by the National Park Service and the Air Force, the new 7,000 square-foot-facility incorporates both a visitor center with interpretive space as well as administrative offices.

Blending with the native landscape, the facility boasts integrated sustainable design that incorporates LEED requirements to the Gold level. Other sustainable features include a geothermal heat pump heating/cooling system, a non-discharging wastewater lagoon system and energy efficient lighting.

The facility is also designed with full ADA accessibility include curbing in the parking area and maximum 5% sloped walkways, accessible doors on the building and accessible restrooms.

The public portion of the building features immersive interpretive exhibits, a theater and multi-purpose room, and retail space for the Eastern National sales outlet.

The bas relief sculpture located near the entry to the visitor center the symbols of the Cold War superpowers along with representations of the respective nuclear arsenals to set the scene.

Visitor Center Exhibits

Exhibits in the visitor center provide a public venue for examining the challenges and paradoxes of Cold War, reflecting on a peaceful prairie that once held the power to destroy the world.

Exterior
A sculpture serves as an interpretive introduction, using bas-relief elements to contrast the symbols and missiles aimed by the two superpowers at each other during the Cold War.

With powerful imagery the three banners representing "Land, Sea, and Air," introduce each component of the nuclear defense triad; notably, two of the three were based out of nearby Ellsworth Air Force Base.

Lobby
"Great Plains or Ground Zero?" provides a brief interpretive and orientation overview so that guests may plan their visits—considering options for exploring the interpretive exhibits at the visitor center, touring Delta-01 and Delta-09, and/or visiting the South Dakota Air & Space Museum at Ellsworth Air Force Base.

"The Nation's Nuclear Defense" interpretive panel provides a contextual and thematic introduction to the nation's strategic triad of land, sea, and air defenses, and how Ellsworth AFB and the 44th Strategic Missile Wing fit within the triad. Maps provide a quick overview of the geography and command structure of the missile field. A graphic shows the relationship between the wing, squadrons, flights, and all 150 missiles.

"Dakota Destinations" provides a quick visual overview of nearby destinations, including Badlands National Park, Mt. Rushmore National Memorial, Devils Tower National Monument, Wind Cave National Park, Jewel Cave National Monument, Buffalo Gap National Grasslands, Black Hills National Forest, Custer State Park, and the Air Force Museum at Ellsworth Air Force Base. An inset video monitor features highlights from the Black Hills national parks.

"30 Minutes or Less" is a dramatic multimedia wall, designed to convey the climate of fear and intense polarization between East and West during the Cold War. Three monitors create a dynamic vista and add motion to the lobby.

When the Home Front Becomes the Frontline
"When the Home Front Becomes the Frontline" provides a thematic introduction to the Cold War that no one wanted to wage—and to the nuclear weapons that simultaneously deterred aggression and threatened devastation. As a consequence of their presence in our lives, we became forever "a different country."

A "Warning: Restricted Area…Use of Deadly Force Authorized" replica sign just visible inside the exhibit exit provides a thematically consistent message for visitors to walk on by!

The first in a series of visitor prompt panels, *"Home Front | Frontline"* poses a simple question: "How did the Cold War leave its mark on your home or neighborhood?"

The *"Worldwide Delivery in 30 Minutes or Less"* Blast Door transition element features a full-size replica of the Delta-01 launch control center blast door, complete with the Domino's pizza box art.

Bomb Shelter Basements
Through a combination of media, flipbooks, oral histories, and artifacts, *"Bomb Shelter Basements"* interprets popular culture, civil defense strategies, and diverse home front responses during the Cold War.

From the front, the double-sided prompt panel is titled *"Agricultural Fields | Missile Fields"* and asks "How could you live with a 1.2-megaton bomb in your backyard?" From the rear, the panel is titled *"Backyard Bombs | Bomb Shelter Basements"* and asks "How do you think bomb shelters would have kept you safe?"

"Promise & Peril" briefly explores the polarizing nature of the Cold War as expressed in popular culture of the period. The associated recliner provides a moment to reflect and browse a magazine-pouch of

Through a combination of media, artifacts, and exhibits, "Bmb Shelter Basements" interprets the many contradictions of the Atomic Age.

Four short films, including Meet The Missileers, bring life to the story through period film and interviews.

primary civil defense documents.

"Duck and Cover," is a video loop playing on the TV set showcases period US Civil Defense films such as "Bert the Turtle" and Soviet counterparts which may make visitors wonder if they should laugh or cry…

"In Plain Sight" recognizes that local landowners and residents played a special role in the Cold War—they lived with ICBMs in their backyards and had a diverse range of responses to their presence. Pick up the red phone here to listen to a companion audio interview program.

"Freeways, Fallout Shelters, and Family Basements" provides a brief overview of the nation's civil defense effort, including the interstate and defense highway system. An artifact case fitted out with 1962 Civil Defense supplies provides an echo of home and government attempts to prepare for a nuclear war.

"Preserving the American Way of Life," is a series of flip panels that features popular magazine covers on the front and once-classified documents on the inside.

Meet the Missileers

"Meet the Missileers" explores the daily lives of the men and women who trained to handle a 1.2 megaton nuclear missile…without mishap. The tight quarters of the underground control center are recreated here and visitors view an actual capsule toilet and may open a metal locker door to reveal a rotating uniform display, complete with a graphic collage of snapshots, personal memorabilia, and other ephemera on the interior door panel. *"Vigilance Around the Clock"* presents a flipbook of photos showing life in the missile field.

Viewed from the entrance, the *"Battle Ground | Ground Zero"* icon prompt panel provides a brief set-up statement, and then asks visitors "Could you turn the key?," An authentic launch verification panel is located immediately below. When viewed from opposite side, the header on the icon panel reads *"Cold Warriors | Hot Missiles,"* and asks visitors to put themselves in the shoes of trained launch control officers while considering a similar question. The nearby capsule chair provides a moment to reflect and browse a "Top Secret" file of primary source documents, including "Minuteman Service News" and technical orders. *"Hours of Boredom | Seconds of Panic"* introduces the work of missile officers in the underground control center with the *"Meet the Missileers"* short film.

Building and Maintaining the Missile Fields

"Building and Maintaining the Missile Fields" connects the Launch Control Facility (LCF) described in the preceding exhibits with the Launch Facility (LF), the silo facility that former missileer Alonzo Hall calls "the tip of the spear."

"The Tip of the Spear" element replicates a circular silo wall with an actual silo work cage suspended from the ceiling, a mannequin wearing a missile tech uniform, and a large floor graphic featuring a dramatic a view looking into a silo. Collectively these elements provide a sense of scale and immersion for the supporting exhibits about missile technicians.

The primary interpretive panel in this area, *"Building and Maintaining the Missile Fields,"* explores what it took to build the missile fields and then maintain them at a 99-percent flight ready status at all times. Containing a collection of artifacts and memorabilia, the "Cold Warrior Culture" artifact case incorporates a variety of artifacts conveying the scale of the construction effort, its imprint on the landscape and rural economy, and what daily life was like for the missileers. Pick up the red phone here to hear former missileers in the "Do You Have the Courage?" audio program.

"We Will Bury You!"

Explore the Cold War from the Soviet perspective, including a brief comparison of US and Soviet missile systems, Soviet civil defense systems, and reactions of ordinary Soviet bloc citizens "From Behind the Iron Curtain."

"Voices From Behind the Iron Curtain" features a touchable piece of the Berlin Wall and large faux wall photo mural, which includes inset flip panels, which present personal photos and remembrances about the Cold War from the Soviet perspective.

Portions of A Minuteman II reentry vehicle, which once housed a 1.2 megaton nuclear warhead, are on display to illustrate the scale of nuclear destruction.

"We Will Bury You" briefly introduces the Soviet side of the story by providing context for the post World War II military build-up. A looping slideshow of dramatic propaganda posters—with English translations—provides brilliant color, tone, and texture. Soviet Civil Defense posters are reprinted, providing a counterpoint to the US posters elsewhere in the exhibits.

"US vs USSR" explores the SS-18 missile which served as the Soviet answer to the Minuteman system.

Scale of Destruction | Split-Second Decisions

"Scale of Destruction | Split-Second Decisions" are tandem exhibits that interpret the unimaginable scale of potential destruction in the Nuclear Age, as well as the split-second timing and line of communication that guided decision making about whether to launch… or not.

The *"First Strike | Strike Back"* panel asks "Do you think having more nuclear weapons makes the world safe? Less safe?" When viewed from the other side, the *"Ground Zero | Zero Chance"* panel asks, "How might you or your family have lived near ground zero?"

"Scale of Destruction" compares the yield of the atomic bomb dropped on Hiroshima (15 kilotons) to the 1.2-megaton yield of a Minuteman II missile and the 10-megaton yield of a typical Soviet ICBM aimed at American targets. LED strip lights illuminate a bar chart dramatizing the different yields, while a nearby video monitor presents *"Atomic A to Z"* a mesmerizing video of atomic bomb test footage. Above, a large photograph showing the early 1960s test of a 1.2 megaton warhead provides a vivid illustration of itsdestructive power.

The *"Range of Destruction*" rail features a push-button LED interactive illustrating the levels of probable damage from air burst detonations 200-kiloton, 500-kiloton, and 1-megaton bombs. A companion "Find The Target" flipbook, a ground zero atlas, includes illustrations of twenty US cities with one megaton blast zones overlaid to illustrate the destruction of a nuclear attack.

"Split Second Decisions" traces the line of communication, from NORAD to Delta-01, that would have been used to authorize a launch. Throughout the process, from the Commander in Chief to the capsule crew, the two-man rule always applied. No single person could authorize, arm, or launch a Minuteman missile. In addition to interpretive graphics illustrating this line of communication, LED lights on the background panel illustrate the 30-minute flight path from the missile fields to Moscow—or vice versa. Providing scale and authenticity, portions of an actual re-entry vehicle stand sentry between the exhibit panels on this wall.

Pick up the red phone here to listen to the *"Lines of Communication"* oral history station provide a deeper insight into the flow of information and the protocol for all military personnel who worked with nuclear weapons. A nearby video monitor features animation of a present-day Minuteman III test launch.

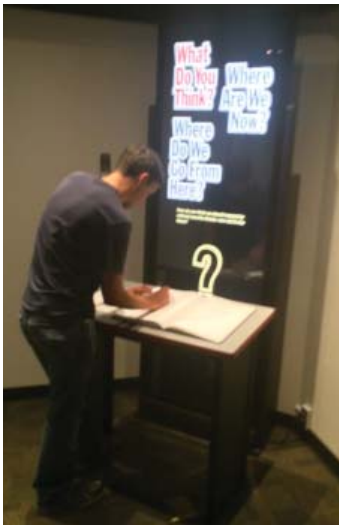
To the Brink…and Back

"To the Brink…and Back" is an immersive, media-rich exhibit providing context and chronology for the decades-long Cold War. A powerful graphic backdrop charts the growth of the global nuclear stockpile, from a modest 6 (all possessed by the U.S.) in 1945, to a peak of about 65,000 in 1986, and dwindling to about 20,000 in 2009.

A background photomural shows the human face and social cost of Cold War aggression, tension, and proxy wars, from post-Hiroshima to Helsinki.

The *"Nuclear Stockpile Sculpture"* (1945–2010) uses a combination of edge-lit applied acrylic panels and three-dimensional tubes to represent the total nuclear stockpile (represented by fluorescent strips applied to the background mural) and the relative percentages belonging to the U.S. (blue columns) and the U.S.S.R. (red columns).

Smaller percentages belonging to other nuclear powers are depicted graphically on the cumulative column. This sculpture sets up the overarching story of build-up and disarmament, providing a detailed timeline from which to interpret major Cold War milestones. The *"Arsenal of Armageddon"* timeline reader rail, spanning 1945 to 2010, provides connec-



The final exhibit allows visitors to record their own responses and reactions to the questions "Where are We Now?" and "Where Do We Go From Here?"

tions to the post-World War II division of Europe, the space race, proxy wars fought in Korea, Vietnam, Angola and Afghanistan, near misses on both sides, and the gradual journey to arms reduction. A small panel allows for more recent events to be highlighted, bringing the timeline up to the present day.

"The Big Buildup," a split screen-style short film playing in a recessed niche, uses rapid-fire editorial pacing to dramatize key moments of nuclear escalation from 1945 through the 1960s. At the other end of the timeline, the companion film *"From MAD to START"* completes the story of the arms race with the more hesitant, halting story of gradual disarmament.

The *"Too Close for Comfort"* details US and Soviet near miss incidents with nuclear weapons throughout the Cold War.

Build Up | Stand Down

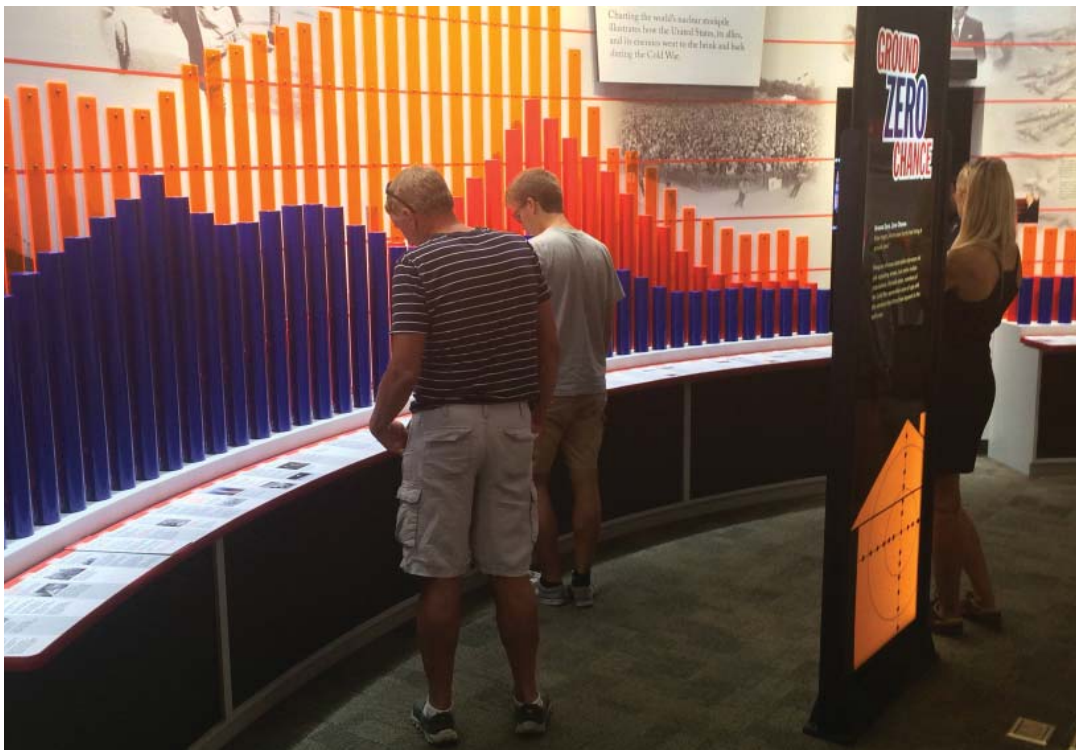
"Build Up | Stand Down" takes a brief look at the story of arms reduction, as seen through the eyes of participants in Minuteman II disarming and silo implosion. The last in the series, the "Build Up | Stand Down" icon panel asks visitors to consider the question "In what ways do you believe Minuteman missiles seemed to help end the Cold War?" A possible follow-up question could be, "Do you think the Cold War is really over?"

The blast door cover from the Oscar-01 launch control center, with original propaganda art stands as a testament to the Cold War service of the Air Force in South Dakota. A "Blast Door Art" slideshow shows a dissolving sequence of historic blast door art imagery. The final exhibit panels feature the downsizing of Minuteman missile sites, including US and Soviet mutual inspections, the preservation and interpretation of Delta-01 and Delta-09, and the establishment of the park along with a silent video loop featuring steps in the disarming and dismantlement process.

Where Are We Now?

"What Do You Think? | Where Are We Now?" revisits the questions posed earlier in the exhibit and gives visitors a final chance to reflect upon them— and maybe change a few preconceptions. A LED ticker provides present nuclear stockpile information. A visitor comment journal — with prompts on the nearby graphic — provides an additional way for visitors to connect, reflect, and share.

The nuclear stockpile sculpture and associated timeline chart the Cold War era nuclear arms race from 1945 to the present-day representing the US, Russian and total nuclear stockpiles over time.



Park Establishment

In creating Minuteman Missile National Historic Site, the American government has transformed what was once a secret and well- guarded location into a public space. As a component of the National Park System, the site is preserved for future generations to learn first-hand of the Minuteman missile's role in the Cold War. This was the hope of Soviet and American leaders even at the end of their bitter bipolar standoff.

Site Selection

The terms of the Treaty Between the United States of America and the Union of the Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms (START Treaty), allowed both the United States and the Soviet Union to preserve examples of their Cold War armaments as static displays for public education purposes. The Minuteman II installations of the 44th Strategic Missile Wing at Ellsworth Air Force Base drew the attention of the National Park Service and the Air Force during the deactivation of Minuteman II ICBMs, since the Launch Facilities (silos) and Launch Control Facilities displayed original technology developed for the early Minuteman I ICBM system. The LFs and LCFs of Ellsworth Air Force Base remained largely as originally constructed, and reflected the massive retaliation strategy that governed the first Minuteman I installations.

For these reasons, the NPS focused on the South Dakota Minuteman LFs and LCFs when selecting an LF and an LCF for preservation.

In 1993 the NPS and the Air Force selected Delta-01 LCF and Delta-09 LF of the 44th SMW for preservation. Delta-01 and Delta-09 were chosen over other sites in South Dakota for their physical integrity and for their location near other federal lands, and Interstate 90. Minuteman Missile National Historic Site is located within easy driving distance of Badlands National Park, Mount Rushmore National Memorial and the Black Hills National Forest. The Buffalo Gap National Grassland is immediatly adjacent, providing a protected natural setting.

The NPS and the Air Force entered into a series of Interagency Agreements to coordinate the effort to convert Delta-01 and Delta-09 into static displays in accordance with the START Treaty. The first such agreement, signed in 1993, committed the NPS to completing a Special Resource Study. This study considered the suitability and feasibility of developing Delta-01 and Delta-09 into a National Historic Site and investigated alternatives for managing the site. The study also considered the environmental and socioeconomic conditions in the area and what effect the new historic site might have on these variables. Funding for the Special Resource Study came from the Department of Defense's "Legacy Resource Management Program," and the completed study was published in 1995.

Delta-01 and Delta-09 Deactivation

The work to deactivate Delta- 01 and Delta-09 differed dramatically from the procedures followed for the other Minuteman II missile sites in South Dakota. The Air Force deactivated both sites but did not dismantle them. Instead, the NPS and the Air Force began planning for conversion of these two sites into monuments to the Cold War and the nuclear threat that existed during the second half of the twentieth century. The Air Force prepared special supplemental orders for these two sites. At the same time, deactivation of Delta-01 and Delta-09 needed to be completed in compliance with the START Treaty. Some of the deactivation tasks included those on the standard Air Force deactivation list, for example removing classified information and hazardous materials. The Air Force removed the Minuteman II missile at Delta-09, severed the Hardened Intersite Cable System

A view looking up from the equipment bay inside the Delta-09 silo at the viewing enclosure that allows visitors to look down at the missile.

(HICS), disconnected or removed other military communications equipment, and disconnected alarm systems used during the Cold War. The technical order for Delta-01 required severing and removal of a one- foot section of the HICS to prevent any future restoration of communications between Delta-01 and Delta-09, overwriting of the Weapon System Controller/Digital Store and Processor, removing all classified information from the site, installation of non- functioning radio control panels, and the replacement of any missing face plates to cover exposed drawer openings. Diesel storage tanks were also removed. Mechanical equipment such as the electrical system, air filtering systems, and heating system remained intact and interior furnishings, including tables, sofas and chairs were retained. The deactivation procedures checklist for Delta-01 was completed on 11 May 1993, and the last entry in the crew log is 26 May 1993. Delta-01 and Delta-09 continued in caretaker status until they were transferred to the NPS. During the period of caretaker status, both NPS and Air Force personnel performed basic maintenance at Delta-01 and Delta-09, upgraded fire and security systems, and installed a viewing enclosure over the missile launcher at Delta-09.

After deactivation, the NPS and the Air Force continued to work together to assure that the proposed Minuteman Missile National Historic Site became a reality. Interagency Agreements between the two organizations continued to coordinate the activities related to the historic site development. In 1995 Historic American Engineering Record documentation for the two sites were repared with funding from the U.S. Department of Defense Legacy Resource Management Program. In 1996 the NPS and the Air Force developed a conversion plan to convert Delta-09 into a static display and the two agencies also finalized plans which included a viewing enclosure to allow future visitors the opportunity to see into the silo. Construction on the enclosure began in 2001.

Enabling Legislation

South Dakota Senators Tom Daschle and Tim Johnson introduced a bill to establish Minuteman Missile National Historic Site in 1998 and Congress began hearing testimony on the bill that same year. The bill failed in 1998 and was reintroduced the following year to the 106th Congress. Representatives from the NPS and the Air Force testified in favor of establishing the site. By 1999 both the House and Senate passed legislation creating Minuteman Missile National Historic Site and authorizing Air Force funds that would have been used to dismantle the two facilities to be used by the NPS "for establishing, operating, and maintaining the historic site." The law describes the purpose of Minuteman Missile National Historic Site to

> *"preserve, protect, and interpret for the benefit and enjoyment of present and future generations the structures associated with the Minuteman II missile defense system; to interpret the historical role of the Minuteman II missile defense system– as a key component of America's strategic commitment to preserve world peace; and in the broader context of the Cold War...."*

Development and Future of the Historic Site

After the federal government officially endorsed the creation of the historic site, the NPS and the Air Force began preparations for the opening of the LF and LCF to the public. Once the legislation was passed, the specific plans to convert Delta-09 to a static display were formally presented to the START Compliance Review Group in Washington, D.C. for approval. Moreover, the new law gave the NPS funds to produce a general management plan for the site. A general management plan attempts to establish a clear management philosophy and provide direction for interpretive themes, resource preservation, and visitor use.

The NPS began work on the general management plan for the site in the spring of 2001 and hosted a series of public meetings to gather input from interested groups and individuals on their vision for the new historic site. The general management planning team included representatives from the Air Force, Forest Service, South Dakota Air & Space Museum, Badlands National Park, NPS Midwest Regional office, NPS Denver Service Center, and NPS Harper's Ferry Center. The general management plan was completed in 2009.

While the NPS occupied itself with the

Sunrise at Delta-09. The potential destructiveness represented by the unarmed training missile displayed in the silo is juxtaposed against the peacefulness and beauty of the surrounding landscape. The thoroughly modern facility situated in the prairie landscape opportunity for visitors to contemplate and draw individual meaning from this contrast.

general management plan for Minuteman Missile National Historic Site, the Air Force worked on the conversion of the Delta-09 LF to a static display to comply with the START Treaty. This conversion was necessary prior to the transfer of ownership to the NPS.

The Air Force worked to acquire an unarmed training missile and refurbished and painted the missile prior to shipping it to Delta-09. Procuring the display missile proved no small task for the Air Force staff working on the site with the NPS. Intense competition for training missiles and/or static display missiles existed, as military museums also desired their own Minuteman II ICBMs for their exhibits. Additionally, many of the high level officers who once staffed the Air Force's six operational missile wings had moved on after their wings were deactivated. These colonels and generals had supported the establishment of a monument to the Cold War and their transfer or retirement reduced high- level support for the new historic site and made obtaining a deactivated Minuteman II ICBM more difficult.

Once Air Force staff at Ellsworth had located the component parts of a training missile at Hill Air Force Base in Utah, technicians at Hill Air Force Base refurbished the object.

On 12 June 2001 the Air Force emplaced the missile in the Delta-09 silo using a Transporter Erector vehicle designed to emplace Minuteman Missiles. Missile crews from 90th Logistics Group at F.E. Warren Air Force Base in Wyoming, many of whom were based at Ellsworth during the Cold War, assisted in the installation of the training missile. Local media and state officials were invited to the emplacement, increasing the profile of Minuteman Missile National Historic Site.

Construction of a viewing enclosure for the missile silo began shortly thereafter. The design of the enclosure represented a joint effort between the NPS and the Air Force and met START Treaty requirements and interpretive needs. The enclosure allows viewing below grade with minimal visual impact to the site. To complete the viewing enclosure and platform, the Air Force opened the silo door one-foot past halfway and welded and grouted the door in place. Crews then placed a glass enclosure and stainless steel railing around the silo opening. Following the completion of the viewing enclosure, a Soviet inspection team traveled to South Dakota on 21 May 2002 to verify that Delta-09 complied with the START Treaty's specifications for static displays.

The Air Force and the NPS conducted a formal transfer of ownership of Delta-01 and Delta-09 to the NPS after the work of converting Delta- 01 and Delta-09 was complete. On 27 September 2002, exactly eleven years to the day from stand down, the Air Force officially turned Minuteman Missile National Historic Site over to the NPS at a ceremony at Delta-09. The festivities included a B- 1 flyover, presentation of colors by the Ellsworth Air Force Base Honor Guard, a performance by the Rapid City Central High School Marching Band, speeches by Fran Mainella, Director of the NPS, and Lieutenant General Robert Hinson, Vice Commander Air Force Space Command. Colonel James Kowalski, Commander of the 28th Bomb Wing, then transferred the keys to Delta-01 and Delta-09 to William Supernaugh, Superintendent, Badlands National Park.

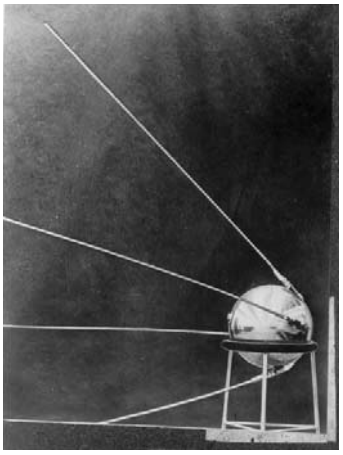
A project office for the park was opened on the south side of exit 131 in 2003. That same year Mark Herberger was appointed the first superintendent of the new park. Following safety reviews and modifications to portions of the structure, the first public tours of Delta-01 were conducted over Memorial Day weekend in 2004. A cell phone tour was developed for the Delta-09 site in 2007, greatly improving the visitor experience there.

Construction of the visitor center began in the fall of 2013 and the building was completed in November 2014. Visitor center exhibits were installed in April of 2016. A park film is production now, with a scheduled completion in the summer of 2017.

Future plans include the construction of parking lots and restrooms at both Delta-01 and Delta-09, in order to provide parking and visitor amenities a respectful distance away from the two historic sites.

Visitors listen to volunteer Al Hall discuss the capabilities of the Minuteman II missile.

History of the Minuteman ICBM Missile System



First official picture of the Soviet satellite Sputnik I, issued on 9 October 1957, showing the four antennaed baby moon resting on a three- legged pedestal. (AP/World Wide Photos)

On October 4, 1957, the Soviet Union successfully launched into orbit the world's first artificial satellite, Sputnik. Ham radio operators in the eastern United States turned their dials to lower frequency bands and anxiously listened as the 184-pound Sputnik emitted a mechanical " . . . beep . . . beep . . . beep . . . " while passing overhead. Other radio operators quickly recorded the broadcast and, within hours, Americans in their living rooms heard Sputnik's transmission via radio and television news flashes. The message seemed to confirm America's worst fears: the Soviets had technologically surpassed the United States and gained supremacy of outer space. The Soviet scientific community wasted little time boasting about their apparent win. Immediately after the launch, one Russian scientist commented,"Americans design better automobile tailfins, but we design the best intercontinental ballistic missiles and earth satellites." In the United States, one headline proclaimed: "U.S. Must Catch Up with Reds or We're Dead."

In truth, the significance of the successful launching was not so much Sputnik, but the huge Soviet rocket that hurled the satellite into space. With Sputnik, the Soviets demonstrated the ability of their SS-6 launcher to propel a missile toward a target thousands of miles away. Four years earlier, the Soviets exploded the "H-bomb." Now, the frightening prospect of a Soviet missile delivering a nuclear bomb to an American city in less than an hour revived what some called a ''Pearl Harbor atmosphere'' throughout the United States. At the urging of his military advisors and under tremendous public pressure, President Dwight D. Eisenhower reluctantly accelerated America's ICBM program.

The shock of Sputnik abruptly reversed what Air Force Secretary Donald Quarles had characterized as America's "poor man's approach" to the ICBM program. Within six months after Sputnik, the Nation's space research and development budget mushroomed from an average half billion dollars a year to more than $10.5 billion. Much of the money went to the development of the Minuteman missile. In 1958, Congress increased the appropriation for Minuteman from $50 to $140 million. The following year, Congress added two billion dollars to the Minuteman budget, to be spread out over the next five years.

Sputnik sparked the development and deployment of the Minuteman missile. But the origins of the Minuteman missile program were deeply rooted in the years immediately following World War II—when the world's two superpowers began to engage in the spiralling arms race of the Cold War.

Origins Of The Arms Race

On January 7, 1954, President Eisenhower delivered his first State of the Union address to the Nation. After declaring that "American freedom is threatened so long as the Communist conspiracy exists in its present scope, power and hostility," the President outlined hisplans for defending lhe Nation against that threat. "We will not be aggressors," he said, "but we ... have and will maintain a massive capability to strike back." Eisenhower's comments reflected the doctrinal basis behind much of America's strategic planning during the Cold War era.

President Eisenhower's view of the Soviet Union was similar to one thal had been articulated nearly eight years earlier by George Kennan, a diplomat at the US embassy in Moscow. Watching the Soviets surround themselves with a "buffer zone" that included much of eastern Europe following World War II, Kennan had argued that these moves resulted from a fanatical Soviet "expansionism" that was ultimately bent on disrupting American society, destroying the American way of life, and breaking the international authority of America. The only

President Dwight Eisenhower giving a television speech in the White House about science and national security, next to a nose cone of an experimental missile. (Library of Congress)

way to deal with this threat, Kennan suggested, was for the United States to adopt a policy of "patient but firm and vigilant containment of Russian expansive tendencies."

Although good in theory, containment proved nearly impossible to put into practice. In order to truly contain the pervasive Soviet threat, observed one top US official in 1954, the Nation would need to prepare for combat "in the Arctic and in the tropics; in Asia, in the near East and in Europe; by sea, by land, and by air." But while the Soviet Union had mounted a massive effort to rebuild its army and replenish conventional weapons after World War II, America had demobilized at a dizzying rate. Exploiting its position as the sole possessor of the atomic bomb, the United States pursued what some observers called a "bargain-basement" defense policy, using nuclear weapons as stand-ins for foot soldiers.

Fiscally conservative, President Eisenhower also wanted to keep America's atomic arsenal to the minimum amount necessary to deter Moscow. The President and his chief economic advisor, Arthur H. Burns, believed that the Federal government needed to cut spending, reduce taxes, and balance the budget in order to achieve steady economic growth. Despite protests from the Joint Chiefs of Staff, Eisenhower continually pressed for large cuts in military spending, which consumed almost 70% of the national budget at the time he took office in 1953.

The American ICBM Program

American military planners began developing ballistic missiles immediately after World War II. But by the late 1940s, America's missile program began to languish, largely because the Nation's nuclear superiority seemed secure. In 1949, when the Soviet Union developed its atomic bomb, America responded with an even more powerful weapon—a thermonuclear device that used a small atomic trigger to initiate a fusion reaction in hydrogen isotopes. Successfully tested in 1952, the H-bomb seemed to guarantee America's nuclear superiority. But in August 1953, the Soviets exploded their own H-bomb, and many US military experts also believed that the Soviets could deliver their new weapon via an ICBM. For the first time, the Soviets seemed poised to take the lead in the arms race.

Following the Soviet's successful H-bomb test, two independent US organizations reevaluated the strategic importance of ICBMs

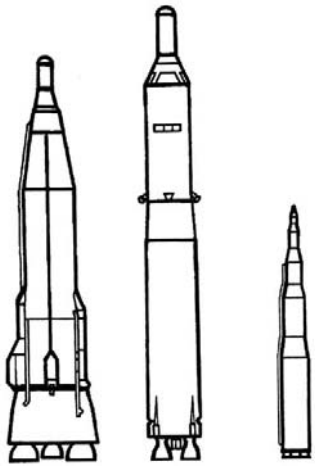
to national security. As Dr. Bruno Augenstein of the RAND Corporation observed, "If the Soviet Union beat the United States in a race for the ICBM, the consequences would be catastrophic." An Air Force committee headed by Dr. John von Neumann, a Princeton University mathematics professor, also assessed the arms race. Code-named the "Teapot Committee," von Neumann's group investigated "the impact of the thermonuclear [bomb] on the development of strategic missiles and the possibility that the Soviet Union might be somewhat ahead of the United States." In February 1954, RAND and the Teapot Committee released their reports, both of which reached the same conclusion: recent advances in thermonuclear technology made an ICBM practical. Furthermore, an ICBM "could be developed and deployed early enough to counter the pending Soviet threat if exceptional talents, adequate funds and new management techniques suited to the urgency of the situation were authorized."

By May 1954, the Air Force had mapped out a development plan for the new weapon. In June, Vice Chief of Staff General Thomas D. White ordered the Air Research and Development Command "to proceed with the development of an ICBM at the highest speed possible, limited only by the advancement of technology in the various fields concerned." In July, the Air Force established a special project office to administer the program. Based on the West Coast, the new agency was consequently called the Western Development Division. Bernard A. Schriever, a 43-year-old brigadier general, headed Western Development Division. The Air Force expected the newly-promoted young general to place a fully operational ICBM weapon system into the hands of the Strategic Air Command within six years. The Air Force considered Western Development Division's mission so important to national security that even its initials, WDD, were classified beyond top secret.

On August 5, 1954, General Schriever and a small group of military officers converged on an abandoned parochial school in the Los Angeles suburb of Inglewood to begin their work. To avoid arousing the curiosity of nearby residents, the officers wore civilian clothes. Journalist Roy Neal, who chronicled the development of the Minuteman missile system, described what they found:

> *No sign identified the white schoolhouse as the Western Development Division. . . . The windows were frosted and heavily barred. All outside doors, except one, were locked. The only entrance was across a chain-link*

Air Force Assistant Secretary for Research and Development Trevor Gardner (left) and Major General Bernard Schriever (right)–two champions in the development of the ICBM (Courtesy U.S. Air Force, History Division)



Measuring up missiles: from left to right, scale drawings of Atlas, Titan I, and Minuteman I ICBMs

fenced parking lot. A security guard manned the door. . . Some of the old-timers recall. . . the comment of the school boy who was sauntering by the school building. Eying the frosted glass and steel-barred windows, he said to a chum, "Boy am I glad I don't go to school here."

In this inconspicuous but carefully secured setting, the hand-picked staff of the Western Development Division began the effort to build an intercontinental ballistic missile.

First Generation ICBMs: Atlas and Titan

The Western Development Division staff began its work by reviving a missile project that had originated shortly after World War II. In 1946, the Air Force had contracted with the Convair Corporation to design a long-range ballistic missile called the MX-774. Like many post-war missile projects, the MX-774 lost most of its government funding after only one year. But, instead of dropping the project, Convair Corporation continued working on its own, steadily advancing the state of missile technology. In 1951, the Air Force acknowledged these efforts by hiring the company to develop plans for a more advanced missile, called the Atlas.

The Atlas was essentially a highly evolved version of the German V-2 missile, which Germany had used against the Allies during the waning years of World War II. Like the V-2, the Atlas was powered by rocket engines that burned a mixture of liquid fuel and oxidizer. But while the V-2 had an effective range of only a few hundred miles, the Atlas had to deliver its payload to a target more than 5,000 miles away. Realizing that a missile's range could be increased by reducing its weight, Convair equipped the Atlas with an innovative, ultra-light airframe. Convair assembled the missile from rings of paper-thin stainless steel, stacked together like stovepipes and welded at the seams to form cylinders. The cylinders were then inflated with nitrogen gas to give the missile its structural integrity.

By 1954, the Atlas was the Nation's most advanced ballistic missile. Nonetheless, the missile was years away from production. No prototype had been flight tested, and some skeptics feared that when Atlas's powerful engines were fired for the first time, the missile's thin-skinned airframe would buckle in on itself, leaving America's hopes for an ICBM lying on the launch pad like a gigantic ball of tin foil.

General Schriever and his staff were aware of these concerns. So while they proceeded with the Atlas program, they also looked for a backup. In October 1955, the Air Force contracted with the Glenn L. Martin Company to produce a new ICBM called the Titan. Like the Atlas, the Titan used liquid propellants, but its advanced two-stage design allowed for a conventional, and more reliable, airframe.

Still, America's missile program was hampered by funding problems. In 1956, Air Force Secretary Donald Quarles rejected the operational budget for the ICBM program, and proposed the elimination of either Atlas or Titan, which he considered redundant. That same year, the Air Force lost its most effective missile proponent when Assistant Secretary Trevor Gardner, the "Missile Czar," announced his retirement, citing continued cuts to his missile research and development budgets. Undeterred by Gardner's retirement, Quarles's austerity campaign continued into 1957 when the ballistic missile program was slashed by $200 million. In July, the Eisenhower administration initiated even more cost-saving measures, including cutting missile deliveries, lowering overtime rates, and delaying payments to contractors.

Strength In Numbers: The Missile Gap

This frugal economic climate changed dramatically after Sputnik. In October 1957, when the Soviet Union announced it had used a liquid-fueled ICBM to launch Sputnik into orbit, American scientists and politicians feared a significant "missile gap." Within months, journalists and intelligence analysts began asserting that the Soviet missile force could outnumber the American arsenal by as much as 16 to one by 1960. America's growing sense of insecurity was not lost on Soviet officials, who gleefully announced that their factories were turning out missiles "like sausages." Facing severe criticism for allowing the United States to fall behind in the arms race, the Eisenhower administration poured more money into its missile programs—increasing the Nation's annual space research

The launch of Friendship 7, on February 20, 1962. Boosted by the Mercury-Atlas vehicle, a modified Atlas Intercontinental Ballistic Missile (ICBM), Friendship 7 was the first U.S. manned orbital flight and carried Astronaut John H. Glenn into orbit. Astronaut Glenn became the first American to orbit the Earth. Both the Mercury and Gemini program utilized ICBMs developed to carry nuclear warheads.

(NASA/Marshall Space Flight Center)

and development budget by more than twenty-fold within six months after Sputnik. The administration also highlighted the development of the Atlas and Titan missiles. One governn1ent spokesperson noted that America's missile program was being carefully designed, first to "attain perfection," and then to "develop the ability to produce in volume once that perfection is achieved."

But America's first-generation ICBMs were neither perfect nor mass-producible. A few weeks after Sputnik, the *Wall Street Journal* observed that the weaknesses of America's ICBMs "are so profound that ... generals are sure [the missiles] will be discarded altogetherafter the first half-dozen years." Atlas and Titan were extraordinarily complex, handcrafted machines, containing as many as 300,000 parts, each of which had to be maintained in perfect operating condition. The liquid propellants that powered the missiles' engines were volatile and corrosive, and could not be placed in the fuel tanks until immediately before launch. In addition, the missile crews needed as much as two hours to fuel the missiles. Consequently, instead of being "stable weapons in a state of permanent readiness," these ICBMs required "the desperate and constant attention accorded a man receiving artificial respiration." The missiles were not a "push button affair but will require a highly-trained crew . . . several times as large as the largest bombing crew." Many of these problems could be solved, the *Wall Street Journal* suggested, by developing a simplified "second generation" of missiles powered by solid-fuel rocket engines.

"A lot of work had been done on solids prior to the initiation of the ICBM program in 1954," recalled General Schriever in a 1973 interview, "but there were a number of things that ruled against using solids at that time." Solid propellants in the mid-1950s could not provide enough power to hurl a thermonuclear warhead across an ocean. Also, solids were difficult to manufacture. They were hard to ignite, and there was no way to control their combustion or direct their thrust after ignition. Given these constraints, the Air Force believed that liquid-fueled missiles were "the only immediate way to go ahead." But the Air Force did not entirely abandon the concept of a solid-fuel missile.

In 1956, Schriever reluctantly approved a low-level research program "aimed toward the evolution of a high-thrust .. . solid-fuel rocket." Schriever selected Colonel Edward Hall, Chief of Propulsion Development for the Western Development Division, to head the program. According to historian Robert Perry, Hall was a "near fanatic" about the potential of solid-fuel missiles.

Weapon System "Q"

Colonel Edward Hall and his staff of engineers diligently researched their solid-fuel missile program. Within two years, Hall's group had solved most of the problems associated with solid-fuel rocket engines. In August 1957, the Air Force asked Hall to develop a medium-range, solid-fuel missile to be the landbased counterpart to the Navy's submarine launched, solid-fuel Polaris. Within two weeks, Hall drew up specifications for a remarkable new missile whose range could be varied by simply assembling its three interchangeable propulsion stages in different combinations.

The new missile, dubbed "Weapon System Q," was "the first strategic weapon capable of true mass production," wrote Duke University historian George Reed. "To Hall, the new missile was the perfect weapon for a defense policy characterized by minimum expenditure and massive retaliation; and he urged that this be its chief selling point." Sputnik made it easy for Colonel Hall to make the sale. A few days after the Sputnik launch, Hall went to the Pentagon with General Schriever to build suppo1t for the new missile. As they ascended the ranks of the military hierarchy, Hall refined his plans. By the end of 1957, he determined that "the ICBM version of Weapon System Q would be a three-stage, solid-fuel missile approximately 65 feet long, weighing approximately 65,000 pounds, and developing approximately 100,000-120,000 pounds of thrust at launch." The missile would be stored vertically in underground silos and ""would accelerate so quickly that it could fly through its exhaust names and not be significantly damaged."

In February 1958, Hall and Schriever presented Weapon System Q to the Secretaries of the Air Force and Detense. "We got approval ... within 48 hours," Schriever

Full-scale test of Minuteman I missile, Edwards Air Force Base, California, 1960

(Photograph No. B-08- 018- 1, "Guided Missiles – Boeing SM-80," U.S. Air Force Photo, Record Group 342, National Archives,, College Park, Md.)

recalled. The officers immediately renamed the project. On February 28, 1958, the *New York Times* reported that the Air Force had been authorized "to produce an advanced type of ballistic missile . . . called Minute Man."

Minuteman I

By the end of March 1958, at least seven or the Nation's foremost aircraft manufacturers, including the Boeing Airplane Company, were competing to build the new missile. Although Seattle-based Boeing had built many of the Nation's largest strategic bombers, the company had virtually no experience with missiles. Still, Boeing mounted an all-out effort to win the Minuteman contract, assigning more than 100 employees to work on the project. When the Air Force selection board met to examine the proposals, one top official recalled that "there was no question. . . that Boeing was the right company for the job." In October 1958, the US government contracted with Boeing to assemble and test the new missile.

During the next few months, the rest of the Minuteman missile team came into place. The Thiokol Chemical Company of Brigham City, Utah, the Aerojet General Corporation of Sacramento, California, and the Hercules Powder Company of Magna, Utah, all won contracts to work on the missile's propulsion stages. Minuteman's guidance and control systems went to the Autonetics Division of North American Aviation in Downey, California. The AVCO Corporation of Boston contracted to build the missile's thermonuclear warhead.

Much of the development work for Minuteman took place in northern Utah. Thiokol and Hercules already operated plants in the area and, within a few months, Boeing moved into a new assembly plant that occupied 790 acres at Hill Air Force Base near Ogden. By the beginning of 1960, Boeing's Minuteman work force had grown to nearly 12,000, as the company started to assemble the missiles. Timemagazine reported that the desert north of Salt Lake was "boiling" with activity:

Strange lights glare in the night, making the mountains shine, and a grumbling roar rolls across the desert. By day enormous clouds of steam-white smoke billow up . . . and drift over hills and valleys. Monstrous vehicles with curious burdens lumber along the roads. All these strange goings-on mark the development of the Minuteman, the solid-fuel missile that its proponents confidently expect will ultimately replace the liquid-fuel Atlas as theUS. 's standard ICBM.

According to journalist Roy Neal, the ICBM program created a new national industry: "Tens of thousands of industrial and Air Force managers, engineers, and workers [had] to be trained. New machine tools and test facilities [had to] come into being .... " These efforts changed "the face of America, the make-up of the Armed Forces and the industries that support them."

At the end of 1960, the Air Force took the first Minuteman missile to Cape Canaveral, Florida, for flight testing. The compact new missile was only six feet in diameter and 53 feet high—about half the size of a Titan. Minuteman's three cylindrical, steel-cased propulsion stages were stacked one atop the other, with each stage slightly smaller in diameter than the one beneath it. Each stage was filled with a rubbery mixture of fuel and oxidizer, molded around a hollow, star-shaped core. The Minuteman's guidance system occupied a small compartment above the third stage. The "reentry vehicle" at the tip was identical to the nosecone that would eventually contain a thermonuclear warhead.

Following two aborted launch attempts, the Air Force successfully fired the first Minuteman missile at 11:00 a.m. on February 1, 1961. Even the most experienced missile watchers found it to be "a dazzling spectacle." When the missile's first-stage engine ignited, there was a loud bang. Then the missile began to rise on a column of flame and smoke. Unlike the Atlas or Titan missile, which one observer said left the ground "like a fat man getting out of an easy chair," the Minuteman missile "shot up like a skyrocket." The missile performed flawlessly. The three propulsion stages completed their bums on schedule, then detached themselves and plummeted back to earth, while the unarmed warhead hurled on toward its assigned destination. Twenty-five minutes after liftoff, the reentry vehicle

Minuteman test launch, Vandenberg Air Force Base, 1963

("Site Activation Chronology, Minuteman Project, Ellsworth Air Force Base, South Dakota, July 1963- October 1963," K243.012-40, in USAF Collection, AFHRA)

splashed down in the Atlantic Ocean squarely on target—4,600 miles away.

From his office in Washington D.C.. Air Force Chief of Staff General Thomas D. White described the launch as "one of the most significant steps this Nation has ever taken toward gaining intercontinental missile supremacy." An engineer who witnessed the event put it another way: "Brother," he said, "there goes the missile gap."

The "Underground" Air Force

By the time the flight test took place, the Air Force was already planning for Minuteman missile deployment. According to historian Jacob Neufeld, the Air Force conceptually developed its "ideal" ICBM base in 1955, during the early days of the Atlas program:

> *The missile would be sited inside fixed, underground facilities; it was to have a quick launch reaction; it was to be stored in a launching position; the launch site would require minimal support: and the launch units were to be self-supporting for two weeks.*

Turning these ideas into reality, however, proved difficult. During the height of the "missile gap" hysteria, the Air Force hastily activated the Nation's first Atlas missiles at Vandenberg Air Force Base in California. Here, the Air Force stored the missiles horizontally in "coffins"—concrete-walled, above-ground enclosures. Before the missiles could be fired, servicemen had to raise each missile vertically on a launch pad and add fuel The later Titan and Atlas F series missiles were stored upright in underground silos capped with massive "clamshell" doors. But Air Force engineers were worried that vibrations from the rocket engines might shake the missiles apart before launch. As a result, the Air Force equipped each silo with an elevator that raised the missile to the surface for firing. Although the missiles were stored with tl1eir tanks full of fuel, workers still needed to add volatile liquid oxygen right before launch.

The Air Force took a major step toward achieving its ideal basing system in 1960 with the development of Titan II, which used storable liquid propellants. The Air Force could store Titan II missiles with fully-loaded propellant tanks, and fire them directly from underground silos. Nonetheless, Titan II missiles still needed constant attention from an on-site crew.

When Minuteman was added to the Nation's arsenal, America acquired its first truly pushbutton—literally *turn-key*—missile system. Historian Ernest Schwiebert noted:

> *With the successful utilization of solid propellants, the Minuteman could hide in its lethal lair like a shotgun shell, ready for instant firing. The operational launcher could be unmanned, underground, and hardened to withstand the swface burst of a nuclear weapon. F.ach launcher housed a single weapon and the equipment necessary to support and fire it, and required only periodic maintenance. The missiles could be fired . . . at a moment's notice.*

Minuteman Deployment and Site Selection

The Air Force wanted to deploy Minuteman as a single, immense, "missile farm," equipped with as many as 1,500 missiles. However, the Air Force soon determined that "for reasons of economy 150 launchers should be concentrated in a single area, whenever possible, and that no area should contain fewer than 50 missiles." Consequently, the Air Force organized the Minuteman force into a series of administrative units called " wings," each comprised of three or four 50-missile squadrons. Each squadron was further subdivided into five smaller units, called "flights." A flight consisted of a single, manned, launch control facility, linked to ten, unmanned, underground, missile silos. The silos were separated from the launch control facility and from each other by a distance of several miles.

The Air Force initially considered putting Minuteman missiles as far south as Georgia, Texas, and Oklahoma. But when early models of Minuteman missiles fell short of their intended 5 ,500-mile range, the Air Force selected sites in the northern part of the United States, which was closer to the Soviet Union. In 1960, the Air Force decided to locate the first Minuteman installation on the high plains around Great Falls, Montana, at Malmstrom AFB. In the event of a nuclear accident or attack, the low population density near Malmstrom AFB would minimize civilian

Minuteman comes to South Dakota.

("Site Activation Chronology, Minuteman Project, Ellsworth Air Force Base, South Dakota, July 1963- October 1963," K243.012-40, in USAF Collection, AFHRA)

casualties. In addition, the region offered an established network of roads and, like much of the West, a large amount of easy-to-acquire public land.

The Air Force began constructing the Nation's first Minuteman missile field on March 16, 1961. In the spring of 1962, the Associated Press reported that the Montana silos were being "rushed to completion," and that the first missiles, each loaded with "one megaton of death and destruction," would be ready by late summer. Air Force crews began lowering the weapons into the silos at the end of July, and Malmstrom AFB's first ten-missile flight was hurriedly activated on October 27, 1962, at the height of the Cuban Missile Crisis.

Minuteman Comes To South Dakota

Military strategists began planning for a second Minuteman installation shortly after work got underway at Malmstrom AFB. In June 1960, the Air Force was authorized to add another 150 missiles to the Minuteman force. By early October, military strategists had narrowed their search for a new site to three locations in North and South Dakota. On January 5, 1961, US Senator Francis Case of South Dakota announced that Ellsworth AFB would be the headquarters for the Nation's second Minuteman deployment. Located about 12 miles east of Rapid City, Ellsworth AFB was founded in 1941 as the Rapid City Army Air Base. The Air Corps used the airfield to train B-17 bomber crews, and Ellsworth eventually served as home base for many of America's largest strategic bombers. The base was also headquarters for a Titan I missile squadron.

Although the Defense Department had not yet officially authorized the South Dakota Minuteman installation, Senator Case wanted the land acquired immediately so there would be "no loss of valuable time" once the project was approved. Local ranchers did not share Case's sense of urgency. Fearing that the government might offer below-market prices for their land, the ranchers established the Missile Area Landowners' Association to negotiate fair prices. The association assured fellow citizens that its actions would "not necessarily slow the national defense effort."

While real estate negotiations were underway, the South Dakota State Highway Department spent $650,000 from the Federal Bureau of Public Roads to improve 327 miles of roads leading to the proposed missile sites. By June 1961, Boeing was busy improving the infrastructure. Anticipating that the project would bring in more than 3,000 workers, the company raced to build mobile home camps and cafeterias near Wall, Sturgis, Belle Fourche, and Union Center, as well as in Rapid City.

Missile silo tube under construction in South Dakota.

(Courtesy of Peter Kiewit and Sons', Inc.)

By early summer, more than three-quarters of the local landowners agreed to give the government access to their land. Once the sites were finalized, the Ralph M. Parsons Company, an architectural and engineering firm from Los Angeles, prepared plans for the Minuteman installation. The Air Force assigned responsibility for construction to the US Army Corps of Engineers Ballistic Missile Construction Office. In July 1961, four of the nation's largest construction firms submitted bids for theproject. The low bid came from Peter Kiewit Sons Company of Omaha, whose estimate of $56,220,274 was nearly $10 million below government projections.

A Silo A Day

On September 11, 1961, the groundbreaking ceremony for Ellsworth AFB's Minuteman installations took place at Site L-6 near Bear Butte. The festivities started with a bang. While the Sturgis High School band played, representatives from Boeing, Kiewit, the Corps of Engineers, and Ellsworth AFB set off an explosive charge to begin the excavation.

Despite extreme cold, high winds, and heavy snowfall, construction proceeded at a furious pace through the winter of 1961-62. In mid December, the Corps of Engineers told reporters that "men are working seven days a week, three shifts a day on Minuteman construction." A Corps spokesman said that crews were "able to dig five silo emplacements simultaneously. Each takes from four to ten days . . ." The first squadron, near Wall, was well underway, said the Corps, and work on the second squadron, near Union Center, had already started.

In February 1962, General Delmar Wilson told the Rapid City Chamber of Commerce that despite an ongoing labor dispute between Peter Kiewit Sons and the Ironworkers Union, South Dakota's ICBM deployment suffered fewer work stoppages than any missile program in the Nation. "We're all out . . . to assure that our way of life is maintained," stated Wilson. "This missile project ... is the number one project in the country today. If this guy in Russia wants to start a show, we'll be there to put a hole in him to the best of our ability. "

By early summer of 1963, the steel fabrication was finished at all 165 South Dakota sites, and crews were completing the silos at the rate of one per day. On the last day of June, the first 20 silos were turned over to the Strategic Air Command. On October 23, the Nation's second wing of Minuteman ICBMs was fully operational. The work was completed nearly three weeks ahead of schedule.

Backbone Of The US Nuclear Arsenal

While the Ellsworth AFB sites were under

Aerial view of Delta-01, 1992.

(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-A-2)

construction, the Air Force was building several other Minuteman installations. By the end of 1967, the Nation had 1,000 Minuteman missiles on alert in six separate deployment areas located throughout the north-central United States. In addition to the original installations at Malmstrom AFB and Ellsworth AFB, Minuteman complexes were deployed at Minot AFB and Grand Forks AFB in North Dakota, Whiteman AFB in Missouri, and F.E. Warren AFB in Wyoming. In addition, another squadron was established at Malmstrom AFB. At each installation the Air Force continued to improve and refine the Minuteman operational system.

Newly-elected President John F. Kennedy instigated one of the first significant improvements to the Minuteman weapon system. Soon after taking office in 1961, Kennedy learned that even if he ordered a massive nuclear retaliation to a Soviet attack, a portion of the Soviet's long-range nuclear force would survive to strike again. As a consequence, the Kennedy administration quickly abandoned the strategic policy of releasing America's entire nuclear arsenal in "one horrific spasm." Instead of massive retaliation, Secretary of Defense Robert McNamara recommended a "flexible response." Should deterrence fail, McNamara proposed that America's nuclear weapons be deployed selectively. The first ICBMs would target enemy bombers and missile sites. The remaining ICBMs would be held in reserve, for potential use against Soviet cities. McNamara hoped that the threat to the civilian population would persuade the Soviet Union to end the conflict. McNamara began retooling America's nuclear forces, including Minuteman, to reflect the new military strategy.

However, Colonel Edward Hall and his engineers designed Minuteman to be a fastreacting, mass-attack weapon. Upon receiving the launch command, the officers at each Minuteman facility had to fire all ten missiles under their control. A selective launch of fewer than ten missiles was impossible. In order to conform with the new defense strategy, Air Force engineers had to redesign Minuteman's launch control complex. Historian Clyde Littlefield described the changes:

In order to conform to the new concept, engineering changes had to be made to allow a combat crew in a control center to switch targets and to fire one or more missiles selectively, conserving the remainder for later use . . .. Greater flexibility in targeting and firing required a significant extension to the limited survival time [of each operational site]. The [original] Minuteman facility design did not provide for the protection of the

View of the Delta-01 launch control center towards the blast door, deputy commander standing in front of modular bed storage uni September 1992.

(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-A-73)

power supply. . . . At a control center, power generators were above the ground . . .. When and if these generators stopped functioning, the operational potential of the system would be reduced to only six hours. Revised strategic concepts required that the weapon survive at least nine weeks after an initial enemy attack.

To meet this requirement, the Air Force put the generators in underground capsules next to each launch control center. Although the Air Force considered incorporating these generators into the Minuteman facilities at Ellsworth AFB, construction was already underway there, making the changes impractical. Consequently, the generator capsules began with the third Minuteman deployment area at Minot AFB in North Dakota.

The Next Generations: Minuteman II And III

By the time planning began for the final Minuteman deployment area, the Air Force had developed a vastly improved version of the missile. Called Minuteman II, the new missile offered improved range, greater payload, more flexible targeting, and greater accuracy, leading one Air Force spokesperson to estimate that its "kill capacity" was eight times that of Minuteman I. Minuteman II was deployed first at Grand Forks AFB, North Dakota. In September 1965, South Dakota Congressman E. Y. Berry announced that the Ellsworth AFB facilities would also receive the new missile system. According to Berry, Minuteman II would help Ellsworth AFB remain "one of the nation's most important military installations." In October 1971, Boeing began refitting the Ellsworth silos to accommodate Minuteman II, and completed the project in March 1973.

In May 1964, the Soviet Union displayed a battery of anti-ballistic missiles in Moscow's Red Square, prompting concern about the vulnerability of Minuteman I and II missiles. The following year, the Air Force began to develop an even more advanced version of the missile. By late summer of 1968, Minuteman III was ready for testing. Longer and more powerful than its predecessors, Minuteman III offered an improved guidance system that could be retargeted in minutes. But, according to the New York Times, the missile's " most telling advantage" lay in its "revolutionaıy new warhead: the MIRV, or multiple independently targeted reentry vehicle.'' The MIRV could deliver three hydrogen bombs to widely scattered targets, a capability that would "render current and contemplated antimissile defense systems largely inadequate," and "thrust the world into a new era of weapons for mass destrnction."

President George H.W. Bush (left) and Soviet President Mikhail Gorbachev (right) signing the START Treaty at the Kremlin in Moscow, 31 July 1991.

(Courtesy of the George Bush Presidential Library)

Missile silo implosion, South Dakota

(Courtesy of the 28th Civil Engineer Squadron, Ellsworth Air Force Base)

The Air Force deployed Minuteman III at Warren, Minot, Grand Forks, and Malmstrom Air Force Bases, and extensively modified the Minuteman launchers at these locations to accommodate the new missiles. Each launch tube was equipped with a new suspension system that could hold the missile absolutely motionless during the aftershocks of a nuclear attack. The Air Force also installed a system of seals, filters, and surge arrestors designed to prevent electronic equipment from being damaged by the powerful electromagnetic waves generated during nuclear explosions.

In July 1975, when the last of the Nation's 550 Minuteman III missiles was lowered into its silo at Malmstrom AFB, Montana, only 450 Minutemen II remained in the American arsenal—at Malmstrom, Ellsworth, and Whiteman Air Force Bases. This force strncture remained intact for nearly two more decades.

Deactivation Of The Minuteman II System

The fall of the Berlin Wall in November 1989 marked the beginning of the end of the Cold War. On July 31, 1991, President George Bush and Soviet leader Mikhail Gorbachev signed the Strategic Arms Reduction Treaty (START), which placed a limit on the worldwide number of ICBMs and prescribed a process for their destruction. The treaty coincided with the end of the Cold War, and the Air Force's growing disenchantment with the escalating costs of repairing and maintaining the Minuteman II system. On September 27, 1991, President Bush announced on national television his "plan for peace." As part of the plan, Bush called for "the withdrawal from alert, within 72 hours," of all 450 Minuteman II missiles, including those at Ellsworth AFB.

On December 3, 1991, an Air Force crew arrived to remove the first of Ellsw011h AFB's 150 Minuteman II missiles: Golf Two (G-2), a launch facility near Red Owl, about 60 miles northeast of Rapid City. The *Rapid City Daily Journal* reported on the crew's progress.

> *Disarmament began with snow shovels at dawn ... as Airman 1st Class James Comfert and his colleagues cleared the launch-door rail. . . . Six hours later, a Minuteman 11 intercontinental ballistic missile was stored safely in its transporter/erector truck. G-2 was just a high-tech hole in the ground.*

According to the *Rapid City Daily Journal*, the Minuteman deactivation process at Ellsworth AFB would continue for at least three more years:

> *First, warheads and guidance systems [will be] removed. Then the missiles will be pulled. . . . The headframes of the missile silos will be destroyed and the tubes will be filled with rubble. The launch control capsules will be buried under rubble and a thick concrete cap. The land and above-ground buildings at launch control centers will be sold.*

Although all of the Minuteman II facilities at Ellsworth AFB were slated for demolition, the Air Force, in conjunction with the National Park Service, selected two representative sites—Launch Control Facility Delta One and Launch Facility Delta Nine—for preservation as nationally significant icons of the Cold War. When the Minuteman II deactivation was completed in the mid-1990s, these two sites became the only remaining intact examples of the original Minuteman configuration.

National Park Service
U.S. Department of the Interior

Minuteman Missile National Historic Site
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www.nps.gov/mimi