GRAND FORKS AIR FORCE BASE
Missile Alert Facility Oscar-Zero
Cooperstown Vicinity
Griggs County
North Dakota

PHOTOGRAPHS

HISTORIC AMERICAN ENGINEERING RECORD
Midwest Regional Office
National Park Service
1709 Jackson Street
Omaha, Nebraska 68102
<table>
<thead>
<tr>
<th><strong>Location:</strong></th>
<th>East-central Griggs County, North Dakota; 4 1/2 miles north of Cooperstown and 1/4 mile west of North Dakota State Highway 45 UTM: 14.565750.5260615</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Date of Construction:</strong></td>
<td>1964-1965 as part of Minuteman II; converted to Minuteman III in 1973</td>
</tr>
<tr>
<td><strong>Designer:</strong></td>
<td>Ralph M. Parsons Company, Los Angeles, California</td>
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<tr>
<td><strong>Builder:</strong></td>
<td>Morrison-Perini-Leavell Company, South Gate, California</td>
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<tr>
<td><strong>Present Owner:</strong></td>
<td>United States Air Force, Grand Forks Air Force Base (AFB), North Dakota</td>
</tr>
<tr>
<td><strong>Present Use:</strong></td>
<td>vacant</td>
</tr>
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<td><strong>Significance:</strong></td>
<td>Beginning with the end of World War II and continuing to the present, the Cold War and the resulting arms race between the United States and the Union of Soviet Socialist Republics (USSR) has formed an overarching theme for the cultures of both countries. The United States has based its foreign policy of strategic deterrence on an arsenal of nuclear weapons based from submarines, airborne bombers, and on land. As the land-based leg of the United States Triad, intercontinental ballistic missiles (ICBMs) armed with nuclear warheads represent the definitive technological refinement for weapons of mass destruction. They reflect the philosophy of a contemporary military establishment that holds high technology, rather than brute force, as the ultimate extension of military power.</td>
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Since their inception in the 1950s, ICBMs have undergone a continuing evolution of form and function, as the Air Force has refined both the warheads and the delivery systems to make them more lethal and more accurate. The liquid-fueled Atlas and Titan missiles and the solid-fueled Minuteman missiles each represented technological improvements over their predecessors. The missiles themselves and the auxiliary facilities built to maintain and launch them display a level of technological sophistication that is unrivaled in the built environment.

Administered by Grand Forks AFB in North Dakota, Wing VI is the last cluster of Minuteman missile sites built by the Air Force, and it represents the conclusive step in design and construction of this unique architectural and technological form. As one of fifteen Missile Alert Facilities (MAFs) associated with the 150-missile Wing, MAF Oscar-Zero has formed an integral part of the Minuteman system. Originally built in the 1960s to control ten unmanned Minuteman II launch facilities, it was modified in the 1970s to accommodate Minuteman III missiles. Longer and more powerful than its predecessors, Minuteman III was equipped with improved propulsion and guidance systems. But the missile's most noteworthy feature was its multiple independently targeted reentry vehicle (MIRV). This new warhead could deliver three nuclear bombs to widely scattered targets, a capacity that would thrust the world into a new era of weapons for mass destruction.

**Historians:**
Clayton B. Fraser, November 2000, revised by Andrée Urbas, July 2001

**Project Information:**
The Historic American Engineering Record (HAER) documentation of Minuteman III Missile Alert Facility (MAF) Oscar-Zero and Launch Facility (LF) November-33 was conducted by Fraserdesign of Loveland,
Colorado, under a subcontract agreement with Earth Tech of Colton, California. Earth Tech was, in turn, contracted by the Department of the Air Force, Headquarters Air Force Center for Environmental Excellence (HQ AFCEE) at Brooks AFB, Texas. Earth Tech subsequently conducted additional research, and revised this document in July 2001.

The Air Force has deactivated its Wing VI missile sites under treaty with the USSR and is contemplating the eventual demolition of these sites. The HAER documentation is intended to mitigate, in part, the impact on the sites by this action. Photographic documentation, research, and preparation of this report were undertaken in October-November 2000 by Clayton B. Fraser, Principal of Fraserdesign, with the assistance of Earth Tech and the Missile Engineering Group at Grand Forks AFB.

Previous documentation of the Wing VI missile field sites was undertaken in January 2000 by Fraserdesign under a similar contracting agreement with Earth Tech and the Air Force. This entailed documentation of the missileers’ art murals that had been painted in the fifteen Missile Alert Facilities in the 1980s. Earth Tech, in turn revised this document in July 2001. These paintings ranged from highly crafted, full-color illustrations applied to the inside surfaces of the facilities’ Launch Control Capsules to written rosters of missileers who had served in the MAFs (see ND-13).

**Description**

In 1963 Grand Forks AFB, outside of Grand Forks, North Dakota, was designated as the support base for the deployment of 150 Minuteman II ICBMs. Representing the most advanced, and most lethal weapons to date in the United States’ nuclear arsenal, these ICBMs were situated in underground concrete silos reinforced to withstand direct enemy attack and controlled remotely from other underground facilities. For administrative and logistical purposes, the Minuteman force had been organized as a series of separate units called Wings, with each Wing administered from a different Air Force base. Each Wing in turn managed either three of four missile squadrons. And each squadron contained five flights, each comprised of a manned command post called an MAF and ten unmanned missile silos LFs.

Grand Forks AFB functioned as the home for Wing VI of the Minuteman ICBM force, the last Wing formed by the Air Force. Designated as the 321st Strategic Missile Wing (SMW), it housed three Strategic Missile Squadrons (SMSs), the 446th, 447th, and 448th SMSs, with fifty missiles in each. The fifteen missile flights administered by these squadrons are designated in alphanumeric order. Comprising the 446th Squadron, Flights Alpha through Echo are dispersed through northern North Dakota immediately south of the border with Canada. The 447th
SMS is comprised of Flights Foxtrot through Juliet south of the 446th, and the 448th is comprised of Flights Kilo through Oscar south of the 447th and southwest of Grand Forks AFB.

Within each Flight, the MAF is designated with the numeral 0 (e.g., Oscar-Zero), and the ten LFs with numerals arranged sequentially through the Wing (e.g., November-33). A Flight’s numbering system corresponds roughly to its geographical layout. The MAF typically occupies a central position, with the LFs arrayed around it within the flight area. These missiles are strategically separated from each other by several miles to minimize damage from enemy attack. In the perimeter arrangement at Grand Forks, the first-numbered site within a Flight is always in the northeast, with subsequent sites positioned clockwise in numerically ascending order. Oscar Flight is situated southwest of Grand Forks AFB, with its MAF situated at the Flight’s southern end about 4 1/2 miles north of the small town of Cooperstown. Oscar Flight forms an irregular polygram covering roughly 23 miles on its north-south axis by 19 miles on its east-west axis, which extends over the rolling, arid plains of northeast Griggs County. Approached from an asphalt-surfaced state highway, its MAF is among the most readily accessible of the Grand Forks facilities, which has made it a likely candidate for eventual preservation and interpretation.

In design, layout, and construction, the facilities at Oscar-Zero are essentially identical to the other fourteen Minuteman flights that constitute Wing VI. Its MAF is set off from the surrounding grasslands by a barbed-wire-topped, chain-link perimeter fence, and is accessed via an asphalt-surfaced driveway connecting to a north-south state highway to the east of the facility. Passing by the paved helipad, this road enters the MAF enclosure through an electrically operated, sliding vehicular gate controlled from the security office of the Launch Control Support Building. The road terminates between the Launch Control Support Building and the Vehicle Storage Building to form a central parking area.

The Oscar-Zero MAF is a compact complex of aboveground and underground buildings and structures. Typical of structures associated with Cold War facilities, these buildings are relatively plain-faced, with little in the way of style or ornamentation to distinguish them architecturally. The aboveground buildings employ mass-produced materials (asphalt shingles, steel siding, prefabricated windows, and doors) that became widely available for residential construction after World War II. Presenting the appearance of a ranch house and its detached garage, albeit surrounded by an 8-foot chain link fence with barbed wire cap, they assume the benign appearance of spec residential spec design. Built for more sophisticated, and more stringent
requirements, the underground structures feature more exotic materials and construction techniques such as thick-walled, blast-hardened, cast-in-place concrete; counterbalanced, eight-ton concrete-filled steel blast doors; thick copper EMP perimeter strips; and work platforms suspended from the ceilings by steel chains and hydraulic shock absorbers.

Economy, availability, and performance dictated the buildings' configurations and use of materials. All were designed to fulfill specific needs and were built largely from standardized plans. Such low-tech structures as the Vehicle Storage Building resemble typical residential construction of their time. The more sophisticated structures needed for communications, missile launching, and missile control are more difficult to associate with residential antecedents. These were typically designed with specific configurations to house specific equipment and fulfill highly technical, very precise needs. Built to withstand concerted airborne attacks from enemies, as well as the destructive forces of rocket blast from their own missiles, the launch facilities and their control centers are unlike any other structures ever built.

Associated Structures
Several aboveground and underground radio antenna structures are situated within the fenced grounds of the MAF. These antennae are part of a complex communications network developed to maintain missile launch control and communication during and after a nuclear attack.

Hardened Ultra-High-Frequency Transmit and Receive Antenna
Northeast of the Support Building is the blast-hardened Ultra-High-Frequency Transmit and Receive Antenna. The primary purpose of this device is to provide a channel between the Oscar-Zero LCC and the Airborne Launch Control Center (LCC), an aircraft that functions as a back-up control center in the event that ground-based control centers are incapacitated by a nuclear blast. The antenna was also designed to receive alert, launch, and execution orders from Strategic Air Command (SAC) communications rockets and to permit communications via Air Force satellites. The Ultra-High-Frequency Antenna consists of a massive, cast-steel frustrum bolted to a thick, reinforced-concrete square slab. Over the frustrum is a conical fiberglass weather dome.

Hardened High-Frequency Receive Antenna
High-frequency radio provides SAC with point-to-point voice communications as a backup of the land-line systems for control of the weapon systems. The High-Frequency Receive Antenna is set into the ground north of the Launch Control Support Building. The below-grade structure consists of a reinforced concrete cylinder measuring about 16 feet in diameter and 37 feet deep. The cylinder is covered by a
concrete cap. Distributed evenly around the perimeter of the structure are five small ports, each containing a slender, ballistically actuated, steel monopole antenna. One monopole extended from the cylinder at all times. If the exposed antenna was damaged during an attack, a replacement could have been deployed rapidly through the detonation of an explosive squib in an adjacent port. This system was deactivated in 1971.

Survivable Low-Frequency Communications System
This is a low-frequency radio teletype that has receive-only capability. Installed in 1966-1967, the system consists of a buried antenna, a receiver installed in an electronic rack inside the Launch Control Center, and a teleprinter mounted in the LCC.

ICBM Super-High Frequency Satellite Terminal
This structure is situated a few feet from the north side of the Launch Control Support Building. It consists of an aboveground pole, atop of which is mounted a large dome.

Helipad
The concrete helipad at Oscar Flight measures 50 feet by 50 feet and is situated outside the security fence at the east end of the MAF.

Sewage Lagoon
Situated just outside the perimeter fence to the west is a sewage lagoon used for treating waste materials produced at the MAF. The sewage lagoon is an open-top settling basin surrounded by an earthen berm.

Historical Overview
In the aftermath of World War II, the geopolitical complexion of Europe began to change radically as several of the combatants maneuvered to reposition themselves in the decimated continent. The principal instigator of change was the USSR under the dominion of Josef Stalin, which had suffered millions of military and civilian casualties in its brutal conflict with Germany. Despite these losses, the Soviets emerged with the most powerful army in the European theater. This provided them with undeniable military and political clout. In post-war agreements with the other Allies at Yalta and Potsdam, the Soviets acquired large portions of east Poland, east Germany and part of Czechoslovakia. They claimed the territory as retribution for their staggering losses, but they also intended to use Eastern Europe as a buffer zone against future military incursions from the West. Stalin consolidated his position as undisputed head of the USSR by replacing coalition governments in the countries under his control with a monopolistic, centralized government, which he commanded. "An iron curtain is drawn upon [the Russian] Front," British Prime Minister Winston Churchill warned U.S. President Harry
Truman in May 1945. "There seems little doubt that the whole of the region will soon be completely in their hands."¹ So began the Cold War.

Unlike the World War that preceded it, the Cold War was undeclared, which did not involve actual combat between the major powers. In fact, for a period immediately after WWII the Allies may not even have been able to contest the Soviets in a serious conflict. The Soviets had maintained their military strength in the post-war period, while the Allies were rapidly demobilizing their armies across the European theater. As early as April 1945 the Office of Strategic Services [OSS, predecessor to today's Central Intelligence Agency] had warned that, at the current pace of Allied disarmament, the Soviets would be able to dominate Europe and parts of Asia and would soon exceed the United States in military strength.

But, Congress was more interested in bringing American soldiers back home and returning to peacetime culture. By early 1947 the United States had reduced its armed forces from 12 million strong to about 1.5 million and had cut its defense budget from $91 billion to $10 billion. Despite abundant evidence and repeated warnings of Soviet expansionism, Congress was willing to rely on America's sole possession of the atomic bomb to keep the USSR at bay. Truman was so worried by Congressional indifference toward the Soviet threat that he once complained that the United States lacked the power to intercede against a Russian incursion in Europe because the army was down to a single operational division.²

Although the Allied and Soviet blocs were never involved in a full-scale shooting war, they squared off against each other over the following years in a variety of other ways, using diplomacy, acting through client states and brandishing their military might in regional confrontations around the world. The first of these stand-offs occurred early in 1947, when Great Britain announced that it could no longer support forces battling Soviet-sponsored communists in Greece and Turkey. To fill the void, Truman in March 1947, successfully lobbied funds from Congress to support "free people who are resisting subjection by armed minorities or outside pressures." This address became known as the Truman Doctrine, which would form the basis for the United States' newly adopted policy of "containment" against Soviet expansion. As first stated publicly four months later by


George Kennan, a diplomat in the United States embassy in Moscow, the United States would pursue a largely peaceful policy of "long-term, patient but firm and vigilant containment to thwart Soviet expansionist tendencies."³

A year later, Truman had another opportunity to test his containment policy, when the USSR staged a blockade of West Berlin in June 1948. To supply the besieged city, the United States and Great Britain organized the Berlin Airlift, a massive transport of food and supplies using up to hundreds of flights per day. As part of the campaign, the United States deployed two Wings of B-29 Superfortress bombers to Great Britain, with the implicit threat of bombing raids against the USSR. Although not capable of delivering nuclear warheads, these airplanes served to remind the Soviets of America's nuclear capacity.

The Allies further bolstered their resolve against Soviet aggression in March 1949 by forming the North American Treaty Organization (NATO). Comprised of the United States, Canada and ten Western European nations, NATO's express purpose was defensive and retaliatory. "The parties agree that an armed attack against one or more of them in Europe or North America," NATO's charter stated, "shall be considered an attack against them all." As a result, Stalin lifted the Berlin blockade in May 1949, and the airlift ceased operating that September, but the escalating tensions surrounding the partitioning of Berlin became a focal point for the Cold War that would last for decades.

The policy of containment as practiced by the United States and the Allies hinged largely on America's nuclear monopoly. That monopoly was broken on August 29, 1949, when the Soviets detonated their first atomic bomb. The USSR had been working on its own bomb since 1945, when it established the Special Committee on the Atomic Bomb. For their device, the Soviets copied directly from detailed specifications of America's atomic bomb, smuggled out of the country by spies.⁴


⁴Probably the spy most responsible for assisting the Soviets in their atomic bomb program was German scientist Klaus Fuchs. Arrested in Britain in February 1950, Fuchs had passed a detailed description of the American plutonium bomb to the Soviets, speeding up their development program by one or two years. Two other spies uncovered that year were Bruno Pontecorvo and Alan Nunn May, who had both worked at the Chalk River atomic energy plant in Canada.
Truman received news of the detonation in a cabinet meeting three weeks after the fact. "The calmer the American people take this the better," reassured Gen. Omar Bradley, Chairman of the Joint Chiefs of Staff. "We have anticipated it for four years, and it calls for no change in our basic defense plan." Bradley's tone may have been soothing, but in truth American military and scientific experts had badly underestimated Soviet technological progress and were shocked by the timing of the detonation. Opinions had varied as to when the Soviets might develop nuclear capability, but few thought it would be before the mid-1950s.5

Along with the bomb, the Soviets had developed their own strategic bomber, the Tu-4 Bull, a direct copy of the American B-29 Superfortress.6 American military officials estimated that the Soviets had some 200 Tu-4s early in 1948, with as many as 1,000 expected to be completed within a year. With this, the Soviets now had an atomic bomb and the means with which to deliver it, causing increasing apprehension among the American public. That year the military formulated Halfmoon, a secret war plan, rejected by Truman, that contemplated a massive atomic air offensive on the USSR.

In 1950, the Department of Defense and the Atomic Energy Commission published a 438-page civil defense guide explaining what actions needed to be taken in the event of a Soviet nuclear attack. According to a National Security Circular published that April, the USSR was then "widening the gap between its preparedness for war and the unpreparedness of the free world." The concern caused by the circular grew into genuine alarm two months later, in June 1950, when Soviet-backed North Koreans swept across South Korea almost unchallenged in June 1950. A Gallup Poll staged a month later revealed that more than three-quarters of Americans favored the wartime use of atomic weapons.7 This with, an arms race had begun in earnest.


By mid-1950 the United States had some 298 atomic bombs stockpiled at newly constructed alert facilities, termed Q Areas, situated around the country and in Canada, Morocco, and Spain. In 1951, with full-scale production underway, the nation’s arsenal had almost doubled, and by the end of 1952, the number of atomic bombs stood at 832. SAC, established in 1946 as the Air Force’s long-range reconnaissance and attack arm, then maintained 250 nuclear-capable B-29 and B-36 aircraft. To defend against a possible Soviet air attack, the Air Force began building a permanent radar network around the country and had initiated Project Charles at the Massachusetts Institute of Technology (MIT), an automated, computerized control system that later evolved into the Semiautomatic Ground Environment (SAGE).

In 1950, Truman ordered development of the hydrogen bomb. That year the U.S. Atomic Energy Commission began a series of atomic tests in the Nevada Desert, once exploding two bombs in two days in January 1951. Work on the new hydrogen fusion bomb progressed rapidly to the point that in November 1952, the first prototype was tested successfully at Eniwetok Atoll in the Marshall Islands. Within months, the United States had an operational thermonuclear weapon. Called the “Super bomb,” the Super, and Campbell’s (as in soup), by scientists working on the project, this thermonuclear device dwarfed the original atomic bomb in destructive capacity. “Here, with one terrible strike, was the capacity to unleash 1 million tons of TNT,” historian David Halberstam states. "Given the fact that in all World War II only 3 million tons of TNT had been used, the imagination could scarcely comprehend this new destructive power. It was far more than a more

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8 Called hydrogen bombs because of the hydrogen isotopes deuterium and tritium used as their principal fuel, these new devices were also termed thermonuclear bombs because of the intense heat they generated to trigger nuclear fusion. Older type atomic bombs such as those used in Japan at the end of WWII relied on nuclear fission involved in splitting the nuclei of heavy atoms such as plutonium or uranium. Nuclear fusion, on the other hand, generated energy by creating heavy nuclides from lighter ones. Unlike fission bombs, fusion bombs were not limited in size by their critical mass. They could be manufactured with much smaller weight than the earlier atomic bombs, while developing far greater destructive power. For example, the fission bomb dropped on Hiroshima weighed about 5 tons and generated about 13 kilotons of energy. (A kiloton is equivalent to the explosive force of 1,000 tons of TNT.) The fusion bombs being developed by the United States weigh only about 1,500 pounds and generate about seventy times more energy, for a yield of about 1 megaton, or 1 million tons of trinitrotoluene (TNT).
powerful alternative to the atomic bomb; it threatened the very existence of humanity."

The Super had returned what some thought was a permanent edge to the United States in the arms race, but this nuclear superiority did not last long. On August 14, 1953, Stalin’s successor, Soviet Premier Georgi Malenkov, again shocked United States officials when he announced that the USSR had successfully detonated its own hydrogen bomb. The Soviet device was more compact than the one the United States had built and was capable of being dropped from an airplane. To make matters worse, American military experts believed that the Soviets had the capacity to deliver their new weapon using an ICBM.

In 1950, the National Security Council (NSC) had estimated that the Soviets would surpass the United States in nuclear superiority at 1954. According to the Council, the rapidly expanding arsenals of the two superpowers alone might provoke a war. A surprise attack by the superior force was not only possible but probable. In 1952, the “Lincoln Summer Study Group,” a collection of American and Canadian scientists, projected that such a Soviet first strike would kill between 100 and 150 million Americans. With these latest developments, it appeared that the Soviets had taken a decisive lead in the arms race, placing the United States in a vulnerable strategic position.

The United States, for its part, had allowed its ballistic missile development program to languish during the late 1940s and early 1950s. Conservative Air Staff (Chief of Staff, USAF) officials were still skeptical of the ability for intercontinental missiles to deliver nuclear warheads reliably and efficiently. Responsible for U.S. Air Force planning, they purchased new bombers in lieu of missile development. In 1953, the United States had 1161 atomic bombs and 1000 airplanes to carry them, but no operational long-range missiles. Although military planners had continued to experiment with delivery systems based on the German V-2 rocket immediately after WWII, the massive post-war cuts in defense spending and Congressional complacency about United States nuclear superiority had essentially quelled further missile development. Russian technological developments in the early 1950s so radically changed the global balance of power, though, that the United States was compelled to rethink its own nuclear policy and reevaluate its weapons systems.

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9 Halberstam, 29.
National Security Council paper urging nuclear diversification, combined with a Rand Corporation study that outlined technological improvements in rocket propulsion and guidance, prompted the government to change its official position on ICBMs.

The first reinvestment in ballistic missiles occurred in January 1951, when the Air Force Research and Development Command (ARDC) commissioned the Convair Corporation to resume studies it had started in 1946 (and dropped a year later due to lack of support). Designated Project MX-1593 and code-named "Atlas", the study represented a preparatory foray into ballistic missile research. Convair's study, completed in July 1951, concluded that the Atlas was technologically feasible and urged the Air Force to proceed with its development. The ensuing rift between ARDC, which urged further ICBM development, and Air Staff, which was still invested heavily in bombers, lasted for two years. With proper funding and commitment, ARDC argued, Atlas could be operational by 1960. The Command warned that if the proposed program was delayed, the United States "may be running a grave risk of being subjected to an intense bombardment to which we may not be able to retaliate." 12

In 1953, ARDC and Air Staff struck a compromise that set a completion date for research and development sometime after 1964. Also in 1953, a more wide-ranging study of current affairs was undertaken by the Strategic Missiles Evaluation Committee, a "special group of the nation's leading scientists" led by venerable Princeton mathematics professor John von Neumann. Code-named the "Teapot Committee," the group was charged with investigating "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 its findings issued early in 1954, the Teapot Committee reported that ICBMs could be used to deliver nuclear devices and speculated

11The Atlas was initially designed to carry an atomic bomb weighing 7000 to 8000 pounds, travel 5000 nautical miles and deliver the warhead to within 1500 feet of the target. The successful test of the much lighter and more powerful hydrogen bomb in 1952 allowed military planners to cut the payload requirement by more than half and expand the radius of accuracy to one mile. This effectively permitted a substantially lighter rocket steered by a less complicated guidance system. Jacob Neufeld, Ballistic Missiles in the United States Air Force, 1945-1960 (Washington, D.C.: Office of Air Force History, 1990), 90-92, 98.

that the Soviets were well on their way to developing a functional ICBM system of their own. The committee concluded that the United States could deploy an ICBM system to counter the pending Soviet threat only, "if exceptional talents, adequate funds and new management techniques suited to the urgency of the situation were authorized." The Committee warned that such talent might have to be drafted from industry, government and academia, and that, once assembled, the development team should be "relieved of excessive detailed regulation by existing government agencies." 13

Newly elected President Dwight D. Eisenhower, in his first State of the Union speech delivered in January 1954, reflected the Teapot group's commitment to retooling America's nuclear arsenal. "We will not be aggressors," he stated, "but we ... have and will maintain a massive capability to strike back." Eisenhower's assertion, summarized by the catchphrase "massive retaliation," marked a significant change in the way in which the United States would try to counter Soviet expansionism. 14 Rather than maintain extensive ground forces in Europe in an effort to contain the Soviets, the United States would pursue a new foreign policy, one of "deterrence" against direct Soviet attack. Under the strategy of deterrence, the United States would be able to strike back in the wake of a massive Soviet missile attack. This so-called "second-strike" capability would drive American nuclear development over the succeeding five decades, resulting in the expenditure of hundreds of billions of dollars and the development of an increasingly lethal series of missile systems that has culminated with the Peacekeeper program in the 1980s. 15

Stating that "there is no defense for a country that busts its own budget," Eisenhower resisted increased military expenditures over the objections of a Democratic Congress, but he did actively support the ballistic missile program. Under Eisenhower's encouragement, the


14The phrase "massive retaliatory damage" was apparently first used in a National Security Council document in 1953. In it the NSC warned that local conflicts involving tactical weapons could escalate into a general nuclear war between the United States and the Soviet Union and that the United States needed offensive nuclear capabilities to offset the possibility of Soviet attack. Crockatt, The Fifty Years War, 142-143.

Atlas missile program was rapidly revitalized. In July 1954, the Air Force established the Western Development Division [WDD], headquartered in Inglewood, California. Directed by Brig. Gen. Bernard A. Schreiber, the WDD was charged with delivering a fully operational weapons system to the SAC by 1960.

The WDD immediately began full-scale work on the Atlas missile, essentially an updated version of the V-2, featuring a single-stage projectile that burned a combination of liquid fuel and oxidizer to achieve an effective range of over 5000 miles. Because of doubts about the viability of the thin-skinned Atlas, the WDD concurrently began developmental work on another prototype ICBM called the Titan. In October 1955, after reviewing proposals from several aircraft contractors, WDD awarded a contract to the Glenn L. Martin Company to produce the Titan. Like the Atlas, it burned liquid fuel, but its two-stage design allowed the use of a conventionally configured, rigid airframe.16

When intelligence reports indicated that the Soviets were also working on an Intermediate Range Ballistic Missile (IRBM) for use in the European theater, Eisenhower authorized development of IRBMs as well. Late in 1955, Douglas Aircraft received a contract to produce Thor IRBM; Chrysler would produce Jupiter. Both would employ single-stage, liquid-fuel rockets with inertial guidance. With a range of between 1,500 and 3,000 nautical miles, Thor would be stored in a horizontal position, Jupiter on vertical, field-deployed launchers.17

The Soviets dealt the United States military establishment yet another devastating blow on October 4, 1957, when they announced that they had used a liquid-fueled ICBM to launch a 185-pound Sputnik satellite into outer space. This launch shattered Americans' sense of technological superiority and served to confirm what many scientists had suspected; that the Soviets had the technological capability to pitch nuclear warheads onto America. While Russian officials boasted that they were turning out missiles "like sausages," intelligence analysts in the United States were predicting that the Soviet missile arsenal could outnumber America's by as many as 16 to 1 by 1960. Pundits pointed to


17From Snark to Peacekeeper: A Pictorial History of Strategic Air Command Missiles (Offutt Air Force Base, Nebraska: Office of the Historian, HQ Strategic Air Command, 1990), 51. By 1960, the United States had deployed 60 Thor missiles in Great Britain and 45 Jupiters in Italy and Turkey. These were phased out only 2 years later, as the United States installed its first ICBMs.
the apparent disparity between the Russian and American space programs, coining a new phrase, "missile gap," that received widespread circulation in the press.\textsuperscript{18}

Critics of the Eisenhower administration seized the opportunity to castigate Ike for endangering United States security in the name of budget balancing. Democrats with an eye toward the upcoming presidential election were particularly vocal. In November 1958, Massachusetts Senator John F. Kennedy charged that Eisenhower had sacrificed national security for fiscal policy, subjecting the country, as he said, to "a peril more deadly than any wartime danger we have ever known."\textsuperscript{19} Armed with classified photographs taken by U-2 spy planes showing that the Soviet missile program was not as advanced as many had thought, the Eisenhower administration was more sanguine about the situation.\textsuperscript{20}

In response to the developments, the government made incremental changes in its missile program. It increased the number of Atlas squadrons from four to nine, accelerated the Navy's Polaris missile program, continued the development of Titan II and initiated the development of a new solid-fuel missile. Officials in the Eisenhower administration responded to critics by saying that the government was seeking to "attain perfection," in its missile development, and then to "develop the ability to produce in volume once that perfection is achieved."\textsuperscript{21}

\textsuperscript{18}Lonnquest and Winkler, 65-66.


\textsuperscript{20}As it turns out, Eisenhower was right about the missile gap, though the classified nature of the U-2 photographs prohibited him from using them in defense against the Democrats during the 1960 presidential campaign. Kennedy and the Democrats used the so-called missile gap to great effect against Eisenhower's Vice President, Richard Nixon, but once Kennedy assumed the presidency, the issue was quickly dropped. What the photos had revealed was that the Soviets' missile program then consisted only of a handful of missiles then undergoing preliminary testing. The rapid disappearance of the missile gap prompted the New York Times to editorialize that "the missile gap" like the "bomber gap" before it is now being consigned to the limbo of synthetic issues, where it always belonged." New York Times, November 27, 1961.

In truth, America's missiles were then far from perfect. No one was sure that the Atlas missile, with its paper-thin stainless steel skin inflated with nitrogen gas, could be successfully launched in significant numbers. Both it and the more conventionally configured Titan were exceedingly complex, essentially hand-built structures that depended on hundreds of thousands of intricately interrelated parts for successful launches. Both were powered by liquid fuel, which was so volatile and corrosive that the missiles could only be loaded immediately before launch. And both required large forces of highly trained personnel acting without error for successful maintenance and operation. "Their weaknesses are so profound," the Wall Street Journal reported in November 1957, "that generals are sure (the missiles) will be discarded altogether after the first half-dozen years."²²

Nevertheless, these missiles were all that the United States had to counter the Soviets. In the face of growing missile gap panic following Sputnik, the military moved quickly to deploy its first ICEMs well ahead of the schedule that ARDC and Air Staff had agreed to four years earlier. In November 1957, the government announced that four flights of Atlas missiles, each with six missile launching sites, would be built within a 25-mile radius of F.E. Warren AFB, Wyoming. Other Atlas missiles would be deployed at Vandenberg AFB, California and at other bases distributed around the country. With the responsibility for training and deployment of America's ballistic missiles as well as its nuclear-armed bombers, the SAC began construction of bomber and tanker alert facilities in 1958.

The Vandenberg Atlases had been hurriedly deployed by simply standing them upright on launch pads. As the next generation, Atlas "D" missiles at Warren and the other bases afforded better protection from enemy attack. They were housed in three pairs of launch sites per squadron, the missiles lay horizontally in concrete-walled, open-topped, above-ground "coffins." Later Atlas "E" missiles were further protected from missile blasts by earthen berms and retractable concrete doors on their coffins. Additionally, Atlas E missiles were no longer dependent upon the guidance system of a central LF and could be fully dispersed in individual launch sites.²³

Despite these incremental changes in the Atlas system, the missiles still suffered from a fundamental flaw in their liquid-fuel propellant. In order to launch the Atlases, the missiles first had to


²³Ibid.; New York Times, March 5, 1961; Lonnquest and Winkler, 440-441.
be tilted upright, fueled, and ignited in a relatively slow, cumbersome and volatile process. To streamline this operation and afford a greater degree of protection from incoming warheads, the Air Force began storing Atlas "F" Series and Titan "I" missiles upright in underground, reinforced concrete silos, capped with massive steel blast doors. With fears of vibrations from silo launches, the missiles had to be hoisted by elevator out of their silos and fueled before firing. These silos were oversized to accommodate the complicated propellant-loading system.

Comprised of storage tanks, pumps, and a maze of piping, this system was designed to pour 250,000 pounds of helium, liquid oxygen, and highly refined kerosene into an Atlas "F" missile within fifteen minutes for a "quick launch." The process proved exceedingly dangerous, as four Atlas and two Titan silos were inadvertently destroyed during fueling exercises. Although requiring almost constant maintenance, Titan II marked an improvement in launch time in that the missiles could be stored completely fueled and launched directly from their hardened silos.24

Titans in underground silos represented a significant step toward the military's ideal launch system. The ultimate solution for slow launch times, however, lay in using solid fuel for the rockets. "A lot of work had been done on solids prior to the initiation of the ICBM program in 1954," Brig. Gen. Bernard A. Schreiver later stated. "But there were a number of things that ruled against using solids at that time."25 The Air Force had contemplated using solid-fuel motors in its Atlas missiles but had concluded that they would be difficult to cast and could not generate sufficient thrust. Moreover, solid fuel was sometimes difficult to ignite and, once ignited, its thrust was difficult to control.

In 1956, the Air Force resumed its solid-fuel investigations under the code name "Weapon System Q." Responsibility for the program was given to WDD's Chief of Propulsion Development, Col. Edward Hall, an ardent proponent of solid fuels. By the summer of 1957, Hall had developed a series of solid-fueled missiles, dubbed Minuteman for tactical, intermediate, and intercontinental deployment.

As conceived by Hall, Minuteman would be the first strategic weapon capable of mass production using interchangeable parts. The missile's range and mission could be modified simply by assembling its three

24Jacob Neufeld, The Development of Ballistic Missiles, 192.

propulsion stages in different combinations. This way thousands of these relatively small, solid-fuel missiles could be deployed in widely dispersed, unmanned silos linked electronically to central launch control facilities (LCFs). According to 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."26 However, the Air Force did not buy into this concept until fall 1957, when the Navy in began serious consideration of Hall's missiles for use in its Polaris program as a preemptive maneuver. Hall's case for a new solid-fuel missile was made easier by the Sputnik launch. In October 1957, just days after news broke about Sputnik, he presented his plan to Gen. Schreiber, who in turn, presented it to the Secretary of the Air Force and Secretary of Defense. It was received enthusiastically.27

Hall's Minuteman presented several significant departures from Atlas and Titan technologies. The most apparent difference was its diminutive size. Atlas and Titan II stood 82 1/2 and 108 feet tall, respectively. With a height of 53 feet, a girth of 6 feet and a relatively svelte weight of 65,000 pounds, Minuteman was half the size of Titan. It featured three cylindrical propulsion stages, each slightly narrower than its predecessor, and developing about 100,000 to 120,000 pounds of thrust stacked one atop the other. An inertial guidance system and a thermonuclear warhead were housed in the uppermost stage. Deployed in widely dispersed silos, hardened to withstand 200 pounds per square inch (psi) overpressure, Minuteman would be capable of delivering a 1- to 5-megaton nuclear warhead to a target 6,500 miles away.

Unlike Atlas and Titan, which required constant maintenance, the missiles would require minimal upkeep and ground support facilities, and they could be launched remotely by two-man crews from centralized facilities that each controlled ten missiles. The solid fuel could be kept aboard the missile for long periods, meaning the missiles could be stored ready for immediate launching. The missiles could be launched directly from their silos, passing safely through their own exhaust smoke, affording full protection up to the moment of launch and making it possible to launch thousands of nuclear warheads almost


instantaneously. Hall estimated that, with full-scale development and deployment, 1,500 Minuteman missiles could be operational by 1965.

In February 1958, the Air Force budgeted $50 million toward research and development of the Minuteman system. That fall, with the Air Force Ballistic Missile Division (AFBMD) developing the components and selecting contractors, the go-ahead was given for full-scale production. The Sputnik launch had ignited a new sense of urgency among military planners, forcing the Air Force to move the deadline for delivery of an operational Minuteman up from July 1963 to June 1962. To accomplish this, Schreiver employed the concept of "concurrency," entailing simultaneous design of production lines, selection of contractors, training of crews, construction of bases and the development of ground support equipment. The benefit of concurrency was rapid deployment of the missiles. "By building a higher degree of concurrency into the schedule," historian Roy Neal stated, "by deliberately overlapping development testing, production construction, and site activation to a greater extent, the first operational missiles could be delivered to the Strategic Air Command a full year ahead of the original program scheduled." 28

Concurrency had its price. With so many processes occurring at once at different locations, compromises were made on the missiles' design, and a high degree of flexibility was built into the process out of necessity. Schreiver warned: "We may have to compromise some design features. The proposal [to accelerate the schedule] is conceivable, but the initial product is likely to be degraded. On the early missiles we may have to lose some range or accuracy in the process." Concurrency demanded a relatively high degree of standardization on such project elements as MAF and LF design, siting, and construction. It also precipitated a great deal of redundancy and waste with numerous false starts, but under the circumstances these were inevitable.

Col. Otto Glasser was appointed by Schreiver to head the Minuteman program in 1958. It was Glasser’s idea to stagger production lines to allow the second line the time to retool if modifications were necessary. With scientists and engineers learning on the fly, this ability to make modifications without disrupting production proved to be the decisive aspect in the success of the Minuteman program. 29


29 Neal, 119. Concurrency had been employed to a lesser extent on the Atlas program as well, and the experience there was instructive to military planners. By April 1962, the Army Corps of Engineers, which had been given responsibility for building the launch facilities, had issued almost 2,700
Late in 1958, several of the nation's largest defense contractors competed aggressively for the multi-million dollar contracts to build the Minuteman missiles and launch support facilities. In October 1958 the Boeing Airplane Company of Seattle received the contract to build the missile's airframe, install the components manufactured by other contractors, and test the system's functionality. The contract for the guidance system went to the California-based Autonetics Division of North American Aviation (later a division of Rockwell International) in Downey, California.

The reentry vehicle would be manufactured by the AVCO Corporation of Boston. The contract to build the first-stage motor went to the Thiokol Chemical Corporation of Utah, the second stage motor to the Aerojet General Corporation of Sacramento, and the third-stage motor to the Hercules Powder Company of Utah. To produce this new-generation weapon, Gen. Schriever first needed to develop an entirely new industrial process. "Tens of thousands of industrial and Air Force managers, engineers, and workers [had] to be trained," historian Roy Neal stated. "New machine tools and test facilities [had to] come into being ... Literally, he [had to] change the face of America, the make-up of the Armed Forces and the industries that supplied them."\textsuperscript{30}

Using an accelerated research schedule based upon the principal of concurrency, the Air Force was able to develop the Minuteman system and begin its production within a year after its authorization. By the end of 1960, the first operational Minuteman was shipped to Cape Canaveral, Florida, for testing. In February 1961, after two aborted launch attempts, Minuteman was successfully launched for the first time. Unlike its liquid-fuel predecessors, which rose slowly from their launch pad "like a fat man getting out of an easy chair," the Minuteman lurched quickly from its silo with a loud bang and a huge ring of flame and smoke. Three seconds after clearing the silo, the missile began turning toward its target, and, after sixty seconds and about 15 miles, the first stage separated. The second stage separated after 117 seconds, the third stage after 181 seconds.

By that time the missile had reached a height of 118 miles and a velocity of 23,000 feet per second. The test Minuteman arced gracefully over its trajectory, and the unarmed warhead splashed down

change orders for construction of the Atlas D, E, and F facilities. The cost of these changes aggregated some $96 million, or about 40 percent more than the contract base price. "Missile Squadron Accepted." Grand Forks Herald, 1966.

\textsuperscript{30} Ibid., 27, 48.
4,600 miles away in the Atlantic Ocean. The twenty-five minute test was an unqualified success, with each stage igniting precisely on time and the warhead landing within the target zone. It was, according to Air Force Chief of Staff, Gen. Thomas D. White, "one of the most significant steps this nation has ever taken toward gaining intercontinental missile supremacy." The Minuteman, with its solid fuel, low maintenance and rapid launch time, finally offered the perfect deterrent that the Eisenhower administration had been seeking. According to Air Force historian Ernest Schweibert:

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 surface burst of a nuclear weapon. Each 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.

The success of Minuteman cemented the expanding role that ballistic missiles would play in tactical warfare. Though the U.S. would continue to carry nuclear bombs on both airplanes and submarines, it had become abundantly clear that the heart of deterrence lay in land-based missiles. In December 1961 Secretary of Defense Robert McNamara took a longer view of the role that ICBMs would play in the future:

The introduction of ballistic missiles is already exerting a major impact on the size, composition, and deployment of the manned bomber force, and this impact will become greater in the years ahead. As the number of ... ballistic missiles increases, requirements for strategic aircraft will be gradually reduced.

Following the successful test launch, and a follow-up launch from Vandenberg in November, the Air Force could begin planning for full-scale production and deployment of Minuteman. Atlas ICBMs had been distributed over nine sites scattered across the country from New York to California. In contrast, military planners had originally proposed

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31 Ibid., 41.


33 Quoted in Norman Polmar, Strategic Air Command: People, Aircraft, and Missiles (Annapolis, Maryland: Nautical and Aviation Publishing Company of America, 1979), 78.
to amass all of the nation’s Minuteman missiles, as many as 1,600, in an enormous “missile farm” at a single facility. Even before the launch of the Minuteman prototype, the Air Force also contemplated loading the missiles onto mobile railroad car launchers and shuttling them, like an enormous shell game, over existing commercial rail lines around the country.

In the summer of 1960, SAC conducted a series of tests of its mobile missile scheme. Dispatched from Hill AFB, Utah, the missiles were ferried in railroad cars across the West and Midwest “to study such factors as the ability of the nation’s railroads to support mobile missile trains, problems of communication and control, problems of vibration and their probable effect on sensitive missiles and launch equipment as well as the human factors involved in this operation.” The Air Force had planned six test runs, but canceled the last two. In December 1961, the Kennedy administration canceled the Mobile Minuteman program entirely in favor of basing the missiles in hardened silos. It was later 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.”

As eventually deployed, the missiles were organized into administrative units called Wings, each Wing comprised of three or four fifty missile squadrons. Each squadron was in turn subdivided into five smaller units called Flights. And each Flight was comprised of ten unmanned, underground LFs containing one ICBM each. These LFs were configured as reinforced concrete silos with massive blast doors hardened to withstand a direct hit from an enemy warhead. They were dispersed over large areas to prevent destruction of multiple LFs by single warheads. The LFs were linked by means of underground cables and an airwaves communication network to an MAF centralized within each flight. The MAF consisted of an aboveground launch control support building, which provided access to the underground LCC and launch control equipment building.

Once they had decided to scatter the missiles over several sites, Air Force tactical planners considered deploying Minuteman launch facilities as far south as Georgia and Texas. When the effective range of the first Minuteman missiles was determined to be 4,300 miles, however, they instead decided to place the missiles across the sparsely populated areas in the northern United States, which were relatively close to the Soviet Union. The degree of physical separation required among the LFs and the MAFs meant that the

34 Norman Polmar, Strategic Air Command, 71, 77-78; Clyde R. Littlefield, "The Site Program - 1961," AFSC Historical Publications Series, 62-2-4, 68.
missile fields cover large tracts of land, available in the West. And the Air Force’s policy of using public lands and existing support facilities, when possible for its missile sites dictated that the Minuteman sites be situated near existing SAC bases in Montana, Wyoming and the Dakotas.

The first deployment area designated Wing I, was outside Malmstrom AFB, Great Falls, Montana. Construction at Malmstrom began in March 1961, and proceeded rapidly over the next eighteen months. The program took on a new urgency as Malmstrom’s first ten-missile Flight was declared active in October 1962, when United States spy planes observed Soviet Intermediate Range Missile emplacements under construction in Cuba. The “Cuban Missile Crisis,” as the episode came to be known, represented the most serious threat to United States security to date during the Cold War.

The Malmstrom Wing was comprised of four fifty missile squadrons. It was followed by Wing II, a three-squadron cluster that sprawled over 15,000 square miles outside of Ellsworth AFB, South Dakota. Wing III consisted of three fifty missile squadrons covering 12,000 square miles around Minot AFB, North Dakota, Wing IV had three fifty missile squadrons around Whiteman AFB, Missouri, and Wing V was made up of four fifty missile squadrons around F.E. Warren AFB, Wyoming.

The Air Force and Congress had vacillated about the number of Minuteman missiles to be deployed, with as many as 1,600 silos once contemplated. This number was eventually pared down to 1,000, 850 of which had already been authorized for construction in the first five Wings. In January 1961, the Air Force began investigating locations for its sixth and final cluster of 150 Minuteman launch sites. Two years later, in February 1963, the government announced that “Wing VI” would be situated in a 6,500-square-mile area around the existing Grand Forks AFB in eastern North Dakota. "I understand the Defense Department will be announcing very soon the location of a Minuteman Missile complex connected with the Grand Forks AFB," North Dakota Senator Milton Young stated on February 8th. "The area covered by this complex would include the Red River Valley, and areas to the west."35

Grand Forks AFB had been fully operational for less than three years when the announcement was made. First authorized in 1954, the facility was one of several Air Defense Command (ADC) installations situated across the north United States to form the nation’s air defense network. The base’s principal mission would be as a facility

for the Semi-Automatic Ground Environment SAGE) network. The SAGE program had been initiated in 1953 as the Lincoln Transmission System developed by MIT. As proposed by MIT researchers, the system would consist of a series of command and control posts situated in the north United States, which would serve to detect ballistic missile attacks from the USSR and scramble nuclear-equipped long-range bombers for a retaliatory strike.

Renamed SAGE in 1954, the computerized detection system underwent testing at Cape Cod the following year and, after considerable refinement, began deployment early in 1956. Each of the thirty-four SAGE direction centers planned by ADC was responsible for attack detection within a defined geographic area. Initially planned as hardened, belowground facilities, SAGE complexes were eventually housed in shock-resistant and contamination-proof aboveground structures. Complexes such as the one at Grand Forks entailed both the SAGE computer detection systems and air base facilities from which long-range bombers would be launched for a nuclear counterattack against the Soviets.36

In 1956, the Eisenhower administration appropriated $19 million toward construction of the Grand Forks facility and work began that February on its 12,350-foot-long runway. Construction was underway on the runway and associated buildings in August, when the Air Force announced that the Base’s mission was being expanded to include a fighter squadron. In September 1958, the 4133 Strategic Wing was activated. In December 1959, the Grand Forks sector of SAGE began operations, and in May, the 18th Fighter Interceptor Squadron was transferred to Grand Forks. That month the Base received its first complement of KC-135 Stratotankers. In February 1963, the 4133rd was redesignated the 319th Bombardment Wing (Heavy), with the arrival of 52 Stratofortress bombers. In July 1963, SAC assumed command of Grand Forks AFB.37


The announcement in 1963, that Grand Forks AFB would house Wing VI was greeted enthusiastically by the city. Established in 1874, as a trading post on the Red River, Grand Forks had grown steadily through the nineteenth and twentieth centuries as a trading center for the surrounding farming community. The city had welcomed the initial construction of the air base in the late 1950s, donating $65,000 toward the purchase of a 5,400-acre tract of land on which to build the facility. It proved an investment well made. Since its inception, the air base had infused tens of millions of dollars into the local economy, both through construction projects and through the payroll of the thousands of military personnel stationed there.

The base brought continued prosperity to Grand Forks. As new residential neighborhoods were platted, six new schools were constructed, and numerous new businesses formed to accommodate the massive influx of residents. Additionally, Base administration worked to foster good relations with the city. The proposed missile facilities would boost the Base’s population by 1,200, mostly military people and their dependents. As reported by the Grand Forks Herald in February 1963, “A boon to the economy of the Greater Grand Forks area, as well as other towns and cities in the missile building area, was seen by business, civic and educational leaders here.”

As it had on all other Air Force missile facilities, the U.S. Army Corps of Engineers was given responsibility for construction of the Minuteman launch sites and support facilities around Grand Forks. The Corps had actually been active in the area since the winter of 1961-1962. At that time it had hired the Grand Forks engineering firm Porter, O’Brian and Armstrong to conduct soils tests at the proposed launch sites. Employing up to 200 people, the engineers had been making test borings since September 1962.

Although Sen. Young had speculated that some of the missile sites would be situated in west Minnesota, in truth the sites were clustered northwest, west, and southwest of the base in North Dakota. The missile field would contain 150 Launchers and fifteen LCCs. These would be organized in typical fashion into fifteen Flights, each

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40 "Missile Complex to be a Big Project," Grand Forks Herald, February 10, 1963.
Flight containing ten launchers arrayed around the LCC. All were to be distributed over a rectangular area roughly 60 miles wide and 150 miles long that extended from the Canadian border on the north to Valley City on the south. The field's east edge lay about 25 miles west of Grand Forks, its west edge about 85 miles west to Devils Lake.41

By June, the advance teams had begun to arrive in Grand Forks in preparation for start of work that autumn. Boeing, which was responsible for the missile installation and site activation, established dispatch centers near Adams and Finley to serve the north and south sites, respectively. The centers would function as company headquarters during the project, from which engineers could monitor site construction and later missile assembly and testing. In addition to the company headquarters, Boeing announced that it would build family mobile home parks near Grand Forks, Grafton, and Mayville. A Site Activation Task Force (SATAF), charged with overseeing the construction for the Air Force, arrived at Grand Forks in June, as did a Corps of Engineers team. "The work force, both military and civilians, will be small over the next few months," the Herald reported, "gradually increasing as launch-site construction begins in the fall and the sites become ready for equipment installation and check-out."42

At Grand Forks, as at the other five preceding Minuteman facilities, oversight of the entire installation process from site selection to turnover of the system to SAC fell under the aegis of the Air Force Ballistic Systems Division. The Army Corps of Engineers (USACE) was responsible for the design of operational ground facilities. For the rest of the project elements, the Air Force contracted with private architects, engineers and contractors. The Ralph M. Parsons Company (Parsons-Inter-American) of Los Angeles was given responsibility for the architectural engineering. Established in 1944, Parsons had been consulting for the military since 1948 on such projects as the nuclear research facilities at Los Alamos, New Mexico, and the Titan II launch facilities, as well as fuel development for the Navy and Air Force.

On February 20, 1964, in the City Auditorium in St. Paul, Minnesota, SATAF officials opened bids for construction of the LF's, while an eager crowd of some 600 contractors and subcontractors looked on. The


general contract was awarded to a consortium of three major firms led by the Morrison-Knudsen Company of Boise, Idaho. M-K, as the huge construction firm was commonly known, had been one of the six companies that built the Hoover Dam in the 1930s, numerous military facilities in the 1940s, and large-scale industrial plants in the 1950s. M-K had built the first Titan II silos at Lowry AFB outside of Denver, as well as the Minuteman facilities at Warren and Whiteman. M-K's winning proposal was $121 million, which, though exceeding the government estimate by more than 20 percent, was accepted by SATAF. "The earlier five Minuteman Wing construction contracts have each been for less than $100 million," the Herald reported. "The eastern North Dakota Wing, however, will have an advanced model of the solid-fuel Intercontinental Ballistic Missile and will involve more hardened underground facilities than the earlier Wings."44

The "advanced model" of Minuteman missile referred to by the newspaper was the newly developed Minuteman II. Military planners were continually upgrading America's nuclear arsenal, developing warheads that were more destructive and delivery systems that were more powerful and more accurate. Even as Minuteman I missiles were being installed in silos at Minot, Whiteman, and Warren, the Air Force Ballistic Missile Division was experimenting with an improved version of its mainstay weapon. Although only slightly longer than its predecessor, Minuteman II embodied several significant technological advances. With an improved guidance system powered by a microelectric computer, it was far more accurate. Moreover, it could carry a greater number of preprogrammed targets within its internal memory. The second-stage motor had been redesigned with a new injection system that generated thrust through a single nozzle, increasing the missile's effective range from 6,700 miles to 9,000 miles. With more power than its predecessor, Minuteman II could carry a larger, 1.2-megaton warhead. Finally, Minuteman II could more effectively disguise its reentry vehicle from enemy detection.45

In March 1962, Boeing received the contract to build the new missile. Even before the first Minuteman II was tested successfully in September 1964, the Defense Department had already authorized the

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43 The three successful bidders were Morrison-Knudsen of Boise; the Perini Corporation of Framingham, Massachusetts; and C.H. Leavell and Company of El Paso.


45 Lonnquist and Taylor, 246.
Minuteman Force Modernization Program. Under this program, all of the nation's Minuteman ICBMs in Wings I through V would be replaced with the improved Minuteman II missiles. Wing VI at Grand Forks, then in the early stages of construction, would be the first to receive the new, improved missiles.

In addition to changes in the missile itself, the Air Force had been modifying its LFs with each successive Wing. At Minuteman Wings I and II at Malmstrom and Ellsworth, only the LCCs were situated underground, and the Launch Control Equipment Buildings were aboveground, operating out of the Support Building. The MAFs of the Warren, Minot, and Whiteman fleets featured Launch Control Equipment Buildings buried underground in a dumbbell configuration across a central tunnel junction from the LCC. The differences in these two designs was the result of strategic policy change instituted during the early days of the Kennedy administration. Air Force historian, Clyde Littlefield explains:

During the first half of 1961, the national strategic concept completed a shift from massive retaliation to controlled response. In consonance with the earlier concept, the Air Force had designed the Minuteman as a quick reacting mass attack weapon ... A combat crew would fire a minimum of ten missiles. 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 did not provide for the protection of the 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.\(^{46}\)

In September 1961, Air Staff authorized the Ballistic Systems Division to proceed with plans to harden the generators against nuclear blast. The Division decided to install the generators in hardened underground capsules situated next to the MAFs. Construction was well underway at Wing II by the time these changes were proposed. Consequently, the underground equipment capsules were introduced with the third Minuteman Wing at Minot AFB in 1962. The underground buildings of the Grand Forks MAFs featured the distinctive dumbbell configuration, but

\(^{46}\)Littlefield, "The Site Program," 80-81.
the reinforced concrete enclosure around the Launch Control Center was substantially larger than that of its predecessors. And the enclosure around the Launch Control Equipment Building was shaped like a true capsule, not the flat-floored, dome-roofed structure used at Wings III, IV, and V.

Construction on the Grand Forks missile field began in earnest in the spring of 1964. On March 12th, a day after the 500th Minuteman rolled off the assembly line in Ogden, Utah, earthmovers began scraping the surface soil at LF Golf-12, near Park River. "Big earth-moving machines which made a mammoth appearance against the prairie skyline made the first cut in farmland near here Thursday morning to launch construction of the massive Minuteman Missile Wing Six defense project," Herald reporter Lloyd Tinnes stated. The ground was tough, frozen about 16 inches deep, as about 150 persons watched the "big show" after trudging about 400 to 500 yards over a plowed field. One visitor commented, "I've had my exercise for the day."

Construction continued apace through summer and fall 1964. With an average of about 5,500 people working at various sites in eastern Dakota, M-K made steady progress during the warm-weather months. Work on the LFs and MAFs was exacting and often dangerous, but with hundreds of silos already completed elsewhere, the construction technique had been well tested by the time that the contractors began building the LFs here. Typically, a construction crew excavated a circular cut down to a level of about 34 feet and from there bore a 15-foot-diameter hole down to 94 feet. To excavate this hole, they used a giant crane-mounted auger or clam-shell excavator. M-K had planned to auger 119 of the 150 LF holes, but circumstances often changed their excavating techniques. In a summary report, USACE described the process and its problems:

Two general methods of shaft excavation were used to accomplish the work, conventional mining and auger methods. Generally only one method was planned for each site. This plan was changed on many sites for two reasons: the method chosen was found inadequate or uneconomical for the materials encountered or the equipment was transferred from one site to another to accomplish the most excavation in the least amount of time.

The auger method was inadequate in many instances to complete the shaft excavation due to unstable material, material too hard for the auger to cut, or large volumes of water washing the material off of the auger making material removal very inefficient. The reduced time required to excavate a shaft or even part of a shaft made this method economical. In many of the shafts, it is estimated that the auger method cut the anticipated conventional
excavation time to less than 25 percent... In some of the shafts, particularly in A, B and C Flights, the auger was used to accomplish the excavation to approximate reference elevation 910 to 915 and the auger transferred to another site, these shafts were completed and shored by follow-on conventional shafting crews. This type operation was done to expedite the shafting and release the auger rigs at the earliest possible date.  

With the shaft thus excavated, the men installed a 62-foot-long, prefabricated steel silo liner into the hole. Fabricated by U.S. Steel's American Bridge Division and shipped to the site by train and truck, this liner featured quarter-inch-thick steel plate walls and concentric circles of steel reinforcing rods. With the liner in position, concrete was pumped between it and the walls of the excavation to form the cylindrical silo. The upper level of the silo, with its equipment rooms and stairways and the capsule-shaped equipment building, were constructed using traditional concrete-and-steel erection methods. Once the underground portions of the LF were completed, soil would be backfilled into the remaining excavations. MAFs were built using much the same techniques.

By late autumn, Morrison-Knudsen crews were hurrying to backfill as many of the excavations as they could to avoid damage from winter snow and freezing water. By November 1st, the contractors had 6,725 people working feverishly to close as many holes as they could. Still, the Dakota winter took its toll. On November 20th the temperature dropped below 0°F and stayed there for weeks. "There were sites in nearly every stage of construction such as exposed foundations, structures with concrete partially placed with no backfill, structures with all concrete placed with little or no backfill, and sites with complete backfill," a Corps engineer later reported. Numerous sites were damaged sufficiently by frost heaving to require repairs, costing the contractor millions of dollars in damages.  

The initial excavation on MAF Oscar-Zero began on July 27, 1964 and completed three days later. Using a standard scraper, the open-cut hole for the launch control capsule and equipment building capsule were excavated in mid-August. Heavy rains forced the contractors to cease operations soon thereafter, and when work resumed at the end of the month the walls of the excavation began collapsing due to the excessive water. To correct this, the men extended the excavation to

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48Ibid., 23-25.
lessen the angle of repose, involving some 37,000 cubic yards of additional excavation. By September 20th the pit was completed and work began on the underground capsules. Concrete work on Oscar-Zero was partially complete when the hard freeze came late in November, but water accumulation during the winter inundated the foundations and protected them from freezing.49

Slowed during the bitter winter, full-scale construction resumed the following spring and continued into the summer. By August 1965, M-K had essentially completed more than 100 of the LFs, and in forty of these Boeing was installing the weapons systems. On 5 August the first Minuteman II missile arrived at Grand Forks aboard a specially designed railroad flatcar, accompanied by two Air Force "bird watchers." "It was wrapped in a grey cocoon as it arrived at the base," Lloyd Tinnes reported for the Herald.

Once the railroad car had reached the offloading facility at the air base, it took a crew of Boeing Co. Personnel just 12 minutes to transfer the missile to a truck for delivery to a missile transfer building ... The nuclear warhead was not attached as the missile arrived at the base by railroad flatcar Thursday afternoon, after passing through Grand Forks earlier in the day. Nevertheless, there were big 'explosive warnings' on the flatcar, because the missile does carry the solid propellant which would fit it on its possible 7,000-mile journey if the president ever should order retaliatory attack on an enemy.

The next day the unarmed missile was loaded aboard a transporter-erector vehicle, one of three delivered to the base by Boeing, and trucked to LF Golf-15. There it was tipped upright by the vehicle and lowered into the completed silo.50

By the end of August M-K had completed 130 of the 150 LFs and 12 of the 15 MAFs. Five missiles had been delivered by rail and installed, and crews of the Sylvania Electric Products Division were installing antennas at the 165 sites. Other crews of the American Filter Company were installing environmental control systems at the sites, and Boeing technicians were installing the heavy gear associated with the launch systems.51

49Ibid., 189.
50"1st Minuteman Received Here," Grand Forks Herald, August 5, 1965.
To operate the missiles, the Air Force had activated the 321st Strategic Missile Wing the previous November. On Base, the Wing had occupied Building 306, a massive structure that had formerly functioned as the SAGE Direction Center for ADC. In 1965, the Wing’s three missile squadrons, the 446th, 447th, and 448th, were activated and crews had begun training at Vandenberg AFB, California. On April 25, 1966, the 50 missiles under the aegis of the 447th Strategic Missile Squadron (Foxtrot, Golf, Hotel, India, and Juliet Flights) were turned over by Boeing to the SAC and declared operational. These formed the first Minuteman II Squadron in the country. One additional Flight was placed online by June, and the remainder was activated incrementally over the following months. On December 7, 1966, the 321st Wing, with its 150 Minuteman II missiles, was declared fully operational.

With the construction completed and the 150 missiles armed and online, emphasis for the base turned to maintenance and training. The launch crews trained and drilled constantly to maintain a high level of readiness. The training program typically began with technical courses offered by Air Training Command at Chanute AFB, Illinois, for familiarization with the weapons system, followed by Operational Readiness Training at Vandenberg AFB and on-site drilling and coursework at the Wing VI facilities. Missile combat crews at Grand Forks AFB, as at the other Minuteman Wings, consisted of two officers in the grade of captain or lieutenant. Called "missileers," these officers worked twenty-four hour shifts on alert duty. Missileers pulled an alert duty every three days, averaging between six and ten per month. They were required to take turns sleeping during the shift, so that at least one officer was awake at any time. During an alert, with little else to do, missile combat crew performed routine fault monitoring, watching the computer consoles for operational irregularities or other signs of trouble. The status of each of ten missiles, along with their support equipment and launcher sites, was continuously relayed to the MAF and monitored by the missileers.

The 321st had been first formed as the 321st Bombardment Group in June 1942, stationed at Barksdale AFB, Louisiana. Flying B-25 Mitchells on bombing raids over Italy between 1943 and 1945, the group distinguished itself during World War II before it was deactivated in June 1949. Four years later, the group was reactivated as the 321st Bombardment Wing, flying B-47 Stratojets from Pinecastle AFB, Florida. In August 1964, it was redesignated the 321st Strategic Missile Wing. Warriors of the North, 3.

SAC had initially drawn from the ranks of its existing aviators for its missileers, but when this pool of candidates became depleted during the Vietnam War, the Air Force began enlisting directly from its commissioning sources. During this time, SAC was required to recruit some 900 new missile combat crewmen per year to man the 1054 silos then operational. Before undergoing the three-step training regimen at Chanute, Vandenberg, and Grand Forks, each candidate underwent extensive medical and psychological evaluation by SAC's Human Reliability Program. Eventually, as the complexion of the missileer ranks changed over time, the average missileer was twenty-seven years old and had logged little actual flying experience.

As an indication of the relative amount of commitment between pilots and missileers, the Air Force in 1979 spent $375,000 to train a pilot and $22,000 to train a missileer. Life in the underground capsules consisted of moments of attentiveness surrounded by hours of boredom. "Capsule life is spartan," one combat crew commander later wrote.

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To exacerbate this situation, the missileers often had to travel long distances between base and their MAFs. Driving in vans over snowpacked highways and county roads, the crewmembers based at Grand Forks had to travel as far as 130 miles between base and the furthest duty station in the Alpha Wing.

The crewmembers' activity was tightly regulated when they were in the Launch Control Center belowground, but their off-duty time aboveground was less strictly monitored. The Launch Control Support Building in each Wing was equipped with facilities to occupy and entertain the crew members during the long hours when the inclement weather and short winter days of North Dakota forced them indoors. The Support Building offered a manned kitchen and dining facility, as well as a

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living room with television, lounge, and makeshift library supplied by
the crews with magazines and paperback books. A recreation room with
a billiard table was situated beside the living room and beyond that
was a weight room with exercise equipment. Dormitory rooms with bunk
beds provided sleeping quarters for the off-duty crewmembers. These
were separated from the kitchen and toilet room by insulated walls,
with staggered studs for soundproofing, and isolated from the rest of
the Support Building in their own hallway. Though the facility was
purposefully home like in its layout and furnishings, it was not
actually home to the crewmembers.

Missile duty was generally considered to be a dead end in an officer’s
career, and many of the missileers would rather have been pilots. As
a result, officers assigned to missile crew duty tended to leave after
they fulfilled their service obligation, and turnover was relatively
high among the missileers. To introduce a degree of romance into an
otherwise mundane job, the Air Force resorted to some marginal job
trappings. Missileers wore colored silk scarves (yellow for
instructors, red, green, and blue for the grades of combat
crewmembers) and toted .38 caliber revolvers, like pilots, in their
sealed capsules. Borrowing from pilots’ lexicon, they called the
collected group of missiles a Wing, the missiles birds, alert missiles
sorties, ten-missile groups flights, and twenty-four hour shifts
alerts. The MAPs were made to resemble airplane cockpits, down to the
red seatbelts, which ostensibly were there to help the crewmembers, in
their heavily dampened and hydraulically balanced capsule, ride out a
nuclear attack 50 feet above.

To compensate its launch crews and bolster morale, the Air Force
initiated an undergraduate college education program in 1962, which
was later expanded to include Master of Science degrees in business
administration. "This is in effect a case of our getting our day’s
work from [the missileers] and, in addition, they undergo education," stated Maj. Gen. H.G. Thorne. Without the incentives, Thorne
testified before the House Appropriations Subcommittee in 1963, "you
would not be able to put them back in the hole again."55 Thorne
told the Committee that officers considered missile duty to be
"pretty unattractive" without incentives. In truth, missile duty was
both unexciting and stressful. "Life on a SAC missile crew was
constant study," Col. John Moser later recalled:

Reading tech orders and Emergency War Order procedures, training,
testing, evaluations, and alert. The routine became so 'routine'

because the pressure was never off. The crew commander was ultimately responsible for how his crew performed and since this was my first command, I took it seriously. Not only were we tested back at our base, we were often given surprise evaluations by visiting staff members while we were on alert.

Our Wing commander had a reputation for, one, being a living terror and, two, making surprise visits to launch control centers (LCC) to "look at the troops." My crew was on alert when the topside security chief notified me that the commander was on site and requested permission to come down to the LCC. Did I have a choice? After he entered the LCC, I gave him the typical visitor's briefing and he began to "poke" around the capsule. As luck would have it, a practice emergency war order came over the SAC "primary alerting system" at that time. My deputy and I proceeded to run our checklists, coordinate our actions with higher headquarters, and complete the exercise -- in a very efficient and professional manner, or so we thought -- and the commander departed without further comment. Upon arriving back at the squadron the next day, we discovered that we had failed the observed exercise. The commander had found a loose bolt lying under one of the electronics cabinets which, in his opinion, would have caused the LCC to not be "hardened" against a possible nuclear strike -- that is, the bolt could have ricocheted around the capsule, possibly neutralizing our launch capability. The bolt probably had been there since the LCC was installed years before; however, forgiveness was not SAC policy.

Until the mid-1980s, these crews were all-male. Women slowly worked their way into the Minuteman program, working as cooks or maintenance workers in the LCS Buildings where the bedrooms and toilets had been modified to accommodate them. In 1986 two-women launch crews began serving alert duty, and two years later SAC began allowing mixed-gender crews in the MAFs.

To foster excellence among its combat and maintenance crews, SAC staged competitions among the various missile squadrons similar to the bombing competitions that SAC had been sponsoring since the 1950s.

Planning for the first missile competition began as the Grand Forks Wing was becoming operational in mid-1966 and was held in April 1967 at Vandenberg AFB. The 351st Strategic Missile Wing of Whiteman AFH swept all of the Minuteman-class awards and won the first Blanchard Trophy. Named to honor Gen. William H. Blanchard, who had died in

56 Chris Adams, Inside the Cold War, 109-110.
1966 while serving as the Air Force Chief of Staff, this new prize was awarded to the best Missile Wing, either Titan or Minuteman, in the competition. Though the same six Minuteman and three Titan II Wings contended for the honor each year, the competition was intense.

SAC sponsored its second missile competition at Vandenberg in May 1969, with all of the nine Wings in attendance. With the highest score in the combined areas of operations and maintenance, the 321st Wing of Grand Forks AFB took home the Blanchard Trophy. Subsequent competitions held at Vandenberg were won by the Ellsworth and Whiteman Wings until 1974, when the 321st, competing under the slogan "Eat 'Em Up," captured both the Blanchard Trophy and the award as the best Minuteman Wing.57

The launch crews worked to keep their reflexes sharp by performing frequent practice runs or alerts. "A big problem for a soldier standing by a missile system is boredom," the Associated Press reported in 1963. "He checks and rechecks a weapon he hopes will never be used." In the event that they would actually be called to launch the missiles under their command, the two missileers would take their launch keys and preset authenticators out of steel lockboxes situated above their consoles. After verifying the authenticity of the orders, they would insert the codes they had received into the enable panels, insert the keys into the switches and turn them in unison. A predetermined number of missiles would then burst from their silos and arc toward preprogrammed targets unseen, a continent away.58

The missileers maintained the LCCs in absolutely pristine condition for the first twenty years of their operation. In the 1980s, however, the crews began painting murals on the inside surfaces of the capsules. Featuring a variety of topics and themes, these murals ranged in artistic accomplishment from cartoon-like to well-crafted. Many of the murals, including one over the doorway in Oscar-Zero, took up the "Warriors of the North" motif, with fur-clad Vikings aggressively brandishing weapons in front of a sunburst/snowflake logo. The painting in some of the MAFs was coordinated through an overriding visual theme. Charlie-Zero (C-0), for instance, used wordplay to establish itself as "The Deep Blue Sea." It featured underwater scenes painted in the capsule itself and in the shaft of the access elevator. In its elevator shaft, Golf-Zero featured a

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57 Polmar, Strategic Air Command, 104-140.

full-height Minuteman missile, which reveals itself incrementally as
the elevator cab descends to the tunnel junction. November-Zero
employed an improbably nautical theme in its paintings, even going to
the extent of mounting false portholes on the Launch Capsule walls in
violation of Air Force regulations. In the tunnel junctions of
several of the MAFs, crew members painted their squadron emblems, and
in virtually all of the MAFs, the last missileers to pull active alert
duty signed their names in rosters by the Launch Capsule doors.

Even as it was beginning to install Minuteman II missiles in the
silos at Grand Forks in 1965, the Air Force was planning its next
generation weapon. Under development by Boeing since 1965,
Minuteman III represented the next generation in missile
technology. It was longer than its two predecessors and, with
its larger third-stage motor, had greater range and more powerful
thrust. Additionally, Minuteman III featured a fourth stage: a
liquid-fueled bus intended to add propulsion to the warhead
during re-entry. The most significant -- and controversial --
difference between this missile system and its predecessors lay
in the configuration of its warhead. Minuteman III was capable
of delivering three independently guided nuclear devices at
separate targets, a capability that would "thrust the world into
a new era of weapons for mass destruction."

The Air Force began testing Minuteman III prototypes at Cape Kennedy
in August 1968. The first Wing to receive the new ICBMs was Minot,
which deployed 150 Minuteman III missiles by 1971. This was followed
by 150 at Grand Forks in 1973, 50 at Malmstrom, and 200 at F.E.
Warren, for a total of 550 missiles. Though the new missile sported
different dimensions and operating systems than its predecessors, it
was designed to be deployed from the existing Minuteman I and
Minuteman II silos with minimal alterations to the ground facilities.

The greatest change occurred in the LCFs, which required additional
hardening of the concrete silos and installation of new suspension
systems to hold the missiles steady against the impact of a nuclear
attack. The greatest functional change involved the guidance system
for the new missiles. As described by historian Jeffrey Hess:

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59 As quoted by Jeffrey A. Hess and Christine A. Curran in "Minuteman III ICBM
Launch Control Facility November-1: Warren Air Force Base Missile Alert

60 "Minuteman III Work Begins," Minuteman Service News 48 (January - February
The Air Force began installing an innovative retargeting system called Command Data Buffer (CDB) at Warren in 1973. The CDB facilitated rapid, remote retargeting of the missiles in the event target priorities were reshuffled. In the past, these operations were done manually by maintenance crews who brought new tapes to the silos to reset the missile guidance computer. Retargeting with Command Data Buffer meant that a missile combat crewmember could transmit new target constants to individual missiles within their flights from the launch control center. This innovation added an operational command and control flexibility that previously was unavailable to Strategic Air Command.61

Most of the changes made to the LFs and MAFs after installation of the Minuteman III system entailed minor incremental improvements to the missiles' operational systems and the communications systems in the MAFs. They involved modifications to the electronic equipment, but little in the way of structural changes. The most notable exception to this began in April 1985, when SAC and the Air Force Logistics Command jointly initiated a major Minuteman upgrade and modification. Called Rivet MILE (Minuteman Integrated Life Extension Program), this $493 million program involved the structural reconditioning, repairs and maintenance of the LF and MAF facilities. It was phased in nationally in three-year increments, with cycles running from 1985-1988, 1988-1991, and 1991-1994. The most visible modifications to the MAFs included new steel siding and windows and interior remodeling to accommodate newly installed female crewmembers.62

During the 1980s the Cold War was showing unmistakable signs of winding down. By the end of the decade the Berlin Wall had been demolished and the two Germanys reunified. Many of the former Eastern Bloc countries had broken from Russia to form democratically elected governments of their own, and the USSR itself was disintegrating after decades of funneling massive funds into arms escalation. By the time the Warsaw Pact formally disbanded in March 1991, the Cold War was essentially over.

In July 1991, President George Bush and Soviet Premier Mikhail Gorbachev executed the Strategic Arms Reduction Treaty (START), which limited the number of ICBMs held by their respective countries and mandated the destruction of launch facilities. Rather than maintain

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61 Hess and Curran, 40.

the aging Minuteman II facilities, the Air Force opted to scrap them entirely, which Bush announced to the nation in September 1991, in a sweeping "plan for peace." One of the casualties of the new agreement was Wing VI. In the mid-1990s, the missiles were all removed from their silos and shipped off. Today, as part of an ongoing demolition program, the LFs and MAFs are being dynamited or filled. Eventually, according to current plans, only Oscar-Zero and November-33 will remain in place to interpret this important aspect of Cold War history.
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