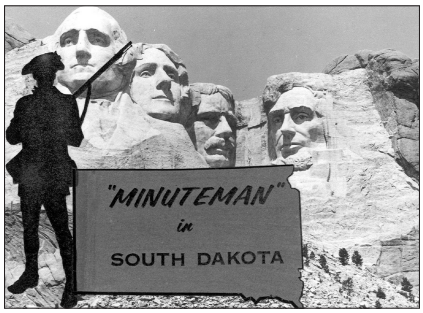
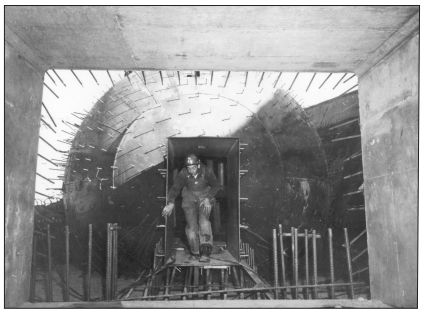








The Missile Plains: Frontline of America's Cold War

Historic Resource Study

Minuteman Missile National Historic Site

South Dakota

NATIONAL PARK SERVICE

The Missile Plains:
Frontline of America's Cold War

Historic Resource Study
Minuteman Missile National Historic Site, South Dakota

Prepared for
United States Department of the Interior
National Park Service
Midwest Regional Office

2003

Prepared under the supervision of:
Dr. Jeffrey A. Engel, Principal Investigator

Authors:
Mead & Hunt, Inc.
Christina Slattery
Erin Pogany
Mary Ebeling
Amy R. Squitieri

Recommended:

Acting Site Manager, Minuteman Missile National Historic Site — Date 09/23/03

Superintendent, Badlands National Park — Date 9/17/03

Concurred:

Chief, Cultural Resources, Midwest Region — Date 9.30.03

Associate Regional Director
Cultural Resources and Stewardship Partnerships — Date 10/02/03

Approved:

Regional Director
Midwest Region — Date 10-3-03

Table of Contents

List of Illustrations ..... **iv**
List of Abbreviations ..... **viii**
Preface ..... **x**
Introduction ..... **xi**
Establishment and Purpose xi
Geographic Location xi
Significance of Minuteman Missile National Historic Site xi
Organization of the Historic Resource Study xii
Section 1 – The Cold War and National Armament **1**
Chapter 1: The Cold War (1945–62) 1
Introduction 1
Origins of the Cold War 2
Eisenhower and Waging Peace 5
Sputnik 8
Kennedy Administration and the First Minuteman Deployment 8
Chapter 2: U.S. Strategic Missile and Armament Systems (1950s–60s) 14
Intercontinental Ballistic Missile Program Beginnings 14
Liquid-Fuel Intercontinental Ballistic Missiles: Atlas and Titan 17
Chapter 3: Minuteman and the Next Generation (1960s–present) 25
The Missile Gap and Minuteman 25
Development of Solid-Fuel Intercontinental Ballistic Missiles 26
Minuteman I 26
Minuteman II 31
Minuteman III and the Next Generation 32
Section II – Life on the South Dakota Plains: Before, During, and After Minuteman **40**
Chapter 1: Life and Landscape Before Minuteman (to the 1960s) 40
South Dakota Plains Geological Formations 40
Native American Settlement 40
Early European Exploration and the Fur Trade 42
Euro-American Land Speculation, Settlement, and Immigration 42
Western Plains Settlement and Agricultural History 43
Chapter 2: U.S. Air Force, Strategic Air Command, and Ellsworth Air Force Base (1940s–90s) 49
Establishment 49
Strategic Air Command 50
Ellsworth Air Force Base 52
Chapter 3: Minuteman Missile Sites in South Dakota (1960s-80s) 61
Site Location 61
Land Purchase 61
Minuteman Missile Area Landowners Association 62
Site Construction 64
Site Activation 66
Economic and Social Impacts on the Region 67
The Cold War Continues 70
Chapter 4: Delta-01 and Delta-09 (1960s–80s) 81
Overview of the Complex 81
Launch Control Facility Delta-01 81
Launch Facility Delta-09 87
Conversion to Minuteman II 90

Chapter 5: Missileer Culture: Day-to-Day Life (1960s–91) 108
At the Launch Control Facility 109
In the Launch Control Center: Missile combat crew 113
Changes in Missile Culture 117
Section III – Peace Movement, Nuclear Disarmament, and the Future 133
Chapter 1. Opposition to Nuclear Armament (late 1950s–90s) 133
The National and International Debate 133
Activist Groups – Beliefs and Mission 136
Efforts in South Dakota (1980-90s) 136
Continued Activism 137
Chapter 2: Strategic Arms Reduction Treaty and Disarmament of Minuteman II (1990s) 141
End of the Cold War 141
START Treaty 141
Deactivation of Minuteman II Sites 142
Deactivation of Ellsworth Air Force Base's Minuteman II Missiles 143
Chapter 3: Minuteman Missile National Historic Site (1990–present) 152
Site Selection 152
Delta-01 and Delta-09 Deactivation 152
Enabling Legislation 153
Development and Future of the Historic Site 154
Conclusion 162
Notes 165
Bibliography 180
Index 199
Appendices 204
A. Minuteman Missile National Historic Site Cultural Resource Base Maps 205
B. Minuteman Missile National Historic Site National Register Nomination 209

List of Illustrations

Plate 1. The Big Three Conference at Yalta, 12 February 1945

Plate 2. British Prime Minister Winston Churchill, United States President Harry S. Truman, and Soviet Premier Joseph Stalin meeting at the Potsdam Conference, August 1945

Plate 3. First official picture of the Soviet satellite Sputnik I, issued on 9 October 1957

Plate 4. President Kennedy with Secretary of Defense Robert McNamara, SAC Commander General Thomas S. Power, and Lt. General Howell M. Estes, Jr. at Vandenberg Air Force Base, California, March 1962

Plate 5. Air Force Assistant Secretary for Research and Development Trevor Gardner and Major General Bernard Schriever–two champions in the development of the ICBM

Plate 6. Cutaway drawing of an Atlas D ICBM

Plate 7. Drawing of Titan I, the United States' first two-stage ICBM

Plate 8. Titan I missile with crew

Plate 9. Minuteman test launch, Vandenberg Air Force Base, 1963

Plate 10. Scale drawings of Atlas, Titan I, and Minuteman I ICBMs

Plate 11. Full-scale test of Minuteman I missile, Edwards Air Force Base, California, 1960

Plate 12. Line drawings showing the evolution of the Minuteman ICBM

Plate 13. Line drawing showing an exploded view of Minuteman II and the Minuteman II Transporter Erector

Plate 14. Flight sequence of Minuteman II ICBM

Plate 15. The gently rolling plains of western South Dakota

Plate 16. The striking landscape of the South Dakota Badlands

Plate 17. A western South Dakota homestead, 1936

Plate 18. Location of Minuteman II missile sites in the United States, highlighting South Dakota and the Delta Flight

Plate 19. Transporter Erector at Ellsworth Air Force Base

Plate 20. Pride hangar at Ellsworth Air Force Base

Plate 21. Shield of the 44th Strategic Missile Wing at Ellsworth Air Force Base

Plate 22. Shield of the 66th Strategic Missile Squadron at Ellsworth Air Force Base

Plate 23. Shield of the 67th Strategic Missile Squadron at Ellsworth Air Force Base

Plate 24. Shield of the 68th Strategic Missile Squadron at Ellsworth Air Force Base

Plate 25. The Black Hills Bandits of the 44th Strategic Missile Wing

Plate 26. Minuteman comes to South Dakota

Plate 27. Groundbreaking ceremony at Lima-06 in South Dakota, 11 September 1961.

Plate 28. Aerial view of Delta-01 during construction

Plate 29. Launch Control Center under construction in South Dakota

Plate 30. Launch Control Center nearing completion in South Dakota

Plate 31. Interior of a Launch Control Center during construction in South Dakota

Plate 32. Launch tube under construction in South Dakota

Plate 33. Aerial view of a launch tube under construction in South Dakota

Plate 34. Launch Facility nearing completion in South Dakota

Plate 35. A Boeing crew assembles a first-stage Minuteman engine at the Air Force Missile Test Center, Cape Canaveral, Florida, 14 June 1963

Plate 36. Northern Heights Mobile Home Park in Rapid City

Plate 37. Aerial view of Delta-01

Plate 38. Aerial view of Delta-01 highlighting the aboveground buildings used by missile crews

Plate 39. Site plan, Launch Control Facility

Plate 40. View of Launch Control Facility Support Building, Delta-01

Plate 41. Main entrance and security bay of Launch Control Facility Support Building, Delta-01

Plate 42. Interior plan view of Delta-01

Plate 43. Line drawings of interior of Delta-01 Launch Control Center

Plate 44. Interior side of blast door, Delta-01

Plate 45. Launch Control Center at Delta-01

Plate 46. Delta-01 Missile Commander's Launch Control Console

Plate 47. Line drawing of a Launch Control Console

Plate 48. Aerial view of a completed Launch Facility in 1963

Plate 49. Site plan and cut-away view of Delta-09 Launch Facility

Plate 50. Topside view of Delta-09 Launch Facility with missile launcher and personnel access hatch

Plate 51. Personal access ladder into missile launcher, Delta-09

Plate 52. A Delta Flight missile being emplaced in the Transporter Erector

Plate 53. Interior of Delta-09 silo showing launch tube encircled by electronic equipment

Plate 54. Azimuth marker

Plate 55. Day room in Launch Control Facility Support Building at Delta-01

Plate 56. Day room in Launch Control Facility Support Building at Delta-01

Plate 57. Kitchen in Launch Control Facility Support Building at Delta-01

Plate 58. Facility Manager's bedroom at Delta-01

Plate 59. Delta-01 Launch Control Facility, Security Control Center

Plate 60. Delta Flight Peacekeeper vehicle used by security personnel

Plate 61. Delta-01 sleeping quarters

Plate 62. Missile art in vestibule of Launch Control Center, Delta-01

Plate 63. Blast door, Launch Control Center, Delta-01

Plate 64. Delta-01 Launch Control Center with crew

Plate 65. Deputy Commander Control Console, Launch Control Center, Delta-01

Plate 66. Missile Commander Control Console, Launch Control Center, Delta-01

Plate 67. Launch enable control panel, above Deputy Commander Control Console, Launch Control Center, Delta-01

Plate 68. Launch Control Center, escape hatch

Plate 69. Oscar-01 Launch Control Center, Ellsworth Air Force Base

Plate 70. Launch Control Center art, Ellsworth Air Force Base

Plate 71. Launch Control Center art, Ellsworth Air Force Base

Plate 72. Peace March in Peetz, Colorado, Good Friday 1988

Plate 73. Spring Equinox Vigil, 1988

Plate 74. Word War II munitions bunkers now used to store farm produce and equipment, near Bronson, Nebraska, 1988

Plate 75. Berliners sing and dance a top The Berlin Wall

Plate 76. President George H. W. Bush and Soviet President Mikhail Gorbachev signing the START Treaty at the Kremlin in Moscow, 31 July 1991

Plate 77. Transporter Erector positioned to remove missile, Delta Flight

Plate 78. Missile silo implosion, South Dakota

Plate 79. Missile silo being filled after implosion, South Dakota

Plate 80. Launch Facility after completion of deactivation, South Dakota

Plate 81. The training missile in the transporter erector prior to emplacement in the Delta-09 silo

Plate 82. Convoy transporting training missile for emplacement at Delta-09

Plate 83. Transporter Erector ready to emplace the training missile at Delta-09

Plate 84. Training missile emplacing, Delta-09 silo

Plate 85. Training missile emplacement team

Plate 86. Line drawing of Delta-09 viewing enclosure

Plate 87. Missile viewing enclosure, Delta-09

Plate 88. Ellsworth Air Force Base Honor Guard, Minuteman Missile National Historic Site dedication ceremony

Plate 89. Lieutenant General Robert Hinson, Vice Commander, Air Force Space Command and William R. Supernaugh, Superintendent, Badlands National Park during the dedication ceremony

Plate 90. Colonel James Kowalski, Commander, 28th Bomb Wing, Ellsworth Air Force Base and William R. Supernaugh, Superintendent, Badlands National Park conduct the official transfer of ownership for Delta-01 and Delta-09

List of Abbreviations

ABM	Antiballistic Missile Installations
AD	Air Division
Air Staff	Air Force Air Staff
ARDC	Air Research and Development Command
Army Corps	Army Corps of Engineers
BG	Bombardment Group
BMD	Ballistic Missile Division
BMW	Bombardment Missile Wing
BS	Bombardment Squadron
BW	Bombardment Wing
CEBMCO	Corps of Engineers Ballistic Missile Construction Office
CIA	Central Intelligence Agency
Convair	Consolidated Vultee Aircraft Corporation
DE	Declaration of Excess
EWO	Emergency War Order
FMMS	Field Missile Maintenance Squadron
GSA	General Service Administration
HF	high frequency
HICS	Hardened Intersite Cable System
ICBM	Intercontinental Ballistic Missile
IG	Inspector General
IMPSS	Improved Minuteman Physical Security System
ISST	ICBM Super-High-Frequency Satellite Terminal
JCS	Joint Chiefs of Staff
LCC	Launch Control Center
LCF	Launch Control Facility
LF	Launch Facility
MALA	Missile Area Landowners Association
MP	Military Police
MPT	Missile Procedures Trainer
NATO	North Atlantic Treaty Organization
NPS	National Park Service
OMMS	Organizational Missile Maintenance Squadrons
ORI	Operational Readiness Inspections
RON	Remain-Over-Night
ROTC	Reserve Officers' Training Corps
SAC	Strategic Air Command
SALT Treaty	Strategic Arms Limitation Talks Treaty
SDI	Strategic Defense Initiative
SELM	Simulated Electronic Launch-Minuteman
SLBM	Submarine Launched Ballistic Missile
SLFCS	Survivable Low-Frequency Communication System
SMS	Strategic Missile Squadron
SMW	Strategic Missile Wing
START Treaty	Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms

TE	Transporter Erector
UHF	ultrahigh frequency
USDA	United States Department of Agriculture
USSTRATCOM	United States Strategic Command
VHF	very high frequency
WADC	Wright Air Development Center
WDD	Western Development Division, extension of ARDC

Preface

The purpose of this study is to bring to light the history and context of Minuteman Missile National Historic Site. To achieve this goal, a number of individuals and organizations have generously shared their knowledge and resources. Our special thanks extend to the staff of the National Park Service, including project manager Ron Cockrell, Minuteman Missile National Historic Site Historian Sue Lamie, Badlands National Park Superintendent William R. Supernaugh, contract manager Ron Eilefson, Mary McVeigh and Dan Savage of the Denver Service Center, Historic American Engineering Record staff, and additional National Park Service staff that reviewed and commented on the study.

We would also like to thank individuals at Ellsworth Air Force Base in South Dakota who offered support and provided access to research materials, including Tim Pavek, Environmental Engineer with the 28th Civil Engineer Squadron; Cheryl Cordray, Rich Kauk, and Dan Rexroad in the Real Estate division of the 28th Civil Engineer Squadron; and Staff Sergeant Dennis Wilkinson of the Ellsworth Air Force Base the 28th Bomb Wing History Office.

We are especially grateful to the individuals who took the time to be interviewed thereby providing valuable insight on many topics of this study. Our thanks go to: Jay Davis, Ted Hustead, John LaForge, Wendy McNiel, Gene Williams, and Tom Wilson.

Our appreciation is extended to several individuals and organizations that offered their support and resources, including Charles Simpson of the Association of Air Force Missileers; Ron Alley of the South Dakota Air and Space Museum; Michael L. Faust of Peter Kiewit and Sons' Inc. in Omaha, Nebraska, for sharing historic construction images and company newsletters; Bonnie Urfer and the Nukewatch organization for providing information and sharing photographs; and the staff of the South Dakota State Historic Preservation Office.

In addition our thanks go to the staffs of the various repositories with whom we consulted during the course of research for this project: Dr. Frederick Shaw and Joseph Caver and the staff of the Air Force Historical Research Agency at Maxwell Air Force Base in Montgomery, Alabama; the Air University Library at Maxwell Air Force Base; Bill Burr and the staff of the National Security Archive in Washington, D.C.; the John F. Kennedy Library in Boston; the Dwight D. Eisenhower Library in Abilene, Kansas; the Harry S. Truman Library in Independence, Missouri; the National Archives and Records Administration; the Boeing Archives; and the South Dakota State Historical Society State Archives.

This report was prepared under the direction of Dr. Jeffrey A. Engel, Principal Investigator. Christina Slattery of Mead & Hunt served as the project manager and primary author, with contributions from Mary Ebeling, Erin Pogany, and Amy R. Squitieri of Mead & Hunt. The report was also prepared with assistance from Emily Schill, Matthew Becker, and Victoria Redstone of Mead & Hunt.

Cover photos: Launch Control Center construction photo from Peter Kiewit and Sons', Inc.; Aerial view of Delta-01 from Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-A-1; Minuteman comes to South Dakota from "Site Activation Chronology, Minuteman Project, Ellsworth Air Force Base, South Dakota, July 1963-October 1963," K243.012-40, in USAF Collection, AFHRA; and Launch Control Center construction photo from National Park Service.

Introduction

Establishment and Purpose

In 1999 President Bill Clinton signed into law (Public Law 106-115) an Act of Congress providing for Minuteman Missile National Historic Site. Congress stated the purpose of the new park as follows:

> To preserve, protect, and interpret for the benefit and enjoyment of present and future generations the structures associated with the Minuteman II missile defense system;
>
> 1. to interpret the historical role of the Minuteman II missile defense system–
>
> a. as a key component of America's strategic commitment to preserve world peace; and
>
> b. in the broader context of the Cold War; and
>
> 2. to complement the interpretive programs relating to the Minuteman II missile defense system offered by the South Dakota Air and Space Museum at Ellsworth Air Force Base.

To accomplish this purpose, the Secretary of the Interior was empowered to administer the site in accordance with the provisions of law generally applicable to units of the National Park System, including the establishing act of the National Park Service, approved 25 August 1916 (16 U.S.C. 1 et seq.) and the National Historic Sites Act of 21 August 1935 (16 U.S.C. 461 et seq.).

Geographic Location

Minuteman Missile National Historic Site, historically a part of Ellsworth Air Force Base, consists of Minuteman II Intercontinental Ballistic Missile (ICBM) Launch Control Facility (LCF) Delta-01 and Launch Facility (LF) Delta-09, located adjacent to Interstate 90 about fifty miles east-southeast of Rapid City, South Dakota. The LCF and the LF lie approximately ten miles apart. The Minuteman LCF Delta-01 site occupies an open, grassy tract of land on the west side of Jackson County Road CS 23A, approximately one-half mile north of Interstate 90, Exit 127. Minuteman LF Delta-09 site is located approximately ten miles west-northwest of LCF Delta-01. The LF Delta-09 occupies part of an open, grassy tract of land straddling Pennington County Road T512, about 0.6 miles west and south of Interstate 90, Exit 116. A visitor center will be the third component of Minuteman Missile National Historic Site and is planned to be located near Interstate Highway 90 and in proximity to the two historic sites.

Significance of Minuteman Missile National Historic Site

Delta-01 and Delta-09 were part of the Minuteman I and II missile systems that once dotted the landscape of South Dakota, North Dakota, Missouri, Montana, Wyoming, Colorado, and Nebraska. Minuteman III missiles remain in Wyoming, Montana, North Dakota, Colorado, and Nebraska. For nearly thirty years these missiles and their facilities remained on continuous alert and served an important role in America's triad of defense, including land-based ICBMs,

submarine-launched missiles, and manned bombers. To deter Communist aggression, the United States developed Minuteman I with the ability to respond to an enemy attack with immediate and massive retaliation. In 1961 the Kennedy administration shifted the national policy to one of controlled response. The upcoming Minuteman II design was modified to allow for the launching of one or more missiles and providing a greater survival rate for the site with support facilities hardened belowground that were built to withstand the surface burst of a nuclear weapon. The first Minuteman II squadron went on alert in 1966 and in the following years Minuteman I facilities across the country were upgraded.

The Delta Flight Complex of Ellsworth Air Force Base, originally Minuteman I systems and updated in the early 1970s to Minuteman II, received new weapons, but the original structures were not modified and continued to represent the massive retaliation strategy of the early years of the Cold War. Facilities at other Minuteman deployment areas were configured or modified to implement the new controlled response strategy.

Minuteman II sites, with the exception of Delta-01 and Delta-09 of Ellsworth Air Force Base and Oscar-01 of Whiteman Air Force Base in Missouri, were destroyed or converted to Minuteman III sites in agreement with the Strategic Arms Reduction Talks Treaty. The remaining site on Whiteman Air Force Base, Oscar-01, is an underground Launch Control Center. Oscar-01 no longer has an associated LF and never included an aboveground LCF support building because it was supported by the surrounding base. Oscar-01 was originally constructed to reflect the later controlled response era of the Minuteman design with the construction of ground support facilities hardened (blast-proof) below ground.

Minuteman Missile National Historic Site is the only intact Minuteman II site remaining in the United States that contains an LCF and LF. Delta-01 and Delta-09 are also the only remaining intact examples that demonstrate the original Minuteman I configuration (modified to Minuteman II), designed to implement the Cold War policy of massive retaliation. Minuteman Missile National Historic Site provides the opportunity to interpret the Cold War and the role of the Minuteman missile defense system and what it meant to work with the missiles and live near the sites.

Organization of the Historic Resource Study

To assist in the interpretation and understanding of the cultural, political, social, and economic history of Minuteman Missile National Historic Site, the Historic Resource Study is divided into three main sections.

Section I – The Cold War and National Armament will provide the global and national context for Minuteman Missile National Historic Site. Chapter 1 of Section 1, the history of the Cold War, focusing on the 1950s and 1960s, will describe how nuclear systems developed. This chapter will also focus on the political climate and foreign policy decisions of Presidents Eisenhower and Kennedy and how these factors affected development of strategic missiles and nuclear armament systems. Chapter 2 will provide a background on ICBM program beginnings and liquid-fuel ICBMs, placing the development of solid-fuel ICBMs into context. Chapter 3 will discuss development and capabilities of both the Minuteman I and Minuteman II missile systems and provide an overview of the development of Minuteman III and the future generation of missile development.

Section II – Life on the South Dakota Plains: Before, During, and After Minuteman will present the history of the Minuteman missile in South Dakota in five chapters. Chapter 1 will provide a brief overview of the prehistory and history of the region discussing Native American history, land speculation and settlement, and continued agricultural uses. This background will describe the landscape and environment prior to the establishment of 150 Minuteman I and II LFs and fifteen LCFs throughout the state.

Chapters 2 to 5 will continue to discuss the development, construction, and activities of the missile sites in South Dakota from the 1960s through the 1980s when the sites were still active, with an emphasis on LCF Delta-01 and LF Delta-09. A history of the U.S. Air Force highlighting the Strategic Air Command and Ellsworth Air Force Base in Chapter 2 will provide the background for a discussion of the 44th Strategic Missile Wing, which commanded the Minuteman sites in South Dakota. Chapter 3 will provide the history of the location, land purchase, and construction of the Minuteman sites in South Dakota. This chapter will also discuss both immediate economic and social impacts to the region, as well as the effects over the years. The location and features of Delta-01 and Delta-09 will be described and illustrated in Chapter 4. Section II will continue with a discussion of the day-to-day activities of the personnel assigned to the missile sites in Chapter 5. This discussion will include the training, roles, and responsibilities of the missile combat crew, facility manager, security and maintenance personnel, and the cook. Section II will conclude by addressing changes in the roles, responsibilities, and personnel at the sites during the Minuteman's tenure, including the introduction of female missileers and addressing racial issues among personnel at the sites and within the greater community.

Section III – Peace Movement, Nuclear Disarmament, and the Future will return to the national and international arenas discussing the opposition to nuclear armament, the end of the Cold War, and the future for Minuteman Missile National Historic Site. The national peace movement discussion in Chapter 1 will feature regional protests conducted at the missile sites. Chapter 2 will focus on nuclear arms treaties, including the Strategic Arms Reduction Talks Treaty and the deactivation of the Minuteman sites. The deactivation discussion will focus on the sites in South Dakota, including landowner issues, the inactivation of the 44th Strategic Missile Wing, and the opportunity to retain Delta-01 and Delta-09 for interpretive purposes. Chapter 3 will highlight the process to establish Minuteman Missile National Historic Site and the cooperation between the U.S. Air Force and the National Park Service towards this effort.

Section 1 – The Cold War and National Armament

Chapter 1: The Cold War (1945–62)

Introduction

The story of the Minuteman missile program is a Cold War tale. Journalist Walter Lippmann's 1947 book, *The Cold War*, first used and popularized the term "cold war" to refer to the post-World War II confrontation between the United States and the Soviet Union. Two years earlier, British author and journalist George Orwell called a world living in the shadow of a nuclear war "a peace that is no peace" and referred to it as a "cold war."[1] The term, Cold War, would come to define the political, social, and economic history of the second half of the twentieth century. More than merely a military standoff, the Cold War offered a stable international system forged by the world's emerging two superpowers–the United States and the Soviet Union–that lasted more than four decades. This system formed almost immediately following World War II, when the United States and the Soviet Union epitomized the differences between a capitalist and a communist world. The conflict that arose between these two fundamentally irreconcilable systems, paradoxically based upon stability through mutual destruction, helped spawn development of new weapons systems, including the Minuteman I and II.[2]

The use of the atomic bomb at the end of World War II forever altered the tone of international relations. The devastation caused on 6 August 1945 at Hiroshima and 9 August 1945 at Nagasaki led the world to fear an atomic war, and to fear what atomic weapons could do, even to their inventors. As H. V. Kaltenborn, one of the most respected American broadcasters of the period, told his listeners on the night of 6 August 1945, "We must assume that with the passage of only a little time, an improved form of the new weapon we use today can be turned against us."[3] This fear dominated the Cold War, as policymakers and pundits alike recognized that any potential conflict could escalate to the point of global destruction once both superpowers possessed these weapons. Hiroshima changed everything, the Congressional Aviation Policy Board concluded in 1948, "Militarily speaking, at that same hour the security frontiers of all nations disappeared from the map. National defense, in the traditional sense, is no longer possible. The cycle of history has turned, and once again civilization stands vulnerable to annihilation."[4]

With the benefit of hindsight, we may now clearly state that this overt threat of nuclear annihilation kept both sides from pursuing a more aggressive or expansionistic foreign policy as the U.S. and the Soviet Union during the Cold War were very aggressive in maneuvering with third world countries in an attempt to tilt the theoretical balance of power in their own favor.

With nuclear weapons and the atomic bomb at the heart of this threat, American policymakers believed their country had to stay technologically ahead of the Soviets if it was to survive. They were determined to maintain their atomic monopoly as long as possible, and thereafter to use their technological superiority for diplomatic leverage. The Soviet Union was bent upon global domination, policymakers reasoned, and if the Soviets believed that the American force could be defeated, it seemed likely that Moscow would strike. Technological superiority, in other words, when coupled with the ability to deliver unprecedented force, was required to maintain the peace.

The Minuteman missile program and the efforts of the military and civilian personnel of the 44th Strategic Missile Wing of Ellsworth Air Force Base are each a product of this Cold War system. In order to deter communist aggression, the United States developed the Minuteman I missile system with the ability to

respond to an enemy attack with immediate and massive retaliation. The origins of the Cold War help to identify how the Soviet-American relationship deteriorated and the two sides became entrenched for over four decades–this background is fundamental to understanding why such powerful military weapons were deployed in South Dakota–some thousands of miles from the Soviet border. In the Cold War, as we shall see, the front line was everywhere.

Origins of the Cold War

Zones of Contention

The mutual antagonism of the Soviets and Americans, leading to the Cold War, developed after World War II as the two sides competed over a number of geographic and political zones of contention. In several confrontations and diplomatic situations, American policymakers in particular learned important lessons, including that the Soviet Union was no longer an ally, that Moscow intended to expand the physical realm of communism, and that the Soviets could only be deterred by force and the threat of force.

Two major conferences–Yalta and Potsdam–were held in 1945 with the Soviets, British, and Americans to determine the fate of Europe and defeated Germany. The Yalta Conference, at the Russian Black Sea resort in February, was the last meeting of the Big Three allied leaders–American President Franklin D. Roosevelt, British Prime Minister Winston Churchill, and Soviet Premier Joseph Stalin. At the conference, debates over Poland's postwar borders and government put Roosevelt and Churchill at odds with Stalin. Within months of Yalta, Soviet control over Poland and the rest of Eastern Europe had evolved into a serious concern for the future of Western Europe.[5]

Leaders of the three countries met again at the Potsdam Conference, outside of the captured Berlin, from 17 July to 2 August 1945. This was the last major conference of World War II, and its participants attempted to build upon the efforts of the Yalta Conference. However, the United States and Britain found themselves again unable to come to an agreement on many diplomatic issues with the Soviet Union. President Harry S. Truman, who had taken office following Roosevelt's death on 12 April 1945, and many Potsdam attendees, saw the Soviet Union shifting from a wartime ally, even a frequently difficult one, to an outright adversary.[6]

The postwar battle over the control of Germany and Berlin demonstrates how tensions evolved dividing Europe into East versus West. Germany was physically and ideologically divided between the two sides. For the United States, a strong rebuilt Germany capable of sustaining its own redevelopment while supporting its neighbors seemed vital to the success of Western Europe, while Soviet leaders longed for a ravaged Germany, incapable of ever again attacking the East. The superpowers' division over Germany's fate was centered symbolically on the country's former capital, Berlin. The United States, Britain, France, and the Soviet Union each had military troops stationed in Berlin–110 miles into the heart of the Soviet occupation zone and the future East Germany–and their presence led to the 1948 Berlin Blockade (discussed below).

American financial assistance toward the reconstruction of Europe following the war also contributed to a deteriorating relationship between the United States and the Soviet Union. The United States emerged from the war with a strong economy, and was in the position to provide aid to Europe, a situation ultimately resented by the Soviets. Initially the United States offered aid on a country-by-country basis, with $3.75 billion going to the British in 1945-46 and $1.2 billion to France the following year.[7] The Soviets requested $1 billion in aid in 1945, but due to crumbling East-West relations, the Truman Administration never formally approved an aid package for Moscow. State Department officials claimed to have "lost"

the Soviet request, though later historians have proved their story was fabricated so as to provide justification for rejecting Moscow's plea. No matter the reason, Moscow's failure to garner American postwar aid proved a contentious issue in Soviet-American dealings.

The United States also faced conflict with the Soviets outside of Europe. The fate of China, for example, as a result of its civil war, was of crucial interest to the two superpowers if for no other reason than its status as the world's most populous country. Led by Mao Zedong, China's Communists eventually won power, leading to greater American concerns over the future of the capitalist system without its most populous member and to domestic attacks against the Truman Administration for "losing" China. Communism's victory in this crucial early Cold War battle helped American policymakers understand the growing threat of this dangerous new ideology and gave the United States a new and bitter adversary in Asia.

The Iranian Crisis of 1946 also contributed to the polarization of Soviet-American relations. Following World War II the Soviets agreed to end their occupation of northern Iran and remove their troops within six months of the conflict's end. When the Soviets did not comply with their wartime promise and continued to occupy northern Iran and use political and military pressure to gain oil concessions, President Truman threatened war and mobilized troops to the area. These actions forced the Soviets to withdraw without concessions, offering proof to American policymakers that the Soviets responded only to force. By 1947, therefore, tensions ran high between the East and West and American leaders had developed an increasingly hostile view of Russia.[8]

Declarations of Cold War

Tensions between the two countries escalated during the post-World War II period and declarations by leaders on both sides, including Stalin and Churchill, and strategists, such as United States diplomat George Kennan, began to formally announce the existence of a Cold War. At the heart of their message was recognition of the posturing by the two superpowers with opposing ideologies and world views.

Such declarations of Cold War began as early as 1946. In February of that year, Stalin's Soviet Party Congress speech made the growing East-West conflict seem inevitable. Cold War historian Walter LaFeber discussed how Stalin's speech cast a pall over contemporary East-West negotiations,

> "In an election speech of February 9, the Soviet dictator announced that Marxist-Leninist dogma remained valid, for 'the unevenness of development of the capitalist countries' could lead to 'violent disturbance' and the consequent splitting of the 'capitalist world into two camps and the war between them.' War was inevitable as long as capitalism existed. The Soviet people must prepare themselves for a replay of the 1930s by developing basic industry instead of consumer goods and, in all, making enormous sacrifices demanded in 'three five-year plans, I should think if not more.' There would be no peace, internally or externally. These words profoundly affected Washington. Supreme Court Justice William Douglas, one of the reigning American liberals, believed that Stalin's speech meant 'The declaration of World War III.' "[9]

Two weeks after Stalin's speech, in late February, United States diplomat George Kennan responded to a State Department request for an analysis of Soviet expansionism and global intentions with what became another such declaration of a Cold War. Kennan's response, later given the descriptive title "The Long Telegram," warned that Soviet policies assumed western hostility and that Soviet expansionism was inevitable.[10] Moscow would only be deterred by forceful opposition, be it political or military, and Kennan thus recommended that the United States employ a policy of "long-term patient but firm and

vigilant containment."[11] His analysis was well received by United States policymakers who felt that the telegram confirmed their views and the tougher stance the Truman administration was taking with the Soviets.

One month later, in his March 1946 speech at Fulton, Missouri, ex-British Prime Minister Winston Churchill presented his views on the East-West conflict. Churchill coined the term "iron curtain" in this speech and outlined a global alliance between Europe and the United States, "From Stettin in the Baltic to Trieste in the Adriatic an iron curtain has descended across the Continent. Behind that line lie all the capitals of the ancient states of Central and Eastern Europe. Warsaw, Berlin, Prague, Vienna, Budapest, Belgrade, Bucharest and Sofia; all these famous cities and the populations around them lie in what I must call the Soviet sphere, and all are subject, in one form or another, not only to Soviet influence but to a very high in some cases increasing measure of control from Moscow."[12]

During the final passage of the American Treasury loan to Britain in July 1946, American Congressional leaders outlined their own declaration of Cold War, as they described the world as half free and half communist in order to win approval for the politically contested loan. Leaders, such as Speaker of the House Sam Rayburn, argued that the United States must support its longtime ally in Britain, especially as the bipolar division of the world seemed impossible to overcome. The United States committed $3.75 billion in loans to Britain for reconstruction of its economy, which was, in the words of historian Derek Leebaert, the "first distinctly postwar commitment of U.S. economic and political power."[13] As Rayburn explained in defense of the loan, "I do not want Western Europe, England, and all the rest of Europe pushed toward an ideology that I despise" and "I fear that if we do not cooperate with our great natural ally [Britain] that is what will happen."[14] As Cold War historian Dr. Jeffery A. Engel has written, to thinkers like Rayburn, "Only a strong Great Britain, an unsinkable American island-base of anti-communism set off the coast of Europe could prevent Soviet domination of the continent, he argued, and only an economically strong Britain, a Britain strengthened by a $3.75 billion loan, could possibly remain solidly in the American camp."[15]

American Cold War Policy

By 1947 it had become apparent to most observers that the world was splitting in two–East and West–leaving the inevitable conflict of the Cold War. Quickly the lines in the sand were drawn even deeper as the Soviets and Americans clashed ideologically and militarily on a number of fronts. In February, for example, Britain's decision to cease aid to Greek forces fighting a Communist insurgency prompted the Truman Administration to assume new responsibilities throughout all of Southern Europe. The ensuing "Truman Doctrine" committed $400 million in aid to Greece and Turkey–a huge sum given Congressional fiscal conservatism at the time–and offered a precedent for further American assistance to any "free peoples" engaged in a struggle against "terror and oppression" and "the suppression of personal freedoms."[16] Truman's Manichean worldview pitted the world in two, good against evil, for to American policymakers, Communism seemed everywhere on the march. "Like apples in a barrel infected by one rotten one," Secretary of State Dean Acheson explained, "the corruption of Greece would infect Iran, and all to the East."[17] Without American aid, Europe and Africa would be next, he continued and "we and we alone could break up the [Soviet] play." Western Europe subsequently received its own brand of American economic stimulus later that year, with the Marshall Plan designed to promote economic recovery and stability as a vaccine against the Communist "infection." The Soviets refused to participate in the plan, which Foreign Minister Molotov denounced as a "new venture in American imperialism."[18] The Soviets offered their own aid package for Eastern Europe and, with dollars flowing to one half of the continent and rubles to the other, the division of East and West grew even deeper. The Truman Administration later followed-up this aid program to Europe with "Point Four," a program similarly designed to spread American technical know-how and dollars throughout the developing world as a means of countering Soviet expansion.[19]

Conflict continued with the Soviet Union determined to push the United States and its allies out of West Berlin. In June 1948, the Soviets imposed a blockade on West Berlin in an attempt to cut off supplies to the city. The United States and its allies began to supply the city with a massive airlift of unprecedented size, and the Soviets ended the blockade in May 1949. The United States' commitment to Western Europe's defense, exemplified by efforts during the Berlin Blockade, led to the establishment of the North Atlantic Treaty Organization (NATO) in April 1949. NATO provided for a collective defense of its members, as the organization's charter promised that an attack on one would be considered an attack on all. NATO represented the United State's commitment to its European allies and would become an important key to containing the Soviet Union in Europe.[20]

Shortly after the lifting of the Berlin Blockade, in August 1949, the Soviet Union broke the American nuclear monopoly by developing its own atomic bomb. The Soviets had matched the United States' key technology sooner than most expected. This development forced the United States to reevaluate its defense posture and accelerated the creation of even more powerful weapons, such as the hydrogen bomb, to regain its nuclear superiority. An analysis of the United States' defense position was presented to President Truman in the National Security Council Paper Number 68 (NSC 68). NSC 68, authored largely by Paul Nitze of the State Department policy staff, would come to shape American policy for many years. NSC 68 outlined that the United States needed to be prepared globally for Soviet or communist expansionism and that containment should become a global policy. The directives outlined in NSC 68 were written prior to the North Korean invasion across the 38th parallel but were not adopted until September 1950, after this conflict proved to many the necessity of American military buildup.

By the early 1950s American foreign policymakers knew that the Cold War was here to stay. Communism seemed everywhere on the move, exemplified by the crises described above and then most dramatically with the North Korean invasion of June 1950 that began the Korean War. Western policymakers believed countries at risk from Communist aggression might fall if their neighbors succumbed, like the rotten apples of Acheson's metaphor or, more commonly, like so many dominoes: if one country was lost to the Communists, so too would be the next, and the next. Communism had to be stopped, but at what cost? The increasing conflict between the United States and the Soviet Union and the arms race would shape the United States strategic defense program and Intercontinental Ballistic Missile (ICBM) development. In the Cold War, the United States would maintain its stance that the only way to halt the expansion of communism was through development of increasingly advanced weapons systems. As we shall later see, one such system would be the Minuteman. Before that missile would be deployed, however, there would be events and developments, international and technological, which would shape this weapon and the communities that housed it.

Eisenhower and Waging Peace

The Cold War and the directives of NSC 68 led to a significant increase in American military spending. Just over $13 billion was spent on the country's defense in 1950, while only three years later total American defense spending exceeded $50 billion, or nearly forty percent of the federal budget.[21] Much of this increased spending can be attributed to the Korean War; however, many United States policymakers believed that defense spending would continue at this elevated level for the foreseeable future. Their predictions ultimately proved correct, as spending on American forces dipped after the war to approximately $34-$38 billion a year, while military and financial aid delivered to allies in the name of halting communism averaged nearly $12 billion annually throughout the remainder of the decade. This level of Cold War spending became the norm until the height of the costly Vietnam War.

President Dwight D. Eisenhower took office in 1953 with a pledge to lower the cost of waging the Cold War, what he called "waging peace." He feared a prolonged military conflict and a commensurate expansion of the military and federal government might undermine the country's democratic values. President Eisenhower did not dispute NSC 68's basic principles, in particular its contention that Soviet Communism was inherently expansionistic and thus a threat to the United States, but he feared the effects of a broad Cold War fight on America's economy and society. Increased military spending could warp the marketplace, while efforts to combat Communism at home, if not carefully regulated, might ultimately undermine American civil liberties. As Eisenhower stated, his administration was charged with defending "a way of life," not just a territory and "We could lick the whole world if we were willing to adopt the system of Adolph Hitler."[22]

These were hardly idle concerns. During this same period, Senator Joseph McCarthy led the charge against Communism at home, popularly known as the Red Scare, with largely unsubstantiated accusations that Communists had infiltrated the federal government and the State Department in particular. McCarthy's accusations caused a sensation. Following televised Congressional hearings in 1954, where McCarthy accused the Army of harboring Communists, he was censured by the Senate for his actions. The country's rabid anti-Communist hysteria began to slow, though Cold War fears continued to color American political and cultural life for more than a generation. As Eisenhower had feared, anti-Communism, as espoused by McCarthy and others, was distorting American values.

As Commander-in-Chief and as a former Army General, Eisenhower at least exerted greater control over the military. He believed in the conservative (what earlier generations would have called republicanism or classical liberalism, terms that change over time though their meanings remain the same) ideal that democracy and militarism are forever at odds, as he held significant faith in civilian rule.[23] Based on these beliefs he called for a reconsideration of the country's Cold War policies upon taking office. He initiated "Project Solarium"–named for the room of the White House where the project was discussed–which requested three blue-ribbon, top secret panels to separately consider and propose a strategy for America's Cold War policy.

Group A was headed by diplomat and Soviet expert George Kennan. Kennan's group concluded that since the Soviet threat remained strong, the previous administration's containment policy should be continued. They recommended continued expansion of defense spending and military buildup. As reported by Group A, "If we can build up and maintain the strength of the free world during a period of years, Soviet power will deteriorate or relatively decline to a point which no longer constitutes a threat to the security of the United States and to world peace."[24]

Group B was led by Air Force Major General James McCormack, an expert on atomic weapons. The members of McCormack's group proposed drawing a "line of no aggression" around the Communist Bloc and areas necessary to the United States security.[25] Entry or expansion beyond the line would result in an atomic attack on the Soviet Union. Group B's plan offered the advantage of limiting military spending, but featured two major obstacles: where to draw the line, and how to procure Congressional and public support for an atomic war should the Soviets cross the line.

Vice Admiral Richard Conolly headed up Group C in the discussion of the nation's future Cold War policy. His group advocated an aggressive approach to winning the Cold War and reversing Communism, a policy publicly dubbed "roll back." They stated that the United States should "prosecute relentlessly a forward and aggressive political strategy in all fields and by all means: military, economic, diplomatic, covert, and propaganda."[26] Through aggressive means, Communism would be swiftly eradicated and democracy "restored."

President Eisenhower ultimately adopted none of the three options, choosing instead a combination of the first two, which were drafted into National Security Council Paper Number 162 (NSC 162), his administration's Cold War blueprint. NSC 162 advocated extensive reliance on nuclear weapons as the country's primary deterrent to Communist expansionism and aggression. It advocated vigilance against future Communist expansion but not direct roll back unless the United States was in position for victory. The policy focused on keeping America safe, but as importantly, also fiscally secure. No one in 1953 could predict how many years the Cold War would last and the administration felt strongly that it needed a policy that could be sustained for possibly a decade or more. Secretary of the Treasury George Humphrey explained, "if we mean to face this Soviet threat over a long time, we must spend less than we now are spending and do less than we now are doing."[27]

Following Project Solarium and the revision of the document to NSC 162/2, the United States had a new doctrine for winning the Cold War at an affordable cost. NSC 162/2 called for the use of an atomic strike force capable of deterring the Soviets from action. To contain Communism, Eisenhower authorized the expansion of the country's nuclear arsenal and the stage was set for the continued development of nuclear weapons, including what would later be called the Minuteman missile. The number of atomic weapons grew from one thousand in 1953 to more than eighteen thousand by the time President Eisenhower left office in 1961. During this same period, America's military budget dropped from $50 billion in 1953 to an average of $34 billion with savings achieved largely through reductions in troop levels. The increase in the country's nuclear arsenal and the idea that Soviet threats and expansionism would be met with awesome power became known as the policy of "massive retaliation."

The Problem of Massive Retaliation

Massive retaliation limited the Eisenhower administration's policy options. The 1954 Dien Bien Phu crisis in Vietnam, for example, demonstrated the limitations of too great a reliance on the nuclear response. Since 1945 the United States had supported France's efforts to defend its colonial presence in Indochina, both militarily and economically, and in 1953, France and the United States adopted the Navarre Plan to prevent the Communist-led Viet Minh takeover of the region. That same year French General Henri Navarre established a military base at Dien Bien Phu in northwestern Vietnam in hopes of luring the Viet Minh into battle. The Viet Minh laid siege on the French and a standoff occurred, with the United States airlifting supplies to the French.

Many of Eisenhower's advisors, including National Security Council (NSC) Chairman Admiral Arthur Radford, believed the only way to save the French was by dropping atomic bombs on their opponents. Eisenhower rejected this suggestion, arguing that nuclear weapons were too destructive to use in a limited conflict, and perhaps too politically damaging to use at all. "You boys must be crazy," he said. "We can't use those awful things against the Asians for the second time in ten years. My God."[28] Without support from either American ground forces or nuclear weapons, the French garrison fell to the Viet Minh on 7 May 1954.

The decision not to use nuclear weapons in Vietnam called into question the administration's policy of massive retaliation and deterrence. Massive retaliation might have been a successful policy for keeping the Cold War in balance and an option for stopping a major Soviet advance into Western Europe–although it was never put to this test–but it did not answer everything. If the administration was not ready to use nuclear weapons in all situations, Eisenhower's strategists reasoned, other options needed to be available to American leaders. Ironically, at an earlier time, Eisenhower had publicly stated that nuclear bombs were like any weapon, and could be "used just exactly as you would a bullet or anything else."[29] In

private, however, the president and his top advisors were each beginning to doubt the wisdom and utility of relying solely on the atomic threat. Despite their concerns, Soviet developments would soon prompt the United States to continue and even to expand its nuclear capabilities.

Sputnik

On 4 October 1957 the Soviets launched the world's first satellite, named Sputnik I. The launching shocked much of the world, not only for its scientific importance, but also because of the implications of this technology for American and Free World security. If the Soviets had rockets to launch satellites, many concluded that they would soon be able to develop ICBMs that could reach the United States. The Soviet achievement moreover demonstrated their technological lead in this field over the United States, and began the space race. As American security was predicated on maintaining technological superiority, Sputnik terrified the nation.

President Eisenhower responded by increasing spending on missile development. In January 1958, three months after the Soviets, the United States successfully launched its own satellite, after a number of publicized failures. At this same time, the Pentagon's feasibility studies for intercontinental missiles, including the Minuteman missile, had been completed, and planning was underway for funding and development of this American military response.

Kennedy Administration and the First Minuteman Deployment

By the end of the 1950s, many Americans believed their country needed new Cold War policies. They feared for national security in an age of ballistic missiles, and they also questioned the effectiveness of the Eisenhower administration's policies for halting Communist expansion in the Cold War's periphery– those areas outside of Europe and the United States. Many observers believed the next great Cold War conflicts would occur in just these regions. Congress asked for hearings in 1959 to review the United States position in the space race, and Democrats subsequently campaigned against Republican Cold War policies, charging that they had allowed the Soviets to get ahead of the United States in missile development, creating a missile gap. The "gap" represented the difference between the number of missiles it was believed the Soviets possessed and the number of American missiles. Ironically, a missile gap did not exist. In actuality, the Soviets possessed significantly fewer missiles than most Americans believed and Democrats had claimed. Espionage and photographs from U-2 spy planes proved the deficiencies of Soviet nuclear arms, but the administration could not publicly state this fact without compromising national security and letting the world and the Kremlin know about the American spying capabilities. In the 1960 presidential election, Democratic candidate John F. Kennedy narrowly defeated Vice President Richard Nixon. Nixon had refused to compromise national security by leading a countercharge that refuted Democratic claims of a missile gap, and a new administration took office.[30]

Kennedy promised to improve American Cold War capabilities, including defense. He supported the Minuteman program and the country's continued development of ICBMs. Kennedy and his administration focused on a new Cold War policy to maximize policy options beyond a massive nuclear retaliation. This new policy became known as "flexible response," and included creation of new Cold War institutions, such as highly trained combat troops known as Green Berets or Special Forces, and even the Peace Corps. Kennedy also advocated vigilance towards the Soviets. His refusal to bend to Soviet pressure contributed to the Berlin Crisis of 1961 (when he activated his military reserves in response to Soviet demands that the West evacuate its military presence in the city, a crisis that culminated in Soviet construction of the Berlin Wall) and the Cuban Missile Crisis the following year, precipitated by Moscow's planned installation of nuclear missiles in Cuba, only ninety miles from the American coast. An

American quarantine of Cuba, and a secret agreement to dismantle Jupiter missiles in Turkey in exchange for removal of the Soviet missiles from Cuba, ultimately eased tensions and avoided disaster, though the world stood closer to the brink of nuclear war than arguably at any other time. Each crisis increased nuclear tensions between the superpowers, who wielded destructive power unknown and unimaginable to previous generations. It is in this context that the Minuteman was deployed and played its Cold War role.



Plate 1. The Big Three Conference at Yalta, 12 February 1945, from left to right: British Prime Minister Winston Churchill, United States President Franklin D. Roosevelt, and Soviet Premier Joseph Stalin
(AP/Wide World Photos)

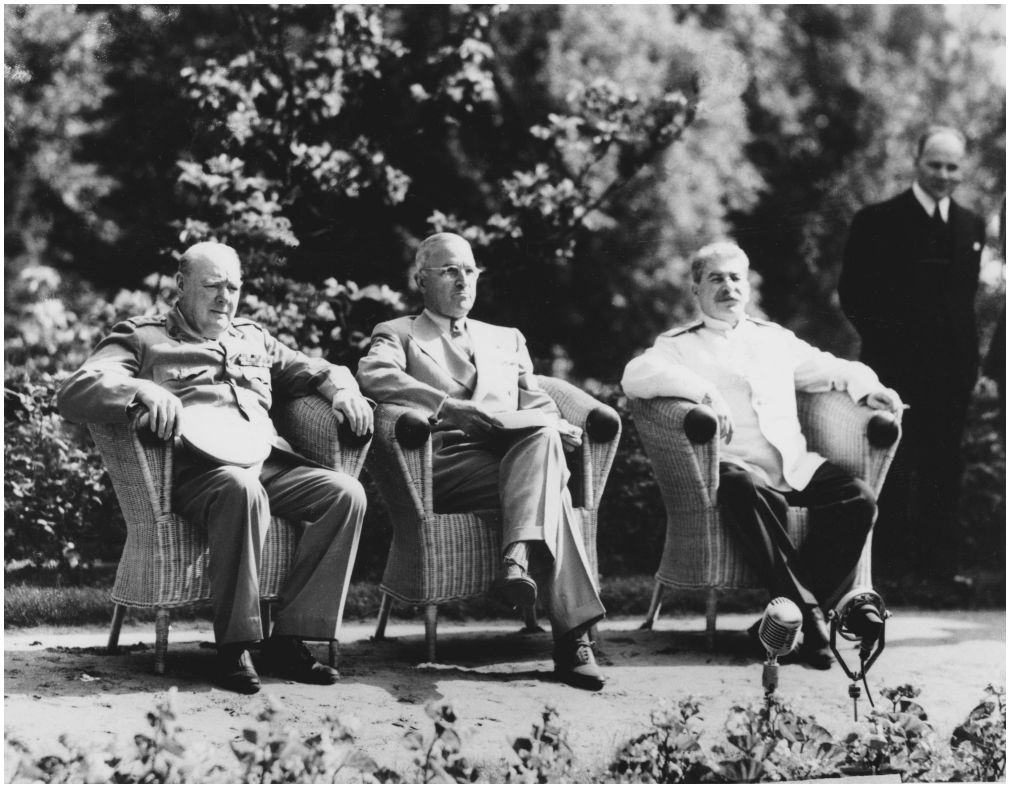


Plate 2. British Prime Minister Winston Churchill, United States President Harry S. Truman, and Soviet Premier Joseph Stalin meeting at the Potsdam Conference, August 1945 *(AP/World Wide Photos)*

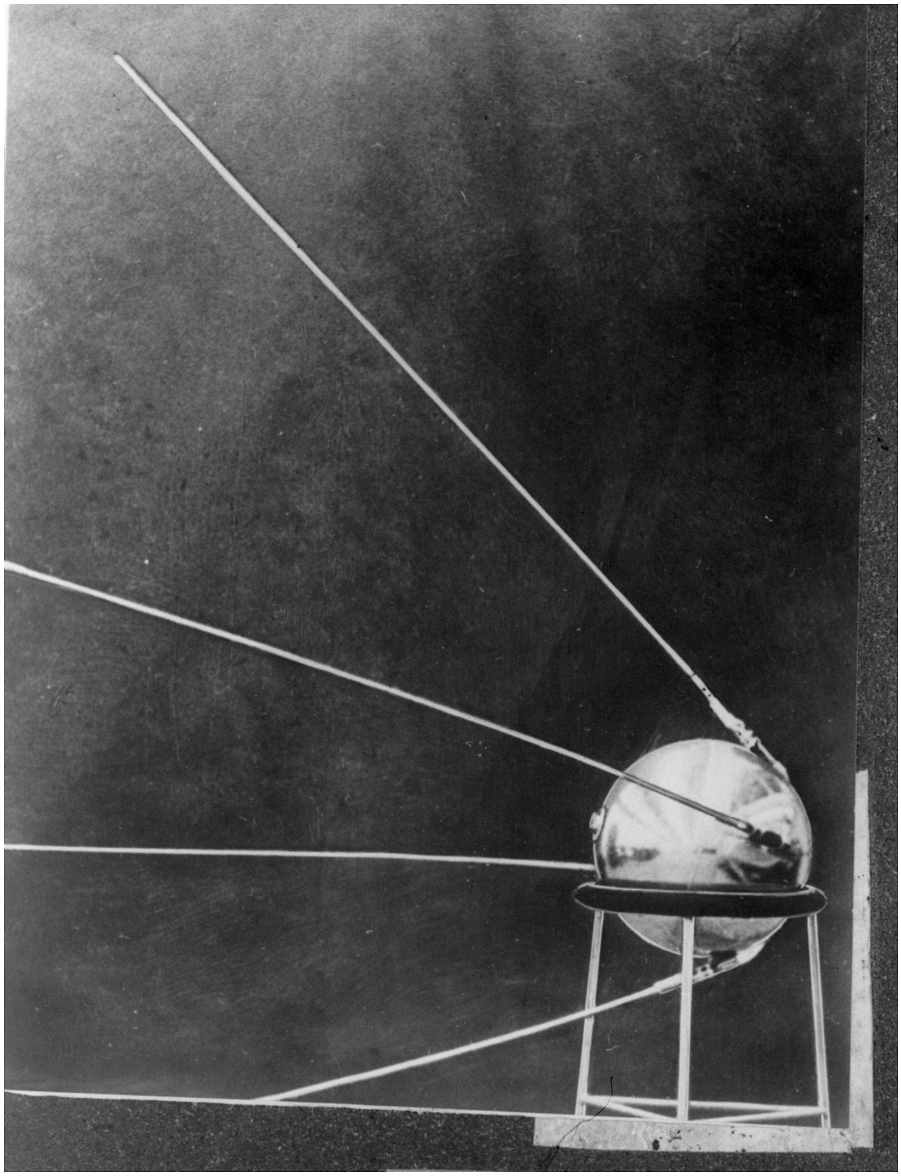


Plate 3. First official picture of the Soviet satellite Sputnik I, issued on 9 October 1957, showing the four-antennaed baby moon resting on a three-legged pedestal *(AP/World Wide Photos)*



Plate 4. President Kennedy (*center*) with Secretary of Defense Robert McNamara (*far left*), SAC Commander General Thomas S. Power (*right*), and Lt. General Howell M. Estes, Jr. (*right background*) at Vandenberg Air Force Base, California, March 1962 *(Courtesy U.S. Air Force, History Division)*

Chapter 2: U.S. Strategic Missile and Armament Systems (1950s–60s)

Intercontinental Ballistic Missile Program Beginnings

The Minuteman program was a Cold War story, but development of the missile system offers its own history. This section explores the evolution of America's ballistic missile program, of which the Minuteman would play a vital role. By the time of the Cuban Missile Crisis in 1962 the United States had succeeded in developing nuclear missiles with intercontinental range. However, America's early forays into strategic missiles suffered from a lack of funding, bureaucratic infighting, and interagency tensions that slowed early research into missile armament systems.[31] Although the progression from piloted weapons systems to missiles seems obvious in retrospect, that conclusion remained uncertain at the onset of the Cold War.

Many high-level politicians and military officers began to think more seriously about Intercontinental Ballistic Missile (ICBM) development in response to these tensions, leading the Air Force to initiate a crash program in ICBM development through the newly formed Air Research and Development Command (ARDC).[32] The ARDC and the new crash program built on previous missile research conducted by the Consolidated Vultee Aircraft Corporation (Convair) for Air Force contract MX-774. Convair's contract had been canceled in 1947 as part of the Air Force's post-Word War II cuts in military spending.[33]

The news in 1949 that the Soviets had tested an atomic bomb sparked revived interest in air defense systems, though of course, in an age of aerial warfare, the potential for long-range Soviet strikes upon American soil had never been far from the minds of Washington strategists.[34] "Attacks can now come across the arctic regions, as well as across oceans, and strike deep…into the heart of the country," General Carl Spaatz, commander of American strategic bombing in World War II told a Senate Committee in 1945. "No section will be immune," he warned, "the Pearl Harbor of a future war might well be Chicago, or Detroit, or Pittsburgh, or even Washington."[35] North Korea's 1950 invasion of South Korea–an attack perceived by many Western strategists as part of a concerted global strategy by the Soviets–made Western fears of attack seem all the more prescient.

Air Research and Development Command

The Air Force established the ARDC in 1950 specifically for development of the Air Force missile program.[36] Many issues remained to be solved before the ICBM could get off the ground. Development of the ICBM program was hampered by resistance on the part of one branch of the Air Force, the Air Force Air Staff (Air Staff), and inefficient cooperation between different branches of the military.[37] The Air Staff was the planning body within U.S. Air Force Headquarters. As a Major Command, the ARDC (later known as the Air Force Systems Command) was below the Air Staff in the hierarchy of the U.S. Air Force.[38] Initially the Air Force opposed further research and development on the grounds that available technology was not advanced enough for the successful development of missiles with intercontinental range. Members of the Air Staff questioned the reliability and effectiveness of ICBMs.[39] Additionally, the culture within the Air Force at the time favored development of bombers and the integration of missiles with aircraft development. Achievement of high rank in the service required pilot training and command of squadrons or wings, and only officers could be pilots. These flyers were thus naturally hesitant to endorse a new and potentially significant weapons system that carried the potential of diminishing the value of their skills (as pilots) to the Pentagon. Indeed, the Air Force went so far as to designate its missiles "pilotless aircraft," implicitly signifying that any real aircraft carried a human commander. The lack of an integrated development plan further hampered missile research and development and budgetary issues resulting from President Truman's economy drive compounded the problems of

developing the ICBM program. Only after the Air Force began to integrate its missile program with its aircraft program did it become apparent that missile development needed a separate, focused effort.[40]

The Air Force had competition in missile development from both the Army and the Navy. Missile development programs underway at the beginning of the 1950s included the Army's Redstone project, headed by Wernher von Braun and the Jupiter Intermediate Range Ballistic Missile, as a joint venture between the Army and Navy.[41] The Air Force found itself in a position of losing its defensive capabilities and therefore stature in the armed forces if it did not keep up with missile technology.

Rather than allowing themselves to fall behind technologically, the Air Force overcame its reticence and approved a contract with Convair in January 1951 for development of a ballistic missile carrying a heavy nuclear payload with a five thousand-mile range and a circular error probable (acceptable radius of target error) of 1,500 feet.[42] This new missile project, known as the MX-1593 or Atlas, was largely based on Convair's earlier Air Force project, the MX-774. Convair now built on earlier engineering efforts to create the Atlas ICBM.[43]

In 1952 Trevor Gardner, Special Assistant for Research and Development to Air Force Secretary Harold E. Talbot, asked the Air Force for performance specifications and a justification of the deployment schedule for the Atlas. The response from the ARDC asserted that "the ballistic rocket appears, at present, to be the ultimate means of delivering atomic bombs in the most effective fashion."[44] Funding for the Atlas remained limited, however, and important logistical problems had to be overcome in its development before it could meet the Air Force's requirements.

Bomb weight, maximum range, and nose cone design to withstand reentry were three formidable early problems faced by missile developers. However, scientific advances created thermonuclear devices that were lighter than earlier generations of nuclear weapons while possessing more destructive capability–in 1952 the validity of thermonuclear detonation was proven. During this same period, more powerful liquid-fuel engines became available and it became clear that ICBMs with a range of over five thousand miles could be built. The combination of more powerful engines and lighter bombs solved the problem of limited missile range. The development of a blunt, copper heat-sink in 1952 to absorb the fierce heat of the reentry vehicle solved the third problem.[45] Now the ARDC and Convair needed to transfer these new technologies to its Atlas missile system

The Air Staff did not agree with the ARDC on Atlas development and funding and refused to commit the necessary funds for full-scale development. The ARDC refused to give up, citing the urgent need for an ICBM in the interest of national security. The ARDC favored full-scale development on an accelerated schedule, whereas the Air Staff preferred additional research before committing more funding to the program. After two years of political maneuvering, the Air Staff and ARDC reached a compromise in 1953. This agreement produced a development plan that called for the research and development phase for the Atlas to be completed by "sometime after 1964" and for an operational missile by 1965.[46]

Teapot Committee and RAND Report

While American leaders worked to develop their own strategic missile force, they also strove to evaluate United States military defense capabilities in relationship to their closest rival. Two committees were formed during this period to study the Soviet Union's potential threat. The Strategic Missiles Evaluation Committee, code name Teapot Committee, was formed in 1953 by Trevor Gardner and was chaired by famed mathematician Dr. John von Neumann of the Institute for Advanced Studies. The Teapot Committee was developed to evaluate current programs and the level of technology of potential enemies

(mainly the Soviet Union), and to recommend solutions for identified problems. A concurrent study focusing on similar questions was conducted by the RAND Corporation, a security studies think-tank with long ties to the Air Force.[47]

Both studies produced alarming findings. They each independently determined that Soviet missile technology had advanced significantly in the short period since World War II, and that only a major push in missile development in the United States could overcome this technology gap. Policymakers of this period fervently believed that falling technologically behind the Soviets in the defense arena would be inviting the disaster of a Soviet attack.[48] The reports also concluded that development of an operational ICBM system within six years was an attainable goal if the Air Force would commit the appropriate talent, funds, and management strategies to the project.[49] According to Teapot, the Atlas program in particular– as the most advanced American missile program then under development–had to be accelerated for the sake of national security. President Eisenhower took these findings most seriously, and ordered work on the ICBM program accelerated by assigning it "the highest national priority."[50] The Western Development Division (WDD), an extension of the ARDC, was created and assigned to spearhead the development of ICBMs.

Western Development Division
Trevor Gardner, Air Force Chief of Staff General Nathan F. Twining, and Lieutenant General Donald Putt received approval for a management agency within the Air Force, the WDD, whose primary purpose would be to develop an ICBM.[51] The WDD was created "solely for the prosecution of research, development, test, and production leading to a successful intercontinental ballistic missile."[52]

The WDD facilitated the rapid development of the Atlas system, and its employees worked long hours to get the job done. For example, Lieutenant General Otto Glasser reported that a normal work-week consisted of ten-hour days, six days a week, with extra time often being put in on Sundays.[53] The main function of this working group was not to actually build an ICBM, but to work together with private contractors to design the new weapon as quickly and cheaply as possible.[54] The project became a race against time, with the goal of an operational ICBM by the end of the 1950s–the estimated date for an operational Soviet ICBM.[55] To many of the workers, the very safety and security of the United States seemed to hinge on the success of their program.

To help meet its goals, the WDD contracted with the Ramo-Wooldridge Corporation of Los Angeles, California to provide technical direction. This joining of forces speaks to the increased size and importance of the ICBM program in the Air Force's eyes. The number of Ramo-Wooldridge staff members assigned to assist the WDD on the ICBM project started with 170 staff members at the beginning of 1954 and grew to 5,182 by the end of 1960.[56]

The WDD opened its office in a former elementary school in Inglewood, California, in 1954 with General Bernard A. Schriever, a forty-three year-old well respected brigadier general, appointed as its head. In an attempt to maintain a low profile for this top-secret project, military staff stationed at the WDD wore civilian clothes.[57] ICBM chronicler and journalist Roy Neal described the WDD headquarters in these words, "No sign identified the white schoolhouse as the Western Development Division… The windows were frosted and heavily barred. All outside doors, except one, were locked. The only entrance was across a chain-link fenced parking lot. A security guard manned the door… Some of the old-timers recall… the comment of the school boy who was sauntering by the school buildings. Eying the frosted glass and steel-barred windows, he said to a chum, 'Boy am I glad I don't go to school here.' "[58]

The WDD staff began their work designing and coordinating the construction of the Atlas ICBM. In 1955, the WDD requested and received Air Force approval to develop a second ICBM, the Titan, concurrently

with the Atlas. The WDD initiated the research and development on the Titan in the hope that if Atlas was delayed, Titan with slightly different engineering could be made operational by the end of the 1950s and keep the United States from falling behind in the missile race.[59]

Liquid-Fuel Intercontinental Ballistic Missiles: Atlas and Titan

One of the most important early problems tackled by missile developers working with the WDD was that of fueling the rocket, or more accurately, of finding a fuel that would be effective in flight, but also safe on the ground. Early ICBMs were powered by a highly volatile liquid-fuel mixture of liquid oxygen and kerosene or nitrogen tetroxide.[60] This mix powered both the early ICBMs–Atlas and Titan. Problems with liquid fuel were evident from the early days of development and posed challenges and safety issues for on-site crews. Liquid fuel was heavy and unstable and dangerous to handle and store. Other practical issues included the need to store the fuel outside the missile, loading the fuel just prior to launch. This complication made it necessary to develop a safe system of pumps, storage tanks, and mixing chambers to store the fuel.

The other option for powering the new ICBMs was solid fuel, which was only in the beginning stages of research and development when the Atlas missile program began in earnest in 1954.[61] Given the mission of the WDD to produce a working ICBM in the shortest possible timeframe, liquid fuel was the only viable option for the first ICBMs.[62]

Atlas

The Atlas missile was the first ICBM activated by the Air Force. The development and deployment of this ICBM was the result of a massive, fast-tracked effort on the part of the WDD, the ARDC, and its contractors. By December 1955, one year after the Atlas development program was taken over by the WDD, there were fifty-six contractors working on the Atlas program.[63] By 1957 the list of contractors had grown to 157.

Early specifications for the Atlas missile required a 240,000 pound vehicle with two 135,000 pound booster engines and a sixty thousand pound sustainer engine. Although Atlas development utilized certain elements of existing technology, including propulsion systems designed for the canceled Navaho cruise missiles, the Atlas design was state-of-the-art.[64] The Atlas missiles had to be pressurized while on alert, because the stainless steel shell was so thin–a requirement of flight–that only pressure kept it in place while on the ground. If the missile was fueled and launched, the liquid oxygen fuel inside the missile created the necessary pressure to hold the missile's shape. This system allowed for a much lighter airframe, but required continual maintenance to prevent structural collapse. In layman's terms, an unpressurized Atlas missile might best be understood as a deflated balloon.[65]

The first Atlas ICBM was tested successfully on 17 December 1957 and the first Atlas missile went on alert at Vandenberg Air Force Base in California on 31 October 1959.[66] Atlas missile crews were in place at numerous air force bases by 1961, and a year later, twelve Atlas squadrons were on alert, in addition to the missile at Vandenberg.[67]

Three generations of the Atlas missile were deployed by the Air Force–Atlas D, E, and F. Technological advances would be seen in each new generation of Atlas produced, most notably through improvements in thrust, launch, and guidance system. As the Atlas is the direct predecessor of the Minuteman missile, some key details of the progression of this system will shed useful light on the Minuteman's origins.[68]

Atlas D

- First deployed in 1959.
- First deployed at Vandenberg Air Force Base in California, F.E. Warren Air Force Base in Wyoming, and Offutt Air Force Base in Nebraska.
- F.E. Warren Air Force Base had two squadrons with six missiles. Vandenberg Air Force Base and Offutt Air Force Base had three squadrons for a total of nine missiles at each base.
- Possessed 360,000 pounds of thrust and measured eighty-two feet long.
- Propelled by a one-and-one-half stage liquid-fuel rocket.
- The missile was stored horizontally and housed aboveground in soft complexes with gantries or "coffins."
- To launch, the missile roof was pulled back, the missile raised to a vertical position, fueled, and fired.
- The launch sequence began when the two boosters and the sustainer engine were lit. Two small vernier engines above the sustainer ignited shortly after lift-off (2.5 seconds). Booster engines burned once in flight, and these, along with the turbo-pumps, were discarded quickly once a signal was received from the ground station. The sustainer engine was the last to extinguish and the vernier engines were responsible for course and velocity corrections.[69]
- Three missiles, a control center, and a radio guidance system were controlled by a single missile crew.
- The radio guidance system was accurate to one and one-half miles and could only control one missile at a time.
- Armed with a one-megaton thermonuclear warhead.
- Range of approximately 6,400 miles.

Atlas E

- First deployed in 1961.
- First deployed at Fairchild Air Force Base in Washington, Forbes Air Force Base in Kansas, F.E. Warren Air Force Base, and Vandenberg Air Force Base.
- Nine missiles comprised a squadron. Fairchild, Forbes and F.E. Warren Air Force Bases had three squadrons. Vandenberg had one squadron.
- Atlas E was more powerful than Atlas D, with 389,000 pounds of thrust.

- Range of approximately 9,400 miles.
- Controlled by a self-contained, automatic inertial guidance system accurate to within one and one-half miles.
- Armed with a one-megaton thermonuclear warhead.
- Missiles were stored in aboveground coffins.
- To launch, the Atlas E was raised to a vertical position and fueled.
- A separate launch crew staffed each missile site.

Atlas F

- Placed on alert in 1962.
- First deployed at Schilling Air Force Base in Kansas, Lincoln Air Force Base in Nebraska, Plattsburg Air Force Base in New York, Altus Air Force Base in Oklahoma, Dyess Air Force Base in Texas, and Walker Air Force Base in New Mexico.
- Twelve silos and a support base formed a squadron.
- One squadron was deployed at each of the six bases mentioned above.
- More powerful than Atlas E, with 390,000 of thrust.
- Range of approximately 9,400 miles.
- Armed with a one-megaton thermonuclear warhead.
- Controlled by self-contained, automatic inertial guidance system accurate to within one and one-half miles.
- Missile stored vertically in hardened underground silo.
- Missile raised to surface on elevator during launch sequence.
- A single missile was housed in the Atlas F silo with an adjoining underground launch control facility.[70]

By 1962 the number of Atlas missiles scattered across the country had grown to 126.[71] Though first, the Atlas was never intended to be the only American strategic missile. It was destined to be eclipsed in its role by the more advanced Titan and Minuteman systems to follow. The last Atlas missile was launched at Vandenberg on 24 March 1995. Rather than a nuclear payload, this Atlas E carried a Defense Meteorological Weather Satellite to orbit.[72]

Titan I

The development of the Titan missile resulted from the decision of the WDD and the Eisenhower administration in 1955 to move forward with the development of a second ICBM, in case the Atlas ran into

delays.[73] The WDD developed Titan ICBMs concurrently with the Atlas.[74] Titan I had several distinct advantages over the Atlas, including greater range, speed, and warhead size. As with the information detailed on the Atlas above, some key moments and statistics for the Titan program will help provide context for the more exhaustive Minuteman discussion to follow. Features of the Titan I include:

- Combat crews began working at the Titan I missile sites in 1961.
- First Titan I went on alert in 1962 at Lowry Air Force Base in Colorado.
- In 1962 Titan I ICBMs were deployed in six squadrons having three missiles each.
- Deployments were located at Beale Air Force Base in California, Ellsworth Air Force Base in South Dakota, Larson Air Force Base in Washington, Mountain Home Air Force Base in Idaho, Vandenberg Air Force Base in California, and Lowry Air Force Base.
- Measured ninety-eight feet long and possessed a self-supporting frame.
- Three missiles were housed in adjacent silos and controlled by a single launch control facility, thereby making this system more efficient for the Air Force to operate.
- A single Titan I, with a range of over 6,300 miles, was capable of launching fifteen minutes after the order was received.
- Two additional Titan I ICBMs in the squadron launch at seven-and-a-half-minute intervals after the first missile.
- Propellant consisted of a two-stage liquid oxygen and kerosene system.
- Missile housed in a 165-foot-deep silo and was raised to the surface for launch.
- Armed with a single four megaton thermonuclear warhead.
- Used to successfully test a "hot" launch directly from the silo. The ability to launch directly from the silo without raising the missile to the surface resulted in a quicker launch time.[75]

Titan I remained on alert for only three years–from 1962 until 1965–before being replaced by the Titan II.

Titan II

Titan II was approved for development in 1959 and was designed to correct some of the perceived shortcomings of the Titan I system. Fifty-four Titan II ICBMs, deployed at Davis-Monthan Air Force Base in Arizona, Little Rock Air Force Base in Arkansas, and McConnell Air Force Base in Kansas, remained on active duty until deactivation began in 1982 and was completed in 1987.[76]

Features of Titan II include:

- Improved inertial guidance and fuel systems.
- Armed with a nine megaton thermonuclear warhead.

- A maximum range of nine thousand miles.
- Employed storable propellants.
- Ability to launch in two minutes.
- Improved rocket engines featured 432,000 pounds of thrust in the first stage and a second stage with 100,000 pounds of thrust.
- Based on the successful tests conducted with Titan I, the Titan II could be launched directly from the silo without having to be raised to the surface.
- Squadrons consisted of nine missiles, each in an underground silo and controlled by a neighboring underground Launch Control Center.
- Two officers and two enlisted combat crew staffed the Launch Control Facility. Beginning in 1978 the first female crewmembers served on the crew of Titan II, setting the precedent for the later mixed-gender Minuteman crews.

As the above discussion demonstrates, both the Atlas and Titan programs offered significant improvements over the manned strategic weapons systems that preceded them. However, each had its shortcomings. The Minuteman was designed to overcome these deficiencies. It is to the Minuteman itself that we next turn.



Plate 5. Air Force Assistant Secretary for Research and Development Trevor Gardner (*left*) and Major General Bernard Schriever (*right*)–two champions in the development of the ICBM
(Courtesy U.S. Air Force, History Division)

Intercontinental Ballistic Missiles

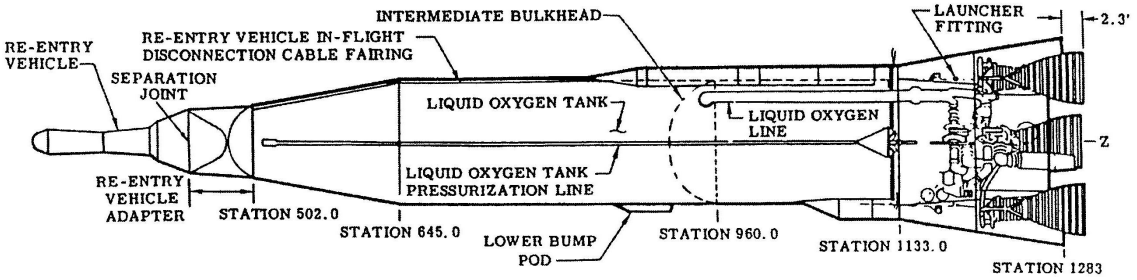


Plate 6. Cutaway drawing of an Atlas D ICBM. Later Atlas E and F missiles used the same airframe but added more powerful engines *(John C. Lonnquest and David F. Winkler, To Defend and Deter: The Legacy of the United States Cold War Missile Program (Washington, D.C.: Department of Defense, Legacy Resource Management Program, 1996), 210)*

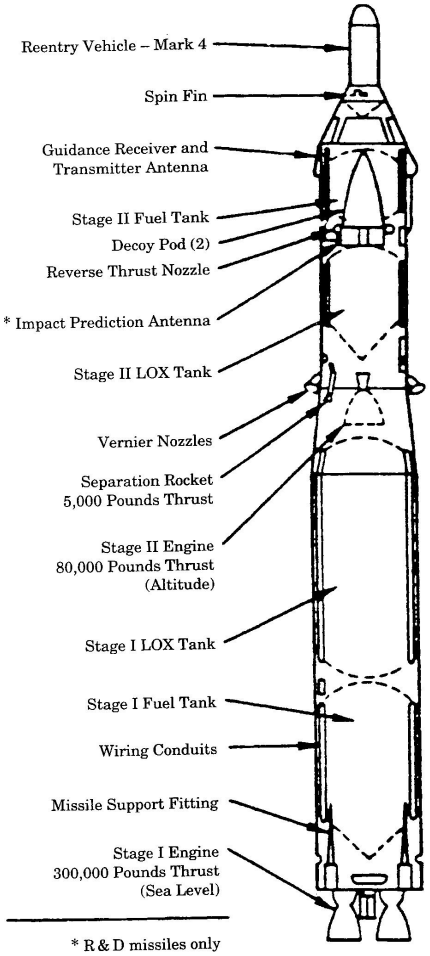


Plate 7. Drawing of Titan I, the United States' first two-stage ICBM *(Lonnquest and Winkler, To Defend and Deter: The Legacy of the United States Cold War Missile Program, 228)*



Plate 8. Titan I missile with crew *(Photograph No. B-13-026-2, "Guided Missiles–Martin Titan," U.S. Air Force Photo, Record Group 342, National Archives, College Park, Md.)*

Chapter 3: Minuteman and the Next Generation (1960s–present)

The Missile Gap and Minuteman

Although the liquid-fueled Atlas and Titan systems were operational by the early 1960s, the Air Force actively sought to develop another Intercontinental Ballistic Missile (ICBM)–one powered by solid fuel that would be more cost-effective, smaller, and better suited to mass production. This push for improved technology was largely driven by the desire to surpass Soviet missile technology and overcome what seemed a growing "missile gap." The Soviet Union's successful launch of "Sputnik," the world's first man-made orbiting satellite, in 1957, had rattled American policymakers and military strategists to their core.[77] Sputnik seemingly demonstrated that the Communist World was clearly in the lead in missile technology, and on 23 October 1957, a board of civilian consultants told Central Intelligence Agency (CIA) Director Allen Dulles that the United States trailed the Soviets in this vital field by "two to three years." Production of a Soviet ICBM capable of striking the United States was "nearly" a reality, they warned, and they predicted Soviet deployment of a dozen such missiles by the end of 1958. In their words, the United States was entering "a period of grave national emergency." Within two years, Congressional hearings concerning the "missile gap" provided the public with a view into the superpower race for rockets, whole they simultaneously offered the Air Force opportunity to promote expensive new missile systems. Estimates of Soviet capabilities varied widely through these years. The Kremlin did not publicize its military plans and what claims it did make were rarely trusted in the West, nor did it need to endure the public process of Congressional funding as the Pentagon. Senator Stuart Symington, formerly the first Secretary of the Air Force, used CIA estimates to inform Eisenhower during the Summer of 1958 that the Soviets might have as many as 500 ICBMs by 1961. Flights by high-altitude spy planes such as the U-2 in 1959 and 1960 later fostered lower estimates of Soviet capabilities, though no one in the West could know for certain the true measure of Soviet missile strength.[78]

Though Democrats would make the "missile gap" an important political issue in the 1960 election, later records disproved its existence. The United States actually possessed greater nuclear strike capabilities at this time. Not only did Western forces field larger bomber forces, but though exact numbers of Soviet capabilities remain impossible to state with accuracy, a problem compounded by their varied range and destructive capabilities, so too was the West ahead in missiles. Before departing office, for example, the Eisenhower Administration increased the scope of its second-generation missiles to 384 Polaris and 540 Minuteman, as opposed to less than one hundred fully capable Soviet ICBMs. Everyone expected both sides to only increase their nuclear strike capabilities in the years to come–just as American policymakers planned to deploy systems such as the Minuteman for decades at least, though in the final analysis, domestic politics and budgetary restraints (or opportunities) affected American missile deployments as much as estimates of Soviet capabilities. As historian Peter Roman has concluded, "ironically, the administration had finally initiated the buildup that the missile gap critics had clamored for–and did it just as intelligence estimates of Soviet missiles were being revised downward." Indeed, the Air Force took advantage of the political atmosphere fostered by the Congressional inquiries and public concern over the missile gap to present an initial plan to Congress for accelerating the Minuteman program beginning in 1960, calling for 445 Minuteman missiles to be operational by January 1965 and eight hundred missiles by June 1965, leaving an exasperated Eisenhower to exclaim "perhaps we should go crazy and produce ten thousand Minutemen." In an era of Cold War fear, the only proper number of nuclear arms seemed the number capable of installing confidence in one's own public, and confidence of an assured retaliation in one's enemy.[79] The new Minuteman missile, designed to be hidden and protected in a hole in the ground, was referred to by President John F. Kennedy following the Cuban Missile Crisis as his "ace in the hole."[80] This was also the title of Roy Neal's 1962 history that chronicled the development of the Minuteman missile.

Development of Solid-Fuel Intercontinental Ballistic Missiles

The development of solid fuel for ICBMs occurred simultaneously with the deployment of the Atlas and Titan ICBMs. The liquid fuel that powered these rockets added weight to the missile reducing its range, while the extreme volatility of liquid fuels made them dangerous to work with. Solid fuels promised to allow for smaller and cheaper missiles with greater effective range, while simultaneously eliminating the need for a problematic liquid-fuel system.[81]

By 1955 missiles propelled with solid fuel proved practical for shorter flights and two years later solid-fuel technology had progressed sufficiently for scientists to recommend large-scale development of a solid-fuel ICBM. Buoyed by these results, the Air Force authorized a series of studies that same year to develop a solid-fuel ICBM that was smaller than either the Atlas or Titan. Contracts to study solid-fuel missiles were finalized in 1956, and, rather than being completed in-house by the WDD, the work was awarded to the Wright Air Development Center (WADC), a private corporation contracted by the Air Force for missile development. The WADC directed the work of companies such as Aerojet-General, Thiokol, and Phillips Companies as they proceeded with solid-fuel feasibility studies.[82] General Bernard Shriever, who headed the Air Force Ballistic Missile Division (the WDD prior to renaming in 1957) during the first years of the Minuteman program, felt that the transition from liquid to solid fuel, with its more powerful engines, greater range, and increased safety, was the most significant advancement in ICBM development, allowing the United States to jump ahead of the Soviets in missile technology.[83]

Minuteman I

Development

The Minuteman grew from this massive effort, and a further illumination of the role played by its principal designers in the early years of development offers valuable insights into the Minuteman's initial design. While WADC oversaw its solid-fuel studies, Lieutenant Colonel Edward (Ed) Hall of the Ballistic Missile Division (BMD) had been transferred from the faltering Thor Intermediate Range Ballistic Missile program to his own office within the BMD. General Shriever gave Hall the freedom to design a solid-fuel missile, designated at that time Weapons System Q. Hall distilled the growing mass of information produced by the variety of contracted studies on solid fuel and other missile technologies. Hall generally worked alone, at first without even an administrative assistant. The one person Hall collaborated with regularly was Barney Adelman of Ramo-Wooldridge. Hall and Adelman worked to produce a design for a solid-fuel missile.[84]

Hall ultimately incorporated technologies developed by a series of recent Air Force studies, including new swivel nozzles to control missile direction and an accurate method of shutting off the engines. In addition, he used previous studies to calculate warhead size and weight and research on solid fuel to determine the distance the missile could travel. Hall's final feasibility study, produced in 1957, outlined a series of missiles powered by the new fuel technology he named the "Minuteman" as a symbolic reminder of the country's military past and to reflect the quick response time of the missile system. Minuteman was designed to be an efficient, reliable weapon that could be mass-produced, stand unattended for long periods, be operated and maintained by small crews, stored and launched from underground silos, and automatically monitored for condition and combat readiness. It offered, in short, the solution to the troubling missile gap.[85]

The Air Force accepted Hall's design–retaining the name Minuteman–in March of 1958, and began planning for funding and developing a Minuteman force.[86] The Pentagon initially planned to deploy one hundred Minuteman missiles by 1964 and another four hundred by 1965.[87] Delays and budget troubles plagued the early development of the Minuteman, however. Though the Air Force positioned itself

solidly behind the development of the Minuteman, the Joint Chiefs of Staff (JCS) did not share their enthusiasm for the Minuteman program, preferring other strategic defense options, such as the Intermediate Range Ballistic Missiles, Thor and Jupiter. Rumors of stalling tactics on the part of the JCS began to circulate. The Air Force Ballistic Missile Committee and the Office of the Secretary of Defense backed the Minuteman development, but a request for $150 million for fiscal year 1959 was initially reduced to $50 million.[88] Without those extra funds, the Minuteman's supporters warned, the missile would not be ready for operational deployment by the early 1960s.

Funds were not forthcoming until the BMD and the Air Force persuaded General Sam Anderson, commander of Air Research and Development Command (ARDC), Chief of Staff General Thomas D. White, Vice Chief of Staff General Curtis LeMay, and Secretary of the Air Force James Douglas of the viability of the Minuteman.[89] General Schriever asserted to these men that there were no problems with either the concept or design of the new missiles and he asked for flexibility in carrying out the first part of a development program. He stated that he could prove his point within six months, if given the funding.[90]

After the general finished convincing his immediate superiors of the viability and utility of the program, he turned his attention to the three men who would make the final decision on Air Force program funding– Secretary of Defense Neil McElroy, Assistant Secretary of Defense William Holaday, and Deputy Assistant Secretary of Defense Donald Quarles. General Schriever arranged a deal whereby the BMD received $50 million for the first six months of 1959. If in that time the BMD could prove the efficacy of the Minuteman, the remaining $100 million would be released for Minuteman development.[91]

By 7 January 1959, the Air Force established an operational schedule for the Minuteman. The first flight test was to take place in December 1960 with an operational weapon system in place by 1963. This ambitious schedule generated a great deal of skepticism on the part of outside scientists and government officials, but Schriever and his team were certain that the program could succeed. To close the "missile gap," and more importantly to prove that they were the best service to do so, the Air Force needed the Minuteman, and in a hurry.[92]

Testing

The BMD successfully launched a "tethered" Minuteman I prototype on 15 September 1959. This test showed that the Minuteman could be fired directly from an underground silo, prompting the Air Force to fast-track the program in the hopes of having the first Minuteman I on duty by 1962.[93] The production of the first operational Minuteman I force was approved in March 1960 and consisted of 150 missiles assigned to a single missile wing at Malmstrom Air Force Base in Montana. The wing had three squadrons with fifty missiles each. Construction on the operational facility to house the missile wing at Malmstrom began in March 1961.[94] The previous month at Cape Canaveral, the first full test of a Minuteman I proved successful–the missile deposited its warhead 4,600 miles from the launch site.[95] During these tests the missiles did not employ armed atomic warheads. *TIME* magazine reported that an awed observer murmured "Brother, there goes the missile gap" and described the successful test flight as follows, "Even for sophisticated missile watchers, the men who have marked the flight of so many of Cape Canaveral's great fire-breathing birds, last week's show was a dazzling spectacle. The blast-off was swift and sure; there was none of that heart stopping hover of other tests when liquid-fueled monsters seemed to balance in uncertain equilibrium before they picked up the momentum of flight."[96]

Secretary of Defense Robert McNamara, a longtime advocate of a strong strategic defense and the elimination of the missile gap, became a leading advocate, within the new Kennedy Administration, of the Minuteman program following a March 1961 visit to the BMD. During this visit scientists demonstrated their advances in solid-fuel technology. McNamara walked away from this meeting more convinced than ever of the need, and of the value, of the new Minuteman missile system.[97] The production of the

Minuteman I proved successful, and by 1964 McNamara determined the Minuteman missile force would consist of one thousand missiles. As with any program of this size (and expense), his determination of this number was reached only after lengthy consultations with the JCS, the National Security Council, the White House, think tanks such as RAND, and congressional leaders. By June 1965 the Air Force was on the way to meeting this target, with an operational force of eight hundred Minuteman I missiles located at Malmstrom Air Force Base, Ellsworth Air Force Base in South Dakota, Minot Air Force Base in North Dakota, Whiteman Air Force Base in Missouri, and F.E. Warren Air Force Base in Wyoming.[98]

Design

Minuteman I was designed to be a "highly reliable, three-stage, solid-propellant weapon" that could endure long periods in storage and travel over five thousand miles to reach its target.[99] This was further than any of the earlier generations of ICBMs. Yet the Air Force required more than simply a new missile to make the Minuteman system work. Launch Facilities (LFs) and other support structures had to be designed in order for the Minuteman to prove an effective deterrent to Soviet aggression.

The initial Minuteman I force was divided into five missile wings of either three or four missile squadrons per wing. Fifty missiles made up a squadron, and each squadron was further divided into five flights of ten missiles. A flight had its own Launch Control Center (LCC) that monitored ten LFs. To reduce its vulnerability to enemy attack, each flight was dispersed across several miles, with the LCC located a minimum of three miles from any missile and the missiles similarly distanced from each other.[100]

In Minuteman I wings I and II electrical and environmental support equipment were initially located aboveground in the Launch Control Facility (LCF) support building. The missile system was constructed during a time when the doctrine of "massive retaliation" directed strategic planning–the military expected to launch the entire Minuteman I force in retaliation for a Soviet attack, and though a grim prospect, post-attack survivability of more than several hours for the crew was consequently not considered an essential feature of the design.[101] This strategy changed with the construction of Minuteman I wings III to V, and LCC support equipment moved underground as part of the new "controlled response" strategy, which called not only for the possibility of a limited or controlled American nuclear response, but also consequently for post-attack missile survivability. No one thing prompted this change in American strategic thinking. Rather, "controlled response" developed organically by the close of the 1950s as a potential answer to the limitations of "massive retaliation," most specifically the way an all-or-nothing nuclear response to potential superpower conflicts threatened to too severely limit the options available to policymakers engaged in a crisis. By developing the ability to strike with limited components of their nuclear arsenal, American policymakers hoped to achieve not only greater flexibility in the international arena, but also greater success as well, as "controlled response" led to the Kennedy Administration's famed "flexible response" policies, which called for non-nuclear and even irregular (such as the Special Forces) applications of military might. Not every crisis warranted a full-scale nuclear response, after all, and by the 1960s, American leaders demanded the tools necessary to meet the changing needs of a Cold War fought increasingly in the global periphery.[102]

Contractors

Boeing received the original contract for the design, assembly, and testing of Minuteman I in October 1958 and later contracted to develop hardware and electronics and check operational facilities.[103] Other associate contractors for the Minuteman system included AVCO and General Electric for reentry vehicles designed to deliver nuclear warheads to their targets, Autonetics Division of North American Rockwell for guidance systems, and Bell Aerosystems for post-boost control and a navigation system for the reentry vehicle. The post-boost controls served the critical function of controlling the reentry vehicle after it had separated from the missile and began to descend to its target. Sylvania won the contract for the ground electronics system and TRW Systems headed up systems engineering and technical direction.[104]

Three contractors were chosen to develop the three solid-propellant stages for Minuteman I. Each of these three stages performed specific functions. The first stage launched the missile, the second stage provided additional thrust as the missile traveled towards the target, and the third stage propelled the reentry vehicle with its nuclear payload back into the atmosphere and to its designated target.[105]

The Thiokol Chemical Company built the first stage–the M55 motor. The M55 produced two hundred thousand pounds of thrust using a combination of Thiokol synthetic rubber, powdered aluminum, and ammonium perchlorate (AP). Its steel casing utilized four small, swiveling nozzles for propulsion and navigation. Aerojet-General constructed the sixty thousand-pound thrust second-stage engine, which was fueled by polyurethane and AP, while also employing swiveling nozzles and a steel casing. Aerojet-General replaced the steel casing initially employed in its engine with lighter and stronger titanium in 1962. The third stage was constructed by Hercules and consisted of a thirty-five thousand pound thrust motor with a composite AP propellant and a technologically advanced glass-fiber filament-wound casing.[106] By employing so many contractors for the Minuteman I project, the Pentagon managed to spread earnings from the lucrative missile program throughout the American aerospace industry, providing jobs for thousands of workers and profits for even more investors, and pleasing politicians with companies in their home districts. The variety of contractors also ensured the wide-spread dissemination of advanced technologies and procedures throughout the industry, in what was effectively a Pentagon-sponsored investment in the education and research of its most vital defense firms.

Minuteman Production Board

Boeing and a group of other associate contractors managed the design and building of the Minuteman I missiles. Because of the large number of contractors involved in the project, contract management for Minuteman production became quite cumbersome and in 1962 Major General Thomas Gerrity, head of the Ballistic Systems Division of the BMD, brought the associate contractors together to seek a more efficient production program in order to ensure a timely completion.[107] Representatives from Boeing, Thiokol, Hercules, Aerojet-General, AVCO, Space Technology Laboratories, and Autonetics were invited to the meeting, which ultimately established the Minuteman Production Board. This group of associate contractors had unprecedented direct participation in assembling the Minuteman system. Each associate contractor had a member on the board. Board members also had the authority to commit to corrective measures to address any production problems that arose.[108] By putting their reputations on the line, and by simultaneously providing each contractor with the flexibility and opportunity to solve any unforeseen problems in their own product, Gerrity's production board managed the Minuteman program with impressive efficiency.

Capabilities

The missile the Air Force and contractors produced was a marvel for its time. Minuteman I stood 55.9 feet long and, when fueled and armed, weighed sixty-five thousand pounds with a maximum speed exceeding fifteen thousand miles per hour. The first Minuteman I, model IA, could travel approximately 4,300 miles, which fell short of the expected range of five thousand miles due to a problem with the swivel nozzles that controlled the missile's propulsion. The Air Force subsequently produced the Minuteman IB, which had an improved second-stage motor housing made of titanium. The new housing improved on the steel housing used for the Minuteman IA, lightening the missile and increasing its range over the Minuteman IA.[109] The Minuteman IB traveled approximately six thousand miles to its target. Both missiles featured an inertial guidance system designed to deliver a single warhead to a preprogrammed target halfway around the world in less than half an hour after launch.[110]

National Site Selection
The Air Force went through a rigorous process of selecting sites to house its Minuteman missiles. During the early stages of Minuteman I deployment, the site location was restricted by the maximum flight distance of the Minuteman IA. This range led the Air Force to search for sites in the northern United States, bringing the missiles within closer range of the Soviet Union.[111]

Other factors restricted site selection for the new Minuteman. For example, sites had to be within the continental United States lest foreign states argue that the housing of missiles on their territory gave them a say in their use. In the early days of the Cold War, for instance, the Truman and Eisenhower administrations encountered the British government's insistence that nuclear weapons aboard American bombers based in the United Kingdom could only be used with London's approval.[112] Additionally, the Air Force required that Minuteman I ICBMs be spaced far enough apart to be considered separate targets, so that one Soviet strike would not debilitate a significant number of American missiles. The missiles also had to be far enough inland to be outside the range of sea-launched Soviet missiles, yet still within effective range of identified enemy targets. To reduce the expense of deploying Minuteman I, the Air Force located the command and support facilities for the new Minuteman weapon system at existing Strategic Air Command (SAC) bases.[113] (For a discussion of SAC, see Section II, Chapter 2: U.S. Air Force, Strategic Air Command, and Ellsworth Air Force Base). By using existing bases, the Air Force took advantage of existing infrastructure, and avoided the need to develop a site from the ground up.

Army Corps of Engineers
The Army Corps of Engineers (Army Corps) held the responsibility for construction administration and construction of the Minuteman LFs and LCFs. Once the support bases were identified by the Air Force, the Army Corps, the BMD, and SAC Headquarters at Offutt Air Force Base in Nebraska sited the individual silo sites. The team worked together, conducting soil analyses and topographical and geographical surveys to help locate the specific locations for the missile silos.[114] By 1960 decisions on site locations had been made and the construction of the Minuteman I LFs and LCFs was well under way.[115]

Given the location of most Minuteman sites on the upper plains, the Omaha District of the Army Corps of Engineers (Omaha District) oversaw the construction of the Minuteman LFs and LCFs. The construction of the LFs was, in the words of historian Ernest Schwiebert, "the largest financial outlay of the ballistic missile program."[116] However, the construction of the facilities for Minuteman I at Minot Air Force Base in North Dakota in the early 1960s were estimated by the Army Corps to cost $400,000 per silo, which was significantly cheaper than the cost of the earlier Atlas and Titan systems in the late 1950s and early 1960s at $2 million per silo. The special fueling facilities required for the liquid-fuel ICBMs and smaller size of the Minuteman I resulted in this difference in price, further proof of the Air Force's claim that the Minuteman would save money while providing a more powerful nuclear deterrent.[117]

Typically, the Omaha District supervised the Minuteman installations and planned for their specific location, and then hired private contractors to build the facilities. Omaha's Peter Kiewit Company won the right to serve as prime contractor for construction at many of the missile sites. The Omaha District provided design services and contract management for construction of Minuteman's ground facilities at F.E. Warren Air Force Base in Wyoming, for example, as well as Ellsworth Air Force Base in South Dakota, Minot Air Force Base in North Dakota, and Grand Forks Air Force Base in North Dakota.[118] The construction at Minot Air Force Base displays the scope of the effort required to construct the LFs and LCFs for the Minuteman missile. The Minot site demanded construction of 150 silos and fifteen LCFs in a twelve thousand-square-mile area. During peak construction, Kiewit and its subcontractors employed six thousand workers, 1,100 vehicles, and 115 cranes to keep construction on pace to meet the aggressive project schedule.[119]

By December 1962 Minuteman IA had been deployed at Malmstrom Air Force Base in Montana. The Air Force also deployed the upgraded Minuteman IB with a titanium second-stage engine case at Ellsworth Air Force Base, Minot Air Force Base, F.E. Warren Air Force Base, and Whiteman Air Force Base in Missouri. The Minuteman I missiles at these bases were clustered around former Atlas complexes. By June 1965, eight hundred silos across the country housed the new Minuteman I ICBMs.[120] The complete installation of the Minuteman I LFs eventually took ten years and faced a range of challenges dependent on the specific conditions at each site. Adverse conditions varied from particularly trying winters to soil conditions that required special engineering techniques to construct structurally sound missile silos and underground LFs.[121]

Once activated, the Minuteman missile was always in a state of readiness requiring less maintenance than earlier missiles and this impact was described by Lt. Col. George V. Leffler, commander of the 100th Strategic Missile Squadron, "The Minuteman is like getting a new car and not getting the keys. You can't drive it. You have no sense of ownership. With a liquid missile, you can run it up out of the silo on the elevator, fuel it, go into the countdown. We can't touch a thing."[122]

Minuteman II

Development and Design

Even as the Air Force began deploying Minuteman I missiles in 1962, research and development into the Minuteman II had already begun. The new Minuteman was created to improve on the missile guidance systems, payload capacity, and anti-missile defenses of the Minuteman I. Minuteman II facilities offered survivability more in line with the Kennedy administration's "controlled response" doctrine. The first test launch of Minuteman II occurred at Cape Canaveral in 1964 and the first operational launch occurred one year later. As part of the Force Modernization Program begun in 1966 to modernize the Air Force missiles, the Minuteman II ICBMs eventually replaced the entire fleet of Minuteman I ICBMs. In 1968, just three years after the first test launches, 350 Minuteman II ICBMs were in the ground. Between 1969 and 1975, the program replaced the Minuteman I with Minuteman II missiles, and upgraded LCFs and silos to accommodate the more sophisticated missile.[123]

Capabilities

The second generation of the Minuteman missile, Minuteman II, differed from its predecessor in several important ways. It was a larger missile designed to accommodate increased engine and warhead size, measuring 57.6 feet long and weighing seventy thousand pounds. As with its predecessor, Minuteman II was capable of reaching speeds in excess of fifteen thousand miles per hour. Minuteman II offered an improved second-stage engine manufactured by Aerojet-General, improved targeting system, extended range, electronic autopilot, all-inertial guidance system, and an Avco Mark IIC reentry body with a one- to two-megaton nuclear warhead.[124] These improvements allowed the Minuteman II to strike targets from a greater distance with greater precision. New anti-missile technology increased the chances of the missile avoiding an enemy's defenses and delivering its warhead. The missile gap had become a thing of the past by the mid-1960s, as American intelligence proved beyond doubt the superiority of American missiles over their Soviet counterparts. However, this fact did not keep the Air Force from continuing to improve its product.[125]

National Site Conversion

Much of the work for site selection had already been completed with Minuteman I. When Minuteman II was ready for deployment, the Air Force established priorities for replacement of the Minuteman I missiles, and the first Minuteman II was deployed at Grand Forks Air Force Base, North Dakota, in August 1965. The first operational Minuteman II squadron, the 447th Strategic Missile Squadron, went on

alert at Grand Forks Air Force Base in 1966. Minuteman II ICBMs eventually went in the ground at another five SAC bases (Malmstrom Air Force Base, Ellsworth Air Force Base, Minot Air Force Base, F.E. Warren Air Force Base, and Whiteman Air Force Base). Malmstrom Air Force Base was also selected as the location for an additional Minuteman squadron, and LFs and LCFs were consequently constructed at this base.[126]

Minuteman III and the Next Generation

In July 1965, after the entire Minuteman I force was declared operational and prior to Minuteman II deployment, the Air Force contracted with Boeing for research and development for the next phase of Minuteman, Minuteman III.[127] Minuteman III represented a change in the United States' strategic planning, and consequently resulted in additional advancements in missile technology. Minuteman I was designed based on the theory of "massive retaliation" which required the missiles to launch at one time in retaliation to an attack. Minuteman II was designed based on the theory of "controlled response" which required some of the missile fleet to survive a nuclear attack. Minuteman III was designed under a theory of "flexible response" which required the missile to be able to fire independently and target multiple potential aggressors.[128] Like the earlier Minuteman missiles, Minuteman III underwent rapid development. Five hundred fifty Minuteman IIIs were in the ground by 1977 and Minuteman III sites were later located in Colorado, Nebraska, Wyoming, Montana, and North Dakota. Four hundred fifty Minuteman II and fifty-four Titan II ICBMs remained on alert at this time, after retirement of Atlas and Titan I.[129]

Capabilities

Minuteman III stands 59.8 feet long and weighs 76,000 pounds. The new generation of Minuteman employed an upgraded third-stage engine, post-boost navigation control of the reentry vehicle, and an MK12 reentry vehicle possessing three nuclear warheads that could be independently delivered to multiple targets. The upgraded engine and the greater navigation control enabled the weapon to reach multiple targets more quickly and accurately than the previous generations of Minuteman. Previous Minuteman missiles carried a single nuclear warhead and therefore could only strike a single target.[130]

Advancements in Missile Technology and the Cold War

Much of the research and development effort to improve missile technology in the later part of the twentieth century centered on increasing the sophistication of the Minuteman III system. Efforts to increase the accuracy of Minuteman reentry vehicles and to design these vehicles to be less detectable by radar were ongoing in the 1970s[131] Today the Minuteman system is commonly thought of as part of a "triad" defense system involving land-based missiles, submarine-launched ICBMs (known as SLBMs) controlled by the Navy, and Air Force manned nuclear bombers. When analysts use the term triad, they refer to these three independently operated nuclear systems (land-, air-, and sea-based), reasoning that three such disparate systems would collectively prove less vulnerable to enemy attack than any solitary system might be.[132]

The purpose of America's nuclear program was, at its most basic, one of deterrence. With the ability to launch unprecedented destruction, American strategists reasoned that no foreign foe would dare strike at Western vital interests. Throughout the Cold War, none did. The superpowers fought bitter and brutal wars on the Cold War's periphery, through proxy states and powers. Korea, Vietnam, and Angola provided stark examples of Cold War geopolitics played out on a local stage, often with deadly results. Minuteman was never designed for such conflicts; it was instead a product built and deployed for one purpose: to deter a direct Soviet strike at Europe or at the United States itself. Its was a global mission.

Ultimately, the Cold War system that spawned Minuteman and the doctrine of mutual assured destruction through nuclear deterrents came to an end. The details of the Cold War's final chapters will be discussed in greater depth in later sections. For now, it is important to note that the Minuteman II system lasted through the end of the Cold War, but not long after. The international system experienced dramatic changes throughout the 1980s. Renewed American military spending following the pain of Vietnam, initiated by the Carter Administration but later taken to new heights by President Ronald Reagan, helped exacerbate East-West tensions following the period of relative d tente of the 1970s. Simultaneously, Communist leaders behind Europe's Iron Curtain faced a new spirit of change and reform. Such calls for reform were prompted in part by outside forces (such as Reagan's vitriolic anti-communist rhetoric, improved access to Western media including television broadcasts, and calls for change from prominent human-rights advocates such as Pope John Paul II), but found their greatest expression in domestic reform movements such as Poland's Solidarity. The tide of discontent, when coupled with a growing awareness of their country's inability to match American military spending (and technological advancement more broadly) prompted dramatic changes in the Soviet system by a group of political reformers led by Mikhail Gorbachev. As we shall see, Gorbachev prompted political, economic, and social reforms at home, and helped create a new atmosphere of East-West cooperation, in particular following Reagan's departure from office. The Cold War informally ended in 1989, when West and East Germans spontaneously gathered in Berlin to tear down the hated wall that had divided them for a half-century. It formally ended two years later, when a failed coup attempt in Moscow led ultimately to the dissolution of the Soviet empire in favor of a democratic regime headed by Russia's first post-Cold War president, Boris Yeltsin.

Whether the threat of nuclear annihilation had safeguarded superpower relations during the Cold War, keeping them from mutual assured destruction, can never be fully known or determined. What is clear is that deterrence worked, in the sense that the two sides never came to direct nuclear blows (though as we shall see, they came close), in no small part because of the fear of widespread nuclear war. Minuteman was one such deterrent….against global communism. As we shall see, it was a weapon that came to shape the American landscape, leaving a mark on the men and women who operated it.



Plate 9. Minuteman test launch, Vandenberg Air Force Base, 1963 *("Site Activation Chronology, Minuteman Project, Ellsworth Air Force Base, South Dakota, July 1963-October 1963," K243.012-40, in USAF Collection, AFHRA)*

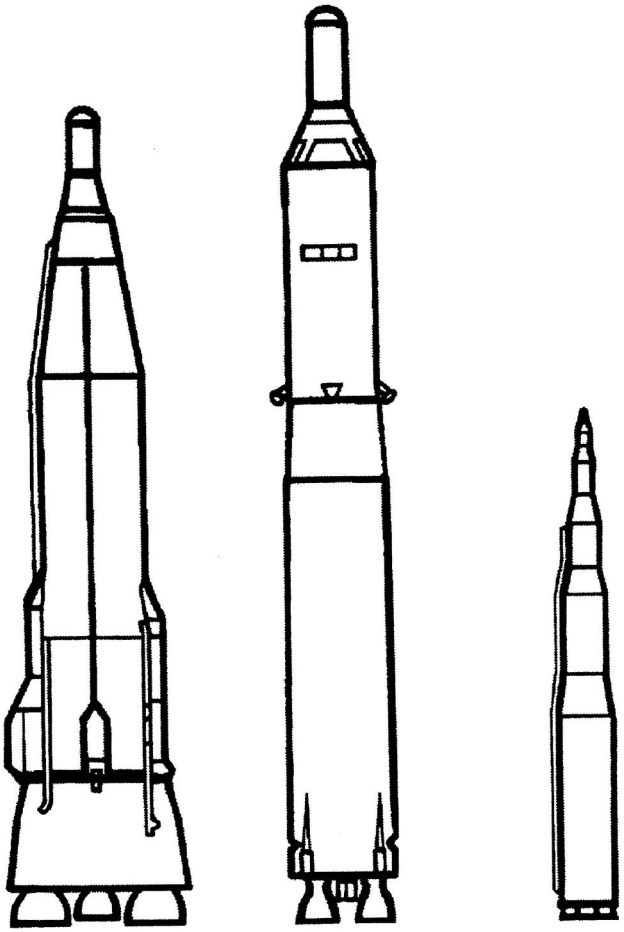


Plate 10. From left to right, scale drawings of Atlas, Titan I, and Minuteman I ICBMs *(John C. Lonnquest and David F. Winkler, To Defend and Deter: The Legacy of the United States Cold War Missile Program, 65)*



Plate 11. Full-scale test of Minuteman I missile, Edwards Air Force Base, California, 1960 *(Photograph No. B-08-018-1, "Guided Missiles – Boeing SM-80," U.S. Air Force Photo, Record Group 342, National Archives,, College Park, Md.)*

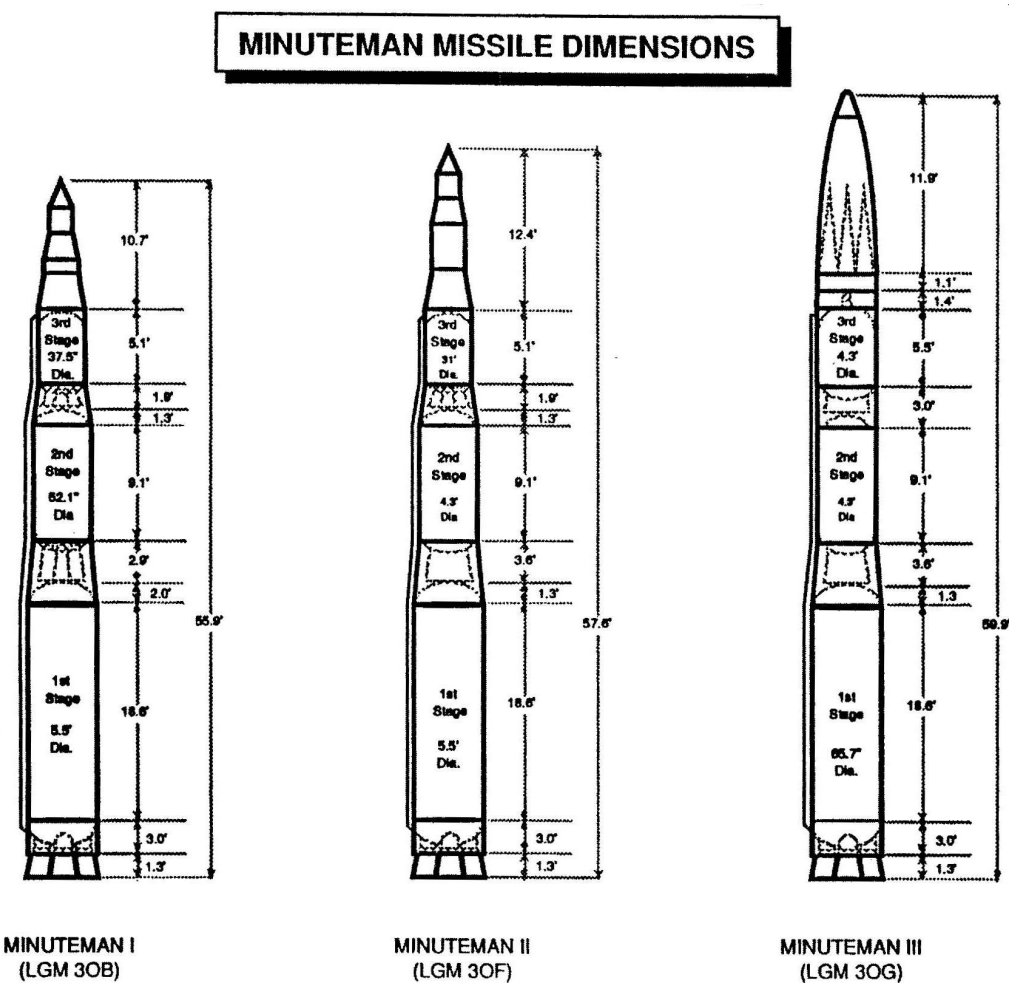


Plate 12. Line drawings showing the evolution of the Minuteman ICBM *(Lonnquest and Winkler, To Defend and Deter: The Legacy of the United States Cold War Missile Program, 243)*

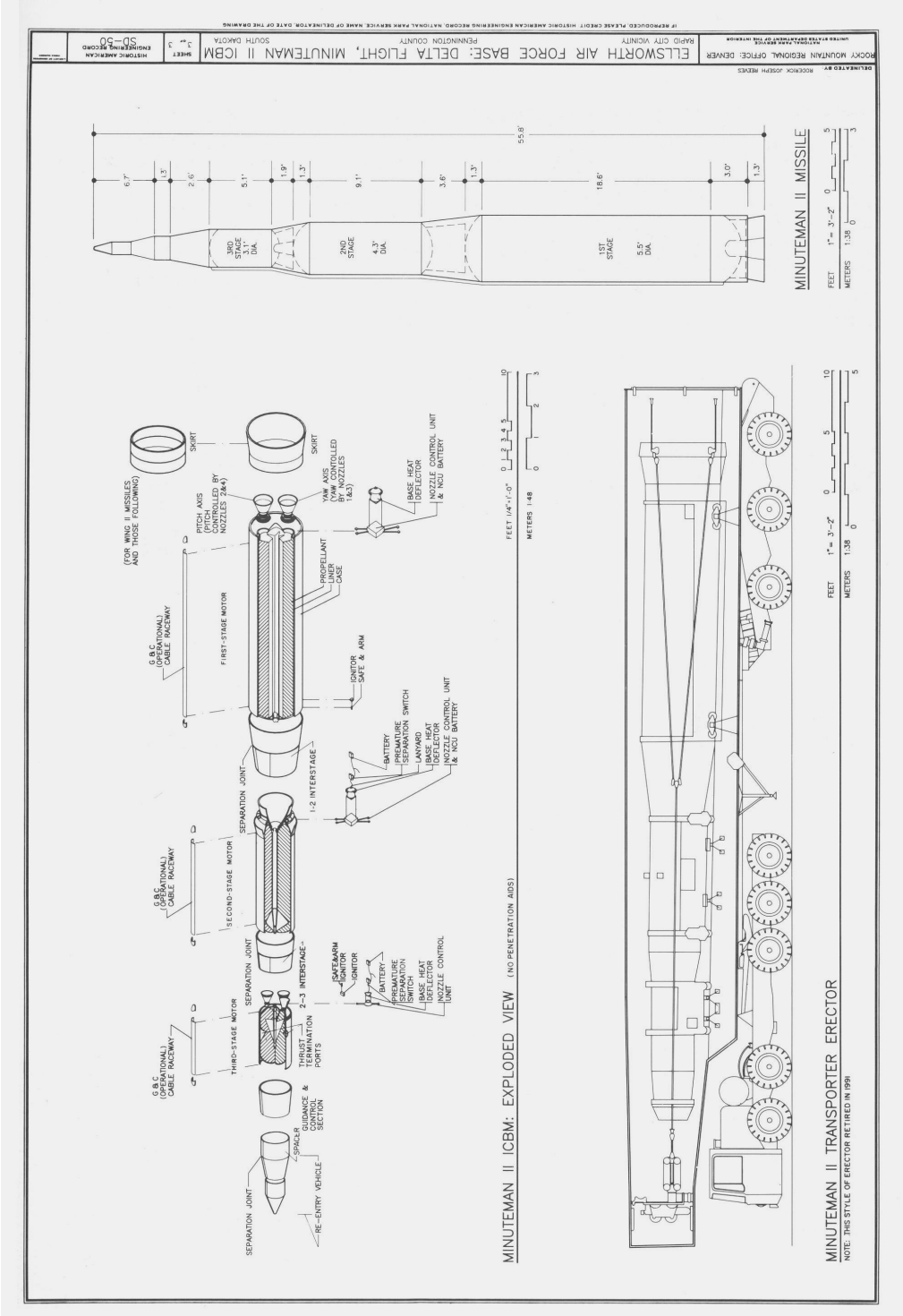


Plate 13. Line drawing showing an exploded view of Minuteman II and the Minuteman II Transporter Erector *(Library of Congress, Prints & Photographs Division, HAER SD-50-sheet 3)*

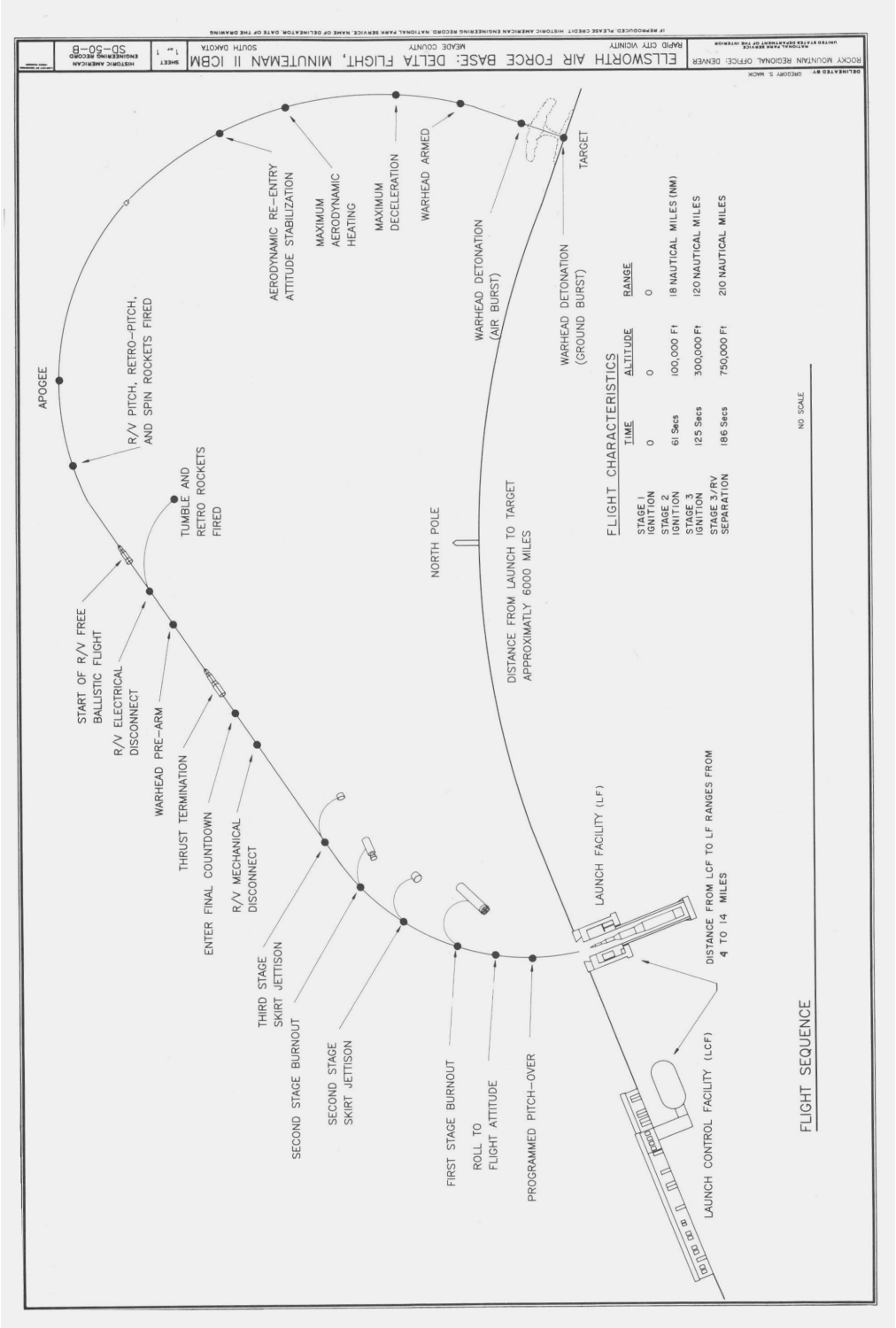


Plate 14. Flight sequence of Minuteman II ICBM
(Library of Congress, Prints & Photographs Division, HAER SD-50-sheet 4)

Section II – Life on the South Dakota Plains: Before, During, and After Minuteman

Chapter 1: Life and Landscape Before Minuteman (to the 1960s)

The Minuteman changed the northern plains, but clearly the missile system was one small moment in the region's far broader history. It is a land rich in geological, archeological, and sociological detail, with stories that range as far back as prehistory. In order to place the relatively short life span of the Minuteman (less than two generations) into the story of a land whose past is best measured in millennium, we now turn to the plains in the time before the Cold War.

South Dakota Plains Geological Formations

South Dakota lies within the boundaries of the Missouri Plateau, a continental landform that displays a variety of geological features, including three main geologic divisions. The first division, the Central Lowlands, lies east of the Missouri River and was formed through glacial activity between ten thousand to seventy-five thousand years ago. The second division extends west from the Missouri River and is known as the Western Plains. The Western Plains of South Dakota are part of the Great Plains and are the least populous section of the state. Landforms in the Great Plains are unglaciated and retain soils formed by shallow seas that covered the region approximately seventy-five million years ago. The state's third major geologic region, known as the Black Hills, was formed by pressure from the earth's tectonic plates that forced subsurface rock upward to create a sixty-mile-wide and 125-mile-long region known for its natural beauty.[133]

The seas that once covered South Dakota's Western Plains deposited limestone and sandstone overlain by soft Pierre shale. As the shale eroded through water and wind action, the rolling terrain in the Western Plains emerged, leaving short-grass plains mixed with eroded river valleys. The Badlands lie within the Great Plains. The striking landscape of the Badlands emerged from the process of erosion caused by water and wind, which created tall spires of sedimentary rock and exposed rich fossil deposits. Native Americans and white settlers alike viewed the landscape with respect and awe. In 1939 President Roosevelt established the Badlands National Monument and in the 1960s Congress expanded the monument by adding more than 130,000 acres of Oglala Sioux tribal land. The National Park Service and the Oglala Sioux jointly manage these lands. In 1978 Congress designated the Badlands a National Park, further safeguarding the region's future.[134]

Native American Settlement

The presence of Native American cultures in South Dakota spans thousands of years and includes five major periods–Paleo-Indian, Archaic, Woodland, Plains Village, and the plains Sioux.[135] The Western Plains has experienced continuous occupation by native people who were removed to reservations through either treaty or the series of nineteenth-century wars fought between the Sioux and the United States Army.

These Native American cultures adapted to the changing environmental and political factors at work in the region. Environmental factors influencing native cultures included the availability and size of animals

for use as a food source and the availability of technologies for utilizing natural resources. Political factors directing cultural change included intertribal warfare and the arrival of, and ensuing population pressure from, Euro-Americans. Euro-Americans brought with them foreign political, agricultural, and property systems, as well as diseases that changed the power structure in the region.

The earliest people to reside in the area that later became South Dakota, the Paleo-Indians, practiced nomadic big game hunting, taking advantage of plentiful large game, such as Mastodons. Archaic period hunter-gatherers established themselves after the big game had disappeared. This group took advantage of available smaller game and the nuts and berries that grew wild in the area. As the Woodland tradition developed, a settled agricultural economy complete with a complex agricultural tool kit and a sophisticated religion blossomed. The Plains Village communities, typified by the fortified settlements of the Arikara, or Ree, tribe were present when the first white explorers arrived in South Dakota. The Arikara tribe established a dominant culture during the sixteenth century. Decimated by smallpox brought by the Europeans, the Arikara had entered a state of decline by the time the Sioux began arriving in the area in the eighteenth century.[136]

When the early French, Spanish, and Euro-American explorers arrived in the region in the second half of the eighteenth and early nineteenth century, they initially encountered the Sioux, as well as remnants of the Arikara. The Sioux were a confederation of nomadic tribes, whose culture centered on the bison, which the tribe followed across the plains. The Teton Sioux, who controlled the western part of the state, were known as fierce warriors and expert horsemen, thus giving the Sioux their warrior-nomad reputation. Other branches of the Sioux, such as the eastern, Yankton tribe, did not participate in warfare to the same extent.

Starting in the 1850s, the Sioux began to feel pressure from the United States government to cede their land so that the area could be opened to Euro-American settlement. Conflict and treaties between the Sioux and the federal government continued through the second half of the century. Treaties negotiated in 1851, 1858, and 1868 reserved western South Dakota, known as the Great Sioux Reservation, for the Sioux and in return the tribe left their lands east of the Missouri River.

These early agreements did not end the conflict between the settlers and the Sioux, however. Additional agreements would be necessary as Euro-Americans pressed further west. Increasing demands for land from white settlers and the discovery of gold in the Black Hills in 1874 resulted in mounting encroachments into Sioux territory. As land-hungry settlers continued to arrive in increasing numbers, the government persisted in pushing the Sioux out of sections of the Western Plains and the Black Hills until finally the majority of South Dakota's lands were under the control of either homesteaders, miners, or the government. Sioux lands remaining in South Dakota are presently on eight reservations: Cheyenne River, Crow Creek, Lower Brule, Pine Ridge Oglala, Rosebud, Sisseton-Wahpeton, Yankton, and Flandreau Santee.[137] The Air Force made a conscious effort to avoid reservation lands when constructing Minuteman sites.[138] Minuteman installations in South Dakota are bordered by the Cheyenne River reservation on the north, Pine Ridge Oglala and Rosebud on the south, and Lower Brule on the east.

To understand the forces acting on the Sioux during the nineteenth century into the middle of the twentieth century, it is necessary to trace the history of European and Euro-American exploration and settlement of South Dakota. The following section summarizes the settlement of South Dakota by Euro-Americans.

Early European Exploration and the Fur Trade

Three major expeditions through the lands that would include the future state of South Dakota paved the way for occupation by Euro-American settlers. France and Spain, which both laid claim to the territory prior to the United States purchase of the land in 1803, sent representatives to the area in search of a mythical western sea and to identify ways to exploit the area's lucrative fur trade. After the Louisiana Purchase, the Lewis and Clark expedition followed in 1804-1806. Lewis and Clark spent fifty-four days in what would become South Dakota in the fall of 1804 recording information on the region's natural environment and its inhabitants. Following the successful return of their expedition in 1806, fur traders increased their activities in South Dakota, beginning fifty years of intensive harvesting of beaver and bison pelts for market.[139]

The period between 1827 and 1840 saw the most intense fur-trading activity in South Dakota. By the beginning of the 1850s, changes in current fashions reduced the demand for furs, and the industry consequently declined. The edge of Euro-American settlement simultaneously moved west towards the Missouri River, leading the federal government to further pressure the indigenous Sioux population to cede lands west of the Missouri to the settlers.[140]

Euro-American Land Speculation, Settlement, and Immigration

Settlement of the area increased after the federal government established the military post at Fort Randall on the upper Missouri River in 1856. Threats from Teton Sioux who were responding to encroachments on their native land to travelers on the Oregon Trail prompted a government decision to send troops to the area. General William Harney led a force of approximately one thousand soldiers to the territory with orders to address the issue in western South Dakota territory. During this time, the government began negotiations with the Yankton Sioux for the territory between the Big Sioux and Missouri Rivers. The Yankton Sioux eventually agreed to leave this area in 1858 and move to a reservation, marking the formal beginning of white settlement of South Dakota.[141]

Congress established the Dakota territorial government in 1861, encompassing the future states of North and South Dakota. The Civil War, harsh climate, and troubled negotiations with the local Sioux populations hindered settlement until the 1870s, however. In 1860, for example, just 500 settlers had made the southeastern section of the territory their home. By the 1870s conditions had improved–the war had ended, the drought and grasshopper invasion had ceased to threaten crops, the Sioux had been confined to reservations, and the railroads had arrived.[142]

The Homestead Act of 1862 and completion of the Dakota Southern Railroad between Sioux City, Iowa, and Yankton, South Dakota, in 1873 played a major role in encouraging the region's settlement. Eager to boost immigration to the region, the railroads distributed pamphlets that promoted South Dakota's agricultural promise and favorable climate. Though not always accurate, these pamphlets encouraged thousands to move, and the increased rate of settlement is reflected in U.S. census data, which records ten thousand settlers in South Dakota by 1870.[143] Early settlers were primarily of Norwegian, Irish, Swedish, Dutch, Danish, and British descent. Between 1869 and 1874, Czechs and German-Soviets, as well as Hutterite, Mennonite, and eastern European Jewish religious groups, immigrated to the territory and established communities.[144]

Euro-American settlement of the South Dakota Territory stalled during the financial panic that gripped the nation from 1873 to 1877. A shaky economy, highlighted by the 1873 stock market crash, combined with a resurgence of the grasshopper plague, effectively halted large-scale settlement until 1878.[145]

The Black Hills gold rush provided the only source of continued settlement activity during this period. The discovery of gold in the Black Hills during the summer of 1874 created enormous pressure from settlers to gain entry to the Black Hills, which were still held by the Sioux. Prospectors could not be deterred from entering the area surreptitiously, and the United States government found itself forced to begin negotiations with the Sioux for access to the area. The rush peaked in 1877, and in the same year the government ratified a treaty with the Sioux that ceded the Black Hills west of the 103rd meridian and additional lands formed by the forks of the Cheyenne River. The Sioux also granted right-of-way for three wagon trails in the Black Hills.[146] To date this treaty remains controversial in the region.

The Black Hills gold rush resulted in the beginning of Euro-American settlement in the western portion of South Dakota. Rapid City was established in 1874 and quickly became the "eastern gateway" to the Black Hills region. Other communities such as Deadwood and Lead also developed during this period. New civil divisions developed after the ratification of the treaty with the Sioux in 1877, including Custer, Lawrence, and Pennington Counties. Almost a century later, Pennington County would become the home of several Minuteman installations, including the Delta-09 Launch Facility (LF).

Western South Dakota's gold rush began to wane in 1877 as surface gold deposits became exhausted. Homesteaders would not arrive on South Dakota's Western Plains in large numbers again until the 1890s.[147] However, settlement in the eastern section of the state began to increase rapidly. The Great Dakota Boom saw the influx of thousands of new settlers. The population in the eastern half of the state more than tripled between 1880 and 1885, rising from eighty-two thousand to two hundred and forty-nine thousand.[148] By 1889 South Dakota gained recognition as a state.

Western Plains Settlement and Agricultural History

The settlement of South Dakota's Western Plains is inextricably tied to agriculture. Early agricultural history of the region focused on raising livestock and ranching. Pennington County, created in 1877 during the Black Hills gold rush, and Jackson County, established in 1883, are located in what developed as prime ranching territory starting in the 1880s and in what became missile country during the twentieth century. Ranchers began driving their Texas Longhorns through the Black Hills as soon as the treaty with the Sioux opening this area was finalized. Large open range ranching operations dominated the landscape prior to the mid-1880s.[149] During this period, ranchers, often financed with out-of-state capital, found tracts of unfenced, unsettled land that could support large operations. By 1884 between seven hundred thousand and eight hundred thousand cattle roamed South Dakota's Western Plains, most of which were destined for markets in the East.[150]

The environmental and political forces at work in the late 1880s resulted in a shift to moderate and small-scale livestock production.[151] The climate on the Western Plains left large open range ranching operations susceptible to severe weather patterns. For example, the winter of 1886-1887 brought devastating storms that decimated the cattle herds and put many of the large ranches out of business. Homesteaders also pressured the ranchers by erecting fences around their claims. The new fences impeded ranching operations, which depended on large tracts of open range to feed their cattle. This issue caused strained relations between the homesteaders and the ranchers and further complicated the ranchers' situation as they tried to recover from heavy livestock losses.

Additionally, as homesteaders arrived in greater numbers, the large ranchers found themselves increasingly out of favor politically, as public opinion tended to favor the permanent settlement that came with homesteading. By this time the surviving large ranches had been relegated to leasing lands from

Native American reservations that had not yet been opened for settlement. The 1890s saw a boom in the smaller ranching outfits and these outfits joined the growing number of homesteaders seeking success on South Dakota's Western Plains.

By the turn of the twentieth century, settlers were distributed across the state. From the end of the nineteenth century to 1915, the state experienced the second Dakota Boom, which focused on the Western Plains area. Several factors helped to spark the renewed interest in settlement. The opening of additional Native American lands for settlement starting in the 1890s drew homesteaders to the Western Plains. The opening of these lands also sounded the death knell of the large range cattle operations, as the reservation lands formed the last stretch of open land in western South Dakota.[152] The government distributed lands on the newly opened reservations through a two-pronged system. Sections were either distributed among potential claimants through a lottery system or, in the case of Pennington County, through the more traditional route of the claims office. The claims office processed applications by homesteaders desiring to settle sections of land and attempted to impose some order on the homesteaders rush for land.[153]

The completion of the Chicago and Northwestern and the Chicago, Milwaukee and St. Paul Railroads west of the Missouri River in the first decade of the twentieth century opened the area for further settlement. The railroads facilitated trade and brought a wave of new settlers. Towns appeared along the rail lines almost overnight, as prospective homesteaders made their way west. Rail connections linked Pierre and Chamberlain on the Missouri River with Rapid City and Lemmon with Mobridge in the northwest by 1907.

Located in Pennington County, Wall was one of the towns that appeared along the route of the Chicago and Northwestern Railroad. Established in 1907, Wall received its name from the eight-mile-long outcropping that forms the Badlands, commonly referred to as "the wall" by cattlemen.[154] Wall would later become famous as the home of the tourist mecca Wall Drug. It is the closest community to the 66th Strategic Missile Squadron that included Delta-01 and Delta-09.

The second boom was also largely motivated by proponents of the dry-farming movement who asserted that the western South Dakota plains could be successfully farmed with drought-resistant plants using new techniques, including deep plowing and cultivating fallow. Availability of water in an area that receives less than nineteen inches of rainfall every year had been the most persistent concern for homesteaders in this region. Proponents of dry farming hoped to improve the area's agricultural economy and encourage a more permanent, stable settlement than the ephemeral ranching that previously dominated the region. Followers of the movement came to western South Dakota to practice the new farming method, but because dry farming is a labor-intensive method, they faced more difficulties than they had anticipated.[155]

Starting in 1907 the United States Department of Agriculture (USDA) conducted a series of farming experiments designed to improve agriculture in western South Dakota. The beginning of the program focused on testing dry-farming techniques in semi-arid climates. In 1912 the USDA's Newell Station began receiving water from the Belle Fourche Irrigation Project. The USDA investigated the merits of irrigation in the region to determine which type of agriculture was best suited for the region.[156] Their irrigation and dry-farming experiments established that dry farming was preferable to irrigation in western South Dakota, largely because irrigation could not be counted on to save crops in times of severe drought. In addition to the comparative study of dry farming versus irrigation, data was collected to determine which trees might produce the best shelterbelts; the best crop rotation and tilling methods; methods of cultivation to reduce erosion; which fertilizers were most effective; and successful livestock raising techniques.[157]

Although the studies conducted by the USDA showed that dry farming held the promise to improve agriculture west of the Missouri River, most farmers did not adopt the labor-intensive, dry-farming system. A growing number of homesteaders on the Western Plains turned instead to cattle, sheep, or horse ranching in combination with a system of diversified farming.[158]

The challenge of homesteading on the Western Plains of South Dakota extended beyond the normal concern about availability of water. The regularity with which droughts and severe weather affected the ability of homesteaders to produce even a subsistence crop caused many farms to fail, and homesteaders to permanently leave the area. The drought of 1910-1911 stopped the early twentieth-century homesteading boom. Homesteaders were hit hard as crops failed when the rains did not come. Those who survived the drought resigned themselves to the wild variations in climate that was simply a fact of life on the western South Dakota plains.[159]

Drought prompted many farmers across the state to attempt to further diversify their production. In particular, dairy farming became important to the homesteaders, and cooperative creameries were established, extending as far west as Rapid City. The government aided in educating farmers about drought-resistant crops and diversified agriculture by creating the South Dakota Agricultural Extension Service in 1915. In 1917 the state legislature provided further aid to farmers. For example, it passed a rural credit law authorizing the state to provide loans to farmers and created a state office to promote the state's agricultural products.[160]

World War I fostered a bubble in agricultural prices as demand for food in the European markets increased. Livestock producers in western South Dakota reaped huge profits as meat and grain prices tripled. However, the boom was followed by an equally dramatic bust as farm prices dipped after the end of the war, creating a depression in western South Dakota's farm economy during the 1920s. Indeed, it has often been said that the Great Depression of the 1930s in fact began a decade earlier for the country's farmers and ranchers.

Also during the 1920s, a myriad of technological advances offered the homesteader the ability to cultivate larger tracts of land in less time than had previously been possible. Tractors and combines increased the number of acres any one farmer could cultivate and had the unintended effect of encouraging farmers to bring marginal lands under cultivation. Consolidation of lands also reduced the number of homesteads on the Western Plains.[161] The 1930s saw the official end to the homesteading period. With the passage of the Taylor Grazing Act of 1934, which regulated grazing on public lands through a permitting process, the homestead era had ended.

Wall Drug continued to provide economic activity in the Western Plains town of Wall during the Depression. Ted Hustead purchased the store in 1931, and moved his wife, Dorothy, and son, Bill, from Sioux Falls, Iowa, to Wall. Typical for the Depression, the store had difficulty bringing in customers. Although tourists drove by on their way to Mount Rushmore and Yellowstone, they did not normally stop at Wall Drug until Dorothy Hustead had an idea. Dorothy suggested giving away free ice water and putting signs on the tourist routes advertising the water. The strategy worked brilliantly, and soon tourists were stopping for water and purchasing other items while at the store. By the time Bill Hustead took over management of the store in 1951, Wall Drug had become a success. The Husteads expanded the store over a period of forty years, beginning in 1951, to better serve the growing number of tourists that arrived daily. Roadside advertising on a worldwide scale has further raised the profile of Wall Drug. Today, in the opinion of Ted Hustead, Ted and Dorothy's grandson, Wall Drug "is probably the number one roadside attraction in America."[162]

The success of businesses like Wall Drug stands in stark contrast to the hardships experienced by many, if not most, homesteaders on the Western Plains. Farmers on South Dakota's Western Plains were already reeling from the effects of the drop in prices after the close of World War I when the Depression and the six-year drought, known as the Dust Bowl, hit the plains. The effect of the drought cannot be overestimated. A single storm in May 1934 removed approximately three hundred thousand tons of topsoil from the Great Plains.[163]

Beginning in 1933, the Roosevelt administration and Congress approved several measures to alleviate hardship on the country's farmers. The Resettlement Administration, which became known as the Land Use Program, was established in 1935 to oversee the reclamation of marginal farmland. The program affected South Dakota's Western Plains significantly. The government purchased 850,000 acres of marginal lands from homesteads in the Western Plains of South Dakota. The government then tore down the homestead buildings and reseeded the land with native grasses. In 1954 the National Grasslands were created out of South Dakota's reclaimed agricultural land at Buffalo Gap, Fort Pierre, and Grand River.[164]

During World War II, farmers in South Dakota experienced price fluctuations similar to those seen during World War I. By 1951, however, prices returned to a profitable level. The development of a cattle-feeding industry in the 1950s in the eastern part of the state complemented the cattle raising and grazing on the Western Plains. Livestock raising accounted for seventy-nine percent of South Dakota's agricultural production in 1966.[165]

The evolution of the state's highway system throughout the twentieth century further aided the economy on the Western Plains. During the Depression, United States Highway (USH) 14 formed the major east-west route crossing the state. USH 14, also known as the Black and Yellow Trail, provided tourists with an alternate route to the popular Yellowstone National Park and also provided a means of transporting agricultural products to eastern markets. The highway proved quite popular, and the segment between Rapid City west to the Wyoming state line was upgraded from a two-lane to a four-lane road in 1953.

The passage of the Federal Highway Act in 1956 set the ambitious goal of completing an interstate highway system within fifteen years. The Federal Highway Act had its origins in the Defense Highway Act of 1941 that focused federal funds to a Strategic Network of Highways with defense uses, such as roads to military bases and defense manufacturing plants. Also near the end of World War II the Federal-Aid Highway Act of 1944 called upon states and the Bureau of Public Roads to designate a national system of interstate highways, connecting state capitals, principal metropolitan areas, cities, and industrial centers by direct routes. The segment of USH 14 near Rapid City, with its recent upgrade to a four-lane road, was well positioned to become part of the new interstate system and was incorporated into the system shortly after the passage of the Federal Highway Act.

USH 14, later roughly shadowed by Interstate 90, bisected the lands that would soon be dotted with Minuteman missiles. Beginning in 1961, the Air Force constructed 165 Minuteman missile installations on the Western Plains of South Dakota, directed by the 44th Strategic Missile Wing based at Ellsworth Air Force Base. Moving from east to west across the plains, Ellsworth's three squadrons were located near the towns of Wall, Union Center, and Sturgis. The squadron near Wall operated the Launch Control Facility and Launch Facility now comprising Minuteman Missile National Historic Site in Jackson and Pennington Counties. Before detailing these specific facilities, we next turn to the Air Force.



Plate 15. The gently rolling plains of western South Dakota *(Photograph by Mead & Hunt)*



Plate 16. The striking landscape of the South Dakota Badlands *(Photograph by Mead & Hunt)*



Plate 17. A western South Dakota homestead, 1936 *(Library of Congress, Prints & Photographs Division, FSA-OWI Collections, Reproduction number LC-USF34-004666-D DLC)*

Chapter 2: U.S. Air Force, Strategic Air Command, and Ellsworth Air Force Base (1940s–90s)

Establishment

Air combat became the dominant brand of warfare during World War II, prompting a major restructuring of American military aviation after 1945. Following establishment of the Strategic Air Command (SAC) in 1946, the National Security Act of 1947 established the U.S. Air Force as an independent branch of the military. These were the institutions that directed America's strategic deterrent through the Cold War. Ellsworth Air Force Base in South Dakota, established in 1942 as an Army airfield, became part of the Air Force and SAC. As the following pages will demonstrate, in the mid-twentieth century SAC activated intercontinental bomb and missile wings at Air Force bases throughout the country that assisted in deterring a major conflict between the world's superpowers. Of course the superpowers battled throughout the Cold War in proxy wars throughout the developing world (in Korea and Vietnam most famously), but the type of awesome destructive power embodied in the Minuteman program was designed for another purpose: for the global thermonuclear conflict no one wanted to fight.

The U.S. Air Force originated as the Aeronautical Division of the Army Signal Corps in 1907. In the words of one official Air Force history, this predecessor oversaw "all matters pertaining to military ballooning, air machines, and all kindred subjects."[166] In subsequent years, the Army Aeronautical Division became the Air Service, the Air Corps, and finally the Army Air Forces, before emerging as the U.S. Air Force.[167] Aviation strategists argued throughout World War II that an independent airpower branch could best manage the complexities of modern air warfare. American pilots, moreover, chafed at the independent air forces they saw within the British and Soviet militaries. The establishment of the Air Force as an independent agency was the particular vision of General Henry H. Arnold (known to his men as "Hap"), a thirty-nine-year veteran of the United States military. In a report on the conduct of the air war during World War II Arnold suggested "three autonomous services, each of which has an equal and direct share of the total responsibility."[168] He speculated that a separated Air Force, Army, and Navy would form a balanced military that ensured efficiency by reducing duplicate efforts. On 26 July 1947, when the National Security Act became law, Arnold and those like him finally had their wish, and two months later President Truman appointed W. Stuart Symington as Secretary of the Air Force and General Carl A. Spaatz as the first Chief of Staff.[169]

When the Air Force separated from the Army, it gained control over all surface-to-surface aircraft and strategic missiles through SAC. While the new service took command of all area air defense missiles, the Army retained control of missiles used to protect Army field forces from air attack.[170] In the 1950s, when the nation entered the Space Age with the development of nuclear strategic weapons and ballistic missiles, the Department of Defense called upon Air Force bases around the country, such as Ellsworth Air Force Base, to operate and maintain bombers and missiles administered through SAC. Air Force personnel began training for new duties as missileers and missile support staff. Today, the Air Force continues to operate Minuteman III and Peacekeeper Intercontinental Ballistic Missiles (ICBMs) administered by U.S. Strategic Command (USSTRATCOM), SAC's successor.[171]

To better explore the strategic role of South Dakota's Minuteman ICBMs, a brief history of SAC, Ellsworth Air Force Base, and the 44th Strategic Missile Wing (SMW) follows. (A chart outlining the organizational structure of the U.S. Air Force is located at the end of this chapter.)

Strategic Air Command

The U.S. Army Air Forces established SAC on 21 March 1946 as one of three major combat commands of the agency. While the Air Defense Command provided protection for the continental United States and the Tactical Air Command supported the Army and the Navy in the field, SAC, the offensive branch, became the foundation of the nation's defense against the growing threat of atomic war.[172] SAC became a part of the Air Force in 1947, but continued its role as chief administer of all of the military's strategic nuclear weapons and central communication node for deployment of these powerful weapons.

Located first at Bolling Field in the District of Columbia, SAC's headquarters quickly moved to Andrews Air Force Base in Maryland. Initially, SAC was comprised of the 8th Air Force, headquartered at Fort Worth, Texas, and the 15th Air Force, headquartered at Colorado Springs, Colorado, and included eighteen bases and nine bomber groups. The command's first atomic weapon operation was "Operation Crossroads," which tested the effects of air-dropped and submerged atomic detonations on naval targets off the Bikini Islands in the South Pacific.

With expanding responsibilities, however, SAC eventually required larger facilities. In November 1948 the Air Force relocated SAC Headquarters to Offutt Air Force Base in Bellevue, a suburb of Omaha, Nebraska, well beyond the existing nuclear range of the nation's enemies at that time. Remaining in the Washington, D.C., area would have interrupted SAC's training missions, due to the existing heavy air traffic in the area. Furthermore, although forty bases were candidates for SAC's new headquarters, Offutt provided a good mid-continent location that had existing runways, large hangars, and support facilities. The organization's successor USSTRATCOM remains headquartered at Offutt to this day.[173]

With the outbreak of the Korean conflict in 1950 and subsequent invention of the hydrogen bomb–a device capable of creating a far greater destructive force than the bombs that devastated Hiroshima and Nagasaki–the arms race between the superpowers significantly accelerated. President Eisenhower called for a reexamination of the national defense upon entering office in 1953, and his demand, made partly to alleviate the country's need for an expensive massive standing army, resulted in an increased reliance on nuclear weapons and air power to deter warfare. His administration consequently invested more of the nation's defense funding in the Air Force than his predecessors had, and much of this new money went to SAC. While retaining key elements of the nation's security policy devised under President Truman, such as the doctrine of containment, the Eisenhower Administration publicly advanced a policy of "massive retaliation" in which the U.S. would not limit its response to future aggression.[174] Soviet military incursions into Europe, for example, would be met by nuclear strikes at Moscow. If such an awful event came to pass, SAC would deliver the blow. By the end of 1953 it administered seventeen atomic wings, eleven of which were equipped with armed bombers and crews, and the number of personnel continued to grow. In the 1950s SAC personnel grew from 85,000 to 262,000, many of whom were civilians employed for SAC support.[175]

Armed with the mission of deterring aggression, SAC employed both air- and surface-launched guided missiles. Air-launched missiles included the Quail and Hound Dog fired from the B-52 bomber and the Short Range Attack Missile, launched from the B-52 and the FB-111. Surface-launched missiles included the Snark, the Thor and Jupiter intermediate range ballistic missiles, and the Atlas, Titan, and Minuteman ICBMs.[176] By the 1960s the combination of the Air Force's bombers and ICBMs with the Navy's missile-launching submarines formed SAC's "triad" in deterring nuclear warfare against the nation.[177] With three nuclear options, American strategists reasoned, no foe would be able to silence America's potential nuclear response.

While SAC oversaw these programs and made decisions regarding bombers and missiles, the Air Force bases supported the organization's installations. Although the Air Force operated and maintained the missiles, SAC gave all orders pertaining to strategic weapons in the military; including wing assignments and which military bases would be assigned nuclear weapons. SAC decided on the location of ICBM installments, assigned squadrons, and installed missiles near existing Air Force bases to take advantage of their support facilities. SAC also gave orders on the proximity of ICBMs to other silos and communities.

SAC commanders determined when strategic bombers and ICBMs were activated, when they were placed on alert or heightened alert status, and when they were deactivated. For example, during the Cuban Missile Crisis in October 1962, SAC required for the first time that all twelve Series F Atlas ICBMs go on alert at four Strategic Missile Squadrons (SMS), including the 550th SMS at Schilling Air Force Base in Kansas, the 551st SMS at Lincoln Air Force Base in Nebraska, the 577th SMS at Altus Air Force Base in Oklahoma, and the 578th SMS at Dyess Air Force Base in Texas.[178] A decade later, in October 1973, SAC placed the 44th Strategic Missile Wing (SMW) at Ellsworth Air Force Base on increased alert status as a result of anticipated Soviet interference in the Arab-Israeli War.[179] Of course, the execution of these commands came only at the order of the President and his National Security Council.

Another duty of SAC in overseeing the Minuteman program was determining the effectiveness of the Air Force's combat crews. SAC assigned an Inspector General (IG) to each Air Force base. Each IG would perform Operational Readiness Inspections (ORI) at ICBM Launch Control Facilities (LCFs) at their base. The first ORI took place at the 706th SMW at F.E. Warren Air Force Base in Wyoming in July and August 1961. While SAC rarely distributed excellent ratings, Ellsworth's 44th SMW received several excellent scores throughout its history.[180]

Throughout its existence, according to Air Force lore, SAC's emblem and motto symbolized the institution's goals. The emblem was a sky-blue, shield-shaped image with an armored arm grasping a green olive branch and three red lightning bolts. Official histories note that the blue background represented Air Force operations, while the armored arm symbolized strength, power, and loyalty. The olive branch symbolized peace and the lightning flashes represented speed and power, all qualities of SAC's mission. The group's original motto, "War is our profession–Peace is our product," proved offensive to some, however, and the slogan was changed to "Maintaining Peace is our Profession." The Air Force changed the motto once more in 1958 (after an artist found there were too many words to paint on a sign that advertised a reenlistment campaign), choosing the pithier "Peace is our Profession."[181]

All discussion of slogans and emblems aside, SAC proved a uniquely dedicated and motivated organization throughout its history. Its crew, staff, and pilots believed their work necessary to maintaining the peace, and to deterring Soviet aggression worldwide. In its early years especially, under the leadership of its hard-charging commander General Curtis LeMay, SAC's personnel developed a reputation for working harder, faster, and longer than the bomber wings that preceded it. Its planes set records for endurance in the air, and maintained a constant presence in the skies in case of surprise Soviet attack. LeMay's reputation as a military hawk, and his belief that nuclear war could be won–at a time when many leaders, Eisenhower in particular, considered nuclear war a sure loser for all–later prompted criticism from historians, peace activists, and even his political superiors. President John Kennedy, for one, never forgot or apparently forgave the General for advocating immediate bombing missions at the height of the Cuban Missile Crisis, advice the President believed would have led directly to the nuclear war he strove to avoid. Indeed, even movie directors lampooned LeMay, as the bombastic and paranoid General Buck Turgidson (played by George C. Scott) of Stanley Kubrick's 1964 *Dr. Strangelove or How I Learned to Stop Worrying and Love the Bomb* was modeled after the SAC Commander. He preferred to cultivate another image, that of the hard-working and dedicated public servant, charged with a mission others neither liked nor would accept, the kind of commander pictured in the Jimmy Stewart classic film,

1955's *Strategic Air Command*. LeMay and SAC aided in the production of the latter, even assigning a colonel as the movie's technical director. Not surprisingly, *Dr. Strangelove* never received the Air Force's official endorsement. Nine years (and successive world crises such as Berlin and Cuba) made quite a difference in cinematic portrayals of SAC and its commander.[182]

With the fall of the Berlin Wall and the end of the Cold War, SAC was officially deactivated 1 May 1992 and was replaced by the U.S. Strategic Command, known as USSTRATCOM. On 1 October 2002 USSTRATCOM and U.S. Space Command both disestablished and a new U.S. Strategic Command stood up at Offutt Air Force Base, responsible for both missions.

Ellsworth Air Force Base

One Air Force Base under SAC's administration was Ellsworth Air Force Base near Rapid City, South Dakota. Although Ellsworth became a significant SAC Air Force base, operating and maintaining both bombers and missiles, its history predates the atomic age. The U.S. War Department established the Rapid City Army Air Base, which eventually became Ellsworth Air Force Base, in January 1942. Shortly after the U.S. joined World War II the base served as a training location for B-17 Flying Fortress crews. Weather reconnaissance and combat squadrons briefly trained at the base after the war, until operations ceased in September 1946. When the base reopened in March 1947, the 28th Bombardment Wing (BW) with the flying B-29 Superfortress was stationed at the Rapid City Army Air Base.[183]

In January 1948 the Air Force Chief of Staff, General Carl A. Spaatz, renamed the installation Weaver Air Force Base in honor of Brigadier General Walter R. Weaver, a pioneer in Air Force development. Five months later, at the public's request, the base was returned to its original name, Rapid City Army Air Base. However, President Eisenhower traveled to South Dakota in 1953 for yet another ceremony renaming of the air base. This time, the base was named in memory of Brigadier General Richard E. Ellsworth, commander of the 28th Strategic Reconnaissance Wing, and one of twenty-three crewmembers who perished in a plane crash over Newfoundland in March of that year.[184]

Over the years SAC continuously reassigned units to Ellsworth and upgraded facilities, manpower, and technology on the base. Ellsworth Air Force Base officially began its role in the Space Age in 1960 with the construction of Titan I ICBM facilities. The 850th SMS, originally assigned as the 28th BW, was assigned to operate and maintain the Titans. Two years later SAC activated the 44th SMW, and within that the 66th SMS was the first of three squadrons to operate 150 Minuteman I ICBMs throughout western South Dakota. The 44th SMW, whose motto was "Aggressor Beware," not only hosted two generations of ICBMs–Titan and Minuteman I–but was the only wing to have two generations at that time. Furthermore, after SAC activated Minuteman II ICBMs in the early 1970s, the base was known at the "Showplace of SAC" for their operation and maintenance of two of SAC's "triad" of nuclear deterrence, strategic bombers and Minuteman II ICBMs.[185]

With advancements in missile technology, as well as the evolution of the Cold War, Secretary of Defense Robert McNamara ordered SAC to accelerate the phase-out of the Atlas and Titan I ICBMs on 16 May 1964. By February of the following year, SAC had removed all Titan I missiles from their silos at Ellsworth, leaving only Minuteman I ICBMs.[186] To prove the ability of Minuteman crews and the missiles, McNamara then approved "Project Long Life," a series of operational tests hosted by Ellsworth Air Force Base. The program called for a realistic test of the Minuteman IB system through short-range base launches of three modified ICBMs. The first test missile, loaded with enough propellant for a seven-second flight and a range of approximately two miles, was launched from Launch Facility (LF) November-02 on 1 March 1965 at Ellsworth and was the only Minuteman missile ever launched from an

operational silo. "Project Long Life" demonstrated the ability of SAC's missile crews to actually launch Minuteman ICBMs, and marked an important moment in the history of the Minuteman project.[187]

When SAC finished converting the Minuteman I missiles in South Dakota to Minuteman II ICBMs in 1973, Ellsworth Air Force Base was selected to host the "Giant Pace Test 74-01." This program administered the first Simulated Electronic Launch-Minuteman (SELM) exercise. During the test missileers successfully simulated the launch of eleven SELM-configured missiles on the command of both underground LCFs and the Air Force's Airborne Launch Control System.[188] This test proved the effectiveness of the Minuteman's communications systems, a key component for a weapon designed to operate in a crisis situation under the most stressful conditions.

By the mid-1980s major changes were taking place at Ellsworth Air Force Base. The Air Force began deactivating the maturing fleet of B-52s and started to prepare the 28th Bombardment Missile Wing (BMW) for a fleet of B-1B Lancer bombers. In 1986 the Air Force hired contractors to construct dormitories, security police headquarters, and maintenance facilities for the supersonic craft. They also revamped the runway. By January 1987 Ellsworth accepted the first of thirty-five new bombers.[189]

Changes continued into the 1990s at Ellsworth Air Force Base. The signing of the Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms (START Treaty) in July of 1991 significantly affected the base's operations. On 27 September 1991 President George H. W. Bush ordered the removal of all Minuteman II ICBMs from alert status. The Air Force took the missiles off alert immediately and began removing them from the underground silos. In 1991 the Air Force began deactivation procedures and later dismantlement, including imploding the empty LFs and dismantling the LCFs.[190] The START Treaty allowed for the preservation of an LCF and LF to serve as an interpretive tool. LCF Delta-01 and LF Delta-09 of Ellsworth Air Force Base, the subjects of this study, were chosen to be preserved for interpretation. Ellsworth remains an operational base to this day, home of the 28th Bomb Wing.

44th Strategic Missile Wing

One of SAC's several missile wings during the Cold War included the 44th SMW, based at Ellsworth. This wing maintained both Titan and Minuteman missiles through its thirty-year tenure in South Dakota, and a brief history of the 44th and its strategic squadrons follows.

The 44th SMW originated as the 44th Bombardment Group (BG) on 20 November 1940, a unit first activated in January of 1941 at MacDill Field in Florida. The Air Force soon thereafter moved the 44th BG to Barksdale Field in Louisiana. Known as the "Flying Eight Balls," the group was equipped with the B-24 Liberator, a four-engine long-range bomber. After serving in World War II the 44th BG was deactivated and reactivated several times. On 1 January 1962 the Air Force deactivated the 44th BG a final time, though it was redesignated that same day as the 44th SMW at Ellsworth Air Force Base under the command of the 821st Strategic Aerospace Division, headquartered at the base.[191]

SAC assigned four strategic squadrons to the 44th SMW, including three Minuteman squadrons–the 66th, 67th and 68th - and one Titan squadron, 850th. The wing received its first operational Titan missile on 22 June 1962.[192] The other squadrons originated as the 66th, 67th, and 68th Bombardment Squadrons (BS) in the fall of 1940 at MacDill Field in Florida, where they too were equipped with Liberator bombers.[193] In addition to the four SMSs, the 44th SMW also employed several support units at Ellsworth Air Force Base. The Missile Wing Command Section included the 44th Missile Wing Commander and Vice Commander who oversaw missile combat crews and the support staff. The 44th Maintenance Support Squadron provided administrative support and training of maintenance groups that serviced the missiles and their

facilities. The 45th Missile Security Group and the 44th Missile Security Squadron had the task of securing the missile sites and protecting them from sabotage.

On 1 July 1962 SAC activated the first of South Dakota's Minuteman squadrons near Wall. The Minuteman I ICBMs were assigned to the 66th SMS, including fifty officers and two enlisted members.[194] The Air Force only allowed officers to serve as launch crews, hence the unusual ratio of ranks. When the Air Force activated the 66th SMS they also activated SAC's first Minuteman IB squadron. Minuteman's first variant, IA, contained a flawed first stage that reduced its range by two thousand miles. Rather than stall the nation's defense effort, SAC approved the installation of the flawed 150 Minuteman IA ICBMs at Malmstrom Air Force Base. Additional Minuteman I deployments consisted of the upgraded Minuteman IB, with the first 150 missiles activated at Ellsworth Air Force Base.[195]

The Boeing Company installed Ellsworth's first Minuteman IB ICBM in February 1963 in the Bravo flight of the 66th SMS.[196] The squadron's first Minuteman missile was activated in April 1963 and the first total flight of ten missiles was activated 20 June 1963.[197] The 67th SMS was located around Union Center, northeast of Rapid City, and the 68th SMS was situated around Belle Fourche, northwest of Rapid City. The last Minuteman I ICBM flight was accepted by the 44th SMW on 23 October 1963.[198] SAC declared all three of Ellsworth's Minuteman SMSs combat ready on 1 November 1963, and ordered all of its Titan I ICBMs deactivated soon after. By February of 1965 all nine Titan missiles at Ellsworth were removed from their silos. One month later, on 25 March 1965, SAC deactivated the 850th SMS.[199]

As technology advanced, so did the need to improve training. In November 1965 the Air Force installed Ellsworth's first Missile Procedures Trainer (MPT) to help missileers of the 44th SMW meet training requirements. To simulate the later Minuteman II ICBMs, SAC installed a second MPT at Ellsworth in April 1970. The MPT assisted the crews of the 44th SMW in competing in the Olympic Arena Competition, a contest between all of SAC's missile wings at Vandenberg Air Force Base in California. In 1970, 1982, and 1992 Ellsworth crewmembers won the coveted Blanchard Trophy for the "Best of the Best." In the following years they frequently claimed other top awards.[200] Other ICBM bases that competed against Ellsworth's 44th SMW in the Olympic Arena knew them as the "Black Hills Bandits."

In June 1971, SAC deactivated the 821st Strategic Aerospace Division and named the 44th SMW the host wing at Ellsworth Air Force Base. The 44th SMW was then reassigned under the command of the 4th Air Division (AD) at F.E. Warren Air Force Base in Wyoming. Additional organizational changes took place within the 44th SMW in 1975. In an effort to increase efficiency and improve missile maintenance, SAC deactivated the 44th Missile Maintenance Squadron on 30 September 1975 and activated the Field Missile Maintenance and Organizational Missile Maintenance Squadrons.[201]

Reorganization and deactivation continued throughout the 1970s and 1980s. In 1982 the 44th SMW transferred to the command of the 57th AD of Minot Air Force Base in North Dakota and then six years later was transferred to the to the 12th AD, relocated to Ellsworth and became the new host unit for the base. When President Bush signed the START Treaty, SAC ordered that all Minuteman II ICBMs be deactivated immediately. Deactivation at Ellsworth Air Force Base officially began when SAC removed the first Minuteman II ICBM from Golf-02 near Red Owl, South Dakota on 3 December 1991. Dismantlement was complete when SAC imploded LF Kilo-06 on 16 September 1996.[202] The 44th SMW formally inactivated on 4 July 1994 during a ceremony at Ellsworth Air Force Base. Colonel Roscoe Moulthrop, the final 44th SMW Commander, stated that the inactivation "marked a step back from the brink of nuclear extinction and a step forward into the sunlit world of freedom for our children and their children."[203] Today, a replica missile at the South Dakota Air and Space Museum, located just outside of the main gate of Ellsworth Air Force Base, and Delta-01 and Delta-09 stand as symbols of Minuteman's thirty-year era in South Dakota.

Organizational Structure of the Air Force
(in descending order)

Headquarters U.S. Air Force
↓
Major Command
↓
Direct Reporting Unit
↓
Field Operating Agency
↓
Separate Operating Agency*
↓
Air Forces
↓
Divisions*
↓
Wings
↓
Groups
↓
Squadrons and Flights

* - denotes those levels of organization that are no longer in use

Air Forces–A tactical level of command in the U.S. Air Force that is subdivided into wings, groups, squadrons, and flights. Air forces were both numbered and named originally, but only numbered air forces are still in existence.

Wing–There are three different types of wings: operational, air base, and specialized mission. Operational wings and air base wings are essentially in charge of the maintenance and basic operation of a base. A specialized mission wing has a specific task such as intelligence or training.

Groups–Groups represent an intermediate level of command to provide a level of leadership between the squadrons or flights and the wings.

Squadrons and Flights–Squadrons and flights are the basic units of the U.S. Air Force. Their purpose can either be functional, such as performing duties to maintain the base, or organized to carry out a specific mission.

Source: "Types of USAF Organizations," 12 October 2001 <http://www.au.af.mil/au/afhra/wwwroot/rso/organizations.html> (25 August 2003).

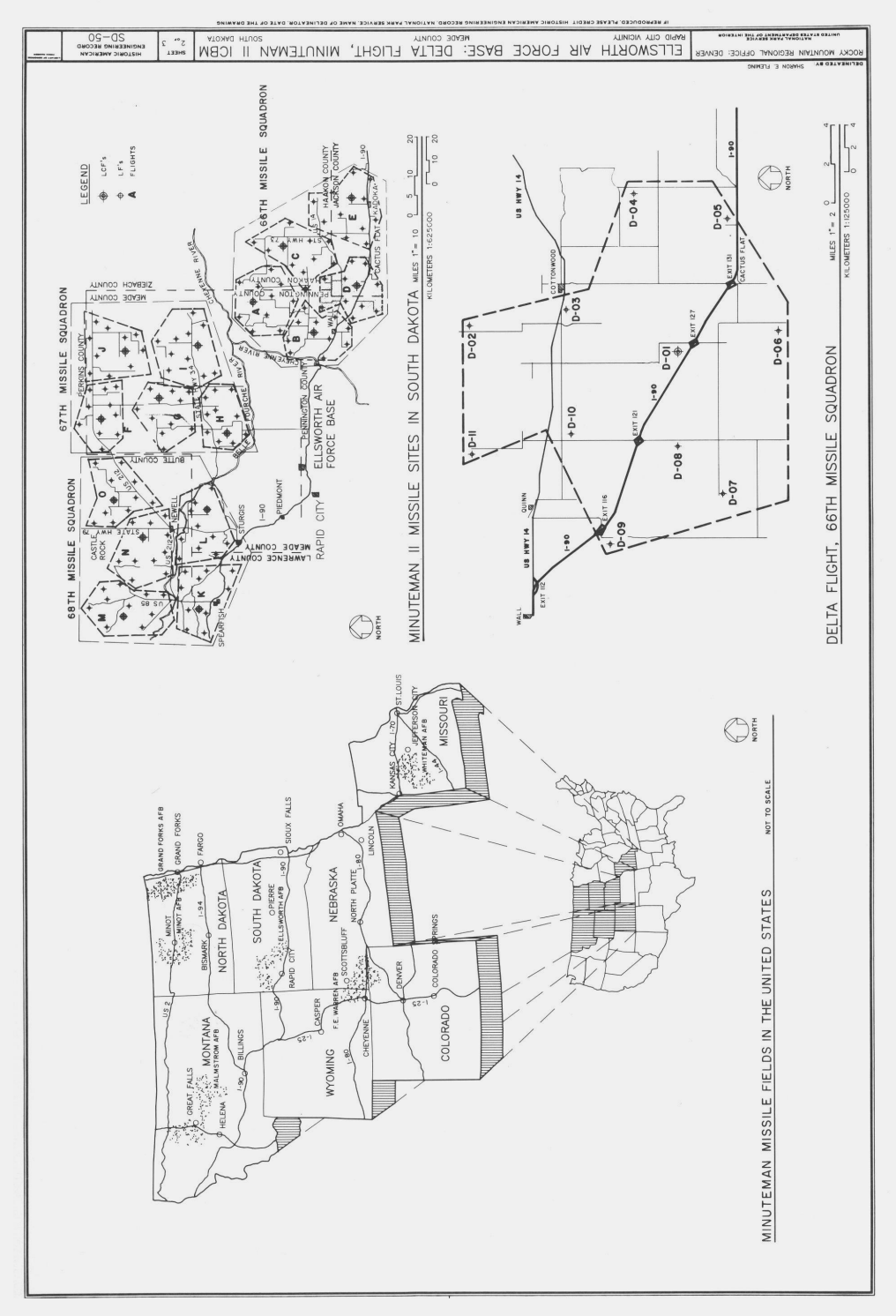


Plate 18. Location of Minuteman II missile sites in the United States, highlighting South Dakota and the Delta Flight *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-sheet 2)*



Plate 19. Transporter Erector at Ellsworth Air Force Base *("Site Activation Chronology, Minuteman Project, Ellsworth Air Force Base, South Dakota, July 1963-October 1963," K243.012-40, in USAF Collection, AFHRA)*



Plate 20. Pride hangar at Ellsworth Air Force Base *(Courtesy of Ellsworth Air Force Base, Base Historian's Office)*



Plate 21. Shield of the 44th Strategic Missile Wing at Ellsworth Air Force Base *(44th Missile Wing Commemorative Committee, Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994 (Rapid City, S.Dak.: Grelind Printing, 1993), 1)*



Plate 22. Shield of the 66th Strategic Missile Squadron at Ellsworth Air Force Base *(44th Missile Wing Commemorative Committee, Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994, 101)*



Plate 23. Shield of the 67th Strategic Missile Squadron at Ellsworth Air Force Base *(44th Missile Wing Commemorative Committee, Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994, 105)*



Plate 24. Shield of the 68th Strategic Missile Squadron at Ellsworth Air Force Base *(44th Missile Wing Commemorative Committee, Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994, 109)*



Plate 25. The Black Hills Bandits of the 44th Strategic Missile Wing *(Courtesy of National Park Service)*

Chapter 3: Minuteman Missile Sites in South Dakota (1960s-80s)

In the late 1950s the Air Force chose South Dakota as one of the locations to base the nation's nuclear arsenal with the installation of Minuteman missiles. The Army Corps of Engineers (Army Corps) began surveying sites throughout western South Dakota by the fall of 1960, and subsequently began negotiating with landowners for rights-of-entry to construct Launch Facilities (LF) and Launch Control Facilities (LCF) on their property. The Minuteman I Intercontinental Ballistic Missile (ICBM) construction program at Ellsworth Air Force Base progressed rapidly. Under supervision of the Army Corps , Peter Kiewit and Sons' Inc. (Kiewit Company), the Boeing Corporation, and their subcontractors began construction of the 150 LFs and fifteen LCFs during the fall of 1961. Their work, both in construction and then in activation of the Minuteman I, furthered the nation's defense program, but also affected western South Dakota economically and socially, an influence that remained through the Minuteman's deactivation.

Site Location

The Air Force's policy on site selection in South Dakota was multifaceted. Sites were primarily selected by balancing a variety of criteria, including maximizing Minuteman operations, minimizing each sites' vulnerability to sabotage, using the taxpayers' money wisely, and adapting individual sites to construction and operational needs, all with an eye to unique qualities of individual locations.[204] Other factors that contributed to the selection of sites were the physical features of the land, including the geology and terrain of the area, the types of soil, and the amount of available ground water.[205]

For cost and efficiency, the Air Force located missile sites near the existing Ellsworth Air Force Base in order to provide logistical support to the facilities. The missiles were located within an area approximately one hundred miles east and north of the base, in an expanse covering approximately 13,500 square miles of western South Dakota. The three Minuteman I ICBM squadrons at Ellsworth Air Force Base, each consisting of five LCFs and fifty LFs, were located in the vicinity of the communities of Wall, Union Center, and Belle Fourche.[206]

The Air Force positioned each missile flight (one LCF and ten LFs) in the same geographic area, but individual LFs could not be directly adjacent to another LF or the LCF. Minimally, the Air Force required LFs and LCFs to be geographically separated by an area large enough to withstand a ten-megaton explosion at an adjacent facility. Air Force specifications also required that the sites be separated so multiple facilities could not be targeted together.[207] The Air Force additionally attempted to select sites that would have the least adverse effect on nearby communities and private property.[208]

Land Purchase

The Air Force selected LF and LCF sites based on the surveys completed by the Army Corps, Omaha District Office. Prior to construction of the missile sites in South Dakota, right-of-entry, easements, and land purchase agreements needed to be made with hundreds of property owners. The acquisition for the 150 LFs, fifteen LCFs, and approximately 1,732 miles of Hardened Intersite Cable System (HICS) connecting the facilities included three phases. The first phase was securing right-of-entry for survey and exploration of proposed sites. Next, the Air Force worked with landowners to obtain right-of-entry for facility construction. The final phase included negotiations for land purchase or permanent easements and compensation for damages during the construction of the facilities.[209]

Phase one began in the fall of 1960. The right-of-entry Air Force representatives inspected potential sites throughout western South Dakota to assess the soil, geology, terrain, and ground water for suitability for site construction.[210] By early 1961 the locations for the LFs and LCFs were identified and HICS routes mapped. Following site selection, the Army Corps solicited landowner's signatures for right-of-entry to commence construction of the LFs and LCFs on their property. For the construction of each LCF or LF the Air Force required temporary construction easements of between four to six acres for construction equipment and dirt removed from the silos.[211] Following the right-of-entry for construction, the Army Corps negotiated with landowners to purchase the land. In land purchase and easement negotiations, the government was required to provide just compensation, defined as fair market value.[212]

In addition to land purchase, the government obtained permanent easements at the LF and LCF sites. It needed these easements in order to restrict land use in the area surrounding each LF and LCF to certain types of construction and agricultural activities.[213] The government also obtained permanent easements for the access road at both the LF and LCF and for the azimuth markers at each LF site, which were located outside of the fence and used to site the missile. Following construction the land was inspected by a real estate representative of the Army Corps and through negotiation an agreement was made with the owner for a cash settlement of any damages.[214]

Army Corps representatives negotiated with several hundred more property owners for easements for the underground HICS connecting the LFs and LCFs. These cables, installed four to eight feet below ground and used to transmit data between missile sites, required a temporary construction easement of thirty-five feet in width for approximately 1,732 miles between all 165 sites. After construction was complete, the government obtained a permanent easement for a path sixteen and one-half feet wide.[215] Following installation of the HICS, landowners could return to using the land above the cable for normal ranching or agricultural activities.

Such large-scale construction was not without its inconveniences, and to address some of the issues pertaining to land acquisition during this initial period, the Army Corps real estate field office distributed a pamphlet to property owners in western South Dakota titled "Facts About Minuteman Land Acquisition." The pamphlet promised landowners that the government would negotiate for the purchase of property and address any damages and losses. The pamphlet reminded the property owners that the Constitution permits the taking of private property for public use as long as the landowner was paid "just compensation."[216] Even with the issue of national security at stake, policymakers had no desire simply to confiscate land. If the landowners and the government could not agree on compensation, however, the government had the right to acquire the land through condemnation. A declaration of taking was filed and compensation was deposited with the court for the property owner. Negotiations continued and if an agreement could not be made the condemnation case would be brought to trial.

Minuteman Missile Area Landowners Association

While construction crews built some of the Minuteman sites in South Dakota on land already owned by the government, such as LF Delta-09, contractors constructed most of the sites on private property. During the site-selection process, some landowners did not feel that the Army Corps provided enough information to sign rights-of-entry to their property. To ensure that the government took landowners' rights into consideration during site selection and fairly compensated landowners, a group of farmers and ranchers formed the Minuteman Missile Area Landowners Association (MALA) in the early 1960s. MALA disseminated information to area landowners, believing that working collectively would aid the defense effort while safeguarding their private interests.

Members paid a minimal fee of one dollar to participate in the organization, primarily to cover the cost of postage and mailings. The MALA's first president was Eugene Pellegrin of Enning, South Dakota, and the first vice president was Cecil Hayes of Elm Springs, South Dakota. Eight additional members, including Burle Dartt, Ray Naescher, Ben Paulsen, Tony Oergerli, Robert Simpfendoerfer, Delbert Paulsen, Ferdinand Schroeder, and Leonel Jensen, served as directors to assist in collecting and distributing information.[217] In addition to nearly 150 MALA members supporting their cause, United States Senator Francis H. Case also attempted to assist negotiations between the landowners and the Air Force and Army Corps. Although Case was a longtime proponent of strong national defense and a supporter of the Minuteman I missile program at Ellsworth Air Force Base, he often corresponded with the landowner organization and the Army Corps concerning the project and advocated for fair and timely compensation.[218]

Most landowners understood that the national defense program required the installation of Minuteman missiles, and the technical reasons why the Air Force required use of their land. Prior to signing any agreements, however, MALA members wanted the government to address the disadvantages of having a LF or LCF constructed within their property. Many landowners were concerned that the location of the proposed sites would disrupt irrigation systems, take irreplaceable land, or interfere with agricultural operations. While their primary stated goal was to obtain a reasonable settlement for land and construction damages, the group also wanted to minimize the effects of the missile system upon nearby schools, roads, and the local police force.[219]

Prior to signing rights-of-entry needed for construction, the MALA voiced their concerns with Air Force and Army Corps personnel at several meetings in Rapid City in 1960 and 1961. MALA members questioned how the Air Force selected locations for the LFs and LCFs. Individual MALA members desired to know if selected sites could be moved to sections of their property less desirable for agricultural purposes.[220] In early April 1961, an Army Corps real estate representative explained that the missiles were part of an interrelated system and the location could not be altered aside from minor changes.[221] One property owner offered to donate the land if the Air Force would move the proposed LF to a corner of the wheat field instead of in the middle. His offer was rejected, and, in this case, the Air Force did not alter the proposed site for this facility.[222]

MALA members also pressed the Air Force at these meetings for further information about compensation for their land and losses. Many wanted to know what assessment they should expect for their property, and if they would receive compensation for damages incurred during construction or from decreases in land value due to the presence of the missiles in the area.[223] Army Corps officials responded that landowners were entitled to fair compensation for their losses and that the dollar value would be reached through negotiation between the government agency and individual property owners. Compensation for damages would be negotiated in much the same way.[224] Although many landowners received compensation for their land and losses, some felt the settlement offered was inadequate.[225]

After months of meetings and negotiations, seventy-five percent of the property owners of proposed missile sites signed rights-of-entry agreements by July of 1961. At the same time, approximately ninety percent of landowners involved with the underground cables had also signed agreements.[226] MALA president Pellegrin stated in a newspaper article that many of the property owners who refused to sign the agreement were negotiating for damages unique to their property.[227] In some cases, property owners never signed the rights-of-entry agreement needed to begin construction and in these cases, the Army Corps filed declarations of taking and deposited money with the court for the property owner. The Army Corps based the compensation on the government's original estimate of fair market value for the property. [228]

Despite efforts of the MALA to protect their rights and obtain compensation for their losses, some members of the public and government criticized the organization's members. They condemned landowners for slowing the defense effort, termed them unpatriotic, and accused them of holding up new business created by the influx of construction workers and additional Air Force officers.[229] The Air Force and Army Corps often reminded members of the MALA and other residents of western South Dakota of the importance of the Minuteman I ICBM program to the security of the United States. For example, the land acquisition pamphlet distributed to property owners stated, "like its prototype, the Minuteman of 1774, this immensely-important project for our national defense is authorized by the Congress of the United States."[230] Criticism aside, however, not every delay in Minuteman construction could be pinned on reluctant landowners. As late as March 1961, Congress had not yet fully appropriated the funding for the Minuteman I ICBM missile program at Ellsworth Air Force Base. Therefore, property owners did not stall construction of the sites in South Dakota or the nation's defense effort.[231] In reality, the land acquisition and construction of the Minuteman I missile facilities in South Dakota was an accelerated program that exceeded many expectations. Approximately one year after Army Corps representatives started testing soil and mapping missile facilities contractors began construction. After the construction of the LFs and LCFs in western South Dakota the MALA disbanded. The organization remained inactive until the early 1990s when the Air Force began the deactivation process of the Minuteman II ICBMs and a new generation of property owners worked together to disseminate information and provide support.

Site Construction

In 1960 the U.S. Army established the Corps of Engineers Ballistic Missile Construction Office (CEBMCO) as an independent organization to supervise missile site construction across the country, including Ellsworth Air Force Base. With the new agency, the construction of ICBM facilities fell under uniform and centralized control.[232] The commanding officer of CEBMCO appointed weapon system directors to manage the construction of Minuteman facilities at Ellsworth Air Force Base, as well as other ICBM construction sites. These directors worked at area offices, such as the one at Ellsworth Air Force Base, to directly supervise the construction of numerous contractors for the multiple phases of the construction process.[233]

CEBMCO originated with a staff of twenty-seven to supervise the construction of the missile facilities throughout the United States. That number grew to three thousand employees working in seventeen states by the mid-1960s. In South Dakota, CEBMCO appointed Colonel Sidney T. Martin to direct the construction project, while Lieutenant Colonel George V. Svoboda was named deputy engineer, Lieutenant Colonel James M. Gale assistant engineer, and Warren Withee served as the Chief of the Construction Branch.[234] At the time, constructing missile facilities was one of the largest construction projects undertaken by the Army Corps. In the 1960s CEBMCO and its predecessor agencies supervised the construction of 1,200 missile facility sites nationwide, including the 165 sites in South Dakota.[235]

Although CEBMCO staff at Ellsworth did not physically design or construct the LFs or LCFs, they were responsible for soliciting bids, selecting contractors, and reviewing plans. After supervising contractors during construction, CEBMCO aided the Air Force site activation task force in fitting the silos with operational missiles.[236]

In the summer of 1961 the Home Office Special Projects District at Kiewit Company in Omaha, Nebraska, won the bid to construct the Minuteman I ICBM silos for Ellsworth Air Force Base in South Dakota. The Kiewit Company bid estimate of $56,220,274 was nearly $10 million less than government projections.[237]

Using the designs developed by Parsons-Staven, a Los Angeles architectural-engineering firm, Kiewit Company was the primary contractor for the Minuteman I ICBM facilities in South Dakota.[238] The contract included preparing sites for facility construction and installing facilities using prefabricated parts. They were also responsible for negotiating with landowners over damages caused by the storage of excess dirt excavated from the silo shaft.

Groundbreaking ceremonies for the construction of the Minuteman I ICBM silos in South Dakota took place on 11 September 1961 in front of a crowd of approximately two hundred on-lookers at a site later known as Lima-06, located just north of Sturgis. Instead of the traditional shoveling of dirt to symbolize the start of construction, a small explosion signified the power of this immense undertaking. The ceremony theme was "Partners for Peace."[239]

To make for a more efficient construction process, contractors assigned crews specific tasks, which they then performed at numerous sites. Crews assigned to the Minuteman construction project in South Dakota varied in size from four to thirty, depending on the complexity of their task.[240] The first step in constructing the LFs was the excavation and grading at each site. The construction crew assigned this task used a bulldozer and clam shovel to create a circular cut that they then excavated to a depth of approximately thirty-five feet. After this task, the crew moved on to another site to complete the same task until all 150 LFs were excavated. A second crew moved in and proceeded to dig the shaft for the silo using a large auger. The shaft was a circular hole with a diameter approximately fifteen to eighteen feet and extended over eighty feet below the ground. The next task involved a third crew that poured a concrete deflector plate into the bottom of the shaft. After this crew secured the bottom of the hole, steel contractors lowered a twenty-five-ton, sixty-two-foot prefabricated steel liner into position. The liner, which formed the skeleton of the silo, included a quarter-inch steel plate and rings of reinforced bars. Contractors then poured concrete around the exterior of the steel liner, forming a twelve-inch-thick wall. Additional crews constructed a lower equipment room around the silo and a support building adjacent to the silo, both of reinforced concrete and below ground level. Once this stage was complete, crews backfilled the sites with dirt originally excavated for the silo and facility.[241]

Kiewit Company subcontracted much of the work to other firms. For example, Summit Construction Company was responsible for the initial site grading, excavating to the approximate thirty-five-foot level, and storing dirt from those tasks. The Gustav Hirsch Organization installed electrical conduit and backfilled the area around the conduit. Natkin and Company installed mechanical pipes and was responsible for the backfill and compaction around them. For the installation of the HICS, Kiewit Company retained American Bridge Design–United States Steel Corporation.[242]

The construction procedure involved moving nearly twenty million cubic yards of dirt for the 150 LFs and fifteen LCFs. In addition, contractors poured nearly one hundred fifty thousand cubic yards of concrete and used thirty-five thousand tons of steel to reinforce the underground facilities.[243] Although the numbers appear large, constructing Minuteman I ICBM LFs was much less challenging than the construction of earlier Atlas and Titan LFs. Minuteman I LFs were smaller than earlier ICBM facilities and they used prefabricated parts and standardized construction techniques. Furthermore, the Minuteman I LFs did not require the elevator that positioned the missile for launch or the complex loading system that burdened earlier missiles.[244]

Despite steps taken to minimize costs and speed deployment, Minuteman construction did not always proceed smoothly. In some instances, work stoppages, weather, and injuries delayed construction of the 165 Minuteman LFs and LCFs in South Dakota. The famously unpredictable plains weather affected the construction of the sites with dust storms, heavy rains, snow, and even severe cold temperatures. Moreover, work at the missile sites in South Dakota stopped on several occasions due to labor difficulties.

For example, on 6 June 1962 the American Bridge Company millwright workers went on strike for two days to protest the Kiewit Company's assignment of the setting anchor bolt task to ironworkers, which they believed to be their task. One week later Gustav Hirsch electricians protested the Kiewit Company's requirement that they report for work directly to LFs instead of a central point.[245] Contractors and workers dealt with such problems using "policies, procedures, and methods of adjustment" developed by the Missile Sites Labor Commission, the eleven-person agency appointed by President Kennedy in 1961 to aid in resolving labor disputes at missile and space sites quickly, and therefore without delay to the national defense program.[246]

Worker safety was an important issue at the missile construction sites and the Kiewit Company required employees to wear hard hats. During the two-year intensive construction period employing thousands of workers, sixty-two injuries and two fatalities were reported at the missile facilities in South Dakota.[247] In comparison, Minot Air Force Base in North Dakota experienced thirty-six construction-related injuries and two deaths, while Malmstrom Air Force Base suffered twelve injuries and one fatality.[248] Clearly this was dangerous work, as with all heavy construction, though the Kiewit Company received the National Safety Council's Award of Honor in 1962 for its missile construction efforts. During the second half of that year, the company logged over eight hundred thousand accident-free work hours, offering a safety record due in part to regulations set forth by the Army Corps. For example, the Army Corps required that any excavations at the sites had to have a slope on its bank so it would not cave in on anyone working inside the hole or shaft.[249]

Despite delays and unfortunate incidents, construction in South Dakota was completed by the fall of 1963, in less than two years. Construction of Delta-01 had been completed the previous year on 29 November 1962 at an estimated cost of just over $800,000 and construction of Delta-09 was completed on 26 November 1962 at an estimated cost of $354,500. The final costs for the construction of the Minuteman missiles in South Dakota may have been as high as $75.7 million.[250]

Missile installation

While Kiewit Company and other contractors worked to construct missile facilities throughout western South Dakota, the Boeing Company assembled the actual missiles, and developed much of the ground-support equipment, such as the launch control system, and the security system. More importantly, Boeing ensured that the missiles worked through testing, installed the missiles beginning in February 1963, and maintained them before transfer to the Air Force in the summer and fall of 1963.[251] Delta-01 and Delta-09 were turned over to SAC on 30 June 1963, making them among the first Minuteman sites to be activated at Ellsworth.

The emplacement of the missile in the silo employed skilled crews using a Transporter Erector (TE). After operators backed the TE into place, the missile container was raised to a vertical position over the silo opening. The missile was then freed from its restraining harnesses and a large hoist lowered it into the launcher. Once the missile was in the silo, technicians attached the reentry vehicle on top of the guidance and control system. After installing the reentry vehicle, the missile was aligned and oriented to the North Star and a targeting team set the arming and fusing system.[252] After Boeing finished installing all 150 missiles, the Air Force Systems turned the LFs and LCFs into operational facilities and SAC declared all three Strategic Missile Squadrons (SMS) combat ready on 1 November 1963.

Site Activation

The 44th Strategic Missile Wing (SMW) at Ellsworth Air Force Base was activated on 1 January 1962. Air Force personnel assigned to the 44th Missile Wing began training even while construction and development of missiles for the South Dakota Minuteman program was underway. Ellsworth Air Force

Base received its first Minuteman I in February 1963.[253] The Air Force placed the first total flight of Minuteman I ICBMs at Ellsworth Air Force Base on alert status in July 1963 when Base commander, Colonel Kenneth W. Northamer, handed over the keys for the flight to Colonel Virgil M. Cloyd, commander of the 44th SMW.[254] By November 1963, the 66th, 67th, and 68th SMS of the 44th SMW were ready for combat.[255] Each squadron was responsible for five flights of ten missiles, totaling 150 Minuteman I missiles.

Economic and Social Impacts on the Region

Economic Boost to the Region

Like earlier ICBM programs, the Minuteman program had many lasting effects on western South Dakota. The immediate and lasting impacts of the Minuteman missile program on South Dakota and its people are clearly a part of the missile story and were described by former missileer, Craig Manson,

> "It is a world historical event as well, … the communities, the people who lived in those communities–they are all part of the story, too. Wall Drug, where many, many, many missile crews had breakfast and lunch, that's kind of part of the story. The Diamond Caf in Newell, South Dakota, I don't know if it is even still there, but that is part of the story because it would not have been there long if it hadn't been for the missile crews, you know; Bear Butte in western South Dakota, Spearfish and Belle Fourche and towns like Philip and White Owl in the north central part of the state, and all of these communities are part of the story, too, and the way the people in these communities felt, whether they liked it or whether they didn't like it, however they felt about living in the shadow of those missiles."[256]

The large influx of construction workers in the early 1960s and the presence of additional Air Force personnel over the following thirty years affected local communities both economically and socially. Construction of the Ellsworth Air Force Base Titan facilities outside of Sturgis, New Underwood, and Hermosa beginning in late 1959 boosted the local economy and real estate market by providing jobs and demands for housing and goods and services.[257] This trend continued with the construction of the Minuteman I facilities in western South Dakota. Rapid City and smaller communities near the bases and missile sites benefited economically. Examples of increased economic activity brought by the expansion of the staff at Ellsworth Air Force Base are described in the following paragraphs.

The Kiewit Company alone employed nearly three thousand workers at the missile construction sites.[258] The Army Corps and Boeing Company also employed large numbers of staff in South Dakota during the early 1960s. While some of the employees were transient and moved to South Dakota to work on the project, many area residents found work on the construction, therefore stimulating the local economy.[259]

The employment opportunities offered to local residents during the construction of the sites was a significant impact on the local economy. When local resident Gene S. Williams was asked about how the public felt about the missiles being placed in South Dakota, he stated: "Well when they first were being constructed, you know, I think there were a lot of people that looked at them as jobs. It was very good to the local economy. There were high paying jobs, there were a lot of people that had an opportunity to work on the missile sites that, you know, that was probably as good a paying job as you could have gotten anywhere at the time. There were people that picked up skills associated with working on them that have used them the rest of their life."[260] In another case, Thomas Wilson, a Kiewit Company worker who had relocated to South Dakota, was asked about his feelings constructing missile sites, he simply stated, "I figured I had a job."[261]

By some estimates, the influx of new South Dakota residents, most of them union members, helped decide one of the state's closest elections, George McGovern's 1962 Senate victory. As activist Jay Davis recalled: "they were outsiders, they weren't from here, they didn't stay here long but they voted in that election….so George McGovern the great spokesman for peace may have owed his very election, as close as it was, to the workers who were building the missile silos to further the nuclear arms race."[262]

The missile sites themselves brought increased staff to Ellsworth Air Force Base to operate and support the facilities, while the crews and their families became a permanent part of the area's economy and social fabric until the program's deactivation a generation later. "It brought more people into the area," Wall Drug owner Ted Hustead recalled. "There have been a lot of men that were stationed at Ellsworth Air Force Base during the '60s and even today, that found their bride in western South Dakota."[263]

Employment in the area increased not only from direct employment for missile construction, but through the industries that supported the influx of workers. Housing surrounding Ellsworth Air Force Base was needed to accommodate the temporary workers, for example, and Boeing planned three trailer parks in 1961 to accommodate 120 units each.[264] Housing construction and an increase in demand for basic day-to-day needs, such as food and clothing, was an economic boom for the area.

Many local businesses, such as Wall Drug, benefited from the increased population during the Minuteman construction phase. Although the business did not permanently expand due to the presence of construction crews, the workers did have an impact on the business in the early 1960s. During this time Wall Drug would open its doors at 4:30 in the morning to prepare breakfast for the construction crews and pack box lunches.[265] Wall Drug also experienced business from missileers and other Air Force personnel during the years Minuteman I and II ICBMs were on alert status in South Dakota. Many times, LCF personnel would stop at Wall Drug to pick up food for barbeques or personal essentials needed for their three-day alert tour that they may have forgotten on base.[266] With the introduction of new Air Force personnel regularly traveling through the area, Wall Drug began advertising free coffee and donuts for Minuteman missile crews. This eventually led to free coffee and donuts to all veterans, truck drivers, hunters, snowmobilers, and honeymooners.[267]

The local economy continued to benefit from the presence of the Minuteman at Ellsworth Air Force Base into the later part of the twentieth century. During the Force Modernization Program begun in 1971, the Air Force upgraded the Minuteman I missiles of the 44th SMW with Minuteman II missiles. The project continued until March 1973 and employed over three hundred local residents. Local businesses benefited from the sale of supplies for the project.[268] Rapid City, as a regional center in the state, can be attributed in part to the number of people that were stationed at Ellsworth Air Force Base over the years to work at the base and the missile sites.

Public Improvements

In addition to the economic boost, public utilities were also improved during the Minuteman I construction phase. In the spring of 1961 the Air Force initiated an accelerated program to improve 327 miles of roads. Contractors needed improved roads throughout rural, western South Dakota to move heavy equipment to the missile sites, and the U.S. Bureau of Public Roads, Defense Fund provided funds that Congress allocated for road improvements.[269] Many of the improved roads to the missile sites were paved, which was a significant improvement over the area's typically unpaved rural roads. During the missile site construction in South Dakota the federal government designated specific routes for construction crews to follow to the sites. The government contracted with the involved county to conduct road repairs for damage from trucks hauling equipment or materials. In some cases, however, contractors did not follow designated routes, and their crews and equipment inadvertently damaged additional roads. Pennington County billed the government some $150,000 in 1962, to cite one example,

to offset the cost of road damage on undesignated routes caused by missile construction.[270] Over the years of Minuteman I and II activation in South Dakota, the road networks continued to be maintained through federal, state and local funds to accommodate Air Force personnel and maintenance activities of the sites.

Many schools also felt a direct impact from the Minuteman construction phase in the early 1960s. The Rapid City schools grew by about one thousand additional students from the nearby Titan project. *The Rapid City Journal* in January 1961 reported that it was anticipated that a similar number of students would also enroll in the Rapid City schools as a result of the Minuteman site construction.[271] It is unknown how much enrollment increased as a result of the influx of Minuteman workers' children during the two years of construction.

Race Relations

The influx of workers during the construction of the missile sites and Ellsworth Air Force Base personnel over the years included people of various ethnic backgrounds, including African Americans. Racial inequality and discrimination, both on and off base, were not isolated to Ellsworth Air Force Base and the Rapid City area, but rather are likely a window into the racial tension and discrimination being experienced by the rest of the country. Rapid City and the region around the base were not very racially diverse, and as a result, African American base personnel pointed out the lack of social centers and ethnic opportunities off base.

Alan Gropman's book, *The Air Force Integrates, 1945-1964*, reports that African American airmen at Ellsworth Air Force Base "were rejected by the local communities, and base officials seemed to be indifferent to their plight. Many business establishments were closed to blacks, all taverns were segregated, and housing for blacks was extremely limited, substandard, and exceptionally expensive."[272] Initially, some members of the Air Force opposed becoming involved in integration issues within the communities outside of the bases, feeling this was outside of their realm of control. The passing of the 1964 Civil Rights Act opened public accommodations to African Americans and allowed the Air Force to take more initiative in integration measures within the communities outside its bases.[273] Following the passage of the Civil Rights Act, some racial tensions continued to some extent both on and off base for air men of different cultural backgrounds.

Oral interviews with past personnel of Ellsworth Air Force Base during the late 1960s through the early 1990s offered varying opinions on the degree of racial tension between African American and minority Air Force personnel and the surrounding community. Ken Bush, an African American stationed at Ellsworth Air Force Base during the mid-1970s and 1980s, stated that "I can honestly say that I was never mistreated anywhere I went." However, he did recall an isolated incident from the 1980s where he and another African American were refused service at an establishment in Rapid City. The matter was taken to the Rapid City Council and the two did not pursue further action.[274] Lieutenant Colonel Robert Wilson stationed at Ellsworth stated that race relations were not a problem on base, but that there were significant problems outside the base community and was surprised how African Americans and Native Americans were treated.[275]

In the Rapid City area there has historically been racial tension between the descendants of Euro-American and Native Americans, but based on the oral interviews collected to date, there is no evidence of significant tensions between the military community at Ellsworth Air Force Base and the surrounding Native American residents, at least in terms of affecting base operations.

Living Next to the Missiles

As is often the case, the presence of a large military base has a significant impact on the region. Ellsworth has become an important fixture in the community. In these ways the Minuteman program left a lasting

social and economic imprint on western South Dakota, and not only in ways typically measured by statistics and numbers. An amateur baseball team in Sturgis has adopted the name Titans, referencing the Titan missiles that were once deployed a few miles east of Sturgis. In another example, several streets in Rapid City now bear names reflecting the history and heritage of the base, including Minuteman Drive and Atlas Street.

Initially the missiles brought jobs and money to the area, but as time went on the residents had to learn to deal with nuclear weapons in their backyards. Local rancher Gene S. Williams recalled that a lot of the people that had missiles sites put on their land were from an era that had traveled by horse and buggy or could recall this time, "and now you're putting a hole in the ground for a missile that could launch and go, you know, fifteen thousand miles and blow up millions of people. I mean, these types of things I think were hard for people to even put their arms around."[276]

For the children growing up amongst the missiles and Ellsworth Air Force Base in South Dakota, the Cold War was a part of every day life and evokes vivid memories. Tim Pavek, an environmental engineer at Ellsworth Air Force Base, recalls from his childhood hearing the B-52s. "…I remember when I was a, a little boy in bed here on a hot summer night with the windows open and I'd hear the distant rumble of the B-52s here at Ellsworth taking off. And, and, almost lay in bed shaking wondering if that was a practice mission and they'd come back or if this was the real thing and within a few minutes we'd see the fireballs of, you know, nuclear weapons over western South Dakota. So, having lived next to this Air Force base, you know, we knew that we were a big red-and-white bull's eye on the Soviet map, or that was my perception at the time."[277]

Tim Pavek recalled another childhood memory of the Cold War told to him by a gentleman who grew up in South Dakota, "… he says 'I remember sitting down at the kitchen table with my parents and having a very frank discussion over what we should do with regard to this, the threat of nuclear war. Um, whether we should build a bomb shelter–the people down the street were building a bomb shelter. How we should prepare ourselves for this eventuality.' "[278]

The missiles also perhaps left emotional scars. "And here you're sitting with a thermonuclear device, that is a half mile from your house," local rancher Gene S. Williams commented, "and you know well somebody punches the wrong signal code in or turns the wrong key and you're just vapor. You don't want to dwell on that too much but you also recognize that it wasn't just the enemy that was going to blow you up, you could blow yourselves up."[279] Paradoxically, the missiles themselves, and their LFs and LCFs, were less physically imposing on the state's landscape.

The Cold War Continues

The domestic and local impact of the Minuteman program in economic, political, and even psychological terms, all occurred in the context of sweeping movements within the international system. Whereas the program had begun in an era when only the two superpowers possessed nuclear weapons, by the close of the 1960s at least three nations (Britain, France, and the People's Republic of China) publicly possessed this ultimate power. Other countries, Israel and South Africa (clandestinely), and Pakistan and India (publicly) would join the nuclear club within a generation, while at the time of this writing, North Korea appears on the brink of doing the same. What once was the domain of only superpowers clearly has grown in scope. Minuteman was designed largely for a total global nuclear war, as a deterrent of awful destruction useful for warding off the complete devastation of a large-scale nuclear exchange. Whether such a system would and could help control this new era's increased risk of limited nuclear exchanges remains to be seen.

The superpowers responded to growth of the nuclear club with alarm, and with a surprising amount of cooperation. Each led collective military organizations by the mid-1950s, the North Atlantic Treaty Organization (NATO) and the Warsaw Pact in Europe most famously. Each also believed their own nuclear sword sufficient for defending theirs and their allies' interests. American policymakers thus hesitantly approved of Britain's development of an independent nuclear capability in the 1950s, believing their objection would do little to halt Britain's nuclear program in any event, and loudly criticized France's nuclear program (and subsequent withdrawal from NATO) the following decade. For each of these new nuclear nations, possession of the ultimate weapon symbolized power in a changing world: the power not only to hold its own against lesser foes, but also the power to stand up to Washington or Moscow. "We must rely on the power of the nuclear deterrent," British Prime Minister Harold Macmillan declared, "or we must throw up the sponge!" Moscow proved more adept at halting nuclear development among its allies (who largely lacked the technological and financial resources to develop such expensive weaponry in any event), save for China, which joined the nuclear club only after its break with the Kremlin in the early 1960s. During their 1961 Summit in Vienna, Kennedy and Soviet leader Nikita Khrushchev even obliquely discussed launching a joint air strike against China's embryonic nuclear program, as both leaders considered an Asian nuclear bomb a threat to their individual and collective interests. Realizing such a move would lead to war, they pursued other paths. [280]

By the 1970s, therefore, the bipolarity of the international system seen in the first Cold War years had given way to a world of multiple points of power. Moscow and Washington remained the two largest powers–and possessed the two largest nuclear arsenals by far–but they were no longer wholly dominant. They retained the power to impose their will on others (as in 1954 in Guatemala or in Hungary in 1956 for the United States, to name only two cases), though as the Soviets would learn in 1968 in Czechoslovakia, and the Americans in Vietnam throughout the 1960s, the use of force often carried negative consequence that far outweighed the potential gains of proving hegemony. In recognition of these changes, and of their profound implications for Asian security in particular, President Richard Nixon slowly developed the practice of what his Secretary of State Henry Kissinger termed "triangular" diplomacy. By warming American relations with China, including development of formal diplomatic and trade ties, Nixon hoped to gain leverage in Europe over the Soviets, forcing them to the negotiating table and towards the lessening of East-West tensions known as d tente. The ongoing quagmire of the Vietnam War and domestic crises such as Watergate ultimately limited Nixon's diplomatic options, but the point of his effort remained: that the second half of the Cold War was far different than the first. There were more nuclear powers, and they possessed even greater stocks of nuclear weapons than before.[281]

Some argued the world was a safer place because of these developments. Others saw the breakdown of Soviet-American relations by the close of the Presidency of James Carter as foreboding and a new and more dangerous phase of the Cold War. The Soviet invasion of Afghanistan in 1979, prompted in part by fear of the new Islamist government in neighboring Iran that drew its power at least in part by anti-Americanism, sparked a new crisis in superpower relations. Washington condemned Moscow's move, which if successful would have given the Kremlin new influence in a region pivotal to the world's oil trade, and American leaders spent heavily to arm Afghan resistance forces in their battle against the Red Army. Ironically, these same forces spawned anti-American Islamist movements such as the Taliban and Al Queda, groups that each began as Mujahadiin fighters, armed by the United States for their battle against Communism.[282]

Carter's final year in office saw renewal of Cold War tensions. Contemporary critics such as Ronald Reagan, who won the White House in 1980, and later conservative historians and pundits eager to give Reagan credit for "winning" the Cold War, harshly rebuked what they perceived to be Carter's tepid opposition of and even tacit acceptance of Communism. Such biased interpretations are largely incorrect. Carter accelerated America's military build-up, and withdrew the Strategic Arms Limitation Talks II

(SALT II) from the Senate (where it lacked the votes to pass in any event). He embargoed American wheat and technology exports to the Soviet Union, and even withdrew American participation from the 1980 Olympic Games in Moscow. Like President Truman thirty years before, Carter announced his own "Doctrine," vowing American intervention–most likely nuclear–against any Soviet threat to the vital Persian Gulf. The Cold War was on once more.[283]

President Reagan continued these policies of military strength and tough diplomacy against the Soviets. His rhetoric, and his long-standing visceral opposition to Communism more broadly, helped change the tone of the Cold War. Carter promised opposition to further Communist expansion. Reagan wanted to see Communism's collapse. He called the Soviet Union an "evil empire," and later declared that "Marxism-Leninism" was destined for "the ashheap of history." He refused, in 1981 at least, to meet Soviet requests for arms reductions. By the mid-1980s, the Soviet economy could no longer support the country's competition with the West. When Reagan announced plans for an expensive new space-based missile defense system termed "Star Wars," or officially the Strategic Defense Initiative (SDI), Soviet leaders knew they could not afford to keep pace. Most analysts believed SDI to be technically infeasible. The very fact that Washington seemed willing to spend the money to find out, coupled with their inability to do the same, pushed the realization among Soviet leaders of the necessity of change. They had by 1985 only fifty thousand computers in their entire country, compared to America's thirty million, and youthful reformers such as the energetic Mikhail Gorbachev began a series of radical changes of the Soviet system, with *glastnost* (openness to the West) and *perestroika* (economic reconstruction). Reagan wanted more. "Mr. Gorbachev," he declared in Berlin while overlooking the most visible symbol of the East-West divide, "tear down this wall." Gorbachev could not, at least not without prompting a right-wing revolt at home. The forces he set in play, however, those of change and of modernity, swept through Europe. In November of 1989, Berliners both East and West tore down the wall that had divided them for more than a generation.[284]

The Cold War was not officially over–it had never officially begun–but it was clearly at an end. It would be up to democratic reformers such as Russian President Boris Yeltsin (Gorbachev was a reformer, but he was no democrat) to move the remnants of the Soviet Empire into a new day of cooperation with its neighbors and the world. Political scientist Francis Fukuyama famously declared the progress of history to be finally at an end. With the close of the Cold War, "political liberalism" had finally won out over totalitarianism. The stability of democracies would thereafter reign. As events have sadly shown, the post-Cold War world did not bring the stability promised, leading some pundits to publicly long for the security the bipolar Cold War system offered. The threat of global thermonuclear war might have lessened after 1991, the very threat Minuteman was originally developed to counter and deter. But the world may be no less safe for it. To the question of who "won" the Cold War, while most evidence points to the West, as responsible historians we can only answer as Chinese Prime Minister Zhou Enlai did when asked the significance of the French Revolution: "it is too soon to tell."[285]

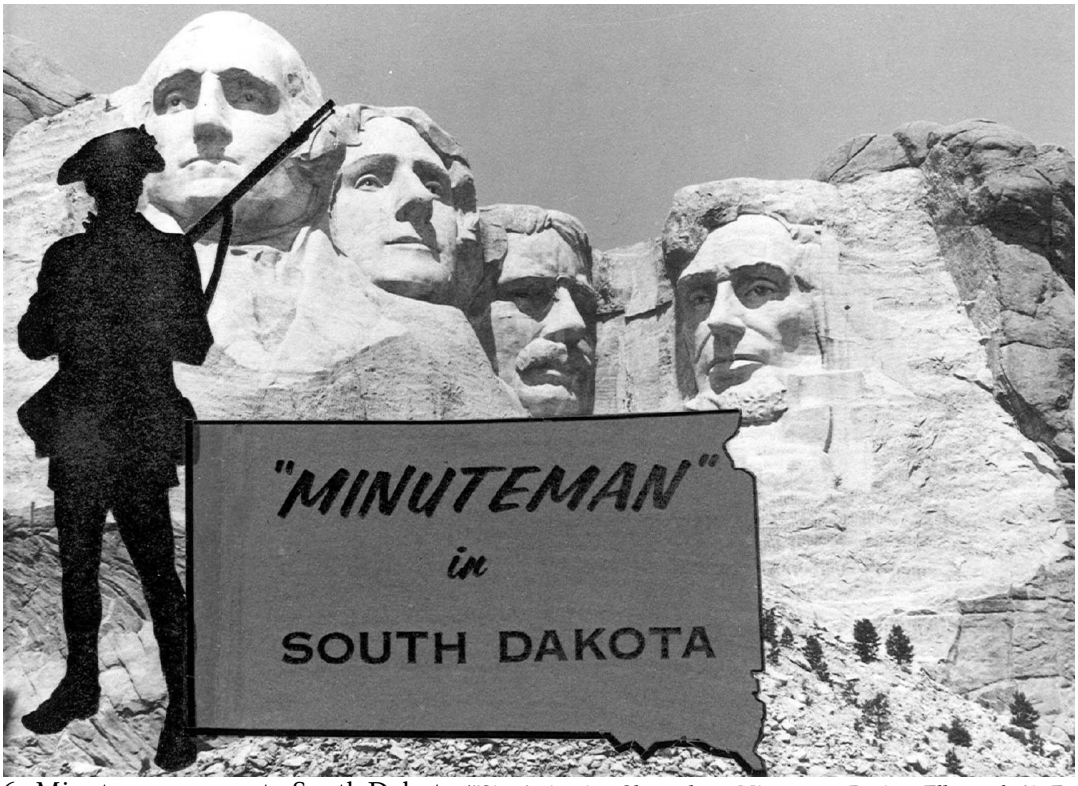


Plate 26. Minuteman comes to South Dakota *("Site Activation Chronology, Minuteman Project, Ellsworth Air Force Base, South Dakota, July 1963-October 1963," K243.012-40, in USAF Collection, AFHRA)*



Plate 27. Groundbreaking ceremony at Lima-06 in South Dakota, 11 September 1961. Standing from left to right are: Major General Homer Jensen, Colonel Kenneth Northamer, South Dakota Governor Archie Gubburd, and Major General Delmar Wilson *("Site Activation Chronology, Minuteman Project, Ellsworth Air Force Base, South Dakota, July 1963-October 1963," K243.0121-6, in USAF Collection, AFHRA)*



Plate 28. Aerial view of Delta-01 during construction *(Courtesy of National Park Service)*



Plate 29. Launch Control Center under construction in South Dakota *(Courtesy of Peter Kiewit and Sons', Inc.)*



Plate 30. Launch Control Center nearing completion in South Dakota *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-30)*



Plate 31. Interior of a Launch Control Center during construction in South Dakota *(Courtesy of National Park Service)*



Plate 32. Launch tube under construction in South Dakota *(Courtesy of Peter Kiewit and Sons', Inc.)*

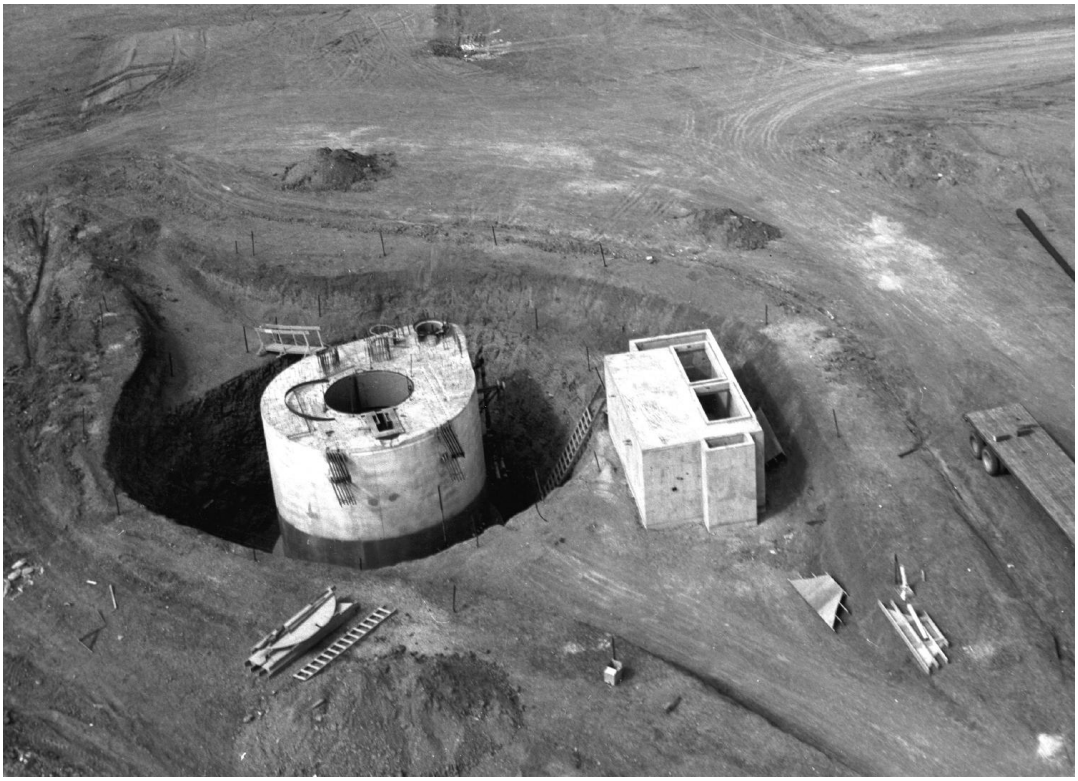


Plate 33. Aerial view of a launch tube under construction in South Dakota *(Courtesy of Peter Kiewit and Sons', Inc.)*



Plate 34. Launch Facility nearing completion in South Dakota *(Courtesy of Peter Kiewit and Sons', Inc.)*



Plate 35. A Boeing crew assembles a first-stage Minuteman engine at the Air Force Missile Test Center, Cape Canaveral, Florida, 14 June 1963 *(Photograph No. B-08-018-1, "Guided Missiles – Boeing "Minuteman," U.S. Air Force Photo, Record Group 342, National Archives, Washington,D.C.)*

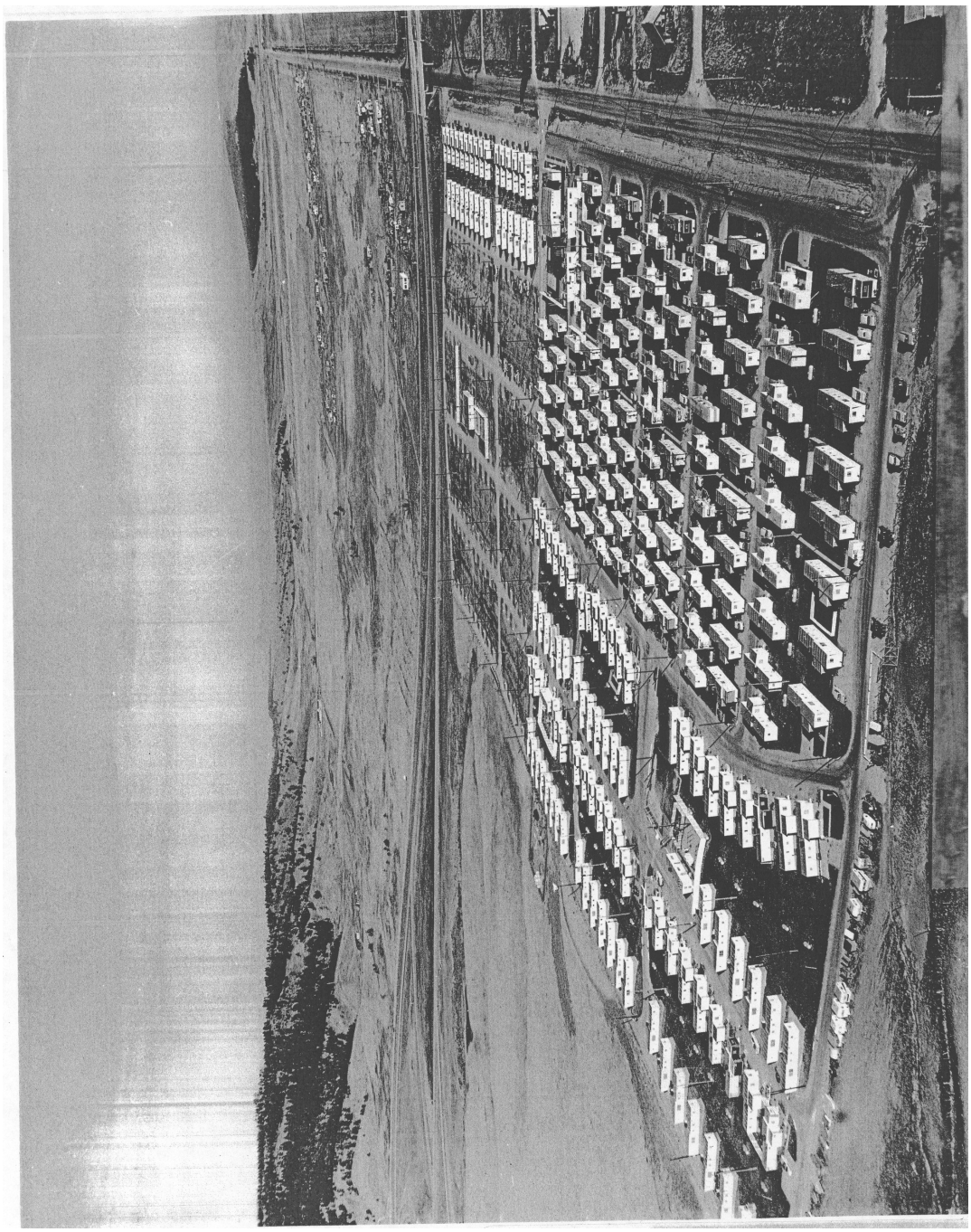


Plate 36. Northern Heights Mobile Home Park in Rapid City that may have housed Minuteman construction workers *(Boeing Archives)*

Chapter 4: Delta-01 and Delta-09 (1960s–80s)

Overview of the Complex

The Minuteman missile is a technological wonder. Designed to launch at a moment's notice, it is capable of achieving speeds exceeding fifteen thousand miles per hour and then striking its target half a world away. Though created to deter war, its destructive capabilities exceeded anything known to previous generations. This force waited beneath the ground, in silos buried eighty feet beneath the surface, directed by operators housed miles away beneath unimposing buildings that dotted the windswept plains. Untold numbers of unsuspecting travelers passed Minuteman installations as they drove across the region's highways and roads. Those on a pilgrimage to such popular destinations as Mount Rushmore, Badlands National Park, Wall Drug, and the Sturgis Motorcycle Rally, or those just traveling home or to a new life across America, passed a portion of the nation's nuclear arsenal. This chapter explores the physical layout and features of the Launch Control Facility (LCF) and Launch Facility (LF), the structures that comprise Minuteman Missile National Historic Site.

Delta-01 and Delta-09 are located in rural South Dakota about fifty miles east-southeast of Rapid City, South Dakota. Built in accordance with the Air Force's dispersal strategy, the LCF and the LF lie approximately ten miles apart. The two facilities were originally linked by a system of blast-proof underground cables and a radio communications network, known as the Hardened Intersite Cable System (HICS). On active duty from 1963 until 1991, the LCF and LF were part of an operational unit, collectively known as Delta Flight, consisting of one LCF and ten missile LFs. Delta Flight was one of five flights assigned to the 66th Strategic Missile Squadron (SMS) of the 44th Strategic Missile Wing (SMW), headquartered at Ellsworth Air Force Base, near Rapid City.

Delta-01 and Delta-09 were turned over to the Strategic Air Command (SAC) on 1 November 1963, making them among the first Minuteman sites to be activated at Ellsworth. With the introduction of modifications to the Minuteman missile, the Ellsworth missile field, including Delta-01 and Delta-09, was upgraded to a Minuteman II installation in the early 1970s. No major structural modifications were necessary for this conversion, and over the years, these facilities were subject to limited new construction and remodeling. In September 1991 all 450 of the nation's Minuteman II missiles were taken off alert. Delta-01 and Delta-09 were deactivated in early 1993 and placed on "caretaker status." Deactivation included the removal of the Minuteman II missile and warhead from Delta-09 and the removal of classified electronic equipment, hazardous materials, environmentally sensitive materials, and equipment saved for use at other sites from both Delta-01 and Delta-09. To the greatest extent possible, the facilities were left to appear as they had when they were first taken off alert.

In 1993 the United States Air Force and the Rocky Mountain Regional Office of the National Park Service initiated studies to determine whether Delta-01 and Delta-09 could be preserved as a unit of the National Park Service. In 1999 Congress designated Delta-01 and Delta-09 as a National Historic Site and the bill was signed into law by President Bill Clinton. The facilities, including all cultural materials of the sites such as furnishings and objects, have been transferred to the National Park Service. The buildings, structures, and landscapes are all important features of Minuteman Missile National Historic Site. The following pages offer a description of these facilities.[286]

Launch Control Facility Delta-01

Delta-01 occupies an open, grassy tract of land on the west side of Jackson County Road CS 23A, approximately one-half mile north of Interstate 90's Exit 127. Delta-01 occupies approximately 6.4 acres of the South Dakota landscape with approximately 1.85 acres located within the security fence.

Approaching the site from the Interstate, it looks like a lone ranch house in the open grassland. Over the years, most travelers on the nearby Interstate probably did not give the site a second look or even know what military capabilities lay within the South Dakota plains.

The area surrounding the site, outside of the security fence, is open grassland with a few small privately owned agricultural buildings located several hundred feet to the northwest. Terrain at the site rises gradually toward the north. A chain-link security fence, topped with strands of barbed wire, encloses the site's buildings and structures. Access to the site is provided by a gently curving gravel driveway on the west side of the county road. The driveway passes over a steel cattle guard and through a remote-controlled, chain-link, sliding gate in the security fence. The LCF support building and the vehicle storage building are located just inside the security fence, with an asphalt drive and parking area to their front. The Launch Control Center (LCC), accessed from the LCF support building, is located below ground and is not visible. Even though Interstate 90 is visible to the south of the site, it has a largely isolated feeling, with the wind whipping across the plains frequently serving as the only companionship.

The remaining area encompassed by the security fence is covered with native grass that was routinely mowed by the Air Force. The area inside the security fence includes a variety of electronic, mechanical, and recreational features designed to support operations and provide diversion for crew assigned to the facility. These features include a volleyball court, horseshoe pit, underground diesel storage tank, aboveground diesel storage tank, water well, gas pump, basketball hoop, flagpole, and utility poles. A code burner, used to destroy security codes, consisting of an open metal drum mounted on metal legs, is located near the volleyball court. Larger-scale resources within the security fence include the hardened high frequency (HF) transmit antenna, hardened HF receive antenna, hardened ultrahigh frequency (UHF) antenna, survivable low-frequency communication system antenna, Intercontinental Ballistic Missile (ICBM) super-high-frequency satellite terminal antenna, television satellite dish, and HICS. A concrete helicopter pad, two sewage lagoons, and the cathodic protection rectifier are located outside of the security fence to the south. A barbed-wire fence with wooden posts surrounds the lagoons.

Launch Control Facility Support Building

The LCF support building is the most prominent surface feature at the site. Located inside the sliding security gate, the support building provided accommodations for Air Force personnel, served as a security control center for the entire flight, and housed environmental, mechanical, and electrical systems for the underground LCC. The support building is an unpretentious, one-story, ranch-form structure with its principal facade facing southeast. It is built of conventional wood-frame construction, and has a low-pitched, side-gabled roof. The main portion of the building is rectangular in plan, measuring approximately thirty-three feet wide and 128 feet long. The southeast wall projects forward near the northeast end to form a wide bay for the installation's security center. A gabled-roof, one-story mechanical wing extends from the building's northeast side, measuring approximately twenty-one feet deep and thirty-four feet wide.

The support building rests atop a concrete-slab foundation. The outer walls are sheathed with wide-lap, steel, clapboard-style siding embossed with a wood-grain pattern. Painted tan, the siding was installed between the mid-1970s and early 1980s to replace the original cement asbestos siding. The roof has minimal overhangs, and is covered with brown, asphalt, T-lock shingles.[287] Large sheet-metal ventilator hoods are located on the roof and back wall of the mechanical wing, and several smaller ventilator hoods project from the roof of the main building above the kitchen and utility room areas. There are steel, ogee-profile gutters at the eaves. Fascia boards, gutters, and verge rafters are painted dark brown.

Windows in the support building are one-over-one, double-hung, sash fitted with white combination storm/screen units. These windows were installed in 1976 to replace the building's original wood sash

windows. Although most of the windows are arranged in groups of two or three, the security center windows are placed closely together, forming a nearly continuous band that extends across the southeast wall and wraps around both sides of the bay, providing the security controllers a clear view of the security gate and entrance road.

The southeast side of the LCF support building has a communication equipment room, water treatment room, and boiler room that are accessed through exterior doors. The boiler room can also be entered from the interior of the building. The rear of the support building has an attached very-high-frequency (VHF) antenna and an air conditioner.

The support building's main entrance is located on the main facade, adjacent to the security bay. A doorway on the northeast side of the main entrance hall opens directly into the security control center. This room served as headquarters for the Air Force security police who maintained a constant vigil over the facilities of Delta Flight. Positioned beneath the windows inside the center is a desk-like console containing telephone and radio equipment. Guards seated at this console could observe the main entrance, operate the entrance gate, check the credentials of visitors to the site, and monitor radio transmissions. An expanded-metal cage set into one corner of the room provided storage space for weapons. A small enclosed vestibule behind the security center served as the sole access point to the underground LCC.

The support building includes both residential spaces, such as the day room, bedrooms, exercise room, and kitchen, and operational and mechanical spaces, such as the security control center, water treatment room, diesel generator room, and boiler room. The interior finishes of the residential spaces at Delta-01 largely date to the late 1980s. Interior spaces in Ellsworth's LCF support buildings were decorated and furnished by the people who occupied them. As part of an ongoing "self help" program, the base supplied materials such as paint, tile, and wall paneling, and Delta Flight personnel supplied the labor required to put the materials into place.

The LCF's main entrance hall leads into the spacious day room area. The day room provided dining and recreational space for topside support personnel. Furnishings include three couches, a television, and both dining tables and booths. The day room walls are covered with wainscoting of pre-finished hardboard or varnished wood. The east wall of the day room is decorated with a large mural depicting a woodland scene. The day room and other rooms in the residential area have suspended acoustical tile ceilings with recessed fluorescent lighting fixtures. A dedication plaque, dating to November 1966, is located inside the day room and reads "as a tribute to the goodwill and mutual understanding between the citizens of this community and the Air Force." A kitchen and pantry are located off the day room. The kitchen and pantry feature metal cabinets and industrial kitchen appliances. The wall of the pantry retains a menu and price list of food items available for purchase by the staff. The kitchen walls are covered with melamine panels and the floors are vinyl.

A doorway off of the day room opens into a long central hallway flanked by seven bedrooms, men's and women's latrines, a boiler room, and a utility closet. The women's latrine was added in the mid-1980s, when the Air Force began to assign women to the duty roster at Minuteman sites. The bedrooms feature carpeted floors, walls finished with fabric-covered sound board, and suspended acoustical ceiling tiles with recessed fluorescent lighting fixtures. The bedrooms were furnished with beds or bunk beds, a desk, and freestanding wardrobe closets. The facility manager was the only personnel to receive his or her own bedrooms. The VIP bedroom has two bunk beds and could sleep four. The two bedrooms assigned to security personnel were outfitted with blackened windows and were provided with sound insulation to allow for daytime sleeping as security alert team personnel and flight security controllers rotated twelve-

hour shifts on their three-day alert. One of the bedrooms for security personnel also includes a locker for weapons and a rifle clearing barrel or a secured can to dummy fire weapons into to verify that they are unloaded.

The wing on the east end of the support building originally contained a single-stall garage and two mechanical equipment rooms. The garage was enclosed in 1975 and converted into an exercise room for staff. The equipment rooms contain a diesel-fueled generator for emergency power, as well as air conditioning and filtration equipment for the LCC.

Launch Control Center
Buried approximately thirty-two feet below ground, the LCC is entered from the LCF support building through a ten-foot-square, reinforced-concrete access shaft that descends from a small vestibule at the back of the security center. This structure served as the command post for the ten dispersed missiles of Delta Flight. Its entry shaft contains a small elevator and a steel-rung ladder surrounded by an open safety cage. The base of the shaft opens into a low-ceilinged vestibule that provides room for a bank of lockers and swing space for an eight-ton, steel-and-concrete blast door that seals the entrance to the control center. One wall of the vestibule is painted with art work depicting a missile labeled "USAF" blasting through the tattered flag of the former Soviet Union.

A small sign on the wall of the vestibule and a yellow line painted across the floor demarcate the beginning of the control center's high-security "no-lone zone, two-man concept mandatory." Any person entering the restricted area had to be accompanied or observed by a second person who was trained to detect erratic behavior, improper activity, or sabotage attempts. Launch control officers carried sidearms to protect the nuclear resources controlled from within the "no-lone zone," and use of "deadly force" was authorized. A piece of art work on the blast door serves as a darkly humorous reminder of the LCC's defining purpose. Emblazoned on the door's outer face is a crudely painted depiction of a red, white, and blue pizza delivery box, labeled "Minuteman II." A hand-lettered legend framing the illustration reads: "World-wide delivery in 30 minutes or less, or your next one is free."[288] Decoration of the blast door and the area outside LCCs was common. Another Ellsworth LCF site, Oscar-01, featured a portrait of *Sesame Street's* Oscar the Grouch with missiles in his paws painted on the wall.

The blast door is secured by twelve hydraulically operated latchpins placed around its perimeter. Emergency procedures allowed for the door to be opened by the facility manager from outside the LCC, but this would take about fifty minutes. When these pins retract, the door swings open on massive roller-bearing hinges to reveal a low, tunnel-like passageway leading to the LCC. Approaching the LCC, one passes the enormous blast door, crouches down to pass under a header of the tunnel, crosses a narrow walk between the outer and inner shell of the capsule, and then through an opening into the control center.

The LCC itself consists of two separate structural elements, nestled one inside the other. On the outside is a protective shell, shaped like an enormous gelatin capsule, that measures twenty-nine feet in diameter and fifty-four feet in length (outside dimensions). It is constructed of heavily reinforced concrete, with walls three to four feet thick, and is lined on the interior with a quarter-inch-thick steel plate. Suspended inside the shell is a box-like acoustical enclosure containing the launch control consoles, communications equipment, missile monitoring equipment, and spartan accommodations for the two-person Air Force launch crew. The acoustical enclosure is rectangular in plan, measuring approximately twelve feet wide and twenty-eight feet long. It rests atop a twelve-foot-by-thirty-two-foot, steel-framed platform. The corners of the platform are suspended by a large pneumatic cylinder called a "shock isolator." Hung from heavy chains attached to the ceiling of the shell, the isolators are designed to let the enclosure bounce as much as two feet in any direction without major damage. An articulated, steel-plate bridge spans the gap

between the platform and the access tunnel. The floor of the acoustical enclosure is made of removable steel plates covered with sheet vinyl. A strip of light brown carpet lies over the floor plates.

Compartments beneath the floor contain survival equipment, emergency batteries, and a motor generator. The walls and ceilings of the enclosure are made of hollow-walled, perforated-steel panels filled with sound-absorbing material. One early visitor to the Ellsworth facilities, Richard B. Stolley, reported that the noise inside the LCC was "almost overwhelming–a high electrical whine. It was comforting proof that all equipment was working, but my ears rang for hours after I left the capsule."[289] A beige fabric headliner is attached to the ceiling framework with Velcro. The headliner was installed in 1990 to help reduce noise levels inside the enclosure, which had previously disturbed crewmembers. Four recessed fluorescent lighting fixtures centered in the ceiling illuminate the enclosure's interior. Emergency task lighting is provided by adjustable spotlights mounted on the ceiling. Virtually every surface inside the enclosure is painted pale green. "It's a color we've learned to detest," observed one Ellsworth missile crew member in 1964.[290]

Upon entering the LCC, one feels that he or she may have stepped back in time or onto a movie set as the communication and computer equipment within largely dates to its installation in the 1960s. The equipment appears "ancient" by today's standards, but continued to be fully functional into the early 1990s when the site was deactivated. The LCC contains two desk-like consoles placed about twelve feet apart. Positioned in front of each console is a swiveling, high-backed, aircraft seat fitted with seat belts and a shoulder harness. The launch control (commander's) console is located at the east end of the acoustical enclosure, directly opposite the entrance. It has an illuminated panel that allowed the commander to continually monitor the operational and security status of each of the ten missiles and launchers in Delta Flight. The communications control (deputy commander's) console is centered against the south wall of the enclosure. It contains an array of radio and telephone equipment that enabled the crew to communicate with other LCFs, base headquarters, and SAC. At the side of each console is a small panel containing a spring-loaded, key-operated launch switch. The keys to these switches were kept in a double-padlocked, red steel box mounted above the deputy commander's console. If crew members had received an order to launch their missiles, they first would have unlocked their padlock (placed on the box at the beginning of their shift) on the red steel box and removed the launch keys and preset authenticators. Then, if the Emergency War Order (EWO) had been determined to be authentic, the missile combat crew members would have inserted the codes they had received into the enabling panel, inserted the keys into the switches, and turned them in unison. If their launch command was verified by a second LCC, one to ten Minuteman missiles would have blasted out of their silos and streaked toward preassigned targets halfway around the world. This system was designed to make it impossible for a single individual or crew to launch the flight's missiles.

Lining the walls of the acoustical enclosure are heavy aluminum electronic racks containing computer equipment, radio transmitters and receivers, a telephone relay system, and a power control panel. The acoustical enclosure is also equipped with a stainless steel latrine, a small refrigerator/microwave oven unit, and a curtained sleeping compartment. Installed in 1991, the sleeping compartment replaced a military cot that had occupied the same space. Virtually everything in the LCC was strapped down or permanently mounted, including the coffee pot and seat belts for the combat crew seats.

The LCC ordinarily used commercial electrical power to run its motor generator, and drew its clean and cool air supply from air-conditioning equipment located aboveground in the LCF support building. However, the center was also capable of operating for sustained periods of time without any support from topside. In the event of a nuclear attack or higher state of readiness, an automatic blast valve system was designed to seal the capsule off from the surface. For extended periods of time crew members would then activate a hand-pumped oxygen regeneration unit to obtain breathable air. The storage batteries and

motor generator beneath the floor would provide emergency electrical power and an emergency air-conditioning unit would prevent vital electronic equipment from overheating. Crew members trapped in the capsule after an attack could theoretically reach the surface through a three-foot-diameter, corrugated-steel escape tube that angles upward from the east end of the LCC. To maintain rigidity, the tube is sand-filled and plugged at its lower end. To make their exit, crew members would have removed the plug, dug out the sand, and climbed up the tube to ground level.

Heated Vehicle Storage Building
A large vehicle storage building, erected in 1968 to provide heated parking for vehicles, stands near the northwest corner of the LCF support building. It is a one-story, three-stall, wood-frame garage with a low-pitched, front-gabled roof. Resting on a concrete slab, the building is rectangular in plan, measuring approximately thirty-two feet by forty feet. Its outer walls are sheathed with wide-lap steel, clapboard-style siding embossed with a wood-grain texture and painted tan. The roof has slight overhangs and brown asphalt T-lock shingles. The main facade includes a large central garage door flanked by two slightly smaller openings. Each of the three openings contains an insulated-steel, overhead door with horizontal flush panels.

The building was constructed to accommodate a front end loader used for snow removal, among other vehicles. Its interior walls are sheathed with hardboard panels. The ceiling is insulated but unfinished. Steel pipe columns between the bays provide additional structural support for the roof. A small enclosed furnace room is in the building's west corner. An enclosed tool storage room, built c.1986, adjoins the rear wall.

Communication Antennae
Delta-01 includes numerous antennae. A blast-hardened, HF transmit antenna, constructed in 1963 and deactivated in the early-1970s, stands near the east side of the compound, about 140 feet due south of the access road. This structure consists of an underground, reinforced-concrete cylinder, approximately twenty-one feet in diameter and fifty feet deep (outside dimensions). The well of the cylinder contains a telescoping, four-sided radio antenna originally capable of extending to a maximum height of 120 feet.

A hardened HF receive antenna is set into the ground about 160 feet south-southeast of the LCF support building. Built in 1963, this structure consists of a reinforced-concrete cylinder covered by a concrete cap and measuring approximately sixteen feet in diameter and thirty-seven feet deep (outside dimensions). Distributed evenly around the perimeter of the structure are five small ports. Each port contained a slender, ballistically actuated, steel, monopole antenna. This antenna system was deactivated c.1987-88.[291] When it was still in use, one monopole extended from the cylinder at all times. If the exposed antenna were to have been damaged during an attack, a replacement could have been quickly deployed through the detonation of an explosive squib in an adjacent port.

A hardened UHF antenna stands near the southwest corner of the LCF support building. It was installed by the Motorola Company in 1976 to provide "unprecedented reliability to radio communications between the base and the missile field."[292] The hardened UHF antenna consists of a massive, cast-steel frustum, bolted to a thick, reinforced-concrete slab sixteen feet square. Surmounting the frustum is a conical, white fiberglass weather dome.

The survivable low-frequency communication system (SLFCS) antenna is buried in the ground about 140 feet east of the LCF support building and is not visible from the surface. Installed in 1968, the SLFCS is part of the facility's EWO communication system. The ICBM super-high-frequency satellite terminal

antenna was installed at the rear of the LCF support building c.1992, at the same time missile sites were being deactivated in Ellsworth's 67th Strategic Missile Squadron (SMS).

Other structures associated with Delta-01 include the cathodic protection rectifier, television satellite dish, and HICS. An electronic device installed in 1963 to protect underground features such as fuel tanks from corrosion, the rectifier is located just outside the security fence on the north side of the access road. Its aboveground portion consists of a white-painted steel electrical box mounted on a wood pole, while the below ground portion consists of a well approximately 220 feet deep, containing eleven graphite anodes. A television satellite dish installed in 1987-88 sits in the grassy area in front of the LCF support building.[293] The HICS was an underground communications link that connected the LCC at Delta-01 with all ten Delta-Flight LFs, including Delta-09 and the rest of the LCFs and LFs of the 66th SMS. The system employed a double-walled cable, pneumatically pressurized so that ruptures could be readily identified. In accordance with the Treaty Between the United States of America and the Union of the Soviet Socialist Republics on Reduction and Limitation of Strategic Offensive Arms (START Treaty), the HICS link was permanently disabled. To demonstrate compliance with the START Treaty, the HICS cable was severed and portions were removed.

A concrete helicopter pad and two sewage lagoons are located outside of the security fence to the south. The two large sewage lagoons used for treating waste materials lie approximately 240 feet southeast of the LCF support building. The original sewage lagoon, constructed in 1963, is an open settling basin, 118 feet square, surrounded by an eight-foot-high earthen berm. In 1970-71, an additional lagoon was appended to the southeast corner of the original structure. The new overflow lagoon is irregular in plan and is considerably larger than the earlier basin. Built in 1970-71, the large helicopter pad provided a safe landing area for the helicopters that were used to transport personnel and equipment between the LCF and Ellsworth Air Force. The helicopter pad consists of a flat concrete slab fifty feet square, surrounded on all sides by a wide shoulder of gravel and asphalt.

Launch Facility Delta-09

Delta-09 is located approximately ten miles west-northwest of LCF Delta-01. It occupies part of an open, grassy tract of land straddling Pennington County Road T512, about 0.6 miles west and south of Interstate 90, Exit 116. Although the Interstate is visible in the distance, the site is in a rural area without other development around it. Historically under Air Force ownership, Delta-09 occupied ninety acres: eighty acres of concurrent use and ten acres of exclusive use, with one acre located within the security fence. Delta-09 is surrounded on the north, west, and south sides by the open land of Buffalo Gap National Grassland, under ownership of the United States Forest Service. In the distance are geological formations similar to those found in Badlands National Park. The launch structures are concentrated inside a rectangular area surrounded by a chain-link security fence. A double gate is located on the east side of the security fence. A gravel access drive leads from the double gate to the nearby county road.

The area inside the enclosure has been graded to form a level, earthen platform that is elevated a few feet above the surrounding terrain. The platform has a gravel surface, and was specifically planned to provide maneuver space for the truck-like transporter-erector vehicles that hauled and emplaced the Minuteman missiles. The missile launcher and LF support building are located near the southern end of the maneuver space platform, with most of their structural elements underground. A smaller rectangular area at the north end of the platform outlined by four, low, small concrete corner pylons served as a landing pad for helicopters. Floodlights mounted atop two wooden utility poles at opposite corners of the maneuver space provided illumination for nighttime maintenance activities at the site. Two remnants of the concrete-base pad from the earlier outer zone security system antennas remain at the site: a square

concrete pad with four reflector mount pedestals is located to the southwest (rear) of the missile launcher and a clutter monument and footing of the antenna pedestal are located to the rear (south) of the launch support building.

Missile Launcher
The missile launcher was designed to serve as a temperature- and humidity-controlled, long-term storage container, protective enclosure, support facility, and launch pad for a Minuteman ICBM. The launcher consists of an underground launch tube (silo), surrounded by a cylindrical equipment room and covered by a hardened, ballistically actuated closure door. A heavily secured hatchway connected to the equipment room allowed Air Force personnel to enter the launcher and step down a metal rung ladder into the upper and lower equipment rooms surrounding the missile to conduct routine maintenance activities.

The launch tube is essentially a reinforced-concrete cylinder lined with a quarter-inch steel plate. It measures twenty-five feet in diameter (inside dimension) and approximately eighty feet deep. The tube rests atop a four-foot-thick, reinforced-concrete foundation, with its lower forty-six feet encased in approximately ten inches of heavily reinforced concrete. A two-inch-thick steel plate on the floor of the tube serves as a blast deflector for the missile's exhaust.[294]

Welded to the walls of the launch tube, about twenty-one feet above the floor, are pulley blocks for the three-point suspension system that supported the installation's Minuteman missile. The suspension system consists of a free-floating, steel missile-support ring attached to three wire cables. The cables pass over the pulley blocks and fasten to large, coil spring-type shock absorbers fixed to the base of the silo.

Encircling the upper portion of the launch tube is a cylindrical, two-level equipment room, built of heavily reinforced concrete with a steel liner. The equipment room is about twenty-five feet by fifteen feet and twenty-eight feet deep, with a four-foot-thick slab foundation, and walls two feet thick. A six-inch-wide "rattle space" between the equipment room and the launch tube allows the two structures to move independently.

The lower level of the equipment room contains a motor generator and supports for twelve large storage batteries. The batteries themselves were removed from the missile launcher during deactivation in 1993. An electrical surge arrestor room is located on the southeast exterior wall of the lower level. The numerous surge arrestors inside were designed to prevent electronic equipment inside the launcher from being damaged by electromagnetic pulses resulting from nuclear explosions. On the south side of the lower level, the cylindrical ballistic actuator that opens the launcher closure door during the launch sequence stands upright and extends through the upper level floor.

The upper level of the equipment room consists of a steel-framed platform covered with a rolled-steel deck plate. Cast into the east outer wall is a narrow, steel-faced bench, calibrated with compass bearings. Part of a complex optical alignment system, the bench originally supported an "autocollimator" (no longer in place) that was used to align the missile's guidance system. Directly above the bench is a canted cylindrical porthole (sight tube) glazed with bulletproof glass that is now permanently welded shut. This sight tube is aligned so as to point through the open access hatch, which allowed guidance technicians to establish visual references to a pair of azimuth markers (surveyors' benchmarks) located on the surface outside of the security fence.[295]

The northwest one-third of the upper-level floor is suspended from a series of coil-spring shock struts attached to the ceiling. Attached to the shock-mounted floor are racks of electronic equipment used to monitor and troubleshoot the missile, communicate with the LCC, and conduct the countdown.

Mounted on the wall adjacent to the equipment racks are two cylindrical, stainless-steel chemical tanks. These tanks originally contained a sodium chromate solution for cooling the Minuteman missile's guidance system. Maintenance workers could gain access to the missile and the bottom of the silo by removing the hatch plates from the side of the launch tube, lowering the access door or "diving board," and installing a motorized cage. The two-person work cage could reach the circumference of the launch tube and also could lower workers sixty feet to the bottom of the silo.

The underground launch tube and equipment room are covered by a massive, reinforced-concrete roof slab, known as the launcher closure. The top of the slab is level with the surface of the maneuver area. The roof slab is roughly teardrop-shaped in plan, with its apex pointing toward the northwest. The reinforced-concrete closure door is three and one-half feet thick and weighs more than ninety tons. If a missile had been fired the launch enclosure would have been blown open with great force. A concrete approach apron on the north side of the launcher closure with steel transporter erector pylons and transporter erector jack pads was used to align and support the transporter erector while the missile was emplaced. Transporter erector landing gear pads are also located just north of the apron.

The area directly south of the missile launcher is approximately three and one-half feet lower than the gravel maneuver area, exposing the south edge of the roof slab. Cast into the southern edge of the roof slab is a pocket-like opening for the launcher's horizontally sliding closure door. A low, buttressed concrete wing wall on each side of the door opening separates the maneuver area from the ground below. A concrete track apron is directly behind the launcher closure with a center track rail and side closure or maintenance tracks. The launcher closure rolls open on two wide steel tracks mounted atop deep reinforced-concrete beams cantilevered out from the launcher. The closure door's steel-sheathed leading edge is shaped like the cowcatcher on a steam locomotive and is designed to clear debris from the tracks when the ballistic actuator flings the door aside. The grade slopes slightly south from the apron to provide drainage away from the launcher. If the missile or one of its major components had to be removed or replaced, maintenance workers would use a hydraulic pipe pusher mounted on a cogged rail in the middle of the track apron to jack the closure door open.

For more routine maintenance activities, workers entered the silo through the personnel access hatch in the northeast corner of the roof slab. The access hatch is a heavily reinforced, steel-and-concrete vault door, operated by two hydraulic cylinders. The door opens into a cylindrical shaft that descends to the lower level of the equipment room. Fitted into the shaft is the "B-plug," a piston-like, steel security door operated by an electro-mechanical actuator. The silo cannot be entered until the B-plug is retracted.

Slight modifications have been made to Delta-09 to prepare it for interpretation as a static display. The launcher closure has been permanently fixated in a partially open position, in agreement with the START Treaty, and a glass and aluminum viewing enclosure was installed over the opening in 2001. A deactivated training missile was installed in the launch tube in 2001. The glass viewing enclosure allows visitors to see into the launcher to view the training missile. (For further discussion of Delta-09 modifications see Section III, Chapter 3: Minuteman Missile National Historic Site)

Launch Facility Support Building

Located adjacent to the missile launcher on the southeast is the 1963 LF support building, which contains an array of mechanical, electrical, and environmental equipment. This box-like underground structure has its roof about one foot above ground level. Constructed entirely of reinforced concrete, the building is rectangular in plan, measuring roughly sixteen feet wide, twenty-five feet long, and eleven feet deep. At the north end of the structure is a narrow rectangular areaway, covered with steel grating and a steel entry hatch. A ladder mounted on the interior wall provides access through the hatch down into the building.

Two removable steel hatches in the middle of the roof of the support building allowed maintenance crews to quickly install large pieces of equipment or remove them for repairs.

The support building contains electrical distribution equipment; a diesel-fueled emergency generator that supplied electrical power when the commercial source was unavailable; a brine chiller unit that provided cold water to the launch equipment room air handler, which in turn, provided the electronic racks and launcher with temperature and humidity-controlled air; a hydraulic pump for the personnel access hatch; a temperature control air compressor; and various panels for mechanical, security, and communications systems.

Associated Structures
Delta-09 includes five structures historically associated with the launcher, two of which are antennae. The improved minuteman physical security system (IMPSS) antenna, a white fiberglass monopole, rises from the base of the roof slab on the east side of the closure-door opening. This antenna is part of the IMPSS that was installed at the launch site in 1989. IMPSS is a microprocessor-based surveillance system designed to detect outer zone intruders. It replaced troublesome older security systems so sensitive that they could be set off by "elk, rabbits, [or] even high-jumping grasshoppers."[296] A hardened UHF antenna, installed c.1968 to link the LF with the SAC's airborne launch control center, is located a few feet to the northwest of the silo opening. It rests atop a thirteen-foot-diameter, reinforced-concrete base, shaped like an inverted saucer. The antenna itself is housed inside a cast-steel frustum capped with a conical, gray fiberglass weather dome.

Three other structures are located at Delta-09 outside the security fence. A cathodic protection rectifier installed in 1982-83 is located on the south side of the access drive, approximately 160 feet east of the security fence. Its aboveground portion consists of a galvanized steel electrical box mounted on a wood pole protected with a small fence. The below ground portion consists of a well approximately 220 feet deep, containing eleven graphite anodes. Two azimuth markers, used in conjunction with the autocollimator to align the Minuteman guidance system, are each located approximately one thousand feet from the launcher–one to the north-northwest and the other to the north-northeast. Each azimuth marker consists of a cylindrical concrete pylon, three feet in diameter and eight feet deep, set vertically into the ground. The visible portion of each pylon is approximately eighteen inches in diameter and four feet high. A disc-shaped aluminum alloy survey plate is set into the top of each pylon. Two HICS marker posts are located to the south of the chain link security fence. The wooden posts are about twelve feet tall with orange bands around the top and directional arrows to mark the location of the underground HICS.

Conversion to Minuteman II

Between 1971 and 1973, facilities at both the Delta-01 and Delta-09 sites were modified slightly when Ellsworth replaced its arsenal of Minuteman I missiles with the more advanced Minuteman II. The most important changes associated with this conversion were contained within the missiles themselves, since Minuteman II featured a more powerful propulsion system and a more accurate guidance system than its predecessor. Changes included installation of new electronic ground-support equipment in existing racks at both the LCF and the LF; and the installation of electronic filters, seals, and circuit-breaking equipment at both sites to protect the facilities against damage from the electromagnetic pulses released by atomic blasts. Because the Minuteman II was slightly longer than the Minuteman I, the missile support ring inside the LF silo was lowered by lengthening suspension cables. The optical alignment system was adapted to work with the new missile by welding stops to the autocollimator bench to limit the instrument's range of motion. The retractor mechanism for the umbilical cable was relocated, and several

other cables and fluid lines within the Missile Launcher were rerouted. No structural changes were required at either the LF or the LCF to accommodate the new missile.[297]

After conversion to Minuteman II, Delta Flight experienced only minor modifications as it continued to fulfill its mission. Changes at the LCF support building included new steel siding and replacement windows, the addition of a women's latrine, air conditioning, and interior redecorating. Alterations to the LCC included the installation of carpet, Velcro-attached fabric acoustical ceiling panels, a curtained sleeping compartment (called a modular bed storage unit), an updated latrine, and a new privacy curtain to accommodate mixed gender crews.

Delta-01 and Delta-09 were among the remote facilities where the men and women of Ellsworth lived and worked. They were designed for security and functionality. They were designed, in the final analysis, for a function each hoped would never be needed. Let us now turn to those men and women, to their duties and their lives, and to the culture of the missileers and the missile crews.



Plate 37. Aerial view of Delta-01 *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-A-2)*



Plate 38. Aerial view of Delta-01 highlighting the aboveground buildings used by missile crews *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-A-1)*

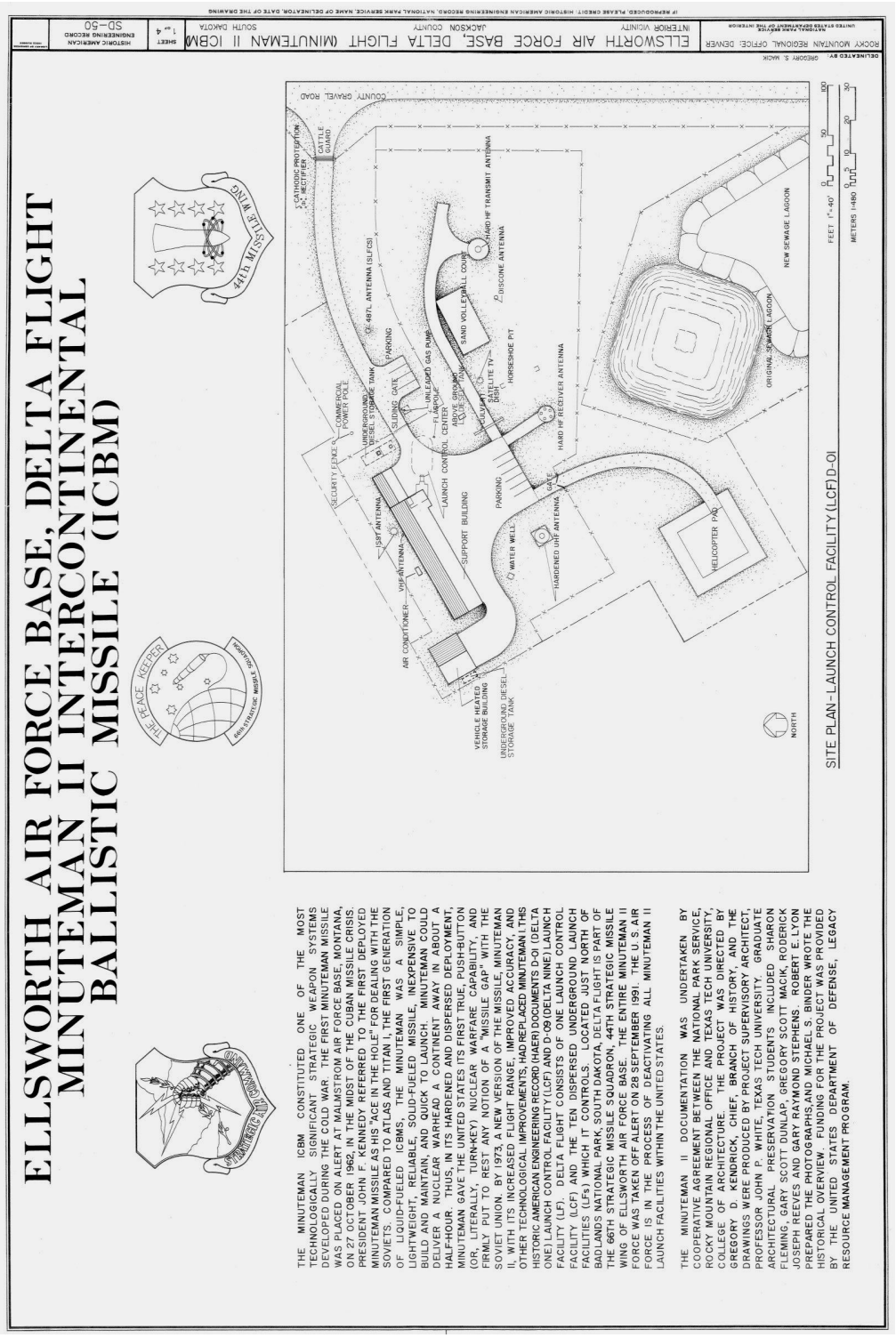


Plate 39. Site plan, Launch Control Facility - correction to text: the Minuteman II system was taken off alert on 27 September 1991 *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-sheet 1)*



Plate 40. View of Launch Control Facility Support Building, Delta-01 *(Photograph by Mead & Hunt)*



Plate 41. Main entrance and security bay of Launch Control Facility Support Building, Delta-01
(Photograph by Mead & Hunt)

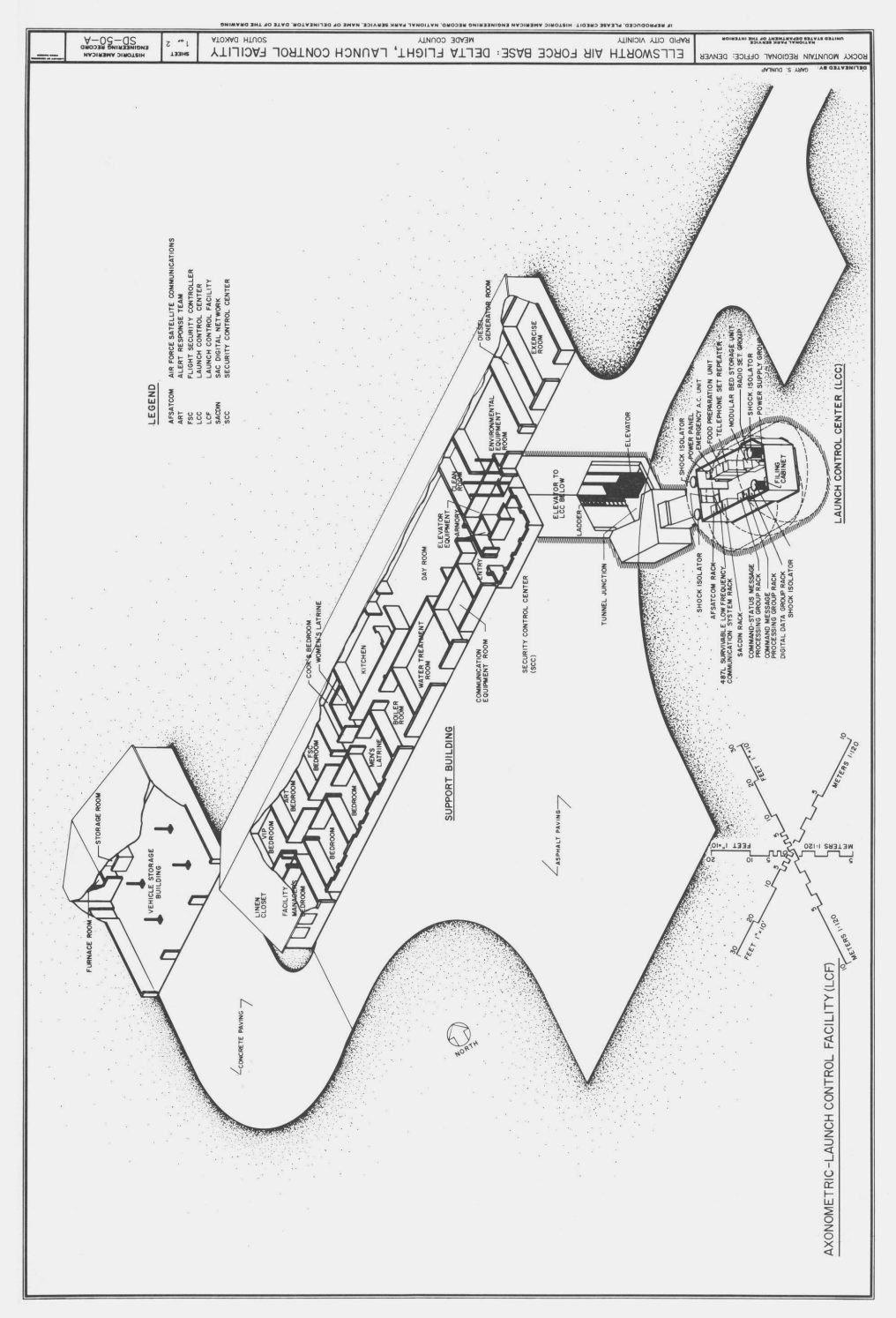


Plate 42. Interior plan view of Delta-01 *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-A-sheet 1)*

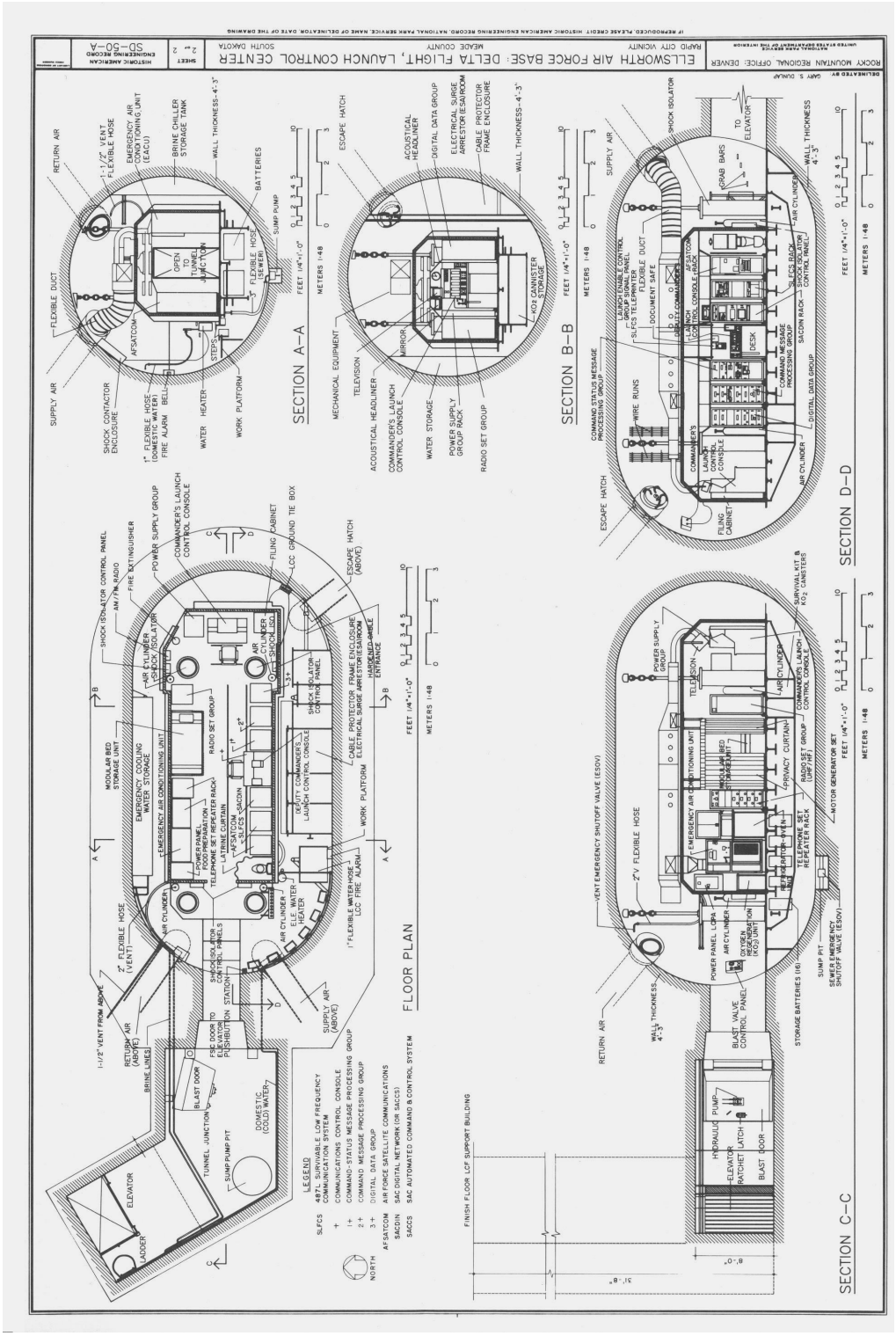


Plate 43. Line drawings of interior of Delta-01 Launch Control Center *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-A-sheet 2)*



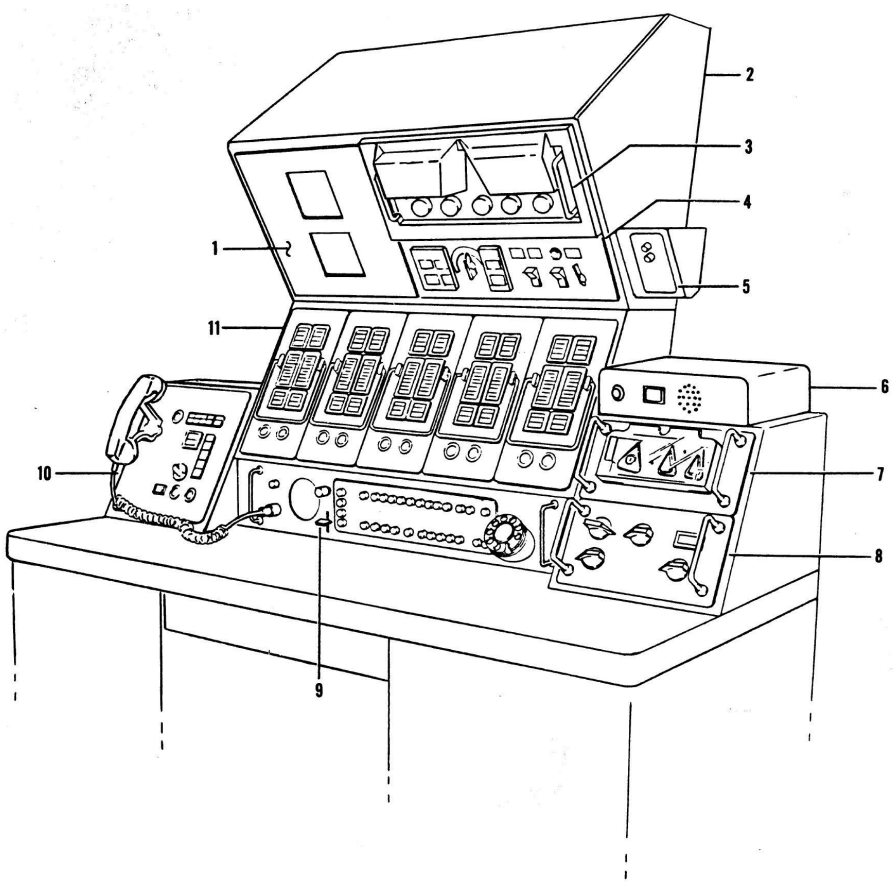
Plate 44. Interior side of blast door, Delta-01 *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-A-56)*



Plate 45. Launch Control Center at Delta-01 *(Courtesy of the 28th Civil Engineering Squadron, Ellsworth Air Force Base)*



Plate 46. Delta-01 Missile Commander's Launch Control Console *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-A-69)*



1 PAS MONITOR PANEL
(SEE T.O. 21M-LGM30F-1-22)
2 RADIO SET CONTROL GROUP
3 HF TRANSCEIVER (SEE T.O. 21M-LGM30F-1-22)
4 RADIO SET CONTROL (SEE T.O. 21M-LGM30F-1-22)
5 ANTENNA CIRCUIT BREAKER PANEL
6 SCPs: AUDIBLE AND DISPLAY SIGNAL DEVICE - INOPERATIVE
7 LAUNCH CONTROL PANEL (SEE FIGURE 1-32)
8 PROGRAM CONTROL PANEL (SEE FIGURE 1-33)
9 TELEPHONE TRANSMITTER CONTROL (SEE FIGURE 1-45)
10 ALARM-MONITOR PANEL (SEE FIGURE 1-30)
11 MISSILE STATUS INDICATOR PANEL (SEE FIGURE 1-31)

Plate 47. Line drawing of a Launch Control Console *("Weapon System Operation Instructions," (U.S. Air Force, 10 March 1986, Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.), 1-57)*

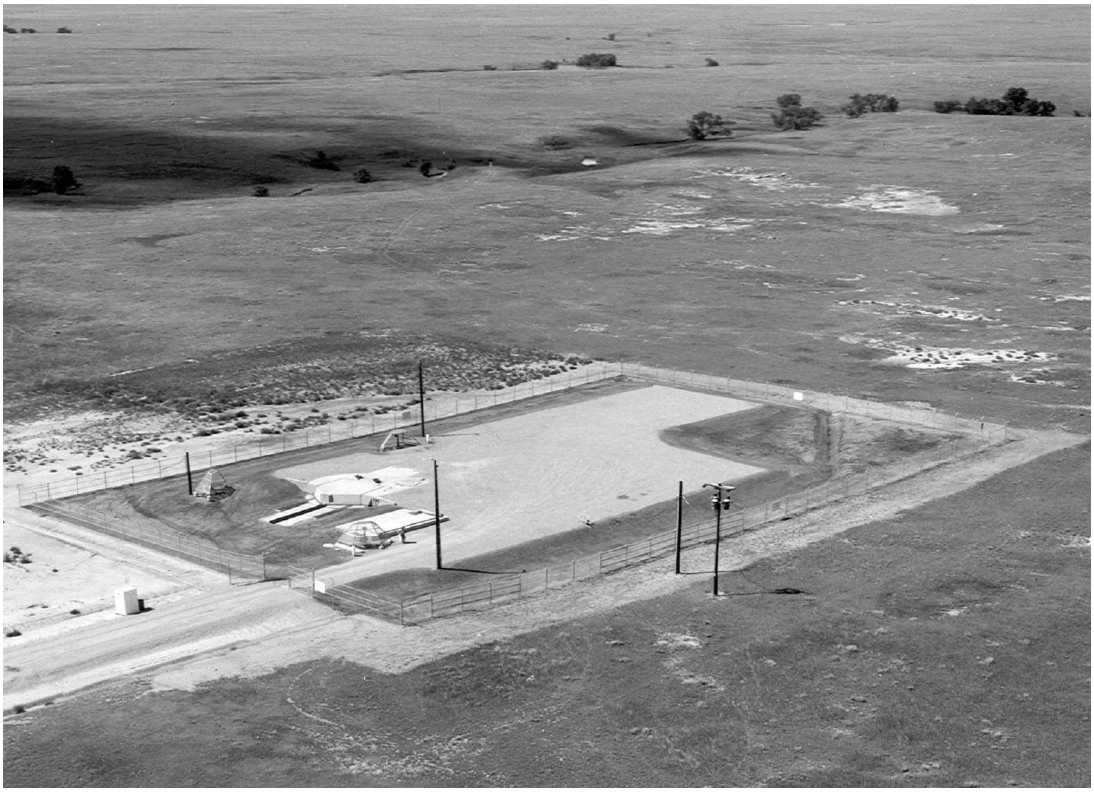


Plate 48. Aerial view of a completed Launch Facility in 1963 *("Site Activation Chronology, Minuteman Project, Ellsworth Air Force Base, South Dakota, July 1963-October 1963," K243.012-40, in USAF Collection, AFHRA)*

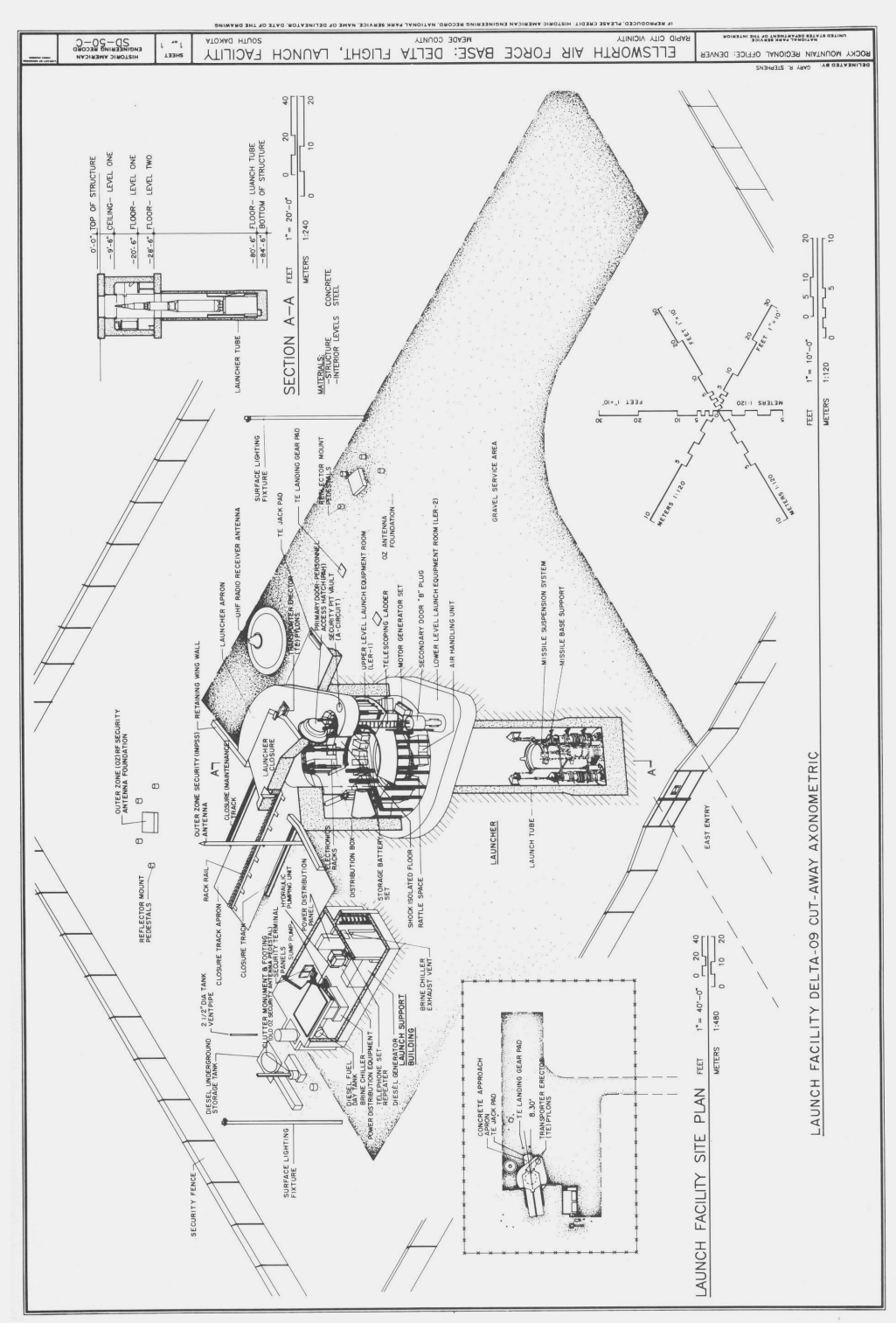


Plate 49. Site plan and cut-away view of Delta-09 Launch Facility *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-C-sheet 1)*



Plate 50. Topside view of Delta-09 Launch Facility with missile launcher and personnel access hatch
(Photograph by National Park Service)



Plate 51. Personal access ladder into missile launcher, Delta-09 *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-C-24)*

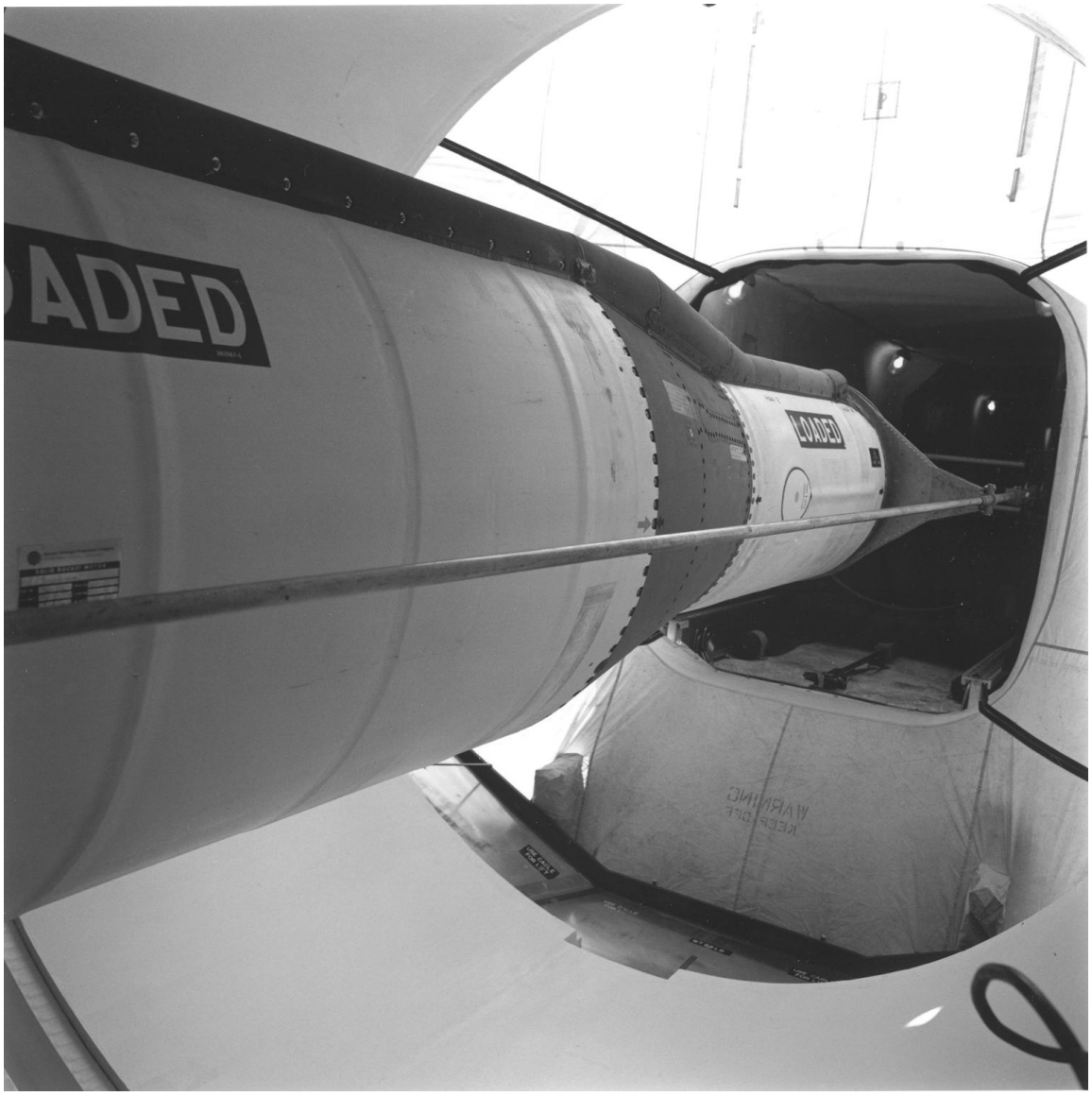


Plate 52. A Delta Flight missile being emplaced in the Transporter Erector *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-C-18)*



Plate 53. Interior of Delta-09 silo showing launch tube encircled by electronic equipment
(Courtesy of National Park Service, Photograph by Richard M. Kohen)



Plate 54. One of two azimuth markers located outside the Delta-09 security fence used by guidance technicians to align the missile's guidance system *(Photograph by Mead & Hunt, Inc.)*

Chapter 5: Missileer Culture: Day-to-Day Life (1960s–91)

Trained and dedicated officers, troops, and technicians managed the awesome destructive force embedded within each Minuteman missile on a day-to-day level. Their lives while on three-day or twenty-four hour alert tours became intertwined with their machines and their mission. Minuteman's Launch Control Facilities (LCF) in South Dakota were operated by Air Force personnel who lived and worked at the sites. Each staff member had their own responsibilities to support the overall function of the LCF, though their primary duty was to support the missile combat crew in the underground Launch Control Center (LCC). Personnel assigned to reside at the LCF included a facility manager, flight security controllers, security alert team members, and a missile rations cook. Maintenance crews occasionally stayed overnight at the facility as well. Activities and duties of the crews evolved over the nearly three decades of Minuteman in South Dakota. The general description of the duties and procedures described below may not reflect all the varying experiences of the Air Force personnel over the years.

While on duty, the staff worked, ate, slept, and relaxed at the LCF. For Air Force personnel, the grounds became a second home for the duration of the tour. Many of the facilities were equipped with recreational facilities such as basketball hoops, ping-pong and pool tables, and weight rooms. They all had a television and some even had satellite televisions and videocassette recorders. In this sense, the sites ceased to be uniform almost immediately upon use, as crew alterations and tastes transformed the LCF into unique living and working environments. Working as a team and frequently serving the same tours, many LCF personnel and teams formed special relationships. In the late 1970s, for example, LCF personnel from Delta-01 of Ellsworth Air Force Base called themselves the "Delta Dogs" and painted a bulldog on the wall. Although the mural has since been painted over, the legacy of the "Delta Dogs" still exists in the minds of the men and women who served at the Ellsworth Air Force Base Delta Flight.[298]

Many Air Force personnel who worked in operations or maintenance at the LCFs went through the Personnel Reliability Program, a psychological screening program that evaluated missileers and support crew. Crew members were not permitted to serve alert tours if something was hindering their ability to think clearly, including medications and marital situations. Commanding officers, coworkers, and friends were asked to report strange behavior and emotional upsets of LCF and LCC personnel that may affect their job performance.[299]

Air Force personnel involved in the Minuteman missile, not just the missileers, were well aware of the seriousness of their mission and the potential consequences of their use. When Martin Pietz, who served on the electro mechanical team at Ellsworth, was asked, "Did it bother you at all that the missile you were supporting, if it were ever used, likely meant the end of life as we know it?" Pietz responded, "You're torn when you work. I mean you have exercises where you have scenarios where you have practice war, in case it, God forbid it ever happened, it wouldn't, you wouldn't sit there and think about 'what am I doing, what am I doing?'… So after, I mean you'd go home that night and you'd think about 'man, what are we doing?' So yeah, did you ever think? Yeah, absolutely! You tried to stay in the mode. It was your job to have things ready to go and hope it never got used."[300]

David Blackhurst, a former missile crew commander recalled that they took their job very seriously and described it once they were in a routine in the following manner, "After awhile we had a saying it was kind of like hours and hours of sheer boredom punctuated by seconds of panic. But basically it was a serious job."[301] Former missileer Craig Manson continued to describe the mindset of a missileer by addressing one of the most difficult questions frequently asked of them. "And so the question frequently is, 'well, you know, how could you do that job knowing that you might be called upon to participate in a war of nuclear devastation?' And I think there's a couple of things that people have to keep in mind. One, the

majority of missile launch officers, even though they're fairly young officers, the majority are married and many of them have children and families, and that's crucial to keep in mind. Two, although no one ever said to a missile officer, 'we are categorically ruling out a nuclear first strike,' because of their faith in American values, I think we were all convinced that America would act only in the best interests of America and the world and not in an unreasonably aggressive posture for no reason at all."[302]

Following is a description of the principal assignments for each of the Air Force personnel assigned to a Minuteman LCF or LCC at Ellsworth Air Force Base.

At the Launch Control Facility

Facility Manager

One facility manager was on duty during each three-day alert tour. While the facility managers were accountable for managing the facility and supervising the topside crew, they were ultimately responsible to the crew commander on duty in the LCC.[303] Facility managers were typically noncommissioned officers with excellent technical and managerial skills who were in their twenties and thirties holding the rank of Master Sergeant, Technical Sergeant or Staff Sergeant. Any Air Force personnel could have applied to serve as a facility manager, including maintenance crew, cooks, and administrative support. Once the Air Force selected an individual to become a facility manager, Strategic Air Command (SAC) required that they visit one of the sites and begin on-the-job training with an experienced facility manager. There was no formal training to become a facility manager. Rather, they learned their job primarily by performing the required tasks.[304]

The facility manager's primary duties included supervising and managing LCF personnel for the combat crew commander, maintaining support equipment, and responding to emergencies under the direction of the missile crew on duty.[305] Also under this job description, however, were a host of additional duties, including everything from acting weatherman, mechanic, innkeeper, and groundskeeper, or essentially, anything needed to keep the LCF running smoothly.

Many missileers called the "jack-of-all-trades" facility manager their "house mouse." The phrase derives from the concept that the LCF performed much like a small hotel serving as a location away from home where security personnel, cooks, and missile crews, and sometimes missile maintenance crew ate, slept, and relaxed, in addition to worked.[306] Despite the frequent lightheartedness of the personnel at the LCF, the facility manager had a difficult and potentially stressful job. In an article published in 1974, Sergeant Roger Wang stated that the primary reason for facility managers is to "support the two guys who someday may have to turn the keys to fire the Minuteman."[307] The purpose of a strategic missile site, to defend the nation by offering a constant and vigilant threat of counter-attack, was rarely far from the minds of such airmen.

After arriving at the LCF, the facility managers used the day's code to get onto the site. Although the LCF security staff knew the facility manager was coming, everyone accessing the site–even those recognized–had to be authenticated before entering the site as a precaution against sabotage or attack. This emphasis on security was included even in routine activities. If the facility manager needed to go down to the capsule, for example, he would first have to authenticate the codes received from Ellsworth Air Force Base with the combat crew. One facility manager, serving at Delta-01, once read his code backwards to the combat crew. Realizing his mistake, the crew asked if he was sure this was the way he wanted to state the codes. Unfortunately, the facility manager did not understand their hint, and was forced to return to Ellsworth Air Force Base to reverify his codes.[308]

After arrival at the LCF, the facility manager's first task would be to walk the facility and the grounds with the manager on-duty for a briefing, where the work performed by the previous alert tour, and the work required for the next, would each be detailed. Every day at the facility offered similar duties. After rising in the morning, the facility manager would phone in a weather report to the helicopter pilot on-duty at Ellsworth Air Force Base. Following breakfast, the facility manager took care of other daily responsibilities. Morning chores included inspection of the LCF grounds, including the water treatment tank, the power generators, and the sewage lagoon. After the daily inspections, the facility manager typically spent much of the day maintaining the facility and repairing support equipment, including replacing light bulbs and refueling vehicles. In the summer the facility manager was responsible for mowing the yard and in the winter he or she shoveled the drive.[309]

Facility managers were also responsible for meeting any individual that entered the LCF property, including everyone from branch chiefs, maintenance crews, and local law enforcement to family members and local ranchers. All visitors needed approval to visit a site, including family members. Visitors could be sponsored by Air Force personnel who prepared a request letter that was then reviewed and approved through the chain-of-command. The facility manager was effectively never off-duty while on an alert tour. If a maintenance crew was scheduled to arrive in the middle of the night for a Remain-Over-Night (RON), for example, the facility manager was required to brief the visitors on safety and arrange for their meals and living quarters.[310]

The facility manager also had the job of calling in stand-bys or personnel replacements as needed. Three days in close quarters sometimes prompted disagreements between LCF personnel. In such cases, the facility manager had the authority to send the aggressor back to base and call in a replacement to finish the alert tour. Emotional problems and medical emergencies at the base or at home also warranted the facility manager to call in stand-by personnel.[311] Although never off-shift while on alert tour, being facility manager offered unique rewards. The manager was the only LCF personnel assigned a single room. Other topside crew shared a room with as many as three others. Some facility managers even had a private television in their bedroom, though again, the amenities of Minuteman II LCFs varied by the time the system came off-line.[312]

Flight Security Controllers

Every three-day alert tour at the LCF included two flight security controllers. The flight security controllers were typically noncommissioned officers with the rank of Sergeant (now Senior Airman), Staff Sergeant, or Technical Sergeant, typically in their twenties. Regulations demanded the presence of one security controller in the security control room at all times, and therefore, each of the three days of the alert tour was split into twelve-hour shifts with one controller manning each shift. The security controller on-shift monitored the LCF grounds, as well as all ten Launch Facilities (LF) in their flight area. The security control room featured windows overlooking the entrance gate and grounds.[313] From this station, the security controllers would check identification of visitors or replacement crews entering the site. A security team's first duty upon arriving at the LCF was a changeover process with the security staff on-duty, including inspections of the building and grounds. The previous security controller would brief the new team on what LFs were down and which ones were under maintenance. The changeover procedure was always the same between shifts and rarely changed.[314]

Each security controller also supervised a two-member security alert team. If the missile combat crew received indication that security was breached at one of the LF sites, they would notify the security controller who would dispatch the security alert team to investigate. The security controllers were also responsible for storing and issuing weapons and ammunition to personnel at the LCF. Weapons were stored in a locker located in one of the security bedrooms and the weapons cage in the security control center.[315] The Air Force equipped the security controllers with M-16s, the military's standard rifle after its

introduction in 1964, with 240 rounds of ammunition or an M-60 machine gun.[316] While on alert tour, but off-duty, security controllers would often spend time playing games, working out, resting, and relaxing. The windows in the security bedroom were darkened to enable controllers assigned to the night shift to sleep during the day.

Security Alert Team

Two security alert teams were assigned to each LCF. The two-person team typically included a Sergeant (now Senior Airman) and an Airman or Airman First Class ranging in age from eighteen to the mid-to-late twenties. The two-person security alert teams rotated being on-duty during the three-day alert tour. The security alert teams, under the supervision of the flight security controllers, were responsible for periodic site inspections and responding to any security breaches that occurred in the flight area, including the LCF and all ten LFs.[317] It was their duty to secure an LF, for example, following an alarm or security breach and remain at the LF until the site was secure and alarmed. Although Air Force records do not indicate any potentially dangerous breaches of security at a Minuteman LF, the security controller frequently dispatched security details to the LFs to verify the integrity of the site. Each LCF and LF was equipped with an alarm system that sounded, if tripped, in the LCC. To combat sabotage the systems were unusually sensitive and the alarm was often set off by squirrels, rabbits, and even grasshoppers.

Some of these dispatch-call incidents proved unusual experiences for security teams. As reported in *LIFE* magazine in 1964, in one instance in South Dakota, an alarm buzzer indicating an LF breach sounded in the LCC and the commander phoned the topside flight security controller who immediately dispatched a security team to the site. The armed security team hurried to the site, where to their surprise they discovered two camels rubbing against the fence. The animals had escaped from a nearby Passion Play.[318] Another incident proved to be a prank. After realizing security teams would respond to such innocuous occurrences as cows grazing near the fence, one local threw a raccoon inside the fence. The local prankster was eventually caught and released after questioning.[319]

Not everything was life or death at the Minuteman sites, and local residents learned not only to coexist with the sites, but also to share the plains with Air Force personnel. "They were usually a bunch of fresh faced kids sent to God's forsaken half acre or something," rancher Gene S. Williams recalled, "I know a couple of times when it was a hundred degrees and there were boys that were stationed up there [a Launch Facility] and my mom took ice tea up to them . . . I suppose now they would have gotten into great trouble because they could have been drugged or something, but you know, that's just how it was."[320]

The security alert team was also responsible for escorting maintenance teams onto the LF grounds. Getting access to the grounds, just as accessing an LCF, required a valid authentication number. Personnel who required authentication received a number and a table of numbers with corresponding letters from Ellsworth Air Force Base. The maintenance personnel would state what table he was working off of and call out the letters that corresponded with his number using a phonetic alphabet. If they had the wrong number or read the code wrong, the standard procedure was for the security to "jack them up" against a fence or wall and check their identification.[321] In order to access the missile launcher, two sets of codes were needed–A side codes of security personnel and B side codes of maintenance personnel. On some occasions, when repairing the launch system or security system proved time-consuming, the flight security controller would send a two or four person "camper team" from base to the LF, capable of working and securing the site overnight, until maintenance completed the necessary repairs.[322]

In addition to their security duties, the security alert team was also responsible for assisting the facility manager in housekeeping duties at the LCF. Their typical areas of responsibility included the hallways, office, day room, bathroom, and their bedrooms.[323]

Missile Rations Cook
One cook was scheduled for each three-day alert tour at each LCF. Missile rations cooks typically held ranks from Airman First Class up to Staff Sergeant and were typically in their twenties. The cook was required to prepare requested meals for the personnel and visitors of the LCF. The cook also assisted the facility manager in responding to emergencies and in standard housekeeping duties. The cook's primary responsibility was for the cleanliness of the kitchen, dining room, and bedrooms.[324]

The cook was responsible for serving four meals per day, including breakfast, lunch, dinner, and a midnight meal. The cook not only served topside crew, but also had the responsibility of taking meals to the missile combat crew in the capsule, and was required to go through the authentication procedure with codes every time they entered the capsule. Most meals were prepared at another site, packaged in foil, and then frozen. The cooks simply heated the foil packs in the oven. Some cooks showed remarkable creativity in completing their tasks, however, making soups or stews out of leftover foil packets, or making seasoned croutons for the salads out of bread.[325] At some facilities, the cook would even barbeque for LCF personnel. After collecting money from the crew, they would have the security team stop at a local store to pick up chicken, steaks, or hamburgers when they were sent off the grounds on other errands.[326] The Delta-01 facility often had fresh breakfasts with eggs sold to them by a nearby rancher, in yet another display of the way missile crews integrated into the daily life of local residents.[327]

Maintenance Crew
Although maintenance crews did not serve regular alert tours at the LCFs, they routinely entered the LF and LCF grounds to perform inspections, conduct routine upgrades, or make necessary repairs. The maintenance force was responsible for ensuring that all systems were operable and on ready status by following precise technical orders written by Air Force engineers. The rank of the maintenance crew varied depending on the experience and responsibilities of the team, and could range from Airman up to Captain.

Each Minuteman wing included a deputy commander for maintenance who operated the base maintenance complex and was responsible for planning, scheduling, and directing all maintenance of LCF and LFs in their wing. Air Force maintenance included four divisions and two squadrons. The Field Missile Maintenance Squadrons (FMMS) and the Organizational Missile Maintenance Squadrons (OMMS) were responsible for the actual maintenance of the Minuteman missiles and support equipment.[328] The FMMS maintained hydraulic and pneumatic systems, site support equipment, and test equipment. This squadron also performed periodic maintenance at the sites. The OMMS had a mechanical and electrical branch that were responsible for the transportation, installation, and removal of missiles, the reentry vehicles and systems, propulsion system rocket engines, and the emergency rocket communications systems. The OMMS also repaired electrical, surveillance, and access systems.[329] Despite routine maintenance and inspections at the LFs, the deputy commander for maintenance routinely received notification of equipment faults at LFs and LCFs directly from the missileers in the LCC.[330]

A maintenance team chief, responsible for supervising the crew, attended every maintenance call. Even with the presence of a security alert team on all maintenance missions, the maintenance team chief was responsible for authenticating their access with the missile commander in the LCC. The team chief was accountable for all activities at the site while they were performing maintenance duties.[331] As of 1963 maintenance teams at LF sites were required to be in contact with the LCF a minimum of every thirty minutes.[332]

Maintenance crews transported their equipment in "U-vans" or utility vans. This van was a three-quarter-ton pickup with a utility box on the back. The utility box had several different compartments that

organized the equipment and tools needed to make repairs at the LFs or LCFs.[333] Work on an LF frequently required access to underground facilities. To do this the maintenance crew had to pass through "formidable mechanical barriers" in a process that sometimes took up to an hour. First the security pit weather cover was removed, a combination was entered, and the security pit vault door was removed. These security procedures allowed retraction of the locking shaft and operation of the controls for the pump and two hydraulic cylinders used to slowly raise the steel and concrete primary door (personnel access hatch). After securing a metal ladder, the crew descended a few feet down the cylindrical shaft and entered another combination into the secondary door (B-plug) and retracted the locking bolts. After a preset timed interval, the large steel plug would lower to the level of the upper equipment room. The crews could then climb down the equipment room surrounding the launch tube, lower their equipment, and begin their maintenance tasks.[334] Two shotguns, ammunition, and gas masks were placed in each silo in 1978 to increase security at the site.[335]

Maintenance crews were only permitted to be in the field a total of sixteen hours on a dispatch to ensure a level of alertness. After completing pre-maintenance tasks, including vehicle and equipment checks and briefings, the team drove to the site, went through the authentication process, and began accessing the underground missile. Since the sixteen hours must include time to return to Ellsworth Air Force Base and go through the pre-maintenance tasks in reverse order, a maintenance team may only have five hours to perform maintenance at the LF. Due to the distance of many of the missile silos from Ellsworth Air Force Base, maintenance crews often remained at the closest LCF overnight on RON.[336]

Although maintenance was usually routine, crews sometimes faced unexpected circumstances. In one unusual incident in 1975, for example, a maintenance crew was dispatched to a Minuteman LCC at Minot Air Force Base in North Dakota to help free four trapped missile crewmen. The incident occurred when two missile crewmembers arrived at the LCC to relieve the crew on duty. They entered the LCC and proceeded through the changeover process, only to discover that the blast door would not open. Maintenance responded to the call of the missile commander for assistance, but the blast doors were designed to resist force from the outside. Through a small hole, maintenance passed technical instructions to the four crew members to dismantle panels from the door. It took eight hours to remove the necessary panels and to dislodge the first of four three-inch pins. Several hours later only one pin remained in place, but it would not budge. A special welding team arrived at the site, and spent an additional four hours cutting through the door. After thirty- and forty-two-hour alert tours, respectively, the two crews were finally free to exit through the twelve-foot by twelve-foot hole.[337] The blast door at Minot, described above, is not the same configuration as Ellsworth's blast door.[338]

In the Launch Control Center: Missile combat crew

Finding the right individuals to serve as missileers in the LCCs posed a paradox for the Air Force that was described in a 1963 *Saturday Evening Post* article, "the job required a reliable, stable, intelligent officer who could be counted on to fire the Minuteman in the chaos of nuclear combat–and not before. But the more intelligent the man, the quicker he would be bored by the capsule routine." Colonel Richard Butler of SAC's personnel branch told the *Saturday Evening Post*, "We needed a kind of hermit, but a hermit would not have the main characteristics we needed."[339]

Missileers completed a rigorous training program prior to their assignment to a missile crew. Chanute Air Force Base in Illinois began hosting a Minuteman program training center for new Air Force recruits on 21 June 1959. Students arrived at Chanute ready to study the safe operation of the Air Force's latest weapon. Training focused on classroom instruction at the Chanute Technical Training Center in three six-hour shifts. Classes included both general training for incoming missileers and specialized training in the

complex systems controlling Minuteman, such as targeting or electrical systems. After completing courses at Chanute, graduates were assigned to Vandenberg Air Force Base in California, where they received Operational Readiness Training. This training provided them with real life experience learning launch and maintenance techniques. After graduating from the training school at Vandenberg, the missileers and technicians received assignments at an operational Minuteman missile wing.[340]

Even after completing basic training for the Minuteman program, crews underwent scheduled training and evaluations once or twice a month to make sure that they continued to perform to the strict standards. Missileers at Ellsworth Air Force Base went for regularly scheduled "rides" in the Missile Procedures Trainer (MPT), also known as "the box" or "simulator," which simulated a Launch Control Center at Ellsworth. The MPT at Ellsworth was located in the large hanger known as the Pride Hanger. Crews emerged from the training, which typically took one to two-and-half hours, having honed their skills for Minuteman procedures. Missileers completing an evaluation practiced their skills and received a score ranking their competency. Those receiving low scores (lower than four on a five-point scale) received additional training to improve their performance.[341]

During the first years of the Minuteman program, combat crews worked thirty-six- to forty-hour alert tours, with eight- to twelve-hour shifts in the LCC, separated by a rest period in the LCF.[342] While topside personnel at the LCF normally pulled a three-day alert tour as a team, the two-person missile combat crew worked a thirty-six- to forty-hour alert tour and averaged five tours in a month. The length of the tour varied for each crew depending on the distance of the LCC from Ellsworth Air Force Base and some facilities were nearly one hundred miles from base.[343]

In July 1977 the shift was changed to a single twenty-four-hour shift, with the crew being replaced by a new missile combat crew dispatched from Ellsworth Air Force Base. Former missileer Craig Manson recalled that he was happy with the change to a single twenty-four-hour shift,

> "The forty-hour alert system was really draining physiologically, just difficult because your schedule was all crazy. You'd go out there, you'd pull eight hours downstairs, during which you were not supposed to sleep, and then you'd go upstairs to sleep, or watch TV or do whatever for eight hours, then you'd change-over downstairs again for another eight hours. You did this until you had a total of twenty-four hours in the hole and sixteen hours upstairs. The last eight hour shift before changeover was the night shift. And so your body clock was all off and then you'd have to be alert enough to drive home. If you were at some of the sites, you know, some of the sites were as much as 150 miles away, and so then you'd have a three hour drive after [laughs] being up all night. So I personally found it horrible, the forty-hour alerts, and I think a lot of people did. They just didn't like it."[344]

When the tour duty changed to twenty-four hours in the LCC, the missileers averaged approximately eight tours per month. A shift did not include time driving to and from the facility or the changeover briefing before and after the shift.[345] The two-person crew included a deputy missile combat crew commander and a missile combat crew commander. Only officers could be assigned to a combat crew, and generally, first lieutenants with a minimum of a year-and-a-half of experience as a deputy commander in the LCC qualified for promotion to the position of crew commander.[346]

The most important responsibility of the missile crew was constant vigilance and preparation to launch the missiles under their control. Other duties included coordinating maintenance and inspections of the missiles and monitoring alert status of the missiles and their support systems designed to ensure the

readiness of their missiles. Additional responsibilities involved monitoring the systems of the LF and maintaining missile equipment logs.[347]

After arriving at the LCF, a missile crew had their identification examined by the flight security controller and then began the authentication procedure with the on-duty missile crew. After they cleared security, they descended down the elevator to the LCC, also known as the "no-lone zone," because one could never enter the capsule alone. After arriving at the blast door a voice would shout "clear" from inside the capsule. The oncoming crew shouted back and the eight-ton door slowly swung open.[348]

Once inside the capsule, the missile crew's shift began during a process called changeover, a formal procedure that allowed for the changing of crews in the LCC. The changeover included a ten-minute briefing on the weather report, call signs, a classified advisory on the day's war plan, and the placement of each crew member's padlock on the metal box that secured the launch keys. The changeover concluded with each departing crew member handing over three items to the deputy and commander- a three-by-five inch card encased in plastic and framed in metal with the day's top secret code to decipher commands from SAC; a key to be inserted into the console and turned in order to fire the missiles; and a .38-caliber revolver. The gun, worn in a holster, was for protection in the unlikely event of intruders. The missile combat crew was prohibited from taking off the holster while in the capsule.[349]

After the capsule door closed, a new crew would check the maintenance logs and inspect support equipment.[350] The duration of their shift was spent running practice drills or reviewing procedures to prepare for SAC's random Operational Readiness Inspections, an examination performed by an Inspector General to determine the effectiveness of the combat crews.[351] The crew had very precise procedures for every task. If they ever received a launch command, both crew members would open the locked box that contained "cookies," or the authentication codes. Once the crew members agreed that the command was authentic they would insert the keys and turn them at the same time, launching a missile.[352]

To launch a missile, an Emergency War Order (EWO) would have come over the SAC radio with a message that the crew had to authenticate. After they agreed that the message was authentic, they unlocked their padlock on the red metal box that contained two keys for launching the missiles. Each crew member would then buckle into their seats and the commander would count down. The deputy commander then flipped a row of "arming" switches for each of the missiles, making them readied for immediate launch. The commander opened the plastic cover over his launch control panel in front of him exposing the area for the launch key, and the deputy commander removed the plastic cover over the cooperative launch switch. Each crew member would insert their key and a "conference call" is ordered where the crew speaks via phone and headset to the squadron command post for readiness reports on other Minuteman capsules. The command post then issues a command to "launch on your count." On the commander's count, both crew members would have to turn the keys at the same moment. The two ignitions are situated far enough apart that one person alone could not reach both keys and single-handedly provide the go ahead to launch a missile. The Minuteman missile cannot be launched without a corroborating signal from another LCC, providing the second vote.[353] Launch procedures were modified slightly in later years when a launch enable control group signal panel was added to the Deputy Commander's Control Console. An unlock code was required to be inserted into the "code inert thumbwheel switches" of the launch enable control panel to enable missiles for launch. [354]

Day-to-day activities for the crew varied. Some days proved to be very slow and other days kept the crew extremely busy. While there were always unexpected maintenance indicators and outer zone security violations at the LCFs, there was also scheduled maintenance at each of the ten LFs under control of the LCC. Weekdays were typically busier than weekend shifts in the capsule because of scheduled maintenance.[355] During the course of a shift there were often procedures for the crew to practice and

review. In addition there was frequent communication from base and SAC, including messages from Looking Glass, the flying command post that kept a SAC general in the air in case ground command posts were out of commission, to make sure all stations were on alert.[356]

To combat boredom, missileers often took advantage of the quiet time to study or rest. Each LCC included a sleeping compartment, where one crew member could rest. His or her partner would naturally remain at their console during such times. Outside of their duties in the LCC, missile crews underwent training several times a month, including courses in weather systems, codes, EWOs, and missile simulation training. SAC offered the opportunity for missileers to pursue academic degrees while on alert to boost morale and as incentive for crewmembers to remain in the Air Force. Many missileers possessed a bachelor's degree and used time in the capsule to work on homework and to fulfill the requirements of a master's degree.[357] When there was not enough free time between alarms to concentrate on studying, missileers often played cards, pursued hobbies, or browsed through magazines. Some missile crews referred to such activities as "frontline defense against alert boredom."[358] In another effort to combat boredom and keep in touch with the world above, former missileers have relayed that there were instances of tapping into the radio communication system to listen to radio programs and football games on the same system that unannounced radio checks were received from SAC. In one case missileers pulling alert at two different LCC facilities worked together to allow one of the missileers to listen to a football game without being caught. A missileer at another LCC agreed to respond to the radio check from SAC posing as the other missileer and then to call him via telephone to relay any information.[359]

At the end of every shift the missile crew proceeded through the changeover process with the incoming crew. After the procedure they traded salutes with the new crew and rode the elevator thirth-two feet to the LCF, carrying with them bags of classified trash to be burned in the code-burner on the grounds as a security precaution.[360]

Although Minuteman missiles were never launched in anger, President Carter did transmit a message over the SAC radio once in 1977. In the midst of a typical shift, the SAC controller unexpectedly warned the combat crews to "standby for a message from the president of the United States." With their hearts pounding, waiting for the authentication code to launch Minuteman, the president said, "Hi, you all. I'm here at the SAC command post and I wanted to see how this thing worked." Although crew members can laugh about it now, the threat of a nuclear attack was very real to them at that moment in 1977.[361]

During active duty, the Minuteman missile and the life of the missileer in the LCC was not as secretive as one might have guessed. In a few cases, national reporters were allowed into the LCC to complete articles and news stories about the missileers and life in a LCC. These events were unusual in that they allowed the public and the Soviet Union to see our military defense systems. However, SAC had a history of showing off our military and technological strength. For example, a massive media campaign accompanied the activation of Project Looking Glass, as reporters received tours of the plane and some even went on test flights.

In the early years of the active Minuteman program, *LIFE* magazine ran an article titled "How it Feels to Hold the Nuclear Trigger." Reporter Richard Stolley and a photographer Bill Ray spent twenty-four hours in an LCC in South Dakota with a SAC escort officer and Minuteman missile crew commander Allen Lamb and deputy commander William Christians. The resulting article and photographs in the 6 November 1964 issue documents the routine activities of the crew at the Lima-01 LCC. This article may have been one of the first to give the country and the world a direct look into the LCC and the duties of a missileer.[362] In January 1978 NBC's *The Today Show* was producing a series of stories on SAC and they were sent to Ellsworth Air Force Base, a base with both missiles and bombers, to film. A missileer crew, including Gary Andrews and Craig Manson, were hand picked to be filmed performing an alert tour in the

LCC at Alpha-01. The reporter, Eric Burns, and the film crew received a visitor briefing prior to being brought down to the capsule to film. Former missileer Craig Manson recalled the following discussion during the briefing, "And part of that briefing was, 'If you hear that warble tone coming out of the box up there, then you must turn off your cameras, go to the back of the capsule, turn around and face the blast door.' Now being journalists, they were highly aggravated at this. And Eric Burns said, 'You mean, we can't film what you do?' And we said, 'no.' And he said, 'Well, what will you be doing?' And I said, 'We will be determining whether or not we have to take emergency action under an Emergency War Order.' And he said, 'Well this would be great history. We want to get that on film. We've got to be able to see that.' I patted my .38 and said, 'no' "[363]

Prior to the visit by the film crew the missile crew received its own briefing from Air Force Public Affairs. The missileers were instructed to give the following response if they were asked a question about nuclear weapons. "And they said, 'Here is your response to the question about nuclear weapons: I can neither confirm nor deny the existence of nuclear weapons at this installation.' " Manson recalled, "And the reason we could say that is because it was true." Manson continued to explain that some missiles had communications and some had warheads and that was what was secret. As it turns out the reporter did not ask about nuclear weapons.[364]

Manson also recalled that, "At Ellsworth, for several years–not always, but for several years–Delta-09 did not have a warhead on it. And I knew that. It was classified at the time, but I knew that. But I didn't know which other ones might not. And Delta-09 didn't for a number of years because Delta-09 was known as the off base training element."[365] When asked about common misperceptions about serving in the missile business, Craig Manson stated that a minor irritation was that "everybody talks about a button. It's not a button, it's a key."[366] On the more serious side, Manson stated, "… because of television and movies and in part because of the image the Strategic Air Command cultivated for itself, people have the idea that missile launch officers were somehow bloodthirsty killers with few morals and no soul and ready to kill millions of people with the turn of that key. And that's just not so. One of the things that's made America great is that we do not have a warrior class in America like some ancient civilizations or some societies today. Our military is drawn from ordinary people living in ordinary communities, growing up with the same values that they perceive around them and missile launch officers come from that same group of people–ordinary Americans with mainstream values."[367]

Changes in Missile Culture

Early on in America's missile era, SAC employed only experienced aviators to staff the first Intercontinental Ballistic Missile (ICBM) silos. However, as these missileers were deployed for service in Asia, SAC began recruiting less experienced Air Force personnel from agencies such as the Reserve Officers' Training Corps (ROTC). Therefore, by the 1970s missileers were typically between the age of twenty-two and thirty, and only a handful had any flight experience. During this time, as many as nine hundred new missileers were trained yearly to staff the 1,054 operational ICBMs.[368]

Female Missileers

The rank of crewmembers was not the only staffing change over the years. The Air Force restricted its female members to noncombat positions until the late 1970s. Fighting against the policy, Wisconsin Senator William Proxmire pushed for the integration of women on missile crews, stating that it was unlikely that women would be exposed to enemy fire in a position launching missiles. In 1977 reporter Andy Plattner asked, "Should women be assigned as missile launch officers, who potentially would be firing nuclear missiles in the event of war?"[369] SAC funded several research studies in the 1970s to determine public sentiment on this question and the views of male crew members already serving. The

results showed that the public, as well as Air Force personnel, felt that women have the mental and physical attributes required to be a missile combat crewperson.[370] However, male crew members felt the integration of women would call for several modifications to their time spent on alert. Furthermore, many wives of crewmembers preferred that the crews were either all-female or all-male.[371]

Women began serving on missile crews for the first time in 1978 on the Titan II missile system, though with some important distinctions. Citing privacy, moral and spousal concerns, SAC took the recommendations of the research studies and required missile combat crews to be either all-female or all-male.[372] Forty-two women served on Titan II crews in this manner until deactivation of the missile system between 1984 and 1987.[373] Soon thereafter, SAC was directed by the U.S. Air Force Headquarters to begin integrating women as Minuteman missileers, but with the same stipulation, only all-female crews could serve.[374]

Women were assigned to "topside" duty at Ellsworth's fifteen LCFs beginning in the mid-1980s; however, the underground LCCs continued to be staffed entirely by men until all female missile crews were allowed by the Air Force in 1986.[375] Ten women were assigned to Ellsworth and served as five all-female Minuteman missile crews. The use of single-gender crews was not without its problems, however. For example, if a female missileer was unable to pull duty for any reason and there were no female replacements available, a male crew had to replace the female crew, leaving it potentially serving more alert tours. After several studies and surveys, SAC began allowing male/female missile crews on 1 January 1988. This not only reduced scheduling issues, but it also increased the opportunities for women in the Air Force.[376] In August 1989, First Lieutenant Michael A. Harbison and First Lieutenant Lisa A. Atkins served Ellsworth's first mixed-gender alert tour at LCC India-01.[377] Once women integrated with men on missile crews, SAC required that missile operations were tasked to guarantee equal career progression for women and men.[378] Pointing out that the training and the standards were the same for both men and women, one former female missileer felt that there were no biases based on gender when she served at Ellsworth Air Force Base in 1991 and 1992.[379]

Race Relations on Base

In 1949 the Air Force became a fully integrated branch of the armed services when President Truman ordered on 26 July 1948 that "there shall be equality of treatment and opportunity for all persons in the armed services without regard to race, color, religion or national origin."[380] Four years later, in 1952, the Air Force was, in practice, completely desegregated.

The Air Force made proactive efforts to deal with race relation issues to alleviate or eliminate potential problems. Training programs, such as "social actions" (remembered by a former missile crew member), were instituted to prevent discrimination.[381] Oral interviews with past personnel of Ellsworth Air Force Base during the late 1960s through the early 1990s offered a positive view of race relations on base. Ken Bush, an African American who served at Ellsworth in the mid-1970s, recalled that race relations within the Air Force "were pretty good at the time I was there."[382] Former site manager David Burris who served at Ellsworth in the late 1970s and early 1980s stated that he believed that there was very little racial divisions on base and it may have been less than the general society, "because you all worked together and everything."[383]

No matter their gender, race, or age, each missileer and each member of their support team was charged with one overriding duty–the maintenance and control of the Minuteman missile. Even stationed in rural South Dakota, they were in a real way on the Cold War's front lines. They considered themselves defenders of freedom and the American way of life. Chief Master Sergeant Martin Pietz, assigned to the 44th Strategic Missile Wing at Ellsworth Air Force Base from 1972 to 1994, described his mission as the following, "Our mission, the way we saw it was, even though we were located in the middle of South

Dakota, we were defending the United States from Russian aggressors. The Soviet Union, I mean basically, that was it. We were…looking at defending our country from the Soviet Union."[384]

Other segments of American society considered themselves veterans of the Cold War as well, including those who found the Minuteman's very existence both abhorrent and a danger to global peace. Having focused on Delta-01 and Delta-09 and the men and women of Ellsworth, we now shift our focus to Cold War dissenters, the Cold War's climax, and the ways American society has begun the process of remembering this half-century conflict.



Plate 55. Day room in Launch Control Facility Support Building at Delta-01 *(Photograph by Mead & Hunt)*



Plate 56. Day room in Launch Control Facility Support Building at Delta-01 *(Photograph by Mead & Hunt)*



Plate 57. Kitchen in Launch Control Facility Support Building at Delta-01 *(Photograph by Mead & Hunt)*



Plate 58. Facility Manager's bedroom at Delta-01 *(Photograph by Mead & Hunt)*



Plate 59. Delta-01 Launch Control Facility, Security Control Center *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-A-50)*



Plate 60. Delta Flight Peacekeeper vehicle used by security personnel *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-15)*



Plate 61. Delta-01 sleeping quarters *(Photograph by Mead & Hunt)*



Plate 62. Missile art in vestibule of Launch Control Center, Delta-01 *(Photograph by Mead & Hunt)*



Plate 63. Blast door, Launch Control Center, Delta-01 *(Photograph by Mead & Hunt)*



Plate 64. Delta-01 Launch Control Center with crew *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-A-57)*

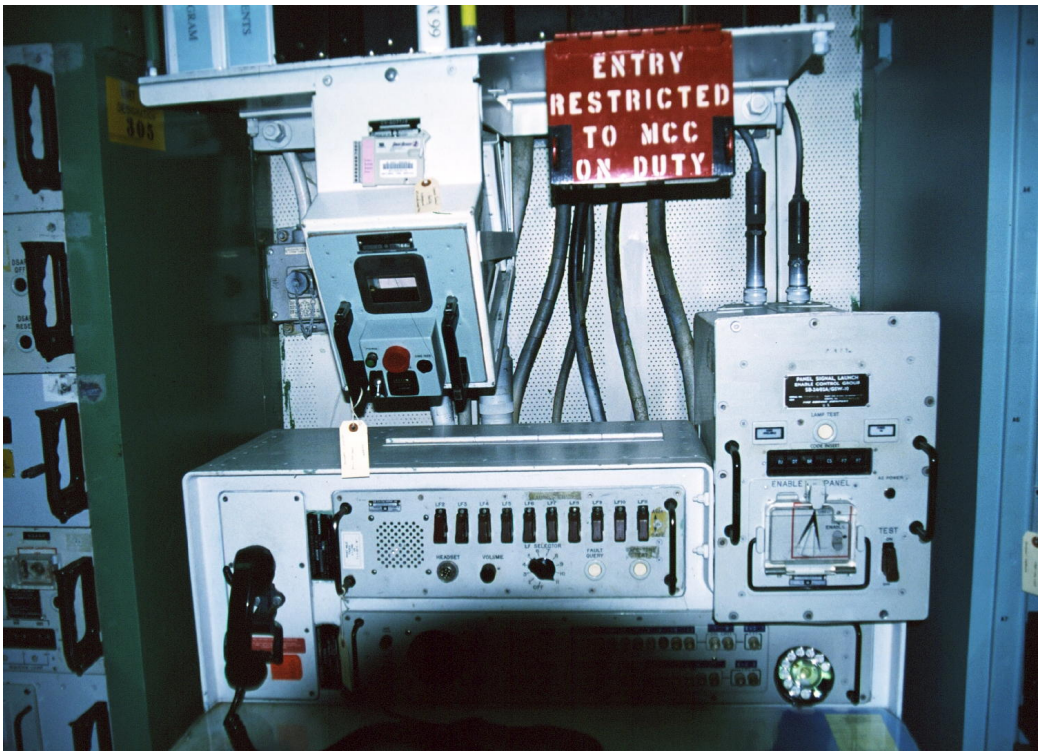


Plate 65. Deputy Commander Control Console, Launch Control Center, Delta-01 *(Photograph by Mead & Hunt)*



Plate 66. Missile Commander Control Console, Launch Control Center, Delta-01 *(Photograph by Mead & Hunt)*

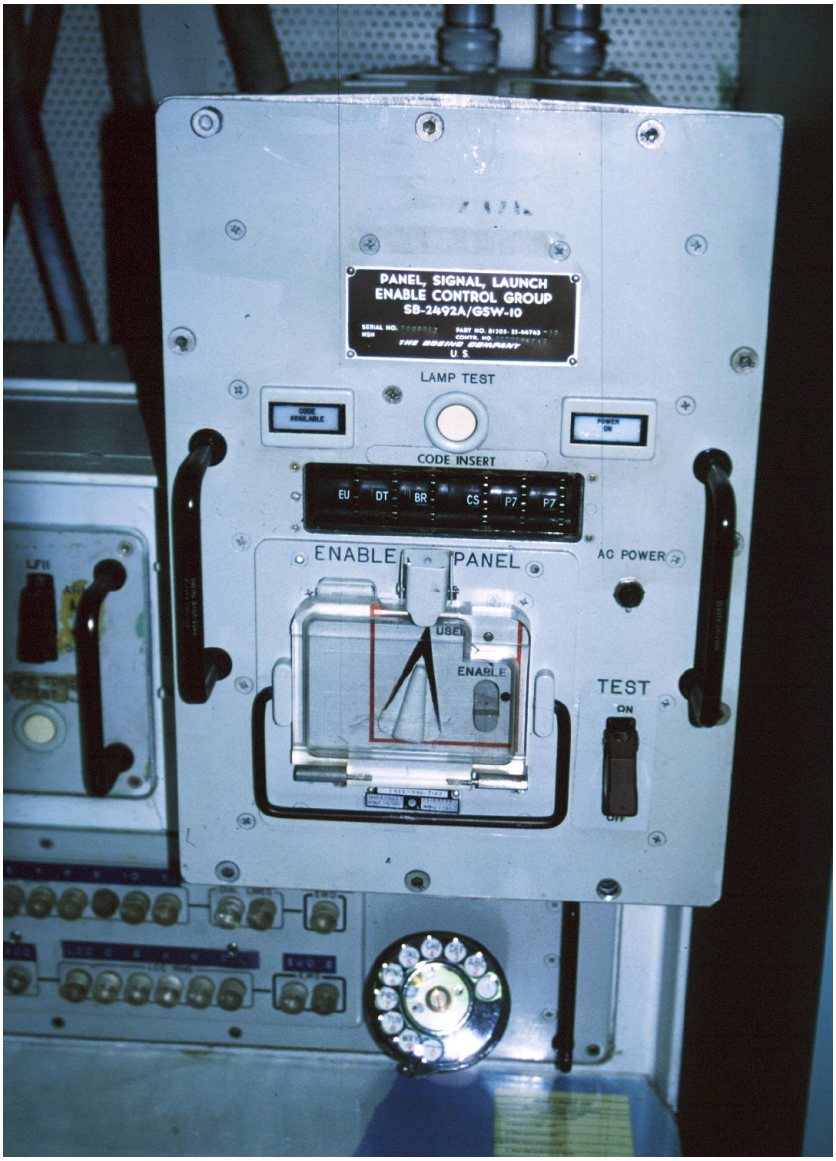


Plate 67. Launch enable control panel, above Deputy Commander Control Console, Launch Control Center, Delta-01 *(Photograph by Mead & Hunt)*

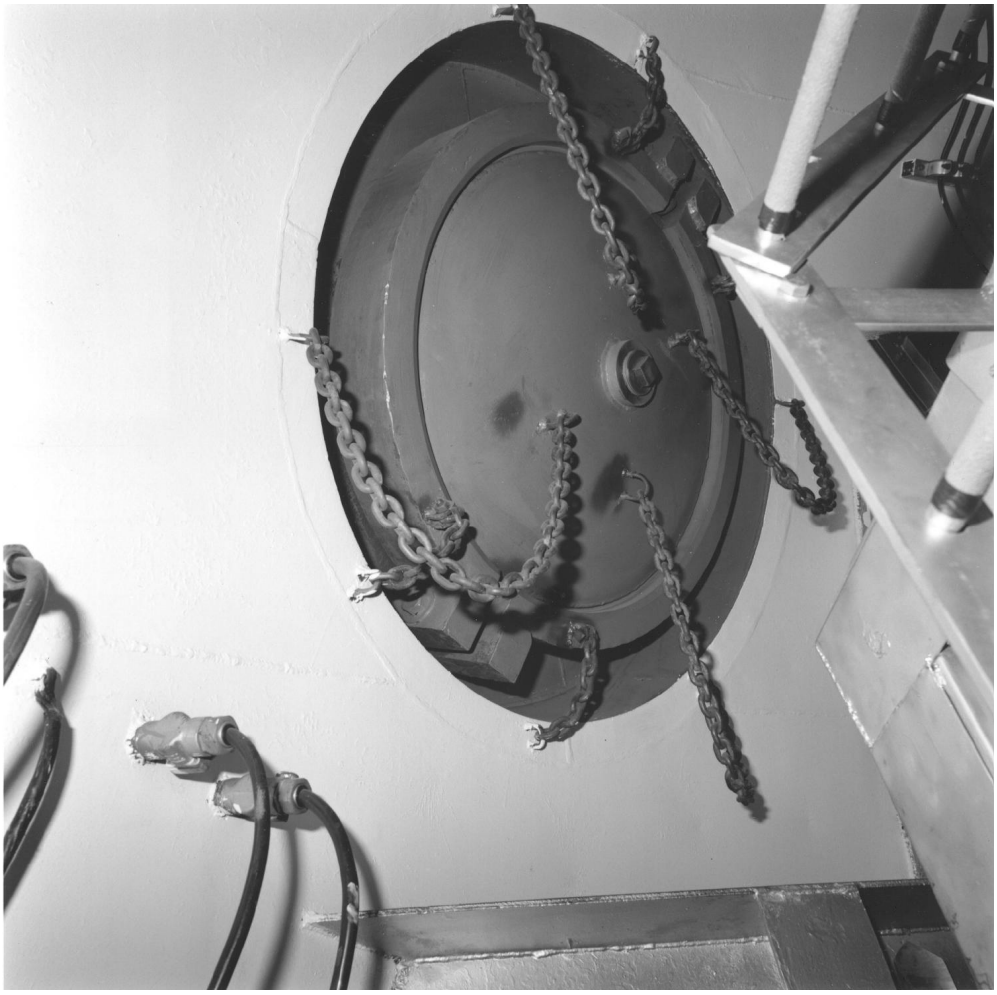


Plate 68. Launch Control Center, escape hatch *(Library of Congress, Prints and Photographs Division, Historic American Engineering Record, Reproduction Number HAER SD-50-A-84)*



Plate 69. Oscar-01 Launch Control Center, Ellsworth Air Force Base *(Courtesy of the 28th Civil Engineer Squadron, Ellsworth Air Force Base)*



Plate 70. Launch Control Center art, Ellsworth Air Force Base *(Courtesy of the 28th Civil Engineer Squadron, Ellsworth Air Force Base)*



Plate 71. Launch Control Center art, Ellsworth Air Force Base *(Courtesy of the 28th Civil Engineer Squadron, Ellsworth Air Force Base)*

Section III – Peace Movement, Nuclear Disarmament, and the Future

Chapter 1. Opposition to Nuclear Armament (late 1950s–90s)

The National and International Debate

After installation of the missile silos in the farm fields of South Dakota's Western Plains, the missiles went largely unnoticed. Housed underground, the missiles were largely inconspicuous. By the end of 1963 three Strategic Missile Squadrons (SMS) each with five flights of ten Minuteman missiles stood on alert across 13,500 square miles of the Western Plains of South Dakota.[385] Additional Minuteman missiles in Missouri, Montana, North Dakota, Wyoming, Colorado, and Nebraska formed a vital component of the United States' nuclear deterrent force.

In the early days of Minuteman facility construction and deployment, discussion about the implications of the mass deployment of nuclear missiles in American communities remained minimal. Most residents generally accepted the nearby missile sites, and whether driven by patriotism, lack of information, indifference, fear of the missiles themselves, or preoccupation with daily life, local residents mostly ignored the missile presence. According to one North Dakota resident, Jody McLaughlin, people "chose not to know. The attitude was, 'I don't want to think about it. I don't want to talk about it or acknowledge it.' "[386] Organized opposition to the placement of Intercontinental Ballistic Missiles (ICBMs) from local residents during this period was virtually nonexistent.[387]

Not everyone accepted the presence of nuclear missiles, however. Acts of resistance against America's nuclear defense program began in the late 1950s and included both solitary protests and organized groups. Individual protests tended to be carried out by local residents, while the early group actions were typically organized by national groups. In 1958 a lone protestor held an anti-nuclear/peace sign at the dedication of F.E. Warren Air Force Base in Cheyenne, Wyoming, as an Atlas site.

An early group action occurred in Cheyenne when the Committee for Non-violent Action, a Philadelphia-based group, mounted a consciousness-raising campaign in the summer of 1958, which sought to stop the construction of Atlas missile sites in the Cheyenne area. The campaign, dubbed "Appeal to Cheyenne," sought to encourage local residents to oppose the construction of the new Atlas site at the F.E. Warren Air Force Base and to raise the level of public awareness and concern about nuclear weapons.[388] Additional campaigns mounted against the missile silo sites and the United States nuclear arsenal included actions by the War Resisters League. In 1959 this group's "Omaha Action" drew national attention to the early Atlas ICBM deployment in Nebraska. The War Resisters League distributed pamphlets encouraging Nebraskans and others to protest nuclear weapons.

The intensity of anti-nuclear activism varied depending on the political climate. Public debate over nuclear weapons in America remained virtually nonexistent during much of the 1960s. The signing of the Nuclear Test Ban Treaty by the United States and the Soviet Union in 1963 appeared to reduce the public's concern over the nuclear weapons issue, as nuclear testing went underground. Nuclear weapons development and testing continued unabated, however–the United States conducted more tests in the five years after the test ban treaty than the five years before its signing–the perception of the nuclear threat lost its immediacy.[389] From the mid-1960s until the early 1970s, many local and national peace groups shifted their focus, concentrating instead on the civil rights movement and the Vietnam War. The anti-

nuclear movement was not reinvigorated until the late 1970s and early 1980s, when Europe and the United States experienced a resurgence of concern over nuclear weapons.[390]

In Europe the renewed activism centered on anxiety over the arms build-up during the Reagan administration and the proposed deployment by the United States of short and medium range nuclear missiles in continental Europe. These anxieties sparked numerous European protests against the arms race that helped inspire the dormant American anti-nuclear movement.[391]

Activists in the United States shared the European's concerns over the nuclear deployments in Europe. Greater public concern in the United States over nuclear missile silos also coincided with the emergence of the nuclear freeze movement, which attracted strong support in the United States.[392] The height of this movement, from 1982 to 1987, encompassed the years of Ronald Reagan's presidency and the years when the United States and the Soviet Union entered a period of renewed tensions, which included a new emphasis on production and deployment of nuclear weapons. This period saw the renewed activity of the national peace movement, as well as the formation of anti-nuclear groups at the state and local levels. For example, the South Dakota Peace and Justice Center, which had been established in 1979, became active in protesting the proliferation of nuclear weapons. This group organized events at Ellsworth Air Force Base and at specific silos to "protest the nuclear arms race."[393]

The reaction of Allen and Lindy Kirkbride, ranchers near Cheyenne who had three MX missile silos on their sixty-five thousand-acre ranch, illustrates the increased public awareness concerning nuclear missiles during this period. The couple played reluctant hosts to the new MX ICBMs, developed in the 1980s by the United States in response to the increasing accuracy of the Soviet ICBMs. Allen Kirkbride, speaking to *USA Today* in 1986, said of the new MX ICBMs on his land "I sit here, and I think I'm in Utopia…[It] really chaps me when one of our elected public officials begs to get one of these projects in my backyard." Lindy Kirkbride equated having the missile silos in her backyard with being kicked by a horse.[394] Her husband's sentiments also illustrate divisions between state politicians, who saw the economic activity brought by the increased military presence as beneficial, and the negative views of some of the ranchers who lived beside the missiles.[395]

The number and scope of missile silo actions increased in the 1980s as the anti-nuclear/peace movement gained momentum. Anxiety over new missile systems, such as the mobile MX missile, drew 400 people to an anti-MX rally at silo Q5 outside of Cheyenne, Wyoming, in the late 1980s. The furor over the MX deployments focused attention back on the Minuteman as well. Peace actions occurred at Minuteman II and III missile sites in Colorado, Missouri, North Dakota, South Dakota, and Wyoming during this period. Though no two were alike, protests typically involved vigils, praying at the site or on the silo cover, trespassing, damaging the surface installations by either hammering on the covers or pouring blood on the site to produce a symbolic disarming, or the delivering of statements from the activist to the military. Such statements commonly referred to international laws, such as the Geneva Convention, which bars attacks on civilians, and the Nuremberg Charter, which bans attempts to annihilate whole populations, as the rationale for disarmament. The activists argued that since the effects of nuclear weapons cannot be limited or controlled that they will harm civilians, thus violating these international laws.[396]

Although a number of anti-nuclear/peace activist groups were based on the east or west coasts, individuals from around the country participated in actions at the missile sites. One such action, performed by members of a Ploughshares group known as the Silo Pruning Hooks, involved people from Wisconsin and Minnesota. The activism of Ploughshares organizations is based on religious convictions that oppose war. The Silo Pruning Hooks members were two Catholic priests, a writer, and a mental health worker. Their action, performed in 1984, involved breaking into silo N-05 in Missouri by cutting

the fence around the silo site, hammering on the silo cap with sledge hammers and jack hammers, and hanging a banner on the gate that read "Why do you do this evil thing? Your brother's blood cries out to me from the earth."[397]

The activities of the Silo Pruning Hooks group raised the level of awareness about existing Minuteman sites at a time when the majority of public attention focused on the possible deployment of the MX mobile ICBM. For members of the Silo Pruning Hooks, the potential dangers and destructive power of the nuclear missiles justified their actions[398]

The actions of members of the Silo Pruning Hooks inspired other groups like Nukewatch, based in Luck, Wisconsin, to undertake consciousness-raising projects of their own. Nukewatch's Missile Silo Project, which resulted in the mapping of one thousand missile silo sites across the country, was intended to be a high profile project capable of furthering public discussion on nuclear weapons. Jay Davis, a local peace activist, participated in the mapping of the rural missile sites in South Dakota and described an encounter with Air Force security personnel at a missile silo,

> ". . . eventually we came to a missile silo right near State Highway 34 and there was a semi truck backed up right onto the pad inside the perimeter of the fence and there were a couple of soldiers, from the Air Force I suppose, with machine guns guarding the missile silo and the semi truck. And we stopped there and, I mean, it was obvious they weren't unloading furniture and this one soldier with the machine gun came over to my car as I was writing down the directions to that silo and also giving it a name and he said, can I help you with anything when I rolled down the window. And I said no thanks we're just tourists. And of course he knew we weren't tourists, but the point was we had a right to be out there driving on the back roads whatever it was we were doing this is supposed to be a free country."[399]

During the mapping of the missile sites in South Dakota, Delta-01 was assigned the name of "Mike and Beth's Launch Control Center" after Mike Sprong and Beth Preheim, peace activists that mapped the Delta Flight. Delta-09 was believed to be assigned the name "Cassandra's Missile" for Cassandra Dixon, a peace activist with Nukewatch.[400]

Nukewatch published the book, *Nuclear Heartland*, which mapped missile silo sites by state and provided an overview of the history of ICBM deployment and the development of national and local resistance movements. As stated by Sam Day, founder of Nukewatch, in the introduction to *Nuclear Heartland*, the goal of this project was to raise awareness and spark a critical debate of the dangers of the continued presence of these weapons and the real threat of a nuclear war. The organization also hoped their maps and information might prompt public visits to the sites by concerned citizens, other activists, or even vacationers.[401]

Throughout the protests of the 1970s and 1980s, relations between the protestors and the military personnel guarding the silo sites largely remained professional and civilized. Young guards often displayed some nervousness around the activists, perhaps because they didn't know what to expect. Protests were often planned and announced in advance, which contributed to a more controlled response from both sides of the protest line.[402] In the words of John LaForge, an activist with Nukewatch, "the people [guards] in charge generally understood that we weren't a threat to them."[403] A level of understanding seems to have been reached between the guards and protestors at most actions. For example, LaForge relates a story that happened during a protest at a missile silo site on Martin Luther King's birthday in the early 1980s, "I was in custody [and] our protest was on a Martin Luther King Birthday, this was before it was made a national holiday, and we all had Dr. King buttons on and I was in

the Air Force squad in the back with the cuffs behind my back and one of the MPs asked me if he could have the button and I just thought that was a nice breakthrough at the time because everybody wanted to celebrate Dr. King no matter what side of the fence you're on with nuclear weapons." LaForge gave the button to the MP.[404]

Activist Groups – Beliefs and Mission

Individuals and groups protesting the nuclear build up during the Cold War acted for a variety of reasons. Some, such as Joe and Jean Gump, participated in actions that damaged silos in Missouri in 1986 and 1987. The Gumps and other individuals did not have any organizational affiliation and protested out of personal religious conviction.[405] Some organized groups also acted out of religious beliefs. The Ploughshares organization based its activism on the biblical reference to hammering swords into ploughshares.[406] The group's activism lay grounded in its members' belief that nuclear weapons were and remain instruments of mass murder.

Some activists objected to nuclear weapons for fear of the environmental consequences of a nuclear accident involving the nuclear material or concerns with future cleanup of nuclear waste. Others, like John LaForge and Nukewatch, adhered to the legal argument that the proliferation of nuclear missiles, with their ability to annihilate whole populations, violated the Geneva Convention and the Nuremberg Charter.[407]

In general, anti-nuclear groups endorsed nonviolent actions aimed at increasing public awareness of the potential dangers of nuclear weapons. Activists hoped that increased awareness would result in the public outcry necessary to disarm nuclear weapons arsenals. Their typically pacifist views, which recalled non-violent protests in Ghandi's India or America's own civil rights marches as models, contributed to the generally peaceful and non-confrontational tone of their protests.

Efforts in South Dakota (1980-90s)

South Dakota's peace movement did not agitate to the same extent as its neighbor North Dakota. In reflecting on the beginnings of anti-nuclear peace activism in South Dakota, long-time peace activist and resident of Rapid City, Jay Davis stated, "The nuclear arms race specifically organizing against that really started to gain steam during the Reagan presidency at the very early 80s and really continued throughout the Reagan presidency and then when President Bush came in 1989 it wasn't long after that that you had the end of the Cold War and all that. Which made this particular issue somewhat moot. It's easy to forget how intense the people felt and how scary things were at times during the 80s."[408]

Jay Davis also reflected that residents of South Dakota and Rapid City in particular have generally been very supportive of their Air Force base. Residents of the state are keenly aware of the economic benefits they enjoy as the result of the military presence on the state's Western Plains, and the military program received substantial local and statewide political support. Peace movement adherents in South Dakota recognized quite early that they were outnumbered by those who supported local military installations.[409]

It is difficult to determine the number of South Dakota residents that identified with or joined the peace movement. Jay Davis stated, "Well we never had as much [activism] in South Dakota as the more urban states so we had that perspective. We were kind of the country cousins to a peace movement that was

much more prominent on the east and west coasts in bigger cities. We certainly had our own branch of it and I'd say it maybe hit its peak from about 1982 to about 1987. So that would be most of the Reagan era."[410]

Local support of the increased military presence at Ellsworth Air Force Base was not universal, however. Individual acts of resistance included rock art symbols placed at the end of the runway at Ellsworth by Marv Kammerer and fellow activists. Kammerer, described by Jay Davis as a "rancher for peace," owns land adjoining Ellsworth Air Force Base.[411] During the Cold War, Kammerer placed three symbols on his land at the end of the runway to signal his objection to nuclear weapons–a peace sign, a Native American earth symbol, and an ecology symbol.

The South Dakota Peace and Justice Center, an organization of "preachers, teachers, and social workers," arranged missile silo demonstrations throughout the state during the 1980s.[412] They were responsible for coordinating Easter Sunday protests at missile silo sites, events that involved prayer vigils and communion. After the services ended, a small group of pre-selected activists trained in nonviolent action trespassed onto the silo sites, sometimes placing an Easter lily on the silo cap. These events were intended to raise the level of public debate about the weapons and to make a statement about the appropriateness of building and maintaining these weapons systems.[413]

The Easter Sunday protests occurred at numerous missile launch facility sites in South Dakota, including at Delta-09 in 1987. Four people trespassed onto the silo site that day and were arrested. The federal magistrate decided to make an example of this group of protestors, fining them $525 each, for a total fine of $2,100. Members of the South Dakota Peace and Justice Center felt obligated to help the protestors pay their fine. However, according to Jay Davis, the South Dakota Peace and Justice Center did not have money in the bank to cover the fines, placing the burden of payment on the members. These fines caused protesters in South Dakota to rethink their methods, and effectively put an end to trespass actions in South Dakota.[414]

When asked to describe the overall impact of the anti-nuclear protests in South Dakota, Jay Davis responded, "Well, I think if we hadn't been there people would have absolutely taken the missile silos for granted. Those silos are there to preserve peace. At worst, they're a necessary evil. At best they help our local economy and by having protests which were broadcast to the state and to the community and the news media people at least became aware of the fact that there is another side to the story. …So we provided balance in a conservative area of the country during a very conservative time."[415]

Continued Activism

Over the years, protestors met with a mixed reaction from the public and anti-nuclear/peace groups in the United States and Europe. The public remained divided on the issue of maintaining the United States' nuclear force, while peace groups could not agree on either the utility or the ethics of damaging government property. Local press coverage ranged from matter-of-fact to openly hostile, accusing the protestors of being unpatriotic or un-American.[416]

Individuals and groups protested the Cold War's nuclear buildup and continue to oppose the very existence of nuclear weapons for a variety of reasons. Religious, legal, and environmental arguments remain central to the agitation for American and international disarmament. The 550 ICBMs still in the ground remain a focus for the peace activists.[417] Today, debate continues to rage throughout the activist community over the usefulness of employing tactics involving property damage to missile silo sites or trespassing onto the sites. European activists have raised concerns over the jail sentences received by

American activists and question the effectiveness of a peace movement that suffers from having many of its leaders in jail. For example, the long sentence of Helen Dery Woodson, a member of the Silo Pruning Hooks who received an eighteen-year jail sentence for trespassing onto a silo Launch Facility and damaging the silo, illustrates the toll of the peace movement on the lives of individuals.[418]

A new tactic employed by the activist groups since the 1990s centers on posing as weapons inspectors and they have attempted to inspect weapon sites in Europe and the United States. To John LaForge, of Nukewatch, these inspections "highlight the hypocrisy of these first world nuclear arm states as well as a way to bring attention to the deployment of the weapons all over the place."[419] For peace activists opposing nuclear weapons, the battle for disarmament continues.

The Cold War, however, has ended. Gone with it are the bipolar tensions that divided the international system for nearly a half century. We next turn to the dismantling of those international tensions and the concurrent dismantling of Minuteman.



Plate 72. Peace March in Peetz, Colorado, Good Friday 1988. Nukewatch founder Sam Day (*left*) is holding the banner *(Courtesy of Nukewatch, photograph by Peetz News Weekly)*



Plate 73. Spring Equinox Vigil, 1988. Banner reads, "U.S. Air Force: Good People Bad Product" *(Courtesy of Nukewatch, photograph by John LaForge)*



Plate 74. Word War II munitions bunkers now used to store farm produce and equipment, near Bronson, Nebraska, 1988 *(Courtesy of Nukewatch, photograph by Barb Katt)*

Chapter 2: Strategic Arms Reduction Treaty and Disarmament of Minuteman II (1990s)

End of the Cold War

Having spent incalculable resources constructing their respective nuclear arsenals, world leaders subsequently spent much of their time and energy in efforts aimed at reducing the risks of nuclear war. Disarmament was one such effort. Presidents Richard Nixon and Gerald Ford negotiated and signed the Strategic Arms Limitation Talks (SALT I and SALT II Treaties) with the Soviet Union in the 1970s with the intent of reducing each country's levels of nuclear arms. SALT I limited anti-ballistic missile installations (ABMs) to two ABMs per country, which, according to historian Michael Kort, rendered them functionally useless and derailed a possible race to develop a missile defense.[420] The SALT I Treaty also put limits on numbers of Intercontinental Ballistic Missiles(ICBMs) and submarine launched ballistic missiles (SLBMs). The subsequent SALT II Treaty, although never ratified by either Congress or the Soviet government, placed additional limits on nuclear arsenals and slowed, but did not end, the arms race.[421] A slowing of the arms race and a reduction in nuclear armaments had to wait until the early 1990s and the end of the Cold War.

As the political and economic structure of the Soviet Union crumbled during the late 1980s, the lengthy Cold War period came to an end. The Solidarity movement in Poland, a reform effort which began in Poland's dockyards and spread, through the aid of global attention from such luminaries as the Polish-born Pope John Paul II, into a national call for political and economic change, highlighted the new spirit of innovation sweeping through Eastern Europe. By the end of the decade, the Berlin Wall fell, Germany had been reunified, and a number of former Eastern Bloc nations had replaced their Communist regimes with democratically elected governments. As the Soviet Union's republics began asserting their independence, the faltering world power found itself unable to retain its satellite states. Facing increasing isolation, the Soviet Union's political structure disintegrated rapidly.[422]

The Cold War formally ended in 1991 with the collapse of the Soviet Union, which President Ronald Reagan had once called the "evil empire."[423] During the conflict, the United States and the Soviet Union were locked in a race to attain military supremacy. The massive nuclear buildup that resulted from the arms race diverted trillions of dollars that might have been spent on domestic programs, but a hot war had been averted.[424] Once the Cold War came to a close, the United States faced the daunting tasks of reducing its nuclear arsenal while simultaneously planning for the nation's continued security.

START Treaty

On 31 July 1991 President George H.W. Bush and Soviet President Mikhail Gorbachev signed the Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms (START Treaty), which limited the number of ICBMs and nuclear warheads either country could possess. The agreement restricted the United States to approximately 8,556 nuclear warheads and the Soviet Union to approximately 6,449 nuclear warheads.[425] Weapons in excess of the agreed upon number would be disarmed and Launch Facilities destroyed. Congress ratified the START Treaty in October 1992. A month after the signing of this treaty, political dissenters attempted a coup against Soviet leader Gorbachev and the fast unraveling Soviet Union finally collapsed.[426]

The signing of the START Treaty concluded disarmament talks that had begun almost a decade earlier in the early 1980s. The START Treaty established limits on the number of ICBMs and their Launch Facilities

(LFs)and warheads; SLBMs, their launchers and warheads; and heavy bombers and their weapons. The terms of the treaty established a three-phase arms-reduction program. Phase I included preparatory tasks prior to the ratification of the treaty. These tasks included provisions for inspections of the missiles and bombers covered by treaty provisions to verify their technical characteristics and gather basic information on the weapons. Phase II initiated continuous monitoring and inspection activities thirty days after ratification of the treaty to verify treaty compliance. Phase III provided for a continuation of monitoring and inspections during the time the treaty remained in force to ensure that both countries did not exceed the number of weapons allowed by the treaty. Reciprocal onsite inspections conducted by both countries assured compliance with the treaty.[427] As part of the agreement, both the United States and the Soviet Union could disarm and preserve a certain number of weapons or facilities for interpretation of Cold War history. Museums or sites to recognize the Cold War are being developed in the Ukraine and Russia.

The collapse of the Soviet Union in 1991 complicated implementation of the START Treaty. The centralized Soviet government no longer existed, and Belarus, Kazakhstan, Ukraine, and Russia, as former Soviet republics, all possessed Soviet nuclear weapons covered under the treaty. Negotiators immediately concerned themselves with solidifying the START Treaty. To their relief, the four newly independent states agreed to comply with the treaty and in 1991 negotiated the Lisbon START Protocol, which stated that the Soviet successor states would "make such arrangements among themselves as are required to implement the Treaty's limits and restrictions…."[428] Under the protocol, Belarus, Kazakhstan, and Ukraine were to return their nuclear weapons to Russia. Due to Belarus' concerns about receiving compensation for its nuclear stockpiles and the safeguarding of the relocated missiles, the exchange was not completed until 1994. The countries also signed the Nuclear Non-Proliferation Treaty as non-nuclear weapons states, thereby formally pledging not to acquire nuclear weapons in the future.

Deactivation of Minuteman II Sites

In the United States, the START agreement coincided with growing Air Force disenchantment with the escalating costs associated with repairing and maintaining the older Minuteman II system. Rather than upgrade Minuteman II facilities to Minuteman III technologies, the Pentagon decided to deactivate the entire Minuteman II force to help comply with provisions of the arms-reduction treaty. On 27 September 1991 President George H.W. Bush announced on national television a dramatic "plan for peace," designed to reduce the tensions of the nuclear age. As one component of his plan, he called for "the withdrawal from alert within seventy-two hours, of all 450 Minuteman II intercontinental ballistic missiles."[429]

After the signing of the START Treaty and the stand down ordered by President Bush, the Air Force began the deactivation of Minuteman II ICBM sites, including the 150 Minuteman II LFs and fifteen LCFs at Ellsworth Air Force Base in South Dakota.[430] Additional Minuteman II installations were associated with Strategic Air Command(SAC) bases at Malmstrom Air Force Base in Montana and Whiteman Air Force Base in Missouri. At Whiteman Air Force Base, all 150 of its Minuteman II LFs were imploded by 1997, but the underground Launch Control Center (LCC), Oscar-01, located on base, was retained for public interpretation. The 150 Minuteman II sites at Malmstrom Air Force Base were converted to Minuteman III systems and the necessary missiles were transferred from the Grand Forks Minuteman III installation, which was then deactivated.

A complex system governed the deactivation and dismantlement of the LFs and the LCFs. The individual Air Force bases executed the technical part of missile site deactivation, removing the missiles and other sensitive equipment and then they turned the LFs and LCFs over to the Army Corps of Engineers (Army Corps) and its consultants to begin the demolition of the sites. The Army Corps managed the demolition of the missile sites, much as they had overseen the construction of the sites. The Army Corps contracted

the demolition and salvage work to private-sector companies, but these companies needed to comply with procedures governed by the START Treaty. Following the dismantlement, the sites were returned to the Air Force for property disposal.

The landmark START Treaty governed the removal of the Minuteman II missiles and the destruction of the LFs. LF elimination began with the opening of the silo door. From this point forward, the process of deactivating the LF took less than 180 days. A series of agreements between the United States and the former Soviet Union allowed the weapons-grade nuclear material from the warheads to be either used for fuel in nuclear reactors or disposed of along with other high-level radioactive waste.[431] Hazardous materials were then removed from the site and contractors salvaged steel and other equipment. Destruction of the silos could be accomplished either by implosion to at least six meters (twenty feet) below ground level or by excavating the former silo to a depth of at least eight meters (twenty-six feet). The silo site then had to remain open for ninety days to allow Soviet satellites time to verify that the removal complied with treaty provisions. After the ninety-day period, crews covered the silo with a concrete cap and graded the top of the silo opening with gravel.[432] Elimination of the LCFs followed the dismantling of the LFs. Communications systems were dismantled and removed, equipment was salvaged, and hazardous materials removed. The Hardened Intersite Cable System (HICS) was severed to render it inoperable and the underground LCCs were welded shut and the elevator shafts were filled in. [433]

Deactivation of Ellsworth Air Force Base's Minuteman II Missiles

The Minuteman II ICBMs at the 44th Strategic Missile Wing (SMW)at Ellsworth Air Force Base became the first missile wing in the country to have its Minuteman II missiles removed under the START Treaty. The deactivation began on 3 December 1991 with the removal of the missile from the Golf-02 silo near Red Owl, South Dakota. The removal of the Air Force's first Minuteman II at Ellsworth Air Force Base in South Dakota marked the beginning of the country's Minuteman II disarmament effort. The last Minuteman II missile in South Dakota was removed from its silo in April 1994. The Air Force conducted numerous studies to minimize economic and environmental impacts on the state and conducted public meetings to solicit input on proposed procedures from residents. The Air Force also disseminated information on silo deactivation through the public meetings and newsletters.

A group of Air Force missile maintainers known as the "Black Hills Bandits" held the responsibility for deactivation of the Minuteman II LFs and LCFs at Ellsworth Air Force Base between 1994 and 1997. [434] This group of trained missile technicians worked to develop deactivation procedures customized to the needs of the 44th SMW, including lists of items to save, building maintenance plans, and procedures for handling hazardous waste. The procedures were based on guidelines for deactivation developed by the Air Force. The group developed the "44 MW Deactivation Maintenance Plan" that set out a fifteen-day schedule for Minuteman II deactivation. Some challenges specific to the 44th SMW included developing techniques for handling hazardous materials, such as polychlorinated biphenols (PCBs) or mercury bulbs. A plan also had to be developed for the removal of the weapon guidance and authentication system.[435] On the eleventh day, the SMW turned the LF or LCF over to the base civil engineering squadron to complete deactivation procedures, including the shutdown of the electrical system.

In addition to the deactivation activities described above, LF sites also required imploding the silos, abandoning or removing the azimuth markers located on private land, filling the silo with rubble, and capping the silo with a concrete lid. Crews also filled sewage lagoons and removed diesel storage tanks at LCFs. The silo door was buried in a fourteen-to twenty-foot-deep hole. The site was then graded to pre-demolition contours and resurfaced with gravel. Non-gravel surfaces were graded and seeded and cathodic protection wells were capped four feet below ground surface. Following deactivation of the

fifteen-day deactivation schedule, the sites were placed in caretaker status until the site was turned over to the dismantlement contractor. While in caretaker status Air Force crews maintained the sites, mowing lawns and repairing security fences. Following dismantlement, a second caretaker status ensued until the site was sold to an adjacent landowner. Deactivation procedures were modified for Delta-01 and Delta-09 as they were going to be preserved for interpretative use (see Section III, Chapter 3: Minuteman Missile National Historic Site for more information).[436]

Landowner Issues

Prior to the dismantling of the silos, a controversy ensued in South Dakota over the best method of removal. The Air Force proposed to implode the silos to a depth of six meters below ground surface, the most economical of the two options specified in the START Treaty. Local ranchers expressed concern over the use of this method, fearing vibrations from the explosives would harm the quality of their water in underground wells. Many ranchers preferred the second acceptable option allowed by the treaty, which required the mechanical excavation of the silo to eight meters. The ranchers felt that the second option had less possibility of disturbing the underground water supply. In a state plagued by low annual rainfall, the integrity of the water system formed a rallying point for property owners.

Ranchers' concerns for their water supply and other aspects of deactivation resulted in the resurrection of the South Dakota group, the Missile Area Landowners Association (MALA), a local ranching interest group that had been active during the early years of Air Force land acquisition for silo construction. MALA made property rights and potential civil problems they feared that might result from deactivation central issues in their negotiations with the Air Force. The group focused on potential damage to wells, the release of easements for the HICS on private land, and establishing the right of landowners to have the first opportunity to repurchase land once the Air Force was ready to sell the LF and LCF properties.[437] Other issues included the disposal of gravel from the sites, which was a concern for landowners near Red Owl, in northern South Dakota, because it was expensive to get gravel to their part of the state. MALA also presented the option of retaining the silos for grain or water storage; however, this alternative violated the START Treaty and could not be pursued.[438] Gene Williams and other members of MALA worked to bring attention to their cause and several national newspapers, including *The New York Times* and *San Francisco Chronicle,* and national television shows, including *ABC Nightly News*, *CBS Evening News*, and *The Today Show*. sent reporters to South Dakota. Williams summarized the group's efforts to protect their rights by stating, "It sure looked like we had an opportunity, maybe, to cut some deals for ourselves if we were going to give $100 million to the Ukraine we should be able to give some gravel to the guys around Red Owl."[439]

MALA successfully lobbied South Dakota representatives to pass legislation specific to the deactivation of the LFs and LCFs, requiring the Air Force to give landowners the right of first refusal to purchase former silo sites located on their property at fair market value. Because the missiles at Ellsworth were the first ICBMs removed as part of the START Treaty, the land purchase rules established for South Dakota set the standard for missile sites across the country.

MALA did not successfully change the method used to destroy the silos. The Air Force had already established stringent specifications for vibration and sound for the implosion that would protect adjacent property. In addition, the Air Force had conducted studies to show that local wells and aquifers would remain intact during the implosion. The Air Force identified two sites for the contractor to demonstrate compliance with these specifications and many people observed the implosion of the first silo which proved to be uneventful. Many landowners were given the opportunity to push the button to implode the silo adjacent to their property. As part of the deactivation process, the Air Force also released its easements for HICS buried on private property. HICS is a hardened, pressurized, buried cable that allowed the LCFs and LFs at the 44th SMW to send messages between facilities. The release of over 2,800

easements for HICS suggests the number of property owners affected by the placement of this cable on their property.[440]

The Air Force clearly spelled out procedures by which landowners might purchase former LFs and LCFs adjacent to their property. If multiple landowners held land adjacent to a missile site, the land was offered for sale to these owners in separate parcels. The General Services Administration (GSA), which coordinated the sale of the LFs and LCFs for the Air Force, offered these parcels to landowners at fair market value. If a landowner opted not to buy the land, the property was offered to government agencies first and if a government agency did not purchase the land, the property was offered for private bid.[441] Property owners received written notice from GSA of the terms of the sale and had thirty days in which to accept the offer.

Owners who purchased the former LF sites received a level graded parcel covered with gravel and surrounded by a chain link fence. The former silo stood underneath the gravel, but the silo was filled with rubble and sealed with a reinforced-concrete cap. Deed restrictions on these former LF and LCF sites prohibit installing wells, digging below two feet in depth at LFs or digging over the capsules or elevator shaft at LCFs, and a requirement to maintain drainage on the property. In addition, the new owners of the LCFs could keep the buildings associated with the facility and gained the right to move the buildings, or reuse them for their own needs.[442]

Once the Air Force completed deactivation of the 150 LFs and fifteen LCFs at Ellsworth Air Force Base, the missile sites began to be sold as excess government property. The last Minuteman II LF in South Dakota, Kilo-06, was imploded on 13 September 1996 and the Army Corps completed their deactivation work at the LFs and LCFs on 16 March 1999. After these activities were complete, the Air Force began environmental documentation at the sites in preparation for offering them for sale to adjacent landowners. Beginning in August 2001, the Air Force began selling the first former LF and LCF sites. By 2002 the LCFs had been sold to adjacent landowners, with the exception of Mike-01, which is in the process of being transferred to the Bureau of Land Management. Buildings at all fifteen of the LCFs remain, and one LCF support building complex is currently being used as a residence. The Air Force anticipates selling the remaining LFs by the end of 2003.[443]

The Minuteman Legacy

With the implementation of the START Treaty, only Delta-01 and Delta-09 of Ellsworth Air Force Base and the Oscar-01 LCC at Whiteman Air Force Base in Missouri remain as examples of Minuteman IIs. A comparison of the Whiteman facility and former Ellsworth facility reveals some significant differences. First, Oscar-01 at Whiteman reflects the "controlled response" era of Minuteman design, with its ground support facilities hardened belowground. In contrast, the Delta-01 LCF, formerly of Ellsworth, belongs to the earlier period of massive retaliation, as indicated by the "soft" siting of its support facilities aboveground. Second, the Whiteman site is located on the Air Force Base proper, instead of being dispersed, like the Ellsworth sites, in a remote missile field, as was more typical of the Minuteman basing configuration. Third, Whiteman's Oscar-01 is not a complete Launch Complex. Not only does it lack a LF, but it also lacks an aboveground LCF support building. In a typical Minuteman Launch Complex, such as represented by the former Ellsworth Site Delta-01, the LCF support building provided accommodations for Air Force personnel stationed in the missile field, and served as a security control center. Since the surrounding air base provided Whiteman's Oscar-01 with these services, a separate LCF support building was considered unnecessary. The Delta Flight Launch Complex in South Dakota is the only surviving intact example of the original Minuteman configuration, designed to implement the Cold War policy of massive retaliation and is also the only intact formerly operational Minuteman II site remaining in the United States.

Since the successful completion of the START Treaty, the United States and the Russian Republic have continued their efforts aimed at further arms reductions. A 1994 agreement between the two countries resulted in reprogramming the targeting system of United States and Russian ICBMs and SLBMs. This important though largely symbolic policy shift meant that United States and Soviet nuclear missiles were no longer aimed at each other.[444] The START II Treaty, ratified in 1996, mandates elimination of all land based ICBMs with multiple independently targeted warheads and a sixty-five percent reduction in each country's remaining nuclear arsenal. The signing of the Helsinki Protocol by the United States and Russia in 1997, better known as START III, established a framework for future arms reduction negotiations that aims to reduce the number of nuclear weapons held by these two countries by an additional thirty to forty percent.

Clearly the international legacy of the Cold War, at least in terms of its nuclear component, remains. The first two generations of Minuteman, however, do not. Having negotiated an end to the Cold War, Soviet and American leaders recognized a need to remember this crucial moment in global history. Minuteman Missile National Historic Site is one such piece of the past and place of memory, and in the next section we will explore this site's origins as a public space.



Plate 75. Berliners sing and dance a top The Berlin Wall, perhaps the most powerful symbol of the Cold War, on 10 November 1989 to celebrate the opening of East-West German borders *(AP/World Wide Photo)*



Plate 76. President George H.W. Bush (*left*) and Soviet President Mikhail Gorbachev (*right*) signing the START Treaty at the Kremlin in Moscow, 31 July 1991 *(Courtesy of the George Bush Presidential Library)*



Plate 77. Transporter Erector positioned to remove missile, Delta Flight *(Library of Congress, Prints & Photographs Division, HAER SD-50-C-7)*

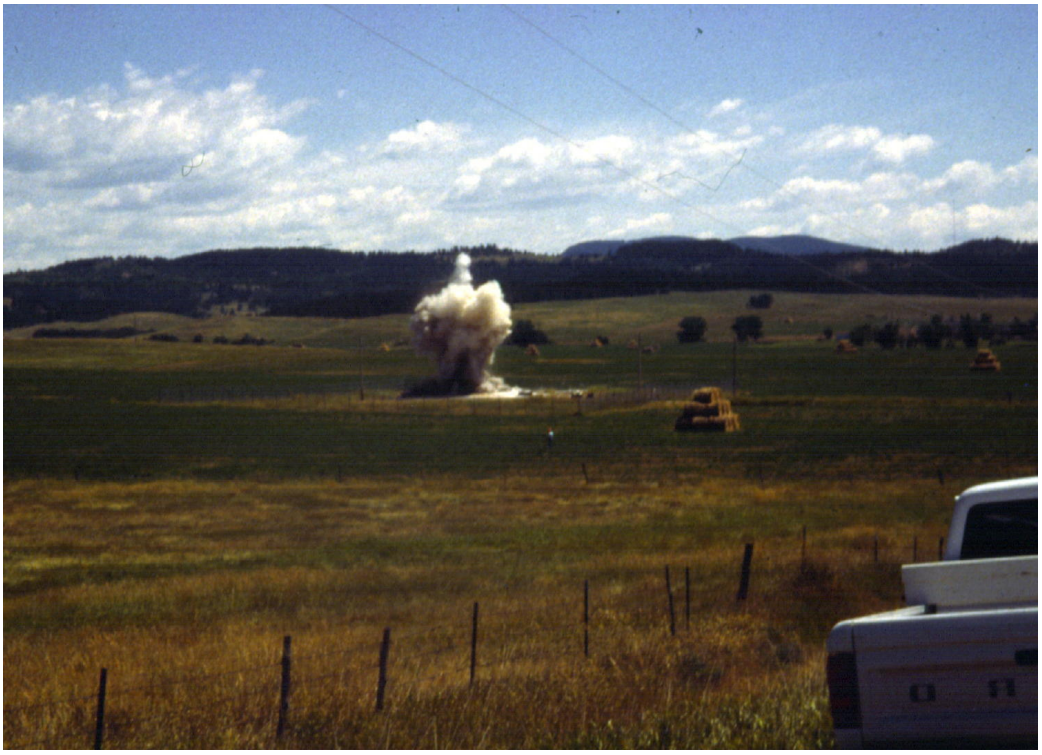


Plate 78. Missile silo implosion, South Dakota *(Courtesy of the 28th Civil Engineer Squadron, Ellsworth Air Force Base)*



Plate 79. Missile silo being filled after implosion, South Dakota *(Courtesy of the 28th Civil Engineer Squadron, Ellsworth Air Force Base)*



Plate 80. Launch Facility after completion of deactivation, South Dakota *(Courtesy of the 28th Civil Engineer Squadron, Ellsworth Air Force Base)*

Chapter 3: Minuteman Missile National Historic Site (1990–present)

Site Selection

In creating Minuteman Missile National Historic Site, the American government has transformed what was once a secret and well-guarded location into a public space. As a component of the National Park System, the site will be preserved for future generations to learn first hand of the Minuteman missile's role in the Cold War. This was the hope of Soviet and American leaders even at the end of their bitter bipolar standoff. The terms of the Treaty Between the United States of America and the Union of the Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms (START Treaty), allow both the United States and the Soviet Union to preserve examples of their Cold War armaments as static displays for public education purposes. The Minuteman II installations of the 44th Strategic Missile Wing (SMW) at Ellsworth Air Force Base drew the attention of the National Park Service (NPS) and the Air Force during the deactivation of Minuteman II ICBMs, since the Launch Facilities (LFs) and Launch Control Facilities (LCFs) in the 44th SMW displayed original technology developed for the early Minuteman I ICBM system. The LFs and LCFs of Ellsworth Air Force Base remain largely as originally constructed, and reflect the massive retaliation strategy that governed the first Minuteman I installations. For these reasons, the NPS focused on the South Dakota Minuteman LFs and LCFs when selecting an LF and an LCF for preservation.

In 1993 the NPS and the Air Force selected Delta-01 LCF and Delta-09 LF of the 44th SMW for preservation. Delta-01 and Delta-09 were chosen over other sites in South Dakota for the physical integrity of the LF and LCF and for their location near other historic sites, federal lands, and Interstate 90. Minuteman Missile National Historic Site is located within easy driving distance of Badlands National Park, Mount Rushmore National Memorial and the Black Hills National Forest. Buffalo Gap National Grassland is adjacent to the LCF and LF, providing a protected natural setting for the historic site.[445]

The NPS's Rocky Mountain Regional Office and the Air Force entered into a series of Interagency Agreements to coordinate the effort to convert Delta-01 and Delta-09 into static displays. The first such agreement, signed in 1993, committed the NPS to completing a Special Resource Study to determine formally that Delta-01 and Delta-09 were the best choice for preservation of a Minuteman II LCF and LF. This study considered the suitability and feasibility of developing Delta-01 and Delta-09 into a National Historic Site and investigated alternatives for managing the site. The study also considered the environmental and socioeconomic conditions in the area and what effect the new historic site might have on these variables.[446] Funding for the Special Resource Study came from the Department of Defense's "Legacy Resource Management Program," which awarded the NPS a $150,000 grant to study alternatives for preserving examples of America's Cold War history.[447] The NPS completed the Special Resource Study in 1995.

Delta-01 and Delta-09 Deactivation

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

Minuteman II missile at Delta-09, severed the Hardened Intersite Cable System (HICS), disconnected or removed other military communications equipment, and disconnected alarm systems used during the Cold War.[448] The technical order for Delta-01 required severing and removal of a one-foot section of the HICS to prevent any future restoration of communications between Delta-01 and Delta-09, overwriting of the Weapon System Controller/Digital Store and Processor, removing all classified information from the site, installation of non-functioning radio control panels, and the replacement of any missing face plates to cover exposed drawer openings. Diesel storage tanks were also removed. Mechanical equipment such as the electrical system, air filtering systems, and heating system remained intact and interior furnishings, including tables, sofas and chairs were retained.[449] The deactivation procedures checklist for Delta-01 was completed on 11 May 1993, however it is not known if this is the last day crews were on the site, or if they had left Delta-01 earlier. Delta-01 and Delta-09 continued in caretaker status until they were transferred to the NPS.[450] During the period of caretaker status, both NPS and Air Force personnel performed basic maintenance at Delta-01 and Delta-09, upgraded fire and security systems, and installed a viewing enclosure over the missile launcher at Delta-09.

After deactivation, the NPS and the Air Force continued to work together to assure that the proposed Minuteman Missile National Historic Site became a reality. Interagency Agreements between the two organizations continued to coordinate the activities related to the historic site development. In 1995 Historic American Engineering Record documentation for the two sites were prepared with funding from the U.S. Department of Defense Legacy Resource Management Program.[451] In 1996 the NPS and the Air Force developed a conversion plan to convert Delta-09 into a static display and the two agencies also finalized plans which included a viewing enclosure to allow future visitors the opportunity to see into the silo. Construction on the enclosure began in 2001.[452] Other activities included the Air Force's sponsorship of a draft National Historic Landmark nomination that was not submitted to NPS for designation.

Enabling Legislation

South Dakota Senators Tom Daschle and Tim Johnson introduced a bill to establish Minuteman Missile National Historic Site in 1998 and Congress began hearing testimony on the bill that same year. The bill failed in 1998 and was reintroduced the following year to the 106th Congress. Representatives from the NPS and the Air Force testified in favor of establishing the site. By 1999 both the House and Senate passed legislation creating Minuteman Missile National Historic Site and the federal budget for that year included $5 million to help preserve Delta-01 and Delta-09. The law describes the purpose of Minuteman Missile National Historic Site as:

> To preserve, protect, and interpret for the benefit and enjoyment of present and future generations the structures associated with the Minuteman II missile defense system;
>
> 1. to interpret the historical role of the Minuteman II missile defense system–
>
>   a. as a key component of America's strategic commitment to preserve world peace; and
>
>   b. in the broader context of the Cold War; and
>
> 2. to complement the interpretive programs relating to the Minuteman II missile defense system offered by the South Dakota Air and Space Museum at Ellsworth Air Force Base.

After the federal government officially endorsed the creation of the historic site, the NPS and the Air Force began preparations for the opening of the LF and LCF to the public. Once the legislation was passed, the specific plans to convert Delta-09 to a static display were formally presented to the START Compliance Review Group in Washington, D.C. for approval. Moreover, the new law gave the NPS funds to produce a general management plan for the site.[453] A general management plan attempts to establish a clear management philosophy and provide direction for interpretive themes, resource preservation, and visitor use.[454]

The NPS began work on the general management plan for the site in the spring of 2001 and hosted a series of public meetings to gather input from interested groups and individuals on their vision for the new historic site. The general management planning team included representatives from the Air Force, Forest Service, South Dakota Air & Space Museum, Badlands National Park, NPS Midwest Regional office, NPS Denver Service Center, and NPS Harper's Ferry Center.[455] The general management plan is expected to be available for public comment in the summer of 2004 and finalized in late 2004 or early 2005.

Development and Future of the Historic Site

While the NPS occupied itself with the general management plan for Minuteman Missile National Historic Site, the Air Force worked on the conversion of the Delta-09 LF to a static display to comply with the START Treaty. This conversion was necessary prior to the transfer of ownership to the NPS. The Air Force worked to acquire an unarmed training missile and refurbished and painted the missile prior to shipping it to Delta-09. Procuring the display missile proved no small task for the Air Force staff working on the site with the NPS. Intense competition for training missiles and/or static display missiles existed, as military museums also desired their own Minuteman II ICBMs for their exhibits. Additionally, many of the high level officers who once staffed the Air Force's six operational missile wings had moved on after their wings were deactivated. These colonels and generals had supported the establishment of a monument to the Cold War and their transfer or retirement reduced high-level support for the new historic site and made obtaining a deactivated Minuteman II ICBM more difficult.[456]

Once Air Force staff at Ellsworth had located the component parts of a training missile at Hill Air Force Base in Utah, technicians at Hill Air Force Base refurbished the object.[457] On 12 June 2001 the Air Force emplaced the missile in the Delta-09 silo using a Transporter Erector vehicle designed to emplace Minuteman Missiles. Missile crews from 90th Logistics Group at F.E. Warren Air Force Base in Wyoming, many of whom were based at Ellsworth during the Cold War, assisted in the installation of the training missile. Local media were invited to the emplacement, increasing the profile of Minuteman Missile National Historic Site.[458]

Construction of a viewing enclosure for the missile silo began shortly thereafter. The design of the enclosure represented a joint effort between the NPS and the Air Force and met START Treaty requirements and interpretive needs.[459] The enclosure allows viewing below grade with minimal visual impact to the site. To complete the viewing enclosure and platform, the Air Force opened the silo door one- foot past halfway and welded and grouted the door in place. Crews then placed a glass enclosure and stainless steel railing around the silo opening. Future visitors will be able to approach the silo and peer down at the Minuteman II display missile in the silo. By 15 August 2001 the viewing enclosure was largely completed.[460] After the installation of the static display missile and the completion of the viewing enclosure, a Soviet inspection team traveled to South Dakota on 21 May 2002 to verify that Delta-09 complied with the START Treaty's specifications for static displays.

The Air Force and the NPS conducted a formal transfer of ownership of Delta-01 and Delta-09 to the NPS after the work of converting Delta-01 and Delta-09 was complete. On 27 September 2002, exactly eleven years to the day from stand down, the Air Force officially turned Minuteman Missile National Historic Site over to the NPS at a ceremony at Delta-09. The festivities included a B-1 flyover, presentation of colors by the Ellsworth Air Force Base Honor Guard, a performance by the Rapid City Central High School Marching Band, speeches by Fran Mainella, Director of the NPS, and Lieutenant General Robert Hinson, Vice Commander Air Force Space Command. Craig Manson, Assistant Secretary for Fish and Wildlife and Parks, Department of the Interior and former missileer, spoke of his memories as an officer of the 44th SMW at Ellsworth. Colonel James Kowalski, Commander of the 28th Bomb Wing, then transferred the keys to Delta-01 and Delta-09 to William Supernaugh, Superintendent, Badlands National Park.[461]

As of 2003, minor modifications had occurred to Delta-01 and Delta-09 in preparation for their opening as Minuteman Missile National Historic Site. New security and fire detection/suppression systems were installed at Delta-01 and Delta-09. Delta-01 remained largely as it was when it was deactivated and care has been taken to keep as much of the original mechanical equipment and historic furnishings at the site. The NPS plans to open Minuteman Missile National Historic Site to the general public, following the completion of an interpretive visitor center, anticipated in 2006.

If not for the dedication of many individuals, both at the Air Force and the NPS, Minuteman Missile National Historic Site site would not have become a reality. For the Air Force and former missileers, the establishment of the historic site provides the opportunity for the public to view their contribution to winning the Cold War. Former missileer Craig Manson stated that the preservation of Delta-01 and Delta-09 "is a most fitting idea because, for this reason, the Cold War dominated the last half of the twentieth century, and some will not believe this or accept this, but most of American life, in one way or another, was defined by the Cold War."[462]



Plate 81. The training missile in the transporter erector prior to emplacement in the Delta-09 silo
(Photograph by Staff Sergeant Melissa Phillips, F.E. Warren Air Force Base, Wyoming, U.S. Air Force photo)



Plate 82. Convoy transporting training missile for emplacement at Delta-09 *(Photograph by Staff Sergeant Melissa Phillips, F.E. Warren Air Force Base, Wyoming, U.S. Air Force photo)*



Plate 83. Transporter Erector ready to emplace the training missile at Delta-09 *(Courtesy of the 28th Civil Engineer Squadron, Ellsworth Air Force Base)*



Plate 84. Training missile emplacing, Delta-09 silo *(Photograph by Staff Sergeant Melissa Phillips, F.E. Warren Air Force Base, Wyoming, U.S. Air Force photo)*



Plate 85. Training missile emplacement team *(Photograph by Staff Sergeant Melissa Phillips, F.E. Warren Air Force Base, Wyoming, U.S. Air Force photo)*

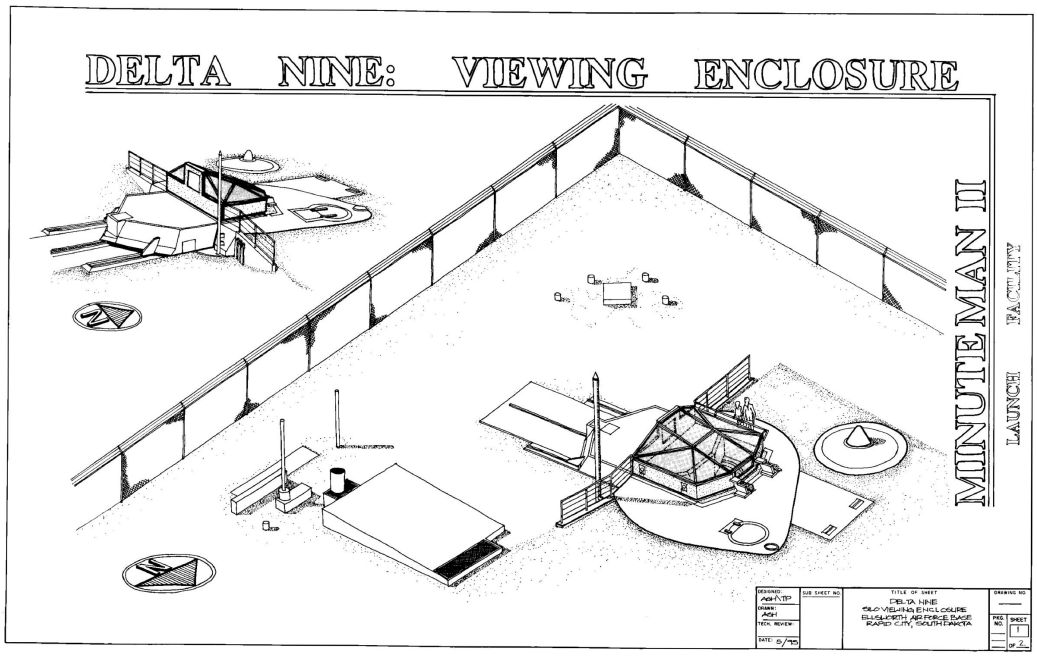


Plate 86. Line drawing of Delta-09 viewing enclosure
(Courtesy of the 28th Civil Engineer Squadron, Ellsworth Air Force Base)



Plate 87. Missile viewing enclosure, Delta-09 *(Photograph by Mead & Hunt)*



Plate 88. Ellsworth Air Force Base Honor Guard, Minuteman Missile National Historic Site dedication ceremony *(Courtesy of Public Affairs Office, Ellsworth Air Force Base)*



Plate 89. Lieutenant General Robert Hinson, Vice Commander, Air Force Space Command (right) and William R. Supernaugh, Superintendent, Badlands National Park (left) during the dedication ceremony *(Courtesy of Public Affairs Office, Ellsworth Air Force Base)*



Plate 90. Colonel James Kowalski, Commander, 28th Bomb Wing, Ellsworth Air Force Base and William R. Supernaugh, Superintendent, Badlands National Park conduct the official transfer of ownership for Delta-01 and Delta-09 *(Courtesy of Public Affairs Office, Ellsworth Air Force Base)*

Conclusion

Minuteman Missile National Historic Site in South Dakota, including Launch Control Facility (LCF) Delta-01 and Launch Facility (LF) Delta-09, will be preserved for future generations to learn about our past and reflect on our country's future. The site encompasses not only the history of the men and women of Ellsworth Air Force Base that maintained the missiles at a ready alert, but in a larger context the history of the Cold War which was a defining period in American history. The Cold War, as many historians have noted, affected every aspect of American life. Its history is vital to understand, especially as we enter a new century, and a new period of international relations. As historian Derek Leebaert has written, "Many of the attitudes and institutions that America is taking into the new century have their roots in an adventure that cost more and shaped more lives than any other in history. Today's world has been molded by the Cold War, as has the world of skill levels, technology, business, and finance. Debates about missile defense, energy, taxes, and terrorism all reflect the experiences of these decades just past."[463]

Isolated on the South Dakota Plains, the Minuteman I and later Minuteman II missiles stood at ready alert to deter Communist or Soviet aggression. They were on the front lines of the Cold War, a conflict with battle lines drawn shortly after World War II, continuing until the fall of the Berlin Wall in 1989, the signing of the Treaty Between the United States of American and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms (START Treaty) in 1991, and thereafter the crumbling of the Soviet Union. The Cold War ended with these events. It never escalated to a "hot war" involving direct combat between Soviet and American troops, the type of combat that, unlike the proxy wars fought by both sides throughout the Cold War, could easily have escalated into a devastating full-out nuclear conflict.

What must be understood in evaluating this period and the contribution of a program such as the Minuteman is that victory in the Cold War did not just happen. It was instead the product of dedication by military personnel and civilians alike, from analysts in Washington, to missile designers in California, and the cook at the LCF. Former employees at the missile sites are proud of how they served our country and have commented that they are anxious to "bring their grandchildren" to Minuteman Missile National Historic Site so they can show them where they once lived and worked in dedication to our country's freedom. Their work left a legacy for future generations, and the place they worked remains a legacy for us all. With the placement of the training missile in the silo, the 90th Logistics Group at F.E. Warren Air Force Base placed a plaque in the silo dedicated to the memory of the men and women who worked and maintained the missile system over nearly three decades. The plaque reads, "rest easy old friend your targets are covered."

Today, the Minuteman II missiles have left little impact on the physical landscape. The landscape has largely been returned to its pre-Cold War state. Following the signing of the START Treaty, the 150 former LF sites in South Dakota, with the exception of Delta-09, were dismantled and a simple chain-link fence surrounding the grassy landscape marks their former boundaries. Components of many of the fifteen LCFs remain.

Even without a thousand-odd missiles beneath the American plains, the images and the effect of the Cold War remain a part of our everyday life, culture, and history. The Berlin Wall stood for generations as a physical symbol of the Cold War, a symbol of a continent divided, and of a people restrained. Project Looking Glass, the Strategic Air Command's airborne command center, flew continuously in the skies from 1961 to 1990 on ready alert to take over command of the nuclear arsenal, if needed. Its very existence illuminated the constant terror of nuclear attack. Generations grew up in fear of Communism and the Soviet Union, and school children learned "duck and cover" techniques to hide under their desks in the

event of a nuclear attack. For their homes, the federal government published "how to" brochures on the construction of bomb shelters and some families built shelters and stored supplies in the hopes of surviving a nuclear attack.

East-West tensions were also a rallying cry, and sometimes a warning. In the later years of the Cold War, a nation cheered as the United States Olympic Hockey Team beat the Union of Soviet Socialist Republics at Lake Placid, New York during the 1980 Olympics. Their "miracle on ice" went beyond a sporting event, with sentiment against the Soviet Union rooted in the decades of the Cold War. Movies addressed the Cold War both through sarcasm, such as Stanley Kubrick's 1964 *Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb*, and through the portrayal of what life may be like after a nuclear attack, as in the 1983 television movie *The Day After*. All of these events and cultural icons have shaped our nation and our collective memory. They are who we are.

The Cold War is in the past, but it has a lasting effect on the present and future. It was a time in the life of our nation and the experience of many individuals that may be unmatched. Minuteman Missile National Historic Site offers the opportunity to reflect upon this significant period in our nation's history and to remember all of the aspects of the times. The opening of these sites to the public will facilitate a public dialogue on the Cold War, nuclear weapons proliferation and disarmament, the role and dedication of Air Force personnel, and the nation's political and military future.

The power and potential destruction of the missiles was and remains incomprehensible for most of us. It is important to remember this past, while simultaneously recognizing that the end of the Cold War did not bring about the wholesale destruction of nuclear arsenals. Minuteman III and subsequent generations of missiles remain throughout the nation's landscape. As a result, peace activists remain committed to the cause of nuclear disarmament, to them a symbol of social injustice as much as of potential destruction. As activist Jay Davis from Rapid City explained, "People ought to ask themselves what's a more important contribution from the Midwest to the world, to feed hungry children and raise their standard of living and start to deal with the problem of world population and all the economic and social issues that revolve around that, which one of our own famous political leaders is pushing? Or is it more important for us to spend our resources on nuclear weapons and on what we think is our national security? And I think that's a pretty stark choice."[464]

The stark choices presented by military programs such as the Minuteman I and II left their mark on the men and women who operated them as well. General George Lee Butler, Commander-in-Chief of the Strategic Air Command and subsequently Commander-in-Chief of the United States Strategic Command, reflected on his role as the head of the United States Air Force and United States Navy Strategic Nuclear forces from 1991 to 1994. For him, the life and death decisions required for the operation of the country's nuclear arsenal were real as perhaps for no other. Butler stated, "I lived for three years, every day of my life, with the requirement to answer a phone within three rings and be prepared to advise the president on how to retaliate with respect to the real or perceived threat of nuclear attack. I found it extremely sobering."[465] General Butler clearly knows first hand what nuclear weapons can do. Since his retirement from the Air Force he has become an advocate for the banning of these weapons.

No matter what personal opinions one has on the Cold War, nuclear weapons, and the actions of the United States and the Soviet Union, all must recognize that the Cold War's lasting social, economic, political, and cultural legacy is a significant part of the nation's history that needs to be understood. The optimism and security that the country felt with the end of the Cold War has been shattered somewhat by the events of 11 September 2001. The United States is now facing new challenges and conflicts within the world. This new adversity provides further proof of the necessity of understanding the work and the lessons of generations' past, as inspiration and guidance for the future. The Cold War is over. South

Dakota's role on the frontlines of this international conflict has ended as well, however efforts at Ellsworth Air Force Base continue currently battling our nation's current war on terrorism. With Minuteman Missile National Historic Site, the Plains might again assume their role in the service of the nation, this time as vessel for its memories.

Notes

[1] Michael Kort, *The Columbia Guide to the Cold War* (New York, N.Y.: Columbia University Press, 1998), 3.
[2] The history of The Cold War was compiled using the following sources: Kort, *Columbia Guide to the Cold War*; Walter LaFeber, *America, Russia, and the Cold War: 1945-1984*, Fifth ed. (New York, N.Y.: Newbery Award Records, Inc., 1985); Derek Leebaert, *The Fifty-Year Wound: The True Price of America's Cold War Victory*, 1st ed. (Boston, Mass.: Little, Brown & Company, 2002), Thomas J. McCormick, *America's Half-Century* (Baltimore, Md.: Johns Hopkins University Press, 1995); and Melvyn P. Leffler and David S. Painter, eds., *Origins of the Cold War: An International History* (New York, N.Y.: Routledge, 1994).
[3] Paul S. Boyer, *By the Bomb's Early Light* (Chapel Hill: University of North Carolina, 1994), 5.
[4] Eugene Emme, *The Impact of Air Power* (New York, N.Y.: Norstrand Company, Inc., 1959), 623-626.
[5] Kort, *The Columbia Guide to the Cold War*, 180; LaFeber, *America, Russia, and the Cold War: 1945-1984*, 14-15.
[6] Kort, *The Columbia Guide to the Cold War*, 160.
[7] Leebaert, *The Fifty-Year Wound: The True Price of America's Cold War Victory*, 25.
[8] Leebaert, *The Fifty-Year Wound: The True Price of America's Cold War Victory*, 23.
[9] LaFeber, *America, Russia, and the Cold War: 1945-1984*, 38.
[10] Kort, *The Columbia Guide to the Cold War*, 138.
[11] Kort, *The Columbia Guide to the Cold War*, 138.
[12] Leebaert, *The Fifty-Year Wound: The True Price of America's Cold War Victory*, 26; David Cannadine, ed., *Blood, Toil, Tears and Sweat: Winston Churchill's Famous Speeches* (London: Cassell Publishers Limited, 1990), 303-304.
[13] Leebaert, *The Fifty-Year Wound: The True Price of America's Cold War Victory*, 25.
[14] Jeffery A. Engel, "'Every Cent from America's Working Man': Fiscal Conservatism and the Politics of International Aid after World War II," *The New England Journal of History* 58, no. 1 (2001): 20.
[15] Engel, "'Every Cent from America's Working Man': Fiscal Conservatism and the Politics of International Aid after World War II," 22.
[16] For Truman Doctrine, see Melvyn Leffler, *A Preponderance of Power: National Security, The Truman Administration, and the Cold War* (Stanford, Calif.: Stanford University Press, 1992), 121-127.
[17] For Acheson, see Walter LaFeber, *The American Age: United States Foreign Policy at Home and Abroad Since 1750* (New York, N.Y.: W. W. Norton & Company, 1989), 477.
[18] Kort, *The Columbia Guide to the Cold War*, 151.
[19] For "Point Four," see David Baldwin, *Economic Development and American Foreign Policy, 1942-1962* (Chicago: University of Chicago Press, 1966).
[20] Kort, *The Columbia Guide to the Cold War*, 102, 157.
[21] H. W. Brands, "The Age of Vulnerability: Eisenhower and the National Insecurity State," *The American Historical Review* 94, no. 4 (October 1989): 965.
[22] Brands, "The Age of Vulnerability: Eisenhower and the National Insecurity State," 970.
[23] On classical liberalism, see Louis Hartz, *The Liberal Tradition in America* (New York, N.Y.: Harcourt, 1985). For republicanism, see for example, Bernard Bailyn, *Ideological Origins of the American Revolution* (Cambridge: Harvard University Press, 1992), and Daniel Rodgers, "Republicanism: The Career of a Concept," *The Journal of American History*, Vol. 79, No. 1. (Jun., 1992), 11-38.
[24] Brands, "The Age of Vulnerability: Eisenhower and the National Insecurity State," 966-967.
[25] Brands, "The Age of Vulnerability: Eisenhower and the National Insecurity State," 967.
[26] Brands, "The Age of Vulnerability: Eisenhower and the National Insecurity State," 968.

[27] Brands, "The Age of Vulnerability: Eisenhower and the National Insecurity State," 969.
[28] LaFeber, *The American Age: United States Foreign Policy at Home and Abroad Since 1750*, 522.
[29] LaFeber, *The American Age: United States Foreign Policy at Home and Abroad Since 1750,* 515.
[30] On Nixon and the Missile Gap, see Peter Roman, *Eisenhower and the Missile Gap* (Ithaca, N.Y.: Cornell University Press, 1995), 112-149; and Christopher Preble, ""The Political Economy of National Security in the Nuclear Age: John F. Kennedy and the Missile Gap" (Ph.D. diss., Temple University, 2002).
[31] Jacob Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960* (Washington, D.C.: Office of Air Force History, 1990), 239.
[32] G. Harry Stine, *ICBM: The Making of the Weapon that Changed the World* (New York, N.Y.: Orion Books, 1991), 147-149.
[33] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960,* 240-241.
[34] John C. Lonnquest and David F. Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program* (Washington, D.C.: Department of Defense, Legacy Resource Management Program, 1996), 29.
[35] M. J. and Mason R. A. Armitage, *Air Power in the Nuclear Age* (Chicago, Ill.: University of Illinois Press, 1983), 16.
[36] Ernest G. Schwiebert, *A History of the U.S. Air Force Ballistic Missiles* (New York, N.Y.: F.A. Praeger, 1965), 70, 78.
[37] "Big Week for Pushing Missile Buttons: U.S. Tries Hard to Catch Up," *LIFE* 43, no. 19 (4 November 1957): 31.
[38] See Lonnquest and Winkler, To Defend and Deter: The Legacy of the United States Cold War Missile Program, 30 and Bernard C. Nalty, ed. *Winged Shield, Winged Sword: A History of the United States Air Force*, vol. 2 (Washington, D.C.: Air Force History and Museums Program, 1997), 206 and U.S. Air Force organizational chart at the end of Section II, Chapter 2.
[39] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 31.
[40] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960,* 66-67.
[41] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960,* 151, 210.
[42] Charles Simpson, "Special History Issue - Land Based USAF Missiles," *AAFM Newsletter* 5, no. 1 (June 1997): 3.
[43] Stine, *ICBM: The Making of the Weapon that Changed the World,* 143-144, 152.
[44] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles,* 70.
[45] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles,* 60-61, 69.
[46] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 31.
[47] Luther L. Stenvick, *The Agile Giant: A History of the Minuteman Production Board* (Seattle, Wash.: Boeing Company, 1966), 19.
[48] Stenvick, *The Agile Giant: A History of the Minuteman Production Board,* 19.
[49] Stine, *ICBM: The Making of the Weapon that Changed the World,* 166; Stenvick, *The Agile Giant: A History of the Minuteman Production Board,* 19-20.
[50] Simpson, "Special History Issue - Land Based USAF Missiles," 3.
[51] Stine, *ICBM: The Making of the Weapon that Changed the World,* 169.
[52] Stenvick, *The Agile Giant: A History of the Minuteman Production Board,* 20.
[53] Lieutenant General Otto J. Glasser, interview by Lieutenant Colonel John J. Allen, typed transcript, 5 January 1984, 55.
[54] Stine, *ICBM: The Making of the Weapon that Changed the World,* 170.
[55] Stine, *ICBM: The Making of the Weapon that Changed the World,* 171.
[56] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles,* 90.
[57] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles,* 79-80.

[58] Roy Neal, *Ace in the Hole* (Garden City, N.Y.: Doubleday & Company, 1962), 64-65.
[59] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 70.
[60] Neal, *Ace in the Hole,* 27; Stine, *ICBM: The Making of the Weapon that Changed the World,* 230.
[61] Neal, *Ace in the Hole,* 27.
[62] Stine, *ICBM: The Making of the Weapon that Changed the World,* 230.
[63] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles,* 93.
[64] The Air Force canceled the Navaho cruise missile in 1957 in favor of developing a supersonic, air-breathing guided missile. For more information on the engineering of the Atlas, see Stine, *ICBM: The Making of the Weapon that Changed the World*, 191.
[65] Charles Simpson, "Atlas - Then and Now," *AAFM Newsletter* 7, no. 1 (March 1999): 7.
[66] Simpson, "Atlas - Then and Now," 7.
[67] "The ICBM Force in the Early 1960s," *AAFM Newsletter* 9, no. 4 (December 2001): 1.
[68] Unless otherwise noted, these statistics come from Simpson, "Special History Issue - Land Based USAF Missiles," 1, 7.
[69] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 211.
[70] Simpson, "Special History Issue - Land Based USAF Missiles," 4.
[71] Stine, *ICBM: The Making of the Weapon that Changed the World,* 227.
[72] "Vandenberg Launches Last Atlas E," *AAFM Newsletter* 3, no. 2 (April 1995): 1.
[73] Colonel Edward N. Hall, interview by Jack Neufeld, typed transcript, 11 July 1989, 8.
[74] Simpson, "Atlas - Then and Now," 1.
[75] Stine, *ICBM: The Making of the Weapon that Changed the World,* 229.
[76] Simpson, "Special History Issue - Land Based USAF Missiles," 1; Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960,* 194, 239; Stine, *ICBM: The Making of the Weapon that Changed the World,* 230.
[77] William Leavitt, "Minuteman: Ten Years of Solid Performance," *Air Force Magazine* 54, no. 3 (March 1971): 24.
[78] Roman, *Eisenhower and the Missile Gap*, 30-63. For Symington, see Roman, *Eisenhower and the Missile Gap*, 37.
[79] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960*, 229. Roman, *Eisenhower and the Missile Gap*, 192. For Eisenhower, see Roman, *Eisenhower and the Missile Gap*, 186.
[80] Malmstrom Air Force Base's Alfa Flight was brought to alert status in conjunction with the origins of the Cuban Missile Crisis. Reportedly President Kennedy referred to Malmstrom's Alfa Flight as America's "First Ace in the Hole." The squadron used this as their motto. "10th Missile Squadron," http://www.globalsecurity.org/wmd/agency/10ms.htm (6 October 2003).
[81] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960,* 186; Neal, *Ace in the Hole*, 28.
[82] Neal, *Ace in the Hole,* 77.
[83] General Bernard A. Schriever, interview by Major Lyn R. Officer and Dr. James C. Hasdorff, typed transcript, 20 June 1973, 8.
[84] Neal, *Ace in the Hole,* 82-88.
[85] Glasser, interview, 67; Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960, 227*; Leavitt, "Minuteman: Ten Years of Solid Performance," 26; Ogden Air Logistics Center, "Minuteman Weapon System History and Description," (Hill Air Force Base, Utah, 1990), 26.
[86] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960,* 227; Neal, *Ace in the Hole,* 78.
[87] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960,* 227.
[88] Neal, *Ace in the Hole,* 95-96.

[89] Neal, *Ace in the Hole,* 297; Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960,* 228-229.
[90] Neal, *Ace in the Hole,* 97.
[91] Neal, *Ace in the Hole,* 97.
[92] Neal, *Ace in the Hole,* 103.
[93] Leavitt, "Minuteman: Ten Years of Solid Performance," 26.
[94] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 26.
[95] Stine, *ICBM: The Making of the Weapon that Changed the World*, 239.
[96] "Closing the Gap," *TIME* (10 February 1961), 16.
[97] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960,* 186.
[98] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 26.
[99] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 36.
[100] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 250.
[101] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 25.
[102] For the evolution of American military strategy from Truman through Kennedy, David Alan Rosenberg, "The Origins of Overkill: Nuclear Weapons and American Strategy, 1945-1960, *International Security*, 7, no. 4 (Spring, 1983), 3-71. For "controlled response" and "flexible response," see Andrew Butfoy, "The Marginalisation of Nuclear Weapons in World Politics? The Case of Flexible Response," *Australian Journal of Political Science* 28, no. 2 (1993): 271-289; and Francis J. Gavin, "The Myth of Flexible Response, United States Strategy in Europe During the 1960s," *International History Review* 23, no. 4 (2001): 847-875.
[103] Stenvick, *The Agile Giant: A History of the Minuteman Production Board*, 48.
[104] William, "Minuteman: Ten Years of Solid Performance," 25.
[105] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 18-19.
[106] Stine, *ICBM: The Making of the Weapon that Changed the World,* 239.
[107] Stenvick, *The Agile Giant: A History of the Minuteman Production Board,* 32-33.
[108] Stenvick, *The Agile Giant: A History of the Minuteman Production Board,* 32-33.
[109] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles*, 246-247; Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 77.
[110] Leavitt, "Minuteman: Ten Years of Solid Performance," 25.
[111] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 77.
[112] For more detailed treatment of the Churchill-Truman understanding of this issue, see Alan P. Dobson, "Informally Special? The Churchill-Truman Talks of January 1952 and the State of Anglo-American Relations," *Review of International Studies* (vol. 23) 27-47.
[113] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 78.
[114] Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960,* 201.
[115] Neal, *Ace in the Hole,* 169.
[116] Schwiebert, *A History of the U.S. Air Force Ballistic Missiles,* 139.
[117] "The Federal Engineer - Damsites to Missile Sites: A History of the Omaha District, U.S. Army Corps of Engineers," (Omaha, Nebr.: U.S. Army Corps of Engineers, 1985), 193.
[118] "The Federal Engineer - Damsites to Missile Sites: A History of the Omaha District, U.S. Army Corps of Engineers," 193.
[119] "The Federal Engineer - Damsites to Missile Sites: A History of the Omaha District, U.S. Army Corps of Engineers," 193.
[120] Stine, *ICBM: The Making of the Weapon that Changed the World,* 240.

[121] "The Federal Engineer - Damsites to Missile Sites: A History of the Omaha District, U.S. Army Corps of Engineers," 194.
[122] James Atwater, "How the Modern Minuteman Guards the Peace," *The Saturday Evening Post* (9 February 1963).
[123] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 24, 26, 33.
[124] Some Minuteman II missiles may have been upgraded to Mark 12 reentry body. Stine, *ICBM: The Making of the Weapon that Changed the World*, 240; Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 31.
[125] Stine, *ICBM: The Making of the Weapon that Changed the World*, 240; Leavitt, "Minuteman: Ten Years of Solid Performance," 25.
[126] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 26, 33; Leavitt, William, "Minuteman: Ten Years of Solid Performance," 25.
[127] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 26.
[128] Irving Stone, "Minuteman: The Best is Yet to Be," *Air Force Magazine* 54, no. 3 (March 1971): 29-30.
[129] Stine, *ICBM: The Making of the Weapon that Changed the World*, 240.
[130] Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 26; Stone, "Minuteman: The Best is Yet to Be," 29.
[131] Edgar Ulsamer, "Minuteman: First Among Equals," *Air Force Magazine* 54, no. 3 (March 1971): 35.
[132] Stone, "Minuteman: The Best is Yet to Be," 30; Ogden Air Logistics Center, "Minuteman Weapon System History and Description," 21.
[133] Edward Patrick Hogan and Erin Hogan Fouberg, *The Geography of South Dakota* (Sioux Falls, S.Dak.: The Center for Western Studies, 1998), 11.
[134] National Park Service, "Badlands National Park Information," n.d., <http//www.badlands.national-park.com/info.htm> (15 May 2003).
[135] Barbara Lass, "South Dakota Prehistory," in *The Future of South Dakota's Past*, ed. Larry J. and Lucille C. Stewart Zimmerman (Vermillion, S.Dak.: University of South Dakota Archaeology Laboratory, 1981), 11.
[136] Lass, "South Dakota Prehistory," 12; "Historic Sites of South Dakota: A Guidebook," ([Vermillion, S.Dak.]: Business Research Bureau - University of South Dakota and The Historical Preservation Center, 1980), 6-8.
[137] "Historic Sites of South Dakota: A Guidebook," 95-96; "Eastern Pennington County Memories" (Wall, S.Dak.: The American Legion Auxiliary, Carrol McDonald Unit, n.d.), 7; Paula Giese, *South Dakota Indian Tribes*, 22 March 1997, <http//www.kstrom.net/isk/maps/dakotas/sd.html> (23 May 2003), 1.
[138] Jay Davis, interview by Mead & Hunt, typed transcript, 6 February 2003, 8-9.
[139] Herbert S. Schell, "Early Explorations to Missile Age; A History of South Dakota," *Rapid City Daily Journal*, 2 March 1961, sec. 4, Centennial Edition; Herbert S. Schell, *History of South Dakota* (Lincoln, Nebr.: University of Nebraska Press, 1961).
[140] Schell, "Early Explorations to Missile Age; A History of South Dakota."
[141] Schell, "Early Explorations to Missile Age; A History of South Dakota."
[142] Allyson Brooks and Steph Jacon, *Homesteading and Agricultural Development Context*, ed. Michael Bedeau, (Vermillion, S.Dak.: South Dakota State Historical Preservation Center, 1994), 9.
[143] Schell, "Early Explorations to Missile Age; A History of South Dakota;" Schell, *History of South Dakota*.
[144] Brooks and Jacon, "Homesteading and Agricultural Development Context," 9.
[145] Brooks and Jacon, "Homesteading and Agricultural Development Context," 9; Schell, "Early Explorations to Missile Age; A History of South Dakota."
[146] Schell, "Early Explorations to Missile Age; A History of South Dakota."
[147] "Eastern Pennington County Memories," 7.
[148] Schell, "Early Explorations to Missile Age; A History of South Dakota."
[149] Schell, "Early Explorations to Missile Age; A History of South Dakota."

[150] Brooks and Jacon, *Homesteading and Agricultural Development Context*, 9.
[151] Brooks and Jacon, *Homesteading and Agricultural Development Context*, 9.
[152] Brooks and Jacon, *Homesteading and Agricultural Development Context*, 22-23.
[153] Bob Karolevitz and Bernie Hunhoff, *Uniquely South Dakota* (Norfolk, Va.: Donning Company, 1988), 120; "Eastern Pennington County Memories," 7.
[154] "Eastern Pennington County Memories," 9.
[155] Brooks and Jacon, *Homesteading and Agricultural Development Context*, 20.
[156] Brooks and Jacon, *Homesteading and Agricultural Development Context*, 21.
[157] Brooks and Jacon, *Homesteading and Agricultural Development Context*, 21.
[158] Brooks and Jacon, *Homesteading and Agricultural Development Context*, 24.
[159] Brooks and Jacon, *Homesteading and Agricultural Development Context*, 24.
[160] Brooks and Jacon, *Homesteading and Agricultural Development Context*, 25.
[161] Brooks and Jacon, *Homesteading and Agricultural Development Context,* 27.
[162] Ted H. Hustead, interview by Mead & Hunt, typed transcript, 7 January 2003, 2.
[163] Brooks and Jacon, *Homesteading and Agricultural Development Context*, 10.
[164] Brooks and Jacon, *Homesteading and Agricultural Development Context*, 11.
[165] Brooks and Jacon, *Homesteading and Agricultural Development Context*, 29.
[166] "Air Force History Overview," *Air Force Link,* 9 May 2003, <http://www.af.mil/history/overview.shtml> (13 May 2003).
[167] Bernard C. Nalty, ed., *Winged Shield, Winged Sword: A History of the United States Air Force*, vol. I (Washington, D.C.: Air Force History and Museums Program, 1997), 371.
[168] Nalty, *Winged Shield, Winged Sword: A History of the United States Air Force*, 372.
[169] Frederick J. Shaw, Jr. and Timothy Warnock, *The Cold War and Beyond: Chronology of the United States Air Force, 1947-1997*, Air Force Fiftieth Anniversary Commemorative Edition (Washington, D.C.: Air Force History and Museums Program in association with Air University Press, 1997), 2.
[170] "Strategic Air Command Missile Chronology" (Omaha, Nebr.: Office of the Historian, Strategic Air Command, 2 September 1975).
[171] The Peacekeeper missiles are recommended for deactivation by the end of 2003 and the missiles of F.E. Warren Air Force Base are currently being deactivated.
[172] Daniel Hoisington, "Headquarters, Strategic Air Command," Historic American Building Record Draft Report (HAPS NO. NE-9-M, N, O) (Washington, D.C.: United States Department of the Interior, National Park Service, May 2001), 9.
[173] Hoisington, "Headquarters, Strategic Air Command," 9, 11.
[174] "Strategic Air Command," *Global Security,* 2 December 2001, <http://www.globalsecurity.org/ wmd/agency/ sac.htm> (13 May 2003).
[175] "Strategic Air Command."
[176] "Strategic Air Command Missile Chronology."
[177] "Strategic Air Command."
[178] "Strategic Air Command Missile Chronology."
[179] 44th Missile Wing Commemorative Committee, *Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994* (Rapid City, S.Dak.: Grelind Printing, 1993), 38.
[180] Captain I. P. Owens, "In Search of Excellence," *Combat Crew* 24, no. 4 (April 1974): 16; "Strategic Air Command Missile Chronology."
[181] 44th Missile Wing Commemorative Committee, *Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994,* 33.
[182] Lawrence H. Suid, *Guts and Glory: The Making of the American Military Image in Film* (Lexington: University Press of Kentucky, 2002).
[183] "Ellsworth AFB History," *Ellsworth Air Force Base,* 1 October 2002, <http://www.ellsworth.af.mil/ history. html> (28 October 2002).

[184] "Ellsworth AFB History."
[185] "Ellsworth AFB History;" Lieutenant General Thomas S. Moorman, Jr., "44th Missile Wing Inactivation" (paper presented at the 44th Missile Wing Deactivation Ceremony and Dinner, 3 July 1994), 3.
[186] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 415.
[187] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 415; Moorman, Jr., "44th Missile Wing Inactivation," 3.
[188] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 415.
[189] "Ellsworth AFB History," <http://www.ellsworth.af.mil/history.html>.
[190] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 416.
[191] 44th Missile Wing Commemorative Committee, *Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994,* 2-6; George A. Rosenbaum, "Brief History of the 44th Strategic Missile Wing," (N.p., n.d.), 2.
[192] 44th Missile Wing Commemorative Committee, *Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994,* 2.
[193] 44th Missile Wing Commemorative Committee, *Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994,* 101, 105, 109.
[194] 44th Missile Wing Commemorative Committee, *Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994,* 101.
[195] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 243.
[196] 44th Missile Wing Commemorative Committee, *Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994,* 34.
[197] 44th Missile Wing Commemorative Committee, *Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994,* 101.
[198] Rosenbaum, "Brief History of the 44th Strategic Missile Wing," 3.
[199] Rosenbaum, "Brief History of the 44th Strategic Missile Wing," 3; Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 415.
[200] 44th Missile Wing Commemorative Committee, *Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994,* 114; Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 415; Moorman, Jr., "44th Missile Wing Inactivation," 5.
[201] Rosenbaum, "Brief History of the 44th Strategic Missile Wing," 4-5.
[202] Timothy J. Pavek, "Minuteman II: The End of an Era" (February 1997), 2.
[203] Major Joe Mecadon, "44th Missile Wing Era Ends at Ellsworth," *Plainsman*, 8 July 1994.
[204] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 78.
[205] "Sites May be Small, But... Minuteman Rates Among Corps' Biggest Jobs," *Rapid City Daily Journal*, 6 April 1961.
[206] "Minuteman Launchers are Turned Over to Air Force," *Rapid City Daily Journal*, 2 November 1962.
[207] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 78.
[208] "Facts About Minuteman Land Acquisition" (Omaha, Nebr.: U.S. Army Engineer District, 1961), 8.
[209] "Landowners Told: Missiles Can't Wait," *Rapid City Daily Journal*, 5 April 1961.
[210] Paul Jensen, ed., "History by Date of the Minuteman Launch Facility, Bravo-09, From the Files of Leonel and Paul Jensen" (1992), 2.
[211] "Sites May be Small, But... Minuteman Rates Among Corps' Biggest Jobs."

[212] "Facts About Minuteman Land Acquisition," 8-9.
[213] "Facts About Minuteman Land Acquisition," 9-10.
[214] "Facts About Minuteman Land Acquisition," 10.
[215] "Sites May be Small, But... Minuteman Rates Among Corps' Biggest Jobs"; "The Mighty Minuteman!," *Kieways* (September-October 1962), 6.
[216] "Facts About Minuteman Land Acquisition," 11.
[217] Jensen, "History by Date of the Minuteman Launch Facility, Bravo-09, From the Files of Leonel and Paul Jensen," 2.
[218] Jensen, "History by Date of the Minuteman Launch Facility, Bravo-09, From the Files of Leonel and Paul Jensen," 2.
[219] "Land Owners Talk Missile Site Values," *Rapid City Daily Journal*, 23 March 1961.
[220] Jensen, "History by Date of the Minuteman Launch Facility, Bravo-09, From the Files of Leonel and Paul Jensen," 2.
[221] "Landowners Told: Missiles Can't Wait."
[222] Gene S. Williams, interview by Mead & Hunt, Inc., typed transcript, 7 January 2003, 3.
[223] Jensen, "History by Date of the Minuteman Launch Facility, Bravo-09, From the Files of Leonel and Paul Jensen," 2.
[224] "Land Owners Talk Missile Site Values."
[225] Jensen, "History by Date of the Minuteman Launch Facility, Bravo-09, From the Files of Leonel and Paul Jensen," 2.
[226] "Corps of Engineers Says... 75 Per Cent Sign for Minuteman Entry," *Rapid City Daily Journal*, 3 July 1961.
[227] "Minuteman Landowners Explain Refusal Cases," *Rapid City Daily Journal*, 5 July 1961.
[228] Further research is needed to identify if any of these cases were brought to trial and their outcome.
[229] Jensen, "History by Date of the Minuteman Launch Facility, Bravo-09, From the Files of Leonel and Paul Jensen," 4.
[230] "Facts About Minuteman Land Acquisition," 6.
[231] "Land Owners Talk Missile Site Values."
[232] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 80-81.
[233] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 81.
[234] "The Mighty Minuteman!," 7.
[235] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 81.
[236] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 81.
[237] "Special Resource Study for the Minuteman Missile Sites: Management Alternatives and Environmental Assessment," (Washington, D.C.: Department of the Interior, Department of Defense, and the U.S. Air Force Legacy Resource Management Program, 1995), 34.
[238] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 414-415.
[239] "First Minuteman Site Ground to be Broken in Ceremony Monday," *Black Hills Bomber*, 8 September 1961.
[240] Hollis J. Limprecht, *The Kiewit Story: Remarkable Man, Remarkable Company* (Omaha, Nebr.: The Omaha World-Herald Company, 1981), 120.
[241] "The Mighty Minuteman!," 4-5; Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 84.

[242] *Peter Kiewit Sons' Company v. Summit Construction and General Insurance Company of America*, 422 F.2d 242, United States Court of Appeals for the Eighth Circuit (26 November 1969).
[243] "The Mighty Minuteman!," 6.
[244] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 83-84.
[245] "Work Stoppages - All Missile Sites - June 1, 1963 - June 1, 1964," Missile Sites Labor Commission, RG280, Box 22, [1964].
[246] "Establishing a Program for Resolving Labor Disputes at Missile and Space Sites, Executive Order 10946, 26 May 1961," n.d. <http://wwwllib.umich.edu/govdocs/jfkeo/eo/10945.htm> (9 May 2003).
[247] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 415.
[248] "Minot AFB," *Global Security.org,* 13 January 2003, <http://www.globalsecurity.org/wmd/facility/minot.htm> (20 June 2003); "Malmstrom AFB: Great Falls International Airport," *Global Security.org,* 13 January 2003, <http://www.globalsecurity.org/wmd/facility/malmstrom.htm> (20 June 2003).
[249] Thomas Wilson, interview by Mead & Hunt, Inc., typed transcript, 3 February 2003, 12; "National Safety Council Honors PKS Districts," *Kieways* (May-June 1963), 17.
[250] Modifications to Delta-09 in 1962 and 1963 raised the cost of the LF to approximately $446,000. "Transfer of Construction," Launch Facility D-1. 29 November 1962. Located in "Supporting Files for Delta-01" in Real Estate Office of 28th Civil Engineer Squadron/CERR, Ellsworth Air Force Base, S.Dak.; "Transfer of Construction," Launch Facility D-9. 26 November 1962. Located in "Supporting Files for Delta-09" in Real Estate Office of 28th Civil Engineer Squadron/CERR, Ellsworth Air Force Base, S.Dak.
[251] "The Briefing," *Boeing Magazine* 28, no. 8 (November 1958); William J. Coughlin, "AF May Do Final Minuteman Assembly," *Missiles and Rockets* (6 June 1960): 39-40.
[252] National Park Service, "Minuteman Missile National Historic Site, General Management Plan Newsletter" (U.S. Department of the Interior, National Park Service, Spring 2001), 8.
[253] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 415.
[254] "USAF Minuteman Flight Activated at Ellsworth AFB," *Autonetics Skywriter* 23, no. 28 (July 1963).
[255] Pavek, "Minuteman II: The End of an Era," 5.
[256] Judge Craig Manson, interview by Sue Lamie, typed transcript, 27 June 2002, 15.
[257] "For West River…Minuteman Promises Economic Lift," *Rapid City Daily Journal,* 17 January 1961.
[258] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 415.
[259] 44th Missile Wing Commemorative Committee, *Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994,* 9.
[260] Gene S. Williams, interview by Mead & Hunt, Inc., typed transcript, 7 January 2003, 5.
[261] Wilson, interview, 2.
[262] Davis, interview, 4-5.
[263] Hustead, interview, 6.
[264] "Boeing's Intentions Not Known," *Rapid City Daily Journal*, 29 May 1961.
[265] Hustead, interview., 4-5.
[266] David Burris, interview by Steven Bucklin, typed transcript, 20 May 1999, 5.
[267] Hustead, interview., 4-5.
[268] *Welcome to Ellsworth AFB: The Largest Operational Base in the Strategic Air Command* (n.p.: Marcoa Publishing, n.d.), 11.
[269] "Missile Road Program Nears Completion Date," *Rapid City Daily Journal*, 28 June 1961.
[270] "Efforts to Recover Damage to County's Roads Run into Delay," *Rapid City Daily Journal*, 27 August 1962.

[271] "When Project Starts... Minuteman Will Affect Region's Schools, Power Transportation," *Rapid City Daily Journal*, 19 January 1961.
[272] Alan L. Gropman, *The Air Force Integrates, 1945-1964* (Washington, D.C.: Smithsonian Institution Press, c.1998), 4, 117-18.
[273] Gropman, *The Air Force Integrates, 1945-1964*, 140.
[274] Ken Bush, interview by Steven Bucklin, typed transcript, 17 May 1999, 9.
[275] Robert Wilson, interview by Steven Bucklin, 18-19.
[276] Williams, interview, 5.
[277] Tim Pavek, interview by Steven Bucklin, typed transcript, 20 May 1999, 4.
[278] Pavek, interview, 13.
[279] Williams, interview, 6.
[280] For Macmillan and development of Britain's nuclear deterrent, see David Nunnerley, *President Kennedy and Britain* (New York, N.Y.: St. Martin's Press, 1972), 117. For JFK, see Gordon H. Chang, "JFK, China, and the Bomb," *The Journal of American History*, 74, no. 4 (March 1988), 1287-1310.
[281] For the broad context of triangular diplomacy, see McCormick, *America's Half-Century,* 155-195.
[282] For a brief discussion of Cold War diplomacy from 1979-1991, including information for the succeeding paragraphs, see LaFeber, *America, Russia, and the Cold War*, 284-335. See also Leebaert, *The Fifty-Year Wound*, 444-637.
[283] LaFeber, *America, Russia, and the Cold War*, 284-335. See also Leebaert, *The Fifty-Year Wound*, 444-637.
[284] For Soviet collapse, see Jack F. Matlock, *Autopsy on an Empire* (New York, N.Y.: Random House, 1995).
[285] For an early critique of universalist predictions after the Cold War, see John J. Mearsheimer, "Back to the Future: Instability in Europe after the Cold War," *International Security* 15, no. 1 (Summer 1990), 191-199. For "End of History" thesis, see Francis J. Fukuyama, *The End of History and the Last Man* (New York, N.Y.: Harper Collins, 1993).
[286] The description of Delta-01 and Delta-09 is adapted from Jeffrey A. Hess and John F. Lauber, "Minuteman II ICBM Launch Control Facility D-1 and Launch Facility D-9, Ellsworth Air Force Base Draft National Historic Landmark Nomination," Prepared for the U.S. Air Force, 1996, conversations with Tim Pavek, 28th Civil Engineer Squadron, Ellsworth Air Force Base, and construction documents from the 28th Civil Engineer Squadron, Real Estate Office, Ellsworth Air Force Base.
[287] Hess and Lauber, "Minuteman II ICBM Launch Control Facility D-1 and Launch Facility D-9, Ellsworth Air Force Base Draft National Historic Landmark Nomination." The draft National Historic Landmark Nomination cites the replacement of the siding in 1976, while project drawings date to 1983. Architectural drawings on file at the 28th Civil Engineering Squadron, Ellsworth Air Force Base, S.Dak., office of Tim Pavek, Environmental Engineer.
[288] The illustration on the blast door was painted in 1991 by Tony Gatlin. See "Ellsworth Air Force Base, 44th Strategic Missile Wing, Blast Door Art," On file at the 28th Civil Engineering Squadron, Ellsworth Air Force Base, S.Dak., office of Tim Pavek, Environmental Engineer. This humorous artistic rendering is a play off of a contemporary popular advertisement for the Domino's Pizza home-delivery restaurant chain.
[289] Richard B. Stolley, "How It Feels to Hold the Nuclear Trigger," *LIFE* 57 (6 November 1964): 38.
[290] Stolley, "How It Feels to Hold the Nuclear Trigger," 38.
[291] Hess and Lauber, "Minuteman II ICBM Launch Control Facility D-1 and Launch Facility D-9, Ellsworth Air Force Base Draft National Historic Landmark Nomination."
[292] "Chronology of the 44th Strategic Missile Wing, 1976," on file at the 44th Missile Wing History Office, Ellsworth Air Force Base, S.Dak. The 44th Strategic Missile Wing was inactivated in 1994, records from the 44th Missile Wing History Office have been sent to the Air Force Historical Research Agency at Maxwell Air Force Base, Montgomery, Ala.

[293] The satellite dish may have been installed in the late 1980s or early 1990s. Hess and Lauber, "Minuteman II ICBM Launch Control Facility D-1 and Launch Facility D-9, Ellsworth Air Force Base Draft National Historic Landmark Nomination."
[294] "Transfer of Construction," Launch Facility D-1.
[295] For a concise explanation of the autocollimator system, see C.M. Plattner, "First SAC Crews Controlling Minuteman," *Aviation Week and Space Technology*, 78 (7 January 1963): 62-63; and Rolf Winterfelt, "Minuteman System is 'Most Reliable,' " *Missiles and Rockets*, 8 (27 February 1961): 39, 53.
[296] Stolley, "How It Feels to Hold the Nuclear Trigger," 38. The IMPSS system is described in Aida E. Roig-Coepton, "1991 Annual Brief History, 44th Missile Wing," 2, on file at the 44th Missile Wing History Office, 44th Strategic Missile Wing, Ellsworth Air Force Base, S.Dak. The 44th Strategic Missile Wing was inactivated in 1994, records from the 44th Missile Wing History Office have been sent to the Air Force Historical Research Agency at Maxwell Air Force Base, Montgomery, Ala.
[297] The changes that would be required to convert the facilities from Minuteman I to Minuteman II are outlined in "What's 'Force Mod?,' " *Minuteman Service News*, 23 (November-December 1965): 11. In addition to the changes listed here, this article, written before the conversion began, also noted that large water tanks would be buried underground at all fifteen of Ellsworth's Launch Control Facilities to help cool the environmental control systems. According to Ellsworth missile engineer Tim Pavek, however, the tanks were never installed. Tim Pavek, Conversation with Hess Roise, Inc., 29 October 1996.
[298] Burris, interview, 5.
[299] Martin Pietz, interview by Steven Bucklin, typed transcript, 18 May 1999, 6.
[300] Pietz, interview, 4.
[301] David Blackhurst, interview by Steven Bucklin, typed transcript, 19 May 1999, 5.
[302] Manson, interview, 6.
[303] Lieutenant Charles Stricklin, "Minuteman's House Mouse," *Airman* 18, no. 4 (April 1974): 34.
[304] Second Lieutenant Robert L. Smolen, "Trapped in the LCF," *Combat Crew* 25, no. 8 (August 1975): 21; Stricklin, "Minuteman's House Mouse," 34-35.
[305] Major John F. Paolucci, "Making Minuteman Missile Combat Crew Duty a Challenge: A Radical View," (Research study, Air Command and Staff College, 1977), 11.
[306] Stricklin, "Minuteman's House Mouse," 33.
[307] Stricklin, "Minuteman's House Mouse," 35.
[308] Burris, interview, 12.
[309] Stricklin, "Minuteman's House Mouse," 32.
[310] Stricklin, "Minuteman's House Mouse," 33.
[311] Burris, interview, 10.
[312] Burris, interview, 4.
[313] Paolucci, "Making Minuteman Missile Combat Crew Duty a Challenge: A Radical View," 11-12.
[314] Bush, interview, 11.
[315] Paolucci, "Making Minuteman Missile Combat Crew Duty a Challenge: A Radical View," 11-12.
[316] Bush, interview, 11.
[317] Paolucci, "Making Minuteman Missile Combat Crew Duty a Challenge: A Radical View," 12.
[318] Stolley, "How It Feels to Hold the Nuclear Trigger," 38.
[319] Williams, interview, 8.
[320] Williams, interview, 6-7.
[321] Pietz, interview, 20.
[322] Bush, interview, 3.
[323] Stricklin, "Minuteman's House Mouse," 35.
[324] Paolucci, "Making Minuteman Missile Combat Crew Duty a Challenge: A Radical View," 12-13.
[325] Bush, interview, 12.
[326] Burris, interview, 5.

[327] Burris, interview, 8.
[328] Donald R. Forbes, "Minuteman Missile Maintenance and Enlisted Career Progression Problems" (master's thesis, Air University, 1983), 19.
[329] Forbes, "Minuteman Missile Maintenance and Enlisted Career Progression Problems," 26-27.
[330] Forbes, "Minuteman Missile Maintenance and Enlisted Career Progression Problems," 28.
[331] Forbes, "Minuteman Missile Maintenance and Enlisted Career Progression Problems," 29.
[332] "History of the 44th Strategic Missile Wing," 1 April through 30 April 1963, 16. In U.S. Air Force Collection, AFHRA, K-WG-44-HI, IRIS No. 4505II.
[333] Pietz, interview by Steven Bucklin, 12.
[334] Forbes, "Minuteman Missile Maintenance and Enlisted Career Progression Problems," 29-30.
[335] "Quarterly History of the 44th Strategic Missile Wing, 44th Combat Support Group," April – June 1978, exhibit 22. In U.S. Air Force Collection, AFHRA, K-WG-44-HI, IRIS No. 1028310.
[336] Forbes, "Minuteman Missile Maintenance and Enlisted Career Progression Problems," 29-30.
[337] Smolen, "Trapped in the LCF," 19-21.
[338] Information provided by Tim Pavek, Environmental Engineer, Ellsworth Air Force Base, S. Dak.
[339] Atwater, "How the Modern Minuteman Guards the Peace."
[340] "Minuteman in the Making," *Air Force Times* 25, no. 21 (January 1965): 5.
[341] Manson, interview, 1-3.
[342] Paolucci, "Making Minuteman Missile Combat Crew Duty a Challenge: A Radical View," 12.
[343] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 100.
[344] Manson, interview, 3.
[345] Wendy McNiel, interview by Mead & Hunt, Inc., typed transcript, 3 February 2003, 4; "SAC's Mixed, Balanced Missile Crews," *Airman* 32, no. 1 (January 1988): 36.
[346] Captain William L. Boone and Major Daniel Tepfer, "Guide to Minuteman Initial Qualification Training," (Research study, Air Command and Staff College, 1978), 4.
[347] Boone and Tepfer, "Guide to Minuteman Initial Qualification Training," 1, 4.
[348] Stolley, "How It Feels to Hold the Nuclear Trigger," 37.
[349] Stolley, "How It Feels to Hold the Nuclear Trigger," 37.
[350] Stolley, "How It Feels to Hold the Nuclear Trigger," 37.
[351] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 101-102.
[352] Blackhurst, interview, 3-4.
[353] Blackhurst, interview, 3-4.
[354] It is believed that the launch enable control panel was added to Delta-01 in the 1970s. "Weapons System Operation Instructions," U.S. Air Force, 10 March 1986 (change 18 – 5 September 1991), 2-12 to 2-14.
[355] McNiel, interview, 3.
[356] Stolley, "How It Feels to Hold the Nuclear Trigger," 40.
[357] McNiel, interview, 4-5; Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program,* 101.
[358] Senior Master Sergeant Tom Kuhn, "Missile Alert," *Airman* 31, no.7 (July 1987): 22.
[359] Robert Wilson, interview, 21-22.
[360] Stolley, "How It Feels to Hold the Nuclear Trigger," 37.
[361] Bob Thompson, "Rethinking the Unthinkable," *The Washington Post*, 28 July 2002, Sunday.
[362] Stolley, "How it Feels to Hold the Nuclear Trigger."
[363] *The Today Show* filmed the segment on 12 January 1978 and it was aired on 26 January 1978. Manson, interview, 11.
[364] Manson, interview, 11-12.
[365] Manson, interview, 12.

[366] Manson, interview, 6.
[367] Manson, interview, 6.
[368] Lonnquest and Winkler, *To Defend and Deter: The Legacy of the United States Cold War Missile Program*, 99.
[369] Andy Plattner, "Should Women Fire Missiles," *Air Force Times*, 5 September 1977, 38.
[370] Major Arthur D. Vaughn, "Is it Feasible to Employ Women on Minuteman Missile Crews?" (Research study, Air Command and Staff College, 1975), 30.
[371] Duane A. Carolus, "A Study of the Attitudes of Married Minuteman Crewmembers and Their Wives Concerning Female Minuteman Crewmembers" (master's thesis, Air Force Institute of Technology, 1978), vii.
[372] John L. Donovan, "The Integration of Women Onto Minuteman Missile Crews" (master's thesis, Central Missouri State University, 1991), 201.
[373] "SAC's Mixed, Balanced Missile Crews," 36.
[374] Donovan, "The Integration of Women onto Minuteman Missile Crews," 201.
[375] Dirk Jameson, "Wing Nears Last Chapter in History," *The Plainsman*, 15 April 1994.
[376] John Ginovsky, "SAC Policy to Allow Male-Female Crews on Missile Alert Duty," *Air Force Times*, 21 December 1987; "SAC's Mixed, Balanced Missile Crews," 36.
[377] 44th Missile Wing Commemorative Committee, *Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994*, 42.
[378] Donovan, "The Integration of Women Onto Minuteman Missile Crews," 83.
[379] McNiel, interview, 7.
[380] Lawrence J. Paszek, "Negroes and the Air Force, 1939-1949," *Military Affairs* 31 (Spring 1967): 9.
[381] Andy Knight, interview by Steven Bucklin, 19 May 1999, 12.
[382] Bush, interview, 9.
[383] Burris, interview, 16.
[384] Pietz, interview, 3.
[385] Rosenbaum, "Brief History of the 44th Strategic Missile Wing," 2.
[386] Samuel H. Day, ed., *Nuclear Heartland: A Guide to the 1,000 Missile Silos in the United States* (McFarland, Wisc.: Progressive Foundation, 1988), 19.
[387] Day, *Nuclear Heartland: A Guide to the 1,000 Missile Silos in the United States*, 21.
[388] Day, *Nuclear Heartland: A Guide to the 1,000 Missile Silos in the United States*, 20.
[389] Paul S. Boyer, "From Activism to Apathy: The American People and Nuclear Weapons, 1963-1980," *The Journal of American History* 70, no. 4 (March 1984): 829-830.
[390] Day, *Nuclear Heartland: A Guide to the 1,000 Missile Silos in the United States*, 21.
[391] Michael Mandelbaum, "The Anti-Nuclear Weapons Movements," *PS* 17, no. 1 (Winter 1984): 27-28.
[392] Mandelbaum, "The Anti-Nuclear Weapons Movements," 25-26.
[393] Davis, interview, 1-2.
[394] Day, *Nuclear Heartland: A Guide to the 1,000 Missile Silos in the United States*, 22.
[395] Day, *Nuclear Heartland: A Guide to the 1,000 Missile Silos in the United States*, 21.
[396] John LaForge, interview by Mead & Hunt, Inc., typed transcript, 3 January 2003, 10.
[397] Day, *Nuclear Heartland: A Guide to the 1,000 Missile Silos in the United States*, 23.
[398] Day, *Nuclear Heartland: A Guide to the 1,000 Missile Silos in the United States*, 23.
[399] Davis, interview, 4.
[400] Day, *Nuclear Heartland: A Guide to the 1,000 Missile Silos in the United States*, 53-54.
[401] Day, *Nuclear Heartland: A Guide to the 1,000 Missile Silos in the United States*, 6-7.
[402] Davis, interview, 9.
[403] LaForge, interview, 10.
[404] LaForge, interview, 10.
[405] Day, *Nuclear Heartland: A Guide to the 1,000 Missile Silos in the United States*, 24.

[406] Isa. 2:4.
[407] LaForge, interview, 8-9; Friends for a Nonviolent World, "A Caution, and an Appeal, to the Personnel of the Minuteman Missile Launch Control System," (Bemidji, Minn.: Friends for a Nonviolent World, 15 January 1989).
[408] Davis, interview, 5.
[409] Davis, interview, 9.
[410] Davis, interview, 5.
[411] Davis, interview, 9.
[412] Davis, interview, 2.
[413] Davis, interview, 2.
[414] Davis, interview, 8.
[415] Davis, interview, 12.
[416] LaForge, interview, 11.
[417] LaForge, interview, 16.
[418] LaForge, interview, 12; Day, *Nuclear Heartland: A Guide to the 1,000 Missile Silos in the United States*, 23-24.
[419] LaForge, interview, 15.
[420] Kort, *The Columbia Guide to the Cold War*, 65.
[421] Kort, *The Columbia Guide to the Cold War,* 66.
[422] For a concise summary of these events, see "End of the Cold War," *The CQ Researcher* 2 (21 August 1992): 721.
[423] Kort, *The Columbia Guide to the Cold War,* 162.
[424] Leebaert, *The Fifty-Year Wound: The True Price of America's Cold War Victory*, 642-645; Kort, *The Columbia Guide to the Cold War,* 81.
[425] "Strategic Arms Reduction Treaty (START)," *AAFM Newsletter* 2, no. 2 (April 1994): 1.
[426] Kort, *The Columbia Guide to the Cold War,* 106.
[427] On-Site Inspection Agency, "Strategic Arms Reduction Treaty Fact Sheet," (Washington, D.C.: U.S. Department of Defense, February 1995), 1.
[428] U.S. Department of State, "Treaty Between the United States of America and the Union of the Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms (START Treaty)," 31 July 1991; "Strategic Arms Reduction Treaty (START)," 1.
[429] Roig-Compton, "1991 Annual Brief History, 44th Missile Wing," 1.
[430] "Workers Now Dismantling 300 Midwestern Missile Facilities," *AAFM Newsletter* 2, no. 2 (April 1994): 1.
[431] Carnegie Endowment for International Peace, "Seventh Clinton-Yeltsin Summit," *Non-Proliferation,* n.d., <http://www.ceip.org/programs/npp/summits7.htm> (17 June 2003); Carnegie Endowment for International Peace, "Clinton-Putin Summit," *Non-Proliferation,* n.d., <http://www.ceip.org/programs/npp/summits7.htm> (17 June 2003).
[432] "Minuteman II Deactivation, Environmental Baseline Survey" (Ellsworth Air Force Base, S.Dak., 5 April 2000), Figure 6.
[433] U.S. Department of State, "Treaty Between the United States of America and the Union of the Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms (START Treaty)"; "Strategic Arms Reduction Treaty (START)."
[434] Lieutenant Colonel Roy A. Griggs and Captain Michael F. Norcross, "Taking Down the 44th Missile Wing" (Ellsworth Air Force Base, S.Dak.).
[435] Griggs and Norcross, "Taking Down the 44th Missile Wing."
[436] "Minuteman II Missile Realty, Ellsworth AFB, South Dakota: Declaration of Excess (DE) Summary," (Ellsworth Air Force Base, S.Dak. 1 February 2000), 3-4.
[437] Williams, interview, 10-12.

[438] Paul Kemezis, "Missile Soil Demolition Causes Flak for Air Force," *Enginnering News - Record* (12 October 1992): 24.
[439] Williams, interview, 11.
[440] "Minuteman II Missile Realty, Ellsworth AFB, South Dakota: Declaration of Excess (DE) Summary," 3; "Missile Site Deactivation Newsletter" (U.S. Air Force, March 2001).
[441] "Missile Site Disposal Newsletter" (Ellsworth Air Force Base, S.Dak., May 2002).
[442] "Missile Plots Offered to Nearby Landowners," *Rapid City Daily Journal*, 15 August 1993.
[443] "Missile Site Disposal Newsletter."
[444] U.S. Department of State, "White House Statement on Mutual Detargeting," 14 January 1994, <http://www.fas.org/nuke/control/detarget/news/940114-331576.htm> (16 October 2003).
[445] "Special Resource Study for the Minuteman Missile Sites: Management Alternatives and Environmental Assessment," 16-18. Delta-09 is located on former U.S. Forest Service land.
[446] "Special Resource Study for the Minuteman Missile Sites: Management Alternatives and Environmental Assessment."
[447] U.S. Department of the Interior, "Defense Department Awards Grant to the National Park Service," (18 October 1993).
[448] "Supplement to Basic Technical Order: Deactivation of Wing II Minuteman Launch Control Facilities," (U.S. Air Force, 7 April 1993).
[449] "Supplement to Basic Technical Order: Deactivation of Wing II Minuteman Launch Facilities."
[450] "Supplement to Basic Technical Order: Deactivation of Wing II Minuteman Launch Control Facilities."
[451] A National Register Nomination for the Minuteman Missile National Historic Site was completed in 2003. The HAER record number for the Delta-01 and Delta-09 documentation is SD-50.
[452] "D-01/D-09 Briefing Notes - SPTG/CC," (Ellsworth Air Force Base, S.Dak., 30 January 2001).
[453] *Minuteman Missile National Historic Site Establishment Act of 1999*, Public Law 106-115, 106th Cong., 1st sess. (29 November 1999).
[454] U.S. Department of the Interior, "Project Agreement: Minuteman Missile National Historic Site General Management Plan/Environmental Impact Statement," (December 2001), 2.
[455] Nancy Baker, "Draft Purpose and Significance Statements," (National Park Service, Badlands National Park, March 2001).
[456] Tim Pavek, "Minuteman Missile National Historic Site," email message (Ellsworth Air Force Base, S.Dak., 2 May 2000).
[457] Training missile (S/N 7205002) is believed to be originally from a Minuteman II Training Launch Facility at Whiteman Air Force Base in Missouri, but it is unlikely that it had been at Hill Air Force Base since the mid-190s when Whiteman's Minutemans were deactivated. Tim Pavek, "Memo for the Record" (Ellsworth Air Force Base, S.Dak., 13 April 2000).
[458] "June Minuteman II Missile Placement Tentative Schedule of Events" (4 June 2001).
[459] Plans for the viewing enclosure were developed by Sayre Hutchinson of the National Park Service and Tim Pavek of Ellsworth Air Force Base.
[460] "D-01/D-09 Briefing Notes - SPTG/CC"; Tim Pavek, "Talking Paper on Ellsworth AFB D-01/D-09 Minuteman Missile Historic Site," (Ellsworth Air Force Base, S.Dak., 2 November 2000).
[461] Bill Cissell, "Park Service Takes Over Missile Sites," *Rapid City Daily Journal*, 28 March 2002, A1-A2.
[462] Manson, interview, 13-14.
[463] Leebaert, *The Fifty-Year Wound: The True Price of America's Cold War Victory*, ix-x.
[464] Davis, interview, 12.
[465] "A Cold Warrior Looks to Ban the Bomb After a Career in Brinkmanship," 23 May 1999, <http://www.wagingpeace.org/articles/butler_la_times_99.html> (25 November 2003).

Bibliography

"10th Missile Squadron." <http://www.globalsecurity.org/wmd/agency/10ms.htm> 6 October 2003.

28th Civil Engineering Squadron, Ellsworth Air Force Base, S.Dak. Architectural and engineering drawings, blueprints, and site plans of Minuteman facilities at Ellsworth. Original real estate records, construction completion reports, and other miscellaneous documents relating to the Minuteman deployment at Ellsworth.

44th Missile Wing Commemorative Committee. *Aggressor Beware: A Brief History of the 44th Missile Wing, 1962-1994*. Rapid City, S.Dak.: Grelind Printing, 1993.

"Air Force History Overview." *Air Force Link*. 9 May 2003. <http://www.af.mil/history/ overview.shtml> 13 May 2003.

Air Force Times, 1962 - 2000.

Armitage, M. J. and Mason R. A. *Air Power in the Nuclear Age*. Chicago, Ill.: University of Illinois Press, 1983.

Atchison, Robert and Robin Mazur. "Thunder Across the Plains: A Pamphlet Dedicated to the Heritage of the 28th Bomb Wing." 1999. Available at the 28th Bomb Wing History Office, Ellsworth Air Force Base, S.Dak.

Atwater, James. "How the Modern Minuteman Guards the Peace." *The Saturday Evening Post* (9 February 1963).

Baar, James. "Huge Minuteman Buildup Starts." *Missiles and Rockets* (6 June 1960): 10-14.

Bailyn, Bernard. *Ideological Origins of the American Revolution*. Cambridge: Harvard University Press, 1992.

Baker, Nancy. "Draft Purpose and Significance Statements." March 2001. Available at National Park Service, Badlands National Park.

Baldwin, David. *Economic Development and American Foreign Policy, 1942-1962*. Chicago: University of Chicago Press, 1966.

"Big Week for Pushing Missile Buttons: U.S. Tries Hard to Catch Up." *LIFE* 43, no. 19 (4 November 1957): 27-34.

Black Hills (S.Dak.) Bomber, 8 September 1961.

Blackhurst, David. Interview by Steven Bucklin. Typed transcript. 19 May 1999. Available at Minuteman Missile National Historic Site, S.Dak.

Blanton, Thomas S. and Malcolm Byrne, eds. *U.S. Nuclear History: Nuclear Arms and Politics in the Missile Age, 1955-1968*. Alexandria, Va.: National Security Archives and Chadwyck-Healey, 1997.

Boone, Captain William L., and Major Daniel Tepfer. "Guide to Minuteman Initial Qualification Training." Research study, Air Command and Staff College, 1978.

Bowie, Robert R. and Richard H. Immerman. *Waging Peace: How Eisenhower Shaped an Enduring Cold War Strategy*. New York, N.Y.: Oxford University Press, 1998.

Boyer, Paul S. Fallout: A Historian Reflects on America's Half-Century Encounter with Nuclear Weapons. Columbus, Ohio: Ohio State University Press, 1998.

----. *By the Bomb's Early Light*. Chapel Hill: University of North Carolina, 1994.

----. "From Activism to Apathy: The American People and Nuclear Weapons, 1963-1980." *The Journal of American History* 70, no. 4 (March 1984): 821-844.

Brands, H. W. *Cold Warriors: Eisenhower's Generation and American Foreign Policy*. New York, N.Y.: Columbia University Press, 1988.

----. "The Age of Vulnerability: Eisenhower and the National Insecurity State." *The American Historical Review* 94, no. 4 (October 1989): 963-989.

"The Briefing." *Boeing Magazine* 28, no. 8 (1958).

Brooks, Allyson and Steph Jacon. *Homesteading and Agricultural Development Context*. Edited by Michael Bedeau. Vermillion, S.Dak.: South Dakota State Historical Preservation Center, 1994.

Burnham, Frank. "Minuteman: Case History of an ICBM." *Armed Forces Management* 16, no. 8 (May 1970): 42-43.

Burris, David. Interview by Steven Bucklin. Typed transcript. 20 May 1999. Available at Minuteman Missile National Historic Site, S.Dak.

Bush, Ken. Interview by Steven Bucklin. Typed transcript. 17 May 1999. Available at Minuteman Missile National Historic Site, S.Dak.

Butfoy, Andrew. "The Marginalisation of Nuclear Weapons in World Politics? The Case of Flexible Response." *Australian Journal of Political Science* 28, no. 2 (1993): 271-289.

Callander, Bruce. "Minuteman Turns 40." *Air Force Magazine* (March 2001): 70-73.

Cannadine, David, ed. *Blood, Toil, Tears and Sweat: Winston Churchill's Famous Speeches*. London: Cassell Publishers Limited, 1990.

Cardoza, Major Thomas J., and Major Kenneth P. Schaebethal. "Reduction of Minuteman Crew Manning." Research study, Air Command and Staff College, 1975.

Carnegie Endowment for International Peace. "Clinton-Putin Summit." *Non-Proliferation*. n.d. <http://www.ceip.org/programs/npp/summits7.htm> 17 June 2003.

Carnegie Endowment for International Peace. "Seventh Clinton-Yeltsin Summit." *Non-Proliferation*. n.d. <http://www.ceip.org/programs/npp/summits7.htm> 17 June 2003.

Carnegie Endowment for International Peace. "US-Russia Summit Agreements and Joint Statements." n.d. <http://www.ceip.org/programs/npp/us-russiasummits.htm> 17 October 2003.

Carolus, Duane A. "A Study of the Attitudes of Married Minuteman Crewmembers and Their Wives Concerning Female Minuteman Crewmembers." Master's thesis, Air Force Institute of Technology, 1978.

Chang, Gordon H. "JFK, China, and the Bomb." *The Journal of American History* 74, no. 4 (March 1988): 1287-1310.

"Chronology of the 44th Strategic Missile Wing." On file at the 44th Missile Wing History Office, Ellsworth Air Force Base, S.Dak.

Clark, Christopher. "Old Silo Becomes Historic Site." *Airman's World*. 2001. <http://www.af.mil/news/airman/1101/world1.html> 9 September 2002.

"Closing the Gap." *TIME* 77 (10 February 1961): 16-17.

"A Cold Warrior Looks to Ban the Bomb After a Career in Brinkmanship." 23 May 1999. <http://www.wagingpeace.org/articles/butler_la_times_99.html> 25 November 2003.

Cold War Study. U.S. House. 107th Cong., 1st sess., H.R. 107, 3 January 2001.

Congressional Record. 102nd Cong., 2nd sess., 1992. Vol. 138, pt. 137.

Coughlin, William J. "AF May Do Final Minuteman Assembly." *Missiles and Rockets* (6 June 1960): 39-41.

"D-01/D-09 Briefing Notes - SPTG/CC." 30 January 2001. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

Davis, Jay. Interview by Mead & Hunt. Typed transcript. 6 February 2003. Available at Minuteman Missile National Historic Site, S.Dak.

Day, Samuel H., ed. Nuclear Heartland: A Guide to the 1,000 Missile Silos in the United States. McFarland, Wisc.: Progressive Foundation, 1988.

"Deactivation of the Minuteman II Missile Wing at Ellsworth Air Force Base, South Dakota: Final Environmental Impact Statement." Strategic Air Command, Omaha, Nebr., 1991. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Delta-01, Launch Control Facility, Environmental Baseline Survey." Ellsworth Air Force Base, S.Dak., 8 January 2001. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Delta-09, Launch Facility, Environmental Baseline Survey." Ellsworth Air Force Base, S.Dak., 8 January 2001. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Department of the Air Force Technical Order: Deactivation of Wing II Minuteman Launch Control Facilities." U.S. Air Force, 14 October 1992. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Department of the Air Force Technical Order: Deactivation of Wing II Minuteman Launch Facilities." U.S. Air Force, 30 November 1995. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Diverse Minuteman Tests Planned Following Successful First Flight." Aviation Week and Space Technology (February 1961): 28.

Dobson, Alan P. 'Informally Special? The Churchill-Truman Talks of January 1952 and the State of Anglo-American Relations.' *Review of International Studies* 23 (1997): 27-47.

Donovan, John L. "The Integration of Women Onto Minuteman Missile Crews." Master's thesis, Central Missouri State University, 1991.

Douglas, James H. Letter to President Dwight D. Eisenhower, 1 March 1960. Available at Dwight D. Eisenhower Library, Boston, Mass. Ann Whitman Files, Administration Series, Box 15. Accessed through the Digital National Security Archive.

Dunn, David H. The Politics of Threat: Minuteman Vulnerability in American National Security Policy. Great Britain: MacMillan Press, 1997.

Emme, Eugene. *The Impact of Air Power*. New York, N.Y.: Norstrand Company, Inc., 1959.

"Eastern Pennington County Memories." Wall, S.Dak.: The American Legion Auxiliary, Carrol McDonald Unit. Available at the Library of Congress, Washington, D.C.

Eger, Major Charles H. "Minuteman Financial History, 1955-1963." U.S. Air Force. Available at the Manuscript Division, Library of Congress, Washington, D.C.

"Ellsworth Air Force Base, 4th Strategic Missile Wing, Blast Door Art." TMs, table, on file in the office of Tim Pavek, Civil Engineer, 28th Civil Engineering Squadron, Ellsworth Air Force Base, S.Dak.

"Ellsworth AFB History." *Ellsworth Air Force Base*. 1 October 2002. <http://www.ellsworth.af.mil/history.html> 28 October 2002.

"End of the Cold War." *The CQ Researcher* 2 (August 1992): 721.

Engel, Jeffery A. "'Every Cent from America's Working Man': Fiscal Conservatism and the Politics of International Aid after World War II." *The New England Journal of History* 58, no. 1 (2001): 20-60.

"Establishing a Program for Resolving Labor Disputes at Missile and Space Sites. Executive Order 10946. 26 May 1961." <http://wwwllib.umich.edu/ govdocs/ jfkeo/eo/10945.htm> 9 May 2003.

Ewart, Michael. Interview by Robert Hilderbrand. Typed transcript. 19 May 1999. Available at Minuteman Missile National Historic Site, S.Dak.

"Fact Sheet." U.S. Air Force. Available at the 28th Bomb Wing History Office, Ellsworth Air Force Base, S.Dak.

"Facts About Minuteman Land Acquisition." Omaha, Nebr.: U.S. Army Engineer District. 1961. Available at the Spearfish Public Library, Spearfish, S.Dak.

"The Federal Engineer - Damsites to Missile Sites: A History of the Omaha District, U.S. Army Corps of Engineers." U.S. Army Corps of Engineers. Omaha, Nebr. 1985. Available at Wisconsin Historical Society Library, Madison, Wisc.

Felices, Major General Salvador E. "A Select Group." *Combat Crew* 22, no. 4 (April 1972): 10-11.

"Former Missile Silo to Become a Park." *CNN*. 27 September 2002. <wysiwyg://5/http://www.cnn.com/2002/US/Central/09/27/missile.park.ap/index.html> 27 September 2002.

Finn, Major Robert J. "Danger Ahead." *Combat Crew* 21, no. 8 (August 1970): 14-17.

Fogleman, Ronald R. "National Missile Defense Program: When, Not Whether." *Defense Issues* 2, no. 48 (1996): 1-4.

Forbes, Donald R. "Minuteman Missile Maintenance and Enlisted Career Progression Problems." Master's thesis, Air University, 1983.

Friends for a Nonviolent World. "A Caution, and an Appeal, to the Personnel of the Minuteman Missile Launch Control System." Bemidji, Minn.: Friends for a Nonviolent World, 15 January 1989. Available at Nukewatch office, Luck, Wisc.

Fukuyama, Francis J. *The End of History and the Last Man*. New York: Harper Collins, 1993.

Gaddis, John Lewis. Cold War Statesmen Confront the Bomb: Nuclear Diplomacy Since 1945. Oxford: Oxford University Press, 1999.

----. *We Now Know: Rethinking Cold War History*. Oxford: Clarendon Press, 1997.

Gavin, Francis J. "The Myth of Flexible Response, United States Strategy in Europe During the 1960s." *International History Review* 23, no. 4 (2001): 847-875.

George, James A. "The Outer Zone." *Airman* 22, no. 3 (March 1978): 3-9.

Giese, Paula. *South Dakota Indian Tribes*. 22 March 1997. <http//www.kstrom.net/isk/maps/dakotas/sd.html> 23 May 2003.

Glasser, Lieutenant General Otto J. Interview by Lieutenant Colonel John J. Allen. Typed transcript. 5 January 1984. In U.S. Air Force Collection K239.0512-1566, IRIS No. 1105118, Air Force Historical Research Agency, Maxwell Air Force Base, Ala.

Goldsworthy, Harry E. "ICBM Site Activation." *Aerospace Historian* 29, no. 3 (Fall/September 1982): 154-161.

Grand Forks Herald, 1987- 1990.

Gray, Colin S. *Missiles Against War: The ICBM Debate Today*. Fairfax, Va.: National Institute for Public Policy, 1985.

----. *The MX ICBM and National Security*. New York, N.Y.: Praeger Publishers, 1981.

Griffith, T. D. "Minuteman Sites Preserved for Posterity." *Heritage Tourism* 36, no. 5 (June 2000): 14.

Griggs, Lieutenant Colonel Roy A. and Captain Michael F. Norcross. "Taking Down the 44th Missile Wing." Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

Griswold, Wesley S. "Minuteman, Our Ace in the Hole." *Popular Science* 179 (July 1961): 62-65, 184.

Gropman, Alan L. *The Air Force Integrates, 1945-1964*. 2nd ed. 1978. Reprint, Washington, D.C.: Smithsonian Institution Press, 1998.

Hahn, Roland E. "Guide For Minuteman Crew Members." 1979. Available at Air University Library, Maxwell Air Force Base, Ala.

Hall, Alonzo. Interview by Robert Hilderbrand. Typed transcript. 18 May 1999. Available at Minuteman Missile National Historic Site, S.Dak.

Hall, Colonel Edward N. Interview by Jack Neufeld. Typed transcript. 11 July 1989. In U.S. Air Force Collection, K239.0512-1820, IRIS No. 1105443, Air Force Historical Research Agency, Maxwell Air Force Base, Ala.

Hall, Steven. Interview by Robert Hilderbrand. Typed transcript. 19 May 1999. Available at Minuteman Missile National Historic Site, S.Dak.

Hartz, Louis. *The Liberal Tradition in America*. New York: Harcourt, 1985.

Hess, Jeffrey A. and John F. Lauber. "Minuteman ICBM National Historic Landmark." Draft National Historic Landmark Nomination, Prepared for U.S. Air Force. December 1996. Available at Minuteman Missile National Historic Site, S.Dak.

Hetland, Cara. "The Last Minuteman." Minnesota Public Radio. 25 September 2001. <http://news.mpr.org/features/200109/26_hetlandc_minuteman-m/index.shtml> 10 September 2002.

"History of the 44th Strategic Missile Wing," 1 April through 30 April 1963. In U.S. Air Force Collection, AFHRA, K-WG-44-HI, IRIS No. 450511.

"Historic Sites of South Dakota: A Guidebook." [Vermillion, S.Dak.]:Business Research Bureau–University of South Dakota and The Historical Preservation Center, 1980.

"History of 44th Strategic Missile Wing." Miscellaneous records. 1962 -1979. In U.S. Air Force Collection, Air Force Historical Research Agency, Maxwell Air Force Base, Ala.

"History of Strategic Air Command." History & Research Division, Strategic Air Command, Nebr. Available at the National Security Archives, Washington, D.C.

Hogan, Edward Patrick and Erin Hogan Fouberg. *The Geography of South Dakota*. Rev. ed. Sioux Falls, S.Dak.: The Center for Western Studies, 1998.

Hoisington, Daniel. "Headquarters, Strategic Air Command." Historic American Building Survey Draft Report. National Park Service. (HABS No. NE-9-M, N, O, 2001). Available at the Nebraska State Historic Preservation Office, Lincoln, Nebr.

"Home of the Minuteman." *TIME* 75 (25 January 1960): 48-50.

Howard, Wayne E. *The Missile Sites Labor Commission.* Washington, D.C.: U.S. Government Printing Office, 1969.

"Human Factors: Aspects of a 30-Day Extended Survivability Test of the Minuteman Missile." U.S. Air Force, School of Aerospace Medicine, Aerospace Medical Division. October 1964. Available at Brooks Air Force Base, Tex.

Hustead, Ted H. Interview by Mead & Hunt. Typed transcript. 7 January 2003. Available at Minuteman Missile National Historic Site, S.Dak.

"The ICBM Force in the Early 1960s." *AAFM Newsletter* 9, no. 4 (2001): 1, 5-8.

"Interagency Agreement Between the Department of the Air Force and the National Park Service, Rocky Mountain Region." 1993. Available at Minuteman Missile National Historic Site, S.Dak.

"Interagency Agreement Between the National Park Service, Badlands National Park and the United States Air Force." 2001. Available at Minuteman Missile National Historic Site, S.Dak.

"Interagency Agreement Between the National Park Service, Midwest Field Area and the United States Air Force." 1997. Available at Minuteman Missile National Historic Site, S.Dak.

"Interagency Agreement Between the National Park Service, Rocky Mountain Region and the United States Air Force." 1994. Available at Minuteman Missile National Historic Site, S.Dak.

"Jackson-Washabaugh Counties, 1915-1965." Jackson-Washabaugh County Historical Society. Available at the South Dakota State Archives, Pierre, S.Dak.

Jacobson, Louis. "Bombs Away." *Government Executive* (December 1996): 25-29.

Jensen, Paul, ed. "History by Date of the Minuteman Launch Facility, Bravo-09, From the files of Leonel and Paul Jensen." 1992. Available in the collection of Gene S. Williams, S.Dak.

----. "Minuteman Deactivation: Landowner Impact Statement and Local Economic Impact." 17 August 1992. Available in the collection of Gene S. Williams, S.Dak.

Johnson, Stephen B. *The United States Air Force and the Culture of Innovation.* Washington, D.C.: Air Force History and Museums Program, 2002.

"June Minuteman II Missile Placement Tentative Schedule of Events." 4 June 2001. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

Kaplan, Fred. *The Wizards of Armageddon.* First Touchstone ed. New York, N.Y.: Simon and Schuster, 1984.

Karcewski, Donald J. "Guide for Missile Maintenance Managers." May 1981. Available at Air University Library, Maxwell Air Force Base, Ala.

Karolevitz, Bob and Bernie Hunhoff. *Uniquely South Dakota*. Norfolk, Va.: Donning Company, 1988.

Kemezis, Paul. "Missile Soil Demolition Causes Flak for Air Force." *Engineering News - Record* (12 October 1992): 24.

Kennan, George. "The Kennan 'Long Telegram.' " In *Origins of the Cold War: The Novikov, Kennan and Roberts "Long Telegrams" of 1946*. Edited by Kenneth M. Jensen. Washington, D.C.: United States Institute of Peace, 1991.

Kieways, 1962 - 1963.

Klass, Philip J. "Minuteman Systems Keyed to Fast-Reaction Demands." *Aviation Week and Space Technology* (29 October 1962): 57-66.

Knight, Andy. Interview by Steven Bucklin. Typed transcript. 19 May 1999. Available at Minuteman Missile National Historic Site, S.Dak.

Knoll, Robert. "Air Force Tests New Missile." *Boeing Magazine* 34, no. 9 (September 1964): 8-9.

Kolcum, Edward H. "Manned Space Flight Program Expanded." *Aviation Week and Space Technology* (18 December 1961): 26.

Kort, Michael. *The Columbia Guide to the Cold War*. The Columbia Guides to American History and Cultures Series. New York, N.Y.: Columbia University Press, 1998.

Kozicharow, Eugene. "Six-Year Program Will Modify Minuteman Launch, Control Facilities." *Aviation Week and Space Technology* 122, no. 4 (4 February 1985): 93.

Krajewski, Captain Donald E. "Danger: New People at Work." *Combat Crew* 20, no. 1 (January 1969): 24-25.

Krause, Colonel Francis R. and Lieutenant Jerald A. Kleinberg. "Condition One - Normal Launch." *Combat Crew* 20, no. 5 (May 1969): 8-14.

Kuhn, Senior Master Sergeant Tom. "Missile Alert." *Airman* 31, no. 7 (1987): 22-23.

Labat-Anderson, Inc. "Deactivation of the Minuteman II Missile System: Final Deactivation Environmental Plan." U.S. Air Force, 1993. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

LaFeber, Walter. *America, Russia, and the Cold War: 1945-1984*. 5th ed. New York, N.Y.: Newbery Award Records, Inc., 1985.

----. The American Age: United States Foreign Policy at Home and Abroad Since 1750. New York, N.Y.: W. W. Norton & Company, 1989.

LaForge, John. Interview by Mead & Hunt. Typed transcript. 3 January 2003. Available at Minuteman Missile National Historic Site, S.Dak.

Lass, Barbara. "South Dakota Prehistory." In *The Future of South Dakota's Past*. Edited by Larry J. and Lucille C. Stewart Zimmerman. Vermillion, S.Dak.: University of South Dakota Archaeology Laboratory, 1981.

"Last Minuteman II Missile Silo Imploded." *Air Force News*. n.d. <http://www. af.mil.news / Dec1997/ n19971222_971628.html> 19 March 2003.

Lauber, John F., et al. "Ellsworth Air Force Base, Delta Flight (Minuteman II ICBM)." Historic American Engineering Record, National Park Service. (HAER No. SD-50, 1995). Available at the Library of Congress, Prints and Photographs Division, Washington, D.C.

Lauber, John F., and Jeffrey A. Hess. "Glenn L. Martin Company, Titan Missile Test Facilities." Historic American Engineering Record. National Park Service. (HAER No. Co-75, 1993). Available at the Library of Congress, Prints and Photographs Division, Washington, D.C.

"Launch Control Facility D-01." Deactivation File. Ellsworth Air Force Base. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Launch Control Facility D-09." Deactivation File. Ellsworth Air Force Base. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

Leavitt, William. "Minuteman: Ten Years of Solid Performance." *Air Force Magazine* 54, no. 3 (March 1971): 22-28.

Leebaert, Derek. *The Fifty-Year Wound: The True Price of America's Cold War Victory*. 1st ed. Boston, Mass.: Little, Brown & Company, 2002.

Leffler, Melvyn P. A Preponderance of Power: National Security, The Truman Administration, and the Cold War. Stanford, Calif.: Stanford University Press, 1992.

Leffler, Melvyn P. and David S. Painter, eds. *Origins of the Cold War*. New York, N.Y.: Routledge, 1994.

Leighton, Richard M. The Cuban Missile Crisis of 1962: A Case in National Security Crisis Management. Washington, D.C.: National Defense University, 1978.

Licklider, Roy. "The Missile Gap Controversy." *Political Science Quarterly* 85, no. 4 (December 1970): 600.

Lightner, Major General Lawrence S. Interview by James C. Hasdorff. Typed transcript. 23 August 1985. In U.S. Air Force Collection K239.0512-1671, IRIS No. 1114569, Air Force Historical Research Agency, Maxwell Air Force Base, Ala.

Limprecht, Hollis J. *The Kiewit Story: Remarkable Man, Remarkable Company*. Omaha, Nebr.: The Omaha World-Herald Company, 1981.

Lonnquest, John C. and David F. Winkler. *To Defend and Deter: The Legacy of the United States Cold War Missile Program*. Washington, D.C.: Department of Defense, Legacy Resource Management Program, 1996.

Lowenthal, Mark M. *START Index: An Index to the Strategic Arms Reduction Treaty*. Washington, D.C.: Congressional Research Service, 1991.

----. Strategic Arms Reduction Treaty: Verification and Compliance Issues. Washington, D.C.: Congressional Research Service, 1992.

MacIntyre, Malcom A. Interview by George M. Watson, Jr. Typed transcript. 26 September 1985. In U.S. Air Force Collection K239.0512-1683, IRIS No. 1070997, Air Force Historical Research Agency, Maxwell Air Force Base, Ala.

"Malmstrom AFB: Great Falls International Airport." *Global Security.org*. 13 January 2003. <http://www.globalsecurity.org/wmd/facility/malmstrom.htm> 20 June 2003.

Mandelbaum, Michael. "The Anti-Nuclear Weapons Movements." *PS* 17, no. 1 (Winter 1984): 27-28.

Manson, Judge Craig. Interview by Sue Lamie. Typed transcript. 27 June 2002. Available at Minuteman Missile National Historic Site, S.Dak.

Manuszewski, Technical Sergeant D. E., Jr. "Minuteman II Missile Returns to South Dakota." *Air Combat Command News Service*. 2 June 2001. <http://www2.acc.af.mil/ accnews/ jun01/ 01204.html> 10 September 2002.

Matlock, Jack F. *Autopsy on an Empire*. New York, N.Y.: Random House, 1995.

May, Elaine Tyler. *Homeward Bound: American Families in the Cold War Era*. New York, N.Y.: Basic Books, 1988.

McCormick, Thomas J. *America's Half-Century: United States Foreign Policy in the Cold War and After*. 2nd ed. Baltimore, Md.: Johns Hopkins University Press, 1995.

McElroy, Neil H. Letter to President Dwight D. Eisenhower, 28 May 1958. Available at Dwight D. Eisenhower Library, Abilene, Kans., Ann Whitman Files, Administration Series, Box 5. Accessed through the Digital National Security Archive.

----. Letter to President Dwight D. Eisenhower, 3 December 1958. Available at Dwight D. Eisenhower Library, Abilene, Kans., Ann Whitman Files, Administration Series, Box 5. Accessed through the Digital National Security Archive.

McFarland, Stephen L. *A Concise History of the U.S. Air Force*. Air Force Fiftieth Anniversary Commemorative Edition. Washington, D.C.: Air Force History and Museums Program, 1997.

McGuire, Frank G. "Minuteman Third-Stage Award Nears." *Missiles and Rockets* (6 June 1960): 42-43.

McIntosh, Phyllis. "Coming Out of Cold Storage." *National Parks* (November-December 2000): 34-37.

McNiel, Wendy. Interview by Mead & Hunt. Typed transcript. 3 February 2003. Available at Minuteman Missile National Historic Site, S.Dak.

McQuade, Lawrence C. Memorandum to Paul H. Nitze, 31 May 1963. Available at John F. Kennedy Library, Boston, Mass. Box 296-298, Missile Gap 2/63-5/63. Accessed through the Digital National Security Archive.

Mearsheimer, John J. "Back to the Future: Instability in Europe after the Cold War." *International Security* 15, no. 1 (Summer 1990): 191-199.

Meyers, Harold B. "The Biggest Invisible Builder in the World." *Fortune* 73, no. 4 (April 1966): 146-151.

Miller, Barry. "ICBMs Get Major Modification." *Aviation Week and Space Technology* 104 (10 May 1976): 67-70.

"Minot AFB." *Global Security.org*. 13 January 2003. <http://www.globalsecurity.org/wmd/facility/minot.htm> 20 June 2003.

"Minuteman II Deactivation, Environmental Baseline Survey." Ellsworth Air Force Base, S.Dak. 5 April 2000. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Minuteman II Emplacement Cost to Top $1 Billion." *Missiles and Rockets* 16 (24 May 1965): 12.

"Minuteman II May Be Operational in 1965." *Missiles and Rockets* 15 (5 October 1964): 17.

"Minuteman II Missile Realty Declaration of Excess (DE) Launch Control Facility, FXFB, D-1." Ellsworth Air Force Base, S.Dak. 7 June 2001. Available at the Real Estate Office, 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Minuteman II Missile Realty Declaration of Excess (DE): Launch Facility, FXFK, D-9." Ellsworth Air Force Base, S.Dak. 7 June 2001. Available at the Real Estate Office, 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Minuteman II Missile Realty, Ellsworth AFB, South Dakota: Declaration of Excess (DE) Summary." Ellsworth Air Force Base, S.Dak. 1 February 2000. Available at the Real Estate Office, 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Minuteman II Real Property Installed Equipment Deactivation Procedures: Launch Facility." U.S. Air Force. 2 March 1992. Available at the Real Estate Office, 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Minuteman II Real Property Installed Equipment Deactivation Procedures: Launch Control Facility." U.S. Air Force. 13 January 1992. Available at the Real Estate Office, 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Minuteman in the Making." *Air Force Times* 25, no. 21 (1-6-1965): 5.

Minuteman Missile National Historic Site Establishment Act of 1999. Public Law 106-115. 106th Cong., 1st sess., 29 November 1999.

Minuteman Service News, January-February 1962 and November-December 1965.

Missile. Produced and directed by Frederick Wiseman. 115 min. Zipporah Films, 1987. Videocassette.

"Missile Shutdown Starts Next Week." *Billings Gazette*. 27 September 2002. <http://www.billingsgazette.com/index.php?display=rednews/2002/09/27/build/wyoming/missles.inc> 3 October 2002.

"Missile Site Deactivation Newsletter." U.S. Air Force. March 2001. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Missile Site Disposal Newsletter." Ellsworth Air Force Base, S.Dak. May 2002. Available at the Real Estate Office, 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Missile Site Turns National Park." *MSNBC News*. n.d. <http://www.msnbc.com/news/812365.asp?osi=-&cpl=1> 3 October 2002.

Moberly, Major Billy L. and Captain Raymond V. McMillan. "Everything But Launch." *Combat Crew* 18, no. 9 (September 1967): 17.

"Modification to Interagency Agreement Between the National Park Service, Badlands National Park and the United States Air Force." 2001. Available at Minuteman Missile National Historic Site, S.Dak.

Moorman, Lieutenant General Thomas S., Jr. "44th Missile Wing Inactivation." Paper presented at the 44th Missile Wing Deactivation Ceremony and Dinner. 3 July 1994. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

Naftali, Timothy J., et al. *John F. Kennedy: The Great Crises*. 1st ed. The Presidential Recordings. New York, N.Y.: W.W. Norton & Company, 2001.

Nalty, Bernard C., ed. *Winged Shield, Winged Sword: A History of the United States Air Force*. 2 vols. Washington, D.C.: Air Force History and Museums Program, 1997.

National Archives. Records of the Missile Sites Labor Administration. RG 280.

National Archives. Records of United States Air Force Commands, Activities, and Organizations. RG 342.

National Park Service. "Badlands National Park Information." n.d. <http//www.badlands.national-park.com/info.htm> 15 May 2003.

National Park Service. "Minuteman Missile National Historic Site, General Management Plan and Environmental Impact Statement Newsletter." National Park Service, U.S. Department of the Interior. March 2002. Available at Minuteman Missile National Historic Site, S.Dak.

National Park Service. "Minuteman Missile National Historic Site, General Management Plan Newsletter." National Park Service, U.S. Department of the Interior. Spring 2001. Available at Minuteman Missile National Historic Site, S.Dak.

Nauman, Dean S., ed. "Vanishing Trails Expedition." Wall, S.Dak.: Vanishing Trails Committee, Wall Chamber of Commerce, 1976. Available at the South Dakota State Archives, Pierre, S.Dak.

Neal, Roy. *Ace in the Hole.* Garden City, N.Y.: Doubleday & Company, 1962.

Ness, Major Richard D. "Swap-Out." *Combat Crew* 22, no. 7 (July 1972): 18-20.

Neufeld, Jacob. The Development of Ballistic Missiles in the United States Air Force, 1945-1960. Washington, D.C.: Office of Air Force History, 1990.

New York Times, 17 August 1992.

Newhouse, John. *War and Peace in the Nuclear Age.* 1st ed. New York, N.Y.: Knopf, 1989.

Newlon, Clarke. "Boeing Starts Work on ICBM Minuteman." *Missiles and Rockets* (27 October 1958): 20-21.

Nunnerly, David. *President Kennedy and Britain.* New York, N.Y.: St. Martin's Press, 1972.

On-Site Inspection Agency. "Strategic Arms Reduction Treaty Fact Sheet." Washington, D.C.: U.S. Department of Defense. February 1995. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

Ogden Air Logistics Center. "Minuteman Weapon System History and Description." Hill Air Force Base, Utah, 1990. Available at Minuteman Missile National Historic Site, S.Dak.

Osgood, Major James D., Jr. "Change Those Targets." *Combat Crew* 25, no. 12 (December 1975): 9-11.

Owens, Captain I. P. "In Search of Excellence." *Combat Crew* 24, no. 4 (1974): 16-17.

Paolucci, Major John F. "Making Minuteman Missile Combat Crew Duty a Challenge: A Radical View." Research study, Air Command and Staff College, 1977.

Partners for National Security. Motion picture script developed by the President's Missile Sites Labor Commission, Available at John F. Kennedy Library, Boston, Mass., Central Files, Box 201, File: FG 697.

Paszek, Lawrence J. "Negroes and the Air Force 1939-1949." *Military Affairs* 31, no. 1 (1967): 1-9.

Pavek, Tim. Conversation with Hess Roise, Inc. 2 October 1996.

----. Interview by Steven Bucklin. Typed transcript. 20 May 1999. Available at Minuteman Missile National Historic Site, S.Dak.

----. Memorandum to OO-ALC/MNS (Colonel Hale), 25 October 2000. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

----. "Memo for the Record." Conference Call, Display Missile for Ellsworth Minuteman (MM) II Historical Site D-09. Ellsworth Air Force Base, S.Dak., 13 April 2000. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

----. "Minuteman II: The End of an Era." February 1997. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

----. "Minuteman Missile National Historic Site." Email message. Ellsworth Air Force Base, S.Dak. 2 May 2000.

----. "Talking Paper on Ellsworth AFB D-01/D-09 Minuteman Missile Historic Site." 2 November 2000. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

----. Missile engineer with the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak. Conversation with Mead & Hunt. 8 and 9 January 2003.

----. "Minuteman II Deactivation Program." n.d. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

Peebles, Curtis. *High Frontier: The United States Air Force and the Military Space Program*. Air Force Fiftieth Anniversary Commemorative ed. Washington, D.C.: Air Force History and Museums Program, 1997.

Pennington County Courant, 1 October 1992.

Peter Kiewit Sons' Company v. Summit Construction and General Insurance Company of America, 422 F. 2d 242, United States Court of Appeals for the Eighth Circuit (26 November 1969).

Pietz, Martin. Interview by Steven Bucklin. Typed transcript. 18 May 1999. Available at Minuteman Missile National Historic Site, S.Dak.

[Huron, S.Dak.] Plainsman, 1986 - 1995.

Plattner, C. M. "First SAC Crews Controlling Minuteman." *Aviation Week and Space Technology* 78 (7 January 1963): 62-63, 65.

Popp, Captain Stephen C., and Captain Karen L. Selva. "Minuteman Missile Facilities Maintenance Technician: Analysis of the Effects of U. S. Air Force Consolidation on Personnel Proficiency and Hardware Conditions." Master's thesis, Air University, 1984.

Prados, John. The Soviet Estimate: U.S. Intelligence Analysis & Russian Military Strength. New York, N.Y.: Dial Press, 1982.

Preble, Christopher. "The Political Economy of National Security in the Nuclear Age: John F. Kennedy and the Missile Gap." Ph.D. diss., Temple University, 2002.

"Quarterly History of the 44th Strategic Missile Wing, 44th Combat Support Group," April - June 1978, exhibit 22. In U. S. Air Force Collection, AFHRA, K-WG-44-HI, IRIS No. 1028310.

Radtke, Captain Schrade F. "Anatomy of Instruction." *Combat Crew* 20, no. 9 (September 1969): 12-14.

The Rapid City Daily Journal and *The Rapid City Journal*, 1961 - 2002.

"Record of Decision for the Deactivation of the Minuteman II Missile Wing at Ellsworth Air Force Base, South Dakota." Ellsworth Air Force Base, S.Dak. 18 November 1991. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Review of SAC ICBM Combat Crew Training, Evaluation, and Scheduling, and Minuteman Academic Program." U.S. Air Force. 11 August 1980. Available at Air University Library, Maxwell Air Force Base, Ala.

Reynolds, Gregg M. "Makin' Missile Makin' Easy." *Boeing Magazine* 33, no. 6 (June 1963): 8-9.

----. "Minuteman Goes on Alert." *Boeing Magazine* 33, no. 1 (January 1963): 3-5.

----. "What Happens on a Minuteman Base?" *Boeing Magazine* 33, no. 4 (April 1963): 3-5.

Reynolds, William J. *South Dakota: The Face of the Future*. Encino, Calif.: Cherbo Publishing Group, 1999.

Riedinger, Thomas. "Minuteman on Wheels." *Boeing Magazine* 21, no. 2 (February 1961): 6-7.

----. "Minuteman on Target." *Boeing Magazine* 31, no. 3 (March 1961): 3-5.

----. "We Deliver." *Boeing Magazine* 32, no. 10 (October 1962): 3-5.

----. "Vandenberg, USA." *Boeing Magazine* 32, no. 11 (November 1962): 3-5.

Rodgers, Daniel. "Republicanism: The Career of a Concept." *The Journal of American History* 79, no. 1 (June 1992): 11-38.

Roig-Coepton, Aida E. "1991 Annual Brief History, 44th Missile Wing." Available at the 44th Missile Wing History Office, 44th Strategic Missile Wing, Ellsworth Air Force Base, S.Dak.

Roman, Peter J. *Eisenhower and the Missile Gap*. Cornell Studies in Security Affairs. Ithaca, N.Y: Cornell University Press, 1995.

Rose, Kenneth D. *One Nation Underground: The Fallout Shelter in American Culture*. New York, N.Y.: New York University Press, 2001.

Rose, Lisle A. *The Cold War Comes to Main Street: America in 1950*. Lawrence, Kans.: University Press of Kansas, 1999.

Rose, Mark. "Cold War Memories: A Critical Period is Commemorated in a New National Historic Site." *Archaeological Institute of America*. 3 May 2000. <http://www.archaeology.org/online/features/icbm/> 10 September 2002.

Rosenbaum, George A. "Brief History: 44th Strategic Missile Wing." n.d. Available at 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

Rosenberg, David Alan. "The Origins of Overkill: Nuclear Weapons and American Strategy, 1945-1960." *International Security* 7, no. 4 (Spring 1983): 3-71.

"SAC's Mixed, Balanced Missile Crews." *Airman* 32, no. 1 (January 1988): 36.

Samuel C. Phillips Collection. Manuscript Division, Library of Congress, Washington, D.C.

Schell, Herbert S. *History of South Dakota*. Lincoln, Nebr.: University of Nebraska Press, 1961.

Schriever, General Bernard A. Interview by Major Lyn R. Officer and Dr. James C. Hasdorff. Typed transcript. 20 June 1973. In U. S. Air Force Collection K168.7257-126, IRIS No. 1086785, Air Force Historical Records Agency, Maxwell Air Force Base, Ala.

Schwiebert, Ernest G. *A History of the U.S. Air Force Ballistic Missiles*. New York, N.Y.: F.A. Praeger, 1965.

Seiler, Captain George J. *Strategic Nuclear Force Requirements and Issues*. Rev. ed. Montgomery, Ala.: Air University Press, 1983.

Serna, Fernando. "Where Mighty Winds Blow." *Airman* 34, no. 3 (March 1990): 14-17.

Sessums, Major General John W., Jr. Interview by Hugh N. Ahmann. Typed transcript. 25-28 July 1977 and 26-31 March 1978. In U. S. Air Force Collection K239.0512-951, IRIS No. 1054535, Air Force Historical Research Agency, Maxwell Air Force Base, Ala.

Shaw, Frederick J., Jr. and Timothy Warnock. *The Cold War and Beyond: Chronology of the United States Air Force, 1947-1997*. Air Force Fiftieth Anniversary Commemorative Edition. Washington, D.C.: Air Force History and Museums Program in association with Air University Press, 1997.

Simpson, Charles. "Special History Issue - Land Based USAF Missiles." *AAFM Newsletter* 5, no. 1 (June 1997): 1-11.

----. "Atlas - Then and Now." *AAFM Newsletter* 7, no. 1 (1999): 1, 4-10.

Smith, James Richard. *Geography of the Northern Plains and Other Essays*. Augustana College Press Monograph Series; No. 6. [Sioux Falls, S.Dak.]: Augustana College Press, 1990.

Smolen, Second Lieutenant Robert L. "Trapped in the LCF." *Combat Crew* 25, no. 8 (August 1975): 19-21.

"The Sources Soviet Conduct." *Foreign Affairs* 25 (July 1947): 566-582.

South Dakota: A State to Behold. Aberdeen, S.Dak.: North Plains Press, 1975.

"Special Resource Study for Minuteman Missile Sites: Management Alternatives and Environmental Assessment." Washington, D.C.: Department of the Interior, Department of Defense, and the U.S. Air Force Legacy Resource Management Program. 1995. Available at Minuteman Missile National Historic Site, S.Dak.

"START I Enters Into Force Nuclear Arsenals to be Reduced Dramatically." Press release. U.S. Arms Control and Disarmament Agency. 5 December 1994. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

Stenvick, Luther L. *The Agile Giant: A History of the Minuteman Production Board*. Seattle, Wash.: Boeing Company, 1966.

Stine, G. Harry. *ICBM: The Making of the Weapon that Changed the World*. New York, N.Y.: Orion Books, 1991.

Stolley, Richard B. "How It Feels to Hold the Nuclear Trigger." *LIFE* 57 (6 November 1964): 34-41.

Stone, Irving. "Companies Vie for Minuteman Contract." *Aviation Week* 68 (17 March 1958): 18-19.

----. "Minuteman: The Best Is Yet to Be." *Air Force Magazine* 54, no. 3 (March 1971): 29-31.

"Strategic Air Command." *Global Security*. 2 December 2001. <http://www.globalsecurity.org/wmd/agency/sac.htm> 13 May 2003.

"Strategic Air Command Missile Chronology." Omaha, Nebr.: Office of the Historian, Strategic Air Command. 2 September 1975. In U.S. Air Force Collection K416.052-10, IRIS No. 1011276, Air Force Historical Research Agency, Maxwell Air Force Base, Ala.

"Strategic Arms Reduction Treaty (START)." *AAFM Newsletter* 2, no. 2 (1994): 1.

Stricklin, Lieutenant Charles. "Minuteman's House Mouse." *Airman* 18, no. 4 (April 1974): 32-35.

Success Before Countdown. Report prepared for the President's Missile Sites Labor Commission. Available at John F. Kennedy Library, Boston, Mass., Central Files, Box 201, File: FG 697.

Suid, Lawrence H. *Guts and Glory: The Making of the American Military Image in Film*. Lexington, Ky.: University Press of Kentucky, 2002.

"Supplement to Basic Technical Order: Deactivation of Wing II Minuteman Launch Control Facilities." U.S. Air Force, 7 April 1993. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Supplement to Basic Technical Order: Deactivation of Wing II Minuteman Launch Facilities." U.S. Air Force, 7 April 1993. Available at the 28th Civil Engineer Squadron, Maxwell Air Force Base, S.Dak.

Taylor, Hal. "McNamara Voices Some Optimism Over Nike-X, Tells Minuteman Plans." *Missiles and Rockets* 14 (3 February 1964): 20-21.

"Transfer of Construction." Launch Facility D-1. 29 November 1962. Located in "Supporting Files for Delta-01" in Real Estate Office of 28th Civil Engineer Squadron/CERR, Ellsworth Air Force Base, S.Dak.

"Transfer of Construction." Launch Facility D-9. 26 November 1962. Located in "Supporting Files for Delta-09" in Real Estate Office of 28th Civil Engineer Squadron/CERR, Ellsworth Air Force Base, S.Dak.

"Treaty Compliance Requirements as They Apply to the Transfer of D-09 Minuteman II Launch Facility Static Display to the National Park Service." U.S. Air Force. 2001. Available at Minuteman Missile National Historic Site, S.Dak.

Ulsamer, Edgar. "Minuteman: First Among Equals." *Air Force Magazine* 54, no. 3 (March 1971): 32-35.

United for America. Report prepared for the President's Missile Sites Labor Commission, 26 May 1962. Available at John F. Kennedy Library, Boston, Mass., Central Files, Box 201, File: FG 697.

"USAF Minuteman Flight Activated at Ellsworth AFB." *Autonetics Skywriter* 23, no. 28 (19 July 1963).

U.S. Department of the Interior. "Defense Department Awards Grant to the National Park Service." 18 October 1993. Available at Badlands National Park, S.Dak.

U.S. Department of the Interior. "Project Agreement: Minuteman Missile National Historic Site General Management Plan/Environmental Impact Statement." December 2001. Available at Badlands National Park, S.Dak.

U.S. Department of State. "Treaty Between the United States of America and the Union of the Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms (START Treaty)," 31 July 1991.

U.S. Department of State. "White House Statement on Mutual Detargeting." 14 January 1994. <http://www.fas.org/nuke/control/detarget/news/940114-331576.htm> 16 October 2003.

U.S. Congress Subcommittee on National Parks and Public Lands. "Statement of Tim Pavek, Minuteman II Deactivation Program Manager, Ellsworth Air Force Base." 14 September 1999. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak

U.S. Senate Committee on National Parks, Historic Preservation and Recreation. "Statement of Tim Pavek, Minuteman II Deactivation Program Manager, Ellsworth Air Force Base." 23 July 1998. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

"Vandenberg Launches Last Atlas E." *AAFM Newsletter* 3, no. 2 (1995): 1.

Vaughn, Major Arthur D. "Is it Feasible to Employ Women on Minuteman Missile Crews?" Research study, Air Command and Staff College, 1975.

Walker, Martin. *The Cold War: A History*. 1st American ed. New York, N.Y.: Henry Holt & Company, 1994.

The Washington Post, 9 April 1994 and 28 July 2002.

"Weapon System Operation Instructions." U.S. Air Force. 10 March 1986. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

Welcome to Ellsworth AFB: The Largest Operational Base in the Strategic Air Command. N.p.: Marcoa Publishing, n.d.

Wharton, Jeane. "Historic South Dakota Foundation Newsletter." Fall 1998. Available at the 28th Civil Engineer Squadron, Ellsworth Air Force Base, S.Dak.

----. "Interpreting the Cold War." *Cultural Resource Management* 22 , no. 9 (1999): 47-48.

White, Major James R. "Women on Minuteman Missile Crews." Research study, Air Command and Staff College, 1979.

White, Major Richard A. E. "What Does It Take?" *Combat Crew* 14, no. 4 (October 1963): 8-11.

Williams, Gene S. Interview by Mead & Hunt. Typed transcript. 7 January 2003. Available at Minuteman Missile National Historic Site, S.Dak.

Williams, Paul K. "Preserving a Cold War Icon: The Minuteman II Missile System." Paper presented at Preserving the Recent Past Conference, Chicago, Ill., 1995.

Wilson, Robert. Interview by Robert Hilderbrand. Typed transcript. 20 May 1999. Available at Minuteman Missile National Historic Site, S.Dak.

Wilson, Thomas. Interview by Mead & Hunt. Typed transcript. 3 February 2003. Available at Minuteman Missile National Historic Site, S.Dak.

Winterfelt, Rolf. "Minuteman System is 'Most Reliable.' " *Missiles and Rockets*, 8 (27 February 1961): 39, 53.

Wolk, Herman S. *Toward Independence: The Emergence of the U.S. Air Force*. Air Force Fiftieth Anniversary Commemorative ed. Washington, D.C.: Air Force History and Museums Program, 1996.

Wood, Captain Timothy C. "Simulated Launch." *Combat Crew* 25, no. 2 (February 1975): 14-15.

Woolf, Amy F. *START: Evolution of Selected Provisions*. Washington, D.C.: Congressional Research Service, 1992.

"Workers Now Dismantling 300 Midwestern Missile Facilities." *AAFM Newsletter* 2, no. 2 (1994): 1-6.

"Work Stoppages - All Missile Sites - June 1, 1963 - June 1, 1964." Missile Sites Labor Commission, RG280, Box 22, [1964]. National Archives, Washington, D.C.

Index

44th Strategic Missile Wing, 51, 52, 53-54, 66, 68, 143, 152. *See also* Ellsworth Air Force Base

Air Force, *see* United States Air Force

Air Research and Development Command, 14-15

Army Corps of Engineers, 30-31, 61, 142-143

Atlas
- Atlas D, 18
- Atlas E, 18-19
- Atlas F, 19
- development, 15, 16
- phase-out, 52
- specifications, 17, 18-19
- relation to Minuteman, 17
- *See also* Intercontinental Ballistic Missile

Blackhurst, David, 108

Boeing Company, 28, 29, 32, 54, 61, 66, 67, 68

Burris, David, 118

Bush, George H. W., 53, 136, 141, 142

Bush, Ken, 69, 118

Carter, James, 33, 71, 72, 116

Churchill, Winston, 2-4

Cold War, 1-9, 33, 70-72, 141, 146, 155, 162-163
- "massive retaliation", xii, 2, 7, 28, 32, 50, 145, 146, 152
- missile gap, 8, 25, 27, 31
- origins, 2-5
- policy (U.S.), 4, 33
- triangular diplomacy, 71

Conolly, Richard, 6

Convair, 14, 15

Corps of Engineers Ballistic Missile Construction Office, 64

Davis, Jay, 68, 135-137, 163

Delta-01
construction, 66
deactivation, 152-153
description, 81-87
Launch Control Center, 84-86
missileers, 108, 109
modifications for Minuteman II, 90-91
as part of Minuteman Missile National Historic Site, 145, 152-155
significance, xi-xii, 145-146, 152
See also Ellsworth Air Force Base, Launch Control Center, Launch Control Facility *and* Minuteman Missile National Historic Site

Delta-09
construction, 66
deactivation, 152-153
description, 87-90, 117
modifications for Minuteman II, 90-91
as part of Minuteman Missile National Historic Site, 145, 152-155
protests, 137
significance, xi-xii, 145-146, 152
See also Ellsworth Air Force Base, Launch Facility *and* Minuteman Missile National Historic Site

Eisenhower, Dwight D., 6- 8, 16, 19, 25, 30, 50-52

Ellsworth Air Force Base
history, 52
and Minuteman, 53-54, 67, 108, 116-117, 142-146, 154-155
and race relations, 69-70, 118
See also 44th Strategic Missile Wing, Delta-01, *and* Delta-09

Emergency War Order, 85, 115, 117

Gorbachev, Mikhail, 33, 72, 141

Intercontinental Ballistic Missile
development, 14-21
design challenges, 15, 17
and Western Development Division, 16-17
See also Atlas, Titan, *and* Minuteman

Kiewit Company *see* Peter Kiewit Company

Kennan, George, 3, 6
and Project Solarium, 6

Kennedy, John F., 8-9, 25, 51, 71

LaForge, John, 135-136, 138

Launch Control Center
deactivation, 143
description, 84-86
staff, 113-117
See also Delta-01

Launch Control Facility
deactivation, 143-144
security procedures, 109-110
See also Delta-01

Launch Facility
deactivation, 143-145
security procedures, 111, 113
See also Delta-09

Manson, Craig, 67, 108-109, 114, 117, 155

McCormack, James, 6

McNamara, Robert, 27-28, 52

Minuteman I, 26-31, 52
components of a missile site, 61
construction, 64-66
contractors, 28-29, 65
deployment, 8-9
design, 28
impact on economy, 67
launch procedures, 115
and missile gap, 25
property acquisition, 61-62
reasons for development, 1, 26-27
site selection, 30, 61
site conversions to Minuteman II, 90-91
specifications, 29
See also Intercontinental Ballistic Missile

Minuteman II, 31-32, 53, 54,
site conversions from Minuteman I, 90-91
deactivation, 142-143
See also Intercontinental Ballistic Missile

Minuteman III, 32-33. *See also* Intercontinental Ballistic Missile

Minuteman Missile Area Landowners Association, 62-64, 144-145.

Minuteman Missile National Historic Site, xi-xii, 152-155, 162-164. *See also* Delta-01, Delta-09

Missile Sites Labor Commission, 66

Missileers
facility manager, 109-110
female missileers, 117-118
flight security controllers, 110-111
life at a missile site, 108-119
living quarters, 110
maintenance crew, 112-113
missile combat crew, 113-117
missile rations cook, 112
public perceptions of, 117
Remain Over Night, 110, 113
security alert team, 111-112
shifts, 114
training, 113-114

National Security Council Papers
Number 68, 5, 6
Number 162, 7

Nuclear Test Ban Treaty, 133

Pavek, Tim, 70

Peace movement, 133-138
beliefs, 134, 136
Nukewatch, 135-136
Silo Pruning Hooks, 134-135, 138
South Dakota Peace and Justice Center, 134, 137
War Resisters League, 133

Peter Kiewit Company, 30, 61, 64-66, 67

Pietz, Martin, 108, 119

Project Solarium, 6, 7

RAND Corporation, 16, 28

Reagan, Ronald, 33, 72, 134, 136, 141

Roosevelt, Franklin D., 2, 40, 46

SALT II, 72, 141

South Dakota
Badlands National Park, 40
and economic impacts of missile construction, 67-69
history, 40-46
location for Minuteman missiles, 61
and missile deactivation, 143-145

South Dakota (*continued*)
and peace movement, 136-137
Wall, 44, 45, 46
See also Ellsworth Air Force Base *and* Wall Drug

Sputnik, 8, 25

Stalin, Josef, 2, 3

START Treaty, 53, 54, 141-146, 152, 154, 162

Strategic Air Command, 50-52
triad of nuclear deterrence, 32, 50, 52

Teapot Committee, 15-16

Titan
development, 16-17
specifications, 20-21
Titan I, 20, 52
Titan II, 20-21, 118
See also Intercontinental Ballistic Missile

Truman Doctrine, 4

Truman, Harry S., 2, 3, 5, 50, 118

United States Air Force,
history, 49, 118
organization, 55

Wall Drug, 45-45, 67, 68. *See also* South Dakota

Williams, Gene S., 67, 70, 111, 144

Western Development Division, 16-17, 26

Wright Air Development Center, 26

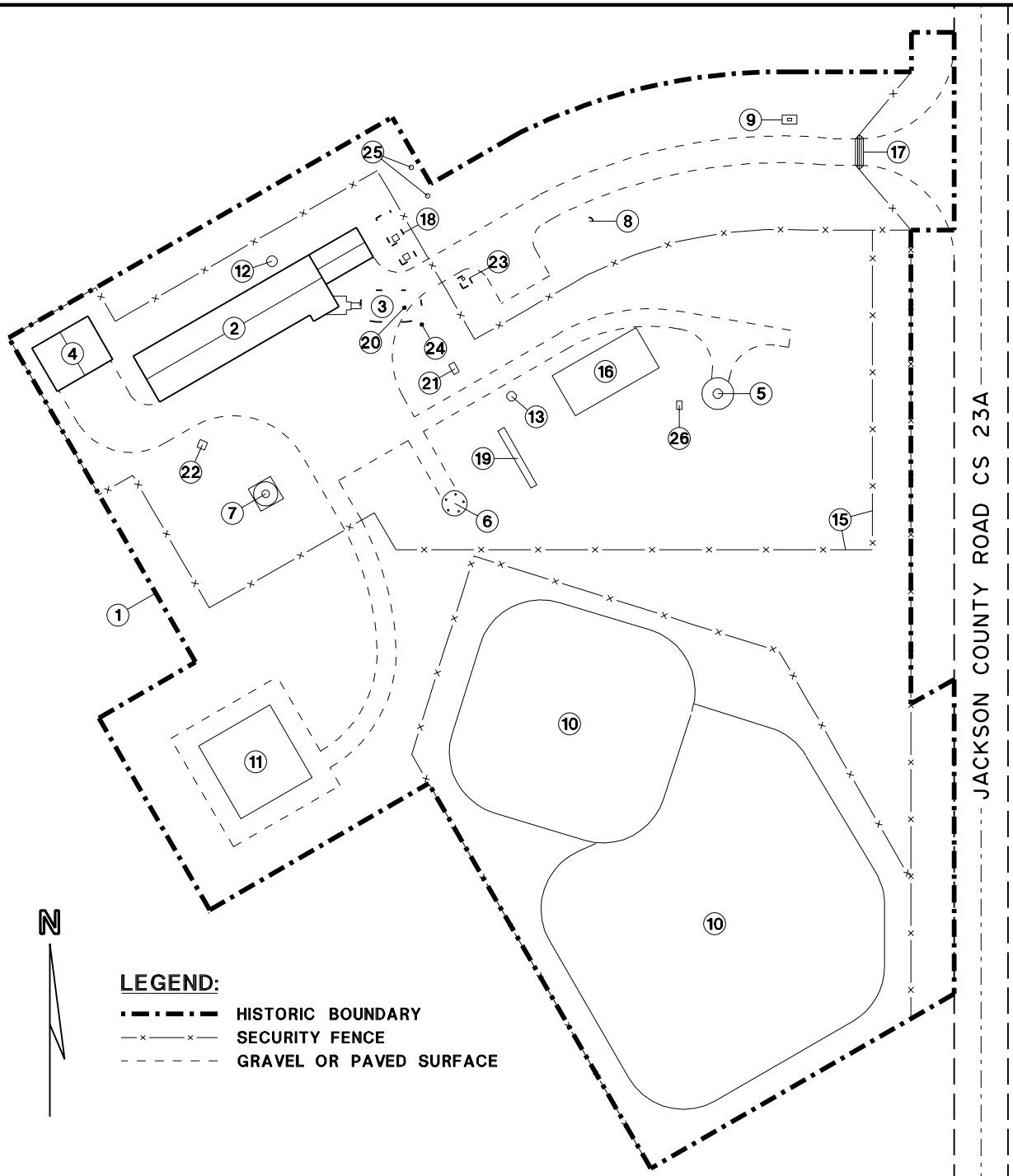
Yeltsin, Boris, 33, 72

Appendices

A. Minuteman Missile National Historic Site Cultural Resource Base Map

B. Minuteman Missile National Historic Site National Register Nomination

A. Minuteman Missile National Historic Site Cultural Resource Base Maps



MAP KEY:

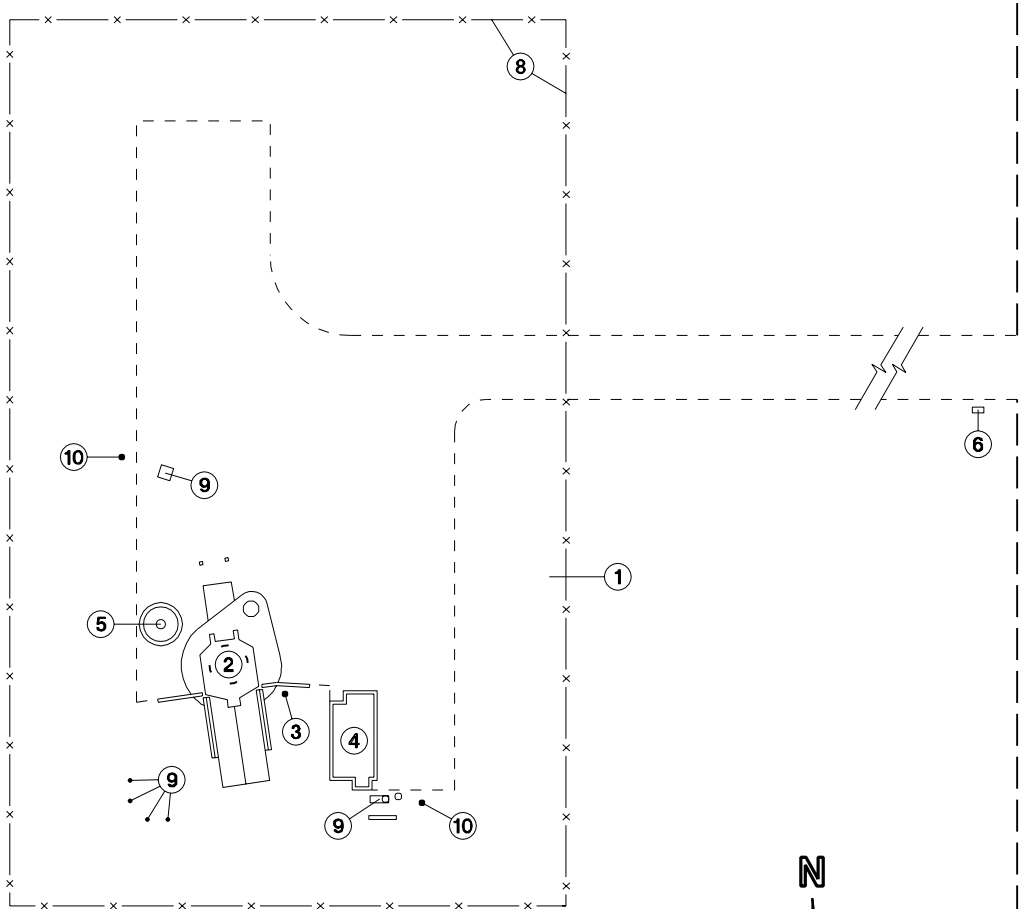
1. LAUNCH CONTROL FACILITY DELTA-01 SITE
2. LAUNCH CONTROL FACILITY SUPPORT BUILDING
3. LAUNCH CONTROL CENTER
4. HEATED VEHICLE STORAGE BUILDING
5. HARD HF TRANSMIT ANTENNA
6. HARD HF RECEIVE ANTENNA
7. HARDENED UHF ANTENNA
8. SLFCS ANTENNA
9. CATHODIC PROTECTION RECTIFIER
10. SEWAGE LAGOON
11. HELICOPTER PAD
12. ISST ANTENNA
13. TV SATELLITE DISH
14. HICS (UNDERGROUND - NOT MAPPED)
15. SECURITY FENCE
16. VOLLEYBALL COURT
17. CATTLE GUARD
18. UNDERGROUND DIESEL STORAGE TANK
19. HORSESHOE PIT
20. BASKETBALL HOOP
21. ABOVEGROUND DIESEL TANK
22. WATER WELL
23. GAS PUMP
24. FLAGPOLE
25. UTILITY POLES
26. CODE BURNER

MINUTEMAN ICBM LAUNCH CONTROL FACILITY DELTA-01

MINUTEMAN MISSILE NATIONAL HISTORIC SITE
SITE PLAN
JACKSON COUNTY, SOUTH DAKOTA

FEET
0 25 50 100
(approximate scale)

SOURCE:
National Park Service, Modified by Mead & Hunt, Inc.



MAP KEY:

1. LAUNCH FACILITY DELTA-09 SITE
2. MISSILE LAUNCHER
3. IMPSS ANTENNA
4. LAUNCH FACILITY SUPPORT BUILDING
5. HARD UHF ANTENNA
6. CATHODIC PROTECTION RECTIFIER
7. TWO AZIMUTH MARKERS (APPROX. 1000' FROM LAUNCHER)
8. SECURITY FENCE
9. OUTER ZONE SECURITY ANTENNA FOUNDATIONS
10. LIGHT FIXTURES
11. HICS MARKERS

LEGEND:

—×——×— SECURITY FENCE

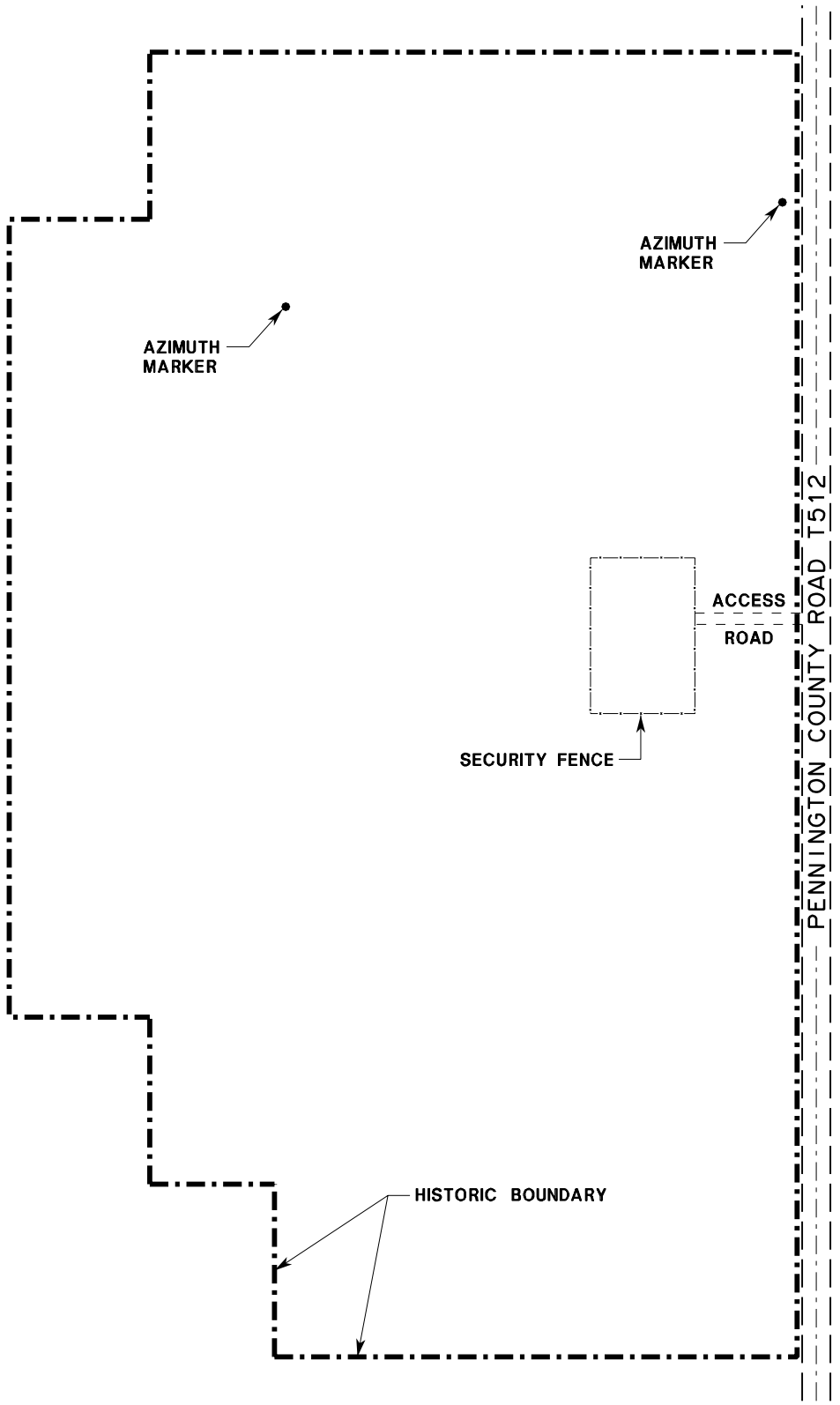
- - - - - - GRAVEL OR PAVED SURFACE

MINUTEMAN ICBM LAUNCH FACILITY DELTA-09

MINUTEMAN MISSILE NATIONAL HISTORIC SITE
SITE PLAN
PENNINGTON COUNTY, SOUTH DAKOTA

FEET
0 15 30 60
(approximate scale)

SOURCE:
National Park Service, Modified by Mead & Hunt, Inc.



N

NOT TO SCALE

MINUTEMAN ICBM LAUNCH FACILITY DELTA-09

MINUTEMAN MISSILE NATIONAL HISTORIC SITE
HISTORIC BOUNDARY MAP
PENNINGTON COUNTY, SOUTH DAKOTA

SOURCE:
National Park Service, Modified by Mead & Hunt, Inc.

B. Minuteman Missile National Historic Site National Register Nomination

OMB No. 10024-0018

United States Department of Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in *How to Complete the National Register of Historic Places Registration Form* (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900A). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name Minuteman ICBM Launch Control Facility Delta-01 and Launch Facility Delta-09, Ellsworth Air Force Base
other names/site number Minuteman Missile National Historic Site (MIMI)

2. Location

street & number Minuteman Missile National Historic Site (MIMI), Delta-01: W side Jackson CR CS23A, approx. .5 mi. N of I-90, Exit 127
city or town Cottonwood **Vicinity** X
state South Dakota **code** SD **county** Jackson **code** 071 **zip code** 57775
(see continuation sheet)

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this X nomination request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property X meets _ does not meet the National Register criteria. I recommend that this property be considered significant _X_ nationally statewide _locally. (_ See continuation sheet for additional comments.)

Signature of certifying official/Title Date

State or Federal agency and bureau

In my opinion, the property _X_ meets _ does not meet the National Register criteria.
(_ See continuation sheet for additional comments.)

Signature of commenting official/Title Date

State or Federal agency and bureau

Minuteman ICBM Launch Control Facility Delta-01 and Launch Facility Delta-09, Ellsworth Air Force Base	Jackson and Pennington	South Dakota
Name of Property	County and State	

4. National Park Service Certification

I hereby certify that the property is:

__ entered in the National Register. ___ See continuation sheet.		
__ determined eligible for the National Register. ___ See continuation sheet.		
__ determined not eligible for the National Register. ___ See continuation sheet.		
__ removed from the National Register.		
__ other, (explain:)		
	Signature of the Keeper	Date of Action

5. Classification

Ownership of Property (check as many boxes as as apply)

	private
	public-local
	public-State
X	public-Federal

Category of Property (Check only one box)

	building(s)
X	district
	structure
	site
	object

Number of Resources within Property (Do not include previously listed resources in the count)

Contributing	Noncontributing	
4	0	buildings
2	0	sites
17	0	structures
0	0	objects
23	0	total

Name of related multiple property listing:
(Enter "N/A" if property not part of a multiple property listing.
N/A

Number of contributing resources previously listed in the National Register
0

6. Function or Use

Historic Functions
(Enter categories from instructions)
DEFENSE/Air Facility

Current Functions
(Enter categories from instructions)
RECREATION AND CULTURE/Museum

7. Description

Architectural Classification
(Enter categories from instructions)
OTHER/ICBM Launch Facility and Launch Control Facility

Materials
(Enter categories from instructions)

foundation	Concrete
walls	Concrete, Metal
roof	Concrete
other	Asphalt

Narrative Description

(Describe the historic and current condition of the property on one or more continuation sheets.)

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for the National Register listing.)

X A Property is associated with events that have made a significant contribution to the broad patterns of our history.

_ B Property is associated with the lives of persons significant in our past.

X C Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.

_ D Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations
(Mark "x" in all the boxes that apply.)

Property is:

_ A owned by a religious institution or used for religious purposes.

_ B removed from its original location.

_ C a birthplace or grave.

_ D a cemetery.

_ E a reconstructed building, object, or structure.

_ F a commemorative property.

X G less than 50 years of age or achieved significance within the past 50 years.

Areas of Significance
(Enter categories from instructions)

Military
Engineering

Period of Significance

1963-1993

Signifiant Dates

1963 1993
1973
1991

Significant Person
(Complete if Criterion B is marked)

N/A

Cultural Affiliation

N/A

Architect/Builder
Ralph M. Parsons Company, Los Angeles, CA (engineer)
Peter Kiewit Sons' Inc., Omaha, NE (builders)
U.S. Army Corps of Engineers (engineers/builders)

Narrative Statement of Significance
(Explain the significance of the property on one or more continuation sheets.)

9. Major Bibliographic References

(Cite the books, articles, and other sources used in preparing this form on one or more continuation sheets.)

Previous Documentation on File (National Park Service):

- preliminary determination of individual listing (36 CFR 67) has been requested
- X previously listed in the National Register (11/29/99)
- previously determined eligible by the National Register
- designated a National Historic Ellsworth Air Force Base landmark
- recorded by Historic American Buildings Survey #
- X recorded by Historic American Engineering Record #SD-50

Primary location of additional data:

- X State Historic Preservation Office
- Other State Agency
- X Federal Agency
- Local government
- University
- Other

Name of repository:

South Dakota

10. Geographical Data

Acreage of Property Launch Control Facility Delta-01, 6.4 acres, and Launch Facility Delta-09, 90 acres
Total: approximately 96.4 acres

UTM References (Place additional UTM references on a continuation sheet.)

Delta-01

	Zone	Easting	Northing
1	14	262170	4862280
3	13	727495	4868340

Delta-09

	Zone	Easting	Northing
2	13	727680	4868340
4	13	728110	4867500

☒ See Continuation Sheet

Verbal Boundary Description (Describe the boundaries of the property on a continuation sheet)

Boundary Justification (Explain why the boundaries were selected on a continuation sheet)

11. Form Prepared By

name/title Christina Slattery, Emily Schill, and Amy R. Squitieri, Architectural Historians
This document is adapted from a draft National Historic Landmark Nomination prepared for the U.S. Air Force by John F. Lauber and Jeffrey A. Hess, Hess Roise and Company in 1996.
organization Mead & Hunt, Inc. **date** October 2003
street & number 6501 Watts Road **telephone** 608.273.6380
city or town Madison **State** WI **zip code** 53719

Minuteman ICBM Launch Control Facility Delta-01 and Launch Facility Delta-09, Ellsworth Air Force Base	Jackson and Pennington	South Dakota
Name of Property	County and State	

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps A USGS map (7.5-or 15-minute series) indicating the property's location.
A sketch map for historic districts and properties having large acreage or numerous resources.

Photographs Representative black-and-white photographs of the property.

Additional Items (Check with the SHPO or FPO for any additional items)

Property Owner

(Complete this item at the request of SHPO or FPO.)

name/title	U.S. Department of the Interior, National Park Service				
organization	Minuteman Missile National Historic Site (MIMI)			**date**	26 June 2003
street&number	Badlands National Park, P.O. Box 6			**telephone**	605.433.5552
city or town	Interior	**state**	SD	**zip code**	57750

Paperwork Reduction Act Statement: This information is being collected for applications to the National Register of Historic Places to nominate properties for listing or determine eligibility for listing, to list properties, and to amend existing listings. Response to this request is required to obtain a benefit in accordance with the National Historic Preservation Act, as amended (16 U.S.C. 470 et seq.).

Estimated Burden Statement: Public reporting burden for this form is estimated to average 18.1 hours per response including time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding this burden estimate or any aspect of this form to the Chief, Administrative Services Division, National Park Service, P.O. Box 37127, Washington, DC 20013-7127; and the Office of Management and Budget, Paperwork Reductions Projects, (1024-0018), Washington, DC 20503.

Delta-09

street & number Minuteman Missile National Historic Site (MIMI), Delta-09: W side Pennington CR T512, approx. .6 mi. W and S of I-90, Exit 116
city or town Quinn **Vicinity** X
state South Dakota **code** SD **county** Pennington **code** 103 **zip code** 57775

Description

Overview of Complex

Historically a part of Ellsworth Air Force Base, the Minuteman Intercontinental Ballistic Missile (ICBM) Launch Control Facility Delta-01 and Launch Facility Delta-09 are located in rural South Dakota about 50 miles east-southeast of Rapid City, South Dakota. Built in accordance with the Air Force dispersal strategy, the Launch Control Facility and the Launch Facility lie approximately 10 miles apart. The Launch Control Facility and the Launch Facility were originally linked by a system of blast-proof underground cables and a radio communications network, known as the Hardened Intersite Cable System (HICS). On active duty from 1963 until 1991, the Launch Control Facility and Launch Facility were part of an operational unit, collectively known as Delta Flight, consisting of one Launch Control Facility and ten missile Launch Facilities. Delta Flight was one of five flights assigned to the 66th Strategic Missile Squadron of the 44th Missile Wing, headquartered at Ellsworth Air Force Base, near Rapid City, South Dakota. By 1967, 1,000 Minuteman missiles were on alert in six separate deployment areas located throughout the north-central United States. The initial Minuteman I force was divided into five missile wings of either three of four missile squadrons per wing. Fifty missiles made up a squadron, and each squadron was further divided into five flights of ten missiles.

Delta-01 and Delta-09 were among fifteen Launch Control Facilities and 150 Launch Facilities constructed in the 13,500-square-mile Ellsworth deployment area between 1961 and 1963. The facilities were built according to standard plans prepared by the Ralph M. Parsons Company of Los Angeles. Peter Kiewit Sons' Inc. of Omaha was the general contractor for the project. The American Bridge Division of U.S. Steel, Los Angeles, fabricated steel components for the installations. The Malkin Company of Omaha was the mechanical subcontractor, and the Hirsch Company of Columbus, Ohio, was the electrical subcontractor. The Boeing Company of Seattle provided ground support equipment.[1] Delta-01 and Delta-09 were turned over to the Strategic Air Command on 30 June 1963, making them among the first Minuteman sites to be activated at Ellsworth.

In succeeding years, the Air Force introduced two major modifications of the Minuteman missile. To differentiate the various versions of technology, missile installations were designated, or redesignated, as Minuteman I, Minuteman II, and Minuteman III. The Ellsworth missile field became a Minuteman II installation in the early 1970s. No major structural modification was necessary for this conversion with Delta-09 modified only minimally by 1973. Over the years, Delta-01 and Delta-09 have seen only a limited amount of new construction and remodeling. Consequently, the facilities at both sites still strongly recall their era of construction and retain historic integrity. In September 1991, all 450 of the nation's Minuteman II missiles, including Launch Control Facility Delta-01 and Launch Facility Delta-09, were taken off alert. Delta-01 and Delta-09 were deactivated in early 1993 and thereafter remained on "caretaker status." In 1993 deactivation activities included the removal of

[1] Ed Niciejewski, "Minuteman Work Speeding," *Rapid City Daily Journal*, 13 December 1961. Subsequent references to the *Rapid City Daily Journal* will be identified with the abbreviation *RCDJ*.

the Minuteman II missile from Delta-09, the severing of the HICS, and the removal of classified electronic equipment, hazardous materials, and environmentally sensitive materials from both Delta-01 and Delta-09. When at all possible, Delta-01 and Delta-09 were left to appear as they had when the facilities were taken off of alert in 1991. Today, the sites, including the landscape components and cultural materials, remain largely as they were during their use by the Air Force. The retention of the sites' landscape and cultural materials will be significant to their future interpretation.

In 1993 the Air Force and the Rocky Mountain Regional Office of the National Park Service selected Delta-01 and Delta-09 for completion of a Special Resource Study examining the feasibility of preserving and interpreting the facilities as a historic site and their suitability for becoming a unit of the National Park Service. The property was also chosen for nomination as a National Historic Landmark symbolizing U.S. participation in the Cold War. The National Historic Landmark nomination was not submitted to the Keeper of the Register pending the outcome of the designation of the facility as a National Historic Site. In 1999 Delta-01 and Delta-09 were designated a National Historic Site by the United States Congress. With the establishment of the Minuteman Missile National Historic Site, the property was listed in the National Register of Historic Places (National Register). This National Register nomination provides documentation for the listed property. It is adapted from the draft National Historic Landmark Nomination prepared by Jeffrey A. Hess and John F. Lauber of Hess Roise and Company in 1996.

With the designation of the Minuteman Missile National Historic Site and the transfer of Delta-01 and Delta-09 from the Air Force to the National Park Service, the sites remained largely unchanged, retaining the same appearance as when they were taken off of alert in 1991. Delta-01 and Delta-09 were deactivated in 1993, with minimal modifications to the sites, and were placed in caretaker status in anticipation of the transfer. Both sites contain cultural materials left by the Air Force, such as furnishings and equipment that play a key role in interpreting the history of the site and defining its character. In National Register terms, Delta-01 and Delta-09 comprise a discontiguous district of two sites that encompass twenty-three contributing resources and associated features and landscape elements that are located both above (topside) and below ground. This property has no noncontributing resources. Associated features, including recreational equipment, mechanical and electrical equipment, historic objects, furnishings, and landscape elements, of Delta-01 and Delta-09 are important components of the overall site and are described in the site descriptions.[2] Based on a records review at the South Dakota State Historical Society State Historic Preservation Office and Archaeological Research Center, there are no other known historic or archeological sites within the historic boundaries of Delta-01 and Delta-09. The future identification of archeological sites at Delta-01 and Delta-09 are unlikely because of the construction methods

[2] These associated features are viewed as important elements of the overall site, but are not individually counted as a part of the National Register resource count.

employed at the sites. A list of resources of Delta-01 and Delta-09 is found below, followed by a description of the individual resources and associated features.[3]

Minuteman ICBM Launch Control Facility Delta-01 and Launch Facility Delta-09

Launch Control Facility Delta-01

Launch Control Facility Delta-01	Contributing Site
Recreation Resources – volleyball court, basketball hoop, horseshoe pit	*Associated Features*
Code Burner	*Associated Feature*
Flagpole	*Associated Feature*
Security Fence and Entrance Gate	*Associated Features*
Support Facilities – storage tanks, water well, gas pump, utility poles	*Associated Features*
Landscape elements, historic furnishings and objects, and equipment	*Associated Features*
Launch Control Facility Support Building	Contributing Building
Launch Control Center	Contributing Building
Heated Vehicle Storage Building	Contributing Building
Hard HF Transmit Antenna	Contributing Structure
Hard HF Receive Antenna	Contributing Structure
Hardened UHF Antenna	Contributing Structure
Survivable Low Frequency Communication System Antenna	Contributing Structure
Cathodic Protection Rectifier	Contributing Structure
Sewage Lagoon	Contributing Structure
Helicopter Pad	Contributing Structure
ICBM Super-High-Frequency Satellite Terminal Antenna	Contributing Structure
Television Satellite Dish	Contributing Structure
Hardened Intersite Cable System	Contributing Structure

[3] Physical descriptions of Delta-01 and Delta-09 are based on a number of sources, including field inspections by John Lauber and Jeffrey Hess in November 1993. The most comprehensive general description of the facilities at Ellsworth Air Force Base appears in a technical manual on file at the Ellsworth's Environmental Management Office (28 CES/CEVC). See "Weapon System Operation Instructions," T.O. 21M-LGM30F-1-13, 5 September 1991. Project blueprints and original site delivery documents on file at the Missile Engineer's Office (28 CES/CEL) at Ellsworth furnish detailed information about construction of the facilities. In addition, Lauber and Hess gleaned valuable information on the operation of the two sites from Tim Pavek and Lt. Mark Bowen. Pavek worked as a civilian missile engineer at Ellsworth, beginning in the early 1980s. He was interviewed by John Lauber at Ellsworth on 5 and 8 November 1993, and subsequently by telephone on 28 February 1994, 11 March 1996, and 29 October 1996. Bowen, who worked as a launch crew training specialist at Ellsworth, was interviewed by Lauber at the installation on 5 November 1993. The status of a "discone antenna" depicted on a 1994 Historic American Engineering Record drawing of Launch Control Facility Delta-01 is uncertain (HAER No. SD-50, sheet 1). Part of the facility's surveillance system, the antenna originally consisted of a network of underground cables attached to an aboveground superstructure. The superstructure had been removed by the mid-1980s, but the condition of the underground cables is unknown. Christina Slattery and Erin Pogany conducted site visits of Delta-01 and Delta-09 in November 2002 and January 2003 to update descriptive information.

Launch Facility Delta-09

Launch Facility Delta-09	Contributing Site
Security Fence and Entrance Gate	*Associated Features*
Support Facilities – utility poles, outer zone security antenna foundations	*Associated Features*
Landscape elements, equipment, and historic objects	*Associated Features*
Missile Launcher	Contributing Structure
Launch Facility Support Building	Contributing Building
Improved Minuteman Physical Security System Antenna	Contributing Structure
Hard UHF Antenna	Contributing Structure
Cathodic Protection Rectifier	Contributing Structure
Azimuth Markers	Two Contributing Structures
HICS Markers	Contributing Structure

Launch Control Facility Delta-01 **Contributing Site** **1963**

The Launch Control Facility Delta-01 site occupies an open, grassy tract of land on the west side of the Jackson County Road CS 23A, approximately 0.5 miles north of Interstate Highway 90, Exit 127. The entire site is 6.4 acres with approximately 1.9 acres located inside the security fence. Delta-01 is located in a rural setting and the site's access road, Jackson County Road, is an improved gravel road. The landscape surrounding Delta-01 is open agricultural land of native grasses. A couple of small agricultural outbuildings are located to the east of the site. From the site, a distant view of Interstate 90 and a billboard is visible to the south.

Delta-01 includes fourteen contributing resources – the Delta-01 site, Launch Control Facility support building, Launch Control Center, heated vehicle storage building, hard HF transmit antenna, hard high-frequency (HF) receive antenna, hardened ultra-high frequency (UHF) antenna, survivable low frequency communication system antenna, cathodic protection rectifier, sewage lagoon, helicopter pad, ICBM super-high frequency satellite terminal antenna, television satellite dish, and HICS. Delta-01 does not include any noncontributing resources. Terrain at the site rises gradually toward the north. A chain-link security fence, topped with strands of barbed wire, encloses the site's buildings and structures. Access to the site is provided by a gently curving gravel driveway on the west side of the county road. The driveway passes over a steel cattle guard and through a remote-controlled, chain-link, sliding gate in the security fence. The Launch Control Facility support building and the vehicle storage building are located just inside the security fence, and an asphalt drive and parking area are located in front of them. The Launch Control Center, accessed from the Launch Control Facility support building, is located below ground and is not visible.

The remaining area inside the security fence is covered with native grass that was routinely mowed by the Air Force. The area inside the security fence includes a variety of electronic, mechanical, and recreational features to support the facility, including a volleyball court, horseshoe pit, underground diesel storage tank, aboveground

diesel storage tank, water well, gas pump, basketball hoop, flagpole, and utility poles.[4] A code burner is located in the grassy area near the volleyball court. This open metal drum mounted on metal legs was used to burn security codes. These associated features and landscape elements provide insight into the use of the facilities by the Air Force and are significant elements of the site. The HF transmit antenna, hard HF receive antenna, hardened UHF antenna, survivable low-frequency communication system antenna, ICBM super-high-frequency satellite terminal antenna, and television satellite dish are located within the security fence. The cathodic protection rectifier is located outside the security fence along the access road. The underground HICS is not visible at the site. A concrete helicopter pad and two sewage lagoons are located outside of the security fence to the south. The area outside of the security fence features native grasses. A barbed-wire fence with wooden posts surrounds the facility's two sewage lagoons in the southeast corner of the site.

The Minuteman ICBM Launch Control Facility Delta-01 contains a wealth of historic objects, furnishings, and technical equipment that reflect the successive use of the facilities by the Air Force. Delta-01, complete with its contents, was transferred from the Air Force to the National Park Service. The historic objects, furnishings, and equipment provide valuable insight into the use of this facility by the Air Force. The contents of Delta-01 are important and are considered associated features of the site.

Launch Control Facility Support Building Contributing Building 1963
The Launch Control Facility support building is the most prominent surface feature at the site. Located inside the sliding security gate, the support building provided accommodations for eight Air Force personnel, served as a security control center for the entire flight, and housed environmental, mechanical, and electrical systems for the underground Launch Control Center where the two-man missile combat crew pulled their duty. Two missile combat crew members were stationed in the underground Launch Control Center. Initially the missile combat crew members served a thirty-six to forty hour alert tour with two eight to twelve-hour shifts on alert in the Launch Control Center, separated by rest periods in the Launch Control Facility support building. In 1977 the shift was changed to a single twenty-four hour shift, with the crew being replaced by a new missile combat crew dispatched from Ellsworth Air Force Base. Eight additional crew members, including two flight security controllers, two two-person armed alert response teams, a cook, and a facility manager, worked three-day shifts in this topside support building.

The Launch Control Facility support building remains largely as it did when Air Force personnel left the site following deactivation of the Minuteman II missiles. The interior remains fully furnished and looks almost as if personnel just left and locked the doors – magazines from the early 1990s remain in the magazine rack, salt shakers are on the table of the dining booth, and the EMDAS (Expanded Minuteman Data Analysis System) log

[4] The gas pump and flagpole are currently in temporary storage in the garage and will be returned to their original locations in the near future. A second underground diesel storage tank was located next to the vehicle storage building, but was removed during the deactivation of the site.

remains on the desk in the facility manager's bedroom. These cultural artifacts are significant associated elements of the site and will aid in the future interpretation of the site.[5]

The support building is an unpretentious, one-story, ranch-form structure. It is conventional wood-frame construction, and has a low-pitched, side-gabled roof. The building is oriented along a northeast-southwest axis, with its principal side facing toward the southeast. A wide, asphalt-paved parking/turnaround area extends along its southeast side. The main portion of the building is rectangular in plan, measuring approximately 33 feet wide and 128 feet long. The southeast wall projects forward near the northeast end to form a wide bay for the installation's security center. A gabled-roof, one-story mechanical wing extends from the building's northeast side and is rectangular in plan, measuring approximately 21 feet deep and 34 feet wide.

The support building rests atop a concrete slab foundation. The outer walls are sheathed with wide-lap, steel, clapboard-style siding embossed with a wood-grain pattern. The siding is painted tan. It was installed between the mid-1970s and early 1980s to replace the original cement-asbestos siding. The roof has minimal overhangs, and is covered with brown, asphalt, T-lock shingles.[6] Large sheet-metal ventilator hoods are located on the roof and back wall of the mechanical wing, and several smaller ventilator hoods project from the roof of the main building above the kitchen and utility room areas. There are steel, ogee-profile gutters at the eaves. Fascia boards, gutters, and verge rafters are painted dark brown.

Windows in the support building are one-over-one, double-hung, vinyl-clad wood sash fitted with white combination storm/screen units. These windows were installed in 1976 to replace the building's original wood sash windows. Although most of the windows are arranged in groups of two or three, the security-center windows are placed closely together, forming a nearly continuous band that extends across the southeast wall and wraps around both sides of the bay.

The southeast side of the Launch Control Facility support building has a communication equipment room, water treatment room, and boiler room that are accessed through exterior doors. The boiler room can also be entered from the interior of the building. The rear of the support building has an attached VHF antenna and an air conditioner. The support building's main entrance is located on the main facade, adjacent to the security bay. A doorway on the northeast side of the main entrance hall opens directly into the security control center. This room

[5] Various inventories and lists have been prepared by the Air Force to identify the equipment and historic objects and furnishings of Delta-01 and Delta-09. In addition a video tape inventory was completed of the sites. The inventories and video tape are currently in the files of Tim Pavek, Civil Engineer, 28th Civil Engineering Squadron, Ellsworth Air Force Base, S.Dak. The National Park Service plans to conduct to catalog the cultural materials at Delta-01 and Delta-09 in the Automated National Catalog System (ANCS+) database.

[6] John F. Lauber and Jeffrey A. Hess, "Minuteman II ICBM Launch Control Facility D-1 and Launch Facility D-9, Ellsworth Air Force Base Draft National Historic Landmark Nomination," prepared for the U.S. Air Force, 1996. The draft National Historic Landmark Nomination cites the replacement of the siding in 1976, while project drawings date to 1983. Drawings on file at the office of Tim Pavek, Environmental Engineer, 28 CES/CEVR, Ellsworth Air Force Base, S.Dak.

served as headquarters for the Air Force security police who maintained a constant vigil over the facilities of Delta Flight. Positioned beneath the windows inside the center is a desk-like console containing telephone and radio equipment. Guards seated at this console had a direct view of the main entrance gate and the road. The guards operated the entrance gate, checked the credentials of visitors to the site, and monitored radio transmissions. An expanded metal cage set into one corner of the room provided storage space for weapons. A small enclosed vestibule behind the security center served as the sole access point to the underground Launch Control Center (description of the Launch Control Center follows).

The support building includes both residential spaces, such as the day room, bedrooms, exercise room, and kitchen, and operational and mechanical spaces, such as the security control center, water treatment room, boiler room, diesel generator room, and environmental support rooms. The interior finishes of the residential spaces at Delta-01 largely date to the late 1980s. Interior spaces in Ellsworth's Launch Control Facility support buildings were decorated and furnished by the people who occupied them. As part of an ongoing “self help” program, the base supplied materials such as paint, tile, and wall paneling, and Delta Flight personnel supplied the labor required to put the materials into place.

The Launch Control Facility’s main entrance hall leads into the spacious day room area. The day room provided dining and recreational space for topside support personnel. The day room furnishings include couches, a television (temporarily placed in storage), and both dining tables and booths. The day room walls are covered with wainscoting of pre-finished hardboard or varnished wood. The east wall of the day room is decorated with a large mural depicting a woodland scene. The day room and other rooms in the residential area have suspended acoustical tile ceilings with recessed fluorescent lighting fixtures. A dedication plaque, dating to November 1966, is located inside the day room and reads “as a tribute to the goodwill and mutual understanding between the citizens of this community and the Air Force.”

A kitchen and pantry are located off the day room. The kitchen and pantry feature metal cabinets and industrial kitchen appliances. The wall of the pantry retains a menu and price list of food items available for purchase by the staff. The kitchen walls are covered with melamine panels and the floors are vinyl. A doorway off of the day room opens into a long central hallway flanked by seven bedrooms, men's and women's latrines, a boiler room, and a utility closet. The women's latrine was added in the mid-1980s, when the Air Force began to assign women to the duty roster at Minuteman sites.[7] The bedrooms feature carpeted floors, walls finished with fabric-covered sound board, and suspended acoustical ceiling tiles with recessed fluorescent lighting fixtures. The bedrooms were furnished with beds or bunk beds, a desk, and freestanding wardrobe closets. The facility manager and VIP guests were the only personnel to receive their own bedroom. The two bedrooms assigned to security personnel were outfitted with blackened windows and were provided with sound insulation to allow security personnel to

[7] Although women were assigned to "topside" duty at Ellsworth's fifteen Launch Control Facilities beginning in the mid-1980s, the underground Launch Control Centers continued to be staffed entirely by men until August 1989, when the base's first mixed-gender crew completed an alert at Launch Control Facility India-01. See Dirk Jameson, "Wing Nears Last Chapter in History," *The Plainsman*, 15 April 1994.

sleep during the day. The bedroom for security personnel includes a locker for weapons and a secured can to dummy fire weapons into to verify that they are unloaded.

The wing on the east end of the support building originally contained a single-stall garage and two mechanical equipment rooms. Floors in the mechanical rooms and utility areas are covered with vinyl, vinyl-asbestos, or asphalt tile. Interior walls throughout the mechanical rooms and utility areas of the support building are sheathed with gypsum wallboard. The garage was enclosed in 1975 and was converted into an exercise room for staff. The equipment rooms contain a diesel-fueled generator for emergency power, as well as air conditioning and filtration equipment for the Launch Control Center.

Launch Control Center **Contributing Building** **1963**

Buried in the earth approximately 32 feet beneath the Launch Control Facility support building is the Launch Control Center. This blast-hardened structure served as the command post for the ten dispersed missiles of Delta Flight. The Launch Control Center is entered from the Launch Control Facility support building through a 10-foot-square, reinforced-concrete access shaft that descends from a small vestibule at the back of the security center. The shaft contains a small elevator and a steel-rung ladder surrounded by an open safety cage. The base of the shaft opens into a low-ceilinged vestibule that provides room for a bank of lockers and swing space for an 8-ton, steel-and-concrete blast door that seals the entrance to the control center. One wall of the vestibule is painted with art work depicting a missile labeled “USAF” blasting through the flag of the former Soviet Union.

A small sign on the wall of the vestibule and a yellow line painted across the floor demarcate the beginning of the control center's high-security "no-lone zone, two-man concept mandatory." Any person entering the restricted area had to be accompanied or observed by a second person who was trained to detect erratic behavior, improper activity, or sabotage attempts. Launch control officers carried side arms to protect the nuclear resources controlled from within the "no-lone zone," and use of "deadly force" was authorized. A piece of art work on the blast door serves as a darkly humorous reminder of the Launch Control Center's defining purpose. Emblazoned on the door's outer face is a crudely painted depiction of a red, white, and blue pizza delivery box, labeled "Minuteman II." A hand-lettered legend framing the illustration reads: "World-wide delivery in 30 minutes or less, or your next one is free."[8]

The blast door can be opened only from inside the Launch Control Center. The door is secured by twelve hydraulically operated latchpins placed around its perimeter. When these pins retract, the door swings open on massive roller-bearing hinges to reveal a low, tunnel-like passageway leading to the Launch Control Center. The Launch Control Center itself consists of two separate structural elements, nestled one inside the other. On the outside is a protective shell, shaped like an enormous gelatin capsule. Oriented along an east-west axis, the shell measures 29 feet in diameter and 54 feet in length (outside dimensions). It is constructed of heavily reinforced

[8] The illustration on the blast door was painted in 1991 by Tony Gatlin. See "Ellsworth Air Force Base, 44th Strategic Missile Wing, Blast Door Art," on file in the office of Tim Pavek, Civil Engineer, 28th Civil Engineering Squadron, Ellsworth Air Force Base, S.Dak.

concrete, with walls 3-4 feet thick. Its interior surface is lined with a 1/4-inch-thick steel plate. Suspended inside the shell is a box-like acoustical enclosure containing the launch control consoles, communications equipment, missile monitoring equipment, and spartan accommodations for the two-person Air Force launch crew. The acoustical enclosure is rectangular in plan, measuring approximately 12 feet wide and 28 feet long. It rests atop a 12-foot-by-32-foot, steel-framed platform. The corners of the platform are suspended by a large pneumatic cylinder called a "shock isolator." The shock isolators hang from heavy chains attached to the ceiling of the shell, and are designed to let the enclosure bounce as much as 2 feet in any direction without major damage.

An articulated, steel-plate bridge spans the gap between the platform and the access tunnel. The floor of the acoustical enclosure is made of removable steel plates covered with sheet vinyl. A strip of light brown carpet lies over the floor plates. Compartments beneath the floor contain survival equipment, emergency batteries, and a motor generator. The walls and ceilings of the enclosure are made of hollow-walled, perforated-steel panels filled with sound-absorbing material.[9] A beige fabric headliner is attached to the ceiling framework with Velcro. The headliner was installed in 1990 to help reduce noise levels inside the enclosure. Four recessed fluorescent lighting fixtures centered in the ceiling illuminate the enclosure's interior. Emergency task lighting is provided by adjustable spotlights mounted on the ceiling. Virtually every surface inside the enclosure is painted pale green. "It's a color we've learned to detest," observed one Ellsworth launch crew member in 1964.[10]

The Launch Control Center contains two desk-like consoles placed about 12 feet apart. Positioned in front of each console is a swiveling, high-backed, aircraft seat fitted with seat belts and a shoulder harness. The launch control (commander's) console is located at the east end of the acoustical enclosure, directly opposite the entrance. It has an illuminated panel that allowed the crew commander to continually monitor the operational and security status of each of the ten missiles and launchers in Delta Flight. The communications control (deputy commander's) console is centered against the south wall of the enclosure. It contains an array of radio and telephone equipment that enabled the crew to communicate with other Launch Control Facilities, base headquarters, and the Strategic Air Command. At the side of each console is a small panel containing a spring-loaded, key-operated launch switch. The keys to these switches were kept in a double-padlocked, red steel box mounted above the deputy commander's console. If crew members had received an order to launch their missiles, they first would have unlocked their padlock on the red steel box and taken their launch keys and preset authenticators out of the red box. Then, if the Emergency War Order had been determined to be authentic, the officers would have inserted the codes they had received into the enabling panel, inserted the keys into the switches, and turned them in unison. If their launch command was verified by a second Launch Control Center, one to ten Minuteman missiles would have blasted out of their silos and streaked toward preassigned targets halfway around the world.

---

[9] One early visitor to the Ellsworth facilities reported that the noise inside the Launch Control Center was "almost overwhelming -- a high electrical whine. It was comforting proof that all equipment was working, but my ears rang for hours after I left the capsule." See Richard B. Stolley, "How It Feels to Hold the Nuclear Trigger," *Life* 57 (6 November 1964): 38.

[10] Stolley, "How It Feels," 38.

Lining the walls of the acoustical enclosure are heavy aluminum electronic racks containing computer equipment, radio transmitters and receivers, a telephone relay system, and a power control panel. The acoustical enclosure is also equipped with a stainless steel latrine, a small refrigerator/microwave oven unit, and a curtained sleeping compartment. Installed in 1991, the sleeping compartment replaced a military cot that had occupied the same space. Virtually everything in the Launch Control Center is securely attached or strapped down, including the coffee pot.

The Launch Control Center ordinarily used commercial electrical power to run its motor generator, and drew its clean and cool air supply from air conditioning equipment located aboveground in the Launch Control Facility support building. However, the center was also capable of operating for sustained periods of time without any support from topside. In the event of a nuclear attack or higher state of readiness, an automatic blast valve system was designed to seal the capsule off from the surface. The storage batteries and motor generator beneath the floor would provide emergency electrical power and an emergency air conditioning unit would prevent vital electronic equipment from overheating. For extended periods of time crew members would then activate a hand-pumped oxygen regeneration unit to obtain breathable air.

Crew members trapped in the capsule after an attack could theoretically reach the surface through a 3-foot-diameter, corrugated-steel escape tube that angles upward from the east end of the Launch Control Center. To maintain rigidity, the tube is sand-filled and plugged at its lower end. To make their exit, crew members would have removed the plug, dug out the sand, and climbed up the tube to ground level.

Heated Vehicle Storage Building Contributing Building 1968

Standing near the northwest corner of the Launch Control Facility support building is a large vehicle storage building. This structure was erected in 1968 to provide heated parking for vehicles, including a front-end loader intended for snow removal. The heated vehicle storage building is a one-story, three-stall, wood-frame garage with a low-pitched, front-gabled roof. Resting on a concrete slab, the building is rectangular in plan, measuring approximately 32 feet by 40 feet. Its outer walls are sheathed with wide-lap, steel, clapboard-style siding embossed with a wood-grain texture and painted tan. The roof has slight overhangs and brown asphalt T-lock shingles. In the building's principal (southeast) facade is a large central garage door opening flanked by two slightly smaller openings. Each of the three openings contains an insulated-steel, overhead door with horizontal flush panels.

The building's interior walls are sheathed with hardboard panels. The ceiling is insulated but not finished. Steel pipe columns between the bays provide additional structural support for the roof. A small enclosed furnace room is in the building's west corner. An enclosed tool storage room, built about 1986, adjoins the rear (northwest) wall.

Hard HF Transmit Antenna Contributing Structure 1963
Near the east side of the compound, about 140 feet due south of the access road, is a blast-hardened or underground protected, HF transmit antenna. This structure consists of an underground, reinforced-concrete cylinder, approximately 21 feet in diameter and 50 feet deep (outside dimensions). The well of the cylinder contains a telescoping, four-sided radio antenna originally capable of extending to a maximum height of 120 feet. It was deactivated in the mid-1970s.

Hard HF Receive Antenna Contributing Structure 1963
The hard HF receive antenna is set into the ground about 160 feet south-southeast of the Launch Control Facility support building. This structure consists of a reinforced-concrete cylinder measuring approximately 16 feet in diameter and 37 feet deep (outside dimensions). The cylinder is covered by a concrete cap. Distributed evenly around the perimeter of the structure are five small ports. Each port contained a slender, ballistically actuated, steel, monopole antenna. This antenna system was deactivated in 1987-88. When it was still in use, one monopole extended from the cylinder at all times. If the exposed antenna were to have been damaged during an attack, a replacement could have been quickly deployed through the detonation of an explosive squib in an adjacent port.

Hardened UHF Antenna Contributing Structure 1976
The hardened UHF antenna stands near the southwest corner of the Launch Control Facility support building. Records indicate that this antenna was installed by the Motorola Company in 1976 to provide "unprecedented reliability to radio communications between the base and the missile field."[11] The hardened UHF antenna consists of a massive, cast-steel frustum or partial cone, bolted to a thick, reinforced-concrete slab 16 feet square. Surmounting the frustum is a conical, white fiberglass weather dome.

Survivable Low Frequency Communication System (SLFCS) Antenna
Contributing Structure 1968
Buried in the ground about 140 feet east of the Launch Control Facility support building, this antenna is not visible from the surface. The SLFCS is part of the Emergency War Order communication system.

Cathodic Protection Rectifier Contributing Structure 1963
Located just inside the security fence on the north side of the access road is the cathodic protection rectifier, an electronic device designed to protect underground features such as fuel tanks from corrosion. The aboveground portion of the rectifier consists of a white-painted steel electrical box mounted on a wood pole. The below ground portion consists of a well approximately 220 feet deep, containing eleven graphite anodes.

[11] "Chronology of the 44th Strategic Missile Wing, 1976," on file at the 44th Missile Wing History Office, Ellsworth Air Force Base, S.Dak. The 44th Strategic Missile Wing was inactivated in 1994, records from the 44th Missile Wing History Office have been sent to the Air Force Historical Research Agency at Maxwell Air Force Base, Montgomery, Ala.

Sewage Lagoon **Contributing Structure** **1963, 1970-71**
Located just outside the security fence, approximately 240 feet southeast of the Launch Control Facility support building, are two large sewage lagoons used for treating waste materials produced at the Launch Control Facility. The original sewage lagoon is an open settling basin, 118 feet square, surrounded by an 8-foot-high earthen berm. In 1970-71 an additional lagoon was appended to the southeast corner of the original structure. Although it is similar in construction to the original pond, the new overflow lagoon is irregular in plan, and is considerably larger than the earlier basin.

Helicopter Pad **Contributing Structure** **1970-71**
Helicopters from Ellsworth Air Force Base were often used to transport personnel and equipment between the Launch Control Facility and the main base. A large helicopter pad located outside the security fence south of the Launch Control Facility support building provided a safe landing area for these aircraft. The helicopter pad consists of a flat concrete slab 50 feet square, surrounded on all sides by a wide shoulder of coarse gravel. The pad was built in 1970-71 to supplant a smaller landing area constructed in 1966 located on the north side of the access road.

ICBM Super-High-Frequency Satellite Terminal (ISST) Antenna
Contributing Structure **c.1992**
The ISST Antenna was installed at the rear of the Launch Control Facility support building at the same time missile sites were being deactivated in the 66th Strategic Missile Squadron.

Television Satellite Dish **Contributing Structure** **1987-88**
The television satellite dish is located in the grassy area in front of the Launch Control Facility support building.

Hardened Intersite Cable System (HICS) **Contributing Structure** **1963**
The HICS is an underground communications link that connected the Launch Control Center at Delta-01 with all ten Delta-Flight Launch Facilities, including Delta-09. The HICS is buried between four and eight feet below ground and is approximately 1,732 miles long. The system employed a double-walled cable, pneumatically pressurized so that ruptures could be readily identified. To demonstrate compliance with the *Treaty Between the United States of America and the Union of the Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms* (START Treaty) agreement, the HICS link was permanently disabled by severing and removing small portions of the cable. The majority of the system still remains underground in its original location, setting, and design remain allowing it to be a contributing feature of the property.

Launch Facility Delta-09 **Contributing Site** **1963**
The Launch Facility Delta-09 site is located approximately 10 miles west-northwest of Launch Control Facility Delta-01. The Launch Facility occupies part of an open, grassy tract of land straddling Pennington County Road T512, about 0.6 miles west and south of Interstate 90 Exit 116. The 90 acre site includes 10 acres that were in exclusive use by the Air Force including 1 acre within the security fence and 80 acres that were in concurrent use

by the Air Force. The Delta-09 site includes nine contributing resources – the overall site, the missile launcher, the Launch Facility support building, the improved Minuteman physical security antenna, the hard UHF antenna, the cathodic protection rectifier, two azimuth markers, and a HICS cable marker – and no noncontributing resources. Delta-09 is surrounded on the north, west, and south sides by Buffalo Gap National Grassland property under ownership of the United States Forest Service. The launch structures are concentrated inside a rectangular area surrounded by a chain-link security fence. A double gate is located on the east side of the security fence. A gravel access drive leads from the double gate to the nearby county road.

The area inside the enclosure has been graded to form a level, earthen platform that is elevated a few feet above the surrounding terrain. The platform has a gravel surface, and was specifically planned to provide maneuver space for the truck-like transporter-erector vehicles that hauled and emplaced the Minuteman missiles. The area surrounding the platform is native grass and the area was routinely mowed by the Air Force. The missile launcher and Launch Facility support building are located near the southern end of the maneuver space platform, with most of their structural elements underground. A smaller rectangular area at the north end of the platform outlined by four, low, small concrete corner pylons served as a landing pad for helicopters. Floodlights mounted atop two wooden utility poles at opposite corners of the maneuver space provided illumination for nighttime maintenance activities at the site. Two remnants of the concrete-base pad from the earlier outer zone security system antennas remain at the site: a square concrete pad with four reflector mount pedestals is located to the southwest (rear) of the missile launcher and a clutter monument and footing of the antenna pedestal are located to the rear (south) of the Launch Facility support building.

The Minuteman ICBM Launch Facility Delta-09 contains historic objects and technical equipment that reflect the successive use of the facilities by the Air Force. Delta-09, complete with its contents, was transferred from the Air Force to the National Park Service. The historic objects and equipment provide valuable insight into the use of this facility by the Air Force. The contents of Delta-09 are important and are considered associated features of the site.

Missile Launcher **Contributing Structure** **1963/2002**

The missile launcher was designed to serve as a temperature- and humidity-controlled, long-term storage container, protective enclosure, support facility, and launch pad for a Minuteman ICBM. The launcher consists of an underground launch tube (silo), surrounded by a cylindrical equipment room and covered by a hardened, ballistically actuated closure door. A heavily secured hatchway connected to the equipment room allowed Air Force personnel to enter the launcher for routine maintenance activities.

The launch tube is essentially a reinforced concrete cylinder, lined with a 1/4-inch steel plate, 12 feet in diameter (inside dimension) and approximately 80 feet deep. The tube rests atop a 4-foot thick, reinforced-concrete foundation, with its lower 52 feet encased in approximately 14 inches of heavily reinforced concrete. A 2-inch thick steel plate on the floor of the tube serves as a blast deflector for the missile's exhaust.

Welded to the walls of the launch tube, about 21 feet above the floor, are pulley blocks for the three-point suspension system that supported the installation's Minuteman missile. The suspension system consists of a free-floating, steel, missile support ring attached to three wire cables. The cables pass over the pulley blocks and fasten to large, coil spring-type shock absorbers fixed to the base of the silo. Encircling the upper portion of the launch tube is a cylindrical, two-level equipment room, built of heavily reinforced concrete with a steel liner. The equipment room is about 30 feet in diameter and 28 feet deep, with a 4-foot thick slab foundation, and walls 2 feet thick. A 6-inch wide "rattle space" between the equipment room and the launch tube allows the two structures to move independently.

The lower level of the equipment room contains a motor generator and supports for twelve large storage batteries. The batteries themselves were removed from the missile launcher during deactivation. An electrical surge arrestor room is located on the southeast exterior wall of the lower level. The numerous surge arrestors inside were designed to prevent electronic equipment inside the launcher from being damaged by electromagnetic pulses resulting from nuclear explosions. On the south side of the lower level, the cylindrical ballistic actuator that opens the launcher closure door during the launch sequence stands upright and extends through the upper level floor.

The upper level of the equipment room consists of a steel-framed platform covered with a rolled-steel deck plate. Cast into the east outer wall is a narrow, steel-faced bench, calibrated with compass bearings. Part of a complex optical alignment system, the bench originally supported an "autocollimator" (no longer in place) that was used to align the missile's guidance system. Directly above the bench is a canted cylindrical porthole (sight tube) glazed with bulletproof glass now permanently welded shut. This sight tube is aligned so as to point through the open access hatch, which allowed guidance technicians to establish visual references to a pair of azimuth markers (surveyors' benchmarks) located on the surface outside of the security fence.[12]

The northwest one-third of the upper-level floor is suspended from a series of coil-spring shock struts attached to the ceiling. Attached to the shock-mounted floor are racks of electronic equipment used to monitor and troubleshoot the missile, communicate with the Launch Control Center, and conduct the countdown. Mounted on the wall adjacent to the equipment racks are two cylindrical, stainless-steel chemical tanks. These tanks originally contained a sodium chromate solution for cooling the Minuteman missile's guidance system. Maintenance workers could gain access to the missile and the bottom of the silo by removing the hatch plates from the side of the launch tube, lowering the access door or "diving board," and installing a motorized cage. The two-person work cage could reach the circumference of the launch tube and also could lower workers 60 feet to the bottom of the silo.

[12] For a concise explanation of the autocollimator system, see C.M. Plattner, "First SAC Crews Controlling Minuteman," *Aviation Week and Space Technology*, 78 (7 January 1963): 62-63; and Rolf Winterfelt, "Minuteman System is 'Most Reliable,'" *Missiles and Rockets*, 8 (27 February 1961): 39, 53.

The underground launch tube and equipment room are covered by a massive, reinforced-concrete roof slab, known as the launcher closure. The top of the slab is level with the surface of the maneuver area. The roof slab is roughly teardrop-shaped in plan, with its apex pointing toward the northwest. The reinforced-concrete closure door is 3 1/2 feet thick and weighs more than 80 tons. There is a concrete approach apron on the north side of the launcher closure with steel transporter erector pylons and transporter erector jack pads to align and support the transporter erector when emplacing the missile. Transporter erector landing gear pads are also located just north of the apron.

The area directly south of the missile launcher is approximately 3 1/2 feet lower than the gravel maneuver area, exposing the south edge of the roof slab. Cast into the southern edge of the roof slab is a pocket-like opening for the launcher's horizontally sliding closure door. A low, buttressed concrete wingwall on each side of the door opening separates the maneuver area from the ground below. A concrete track apron is directly behind the launcher closure with a center track rail and side closure or maintenance tracks. The launcher closure rolls open on two wide steel tracks mounted atop deep reinforced-concrete beams cantilevered out from the launcher. The closure door's steel-sheathed leading edge is shaped like the cowcatcher on a steam locomotive, and is designed to clear debris from the tracks when the ballistic actuator flings the door aside. The grade slopes slightly south from the apron to provide drainage away from the launcher. If the missile or one of its major components had to be removed or replaced, maintenance workers would use a hydraulic pipe pusher mounted on a cogged rail in the middle of the track apron to jack the closure door open.

For more routine maintenance activities, workers entered the silo through the personnel access hatch in the northeast corner of the roof slab. The access hatch is a heavily reinforced, steel-and-concrete vault door, operated by two hydraulic cylinders. The door opens into a cylindrical shaft that descends to the lower level of the equipment room. Fitted into the shaft is the "B-plug," a piston-like, steel security door operated by an electro-mechanical actuator. The silo cannot be entered until the B-plug is retracted.

Slight modifications have been made to Delta-09 to prepare it for interpretation as a static display. The launcher closure has been permanently fixed in a partially open position and a glass viewing enclosure was installed over the opening in 2002. The glass and aluminum viewing enclosure is a domed structure over the opening of the missile launcher. A deactivated training missile was installed in the launch tube in 2001. The open launcher closure with glass viewing enclosure will allow visitors to the site to see down into the launcher to view the training missile. The viewing enclosure and training missile are noncontributing features of the missile launcher.

Launch Facility Support Building **Contributing Building** **1963**
Located adjacent to the missile launcher on the southeast is the Launch Facility support building, which contains an array of mechanical, electrical, and environmental support equipment. The Launch Facility support building is a box-like underground structure, with its roof about 1 foot above ground level. Constructed entirely of reinforced concrete, the building is rectangular in plan, measuring roughly 16 feet wide, 25 feet long, and 11 feet deep. At the north end of the structure is a narrow rectangular areaway, covered with steel grating and a steel

entry hatch. A ladder mounted on the interior wall provides access through the hatch down into the building. Two removable steel hatches in the middle of the roof of the support building allowed maintenance crews to quickly install or remove large pieces of equipment for repairs.

The support building contains electrical distribution equipment; a diesel-fueled emergency generator that supplied electrical power when the commercial source was unavailable; a brine chiller unit that provided cold water to the launch equipment room air handler, which in turn, provided the electronic racks and launcher with temperature and humidity-controlled air; a hydraulic pump for the personnel access hatch; a temperature control air compressor; and various panels for mechanical, security, and communications systems. During the course of deactivation and preparation of the sites for interpretation, some electrical panels have been added that are not historically associated with the Launch Facility support building.

Improved Minuteman Physical Security System (IMPSS) Antenna
Contributing Structure 1989

Rising from the base of the roof slab on the east side of the closure-door opening is a white fiberglass monopole antenna. This antenna is part of the IMPSS that was installed at the site in 1989. IMPSS is a microprocessor-based surveillance system designed to detect outer zone intruders at the launch site. It replaced troublesome older security systems so sensitive that they could be set off by "elk, rabbits, [or] even high-jumping grasshoppers."[13] The IMPSS replaced the original outer zone security antenna.

Hard UHF Antenna **Contributing Structure** **1968 (plans 1970)**

The hard UHF antenna is located a few feet to the northwest of the silo opening. It was installed about 1968 to link the Launch Facility with the Strategic Air Command's airborne Launch Control Center.[14] The UHF antenna rests atop a 13-foot-diameter, reinforced-concrete base, shaped like an inverted saucer. The antenna itself is housed inside a cast steel frustum capped with a conical, white fiberglass weather dome.

Cathodic Protection Rectifier **Contributing Structure** **1982-83**

A cathodic protection rectifier is located on the south side of the access drive, approximately 160 feet east of the security fence. The rectifier protects below ground structures, such as fuel tanks, from corrosion. The aboveground portion consists of a galvanized steel electrical box mounted on a wood pole protected with a small fence. The below ground portion consists of a well approximately 220 feet deep, containing eleven graphite anodes.

[13] Stolley, "How It Feels," 38. The IMPSS system is described in Aida E. Roig-Coepton, "1991 Annual Brief History, 44th Missile Wing," 2, on file at the 44th Missile Wing History Office, 44th Strategic Missile Wing, Ellsworth Air Force Base, S.Dak. The 44th Strategic Missile Wing was inactivated in 1994, records from the 44th Missile Wing History Office have been sent to the Air Force Historical Research Agency at Maxwell Air Force Base, Montgomery, Ala.

[14] The UHF antenna is described in an unattributed site activation document on file at the Ballistic Missile Organization History Office at Norton Air Force Base, Calif.; see "Wing II -- Ellsworth Air Force Base, S.Dak.," 2. Henceforth, materials from this archive will be cited as BMO, with appropriate locators.

Azimuth Markers **Two Contributing Structures** **1963**

The azimuth markers are surveyors' benchmarks that were used in conjunction with the autocollimator to align the Minuteman guidance system. Delta-09 has two azimuth markers. One is located approximately 1,000 feet to the north-northwest of the Missile Launcher, and the other is located approximately 1,000 feet to the north-northeast. Each azimuth marker consists of a cylindrical concrete pylon, 3 feet in diameter and 8 feet deep, set vertically into the ground. The visible portion of each pylon is approximately 18 inches in diameter and 4 feet high. A disc-shaped aluminum alloy survey plate is set into the top of each pylon.

HICS Markers **Contributing Structure** **1963**

Two HICS cable marker posts are located to the south and southeast of the missile launcher approximately 91 feet from the chain link security fence. The wooden posts are about 12 feet tall. The post to the southeast has three orange bands around the top, a directional arrow to delineate the location of the underground HICS cable, and a warning sign that there is an underground buried cable. The second post to the south has two orange bands at the top and two directional arrows.

Discussion of Integrity of Delta-01 and Delta-09

During the time that Delta-01 and Delta-09 served as an active Minuteman ICBM installation, the complex changed very little in terms of its original configuration and construction. Most changes were limited to equipment upgrades and minor remodeling and redecorating. Early changes at Delta-01 included the construction of a freestanding vehicle storage building in 1968 to replace the earlier garage in the wing of the support building. The support building garage was converted to an exercise/game room. A helicopter pad and an additional sewage lagoon were added to the facility in 1970.

Between 1971 and 1973, facilities were modified slightly when Ellsworth replaced its arsenal of Minuteman I missiles with the Minuteman II. The most important changes associated with this conversion were contained within the missiles themselves, since Minuteman II featured a more powerful propulsion system and a more accurate guidance system than its predecessor. Changes included installation of new electronic ground-support equipment in existing racks at both the Launch Control Facility and the Launch Facility; and the installation of electronic filters, seals, and circuit-breaking equipment at both sites to protect the facilities against damage from the electromagnetic pulses released by atomic blasts. Because the Minuteman II was slightly longer than the Minuteman I, the missile support ring inside the Launch Facility silo was lowered by lengthening suspension cables. The optical alignment system was adapted to work with the new missile by welding stops to the autocollimator bench to limit the instrument's range of motion. The retractor mechanism for the umbilical cable was relocated, and several other cables and fluid lines within the missile launcher were rerouted. No structural changes were required at either the Launch Facility or the Launch Control Facility for the new missile.[15]

[15] The changes to convert the facilities are outlined in "What's 'Force Mod?,'" *Minuteman Service News*, 23 (November-December 1965): 11. This article pre-dating the conversion noted that water tanks would be buried at Ellsworth's LCFs to help cool the environmental control systems. According to Ellsworth missile engineer Tim Pavek, the tanks were never installed. Pavek interview, 29 October 1996.

After conversion to Minuteman II, Delta Flight experienced only minor modifications as it continued to fulfill its mission. Changes at the Launch Control Facility support building included new steel siding and replacement windows, the addition of a women's latrine, air conditioning, and interior redecorating. Alterations to the Launch Control Center included the installation of carpet, Velcro-attached fabric acoustical ceiling panels, a modular bed storage unit, and a redecorated latrine and privacy curtain. Following the Minuteman II's being taken off of alert in 1991, the missile was removed from Delta-09. These changes were all made during the period of significance (1963-1993) and do not compromise the historic integrity of the complex.

Additional changes occurred at Delta-01 and Delta-09 during deactivation, beginning in 1993. Classified electronic equipment, hazardous fluids and other environmentally sensitive materials were removed from both sites; underground fuel storage tanks were removed or filled with sand at Delta-01; storage batteries were removed from the Launch Facility; and the ballistic actuator was disconnected from the silo closure door at Delta-09. When classified electronic equipment was removed, the cover plates on the rack system were retained to allow for the appearance of the original equipment. In compliance with the START Treaty, the HICS link was permanently disabled by severing and removing small portions of the cable. Although the deactivation activities had a profound impact on the operational status of Delta-01 and Delta-09, they did not significantly affect the complex's original design and workmanship.

To date, minor improvements have occurred to Delta-01 and Delta-09 in preparation for their opening as a Minuteman Missile National Historic Site. Delta-01 remains largely the same as it was when it was deactivated and care has been taken to keep as much of the original materials and furnishings at the site. New security and fire detection/suppression systems were installed at Delta-01 and Delta-09. To convert Delta-09 to a static display, the launcher closure was permanently fixed into a partially opened position and a glass viewing enclosure was constructed over the opening. These minor modifications of the sites do not diminish the overall integrity of Delta-01 and Delta-09 sites and its ability to convey its use as a Minuteman I and II facility.

Minimally modified in terms of their original design, workmanship, and construction, Delta-01 and Delta-09 are well-maintained facilities that retain a high degree of historic integrity. The sites largely reflect the appearance, setting, and design of the Minuteman II sites as they were in 1991, when they were taken off of alert, and remained until 1993 when deactivation procedures began and other Minuteman II sites were dismantled and imploded. Deactivation activities and conversion of Delta-01 and Delta-09 to a unit of the National Park Service has not diminished their ability to convey their historic use and appearance as Minuteman missile facilities used by the Air Force from 1963 to 1993.

Statement of Significance

This Statement of Significance consists of three major sections. It begins with an overview that examines the significance of Launch Control Facility Delta-01 and Launch Facility Delta-09 in terms of relevant National Register Criteria. It then presents an extended historical narrative that places the significance of Delta-01 and Delta-09 in the context of American Cold War strategic planning and in particular the nation's Intercontinental Ballistic Missile (ICBM) program. Finally, it concludes with a comparative analysis that examines the significance of Delta-01 and Delta-09 in relation to other American land-based ICBM installations.

I. Overview

Launch Control Facility Delta-01 and Launch Facility Delta-09 were established as the Minuteman Missile National Historic Site in1999 through the "Minuteman Missile National Historic Site Establishment Act of 1999" passed by Congress on 29 November 1999 and later signed by President Bill Clinton. The national historic site was established:

1. To preserve, protect, and interpret for the benefit and enjoyment of present and future generations the structures associated with the Minuteman II missile defense system;
2. to interpret the historical role of the Minuteman II missile defense system—
   a. as a key component of America's strategic commitment to preserve world peace; and
   b. in the broader context of the Cold War; and
3. to complement the interpretive programs relating to the Minuteman II missile defense system offered by the South Dakota Air and Space Museum at Ellsworth Air Force Base.[16]

Since the establishment of Minuteman Missile National Historic Site, Delta-01 and Delta-09 have been transferred from the Air Force to the National Park Service. With the establishment of the Minuteman Missile National Historic Site, the property was listed in the National Register in 1999. This nomination is being prepared to provide the background documentation for the listed property.

The Minuteman ICBM Launch Control Facility Delta-01 and Launch Facility Delta-09 are nationally significant applying National Register Criterion A: History and Criterion C: Engineering. The period of significance for the Minuteman ICBM Launch Control Facility Delta-01 and Launch Facility Delta-09 encompasses the period of use by the Air Force beginning in 1963 when the missiles were activated and ending in 1993 when the sites were deactivated. By 1973 the Minuteman I sites were converted to Minuteman II sites and in 1991 the Minuteman II missiles were taken off alert and the removal of the missiles began. Following the removal from alert, the Launch Control Facilities and Launch Facilities otherwise remained intact and were placed on "caretaker status," until

[16] *Minuteman Missile National Historic Site Establishment Act of 1999*, Public Law 106-115, 106th Cong., 1st sess. (29 November 1999).

deactivation procedures began in 1993. Delta-01 and Delta-09 remained in caretaker status until they were transferred to the National Park Service.

Criterion A: History

Minuteman ICBM Launch Control Facility Delta-01 and Launch Facility Delta-09 represent the only remaining intact examples of the original Minuteman configuration, which was developed specifically to implement the massive retaliation deterrent strategy that characterized American nuclear policy during the early Cold War period. Consequently, the complex has achieved national significance under National Register Criterion A as important tangible evidence of American participation in the Arms Race and the Cold War.

When the Soviet Union extended its boundaries and increased its military strength after World War II, many American leaders ascribed these activities to a deep-seated and innately hostile Soviet expansionism. The Soviets would be satisfied, they believed, only when the American economic and political system had been destroyed and the entire world had been converted to Communism. To frustrate these perceived intentions, the United States adopted a policy of "patient but firm . . . containment of Russian expansive tendencies."[17] By the early 1950s, however, it had become apparent that any attempt to confront Soviet power using conventional military forces would be logistically impossible and politically unacceptable. Faced with these prospects, American leaders formulated a new strategy. Henceforth, United States military planners would attempt to deter Communist aggression by developing an ability to respond to an enemy attack with immediate and massive retaliation. Nuclear weapons and new delivery systems would be essential to achieving this capability.

As the nation mobilized to implement the massive retaliation strategy during the 1950s, the Air Force was called upon to develop and deploy an entirely new type of weapon capable of delivering thermonuclear warheads to targets half a world away- the ICBM. According to General Bernard A. Schriever, who directed the effort, the ICBM project was "the largest military development program ever undertaken by this nation in peacetime."[18] By the early 1960s, the missile program had helped to make the "military-industrial complex" a fact of American economic and social life. Billions of American dollars, hundreds of thousands of American workers, and more than 2,000 American companies were directly involved in the effort to develop an effective ICBM.

The Air Force initially concentrated its efforts on developing and deploying a succession of powerful liquid-fueled ICBMs, including the Atlas series, as well as the Titan I and Titan II missiles. These weapons gave the United States a formidable deterrent force. However, the extraordinarily complex liquid-fueled ICBMs were expensive and difficult to produce in large quantities. This, coupled with their need for constant maintenance, made widespread deployment impractical. Recognizing the limitations of liquid-fueled missiles, the Air Force had also been experimenting with solid-propellant ICBM technology during the late 1950s and the Minuteman weapon system was the result of this endeavor. Simpler in design than their liquid-fueled antecedents, the Minuteman was

[17] "The Sources of Soviet Conduct," *Foreign Affairs* 25 (July 1947): 575.

[18] General Bernard A. Schriever, "The USAF Ballistic Missile Program," *Air University Quarterly Review* 9 (Summer 1957): 5.

relatively inexpensive to build, lent itself to mass production, and required much less maintenance in the field. With these advantages, the Minuteman weapon system promised to give the United States a capability for massive retaliation based on sheer strength of numbers.

Beginning in 1962, the Air Force deployed 1,000 Minuteman missiles in hardened underground launch silos dispersed throughout the north-central United States. For the next three decades, this force remained on continuous alert -- forming what the *New York Times* described as "the backbone" of the American nuclear arsenal, and serving as a pivotal instrument of American diplomacy.[19] With its ability to unleash apocalyptic destructive power on an enemy at a moment's notice, the Minuteman helped make "hot war" unthinkable, thereby helping to make the protracted standoff of the Cold War possible.

The first two Minuteman installations, each equipped with 150 missiles, were activated at Malmstrom Air Force Base in Montana and Ellsworth Air Force Base in South Dakota in 1962-1963. These identical installations were configured specifically to implement the massive retaliation strategy. In contrast, facilities at all subsequent Minuteman deployment areas were configured to implement a new "controlled response" strategy initiated by the Kennedy administration in 1961. The controlled response strategy called not only for the possibility of a limited or controlled American nuclear response, but also consequently for post-attack missile survivability and was demonstrated in the upcoming Minuteman II design.

After their original activation, the Minuteman facilities at Malmstrom were partially rebuilt to further protect them from nuclear blast effects and to accommodate a more powerful missile known as the "Minuteman II." Although the Ellsworth missile field also received the new weapon -- and hence became a "Minuteman II" installation -- its existing facilities were not structurally modified. At Malmstrom, for example, the launch facilities were altered by the addition of 10 inches of borated concrete to the silo closure doors. But at Ellsworth, apparently because engineers suspected that soil conditions might not support the weight of additional structural materials, the original silos were left intact.[20]

---

[19] Bernard Weintraub, "U.S. Predicts Threat to its Missile Force," *New York Times*, 6 November 1977. Subsequent references to the *New York Times* will be identified by the abbreviation *NYT*. The nation's Cold War-era defense strategy was built around a "triad" of nuclear weapons, consisting of land-based intercontinental ballistic missiles, a fleet of nuclear weapon-carrying conventional aircraft, and an array of sea-launched ballistic missiles. By basing nuclear weapons on land, sea, and air, military planners sought to preserve the integrity of the American deterrent by making it virtually impossible for an enemy to destroy the nation's entire nuclear force by launching a first strike. Noting that the land-based component of the triad included not only 1,000 Minutemen, but also 54 liquid-fueled Titan II ICBMs, Weintraub described the Minuteman as "the most advanced missile," and called the Minuteman force the "backbone of the United States missile arsenal."

[20] See "Minuteman Deployment and Modification Matrix," *Minuteman Weapon System: History and Description* (Hill Air Force Base, Utah: Ogden Air Logistics Center, 1990): 33. The limiting effect of soil stability on silo modification at Ellsworth was noted by Ellsworth missile engineer Tim Pavek in a telephone interview with John Lauber, 29 October 1996.

Following the dissolution of the Soviet Union in 1991, President George Bush ordered the immediate deactivation of the nation's entire Minuteman II force. The 150 previously altered launchers at Malmstrom were scheduled for further modifications to accommodate the Minuteman III missile system. The launchers at Ellsworth were slated for demolition in accordance with the terms of the START Treaty. In March 1994 the Air Force began to implode the Minuteman Launch Facilities at Ellsworth Air Force Base, and by mid-September 1996, 149 of the 150 silos originally associated with the base had been destroyed. As the sole survivors of the Ellsworth Minuteman II missile field, Launch Control Facility Delta-01 and Launch Facility Delta-09 are the nation's only remaining facilities that represent the original Minuteman configuration. In terms of engineering, they are the most pristine expression of the ICBM component of the massive retaliation deterrent strategy that so strongly shaped American military posture during the early Cold War period.

Criterion C: Engineering
Minuteman ICBM Launch Control Facility Delta-01 and Launch Facility Delta-09 have achieved national significance under National Register Criterion C: Engineering as the country's most intact remaining example of the original Minuteman configuration and illustrate a major breakthrough in American missile technology. The complex is the only remaining Minuteman II example in the country that includes both the Launch Control Facility and Launch Facility.

The ICBM's value as a deterrent was contingent upon its ability to retaliate instantly even after a nuclear attack. The Air Force realized quite early that in order to preserve that capability, it would have to devise a basing system that could protect the missile and its crew during an attack and that could continue to function perfectly afterwards. By 1955, nearly five years before the United States actually deployed its first ICBM, military planners had already determined that the ideal basing configuration would allow American missiles to be deployed on individual, remote-controlled launchers dispersed across a broad geographic area. Such a highly decentralized distribution of the weapons would make it virtually impossible for an enemy to destroy the entire United States deterrent force by launching a first strike. To ensure that the United States could make good on its threat to retaliate with massive force following an attack, planners determined that the missiles and their crews should be housed in hardened facilities belowground, so that a thick layer of soil would shield them from the effects of the blast and radiation.

As several generations of American ICBMs were activated during the early 1960s, engineers moved progressively closer to the goal of basing the systems in fully hardened facilities. The first Atlas missiles were designed to be installed on aboveground launchers that provided minimal protection from blast effects. The next generation of ICBMs -- the Titan I missiles -- were stored on elevators in underground silos and raised out of the ground for launch. By the time the first Titan II ICBMs were activated in the early 1960s, they were capable of being both stored in, and launched from, fully hardened underground silos.

The goal of full dispersal, however, took longer to achieve. The Atlas, Titan I, and Titan II missiles all used liquid-fueled propellant systems that required constant attention from on-site crews. To meet this requirement, the

Atlas and Titan I missiles were deployed in "clusters," each consisting of several individual launchers grouped closely around a single, fully staffed control center. The drawback to this arrangement was that an enemy could destroy the entire cluster with a single direct hit. In contrast, the Titan II ICBMs were deployed in a "unitary" configuration in which the missiles were housed in individual underground silos, each directly attached to its own fully staffed, underground Launch Control Center. Although this configuration theoretically allowed for a greater degree of dispersal, in actuality the system's considerable cost prevented full-scale deployment. When deployed in limited numbers (as was the case), the Titan II was strategically vulnerable, since a direct hit could take out the launcher and its control center.[21]

With the activation of the original Minuteman missiles at Malmstrom and Ellsworth Air Force Bases in 1962-1963, military engineers finally achieved the dual goals of basing ICBMs in fully dispersed, hardened Launch Facilities. The relatively inexpensive, solid-fueled Minuteman was much easier to store and maintain than its predecessors. The Minuteman did not require constant attention from on-site crews, the missiles could be installed in fully hardened, individual underground silos dispersed across a wide geographic area. A single, two-person launch crew quartered in a separate, hardened underground facility could by remote control monitor and launch a "flight" of ten Minuteman missiles dispersed several miles away. An enemy hit on any individual launcher would have no effect on the remaining missiles in the flight. With some refinements, the basing system first used at Malmstrom and Ellsworth would remain the standard for all subsequent land-based American ICBMs, accommodating three generations of Minuteman missiles, as well as the later solid-fueled Peacekeeper missile.[22]

A shift in American strategic policy from the massive retaliation concept of the 1950s to the controlled response concept of the 1960s led to changes in the four Minuteman deployment areas completed after Ellsworth. During several decades of service, facilities at five of the nation's six Minuteman installations received structural

[21] Activated at approximately the same time as the Minuteman, the nation's fifty-four Titan II missiles were based in underground silos linked to individual underground control modules. The Titan IIs used storable liquid propellants that gave them a faster response time than the Atlas and Titan I missiles. Within a month of their activation, however, Titan II missiles at two operational sites had developed potentially dangerous leaks caused by acids formed when oxidizer combined with moisture in the atmosphere. Despite a rigorous and continuous maintenance program, the volatile liquid propellants continued to cause problems with the Titan IIs. By 1980 there had been so many accidents that some people living near the silos "were convinced that the Titan II missiles that are supposed to help them sleep better at night pose more dangers . . . than the Russians." After a 1980 explosion at a Titan II site in Damascus, Arkansas sent a nine-megaton thermonuclear warhead into a cornfield near one Titan II site, politicians and defense department officials alike began to call for their retirement. Deactivation began in July 1982 and was completed by late summer 1987. The solid-fueled Minuteman, in contrast, was relatively inexpensive and easy to maintain. "With Minuteman," wrote one observer in 1967, "the thing sits in a hole unattended. When you need it you hit the button and away she goes." See John F. Lauber and Jeffrey A. Hess, "Glenn L. Martin Company, Titan Missile Test Facilities," 1993, HAER No. CO-75, HABS/HAER Collection, Library of Congress, Washington, D.C., 64-66. The first quote is from "Titan a Big Threat," *U.S. News and World Report* 89 (29 September 1980): 8. The second quote is from Mark Bearwald, "Requiem for the Titans," *Denver Post,* 26 February 1967.

[22] The nation's entire complement of fifty solid-fueled Peacekeeper ICBMs was deployed in modified Minuteman silos at F.E. Warren Air Force Base, Wyo. in 1986. See "Minuteman Deployment and Modification Matrix," 26.

upgrades intended to increase the hardness of their launch silos and accommodate advances in missile technology. Because the Ellsworth sites alone were excluded from the reconstruction program (although their missiles were upgraded to Minuteman II), their original structural features remained virtually unaltered. In the mid-1990s, 149 of the original 150 Ellsworth missile silos were destroyed in conformance with the provisions of the START Treaty, signed by the United States and the Soviet Union at the beginning of the decade. Consequently, Launch Control Facility Delta-01 and Launch Facility Delta-09 comprise the only complete Launch Complex remaining at Ellsworth. As such, they have achieved exceptional national significance as the most intact example of the first ICBM basing system to meet the dual goals of full dispersal and full hardening. This basing system, as exemplified by Delta-01 and Delta-09, served as the paradigm for all of the nation's subsequent land-based ICBMs.

Criteria Consideration G: Property Achieving Significance Within the Last Fifty Years
Properties less than fifty years old are not ordinarily eligible for designation in the National Register. However, National Register Criteria Consideration G allows for exceptions to this rule under certain conditions. According to *National Register Bulletin 15*, a property less than fifty years old may be eligible for National Register designation if it can be demonstrated that the property has achieved "exceptional importance."[23] *National Register Bulletin 22* also notes that some resources by their very nature are subject to circumstances that destroy their integrity before they reach fifty years of age, and that such resources may warrant exceptions to the fifty-year rule. Both exceptions apply in the case of the Minuteman ICBM Launch Control Facility Delta-01 and Launch Facility Delta-09.

The effort to develop, build, deploy, and maintain an effective ICBM force spawned an unprecedented peacetime defense mobilization that deeply affected American economic, technological, and political life for more than four decades following World War II. The Minuteman complex at Ellsworth was an important product of that effort.

Despite the overwhelming national significance of the American ICBM program, however, changing technology and international treaty requirements have brought about a dramatic reduction in the number of ICBM-related resources that remain in the United States. All of the Atlas and Titan I sites were deactivated and dismantled during the late 1960s, and only one of the nation's fifty-four Titan II installations remains intact. A similar fate awaits the nation's Minuteman installations. Since 1991, 450 of the nation's original 1,000 Minuteman Launch Facilities have been deactivated and slated for demolition, and more than 230 of those have already been destroyed. The 550 Minuteman launchers that remain on active duty have been substantially modified to accommodate the advanced Minuteman III and Peacekeeper weapon systems that constitute the nation's post-Cold War deterrent force. The Minuteman complex at Ellsworth is the only remaining ICBM site in the nation that still

[23] *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*, (Washington, D.C.: National Park Service, U.S. Department of the Interior, 1991): 41-43. Also see *National Register Bulletin 22: Guidelines for Evaluating and Nominating Properties That Have Achieved Significance Within the Last Fifty Years*, (Washington, D.C.: National Park Service, U.S. Department of the Interior, n.d): 4-5.

retains the essential features of the original Minuteman basing system deployed during the early Cold War period. The exceptional national importance of the ICBM program, and the ephemeral nature of its artifacts were formally recognized in 1993 when the Titan II ICBM Launch Complex associated with Davis-Monthan Air Force Base near Tuscon, Arizona, was successfully nominated as a National Historic Landmark.[24] Although it was only thirty years old at the time of its nomination, this property was deemed exceptionally significant as the nation's only remaining Titan II site. The remaining Minuteman Launch Complex at Ellsworth Air Force Base, South Dakota, is worthy of the same consideration.

II. Historical Narrative

Introduction

On 7 January 1954, President Dwight D. Eisenhower delivered his first State of the Union Address to a joint session of Congress. He began his speech with a lengthy discussion of foreign affairs and defense policy. After stating his belief that "American freedom is threatened so long as the Communist conspiracy exists in its present scope, power and hostility," he outlined his plans for defending the nation against that threat. "We will not be aggressors," he said, "but we . . . have and will maintain a massive capability to strike back."[25] Eisenhower's comments -- which were translated into the catch phrase massive retaliation -- reflected the doctrinal basis behind much of the nation's strategic planning during the Cold War era.

The Origins of the Arms Race[26]

Eisenhower's view of the Soviet Union was similar to one that had first been articulated nearly eight years earlier by George Kennan, a diplomat at the United States Embassy in Moscow. Watching the Soviets surround themselves with a "buffer zone" that included much of eastern Europe following World War II, Kennan had warned that these moves resulted from a fanatical Soviet "expansionism" that was ultimately bent on disrupting American society and breaking the international authority of the American nation. The only way to deal with this threat, Kennan suggested, was for the United States to adopt a policy of "patient, but firm and vigilant containment of Russian expansive tendencies."[27]

---

[24] David K. Stumpf, "National Historic Landmark Nomination: Titan II ICBM Missile Site 8 (571-7)," TMs, 1993. On file at the National Park Service, Rocky Mountain Regional Office, Division of Cultural Resources, Denver, Colo.

[25] "The Text of President Eisenhower's Message to Congress on the State of the Union," *NYT*, 8 January 1954.

[26] Much of the ensuing discussion of American strategic planning during the Cold War is derived from Lauber and Hess, "Glenn L. Martin Company."

[27] Kennan discussed Soviet expansionism in a 1946 telegram to the State Department. See Kennan, George. "The Kennan 'Long Telegram,'" in *Origins of the Cold War: the Novikov, Kennan, and Roberts "long telegrams" of 1946*, ed. Kenneth M. Jensen (Washington, D.C.: United States Institute of Peace, 1991), 28. His formulation of the containment policy appeared in "The Sources of Soviet Conduct," 575.

Although containment sounded good in theory, it eventually proved nearly impossible to put the policy into practice. In order to truly contain the pervasive Soviet threat, observed one top Eisenhower administration official in 1954, the nation would have needed to prepare for combat "in the arctic and in the tropics; in Asia, in the near East and in Europe; by sea, by land and by air."[28] Such vigilance would have required an enormous and well-equipped army. In contrast to the Soviets, who had mounted a massive effort to rebuild their army and replenish their supply of conventional weapons after World War II, the Americans had been demobilizing their armed forces at a dizzying rate. Exploiting its position as sole possessor of the atomic bomb, the United States had pursued a "bargain-basement" defense policy, using nuclear weapons as stand-ins for infantry battalions.

After the Soviets broke the American nuclear monopoly by developing an atomic bomb of their own in 1949, American policymakers responded with an even more powerful weapon -- a thermonuclear device that used a small atomic trigger to initiate a fusion reaction in hydrogen isotopes. When the United States successfully tested its first hydrogen bomb in 1952, the weapon promised to reestablish the nation's nuclear superiority once and for all. But at the end of August 1953, the Soviets exploded a sophisticated hydrogen bomb (H-bomb) of their own. Many American military experts believed that the new Russian weapon was capable of being delivered by an ICBM. For the first time, the Soviet Union seemed poised to take the lead in the Arms Race.

The Origins of the American Arms Race

American military planners had initiated several attempts to develop ballistic missiles immediately after World War II. During the late 1940s, however, the nation's nuclear superiority had seemed secure, and the missile programs were allowed to languish. The Soviet H-bomb abruptly ended this complacency, and prompted two independent organizations to reevaluate the strategic importance of the ICBM.

One study was initiated by Dr. Bruno Augenstein, a RAND Corporation physicist who believed that "if the Soviet Union beat the United States in a race for the ICBM, the consequences would be catastrophic."[29] At about the same time, the Air Force assembled a committee of eminent scientists headed by Dr. John von Neumann, a Princeton University mathematics professor. Von Neumann's group, code-named the "Teapot Committee," was explicitly ordered to investigate "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."[30] The RAND and Teapot Committee reports were released just a month after Eisenhower's 1954 State of the Union Address. Both studies reached essentially the same conclusions: recent advances in thermonuclear technology made an ICBM

[26] Secretary of State John Foster Dulles, as quoted in H. W. Brands, Jr., *Cold Warriors* (New York: Columbia University Press, 1988), 16.

[29] Fred Kaplan, *Wizards of Armageddon* (Stanford, Calif.: Stanford University Press, 1991), 112.

[30] Dennis J. Stanley and John J. Weaver, "An Air Force Command for R & D, 1949-1976. The History of ARDC/AFSC," Office of History, Headquarters, Air Force Systems Command, N.C.," n.d., 22, in United States Air Force Historical Research Agency, Maxwell Air Force Base, Montgomery, Ala., Document K234.04-39. Hereafter, materials from this archive will be cited as HRA, with appropriate locators.

practical. Furthermore, such a device "could be developed and deployed early enough to counter the pending Soviet threat *if* exceptional talents, adequate funds, and new management techniques suited to the urgency of the situation were authorized."[31]

The Air Force quickly made the ICBM its top priority. By mid-May 1954, officials had mapped out a development plan for the new weapon, and at the end of June, Air Force Vice Chief of Staff, General Thomas D. White, ordered the Air Research and Development Command "to proceed with the development of an ICBM at the highest speed possible, limited only by the advancement of technology in the various fields concerned."[32] In July the Air Force established a special project office to administer the program. The new agency was to be based on the West Coast, and was consequently called the Western Development Division. The organization's mission was considered so important to the national security that "even its initials, WDD, were classified beyond top secret."[33]

A newly promoted, forty-three year-old brigadier general named Bernard A. Schriever was selected to head the new agency. By 1960 the young officer was expected to place a fully operational ICBM weapon system into the hands of the Strategic Air Command (SAC), the military command responsible for the Air Force's strategic nuclear weapons. To accomplish this task, writes ICBM chronicler and journalist Roy Neal, Schriever had to create an entire new industry from the ground up:

> Tens of thousands of industrial and Air Force managers, engineers, and workers [had] to be trained. New machine tools and test facilities [had to] come into being. . . . Literally, he [had to] change the face of America, the make-up of the Armed Forces and the industries that support them.[34]

On 5 August 1954, Schriever and a small group of military officers converged on an abandoned parochial school in the Los Angeles suburb of Inglewood. To avoid arousing the curiosity of nearby residents, the officers had been instructed to leave their uniforms home and to arrive at their new headquarters in civilian clothes. Neal describes what they found when they got there:

> No sign identified the white schoolhouse as the Western Development Division. . . . The windows were frosted and heavily barred. All outside doors, except one, were locked. The only entrance was across a chain-link fenced parking lot. A security guard manned the door. . . Some of the old-timers recall . . . the comment of the school boy who was sauntering by the school building. Eying the frosted glass and steel-barred windows, he said to a chum, 'Boy am I glad I don't go to school here.'[35]

---

[31] Robert L. Perry, "The Atlas, Thor, Titan, and Minuteman," in *The History of Rocket Technology; Essays on Research, Development, and Utility*, ed. Eugene Emme (Detroit: Wayne State University Press, 1964), 144.

[32] "Air Force Ballistic Missile Test Program," 1957, 1, in BMO, Norton Air Force Base, San Bernardino, Calif., in Box L-1.

[33] Kaplan, *Wizards*, 116.

[34] Roy Neal, *Ace in the Hole* (Garden City, N.Y.: Doubleday & Company, Inc., 1962), 48.

[35] Neal, *Ace in the Hole*, 64-65.

In this inconspicuous but carefully secured setting, the handpicked staff of the Western Development Division began organizing the effort to build an effective ICBM.

The First Generation: Atlas and Titan

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

In concept, the Atlas was essentially a highly evolved version of the German V-2 missile that had been used against the Allies during the waning years of World War II. Like the V-2, the Atlas was powered by rocket engines that burned a mixture of liquid fuel and oxidizer. But while the V-2 had an effective range of only a few hundred miles, the Atlas was expected to deliver its payload to a target more than 5,000 miles away. Convair could have attempted to meet this requirement by building the Atlas as an enormous version of the V-2. Instead, Convair engineers sought a more sophisticated solution. Realizing that they could greatly extend a missile's range by reducing its weight, the engineers decided to equip the Atlas with an innovative, ultra-light airframe. The missile was assembled from rings of paper-thin stainless steel, stacked together like stovepipes and welded at the seams to form a seemingly flimsy cylinder. This cylinder was then inflated with nitrogen gas to give the missile its structural integrity.

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

General Schriever and his staff were well aware of these concerns. So while they rushed ahead with the Atlas program, they also began looking for a backup system. During the fall of 1954, the Western Development Division asked several aircraft manufacturers to investigate the feasibility of building an alternate ICBM. The studies were completed by Christmas, and in January 1955, General Schriever presented their findings to his superiors. By the end of April the Air Force had authorized the Western Development Division to proceed with the development of a backup missile. In October 1955, the Glenn L. Martin Company was given a contract to produce a new ICBM called the Titan. Like the Atlas, the new Titan would use liquid propellants, but its advanced two-stage design would allow the missile to utilize a conventional -- and more reliable -- airframe. Before either of America's two ICBMs got off the ground, however, the Soviets struck another blow.

Strength in Numbers: The Missile Gap

On 4 October 1957, the Soviet Union announced that it had used a liquid-fueled ICBM to launch a 185-pound artificial satellite called "Sputnik" into orbit around the Earth. This demonstration of Russian technological prowess caused many American scientists and politicians to fear that the Soviet Union had opened a significant "Missile Gap" that would give them a commanding lead in the Arms Race. "If the Reds can put a 185-pound object into space," they reasoned, "they also have the ability to fire long-range missiles."[36] Within a few months, American journalists and intelligence analysts began to assert that the Soviet missile force could outnumber the American arsenal by as much as sixteen to one by 1960.[37] America's growing sense of insecurity was not lost on Soviet officials, who gleefully boasted that their factories were turning out missiles "like sausages."[38]

Facing severe criticism for allowing the United States to fall behind the Soviets in the Arms Race, the Eisenhower administration responded that its missile programs had never been intended to merely "put something together" in a hurry. The programs were carefully designed, said a spokesperson, first to "attain perfection," and then to "develop the ability to produce in volume once that perfection is achieved."[39]

But America's first-generation ICBMs were neither perfect nor mass producible. In fact, observed the *Wall Street Journal* a few weeks after Sputnik, "their weaknesses are so profound that . . . generals are sure [the missiles] will be discarded altogether after the first half-dozen years."[40] The Atlas and Titan missiles were extraordinarily complex, hand-crafted machines, containing as many as 300,000 components, each of which had to be maintained in perfect operating condition in order for the missile to successfully complete its mission. The liquid propellants that powered their engines were volatile and corrosive, and could not be placed into the missiles' tanks until immediately before launch. The fueling process itself could take as long as two hours. Consequently, instead of being "stable weapons in a state of permanent readiness," these early ICBMs would "require the desperate and constant attention accorded a man receiving artificial respiration. A missile unit will be no pushbutton affair but will require a highly-trained crew . . . several times as large as the largest bombing crew." Many of these problems could be solved, the *Wall Street Journal* suggested, by developing a greatly simplified "second generation" of missiles powered by solid-fuel rocket engines.[41]

---

[36] "Russia's Moon," *Wall Street Journal*, 7 October 1957. Subsequent references to this publication will be identified by the abbreviation *WSJ*.

[37] As Rutgers University political scientist Roy Licklider has correctly observed, these estimates were based more on fear than on fact, for "the missile gap . . . never developed." See Roy Licklider, "The Missile Gap Controversy," *Political Science Quarterly* 85 (December 1979): 601, 605.

[38] John Prados, *The Soviet Estimate* (New York: Dial Press, 1982): 77.

[39] Prados, *The Soviet Estimate*, 77.

[40] "Myths and Missiles," *WSJ*, 21 November 1957.

[41] "Myths and Missiles."

Weapon System "Q"

The solid propellants available in the mid-1950s could not provide the power needed to hurl a heavy warhead across an ocean. "A lot of work had been done on solids prior to the initiation of the ICBM program in 1954," recalled Schriever in a 1973 interview, "but there were a number of things that ruled against using solids at that time."[42] Solids were difficult to manufacture. They were often hard to ignite, and once ignited, there was no way to control their combustion or direct their thrust. With these constraints, liquid-fueled missiles, despite their "volatile, hard to handle" propellant mixtures, presented "the only immediate way to go ahead" in 1954.[43]

However, the Air Force did not entirely abandon its efforts to develop a viable solid-propellant missile. In 1956 General Schriever had reluctantly approved a low-level research program "aimed toward the evolution of a high-thrust . . . solid-fuel rocket." The person he selected to head the program was Colonel Edward Hall, Chief of Propulsion Development for the Western Development Division. According to Air Force historian Robert Perry, Hall was a "near-fanatic" about the potential of solid-fueled missiles.[44]

Despite the Air Force's half-hearted support for the solid-fuel development program, Hall and others diligently pursued their research, and within two years, most of the technical problems involved with solid-fueled rocket engines had been solved. In August 1957 the Air Force asked Hall to help develop a medium-range, solid-fuel missile that would serve as a land-based counterpart to the Navy's submarine-launched, solid-fuel Polaris which was currently under development. Within two weeks Hall had drawn up specifications for a remarkable new missile whose range could be varied by simply assembling its three interchangeable propulsion stages in different combinations. The new missile, dubbed "Weapon System Q," was "the first strategic weapon capable of true mass production," writes Duke University historian George Reed. "To Hall, the new missile was the perfect weapon for a defense policy characterized by minimum expenditure and massive retaliation; and he urged that this be its chief selling point." Sputnik made it considerably easier for him to make the sale. A few days after the Soviets launched their satellite, Hall went to the Pentagon with Schriever to begin building support for the new missile. As they ascended through the ranks of the military hierarchy, Hall continued to refine his plans. By the end of the year, he had determined that "the ICBM version of Weapon System Q would be a three-stage, solid-fuel missile approximately 65 feet long, weighing approximately 65,000 pounds, and developing approximately 100,000-120,000 pounds of thrust at launch." The missile would be stored in underground silos and "would accelerate so quickly that it could fly through its exhaust flames and not be significantly damaged."[45]

---

[42] General Bernard A. Schriever, interviewed by Major Lyn R. Officer and Dr. James C. Hasdorff, Washington, D.C., 20 June 1973, 6-7. HRA K239.0512-676.

[43] Neal, *Ace in the Hole*, 27.

[44] Perry, "The Atlas, Thor, Titan, and Minuteman," 155, 157.

[45] George Reed, "U.S. Defense Policy, U.S. Air Force Doctrine and Strategic Nuclear Weapon Systems, 1958-1964: The Case of the Minuteman ICBM," Ph.D. diss., Duke University, 1986, 58-59.

At the beginning of February 1958, Hall and Schriever presented the System Q concept to the Secretary of the Air Force and the Secretary of Defense. "We got approval of [the] program within 48 hours," Schriever remembered many years later.[46] The officers immediately gave the project a new name. On 28 February 1958, the *New York Times* reported that the Air Force had been authorized "to produce an advanced type of ballistic missile . . . called Minute Man."[47] The missile program was named the “Minute Man” as a symbolic reminder of the country’s military past and to reflect the quick response time designed into the missile system.

Minuteman

By the end of March 1958, at least seven of the nation's foremost aircraft manufacturers were competing for the opportunity to build the new missile. The Seattle-based Boeing Airplane Company was one of them. Although the company had produced many of the nation's largest strategic bombers, it had virtually no experience with missiles. Recognizing that it needed to break into this burgeoning field in order to remain competitive in the defense industry, Boeing mounted an all-out effort to win the Minuteman contract, assigning more than 100 key employees to work on the project. The effort paid off handsomely. When the contractor selection board met to examine the proposals, recalled one top Air Force official, "there was no question . . . that Boeing was the right company for the job."[48] In October 1958, Boeing won the contract to assemble and test the new missile.

During the next few months, the other members of the Minuteman team were also put into place. The Thiokol Chemical Company of Brigham City, Utah; the Aerojet General Corporation of Sacramento, California; and the Hercules Powder Company of Magna, Utah, all won contracts to work on the missile's propulsion stages. The contract for the missile's guidance and control systems went to the Autonetics Division of North American Aviation in Downey, California, and the AVCO Corporation of Boston was hired to build the Minuteman's thermonuclear warhead.[49]

Much of the development work for the Minuteman took place in northern Utah. Both Thiokol and Hercules already operated plants in the area, and within a few months, Boeing had moved into an enormous new assembly plant occupying 790 acres at Hill Air Force Base near Ogden. By the beginning of 1960, Boeing was beginning to put all the pieces together, and *Time* magazine reported that the desert north of Salt Lake was "boiling" with activity:

---

[46] Schriever interview, 20 June 1973, 6-7.

[47] Jack Raymond, "500 to 5,500-Mile Missile is Approved for Air Force," *NYT*, 28 February 1958.

[48] Neal, *Ace in the Hole*, 113. Neal attributes the comment to Colonel Otto Glasser, who administered the Minuteman program from 1958 to 1959.

[49] Neal, *Ace in the Hole*, 113.

> Strange lights glare in the night, making the mountains shine, and a grumbling roar rolls across the desert. By day enormous clouds of steam-white smoke billow up . . . and drift over hills and valleys. Monstrous vehicles with curious burdens lumber along the roads. All these strange goings-on mark the development of the Minuteman, the solid-fuel missile that its proponents confidently expect will ultimately replace the liquid-fuel Atlas as the U.S.'s standard ICBM.[50]

By the end of 1960, the first complete Minuteman was taken to Cape Canaveral, Florida, for flight testing. The compact new missile was only six feet in diameter and 53 feet high -- about half the size of a Titan. Its three cylindrical, steel-cased propulsion stages were stacked one atop the other, with each stage slightly smaller in diameter than the one beneath it. Each stage was filled with a rubbery mixture of fuel and oxidizer, molded around a hollow, star-shaped core. The star-shaped core allowed for the propellant to have an initial large burning surface and therefore, an increased thrust, and to decrease as the points burned away. The Minuteman's inertial guidance system, designed to deliver a single warhead to a preprogrammed target, occupied a small compartment above the third stage. The "reentry vehicle" at the tip was identical to the nose cone that would eventually contain the missile's thermonuclear warhead.

Following two aborted launch attempts, the missile was successfully fired at 11 o'clock in the morning on 1 February 1961. Even the most experienced missile watchers found the event to be "a dazzling spectacle." The difference was apparent from the very beginning. First there was a loud bang when the Minuteman's first-stage engine ignited. Then the missile rose on a column of flame and smoke. Unlike the Atlas or Titan missiles, which left the ground "like a fat man getting out of an easy chair," the new Minuteman leaped off its launch pad and "shot up like a skyrocket."[51] And the missile performed flawlessly once it left the ground. Its three propulsion stages completed their burns precisely on schedule, then detached themselves and plummeted back to earth, while the unarmed warhead hurtled on toward its assigned destination. Twenty-five minutes after liftoff, the nose cone splashed down in the Atlantic Ocean squarely on target -- 4,600 miles from where it had started out. From his office in Washington, Air Force Chief of Staff General Thomas D. White described the launch as "one of the most significant steps this nation has ever taken toward gaining intercontinental missile supremacy." But an engineer who witnessed the event firsthand put it another way: "Brother," he said, "there goes the missile gap."[52] The missile gap was the perception that the Soviet Union had gotten ahead of the United States in missile development and production.

---

[50] "Home of the Minuteman," *Time* 75 (25 January 1960): 48.

[51] Wesley S. Griswold, "Minuteman, Our Ace in the Hole," *Popular Science* 179 (July 1961): 62.

[52] "Closing the Gap," *Time* 77 (10 February 1961): 16. General White is quoted in Neal, *Ace in the Hole*, 41. While the Minuteman program was underway, the Air Force also continued its efforts to develop a viable liquid-fueled ICBM. In May 1960 the Glenn L. Martin Company was awarded a contract to develop an advanced version of the original Titan missile. The company responded by designing the Titan II, a second-generation ICBM that was considerably larger, more powerful and more accurate than the Titan I. The Titan II was also designed to utilize liquid propellants that could be stored for long periods at ordinary temperatures in the missile's own tanks. By eliminating the need to load tanks with propellants when an alert was sounded, this change made it possible to

The Underground Air Force

By the time the flight test took place, plans for deploying the Minuteman were already well underway. According to missile historian Jacob Neufeld, the Air Force had first described its ideas for an ideal ICBM base in March 1955, during the early days of the Atlas program:

> the missile would be sited inside fixed, underground facilities; it was to have a quick launch reaction; it was to be stored in a launching position; the launch site would require minimal support; and the launch units were to be self-supporting for two weeks.[53]

Turning these ideas into reality, however, proved to be an arduous task. The first operational Atlas missiles, hastily activated at the height of the Missile Gap hysteria in 1959, were simply set upright on the launch pads at Vandenberg Air Force Base, California. Later these missiles were stored horizontally in "coffins," -- concrete-walled, aboveground enclosures with open tops. Before the missiles could be fired, they had to be tilted to a vertical position and filled with propellants. The next improvement, in the Atlas "E" series missiles, placed the coffins in earthen berms covered with retractable, reinforced-concrete doors designed to provide a modest measure of protection against nuclear blasts. As a further refinement, the Titan I and Atlas "F" series missiles were stored upright in underground, concrete and steel silos capped with massive, double, "clamshell" doors. These installations were designed to withstand blast pressures of 100 pounds per square inch. Concerned that vibration from the rocket engines would shake the missiles to pieces before they left the ground, engineers equipped each silo with an elevator that raised the missile to the surface for firing. Although the missiles were stored with their tanks full of fuel, they still needed to be loaded with volatile liquid oxygen so that the fuel could be ignited. This loading process could only be done after the missiles had been raised to the surface, and it was a slow, delicate operation that increased the weapon's vulnerability and restricted its reaction time.[54]

The Air Force took an important step toward achieving its ideal basing system in 1960, when it began to develop the Titan II -- a second-generation missile that was designed to use completely storable liquid propellants. These missiles could be kept ready with fully loaded propellant tanks and could be quickly fired directly from their hardened underground silos. Nonetheless, the Titan IIs were still highly complex machines that required constant attention from on-site crew members. Consequently, each missile silo had to be connected to its own adjacent Launch Control Facility.

---

launch the Titan II in approximately two minutes, following the command. See Lauber and Hess, "Glenn L. Martin Company," 59-61.

[53] Jacob Neufeld, *The Development of Ballistic Missiles in the United States Air Force, 1945-1960* (Washington, D.C.: Office of Air Force History, 1990), 176.

[54] Neufeld, *Development of Ballistic Missiles*, 192.

It was not until the Minuteman missile was added to the American arsenal that the ICBM basing program realized its cherished ideals of protected storage, minimal maintenance, and instantaneous response. Writes Air Force missile historian Ernest Schwiebert:

> 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.[55]

Deployment and Site Selection

The original Minuteman deployment plan, drafted in 1959, called for the creation of a single, immense, "missile farm," equipped with as many as 1,500 missiles. Planners soon determined, however, "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."[56] Consequently, the nation's Minuteman force was organized into a series of administrative units called "wings" -- each comprised of either three or four 50-missile "squadrons." Each squadron was further subdivided into five smaller units, called "flights." A flight consisted of a single, manned, underground Launch Control Center, linked to ten unmanned, underground Facilities (silos). The silos were physically separated from the control center and from each other by a distance of several miles. The Air Force initially considered deploying the Minuteman as far south as Georgia, Texas, and Oklahoma, but when it became apparent that the early models of the missile would fall short of their intended 5,500-mile range, planners quickly determined that they could solve the problem by selecting sites "in the northern part of the United States relatively close to the Soviet Union."[57]

By early 1960 the Air Force had decided to locate the first Minuteman deployment area on the high plains around Great Falls, Montana. This small city offered virtually everything the planners had been looking for. It was the home of Malmstrom Air Force Base, which could provide crucial logistical support for the new installation. The area's low population density meant that civilian casualties in the event of an accident or attack would be minimized. The region had an established network of improved roads, and there was an abundance of easy-to-acquire public land.[58]

---

[55] Ernest G. Schwiebert, *A History of the U.S. Air Force Ballistic Missiles* (New York: Frederick A. Praeger, 1965), 137.

[56] Clyde R. Littlefield, *The Site Program-1961*, AFSC Historical Publications Series 62-24-4, 68, BMO. The missile farm concept is described in Neal, *Ace in the Hole*, 132. The Air Force also considered basing the Minuteman on specially built railroad cars. After spending more than $108 million to develop the mobile deployment plan, the federal government abandoned the idea in December 1961. See Jack Raymond, "Plan for Missile on Rails Killed in Favor of Underground Sites," *NYT*, 14 December 1961.

[57] Littlefield, *The Site Program*, 68.

[58] For background on the Malmstrom selection, see Neal, *Ace in the Hole*, 154-55.

Construction of the Malmstrom complex began on 16 March 1961. The work progressed ahead of schedule, and in the spring of 1962, the Associated Press reported that the Montana silos were being "rushed to completion," and that the first missiles, each loaded with "one megaton of death and destruction," would be in place by "late summer."[59] Air Force crews began to lower the weapons into their silos at the end of July, and Malmstrom's first, ten-missile flight was hurriedly activated on 27 October 1962, at the height of the Cuban Missile Crisis.

Minuteman Comes to Ellsworth Air Force Base

In June 1960, while the plans for the Malmstrom missile field were still on the drawing board, the Air Force received authorization to add another 150 missiles to the Minuteman force. Planners immediately began looking for appropriate sites, and by early October, the search had been narrowed to three locations in North and South Dakota. The selection committee reached its decision at the end of December, and on 5 January 1961, U.S. Senator Francis Case of South Dakota announced that Ellsworth Air Force Base had been selected as headquarters for the nation's second Minuteman deployment area.[60] Located on the open prairies about 12 miles east of Rapid City, Ellsworth had been established in December 1941 as the Rapid City Army Air Base -- one of several airfields built by the Air Corps for training B-17 bomber crews. The installation also served as home base for many of the nation's largest strategic bombers. In addition, Ellsworth had been selected as headquarters for one of the nation's Titan I missile squadrons.[61]

Although the Defense Department had not yet officially approved the South Dakota Minuteman installation, Senator Case indicated that the land acquisition process would begin immediately, so that there would be "no loss of valuable time" once the project was approved. Area ranchers did not share Case's sense of urgency. Fearing that the federal government would use the high-priority status of the missile program as an excuse to pay below-market value for their property, the ranchers established the Missile Area Landowners' Association to negotiate fair land prices. The Association was careful to assure fellow citizens that their actions did "not necessarily slow the national defense effort."[62] While real estate negotiations were underway, the South Dakota State Highway Department used $650,000 from the Federal Bureau of Public Roads to improve 327 miles of gravel roads leading to the prospective missile sites. By mid-June 1961, Boeing was also busy with infrastructure improvements. Anticipating that the project would bring more than 3,000 workers into the area, the company raced to erect mobile-home camps and cafeterias near Wall, Sturgis, Belle Fourche, and Union Center, as well as in Rapid City.[63]

---

[59] Jack Zygmond, "Montana Minuteman Silos Near Completion," *RCDJ*, 25 March 1962.

[60] "Here Comes the Minuteman," *RCDJ*, 5 January 1961.

[61] For background on the base, see Gordon Hanson, "Fifty Years of War and Pace at Ellsworth Air Force Base," and "Base Units Soared in Enemy Skies," both in *RCDJ*, 24 July 1992.

[62] Dick Rebbeck, "Missile Area Landowners Refuse to Sign Present Rights of Entry," *RCDJ*, 4 May 1961.

[63] See the following articles in *RCDJ*: "Roads to Missile Sites Get Crash Program Rush," 4 May 1961; "Minuteman Missile Schedule Here Revealed," 14 June 1961.

By early summer, more than three-quarters of all area landowners had agreed to give the government access to their land.[64] Once the sites had been finalized, the Ralph M. Parsons Company, an architectural/engineering firm from Los Angeles, began to prepare detailed plans for the South Dakota installations. The Air Force had assigned responsibility for actual construction of the Minuteman facilities to the U.S. Army Corps of Engineers Ballistic Missile Construction Office. In mid-June, the Corps sent out a request for construction bids, and within a month four of the nation's largest contracting firms had submitted proposals for the project. The low bid came from Peter Kiewit Sons' Company of Omaha, whose estimate of $56,220,274 was nearly $10 million below government projections.[65] On 1 August, the Corps gave Kiewit a fixed-price contract for "digging and pouring 150 underground silos 12 feet in diameter and 80 feet deep, plus fifteen control centers."[66] The construction sites would be distributed across an area of nearly 13,500 square miles located to the east, north, and northwest of Rapid City. Kiewit set to work immediately, hiring construction crews and moving heavy equipment onto the job sites.

A Silo a Day

The official groundbreaking ceremony for Ellsworth's Minuteman complex took place at Site Lima-06 near Bear Butte on 11 September 1961. The festivities started with a bang. While the Sturgis High School band played in the background, representatives from Boeing, Kiewit, the Corps of Engineers, and Ellsworth Air Force Base set off an explosive charge to begin the excavation.[67]

Despite extreme cold, high winds and heavy snowfall, construction activity proceeded at a furious pace through the winter of 1961-62. At a press briefing in mid-December, a Corps of Engineers spokesman told reporters that "men are working seven days a week, three shifts a day on Minuteman construction.... Crews …. are able to dig five silo emplacements simultaneously. Each takes from four to ten days [depending on soil conditions]." Work on the first squadron, near Wall, was "well underway," he said, and work on the second squadron, near Union Center, had already been started.[68]

The *Rapid City Daily Journal* explained how a hardened silo was built:

> Conventional earthmoving equipment scoops an open cut 12 feet deep. A backhoe perches on the edge of a large hole in this cut and digs a hole 20 feet deeper. The remaining 52 feet of depth is 'mined' by a

[64] "75 Per Cent Sign for Minuteman Entry," *RCDJ*, 3 July 1961.

[65] "Kiewit Lowest Bidder on Minuteman Project," *RCDJ*, 25 July 1961.

[66] "Minuteman Contract Awarded to Kiewit," *RCDJ*, 2 August 1961. For background on the Peter Kiewit Sons' Company, see Harold B. Meyers, "The Biggest Invisible Builder in the World," *Fortune* 73 (April 1966): 146-51, 197-98, 200.

[67] "Minuteman Job Formally Started Near Bear Butte," *RCDJ*, 11 September 1961.

[68] Niciejewski, "Minuteman Work Speeding."

> clamshell.... When each hole is at the full depth of 84 feet, a steel 'can' 12 feet in diameter is carefully positioned in it. Reinforced concrete is poured between the can and earth.[69]

In February 1962, General Delmar Wilson told the Rapid City Chamber of Commerce that despite an ongoing labor dispute between Peter Kiewit Sons' and the Ironworkers Union, South Dakota's missile program had suffered less work stoppage than any missile program in the nation. "We're all out… to assure that our way of life is maintained," said Wilson. He continued, "This missile project . . . is the number one project in the country today. If this guy in Russia wants to start a show, we'll be there to put a hole in him to the best of our ability."[70]

The construction continued at Ellsworth for another year and a half with the construction of Delta-09 was completed in late 1962. By early summer of 1963, the steel fabrication was finished at all 165 sites, and crews were completing the launchers at the rate of one per day.[71] On the last day of June, Ellsworth's first twenty launchers were turned over to the Strategic Air Command. On 23 October, the nation's second wing of Minuteman ICBMs was declared fully operational. The work had been completed nearly three weeks ahead of schedule.[72]

A Shift in Policy: From Massive Retaliation to Controlled Response

While the Ellsworth complex was under construction, work was also underway on several other Minuteman installations. When the full schedule was completed in 1967, the nation had 1,000 Minuteman missiles on alert in six separate deployment areas located throughout the north-central United States. In addition to the original installations at Malmstrom and Ellsworth, there were Minuteman complexes at Minot and Grand Forks Air Force Bases in North Dakota; Whiteman Air Force Base in Missouri; and F.E. Warren Air Force Base in Wyoming. Another squadron had also been installed at Malmstrom. As each new installation was put into place, the Air Force continued to improve and refine the Minuteman operational system.

One of the first significant improvements resulted from a 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

[69] Niciejewski, "Minuteman Work Speeding."

[70] "Wilson Lauds S.D. Missile Work," *RCDJ*, 16 February 1962.

[71] "Minuteman Missile Steel Work is Now Completed," *RCDJ*, 14 June 1963.

[72] "Ellsworth Takes Over First 20 Minutemen, " *RCDJ*, 1 July 1963; "Minuteman Wing Here Operational," *RCDJ*, 23 October 1963.

> later use.... Greater flexibility in targeting and firing required a significant extension to the limited survival time [of each operational site]. The [original] Minuteman facility design did not provide for the protection of the 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.[73]

To meet the requirement of greater survivability, the Air Force decided to install the power generators at Minuteman sites in hardened underground capsules located next to each of the control centers. Although the Air Force investigated the feasibility of incorporating hardened generator capsules into the facilities at Ellsworth, construction had already started there by the time the decision was made, making the change impractical. Consequently, the generator capsules were introduced with the third Minuteman deployment area at Minot Air Force Base, North Dakota. Thus, the only Minuteman sites to reflect fully the nation's original Cold War strategy of massive retaliation were those at Malmstrom and Ellsworth.

Minuteman II

By the time planning began for the final Minuteman deployment area, the Air Force had developed a vastly improved version of the missile itself. The new missile, called the Minuteman II, offered improved range, greater payload, more flexible targeting, and greater accuracy, leading one Air Force spokesperson to estimate that its "kill capacity" was "eight times that of Minuteman I."[74] In early 1964, Secretary of Defense Robert McNamara told the House Armed Services Committee that the Defense Department was planning to upgrade the first five deployment areas by replacing their Minuteman I missiles with the more advanced Minuteman IIs.[75] The project was approved in the spring of 1965, and the first of the new missiles were deployed at Grand Forks Air Force Base, North Dakota, in 1966. In the fall of that year, South Dakota Congressman E.Y. Berry announced that the retrofit program would also be employed at Ellsworth. According to Berry, the new missiles would help Ellsworth maintain its position as "one of the nation's most important military installations."[76] The new missiles arrived in South Dakota in October 1971, when Boeing began to refit the Ellsworth silos to accommodate the Minuteman II system. The project was completed on 13 March 1973.[77]

---

[73] Littlefield, *The Site Program*, 80-81.

[74] "Minuteman II Emplacement Cost to Top $1 Billion," *Missiles and Rockets* 16 (24 May 1965): 12.

[75] Hal Taylor, "McNamara Voices Some Optimism Over Nike-X, Tells Minuteman Plans," *Missiles and Rockets* 14 (3 February 1964): 20.

[76] "Minuteman Updating Due Soon," *RCDJ*, 19 September 1966.

[77] "Fact Sheet, 44th Missile Wing," Media Relations Department, Ellsworth Air Force Base, June 1992. Also see "Chronology 44th Strategic Missile Wing, 44th Combat Support Group, 1 January through 31 December 1973." Both documents are on file at the 44th Missile Wing History Office, Ellsworth Air Force Base, S.Dak.

Minuteman III

Meanwhile, the Air Force was already planning for yet another version of the Minuteman. In May 1964 the Soviet Union had put a battery of anti-ballistic missiles on display in Moscow's Red Square, prompting concern about the vulnerability of Minuteman I and II missiles.[78] Consequently, in 1965, the Air Force began to develop an advanced version of the missile called the Minuteman III. By late summer of 1968, the new missile was ready for testing.

Longer and more powerful than its predecessors, the Minuteman III was equipped with an improved guidance system that could be retargeted in a matter of minutes. But according to the *New York Times*, the missile's "most telling advantage" lay in its "revolutionary new warhead -- the MIRV, for multiple independently targeted reentry vehicle." This new warhead could deliver three hydrogen bombs to widely scattered targets, a capability that would "render current and contemplated antimissile defense systems largely inadequate," and would thus "thrust the world into a new era of weapons for mass destruction."[79]

The Minuteman III was deployed in existing silos at F.E. Warren, Minot, Grand Forks, and Malmstrom Air Force Bases. Unlike the Minuteman II modification, which was basically a matter of reequipping existing facilities, the Minuteman III upgrade involved some structural reconstruction. At the launch silos, a new suspension system was installed to hold the missile absolutely motionless during the aftershock of a nuclear attack. In addition, the silo closure doors were rebuilt with a ten-inch-thick layer of borated concrete to protect the missile from radiation, and the ballistic actuators that opened the doors were rebuilt to handle the extra load. The refurbished silos were also equipped with a system of seals, filters, and surge arrestors designed to prevent sensitive electronic equipment from being damaged by the powerful electromagnetic waves generated during nuclear explosions.[80] When the last of the nation's 550 Minuteman III missiles was lowered into its silo at Malmstrom Air Force Base, Montana, in July 1975, only 450 Minutemen II remained in the American arsenal -- at Malmstrom, Ellsworth, and Whiteman Air Force Bases. This force structure of 1,000 ICBMs remained intact for nearly two decades.[81]

---

[78] Reed, "Case of the Minuteman," 267.

[79] "Two New Missiles to Get Test Today," *NYT*, 16 August 1968.

[80] The Minuteman III modifications are discussed in detail in Barry Miller, "ICBMs Get Major Modification," *Aviation Week and Space Technology* 104 (10 May 1976): 67-70. Minuteman II changes included installation of new electronic ground support equipment in existing racks at both the launch control and launch facilities, and the installation of electronic filters, seals, and circuit-breaking equipment at both sites to protect the facilities against damage from the electromagnetic pulses released by atomic blasts. Because the Minuteman II was slightly longer than the Minuteman I, the missile support ring inside the launch silo was lowered by lengthening suspension cables. The optical alignment system was adapted to work with the new missile by welding stops to the autocollimator bench to limit the instrument's range of motion. The retractor mechanism for the umbilical cable was relocated, and several other cables and fluid lines within the Missile Launcher were rerouted. No structural changes were required at either the launch facility or the launch control facility to accommodate the new missile. See "What's 'Force Mod?,'" *Minuteman Service News* 23 (November-December 1965): 11.

[81] Fifty Minuteman IIIs at F.E. Warren Air Force Base were replaced with Peacekeeper (MX) missiles in 1986, as described in "Minuteman Deployment and Modification Matrix," 26.

Reduction and Deactivation

During the late 1980s, the world saw unmistakable signs that the lengthy Cold War period was coming to an end. By the end of the decade, the Berlin Wall had been dismantled, Germany had been reunified, and a number of former Eastern Bloc nations had replaced their Communist regimes with democratically elected governments. As the new decade began, the Soviet Union disintegrated rapidly as its constituent republics declared their independence one by one. When the Warsaw Pact was dissolved in March 1991, the enemy that President Ronald Reagan had once called "the evil empire" essentially ceased to exist.[82] Four months later, on 31 July 1991, President George H.W. Bush and Soviet Leader Mikhail Gorbachev signed the *Treaty Between the United States of America and the Union of the Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms* (START Treaty), which placed a limit on the number of ICBMs and prescribed a process for the destruction of their Launch Facilities.

The START Treaty coincided with growing Air Force disenchantment with escalating costs associated with repairing and maintaining the older Minuteman II system. Rather than upgrade Minuteman II facilities with Minuteman III, the Pentagon decided to deactivate the entire Minuteman II force to help comply with provisions of the arms-reduction treaty. On 27 September 1991, Bush appeared on national television to announce a dramatic "plan for peace," designed to reduce the tensions of the nuclear age. As one component of his plan, he called for "the withdrawal from alert within 72 hours, of all 450 Minuteman II intercontinental ballistic missiles," including the missiles at Ellsworth Air Force Base.[83]

Five weeks later, on 3 December 1991, an Air Force crew arrived at Launch Facility Golf-02, located near Red Owl, about 60 miles northeast of Rapid City. They had come to remove the first of Ellsworth's 150 Minuteman IIs:

> Disarmament began with snow shovels at dawn, . . . as Airman 1st Class James Comfert and his colleagues cleared the launch-door rail. . . . Six hours later, a Minuteman II intercontinental ballistic missile was stored safely in its transporter/erector truck. G-2 was just a high-tech hole in the ground.[84]

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

> First, warheads and guidance systems [will be] removed. Then the missiles will be pulled. . . . The headframes of the missile silos will be destroyed and the tubes will be filled with rubble. The launch

[82] For a concise summary of these events, see "End of the Cold War," *The CQ Researcher* 2 (21 August 1992): 721.

[83] Aida E. Roig-Compton, "1991 Annual Brief History, 44th Missile Wing," 1992, 1. On file at the 44th Missile Wing History Office, Ellsworth Air Force Base, S.Dak. The 44th Strategic Missile Wing was inactivated in 1994, records from the 44th Missile Wing History Office have been sent to the Air Force Historical Research Agency at Maxwell Air Force Base, Montgomery, Ala.

[84] Bill Harlan, "ICBM Silo Becomes Hole in the Plains," *RCDJ*, 4 December 1991.

control capsules will be buried under rubble and a thick concrete cap. The land and aboveground buildings at launch control centers will be sold.[85]

By late 1996, 149 of the original 150 Launch Facilities at Ellsworth had been imploded in accordance with terms of the START Treaty. Only one Launch Complex remained intact, consisting of Minuteman ICBM Launch Control Facility Delta-01 and Launch Facility Delta-09.[86] These sites were spared with the intention of converting them into interpretive museum facilities open to the general public.

III. Significance of Delta-01 and Delta-09 as Compared to Other ICBM Sites

Comparison to Other Land-Based ICBM Installations

Other sites relating to the Minuteman ICBM Delta-01 Launch Control Facility and Delta-09 Launch Facility include the first and second generation ICBMs -- Atlas, Titan I, and Titan II. All of the first-generation ICBM Atlas and Titan I sites were deactivated by the Air Force by the end of 1965. These missile sites were then partially dismantled and many were sold to entrepreneurs. Two second-generation, liquid-fueled Titan II sites have survived. The first, Site 571-7, now operated by the Titan Missile Museum, is located near Tuscon, Arizona, and has been designated a National Historic Landmark.[87] The other Titan II Site, 395 Charlie, is located within Vandenberg Air Force Base, where Titan missiles were tested and where missiles were maintained on alert for a short period of time.

The Minuteman missile introduced several notable technological advances over earlier ICBMs, including fuel type, reliability, accuracy, and mass-producibility. In addition, the basing systems for the Minuteman and the Titan were substantially different. The Minuteman had one Launch Control Center linked to ten missiles. Each Titan II control center, in contrast, could launch only one missile. Therefore, Delta-01 and Delta-09 represent technological advancements from earlier ICBMs, such as Atlas, Titan I, and Titan II are significant as representatives of the next generation of ICBMs.

---

[85] Bill Harlan, "South Dakotans Grew Up with Aged Minuteman," *RCDJ*, 4 December 1991.

[86] Donald Meuschke, Natural Resource Manager, Whiteman Air Force Base, Mo., telephone interview with John Lauber, 22 October 1996.

[87] Stumpf, "National Historic Landmark Nomination: Titan II ICBM Missile Site 8 (571-7)," TMs, 1993. On pages 18 and 19 of his nomination, Stumpf specifically mentioned the proposal to preserve Ellsworth sites Delta-01 and Delta-09. Noting that "the surviving launch sites associated with the solid-fueled Minuteman missile would be most comparable to the level of national significance of the Titan II missile," he stated that, in his opinion, both the Titan II and Minuteman ICBMs "possess exceptional national significance for which representative sites would be worthy of NHL designation."

Comparison to Other Minuteman Sites
When the nation's Minuteman force reached full strength in 1967, it consisted of 1,000 Minuteman I and Minuteman II missiles, divided among six deployment areas, as follows:

200 missiles at Malmstrom Air Force Base, Montana (Wing I)
150 missiles at Ellsworth Air Force Base, South Dakota (Wing II)
150 missiles at Minot Air Force Base, North Dakota (Wing III)
150 missiles at Whiteman Air Force Base, Missouri (Wing IV)

200 missiles at F. E. Warren Air Force Base, Wyoming (Wing V)
150 missiles at Grand Forks Air Force Base, North Dakota (Wing VI)

The Minuteman missiles for each flight were housed in individual, hardened underground silos (Launch Facilities) located several miles apart. A network of buried cables connected the ten silos in each flight to a central underground command post (Launch Control Facility). Each command post was staffed at all times by a two-person Air Force launch crew. An aboveground support building at each Launch Control Facility provided accommodations for security guards and other personnel.

Facilities at the six deployment areas were originally built according to three similar, yet clearly distinguishable, standard plans, each reflecting a distinct phase in the evolution of both strategic policy and missile technology. The nation's first two Minuteman deployment areas, activated at Malmstrorm Air Force Base, Montana, in 1962 and at Ellsworth Air Force Base in 1963, were designed specifically to implement the massive retaliation strategy formulated by the Eisenhower administration during the early Cold War period. The facilities at Minot, Whiteman, and Warren Air Force Bases, activated in 1964 and 1965, incorporated a number of design refinements required by the Kennedy administration's shift to a "controlled response" strategic policy in 1961. The facilities at Grand Forks Air Force Base, activated in 1966, and at a fifty-missile unit (Squadron 20) added to the Malmstrom deployment area in 1967, also conformed to the requirements of the controlled response policy, but were designed specifically to accommodate the Minuteman II weapon system.[88]

Under the massive retaliation policy, combat crews were expected to respond to an attack by immediately launching all of the missiles under their control, sending them to pre-selected targets. Because the entire Minuteman flight was expended in one swift action, there was no need to protect the facilities for an extended period of time following the launch. Therefore, power generation equipment necessary for launch could be located in unhardened facilities located aboveground. Facilities constructed in accordance with the "controlled response" policy, however, were required to survive an attack and remain operational for up to nine weeks so that crews could retarget and selectively launch one or more missiles as battle conditions dictated. To make sure that the installations could retain their launch capability for an extended period of time, power generation

[88] "Minuteman II Emplacement Cost to Top $1 Billion," 12.

equipment was placed in hardened enclosures beneath the surface. Physical facilities erected at the six deployment areas clearly reflect the change in policy. At Ellsworth and Malmstrom, mechanical support equipment for the Launch Control Facilities and Launch Facilities was housed in "soft" buildings located at ground level. At all subsequent sites, this equipment was installed in blast-proof "hardened" enclosures underground.

In 1966, the Air Force began to replace the nation's entire Minuteman I arsenal with an improved version of the missile called the Minuteman II. This "Force Modernization Program," completed at Ellsworth Air Force Base in 1973, required no major structural modifications to existing facilities.[89] A more significant change was initiated in 1971, when the Minuteman II launchers at Minot, Grand Forks, F. E. Warren, and Squadron 20 at Malmstrom were rebuilt to accommodate the more advanced Minuteman III missile. By 1975, 550 silos in these deployment areas had been equipped with new electronic ground support equipment and missile suspension systems, and their closure doors had been reinforced with nearly twenty tons of additional concrete. Closure doors on the remaining Minuteman II launchers at Whiteman and Malmstrom were reinforced at about the same time. The facilities at Ellsworth, however, remained unaltered, apparently because there was some question whether soil conditions would properly support the added weight of the modifications. After the Minuteman III modifications were completed at the other bases, the 150 Launch Facilities and 15 Launch Control Facilities at Ellsworth remained the only facilities representing the original Minuteman configuration.

Following the dissolution of the Soviet Union in 1991, President George H. W. Bush ordered the immediate deactivation or upgrade of all 450 remaining Minuteman II sites, divided equally among Ellsworth, Malmstrom, and Whiteman Air Force Bases. The 150 Minuteman II launchers at Malmstrom Air Force Base were scheduled for conversion to the Minuteman III system, and the necessary missiles were eventually transferred from the Grand Forks Minuteman III installation, which in turn was deactivated. The Minuteman II launchers at Ellsworth and Whiteman Air Force Bases were slated for demolition instead of upgrade.[90]

---

[89] The Force Modernization Program was authorized in 1963, and was implemented at the nation's 800 Minuteman I sites over the next ten years. As military historian Michael Binder observed in his 1993 HAER study of Ellsworth Sites Delta-01 and Delta-09, the generic program included improved electromagnetic pulse protection and physical strengthening of launch facilities against nuclear attack; installation of advanced electronic equipment in launch facilities and Launch control centers for command, status, and monitoring of the new Minuteman II; extended survivability (new batteries); and silo upgrades. At Ellsworth, however, "not all of the program's components were implemented. For example, the electromagnetic pulse hardening went only halfway. Another feature unique to Ellsworth was the partial ... silo upgrade, meaning that, compared to the other five Minuteman wings, Ellsworth's silos did not receive the same degree of hardening. For example,… extra concrete was *not* added to the top of the launcher closure and closure surround, perhaps due to the 'soft' ground in which many of Ellsworth's silos sat." Because of the limited alterations at the South Dakota installations, Binder concludes that the Ellsworth sites are the least modified of all the six Minuteman wings, and "therefore the wing is most closely representative of the original Minuteman I deployment." See Michael S. Binder, "Thirty Minutes to Armageddon," Draft Historic American Engineering Record, WS-133A-M, Ellsworth Air Force Base, Launch Control Facility D-1, and Launch Facility D-9, 1993.

[90] Chuck Haga, "A Missile Leaves the Prairie -- Quietly," *Minneapolis Star-Tribune*, 9 June 1996.

By late 1996, 149 of the original 150 Minuteman Launch Facilities at Ellsworth had been imploded in accordance with the terms of the START Treaty. A single Launch Complex, consisting of Launch Control Facility Delta-01 and Launch Facility Delta-09, was kept intact for purposes of future historical interpretation for the general public. At Whiteman Air Force Base, all 150 of its Minuteman II Launch Facilities were imploded by 1997.[91] The underground Launch Control Center, Oscar-01, located on Whiteman Air Force Base, was retained for public interpretation and is available to tour.

A comparison of the Whiteman facility and former Ellsworth facility reveals some significant differences. First, Oscar-01 at Whiteman reflects the "controlled response" era of Minuteman design, with its ground support facilities hardened belowground. In contrast, the Delta Flight Launch Complex, formerly of Ellsworth, belongs to the earlier period of massive retaliation, as indicated by the "soft" siting of its support facilities aboveground. Second, the Whiteman site is located on the Air Force Base proper, instead of being dispersed, like the Ellsworth sites, in a remote missile field, as was more typical of the Minuteman basing configuration. Third, Whiteman's Oscar-01 is not a complete Launch Complex. Not only does it lack a silo Launch Facility, but it also lacks an aboveground Launch Facility support building. In a typical Minuteman Launch Complex, such as represented by the former Ellsworth Site Delta-01, the Launch Control Facility support building provided accommodations for Air Force personnel stationed in the missile field, and served as a security control center. Since the surrounding air base provided Whiteman's Oscar-01 with these services, a separate Launch Control Facility support building was considered unnecessary.

Conclusion

The significance of Minuteman ICBM Launch Control Facility Delta-01 and Launch Facility Delta-09 has been recognized through the establishment of the Minuteman Missile National Historic Site. The Delta Flight Launch Complex, originally associated with Ellsworth Air Force Base, is the only remaining formerly operational intact example of the original Minuteman basing configuration, designed to implement the Cold War policy of massive retaliation. The Delta Flight complex is also the only intact Minuteman II site remaining in the United States that contains a Launch Control Facility and Launch Facility. The complex is nationally significant under Criterion A in the area of history as a representation of the United States early Cold War policy of massive retaliation. The complex, originally designed as Minuteman and updated to Minuteman II, physically represents policies and products of the Cold War. Technologically the complex is nationally significant under Criterion C: Engineering as an intact example of the Minuteman I system and for its ability to demonstrate major technological advancements in missile technology.

[91] Donald Meuschke, telephone interview with John Lauber, 22 October 1996 and "Last Minuteman II missile silo imploded," *Air Force News*, n.d., <http://www.af.mil/news/Dec1997/n19971222_971628.html> (19 March 2003).

Bibliography

Books

Brands, H.W., Jr. *Cold Warriors*. New York: Columbia University Press, 1988.

Kaplan, Fred. *Wizards of Armageddon.* Stanford, Calif.: Stanford University Press, 1991.

Kennan, George. "The Kennan 'Long Telegram.'" In *Origins of the Cold War: the Novikov, Kennan, and Roberts "Long Telegrams" of 1946*, edited by Kenneth M. Jensen. Washington, D.C.: United States Institute of Peace, 1991.

Neal, Roy. *Ace in the Hole.* Garden City, New York: Doubleday & Company, Inc., 1962.

Neufeld, Jacob. *The Development of Ballistic Missiles in the United States Air Force, 1945-1960.* Washington, D.C.: Office of Air Force History, 1990.

Perry, Robert L. "The Atlas, Thor, Titan, and Minuteman." In *The History of Rocket Technology*; *Essays on Research, Development, and Utility*, edited by Eugene Emme. Detroit: Wayne State University Press, 1964.

Prados, John. *The Soviet Estimate.* New York: Dial Press, 1982.

Schwiebert, Ernest G. *A History of the U.S. Air Force Ballistic Missiles*. New York: Frederick A. Praeger, 1965.

Periodical Articles

"Closing the Gap." *Time* 77 (10 February 1961): 16-17.

"End of the Cold War." *The CQ Researcher* 2 (21 August 1992): 721.

Griswold, Wesley S. "Minuteman, Our Ace in the Hole." *Popular Science* 179 (July 1961): 62-65, 184.

"Home of the Minuteman." *Time* 75 (25 January 1960): 48-50.

"The Sources Soviet Conduct." *Foreign Affairs* 25 (July 1947): 566-582.

Licklider, Roy. "The Missile Gap Controversy." *Political Science Quarterly* 85 No.4 (December 1970): 600.

Meyers, Harold B. "The Biggest Invisible Builder in the World." *Fortune* 73 (April 1966): 146-151, 197-200.

Miller, Barry. "ICBMs Get Major Modification." *Aviation Week and Space Technology* 104 (10 May 1976): 67-70.

"Minuteman II Emplacement Cost to Top $1 Billion." *Missiles and Rockets* 16 (24 May 1965): 12.

"Minuteman Deployment and Modification Matrix." *Minuteman Weapon System: History and Description*. Hill Air Force Base, Utah: Ogden Air Logistics Center, 1990.

Plattner, C.M. "First SAC Crews Controlling Minuteman." *Aviation Week and Space Technology* 78 (7 January 1963): 62-63, 65.

Schriever, General Bernard A. "The USAF Ballistic Missile Program." *Air University Quarterly Review* 9 (Summer 1957).

Stolley, Richard B. "How It Feels to Hold the Nuclear Trigger." *Life* 57 (6 November 1964): 34-41.

Taylor, Hal. "McNamara Voices Some Optimism over Nike-X, Tells Minuteman Plans." *Missiles and Rockets* 14 (3 February 1964): 20-21.

"Titan a Big Threat." *U.S. News and World Report* 89 (29 September 1980): 8.

"What's 'Force Mod?'" *Minuteman Service News* 23 (November-December 1965): 11-12.

Winterfelt, Rolf . "Minuteman System is 'Most Reliable.'" *Missiles and Rockets* 8 (27 February 1961).

Newspapers

Bearwald, Mark. "Requiem for the Titans." *Denver Post*, 26 February 1967.

Haga, Chuck. "A Missile Leaves the Prairie – Quietly." *Minneapolis Star-Tribune*, 9 June 1996.

Jameson, Dirk. "Wing Nears Last Chapter in History." *The Plainsman* (Ellsworth Air Force Base, S.Dak.), 15 April 1994.

New York Times, various years.

Rapid City Daily Journal, various years.

Wall Street Journal, various years.

Unpublished

Binder, Michael S. "Thirty Minutes to Armageddon." Draft Historic American Engineering Record, WS-133A-M Minuteman II ICBM, Ellsworth Air Force Base, Launch Control Facility D-1, and Launch Facility D-9, 1993.

"Last Minuteman II missile silo imploded." *Air Force News*. N.d. <http://www.af.mil/news/Dec1997/n19971222_971628.html> (19 March 2003).

Lauber, John F. and Jeffrey A. Hess. "Historic American Engineering Record, Glenn L. Martin Company, Titan Missile Test Facilities," 1993. HAER Number CO-75. HABS/HAER Collection, Library of Congress, Washington D.C.

Lauber, John F. and Jeffrey A. Hess. "Minuteman II ICBM Launch Control Facility D-1 and Launch Facility D-9, Ellsworth Air Force Base Draft National Historic Landmark Nomination." Prepared for the U.S. Air Force, 1996.

Reed, George A. "U.S. Defense Policy, U.S. Air Force Doctrine and Strategic Nuclear Weapon Systems, 1958-1964: The Case of the Minuteman ICBM." Doctoral dissertation. Durham, N.C.: Duke University, 1986.

"Weapon System Operation Instructions." On file at the Environmental Management Flight, 28th Civil Engineering Squadron, Ellsworth Air Force Base, S.Dak. T.0. 21M-LGM30F-1-13, 1991.

Interviews

Bowen, Mark (Lieutenant). Minuteman launch crew training specialist. Interviewed by John F. Lauber, 5 November 1993, Ellsworth Air Force Base, S.Dak.

Meuschke, Donald. Natural and Cultural Resources Manager, Whiteman Air Force Base, Mo. Telephone interviews by John Lauber, 12 March and 22 October 1996.

Pavek, Tim. Missile engineer with the 28th Civil Engineering Squadron, Ellsworth Air Force Base, S.Dak. Interviewed by John F. Lauber on 5 and 12 November 1993, Ellsworth Air Force Base, S.Dak. Telephone interview by John Lauber 28 February 1994, 11 March 1996, and 29 October 1996. Interview by Mead & Hunt on 8 and 9 January 2003.

Schriever, Bernard A. (General). Former commander of Western Development Division. Interviewed by Maj. Lyn R. Officer and Dr. James C. Hasdorff, 20 June 1973, Washington, D.C. Transcript in collection of USAF Historical Research Agency, Maxwell Air Force Base, Ala. File K239.0512-783.

Archival Sources

Air Force Historical Research Agency, Maxwell Air Force Base, Ala. Miscellaneous records pertaining to the American ICBM program.

Ballistic Missile Organization History Office, Norton Air Force Base, San Bernardino, Calif. Miscellaneous records pertaining to the ICBM program in general and to the Minuteman program in particular.

28 Civil Engineering Squadron, Ellsworth Air Force Base, S.Dak. Architectural and engineering drawings, blueprints and site plans of Minuteman facilities at Ellsworth. Original real estate records, construction completion reports, and other miscellaneous documents relating to the Minuteman deployment at Ellsworth.

44th Missile Wing History Office, Ellsworth Air Force Base, S.Dak. Unit histories and other records relating to the Minuteman activities at Ellsworth. After the inactivation of the 44th Missile Wing, many of these records were transferred to the Air Force Historical Research Agency, Maxwell Air Force Base, Ala.

Other Sources

Minuteman Missile National Historic Site Establishment Act of 1999. Public Law 106-115, 106th Cong., 1st sess., 29 November 1999.

National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation. Washington, D.C.: National Park Service, U.S. Department of the Interior, 1991.

National Register Bulletin 22: Guidelines for Evaluating and Nominating Properties That Have Achieved Significance Within the Last Fifty Years. Washington, D.C.: National Park Service, U.S. Department of the Interior, n.d.

Geographical Data

UTM References (continued):

Delta-09

5	13	728780	4867500
	Zone	Easting	Northing

6	13	727605	4867680
	Zone	Easting	Northing

Verbal Boundary Description:
The Minuteman ICBM Launch Complex is a discontiguous historic district including two sites, Launch Control Facility Delta-01 and Launch Facility Delta-09. The boundary of Delta-01 includes 6.4 acres within the northeast quarter of the northeast quarter of Section 16, Township 2 South, Range 18 East including legal tracts FD-100, FD-103, FD-104 and FD-100E-1. The boundary of Delta-09 includes 90 acres within the northeast quarter of Section 26, Township 1 South, Range 16 East, including the south half of the northeast quarter of the northeast quarter, the southeast quarter of the northeast quarter, the east half of the east half of the southwest quarter of the northeast quarter, the southeast quarter of the southeast quarter of the northwest quarter of the northeast quarter, the northeast quarter of the northeast quarter of the southeast quarter, the east half of the northwest quarter of the northeast quarter of the southeast quarter, and the northwest quarter of the northwest quarter of the northeast quarter of the southeast quarter. The Minuteman ICBM Launch Complex encompasses a total of approximately 96.4 acres. The boundaries of Delta-01 and Delta-09 are delineated on the historic boundary maps entitled “Minuteman ICBM Launch Control Facility Delta-01” and “Minuteman ICBM Launch Control Facility Delta-09.”

Boundary Justification:
The boundary of the Minuteman ICBM Launch Control Facility Delta-01 and Launch Facility Delta-09, Ellsworth Air Force Base encompasses the areas that were historically used by the Air Force to operate Delta-01 and Delta-09. The boundary at Delta-01 corresponds to the 6.4 acre parcel that was transferred from the Air Force to the National Park Service. The boundary at Delta-09 was delineated to encompass the 90 acres of the site historically used by the Air Force. Ten acres were in an exclusive use area and included the area within the security fence. The remaining 80 acres, in concurrent use, were under ownership of the United States Forest Service and operated by the Air Force under a Memorandum of Understanding. The concurrent use area includes the azimuth markers located approximately 1,000 feet to the northeast and northwest of the missile launcher, the HICS markers south of the security fence, and the cathodic protection rectifier on the southside of the access road.

Photographs

The following information pertains to the photographs:

Minuteman Launch Control Facility Delta-01
West side of Jackson County Road CS23A, approximately .5 miles north of Interstate-90, exit 127
Jackson County, South Dakota

Minuteman Launch Facility Delta-09
West side of Pennington County Road T512, approximately .6 miles west and south of Interstate-90, exit 116
Pennington County, South Dakota

Historic American Engineering Record (HAER) photographs (SD-50) taken by Robert Lyon, November 1992 and January 1993.
HAER negatives in the collection of the Library of Congress.

Other photographs taken by Christina Slattery, Mead & Hunt, November 2002.
Negatives in the collection of the National Park Service.

Photo 1 of 42
Minuteman Launch Control Facility Delta-01
Aerial view
View facing north
HAER photograph SD-50-A-2

Photo 2 of 42
Minuteman Launch Control Facility Delta-01
Aerial view
View facing west
HAER photograph SD-50-A-1

Photo 3 of 42
Minuteman Launch Control Facility Delta-01
Support building, main facade
View facing northwest

Photo 4 of 42
Minuteman Launch Control Facility Delta-01
Support building, main facade
View facing north

Photo 5 of 42
Minuteman Launch Control Facility Delta-01
Entrance gate and east wall of support building
View facing west

Photo 6 of 42
Minuteman Launch Control Facility Delta-01
Security Control Center
View facing north

Photo 7 of 42
Minuteman Launch Control Facility Delta-01
Support building, rear side
View facing west

Photo 8 of 42
Minuteman Launch Control Facility Delta-01
Heated vehicle storage building
View facing northwest

Photo 9 of 42
Minuteman Launch Control Facility Delta-01
Code burner with hard HF transmit antenna in background
View facing northeast

Photo 10 of 42
Minuteman Launch Control Facility Delta-01
Helicopter pad
View facing southwest

Photo 11 of 42
Minuteman Launch Control Facility Delta-01
Support building interior, day room
View facing west

Photo 12 of 42
Minuteman Launch Control Facility Delta-01
Support building interior, facility manager bedroom
View facing southwest

Photo 13 of 42
Minuteman Launch Control Facility Delta-01
Diesel generator room, diesel motor generator, diesel fuel day tank at right rear
View facing northwest
HAER photograph SD-50-A-47

Photo 14 of 42
Minuteman Launch Control Facility Delta-01
Security Control Center
View facing east
HAER photograph SD-50-A-50

Photo 15 of 42
Minuteman Launch Control Facility Delta-01
Reinforcing steel and forms for egg of Launch Control Center
View facing northwest
HAER photograph SD-50-24
Photographic copy of photograph (c. 1962, original print in possession of Peter Kiewit Sons' Co., Omaha, Nebraska. Photographer unknown)

Photo 16 of 42
Minuteman Launch Control Facility Delta-01
Launch Control Center, nearly buried
View facing southeast
HAER photograph SD-50-30
Photographic copy of photograph (c. 1962, original print in possession of Peter Kiewit Sons' Co., Omaha, Nebraska. Photographer unknown)

Photo 17 of 42
Minuteman Launch Control Facility Delta-01
Launch Control Center, exterior side of blast door
View facing southeast

Photo 18 of 42
Minuteman Launch Control Facility Delta-01
Launch Control Center, exterior side of blast door
View facing southeast

Photo 19 of 42
Minuteman Launch Control Facility Delta-01
Launch Control Center, interior side of blast door
View facing north
HAER photograph SD-50-A-56

Photo 20 of 42
Minuteman Launch Control Facility Delta-01
Launch Control Center interior
View facing east

Photo 21 of 42
Minuteman Launch Control Facility Delta-01
Launch Control Center, communications control (deputy commander's) console
View facing southeast

Photo 22 of 42
Minuteman Launch Control Facility Delta-01
Launch Control Center, launch control (commander's) console
View facing east

Photo 23 of 42
Minuteman Launch Control Facility Delta-01
Interior of launch Control Center, commanders launch control console, plexiglass shield up
View facing east
HEAR photograph SD-50-A-69

Photo 24 of 42
Minuteman Launch Control Facility Delta-01
Interior of Launch Control Center, escape hatch
View facing southeast
HAER photograph SD-50-A-84

Photo 25 of 42
Minuteman Launch Facility Delta-09
Aerial view
View facing southwest
HAER photograph SD-50-C-1

Photo 26 of 42
Minuteman Launch Facility Delta-09
General view
View facing east

Photo 27 of 42
Minuteman Launch Facility Delta-09
General view
View facing southwest

Photo 28 of 42
Minuteman Launch Facility Delta-09
General view
View facing south

Photo 29 of 42
Minuteman Launch Facility Delta-09
Viewing enclosure
View facing west

Photo 30 of 42
Minuteman Launch Facility Delta-09
Viewing enclosure and support building
View facing west

Photo 31 of 42
Minuteman Launch Facility Delta-09
Viewing enclosure and access hatch
View facing southwest

Photo 32 of 42
Minuteman Launch Facility Delta-09
Access hatch
View facing southwest

Photo 33 of 42
Minuteman Launch Facility Delta-09
Viewing enclosure and launcher closure detail
View facing northeast

Photo 34 of 42
Minuteman Launch Facility Delta-09
Missile silo detail with launcher closure
View facing southeast

Photo 35 of 42
Minuteman Launch Facility Delta-09
Missile enters the transporter/erector
View facing north
HAER photograph SD-50-C-18

Photo 36 of 42
Minuteman Launch Facility Delta-09
Personnel access ladder
View from upper level of underground Launch Facility looking up to personnel hatch
HAER photograph SD-50-C-24

Photo 37 of 42
Minuteman Launch Facility Delta-09
Upper level, alignment/autocollimator ring
View taken in interior of upper level of Launch Facility
HAER photograph SD-50-C-35

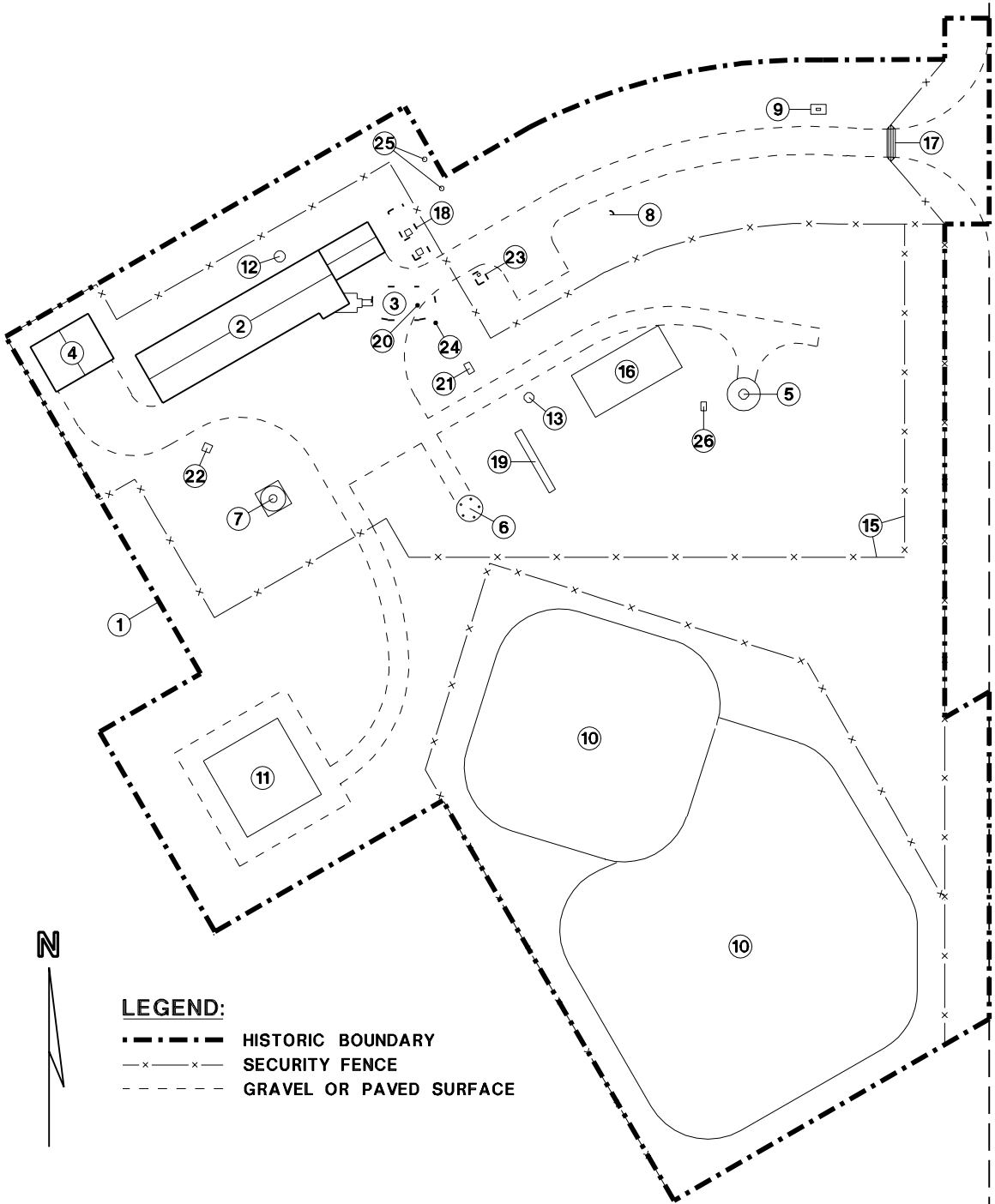
Photo 38 of 42
Minuteman Launch Facility Delta-09
Upper Level, electronic racks (Left to right – status command message processing group, UHF radio, IMPSS rack security, power supply group rack)
View taken in interior of upper level Launch Facility
HAER photograph SD-50-C-40

Photo 39 of 42
Minuteman Launch Facility Delta-09
Lower level, ballistic gas generator at left, LDB panel at right
View taken in interior of upper level Launch Facility
HAER photograph SD-50-C-33

Photo 40 of 42
Minuteman Launch Facility Delta-09
Support building
View facing southeast

Photo 41 of 42
Minuteman Launch Facility Delta-09
Launch interior
Diesel motor generator at center left, diesel electric unit at upper center, batteries at bottom center
View facing northwest
HAER photograph SD-50-C-55

Photo 42 of 42
Minuteman Launch Facility Delta-09
Northeast azimuth marker (outside of security fence)
View facing southwest



MAP KEY:

CONTRIBUTING RESOURCES:

1. LAUNCH CONTROL FACILITY DELTA-01 SITE
2. LAUNCH CONTROL FACILITY SUPPORT BUILDING
3. LAUNCH CONTROL CENTER
4. HEATED VEHICLE STORAGE BUILDING
5. HARD HF TRANSMIT ANTENNA
6. HARD HF RECEIVE ANTENNA
7. HARDENED UHF ANTENNA
8. SLFCS ANTENNA
9. CATHODIC PROTECTION RECTIFIER
10. SEWAGE LAGOON
11. HELICOPTER PAD
12. ISST ANTENNA
13. TV SATELLITE DISH
14. HICS (UNDERGROUND - NOT MAPPED)

ASSOCIATED SITE FEATURES:

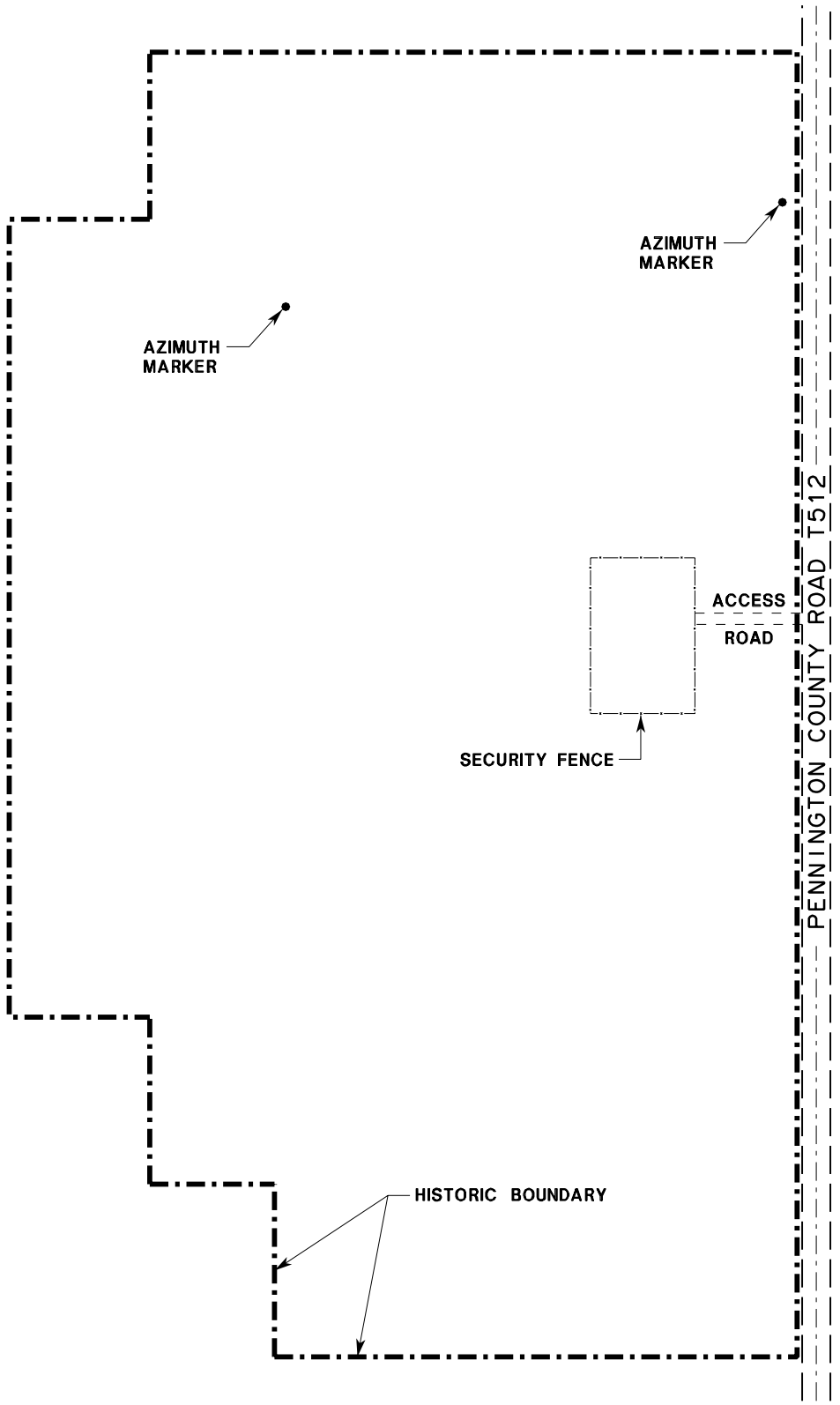
15. SECURITY FENCE
16. VOLLEYBALL COURT
17. CATTLE GUARD
18. UNDERGROUND DIESEL STORAGE TANK
19. HORSESHOE PIT
20. BASKETBALL HOOP
21. ABOVEGROUND DIESEL TANK
22. WATER WELL
23. GAS PUMP
24. FLAGPOLE
25. UTILITY POLES
26. CODE BURNER

MINUTEMAN ICBM LAUNCH CONTROL FACILITY DELTA-01

MINUTEMAN MISSILE NATIONAL HISTORIC SITE
SITE PLAN
JACKSON COUNTY, SOUTH DAKOTA

FEET
0 25 50 100
(approximate scale)

SOURCE:
National Park Service, Modified by Mead & Hunt, Inc.



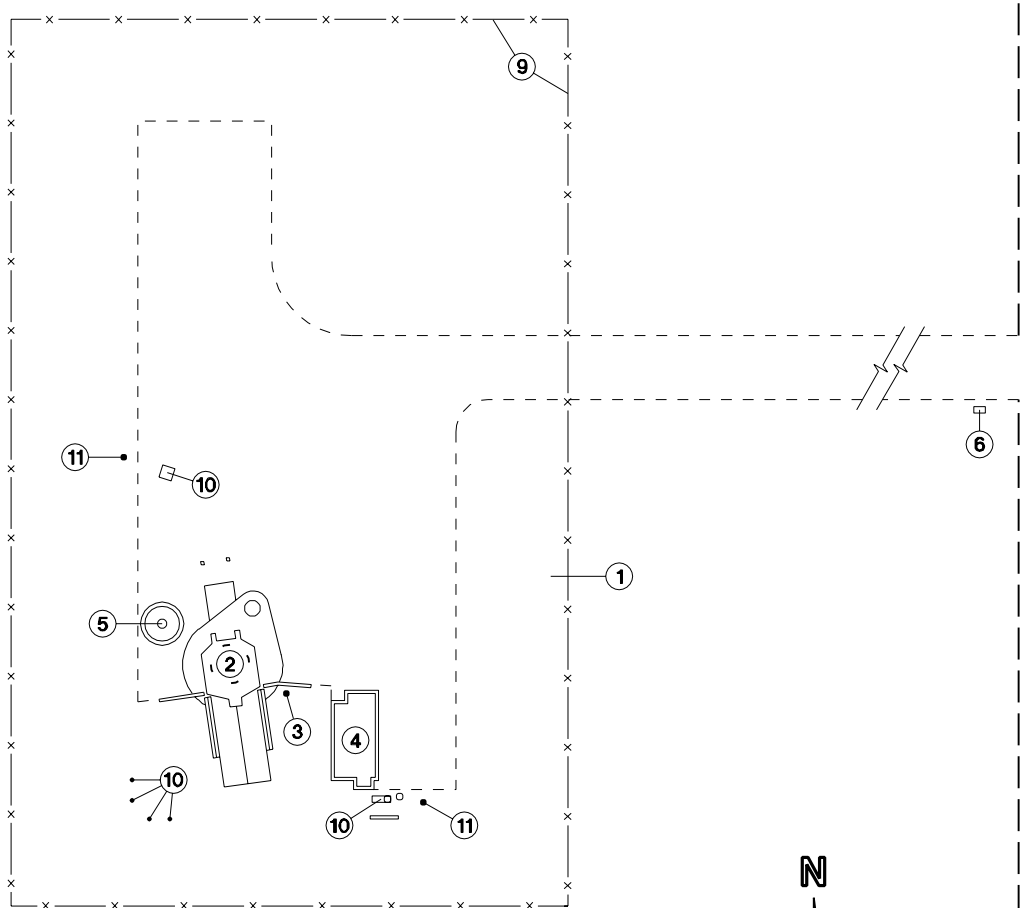
N

NOT TO SCALE

MINUTEMAN ICBM LAUNCH FACILITY DELTA-09

MINUTEMAN MISSILE NATIONAL HISTORIC SITE
HISTORIC BOUNDARY MAP
PENNINGTON COUNTY, SOUTH DAKOTA

SOURCE:
National Park Service, Modified by Mead & Hunt, Inc.



MAP KEY:

CONTRIBUTING RESOURCES:

1. LAUNCH FACILITY DELTA-09 SITE
2. MISSILE LAUNCHER
3. IMPSS ANTENNA
4. LAUNCH FACILITY SUPPORT BUILDING
5. HARD UHF ANTENNA
6. CATHODIC PROTECTION RECTIFIER
7. TWO AZIMUTH MARKERS (APPROX. 1000' FROM LAUNCHER)
8. HICS MARKERS

ASSOCIATED SITE FEATURES:

9. SECURITY FENCE
10. OUTER ZONE SECURITY ANTENNA FOUNDATIONS
11. LIGHT FIXTURES

LEGEND:

—×——×— SECURITY FENCE

- - - - - - GRAVEL OR PAVED SURFACE

MINUTEMAN ICBM LAUNCH FACILITY DELTA-09

MINUTEMAN MISSILE NATIONAL HISTORIC SITE

SITE PLAN

PENNINGTON COUNTY, SOUTH DAKOTA

FEET
0 15 30 60
(approximate scale)

SOURCE:
National Park Service, Modified by Mead & Hunt, Inc.