



North Dakota Public Service Commission

Langdon Wind Energy Center

Cavalier County, North Dakota

July 23, 2007

Prepared by



TETRA TECH EC, INC.

**133 Federal Street
Boston, MA 02110
617-457-8200**





**STATE
HISTORICAL
SOCIETY
OF NORTH DAKOTA**

COPY

July 18, 2007

John Hoeven
Governor of North Dakota

North Dakota
State Historical Board

Marvin L. Kaiser
Williston - President

Albert I. Berger
Grand Forks - Vice President

Chester E. Nelson, Jr.
Bismarck - Secretary

Gerold Gemtholz
Valley City

A. Ruric Todd III
Jamestown

Diane K. Larson
Bismarck

John E. Von Rueden
Bismarck

Sara Otte Coleman
Director
Tourism Division

Kelly Schmidt
State Treasurer

Alvin A. Jaeger
Secretary of State

Douglass Prchal
Director
Parks and Recreation
Department

Francis Ziegler
Director
Department of
Transportation

Merlan E. Paaverud, Jr.
Director

Ms. Tracey Martorano
Project Engineer
Tetra Tech EC
133 Federal Street 6th Floor
Boston MA 02110

**NDSHPO Ref.: 07-0400b Tetra Tech-FPL/ Langdon Wind Farm, Cavalier
County, North Dakota, Class II and III CRI Report and Concurrence with
Determination of Effect and Acceptance of Mitigation Plan**

Dear Tracey:

We have reviewed: "Langdon Wind Energy Center A Class II and III Cultural Resource Inventory in Cavalier County, North Dakota," prepared by Ed Stine, (Metcalf Archaeological Consultants, July 2007), and find it acceptable.

If consulted by a federal agency, we concur with an "Adverse Effect" and a significant site affected determination. The mitigation plan as outlined to mitigate the adverse effect to significant and National Register eligible site 32CV113 is acceptable. We look forward to working with you on this project. If you have questions please contact either Susan Quinnell at (701) 328-3576 or Paul Picha at (701) 328-3574.

Sincerely,

Merlan E. Paaverud, Jr.
Director, State Historical Society of North Dakota
and
State Historic Preservation Officer (North Dakota)

c: Suzanne Nelsen, MAC
c: Patrick Fahn, PSC

Accredited by the
American Association
of Museums

Langdon Wind, LLC

817 3rd St
Suite 106
Langdon, ND 58249
(701) 256-3298

July 16, 2007

Mr. Merlan E. Paaverud, Jr.
Director, State Historical Society of North Dakota and
State Historic Preservation Office (North Dakota)
612 East Boulevard Avenue
Bismark, ND 58505-0830

NDSHPO Ref: 07-0400a Tetra Tech/Langdon Wind Farm, Cavalier County, North Dakota, Class II and III CRI Report with Recommendations

Dear Mr. Paaverud,

We have received your letter of review for the report entitled "Langdon Wind Energy Center Class II and III Cultural Resource Inventory in Cavalier County, North Dakota" prepared by Metcalf Archaeological Consultants in June 2007. One issue of concern noted in this letter states that the NDCRS distance from Turbine T47 to the Nekoma Pyramid (32CV113-Safeguard Complex) is closer than identified in our report. We will revise this document updating the 32CV113 NDCRS information to state that the structure is 0.75 miles west of proposed T47 and we will resubmit the report to your office.

We have, as you know, discussed this project frequently with various stakeholders in the local community and have consistently received their enthusiastic support for the wind farm. Two of our most consistent supporters are the Army staff in charge of the base realignment and closure (BRAC) and the Cavalier County Jobs Development Authority.

We would like to propose a mitigation plan, as recommended by Ms. Quinnell that targets public interpretation of the site. Our plan is to provide funding to assist in the development of an interpretive kiosk, or an alternative means for public interpretation as determine appropriate by the local stakeholders for the Nekoma Pyramid. Per ND SHPO's request, the stakeholders who will receive this funding will submit all developed interpretive information for review to ND SHPO and the caretaker of the site before publishing.

With this mitigation plan in place, Langdon Wind, LLC understands that ND SHPO will provide an expedited concurrence letter of "*No Adverse Effect*" or "*No Historic Properties Affected*". Should you have any questions or concerns, please call me at (561) 691-7240.

Sincerely,


Scott Scovill

cc: William J. O'Donnell, II (Program Manager, Dept of the Army)
Tracey Martorano, (Project Manager, Tetra Tech)

**PLAN TO MITIGATE ADVERSE EFFECTS OF
LANGDON WIND FARM, CAVALIER COUNTY, NORTH DAKOTA
ON SITE 32CV113 (SAFEGUARD COMPLEX)**

SITE 32CV113 (SAFEGUARD COMPLEX)

Site 32CV113, Safeguard Complex, also known as the Stanley R. Nicholson Safeguard Site, is located in Cavalier County, North Dakota (Figure 1). One component, the Missile Site Radar (MSR) complex, was located 12 miles south of Langdon, North Dakota. The 470-acre MSR site contained the shorter-range missile control radar and almost half of the Safeguard system's defensive Spartan and Sprint missiles. The MSR construction was completed in 1974 and it was deactivated by about 1976 (Lonquest and Winkler 1996). Attachment 1 contains a description of the Safeguard Site extracted from Lonquest and Winkler 1996. The MSR is the only anti-ballistic missile (ABM) system actually constructed in the United States. The site has been determined eligible for listing in the National Register of Historic Places (NRHP) under Criteria A and C and under Criteria Consideration G, as a Post World War II Property defined as a military installation exceptionally important because of its contribution to the Cold War arms race (Metcalf Archaeological Consultants 2007).

PROPOSED PROJECT DESCRIPTION

Langdon Wind, LLC ("Langdon Wind") has applied to the North Dakota Public Service Commission for a Certificate of Site Compatibility (Certificate) to construct the Langdon Wind Energy Center (the Project). The Project is located in Cavalier County, North Dakota (Figures 1 and 2), and would be approximately 159 megawatts (MW) in size, consisting of up to 106 wind turbine generators. Langdon Wind will own 79 General Electric (GE) 1.5 MW turbines totaling 118.5 MW. Otter Tail Power Company (OTP) will own 27 GE 1.5 MW turbines totaling 40.5 MW. Associated facilities include a Project substation, operations and maintenance facilities, up to four meteorological towers, a construction lay-down area, access roads, above and/or below ground electrical collection system(s) and cabling, and an approximate eleven-mile 115 kilovolt (kV) transmission line.

Proposed turbine T47 will be located approximately 0.75-miles east of the Nekoma Pyramid, a prominent element at the Safeguard Complex. The proposed project will be visible from the historic property and it has been determined by ND SHPO that the Langdon Wind Energy Center will result in an adverse effect on the Safeguard Complex.

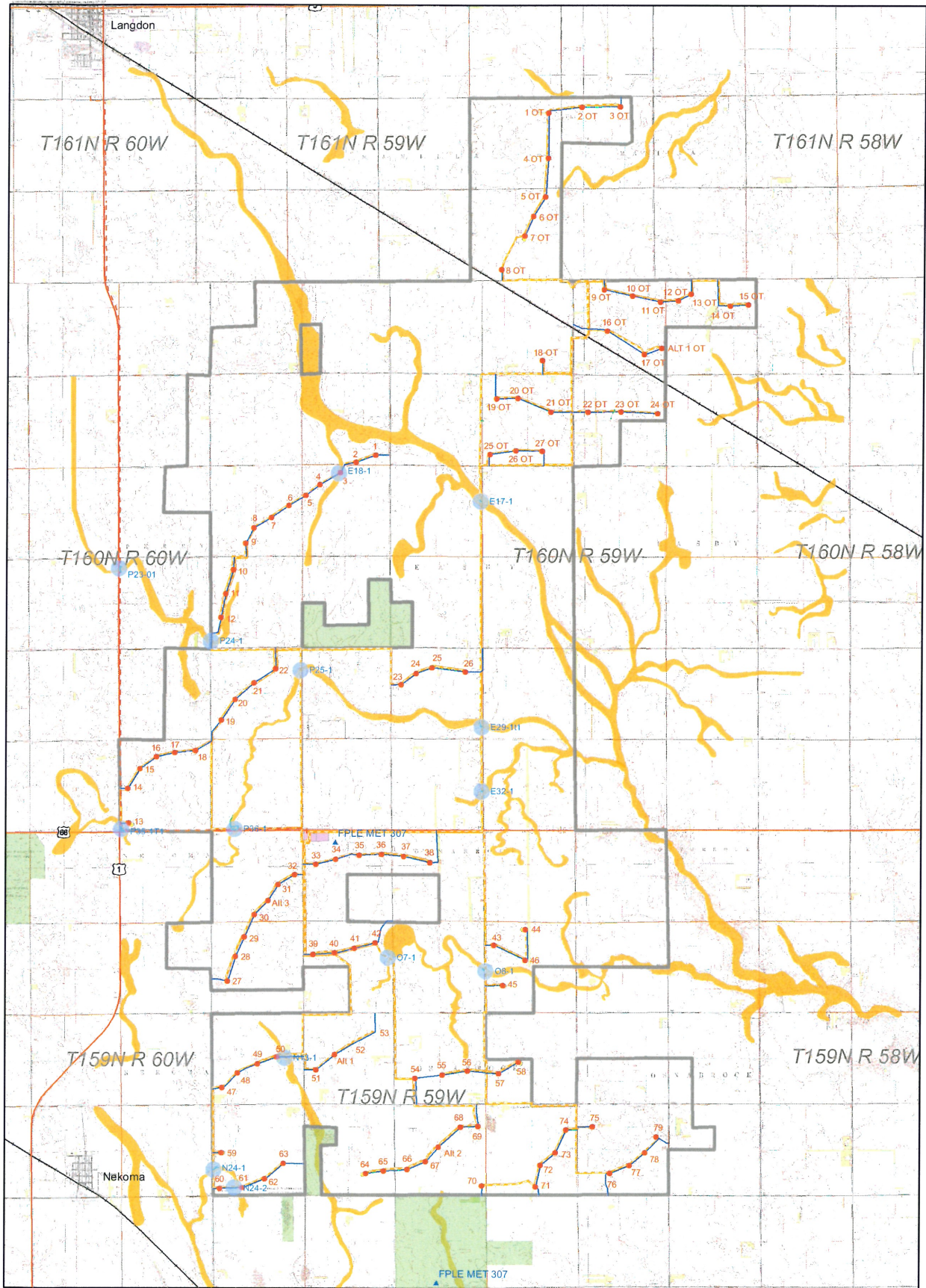
MITIGATION PLAN

The proposed project turbines will stand approximately 118.5 meters from ground to blade tip. Recognizing that methods of visual screening such as planting trees or placing physical barriers that will block a view (e.g. a fence) will not be successful in mitigating visual impacts to this historic site, Langdon Wind proposes an alternative form of mitigation. Langdon Wind proposes to provide mitigation funds not to exceed \$20,000 to the Cavalier County Job Development Authority for interpretive services of the Safeguard Complex. Langdon Wind's consultation with SHPO staff, BRAC Army staff, and local stakeholders, including the Cavalier County Jobs Development Authority, has indicated that public interpretation of the Safeguard Complex is a common priority. The money provided by Langdon Wind will benefit the local community by enabling the stakeholders to work with SHPO to develop an appropriate method of public interpretation, such as a development of a historical information kiosk in a publicly accessible location. Langdon Wind understands a condition to the mitigation will require that the resulting interpretive displays, brochures, or other items, will be presented to SHPO for approval prior to their installation or distribution.

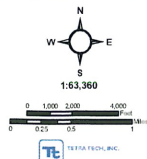
REFERENCES CITED

Lonnquest, John C. and David F. Winkler. 1996. *To Defend and Deter: The Legacy of the United States Cold War Missile Program*. USACERL Special Report 97/01, November 1996. A study sponsored by the Department of Defense Legacy Resource Management Program Cold War Project.

Metcalf Archaeological Consultants, Inc. 2007. *Langdon Wind Energy Center: A Class II and Class III Cultural Resource Inventory in Cavalier County, North Dakota*. Prepared for Tetra Tech EC, Inc. Boston Massachusetts. NDSHPO #07-400.



July 2007



- Turbine Location
- ▲ MET Location
- Crossings (Jurisdictional)
- Wetland GPS Lines
- Service Roads
- - - Underground Collector
- - - Transmission Line
- Substation O&M Laydown Area
- Turnaround (250' dia.)
- Approximate Project Area
- Langdon WPA-WE Area
- Jurisdictional Wetland

Figure 1
Langdon Wind Energy Center
Cavalier County, North Dakota



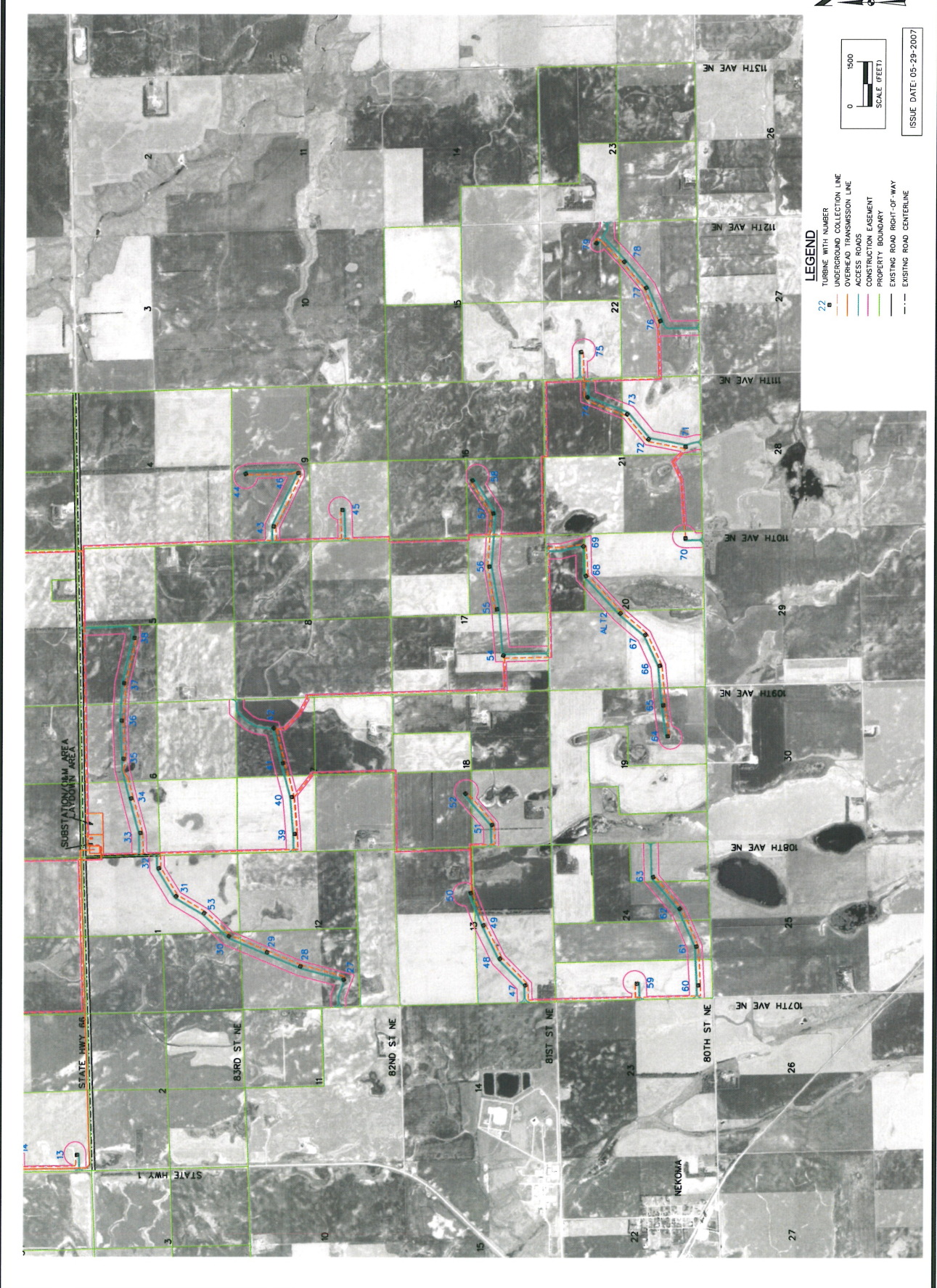
1070076
Sheet 1 of 3

FPL - LANGDON, ND PRELIMINARY SITE PLAN

CAVALIER COUNTY, NORTH DAKOTA

Project No: 1070076
Scale: 1" = 1500'
Date: 02-07-07
DW: MCG
Checked By: MCG
Marked: MCG
Date: 02/07/07
02/27/07
02/27/07
02/27/07
02/27/07
02/27/07

1751 MADISON AVENUE
COUNCIL BLUFFS, IOWA 51503
712-322-3202
319-362-9994
ATLANTIC, IA
712-322-6000
MANKATO, IA
816-304-2222
ST. JOSEPH, MO
816-304-2222
MAYVILLE, MO
816-304-2222



ISSUE DATE: 05-29-2007

SCALE (FEET):
0 1000

LEGEND

- 22 TURBINE WITH NUMBER
- UNDERGROUND COLLECTION LINE
- OVER-HEAD TRANSMISSION LINE
- ACCESS ROADS
- CONSTRUCTION EASEMENT
- PROPERTY BOUNDARY
- EXISTING ROAD RIGHT-OF-WAY
- EXISTING ROAD CENTERLINE

ATTACHMENT 1

**ANTIBALLISTIC MISSILES (ABM): THE SAFEGUARD SYSTEM
EXCERPTED FROM *TO DEFEND AND DETER: THE LEGACY OF THE UNITED STATES
COLD WAR MISSILE PROGRAM*, LONNQUEST AND WINKER 1996. USACERL SPECIAL
REPORT 97/01**

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
26 FEDERAL PLAZA
NEW YORK, N.Y. 10278-0090

TO DEFEND AND DETER:
THE LEGACY OF
THE UNITED STATES
COLD WAR MISSILE PROGRAM

JOHN C. LONNQUEST
AND
DAVID F. WINKLER

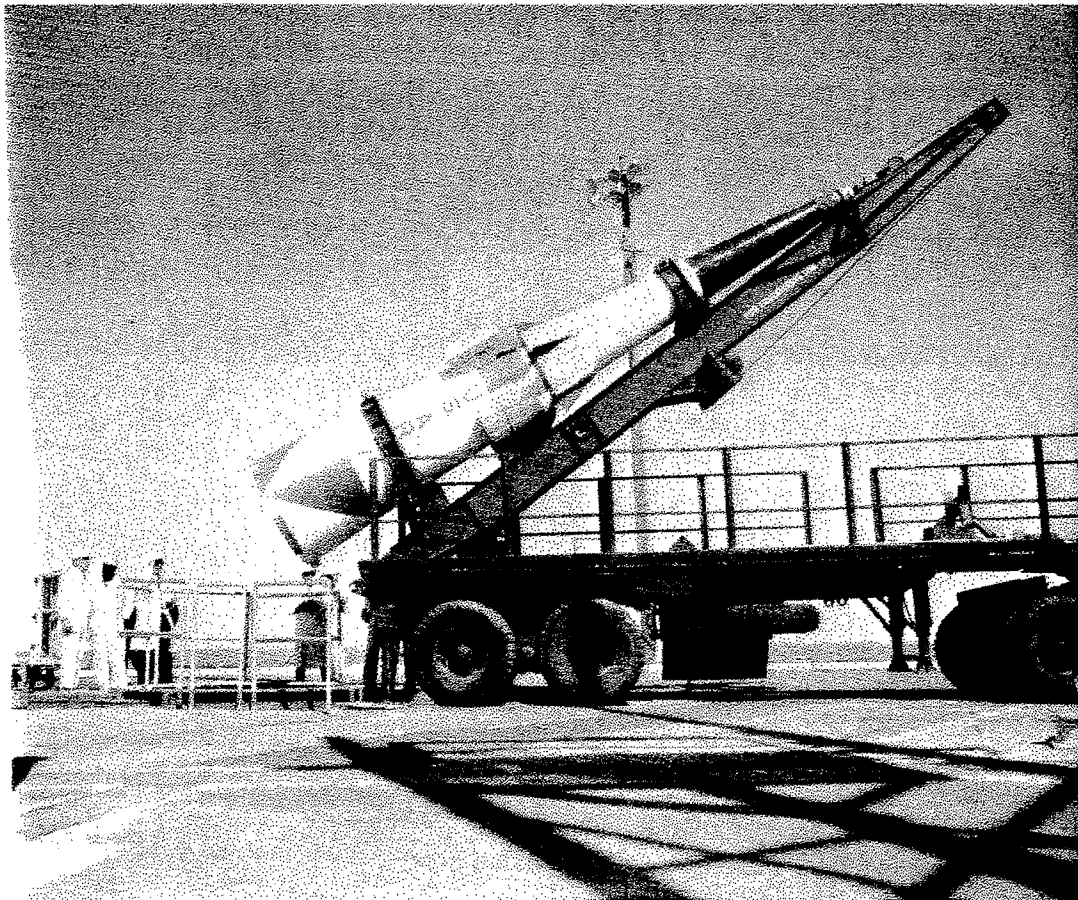
USACERL Special Report 97/01
November 1996

A study sponsored by the Department of Defense
Legacy Resource Management Program
Cold War Project

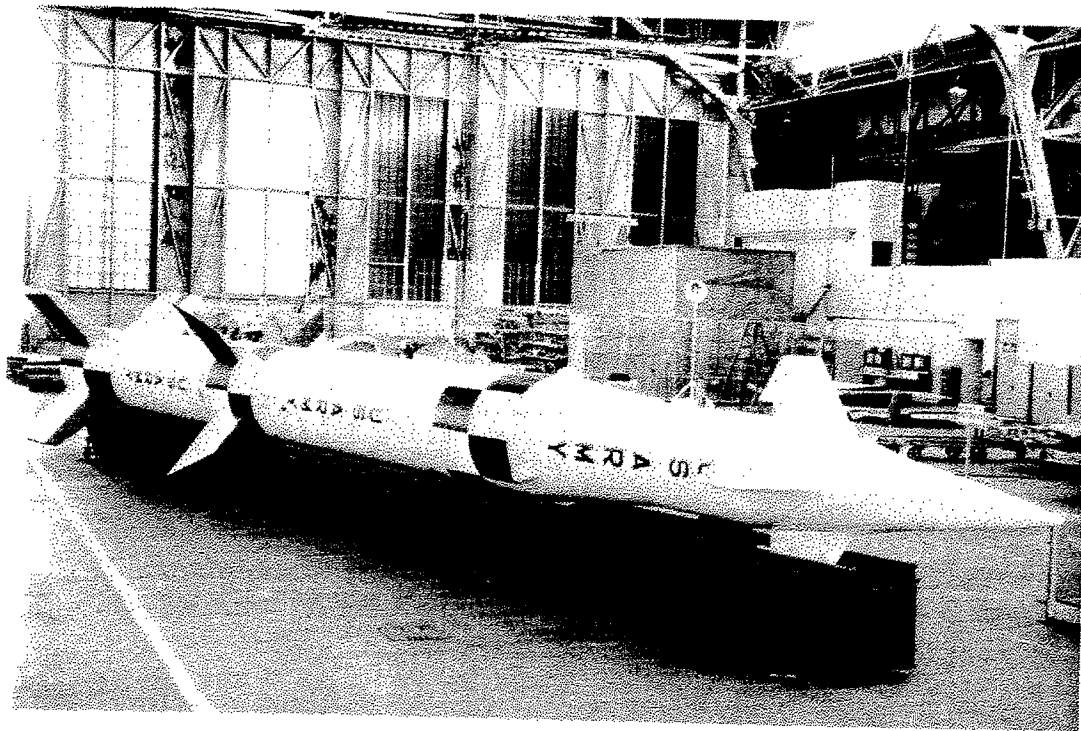
Antiballistic Missiles (ABMs): the Safeguard System

Summary

Deployed briefly in the mid-1970s, the Safeguard antiballistic missile system was the product of two decades of research, development, and testing. Army antiballistic missile development began under the Nike Zeus program (1956-1963), and continued under the Nike X (1963-1967) and Sentinel (1967-1969) programs before culminating in the Safeguard system (1969-1976). Incorporating incremental improvements in missile technology, combined with revolutionary advances in phased-array radar and advanced computers, the Safeguard system was eventually deployed at just a single site—the Stanley R. Mickelsen Safeguard Complex (SRMSC) near Grand Forks, North Dakota.



A Sprint missile being lowered into its underground silo.



A full-scale mockup of a Spartan missile.

Technical Specifications

The Safeguard ABM system was composed of three main components: sophisticated radars, powerful computers, and the sleek, deadly interceptor missiles—the Sprint and the Spartan.

Spartan

Length: 55 feet

Diameter: 42 inches

Wingspan: 118 inches

Weight: 28,700 pounds

Fuel: Solid propellant

Maximum engagement altitude: 330 miles

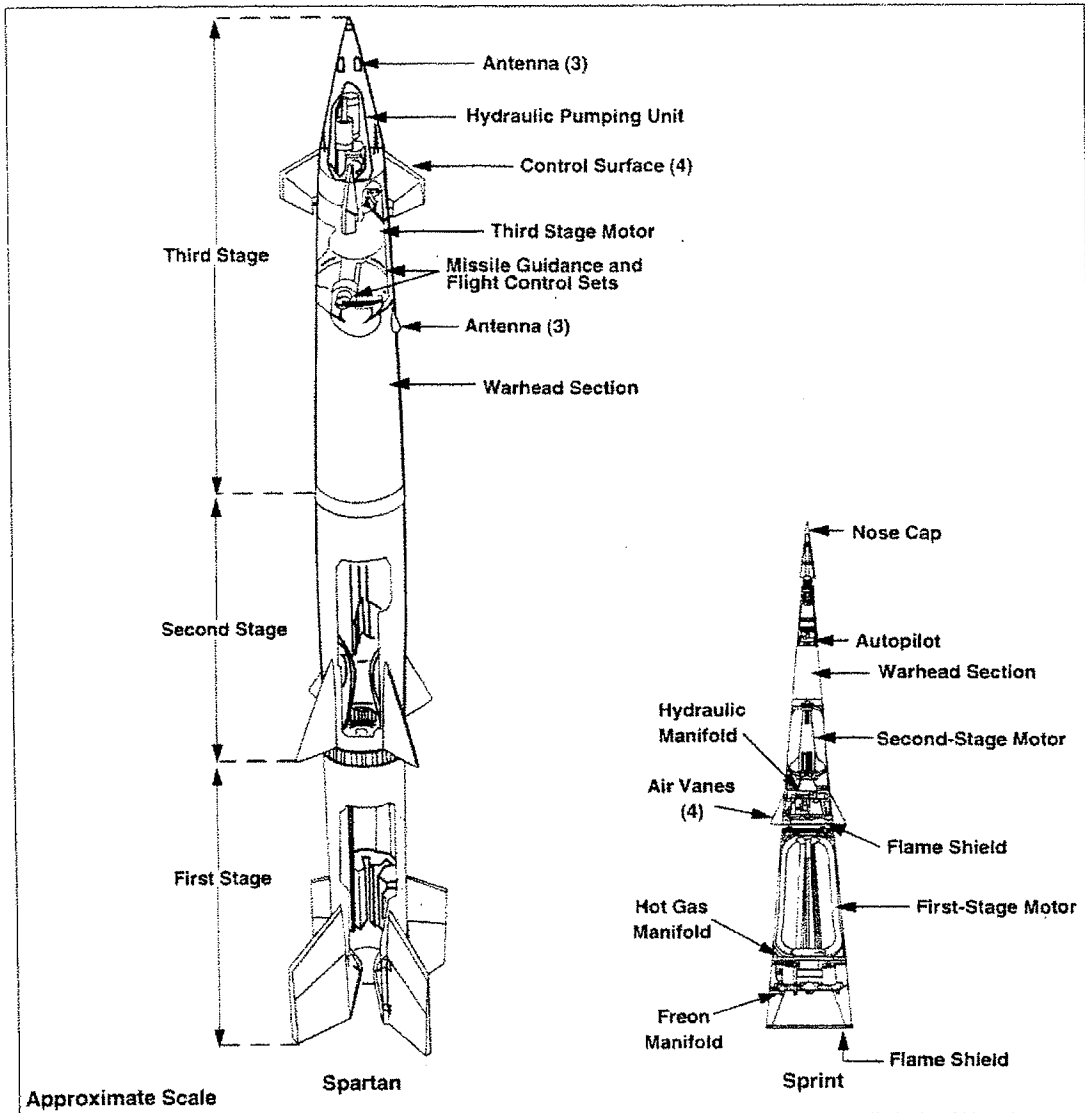
Range: Approximately 465 miles

Speed: Mach 10 (7,418 mph)

Guidance: Ground-based radio directed

Warhead: Nuclear, yield 5 megatons

Air Defense Missiles



These scale drawings reflect the dramatic differences between the Sprint and Spartan missiles.

Sprint

Length: 27 feet

Diameter at base: 4 feet 6 inches

Weight: 7,500 pounds

Fuel: Solid propellant

Vertical text on the right edge of the page, likely a page number or reference code.

Antiballistic Missiles (ABMs)

Maximum engagement altitude: 24 miles

Range: 25 miles

Guidance: Ground-based radio directed

Warhead: Nuclear, low-kiloton range yield

Contractors

Safeguard primary contractor: Western Electric Company
New York, New York

System design: Bell Laboratories
Whippany, New Jersey

Perimeter acquisition radar: General Electric
Syracuse, New York

Missile site radar: Raytheon
Boston, Massachusetts

Data processing system: Bell Laboratories
Whippany, New Jersey
Western Electric
New York, New York

Spartan subcontractor: McDonnell-Douglas
Santa Monica, California

Sprint subcontractor: Martin Marietta Corporation
Orlando, Florida

Guidance systems: Bell Laboratories
Whippany, New Jersey

System Operation

The Stanley R. Mickelsen Safeguard Complex consisted of four elements: the Perimeter Acquisition Radar (PAR) complex near Concrete, North Dakota; the Missile Site Radar (MSR) complex 12 miles south of Langdon, North Dakota; and the four Remote Sprint Launch (RSL) sites clustered within 20 miles of the MSR. The fourth element, the Ballistic Missile Defense Center (BMDC) in Colorado, was the only component of the SRMSC located outside of North Dakota. The BMDC was the highest echelon of command and control in the Safeguard system. The BMDC integrated the Safeguard within the North American Air Defense Command, and allowed the Commander of the Continental Air Defense Command (CONAD) to exercise operational command of the Safeguard system.

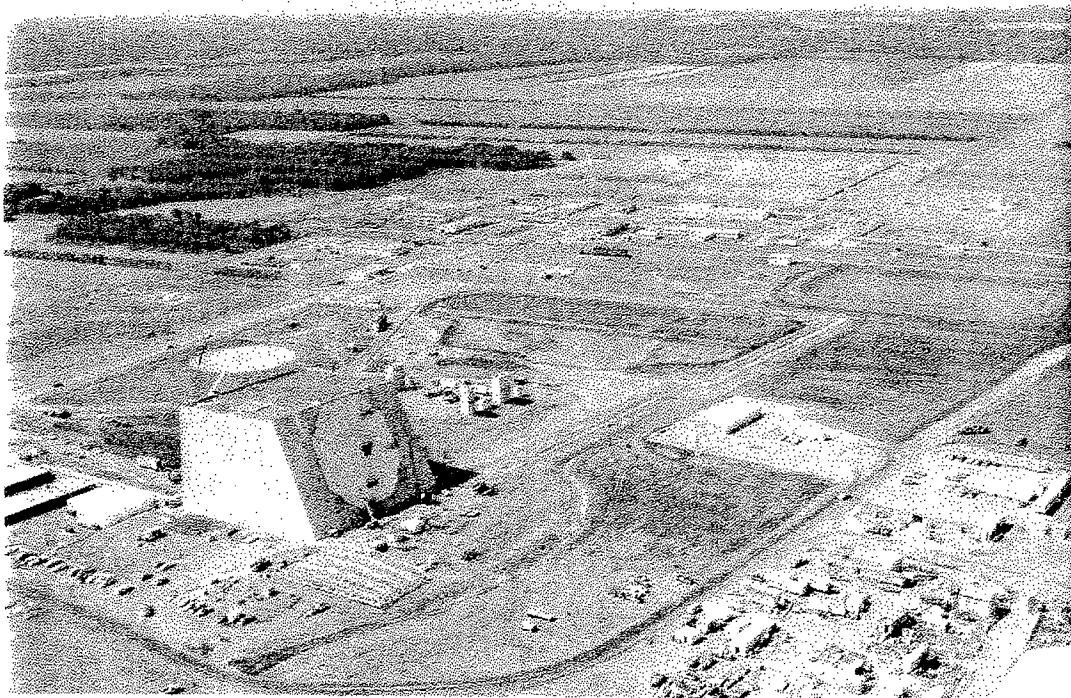
The defensive Sprint and Spartan missiles were technological marvels. However, the centerpieces of the Safeguard System were the tracking radars and associate

Air Defense Missiles

computers that rapidly sorted the incoming data and provided instructions to the interceptor missiles.

The largest of Safeguard's structures, the Perimeter Acquisition Radar Building (PARB), consisted of a huge phased-array antenna mounted on a sloped surface facing due north.

The PAR was capable of identifying and tracking incoming missiles at ranges up to 2,000 miles. Unlike a conventional "moving" radar antenna, the PAR's "phased-array" antenna incorporated 6,888 elements, each sending a pulse that would bounce off an incoming target coming over the North Pole. Through comparison of the reflected signals received back from the incoming object, trajectories were computed and this information was passed to the Missile Site Radar (MSR). To operate the PAR, an Army Surveillance Battalion of about 400 personnel would be required to man a three-section watch.



This 1972 photograph shows the Perimeter Acquisition Radar (PAR) site at SRMSC under construction. To the right of unfinished radar building is the power plant. The buildings in the background include enlisted housing, a dispensary, and a community center.

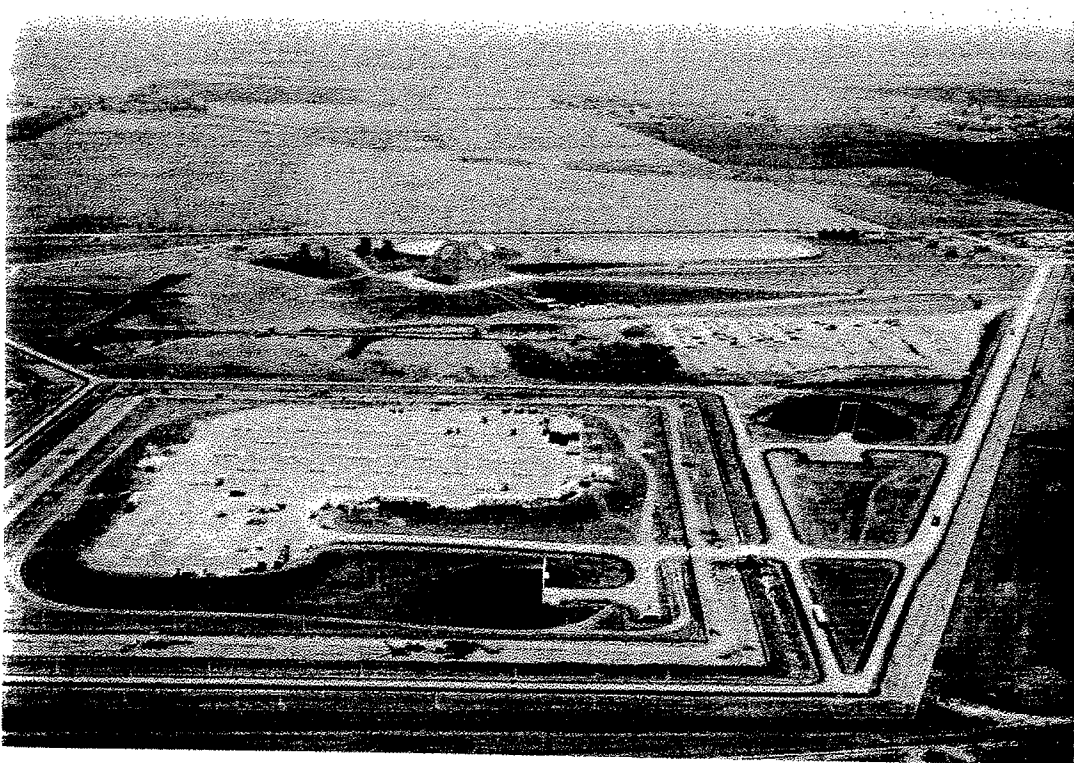
Antiballistic Missiles (ABMs)

The 470-acre MSR site housed the shorter-range missile control radar and nearly half of the Safeguard system's defensive Spartan and Sprint missiles.

Located in a pyramid-shaped building, the site's phased-array radar had over 20,000 elements distributed equally between its four faces. Using the radar data supplied by the PAR, the MSR located and tracked incoming missiles, computed intercept trajectories, and launched and guided the Spartan and Sprint missiles to their targets. Operating the MSR required a staff of 800 soldiers and civilians.

The Safeguard system's defensive missiles were divided between five facilities: the MSR and the four RSLs. Each RSL deployed between 12 and 16 Sprint missiles. The sites, which were all located within a 20-mile radius of the MSR, were under the operational control of that radar facility.

The Spartan, with a range of nearly 500 miles, was designed to intercept the incoming missiles well outside the earth's atmosphere and destroy them with a multimegaton nuclear warhead.



An aerial view of the Missile Site Radar. In the foreground are the Sprint and Spartan launch areas. Looming over them is the two-tiered Missile Site Control Building.



The Remote Sprint Launch Site #2 under construction in the fall of 1972. The tops of the Sprint Launchers are visible in the center of the picture. The building taking shape at the right was the Remote Launch Operations Building.

Anticipating that some incoming warheads could slip by the Spartan interceptions and enter the atmosphere over North America, a “layered-defense” provided for a last-ditch defense in the form of the Sprint missile. Built by Martin Marietta, the Sprint was designed to operate at hypersonic speeds within the earth’s atmosphere. Sprint’s skin could sustain heat greater than that produced by its own rocket motor. Like Spartan, the two-stage Sprint carried a nuclear warhead.

Developmental History

The antecedent of the Safeguard program can be traced back to March 1955 when the Army contracted with Bell Laboratories to conduct an 18-month “Nike II” study aimed at projecting defensive missiles and supporting infrastructure requirements for the 1960s. With intelligence reporting an imminent Soviet ICBM capability, the Bell study focused on this problem and initially concluded that developing “long-range, high-data-rate acquisition radar” would be crucial. At this time, Bell also demonstrated, using analog computer simulation, that intercepting a target flying through space at 24,000 feet per second was feasible.

The results of the study were presented in October 1956 and 4 months later, the Army awarded Western Electric/Bell Laboratories the development contract for "Nike Zeus." Western Electric/Bell subcontracted the missile work to McDonnell-Douglas. Testing of the prototype missile began at White Sands in 1959; however, limited range considerations forced the program to use facilities at the Naval Test Range at Point Mugu, California.

As the missile work proceeded, Western Electric/Bell forged ahead on radar and supporting systems development. The process reached a point that a site needed to be selected for prototype system installation where actual ICBMs could be tracked and engaged. Already a prototype Zeus Target Track Radar (TTR) had been placed on Ascension Island downrange of Cape Canaveral. However, sensitive political considerations ruled out expanding Zeus facilities at Ascension or other islands off the west coast of Africa that were not owned by the United States. This forced planners to focus on Kwajalein in the Pacific, which already hosted a U.S. naval base. More importantly, this atoll in the Marshall Islands lay 4,800 miles downrange of Vandenberg AFB, then undergoing construction as an ICBM launch site.

As with many development programs, Nike Zeus encountered its share of catastrophic failures. Testing at White Sands proved invaluable as pieces of missiles could be recovered to determine causes for failure. Changes to the control fins corrected one of the initial problems. Meanwhile on March 29, 1961, the TTR at Ascension failed in its first attempt at tracking a Titan ICBM. Two months later, the radar recorded its first tracking success.

In addition to missile testing at White Sands, a prototype Zeus Acquisition Radar (ZAR) and another TTR were constructed and placed into operation. On December 14, 1961, these radars tracked and successfully engaged a Nike Hercules target missile with a Nike Zeus interceptor.

As the results of this demonstration were analyzed, facilities were readied at Kwajalein for the first attempt to intercept an ICBM in flight. This first attempt, on June 26, 1961, failed due to the TTR's inability to pickup the re-entry vehicle after the ICBM's propulsion section broke up. The intercepting Zeus missile also suffered a malfunction.

A partially successful intercept occurred on July 19, 1962, as a Zeus missile came within 2 kilometers of an incoming Atlas D ICBM. On December 12, 1962, a Zeus missile passed well within the kill radius of an incoming ICBM. On May 24, 1963, a Nike Zeus came within lethal range of an orbiting satellite. Tests continued through November 1963, showing consistent success.

Despite these successes, Defense Secretary McNamara chose not to deploy the system, but budgeted for continued research and development. McNamara's concern was that the system still lacked the sophistication to discern between real and decoy warheads and could be overwhelmed in a "saturation attack" since the radars could only manage one interception problem at a time.

Air Defense Missiles

The continued research and development program for a more advanced ABM program was dubbed "Nike X." Under the Nike X program, the Zeus missile evolved into the Spartan. In addition, planners identified the need for a short-range interceptor missile as well as the requirement for a radar that could track and direct the engagement of several targets simultaneously. The short-range interceptor became reality in the form of the Sprint. On March 18, 1963, Martin Marietta received the contract to develop this new missile. In 1965, the first Sprint prototype was launched at White Sands. The needed radar was already under development through a DoD Advanced Research Project Agency program called "Project Defender." Under this program, a low-power, phased-array antenna was completed in the fall of 1960 and tests showed that this nonmoving antenna, using computers, could electronically steer a radar beam in two directions. In June 1961, the Army Guided Missile Agency granted Western Electric/Bell Laboratories a contract to develop a prototype phased-array radar to be built at White Sands. Ground-breaking occurred at White Sands in March 1963.

With advances in solid-state electronics and high-speed computers, the "Zeus Multifunctional Array Radar" demonstrated the use of phased-array radars as part of an ABM defense as a breakthrough possibility. Already, Bell was studying the development of an even more powerful phased-array radar for long range tracking. This second Multifunctional Array Radar would evolve into the Perimeter Array Radar that eventually was deployed in North Dakota.

Meanwhile a smaller phased-array radar, designed to track incoming targets at close range and guide intercepting missiles, was proposed. In December 1963, the Raytheon Company received the contract to work with Bell Laboratories' people to design and build the "Missile Site Radar" (MSR).

In September 1967, Secretary of Defense Robert McNamara announced plans to deploy many elements of the Nike X program—the Perimeter Acquisition Radar (PAR), the Missile Site Radar (MSR), and the Sprint and Spartan missiles—in the new Sentinel antiballistic missile program. The initial deployment plan called for installing the Sentinel at 13 sites in the continental United States and Alaska and Hawaii.

The plan aroused a firestorm of protest in the major cities slated to receive Sentinel installations. Not only was the Sentinel unpopular at home, but President Nixon and his National Security Advisor Henry Kissinger were also concerned that the deployment of the Sentinel system could escalate the arms race with the Soviet Union.

In March 1969, Nixon announced his intention to deploy a "modified Sentinel system" that he called Safeguard. Whereas the Sentinel system was intended to provide a limited nationwide ballistic missile defense, the President ordered that the Safeguard system be positioned to protect a portion of the United States ICBM force.

The Safeguard program initially called for 12 sites. Despite moving the installations away from the nation's major cities, the program still faced rigorous Congressional scrutiny. In August 1969, the Senate authorized the construction of only two sites; one near Malmstrom, Montana, and the other near Grand Forks, North Dakota. Only the site near Grand Forks was ever completed.

As the debate to deploy Sentinel and Safeguard continued, construction of the prototype missile facilities continued at Kwajalein. Completion of launch tubes allowed the first Spartan to be fired from Kwajalein on March 2, 1968. The MSR built on Meck Island completed its first successful track of an ICBM on December 11, 1969. On August 28, 1970, an MSR-controlled Spartan missile successfully intercepted an incoming ICBM. Four months later, this feat was repeated with an MSR-controlled Sprint missile.

Basing Strategy

The placement of facilities for what became known as the Sentinel system announced by Defense Secretary McNamara was never fully revealed to the general public. However, the deployment plan, titled "Nike X DEMOD 1-67," would have placed 15 systems within the continental United States and a system each in Alaska and Hawaii. Continental sites slated to receive Sentinel installations included Boston; New York; Washington DC; Albany, Georgia; Detroit; Chicago; Dallas; Salt Lake; Seattle; San Francisco; Los Angeles; and Whiteman, Grand Forks, Malmstrom, and Warren Air Force Bases.

Construction of the first site at Sharpner's Pond near Boston began in late 1968. However, in that era of antiwar protest, opponents of ABM packed an Army community-relations meeting in late January 1969. The appearance of an adverse public reaction led Senator Edward Kennedy to write a letter to Defense Secretary Laird questioning the viability of the system. This act touched off a heated Senate debate and led to a Presidential review of the Sentinel deployment scheme. On March 14, President Nixon announced the deployment of a "modified Sentinel." Later that day Deputy Defense Secretary David Packard detailed the new deployment scheme to cover 12 sites. With the exception of Washington DC, the new Safeguard sites were to be located away from population centers. Instead of Boston, Detroit, Seattle, San Francisco, and Dallas, sites were to be placed in southern New England, the Michigan/Ohio area, the Northwest, central California, Southern California, and Texas. The four previously designated SAC missile bases, as well as southern Georgia, would still receive ABM defenses. New York, Chicago, Salt Lake, Hawaii, and Alaska lost out in the new scheme.

System Deployment

Phase I of ABM deployment called for immediate construction at sites near Grand Forks and Malmstrom Air Force Bases. Labor problems set back Malmstrom construction and made the base vulnerable as a bargaining chip for talks designed to limit ABM defenses. As a result of the 1972 ABM Treaty, the United States would be allowed to deploy one site away from the national command center (Washington DC) and that site would defend Grand Forks. Completed in 1974, that site was deactivated 2 years later.

Site Configuration

Discounting prototype facilities, the Grand Forks facility became the only location in America ever to host an ABM defense system. Unlike proposed ABM sites in Massachusetts

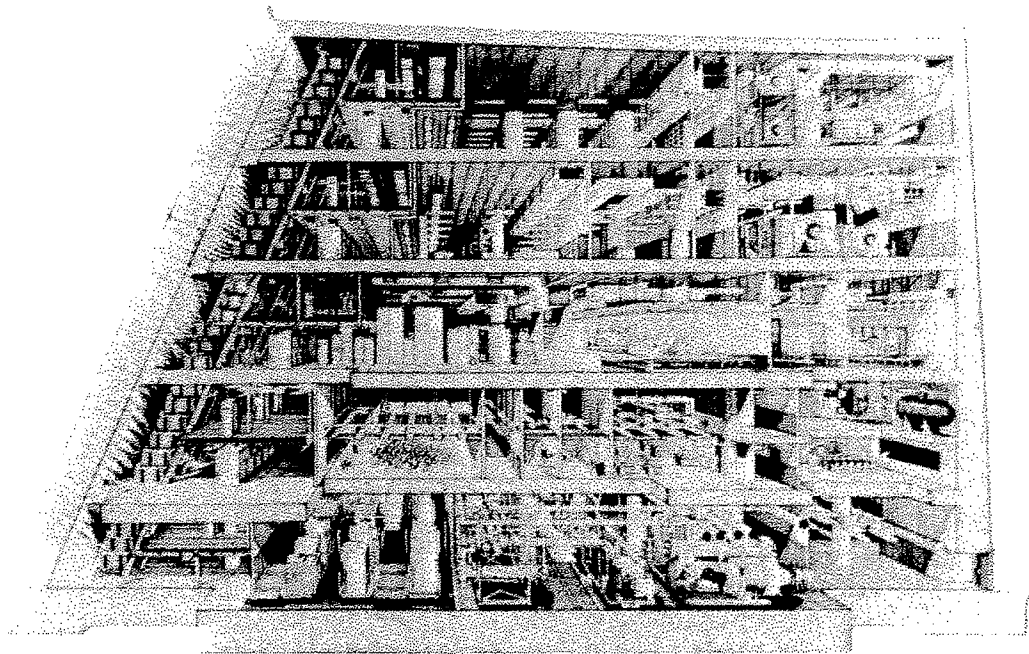
Air Defense Missiles

and Montana where only traces remain of once massive construction efforts, much remains intact in North Dakota.

Aside from the Egyptian pyramids, the Safeguard PAR may be the most solidly constructed building in the world. The structure is truly one-of-a-kind as, unlike the MSR, no prototype PAR had been built. The building is 204 by 213 feet at the base and rises to over 120 feet. The structure's northern-faced antenna wall slopes away from the ground at a 25 degree angle. This antenna face wall consists of a dense reinforced concrete mesh 7 feet thick. The three other walls are also dense reinforced concrete and have a base of 8 feet, tapering to 3 feet at the top. The reinforcing bars, installed vertically, horizontally, and diagonally, are No. 11 gauge; each bar is approximately as thick as a man's wrist. The structure required 63,000 cubic yards of concrete and 8,700 tons of reinforcing steel.

The interior of this completely above-ground structure includes five full floors with a mezzanine located between the second and third floors. Entrance to the building requires passing through two blast locks or through a tunnel leading from the power plant.

The adjacent power plant was housed in a partially buried hardened concrete structure covered with earth for addition blast protection. Inside the plant, five 16-cylinder diesel engines could combine to produce 14.7 megawatts of power. Provisions for emer-



A cutaway drawing of the massive Perimeter Acquisition Radar Building. At the time of its completion in August 1972 it was the largest radar facility in the world and the second tallest structure in North Dakota.

Antiballistic Missiles (ABMs)

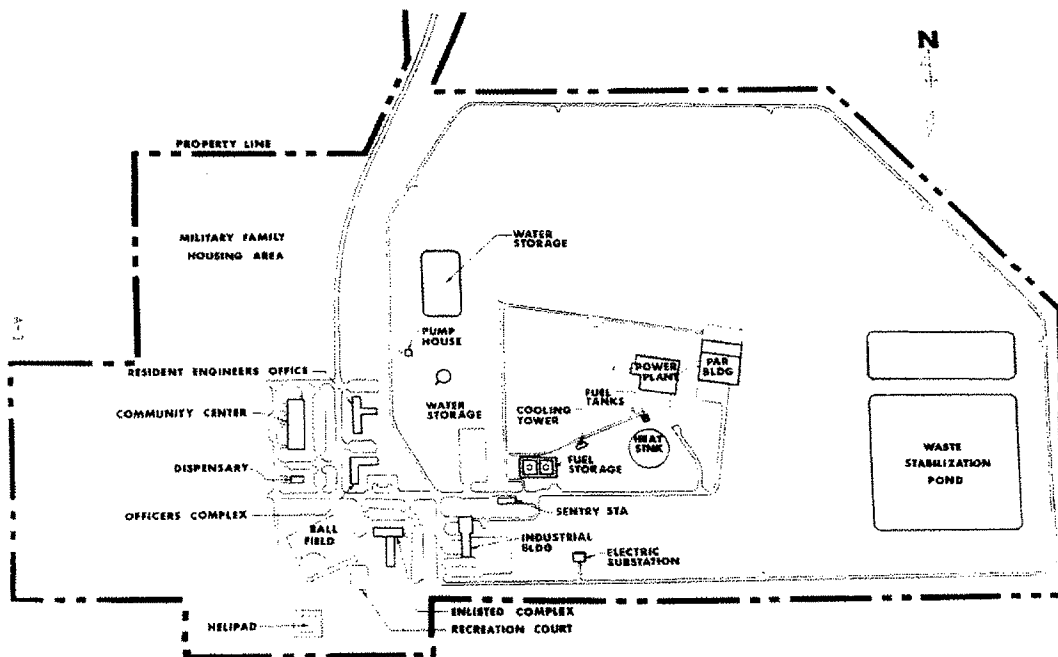
gency operations of the plant included storage for fuel supplies and a recirculating water cooling system featuring an underground storage cavern as a heat sink.

Located some 25 miles from the PAR facility, the Missile Site Radar facility consisted of the Missile Site Control Building (MSCB) and collocated Spartan and Sprint missile launch areas. The MSCB, which housed the radar, had above-ground and below-ground sections. Above ground was a four-sided truncated pyramid; each side had a 30-foot diameter antenna mounted integrally into the 3-foot thick reinforced concrete walls. Each antenna weighed nearly 400 tons and placing the units entailed overcoming unique engineering problems.

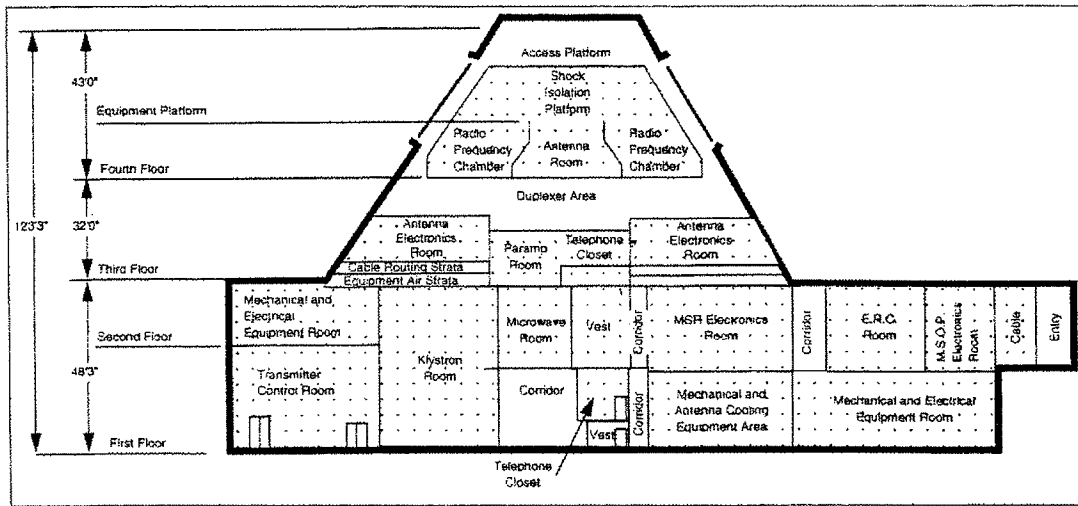
Below the pyramid stood a two-story 231- by 231-foot structure housing the radar transmitting and receiving components, phase shifters, switching gear, and other necessary subsystems. As with the PAR, the MSCB also had an adjoining underground power plant. With six diesel generators, this plant could produce up to 17.3 megawatts of power.

As part of the Missile Site Radar facility, prefabricated launch canisters for Spartan and Sprint launches stood ready to launch the defensive missiles. Sprint launchers were also placed at four remote site locations located to the east, west, north, and south of the MSCB.

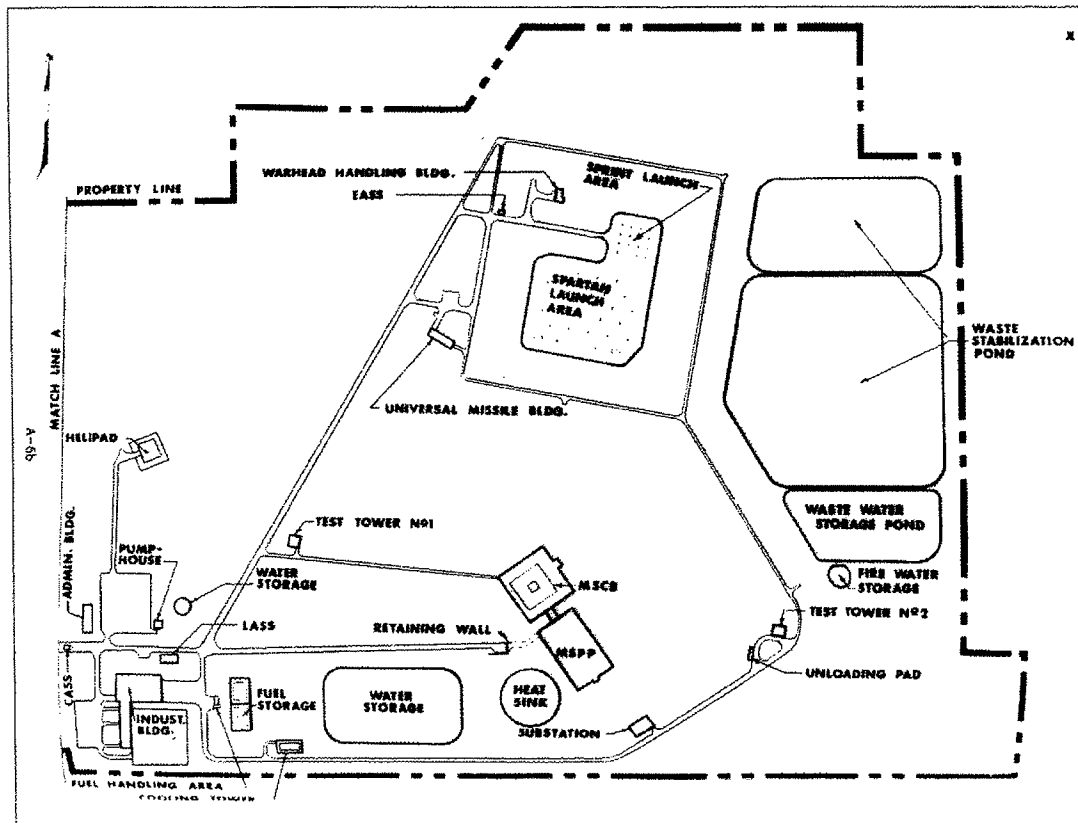
With manpower requirements at both sites consuming over 1,000 personnel, support and housing facilities were built adjoining the structures.



Spread over 279 acres, the PAR Site was a self-sufficient community.



A cross-section of the Missile Site Control Building. The building contained 127,000 square feet of usable floor area. It contained two subterranean main floors and two above-ground turret floors that housed the radars and communication equipment.



In addition to hosting the Missile Site Control Building and the Sprint and Spartan launch areas, the 470 acre Missile Site Radar facility also contained missile maintenance buildings, enlisted and officer housing, a family housing area, dispensary, chapel, gymnasium, and outdoor recreational facilities.

References

The missile technical specifications came from *Jane's All The World's Aircraft: 1971-72*, (New York: McGraw Hill, 1972) and Bill Gunston's, *Illustrated Encyclopedia of the World's Rockets and Missiles*, (New York: Crescent Books, 1979). A thorough technical overview completed for the U.S. Army Ballistic Missile Defense Systems Command is found in Bell Laboratories, *ABM Research and Development at Bell Laboratories: Project History, October 1975*, (Whippany, NJ: Bell Laboratories, 1975). Construction details came from James H. Kitchens, III, *A History of the Huntsville Division, U.S. Army Corps of Engineers: 15 October 1967- 31 December 1976*, (Huntsville, AL: U.S. Army Engineer Division, Huntsville, 1978); and Erwin N. Thompson, *Pacific Ocean Engineers: A History of the U.S. Army Corps of Engineers in the Pacific, 1905-1980*, (Ft. Shafter, HI: U.S. Army Engineer Division, Pacific Ocean, 1980). Another excellent source is the Historic American Engineering Record (HAER No. ND-9) of the Stanley R. Mickelsen Safeguard Complex currently being prepared under the direction of the U.S. Army Space and Strategic Defense Command, History Office, Huntsville, Alabama. For detailed coverage of the construction of the Safeguard sites at Grand Forks, complete with superb pictures and illustrations, see the U.S. Army Corps of Engineers, Huntsville Division, "Safeguard- A Step Toward Peace," n.d., in the Research Collection, Office of History, Headquarters Army Corps of Engineers, Alexandria, VA, Military Files XVIII-36. Also, Donald Baucom's, *The Origins of SDI, 1944-1983*, (Lawrence, KS: University Press of Kansas, 1992), incorporates the political debate into a finely compressed technical overview.