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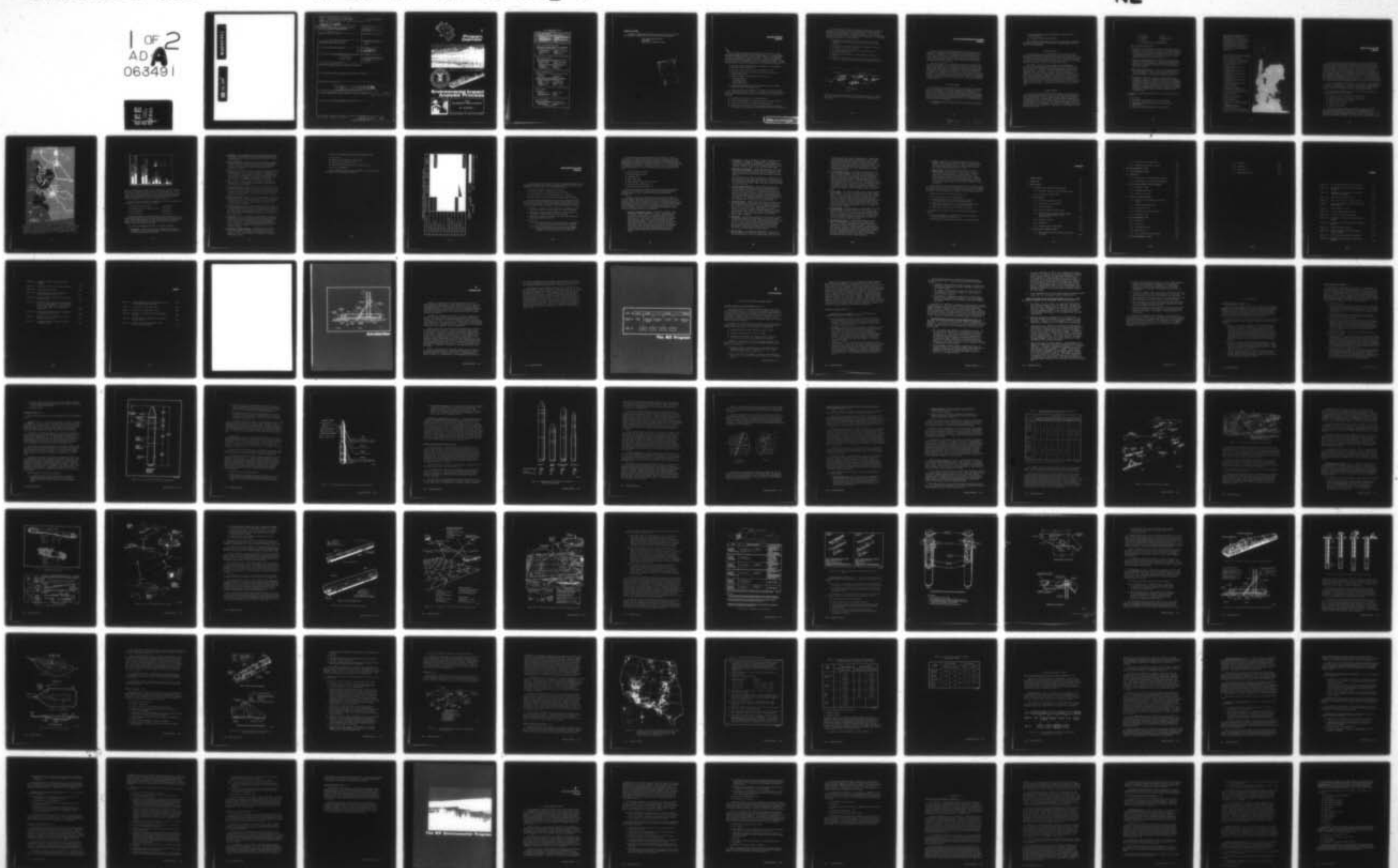

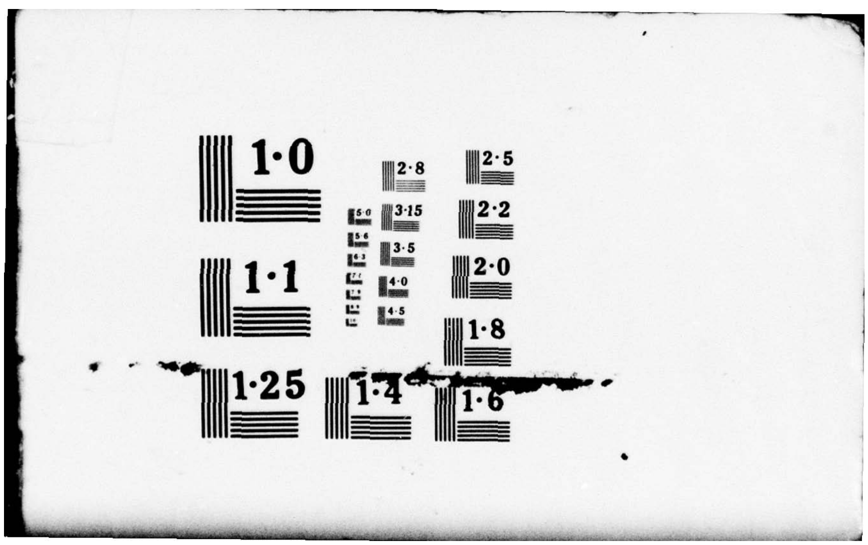
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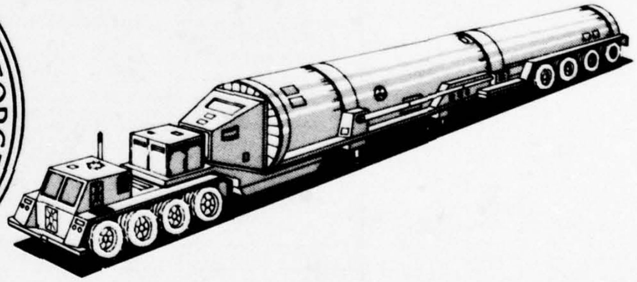
Program Overview



Environmental Impact Analysis Process

FINAL
ENVIRONMENTAL IMPACT STATEMENT

MX: MILESTONE II

DEPARTMENT OF THE AIR FORCE

FINAL ENVIRONMENTAL IMPACT STATEMENT
MX MILESTONE II

VOLUME I: PROGRAM OVERVIEW

VOLUME I PRESENTS AN OVERVIEW OF THE ENTIRE MX SYSTEM INCLUDING:

- THE MX MISSILE AND BASING MODE ACQUISITION PROCESS
- THE ENVIRONMENTAL PROGRAM AND ENVIRONMENTAL STATEMENTS TO BE PREPARED FOR DECISION-MAKERS AND THE PUBLIC
- A SUMMARY OF THE POTENTIAL ENVIRONMENTAL EFFECTS OF PAST AND FUTURE MX DECISIONS
- IDENTIFICATION OF FUTURE ACTIONS ANTICIPATED AS PART OF THE MX SYSTEM

VOLUME II: FULL-SCALE ENGINEERING DEVELOPMENT

VOLUME II ADDRESSES THE ENVIRONMENTAL IMPACTS OF EXPENDITURE OF RESOURCES TO DESIGN, CONSTRUCT, AND TEST MISSILE AND BASING MODE VEHICLE COMPONENTS AND THE ASSEMBLED MISSILE AND VEHICLES. KEY ISSUES ARE:

- EXPENDITURE OF $5 TO $7 BILLION FOR FULL-SCALE ENGINEERING DEVELOPMENT (FSED)
- CREATION OF JOBS THROUGHOUT THE NATION
- GROWTH INDUCEMENT CONCENTRATED IN 9 STATES
- CONSUMPTION OF ENERGY AND WATER RESOURCES
- ATMOSPHERIC EMISSIONS

VOLUME III: MISSILE FLIGHT TESTING

VOLUME III PROJECTS ENVIRONMENTAL IMPACTS OF MX FLIGHT TESTS ON VANDENBERG AIR FORCE BASE AND CENTRAL CALIFORNIA. KEY ISSUES INCLUDE:

- GROWTH RELATED IMPACTS TO NORTHERN SANTA BARBARA COUNTY
- CUMULATIVE IMPACTS OF MX, THE SPACE SHUTTLE, AND THE PROPOSED LNG PLANT
- FOUR CANDIDATE SITING AREAS (CSA) WERE EVALUATED TO ASSESS SITE SPECIFIC ENVIRONMENTAL IMPACTS RELATED TO THE FOLLOWING KEY ISSUES:
  - –TRANSPORTATION
  - –WATER RESOURCES
  - –RARE OR ENDANGERED SPECIES
  - –AIR QUALITY
  - –ARCHAEOLOGY
  - –MINERAL RESOURCES

VOLUME IV: BASING MODE EVALUATION

VOLUME IV EVALUATES THE ENVIRONMENTAL IMPACTS ASSOCIATED WITH THE FOLLOWING FOUR BASING MODES:

- VERTICAL SHELTER
- BURIED TRENCH
- HORIZONTAL SHELTER
- SLOPE-SIDED POOL

THE POTENTIAL FOR ENVIRONMENTAL IMPACT ASSOCIATED WITH EACH BASING MODE IS EVALUATED AT SEVEN BASING MODE COMPARISON AREAS (BMCA) THROUGHOUT THE WESTERN UNITED STATES. KEY ENVIRONMENTAL ISSUES INCLUDE:

- VARIATION OF SPACING BETWEEN AIMPOINTS
- AREA SECURITY VERSUS POINT SECURITY
- DISTURBED OR UNDISTURBED ENVIRONMENT
- PUBLIC OR PRIVATE LAND
- WATER RESOURCES REQUIRED
- CONSTRUCTION RESOURCES REQUIRED
- ENERGY RESOURCES REQUIRED

VOLUME V: APPENDICES

VOLUME V CONTAINS:

- BIOLOGICAL APPENDICES AND SPECIES LISTS
- REGIONAL INDUSTRIAL MULTIPLIER SYSTEM (RIMS) DESCRIPTION
- BASING MODE EVALUATION
- GLOSSARY
- REFERENCES

VOLUME VI: PUBLIC COMMENTS

VOLUME VI PRESENTS PUBLIC RESPONSE TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT. INCLUDED IN THIS VOLUME ARE:

- LETTERS RECEIVED FROM AGENCIES AND ORGANIZATIONS
- RESPONSES TO QUESTIONS RAISED BY THE PUBLIC
- PUBLIC HEARING TRANSCRIPTS

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SAMSO/MNND
Norton AFB, California 92409

PROGRAM OVERVIEW
SUMMARY

The Full-Scale Engineering Development decision point in a system acquisition program is referred to as a Milestone II. At this milestone, the Defense Systems Acquisition Review Council (DSARC) is to reaffirm the need for the program and to assess the degree to which the program will achieve desired system performance within cost and schedule limitations. The review results in recommendations to the Secretary of Defense. The following major issues will be considered in the Milestone II decision.

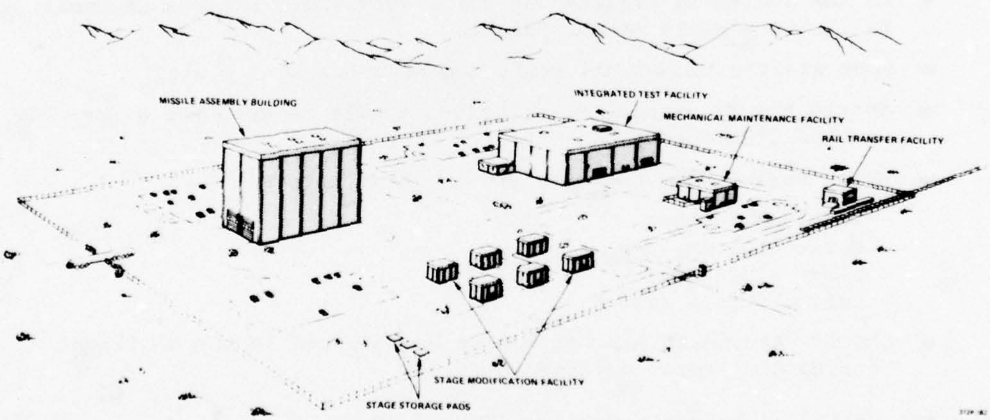
- Is there a valid requirement for a survivable Intercontinental Ballistic Missile (ICBM) Force?
- What are the technical, cost, and environmental risks?
- Should the MX or some alternative missile be used for a survivable ICBM force?
- Which basing mode concepts should enter into FSED?
  - vertical shelter
  - horizontal shelter
  - slope-sided pool
  - inline hybrid trench
- Should Vandenberg Air Force Base be selected as the MX flight testing and system development site?

Full-Scale Engineering Development, if approved, will run for about 5 years. Expenditures ranging from $5 to $7 billion were used for analysis in this FEIS. Proceeding into Full-Scale Development would encompass the following:

- Development and testing of a prototype missile
- Design and development of a basing system with support facilities
- Screening and selection of potential deployment areas
- Gathering cost, technical, and environmental data for evaluation in reaching a future production and deployment decision, Milestone III

If the objectives of FSED are successful, additional environmental analysis will be prepared prior to proceeding to the final milestone, Milestone III (the decision to produce and deploy). Two additional separate environmental impact statements are planned for use in deciding on selection of site(s) and for the Milestone III decision. An affirmative decision at Milestone III could include:

- Manufacture and assembly of sufficient missiles and space components for an operational force of about 200 to 250 MX missiles
- Construction of support facilities and equipment for missile deployment at the site(s) selected
- An initial operational capability in the mid-1980s (i.e., 10 operational missiles)
- Operation and maintenance of the MX system into the 21st century
- Spending an additional $15 to $25 billion for the MX system acquisition, operation and support over its planned life cycle



Full-scale engineering development will include construction of assembly and launch facilities for one or more basing modes at Vandenberg Air Force Base.

FULL-SCALE ENGINEERING DEVELOPMENT SUMMARY

Full-scale engineering development (FSED) of the MX missile is basically a refinement of existing intercontinental ballistic missile technology. Refinement of the technology is not expected to cause new or otherwise significant environmental effects. Therefore, FSED is not expected to cause any significant impacts upon the environment other than the expected effects on capital and labor resulting from any multi-million dollar project.

The ICBM Program Office at Norton Air Force Base, California will manage the MX Program. The Program Office will let contracts for the design, fabrication, and test of individual elements of the MX system; these system elements will be developed in facilities throughout the United States. Environmental consequences of full-scale engineering development are examined at three levels: national, regional, and site specific. Site specific effects are primarily a function of testing and validation activities while national and regional effects are primarily a function of the investment of several billion dollars for development and manufacturing.

SITE TEST IMPACTS

FSED will include testing activities to be conducted at increasing levels of complexity as full-scale engineering development moves from design and development of individual components and assemblies, to production and integration of complete subsystems including the missile itself. Test objectives encompass subsystem compatibility, performance and reliability. Among these are wind-tunnel tests, simulated nuclear effects and destruct tests of main-motor stages. Three government test facilities have been identified:

- Arnold Engineering Development Center, Arnold Air Force Station, Tennessee

- Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, California
- Kirtland Air Force Base, New Mexico

Test programs at these specific sites will represent a continuation of similar activities and are not expected to produce impacts unique to MX full-scale development.

NATIONAL IMPACTS

At the national level, the expenditure of money for MX and the resulting competition for natural resources, will occur over a five-year period. An expenditure range of $5 to $7 billion was used to perform the environmental impact analysis for this FEIS. The range of potential costs will narrow as several key decisions including choice of the basing mode security system, and spacing of aimpoints are made.

Development of MX will create a demand for some unemployed or alternatively employed aerospace workers to reenter the industry, as well as additional competition among aerospace companies for currently employed workers. In addition, economic stimulation will result in additional jobs nation-wide in indirect and induced industries. The number of jobs resulting from full-scale engineering development is dependent upon the level of unemployment in the nation at the figure of full-scale engineering development expenditures and the source of full-scale engineering development funds. Funding through taxation and 4 percent of the work force unemployed would result in 20,000 direct and indirect jobs nationally. An 8 percent unemployment level with the same expenditure would result in approximately 130,000 direct and indirect jobs.

REGIONAL IMPACTS

The $5 to $7 billion MX expenditures analyzed in this report will induce employment adjustments in those regions with industrial specialization in aerospace. In turn, population and demand for housing and requisite services will be affected. Aerospace industry employment is concentrated in about 20 states while many other states will be involved in development of the guidance system, transportation system, and propulsion systems. The MX expenditures related to development of prototype missiles and missile transporters is expected to be concentrated in the following nine states:

- California
- Washington
- Colorado
- Utah
- Massachusetts
- Texas
- New York/New Jersey/Connecticut

Specific regional impacts are:

- Increases in job opportunities, both directly working on the MX project, and indirectly as a result of economic stimulation. Total jobs in any one region resulting directly and indirectly from full-scale engineering development could range as high as approximately 47,000 in the State of California. Exact numbers will depend on award of contracts.

- Potential local population growth resulting from increased employment. Since employment in aerospace and support industries is heavily concentrated in large metropolitan areas, population in-migration is expected to be small except at a very localized level.

- Water and energy resources. Current water supply constraints may inhibit growth in specific states including parts of southern California. Electric power supply may be impacted in certain regions in the northeastern United States.

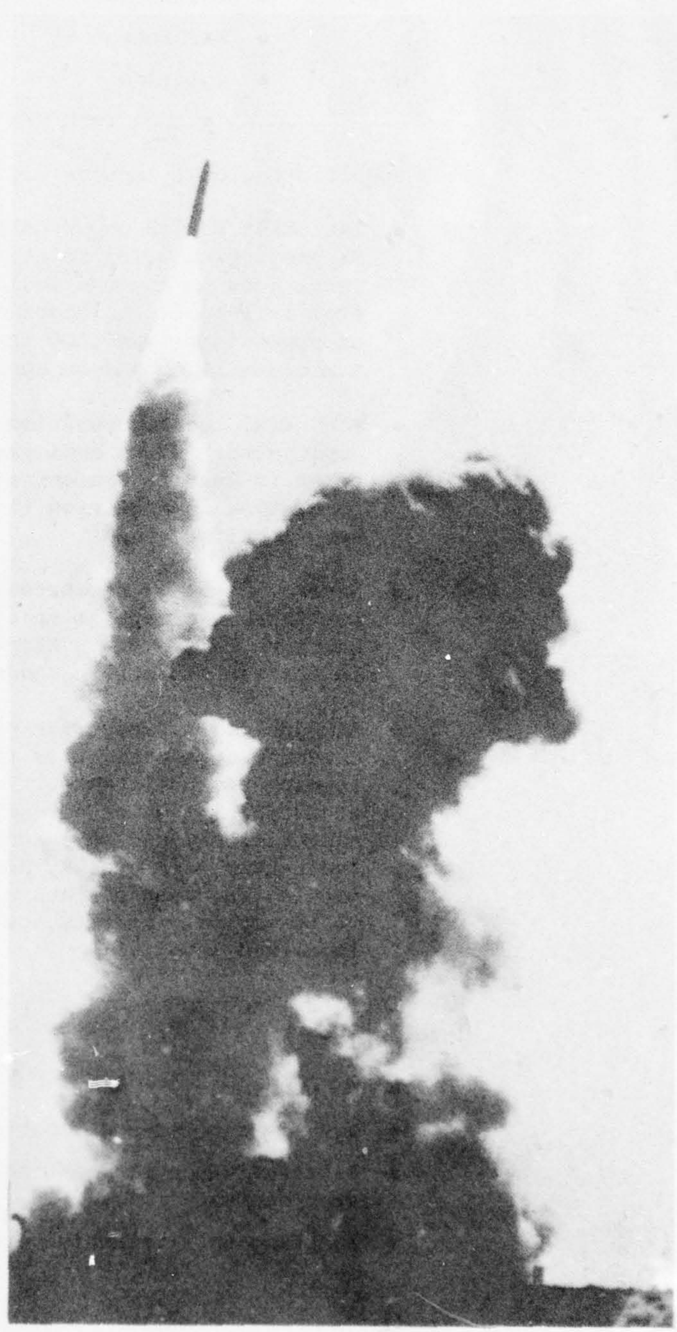
- Air quality. Except for propulsion systems testing, most developmental activities themselves do not directly produce atmospheric pollutants. Propulsion systems will be developed at facilities which already possess the required technological capabilities, and have conducted similar tests over the years. Indirectly, air quality degradation resulting from increased population, transportation, and energy consumption is expected to be minimal; effects would be observed only at a very localized level.

There are four project alternatives to full-scale engineering development:

- No project
- Development and modification of existing systems
- Alternative development schedules, including delay or postponement
- Adopting an alternative missile to MX or MM III

MX missile development tests are proposed to be conducted at Vandenberg Air Force Base. MX test launches will be similar to the Minuteman I, II and III tests and operational exercises currently performed on the base. Minuteman launches comprised over 60 percent of all VAFB launches during 1977.

- Aerospace Vehicle Equipment Fit Checks
- Umbilical Retraction Test
- MGCS Transportation and Handling Test
- IFSS Transportation and Handling Test
- Canister Transportation and Handling Test
- VAFB Stage I Transportation and Handling Test
- VAFB Stage II Transportation and Handling Test
- VAFB Stage III Transportation and Handling Test
- VAFB Stage IV Transportation and Handling Test
- Reentry System Transportation and Handling Test
- Launch Complex Assembly and Launch Verification Test
- Missile Ejection Tests
- Reentry System Integration/ Compatibility and Processing Test
- Missile Guidance System Processing Test
- IFSS Processing Test
- Stage IV Processing Tests
- Stages I, II, and III Flight Processing Tests
- Missile Interface Test
- Canister/Launch Complex Refurbishment Test
- AVE/Laboratory Integration/ Compatibility Tests
- Missile Ejection Test (Short Burn)
- Ground Test Missile Launch Complex Test



MISSILE FLIGHT TESTING SUMMARY

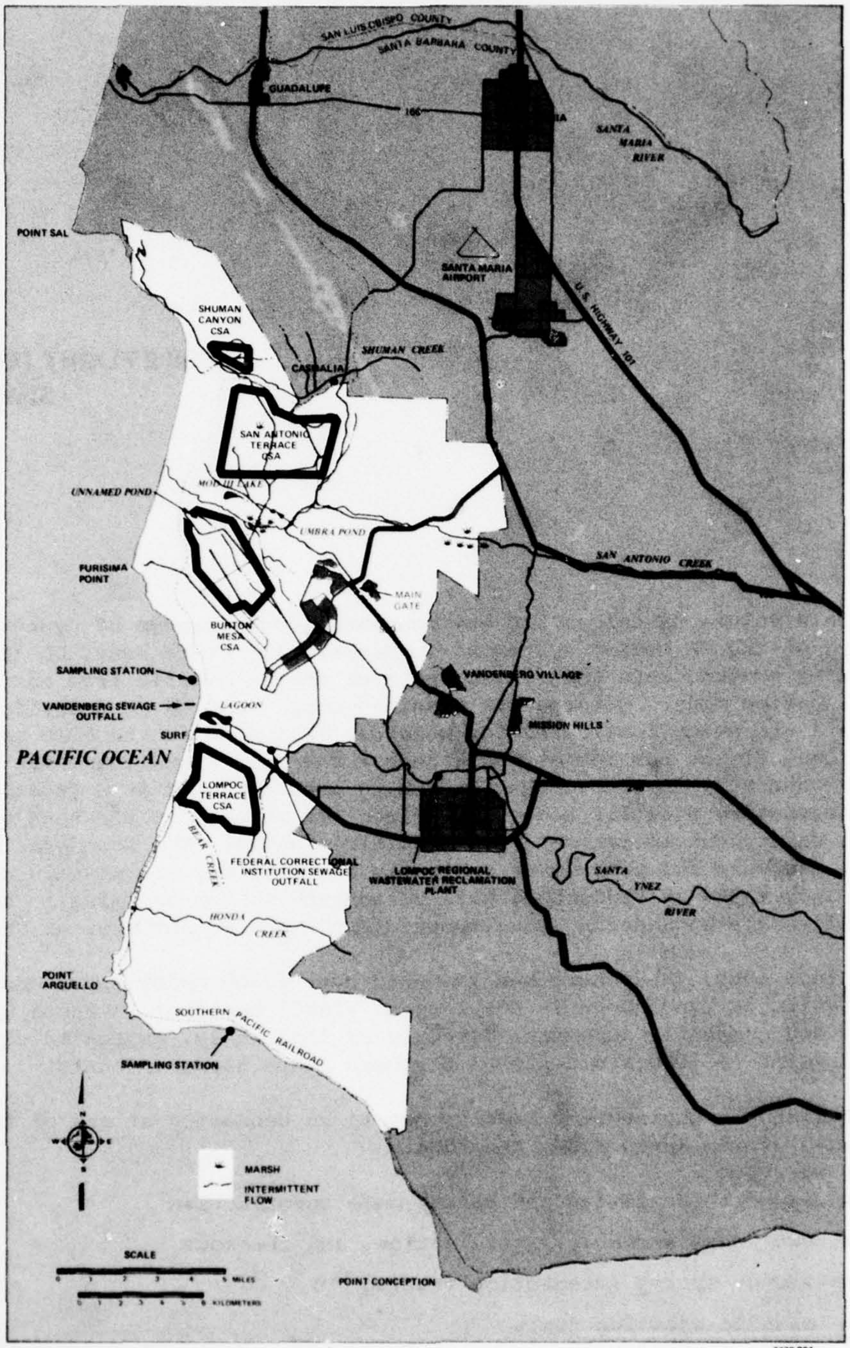
This volume describes the environmental consequences of system level testing of the MX weapon system at Vandenberg Air Force Base, CA (VAFB) including ground tests and flight tests of the MX missile from an operational basing mode. Alternative missiles other than MX as described in Volume I are being considered for possible inclusion in the FSED and, therefore, flight testing at Vandenberg. The only significant variations in environmental impact to the Vandenberg area expected as a function of the alternative missiles being considered are related to the handling and launch safety considerations of a specific missile. The standard launch safety analysis and procedures currently in force for all missile assembly and launch tasks at Vandenberg will be adhered to for any missile selected for Full-Scale Engineering Development (FSED) and Flight Test at Vandenberg.

Since 1959, Vandenberg has launched over 1,400 major space and ballistic missions. Vandenberg is the largest single employer in Santa Barbara County and currently supports, directly or indirectly, approximately one-third of the 115,000 residents of northern Santa Barbara County.

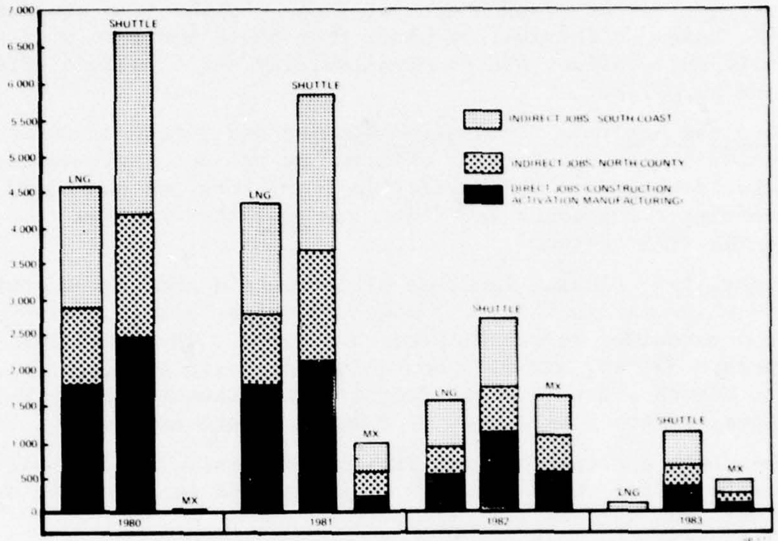
Full-Scale Engineering Development to be conducted at one of four Candidate Siting Areas (CSAs) include:

- support facilities and basing mode construction
- equipment assembly, installation, and checkout
- weapon system integration testing
- missile ejection tests
- missile flight tests

Construction of three shelters with required support facilities would disturb approximately 55 acres (22 ha). Alternatively, construction of the buried trench basing mode would require two 2 mi (3.2 km) trenches and disturb approximately 180 acres (72 ha). Two missile ejection tests may be conducted, one with an inert missile and the second



The relationship of the four candidate siting areas to surface waters on Vandenberg. Of particular importance from a biological perspective are San Antonio Creek, the habitat for an endangered fish, the unarmored threespine stickleback; and the area between Purisima Point and San Antonio Creek where 15 nesting pairs of the endangered least tern were located in the spring of 1978.



using a short-burn first stage. Twenty flight tests will be launched and flown in the Western Test Range during 1983 through 1987. The re-entry vehicles will be targeted into four separate target areas in the Pacific near the Marshall Islands and may be recovered after spashdown. Follow-on operational tests will be conducted by the Strategic Air Command throughout the life cycle of the weapon system.

Costs for the construction and operation of the MX test program at Vandenberg have been tentatively estimated at:

• construction of facilities	$50 million
• integrated testing & support systems	$90 million
• test equipment	$60 million
• MX flight tests	$200 million

Construction workers will number about 250 for the period of Spring 1981 through Winter 1982. These workers will tend to be transient as the combined Space Shuttle and the MX labor demand will exceed local supply. MX technical support will begin in early 1981 and increase through 1983 to 580 permanent personnel.

Key issues at Vandenberg and within its environs include:

- Topography: Alteration of terrain, destruction of natural vegetation, fugitive dust generation, and filling and diversion of minor stream channels will occur.

- Hydrology: Water requirements will be supplied from aquifers on the base. Withdrawal of water from these aquifers will not significantly affect offbase availability nor should it affect onbase suppliers.

- Biological Habitat: Endangered species and remote or unusual habitats could be adversely affected by project implementation at specific sites. The California least tern and unarmored threespine stickleback are federally protected species potentially affected.

- Air Quality: Missile launches will create a short-lived exhaust cloud which may include: hydrogen chloride, aluminum oxide, carbon monoxide, carbon dioxide, and water. The cloud will be dispersed quickly and will not result in toxic levels of pollutants beyond a few thousand feet from the launch point. No regional effects, permanent or temporary, are expected.

- Noise: Both construction activities and missile firings will generate noise. Noise impacts on population centers both on- and off-base will be minimal.

- Socioeconomic Impacts: The amount of growth anticipated can be absorbed by planned community facilities. Increased populations will place some added strain on housing and road networks. The planned phasing of construction for MX will soften the drop-off of construction employment resulting from completion of Space Shuttle construction.

- Temporary Housing: Temporary housing for transient construction workers during 1981 to 1983 will be required. Mobile homes and recreational vehicles are a major potential source of housing for these workers, however, adequate parks do not exist to accommodate these vehicles.

- Permanent Housing: A North County housing market impact will be created by new permanent employees at Vandenberg plus population generated indirectly by the economic stimulus of the project. The 1981 project-generated demand will be for 175 to 230 housing units and by 1985 this demand will increase by an additional 840 to 990 units.

- Archaeology: Much of Vandenberg contains numerous undisturbed archaeological sites. Preliminary ground surveys of the four candidate siting areas revealed no new surface archaeological finds. Adoption of the trench basing mode may unavoidably disrupt some sites. As required by law, these impacts will be mitigated by the development and implementation of a data recovery program.

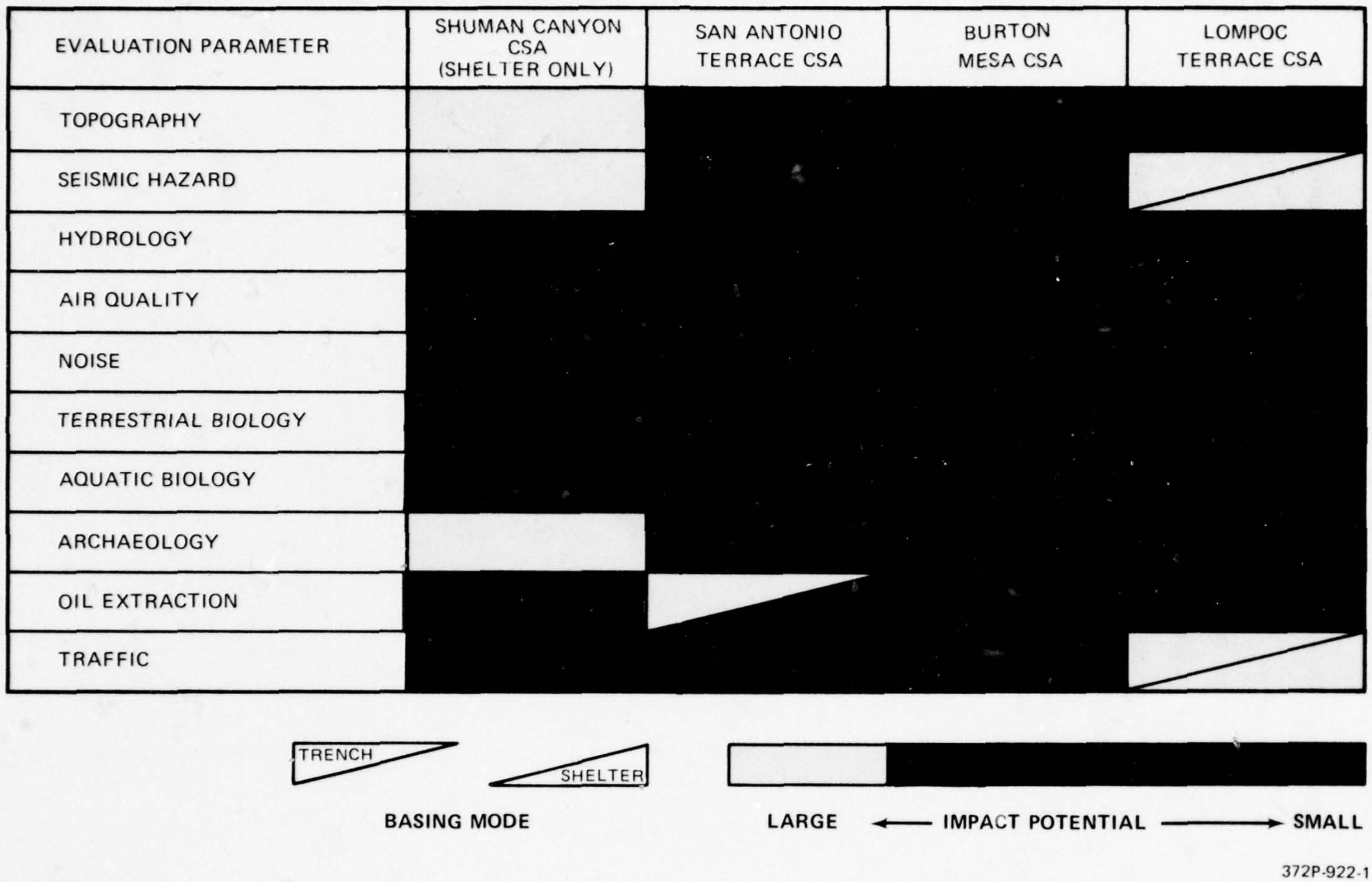
- Candidate Siting Area Impacts: A comparison of the relative environmental impact potential of the conceptual facility layouts at each of the Candidate Siting Areas (CSAs) is provided on p. xviii The facilities are configured to minimize environmental impact.

Project alternatives to flight tests at Vandenberg are:

- No project
- Reduction in the number of flight tests
- Flight tests at other locations
- Construction of the project at a different scale
- Project postponement

These alternatives do not meet the schedule or national security requirements for the program as proposed.

COMPARISON OF IMPACT POTENTIAL AT CANDIDATE SITING AREAS



BASING MODE EVALUATION
SUMMARY

Four basing modes are considered in the Basing Mode Evaluation. The basing mode selected could impact considerable land areas, energy, natural resources, and the economy. The four basing modes are:

- horizontal shelter (a bunker-like structure)
- vertical shelter (an underground vertical tube)
- slope-sided pool (a covering of water for the missile)
- hybrid buried trench (a horizontal concrete tube structure)

Each basing mode analyzed employs the multiple aimpoint strategy which forces the enemy to target each shelter, trench aimpoint or pool if he is to destroy the United States ICBM retaliatory forces. In designing multiple aimpoint systems, strategists consider four points:

- hardness: the ability of the missile at the aimpoint to survive the effects of a nuclear blast at a selected distance
- dispersion: spacing between aimpoints so that an attack on one does not disable missiles at other aimpoints
- deception: methods which prevent the enemy from determining which aimpoints house missiles
- security:

  area—entire fenced regions in which the missile is deployed and from which unauthorized personnel are excluded

  point—only the immediate location surrounding the aimpoint is controlled; small area exclusion of unauthorized personnel with limited activity in a larger area

Environmental impacts associated with basing modes will vary by site location. Potential least cost engineering construction areas were divided into seven physical-biological provinces and sample Basing Mode Comparison Areas (BMCAs) were defined to prepare the environmental analysis. These BMCAs are chosen for environmental analysis only; no siting decisions are suggested by the BMCAs. The choice of a site is not to be addressed as part of Milestone II. The seven sample basing mode comparison areas are:

- Central Nevada Great Basin
- California Mojave Desert
- Luke/Yuma (AZ)
- White Sands (NM)
- West Texas-Rio Grande Basin (TX, NM)
- Texas/New Mexico High Plains
- South Platte Plains (NE, KS, CO)

Analysis and study of the BMCAs identified important environmental concerns in the basing mode selection which should be considered in deciding whether or not to proceed with full-scale engineering development.

Comparison of the four candidate basing modes indicates that the level of impacts associated with each option is roughly the same for each particular BMCA. Each basing mode offers certain advantages and disadvantages for particular environmental concerns, but impact potential varies significantly, more by site than by basing mode, and no consistent pattern of environmental impacts leading to a preferred basing mode can be discerned. Therefore, selection of a basing mode must be made in concert with other engineering and cost considerations.

- Concern with Important Species. The potential impacts of all modes upon important species are similar, ranging from small to moderate. The potential for adversely affecting one or more protected species exists virtually anywhere the project could be sited. Site-specific differences among the basing mode comparison areas are evident and outweigh variations among the basing modes. Area security fencing that does not allow passage of wildlife could be a significant problem in some areas. (The currently proposed fence does allow passage of certain wildlife.) Water use (especially in the slope-sided pool mode) could affect endangered fish species in isolated desert spring-fed pools by reducing their water supply.

- Air Quality. No major differences in impact potential can be attributed to a change in the basing mode. Site-specific meteorological conditions and ambient air quality present significant variations in the level of potential impacts. Impact potential is small, except in the California Mojave BMCA.

- Water Quality and Supply. Significant variations in the impact potential occur among the various BMCAs with relatively minor variations among the basing modes. Little difference in the impact potential levels exists between area security and point security.

  Water availability is highly site-dependent. Deployment of the MX system will require large quantities of water for concrete, dust suppression, compaction, and other uses. Some of the arid and semi-arid areas contain endemic fish which could be affected by project water use.

- Loss of Recreational Access. Basing modes utilizing point security reduce the impact potential in areas where there is a large proportion of currently accessible public land. The relatively small differences in construction and operations personnel and induced population growth associated with variations in basing mode and spacing cause no clear differences in the induced traffic congestion component to recreational access loss; however, this component does vary significantly with site depending upon the capacity of the road network.

- Natural Resources. Impacts involving aesthetic concerns, loss of natural vegetation and habitat value, and water resources are influenced by the amount of area disturbed by the project, the total area of the project, and water uses of the project. Impacts vary relatively little among modes, but reveal a strong site-specific component. Expanded spacing in any mode causes greater impacts by increasing all of the above environmental effects. Point and area security have relatively similar impact potential.

- Land Rights. No significant differences in the level of impact potential exist among the basing modes. The level of impact is affected more by the security configuration than by the choice of a site. Point security shows markedly reduced potential impacts. Rural population density is greatest in productive agricultural areas with a high proportion of private land. Displacement of population and acquisition of private land are likely to produce moderate to large impacts.

- Economic Issues. No significant differences in the level of impact potential exist among the basing modes. Further, significant differences do not occur between alternative security or between alternative spacing configurations. Impacts tend to be relatively large due to requirements for local governments to provide community facilities and service to support large-scale growth. The creation of new jobs that may be filled by local residents partially offsets this impact. Area security may produce somewhat greater impacts due to loss of production from current land uses, particularly if combined with expanded spacing.

- Local Government Issues. No significant differences in the level of impact potential exist among the basing modes. The level of impact potential is affected more by site selection than by the choice of a basing mode, with the California Mojave and Luke/Yuma showing low impact potential relative to Central Nevada, White Sands, or the South Platte areas. No significant differences occur in the level of impact potential when comparing point and area security or when comparing nominal and expanded spacing. Impacts are generally the result of in-migration of people requiring increased services and facilities to be provided by local governments from a limited tax base.

- Public Safety. The concern for public safety shows no significant variation in the level of potential impact among basing modes. The level of impact is affected more by site considerations and variations than by security configurations. Site selection shows the largest differences because the BMCAs have widely different population densities and therefore variation in the numbers of people concerned about safety issues. Potential impact levels are generally small in the areas with low population densities and moderate to large in areas with high population densities.

- Airways Impeded. Potential impact on airways shows very little variation among the different modes in area security. The impact potential is quite site-specific, varying from small to large, but increases considerably from nominal spacing, area security to expanded spacing, area security. Point security can be considered a mitigation of this potential impact as it does not require airway restrictions.

- Archaeological Issues. No significant differences in the level of impact potentials exist among the basing modes. Impacts are strongly site-dependent. Expanded spacing may incrementally increase the impact potential. Areas such as White Sands, Luke/Yuma, California Mojave, Central Nevada, and West Texas-Rio Grande are areas where archaeological remains have been well-preserved because of both the arid climate and the lack of intensive agriculture. White Sands and the California Mojave both have a high density in the types of archaeological sites that have been preserved.

- Cement. Construction of the hybrid trench may have large potential impact on availability of cement. The other basing modes show no difference in level of impact potential, with all modes producing small impacts. Area and point security have similar impact potential for all sites.

- Energy Issues. No significant differences in the level of impact potentials exist among the basing modes. Neither the proposed security systems nor the alternative spacings significantly affect the level of impact potential. The level of impact potential is more affected by site selection than basing mode but both the project requirements (including the project and the associated new population) and the levels of generating capacity that will be available depend on a range of unknowns.

Other alternatives to the proposed basing modes were rejected because they either lacked the necessary survivability in the event of an attack, were deemed not cost-effective, or they were impractical with the present technology, therefore they were not subjected to environmental analysis.

Alternatives to the selected basing modes were:

- use of existing silos for MX deployment
- air mobile options (use of wide-body jet aircraft or helicopter-dirigibles to carry and launch missiles)
- unprotected options (missile launch vehicles dispersed over roads, rails, waterways, or on unprepared surfaces)
- subterranean options (hard rock tunnel, soil tunnel)

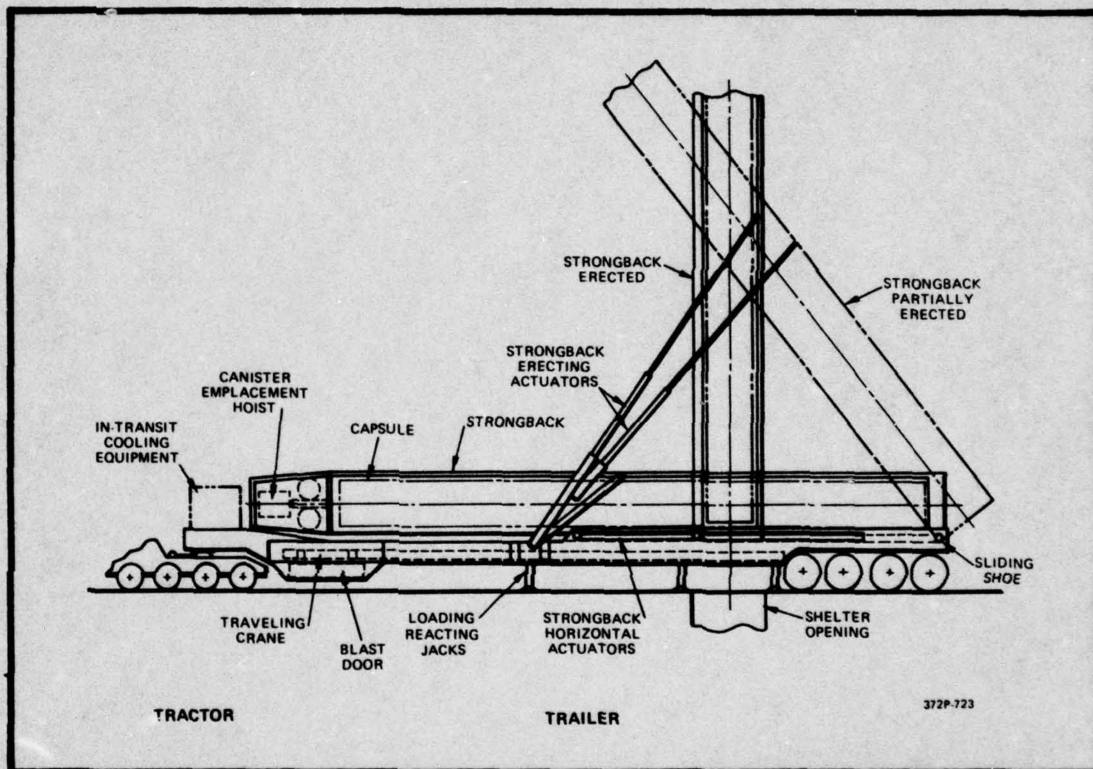
In addition, the following system alternatives/scenarios were evaluated:

- interim deployment of Minuteman III missiles in MX basing modes in southwestern United States
- MAP deployment of Minuteman III missiles in northern basing

CONTENTS

FIGURES

TABLES



Introduction

1
INTRODUCTION

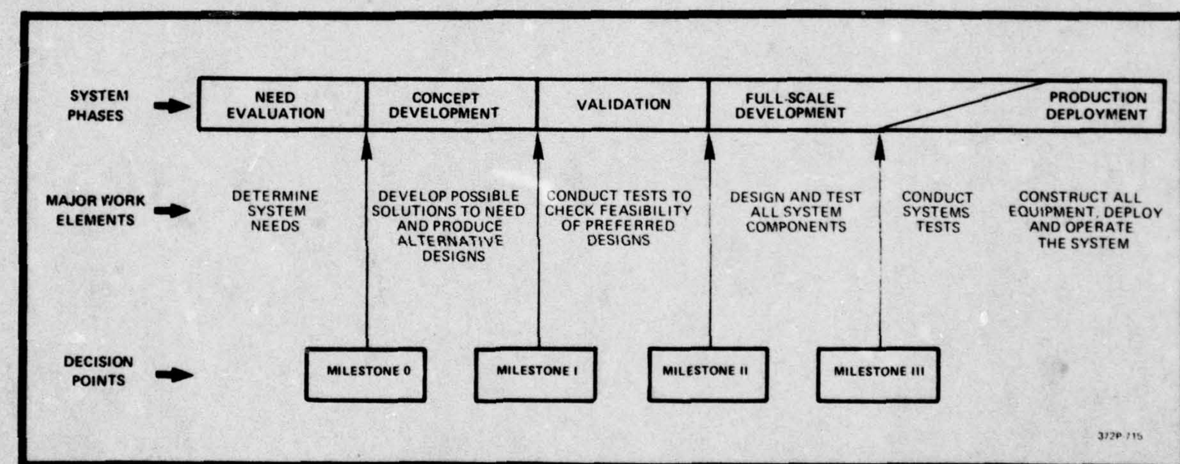
Volume I is a description of the MX system and of the environmental program accompanying the systems acquisition process. The text also addresses key environmental issues expected at various stages of program development, the methodologies used to evaluate program impacts, the efforts to monitor impacts, and the possible environmental effects that could result from decisions which may be made during the system acquisition processes.

Following the introduction in Section 1, Section 2 addresses the need for the MX system and describes the system and its acquisition process. The need for a new strategic land-based missile is discussed in relation to the basic U.S. policy of strategic deterrence and response-strike capability. The developing threat is discussed in terms of United States versus Soviet capabilities, and the requirements for survivability, flexibility, and reliability of nuclear deterrence.

After the need for a new weapons system is described, the features of the MX system are presented. The Multiple Aimpoint (MAP) concept is described as are the basic facilities required for implementation of the concept. Following description of the multiple aimpoint concept and the basic requirements of the MX system, is a more detailed description of the proposed Missile X and potential alternatives, of the four most feasible basing modes and related ground equipment which have received the most detailed consideration, of the conceptual support base facilities needed for deployment, and of the potential deployment areas and the general deployment configuration. The full description of the MX system is followed by a description of the acquisition process for the system.

Section 3 addresses the environmental program associated with the MX systems acquisition process. Environmental analyses are included during all phases of systems planning, testing, and implementation. Section 3 begins with a description of the environmental process and of the federal requirements for environmental impact statements (Section 3.1). The environmental impact statements which will be used in making the MX acquisition milestone decisions are discussed in Section 3.2.

Environmental issues associated with each of the existing and proposed environmental impact statements are addressed in Section 3.3. These key issues anticipate public reaction and major environmental concerns over important elements of the decisionmaking process and over implementation of the MX system. Section 3.2 describes the methodologies which were used and which are being developed to determine baseline conditions and potential impacts likely to result from various aspects of the implementation of the MX system. Section 3.4 discusses monitoring programs designed to provide a continuing evaluation of the existing versus projected project impacts and a means of validating or modifying impact analysis methodologies. Finally, the expected environmental effects of the MX system are summarized in relation to the key environmental issues.



The MX Program

2

THE MX PROGRAM

2.1 THE ROLE OF THE ICBM IN NATIONAL SECURITY

Strategic Deterrence, and the TRIAD Concept (2.1.1)

The ultimate aim of U.S. strategic nuclear weapons systems is to deter aggression against the United States and its allies. To do this, the United States has sought to maintain a survivable high-quality force. A potential attacker will see no advantage in a first strike if he is convinced that sufficient forces for devastating retaliation will survive that attack. Deterrence, then, is the prevention of hostile action through fear of consequence—a state of mind brought about by a credible threat of some sort of reprisal.

To achieve the goal of maintaining stability, the United States has implemented what is referred to as a TRIAD of strategic nuclear forces based on land, sea, and air. The three legs of the TRIAD are:

- Land-Based Intercontinental Ballistic Missiles (ICBMs)
- Submarine-Launched Ballistic Missiles (SLBMs)
- "Air-breathing" systems, e.g., manned aircraft capable of delivering nuclear weapons and unmanned cruise missiles.

In addition to being able to inflict unacceptable damage on the Soviet Union in retaliation, our surviving strategic offensive forces must have the ability to:

- Implement a range of selective options to allow the National Command Authorities (NCA) the choice of other than a full-scale retaliatory strike if needed, and
- Hold a secure force in reserve to ensure that the enemy will not be able to coerce the United States after a U.S. retaliatory strike.

ICBMs play an important role in the TRIAD; they provide immediate, positive retaliatory capability through survivability, quick reaction, short flight times, penetration of defense, yield, and accuracy. They are continuously on alert in hardened and dispersed protective structures (silos), and are highly reliable. Launch control systems are both hardened against attack and take multiple forms ("redundancy") to assure that the force can be launched when authorized (and only when authorized) after attack. Communications from command authorities are also redundant and highly reliable, to provide an assured response. Flexibility is added through a capability for retargeting on command. ICBMs can be deployed effectively against the entire range of targets, with operating costs markedly less than those of bombers or SLBMs. In sum, existing land-based ICBMs are ready and responsive with built-in flexibility. They are directly controllable by the National Command Authority (NCA) and contribute significantly to crisis stability--the essence of deterrence.

Need for an Improved ICBM (2.1.2)

Current Status of U.S. ICBMs (2.1.2.1). The United States currently has three types of ICBMs in service:

- TITAN II became operational in 1963, and 54 are in service. The TITAN warhead is the largest in the U.S. ballistic missile inventory, and the missile has a high day-to-day alert rate. Continuing efforts have been made to extend its service life and lower its operating costs.
- MINUTEMAN II (MM II) reached a deployment of 450 missiles in 1967. The MINUTEMAN force has been characterized by high day-to-day alert rates, low operating costs, and high reliability. Changes have been incorporated since 1967 to improve its flexibility, but there are no currently approved modernization programs. A silo upgrade program for improving system survivability against attack is nearing completion. The missile has a single warhead, with range and accuracy to cover most targets of interest.
- MINUTEMAN III (MM III) was deployed from 1970 to 1975, and 550 are in service. The accuracy with which a MINUTEMAN III can place warheads on three targets and its remote retargeting capability provide operational capability and confidence. Modernization programs include an improvement in accuracy and substitution of a new reentry vehicle (warhead) with higher yield than that of the current MM III. A silo upgrading program was completed in 1977.

MM III production draws to a close with the delivery of the last 30 missiles in 1978. Continuing advanced technology programs include:

- Maneuvering reentry vehicles (MARVs) designed to increase the probability of penetrating an enemy's defenses and destroying the intended target.
- The advanced ICBM Technology program to develop technology for elements of a new missile system (MX) rather than upgrading existing missiles.
- Development of a retargeting capability for Airborne Launch Control Centers (ALCCs) which provide a link in the Command, Control, and Communications electronics system for the Minuteman system.

The entire U.S. ICBM force is emplaced in silos—vertical launching structures buried in the ground with the self-contained electronics and support equipment necessary to launch a missile and provided with hardened covers to withstand likely levels of nuclear attack. These silos are separated by sufficient distances so that a nuclear detonation close enough to destroy or disable one will leave the others unaffected. The missiles are also geographically dispersed within the United States so that a saturation attack cannot be mounted against a single area.

<u>The Developing Soviet Threat and Future Implications (2.1.2.2)</u>. At this time, the Soviets have over 1,400 ICBM launchers at operational complexes, vs. 1,054 for the United States. New Soviet ICBMs have greater reliability, range, payload, and accuracy than the systems they are replacing. Implications of U.S./Soviet capabilities and trends include the following:

- All U.S. missiles are emplaced in fixed positions (silos), and the locations of those silos can be determined accurately by the Soviet Union. Consequently, the ICBM force is becoming increasingly vulnerable as the Soviets deploy missiles with payloads and accuracies adequate to ensure destruction of U.S. silo-protected ICBMs. Substantial existing and continuing reductions in survivability of the U.S. ICBM force have been projected on this basis to the point that its deterrent value may be questionable by the mid-1980s.
- With deployment of Soviet missiles in super-hard silos, the accuracy and yield of the weapons targeted against them must be increased so that they will clearly perceive that after a preemptive strike their remaining ICBM weapons would be at risk in a U.S. retaliatory strike.

- Continued deployment of Soviet "fourth generation" missiles (the SS-17, 18, and 19) with multiple independently-targeted reentry vehicles (MIRVs) and their known development of a fifth generation of land-based missiles, poses a threat to our ability to maintain a strategic balance with respect to the Soviet Union. Projections of the numbers and accuracy of Soviet ICBM weapons in the early-to-mid 1980s indicate that a relatively small number of their ICBM weapons could destroy a significant portion of our silo-based force while leaving the Soviets with a large number of residual weapons for other tasks.

- Soviet implementation of mobile based missiles introduces uncertainty into U.S. knowledge of specific target points.

Possible Alternatives to Anticipated Threats (2.1.2.3.). Among the possible responses to the developing threat described above are:

- Do nothing. This will result in a continued degradation of the retaliatory capability of our ICBM force. By the mid-1980s, the United States would not have much confidence that more than a small percentage of our missiles could survive a Soviet preemptive attack. Thus, the deterrent value of the land-based ICBM element of our strategic TRIAD could seriously erode.

- Negotiate appropriate agreements with the Soviet Union. A SALT TWO Strategic Arms Limitation (SAL) agreement is being negotiated. However, it is not expected to delay the rate at which the vulnerability of our ICBM force is increasing.

- Adopt new tactics. Potential vulnerability problems could be minimized by adopting a policy of launching the ICBM force before Soviet attacking weapons would arrive and detonate. This is only an option under present strategy. The decision to launch would have to be made rapidly based on information from our warning sensors. This policy would only be adopted with the greatest caution, for a launch based on inaccurate warning assessment could precipitate a destructive nuclear exchange in error and must be avoided.

- Improve existing retaliatory systems. Some programs are in progress to improve the retaliatory capability of the existing ICBM force. A program to increase the hardness of our existing silos will soon be complete. A program to improve the effectiveness of Minuteman III is ongoing. These programs will provide some modest, near term improvement in survivability and retaliatory capability. With these improvements, the existing force is at its practical limit for improving survivability and effectiveness. Although some marginal improvement might be possible, the large cost would not be reasonable.

- Develop and deploy defensive system. All such systems have major technical and operational uncertainties. They all depend on warning, and are subject to countermeasures. Additionally, Anti-Ballistic Missile (ABM) systems are limited by treaty everywhere but at Grand Forks, North Dakota, and even there to 100 missiles.
- Increase the number of ICBMs. To provide a sufficient retaliatory capability, thousands of new ICBMs would have to be deployed. This would abrogate the strategic arms limitation (SAL) agreements.
- Modify Minuteman III for mobile basing. The attractiveness of this option depends on the desired level of surviving capability.
- Develop and deploy a new more survivable retaliatory system based on a common missile also usable in Trident submarines or having elements in common with such a missile.
- Develop and deploy a new more survivable retaliatory system based on a missile designed for the purpose. This alternative is the subject of this report. The system is known as the Missile X, or MX system.

The MX concept involves two basic elements: the missile itself, and its method of survivable basing. The missile is to have both increased payload and accuracy, to give the required retaliatory effectiveness with relatively small numbers of missiles. The basing mode is to incorporate the multiple aimpoint (MAP) concept (i.e., the missile is to be mobile rather than fixed, and suitable precautions will be taken to prevent knowledge of its location).

2.2 THE MX SYSTEM

The Multiple Aimpoint Concept (2.2.1)

In the multiple aimpoint (MAP) concept, a missile is not emplaced permanently in a single facility as with the present Titan and Minuteman missiles, but may be located at any one of a relatively large number of individual protective structures, or aimpoints. Effective measures are taken to deny the enemy knowledge of the location of the missile, so that to be assured of its destruction he must attack all the aimpoints, rather than just the ones containing the missiles.

There are three factors that must be taken into account in the design of a multiple aimpoint system: hardness, dispersion, and location uncertainty,

- Hardness is a measure of the ability of the missile at the aimpoint to survive the effects of a nuclear weapon attack at a selected distance. The principal effects that must be accounted for are radiation, electromagnetic pulse, air blast, and ground motion. The requirements for hardness to these effects are important in determining engineering specifications and redundancies in the system. Aimpoint hardness should be sufficient that one or two warheads must be assigned to each protective structure to assure destruction of its associated missile.
- Dispersion relates to the distance between aimpoints. There must be a sufficient distance between aimpoints that an attack on one will not disable missiles at adjacent aimpoints. Hardness and spacing can be traded off within limits (i.e., harder aimpoints may have closer spacings).
- Location uncertainty keeps the enemy from determining which of several aimpoints contains a missile, or does not contain a missile. Missiles may be moved above ground on roads or rails, or below ground in tunnels or trenches.

Basic Features of MX System (2.2.2)

The desired size and weight of the missile is determined by an optimization which includes, among other things, the variety of intercontinental targets, their range and hardness. The size and weight, in turn, largely determine the specific design of equipment needed for mobility. In addition to the missile and transporting equipment, extensive systems for security, communications, launch control, support, maintenance, and other related functions are necessary. The following basic elements are common to the MX weapons system, regardless of the specific method ultimately selected for its deployment:

- The missile proper
- A missile canister, which both provides a level of protection for the missile including various effects of a nuclear attack, and permits its use in the "cold launch" mode. A gas generator pops the missile out of the canister prior to ignition of the rocket motor.
- Multiple hardened aimpoints among which the canisterized missile may be moved in such a way that its exact location is unknown to a potential aggressor.
- Special vehicles for transporting the missile among aimpoints. Additional vehicles may be required, depending on the specific aimpoint concept adopted, for providing concealment during above-surface moves, protection against blast effects accompanying an attack or for transporting some items of equipment (e.g., the complete missile from its assembly building to a buried trench).
- Equipment for command, control, and communications (known as the C^3 function).
- Support facilities at the operational site, including structures and equipment for assembly and checkout of the missiles; command, control and communications; maintenance and repair, warhead storage; surveillance to alert the security forces to attempted intrusions, intelligence-gathering efforts outside the restricted area, or potential sabotage; maintenance of emergency power during accidental power outages or as a consequence of attack; and housing and messing of onduty personnel.
- Support facilities at an adjacent Air Force Base (new, expanded, or reactivated as appropriate) to provide Wing Operations Control and Administrative functions, maintenance, and repair functions not feasible on the operational site, logistics support (e.g., storage of spare parts, loading/unloading facilities), and onbase support facilities for assigned personnel.

- Airborne Launch Control Centers (ALCCs) for command, communications and control during or after an attack, if ground facilities for this purpose were disabled.
- Security systems.

Candidate Missiles (2.2.3)

This section discusses the missiles considered for multiple aimpoint basing.

Missile X (2.2.3.1). The essential elements of Missile X are shown in Figure 2-1. It is 70.5 ft (21.5 m) long, 92 in. (233 cm) in diameter, and weighs 190,000 lb (86,200 kg). The missile would have three solid-propellant rocket motors, and a post-boost vehicle. The entire missile would be encased in a steel canister (not shown) that both provides protection against damage and permits "cold launch" of the vehicle.

The missile at 190,000 lb (86,200 kg), is too heavy to move over public roads, and will be broken down into stages for transportation and assembly at the deployment site. (Transportation of the main motor stage alone is estimated to require a tractor-trailer vehicle requiring special permits in most states.) The missile and the transporter vehicles required to provide mobility must consequently be assembled in the deployment area, and moved on specially designed roads.

In operation, the canisterized missile is erected or emerges from its shelter, and a fast-burning propellant at the bottom of the canister (not carried by the missile) is ignited. The resulting gas pressure "pops" the missile out of the canister, in a "cold launch." The main engine (Stage I) then ignites and propels the missile on its flight path.

The course of the missile is sensed by instruments in Stage IV so that corrections can be made to maintain the desired flight path. When the propellant in Stage I is expended, the stage is separated from the remainder of the missile and the second stage is ignited. Similarly, Stage II is separated at burnout and Stage III is ignited. Burning of the Stage III propellant can be terminated by the flight control instrumentation to control range. At termination of the third stage, the post-boost vehicle (PBV) is separated, and continues on its trajectory to the target.

The PBV consists of three active elements:

- A postboost propulsion system (PBPS) that has a number of liquid-fueled rocket engines that allow for additional accuracy and range, and for positioning of the deployment module.

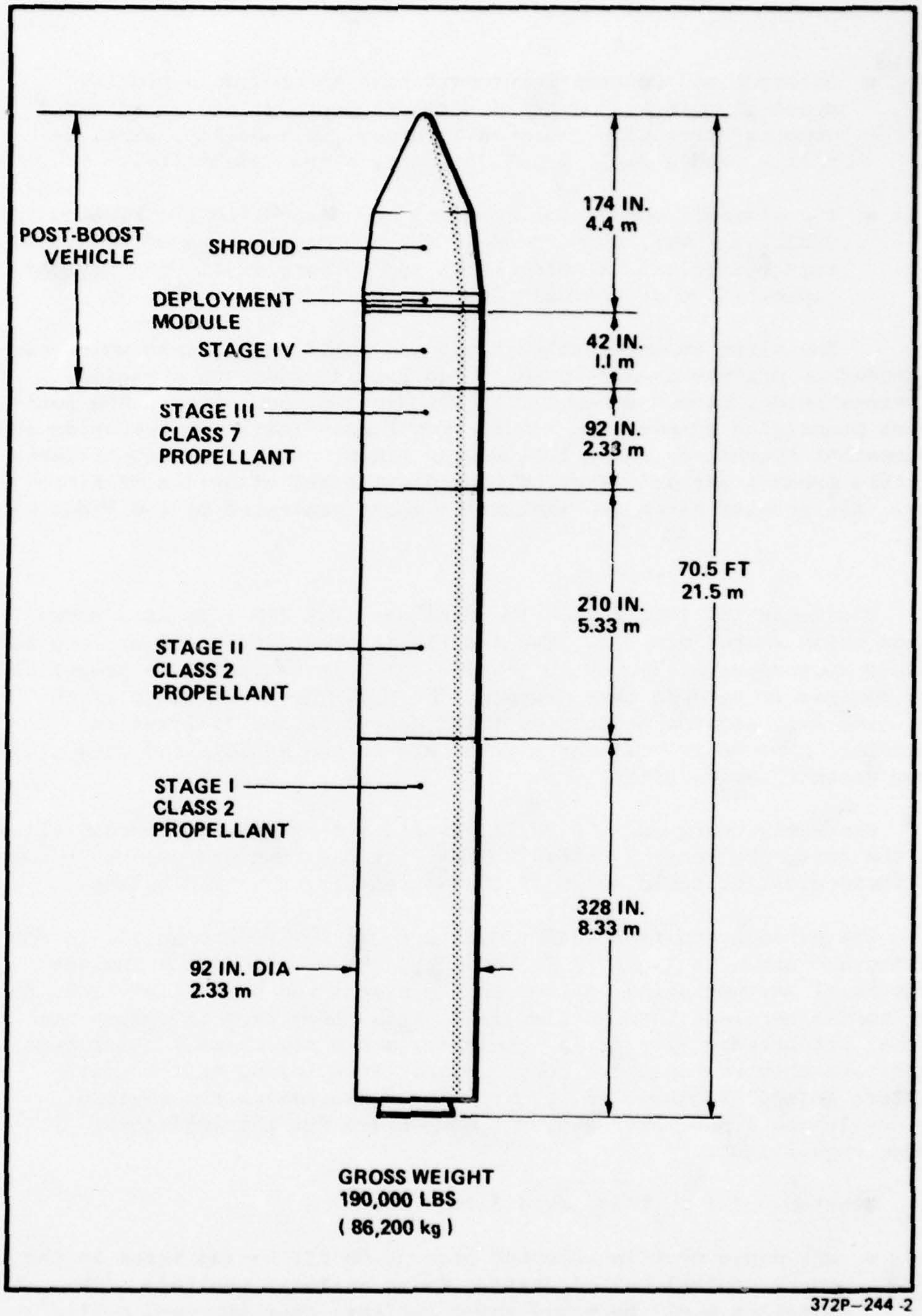


Figure 2-1. The conceptual MX baseline configuration.

- Guidance and control instrumentation to provide a precise means of maintaining the desired trajectory, and an advanced computer providing improved accuracy, reliability, survivability, and a rapid preflight retargeting capability.

- A deployment module for mounting and dispensing the reentry vehicles (RVs), or warheads. The number and type of RVs in this module can be selected as appropriate within the payload capabilities of the missile.

The first three missile stages use solid propellants which can be expected to produce exhaust gases which include hydrogen chloride, aluminum oxide, carbon monoxide, carbon dioxide, and water. The post-boost propulsion system uses liquid propellants (nitrogen tetroxide and monomethyl hydrazine) which ignite when mixed. The major constituents of this exhaust gas are water, carbon dioxide and of oxides of nitrogen. All exhaust gases are similar to those generated by the Minuteman III.

Minuteman III (2.2.3.2). The Minuteman III (MM III) is a three-stage solid rocket missile. The missile is about 60 ft (18 m) long and weighs approximately 78,000 lb (35,380 kg). It has a liquid propellant PBV similar in type to that proposed for MX. The first stage is 66 in. (168 cm), and the second and third stages 52 in. (132 cm) in diameter. The MM III can carry three RVs to the anticipated target base from present basing sites.

Currently there are 550 MM III missiles deployed in hardened silos in the north and central United States. It has been proposed that some of these missiles could be modified and redeployed in MAP basing.

The minimum modifications required to deploy Minuteman III in MAP basing are shown in Figure 2-2. Briefly, the modifications include structural strengthening of the reentry system and propellant tanks for horizontal carriage between aimpoints, attachment tabs to ensure the proper fit between missile and canister, and a new Stage I skirt and sabot assembly required for cold launch. Redeploying to the southwestern United States would require either decreasing the payload or developing a new motor stage to compensate for the additional range requirement.

Minuteman III is being considered for:

- MAP deployment in selected present MM III basing areas in the north central United States, using vertical shelters. The missiles would be moved among shelters over improved public roads.

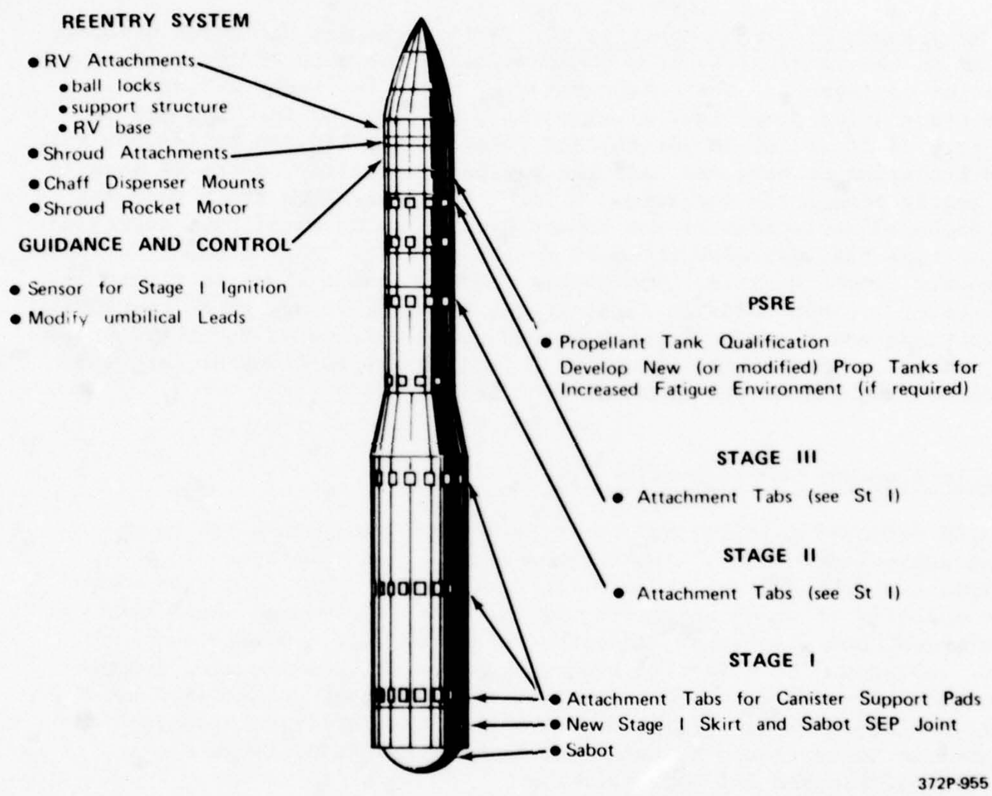


Figure 2-2. Minimum Minuteman III missile modifications for MAP.

- Interim MAP deployment in the "Southwestern" basing area ultimately selected for MX deployment, in the vertical shelter model. MX facilities would be used, constructed at full scale. The Minuteman III missiles so deployed would ultimately be replaced by MX. This procedure would increase force survivability at an earlier date than is otherwise feasible.

MX/Trident II Common Missiles (2.3.3.3). Recent attention has been focused on the possibility of a common missile for both MX and Trident submarine deployment. The common missile, shown in Figure 2-3, is a three-stage solid propellant missile which is about 83 in. (210 cm) in diameter, 44 ft (13 m) in length, and weighs about 110,000 lb (49,900 kg). It is projected to have one half the payload capability of the MX missile with nearly comparable accuracy. A joint Navy/Air Force study team has also explored variations of the common missile which would have increased capabilities that approach those of the MX missile. This missile is called the mostly common missile. The mostly common missile shown in Figure 2-3, consists of a common missile first stage, a unique second stage for ICBM applications and a common missile second stage serving as the third stage. This mostly common missile is about 83 in (210 cm) in diameter, about 64 ft (20 m) long and weighs about 150,000 lb (68,000 kg).

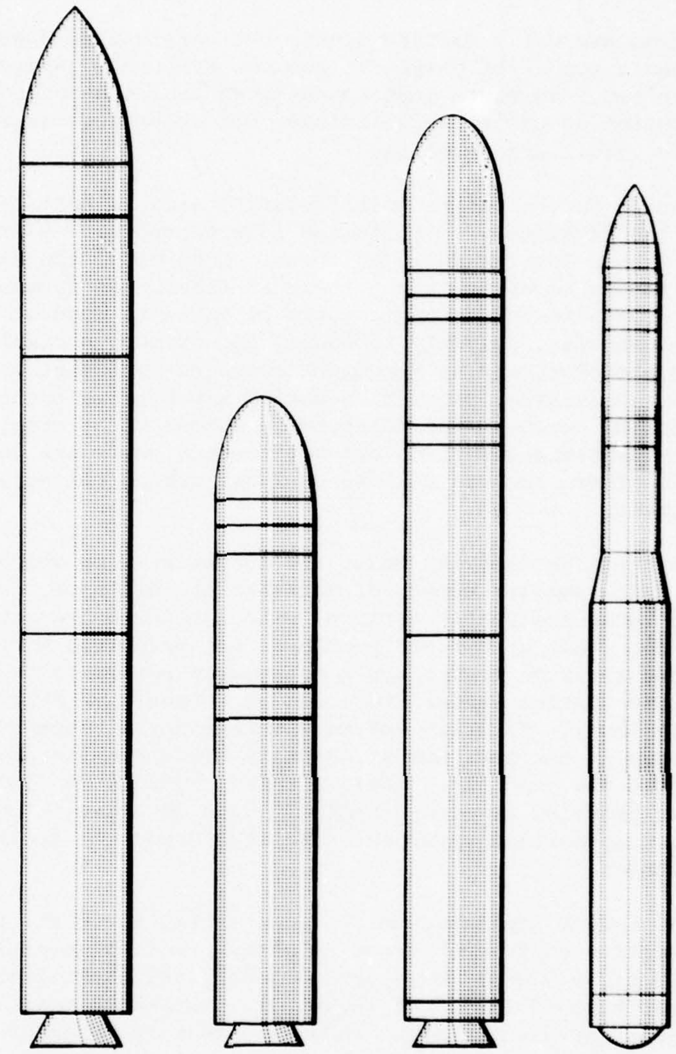
Multiple Aimpoint Security Modes (2.2.4)

The deployed missiles and their associated equipment must be protected against detection, unauthorized access, and sabotage. In a multiple aimpoint system, it is vital that the attacker be denied knowledge not only of which aimpoints contain a missile, which would then be targeted, but also which aimpoints do not contain missiles and need not be targeted. An effective security system is thus required for all aimpoints. The exact configurations of these classes are subject to additional analysis and design during FSED. The following discussion is based on the present, tentative conceptualization of these configurations (Figures 1-1 and 1-2).

Two broad classes of security concepts have been identified for the MX system, termed "point" and "area" security.

In point security, only a small area immediately surrounding the aimpoint is fenced. The fence provides a physical barrier to impede access to the aimpoint. Intrusion sensors protect the fenced area around the aimpoint, and security forces are dispatched when an intrusion is detected.

A safety zone is also established around each aimpoint because of the potential hazard from propellants if a missile is present. The size of this safety zone is determined by the explosive hazard. Inhabited



	MISSILE X	COMMON MISSILE	MOSTLY COMMON MISSILE	MINUTEMAN III
Approximate Weight, lbs.	190,000	110,000	150,000	78,000
(kgs.)	(86,200)	(49,900)	(68,000)	(35,400)
Length, ft.	71	44	64	60
(m.)	(21.6)	(13.0)	(19.5)	(18.3)
Maximum Diameter, ft.	7.7	7.1	7.1	5.5
(m.)	(2.3)	(2.2)	(2.2)	(1.7)

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Figure 2-3. Approximate characteristics of potential candidate mobile ICBMs.

structures are not permitted within the safety zone, and roads must be more than a specified distance from the aimpoint. Where private lands are involved, easements must be obtained from the owners to restrict construction of habitable buildings, but other uses (agriculture, recreation, etc.) are permitted.

Access to the entire point-security area is unrestricted except within the relatively small fenced zone around each aimpoint and at the support areas for the deployed force. Control of the airspace above the parcel is not required, since there is freedom of movement on the ground. Adequate measures must consequently be taken to counter portable or emplaced sensors, possibly including use of decoys simulating the missile at each aimpoint, and/or frequent "sweeping" activities to detect emplanted sensors. Similarly, physical security may require the use of large escort teams during deceptive or maintenance movements of missiles or decoys. Security system acquisition and maintenance costs are consequently increased. These factors will be explored during Full-Scale Engineering Development.

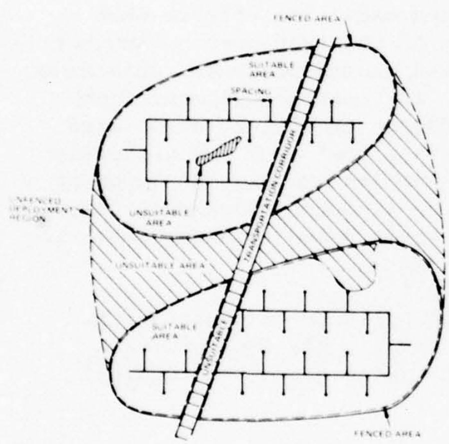
In the area security mode, the larger area in which a number of aimpoints and a smaller number of missiles are deployed, is enclosed by a warning fence and posted notices, with a cleared area on both sides of the fence. Only authorized personnel are permitted within the fenced area, and their movements are continuously monitored by personnel at an Operations Control Center (OCC) and at an assigned Alert Maintenance Facility (AMF). Security forces with appropriate vehicles and weapons are housed at the AMF, and at Security Alert Facilities (SAFs) dispersed throughout the controlled areas. Entry controls and intrusion sensors are also provided at each aimpoint. Upon detection of penetration of the area by unauthorized personnel security forces are dispatched to assure interception.

To prevent implantation of sensors from aircraft, the airspace over area security deployment areas is restricted (no access) to an altitude of 5,000 ft (1,524 m) above ground level, and controlled (permit required) to an altitude of 18,000 ft (5,486 m). Perimeter vehicle patrols and helicopter patrols are maintained as necessary to ensure security of the deployment area.

Fenced areas will be of radically different sizes for point and area security modes and this constitutes a major and important difference between these two security configurations. As a rough first approximation, geographic deployment regions will be the same for both point and area security. However, if aimpoints are located for minimum population impact in the point security configuration, e.g., minimize necessity for people moving, the point security mode may have a larger overall deployment area than the area security mode. Safety areas will only apply to point security. For the area security mode, it is expected they will be included inside the fenced area.

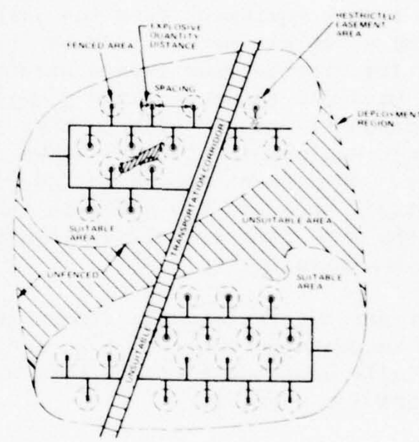
Below is a graphic representation of point and area security land use. As shown, the fenced areas can be separated so as to avoid transportation corridors and otherwise unsuitable areas such as large population centers.

Another possibility that could mitigate the impact of the large fenced areas required by the area security mode is the concept of "split-basing." In this concept, the total missile force may be divided into two or more major groupings, and deployed at geographically separated locations. This would allow more flexibility in avoiding populated, or otherwise unsuitable, areas because of the relatively smaller fenced land requirement at each deployment.



AREA SECURITY

EACH OF THE TWO SUITABLE AREAS WILL CONTAIN ABOUT 24 MISSILES. 480 SHELTER OR 52 TRENCH AIMPOINTS. THIS AREA WOULD BE APPROXIMATELY 300-600 [illegible] AND THE ROUGH DIMENSIONS WOULD BE [illegible]



POINT SECURITY

Point security should have less impact on existing land uses and may therefore have some advantages. On the other hand, area security may have operational advantages. These environmental and operational factors will be considered, along with split basing, in deciding which security concept will be used.

Multiple Aimpoint Candidate Basing Modes, Related Ground Equipment, and Key Characteristics (2.2.5)

Two basic aimpoint configurations are being considered for mobile basing of the MX: buried trenches, and protective shelters.

The buried trench concept envisions movement of the missile within shallow-buried concrete tubes, each of which has a large number of protective structures or aimpoints. The missile, on a transporter/launcher vehicle, is moved randomly between aimpoints within the tube in such a way that its exact position cannot be determined by an aggressor by any known means (e.g., by visual observation, infrared or thermal detection, listening devices, radar, gravity, or magnetic sensors).

The aimpoint structure and its earth overburden protects the missile and its launch equipment from the airblast and radiation effects that accompany a nuclear attack. Shock isolators on the transporter launcher protect the missile from severe attack-induced ground motions. Shielding is also provided to protect the missile and its control equipment from "electromagnetic pulse" effects that could damage or disturb associated electronic equipment. Devices known as "blast plugs" seal the protective structure and prevent damage to the missile and its associated equipment if an attack breaches the concrete tube and an airborne shock wave travels within the tube itself. All aimpoints must be attacked to assure destruction of the missile.

For firing, the missile (in a protective cylinder or canister) is erected through the concrete tube and earth cover. The concrete tube is specially designed to facilitate breakout, yet provide the required protection for survival.

The shelter concept is based on moving a missile, with launch and control equipment, above ground among a large number of protective shelters. An aggressor must successfully attack all shelters to assure destruction of the missile force. Since the missile and its associated equipment are moved above ground, it must both be shielded from observation during a move, and "deceptive" moves must be made so that its actual location remains unknown. The transport vehicle thus visits many shelters to go through the motions of missile emplacement, and maintain location uncertainty.

Several possible types of shelters are under consideration, in three broad classes:

- Horizontal Shelters, in which the missiles are emplaced in sealed horizontal protective structures (earth-covered concrete tubes), and erected to fire. (The missile may be moved outside of the shelter and elevated for launch, or may break out through the structure and overburden, as in the buried trench concept.)

- Vertical Shelters, in which the missiles are emplaced in sealed vertical concrete structures. Erection is not necessary for launching.
- Pools, in which the missiles are emplaced horizontally in waterproof launchers in the bottoms of water-filled pools, and are erected for launching.

Protection against nuclear weapons effects is similar in the shelter concept to that for the trench. Radiation and airblast protection are provided by the shelter. Ground-shock and electromagnetic pulse protection are provided by shock isolators and appropriate shielding.

Within any of these concepts or their variants, power for peacetime operation is provided from commercial sources. Sufficient standby power is provided for operation during loss of commercial power, and hardened sources allow survival and launch for a considerable period after attack. Both hardened and redundant C^3 systems assure that the missiles will be launched when authorized.

Survivability of retaliatory strike-force is related to the degree of hardness of the aimpoints, the number and spacing of the aimpoints, and the number of missiles. Two different sets of such combinations were studied for this environmental statement. The first, called the nominal spacing set, would give essentially equal retaliatory capability for a postulated attack scenario, at minimum cost for each mode. The second, called the expanded spacing set, are similarly comparable for a more severe attack scenario. Table 2-1 gives the nominal values for those systems parameters which were used in this study for each of the four area security and three point security options considered. (Buried trench is not considered adaptable to point security.)

Buried Trench and Variants (2.2.5.1). Figure 2-4 shows the buried trench generic concept, based on hardened inline aimpoints. An array of buried concrete tubes (buried trenches) is shown emplaced in a dedicated (secure) area. Within each tube is a train consisting of two blast plugs, and a transporter launcher with its canisterized missile. The "breakout" concept is shown at the lower left of the figure.

At the entrance to each trench is a trench support building, connected to a primary support area by a network of roads. The trench support buildings permit limited maintenance activities to be carried out without revealing that the assigned missile is out of service. The road network allows movement of equipment and materials between the trenches and the primary support area, and also facilitates movement of the security patrols, alert reaction teams, and maintenance teams.

Environmental control facilities at both ends of each buried trench provide a constant flow of cooling air to the missile transporter launcher. Power equipment buildings provide emergency power.

Table 2-1. System parameters and their nominal values for the deployment modes considered.

PARAMETER	VALUE FOR MODE							
	HORIZONTAL SHELTER		VERTICAL SHELTER		SLOPE-SIDED POOL		HYBRID TRENCH	
	NOMINAL	EXPANDED	NOMINAL	EXPANDED	NOMINAL	EXPANDED	NOMINAL	EXPANDED
Area Security								
Missiles	250	250	230	275	205	205	198	250
Aimpoints/ Missile	19	19	20	17	26	26	52	49
Aimpoints	4,750	4,750	4,600	4,675	5,330	5,330	10,296	12,250
Spacing[1] ft	5,000	8,800	3,800	7,000	4,300	7,300	2,200/ 3,400	2,700/ 4,800
(m)	(1,524)	(2,682)	(1,158)	(2,134)	(1,311)	(2,225)	(670/ 1,036)	(823/ 1,463)
Construction Period	5 yrs	5 yrs	5 yrs	5 yrs	5 yrs	5 yrs	5 yrs	5 yrs
Point Security								
Missiles	250	250	230	275	205	205	—	—
Aimpoints/ Missile	19	19	20	17	26	26	—	—
Aimpoints	4,750	4,750	4,600	4,675	5,330	5,330	—	—
Spacing ft	5,000	8,800	3,800	7,000	4,300	7,300		
(m)	(1,524)	(2,682)	(1,158)	(2,134)	(1,311)	(2,225)		
Construction Period								

372T-1000-2

[1]Spacings for trench are given as along-trench/between-trench.

The command, control, and communications system includes both above-ground structures such as operational control centers, radio repeater links, etc. and hardened facilities such as buried antennas and cable.

Above-ground facilities for security (Figure 2-5) include security alert facilities (SAFs) maintained throughout the area to house alert reaction teams; radar intrusion detectors which overlap and provide coverage both inside and outside of the controlled area; perimeter cleared areas and fences; and patrolled perimeter roads. (Point security is not being considered for the buried trench concept.) Alert maintenance facilities (AMFs) would provide facilities and housing for alert maintenance teams for rapid repair of failed equipment, and would also monitor security status and dispatch security strike forces.

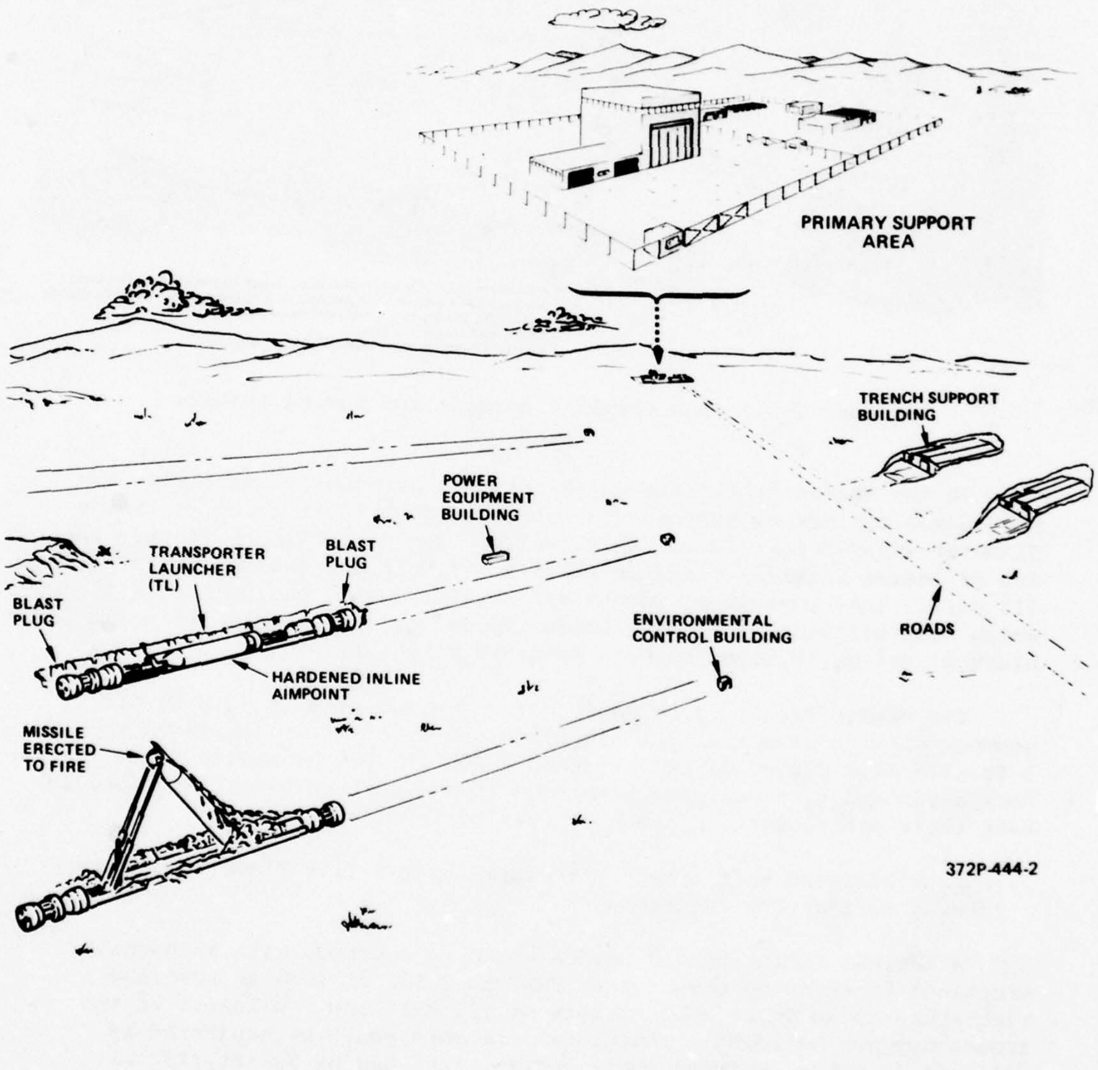


Figure 2-4. Buried trench generic concept.

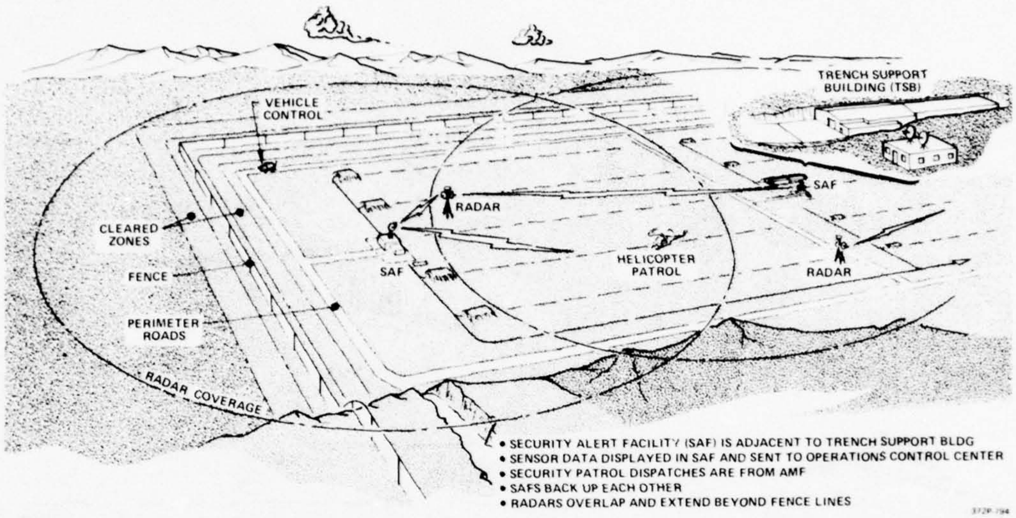


Figure 2-5. Area security concept for buried trench.

In the inline hybrid trench structure as presently conceived, the hard aimpoints are reinforced concrete cylinders 13 ft (4 m) in inside diameter with 10 in. (25 cm) thick walls. The connecting soft structures are of lesser interior diameter (11.5 ft [3.5m]) and wall thickness (6 in. [15 cm]). They contain minimum steel reinforcement, except in the floor, which must withstand the heavy loads imposed by the vehicle train (TL and blast plugs) as it moves between hardened aimpoints.

The entire trench is buried under a minimum of 3 ft (0.9 m) of compacted earth except at the aimpoints, where cover is increased to 5 ft (1.5 m). Curves of as little as 2,000 ft (610 m) radius (both horizontal and vertical) are permitted in the soft structures to facilitate their emplacement in areas of varying topography.

Both hard and soft trench structures have a flat floor to provide a running surface for the vehicles.

A nominal inline hybrid trench would be equipped with 52 hardened aimpoints (protective structures, PS), at 2,200 ft (670 m) spacings. Such a trench would be 20.3 statute mi (32 km) long, exclusive of the trench support building. Individual trenches would be separated by 3,400 ft (1,036 m) between their centerlines, and by 500 ft (152 m) end-to-end. (Precise values are subject to change as the result of continuing studies).

Figure 2-6 shows conceptual vehicles for use with the inline hardened aimpoint. The transporter launcher is 147 ft (45 m) long, 10.25 ft (3.13 m) wide, and weighs 636,000 lb (288,500 kg). It carries the canisterized missile, its erection system, propulsion and steering equipment, mobile operational support equipment, and automatic connecting equipment for the command, control, and communications circuits; pickup systems to the peacetime power supply (derived from a commercial power network); and emergency battery supplies for post-attack survival power.

The conceptual blast plugs are 42 ft (12.8 m) long, 11 ft (3.35 m) in diameter, and weigh 117,000 lb (53,100 kg). The units include a plate that expands to 13 ft (4 m) in diameter to lock the blast plugs in place at either end of the protective structure, ventilation and access ports, a ventilation system for post-attack cooling, and a propulsion and steering system.

Alternatives to the inline hybrid aimpoint structure include two types of "hybrid spurs" in which the aimpoints are not part of the buried trench proper, but can be considered as hardened shelters accessible from the buried interconnecting tube (Figure 2-7). These variants require only one blast plug, or could be secured by blast doors. This type of structure can provide increased protection against the pressure pulse accompanying an attack that breaches the tube. Various design details are being considered.

A continuous hardened trench, with steel-fiber or conventional bar-type reinforcement, has also been considered. This version has internal ribs along its entire length, for reduction of in-trench shock waves by multiple reflections and for securing the blast plugs in place. A continuous soft trench, with hardened vehicles was also studied. Operation with either option would be similar to that for the inline hybrid baseline version.

Horizontal Shelter Variants (2.2.5.2). Figure 2-8 shows the discrete aimpoint generic concept, based on a drive-out or "loading dock" horizontal shelter. The array of hardened aimpoints is shown emplaced in a dedicated (secure) area, but there is also potential for using point security. Within selected shelters, canisterized missiles are emplaced on missile launch vehicles (MLVs) that can enter and leave the shelters automatically from their special transporters, but are not designed to be moved on roads.

In this specific concept, the shelter consists of four basic elements:

- A buried reinforced concrete cylinder with a hemispherical inner end, and a flat floor to carry the MLV. The conceptual structure is approximately 158 ft (48.2 m) long with a 10 in. (25 cm) thick wall, except at the exposed end where the wall is 36 in. (91 cm) thick. The inner diameter of the cylinder is 13 ft (4.0 m)

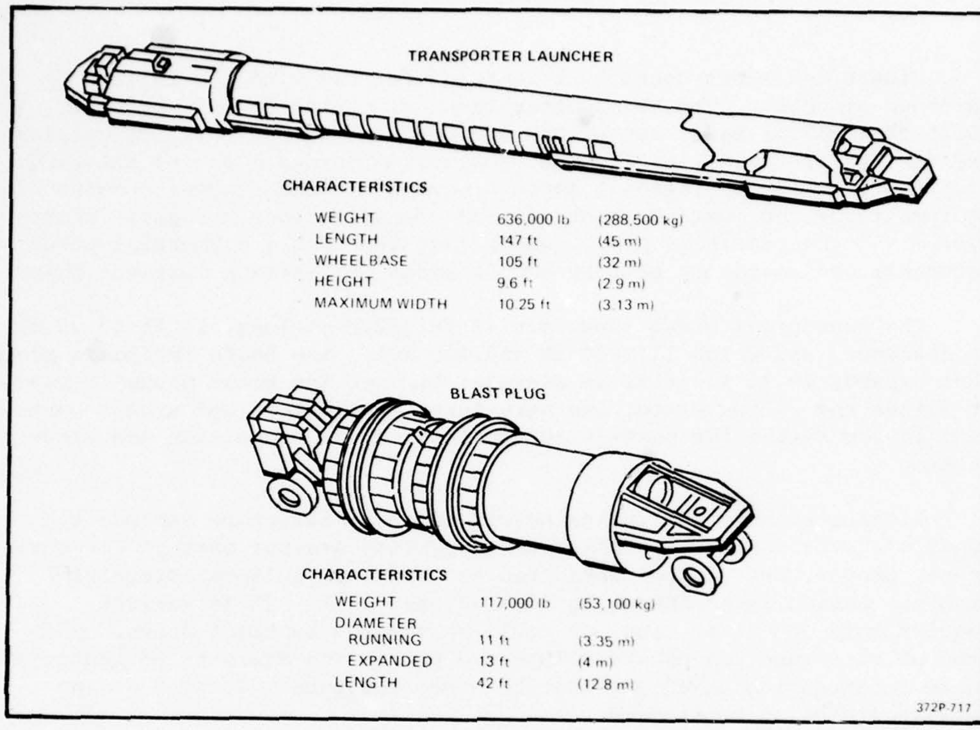


Figure 2-6. Conceptual vehicles for use with the inline hybrid aimpoint.

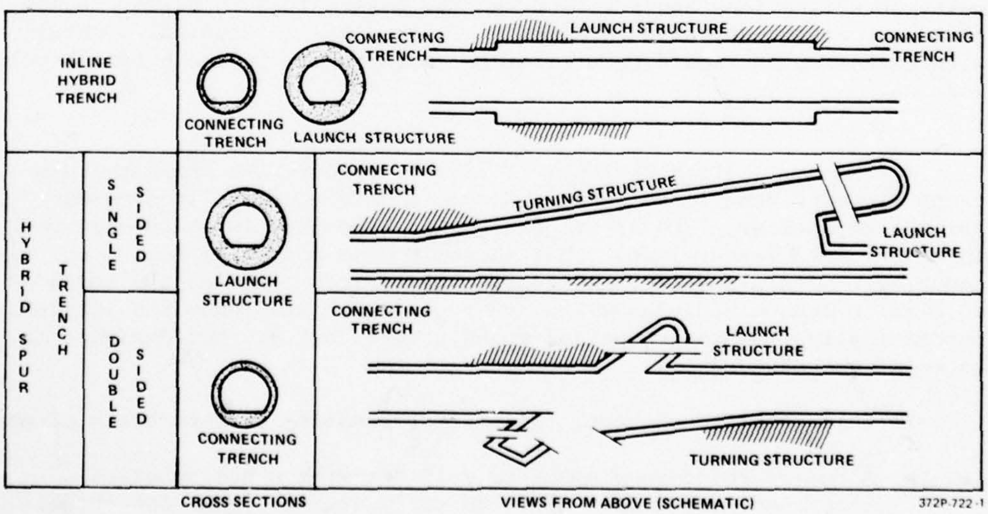


Figure 2-7. Hybrid aimpoint variants.

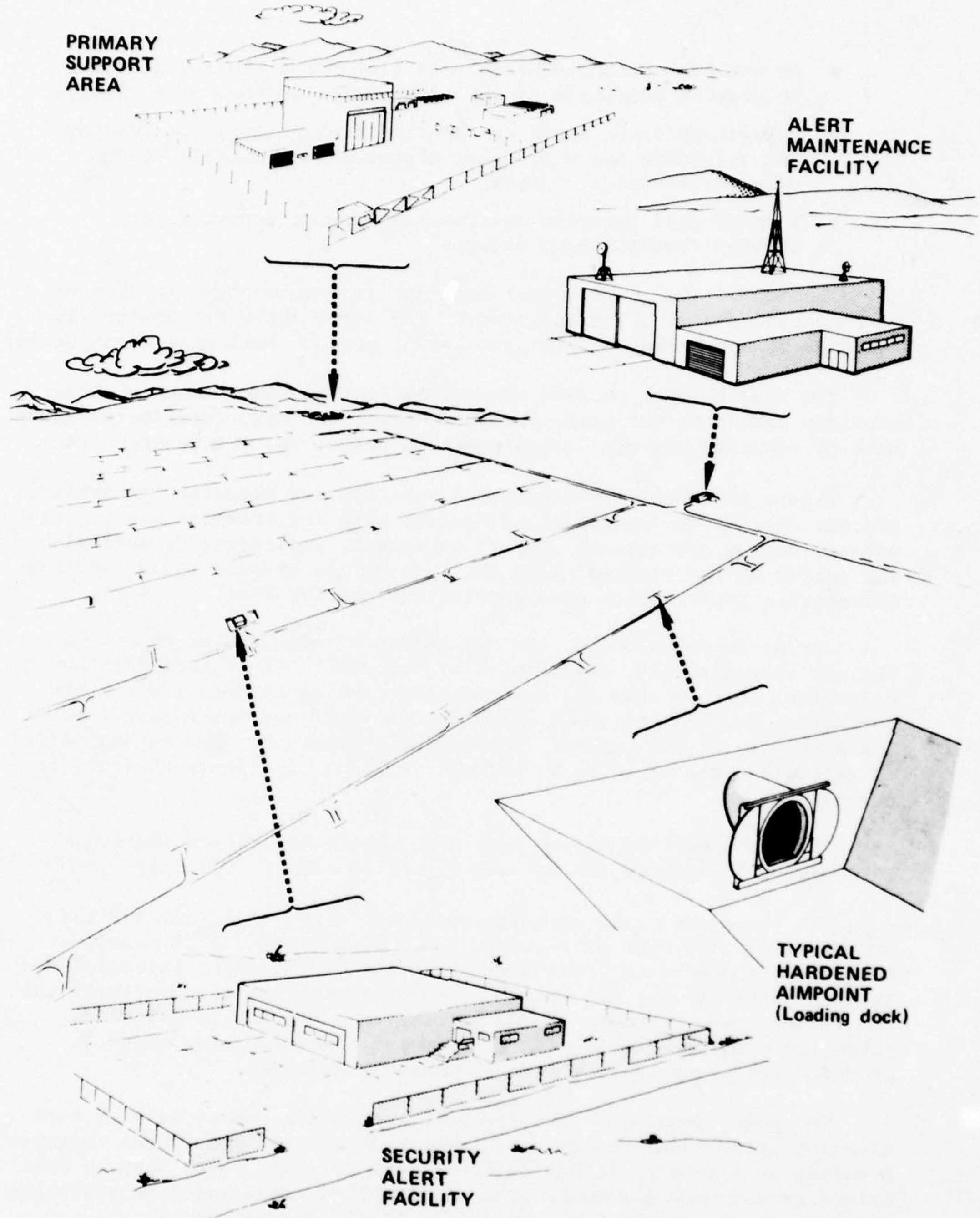


Figure 2-8. Discrete aimpoint generic concept.

- An antisurveillance shield that closes the shelter entrance to prevent detection of the presence or absence of a missile
- A level concrete apron in front of the shelter, for loading and unloading the MLV, using a specialized missile launch vehicle transporter (MLVT)
- A reinforced concrete downramp to provide access to the shelter from the road network

The top of the main shelter cylinder is covered by 5 ft (1.5 m) of compacted protective earth cover. The earth above the shelter is restored to approximately its preexisting contour following construction.

The road network permits movement of the missiles among shelters, provides access to the primary support area, and also facilitates movement of security patrols, alert reaction teams, and maintenance teams.

Figure 2-9 shows the conceptual vehicles for use with the system. The MLV carries the canisterized missile with its erection system, drive motors, mobile operational support equipment, and emergency batteries. The entire MLV is carried among shelters by the missile launch vehicle transporter (MLVT) which also carries the shelter door.

During an actual move, the MLV guides itself into or out of the shelter automatically, under cover of the MLVT. The connect/disconnect operations for the command, control, and communications circuits are automatic, so that personnel need not enter the shelter during a move. The MLVT also visits numerous unoccupied shelters to simulate moves and to maintain uncertainty as to which of the many available shelters is occupied.

The conceptual C^3 system uses both mobile and buried (hardened) antennas, and an extensive network of buried cables (See Figure 2-10).

The conceptual area security system (Figure 2-11) includes aboveground facilities such as Security Alert Facilities (SAFs) dispersed throughout the area to house Alert Reaction Teams; radar intrusion detectors which overlap and provide coverage both inside and outside the controlled area; patrols; perimeter cleared areas and fences; and patrolled perimeter roads. An Alert Maintenance Facility (AMF) is provided for approximately each 50 missiles deployed.

The point system of security would provide a fenced area at each aimpoint, with radar and other intrusion detectors, and access controls. A safety area free of inhabited structures or roads would also be maintained around each aimpoint. The uncontrolled areas would be available for appropriate compatible uses (agriculture, recreation, etc.).

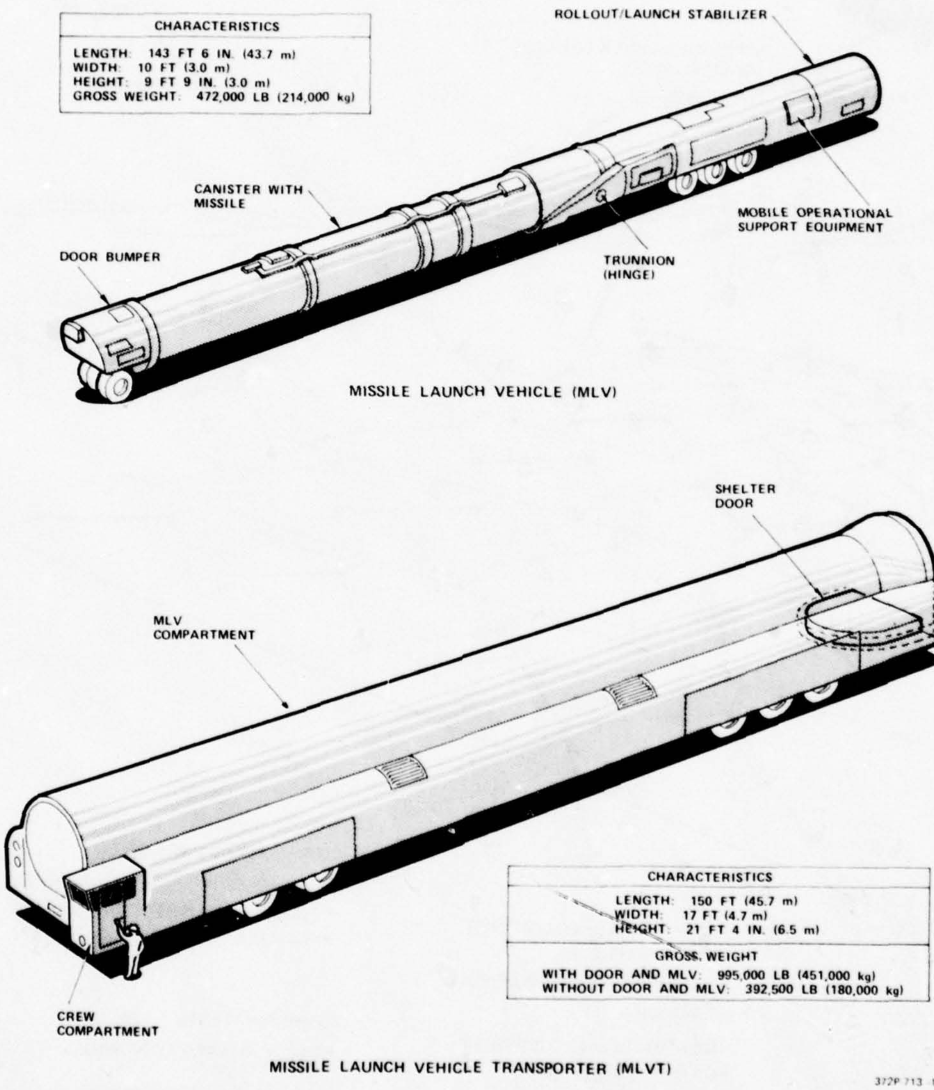


Figure 2-9. Conceptual loading dock vehicles.

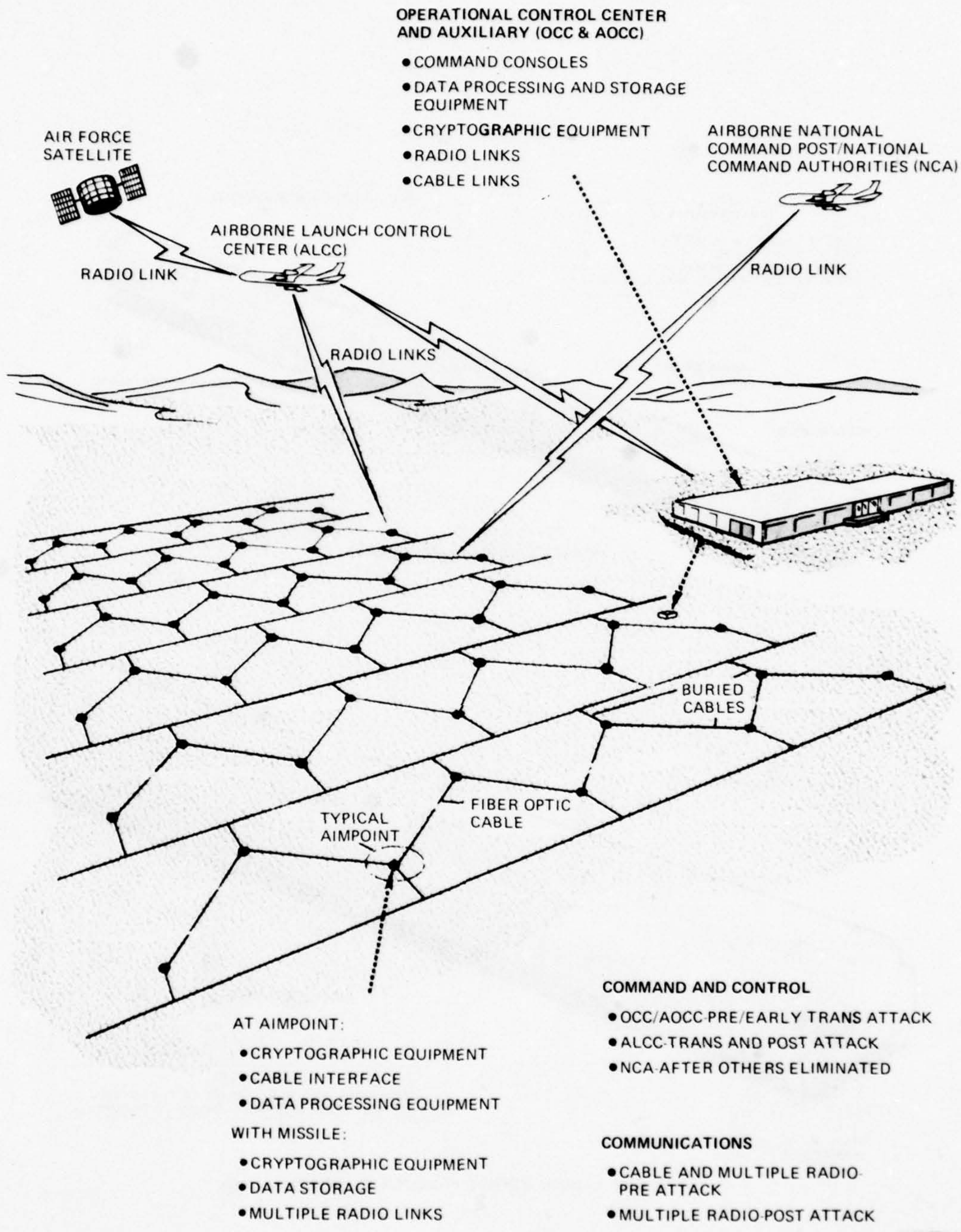


Figure 2-10. Conceptual C^3 system for discrete aimpoint concept.

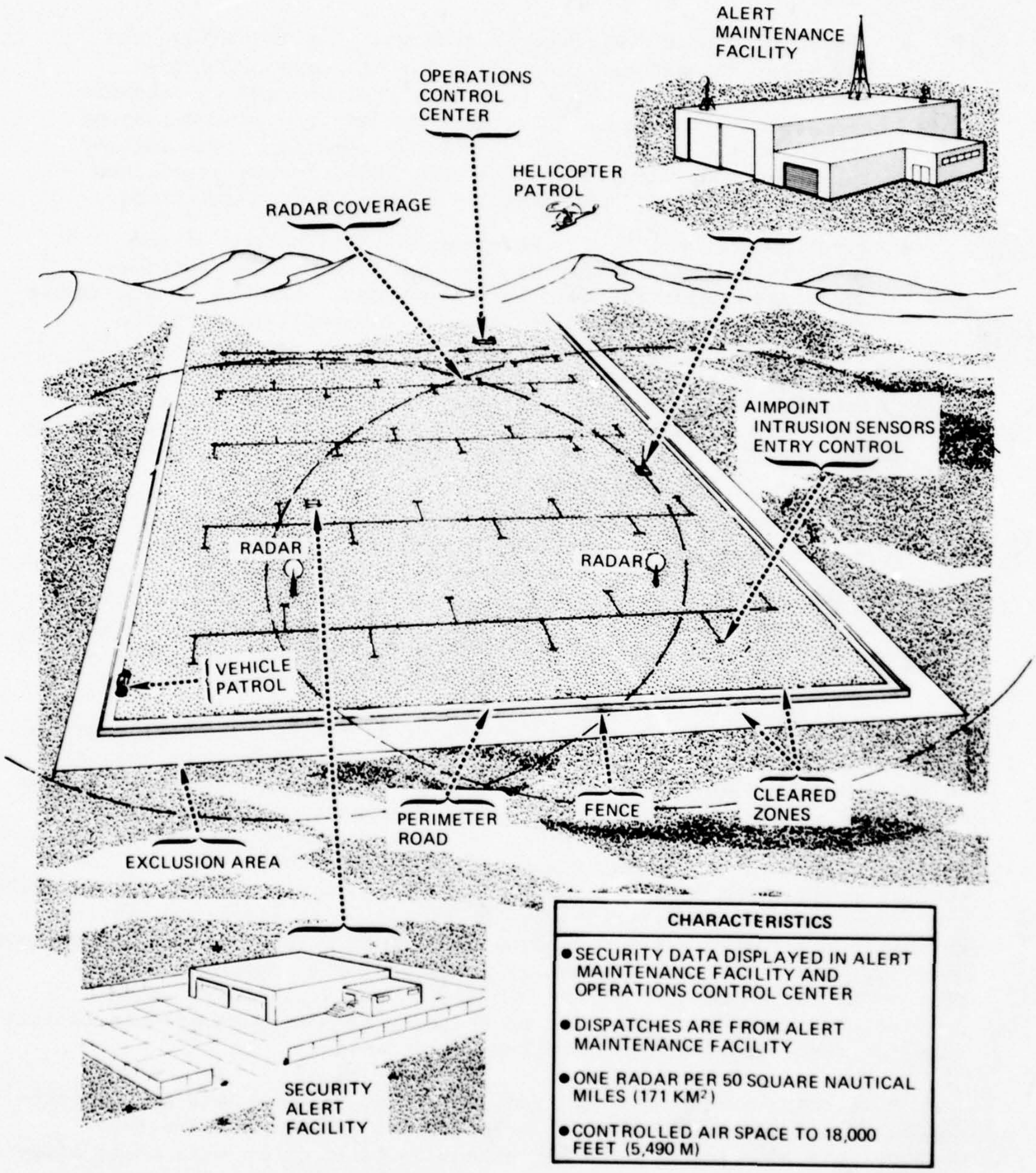


Figure 2-11. Area security concept for discrete aimpoint system.

Three variants of the horizontal shelter are under consideration (these are pictured in Figure 2-12).

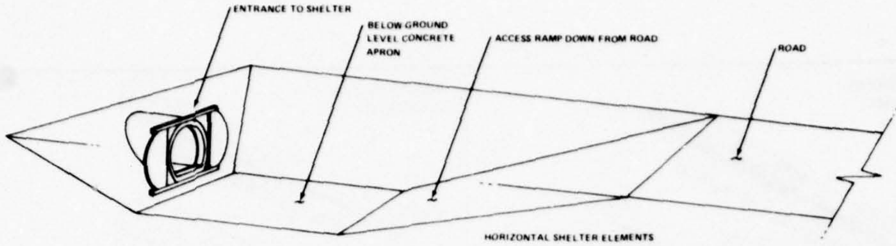
- The loading dock form described above. For launching, the MLV first "bumps" the blast door out of place. The door then falls into the space below the shelter, and the missile emerges into the space above the door and any attack-induced debris on the apron. Part of the MLV remains in the shelter to support the missile and the additional forces associated with its erection. The missile is then erected and fired.

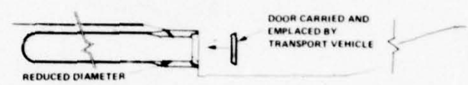
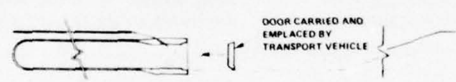
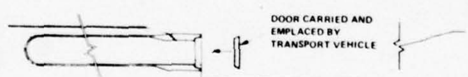
- The plowout variant. In this variant, the bottom of the shelter is approximately at the same level as the concrete apron from which the missile is emplaced. The MLV is a roadable vehicle, moved under cover of an antisurveillance vehicle (visual and radar shield). For launching, the MLV rolls out onto the concrete apron, plowing through any attack-induced debris. When the missile clears the shelter, it is erected and fired. A larger-diameter shelter is required to accommodate the roadable MLV, so that more materials are required as compared with the loading dock.

- The "breakout" concept. This configuration is similar to a section of buried trench that acts as a shelter. For launching, the missile breaks out through the structure and earth overburden to its firing position, as in the buried trench concept. Both the loading dock (non-roadable vehicle) and plowout (roadable vehicle) shelter concepts are applicable to this variant.

In addition to the possible variations in horizontal shelter design, there are also two possible variations in the protective door concept. In the fixed-door plowout concept, each shelter is equipped with a heavy blast door, which is opened by permanent equipment installed in the shelter itself. As an alternative, the blast doors can be carried from shelter to shelter with the missile, so that only those shelters that require a heavy and expensive blast door are so equipped (see Figure 2-12). (The others are fitted with deceptive shields.) In normal operation, the blast doors are carried, removed, and emplaced by the missile transport vehicle. Where emergency egress is required for a launch, the blast door is either plowed out by the missile launch vehicle or, in the loading dock concept, pushed out of place by the emerging missile to fall into the space provided for attack-induced debris.

More complex vehicles with heavier loaded weights, and more weight-capable roads are required with carry-door vs. fixed-door shelters. However, the need for massive and expensive blast doors with their associated actuation mechanisms at every shelter is eliminated, potentially resulting in net cost reductions. Figure 2-13 shows conceptual vehicles for use with the horizontal plow-out shelter variants.



TYPE	CONCEPT (SCHEMATIC)	LAUNCH SEQUENCE
DRIVE-OUT SHELTER, (LOADING DOCK)		• DOOR FORCED OUT BY EMERGING MISSILE, DROPS TO APRON • MISSILE EMERGES, ERECTS AND FIRES*
PLOW-OUT SHELTER, FIXED DOOR		• DOOR OPENS • MLV PLOWS OUT ONTO APRON • MISSILE ERECTS AND FIRES
PLOW-OUT SHELTER, CARRY DOOR		• MLV WITH DOOR PLOWS OUT ONTO APRON • MISSILE ERECTS AND FIRES
BREAK-OUT SHELTER, (LOADING DOCK)		• DOOR REMAINS IN PLACE • MISSILE BREAKS OUT THROUGH STRUCTURE AND OVERBURDEN, FIRES IN PLACE
BREAK-OUT SHELTER, FIXED DOOR		SAME AS ABOVE
BREAK-OUT SHELTER, CARRY DOOR		SAME AS ABOVE

*PART OF VEHICLE REMAINS IN SHELTER TO SUPPORT MISSILE AND ERECTION FORCES 372P-711-2

FEATURES:

- LOADING DOCK DOES NOT REQUIRE ROADABLE MISSILE LAUNCH VEHICLE, CAN THUS HAVE REDUCED INSIDE DIAMETER, REQUIRES LESS MATERIAL, LESS COST TO CONSTRUCT
- CARRY DOOR REQUIRES ONLY ONE DOOR PER MISSILE VS. ONE DOOR PER SHELTER, REDUCED DOOR COST, INCREASED VEHICLE AND ROAD COST.
- BREAKOUT ELIMINATES UNCERTAINTIES ASSOCIATED WITH DEBRIS, BUT INTRODUCES UNCERTAINTIES ASSOCIATED WITH BREAKOUT.

Figure 2-12. Horizontal shelter variants.

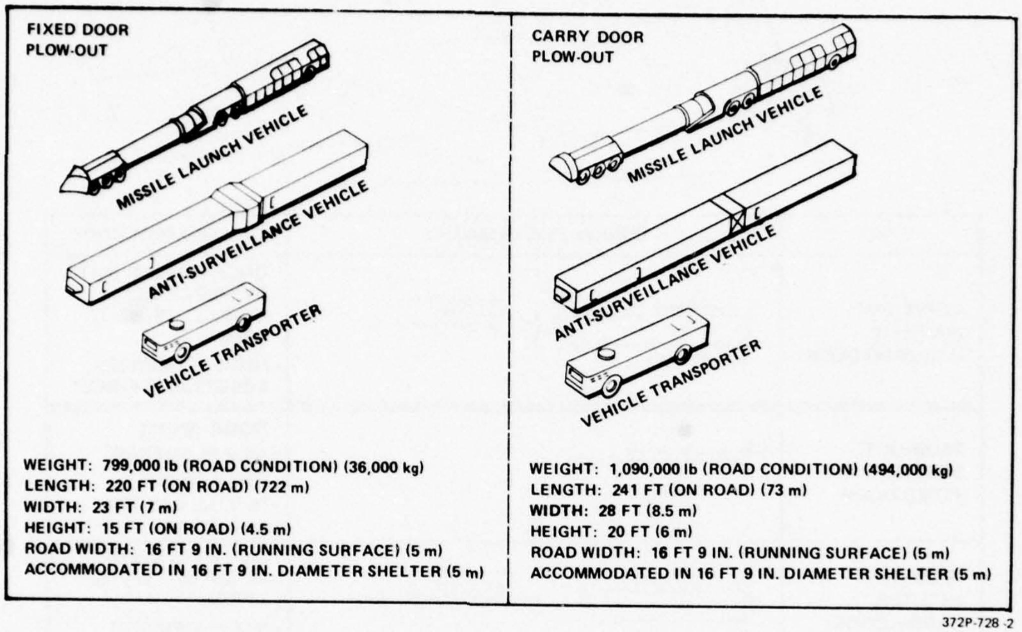


Figure 2-13. Typical conceptual horizontal plow-out shelter vehicles.

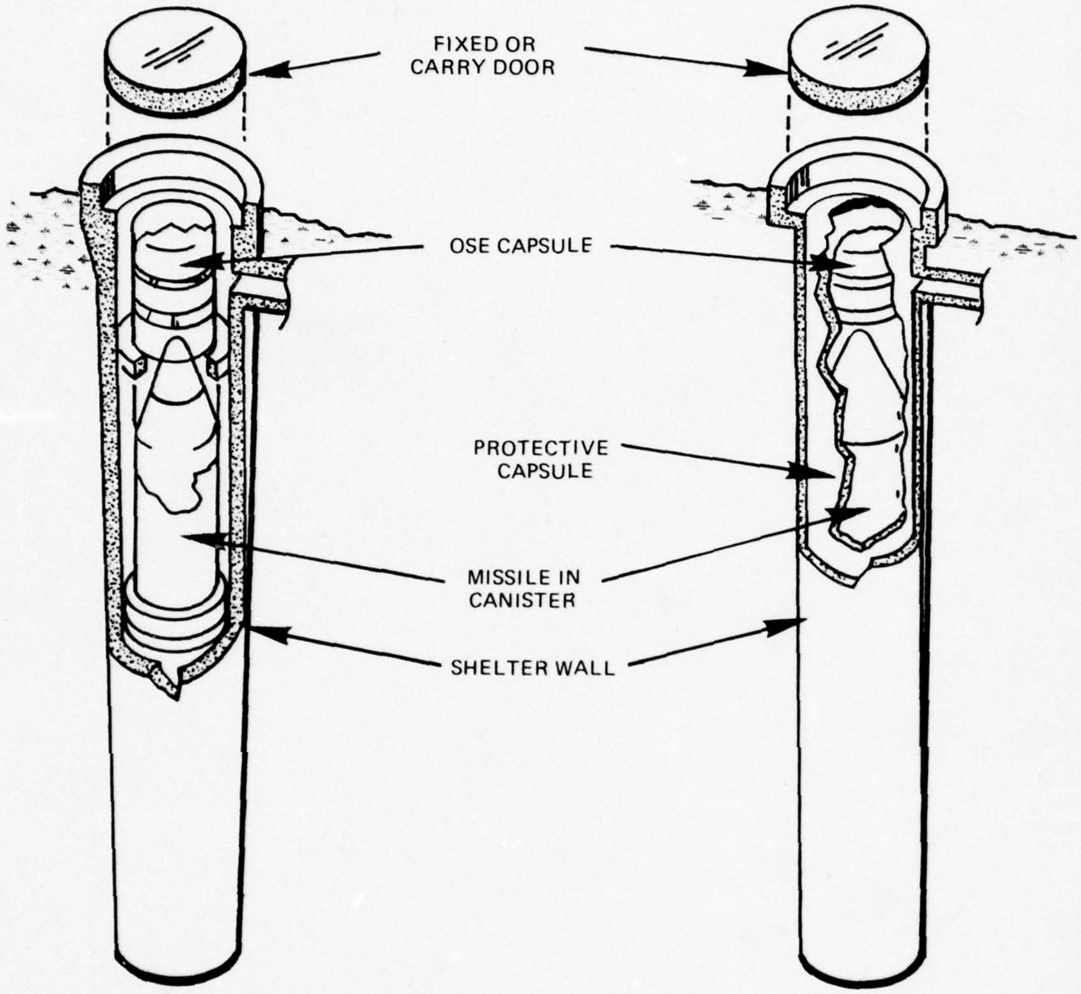
Vertical Shelter Variants (2.2.5.3). Vertical shelters are also being considered as discrete aimpoints. There are two variants of this concept:

- The hard vertical shelter, in which most of the protection to the missile is provided by the strength of the structure proper.
- The soft vertical shelter, with a lesser degree of inherent structural protection, but with additional protection carried with the missile.

The fixed-door vs. carry-door option also applies to either type of vertical shelter, so that there are four potential variants.

The shelter (Figure 2-14) site includes:

- A maneuvering area for the transport vehicles.
- A reinforced-concrete cylindrical vertical shelter for the canisterized missile with its onboard Operational Support Equipment (OSE).
- A circular concrete pad around the vertical shelter entrance, to carry the loads associated with missile/OSE emplacement and removal.



HARD

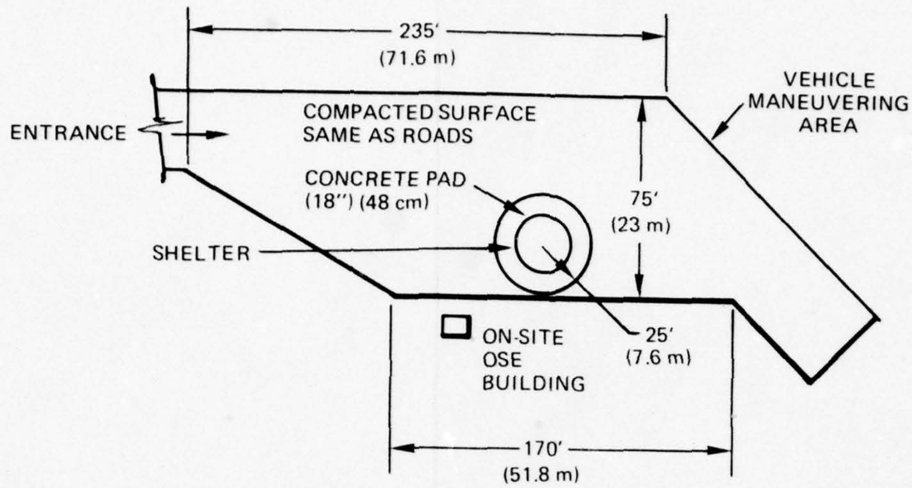
SOFT

HARD AND SOFT VERTICAL SHELTER ELEMENTS

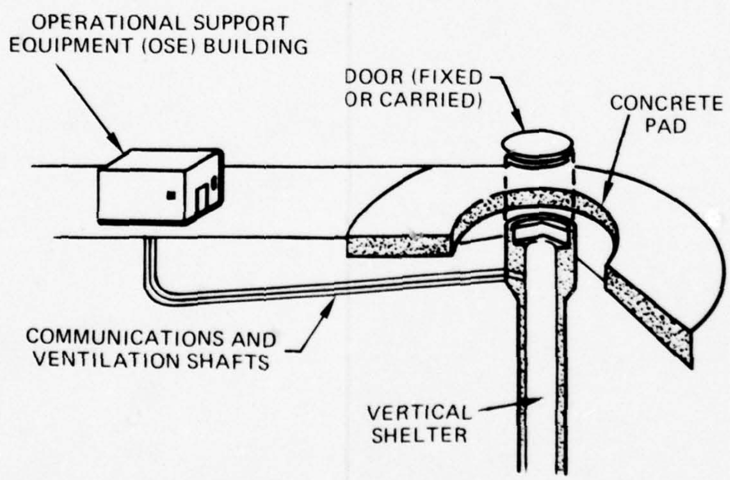
FEATURES:

- POTENTIALLY LEAST COST
- BEST KNOWLEDGE OF DESIGN CHARACTERISTICS:
- GREATER CONFIDENCE IN HARDNESS COULD LEAD TO REDUCED SPACING, USE OF LAND
- CARRY-DOOR/FIXED-DOOR OPTIONS APPLY

/



HARD FACILITY SITE PLAN



CONCEPTUAL ELEMENTS

372P-718-2

Figure 2-14 Vertical shelter elements and variants.

2

- A "soft" operational support equipment (OSE) building, which provides onsite OSE, and related functions for peacetime operation.

A typical hard vertical shelter would be approximately 125 ft (38 m) deep, with an inside diameter of 13 ft (4 m) and a 9 in. (23 cm) thick wall. A 2 ft (60 cm) thick reinforced concrete floor would support the loads imposed by an emplaced missile, and thicker walls would be provided at the top to withstand attack effects and support the blast door. A larger inside diameter would be necessary for the soft shelter, to accommodate the protective capsule that would surround the canisterized missile, and correspondingly thinner shelter walls would be provided.

Special transporter vehicles for vertical shelter options would be designed to carry the missile horizontally, erect it over the shelter, and insert the missile into place. Figure 2-15 shows a conceptual transporter/emplacer vehicle, and Figure 2-16 shows a typical emplacement sequence.

On a command to launch, the canister is raised by actuation of a hoist, carrying the blast door and OSE capsule above the debris. The blast door and OSE capsule are then jettisoned at a sloped joint, falling free of the shelter and the missile is then ready to launch. Figure 2-17 shows a conceptual launch sequence.

Pool Variants (2.2.5.4). Emplacement of missiles in water-filled pools is also being considered as a discrete aimpoint concept. In this concept, the missiles with their on-board operational support equipment would be carried in pressurized, waterproofed capsules resting on the pool bottoms. The pools would provide both air blast and radiation protection during an attack.

Two variants of the pool concept have been considered:

- The slope-sided pool, in which the water is contained by a suitable liner. The Missile Launch Platform (MLP) is emplaced by a Platform Transporter (PT) that enters the pool on a concrete ramp.

- The vertical-wall pool, in which the water is contained by a reinforced-concrete structure. The Missile Launch Platform is emplaced by a Platform Transporter that drives over the pool, and lowers the Missile Launch Platform to a submerged concrete floor.

The vertical-wall pool requires less water than the slope-sided pool, and the Platform Transporter does not need to enter the water. However, as compared with the slope-sided pool, more materials are required, emplacement of the Missile Launch Platform is more difficult,

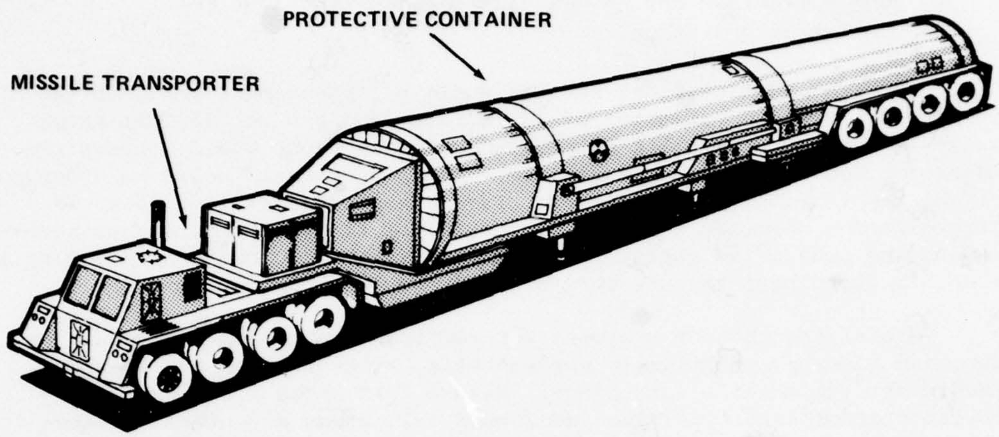


Figure 2-15. Conceptual vertical shelter transporter/emplacer.

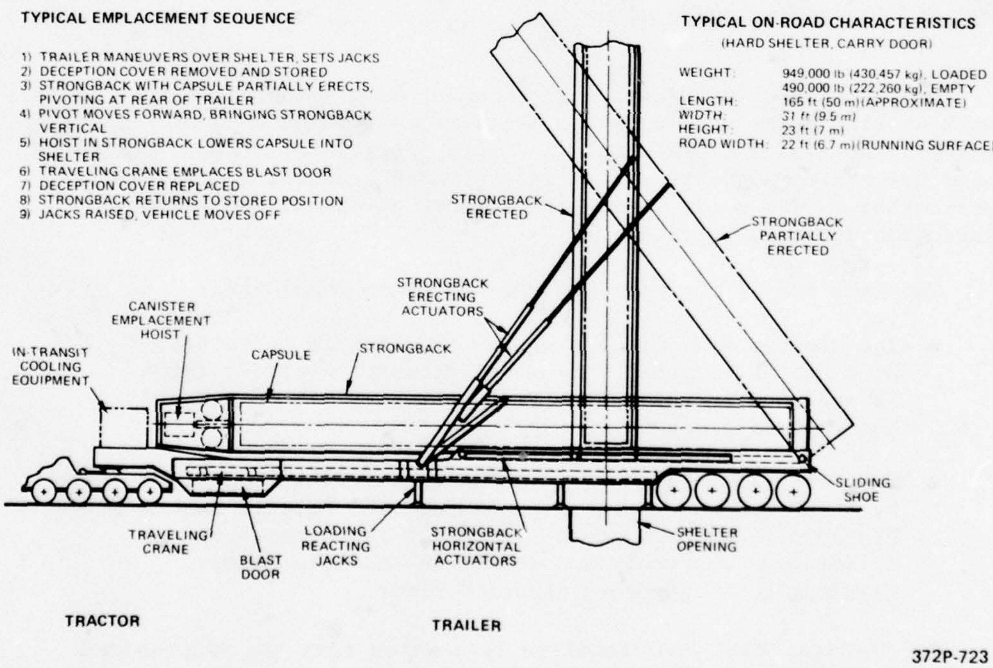


Figure 2-16. Conceptual vertical shelter emplacement sequence.

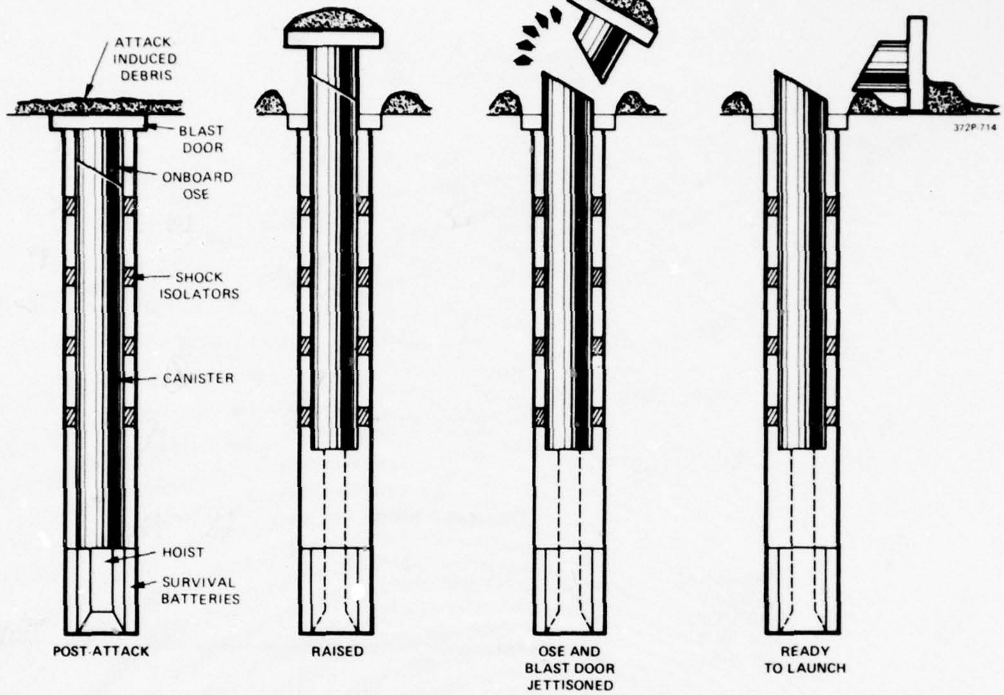


Figure 2-17. Conceptual vertical shelter launch sequence.

and deception during emplacement is harder to achieve. There is also substantial uncertainty with respect to pool-wall failure under attack, which could either damage the Missile Launch Platform or expose its location through loss of water. In view of these factors, only the slope-sided pool concept is under serious consideration.

For the slope-sided pool concept (Figure 2-18) the pool proper is excavated below ground level, with the excavated material used to construct a dam-like berm at its periphery to minimize earth-handling requirements. A reinforced-concrete ramp, 30 ft (9 m) wide and 12 in. (30 cm) thick, provides access to a similar level pad on the bottom of the pool for emplacement of the Missile Launch Platform.

The sloped sides inside the pool are waterproofed with a plastic liner. The pool is 24 ft (7.3 m) deep and is filled to a depth of 21 ft (6.4 m), requiring approximately 2.2 million gallons (10,000 m^3) of water. An above-ground Operational Support Equipment building provides on-site command, control and communications equipment; a well for pool-water supply; and water-heating and filtration equipment. A metalized plastic pool cover, approximately 2 ft (60 cm) below the surface, provides protection against both visual and radar observation.

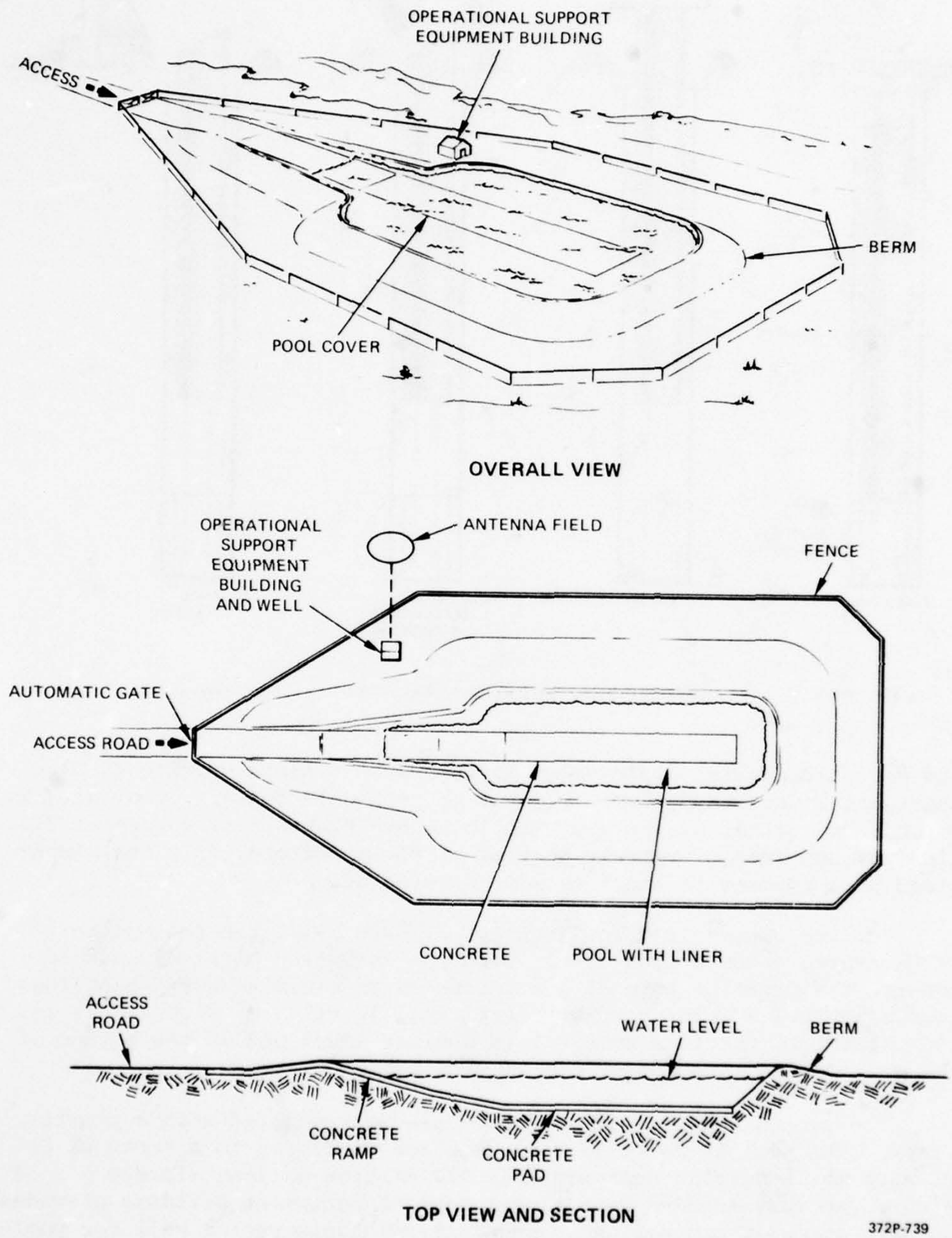


Figure 2-18. Slope-sided pool concept.

The entire aimpoint facility, except for a buried antenna, is enclosed by a fence adequate to exclude roving animals and to minimize the amount of debris that blows into the pool.

Again, special transport vehicles would be required (Figure 2-19). To emplace the Missile Launch Platform, the entire Platform Transporter enters the pool along the concrete ramp provided, to a position on the level concrete pad at the pool bottom. If the transporter is loaded, sufficient water is taken aboard so that the water level in the pool does not change by more than the amount associated with entry of an unloaded unit. The Missile Launch Platform is then emplaced, and a door at the end of the PT opened to provide clearance for drive-out over the MLP. The vehicle is then driven (and winched) out of the pool, to move to its next position.

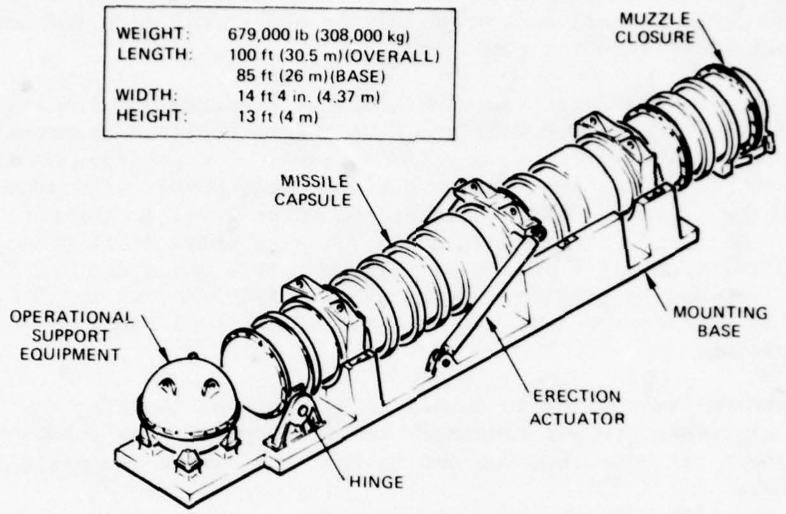
The Platform Transporter is double-ended, so that "backing" or turn-around maneuvers are not required, and its top does not submerge, so the operators can move from one end to the other while the vehicle is in the pool.

On a command to launch, the waterproof missile capsule is erected by gas-generator powered actuators, the muzzle closure is opened, and the missile is fired.

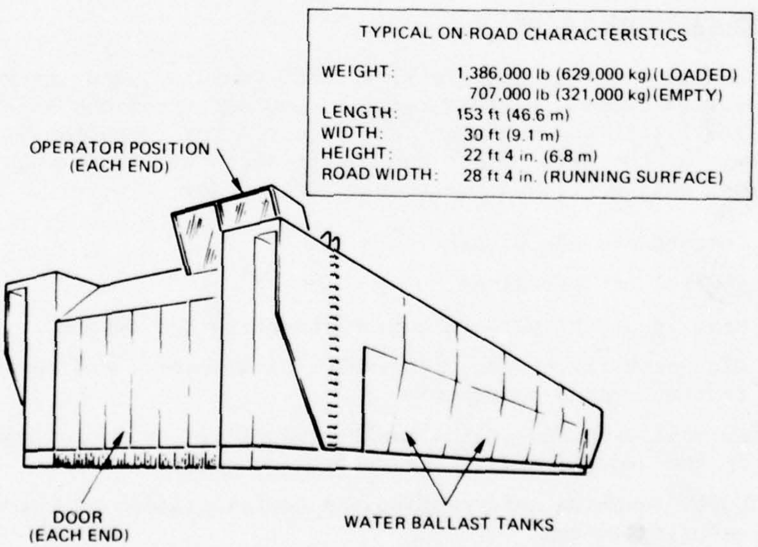
Support Facilities (2.2.6)

In addition to the aimpoints, special vehicles, and interconnecting roads described above, a broad range of support functions with their related facilities and equipment are required for operation of a complete MX system. At the site proper and in its vicinity, these include the facilities, equipment, and personnel required for:

- Command and administration
- Control of operations
- Missile assembly, checkout, maintenance and repair
- High-security storage, assembly, disassembly, and repair of reentry system components
- Surveillance and status monitoring of all personnel and vehicles on the ground, and in the controlled airspace
- Quick-reaction interception and neutralization of intruders by security forces
- Quick-reaction maintenance of critical equipment
- Logistics support (handling, storage, transport of equipment and supplies)



CONCEPTUAL MISSILE LAUNCH PLATFORM (POOL)



CONCEPTUAL MISSILE LAUNCH PLATFORM TRANSPORTER

372P-740

Figure 2-19. Conceptual missile launch platform and platform transporter for pool.

- Electrical power (commercial distribution net, standby during outages)
- Training
- Billeting, messing, and recreational facilities for on-duty personnel in the basing area
- Housing, shopping, medical, recreational and related services for assigned personnel and their families.

Some of these functions must be provided in the deployment area proper. Others are appropriate for an Air Force Base adjacent to the deployment area. If the Air Force Base is at a reasonably short distance from the deployment area, a choice can be made respecting still other functions, depending on the conditions at the selected site.

Within these restrictions, the following types of facilities have been identified:

- The Air Force Base (Strategic Missile Support Base, SMSB).
- A primary support area (PSA) in the deployment area, for missile and reentry vehicle assembly and maintenance, and such other functions as may be appropriate.
- Alert maintenance facilities (AMFs), housing quick-reaction maintenance teams and security alert teams. These facilities include continuous displays of surveillance and detection data, stock spare parts, and have the necessary equipment for undercover in-field repair of vehicles. They also have the vehicles, equipment, and weapons to support a quick-reaction maintenance and a security alert team. The number of AMFs is determined by the size of the deployment area, and the selected response times for the quick-reaction maintenance teams. (Approximately one per 50 missiles.)
- Security alert facilities (SAFs), housing quick-reaction security alert teams with their vehicles and weapons. A sufficient number of SAFs are dispersed within the deployment area to permit interception of an intruder within no more than 15 minutes. Security alert teams are dispatched from the corresponding AMF.
- Commercial electrical power distribution facilities, including transmission lines and onsite substations, for peacetime operation. (These facilities would be supplemented with on-site diesel-powered generators to permit normal operation during commercial power outages without degrading the post-attack survival time of the system.)
- Auxiliary operational control centers (AOCCs), to provide command, control and communication functions if the system is deployed in a widely dispersed area.

• An onsite assembly building for the special vehicles.

A conceptual primary support area and adjacent Air Force Base are shown in Figure 2-20. The PSA is a high-security onsite area for missile assembly and onsite maintenance and repair, including assembly, surveillance, and inspection of the reentry vehicles. Headquarters, operational control center, major maintenance, supply, and rail-air offloading facilities are provided at the Air Force Base. Some of the base functions would be transferred to the PSA if the base were relatively remote from the deployment area.

Deployment (2.2.7)

Deployment of the MX system will require very large areas with suitable geological conditions and very low population densities. The entire conterminous United States has received an initial screening to identify potentially suitable areas from an engineering and population

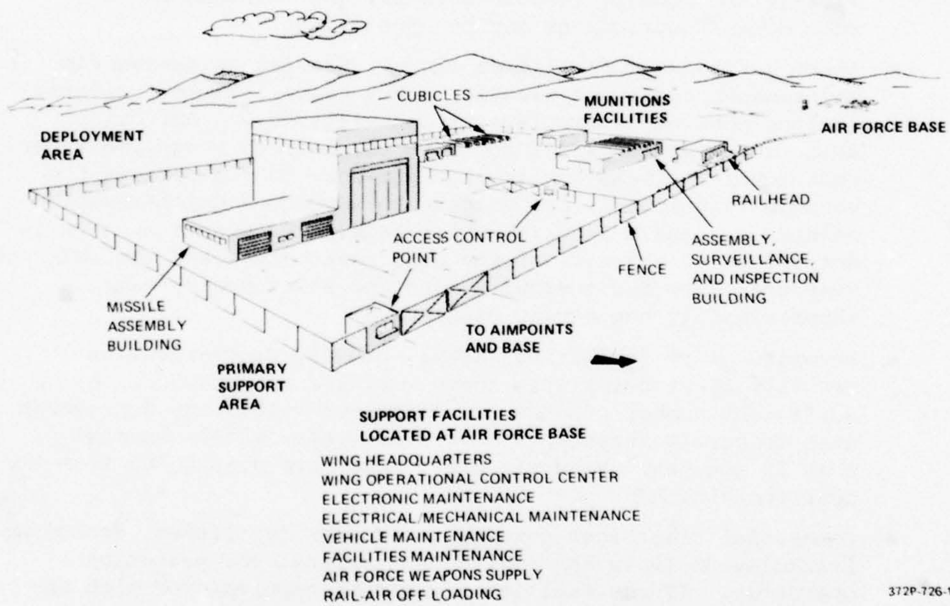


Figure 2-20. Conceptual primary support area and adjacent Air Force Base.

standpoint. All potentially appropriate areas fall in the western states and have been categorized according to physiographic features. Sample areas have been selected as representative of each of the seven physiographic provinces in which potentially suitable areas have been found. Figure 2-21 shows all suitable areas plus the seven areas selected for preliminary evaluation and identified as Basing Mode Comparison Areas (BMCAs). These seven BMCAs have been examined in relation to the impacts which would result from deployment of each of the proposed basing modes, and this is the subject of Volume IV of this DEIS. Deployment of the entire system in each BMCA has been considered as the probable potential project. However, depending upon the system size needed, land acquisition and environmental effects, only a portion of the total deployed force may be installed in any given area ("Split Basing").

The suitable areas were selected by a screening process that considered cultural, economic, and basing feasibility factors, as summarized in Table 2-2. These factors were chosen to minimize environmental and social disruption, and apply to both area and point security. The BMCAs represent samples of these areas for use in comparison of the environmental effects of the various basing options. They are not "selected" or "candidate" areas. The basing site (or sites) is to be chosen at a later date, and the resultant impacts will be addressed in a subsequent Environmental Statement.

Exclusion area land requirements will vary according to the basing mode selected, the survivability desired, the type of security used, and the terrain restrictions within the siting area. The nominal system parameters described for each basing mode in Section 2.2.5 give approximately equal but differing surviving retaliatory capabilities for the nominal and extended spacings shown on Table 2-1. Table 2-3 shows the approximate amounts of land required for each mode shown on that table. "Fenced Area" refers to the area from which unauthorized personnel would be excluded. "Safety Area" refers to the regions around each point security aimpoint from which habitations are excluded, but are otherwise available for public use.

Terrain features influence the area required for deployment, and are more restrictive for trenches than for shelters. For example, in an area with irregular boundaries, shelters can be fitted into spaces along the edges, but trenches (limited to 2,000 ft (610 m) radius curves) cannot, nor can they follow sharply curving edges.

Personnel Support Requirements (2.2.8)

The MX system would be operated by the Strategic Air Command (SAC) of the United States Air Force, with necessary support from other commands such as the Air Force Logistics Command. Operational requirements would involve a wide range of functions, including system operation proper,

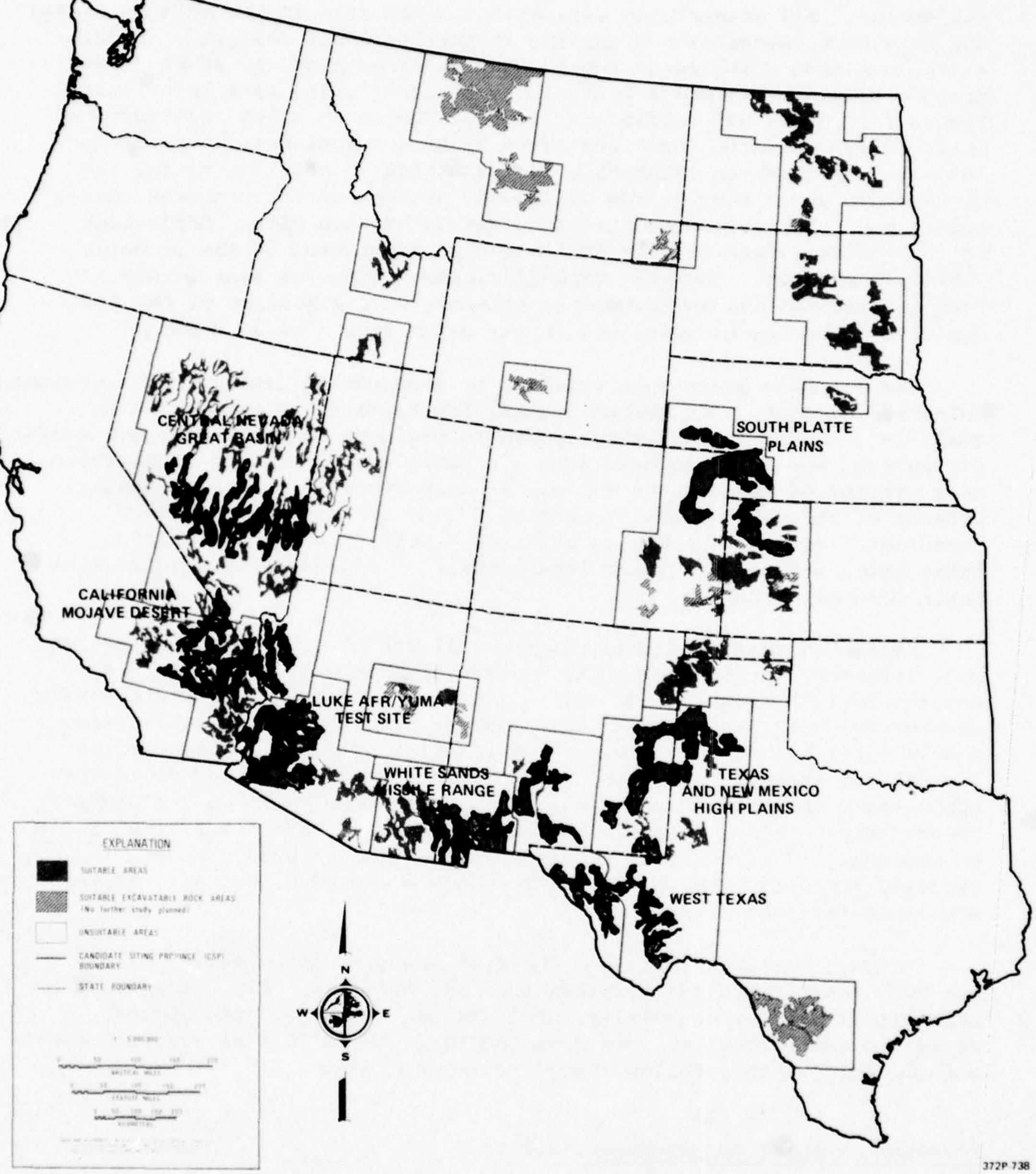


Figure 2-21. Locations of all potential basing areas and the seven selected BMCAs. All suitable land has the same probability of site selection at this time. BMCAs are for comparative purposes only.

Table 2-2. Siting criteria (exclusion areas)

- All significant federal and state parks, monuments, forests, grasslands; historic sites; game preserves and refuges; public lands set aside to preserve areas with unique recreational, historical, and natural values; and areas within 1 nautical mile (1.15 mile, 1.8 kilometer) of their boundaries.
- Indian reservations, and areas within 1 nautical mile of their boundaries.
- Communities, and areas within:

Populations (1970)	Distance
25,000 or more	18 nm (20.7 miles, 33 km)
5,000 - 25,000	3 nm (3.5 miles, 5.6 km)
less than 5,000	1 nm (1.15 miles, 1.8 km)

- Areas within 5 nautical miles (5.75 miles, 9.2 km) of international borders.
- High potential economic resource areas including oil and gas fields, strippable coal, oil shale and uranium deposits, and known geothermal resource areas, and within 1 nautical mile of their boundaries.
- Industrial complexes such as active mining areas, tank farms, and pipline complexes, and within 1 nm of their boundaries.
- Areas with rock or water within 50 ft (15 m) of the surface (150 ft, 46 m, for vertical shelters)
- Areas with slopes exceeding 10 percent, or otherwise unsuitable topography (numerous steep slopes, deep drainages).
- Areas within 1 nautical mile (1.15 miles, 1.8 km) of major buried and surface electrical transmission lines ($\geq$ 115 kV), communication lines, oil and gas pipelines ($\geq$ 4 inch dia.), state and federal paved highways, railroads, large energy or water conveyance projects, military bases, missile sites.

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Table 2-3. Estimated Area Requirements for MX square miles (square kilometers' equivalents in parentheses)

BASING MODE	SPACING	AREA SECURITY	POINT SECURITY (1)	
		FENCED AREA	FENCED AREA	SAFETY AREA
Horizontal Shelter	N	6,175 (15,993)	35 (91)	4,706 (12,189)
	E	19,128 (49,542)	35 (91)	4,706 (12,189)
Vertical Shelter	N	3,959 (10,254)	21 (54)	4,557 (11,803)
	E	13,653 (35,361)	21 (54)	4,632 (11,997)
Slope-Sided Pool	N	5,125 (13,274)	40 (104)	5,280 (13,675)
	E	14,770 (38,254)	40 (104)	5,280 (13,675)
Hybrid Trench	N	5,422 (14,042)	—	—
	E	11,178 (28,951)	—	—

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(1) Does not include road requirements

N = Nominal Spacing

E = Expanded Spacing

maintenance and repair, security, personnel support, and the like. Personnel requirements would be smallest for the buried trench, since, among other factors, the transporter launchers move automatically on command (are unmanned), and maintenance requirements are lower than for the other options. Personnel requirements are higher for point security and for extended spacing, because of requirements for additional security and maintenance forces and because of the longer times required to make deceptive moves in the shelter options.

Estimated personnel requirements are shown in Table 2-4:

Table 2-4. Estimated operational personnel requirements for MX.

BASING MODE	AREA SECURITY		POINT SECURITY	
	NOMINAL	EXPANDED	NOMINAL	EXPANDED
Horizontal Shelter	5,000	10,150	6,400	13,000
Vertical Shelter	4,400	8,900	5,600	11,400
Slope-Sided Pool	5,700	11,500	7,300	14,700
Hybrid Trench	4,200	5,650	—	—

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2.3 ACQUISITION OF DEFENSE SYSTEMS

Major System Acquisition Process, Milestones, and Phases (2.3.1)

Acquisition of Major Systems by the Department of Defense (DOD) is controlled by the provisions of DOD Directives 5000.1 ("Major Systems Acquisitions") and 5000.2 ("Major Systems Acquisitions Process"). These Directives implement the Office of Management and Budget (OMB) Circular A-109 ("Major Systems Acquisitions") which establishes policies and procedures intended to reduce cost overruns and to diminish controversy over whether or not new systems are needed.

OMB Requirements (2.3.1.1). Figure 2-22 gives an overview of the acquisition process as established by the Office of Management and Budget (OMB), Circular A-109, April 5, 1976, and as implemented by the Air Force for major weapon systems. The figure uses the USAF terminology for the required major decision points known as milestones.

OMB Circular No. A-109 requires a continuing analysis of current and continuing mission responsibilities by each agency. This analysis considers current and forecasted mission capabilities, technological

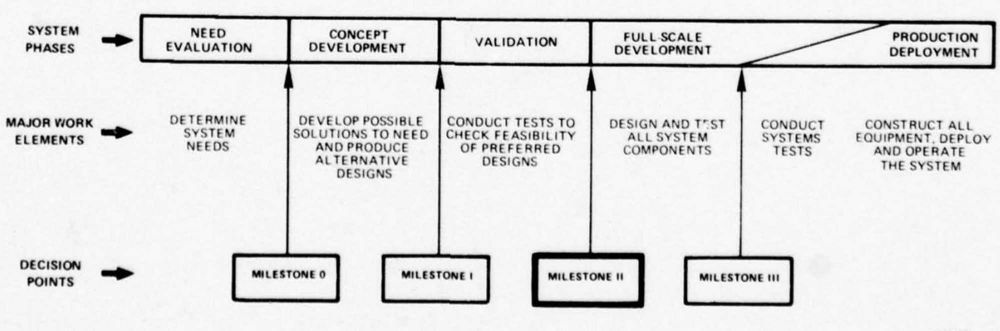

Figure 2-22. Major system acquisition cycle requirements as implemented by the USAF.

opportunities, overall priorities, and resources that are involved. When the analysis identifies a deficiency in existing agency capabilities or an opportunity to establish new capabilities in response to a technologically feasible opportunity, a formal *mission need statement* is produced.

The mission need statement includes the mission purpose, capability, agency components involved, time constraints, value or worth of meeting the need, relative priority, and operating constraints.

The mission need statement is submitted to the agency head for approval, the first key decision (Milestone 0, Figure 2-22). Approval of the mission need statement allows the designated agency components to move forward with the confidence of having a recognized need. The need is then normally communicated to Congress during the budget process. This permits Congress to consider the major needs of all agencies and to make the decisions to initiate new acquisition programs on a comparative basis. The objective is to have any issues requiring debate by Congress regarding needs occur early in the major system acquisition process before the commitment of major resources toward developing solutions.

Approval of the mission need starts the major system acquisition process by granting authority to explore alternative system design concepts. The feasibility of alternative systems is explored to the point where risks can be accommodated and progress indicates that a proof of concept demonstration is in order. At this point, the concepts recommended for demonstration are submitted to the agency head for approval, along with the other alternatives which were identified and evaluated. The second key decision (Milestone I) is then made to proceed with demonstrations to verify that the chosen concepts are sound, perform in an operational environment, and provide a basis for selection of the system design concepts to be confirmed into full-scale development. The scope of these activities is tailored to the needs of the program. A reaffirmation of the mission need and the program objectives is required at the decision point.

Once the demonstration has verified that the system concept(s) is sound and the risks are acceptable, the agency head may authorize full-scale development and initial production of end items for test and evaluation in an environment that assures effective performance in expected operational conditions. This is the third key decision (Milestone II), and must be accompanied by a reaffirmation of the mission need and the program objectives.

Following satisfactory test results and reconfirmation of mission needs and program objectives, the agency head may authorize full production. This is the fourth key decision (Milestone III). As production systems become available, they are deployed into operational use, thereby providing the capability originally identified in the mission need statement.

DOD/USAF Implementation (2.3.1.2). Major systems are designated as such by the Secretary of Defense. In general, programs involving an anticipated cost of $75 million in Research, Development, Test and Evaluation (RDT&E) or $300 million in production are considered for designation as major systems acquisitions. Special high-level review requirements also apply to strategic, nuclear, and certain other types of systems. The MX Program qualifies on both counts, and is thus subjected to the highest level of control and review.

In brief, Air Force acquisition of a system such as MX proceeds through the OMB sequence of decisions and program activities described above. The decisions made at Milestones 0, I, II, III control Conceptual, Demonstration and Validation, Full-Scale Engineering Development, and Production and Deployment phases of system design and implementation.

Each Milestone decision is directed to the commitment of increased resources to a specified phase of program activity on the basis of demonstrated achievement of approved program objectives. The Secretary of Defense exercises direction and control through the four key Milestone decisions, stating the conditions and constraints for conduct of the program, and must approve any changes in these conditions and constraints. The Secretary of the Air Force is responsible for carrying out approved Air Force programs in accordance with the Secretary of Defense decisions.

The Milestones and their related activities are described briefly below.

Milestone 0 - Program Initiation (2.3.1.2.1). A Milestone 0 decision requires:

- Perception of a mission need by the Secretary of Defense or the Department of the Air Force.
- Preparation and submission of a statement of the mission need and a request for approval to identify and explore alternative solutions to the need by the Secretary of the Air Force. The request is supported by a formal Mission Element Needs Statement (MENS), and submitted to the Secretary of Defense.

If the mission need is determined to be essential and is reconciled with other DOD capabilities, resources, and priorities, the Secretary of Defense approves the mission need. The Department of the Air Force is directed to systematically explore and develop alternative system concepts to satisfy the approved need.

When the Secretary of Defense approves program initiation at Milestone 0, the Department of the Air Force assigns a program manager for a major system acquisition, with responsibility, authority, and accountability for program objectives. The office of the program manager is termed the System Program Office (SPO) and is the single point of contact with industry, government agencies, and other activities participating in the system acquisition process throughout its duration.

A major task of the program manager, following Milestone 0 approval, is to develop and tailor an acquisition strategy for the entire program, including technical, business, and management factors. He also institutes an immediate program for competitive exploration of alternative system concepts.

Milestone I - Demonstration and Validation (2.3.1.2.2). A Milestone I decision requires:

- Completion of the competitive exploration of alternative systems concepts to the point where the selected alternatives warrant system demonstration.
- Preparation and submission of a request for approval to proceed with the demonstration and validation effort by the Department of the Air Force. Its recommendations are documented in a Decision Coordination Paper (DCP).
- Review of the recommendation by an Air Force System Acquisition Review Council (AFSARC) and a Defense System Acquisition Review Council (DSARC).

AFSARC and DSARC reviews cover the full range of pertinent factors. Recommendations resulting from these reviews and that of the Secretary of Air Force are forwarded through a formalized process to the Secretary of Defense.

The Secretary of Defense makes the ultimate decision, and if his action reaffirms the mission need, one or more alternatives are selected for competitive demonstration and validation.

Milestone II - Full-Scale Engineering Development (2.3.1.2.3). A Milestone II decision requires:

- Completion of the demonstration and validation activities.
- A determination by the Secretary of the Air Force that the preferred systems should be recommended for full-scale engineering development.
- Documentation of the recommendations.
- Review by the AFSARC and DSARC with recommendations to the Secretary of Defense.

- Reaffirmation of the mission need, and approval of a selected system for full-scale engineering development, by the Secretary of Defense.

This Milestone decision constitutes Secretary of Defense authorization to proceed with full-scale engineering development of the selected system, including procurement of long-lead production items where indicated, and limited production for operational test and evaluation.

Milestone III - Production and Deployment (2.3.1.2.4). A Milestone III decision requires:

- A determination by the Secretary of the Air Force that the system should be recommended for production.
- Documentation of the recommendations.
- Review by the AFSARC and DSARC with recommendations to the Secretary of Defense.
- Reaffirmation of the mission need, confirmation that the system is ready for the production, approval of production of the system, and authorization for its deployment, by the Secretary of Defense.

This Milestone decision constitutes Secretary of Defense authorization for production and deployment of the system. Actual production and deployment requires both authorization of the program and appropriation of funds by the Congress, and approval of the President.

Acquisition of the MX System (2.3.2)

Requirements for an advanced ICBM capability were documented by the Strategic Air Command (SAC) of the U.S. Air Force in 1971. Studies were initiated within the broad framework of the advanced ICBM technology program in 1973 (MX did not formally go through a Milestone 0 because that step in the acquisition process did not exist until 1976). Responsibility for the program was assigned within the Space and Missile Systems Organization (SAMSO) of the Air Force Systems Command (AFSC), and a Systems Program Office (SPO) was designated to manage the effort.

The initial study period concentrated on both missile and basing mode trade-off studies. Missile-related studies concentrated on the technology to develop a new missile with increased throw weight and accuracy. Basing mode studies concentrated on developing methods for countering the potential vulnerability of deployment in fixed-site silos.

The Milestone I decision (then called DSARC I) was made in March of 1976. A Formal Environmental Assessment (FEA) of the comparative environmental effects of trench, horizontal shelter, and pool was considered at this decision point. The Secretary of Defense directed the Air Force to proceed with the validation phase, including two multiple aimpoint concepts: a shelter concept, in which missiles would be moved deceptively among hardened protective structures with above-ground vehicles; and a buried trench concept, in which missiles would move between aimpoints in a buried hardened tube, without appearing above ground except for major maintenance or repair.

Among the activities conducted during the conceptual and validation phases, were:

- System engineering studies and planning.
- Continued evaluation and cost/effectiveness comparison of various mobile basing modes.
- Screening of the United States (excluding Alaska and Hawaii) for potential areas for mobile basing, based on both geotechnical factors (e.g., area, terrain features, excavatibility, depth to bedrock and groundwater) and social considerations (e.g., distance from population centers and transportation corridors, non-interference with national parks and Indian reservations).
- A multiple aimpoint validation (MAV) program to establish feasibility and cost criteria for the buried trench and shelter concepts (including missile breakout feasibility), scale-model hardness validation for protective structures (the HAVE HOST programs), and large-scale explosive tests to establish the response of large areas to nuclear attack (the MISERS BLUFF program).
- Competitive design studies for vehicles suitable for use with the buried trench and shelter concepts.
- A design and development study for a canister to carry the missile, which would be cold launched.
- A design and development study for a demonstration trench-breakout mechanism.
- Design and development of advanced guidance system components, including an Advanced Inertial Reference Sphere (AIRS) and the associated sensing components and computers to provide the desired degree of reliability and accuracy despite the disturbances associated with horizontal carriage during movements as well as erection (from horizontal to the selected firing angle) during a MAP launch.
- Development of advanced microcircuits for guidance and control systems.
- Preliminary design of the three solid-propellant rocket motors that would be used with the missile.
- Design and development of a special nozzle or "exit cone" for the first rocket motor stage that would swivel sufficiently to

permit launching the missile at other than vertical angles, facilitating multiple aimpoint basing.

- C^3, security, and ground power supply system studies.
- Design and development of special extendable nozzle exit cones for the second and third stages, to optimize propulsion efficiency.
- Conduct nuclear survivability tests of critical basing components in conjuction with an underground nuclear explosion (HYBLA GOLD) in November 1977.
- An air-launch feasibility study.

The aim of these and other related studies, developments, and tests is to bring the program to a point where capabilities, costs, and risks are well defined. Appropriate recommendations can then be assessed in depth by the DSARC at Milestone II, and a final decision as to whether or not to proceed with full-scale engineering development can be made by the Secretary of Defense, contingent on congressional approval and appropriation of the necessary funds.

Milestone II Decisions in Brief (2.3.3)

The key decisions to be made by the DSARC at Milestone II involve recommendations to the Secretary of Defense respecting the overall scope of the program necessary to bring complete system development and testing to a point that the desirability of full-scale production and deployment can be evaluated at DSARC III (Milestone III).

Selection of a basing mode is necessary at this point to permit development of the structures, vehicles, security systems, command, control, and communications systems, and related elements that would be necessary for deployment.

During full-scale engineering development, all elements of the complete system necessary to evaluate its performance and facilitate its full-scale production and deployment would be completed. For example, these activities would range from limited production of actual missiles for flight testing (including test launches from the selected "aimpoint" facility) to technical definition of the training equipment necessary to support deployment.

It is important to note that the basing mode decision does not involve selection of a specific site or sites for missile deployment. That decision is to be made at a later date. Additionally, the decision to proceed with full-scale engineering development does not mean that the system will necessarily be deployed. That decision depends on the level of success obtained during full-scale engineering development, reevaluation of the mission need at Milestone III, a favorable recommendation at DSARC III, a decision to proceed by the Secretary of Defense, Congressional authorization, and Presidential approval.

Estimated Budgets for MX (2.3.4)

Through the end of Fiscal Year 1979 (ending 30 September) approximately $450 million will have been expended on the MX Conceptual and Validation phases. Costs for the full-scale development phase will not be firmly established until contracts are let for the work elements involved. These costs will vary with the final system design selected at Milestone II. This statement analyzes environmental impacts based on Full Scale Engineering Development expenditures ranging from $5.0 to $7.0 billion.

Total life-cycle costs for the system will vary with scale of deployment and basing mode. These costs include development, procurement, military construction, activation, all phases of operation (personnel, consumable supplies, spare and replacement parts, etc.), and decommissioning. A life-cycle cost in the range of $20 to $30 billion is anticipated for a 10-year operation period. The system's life cycle will carry it into the twenty-first century.

The MX Environmental Program

3

THE MX ENVIRONMENTAL PROGRAM

3.1 THE ENVIRONMENTAL PROCESS

The fundamental legislation controlling the environmental process at the federal level is Public Law 91-190 (42 USC 4321 et seq), known as the National Environmental Policy Act or NEPA. NEPA requires incorporation of environmental considerations in both planning and decisionmaking for "major federal actions significantly affecting the quality of the human environment," and the preparation of detailed statements on their environmental impact for use in the decisionmaking process. These statements are subject to review by both governmental agencies at all levels and by the public, and must accompany the proposal through the review process.

When the need for an environmental statement is not immediately obvious, the Air Force prepares an environmental assessment. This document analyzes potential project impacts and indicates whether significant impacts can be expected. The Air Force uses this document to decide whether preparation of an environmental statement is appropriate.

In addition to the basic policies of NEPA, a large number of laws, executive orders, and regulations (not detailed here) have been enacted or issued to implement policy or regulate specific environmentally important factors (e.g., air pollution, water pollution). Compliance with these requirements is implemented within the Department of Defense by appropriate directives, and within the Air Force by regulations, manuals, pamphlets, and plans reflecting the basic requirements.

DOD Directive 6050.1, "Environmental Considerations in DOD Actions," is the basic Department of Defense document for implementation of environmental requirements. Air Force Regulation 19-2, "Environmental Assessments and Statements" implements this DOD Directive and controls the documentation process. It requires assessment of the environmental consequences of any proposed action at the earliest state practicable, and production and use of environmental impact assessments cr statements throughout the decisionmaking process for any proposed actions. In addition to the reporting requirements outlined above, the Air Force has also established multidisciplinary environmental protection committees at the headquarters, major command, and base level. These committees have broad responsibilities for assuring that environmental protection requirements are met at all levels of the Air Force. An Environmental Protection Officer (EPO) is also assigned to major programs such as MX to assure constant and well-directed attention to environmental factors.

Environmental statements are required for all actions considered to have a significant effect on the environment or as being highly controversial with respect to environmental impact. They are prepared and revised as necessary by the responsible USAF activity, and are subject to intensive Air Force, agency, and public review. Environmental impact statements are provided at two levels:

- draft environmental statements, subject to extensive agency and public review, including public hearings, when appropriate
- final environmental statements, incorporating and responding to all comments received from review of the draft

Each environmental analysis must contain the following information in sufficient detail to identify and develop the required information for the purpose intended:

- a description of the proposed action, its purpose, and the environment affected
- a description of the environment of the area affected as it exists prior to the proposed action
- the relationship of the proposed action to land-use plans, policies, and controls for the affected area
- the probable impact of the proposed action on the environment, including both direct effects and indirect effects
- an anlysis of the possible alternatives (including taking no action), and of their associated environmental benefits, costs, and risks
- a statement of the probable adverse environmental effects which cannot be avoided if the proposal is implemented, and how avoidable adverse impacts can be mitigated

- a discussion of the extent to which the proposed action involves trade-offs between short-term environmental losses versus long-term gains, or vice versa, and of the possible foreclosure of future options
- an analysis of the degree to which the proposed action curtails the range of potential uses of the environment
- a description of the benefits of the proposed action, in terms of Air Force or broader national policy, which offset the adverse environmental impacts
- details of any unresolved issues
- bibliographic references

Supporting data may be provided as appendices or "baseline studies." Where full disclosure may impair national security by revealing classified information, whenever feasible, classified supplements are produced. The basic environmental statements can then be distributed to agencies and the public, without disclosure of information affecting national security.

When it is determined that a Draft Environmental Impact Statement (DEIS) should be published, the USAF prepares a Notice of Intent for publication in the Federal Register. The document is also reviewed by the Office of Security Review (SAF/OIS). Upon receipt of clearance for security aspects, and approval of the Air Staff and the Deputy for Environment and Safety, Office of the Secretary of the Air Force (SAF/MIQ), the DEIS is published and distributed outside the Air Force as follows:

- Environmental Protection Agency (EPA)
- U.S. Congress
- federal agencies having jurisdiction by law or special expertise with respect to any environmental impact involved
- state and local agencies authorized to develop and enforce environmental standards (through established state clearing houses, where applicable)
- libraries
- each known interested conservation or environmental group or individual
- members of the general public on request

Public hearings may also be held to obtain the broadest possible inputs from the public-at-large, covering the full range of viewpoints. Normally, 45 days are allowed for review and comment.

The MX Final Environmental Impact Statement was prepared after receipt of review comments, including the results of a public hearing. Agency and public comments (including the results of the public hearing) are incorporated as an appendix to the statement. The Air Force's specific answer, or reference to the page in the final statement that answers the question, accompanies those comments.

Upon completion of the FEIS, it is forwarded to USAF/LEEV, with a copy of a proposed news release and recommendations regarding continuation of the project. The FEIS is again reviewed and, on approval, the news release is issued and copies of the document publicly distributed as follows:

- Environmental Protection Agency
- Congress
- all parties who filed substantive comments on the draft statement
- the Defense Documentation Center
- members of the public who request copies

The Environmental Protection Agency publishes a notification of issue of the FEIS in the Federal Register. The FEIS provides the necessary environmental inputs to decisionmakers at "Milestone" decision points. Normally, no implementation of a decision will be taken sooner than 30 days after the Final Environmental Impact Statement (together with comments) has been made available to the EPA and the public.

3.2 METHODOLOGY

Generation of an Environmental Statement (3.2.1)

The contents of an environmental statement were outlined in Section 3.1. The process designed to produce a comprehensive, defensible environmental impact statement begins with a review of the characteristics of the project, analysis of applicable regulatory requirements, and a review of available literature to determine what is known and what is not known about the potentially impacted environment. These reviews and analyses are used to scope out the key environmental issues that must be addressed, and identify any major gaps in available data.

From this preliminary survey, a study plan is established to provide a balanced program with appropriate emphasis on the identified environmental issues and probable impacts. This plan is also structured to provide the required additional data gathering and analyses as efficiently as feasible. The aim of the study plan is to focus the effort on real environmental issues and alternatives, and to assure early and effective continuing interaction between the planning and design groups for the project and the environmental specialists. This interaction is necessary so that methods for reducing potential environmental impacts can be designed into the project, rather than considered as subsequent add-ons at the decision point.

All environmental activities are conducted by an interdisciplinary team of environmental specialists. Each specialist must be qualified by education and experience in a field directly related to the environmental concern to be addressed (air quality, water quality, ecology, etc.), and must interact with the other team members to produce a well-balanced program effort.

Sufficient data are then gathered from all available sources to define the environment of the potentially impacted region as it currently exists, including trends and projections where appropriate, and potential cumulative effects of other activities planned for the area. Emphasis is placed on those factors for which the most detail is necessary to resolve the key issues. The specific means used for data gathering are generally unique to the discipline involved, and are thus extremely varied. Typical examples include interpretation of specialized satellite or air photographs (verified by ground studies); ground surveys and mapping by archaeologists, biologists, and geologists; sampling and analyses by air and water quality specialists; gathering and analysis of data on housing availability, and the level of community services that may be impacted (fire, police, medical, recreational, sanitation, etc.).

The characteristics of the project and its alternatives are then superimposed on the environment to assess their environmental effects. These effects are considered in terms of two phases for a project involving construction: those that will occur during construction proper, and those that will occur as the result of operation. For large-scale, long-term projects, the effects of start-up or "activation" may be considered as well. This analysis permits the probable causes of impacts to be refined, and potential mitigative measures to be established at an early stage for consideration by the project planners and designers.

The process then proceeds to quantification (to the degree possible) of the potential impacts associated with implementation of the project and its alternatives, and cumulative effects of any other activities, with focus on the key issues. Impacts may be positive or negative, and may be interrelated. A project may, for example, stimulate the local economy by creating new jobs, but overload community facilities through the influx of new workers. Similarly, it may eliminate the effects of overgrazing by excluding cattle or sheep from an area, reducing erosion and allowing recovery of the vegetative cover to its natural condition, but resulting in a loss of agricultural productivity.

Quantitative evaluation of impacts frequently requires the formulation of highly technical mathematical models, and analysis by high-speed digital computers. Such analyses are applicable, for example, to the prediction of the impacts on air quality of materials discharged into the atmosphere, of flooding potentials, of traffic generation, and the like. Other impacts are highly subjective and must be related to the possible perceptions of individuals with differing viewpoints. Aesthetic impacts are a typical example of this class.

From the results of impact-related computer simulations and evaluations, the need and required scope for mitigations of detrimental impacts can be evaluated.

Mitigation measures for the identified negative environmental impacts are formulated by the project planners, designers, and environmental specialists for further analysis. To the degree practicable, the measures are incorporated into the project and, if applicable, to the alternatives that will be considered by the decisionmakers. Those negative environmental impacts that cannot be satisfactorily migitated are then identified and quantified to the degree possible. Mitigations not adopted are considered as alternatives. The comparative impacts of the project and its alternatives are also analyzed for consideration in the decisionmaking process.

The results of the study are then invorporated into a draft environmental impact statement published for agency and public review, public hearings, responses to comments, and any necessary modifications before publication of the final environmental impact statement.

Environmental statements may be issued as summaries, with details invorporated into baseline studies or such othersupplementary material as may be useful to reviewers (including the public) or decisionmakers.

Data Gathering and Analysis Methodologies (3.2.2)

As noted in Section 3.5.1, the methods used for data gathering and analysis are both project and discipline dependent. A full description of the methodologies used in each discipline is beyond the scope of this environmental statement. A brief summary of the more unusual techniques applied is given below.

Economic Stimulation (3.2.2.1). Money spent on a project activity (e.g., development of a new rocket motor, construction of launch facilities) has effects extending far beyond the mere expenditure of dollars. For each dollar spent, some amount will be to provide salaries for the workers directly involved (designers, technicians, construction craftsmen, etc.), and other amounts will be spent for necessary materials and supplies (motor case materials, fuels, construction materials, etc.).

Depending on the nature of the materials and supplies involved, some may be available in the local area, and others may not. Some fraction of the required materials and supplies will consequently be purchased locally, and the remainder obtained from suppliers out of the area. Local purchases will both create new jobs in the affected supply industries, and cause them to purchase still additional supplies and services, which may be either purchased locally or imported. New sales and new jobs are consequently created for suppliers in successively lower tiers.

The creation of new jobs places new money into circulation, affecting still other types of suppliers; e.g., retail outlets of all kinds, entertainment industries, and the like.

The net effect is that for each dollar expended on a project, more than one dollar becomes available to stimulate the local economy, and more jobs are created than are directly related to the project proper.

The local and regional stimulation of the economy, and the creation of new jobs depends on two major facotrs:

- the nature of the project (e.g., rocket motor development, launch facility construction)
- the availability of the materials and supplies necessary to support the industry within the area of concern

For example, one type of activity may be more labor intensive than another, and thus less money will be expended for materials and supplies. The types of supplies also vary with the needs of the industry, and will be available to varying degrees within the area under consideration. (For example, for a construction project, all of the sand and gravel needed may be available locally, but all of the steel may have to be imported.)

A complete analysis of the degree of economic stimulation and resulting job opportunities can thus be seen to be extremely complex. Computerized techniques have consequently been developed to permit accurate predictions to be made, both on the basis of the industry involved (e.g., guided missiles), and the area under consideration. Two such computerized models have been used in the analyses performed for this statement. One, the Regional Industrial Multiplier System (RIMS) was developed by the Bureau of Economic Analysis of the U.S. Department of Commerce and applies to a broad range of industries and locations. The other, the Economic Impact Forecast System (EIFS), was developed by the Department of Defense, and estimates economic impacts (including labor multipliers) related to defense activities. Details on both are given in Volume II.

Comparison Areas (3.2.2.2). The eventual deployment site or sites are unknown at this time. Consequently, a set of seven areas (Basing Mode Comparison Areas, or BMCAs) has been used for comparative environmental assessment of basing mode impacts. These areas meet the physical and other requirements for deployment, but do not represent "preselected" or preferred sites. Each of the specific sites selected is a representative sample of broader regions with differing environmental characteristics.

Parametric Impact Evaluation (3.2.2.3). An analytical reproducible method has been used in this envionmental statement to evaluate the comparative environmental impacts of the alternative basing modes. It incorporates mathematical techniques developed to provide a rational basis for decisionmaking where substantial uncertainties exist.

A full description of the method is given in Volume IV. A simplified description is provided below.

In formulating the parametric analysis, three initial inputs are necessary:

- an analysis of the features of the project that could cause environmental effects be a larger change in impact for the same changes in the design factor; if it were flat, there would be no change. The technique also derives sensitivity curves based on these factors, which permit rapid identification of the project features that have the greatest influence on impact level for optimizing mitigation of adverse environmental effects.

For basing mode comparison, 13 environmental concerns have been recognized:

- interference - important species
- air quality
- water quality and supply
- access loss (recreation)
- use of natural resources
- land rights
- economics
- local government issues
- public safety
- airways impeded
- archaeology
- cement
- electricity

Environmental concerns are defined through aggregating the pertinent acceptabilities for selected environmental factors for each basing mode and BMCA. For example, concerns for interference with important species include consideration of environmental effects on:

- threatened and endangered plants
- threatened and endangered small animals
- large mammals
- threatened and endangered aquatic species

The results are documented in bar charts showing the expected value and range of uncertainty for each concern and BMCA, by mode and variation, and in computer printouts. They are summarized in charts showing probable severity of impacts by mode and variation (see Volume IV).

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MX: MILESTONE II. FINAL ENVIRONMENTAL IMPACT STATEMENT. VOLUME --ETC(U)

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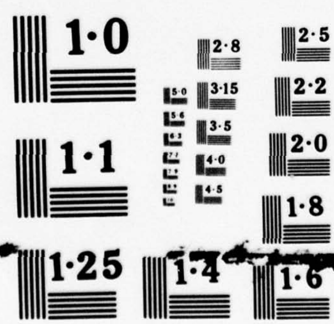

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3.3 MX FINAL ENVIRONMENTAL IMPACT STATEMENTS

Four separate Final Environmental Impact Statements (FEISs) have been defined to date and have or will be produced to aid decisionmakers at key decision points in the overall MX program:

- MX Buried Trench Construction and Test Program FEIS. The MX buried trench construction and test program began in February of 1978 on Luke Air Force Range, Arizona. Two sections of buried trench are being constructed, using different construction methods. This program will demonstrate rapid construction methodology, validate production rates and cost projections for the buried trench basing mode, and exercise a prototype break-out mechanism. The Draft Environmental Impact Statement was filed with the Council on Environmental Quality (CEQ) on 5 August 1977. A public hearing was conducted in Arizona on 19 September 1977 to facilitate public input into the Environmental Impact Analysis process. Comments received during the 45-day review period and at the Public Hearing were incorporated into the Final Environmental Impact Statement (FEIS), which was filed with the Environmental Protection Agency (EPA) in January 1978.
- Milestone II FEIS. The Milestone II FEIS will aid in the DSARC program review and the Secretary of Defense decision for Full-Scale Development (including missile flight testing and associated construction planned for Vandenberg Air Force Base, California), and for the choice of basing mode. The Draft Environmental Impact Statement was filed with the Environmental Protection Agency and made available to the public in July 1978, and a public hearing was held in Lompoc, California in August 1978.
- Deployment Area FEIS. The Deployment Area FEIS will provide a basis for the decision selecting the specific site or sites to be used for deployment of MX. It will also accompany a Military Construction Program (MCP) funding request.
- Production/Deployment FEIS. The Production/Deployment FEIS will be used in the DSARC program review and Secretary of Defense decision at Milestone III for production of MX and its associated equipment, construction of all related facilities, deployment, and operation of the system.

Milestone II FEIS (3.3.1)

The following volumes of this document constitute the Milestone II Final Environmental Impact Statement. Detailed technical studies in support of each volume have been produced and are available for reference. These separate documents are not required for an overall understanding of the scope and environmental consequences of the proposed actions, but rather, they provide detailed backup for the information provided in this Final Environmental Impact Statement.

Full-Scale Development (3.3.1.1). The full-scale development (FSD) section of this document (Volume II) addressed the environmental consequences of full-scale development of the MX system to the point that production and deployment can proceed with minimum cost and risk. The specific items to be developed differ in part with the basing mode that may be selected, but include the following general elements:

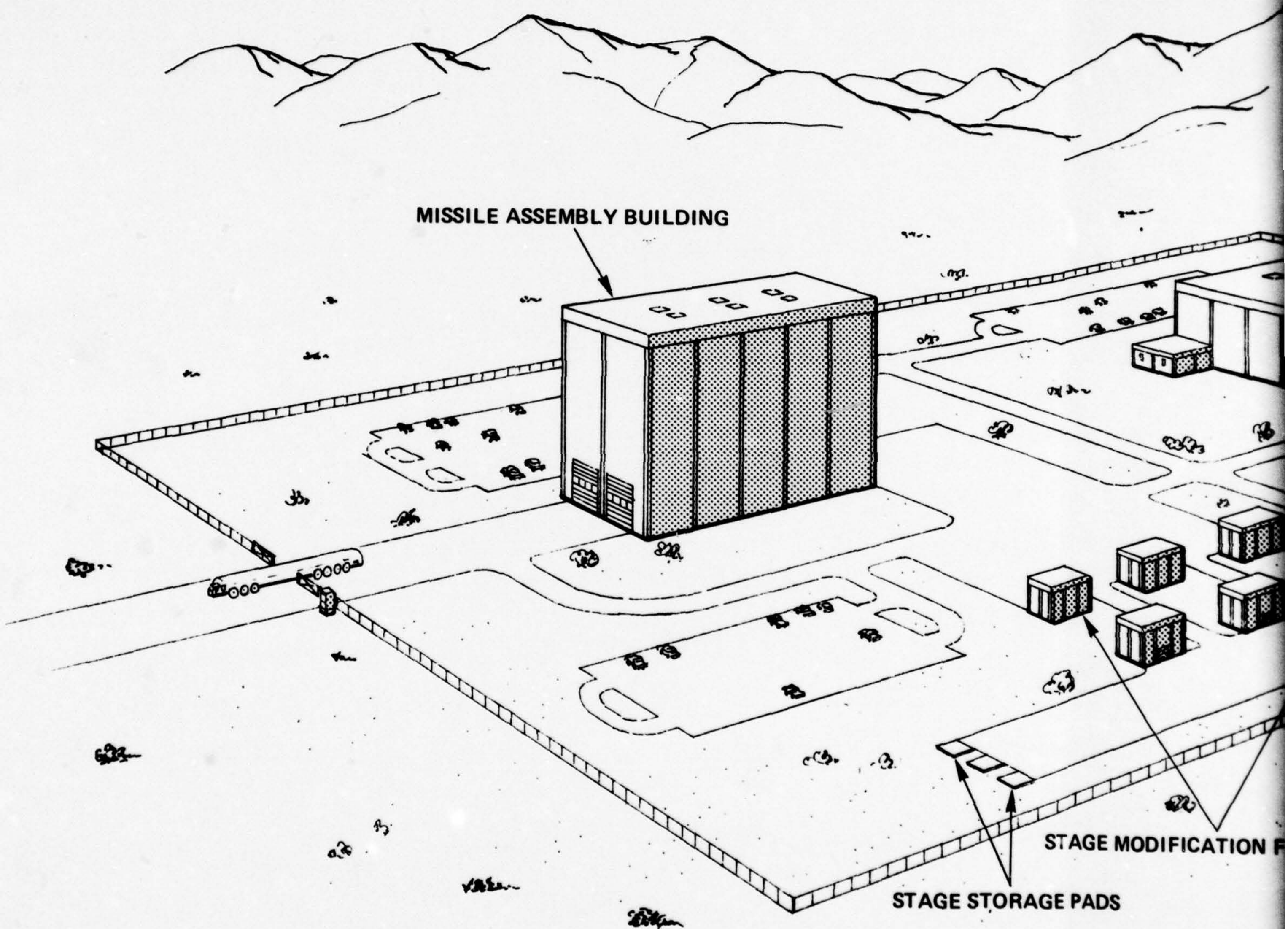
- The missile proper, with its canister for cold launch.
- The protective structures (trench, horizontal shelter, vertical shelter, or pool) to be used.
- Specialized vehicles compatible with the basing mode (trench vehicles, transporter-launchers, antisurveillance shields, etc. as required).
- Support facilities (buildings, roads, etc.).
- Electrical power systems (normal and survivable).
- Command, control and communications systems.
- Physical security systems (area or point, access control, etc.).

Environmental analyses related to full-scale development cannot be site-specific at the present time, since the locations of all related activities have not been identified. The analysis has therefore considered the potential range of impacts.

Flight Testing at Vandenberg (3.3.1.2). Missile ejection and flight tests would be conducted at Vandenberg Air Force Base (VAFB), California.

- One cold-launch ejection test with an inert missile.
- One cold-launch ejection test with a short burn (approximately 7 seconds) of the first stage.
- Twenty flight tests from the selected basing mode facility.

Supporting facilities for these tests will be constructed on-base and the testing effort represents a major activity at a known geographical site. (See Figure 3-2.) Although a specific area on-base has not yet been selected, four candidate locations have been identified, and a



MISSILE ASSEMBLY BUILDING
STAGE MODIFICATION F
STAGE STORAGE PADS

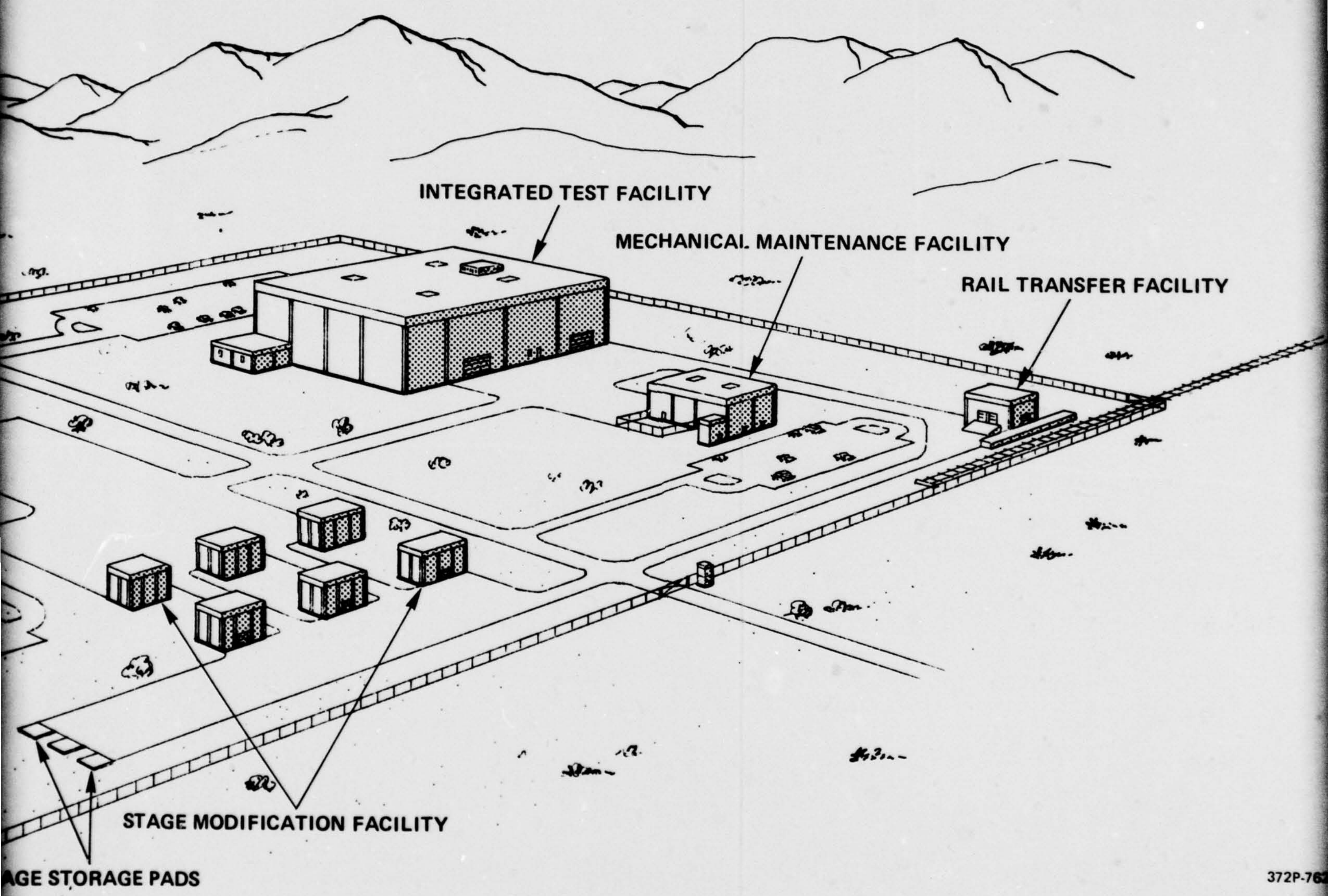


Figure 3-2. Conceptual Flight-Test Support Facilities at Vandenberg AFB.

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comparative environmental analysis has been developed. The essence of this analysis is summarized in Volume III: Flight Testing and Associated Construction at Vandenberg AFB.

Basing Mode Comparisons (3.3.1.3). The various candidate basing modes will have different effects on the environment. These differences vary not only with the type of mode selected, but with its associated features and scale (e.g., number of missiles deployed, number and spacing of aimpoints, area or point security). They will also differ with deployment site characteristics. A quantitative, reproducible, and objective method has been developed for comparing environmental effects of deployment, using seven differing representative areas to establish probable ranges of variation. The results have been used to evaluate the comparative environmental effects of the basing modes considered, and are readily adaptable to variations in mode or to scale of deployment (Volume IV: Basing Mode Evaluation.

Deployment Area FEIS (3.3.2)

If the Milestone II decision results in selecting a basing mode for deployment, that decision will not determine where the system would be deployed. Potential areas in the United States that meet geotechnical and other criteria have been identified, but the total area technically feasible for deployment is significantly larger than that required by the system, and no specific deployment sites have been identified as preferable at this time.

Decisionmakers must weigh environmental impacts, competing land uses, and the relative acceptability of various sites, including public comment on these matters, prior to the Milestone III decision. The Deployment Area FEIS will provide part of this input and will address MX military construction programs (MCPs) and land acquisition actions for public and Congressional consideration.

Deployment site(s) selection and ensuing program activities up to Milestone III, in and of themselves, do not mean that deployment of the MX at that location(s) is or will be irrevocably committed. The decision on whether to deploy the MX system is to be made at Milestone III, and must be approved both by the Congress and by the President.

Milestone III FEIS (3.3.3)

The Milestone III (Production/Deployment) decision also will be assisted by a separate FEIS. The elements to be considered in this FEIS are described briefly below.

Full-Scale Production (3.3.3.1). Full-Scale Production will involve fabrication and testing of the separate major subsystems required for deployment and operation of the system.

Deployment (3.3.3.2). At the time of the Milestone III decision, more will be known about the actual system to be deployed than was available for the Deployment Area FEIS. For example, some details of the basing mode proper will possibly have changed, and the number of missiles proposed for deployment will have been established. Changes may also have occurred within the site area. The environmental effects of deployment will therefore be reassessed for the Milestone III FEIS, so that up-to-date information will be available for agency and public review and for use in the decisionmaking process.

The deployment analysis will consider all phases of deployment activities: Construction, activation, operations, and decommissioning.

Details of construction activities will differ with the final basing mode selected but can be expected to include the factors considered in Volume IV of this environmental impact statement.

Activation activities associated with start-up of the system (on-site assembly, system checkout, and the like) will also be addressed. These activities follow construction, and must precede actual operational use of the system to assure that it will function reliably and in accordance with all design goals.

The impacts of operations over the period of time that the system will remain in service are also similar in kind, but will differ in detail from those described in Volume IV of this environmental impact statement. These will be refined to reflect the characteristics of the actual system proposed for deployment at Milestone III so that the full scope of their environmental implications can be considered. Operations considered will not be limited to those at the site proper and its supporting Air Force Base, but all associated activities nationwide (e.g., continuing spares production and delivery, training, continuing test firing of operational missiles by their control crews from a selected test site such as Vandenberg AFB, and the like).

After the system has served its useful life, it will be decommissioned. The planned activities and costs for decommissioning, the condition and probable use of the site immediately following decommissioning, and the rate and nature of recovery from any residual environmental disturbances will be analyzed and quantified to the degree feasible so that longterm environmental commitments can be considered both in the agency/public review process and by the ultimate decisionmakers.

An affirmative Milestone III decision within the Department of Defense requires a reaffirmation that the mission need exists, and that the proposed system will meet that need. Actual implementation of this decision requires both congressional approval (accompanied with extensive hearings, classified as necessary) and funding, and approval of the President.

3.4 SPECIAL MONITORING PROGRAMS

Special monitoring programs will be conducted throughout the MX acquisition/deployment cycle to provide otherwise unavailable data in support of the environmental analyses, to verify that legal and regulatory requirements are being met, and to minimize adverse impacts. The scope of these activities will be tailored as necessary to meet the needs of the program. Planned activities that are currently identified are described below, by location.

MX Buried Trench Construction and Test Project (3.4.1)

The MX Buried Trench Construction and Test Project involves construction of two sections of full-scale buried trench on the Luke Air Force Range, in southwest Arizona. The first section has been constructed with sections of precast concrete pipe, and a second section is being cast in place, using special equipment. A Final Environmental Impact Statement (FEIS) was produced for this project prior to initiation of construction (see Section 3.3). The objectives of monitoring and observation programs for this project are to establish:

- the actual versus predicted levels of environmental disturbance immediately upon completion of the project, including cleanup and restoration activities
- the nature and rate of recovery of disturbed areas (revegetation and stabilization of surfaces against wind and water erosion)
- the effectiveness of mitigation measures incorporated into the project to eliminate or minimize impacts
- occurrence of unanticipated impacts

Candidate Deployment Sites (3.4.2)

Air quality, meteorological, and background noise data are largely lacking for the areas being considered as candidate deployment sites. Monitoring programs to obtain pertinent data are therefore planned so that valid data will be available for impact assessment. At present, much of this type of information can only be inferred from records taken at installations nontypical of the site areas proper (e.g., meteorological and air quality data from airports or from stations in urbanized areas). Noise level data are essentially unavailable for large areas of the country, and must be obtained to establish background levels.

Construction Sites (3.4.3)

Construction schedules for deployment of the system are not yet established. The rate at which the system is constructed and placed into operations depends both on the scale at which the system is deployed (number of missiles, number of aimpoints), and the urgency of the need at the time the system is ready for deployment. Current estimates range from approximately 3 to 7 years.

During this period, monitoring activities similar to those described above for the MX: Buried Trench Construction and Test Project are planned. The aims of these monitoring activities will be to assure that acceptable levels of environmental impacts are maintained, that the contractors are meeting environmental protection requirements, and that potential problems are identified early so that appropriate mitigation measures can be adopted before environmental effects become serious.

Development and Production Sites (3.4.4)

Major contractors will be required to establish and maintain an Environmental Protection Program to avoid, minimize, or mitigate potential detrimental environmental impacts. Regular reports on their activities are planned.

Operational Sites (3.4.5)

The degree of environmental monitoring required at operational sites will depend on the final deployment method selected, and its scale. (For example, shelter-based systems of large areal extent may require integration of meteorological/air quality monitoring systems into the operational procedure. Such systems would detect air quality degradation at an early stage so that appropriate mitigative measures could be devised and adopted, and provide safety-related predictions of atmospheric dispersion of hazardous materials if accidents occur. Similarly, subsurface water quality/quantity monitoring programs may be necessary if the pool concept is adopted and can potentially result in unacceptable degradation of the quality or quantity of otherwise useful supplies.)

The nature and scope of these activities can only be determined after a specific deployment mode, site or sites, and scale of deployment is selected.

3.5 KEY ENVIRONMENTAL ISSUES

Implementation of the MX system will require significant commitments of the nation's dollars, land, labor, and other resources. Environmental issues have been considered at all stages of program planning and evaluation. Each Milestone decision is based partially upon the environmental impacts associated with continuing through the next major phase of the system acquisition life cycle. Each Milestone decision represents a greater commitment of resources and more significant environmental issues than the previous Milestone decision.

<u>Milestone I</u> (3.5.1)

The Milestone I (or DSARC I) decision confirmed the project need and approved continuation of the project into the validation phase. Design and development projects for systems components such as the advanced guidance system, the special nozzle, and the canister for cold launch were determined to be projects which would not significantly affect the environment.

Several individual projects undertaken during the validation phase were analyzed in formal environmental assessments. The HAVE HOST programs were scale-model hardness tests of protective structures. The MISERS BLUFF program consisted of large-scale explosive tests to establish the response of large areas during nuclear attack. The environmental impacts of these programs were examined in formal environmental assessments and the impacts were found to be below the level requiring preparation of environmental impact statements.

The MX: Buried Trench Construction and Test Project, which was designed to establish feasibility and cost criteria for the buried trench concept, including simulated missile breakout, met the Air Force criteria for actions requiring publication of an environmental impact statement. A final environmental impact statement was published for this program, and construction was initiated in February 1978. Although most of the project impacts are highly localized and not of national significance, several key issues were identified during project planning and preparation of the impact statement. These issues were as follows:

- Aesthetic degradation resulting from loss of relatively pristine desert environment and disturbance of the polished surface layer of gravel called desert pavement.
- Potential erosion and generation of dust as a result of soil disturbance and earth moving activities.
- Interference with proposed critical habitats of the endangered Sonoran pronghorn antelope.
- Interference with the range and breeding activities of the big horn sheep, a large game species.
- Potential loss of protected plant species.
- Potential loss of archaeological resources discovered on the site during impact assessment work.

Most of the potential adverse impacts relating to these key issues have been mitigated by programs implemented during the construction phase. Project effects and mitigation actions are discussed in Section 3.6.

Milestone II (3.5.2)

If the Milestone II decision is affirmative, the need for the MX system will be reaffirmed and full-scale development will be initiated. The four sections that follow address the key environmental issues associated with each of the major aspects of the Milestone II decision. It should be pointed out that these projects have slightly different relationships to the Milestone II decision. An affirmative Milestone II decision will initiate full-scale development work and flight testing, proposed for Vandenberg Air Force Base. The Milestone II decision will include selection of a basing mode for the MX system. The choice of basing modes will be determined, in part, by the environmental information presented in this Environmental Impact Statement.

Full-Scale Engineering Development (3.5.2.1). Key environmental issues involved in the decision to proceed with full-scale development are of both regional and national concern. The total expenditure of money is of national significance because of the commitment of this money to development of a weapon system as opposed to other possible uses. Impacts induced by expenditures of contract dollars in particular industries are of regional concern because of the resulting impacts of labor pools, population, housing, and services required to support population increases. The expected key issues are as follows:

- Commitment of $5 to $7 billion to develop, manufacture, and test MX and ground equipment for full-scale field tests vs. other federal uses of this money or reduction of the federal budget.

- Requirements for skilled labor and materials which might otherwise be available for other projects.
- Potential adverse impacts of labor and support service requirements on regions receiving major full-scale development contracts.
- Requirements for secondary support services needed because of induced growth in regions of major expenditures.

The potential effects of full-scale development and possible mitigation actions are discussed in Section 3.6.

Testing at Vandenberg Air Force Base (3.5.2.2). The testing program proposed for Vandenberg Air Force Base includes major construction activities at one of four candidate siting areas. The testing phase would include missile launches and recovery of system components. If the MX system is finally deployed, operational readiness tests of personnel and equipment may also be conducted at Vandenberg Air Force Base. The key environmental issues associated with this aspect of full-scale development are primarily of a local or regional nature, and are identified as follows:

- Potential conflict of water needs with competing uses. Water availability is a potential issue because of generalized water shortages in the region. The area surrounding Vandenberg depends on both groundwater and surface water supplies for primarily agricultural and domestic water needs. If the water needs for construction and testing of MX system prototypes at Vandenberg interfered with other water requirements in the area, significant controversy could result.
- Potential degradation of air quality. Air quality is a sensitive issue in the south central coast air basin which includes Vandenberg Air Force Base and the surrounding area. Any aspects of the project, such as test launches or increases in vehicle activity, which could further reduce air quality could become controversial.
- Potential degradation of habitat and interference with endangered species. Endangered species and unique habitat types could be adversely affected by project implementation. Vandenberg Air Force Base has been a limited access area for many years and sites on the base which have received little or no disturbance now are rare representatives of habitat types which used to be more abundant along the southern California coastline. Some of these rare habitats are utilized by plant and animal species receiving federal or state protection. Key issues could arise as the result of the possibility that protected species and/or rare habitat types might be disturbed by the project.

- Potential impact upon archaeological sites. Limited access to Vandenberg combined with the area's remoteness have resulted in the preservation of some of the best archaeological sites known that represent the Chumash peoples. Archaeological resources from literature and site surveys have been taken into consideration in the overall environmental analysis as well as in the site-specific layouts presented in this FEIS. Key candidate siting area specific issues that could arise include disturbance due to roads, potential subsurface archaeological resources, and as yet undiscovered sites.

- Potential annoyance from noise. Noise may become an issue as a result of test launches. Although Vandenberg activities have included similar launches in the past, there is a potential for community opposition to increases in launch frequency or even to continuation of launching activity.

- Socioeconomic impacts resulting from rapid population increase and decline may become key issues if the MX program overlaps with other proposed major projects such as the Space Shuttle or a proposed nearby liquified natural gas (LNG) terminal.

The potential effects and mitigation actions of the testing program at Vandenberg Air Force Base are discussed in Section 3.6.

Basing Mode Comparison (3.5.2.3). A basing mode for the MX system will be selected as a result of the Milestone II decision, and environmental factors will be weighted heavily in the selection of the basing mode. Although neither a basing mode nor a site for eventual deployment has been selected, the potential impacts of different basing mode possibilities must be evaluated with regard to feasible types of sites. Key environmental issues related to a specific basing mode may differ depending on the type of area in which it is deployed. These key issues are of a regional nature. Other key issues are of national significance and will be of concern regardless of the basing mode selected or the area chosen for deployment. The major key issues related to the basing mode decision are as follows:

- The relative environmental acceptability of each basing mode at each of several different siting areas will be a major issue. Because the commitment to a basing mode will be made at the Milestone II decision, it is important to understand the differences in environmental impacts in relation to different siting areas.

- Exclusion areas within which other uses will be restricted or denied will be required for the life of the project. Road easements will be necessary for operations. The amount of area so required depends on the mode selected, the scale of deployment, and whether area or point security is adopted.

- Permanent physical alterations of deployment sites would result from implementation of any of the basing modes. The potential for rehabilitation of areas following decommissioning may be a major consideration in determining the environmental desirability of different basing modes.
- The diversion of national and local resources from alternative uses will be of major concern. Large differences among basing modes in the requirements for dollars, land, labor, materials, and other resources will be of major concern.
- Alterations in local and regional socioeconomic conditions will be key issues to the extent that these alterations may differ among basing modes.

The effects of the basing mode selection and possible mitigation actions which have been examined are reviewed in Section 3.6.

Deployment Area FEIS (3.5.3)

The Milestone II decision will shape the form of the ground system vehicles and the MX through the FSED program. The site or sites for deployment will not be determined as part of Milestone II decision but will only be made after a comprehensive environmental evaluation of the impacts of deployments at alternative locations.

General geotechnical requirements have been established for MX bases and the continental United States has been screened to locate suitable areas to meet engineering requirements. The majority of these are located in the southwest.

The Basing Mode Comparison study reported in Volume IV required the candidate basing modes be compared with each other in the context of actual environments and several locations or basing mode comparison areas were established for this purpose. These were selected to cover all representative environments to assure the basing modes were compared under all conditions.

These comparison areas are part of the geotechnically suitable areas but cover neither all candidates nor necessarily the most suitable ones. They are means of comparing basing modes not selection sites. For this reason, they were not investigated to the depth required for comparison of and selection of sites. The Basing Mode Comparison Area analyses did serve to identify key issues which will require detailed investigation and possible development of mitigating measures in the Deployment Area FEIS.

These matters will be the subject of a FEIS specifically devoted to site selection which will be completed well in advance of the Milestone III decision. This will give all concerned parties an opportunity to review and comment on the selected sites in advance of the decision to proceed. The Deployment Area FEIS will include:

- Review of available data on suitable areas and identification and collection of essential baseline information.
- Selection of the most suitable areas for detailed study.
- Identification of key environmental issues using the basing mode comparison study as a major source. Among these may be water supply, endangered species, land rights, local government issues, interference with archaeological sites, and energy supply.
- Detailed layout of base facilities and road networks in each candidate area taking into consideration such factors as existing roads and power transmission corridors.
- Detailed literature and field study of key issues at each proposed location.
- Development of projected impacts and suitable mitigation measures at each location.
- Presentation of environmental information to decisionmakers and the public for consideration with other factors in making the site selection.
- Preparation of an FEIS for the selected site supported by a description of alternatives considered.

Milestone III (3.5.4)

An affirmative Milestone III decision would reconfirm the mission need and would initiate full deployment of an MX system. Deployment would include production of all the necessary missile, ground transportation, communications, and other systems; construction of the basing mode facilities at the selected site or sites; installation of missiles and other equipment at the site; and activation and operation of the functional system. The magnitude of impacts resulting from an affirmative Milestone III decision would be of national significance and major environmental aspects will be considered in reaching the decision. The Milestone III Statement would address the environmental impacts of proceeding with production, deployment, and operation of the system as a whole.

The types of project impacts and key environmental issues related to full-scale deployment would be similar to those identified for full-scale development. This is because the contractors developing missiles and ground support equipment are likely to be involved also in the production of this equipment, should the project proceed into the deployment phase. Similarly, certain key issues and environmental effects resulting from deployment of a particular basing mode in a particular area would be the same as those effects and issues identified in this impact statement addressing the basing mode selection. The additional key environmental issues identified for the Milestone III are as follows:

- The scale of the MX program will be an issue in itself. The scale of the commitments of land, energy, materials, and skilled personnel involved in full-scale production and deployment of the MX system will raise issues of national significance.
- The general public and special interest perceptions of the MX project and its environmental impacts will raise key issues. The interests of many groups and of the general public will be affected by the major commitments of resources resulting from the full implementation of the MX program.
- A key issue will be the ability of the project design to meet performance standards within reasonable limits of cost and environmental impacts.

Deployment phase effects and potential mitigation measures are discussed in Section 3.6.

Other Environmental Requirements (3.5.5)

Introduction (3.5.5.1). Three statements have been identified to date to help decisionmakers and the public understand the environmental impacts of key decisions and their alternatives. In addition, the Air Force prepared assessments on various validation projects and a statement on the trench construction project. Given the uncertainties involved in any major weapon system development, the Air Force cannot guarantee any definite structure to the environmental analysis process. As activities proceed toward and into full-scale development, newly identified needs may necessitate proposals which today are unknown.

When new program needs and proposals arise, they will be appropriately analyzed, including, as appropriate, an environmental assessment or statement. The environmental analysis process is as flexible as the system itself.

Background (3.5.5.2). For the past two years, validation program tasks have concentrated on the MX and two multiple aimpoint basing alternatives—buried trench and horizontal shelter. In December 1977, an intense effort was initiated to evaluate the four most feasible trench and shelter multiple aimpoint (MAP) concepts along with excursions relating to missile size and deployment locations. The results of the evaluation were presented in May 1978 to the Defense Science Board - an advisory group to the Secretary of Defense. The evaluation of survivability characteristics, technical uncertainties, estimated costs, and potential environmental impacts of various MAP basing concepts identified three feasible modes—vertical shelter, horizontal shelter, and in-line hybrid trench. Of these three, there is highest confidence technically in the vertical shelter and this mode appears to be the least expensive although the estimated cost spread for all the options is about 15-20 percent for equal levels of ICBM capability.

The vertical shelter concept is sufficiently well defined to enter full-scale engineering development. An "Engineering Test Bed" effort is being developed to conduct selected activities aimed at reducing the development risk and shortening the development time for critical system elements of the vertical shelter concept.

Engineering Test Bed (3.5.5.3). The engineering test bed would involve the construction of several vertical shelters, inter-connecting roadways, and a base camp. Activities would be conducted over an 18 to 24 month period. The following proposed test activities for the engineering test bed are being considered:

- Construction techniques (Figure 2-14). Several vertical shelters (2.2.5.3) would be constructed to determine the suitability of proposed construction techniques.
- Vehicle Maneuverability/Canister Emplacement (Figure 2-16). Transporter/Emplacer vehicle (s) would be designed and then developed to:
  - demonstrate horizontal carriage of simulated canisterized missiles between vertical shelters; and
  - demonstrate typical erection and emplacement sequences.
- Launch Egress (Figure 2-17). A simulated canisterized missile, with its on-board operational support equipment (OSE) and blast door, would be designed and tested to demonstrate typical launch sequences—the raising of the canister and jettisoning of the OSE and blast door.
- Detectability Testing. Signature analyses will be performed to gain an understanding of the detectability of occupied vertical shelters by use of sensors - acoustic,

chemical, seismic, thermal, magnetic, radiation, radar, radam, and power. This testing will include investigation of the measures which will be used to counter the sensors.

- Physical Security Testing. Physical security type sensors will be installed in and on the perimeters surrounding the vertical shelters. Investigations will be performed to determine and verify the intrusion detection capabilities of the physical security sensors.

Planning for the engineering test bed has been initiated and includes the following tasks:

- Vertical shelter configuration studies. A typical configuration would be 125 ft (38 m) in depth, 13 ft (4 m) in diameter with 9 in. (23 cm) wall thickness. A 2 ft (60 cm) thick reinforced concrete floor would support the canisterized missile loads. Thicker walls would be provided at the top to withstand attack effects and support the blast door. The configuration studies will provide design specifications for the vertical configuration(s).

- Design of Test Hardware. The major test hardware design effort would be on a vertical shelter transporter/emplacer vehicle and a simulated canisterized missile. The conceptual transporter/emplacer vehicle has typical on-road characteristics of 949,000 lbs (430,457 kg) gross weight, 165 ft (50 m) approximate length, 23 ft (7 m) height, and a 22 ft (6.7 m) running surface road width. This vehicle will be designed to accomplish the horizontal carriage and vertical emplacement of the canisterized missile. To demonstrate vertical emplacement capabilities and launch agress, a simulated canisterized missile, its OSE capsule and a blast door will be designed as part of the transporter/emplacer vehicle design activity.

- Proposed Field Test Activities. The major field test activities would be on investigations of vehicle maneuverability/simulated canister emplacement and launch egress. The typical emplacement sequence involves maneuvering the transporter/emplacer vehicle over the vertical shelter, removing/storing the deception cover, bringing the strongback vertical, lowering the canisterized missile into a vertical shelter, emplacing the blast plug, replacing the deception cover and restoring the strongback to a stored position for subsequent vehicle movement. The conceptual vertical shelter launch sequence involves raising the canisterized missile, its OSE capsule and blast door above debris; then, jettisoning the OSE capsule and blast door for unobstructed missile launch. The purpose of the field test activities would be to demonstrate transporter/emplacer vehicle performance capabilities and to gain a thorough understanding of emplacement and launch egress timelines. Detectability tests, physical security test and other tests - to be defined - would also be accomplished.

- Identification of Engineering Test Bed Site. The test bed site would be sufficient in area to permit construction of several vertical shelters separated by approximately 10,000 ft (3,050 m). Initially, land areas of approximately $20nm^2$ ($52\ km^2$) will be screened for geotechnical suitability with ultimate land area usage reduced to an amount consistent with the shelter lay-out described above. The test bed site would be located in an area which is determined to be geotechnically suitable. USAF Ranges and Bases in the southwestern United States are considered to be the candidate sites.

- Environmental Analysis. Environmental analyses including physical, biological and socioeconomic factors will be performed to determine impacts of the proposed action at those geotechnically suitable sites.

3.6 SYSTEM ENVIRONMENTAL EFFECTS

The environmental effects of implementing the MX system will vary with the phase of program acquisition. Previous decisions involved few, if any, commitments of national scope. The Milestone II decision is the first point at which extensive resources may be committed to the project. The final decision as to whether or not to fully implement the MX system will be made at Milestone III, and represents the largest commitment of resources.

Milestone I (3.6.1)

The validation phase of the MX program was initiated in 1976. A Formal Environmental Assessment was produced to aid decisionmakers at this Milestone ("Comparative Environmental Assessment of the Three MX Land Mobile Missile System Concepts," 31 October 1975). The potential environmental impacts of the continuous hardened trench, the plowout fixed-door shelter, and the slope-sided pool were addressed, for representative sites in the southwestern United States. The slope-sided pool showed the lowest comparative environmental ranking, and only the trench and shelter concepts were carried into the validation phase initially.

Two Formal Environmental Assessments (FEAs) and one Final Environmental Impact Statement (FEIS) were generated to aid in the decision making process for subsequent specific elements of the validation program. These are:

- The HAVE HOST tests (FEA)
- The MISERS BLUFF Tests (FEA)
- The MX: Buried Trench Construction and Test Project (FEIS)

All of these projects affect relatively small areas and are subject to effective mitigations. None of the impacts are of national significance.

HAVE HOST (3.6.1.1). HAVE HOST is a series of scaled high explosive field tests to evaluate the survivability/vulnerability of horizontal shelter and buried trench hardened aimpoints, and to develop simulation techniques for use in Full-Scale Development. Comparative cost, performance, and survivability data are being developed in the test program. The test site is on Luke Air Force Range (LAFR), Arizona, approximately 30 mi (48 km) southeasterly of the city of Yuma, and 12.3 mi (19.8 km) south of Wellton.

The environmental assessment of the project (Air Force Weapons Laboratory, 1976) identified the following potential effects and mitigation actions:

- Disruption of approximately 40 acres (16 ha) of desert habitat, mitigated by minimizing the number of roads constructed, and post-project revegetation of site where feasible.
- Minor increases in erosion potential, mitigated by road routing to minimize crossings of drainage channels.
- Possible minor displacement of burrowing animals.
- Temporary and minor deterioration of air quality during construction (principally through dust generation).
- Temporary and minor increases in noise levels during construction.
- Possible breakage of 1 to 2 windows in Wellton, Arizona, and minor roadslides in the Gila Mountains during one test only, mitigated by selecting a test time during which atmospheric conditions will be unfavorable for shockwave propagation.
- Possible startling of animals by the detonations (not expected owing to frequent occurrence of aircraft-produced sonic booms in the area).
- Possible loss of a few reptiles and rodents during detonations.

The site was selected to avoid areas of special ecological importance, and excavations either avoid interference with saguaro cacti, or specimens are transplanted.

MISERS BLUFF (3.6.1.2). MISERS BLUFF was a series of two high explosive tests of ground motion and structural response for evaluating the vulnerability/survivability of MX systems. The test site was on the Planet Ranch in a remote valley (the Rincon Valley) along the intermittent Bill Williams River in west central Arizona. The nearest neighboring ranch is 8 mi (13km), a trailer park is 13 mi (21 km), and the nearest communities are 25 mi (40km) or more from the site. The property was previously cleared of natural vegetation by the owner, and is to be converted to agriculture.

The Environmental Assessment of the project (Defense Nuclear Agency, 1977) identified the following potential impacts and mitigation actions:

- Disturbance of approximately 175 acres (70.6 ha) of land, approximately 125 acres (50.6 ha) of which will be in the area of the test bed. This disturbance will be mitigated by removal of most of the experimental structures, and filling in of the excavations and craters following the tests.
- Damage to animals and plants within 1,100 ft (335 m) of the single-charge event, and 2,000 ft (610 m) of the multi-charge event. Large animals will be driven from the area prior to the detonations.
- Potential damage to a few windows (no structural damage) at the Planet Ranch headquarters, to approximately four windows in Lake Havasu City, and two windows in Parker, Arizona. Minor rockfalls may occur from a cliff adjacent to the test bed. (The tests were timed to occur when meteorological conditions were such as to eliminate window damage at the distant communities.)
- Some economic stimulation in neighboring communities, primarily Lake Havasu City.

The explosion cloud products were not expected to exceed air quality standards, and no effect was expected on water levels or water quality.

MX: Buried Trench Construction and Test Project (3.6.1.3). The MX: Buried Trench Construction and Test Project involves construction of two sections of buried trench to validate cost and construction rate estimates, the technical feasibility of large-scale buried trenches, and proper functioning of a prototype breakout and erection mechanism. The test site is on Luke Air Force Range (LAFR), Arizona, approximately 60 mi (97 km) east of Yuma and 7 mi (11 km) west of the small community of Dateland.

The final environmental statement (Department of the Air Force, January 1978) identified the following potential impacts and mitigation measures:

- Disturbance of approximately 200 acres (81 ha) of land, mitigated by minimizing the width of construction activities along the trench, use of a predisturbed abandoned airfield for construction support facilities, and restriction of workers to defined areas. Access to the site will also be eliminated after construction, to minimize subsequent disturbance of the area.
- Temporary and minor degradation of air quality during construction, (minimized by watering roads and excavation sites to suppress dust generation).
- Loss of pristine desert habitat and desert pavement in some areas. Desert pavement materials are being stockpiled and will be replaced over the corresponding disturbed areas. (This will not restore the initial appearance, but will minimize its change.)
- Saguaro cacti that must be removed are being made available to the Arizona Commission on Agriculture and Horticulture for whatever disposition they recommend.
- Potential increases in water erosion, mitigated by completing most of the construction during the dry season, and post-construction restoration and monitoring, including future corrective actions if necessary.
- Potential disruption of archeological sites, mitigated by rerouting roads to avoid disturbance, and a recovery program with the collected materials deposited in the Arizona State Museum.
- Potential interference with the range and breeding activities of the bighorn sheep mitigated by scheduling construction activities so that they will not occur near the potentially impacted areas at times when sheep are normally present.
- Potential but unlikely interference with critical habitats of the endangered Sonoran pronghorn antelope, mitigated by the relatively short duration of the project and the small area affected, minimization of "startle" noises, restriction of personnel to the site, and continuing coordination with the Fish and Wildlife Service throughout the project life.
- Minor temporary increases in highway traffic and major increases in Dateland, mitigated by rerouting access roads.

Milestone II (3.6.2)

The major effects of the Milestone II decision will be to commit the nation to a program of developing and testing the MX system, and to commit to the use of a particular basing mode for the system.

The key issues relating to the Milestone II decision were discussed in Section 3.3.3 for each major aspect of the decision. The anticipated effects and possible mitigation measures are discussed in the sections which follow.

Cumulative Effects (3.6.2.1). Although the individual activities that result from the Milestone II decision will predominately have local environmental effects, the cumulative effects will be of national scope. The action will also facilitate future actions of even larger scope; including potential production, deployment, operation, and eventual decommissioning of an MX system in the selected deployment mode.

The cumulative effects of the action include:

- Development and testing of system components, production of test facilities, and test activities for both the missile and its selected basing mode.
- Allocation of the total manpower and materials required for the project, diverting them from other potential uses. Full Scale Development of MX is expected to result in as many as approximately 130,000 jobs if the project occurs during high unemployment or 20,000 jobs if the project occurs during low unemployment. Localized shortages of skilled workers could create upward pressure on pay scales, but a nationwide shortage is not expected. Materials requirements for Full-Scale Development will not be great enough to result in shortages of any identified raw materials or finished products.
- Development of the weapons system to the point that its production deployment, operation, and eventual decommissioning would be feasible. The cumulative impact could thus be the expenditure of approximately an additional $15 billion (1976 dollars) over FSED expenditures and allocation of substantial additional resources (manpower, materials, land, energy, etc.) for the purpose. Potential environmental effects of the various phases are outlined in subsequent sections, and will be evaluated in separate future Environmental Assessments and Statements for use in future milestone decision making.

Engineering Development (3.6.2.2). The engineering development phase involves the design and testing of a wide range of items, from major subsystems to individual components required for the complete weapons system. This effort involves a relatively large proportion of highly skilled personnel (e.g., systems analysts, engineers, designers, technicians). A relatively few major contracts will be let by the Air Force for conduct and integration of the major efforts, and some elements of the activities will be performed by specialized groups within the Department of Defense and the Department of the Air Force.

The major or "prime" contractors in turn will let subcontracts for specific elements, and subcontractors in turn will let subcontracts where required. These subsidiary efforts will range from high-technology studies or development efforts to supplies of materials or components meeting applicable military specifications and standards. Contracting to small businesses, labor surplus areas, and minority enterprises, is part of the formal procurement policy of the Department of Defense, and must be implemented by prime contractors and their lower-tier subcontractors. Consequently, the effort will be distributed throughout the United States.

Despite the probable level of subcontracting associated with the effort, the most extensive effects can be expected in the communities and their environs where major contracts are let. Contracts will be let by competitive bidding, so the locations of the activities will not be known until after award. Although cost estimates are developed independently by the Air Force for budgetary purposes and as a benchmark in evaluating bids, these estimates are not available outside the government, since knowledge of the expected dollar values could adversely influence competitive bidding.

The effects of developmental efforts can therefore be assessed only in relative terms, considering the size and technological base of the potentially impacted region and the size of the contract award. The effects anticipated are predominately "indirect," i.e., resulting from the influx of dollars and jobs, and include:

- Increased job opportunities, both directly on the project effort concerned, and as the result of economic stimulation.
- Potential population growth in some local areas as a result of the availability of employment
- Potential needs for additional community facilities and services to support the increased population (e.g., housing, policy, fire, medical services, water supply, waste disposal).
- Potential increased demands on existing facilities (e.g., roads) that cannot reasonably be expanded.

- Potential changes in quality of life as influenced by increased congestion, traffic, noise, air pollution and similar factors associated with changes in total population, population density, and commuting patterns.

Except for propulsion systems testing, most developmental activities of themselves do not produce atmospheric pollutants, and only a few processes (e.g., printed circuit board production) produce potential water pollutants. Propulsion systems will be developed by contractors who already posses the required technological base and facilities, so that direct changes in existing air quality are not expected from this source. For other developmental activities, direct use or minor mofification on expansion of existing facilities is expected, with only minor (if any) direct environmental effects.

Prototype Production (3.6.2.3). Preproduction prototype units of all critical system elements will be produced in sufficient quantitites to permit system testing. These tests will be at a sufficient scale to provide confidence that the required degree of performance and reliability will be attained, and cost goals met, if the system were produced and made operational.

The composition of the labor force will change as the full scale development process cycles from the design and development phase to the prototype production phase. The demand for labor will shift somewhat from the highly skilled to the lesser skilled, including craftsmen, mechanical and electrical assemblers, and the like. The production activities are expected to have essentially the same types of environmental effects as those for the developmental phase, and the same prime contractors are expected to continue this phase of the program.

Some change in the specific locations of subcontracted efforts can be expected, with a change from developmental activities to a requirement for "hardware" items - complete assemblies to individual components and for additional raw materials and other supplies.

The combined effects of FSED development and production activities are addressed in Volume II of this Environmental Statement.

Missile Testing (3.6.2.4). Testing of the missile proper, including launches from the selected aimpoint configuration using its associated launcher, is an element of full-scale development. These activities are planned for Vandenberg Air Force Base, California, and will affect the construction site for the required facilities, population centers on and near the base, and Santa Barbara County as a whole. Key issues were presented in Section 3.5.2.2. Details are given in Volume III of this

Environmental Statement. There are four potential sites on base, with the ultimate selection to be made at a later date.

The following potential effects and mitigation actions have been identified:

- Water Resources - Conflict of water needs with competing uses are not likely since most of the water needs for MX testing at Vandenberg will be supplied from an aquifer local to Vandenberg AFB. Withdrawal of water from this aquifer will not significantly affect off-base water availability. Long-term planning for water needs of the base will be required to minimize overdraft; however, no impact on military water use is expected. The countywide water demand generated directly and indirectly by MX is estimated to reach 110 AF/yr (1.35×10^5 m^3/yr) by 1981. This will be about 0.04 percent of the 1981 total county demand. By 1985, the MX-related demand will peak at about 600 AF/yr (7.4×10^5 m^3/yr) or about 0.23 percent of the total county demand in that year. Although very small, the MX-related water demand will further increase the growing divergency between water supply and water demand in the county unless increased conservation efforts are practiced or supplemental sources are obtained.

- Air Quality - Air quality increases in vehicular emissions which will result from construction and operation traffic and induced growth in the Vandenberg area will be small and probably will not result in measurable changes in air quality except in the immediate vicinity of construction sites. Major transient sources of emissions would be from test-launching of the missile. Potentially harmful rocket exhaust emissions such as hydrogen chloride will be dispersed quickly and will not result in toxic levels of pollutants beyond a few thousand feet from the launch pad. No permanent regional effects are expected.

- Biological Habitat - Degradation of habitat and interference with protected species could occur; however, the conceptual facilities layouts within the candidate siting areas have been positioned within each of the areas to avoid the most sensitive habitats. Some protected species may utilize areas adjacent to candidate siting areas, but if project activities are restricted to the areas defined, no adverse impacts are expected. Similarly, all project design and construction activities will take into consideration the sensitivity of pristine habitats.

- Noise - Both construction activities and missile firings will generate noise. Noise impacts on population centers both on- and off-base will, however, be minimal.

- Socioeconomic effects - The maximum expected increase in employment for north Santa Barbara County as a result of the MX project at VAFB will result in a population increase of 1 or 2 percent greater than the increase projected without MX. This amount of growth can be absorbed by the existing and planned community facilities and will not adversely affect the area. MX impacts combined with Space Shuttle and LNG impacts would not be significant during operational phases, but could require mitigation measures during peak construction years. The most pressing need would be for temporary housing which could be provided by developing adequate parking areas for 75 to 100 recreational vehicles or house trailers used by transient workers.

Milestone III (3.6.3)

The Milestone III decision will commit the required production of equipment and construction of facilities necessary to deploy a force of MXs in a selected site or sites, and the deployment, operation and eventual decommissioning of the system.

The basing mode decision made at Milestone II will have a major influence on the form of all ground-system elements developed in the FSED phase. Specific details may differ however, as the result of continuing evaluation of the potential threat, and of design decisions made during the evaluation of the program. The size of force necessary to respond to the threat assessment will also become more well defined as additional intelligence is gathered and analyzed, and as the attainable performance of the MX force can be predicted with additional confidence.

The site or sites to be used for deployment will also have been established (Site Deployment site(s) selection will precede the Milestone III decision, and appropriate environmental studies and a Final Environmental Impact Statement will be produced to aid in the corresponding decisionmaking process.)

Continuing environmental analysis and a Final Environmental Impact Statement will also be produced to aid in the decisionmaking process at Milestone III. Since the Milestone II decision will facilitate the Milestone III action, a brief summary of potential effects of the latter decision has been included here so that overall environmental concerns can be considered by the decisionmakers at Milestone II.

The potential effects of the Milestone III decision are considered in five broad categories:

- Production of the equipment and spares required for the system.
- Construction of the facilities necessary for the system.
- Deployment of the system, which is assumed to take place over a 5-year nominal period during which part of the system is operational, and construction and installation of the remaining part is in process.

- Operation of the system over its useful life.
- Mission realignment which may either be abrupt or progressive, i.e., the system may expand, remain partially operational or be taken out of service.

Most quantitative estimates refer to the nominal values used for that evaluation, and do not account for inherent variances or the potential for engineering changes during FSED. They may thus be used as a general guide to effects, but must not be considered firm at this time. Appropriate additional studies, interactions between engineering and environmental specialists, and production of a future separate Environmental Statement with comprehensive up-to-date environmental analyses will precede the Milestone III decision and aid the decisionmakers in that decision.

Production (3.6.3.1). Potential effects of production have been considered here in terms of their major socioeconomic impacts. The analysis is based on a scenario in which missiles and their support equipment will be produced at a rate of 50 per year over a 5-year period. This uniform rate for support equipment is a simplification, in that more intensive construction of basic elements of, for example, the command, control, and communications (C^3) may occur early in the program.

Gross shifts in the specific locations of production activities are not expected from those of the preproduction phase, although they are possible. Participation by the major contractors for the FSED phase is likely, since they will have conducted pre-production planning and have the technical base, pre-production experience, and facilities necessary for the production effort.

In order to assess the national effects of a full force of missile system production, the following initial assumptions are made:

- The cost of procurement per missile is estimated to be $36.5 million in 1976 dollars.
- Cost per missile includes production of the missile and all of its support equipment such as missile transport and launch vehicles; command, control and communications (C^3) equipment; canister, and ground support equipment.
- Initial expenditures for the production of a 50 missile force per year would amount to $1,825 million (1976 dollars).

Direct annual expenditures for the production of the missile system describe only a portion of the program's economic effects. In the forefront, certain business firms and households will act as the direct or prime supplies of purchased goods and services from other businesses. The secondary suppliers, in turn, rely upon other suppliers-and so on down the line. The successive rounds of inter-industry and household consumption purchases and sales make up the remaining or indirect and induced component of the total economic effort.

For each component of an action, the overall economic response will be larger than the initial stimulus. Correspondingly, each stimulus will be related to its response by means of a multiplier. The size of the multiplier depends upon the specific needs of the missile (aerospace) industry. The total magnitude of the direct and indirect impacts have been computed using the National Input-Output model (U.S. Bureau of Economic Analysis, 1974). Table 3-1 presents the national impact parameters for the Complete Missile Industry including support equipment.

Table 3-1. National effects parameters for the complete missile industry

EFFECTS PARAMETERS	I-O COEFFICIENTS
Gross Output Multiplier	4.470
Earnings - Output Ratio	0.340
Household Coefficient	0.454
Employment-Earnings Ratio (Missile Industry	64.98/$1 million earnings
Employment-Earnings Ratio (All Industries)	86.34/$1 million earnings

Source: U.S. Bureau of Economic Analysis, 1974.

The gross output multiplier gives the total change in output as a result of a given initial investment. The output-to-earnings ratio provides the labor's share of the increased output as a result of the initial investment. The total earnings include both direct and indirect earnings resulting from labor directly contributing to the project and from successive rounds of inter-industry and household comsumption as supplier industries respond to contracting firms' expenditures for missile system production. Employment-to-earnings ratios allow earnings to be converted to employment. The ratio indicates that for every million dollars of increased total earnings about 86 jobs would be created. Earnings within the missile system industry are calculated by using the household coefficient for this industry. These direct earnings are then converted to direct jobs created in the missile system industry.

National implications of the production of a 250 missile force system and support equipment over a five year period are given in Table 3-2.

Table 3-2. Summary of socioeconomic effects of the missile system procurement.

EFFECT INDICATORS	EFFECT
Estimated Expenditure for 250 Missiles	$9,125,000
Change in Output Over 5 Years	$40,789,000
Change in Earnings Over 5 Years	$13,869,000
Shift in Aerospace Employment	53,780 jobs

The production phase will also involve continued commitment of resources to the project, other than money and manpower. Most of these resources are expected to be in plentiful supply, but shortages may exist for some. The extent to which strategic and critical materials are incorporated into the design will not be known with certainty until the designs are firm.

The other environmental effects associated with production (impacts on community services, etc.) will also occur during the production phase, but with possible differences in scale. These factors will also be addressed at Milestone III.

Construction (3.6.3.2). Construction activities associated with the MX system include construction or expansion of a Strategic Missile Support Base in reasonable proximity to the operating area, and of the aimpoints and support facilities within the operating area previously described. The numbers and types of facilities required will depend on a number of factors, including the basing mode selected, area or point security, the basing site (which may be compact, or in broken terrain), and other site characteristics (e.g., population density and availability of offbase housing and services). Potential effects can therefore be addressed only in the most general terms. Values quoted below assume a 5-year construction period. The FSED effort will also include the development of mitigations additional to those currently identified.

Land Acquisition. Before construction can begin, requisite land must be acquired. The "ownership" classes of land on which the system may be based include:

- Department of Defense (DOD) public lands, which are tracts of land within the public domain, withdrawn for military use. As such, they remain ultimately under the control of the Department of the Interior. These withdrawals are not permanent; those for some potential siting areas are expiring, and all will expire in 1990 under the provisions of the Federal Land Management Act. Re-withdrawal requires mineral surveys, an EIS, and, for tracts over 5,000 acres (2,000 ha), an Act of Congress.
- Other public domain lands which would have to be withdrawn for military use under similar procedures.
- Government acquired lands, which is land previously purchased by the government for use by federal agencies. These lands would have to be transferred from the using agency (DODOR other) to the Air Force for MX use.
- Private lands, which would have to be purchased for the purpose. (Acquisition of easements, as well as outright purchase, is also required for the point security concept.) The necessary funds must be appropriated by Congress.

An FEIS on Deployment Areas selection will precede land acquisition and will consider "ownership" as well as other factors. For the sample areas (BMCAs) and system parameters considered in this environmental statement, as much as 17,600 mi^2 (45,600 km^2) of public non-DOD land would be required (horizontal shelter, area security, expanded spacing, California Mojave BMCA) in an extreme case. Similarly, in areas without public land, as much as 19,128 mi^2 (49,540 km^2) of private land would be required for the same system.

The point security concept reduces these problems considerably; however, there will be increased public exposure, increased demand on available water, and increased operating personnel. In the worst case, approximately 295 mi^2 (765 km^2) of land would be required for aimpoints and roads. Another approximately 5,280 mi^2 (13,675 km^2) of area with restrictive easements would also be necessary for safety requirements. This land would be available for most uses (agriculture, recreation, etc.), but habitable structures would be excluded.

Socioeconomic Effects. Socioeconomic effects during the construction phase are highly site-dependent. For the sample areas considered, direct and induced construction-generated jobs could be as high as 37,000 within the counties affected or 90,000 within the reasonable "Economics Effects Province," where a substantial labor and supplier base exists (trench, expanded spacing, Luke/Yuma). Conversely, in more remote areas the corresponding estimated values are 370 and 12,700, respectively (vertical shelter, nominal spacing, Central Nevada). Although these values are "best estimates" at present, they indicate the wide range associated with locational and basing mode selections.

None of the sample areas contains a sufficient labor force to support the full effort, even at the nominal system parameters used in this Environmental Statement. Different levels of in-migration are therefore expected. Some of the workers and their families are expected to occupy permanent housing, and others to live in temporary housing or labor camps. Again, a wide range of site and project-dependent effects is predictable. As many as 99,500 and as few as 3,000 new residents have been projected on this basis. Similarly, as many as 30,700 and as few as 7,900 workers and some family members may be expected to live in temporary housing and labor camps. New housing units will be required for the in-migrating "resident" workers.

The changes in population associated with construction will also influence the need for public services. Again, this factor is project and site-dependent, ranging from $42.4 million for areas with few existing services and large in-migration to slightly less than $1 million for areas with a well-developed construction labor base and adequate existing services.

The area security mode will require the relocation of rural residents. No towns have been included in the geotechnically acceptable areas nor have any major highways. In each BMCA, however, a substantial number of people live in the rural areas. The number of rural residents who could be relocated in the worst case ranges from approximately 200 up to 70,000. The sheer numbers of people potentially affected in the midwest under area security could make that security mode unacceptable there. Point security is designed to minimize potential resident relocation. The number of rural residents that could require relocation under point security is estimated to be 100. Additional analysis during follow-on Environmental Impact Statements will address localized potential impacts prior to any siting decisions.

Peak-hour traffic is similarly influenced, ranging from a predicted high of 32,000 to a low of 5,600 vehicles.

Although a given project will require essentially the same amount of electrical power regardless of where it is constructed, the actual local demand is also dependent on the in-migration, which increases demand. On this basis, a maximum demand of 120 MW is projected; the minimum demand is 51 MW. (These demands are substantial, and will generally require construction of new facilities).

A range of materials is required for construction, including concrete constituents. Of these, the most critical have been identified as cement and water. Depending on the project and location, cement demand is estimated to range from 5.2 to 0.3 percent of the capacity of the corresponding regional suppliers. Construction represent the major demand on water supplies, which may be inadequate in some areas.

Archeological remains may be threatened by construction activities in some areas. Such remains are customarily avoided, preserved in place, or recovered and deposited in appropriate collection.

Biological Effects. Removal of vegetative cover by surface disturbance during construction will disrupt biological communities at the site by lowering productivity of the natural vegetation, increasing erosion potential, and reducing the availability of food and cover for wildlife. Surface disturbances in relatively undisurbed locations result in a long-term decrease in the biological value of the deployment site as natural habitat area. This effect involves consideration of biological aesthetics as well as habitat disfunction. The loss of natural habitat area will depend upon the present level of disturbance in the deployment area, the rarity of the habitat type in the region, potential for recovery from surface disruption, and the size of characteristics of the project. A relative index of loss of natural biological habitat has been developed which shows the greatest effect for trench-White Sands, and the least for vertical shelter in the Texas/New Mexico Plains and the South Platte BMCAs. Loss of vegetative cover (other than agricultural) may range from approximately 56 to 377 mi^2 (145 to 976 km^2).

Effects on wildlife will generally be directly related to the removal of vegetation during construction. Larger, free-ranging species will be excluded from some areas by fences or other structures related to security requirements. A few very sensitive species of birds and mammals may be displaced by noise or the increased level of human activity brought about by construction and operation of the facility. Exclusion of fencing could be a factor in area security, but is not present in point security.

A decision to deploy MX in an area of limited water availability may result in depletion of water supply to local aquatic habitats. The effect on aquatic biota will depend largely on the project water requirements and acquisition methods (wells, streams, etc.) as well as local hydrological conditions.

Potential adverse effects on rare plant and animal species are not of a different nature than effects on other flora and fauna but are of greater significance because sensitivity of these species to threat of extinction and their legal and aesthetic importance.

Physical Effects. Air quality is potentially degraded by construction activities, however, studies of the range of projects and potential sites conducted for this Environmental Statement indicate that no standards will be violated for any regulated constituent. Construction will result in some temporary decrease in visual range as a result of particulate (dust) generation.

Erosion potential will increase as a result of surface disturbance and possible alteration of drainage patterns by construction activities. Erosion can result in soil loss, alteration of stream channels, siltation of reservoirs, reduced groundwater recharge, and changes in terrestrial and aquatic habitat. Loss of productive agricultural soil is a serious effect of erosion. Erosion potential is judged worst for the buried trench in the southwest, and least for point security in the Texas High Plains sample areas.

Aesthetic Effects. Aesthetic degradation will also occur as a result of the surface disturbance and construction of roads and above-surface structures. Judgments of aesthetic disturbance are highly subjective, but the effects are greatest when the disturbed area is relatively pristine. The presence of fresh scars, occasional dust plumes, earthmoving and other vehicles, stockpiles, batch plants, and temporary structures is likely to produce a stronger aesthetic impact during the transitory construction period than following completion of the project, when activities are reduced and disturbed surfaces recover.

Deployment (3.6.3.3). Deployment, as the term is used here in a specific context, refers to the period during which the system becomes operational. The deployment period begins with installation of equipment in the first group of aimpoints and facilities, and ends when the last group becomes operational. In the interim period, three types of activities may be in progress simultaneously: operation of a portion of the system; installation and checkout of equipment at the next increment of aimpoints to become operational; and construction of additional aimpoints and facilities.

During deployment as so defined, the full construction crew will be employed, additional personnel will be on site for equipment installation and checkout, and Air Force personnel will be operating and maintaining the portion of the system already in service. Peak local socioeconomic effects in particular are expected during this period: maximum employment, need for community services, maximum power demand, and the like. Since neither the basing mode, force size, or period of deployment have been defined at this time, quantitative estimates of effect have not been generated. Periods of 3, 5, and 7 years have been postulated. The shorter period would make the effects more intensive, and the longer period would reduce them.

Off-site activities during the deployment period include progressive expansion of the logistics support system, crew training, and initiation of operational test firings from Vandenberg Air Force Base. Phased expansion of the off-site Strategic Missile Support Base (SMSB) may also occur to provide the facilities necessary to support additional increments of operational missiles. Alternatively, housing and related facilities could be provided in advance of need and made available temporarily to civilian personnel to minimize the ultimate effect of termination of the deployment phase on the affected region.

Operation (3.6.3.4). Manpower, equipment, materials, and power requirements for the fully deployed system will depend on the basing mode and number of missiles deployed, and on the site selected. (Site selection will influence the total area required, and thus total travel time, a need for auxiliary devices such as radio repeater links, potential need for an Auxiliary Operational Control Center in a large area, and potential additional Security Alert Facilities.) Potential effects of the operational phase are summarized below in general terms.

For area security, relatively large areas will be required. At the nominal values used for comparative purposes in this environmental statement, these areas would vary from approximately 3,560 to 19,100 mi^2 (9,220 to 49,500 km^2). Approximately 21 to 40 mi^2 (54 to 104 km^2) would be effectively withdrawn under the point security concept, with the remaining area open to most public use.

Socioeconomic Effects. For the sample areas considered in this environmental statement, direct and induced operation-generated jobs could be as high as 6,600 within the counties affected, or 59,000 within the Economic Effects Province. Conversely, in more remote areas the corresponding values are 250 and 14,300 respectively.* Resident population in-migration is expected to range from a maximum of 14,600 to a minimum of 2,600, and nonresident from 10,900 to 3,000 individuals.

The changes in population associated with operations can result in an additional need for public services ranging in cost from $12.6 to $2.1 million.

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*The values quoted in this section are not necessarily for the same projects or locations as described for construction, and are thus not generally additive.

Peak-hour traffic is estimated to range from a maximum of 13,700 to a minimum of 3,300 vehicles.

New housing required may range from approximately 15,700 to 1,800 units to support the resident in-migration.

Agricultural production could be lost within the exclusion area. The present value of agricultural revenues forgone, should a security mode be chosen which precludes such additional activity, were estimated using a twenty year production loss and the Water Resources Council discount rate of 6 7/8 percent. The value of agriculture revenues lost would range from a low of $100,000 for the 20 year period in the Central Nevada BMCA to a high of nearly $24 billion for horizontal shelter with area security and extended spacing in the Texas High Plains BMCA.

Mining activity would also be disrupted within the exclusion area. The minerals themselves would not be lost, however, and would be recoverable at a later time, which is not the case with loss of agricultural production.

The airspace above area security deployments is to be restricted (no access) to an altitude of 5,000 ft (1,524 m), and controlled (permit required) to an altitude of 18,000 ft (5,486 m). This restriction could result in closure of some small airports, and impede general aviation traffic. In the worst case, approximately 1,400 mi (3,626 km) of commonly used flight paths would be disrupted for the sample areas used in this environmental statement (horizontal shelter, area security, expanded spacing, California Mojave). No restrictions are expected if the point security concept is adopted.

Biological Effects. Areas disturbed by construction will revegetate, although restoration of the preexisting or "climax" vegetative types may require from 30 to 150 years. Areas of undisturbed vegetation that has been overgrazed or otherwise damaged could recover.

Physical Effects. Operational activities will produce air quality emissions and dust generation. Erosion potential will generally be higher during the operations phase than it was prior to construction, but should diminish with time as surfaces stabilize and revegetate.

Aesthetics. Aesthetic degradation will also decrease with time, and, as with construction, will vary in intensity with the pre-deployment condition of the deployment area.

Nuclear Hazard Perceptions. People living in the vicinity of the site may perceive a danger to themselves because of the nearby presence of nuclear weapons, or because they view the region as a target area. These factors have not been serious in other ICBM sites. The perception is likely to be greater with point security than with the area security deployment because people will live within the area, the area will be of large size, and there will be an awareness that armed missiles are being moved above surface within the area.

Mission Realignment (3.6.4.5). Mission realignment, ranging from operations curtailment to expansion, will result in significant changes in the total environment of the deployment area and of neighboring communities. The key socioeconomic effects likely to be felt are identified as follows:

- Regional employment
- Regional population
- Regional civilian employment
- Regional civilian population
- Local public expenditures
- Housing demand

Population and employment effects vary over a wide range. The military and civilian component of these aggregates represents the most significant changes anticipated, although physical and biological effects would also occur.

Engineering Test Bed (3.6.4)

Engineering Test Bed operations for the vertical shelter will probably be located on a USAF Range or Base in the southwestern United States. Major effects will be as follows:

- Physical. Earth displacement and vehicle movement could cause generation of dust. This can be minimized through careful control of vehicles, watering at construction sites, and oiling or paving road surfaces.

  Minor blockage of drainage could occur in basin and range areas of the southwest. However, the relatively small size of the project disturbance will allow siting of the facilities to minimize disturbance to any significant water courses.

  Limited water resources in the arid regions of the west could require additional pumping and/or new wells. The relatively small resource requirements and the choice of areas with few competing water users should eliminate any serious water resources impacts.

- Biological. Effects on natural vegetation will be directly related to the removal of vegetation during construction. A few very sensitive species of birds and/or animals could be displaced by noise and the increased level of human activity. The location of the vertical shelters away from areas of topographical relief, including mountains and major washes, the spacing of the shelters approximately 10,000 ft (3,050 m), and the relatively short duration of the engineering test should minimize any long-term detrimental biological effects.

- Socioeconomic. The small size of the project and the existence of other activities on USAF Ranges and Bases will probably result in minimum requirements for transient workers. However, the possible remote location will generate requirements for temporary housing and support facilities such as water and power. Water for these purposes and for construction may have to be obtained from newly drilled deep wells. Power required is available on USAF facilities through extended transmission lines or, should that prove environmentally or economically too costly, through the use of temporary generators.

- Archaeology. USAF Ranges and Bases are, by their nature, relatively undisturbed areas. In addition, the dry nature of the environment preserves surface artifacts. The preferred location of the engineering test bed operation, with connecting roads in flat valleys, would be unlikely to disturb significant multiuse sites. Impacts to archaeological resources can be minimized through the surveys of areas of major human activity and the location of connecting roads in areas of past disturbance wherever possible.