Editor's Note: this is an extract from the Space and Missile Systems Center's History Office.

SPACE AND MISSILE SYSTEM CENTER
MISSION AND ORGANIZATION

The Space and Missile Systems Center traces its ancestry back to the Western Development Division (WDD) of the Air Research and Development Command (ARDC). WDD was activated on 1 July 1954 and was redesignated the Air Force Ballistic Missile Division (AFBMD) on 1 June 1957. The organization's original mission was to develop strategic missiles for the Air Force, but ARDC added the responsibility for developing the first military satellite system on 10 October 1955. The responsibility for strategic missiles remained with AFBMD and its successors through the decades that followed, but the Department of Defense (DOD) continued to modify and add to its assignment of the responsibility for the space mission. In February 1958, the Eisenhower administration activated the Advanced Research Projects Agency (ARPA) and placed it in charge of all military space programs during their research and development phases. In September 1959, ARPA lost its dominant role, and Secretary of Defense Neil McElroy divided responsibilities for developing military satellites among the three services. The Army was to develop communication satellites; the Navy, navigation satellites; and the Air Force (in effect, AFBMD), reconnaissance and surveillance satellites. Only the Air Force, however, was to develop and launch military space boosters. This arrangement continued until March 1961, when Secretary of Defense Robert McNamara gave the Air Force a near monopoly on development of all military space systems, ending the role of the Army and the Navy except under exceptional circumstances. Some important exceptions to this developmental monopoly occurred during the next 40 years. For example, the development of reconnaissance satellites and related systems soon came under the authority of the National

Members of the Weapon System 117L program gather at the Western Development Division in 1956, soon after the first Air Force satellite program was transferred from Wright Air Development Center.

Reconnaissance Office (NRO), and the Navy developed the first successful space-based navigation system. However, the Air Force continued to exercise a predominant responsibility for military space efforts.[1]

By 1961, therefore, AFBMD had two parallel missions to perform, but it was not necessarily clear that the two missions belonged together. Over the next several decades, in fact, the missile and space functions were separated and rejoined repeatedly, causing numerous reorganizations and redesignations. Because of the increasing importance of space systems, the space and missile functions were separated on 1 April 1961, when AFBMD was inactivated and replaced by the Ballistic Systems Division (BSD) and the Space Systems Division (SSD). On 1 July 1967, the space and missile functions were reconsolidated in the interest of economy, and BSD and SSD were merged to form the Space and Missile Systems Organization (SAMSO). Space and missile functions were separated a second time on 1 October 1979, when SAMSO was divided into the Space Division and the Ballistic Missile Office. These two organizations were redesignated Space Systems Division (SSD) and Ballistic Systems Division (BSD) on 15 March 1989. By the early 1990s, missile programs were being cut back because the cold war had ended, and a final series of redesignations and realignments brought the space and missile functions together for a third time. On 5 May 1990, BSD was redesignated the Ballistic Missile Organization (BMO) and realigned under SSD. On 1 July 1992, SSD was redesignated the Space and Missile Systems Center (SMC), the name it bears today. Finally, in September 1993, BMO was inactivated and absorbed by SMC, recreating the situation that had existed in the 1950s and again in the 1970s, when a single organization was responsible for both space and missile programs.

The Aerospace Corporation

SMC and its predecessors have been supported over the years by private sector organizations that have provided systems engineering for its programs and technical direction to its contractors. The first such organization was the Ramo-Wooldridge Corporation, chosen in 1954 to provide systems engineering and technical direction for WDD's missile programs. In 1958, Ramo-Wooldridge merged with Thompson Products to form Thompson-Ramo-Wooldridge (TRW). However, Congress expressed reservations about the propriety of a profit-making entity serving an agency of the government so closely and exclusively. In 1959, Congress recommended that a nonprofit agency be established as the systems engineering arm of the Air Force for space and missile programs. In June 1960, a nonprofit organization—The Aerospace Corporation—was created at the initiative of the Secretary of the Air Force to perform that function. At that time, plans called for TRW to continue providing systems engineering for existing missile programs and for Aerospace to provide systems engineering for all space programs and for future missile programs. As it turned out, Aerospace did perform some work in the missile field, but it focused primarily on space,

[1] That predominance was recognized by DOD's Commission to Assess U.S. National Security Space Management and Organization in its report published on 11 January 2001. It was translated into policy when Secretary of Defense Donald Rumsfeld, acting on the Commission's recommendations, assigned to the Air Force the "responsibility for planning, programming, and acquisition of space systems" in his assessment of the Commission's report provided to Congress on 8 May 2001.

and TRW remained the primary source of systems engineering for missile programs.

Field Units

Changes in the organizational structure of SMC and its predecessors have been paralleled by changes in field units. Through those field units, its predecessors were involved not only in the development and acquisition of space systems but in space operations as well. Beginning in the 1950s, SMC's predecessors provided or acquired units that controlled military satellites in orbit, conducted satellite launches as well as R&D missile launches, and operated the ranges that supported those launches.[2] The satellite control function was originally performed by the 6594th Test Group, created by AFBMD in 1959, and later by the Air Force Satellite Control Facility, which replaced the Test Group in 1965. During the 1960s, launches were performed by the 6595th Aerospace Test Wing at Vandenberg Air Force Base (AFB) and by the 6555th Aerospace Test Wing at Cape Canaveral Air Force Station (AFS). In 1970, the 6555th became a Group and was realigned under the 6595th, and the 6595th was realigned under a new field unit, the Space and Missile Test Center (SAMTEC). SAMTEC was responsible for overseeing launches at both Vandenberg and the Cape and for operating the Western Test

Left: Brigadier General Osmond Ritland, then vice commander of WDD, breaks ground at Cooke AFB on 8 May 1957 for the construction of space and missile facilities on the west coast. Cooke was soon renamed Vandenberg AFB. Right: Officers of AFBMD's 6555th ATW discuss their final inspection of the Agena spacecraft (in cradle) for the launch of MIDAS 2 on Atlas 45D (in background) on 24 May 1960.

[2] The ranges themselves—that is, the facilities as opposed to the organizations that conducted launches—were controlled during the 1950s and 1960s by organizations that did not report to AFBMD. The ranges reported directly to Air Force Systems Command and were designated the Air Force Missile Test Center at Cape Canaveral and the Air Force Space Test Center at Vandenberg AFB. From 1964 to 1970, both ranges—known then as the Eastern Test Range and the Western Test Range—were overseen by the

Range that supported launches out of Vandenberg. In 1977, it also acquired responsibility for running the Eastern Test Range that supported launches at the Cape. In 1979, SAMTEC was redesignated the Space and Missile Test Organization (SAMTO) and was restructured with two major field units of its own, the Eastern Space and Missile Center (ESMC) and the Western Space and Missile Center (WSMC). ESMC and WSMC conducted launches and operated the ranges on the east and west coasts respectively.

SMC's responsibility for space operations began to change on 1 September 1982, when Air Force Space Command was activated to serve specifically as an operational command for military space systems. In the years that followed, Space Command gradually took over the operational functions previously performed by SMC's field units, and, in the process, it absorbed most of the units themselves. The Air Force Satellite Control Facility was inactivated on 1 October 1987, and most of its personnel and functions were taken over by wing-level units assigned to Space Command. HQ SAMTO was inactivated on 1 October 1989. A year later, the Eastern and Western Space and Missile Centers were reassigned to Space Command, and the transfer of launch operations to Space Command began.[3]

While SMC's predecessors lost field units involved in operations, they temporarily gained units involved in research. In October 1982, the Air Force Space Technology Center (AFSTC) was activated at Kirtland AFB and assigned to Space Division. At the same time, three pre-existing laboratories were assigned to the AFSTC—the Air Force Weapons Laboratory, the Air Force Geophysics Laboratory, and the Air Force Rocket Propulsion Laboratory (later redesignated the Air Force Astronautics Laboratory). Creation of the AFSTC centralized Air Force space technology efforts and reoriented them to better serve the needs of the program offices at Space Division. In December 1990, the AFSTC was redesignated the Phillips Laboratory, and the three laboratories formerly assigned to it were folded into it to form a single super laboratory. In January 1993, Kirtland AFB, where the Phillips Laboratory was located, was transferred to SMC, and the 377th Air Base Wing, the host wing at Kirtland, was assigned to SMC as well. Nevertheless, SMC's subordinate units and their missions were stripped away again during the late 1990s. Phillips Laboratory became part of the newly created, centralized Air Force Research Laboratory on 8 April 1997. The 377th ABW was reassigned to the Air Armament Center at Eglin AFB, Florida, on 1 October 1998 to centralize air armament issues within the Air Force. Some space and missile programs managed at Kirtland AFB were closely tied SMC's central mission and were not reassigned. In general, they provided test and evaluation, launch of experimental payloads, and on-orbit operations from the Space Shuttle. These programs were placed under a single SMC detachment—Detachment 12—on 29 June 2001.

National Range Division, which reported directly to Air Force Systems Command. In 1970, the Space and Missile Test Center (SAMTEC) was set up under SAMSO to oversee both the launching organizations and the ranges as explained above.

[3] Launch operations were transferred incrementally. The Delta II and Atlas E launch operations were transferred first, followed by the Atlas II, Titan II, and Titan IV launch operations.

BALLISTIC MISSILES

The Air Force ballistic missile program had its origins in studies and projects initiated by the Army Air Corps immediately after World War II. These efforts aimed at mating the German V-2 ballistic missile and the atomic bomb, a union that carried the potential for a revolution in strategic warfare. Technical problems held the program back at first, but the situation was changed drastically by the so-called "thermonuclear breakthrough" of the early 1950's. This breakthrough made it possible to manufacture high-yield nuclear weapons that were small enough and light enough to be carried as warheads aboard ballistic missiles.

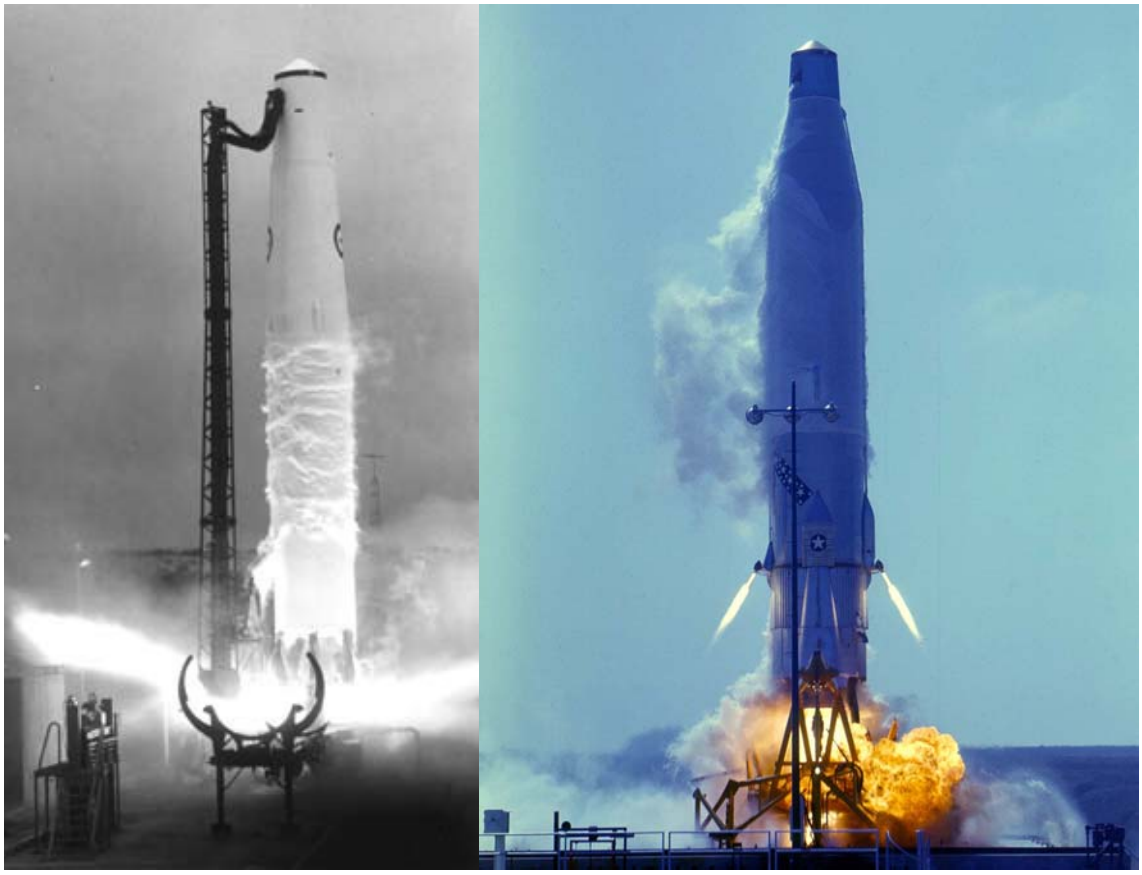
Atlas, Thor, and Titan I

Faced with growing evidence of the Soviet Union's development of thermo-nuclear weapons and ballistic missile technology in 1953, the Air Force Secretariat's architect for research and development, Trevor Gardner, chartered the Strategic Missiles Evaluation ("Teapot") Committee, chaired by Professor John von Neumann, to diagnose the slow pace of America's strategic missile programs. The Committee recommended in 1954 that Project Atlas, the only American ICBM then under development, be reoriented and accelerated. The Air Force established the Western Development Division to carry out that task, sending Brigadier General Bernard A. Schriever to Los Angeles to set up and command the new organization in August 1954.

The three people most directly responsible for the success of the early Air Force Strategic missile programs: Trevor Gardner (Assistant Secretary of the Air Force for Research and Development), then-Maj Gen Bernard A. Schriever (commander of the Western Development Division), and Dr. Simon Ramo (CEO of the Ramo-Wooldridge Corporation).

At first, the Division was responsible for developing only the Atlas, which was being designed and built by the Consolidated Vultee Aircraft Corporation (Convair). It was an intercontinental ballistic missile with liquid-fuel engines and a stage-and-a-half configuration. Within a year, the Division also became responsible for developing an alternate missile called the Titan. A more advanced, two-stage missile to be built by the Martin Company, the Titan was a hedge against failure or delay in the Atlas program. By the end of 1955, the Division was also developing an intermediate range ballistic missile, the Thor, under contract to Douglas Aircraft Company. Finally, it was charged with achieving initial operational capability for the three missile systems. That meant deploying them, a massive undertaking in itself. In barely 18 months, the mission of the Division had undergone an enormous expansion.

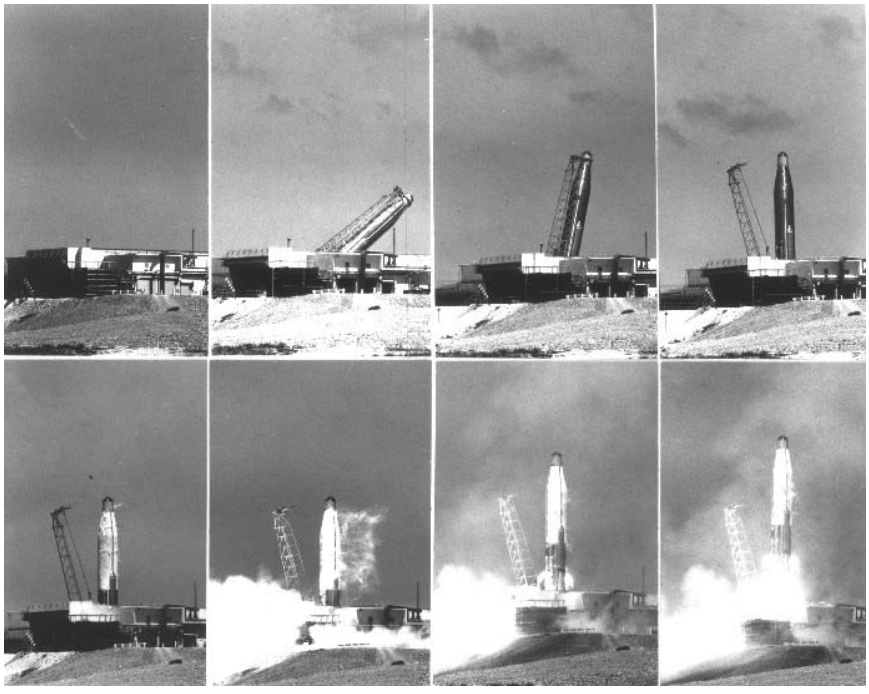
To develop operational missile systems as soon as possible, the Division replaced the conventional pattern of sequential development with concurrent development. Within the framework of a single overall plan, tasks related to development, production, testing, and initial operational capability proceeded simultaneously. Although the concept of concurrency was not new, the Division applied it on a scale never before used in military development programs.



Left: "Lion's Roar," the first launch of a Thor IRBM by an RAF crew, takes place at Vandenberg AFB on 16 April 1959; Right: the first SAC launch of an Atlas missile (Atlas 12D) takes place at Vandenberg AFB on 9 September 1959. SAC then declared the Atlas weapon system operational.

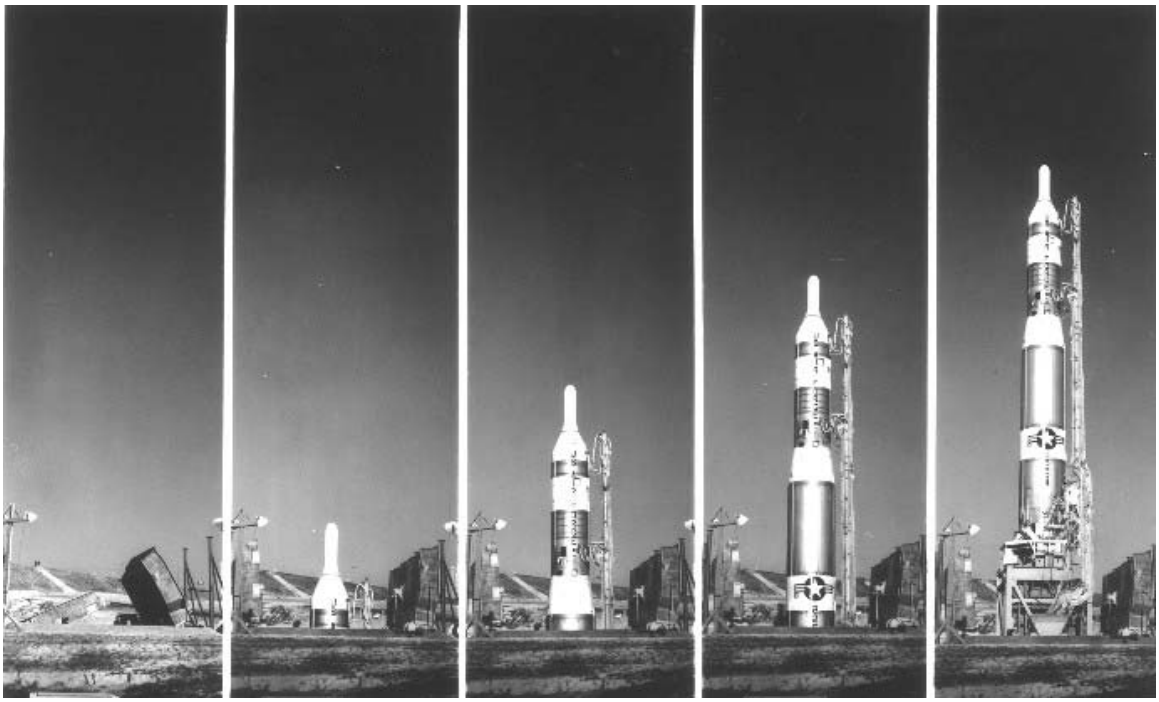
Titan I missile J-7 begins the first successful flight test of an operational Titan I ICBM on 10 August 1960 at the Atlantic Missile Range.

The development of ballistic missile systems slowed in 1956-1957, when the Eisenhower administration made large cuts in defense spending to balance the budget. However, on 4 October 1957, the Soviet Union used an ICBM to launch the first man-made satellite. Sputnik's impact was dramatic. The United States' missile program was given renewed impetus, restrictions were lifted, previous program priorities were reinstated, and funding was vastly increased.



Atlas missile 25-D rises to a vertical position and begins a test flight on 22 April 1960. Atlas Ds—the first Atlas missiles to become operational—were stored in unprotected, above-ground, horizontal launchers. Later models of the Atlas were better protected. Atlas Es were stored in semi-hardened horizontal launchers, and Atlas Fs were stored in hardened vertical silos.

On 20 September 1957, even before Sputnik, the Air Force Ballistic Missile Division successfully launched a Thor missile from Cape Canaveral, Florida. On 17 December, the Division carried out the first successful Atlas launch, also from Cape Canaveral. Following these successes, the Air Force missile program progressed rapidly. Deployment of the Thor was completed in 1960 at four 15-missile Royal Air Force squadrons in England. By the end of 1962, 132 Atlas launchers had been turned over to squadrons of the Strategic Air Command (SAC) by Ballistic Systems Division's Site Activation Task Forces (SATAFs). The Titan I made its first successful operational flight in 1960, and the SATAFs turned over all 54 Titan I launchers to SAC during 1962. By the end of 1962, therefore, all three first-generation missiles were in place and ready for operation.



A Titan I missile emerges from its silo at Vandenberg's Operational System Test Facility in 1960. The Titan I was stored and fueled in a hardened underground silo, but an elevator had to lift it out of the silo before it could be launched. The entire launch sequence took about 15 minutes. Ultimately, the Titan I was deployed in 54 such silo-lift launchers divided among seven operational sites. All became operational in 1962, and all were inactivated in 1965.

Titan II and Minuteman

In the late 1950's, the Ballistic Missile Division began developing two second-generation missiles, the Titan II and the Minuteman. Like the original Titan I, Titan II was a two-stage, liquid fuel missile. Unlike its predecessor, however, it used storable propellants and an all-inertial guidance system, and it could be launched from hardened underground silos. These improvements gave the Titan II quicker reaction time, greater survivability, and improved performance. The first Titan II unit achieved operational status in June 1963 and the last in December of the same year.

The Minuteman was the first American intercontinental ballistic missile to use

solid rather than liquid fuel. It possessed all the virtues of the Titan II, and its use of solid fuel gave it two additional advantages: greater simplicity and economy. The first Minuteman flight test missile was launched on 1 February 1961, and the first two flights of Minuteman missiles was turned over to the Strategic Air Command on 11 December 1962. By the end of 1965, Minuteman missiles had been deployed at four bases in the north central United States, and the older, less efficient, and less economical Atlas and Titan I missiles had been retired from the active inventory. The Minuteman, along with the Titan II, became the mainstay of the nation's strategic missile force. Together with SAC's manned bombers and the Navy's Polaris/Poseidon missile-launching submarines, these missiles formed the triad of strategic deterrent forces that were maintained on day-to-day alert to counter any nuclear attack on the United States or its allies.

A Titan II ICBM undergoes a test launch from an underground silo. Unlike Titan I missiles, which had to be raised to the surface before launch, the Titan II's liquid rocket engines were ignited while it was still in the silo. Therefore the silo had to be constructed with flame and exhaust ducts as shown in this photograph.

Just as the Atlas and the Titan I had been replaced by the Titan II and the Minuteman, the original Minuteman was itself replaced by the more advanced Minuteman II and Minuteman III. The Minuteman II incorporated a new, larger second stage, improved guidance, greater range and payload capacity, and greater resistance to the effects of nuclear blasts. The Minuteman III, for its part, possessed an improved third stage, employed more penetration aids to counter anti-ballistic missile defense systems, and was equipped with up to three independently targetable warheads. By the end of 1975, 450 Minuteman IIs and 550 Minuteman IIIs were in place and ready for operation at six bases in the north central United States.

Other portions of the ballistic missile force were becoming obsolete. The Air Force issued direction to deactivate Titan II missiles on 30 April 1982. The 55 operational missiles were removed from their silos during 1982-1987 and placed into

storage for possible conversion to space launch vehicles.

Peacekeeper and Small ICBM

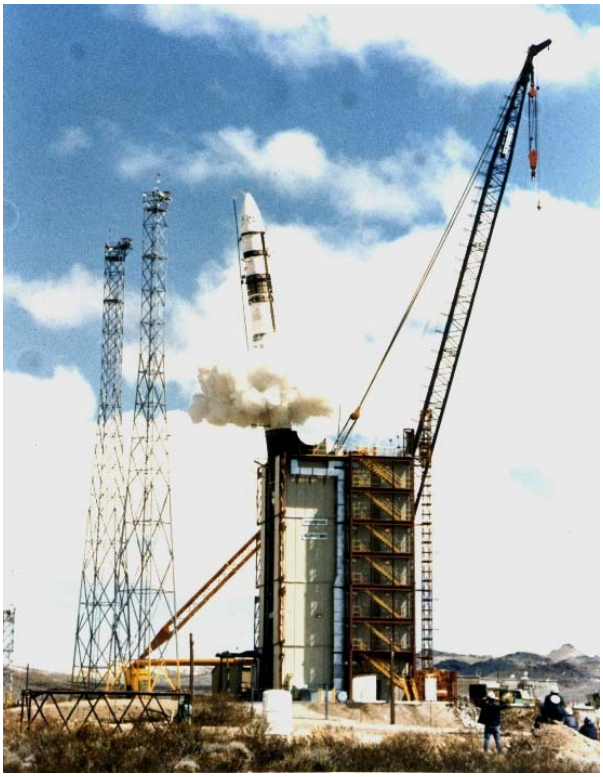
Under the terms of the 1972 Strategic Arms Limitation Agreement with the Soviet Union, this country was barred from increasing the number of strategic missiles in its operational inventory. If it wished to maintain its strategic position *vis a vis* the Soviet Union, therefore, it had to do so by improving the quality of its missiles rather than by increasing the quantity. With this objective in view, an advanced development program was started in late 1973 to define the technology and design concepts for a new strategic missile called Missile X. A great deal of effort was devoted to studying alternate basing concepts for this missile, including air-mobile and ground mobile concepts.

A Peacekeeper missile is launched from its silo. Unlike the Minuteman, which was launched by igniting the stage 1 motor while the missile was still in the silo, the Peacekeeper was ejected from its silo by hot gas, and its stage 1 motor was ignited when it was about 100 feet above the ground. (Photograph courtesy Air Force Space Command Public Affairs Office)

Missile X was renamed the Peacekeeper by President Reagan on 22 November 1982. It was a four-stage ICBM capable of precisely delivering 10 reentry vehicles to different targets more than 6,000 miles away. It successfully carried out its first flight test on 17 June 1983, when a Peacekeeper that had been cold-launched from a canister at Vandenberg AFB reached its target in the Kwajalein Missile Range. In April 1983, the President accepted the recommendation of the Scowcroft Commission that the Peacekeeper be temporarily based in existing Minuteman silos. The first ten missiles went on alert between 17 October and 22 December 1986, and the basing program achieved full operational capability when the fiftieth missile entered its silo on 20 December 1988. DOD accepted a concept for a permanent basing mode in 1986. It involved placing 50 Peacekeeper missiles on 25 trains, which would be kept in protected shelters scattered throughout the country. When war threatened, the trains would be released to travel over the commercial rail network until their missiles had to be

launched. The program entered full-scale development in May 1988. By the early 1990s, however, the Cold War was winding down, and the Soviet threat was diminishing. In a dramatic speech delivered in 27 September 1991, President Bush announced a wide-ranging plan to unilaterally reduce the American nuclear arsenal and eliminate several categories of weapons. As part of the plan, he announced the cancellation of the Peacekeeper Rail Garrison program.

The Scowcroft Commission had also recommended the development of a new, lightweight missile carrying only one reentry vehicle. President Reagan authorized full-scale development of the Small ICBM (SICBM) in December 1986. SICBMs would be housed in mobile launchers based at widespread locations. When hostilities threatened, the launchers would drive out onto the roadways and scatter across the country. The program narrowly escaped termination in 1988 because of reduced funding. It achieved its first totally successful flight test on 18 April 1991, when a SICBM that had been cold-launched from a canister at Vandenberg AFB reached its target in the Kwajalein Test Range. Nevertheless, President Bush canceled the SICBM program in January 1992 because strategic tensions seemed to have decreased after the end of the Cold War.



A simulated Small ICBM being ejected from its launch canister in the Canister Assembly Launch Test Program (CALTP). Like the Peacekeeper, the Small ICBM was to be "cold launched." The missile was to be ejected from a canister, and its stage 1 motor was to be ignited after the missile was in mid-air. The CALTP program tested the launch eject system and the effects of a cold launch on stage 1 of the missile.

Effect of ICBM Reduction Agreements

The Strategic Arms Reduction Treaty of 1991 (START I) and the START II treaty of 1993 progressively reduced the number of warheads that the United States and Russia could maintain and eliminated missiles with multiple warheads. These provisions required the United States to reduce the number of Minuteman missiles, permanently reconfigure the remaining missiles to launch only one warhead each, and scrap its Peacekeeper missiles. In response, the last Minuteman II missiles were dismantled and

stored for use as launch vehicles in 1996, and 150 Minuteman III missile sites were destroyed during 1999-2001. By 2002, the entire Minuteman force consisted of only 500 Minuteman III missiles at three deployment sites. Though START II was never ratified by the United States, subsequent diplomatic agreements limited the number of warheads in each national arsenal even further, and the Moscow Treaty of May 2002 set limits well below START II. After the Moscow Treaty, it appeared that the last Peacekeeper missiles would have to be scrapped in 2012, leaving only the aging Minuteman III missiles on strategic alert. To maintain them, SMC's ICBM Program Office at Ogden Air Logistics Center conducted major Minuteman life extension programs which replaced guidance systems, solid rocket motors, and power systems on the missiles as well as improving communications, command, and control equipment in the launch facilities. Nevertheless, by 2003 the status of ICBM programs was again in doubt. In June 2002, the United States unilaterally withdrew from the Anti-Ballistic Missile Treaty of 1972 in order to develop a National Missile Defense System. In response, Russia announced that it would no longer be bound by the START II agreements.

An Air Force Space Command crew removes the nose section of a Minuteman III missile in a silo at Malmstrom AFB, Montana, early in 2003. Portions of the missile were to undergo flight testing in a launch from Vandenberg AFB as part of Air Force Space Command's continuing evaluation program for the remaining inventory of ICBMs. (Photograph courtesy Air Force Space Command News Service)