CHAPTER III: 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.

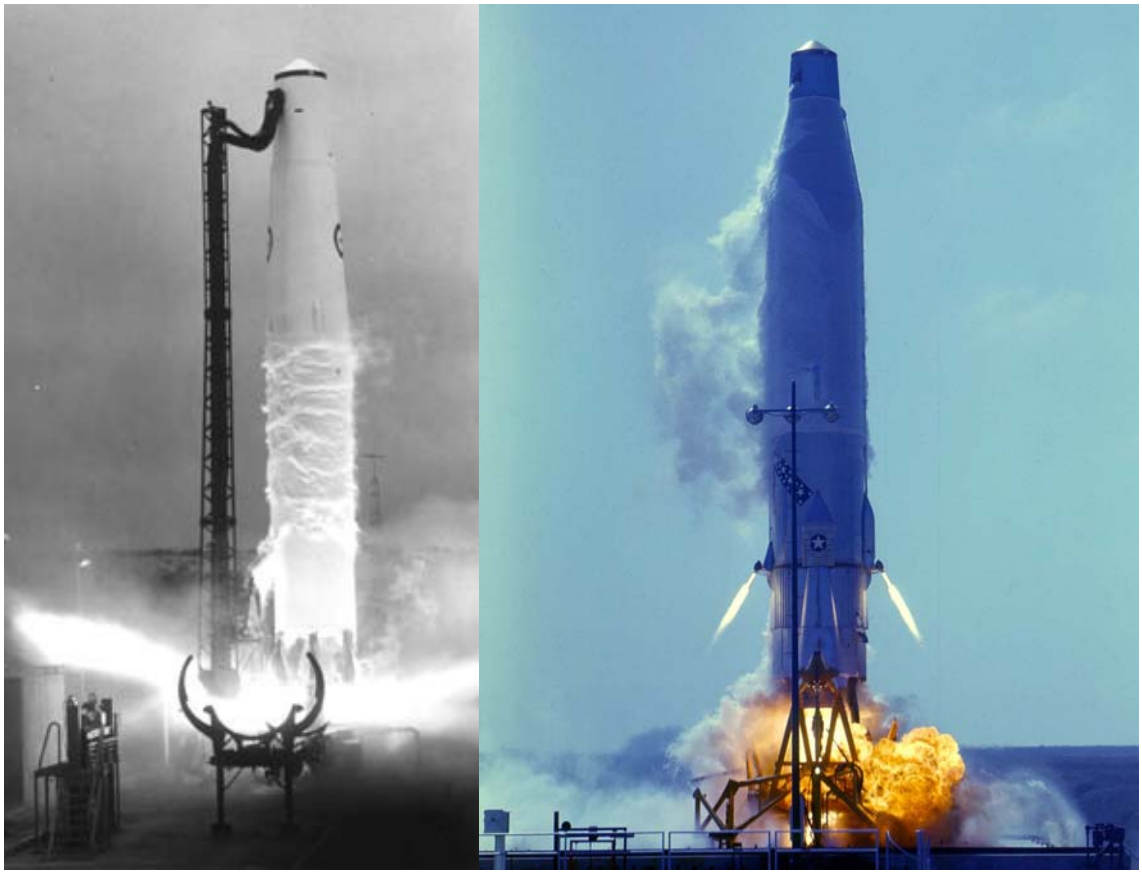
Atlas, Thor, and Titan I

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.



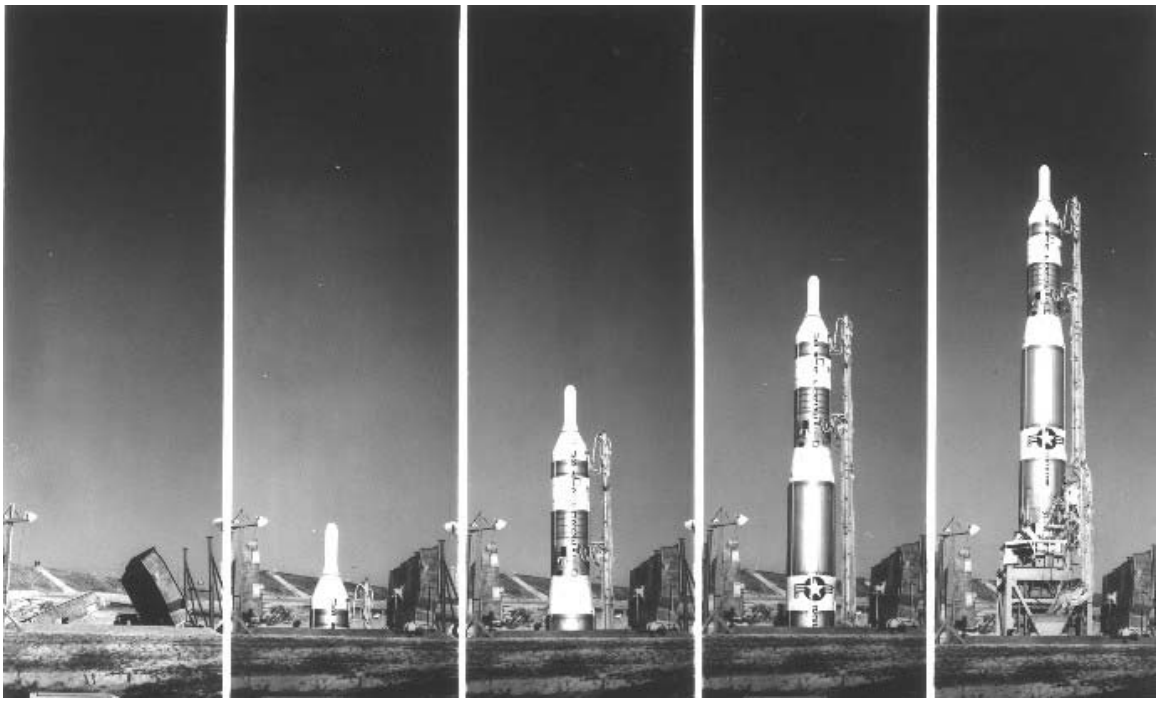
Left: "Lion's Roar," the first launch of a Thor IRBM by an RAF crew, takes place at Vandenberg AFB on 16 April 1959; Right: the first SAC launch of an Atlas missile (Atlas 12D) takes place at Vandenberg AFB on 9 September 1959. SAC then declared the Atlas weapon system operational.

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

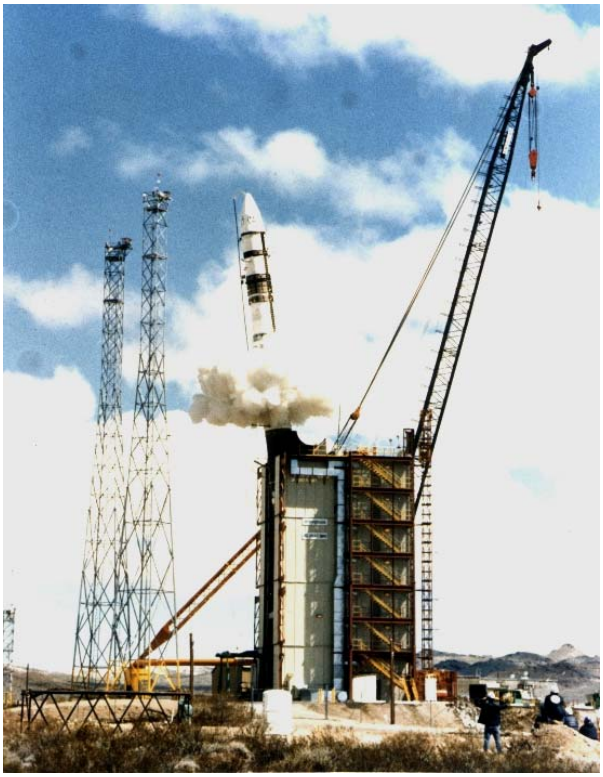
Under the terms of the 1972 Strategic Arms Limitation Agreement with the Soviet Union, this country was barred from increasing the number of strategic missiles in its operational inventory. If it wished to maintain its strategic position *vis a vis* the Soviet Union, therefore, it had to do so by improving 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)