

How the Air Force Got the ICBM

Three Titan I intercontinental ballistic missiles, iconic of the Cold War, stand ready for launch at a western US base. The wrangling over the nuclear missile mission began early. The Army believed that it should belong to the ground service.

The mission could have gone to the Army, which saw ballistic missiles as a new kind of artillery.

By John T. Correll

regarded it as a challenge to the manned bomber. In any case, they said, missiles were supplementary to airplanes, not replacements for them.

"For the next 10 years, long-range air bombardment will be effected by means of subsonic bombers only," Brig. Gen. Thomas S. Power, a future commander of Strategic Air Command, said in 1947.

Power was right. The early atomic bombs weighed five tons and were effective for a radius of about half a mile. They were far too heavy to be delivered by any missile then envisioned. Given the ballistic accuracy of the day, a missile warhead that traveled 5,000 miles might come down 75 miles from its target.

These problems were not resolved until the 1950s, when the development of the hydrogen bomb made warheads much smaller and lighter and when better accuracy was available.

Faced with a choice between ballistic missiles and jet-propelled aerodynamic missiles—which resembled airplanes—the Air Force bet on the aerodynamic ones and put its best efforts there.

Two Kinds of Missiles

Rockets had been around for a long time, but they did not become serious weapons until the introduction in World War II of the German Vergeltungswaffen ("vengeance weapons").

The first of these, the V-1 buzz bomb, was a jet-propelled cruise missile, not a rocket. The world's first ballistic missile was the V-2, which appeared in September 1944.

The Army Air Forces quickly produced a copy of the V-1, called the JB-2 (for "jet bomb"). The AAF also contracted with Northrop for the JB-1, which had an elegant flying wing design that anticipated the look of the B-2 bomber half a century later. The jet bombs were canceled at the end of the war and are remembered today only as historical curiosities.

No weapon symbolized the Cold War more than the intercontinental ballistic missile. It could travel thousands of miles and deliver a warhead on target in minutes. There was no defense against it.

From the 1960s on, it was the main threat in the Soviet nuclear arsenal. Air Force ICBMs, teamed with heavy bombers and submarine-launched ballistic missiles, were the leading element of the US strategic force.

Even before the Germans introduced the V-2 rocket in World War II, the coming importance of guided missiles was understood.

In 1943, Gen. Henry H. "Hap" Arnold, commanding general of the Army Air Forces, predicted, "Someday, not too far distant, there can come streaking out of somewhere—we won't be able to hear it, it will come so fast—some kind of gadget with an explosive so powerful that one projectile will be able to wipe out completely this city of Washington."

It was not foreordained, however, that the ICBM would be an Air Force weapon. It could have gone to the Army. In fact, the Army Ordnance Department made a strong bid to get it. Another solution would have been to parcel out the ICBMs among the various services. Or, the United States could have copied the approach taken by the Soviets, who made the Strategic Rocket Forces a separate service.

Air Force leaders of the 1940s were of two minds about missiles. They saw the potential of the ICBM, but they also

In 1946, the AAF had 12 guided-missile projects going. The effort was divided between aerodynamic missiles, which were jet propelled, and ballistic missiles, which were rocket propelled.

Aerodynamic missiles depended on their engines to sustain them in flight. Ballistic missiles were launched by rocket power and boosted into space, where powered flight ended. The missile then re-entered the atmosphere and followed a ballistic course to its target.

Of the Air Force missile projects under way in 1946, two were of particular significance. One of these was the Convair MX-774, which would eventually evolve into Atlas, the first American ICBM.

More favored, however, was the Northrop MX-775 Snark, a winged cruise missile that looked like a fighter. It had a 42-foot wingspan and was powered by a turbojet engine and two rocket boosters.

The Air Force believed that aerodynamic missiles would be a necessary intermediary stage before ballistic missiles came into use. (Snark would be briefly operational for four months in 1961.)

The more important program was MX-774, forerunner of Atlas. The initial specification was for a supersonic ICBM that could carry a 5,000-pound atomic warhead 5,000 miles and strike within a mile of the target.

The design was based on the German V-2 but with major modifications. It



At left, a shiny Atlas is raised into firing position at the Convair factory in San Diego in 1959. Pictured below is the first operational Atlas launch facility at F.E. Warren AFB, Wyo., circa 1960. The missiles were kept horizontal in such “cof-fins” until crews received an order to prepare the ICBM for firing. It took 15 minutes to set up the kerosene- and liquid oxygen-fueled missile and get it ready for launch.

and in 1955—but the Army persisted in the argument that any missile launched from the ground should belong to the ground forces.

In September 1947, the Air Force was given operational control of pilotless aircraft, strategic missiles (defined as those not employed against targets directly affecting Army operations), and surface-to-air missiles for area defense. The Army kept tactical missiles and SAMs for point defense.

The logic of the Air Force’s case was strengthened by the Key West agreement of 1948, which recognized the Air Force as the service responsible for strategic air warfare.

In March 1950, the Joint Chiefs of Staff made the Air Force responsible for developing long-range strategic missiles and short-range tactical missiles. The Department of Defense confirmed in 1955 that managing the ICBM program was the Air Force’s job.

eliminated some of the metal parts and relied on pressurized fuel tanks for structural stability. That reduced the weight, as did a provision for the nose cone to separate from the missile after burnout. The missile also had gimballed, swiveling engines for stability in flight.

There were three design models. According to Air Force historian Jacob Neufeld, one was called “Teetotaler” because it did not use alcoholic fuel. A second was “Old-Fashioned” because it looked like the V-2. The third and final design was “Manhattan” because it would carry the atomic bomb.

Test flights were partially successful. The missile got off the ground and flew briefly, but then it failed each time and crashed before it got very far.

When postwar budget cuts came, the Air Force preferred aerodynamic missiles to ballistic ones and canceled the MX-774 in 1947. Snark and the short-range Matador cruise missile survived the cut, as did the Bomarc air defense missile.

Convair kept the MX-774 project alive with a combination of leftover development funds and company financing.

The Fight for Control

Airmen in the 1940s regarded mis-



siles as “pilotless aircraft,” with which they had been experimenting for a long time. (The Army Ordnance Department, which was also active in the field, viewed missiles as a kind of artillery.)

In an early division of labor, the War Department had made the Army Air Forces responsible for surface-to-surface pilotless aircraft and put the ground forces in charge of tactical missiles related to ground war.

The missile mission remained in dispute, however, especially when the Air Force became a separate service. The Air Force was assigned responsibility for long-range strategic missiles at least three times—in 1947, in 1950,

Army opposition continued. The author of one Army memo, inadvertently left behind and discovered after a meeting in 1951, took satisfaction in his belief that if the Air Force lost the missile mission, it would become just “another Transportation Corps in 15 or 20 years.”

The Air Force did not help interservice harmony any when it assigned aircraft designations to guided missiles in 1951. Snark, for example, was the XB-62 (for “experimental bomber”). Atlas was the XB-65. Bomarc, being more fighter-like, was the XF-99. The designations were not lasting.

In 1956, the Army laid claim to the missile mission out to a range of



A developmental Titan, left, leaves a test pad near Cape Canaveral, Fla., in 1960. The missile went operational in 1962. Below, a Titan complex under construction. Everything visible would eventually be buried, indicating the depth of the complex.



1,500 miles. That notion was shot down by Secretary of Defense Charles E. Wilson, who ruled that the Army was not to employ any missiles with a range greater than 200 miles. In fact, the Army's Jupiter intermediate-range ballistic missile would be transferred to the Air Force, which already had its own IRBM, Thor.

The Air Force thus gained clear title to the ICBM operational mission.

ICBMs in Earnest

In the early 1950s, the ICBM gathered momentum.

The Russians had the atomic bomb, and intelligence reports said they were moving ahead in missile technology. Communism was on the march in Korea and elsewhere. US defense budgets rose, and there was more money for research and development.

In 1951, the Air Force revived the canceled ICBM program with a contract for Convair to determine the feasibility of a missile that could carry an 8,000-pound warhead for more than 5,750 miles and strike within 1,500 feet of its target. That was a tough specification. This time, the warhead was 3,000 pounds heavier than before.

However, Convair said the task could

be accomplished, given a large enough missile. It might have to be 160 feet long, with five or six engines.

The ICBM was alive again, although the overwhelming majority of the missile development money was going to Snark, Navaho, and other "pilotless aircraft."

ICBMs got another lift after the United States tested a hydrogen bomb in 1952. Scientists said it was possible to build a thermonuclear warhead weighing as little as 1,500 pounds but producing a one megaton yield.

The specification for the warhead on the Convair missile—now called Atlas—was cut from 8,000 to 3,000 pounds. The missile could be 75 feet

long, rather than 160, and three engines would lift it.

When the contract was let in 1955, Atlas was reconfigured. The combined weight of the missile and the warhead was reduced by almost half. With such a powerful warhead, less precision was needed, so the accuracy requirement was reset to between two and about three miles.

In part, the resurgence of ICBM development was the function of strong personalities and leadership.

In 1953, Trevor Gardner became special assistant for R&D to the Secretary of the Air Force. Even people who disliked him gave him top marks for energy and effectiveness. Gardner organized a committee of scientists to oversee strategic missile programs. It was called (for reasons long since forgotten) the "Teapot Committee" and was chaired by John von Neumann of Princeton.

Gardner also recruited the legendary Bernard A. Schriever—then a brigadier general—to manage the ICBM program. In 1954, Schriever became commander of the Western Development Division of Air Research and Development Command, with considerable latitude of authority.

Schriever's industrial partner was Ramo-Wooldridge (later merged with Thompson Products to become TRW), which provided the systems engineering and technical direction. It was a remarkable team, and it pushed the ICBM program ahead with vigor.

Another task for Schriever and the Western Development Division was to develop a second ICBM as an al-



For 45 years, missileers have maintained vigil in deeply buried bunkers such as the one at left. This crew, photographed in the 1970s, monitors the status of 10 Minuteman missiles, dispersed over hundreds of square miles of western prairie. Below, Gen. Thomas White, the USAF Chief of Staff (at the podium), unveils the Minuteman to the public at a 1960 AFA event at San Francisco's civic center. The Minuteman is being erected from a transporter; behind it is an Atlas. Minuteman was more accurate and, being solid-fueled, could be launched in only a few minutes.

This was good news to the Army, which was still maneuvering to build its own ballistic missile force. (It would be a bitter pill for the Army a year later when all IRBMs were given to the Air Force.)

The Air Force was concerned that IRBMs would compete with ICBMs for funding and political support. To reduce that diversion of resources, the Air Force adopted a "family of ballistic missiles" approach in which technology was shared and Thor was developed with "fallout" components and subsystems from the ICBM program.

The Navy soon backed out of the Jupiter program to pursue Polaris, a solid-fuel missile that was better suited for launching from submarines.

In 1956, the Eisenhower Administration and the Pentagon initiated another round of budget cuts. The trend would be hastily reversed a year

later to Atlas. In October 1955, the Martin Co. received a new contract to develop Titan, which would become the largest ICBM ever deployed by the United States.

Titan was a two-stage missile, just over 98 feet long. Like Atlas, it used liquid fuel. However, it did not follow the Atlas pattern of depending on internal pressurization for structural stability. It used conventional aircraft construction techniques for its two stages. Additional structural metal made Titan heavier than Atlas, as well as longer.

Common Warhead

Titan I and Atlas F used the same warhead. The second-generation Titan II was larger, heavier, and had a much larger warhead. Because of that, Titan II would remain in service well into the era of solid-fuel missiles. Newer systems would not pack the same massive punch.

Concurrently, the Secretary of Defense—on advice from the President's Scientific Advisory Committee and others—directed development of an intermediate-range ballistic missile and gave the IRBM a priority status equal to that of the ICBM.



It was a strange decision, induced by fear that the Soviet Union might produce IRBMs first and use them to target all of Europe. Furthermore, the State Department said that confidence in American technological superiority would be damaged if the Russians won the race to field a missile.

It was generally assumed that IRBMs would be operational before the ICBMs were ready. Defense planners did not want to be caught empty-handed. The Air Force was instructed to develop Thor ("IRBM #1"), and the Army and Navy were to work jointly on Jupiter ("IRBM #2"). The latter was to be an adaptation of the Redstone rocket with land- and sea-based variants.

later when the Soviet Union put its Sputnik satellite into space, but, in the meantime, the economizing claimed another casualty. Trevor Gardner, who had gotten the Air Force going on ICBMs, quit in 1956, disgusted with the reductions and slowdowns and the dissipation of technology resources over too many departments and programs.

Missile Gap

In July 1955, long before Sputnik, the White House announced plans for the United States to put a satellite into Earth orbit. The Russians announced similar plans, but nobody paid them much attention.

There were several choices of rockets to launch the proposed satellite. The Air Force offered Atlas, hoping it would not be picked. The Air Force was focused on the ICBM and did not want to scatter its concentration.

Another choice was the Army's Redstone. According to Walter A. McDougall of the University of Pennsylvania, historian of the space race, Redstone was rejected because the former German rocket scientist, Werner von Braun, had developed it. The Administration wanted to avoid any perceived connection to the Third Reich, which might be used by the Russians for propaganda purposes.

Vanguard, a Naval Research Laboratory rocket, was selected instead.

However, the Russians got into space first. On Aug. 21, 1957, they fired an R-7 "Semyorka" ("Number Seven") missile from the Baikonur Cosmodrome near Tyuratam, across the eastern Soviet Union to the Kamchatka peninsula near the Pacific Coast. It was the world's first successful test of an ICBM.

The missile (called SS-6 "Sapwood" in the West) was huge, weighing some 280 tons. To lift off, it required five engines, each with four rocket chambers. It had been unsuccessful in three previous attempts.

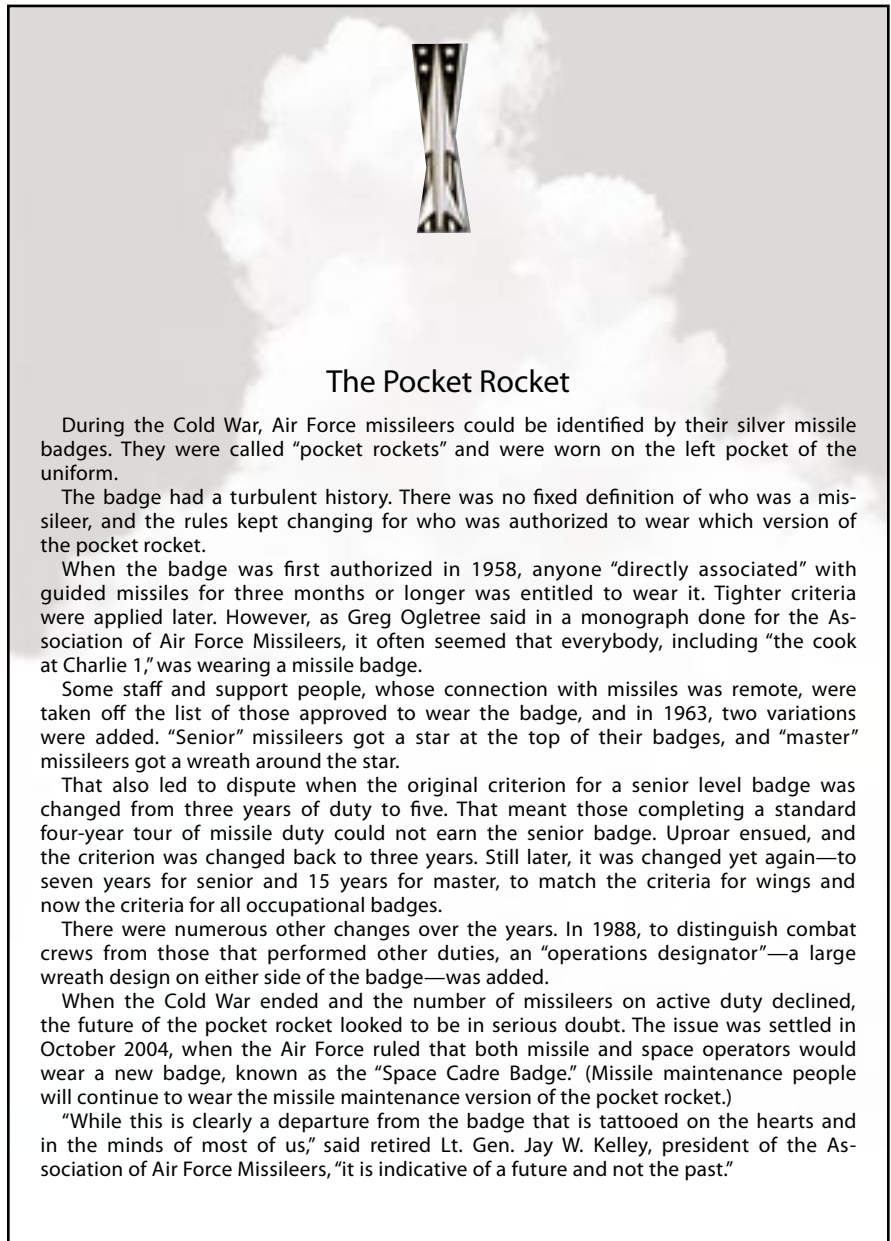
An even bigger shock to the world came two months later, when the Russians used the R-7 to launch Sputnik, the world's first space satellite. The White House tried, without much luck, to play down the achievement.

It got worse on Dec. 6, when the United States made its first effort to put up a satellite. The Navy Vanguard exploded on launch. The London Daily Mail dubbed it "Flopnik," and that was only one of the unflattering terms applied. The United States did not put a satellite into space until Explorer 1, Jan. 31, 1958. The launcher was a Jupiter C, a variant of the Redstone.

Meanwhile, the United States accelerated its ICBM programs. The first successful launch was of the Air Force's Atlas, on Dec. 17, 1957, after two failures.

The perception of a "missile gap" grew despite White House denials. The Democrats seized upon it as a campaign issue.

The impression of a missile gap was exacerbated by the braggadocio of Soviet leader Nikita Khrushchev. "I think I will not be revealing any military secret if I tell you that we now have



The Pocket Rocket

During the Cold War, Air Force missileers could be identified by their silver missile badges. They were called "pocket rockets" and were worn on the left pocket of the uniform.

The badge had a turbulent history. There was no fixed definition of who was a missileer, and the rules kept changing for who was authorized to wear which version of the pocket rocket.

When the badge was first authorized in 1958, anyone "directly associated" with guided missiles for three months or longer was entitled to wear it. Tighter criteria were applied later. However, as Greg Ogletree said in a monograph done for the Association of Air Force Missileers, it often seemed that everybody, including "the cook at Charlie 1," was wearing a missile badge.

Some staff and support people, whose connection with missiles was remote, were taken off the list of those approved to wear the badge, and in 1963, two variations were added. "Senior" missileers got a star at the top of their badges, and "master" missileers got a wreath around the star.

That also led to dispute when the original criterion for a senior level badge was changed from three years of duty to five. That meant those completing a standard four-year tour of missile duty could not earn the senior badge. Uproar ensued, and the criterion was changed back to three years. Still later, it was changed yet again—to seven years for senior and 15 years for master, to match the criteria for wings and now the criteria for all occupational badges.

There were numerous other changes over the years. In 1988, to distinguish combat crews from those that performed other duties, an "operations designator"—a large wreath design on either side of the badge—was added.

When the Cold War ended and the number of missileers on active duty declined, the future of the pocket rocket looked to be in serious doubt. The issue was settled in October 2004, when the Air Force ruled that both missile and space operators would wear a new badge, known as the "Space Cadre Badge." (Missile maintenance people will continue to wear the missile maintenance version of the pocket rocket.)

"While this is clearly a departure from the badge that is tattooed on the hearts and in the minds of most of us," said retired Lt. Gen. Jay W. Kelley, president of the Association of Air Force Missileers, "it is indicative of a future and not the past."

all of the rockets we need: long-range rockets, intermediate-range rockets, and close-range rockets," Khrushchev said in 1957.

He claimed that the Soviet Union had ICBMs in serial production and was turning out missiles "like sausages." In 1959, he said that one Soviet plant had produced, in one year, 250 missiles equipped with hydrogen warheads.

None of it was true. That became evident with imagery from the first photoreconnaissance satellite, the Air Force-CIA Corona, which discovered in 1961 that the Soviet Union had about six ICBMs.

The R-7, which launched Sputnik, was not successful as a weapons system. Only a few R-7 missiles were ever operational as ICBMs.

The actual missile gap in 1961 was in the US favor, but in 1957 and earlier, the Russians probably had been ahead. They just could not sustain and exploit their lead.

"There is little doubt in my mind that we started behind the Soviets in the ballistic missile program," Schriever said. "Of course, neither country had a missile, but they had started well ahead of us, and it was the combined efforts of science and industry and the military that brought about almost a miraculous program."

Fielding the Force

Contrary to expectations, ballistic missiles and aerodynamic cruise missiles made their debut about the same time.

Snark's first successful flight test, covering 4,400 miles, was on Oct. 31, 1957, six weeks ahead of the first successful Atlas test on Dec. 17. Thus, the aerodynamic Snark was technically the first US intercontinental missile.

Atlas achieved initial operational capability in September 1959, not long after the first flight test of Titan I. The first squadron of Titans would be operational in April 1962.

The early ICBMs used cryogenic—or extremely cold—fuels. Both Atlas and Titan were fueled with kerosene and liquid oxygen, which had to be stored separately, kept at a temperature of 280 degrees below zero, and loaded into the missiles just before launch.

Eventually, ICBMs would be based in hardened, underground silos and kept in vertical position for launch, but that came later.

The first operational missiles, Atlas D and E, were stored horizontally above ground in containers called "coffins." The missiles had to be raised upright to load fuel and liquid oxygen prior to launch. Atlas F was placed in an upright position in the underground silo with the fuel stored on board, loaded with liquid oxygen at the beginning of the countdown, then raised to ground level by elevator for launch. It took about 15 minutes to get it ready to fire, according to retired Col. Charles G. Simpson, executive director of the Association of Air Force Missileers.

Titan I was based underground as was Atlas F, with liquid oxygen loaded prior to raising the missile above ground for launch. The first of three missiles at a complex could be launched in about 15 minutes, with the other two following at intervals of about seven-and-a-half minutes.

The follow-on Titan II used different fuel, which could be stored in the missile, and the missile could be fired directly from the underground silo. It could launch in less than a minute, Simpson said.

Minuteman went on alert Oct. 27, 1962, during the Cuban missile crisis late that month. It used solid fuel in each of its three stages, which eliminated many of the storage and handling problems of the liquid fuels. Minuteman was ready all the time and could be launched immediately from the silo.

The IRBMs were not around long. Thor was deployed to the United Kingdom in 1960 and Jupiter to Italy and

Turkey in 1961 and 1962. The last of the IRBMs was retired in 1963.

ICBMs soon established a strong reputation, both in the Soviet Union and in the United States. In 1960, Khrushchev announced that the USSR would stop developing bombers and depend on missiles. Bombers, he said, were obsolete, good only for display in museums. In November 1960, he established the Strategic Rocket Forces as a separate military branch, co-equal with ground, air, air defense, and naval forces.

In 1961, Secretary of Defense Robert S. McNamara said that "I think the evidence points to a declining emphasis on [bombers], but I am not prepared personally at the present time to say for sure that they are on the way out."

Roswell L. Gilpatric, the deputy secretary of defense, felt no such reservations when he left office in January 1964. Writing in *Foreign Affairs* for April 1964, he predicted that, by 1970, the makeup of US strategic retaliatory forces would be "a deterrent force, consisting only of hardened and dispersed land-based and sea-based missiles, with all of the vulnerable, earlier-generation missiles deactivated and all manned bombers retired from active deployment."

ICBMs were good, but both Khrushchev and Gilpatric overstated the case. The Russians resumed building bombers after Khrushchev was deposed. Bombers continued in the US strategic force mix through the Cold War and were still operating effectively almost 50 years later.

Keeping the Peace

A final challenge to the Air Force came from an attempt by the Navy to corner the market on strategic deterrence by claiming that Polaris submarine-launched ballistic missiles were sufficient to meet the nation's needs, without the Air Force ICBMs.

In the late 1950s, the Navy had advocated a strategy of minimum deterrence (later called "finite deterrence"). Naval leaders supported Army arguments that anything beyond the capability to destroy Soviet population centers was "overkill." The Army's leaders wanted defense resources to

be reallocated, with greater emphasis on limited wars, "flexible response," and land forces.

In 1960, the Navy proposed that the entire deterrent force be put at sea, declaring that 45 strategic missile submarines would "come close" to the total deterrent required.

Relying solely on the level of deterrence offered by the Navy was judged too risky, and the attempt to strip the Air Force of strategic missiles subsided. The end result was not what the Navy had in mind.

The Department of Defense did not make a clear choice between finite deterrence and counterforce—the strategy favored by the Air Force. However, in August 1960, Secretary of Defense Thomas S. Gates created the Joint Strategic Target Planning Staff to control the targeting of both Air Force and Navy strategic weapons. The suggestion had come from the commander of Strategic Air Command, who also became director of the JSTPS.

The Air Force by 1962 had fielded four successful ballistic missiles—the Thor IRBM, the liquid-fueled Atlas and Titan ICBMs, and the solid-fuel Minuteman—and was in firm possession of the ICBM mission. By 1964, the number of ICBMs on alert pulled even with the number of bombers on alert.

After that, and until the end of the Cold War, missiles predominated in the Air Force alert force. ICBMs became the mainstay of the US strategic triad, which in 1975 consisted of 1,054 ICBMs, 656 SLBMs, and 497 bombers.

There were further developments, notably the deployment of Minuteman III with multiple warheads (called MIRVs, or multiple independently targetable re-entry vehicles) in 1970, and the introduction of the most capable ICBM of them all, Peacekeeper, in 1986. There was even a revival of the "pilotless airplane" with the Air Force's Ground-Launched Cruise Missile, deployed in Europe in the 1980s to counter Soviet SS-20s.

But by the late 1960s, the ICBM was mature, established, and the bedrock of strategic deterrence. No weapon was more influential in maintaining the peace until the Soviet Union collapsed, bringing the Cold War to an end. n

John T. Correll was editor in chief of *Air Force Magazine* for 18 years and is now a contributing editor. His most recent article, "Full Day," appeared in the June issue.