How the United States overcame the 1960 missile gap in one year

by Marsha Freeman and Robert Gallagher

During the 1960 presidential campaign, Democratic candidate John F. Kennedy charged that the Eisenhower administration was responsible for a "missile gap": a Soviet lead over the United States in the number of deployed intercontinental and intermediate range ballistic missiles.

Kennedy's charge that a missile gap existed was entirely true. The Soviets had four times as many intercontinental (ICBMs) and intermediate-range (IRBMs) ballistic missiles than the United States in 1960 (see table). Kennedy's claim that Eisenhower was to blame, however, was entirely opportunistic. Within months of Kennedy's inauguration, the missile gap had been closed by a "Manhattan Project" initiated under Eisenhower's administration and carried out by the Air Force Research and Development Command (ARDC).

In the 1940s and early 1950s, it was the consensus of the U.S. scientific and defense communities that development of an intercontinental ballistic missile was impossible. Physicist Vannevar Bush, president of the Carnegie Institution and former director of the World War II U.S. Office of Scientific Research and Development, asserted that "a 3000-mile, high-angle rocket shot from one continent to another, carrying an atomic bomb and so directed as to be a precise weapon . . . will not be done for a long period of time to come . . . I think we can leave that out of our thinking."

Overcoming 'barriers of the mind'

Long before the Soviets demonstrated an ICBM capability in August 1957, a small group of scientists and military officers who knew that the ICBM was feasible initiated an effort to overturn the dominant opinion and launch a crash program to develop a U.S. missile force. As Col. Edward Hall of the Air Force Ballistic Missile Division wrote in 1958: "The barrier to be overcome was not of sound, or heat, but of the mind, which is really the only type that man is ever confronted with anyway."

By 1958, Maj. Gen. Bernard A. Schriever, commander of the Ballistic Missile Division, could write that his group had already conducted a development program "which enabled us to accomplish in three and a half years what it took the Soviets seven years to do" in developing missile technology.

In 1953 two developments refuted the arguments against ICBM feasibility. First, the Atomic Energy Commission demonstrated with development of the hydrogen bomb the ability to construct nuclear explosives small enough to be thrown thousands of miles in the nosecone of a rocket.

Second, the Air Force Strategic Missiles Evaluation Committee, chaired by John von Neumann, called for acceleration and expansion of the existing Air Force Atlas ICBM program and its reorganization under a centralized "Manhattan Project"-type military command. The Committee had been organized by ICBM advocates in the Defense Department, such as Trevor Gardner, Air Force Special Assistant for Research and Development, and his assistant, Schriever, with the backing of Air Force Chief of Staff Gen. Nathan Twining and Air Force Secretary Harold Talbott.

The following year the Air Force approved the von Neumann Committee's recommendations and in August 1954 established the Air Force Research and Development Command (ARDC) with Schriever in command of its Western Development Division, later known as the Ballistic Missile Division. In September 1955 Eisenhower gave ICBM development "the highest national priority," the first time a military program had received this designation in peacetime.

Within two years, the Air Force successfully tested the Thor intermediate range ballistic missile, and in December 1957 the Atlas ICBM. Eisenhower's national security advis-

U.S. and Soviet ballistic missile arsenals 1960-63

	1960		Early 1962		Early 1963	
	U.S.	U.S.S.R.	U.S.	U.S.S.R.	U.S.	U.S.S.R.
ICBMs	12	50	63	50+	450	75+
MRBMs/IRBMs	51	200	186	200	250	700

Sources: John M. Collins, *U.S.-Soviet Military Balance*, McGraw-Hill (New York), 1980; Institute for Strategic Studies (London), *Military Balance*, 1959, 1961-62, 1962-63; Ray Cline, *World Power Assessment*, Center for Strategic and International Affairs (Georgetown), 1975.

er, General Cutler, remarked that the United States "had to make up for lost time if we were to catch up with the Soviets." By 1958, the program had employed 18,000 scientists and engineers and 70,000 others in 22 industries and after five years had spent four times as much as the Manhattan Project itself.

By 1959 the project had successively test-flown the Thor, the Atlas and Titan ballistic missiles. Only assembly and deployment was required to close the missile gap. This still lagged the Soviets in 1960 when Kennedy made his famous pronouncement. But within a year the United States had achieved parity. Since the Thor IRBM was ready first, initial U.S. ballistic missile deployments were in Western Europe. As the Atlas, Titan, and Minutemen went into production, intermediate-range missiles were de-emphasized by the United States, but the Soviets, who could deploy them against Europe, continued to build large numbers.

'Moving ahead with everything'

The ICBM program introduced the principle of concurrent pursuit of all aspects of a crash development program. As Schriever wrote:

> This may be defined as moving ahead with everything and everybody, all together and all at once, toward a specific goal. [This] enabled us to . . . compress the time required to obtain operational capability of our ballistic missiles.
>
> We decided to break with tradition—to discard the usual procedure.
>
> weapon, part by part, in a series of consecutive steps—to fashion hand-wrought prototypes before venturing into production tooling. But to reduce the time cycle we decided to attack all areas of our assignment concurrently. In short, we took the calculated risk of planning, programming, and spending our funds concurrently on research, development, testing, production, manpower training, base construction, and other phases of our program.
>
> Our aim was to bring all elements of our program along so that they all would be ready, at each successive stage, to be dovetailed into each other.

The second principle that guided ICBM development was the pursuit of alternate technical approaches to each principal missile subsystem. Propulsion, guidance, nosecone, and re-entry systems each had "backups" developed by separate contractors to add redundancy to the program. After the primary subsystems proved reliable, the backups were combined to form the Titan ICBM.

The test program was also specially devised. The program built huge test stands where missile engines were test-fired under physical restraints without having to expend an entire booster. A special three-stage rocket, the X-17, was produced to test survival of the nosecone during re-entry into the atmosphere. The first stage drove the missile to a high altitude where it dove under the power of the second and third stages. Test ICBMs were assembled with normal production fabrication methods to assure that contractors would be prepared for rapid production of missiles for deployment following the test program.

Under this "Manhattan Project," the first Thor intermediate range ballistic missile came off the assembly line 11 months after the contract was awarded. At that time, the usual development period for a modern aircraft was eight years.

The Atlas and Titan missiles became the "workhorse" launch vehicles for the civilian space program and carried scientific satellites and astronauts into space for the National Aeronautics and Space Administration until NASA developed its first launch vehicle, the Saturn V rocket. In its early phases, the Air Force program produced the engines for the Army Redstone and Jupiter missiles.

In 1958, after the program had demonstrated the Thor and Atlas, Schriever explained the horizons the program had opened up:

> This program has put us on the threshold of space travel. Ballistic missiles, whether Thor, Atlas, or Titan, are in fact primarily space vehicles traversing most of their flight distance in space. They are the forerunners of such projects as lunar rockets, space stations, and spaceships for carrying men and cargo. . . . From a practical standpoint the propulsive unit that lifts a heavy nosecone with its warhead and accelerates it to 25,000 feet per second in outer space could also put a somewhat lighter body in the escape velocity of 35,000 feet per second, or in an orbital path around the earth. . . . Similarly, the ICBM Titan booster engine, when completed . . . could send a man-carrying vehicle on a circumlunar flight—a journey around the moon and back to earth. Further in our future are the potentialities for thermonuclear propulsion and payloads of hundreds of tons.

It was in an effort to reverse the momentum of the ICBM program and the earlier nuclear Navy program that Defense Secretary Robert S. McNamara introduced "cost accounting" into Pentagon defense technology planning and imposed the policy of Mutually Assured Destruction, that the U.S. need only maintain a nuclear retaliatory force.

Schriever warned against exactly these policies at the time he described the program's potential:

> We must look beyond the achievement of parity or superiority vis-à-vis the Soviet Union in this whole field. It would be a colossal blunder if we ever sought to arrest or halt our forward strides at a point where we could match a ballistic missile against every one of the Soviets' or even have more of ours in stockpile. Any letting down at such a juncture would mean that we had fallen victim to a Maginot Line mentality.