

Navaho Missile Program: Part 1

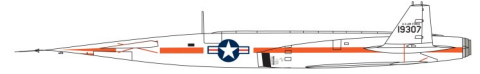
By: Tony R. Landis



Paths to the Present
FLASHBACK

MX-770, NATIV and X-10

During the 1950's and 60's the United States pushed the limits of aerospace vehicle evolution attempting to go faster and higher while exploring the edge of the unknown. As contractors hoped to clutch a big production contract, new designs jumped off the drawing boards at a rapid pace with many making it to the prototype stage. At locations around the United States, the military and industry teamed together to test aircraft of all types, be it bombers, fighters, transports and others. This time also included the era of the Winged Missile, including Mace, Matador, Snark and



BOMARC.

One of most impressive endeavors, North American's *Navaho*, pushed the envelope in many areas including design and test. Capable of navigating halfway around the world at speeds in excess of Mach 2, the *Navaho* represented all that was state of the art for its time, but all of this advanced technology in one package came at a cost. Technical difficulties, in-flight failures and cost overruns became the *Navaho's* Achilles heel.

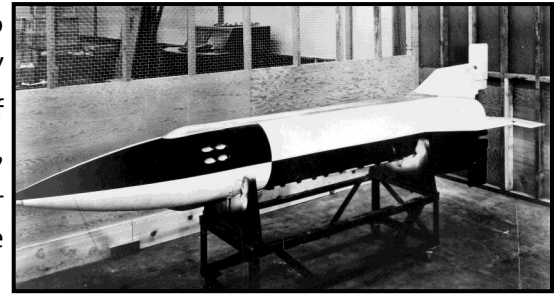
On August 24, 1945, the Army Air Forces (AAF) issued a series of military requirements for several surface-to-surface missiles categorized according to range: 175 to 500 miles, 500 to 1,500 miles and 1,500 to 5,000 miles. All necessitated several requirements: a minimum speed of 600 miles per hour, transportable by air, highway, railroad or ship, and designed so major components could be assembled in the field. Late in 1945, the Air Materiel Command (AMC) requested proposals from 17 potential contractors, which included North American Aviation who submitted a design for a supersonic surface-to-surface missile on December 28th of that same year.



The AAF initiated Project MX-770 (Materiel, Experimental, #770) on April 22, 1946 by awarding North American Aviation (NAA) a one-year study and research program leading to the preliminary design

Before ICBM's took over the long range nuclear delivery mission, winged missiles such as the Northrop SM-62 (top), Martin TM-76 Mace (above) and Boeing IM-99 Bomarc (left) were designed to fulfill that mission.

of a supersonic guided missile with a range of distances from 175 to 500 miles from its launch point. Early design studies for the NATIV (North American Test Instrument Vehicle) missile and construction of a launch ramp began under this contract, which ended on April 22, 1947. The AAF later amended the contract on May 16 to include development of the required component systems. Of importance, as the Industrial Complex continued to mature, the NATIV program gave



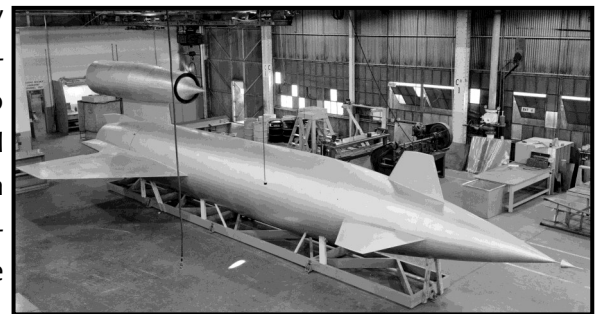
North American Aviation NATIV missile program was undertaken to give NAA experience in the field of rocketry, then in its infancy.

North American critical experience in the field of long-range rocketry.

With the amended contract, NAA constructed a total of fifteen NATIV missiles with static firings of the first, fourteen-foot long, NATIV missile beginning in January 1948. The first flight took place at Holloman Air Force Base, New Mexico on May 26th. Now designated as the RTV-A-3, North American testers made seven flight attempts with the NATIV missiles; only four actually left the launch tower. North American considered one a success, two partial successes and one failed shortly after leaving the tower with the final flight occurring on November 5th. Because of this, the Air Force



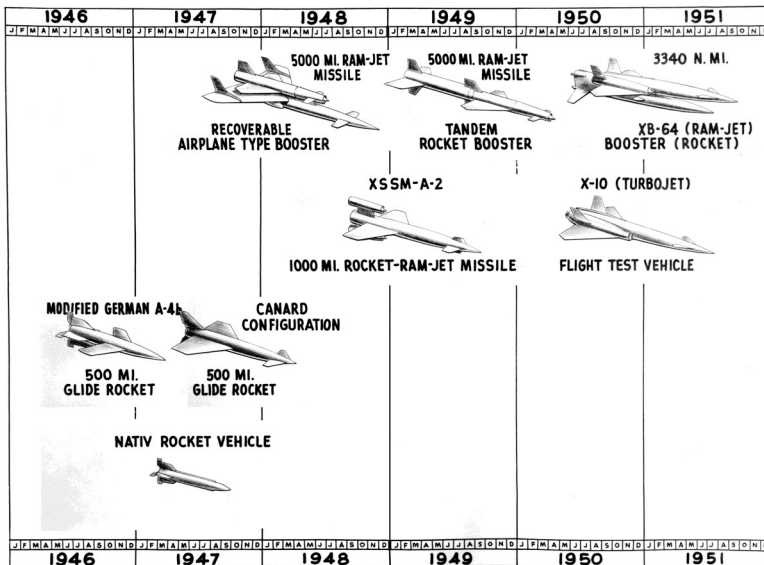
Rare color photo of a NATIV missile being prepared for launch from the Holloman AFB missile test range.



NAA constructed several full scale mockups during the early stages of the MX-770 program including this design, the NA-704. NA-704 was the first of the ramjet-powered, canard-configured design studies.

saw little use in this data for the follow-on program and postponed future launches. The Air Force terminated the NATIV portion of Project MX-770 early in 1949.

PROJECT MX-770 HISTORICAL EVOLUTION OF B-64 MISSILES



North American Aviation spent the next two years developing technology required for the new, long-range missile program, now referred to as *Navaho*. The Air Force required that the operational *Navaho* have speeds in excess of Mach 3 with a range of 5,500 miles. To reach these requirements, in September 1950, NAA proposed a three-step development program and the Air Force agreed. First, there would be a turbojet powered test vehicle, which would be useful in obtaining data on the guidance system, stability and control, and recovery techniques. North American initially designated this system as RTV-A-5, *Navaho I* and subsequently, X-10.

Next, NAA planned an interim ramjet-powered missile designated as XSSM-A-4, *Navaho II*, G-26, XB-64 and subsequently XSM/SM-64. Finally, NAA proposed building and testing a final ramjet-powered, what would become the operational missile, designated as the SSM-A-6, *Navaho II*, G-38, XB-64A and finally XSM-64A/SM-64A.

The first part of Phase 1 testing began at Edwards AFB to prove the basic flight characteristics and reliability of the new design. Next, the Air Force utilized the Air Force Missile Test Center at Cape Canaveral, Florida for operational testing. The prototype X-10 took to the air for the first time on October 14, 1953 for a successful 32 minute flight, safely returning to Edwards AFB. Shortly after the X-10 program began, NAA received the go-ahead to construct five XB-64 test missiles and a short time later they began constructing the mockup for the XB-64A.



The first X-10 Navaho parked on the lakebed prior to another test mission at Edwards AFB.



The second X-10 during one of its three test flights from Edwards AFB. This X-10 Navaho was lost on July 1, 1954.



Not all test flights went as planned. The first flight of the third X-10 came to brief end due to the destruct package being mistakenly wired to the landing gear retraction switch.

at Edwards. Of the initial twelve flights made between August 19, 1955 and November 20, 1956, six performed without flaw, and one X-10, number 52-1, reached a record speed for turbojet aircraft on February 29, 1956 when it reached a maximum speed of Mach 2.06 before returning to perform a

Despite a successful beginning to the flight program, challenges beset the project. Between October 14, 1953 and March 29, 1955, NAA used five X-10 test vehicles and conducted fifteen flights at Edwards AFB.

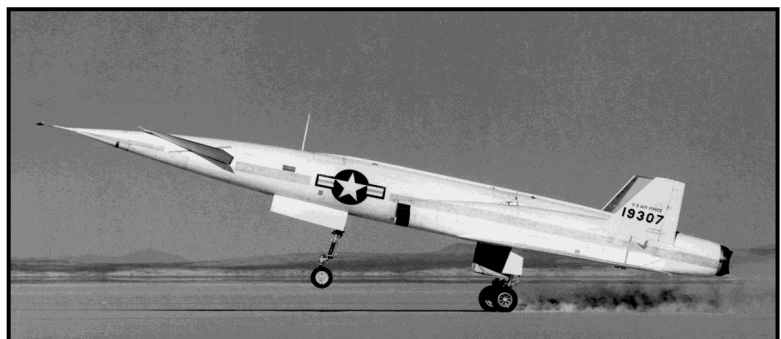
The vehicles reached a maximum speed of Mach 1.84 and max altitude of 41,800 feet, but NAA lost four of the five test vehicles, two of them on their first flights. Surprisingly it was the first prototype, GM-19307, which survived the test program having



As the Navaho program accelerated, the hangar at Edwards AFB became very cramped with multiple X-10 test vehicles as well as all test equipment and spare parts.

made eight of the fifteen test flights at Edwards before being retired.

Once NAA completed the initial test program at Edwards, the X-10 project moved to the Air Force Missile Test Center in Florida for the remainder of the flight program. East Coast testing allowed for better checkout of the XN-6 auto-navigator system, autopilot control modes as well as correct dive techniques that the SM-64 missiles would use while in flight. The East Coast tests went much better than the testing



X-10 ship 1 making one of its final landings on the lakebed at Edwards AFB. This vehicle is the only survivor of the X-10 flight test program.

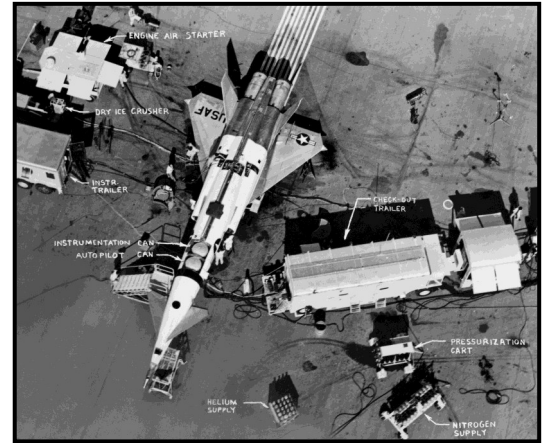


All of the X-10 aircraft that flew from Cape Canaveral Missile Test Center bore a colorful paint scheme to assist with long range tracking. This X-10 Navaho, number 52-2, was lost at sea on its first flight out of the Florida test center.

safe auto-landing back at the Cape Canaveral Skid Strip. At the end of Phase 1 testing, North American had built a total of thirteen X-10 missiles with nine expended during flight testing. With Phase 1 of the Navaho program now complete, the Air Force directed that NAA use three of the remaining four missiles as BOMARC missile targets. As directed, the X-10 team made three flights between September 24, 1958 and January 26, 1959 with two missiles destroyed on



Flights out of the Air Force Missile Test Center at Cape Canaveral had their share of X-10 mishaps just like the flights out of Edwards. X-10 number 52-4 performed an uncontrolled landing on the Skid Strip and ended up being written off after its first flight.

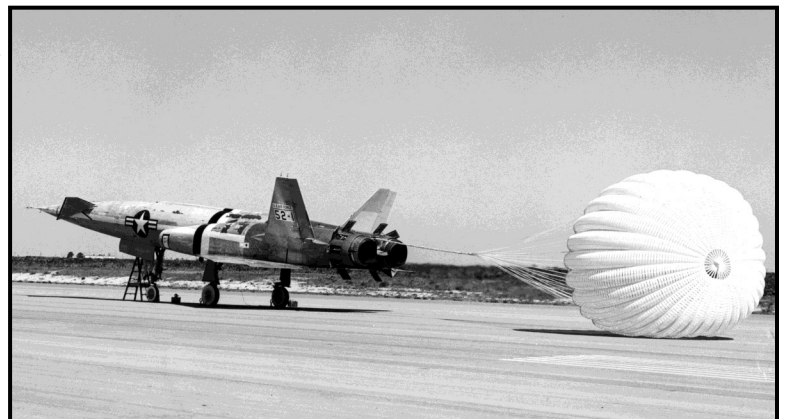


Considering the advanced nature of the Navaho program, the vehicles utilized a minimum amount of ground equipment.

landing and other following an in-flight failure prior to the BOMARC being launched. Only one X-10 survived the test program, the first prototype GM-19307, which is proudly on display at the National Museum of the United States Air Force in Dayton, Ohio.

With the initial objectives met by the X-10, the program was ready to move on to Phase 2, the rocket launched, ramjet-powered, XSM-64.

X-10 number 52-1 sits on the Skid Strip after a successful landing at the East Coast test center. Note the open speed brakes and landing parachute billowing in the ocean breeze.



For further reading, see: ARDC Historical Branch, "Development of the SM-64 Navaho Missile; 1954 to 1958", AFMC History Office, January 1961

Miller, Jay, "The X-Planes : X-1 to X-45" Midland Publishing, 2001



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