

# Directory of U.S. Military Rockets and Missiles

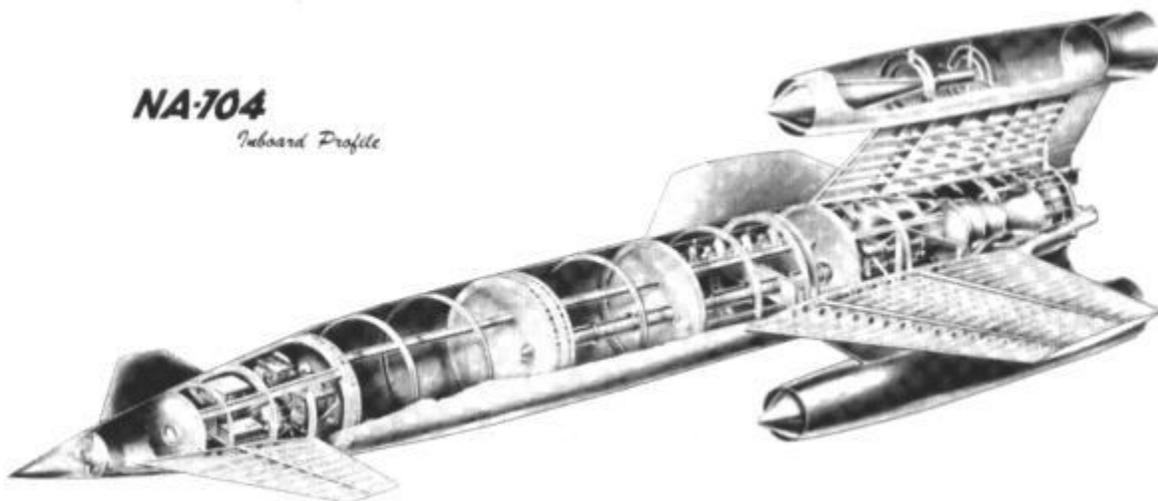
## Appendix 1: Early Missiles and Drones

# SM-64

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## North American SSM-A-2,4,6/B-64/SM-64 Navaho

In the immediate post-WWII period, the U.S. Army Air Force issued study contracts for various general surface-to-surface missile requirements to several aerospace companies. These studies included North American's project **MX-770** for a supersonic missile with a range of 800 km (500 miles), increased to 1600 km (1000 miles) in April 1947. In that year, North American received a contract under project MX-770 for the development of the **SSM-A-2 Navaho** missile.



*Drawing: Dustin Carter collection*

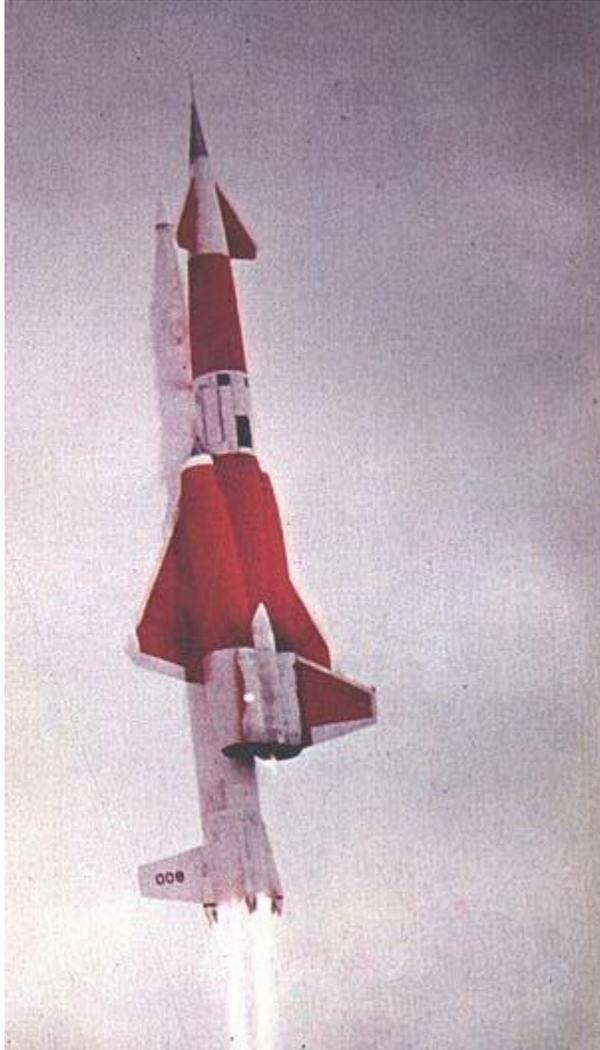
**XSSM-A-2**

The **XSSM-A-2** design (North American Model NA-704) had an integral rocket booster and two fin-mounted ramjets for cruise propulsion. In late 1949 the first XSSM-A-2 missiles were under construction, but in 1950 the whole *Navaho* program was redefined to develop a missile of much longer range (8000 km (5000 miles)). In September 1950, it was decided that the development of the *Navaho* (designated Weapons System 104A) would become a three-phase effort. A turbojet-powered [RTV-A-5](#) aerodynamic test vehicle would be followed by the **SSM-A-4** *Navaho II* ramjet-powered test and evaluation (and possibly interim operational) model, and later by the ultimate **SSM-A-6** *Navaho III* full-range operational missile. North American's **XSSM-A-4** and **XSSM-A-6** designs were better known by their manufacturer's numbers G-26 and G-38, respectively.

In 1951, the USAF assigned aircraft designations to its guided missiles, and the missiles of the *Navaho* family were redesignated as follows:

Old Designation	New Designation
RTV-A-5	<a href="#">X-10</a>
XSSM-A-4	<b>XB-64</b>
XSSM-A-6	<b>XB-64A</b>

The B-64 design used a large liquid-propellant rocket booster to launch a ramjet-powered cruise missile of canard/delta configuration. The test flights of the [X-10](#) between 1953 and 1956 verified the basic aerodynamic design of the cruise stage, and in late 1956 testing of the G-26 was to begin. At that time, the XB-64 (G-26) and XB-64A (G-38) had been redesignated as **XSM-64** and **XSM-64A**, respectively (and the missiles renamed to plain *Navaho* without suffix numeral). However, the XSM-64 suffered from a bewildering list of problems, and the first flight in November 1956 ended after only 26 seconds when the vehicle disintegrated because of longitudinal oscillations. The fifth flight of an XSM-64 in August 1957 was actually the first one to proceed until ignition of the cruise stage's ramjets.



*Photo: USAF*

### **XSM-64**

The XSM-64 was launched from a pad by a large booster with an XLR71-NA-1 two-chamber liquid-fueled rocket engine. The booster accelerated the missile to almost Mach 3 at an altitude of more than 12000 m (40000 ft). Then the two Wright XRJ47-W-5 ramjets of the cruise vehicle ignited and the booster was dropped. Maximum cruising altitude of the XSM-64 was 24000 m (80000 ft), and it could reach a range of 5600 km (3500 miles) at a speed of Mach 2.75. The missile used a North American N-6 inertial navigation system for guidance, but was also equipped with a radio-command uplink and telemetry downlink for testing purposes. It also had a landing gear to reuse the missile after a successful flight, but not a single flight test ever proceeded as far as a landing attempt. The warhead section of the XSM-64 was

designed to accommodate an early fission warhead (like the W-4 or XW-13), but after the invention of the thermonuclear bomb in the early 1950s, the XSM-64 was regarded as a pure test vehicle and no longer as an interim tactical missile.



*Photo: Rockwell International*



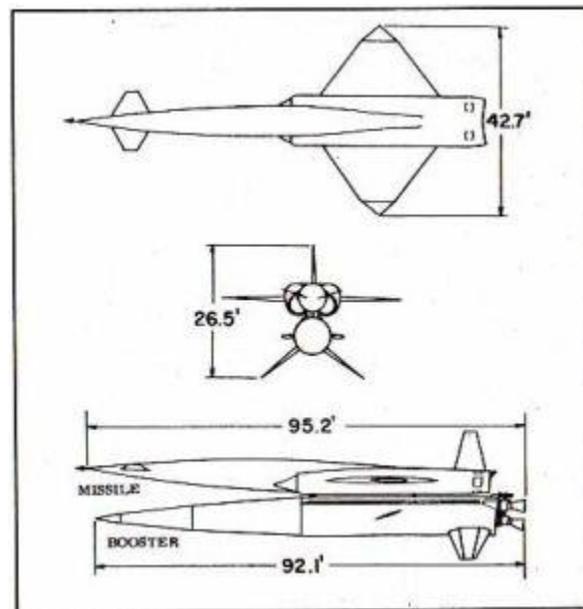
*Photo: USAF, via Tim Johnson*

### **XSM-64**

The XSM-64 program was extremely troublesome, and after only four launches between November 1956 and June 1957, all ending in failure, the USAF cancelled the development of an operational SM-64 missile in July 1957. As an interim long-range strategic missile, the [SM-62 \*Snark\*](#) was far ahead in development, and in the longer term the [SM-65/CGM-16 \*Atlas\*](#) and [SM-68/HGM-25 \*Titan\*](#) ICBMs were much more promising. After the cancellation of *Navaho*, seven more flight tests occurred until

November 1958 to use up some of the sixteen completed XSM-64 vehicles. None of these tests resulted in a 100% successful full-range flight.

The design of the ultimate XSM-64A missile (Model G-38) was completed by North American in February 1957, but the cancellation of *Navaho* meant that no XSM-64As were completed. The G-38 was basically an enlarged G-26 to accommodate a 4 MT W-39 thermonuclear warhead, and used improved RJ47-W-7 ramjets. The booster was also much larger and used a three-chamber XLR83-NA-1 engine, an improved development of the G-26's XLR71. Other differences between the XSM-64 and XSM-64A included the latter's changed wing and canard planforms and single vertical tail. The XSM-64A was to use an N-6B inertial navigation unit, and planned range was 10000 km (6300 miles) at a speed of Mach 3.25. G-38 test missiles would have been recoverable, using a landing gear consisting of nose wheels, a rear skid, and wingtip skids.



*Drawing: USAF, via Tim Johnson*

### **XSM-64A**

## **Specifications**

**Note:** Data given by several sources show slight variations. Figures given below may therefore be inaccurate!

Data for **XSM-64**, **XSM-64A**:

	<b>XSM-64</b>	<b>XSM-64A</b>
Length	Missile: 20.65 m (67 ft 9 in) Booster: 23.24 m (76 ft 3 in)	Missile: 26.7 m (87 ft 7 in) Booster: 28.1 m (92 ft 1 in)
Wingspan	8.71 m (28 ft 7 in)	13.0 m (42 ft 8 in)
Height	2.90 m (9 ft 6 in)	?
Booster Diameter	1.78 m (5 ft 10 in)	2.4 m (7 ft 10 in)
Weight	Missile: 27200 kg (60000 lb) Booster: 34000 kg (75000 lb)	Missile: 54600 kg (120500 lb) Booster: 81500 kg (180000 lb)
Speed	Mach 2.75	Mach 3.25
Ceiling	24000 m (80000 ft)	> 24000 m (80000 ft)
Range	5600 km (3500 miles)	10000 km (6300 miles)
Propulsion	Missile: 2x Wright XRJ47-W-5 ramjet; 36 kN (8000 lb) each Booster: North American XLR71-NA-1 liquid-fueled rocket; 1070 kN (240000 lb)	Missile: 2x Wright XRJ47-W-7 ramjet; 50 kN (11300 lb) each Booster: North American XLR83-NA-1 liquid-fueled rocket; 1800 kN (405000 lb)
Warhead	none	W-39 thermonuclear (4 MT)

## Main Sources

- [1] James N. Gibson: "The Navaho Missile Project", Schiffer Publishing Ltd, 1996
- [2] Bill Gunston: "The Illustrated Encyclopedia of Rockets and Missiles", Salamander Books Ltd, 1979
- [3] Jay Miller: "The X-Planes, X-1 to X-45", Midland Publishing, 2001
- [4] Tim Johnson: Space Launch Report Website (originally at <http://www76.pair.com/tjohnson/>, now **dead link** (10 June 2005))

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