SF-88 NIKE MISSILE ASSEMBLY

and SERVICE AREAS

Western Electric®

Brief History of Post WWII Air Defense Artillery

Nike, named for the mythical Greek goddess of victory, was the name given to a program which ultimately produced the world's first successful, widely-deployed, guided surface-to-air missile system. Planning for Nike was begun during the last months of the Second World War when the U.S. Army realized that conventional anti-aircraft artillery would not be able to provide an adequate defense against the fast, high-flying and maneuverable jet aircraft which were being introduced into service, particularly by the Germans.

During 1945, Bell Telephone Laboratories produced the "AAGM (Anti Aircraft Guided Missile) Report" in which the concept of the Nike system was first outlined. The Report envisioned a two-stage, supersonic missile which could be guided to its target by means of ground-based radar and computer systems. This type of system is known as a "command" guidance system. The main advantage over conventional anti-aircraft artillery was that the Nike missile could be continuously guided to intercept an aircraft, in spite of any evasive actions taken by its pilot. By contrast, the projectiles fired by conventional anti-aircraft artillery (such as 90mm and 120mm guns) followed a predetermined, ballistic trajectory which could not be altered after firing.

The Nike Mission

During the first decade of the Cold War, the Soviet Union began to develop a series of long-range bomber aircraft, capable of reaching targets within the continental United States. The potential threat posed by such aircraft became much more serious when, in 1949, the Russians exploded their first atomic bomb.

The perception that the Soviet Union might be capable of constructing a sizable fleet of long-range, nuclear-armed bomber aircraft capable of reaching the continental United States provided motivation to rapidly develop and deploy the Nike system to defend major U.S. population centers and other vital targets. The outbreak of hostilities in Korea, provided a further impetus to this deployment.

The mission of Nike within the continental U.S was to act as a "last ditch" line of air defense for selected areas. The Nike system would have been utilized in the event that the Air Force's long-range fighter-interceptor aircraft had failed to destroy any attacking bombers at a greater distance from their intended targets.

Nike Deployment

Within the continental United States, Nike missile sites were constructed in defensive "rings" surrounding major urban and industrial areas. Additional Nike sites protected key Strategic Air Command bases and other sensitive installations, such as the nuclear facilities at Hanford, Washington. Sites were located on government-owned property where this was available (for example, on military bases). However, much real estate needed to be acquired in order to construct sufficient bases to provide an adequate defense. This was a sometimes difficult and contentious process. Often, the federal government had to go to court in order to obtain the property needed for such sites.

The exact number of Nike sites constructed within a particular "defense area" varied depending upon many factors. The New York Defense Area -- one of the largest in the nation -- was defended at one time by nearly *twenty* individual Nike installations. Due to the relatively short range of the original Nike missile, the Nike "Ajax", many bases were located relatively close to the center of the areas they protected. Frequently, they were located within heavily populated areas.

Nike Ajax missiles first became operational at Fort Meade, Maryland, during December, 1953. Dozens of Nike sites were subsequently constructed at locations all across the continental United States during the mid fifties and early sixties. Roughly 250 sites were constructed during this period.

Western Electric SAM-A-7/M1/MIM-3 Nike Ajax

The first deployment of Nike-Ajax was in Maryland during March 1954. Nearly 200 additional sites were constructed in strategic areas of the United States. This deployment lasted 4 years. The last Nike-Ajax site was deactivated in 1963.

The first unguided *Nike* missiles were fired in 1946, but problems with the original multi-rocket booster (8 solid-fuel rockets wrapped around the missile tail) soon led to delays in the program. In 1948 it was decided to replace this booster pack with a single rocket booster, attached to the back of the missile. The main propulsion of the missile was a Bell liquid-fueled rocket motor, and the flight path was controlled by the four small fins around the nose. In November 1951 the first successful interception of a QB-17 target drone succeeded. The first production *Nike* (which had been re-designated **SAM-A-7** in 1951) flew in 1952, and the first operational *Nike* site was activated in 1954. By this time, the missile had been designated by the Army as Guided Missile, Anti-Aircraft **M1**.

Technical Specifications:

Overall length: **34 ft. 10 in. with booster. (Missile only 21 ft).**
Diameter: **12 inches**
Wingspan: **4 ft., 6 in.**
Overall weight: **2455 pounds. (Missile only 1000 pounds).**
Fuel:

Missile sustainer motor: JP4 aviation fuel and; hypergolic starter fluid 1.) Aniline/furfural alcohol. 2.) Dimethyl-hydrazine. 3.) Red fuming nitric acid. Red fuming nitric acid was the last starter fluid used.

Booster: **Solid propellant**
Range: **25 to 30 miles**
Speed: **Mach 2.3 (1679 mph)**
Altitude limit: **70,000 feet**
Guidance: **Command guidance from ground emplacement**
Warhead: **High-explosive fragmentation. Three separate warheads located in the nose**(12 lb), **mid-section**(179 lb), **and aft section**(122 lb)**.**

The missile was manufactured by Douglas Aircraft in California. The booster section was manufacture by the Hercules Powder Company, Radford Arsenal Virginia. The missile sustainer motor was manufactured by Bell Aircraft in Buffalo New York. The guidance system was manufactured by Western Electric.

Its range was only about 25 miles, which was too short to make it a truly effective air defense weapon in the eyes of its many detractors. Its supporters countered that the new missile was markedly superior to conventional antiaircraft artillery, and that it was, significantly, the only air defense missile actually deployed and operational at that time.

Western Electric SAM-A-25/M6/MIM-14 *Nike Hercules*

The *Nike Hercules* was the only nuclear-armed surface-to-air weapon, which was operational with the U.S. Army. Development of an improved *Nike* missile began in 1952, with the primary goal to develop a missile with a significantly higher performance than **MIM-3 *Nike Ajax*** (then known simply as *Nike*), which could still be used with the existing *Nike* ground equipment. After it had been shown that the *Nike Ajax* could not be equipped with then existing nuclear warheads, nuclear armament became another goal for the new missile. The **SAM-A-25** *Nike B* program was formally established in June 1953. As with *Nike Ajax*, Western Electric was prime contractor, and Douglas was responsible for the missile airframe.

The *Nike B* (renamed *Nike Hercules* on 15 December 1956) used many components of the *Nike I* (*Nike Ajax*). The booster consisted of four *Nike Ajax* boosters, and the original design used 4 of *Ajax*' liquid-fuel rockets as sustainer propulsion (only 58 were produced). However, the first flight tests with the liquid-fuel sustainer in 1955 proved very troublesome, and a solid-fueled sustainer rocket was eventually used. The first successful interception of a drone target occurred in 1956, and in 1957 the new solid-fuel sustainer flew for the first time. *Nike Hercules* used the same command guidance as the **MIM-3 *Nike Ajax***, with essentially the same ground components.

The first production *Nike Hercules* missiles were delivered in 1958, and quickly replaced the *Ajax* on many *Nike* sites. By then, the *Nike Hercules* had been designated as Guided Missile, Air Defense **M6**. The M6 could be equipped with either an M17 (a.k.a. T45) blast-fragmentation warhead, or a W-31 nuclear fission warhead with yield selectable as 2 kT or 40 kT, or a fixed 20 kt variant. The missile performance was such that even very high-flying bombers could not escape the *Nike Hercules*. Capability against low-level targets remained rather limited, however.

As the *Nike Hercules* began replacing the older *Nike Ajax*, work was underway to improve the acquisition and tracking radar capabilities to fully exploit the missile's greater performance. The major improvement in what was called the *Improved Hercules* system was the new L-band acquisition radar, called HIPAR (High-Power Acquisition Radar). The TTR (Target Tracking Radar) and TRR (Target Ranging Radar) were also improved, having better ECM resistance. The missiles of the improved "*Improved Hercules"* system were designated as **M6A1**. In June 1960, an *Improved Hercules* achieved the world's first successful interception of a ballistic guided missile, when a **MGM-5 *Corporal*** SRBM was shot down. Lastly, *Improved Hercules* introduced a viable surface-to-surface capability to the *Nike* system. The first *Improved Hercules* systems were installed at *Nike* sites in June 1961.

In 1963, the **M6** and **M6A1** missiles were re-designated as **MIM-14A** and **MIM-14B**, respectively. The **MIM-14C** (introduced in 1972) was a modified MIM-14B with an improved missile guidance section for higher maneuverability and better ECM resistance.

Length	41 ft. with booster
Diameter	31.5 inches
Wingspan	6 ft. 2 in.
Weight	10,710 pounds with booster
Booster Fuel	Solid propellant
Sustainer Motor	Solid propellant
Range	Over 75 miles
Speed	Mach 3.65 (2707 mph)
Maximum Altitude	100,000 ft.*
Guidance	Command guidance from ground installations

All in all, the U.S. Army established 145 *Nike Hercules* sites over the years. Production of the nuclear-armed missiles ended in 1964, and gradual phase-out of the MIM-14 began in the late 1960's. The Army originally planned to replace the *Nike* with the new MIM-104 *Patriot* missile, but this plan was not implemented in the USA. Therefore, after the last active *Nike Hercules* sites in the continental U.S. had been deactivated in 1974, except FL and AK which were retired later on, HM-69 was the last to close in 1979. There are no long-range air-defense missiles fielded in the U.S.. In Europe, the U.S. Army retired its last MIM-14 units in 1984, when the MIM-104 *Patriot* was introduced.

In total, more than 25000 *Nike Hercules* missiles of all versions were produced, most being of the MIM-14B variant.

SF-88

Direct Support Units 1955 – 1974

Ordnance Corps

Sierra Army Depot
Herlong, California

197th Ordnance Detachment
(Ft Cronkite)
Alameda, California

194th Ordnance Detachment
(Ft Cronkite)
San Francisco, California

Nuclear Weapons Support Section/
Nike Hercules
Presidio of San Francisco, California

Military Police Corps

Corps of Engineers

Quartermaster Corps

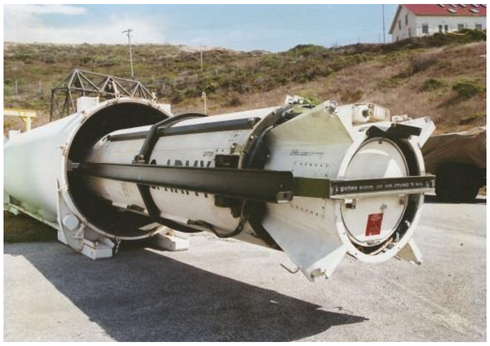
Signal Corps

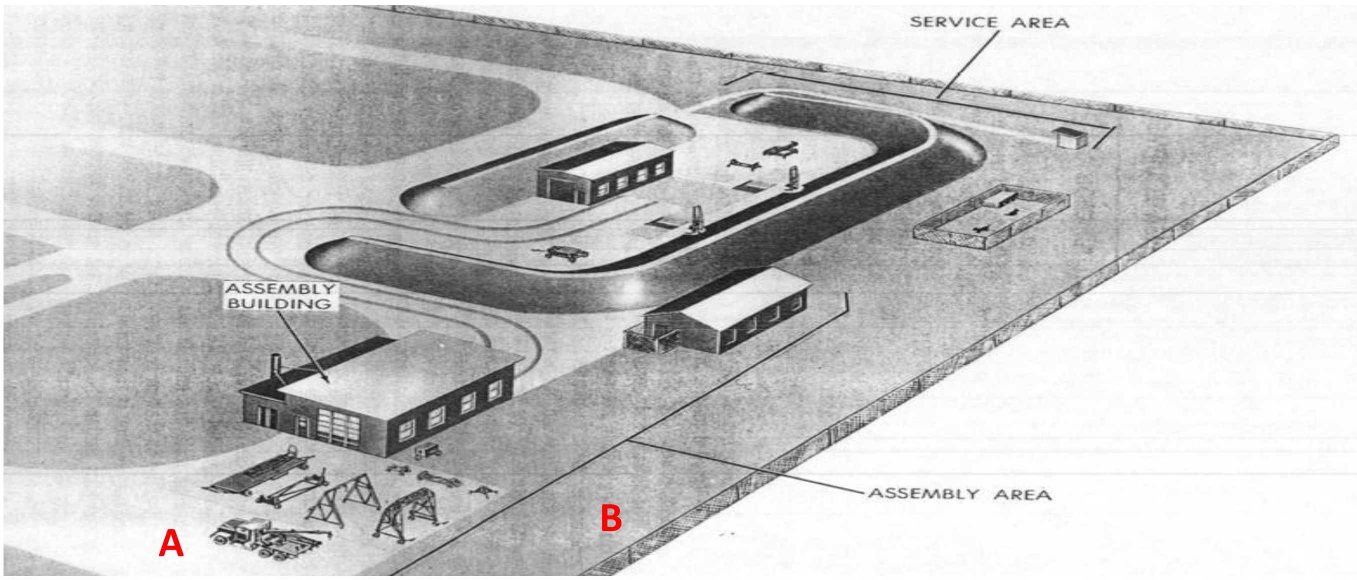
Assembly Area

Nike Ajax:
The missile body of the Nike-Ajax missile (guided missile M1) is received in the assembly area completely assembled except for the installation of the warheads and fins. After uncrating, the fins are attached and functional tests are performed.

Nike Hercules:
The major components of the Nike-Hercules missile (guided missile M-6) are received in the assembly area in shipping containers. The forward body section and the rear body section are received in the same pressurized metal container. The warhead body section is received in a separate pressurized metal container. The main fins and ailerons, the rocket motor cluster fins and accessories, the rocket motor cluster (less fins), and missile rocket motor M30 are received in individual wooden containers. The rocket motor igniters M24A1, missile rocker motor initiators, missile batteries, and other small components are received in individual cartons or cans.

Here the rear body section and the forward body section of guided missile M-6 are uncrated, and the rear main fins and ailerons are uncrated and installed on the rear body section. The forward body section is temporarily installed on the rear body section, the accessory power supply or hydraulic pumping unit serviced, and functional tests are performed on the missile electrical, guidance, and hydraulic systems. At completion of these tests, the accessory power supply of hydraulic pumping unit is again serviced and the missile is taken to the service area.
A) The Assembly & Test Building; Consisted of a Tool Issue room, a Break room (designated smoking area), and a large Missile Assembly and Test Bay.
B) The Generator Building; this building housed four 250KW GE generators with a small sound-proof office. These were maintained by a special prime power Engineer Detachment.





Service Area

The Service area was a multifunction area. With the Ajax, it was a fueling, war-heading and booster/bird mating area. With the Hercules, it was only war-heading, motor installation and booster buildup. The Hercules booster came in a cluster, so the field units had only to install the fins. This was usually done the time the bird was ready to be joined.

Nike Ajax: This is the area that the Ajax was war-headed, electrically tested and fueled (concrete pad behind building)

The fuel; consisted of; JP4 aviation fuel (kerosene) and UDMH (undiluted dimethyl-hydrazine), and, from a separate fuel stand, an oxidizer, INRFRA (inhibited red fuming nitric acid), was pumped into the missile into a separate tank. Red fuming nitric acid was the last starter fluid used. The Ajax was fueled after assembly and warheading were done.

Nike Hercules:

Sustainer Motor installation (M30); after the rear body section has been assembled and tested, it was then pushed over to this point where the sustainer rocket was installed.

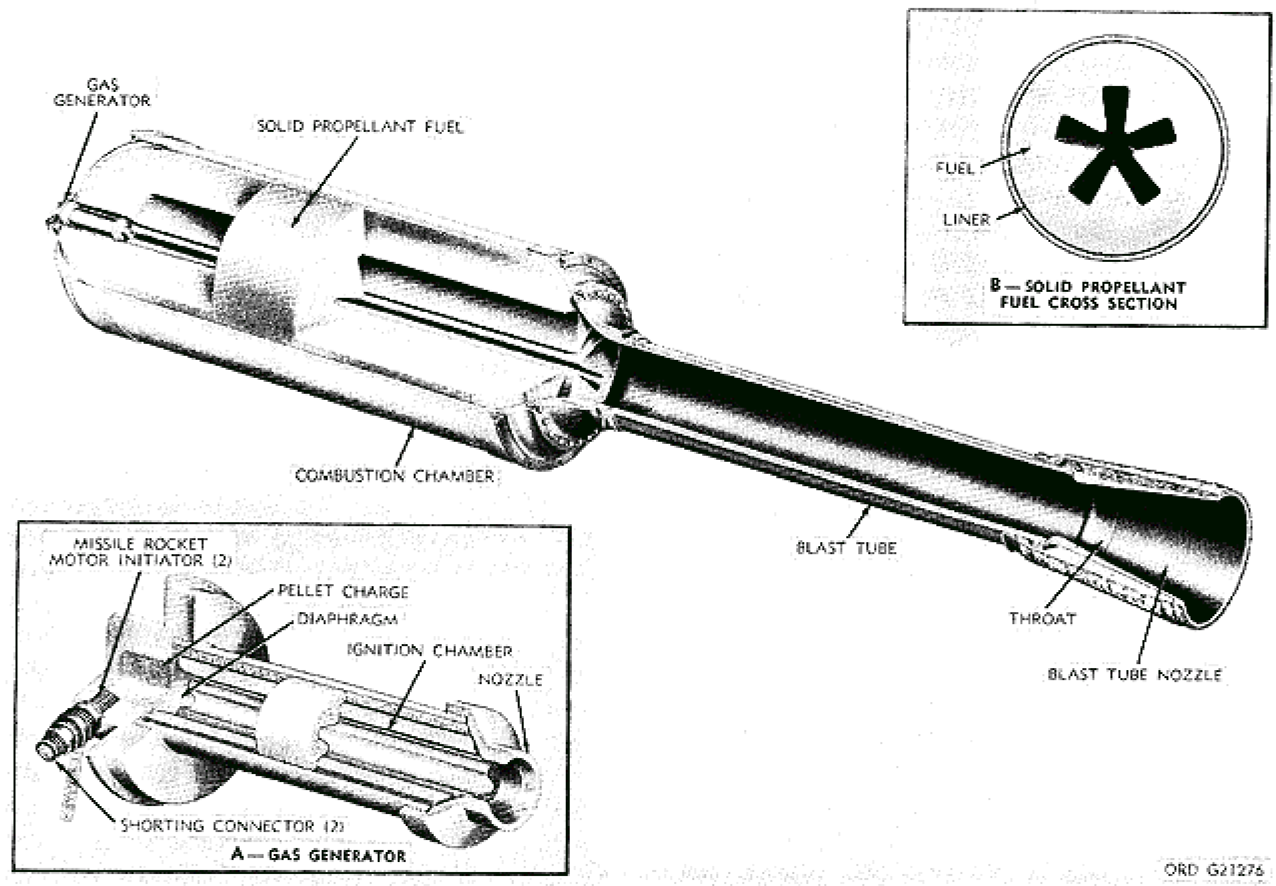
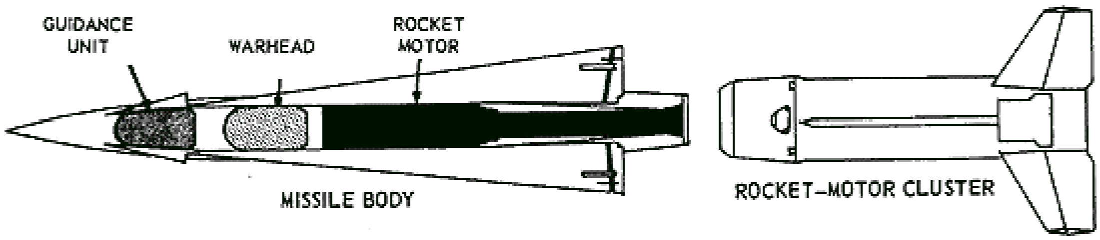


Figure 3-15 (U). Missile rocket motor M30—cutaway view (U).

Service Area (continued)

booster buildup; at many sites this area was used to install the fins on the booster cluster. The earthen berm that skirts the service area was to protect the launch area(LA) from accidental damage from the service area, and protect the service area from the violent flame and out-gassing in the event of a launch.



Warheading Building

Nike Ajax:

Warheads; High-explosive fragmentation. Three separate warheads located in the, nose(12 lb), mid-section(179 lb), and aft section(122 lb).

Nike Hercules:

Warhead installation (T45 or W31);
T45 – (625 pound fragmentation) warhead section would be mated to the rear body section, and then the forward body section mounted to the warhead section. Circuitry tests (Go-NoGo) where performed, when it passed, the missile was moved to the LA for final configuration. Note: in the continental United States (CONUS) normal deployment was only one T45 per pit, the other five where W31s.

W31 With the W-31 boosted fission nuclear warhead safeguarding was paramount. Before un-packaging, the building was secure and an entry control point established at one of the doors. The two man rule was in effect from this point on. The 2 person rule requires a minimum of two people of equal knowledge are allowed access, which is designed to prevent accidental or malicious launch or sabotage of nuclear weapons by a single individual.

PAL Devices (Permissive Action Link) could be uninstalled/installed directly to the warhead by a special team of soldiers (PAL Team) 24 hours a day.

with the W-31 in the M409 Container, the rear body section, and forward body section now secure in the building, Personnel would now be allowed to enter the building using the two-man rule. The M409 would be checked for inner atmosphere and physical conditions, then opened. using the H36 handling beam, the warhead is lifted off of the internal cradle, and aligned on the rear body section for mating. The warhead circuitry and barometric switches would be tested, then the forward body would be mounted. Final Go-NoGo tests where performed and the missile was ready to be escorted to the LA for booster mating and placing in the magazine.

Warhead Section

Warhead installation (T45 or W31);
The warhead section would be mated to the rear body section, and then the forward body section mounted to the warhead section. Circuitry tests (Go-NoGo) where performed, when it passed, the missile was moved to the LA (Launch Area) for final configuration.

T45
The T45 is a 625 lbs. Blast-Fragmentation type warhead that produced a focused burst of approximately 20,000 cubical, 140 grain steel fragments arranged in both single and double layers around the 625 lbs. high explosive charge that contained a booster charge in its center. The detonation process would channel through the M30A1 safety and arming device (armed by the force of acceleration), then igniting the two M38 Explosive Harnesses that directly ignited the warhead booster charge which in turn detonates the warhead charge

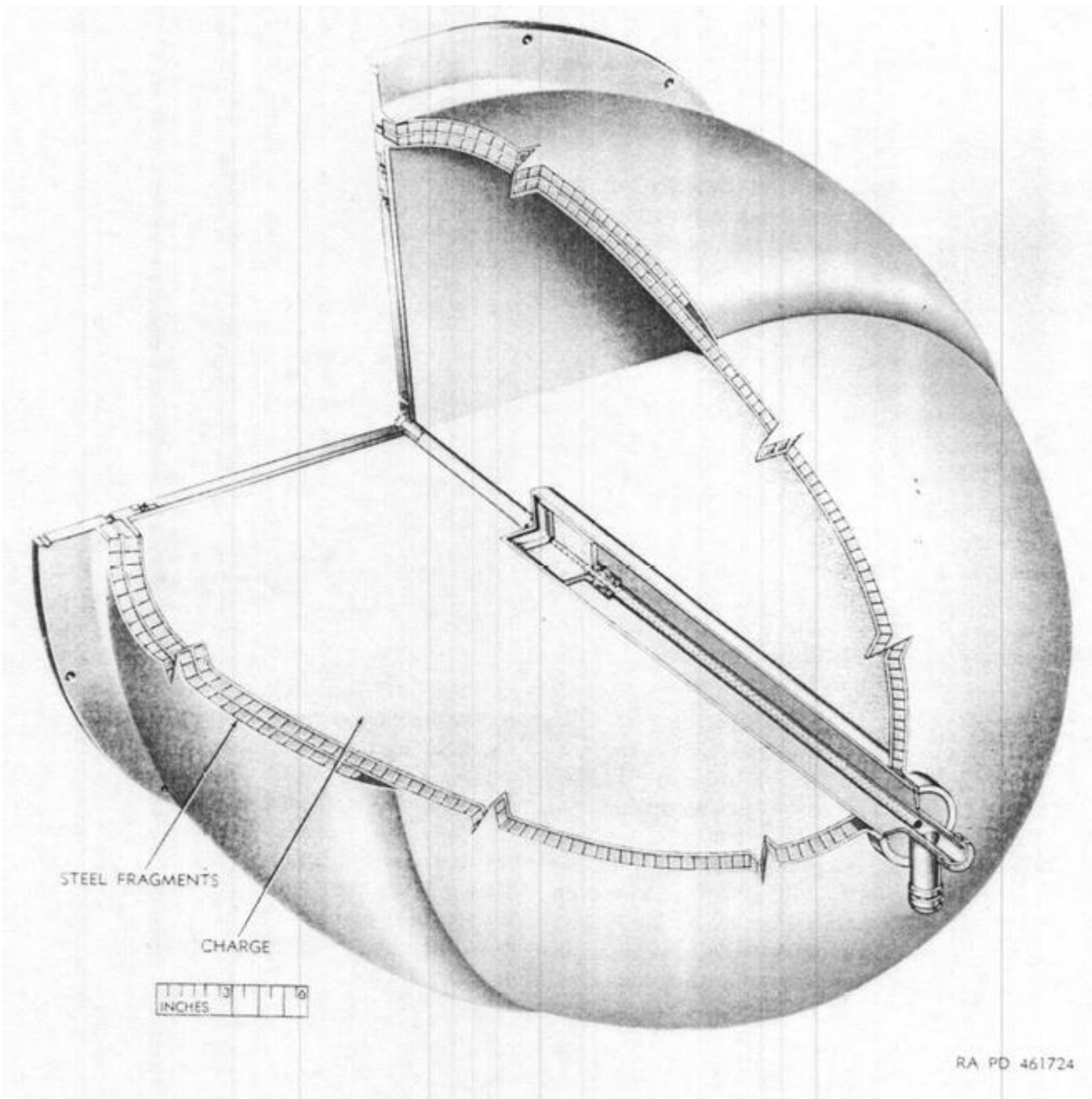
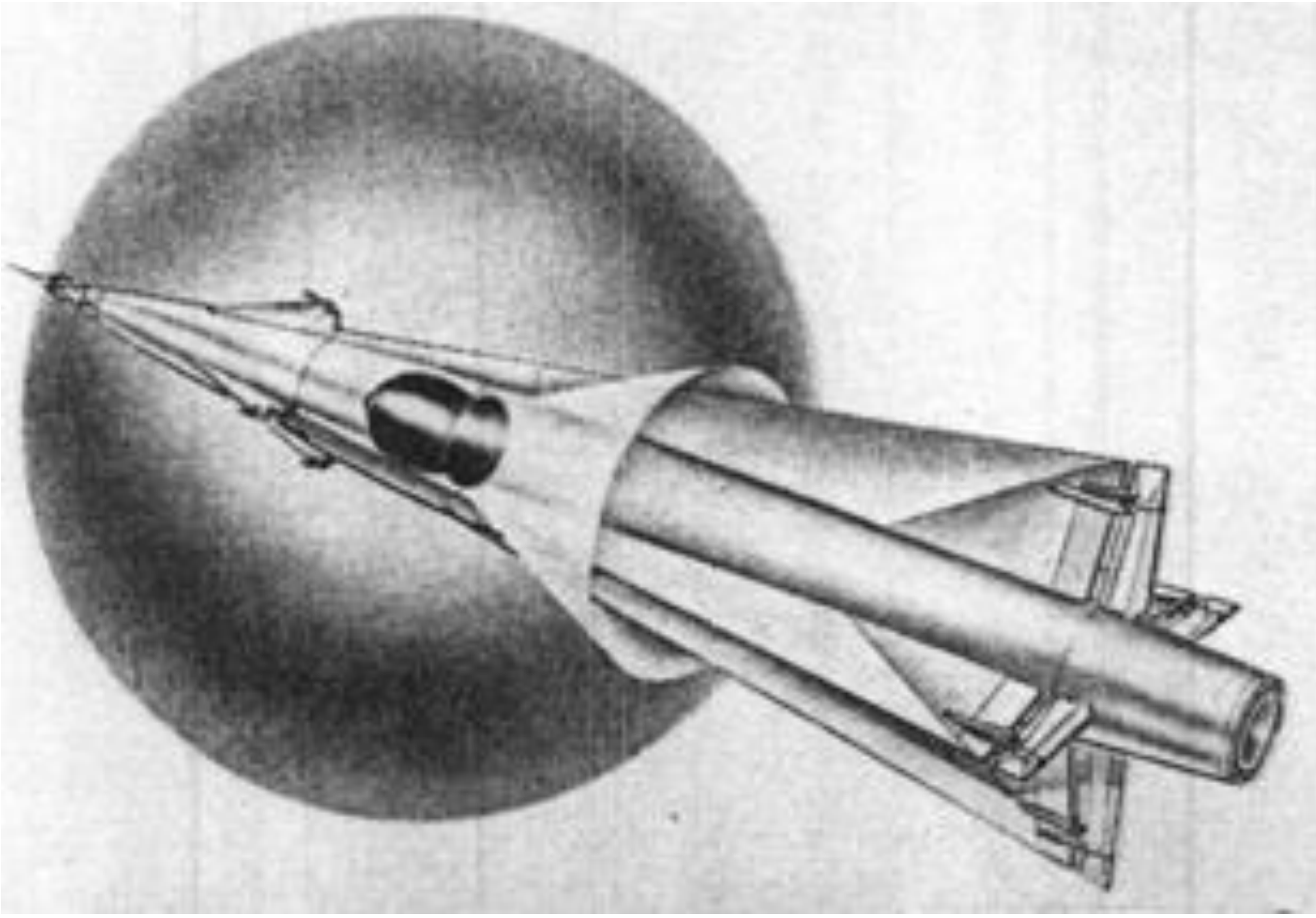


Figure 43 (CMHA). Warhead T45 — cutaway view.

The blast pattern is almost spherical with a conical dead zone at the rear.



W31
With the W-31 boosted fission nuclear warhead safeguarding was paramount. Before un-packaging, the building was secure and an entry control point established at one of the doors. The two man rule was in effect from this point on. The 2 person rule requires a minimum of two people of equal knowledge are allowed access, which is designed to prevent accidental or malicious launch or sabotage of nuclear weapons by a single individual.

with the W-31 in the M409 Container, the rear body section, and forward body section now secure in the building, Personnel would now be allowed to enter the building using the two-man rule. The M409 would be checked for inner atmosphere and physical conditions, then opened. using the H36 handling beam, the warhead is lifted off of the internal cradle, and aligned on the rear body section for mating. The warhead circuitry and barometric switches would be tested, then the forward body would be mounted. Final Go-NoGo tests where performed and the missile was ready to be escorted to the LA for booster mating and placing in the magazine.

Note: in the continental United States (CONUS) common deployment was only one T45 per pit, the other five where W31s.

W31 Warhead^(above) Next Generation Hercules (below)

Warheads

W-7 Warhead (dial-a-yield, *Selectable at <u>Theatre</u> Level*) Multipurpose warhead. Was considered for the Nike Hercules SAM missile warhead 225 mods for the Hercules were produced, but only fielded for a brief time in four Baltimore-DC, Philadelphia, New York, and Chicago. (W-7-X1/X2); 7 yields, 4 mods. The Nike Hercules W-7 was canceled in 1956.

W-31 Warhead (Selectable Yield, *selected at Ordinance Depot Level in CONUS*) Multipurpose boosted fission warhead. The W-31 was produced for the Nike Hercules SAM from 1958 until 1961, eventually retired world-wide in 1989, 2550 were produced.

Yields; the Nike Hercules SAM, used 2 W-31 mods, allowing an option of 3 yields:
W-31 Mod 0, Y2 20KT
W-31 Mod 2, Y1 2 KT, this was not used here in the U.S.
W-31 Mod 2, Y2 40Kt, Fusion-boosted mod2

Side Note; The W-31 used in the 1962 Operation Tightrope test at Johnson Island (on video) was a 12KT W-31 mod 1 normally used as an ADM.

ARADCOM informed the Defense Nuclear Agency of what yields they required to complete their mission. Depots such as the former Seneca Army Depot then constructed the required W-31 warhead sections, and installed the PAL device.

The PAL device for this system was inserted into the SAFE/ARM receptacle then locked with a secure combination, rendering the weapon inert. If someone tried to remove the device forcibly the W-31 would no longer function.

The completed weapon was then transported to the Launch area here in America under heavy guard in its M409 container most often by helicopter.

Then here in the **Warhead Assembly Building** it was mated to the missile and tested again, once assembled the missile was taken to the launcher area and mated with its booster.

No additional warheads were stored on site. If a warhead was damaged or fails a stockpile reliability inspection, an air mission would be arranged and a new W-31 would be brought to site to replace the one in question. The questionable W-31 was flown back to depot.

Flight: Just a quick note, the Nike Hercules may be fired directly at an air target instead of the normal arc shot, but this does greatly reduce its range.

Additional Warhead Info

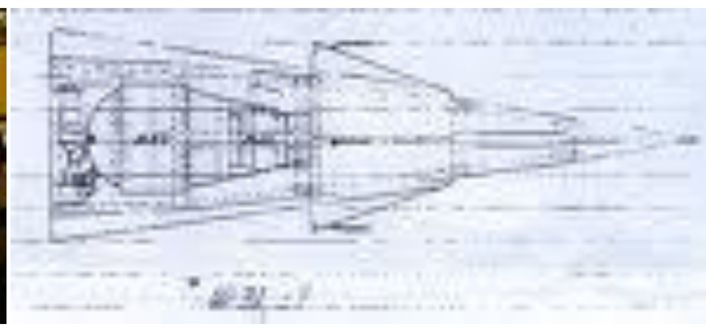
W-31 Warhead (Selectable Yield) Multipurpose boosted fission warhead.

Yields; 1, 2, 12, 20, or 40 Kt Weight (lb.) 900 – 945. Length; 39 - 39.3 Width 28 - 29; 30 in. Applications; Honest John SSM, Nike Hercules SAM, ADM (Atomic Demolition Munitions); Versions used:_Honest John: W-31 Mod 0, 3; Nike-Hercules: W-31 Mod 0, 2; ADM: Mk-31 Mod 1; 4 yields stockpiled in CONUS: 2 for Nike-Hercules (20 and 40 Kt), 3 for Honest John (2, 20, and 40 Kt) Nike Hercules: manufactured 10/58 - 12/61, retired 7/67 - 9/89, 2550 produced.

W-31 Mod 0; Y1: 1kt*, **Y2: 20 kt (M-22)** *Fixed yeild at **Ordinance Depot** Level.*
*Not used with the Nike program

W-31: Mod 2; Y1: 02 kt (M-97)**, **Y2: 40 kt (M-23)** *Selectable at Ordinance Unit Level.*
**Used overseas primarily for Surface to Surface role.

W-31 Mod 1; Y1: 12 kt except for test at Johnson Island 1962. *ADM Only, Not used in the Nike Hercules.*
W-31: Mod 3; 40 kt *only used with the Honest John System.*

W-7 Warhead (dial-a-yield) ***Selectable at Theatre Level*** **Multipurpose warhead.**
Yields; 8, 19, 22, 30, 31,& 61 Kt Weight (lb.) 900 - 1,100; 970 (W-7-X1 / X2); 983 (Betty) Length; 54.8 – 56 Width 30 - 30.5 in. Applications; BOAR air-surface rocket, the Corporal (M-2) and Honest John (M-3) ballistic missiles, ADM, Betty Mk 90 ASW depth bomb, **Nike Hercules SAM missile warhead (W-7-X1/X2); 7 yields, 4 mods**; Corporal yield 2-40 Kt (several options), ADM yield low (90 T?), Betty yield 32 Kt. W-7 warhead manufacture begun 12/53;
BOAR: stockpiled 1956 - 1963, 225 produced; Corporal: stockpiled 1955 - 1965, 300 produced; Honest John: stockpiled 1954 - 1960, 300 produced; ADM: stockpiled 1955-1963, 300 produced; Betty: stockpiled 6/55 - 1960, **225 produced; Nike Hercules: canceled 1956**

Fusion-boosted fission weapons improve on the implosion design. The high temperature and pressure environment at the center of an exploding fission weapon compresses and heats a mixture of tritium and deuterium gas (heavy isotopes of hydrogen). The hydrogen fuses to form helium and free neutrons. The energy release from fusion reactions is relatively negligible, but each neutron starts a new fission chain reaction, greatly reducing the amount of fissile material that would otherwise be wasted. Boosting can more than double the weapon's fission energy release.

Yield & Designation: 2 kt (M-97)   20 kt (M-22)   40 kt (M-23)

Mating the W31 Nuclear Warhead
to the Nike Hercules Missile

Mating of the warhead was usually a very business-like but relaxed , atmosphere but when a TPI team was present, it became a little tense, as might be expected when every minute operation and technique were under intense scrutiny by the members of the TPI Team. Things such as minute inspection and handling of an attachment bolt (and it had better be the correct bolt),cleansing of various surfaces and tools, proper sequence of events as evidenced by a comprehensive check list, proper routing of cables, calibration of test equipment properly certified as up-to-date, knowledgeable personnel present (as determined by sharp questioning of selected individuals), proper grounding of certain equipment, missile, and warhead, lifting equipment properly certified, fire extinguishers and other attendant equipment in working order, and if any lighter, matches, or fire making device was present one might as well give it up – you were finished, and of course the two man rule was in effect (the two man rule specifies not only must two men be present but they must be equally knowledgeable and qualified as to the operation they are conducting.)

The first operation after the missile was present and grounded was to open the M409 warhead can and a Test Set must be present and monitoring the air to detect any presence of nuclear related contaminate. The use of this Tester was later discontinued.

A pressure gauge was then used to determine the pressure inside the warhead container (ideal was 5 psi) and deviation from the norm caused special procedures to be followed.

When the warhead container was opened and the warhead, riding on rails, was slid forward, beginning the sequence of attaching a (H36) lift bar to the 1100 pound warhead and bringing it with a hoist to the attach points at station 87.5 of the missile. (stations are merely the number of inches from the nose (later the ballistic cone) of the missile to the rear of the missile body ((full configuration)).

Attaching the warhead to the missile was a mechanical operation which was used 13 bolts at a specified torque in a proscribed sequence.

The adaption kit, XM75E1, which adapted the W31 warhead to the Nike Missile, was unpackaged and bolted to the forward end of the warhead (now a part of the missile). Keep in mind the W31 could be used in other systems by the use of other adaption kits and the AK XM75E1 was the adaption kit for the Nike Hercules. The missile, less booster, was now almost completely assembled except for the nose cone section, which carried the "stovepipe" or "mushroom" guidance package and the barometric probe.

After installation of the adaption kit and attachment of all electrical cabling, tests of the Cartridge/warhead circuitry were required and for this the T4014 test set was used. The tests were primarily go/no-go except for the testing of the barometric switches which must operate properly at certain altitudes. Simply put, the baro switches allowed final arming of the warhead at a setting (to be determined at the appropriate time) and also to insure failsafe operation when passing through a set altitude (i.e. if a missile gets away and falls unguided the baro switches operate and cause a low altitude one-point destruct of the warhead to occur) . A one point destruct merely means the warhead is detonated from one point (as opposed to an implosion detonation) and results only in a High Explosive (HE) detonation (about 550 pounds of explosive) with no nuclear yield or at least a very small amount. During TPIs using the T74 Trainer round and Training warhead, faults were introduced to the test sets and corrective action was taken by the warhead crew. Of course this never occurred in actual mating operations.

The operation of the Surface to Surface plug, Surface to Air plug and the Safe Plug were tested and ended with the installation of the safe plug.

Upon completion of the XM75E1 cartridge checkout the nose cone is mounted and the missile is taken to the launcher and by use of a crane, mounted on the launcher (the booster is already emplaced on the launcher) with the "boat tail" of the missile sliding in to the space provided in the booster cluster.

Various electrical checks are made, the baro settings are finalized by the use of the Launch Control Indicator in the launching section. The final operation is the examination and installation of the barometric probe on the nose section and installation of the probe cover ("doghouse") .

We have now tested, war headed, tested again, and "joined" the missile to the booster on the launcher and have in effect released the missile to the launcher section chief for normal operations. I may have made a small error or two in the above but I don't think so. After all it has been several decades.

From Rod van Ausdall, June 2004

End of the Nike Era

Although Nike was created in response to Soviet efforts to design and deploy long-range bomber aircraft during the early years of the Cold War, Soviet military strategy soon changed. By the late 1950s, fearing that their manned aircraft would be too vulnerable to attack by American interceptor aircraft armed with rockets and missiles, the Soviet Union focused more of its attention on developing ICBMs or Intercontinental Ballistic Missiles against which there existed, at that time, no effective defense. The Soviet long-range strategic bomber force continued to operate throughout the Cold War. However, these forces never achieved the size or capabilities of their American counterpart, the U.S. Air Force's Strategic Air Command or SAC.

The shifting nature of the Soviet threat meant that the air defense role, for which Nike was originally intended, became relatively less critical as time passed. Defense dollars were needed for other projects (including the development of American ICBMs and potential missile defenses) and also to fund the rapidly growing war in Vietnam. As a result, beginning in the mid 1960s, the total number of operational Nike bases within the continental U.S. was fairly steadily reduced, on an almost annual basis. All Nike Ajax sites in the continental United States were closed down by 1964. Closures of select Nike Hercules sites began during the mid 1960s.

During 1974, all remaining operational sites within the nationwide Nike air defense system were inactivated. Army Air Defense Command (ARADCOM) which administered this system was closed down shortly thereafter. The deactivation of the nationwide Nike missile system signaled the end of one of the nation's most significant, highly visible and costly Cold War air defense programs.

Western Electric

References:

[Redstone Arsenal Historical Information Website]

http://nuclearweaponarchive.org/Usa/Weapons/Allbombs.html

http://www.designation-systems.net/dusrm/index.html

ed@ed-thelen.org

webmaster@nikeordnance.com

Clinton Crane, 55G

Nuclear Weapons Maintenance Specialist

SEAD, ARDEC

NPS, Volunteer in Parks/GOGA & PORE

CLINTONCRANE@aol.com

Photos: U.S. Army

M6 (**MIM-14A/B/C**) (exact model unknown)

For historic comparison of tactical power;

W/H	**yield**	**description**
Mk-I	15 - 16 Kt	Gun-assembly HEU bomb; "**Little Boy**" dropped on Hiroshima
Mk-III	18, 20-23, 37, 49 Kt	Plutonium implosion bomb; "**Fat Man**", Model 1561; Mods 0, 1, 2
W-31	1, 2, 12, **20, 40** Kt	Multipurpose boosted fission warhead: **Nike-Hercules**: Mod 0, 1, 2

Nike Hercules night launch

The missile (with booster) was launched 0.4 seconds ago, is accelerating at 25 times the force of earth's gravity, has risen 60 feet, and it is now going 210 miles per hour.

Four seconds from now, the missile will be:

- going 1,700 miles per hour straight up,
- separated from the booster, (the black flaming thing with the white fins),
- turning (diving) towards the intercept point with the target,
- starting the sustainer rocket engine to reach 2,700 miles per hour.

If the target is 90 miles approaching at mach 1.5, the missile will meet the target 60 miles away in 90 seconds.

The Soviet Bomber Threat

Myasishchev M-4, NATO Name; **Bison**

Myasishchev M-4

M-4 being escorted by an F-15

In July 1955 American observers saw 28 Bisons in two groups during a Soviet air show. The United States government believed that the bomber was in mass production, and the Central Intelligence Agency estimated that 800 would be available by 1960. The display was a hoax; the first group of ten repeated the flyby with eight more. The classified estimates led, however, to American politicians warning of a "bomber gap".

General characteristics

- **Crew:** 8
- **Length:** 47.20 m (154 ft 10 in)
- **Wingspan:** 50.5 m (165 ft 7 in)
- **Height:** 14.10 m (46 ft 3 in)
- **Wing area:** 326.35 m^2 (3,512.8 ft^2)
- **Empty weight:** 79,700 kg (175,700 lb)
- **Loaded weight:** 138,500 kg (305,340 lb)
- **Max. takeoff weight:** 181,500 kg (400,135 lb)
- **Powerplant:** 4 × Mikulin AM-3A turbojets, 85.75 kN (19,280 lb_f) each

Performance

- **Maximum speed:** 947 km/h (588 mph)
- **Range:** 8,100 km (5,030 mi) ferry; 5,600 km (3,480 mi) combat radius.
- **Service ceiling:** 11,000 m (36,000 ft)
- **Wing loading:** 425 kg/m^2 (87 lb/ft^2)
- **Thrust/weight:** 0.25

Armament

- **Guns:** 9×23 mm NR-23 cannon or 6×23 mm AM-23 cannon in ventral, dorsal and tail barbettes. 1,100 rounds in ventral and dorsal barbettes, 2,000 rounds in tail barbette.
- **Missiles:** Up to four cruise missiles carried externally.
- **Bombs:** Typically 9,000 kg (19,840 lb) of internal stores. Up to 24,000 kg (52,910 lb) could be carried, including nuclear and conventional bombs

The Soviet Bomber Threat (continued)

Tupolev Tu-95, NATO Name; **Bear**

Tu-95 development was officially approved by the government on 11 July 1951. It featured four Kuznetsov[4] coupled turboprops fitted with eight-bladed contra-rotating propellers, producing a nominal 8,948 kW (12,000 eshp) power rating.

General characteristics

- **Crew:** 6–7; pilot, co pilot, flight engineer, communications system operator, navigator, tail gunner plus sometimes another navigator.
- **Length:** 46.2 m (151 ft 6 in)
- **Wingspan:** 50.10 m (164 ft 5 in)
- **Height:** 12.12 m (39 ft 9 in)
- **Wing area:** 310 m^2 (3,330 ft^2)
- **Empty weight:** 90,000 kg (198,000 lb)
- **Loaded weight:** 171,000 kg (376,200 lb)
- **Max. takeoff weight:** 188,000 kg (414,500 lb)
- **Powerplant:** 4 × Kuznetsov NK-12M turboprops, 11,000 kW (14,800 shp) each

Performance

- **Maximum speed:** 920 km/h (510 knots, 575 mph)
- **Range:** 15,000 km (8,100 nmi, 9,400 mi) unrefueled
- **Service ceiling:** 13,716 m (45,000 ft)
- **Rate of climb:** 10 m/s (2,000 ft/min)
- **Wing loading:** 606 kg/m^2 (124 lb/ft^2)
- **Power/mass:** 235 W/kg (0.143 hp/lb)

Armament

- **Radar-controlled Guns:** 1 or 2 × 23 mm AM-23 autocannon in tail turret.
- **Missiles:** Up to 15,000 kg (33,000 lb), including the Raduga Kh-20, Kh-22, Kh-26, and Kh-55/101/102 Air-to-surface missiles.

The Soviet Bomber Threat (continued)

Myasishchev M-4, NATO Name; **Bison continued;**

The Myasishchev M-4 Molot (Russian: Молот (Hammer), USAF/DoD reporting name "Type 37",[1][2] NATO reporting name 'Bison'.[3]) is a four-engined strategic bomber designed by Vladimir Myasishchev and manufactured by the Soviet Union in the 1950s to provide a bomber capable of attacking targets in North America. The Myasishchev design bureau was formed to build such a bomber.

Tupolev Tu-95, NATO Name; **Bear**

Tu-4

Tupolev Tu-85

The design bureau led by Andrei Tupolev designed the Soviet Union's first intercontinental bomber, the 1949 Tu-85, a scaled up version of the Tu-4, a Boeing B-29 Superfortress copy. The Tu-4 was deemed to be inadequate against the new generation of American all-weather interceptors.

A new requirement was issued to both Tupolev and Myasishchev design bureaus in 1950: the proposed bomber had to have an un-refueled range of 8000 km (4,970 mi) — far enough to threaten key targets in the United States. Other goals included the ability to carry an 11,000 kg (11 ton) load over the target.

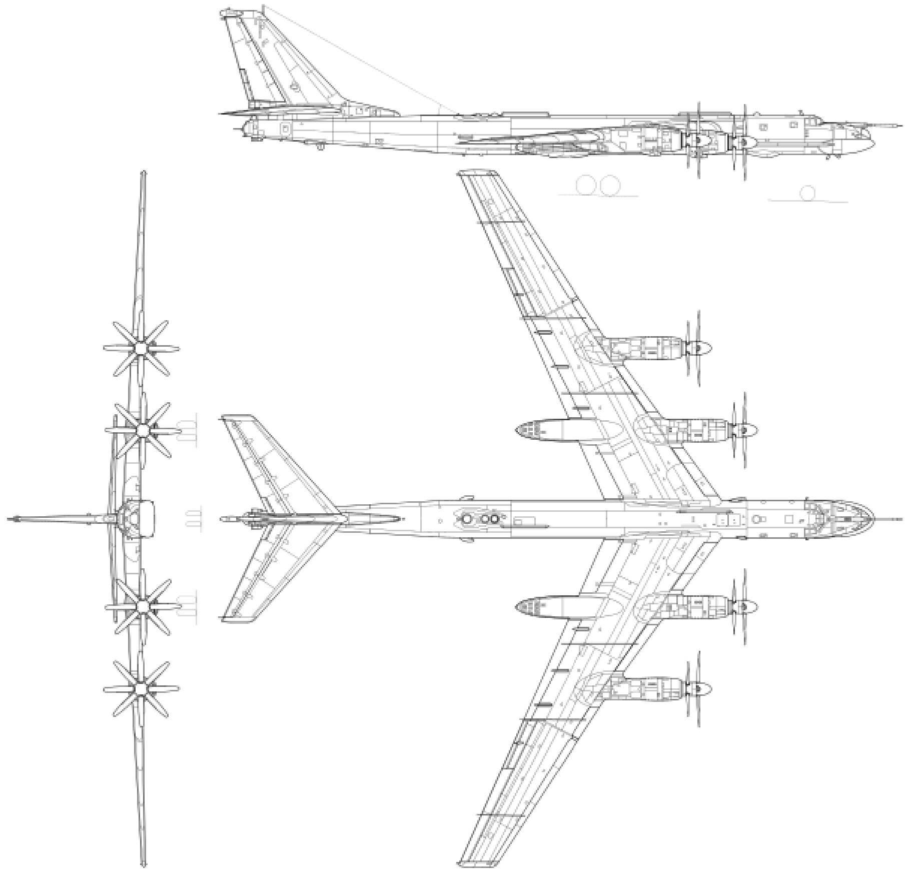
The big problem for Tupolev was the engine choice: the Tu-4 showed that piston engines were not powerful enough to fulfill that role, while the fuel-hungry AM-3 jet engines of the proposed T-4 intercontinental jet bomber did not provide adequate range. Turboprops offered more power than piston engines and better range than jets, with a top speed in between.

The Tupolev Tu-95 (Russian: Туполев Ту–95; NATO reporting name: Bear) is a large, four-engine turboprop-powered strategic bomber and missile platform. First flown in 1952, the Tu-95 entered service with the Soviet Union in 1956 and is expected to serve the Russian Air Force until at least 2040.

The aircraft has four Kuznetsov NK-12 engines, developed by the Kuznetsov Design Bureau with participation of Ferdinand Brandner and other captured German engineers, each driving contra-rotating propellers. An airliner variant Tu-114 holds the record as the world's fastest propeller-driven aircraft. Some experimental aircraft were designed for theoretically higher speeds, but none attained or registered them. It also remains the only turboprop-powered strategic bomber in operational use. Its distinctively swept-back wings are at 35°, a very sharp angle by the standards of propeller-driven

The Soviet Bomber Threat (continued)

Tupolev Tu-95, NATO Name; **Bear continued;**
aircraft, and justified by its operating speeds and altitudes. Its blades, which rotate faster than the speed of sound, according to one media source, make it arguably the noisiest military aircraft on earth, with only the experimental 1950s era Republic XF-84H "Thunderscreech" turboprop powered American fighter design as a likely rival.



The Common Missile Threat (Europe)

SS-20 Mobile Launch Vehicle

Soviet SS-20 IRBM with its 3 MRVs

The Missile Threat (CONUS)

SS-20 (Saber)
In service: 1976 – 1988
Warhead: Three 150 kt MIRVs
Operational range: 5,500 km (3,400 mi)
Guidance system: Inertial

SS-18 Satan ICBM Mobile Launcher

SS-18 Satan ICBM Rail Launcher

Deployed variants of R-36M missiles – NATO SS-18 (Satan)

System:	R-36M	R-36M	R-36M	R-36MUTTH	R-36MUTTH	R-36M2
Treaty-designation:	RS-20A	RS-20A1	RS-20A2	RS-20B	RS-20B	RS-20V
GRAU-designation:	15A14	15A14	15A14	15A18	15A18	15A18M
NATO-designation:	SS-18 Satan Mod 1	SS-18 Satan Mod 2	SS-18 Satan Mod 3	SS-18 Satan Mod 4	SS-18 Satan Mod 5	SS-18 Satan Mod 6
Deployment:	1974–1983	1976–1980	1976–1986	1979–2005	1986–2009	1988–Present
Maximum deployed number:	148	10	30	278	30	58
Length:	32.6 m	32.6 m	32.6 m	36.3 m	36.3 m	34.3 m
Diameter:	3.00 m	3.00 m	3.00 m	3.00 m	3.00 m	3.00 m
Launch weight:	209,600 kg	209,600 kg	210,000 kg	211,100 kg	211,100 kg	211,100 kg
Number of warheads:	8	10	1	10	1	10
Warhead yield:	4 x 1.0 MT + 4 x 0.4 MT	0.4 MT	20 MT	0.5 MT	20 MT	0.8 MT
Range:	11,200 km	10,200 km	16,000 km	11,000 km	16,000 km	11,000 km
CEP:	700 m	700 m	700 m	370 m	370 m	220 m

Northrop KD2R5 "Shelduck" Basic Training Target Drone

The Northrop KD2R5 "Shelduck" basic training drone was used internationally by the armed forces of at least 18 countries. The KD2R5 was used as a training device for ground-to-air gunnery practice. **It was also used as a training target for surface-to-air missiles** such as the Seacat, Tigercat, Redeye, Blowpipe, Sparrow, Chaparral, Hawk, Sidewinder and **Nike**.

Radioplane built a series of improved targets, though details are unclear, unsurprising given the obscurity of the subject as well as the multiple and confusing designations applied to each model.

The ultimate result of this evolution, the "MQM-36 (originally KD2R-5) Shelduck" gunnery target, is well-known, and in fact remains in service. Design of the Shelduck began in1946, with first flight in 1947. It is larger and more businesslike than the RP-5A, and is powered by a flat-four four-stroke McCulloch piston engine with 95 horsepower. The Shelduck can carry radar enhancement devices on its wingtips.

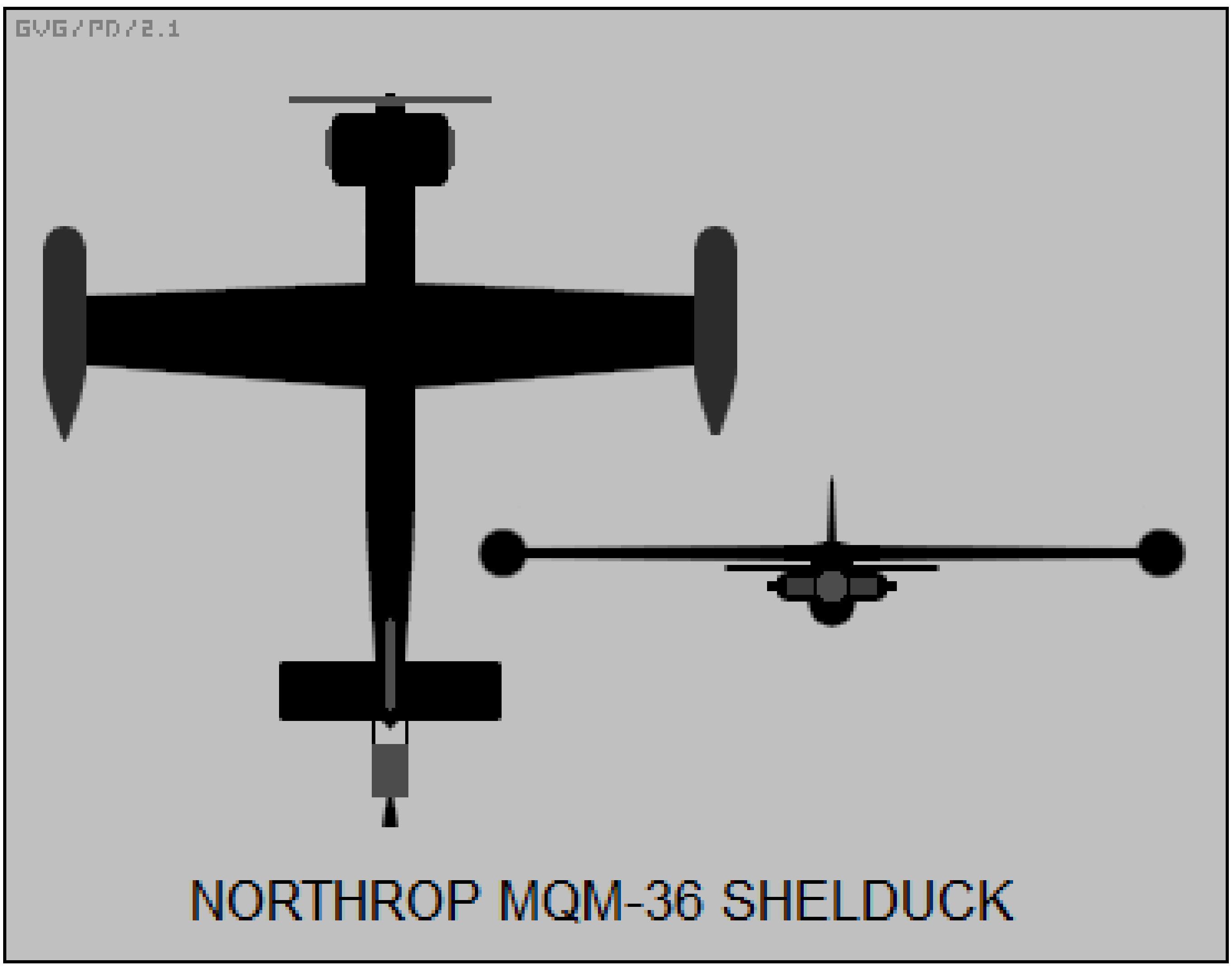
Northrop Radioplane MQM-36 "Shelduck" / KD2R-5:
Wingspan: 3.5 meters: 11 feet 6 inches
Length: 3.85 meters: 12 feet 8 inches
Height: 0.76 meters: 2 feet 6 inches
Empty weight: 123 kilograms : 271 pounds
Launch weight: 163 kilograms : 360 pounds
Maximum speed: 370 KPH : 230 MPH / 200 KT
Service ceiling : 7,000 meters : 23,000 feet
Endurance: 1 hour
Launch scheme: RATO booster or bungee catapult
Recovery scheme: Parachute
Guidance System: Radio control
Radioplane KD2R5 "Shelduck" Basic Training Target Drone

Mounted on Launch Stand
(WMoF Archive / Northrop photo)
Design of the drone was started in 1946 and the prototype flew for the first time in 1947. Since then, more than 55,000 of this type, including early KD2R versions were built.
NORTHROP UNMANNED
TARGET DRONE
Drones like this were designed to be aerial targets for fighter aircraft and ground fired missiles.
They were powered by a small jet engine, had maximum a speed of approximately 650 mph and could stay airborne for up to 2 hours.
They featured a parachute recovery and an autopilot with radio control.

RADIOPLANE BTT FAMILY (SHELDUCK)

* In the postwar period, Radioplane followed up the success of the OQ-2 series with another very successful series of much improved piston-powered target drones, what would eventually be called the "Basic Training Target (BTT)" family. The BTTs remained in service for the rest of the century.

The BTT family began life in the late 1940s, evolving through a series of refinements with the US Army designations of "OQ-19A" through "OQ-19D", and the US Navy name of "Quail" with designations of "KD2R-1" through "KD2R-5". Early models had a metal fuselage and wooden wings, but production standardized on an all-metal aircraft. Radioplane developed an experimental "XQ-10" variant that was mostly made of plastic, but though evaluation went well, it wasn't any major improvement over existing technology and it did not go into production.



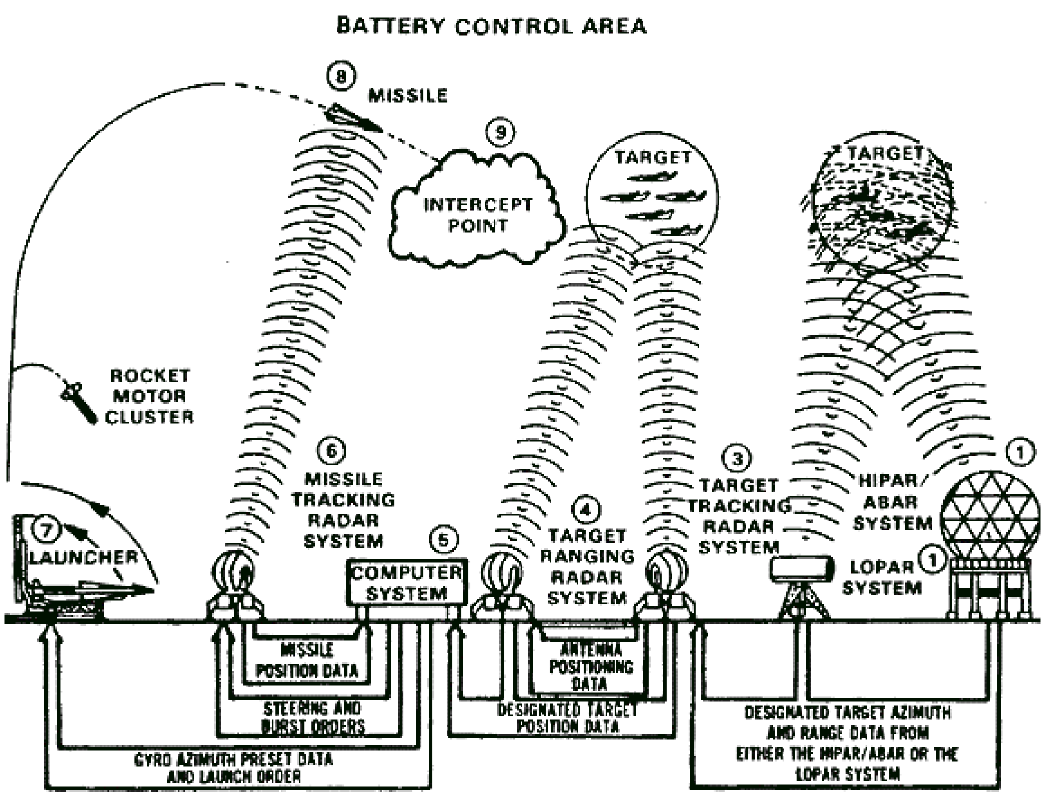
In 1963, when the US military adopted a standardized designation system, the surviving US Army BTT variants became "MQM-33s" and the Navy KD2R-1, the only member of the family still in Navy service, became the "MQM-36 Shelduck". The "BTT" designation wasn't created until the 1980s, but is used here as a convenient way to resolve the tangle of designations.

The MQM-36 was the most highly evolved of the BTT family, but retained the same general configuration as the other members. It was larger and more businesslike than the first-generation OQ-2A series, and was powered by a more powerful flat-four four-stroke McCulloch piston engine with 71.2 kW (95 HP). The MQM-36 could carry radar enhancement devices on its wingtips.

RADIOPLANE MQM-36 SHELDUCK:

spec	**metric**	**english**
wingspan	**3.5 meters**	**11 feet 6 inches**
length	**3.85 meters**	**12 feet 8 inches**
height	**0.76 meters**	**2 feet 6 inches**
empty weight	**123 kilograms**	**271 pounds**
launch weight	**163 kilograms**	**360 pounds**
maximum speed	**370 KPH**	**230 MPH / 200 KT**
service ceiling	**7,000 meters**	**23,000 feet**
endurance	**1 hour**	
launch scheme	**RATO booster or bungee catapult.**	
recovery scheme	**Parachute.**	
guidance system	**Radio control.**	

Over 73,000 BTT targets were built in all, and the type was used by at least 18 nations. Some may still be lingering in service.



Improved Nike-Hercules missile control and guidance system

Northrop RP-76 Target Drone

The Northrop RP-76 (US Army AQM-38A) was a high-performance, rocket powered, radio controlled, and recoverable target missile. It was used for surface-to-air, and air-to-air missile firing practice. It was carried to altitude by fighter aircraft and air launched. Since mid-1959, over 2,000 of these targets were ordered by the US armed forces. **They were used to train US Army Nike missile crews at US and Far East target ranges.** They were also used for air-to-air missile training of US Navy all-weather interceptor fighter pilots at the Pacific Missile Range, Point Magu, California.

The key structural component of the RP-76 was the steel engine case housing the solid propellant rocket motor. To this, the plastic wings, nose section, and aft fuselage were attached. The integral flight control package, including control vanes, was located in the nose section. Augmentation equipment included a Luneberg lens which provided reliable passive reflectivity at a minimum cost as a target for the Nike-Ajax, Nike Hercules, and Hawk missiles.

During the summer of 1960, at the White Sands Missile Range in New Mexico, an AQM-38A climbed to a height of 72,500 feet, attaining a speed of Mach 1.03 during the flight. Later, a new high performance version, designated RP-76E, attained a speed in excess of Mach 2 at an altitude of 80,000 feet.

RP-76 Specifications
Manufacturer Northrop Corporation, Ventura Division, Ventura, California
Propulsion Solid-propellant rocket engine with twin thrust nozzles canted 15 degrees outboard in the horizontal plane
Flight Controls Automatic flight control system with command control override. The control vanes formed an integral part of the fuselage
Recovery A three foot diameter ribbon brake parachute and a second stage 24 foot diameter ring slot main canopy were deployed at a predetermined altitude
Scoring There were provisions for a burst distances indicator (BDI).
Tracking The RP-76 used a Northrop RPTA-l tracking aid system. Smoke generating and night light kits were used for visual tracking.

Span 5 feet, 0 inches
Length 9 feet, 8 inches
Height 1 foot, 6.2 inches
Fuselage Diameter 12 inches
Empty Weight 197 pounds
Launch Weight 301 pounds
Maximum Speed Mach 1.25
Ceiling Over 72,000 feet
Endurance 23 minutes (including 14 minutes of gliding)
Acquisition Range in S-Band 110,000 yds.
Tracking Radar Range in X-Band 73,000 yds.

REAR COVER

SF-88 NIKE MISSILE ASSEMBLY

and SERVICE AREAS

PLEASE TURN OVER

REAR COVER