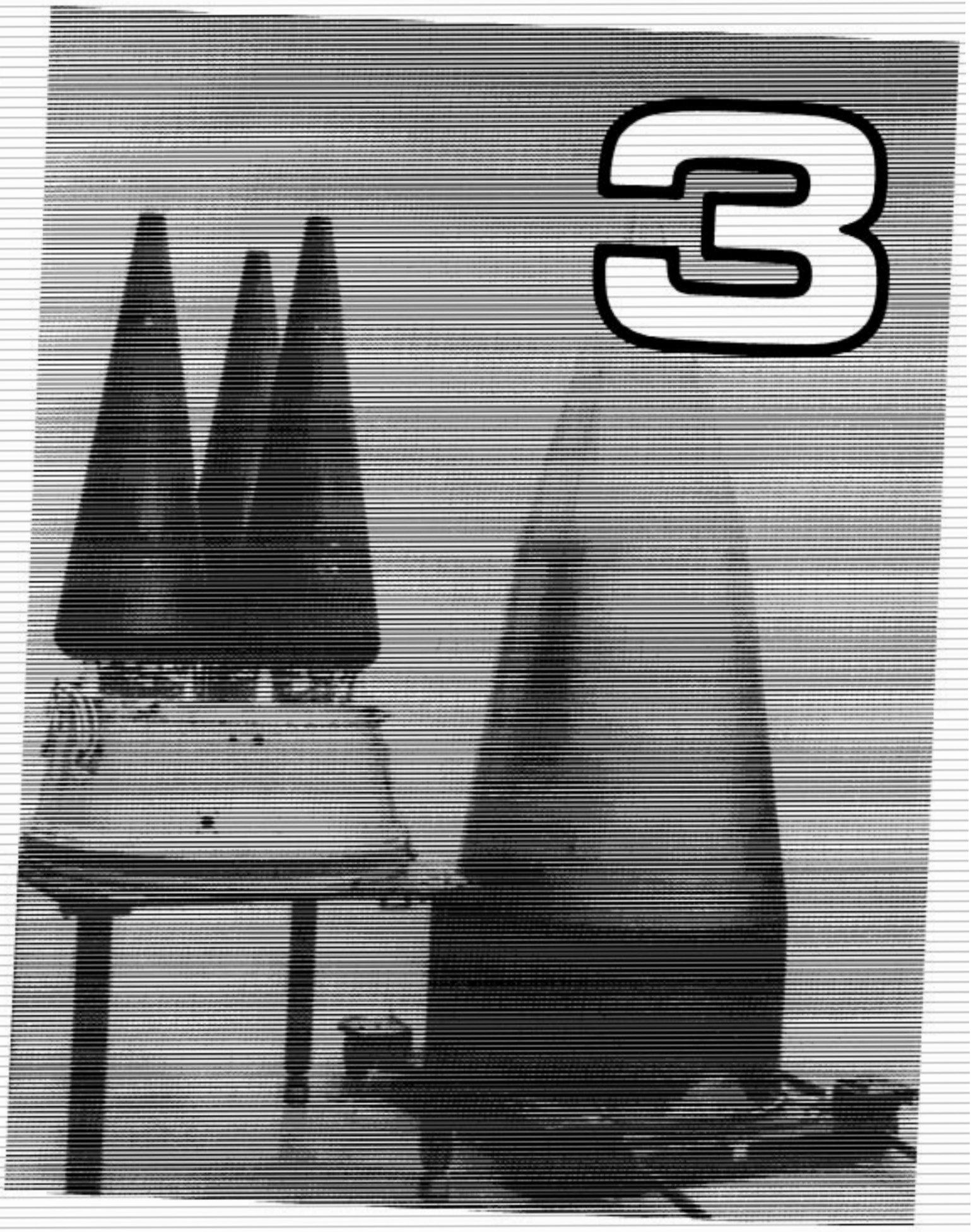
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Chapter Three
U.S. Nuclear Stockpile

This section describes the 24 types of warheads currently in the U.S. nuclear stockpile. As of 1983, the total number of warheads was an estimated 26,000. They are made in a wide variety of configurations with over 50 different modifications and yields. The smallest warhead is the man-portable nuclear land mine, known as the "Special Atomic Demolition Munition" (SADM). The SADM weighs only 58.5 pounds and has an explosive yield (W54) equivalent to as little as 10 tons of TNT. The largest yield is found in the 165 ton TITAN II missile, which carries a four ton nuclear warhead (W53) equal in explosive capability to 9 million tons of TNT.

The nuclear weapons stockpile officially includes only those nuclear missile reentry vehicles, bombs, artillery projectiles, and atomic demolition munitions that are in "active service."[1] Active service means those which are in the custody of the Department of Defense and considered "war reserve weapons." Excluded are nuclear devices under development, test models, those in production, in inactive storage,[2] and devices which have been withdrawn from active service but have not yet been dismantled. The nuclear device contained in the weapon is commonly refered to as the "warhead."

A total of 85 warhead types have been designed and tested since 1945 (see Chapter One). Of that number, 60 have reached the operational stockpile and the remainder have been cancelled before deployment.[3] Five operational warhead types were in production during FY 1983,[4] while some ten warhead types were being either partly or fully retired. Production of five new warheads (W80-0 Sea-Launched Cruise Missile warhead, B83 bomb, W84 Ground-Launched Cruise Missile warhead, W85 PERSHING II missile warhead, W87 PEACEKEEPER/MX warhead) begins in 1983, with deployments starting in December 1983.

The variations in weapons yield, weight, materials, and delivery systems are evident from this chapter's description of each operational warhead. The oldest in the arsenal is the W33, a gun assembly low yield fission warhead for an 8-inch diameter artillery shell, first deployed by the U.S. Army in 1956. The W33 uses highly enriched uranium (oralloy) as its nuclear fissile material and is considered volatile and unsafe. As a result, its nuclear materials and fuzes are kept separately from the artillery projectile. The W33 can be used in two different yield configurations and requires the assembly and insertion of distinct "pits" (nuclear materials cores) with the amount of materials determining a "low" or "high" yield.

In contrast, the newest of the nuclear warheads is the W80,[5] a thermonuclear warhead built for the long-range Air-Launched Cruise Missile (ALCM) and first deployed in late 1981. The W80 warhead has a yield equivalent to 200 kilotons of TNT (more than 20 times greater than the W33), weighs about the same as the W33, utilizes the same material (oralloy), and, through improvements in electronics such as fuzing and miniaturization, represents close to the limits of technology in building a high yield, safe, small warhead. Unlike the W33, the ALCM is fully assembled with its warhead and fuzing system and can be remotely armed from the cockpit of its carrying airplane. Although it is not clear whether the ALCM has one or more warhead yields options, the technology exists with most of the newest warheads to select a variable yield by merely turning a dial.

The stockpile contains weapons of different categories for different "delivery systems": strategic missiles, defensive missiles, tactical/theater/intermediate range missiles, artillery projectiles, atomic demolition munitions, and nuclear bombs. Warheads are allocated generally to Unified and Specified Commands (see Chapter Four) for strategic or theater warfare, or to the Joint Chiefs of Staff "weapons reserve" for future allocation in contingencies not yet anticipated by established war plans. Warheads are utilized by all three military services and the Marine Corps. They are deployed in the United States and abroad and are held for use ("custodial warheads") by allied countries.

The total number of nuclear warheads in the stockpile peaked at over 32,000 in 1967 and has since then generally decreased, with some small interim increases (see Table 1.6, Figure 1.3, and Chapter One).[6] The cur-

1 HASC, FY 1981 DOE, p. 325.
2 Two warheads from the old SAFEGUARD ABM System—the W66 and the W71—are in inactive storage and are being retired beginning in 1982.
3 HASC, FY 1982 DOE, p. 5.
4 These warheads are the B61-3/4 bomb, the W76 TRIDENT I warhead, the W78 Mk-12A MINUTEMAN III warhead, the W79 enhanced radiation artillery warhead, and the W80-1 Air-Launched Cruise Missile warhead.
5 The warheads are consecutively numbered and prefixed with a "Mk," "W," or "B."
6 HASC, FY 1982 DOE, p. 142.

Table 3.1

U.S. Nuclear Weapons Stockpile (1983)

Warhead / Weapon	Year First Deployed	Yield (Kt)	User	Number in Stockpile†	Status
W25 / GENIE	1957	1-5	AF	200	To be possibly replaced by new air-to-air missile
B28 / bomb*	1958	70-1450	AF, NATO	1200	To be replaced by B83
W31 / NIKE HERCULES*	1958	1-20	A;NATO	500	To be replaced by PATRIOT; being partially withdrawn
/ HONEST JOHN*	1958	1-20	NATO	200	Retired from US use, only left in Greek and Turkish armies
W33 / 8-inch artillery*	1956	Sub 1-12	A,MC,NATO	1800	To be replaced by W79
B43 / bomb	1961	1000	AF;MC;N;NATO	2000	To be replaced by B83
W44 / ASROC	1961	1	N	850	To be replaced by Surface Delivered ASW Weapon
W45 / TERRIER*	1956	1	N	310	To be replaced by W81
/ Medium ADM	1964	1-15	A,MC,NATO	300	
W48 / 155mm artillery	1963	0.1	A,MC,NATO	3000	To be replaced by W82
W50 / PERSHING 1a*	1962	60-400	A;NATO	410	To be replaced by W85
B53 / strategic bomb*	1962	9000	AF	150	To be replaced by B83
W53 / TITAN II*	1963	9000	AF	49	Being withdrawn starting late 1982
W54 / Special ADM	1964	Sub 1	A,MC,NATO	300	No planned replacement
W55 / SUBROC*	1965	1-5	N	400	To be replaced by Subsurface Delivered ASW Standoff Weapon
W56 / MM II	1966	1200	AF	540	To be partially replaced with MINUTEMAN III / MX
B57 / depth bomb	1964	Sub-20	AF,MC,N,NATO	1000	To be replaced by Air Delivered ASW Weapon
B61 / bomb	1968	100-500	AF;MC;N;NATO	3000	In production
W62 / Mk-12 MM III	1970	170	AF	900	Being partially replaced by W78
W68 / POSEIDON	1971	40-50	N	3480	Being partially replaced by W76
W69 / SRAM	1972	170	AF	1140	To be replaced by Advanced Strategic Air-Launched Missile or other missile
W70 / LANCE	1972	1-100	A;NATO	945	In production 1981-1982, circa 380 neutron types produced
W76 / TRIDENT I	1979	100	N	2028	In production, circa 3800 planned
W78 / Mk-12A MM III	1979	335	AF	1083	
W79 / 8-inch artillery	1981	1+	A,MC,NATO	120	In production, circa 800 planned
W80 / Air-Launched Cruise Missile	1981	200	AF	350	In production, 1499 planned before transfer to advanced missiles

* Weapons scheduled in present plans for complete or partial retirement in 1982-1987. Other weapons may begin retirement or partial removal in the mid-1980s, but are not included.

† Authors' estimates of stockpile breakdown within range of 26,000 warheads as of 1983.

rent rate of new warhead production is estimated to average approximately five a day, and the rate of old warhead retirement averages about three warheads per day.[7] While the size of the stockpile has reduced since its peak in the mid 1960s, the explosive yield of the weaponry has decreased by two-thirds as new, smaller warheads were introduced.[8]

As new weapons are produced and enter the stockpile, older weapons are retired. Table 3.1, The U.S. Nuclear Stockpile, provides a summary of the current warheads in the stockpile as of 1983 and the future status of each warhead. Of the 24 warheads in the stockpile, at least 10 are slated for replacement with newer generation nuclear warheads over the next decade. Only one, the W31 NIKE-HERCULES, is slated for replacement by a conventional weapon (PATRIOT). Only two warhead types will be completely retired with no replacement planned. According to the Department of Defense, "over the next five years . . . there will be an increase in the total number of nuclear warheads deployed, both strategic and tactical, on the order of several thousand."[9] An estimated 19 new warhead types and approximately 30,000 warheads will enter an expanding arsenal through the early 1990s, creating almost a new generation of warhead types. Descriptions of the warheads known to be in the development stage are contained in subsequent chapters. Table 1.9, Nuclear Weapons Research and Development Programs (Chapter One) provides a summary of those programs.

7 The average age of warheads in the stockpile in 1981 was 12 years. This suggests that in recent years approximately 4% of the existing inventory is retired annually, which is equivalent to approximately 1000 warheads per year or about 3 per day.

8 HASC, FY 1982 DOE, p. 142; Senate Report No. 97-173, 30 July 1981; According to one DOD report, "the total number of megatons was four times as high in 1960 than in 1980"; DOD, FY 1984 Annual Report, p. 55.

9 SASC, FY 1983 DOE, Part 7, p. 4235.

Nuclear Warheads in the Stockpile

W25

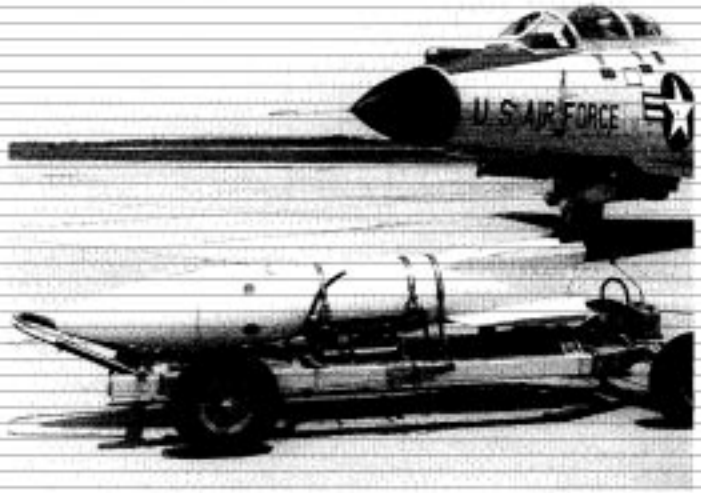

Figure 3.1 GENIE (AIR-2A) rocket.

FUNCTION:	Warhead for GENIE (AIR-2A) unguided strategic air defense air-to-air rocket
WARHEAD MODIFICATIONS:	none known
SPECIFICATIONS:	
Yield:	1.5 Kt; often referenced in the 1.5 Kt range; "a few kilotons,"[1] "less than 2 Kt"[2]
Weight:	833 lb (missile weight)[3]
Dimensions:	
Length:	9 ft 6 in
Diameter:	17.4 in[4] (warhead section only)
Materials:	probably oralloy fission weapon; probably Cyclotol (75 percent RDX) as primary HE[5]
SAFEGUARDS AND ARMING FEATURES:	probably armed by inflight insertion of nuclear materials
DEVELOPMENT:	
Laboratory:	LANL
History:	
1954	Lab assignment (Phase 3)
1957	initial deployment (Phase 5)
Production Period:	1956-1962
DEPLOYMENT:	
Number Deployed:	approximately 200 (1983)
Delivery Systems:	F-106, F-101, F-4, and possibly F-15;[6] under wing or in missile bay of F-101 and F-106[7]
Service:	Air Force
Allied User:	Canada
Location:[8]	United States and Canada with strategic interceptor units of the Tactical Air Command and Canadian Air Command under the control of NORAD (see Table 4.6)[9]
Retirement Plans:	A nuclear warhead is being designed for the Navy's tactical PHOENIX air-to-air missile, which could be used as a replacement for the GENIE.
COMMENTS:	Thousands of dual capable GENIE missiles were produced before production ended in 1962. Versions of GENIE missile include training rocket (ATR-2N), simulator (ATR-2A), and conventional trainer (ATR-2L).

1. *Military Applications of Nuclear Technology*, Part 1, p. 24.
2. Test results of March and May 1956 tests.
3. Fact sheet prepared by National Atomic Museum, Albuquerque, NM.
4. Measurements of missile on display at National Atomic Museum, Albuquerque, NM.
5. Letter from P.R. Wagner, PANTEX, to J.F. Burke, 23 May 1979.
6. The F-15 is nuclear certified, but it is not known whether those aircraft assigned air defense missions would carry the GENIE.
7. Aircraft carry one or two missiles. F-101 and F-4 have capability of carrying 2 GENIEs.
8. For detailed information on deployment, see Chapter Four.
9. ACDA, FY 1982 ACIS, p. 443.

B28

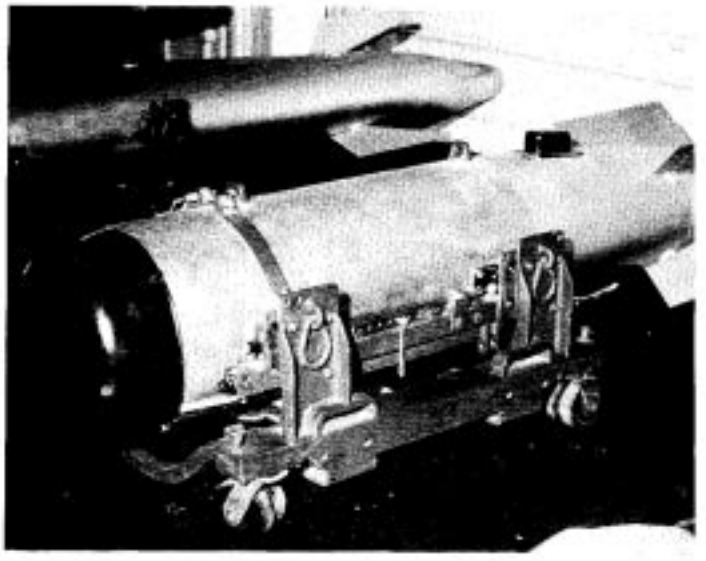

Figure 3.2 B28IN bomb.

FUNCTION: Strategic and tactical thermonuclear bomb built in numerous modifications and carried by a wide variety of aircraft.

WARHEAD MODIFICATIONS:
B28 Mod 0 originally deployed 1958;
B28 Mod 1 originally deployed 1960;
B28 Mod 2 originally deployed 1961;
Mod 0-3 versions inactive; Current B28 versions are the B28 Mod 4 RE/EX and the B28 Mod 5 FI.[4]

SPECIFICATIONS:

Yield: each individual bomb has only one yield;[2] five different yields exist, four are known: 70 Kt, 350 Kt, 1.1 Mt, 1.45 Mt[3]

Weight: 2540 lb;[4] B28RE: 2170 lb; B28EX: 2027-2040 lb; B28FI: 2340 lb[5]

Dimensions:

Length: warhead section is approximately 3 ft in length; B28EX: 170 in; B28RE: 166 in[6]

Diameter: 20 in[7]

Materials: thermonuclear bomb, contains plutonium;[8] lithium-6 deuteride, tritium for fusion; probably PBX-9505[9] or cyclotol as primary HE[10]

SAFEGUARDS AND ARMING FEATURES: Does not provide the same levels of security and safety as the B61.[11] B28FI will be modified under DOE's Stockpile Improvement Program to incorporate new electrical equipment, safety features, and high explosive material more resistant to detonation in fire or crash.[12]

FUZING AND DELIVERY MODE: fuzing option must be selected on the ground by maintenance personnel;[13] air or surface burst. Only one Mod of the B28 (FI) has a laydown option;[14] minimum altitude of delivery is 300-600 feet, can be delivered over the shoulder and at low or medium angle loft.[15]

DEVELOPMENT:

Laboratory: LANL

History:

1955 Lab assignment (Phase 3)
1958 initial deployment (Phase 5)

Production Period: 1957-? (not in production: 1970s on)

DEPLOYMENT:

Number Deployed: approximately 1200 (1983)

Delivery Systems: internal and external carriage; B-52, B-1B;[16] wide variety of dual capable tactical aircraft: A-4, A-6, A-7, F-4, F-100, F-104[17]

Table 3.2
B28 Modifications

B28EX	(Externally carried, free fall, supersonic capable, radar fuzing for airburst/ground burst) Category B PAL
B28IN	(Internally carried, free fall, radar fuzing for airburst/ground burst) Category B PAL
B28FI	(Internally carried, parachute-retarded full fuzing including laydown)
B28RE	(Externally carried, free fall or parachute-retarded radar fuzing for airburst/ground burst) Category B PAL
B28RI	(Internally carried, free fall or parachute-retarded laydown fuzing)

Figure 3.3 Four B28FI bombs loaded into bomb rack which will fit into B-52 bombers.

Service:	Air Force
Allied User:	NATO Air Forces
Location:	United States; Europe[18]
Retirement Plans:	Warhead Improvement Program (see above) is an interim fix until the B83 replacements become available starting in FY 1984.[19] B28s are earmarked for retirement (with B43 and B53) starting in 1984; bombs in B-52 units will be retired in order of 1.1 Mt, 350 Kt, 1.45 Mt and 70 Kt versions.[20]
COMMENTS:	W28 was also used in the HOUND DOG and MACE missiles, both of which have been retired.

1 Letter, National Atomic Museum, to Authors, 13 October 1981; SASC, FY 1981 DOE, p. 76.
2 AW&ST, 10 May 1976, p. 337.
3 SASC, FY 1983 DOD, Part 7, p. 4172. five different yields are known. Y1 = 1.1 Mt, Y2 = 350 Kt, Y3 = 70 Kt, Y5 = 1.45 Mt. Y4 is unknown.
4 GAO, Draft Study for B-1.
5 Information provided by National Atomic Museum, Albuquerque, NM; F-4C Flight Manual (1 September 1963).
6 *Ibid.*
7 *Ibid.*
8 SASC, FY 1982 DOE, p. 282.
9 Film at the National Atomic Museum, Albuquerque, NM.
10 Letter from P.R. Wagner, PANTEX, to J.F. Burke, 23 May 1979. See also "The Thule Affair," *USAF Nuclear Safety*, January-March 1979.
11 ACDA, FY 1979 ACIS, p. 93.
12 HAC, FY 1982, DOE, Part 7, pp. 179, 279; SASC, FY 1981 DOE, p. 79.
13 *Military Applications of Nuclear Technology*, Part 1, p. 7.
14 ACDA, FY 1980 ACIS, p. 109.
15 ACDA, FY 1979 ACIS, p. 92.
16 GAO, Draft Study for B-1.
17 The B28 also was carried on a number of retired aircraft: B-47, B-66, A-3, A-5, F-101, F-105.
18 B28RE bombs are deployed in Europe, AFM 50-5, Volume II, p. 3-67.
19 HAC, FY 1982 DOE, Part 7, p. 279.
20 SASC, FY 1983 DOD, Part 7, p. 4172.

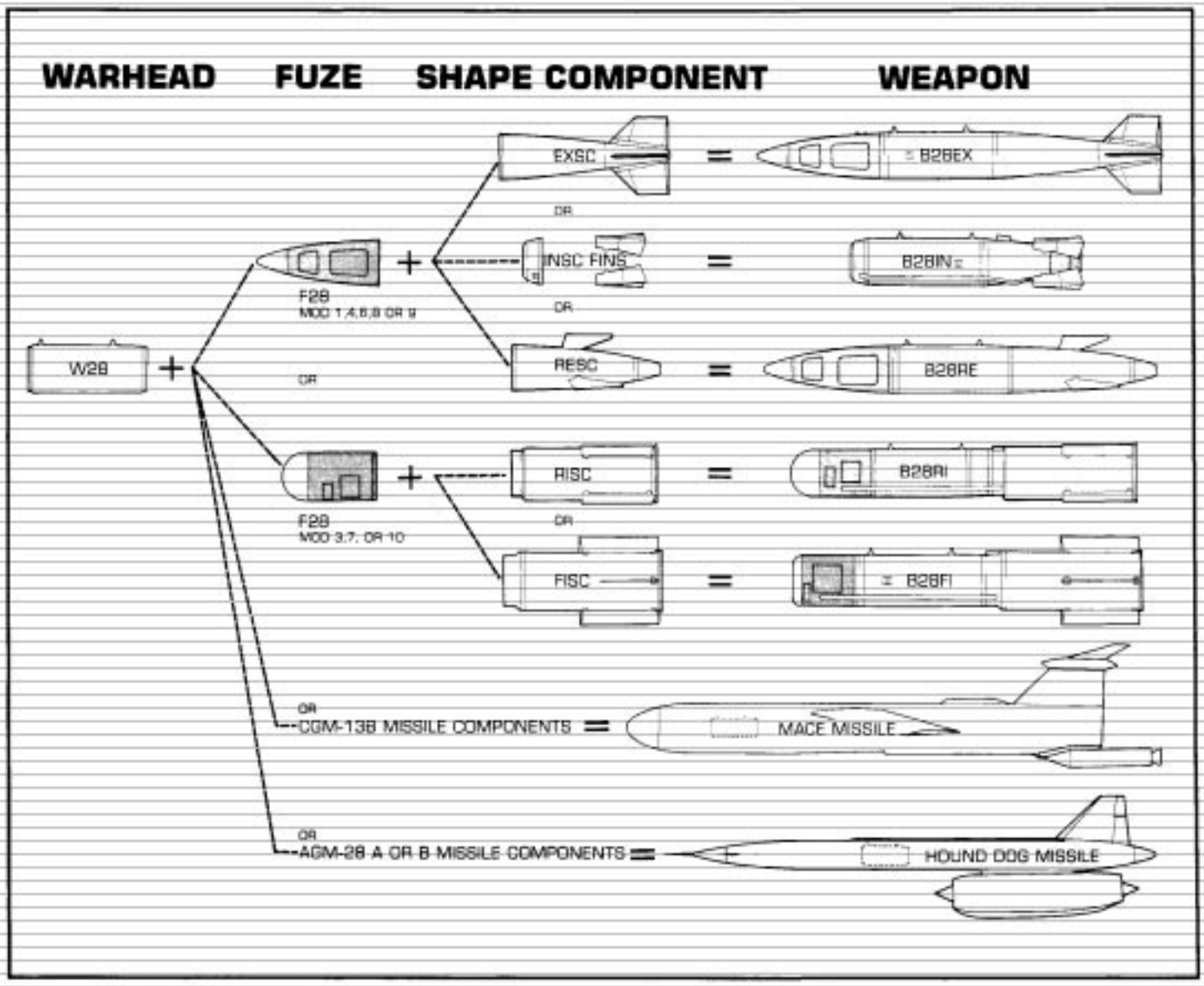

Figure 3.4 Building Block Concept. A graphic portrayal of a single warhead (W28) having several delivery applications.

W31

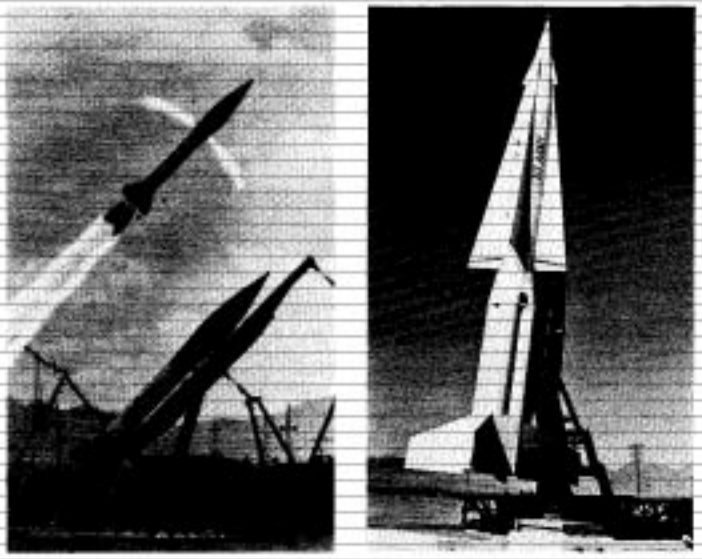

Figure 3.5 HONEST JOHN (MGR-1B), left, and **NIKE-HERCULES (MiM-14)**, right.

FUNCTION: Warhead for the HONEST JOHN (MGR-1B) battlefield support surface-to-surface missile (SSM) and the NIKE-HERCULES (MiM-14) surface-to-air missile (SAM)

WARHEAD MODIFICATIONS: W31 Mod 2 is used on NIKE-HERCULES[8]

SPECIFICATIONS:

Yield: three yield options;[9] 1-20 Kt range, possibly 2-20-40 Kt, most often referred to as 20 Kt[3]

- HONEST JOHN: three separate warhead sections, the M27, M47, and M48; each with a different yield[4]
- NIKE-HERCULES: two separate warhead sections deployed, the M22 and M97; "warheads are interchangeable."[5]

Weight:

- HONEST JOHN: 1238 lb[6]
- NIKE-HERCULES: 1123 lb[7]

Dimensions:

- HONEST JOHN: dimensions of the M480E1 steel shipping container for the warhead section are: length, 134.5 in; width, 44 in; height, 52 in[9]
- NIKE-HERCULES: dimensions of the M409 steel shipping container for the warhead section are: length, 99.25 in; width, 54.25 in; height, 62 in.[9]

Materials: oralloy as fissile material;[10] tritium contained in M47 and M48 HONEST JOHN and M97 NIKE-HERCULES warhead sections;[11] probably cyclotol (75 percent RDX) as primary HE[12]

SAFEGUARDS AND ARMING FEATURES: mechanical combination lock PAL;[13] improvement to NIKE HERCULES proposed for FY 1982 for electrical safety and command and control;[14] M7 timer fuze, burst option air burst-ground, height of burst on HONEST JOHN[15]

DEVELOPMENT:

Laboratory: LANL

History:

- 1954: Lab assignment (Phase 3)
- 1958: initial deployment (Phase 5)

Production Period: 1953-? (not in production: 1970s to the present)

DEPLOYMENT:

Number Deployed: approximately 1000 retired NIKE-HERCULES and HONEST JOHN W31s were returned from Europe during 1980.[16]

- HONEST JOHN: approximately 200 (1983)
- NIKE-HERCULES: approximately 500 (1983)

3

W31

Delivery Systems:	
HONEST JOHN:	dual capable mobile transporter erector vehicle
NIKE-HERCULES:	dual capable launchers at fixed battery firing sites
Service:	
HONEST JOHN:	Army National Guard[17]
NIKE-HERCULES:	Army
Allied User:	
HONEST JOHN:	Greece and Turkey; South Korea(?)
NIKE-HERCULES:	NATO Air Forces of Belgium, Netherlands, Greece, Italy, and West Germany; South Korea (?). Non-nuclear missiles in Denmark, Japan, Norway, Taiwan and Turkey.
Location:	
HONEST JOHN:	United States, Greece, Turkey, South Korea (?)
NIKE-HERCULES:	Greece, Italy, West Germany, South Korea (?)
Retirement Plans:	No plans currently exist to replace NIKE-HERCULES with new nuclear weapons.[18] PATRIOT conventionally armed SAM will begin deployment in the mid-1980s. W31s will remain in the inventory until past FY 1992.[19]
COMMENTS:	NIKE-HERCULES is also capable of being used in surface-to-surface mode. The HONEST JOHN was originally deployed with the Mk-7 warhead. The M72 is an inert training warhead for the HONEST JOHN.[20]

1 U.S. Army, *Nuclear Weapons Maintenance Specialist, Soldier's Manual*, FM 9-55G4 (June 1980), pp. 3-118, 3-139.
2 *Military Applications of Nuclear Technology*, p. 9.
3 See for instance: Fred M. Kaplan, "Enhanced Radiation Weapons," *Scientific American*, 238, May 1978, p. 48; *Tactical Nuclear Weapons: European Perspectives* (London: SIPRI, Taylor & Francis, 1978), p. 111.
4 *Military Applications of Nuclear Technology*, Part 1, p. 9. Three separate warhead sections with three separate yields are deployed. U.S. Army, *Field Artillery Honest John Rocket Gunnery*, FM 6-40-1 (June 1972), p. 3-1.
5 *Military Applications of Nuclear Technology*, Part 1, p. 9. NIKE-HERCULES is often referred to as having a yield of one kiloton, but it probably has yields identical to the HONEST JOHN.
6 U.S. Army, *Special Ammunition Unit Operations*, FM 9-47 (October 1970), p. C-2; see also U.S. Army, *Field Artillery Honest John Rocket Gunnery*, op. cit., (June 1972), p. 3-3.
7 U.S. Army, *Special Ammunition Unit Operations*, op. cit., p. C-4. The M22/M23/M97 nuclear warhead section which contains the W31 warhead weighs 1159 pounds.
8 Ibid., p. C-2.
9 Ibid.
10 HASC, FY 1980 DOE, p. 303.
11 U.S. Army, *Nuclear Weapons Maintenance Specialist, Soldier's Manual*, op. cit., pp. 3-118, 3-139.
12 Letter from P.R. Wagner, PANTEX to J.F. Burke, 23 May 1979.
13 U.S. Army, *Nuclear Weapons Maintenance Specialist, Soldier's Manual*, op. cit., pp. 3-139.
14 HAC, FY 1982 DOE, Part 7, p. 279.
15 U.S. Army, *Nuclear Weapons Maintenance Specialist, Soldier's Manual*, op. cit., p. 3-145.
16 HASC, FY 1982 DOE, p. 104; DOD, FY 1982 Annual Report, p. 135.
17 Last active U.S. Army HONEST JOHN battalion deactivated in 1979. Only remaining U.S. HONEST JOHN units are in the reserves; HASC, FY 1981 DOE, Part 1, p. 931.
18 DOD, FY 1983 RDA, p. VII-14.
19 HAC, FY 1982 DOE, Part 7, p. 279.
20 FM 6-61, p. 47.

W33

Figure 3.6 8-inch conventional artillery projectiles. The W33 nuclear projectile is similar in size and appearance when assembled.

FUNCTION:	Warhead for the M422 8-inch (203mm) artillery-fired atomic projectile (AFAP)
WARHEAD MODIFICATIONS:	two warhead modifications deployed; one with low yield and one with high yield;[1]
SPECIFICATIONS:	
Yield:	two yield options contained in two separate versions;[2] sub Kt - 12 Kt range; often referenced as 5-10 Kt[3]
Weight:	243 lb, 215 lb (114 kg),[4] 264 lb[5]
Dimensions:	dimensions of the M500 container for M422 projectile are: length, 49.5 in; diameter, 11.5 in; dimensions of the M102 "birdcage" for the nuclear materials are: length, 16 in; width, 16 in; height, 25 in[6]
Length:	37 in
Diameter:	8 in
Materials:	gun assembly oralloy fission weapon with insertable materials capsule
SAFEGUARDS AND ARMING FEATURES:	mechanical combination lock PAL, no command disable feature;[7] mechanical fuze[8]
DEVELOPMENT:	
Laboratory:	LANL
History:	
1954	Lab assignment (Phase 3)
1956	initial deployment (Phase 5)
Production Period:	1955-? (not in production during 1970s to the present)
DEPLOYMENT:	
Number Deployed:	circa 1000 in Europe;[9] approximately 1800 estimated overall (1983)
Delivery Systems:	dual capable M110 self propelled 8-inch howitzers, older 8-inch howitzers in Allied forces (M55 and M115)
Service:	Army and Marine Corps
Allied User:[10]	Belgium, Italy, Greece, Netherlands, Turkey, United Kingdom, West Germany
Location:	United States, Greece, Italy, Netherlands, South Korea, Turkey, West Germany

3

W33

Retirement Plans: The W33 will eventually be replaced by the enhanced radiation W79, which began production in 1981.

COMMENTS: Three nuclear materials capsule cores (992 T-Z nuclear package, 992 P-Z nuclear package, and 994 P-W nuclear package) with two separate yields exist (992 and 994); 992 T-Z is a modernized core which contains a limited life component, probably tritium.[11] The warhead must be assembled in the field. Maximum range of M422 is 18,200 meters.[12] It is not ballistically similar to the conventional 8-inch round and requires a special "spotting" round to line the sights of the gun. This reduces accuracy and slows response time.[13] The M423 is the nuclear training round and the M424 is the high explosive spotter.[14]

1 SASC, FY 1982 DOD, Part 7, p. 3889.
2 DOD, FY 1981 RDA, p. VII-5; SASC, FY 1982 DOD, Part 7, p. 3886; SASC, FY 1983 DOD, Part 7, p. 4387.
3 Kaplan, *Scientific American*, op. cit., p. 48; Fred Kaplan, "The Neutron Bomb," The Bulletin of the Atomic Scientists, October 1981, p. 7.
4 *New Encyclopedia*, 15th Ed., 19, p. 694.
5 The weight of the projectile is 243 lb; "armed" weight is higher, possibly 264 lb; National Atomic Museum, Albuquerque, NM.
6 U.S. Army, Special Ammunition Unit Operations, FM 9-47 (October 1970), pp. C-5 - C-6.
7 ACDA, FY 1981 ACIS, p. 271.
8 ACDA, FY 1980 ACIS, p. 181.
9 Walter Pincus, Washington Post, 12 August 1981, p. A12.
10 Most 8-inch units in NATO are currently certified for nuclear rounds; ACDA, FY 1980 ACIS, p. 184.
11 U.S. Army, Special Ammunition Unit Operations, op. cit.; see also U.S. Army, Nuclear Weapons Maintenance Specialist, Soldier's Manual, FM 9-55G4 (June 1980), pp. 3-64, 3-71 - 3-73.
12 Information provided by U.S. Army Armament Research and Development Command, Dover, NJ.
13 ACDA, FY 1979 ACIS, p. 130.
14 LTC Robert B. Rosenkranz, "The 'nuclear' ARTEP is USAREUR— an idea whose time has come," Field Artillery Journal, July-August 1979, pp. 16-19.

B43

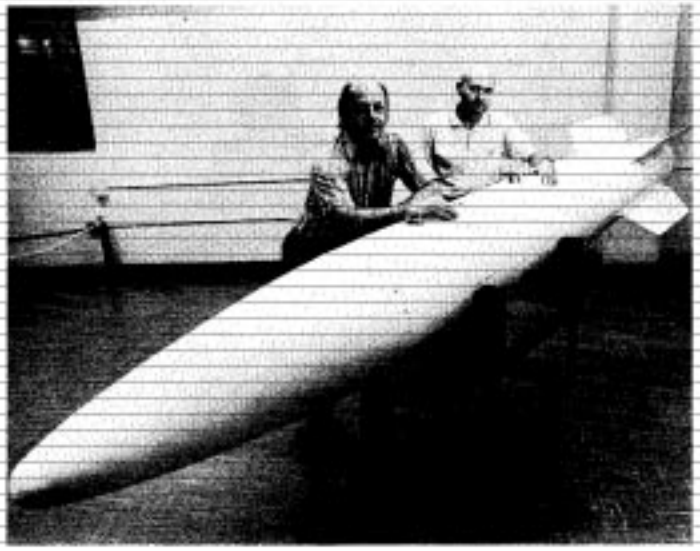

Figure 3.7 B43 bomb on display in the National Atomic Museum, Albuquerque, New Mexico.

FUNCTION:	High-yield nuclear bomb capable of being delivered by most of the nuclear capable strategic and tactical aircraft in the U.S. inventory.
WARHEAD MODIFICATIONS:	B43 Mod 0: without PAL; B43 Mod 1: fuzing radar set, with PAL
SPECIFICATIONS:	
Yield:	1 Mt[1]
Weight:	2060-2330 lb;[2] B43-0: 2060 lb; B43-1: 2120 lb
Dimensions:	
Length:	144 in;[3] 150/165 in[4]
Diameter:	18 in[5]
Materials:	thermonuclear bomb; oralloy as fissile material;[6] lithium-6 deuteride and tritium for fusion
SAFEGUARDS AND ARMING FEATURES:	does not provide the same levels of security and safety as the B61;[7] does not contain IHE, weak link/strong link, CAT D PAL, or command disable[8]
FUZING AND DELIVERY MODE:	laydown mode, retarded or freefall ground burst, retarded or freefall air burst;[9] fuzing option must be selected on the ground by maintenance personnel;[10] minimum altitude of delivery is 300-600 feet, delivery can be over the shoulder and at low or medium angle loft.[11]
DEVELOPMENT:	
Laboratory:	LANL
History:	
1956	Lab assignment (Phase 3)
1961	initial deployment (Phase 5)
Production Period:	1959-? (not in production during the 1970s to the present)
DEPLOYMENT:	
Number Deployed:	approximately 2000 (1983)
Delivery Systems:	internal or external carriage; B-52, FB-111, F-4, F-16, F-111, A-4, A-6, A-7[12]
Service:	Air Force, Marine Corps, and Navy[13]
Allied User:	NATO Air Forces

3

B43

Location:	United States, Europe;[11] South Korea (?), Philippines (?)
Retirement Plans:	to be replaced in strategic forces by B83; being replaced in tactical forces by B61.

COMMENTS: Numerous designs and modifications. Practice bombs are designated BDU-6, BDU-8, BDU-18 and BDU-24. B43 was originally designed to destroy "high-value urban-industrial targets and moderately hard military targets."[13]

1 SASC, FY 1983 DOD, Part 7, p. 4172; yield is Y1 of B43; other yields may also exist.
2 U.S. Navy, Loading and Underway Replenishment of Nuclear Weapons, NWP 14-1, Rev. A (November 1979). The loaded weight of B43 on the H905A bomb truck is given as 2590 lbs. Flight manual for F-4C gives B43-0 weight as 2060; B43-1 as 2120; NATOPS Manual, September 1963, gives B43 weight as 2140.
3 B-58A Flight Manual (USAF TO 1B-58A-1).
4 U.S. Navy, Loading and Underway Replenishment of Nuclear Weapons, op. cit. The dimensions of the B43 on the H905A bomb truck are given as: length, 150/385 in; width, 31 in; height, 31 in.
5 National Atomic Museum, Albuquerque, NM.
6 SASC, FY 1979 DOE, p. 43.
7 ACDA, FY 1979 ACIS, p. 93.
8 SASC, FY 1979 DOE, pp. 42, 47.
9 Ibid.
10 Military Applications of Nuclear Technology, Part 1, p. 7.
11 ACDA, FY 1979 ACIS, p. 92.
12 The B43 was also carried by the following retired aircraft: B-66, A-3, A-5, B-57, B-58, F-100, F-101, F-105.
13 U.S. Navy, Loading and Underway Replenishment of Nuclear Weapons, op. cit., p. 1-5.
14 AFM 50-5, Volume II, p. 3-87.
15 ACDA, FY 1979 ACIS, p. 86.

W44

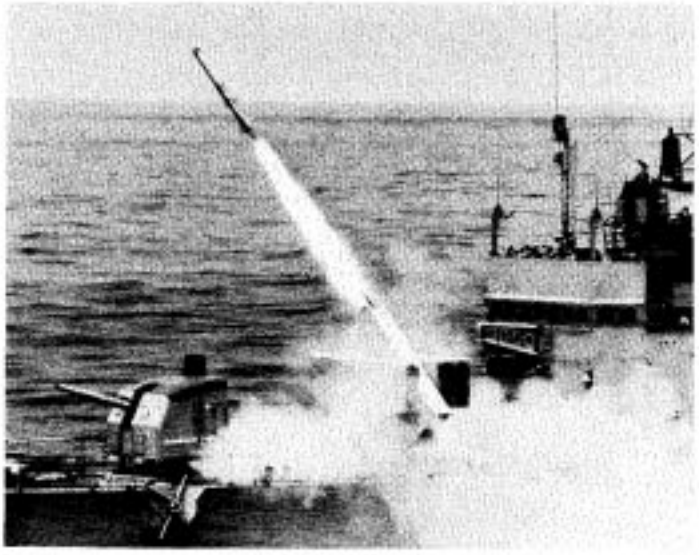

Figure 3.8 ASROC (RUR-5A) being fired from a destroyer.

FUNCTION:	Warhead in nuclear depth bomb (Mk-17) fitted to the ASROC (RUR-5A) Anti-Submarine Warfare (ASW) rocket system aboard surface ships.
WARHEAD MODIFICATIONS:	none
SPECIFICATIONS:	
Yield:	1 Kt[1]
Weight:	less than 280 lb[2]
Dimensions:	dimensions of the H-651 shipping container are: length, 35 in; width, 20 in; height, 22 in.;[3] external diameter of ASROC warhead section is 13.8 in[4]
Materials:	probably fission weapon
SAFEGUARDS AND ARMING FEATURES:	unknown
DEVELOPMENT:	
Laboratory:	LANL
History:	
1956	Lab assignment (Phase 3)
1961	initial deployment (Phase 5)
Production Period:	1960-? (not in production during 1970s to the present)
DEPLOYMENT:	
Number Deployed:	approximately 850 on 170 ships (1983); over 20,000 ASROC missiles were produced; many more than the number of nuclear warheads.[5]
Delivery Systems:	numerous dual capable ASROC launching systems[6]
Service:	Navy
Allied User:	none
Location:	surface combatant ships (cruisers, destroyers, frigates)[7]
Retirement Plans:	to be replaced by the Surface Delivered Anti-Submarine Warfare Weapon, under development, probably starting in the late 1980s.

1 United Nations, Report of the Secretary General, "Comprehensive Study on Nuclear Weapons," A/35/392 (12 September 1980), p. 22.
2 The loaded weight of the H-651 shipping container for the W44 ASROC warhead is 280 lbs. U.S. Navy, *Loading and Underway Replenishment of Nuclear Weapons*, NWP 14-1, Rev. A (November 1979), p. 3-5.
3 U.S. Navy, op. cit.
4 Measurements of ASROC rocket system on display at National Atomic Museum, Albuquerque, NM.
5 Norman Polmar, The Ships and Aircraft of the U.S. Fleet, 12th Ed. (Annapolis, MD: United States Naval Institute, 1981), p. 332.
6 See Chapter Eight for a complete listing of missile launching systems on naval ships.
7 Not deployed on newest class of frigates, the OLIVER HAZARD PERRY (FFG-7) class.

W45

Figure 3.9 TERRIER (RIM-2D) launch.

Figure 3.10 Medium Atomic Demolition Munition (MADM) with (from left) packing container, warhead, coder-decoder unit, and firing unit.

FUNCTION:	Warhead used in two configurations, in the TERRIER (RIM-2D) naval surface-to-air missile (SAM) and in the Medium Atomic Demolition Munition (MADM)
WARHEAD MODIFICATIONS:	Mod 1: TERRIER; Mod 3: MADM; M167, M172, and M175 "atomic demolition charges" are known configurations
SPECIFICATIONS:	
Yield:	
TERRIER:	reported as 1 Kt[1]
MADM:	1-15 Kt range, probably three yields
Weight:	
TERRIER:	less than 365 lb[2]
MADM:	less than 391 lb[3]
Dimensions:	dimensions of the MADM shipping container (H815) are: length, 42.5 in; width, 24.5 in; height, 28 in[4]
Materials:	probably fission weapon
SAFEGUARDS AND ARMING FEATURES:	locking pin, mechanical combination lock PAL; M3 and M4 coder-transmitters, M5 decoder-receiver, M96 firing device on MADM[5]
DEVELOPMENT:	
Laboratory:	LLNL
History:	
Nov 1956	Lab assignment (Phase 3)
1965	initial deployment of MADM (Phase 5)[6]
Production Period:	unknown
DEPLOYMENT:	
Number Deployed:	
TERRIER:	approximately 310 (1983)
MADM:	approximately 300 (1983)
Delivery Systems:	
TERRIER:	numerous dual capable TERRIER launching systems[7]
MADM:	vehicle and air/helicopter portable

3

W45

Service:	
TERRIER:	Navy
MADM:	Army and Marine Corps, Probably Navy
Allied User:	Some NATO nations are trained to use MADM.
Location:	
TERRIER:	guided missile cruisers, 3 aircraft carriers[4]
MADM:	United States, Italy, West Germany, South Korea(?)
Retirement Plans:	nuclear TERRIER is planned for retirement with deployment of the new STANDARD-2/W81.

COMMENTS: TERRIER "BTN" (Beam-riding, Terrier, Nuclear) is obsolescent and the only nuclear SAM left in naval service.[8] MADM is emplaced by an engineer team below the ground surface, or near bridges, tunnels, or other important structural targets. W45 was also used as the warhead for the Army's LITTLE JOHN missile, and the Air Force BULLPUP B (AGM-12D) missile, both of which have been retired from active service.

1 *Tactical Nuclear Weapons* (SIPRI). See also W50.
2 The Mk-22 warhead section weighs 365 lb; U.S. Navy, *Loading and Underway Replenishment of Nuclear Weapons*, NWP 14-1, Rev. A (November 1979), p. 1-8.
3 The loaded weight of the H815 shipping container for the MADM is 886-891 lbs. U.S. Navy, op. cit., p. 1-7; and U.S. Army, *Special Ammunition Unit Operations*, FM 9-47 (October 1970), p. C-1.
4 U.S. Navy, op. cit., p. 1-7; U.S. Army, op. cit., p. C-1.
5 U.S. Army, *Nuclear Weapons Maintenance Specialist, Soldier's Manual*, FM 9-55G4 (June 1980), pp. 3-108 - 3-117.
6 *Tactical Nuclear Weapons*, op. cit., p. 131.
7 See Chapter Eight for a complete listing of missile launching systems on naval ships.
8 The nuclear TERRIER does not appear to be deployed on destroyers: ACDA, FY 1980 ACIS, p. 272.
9 JCS, FY 1981, p. 48.

W48

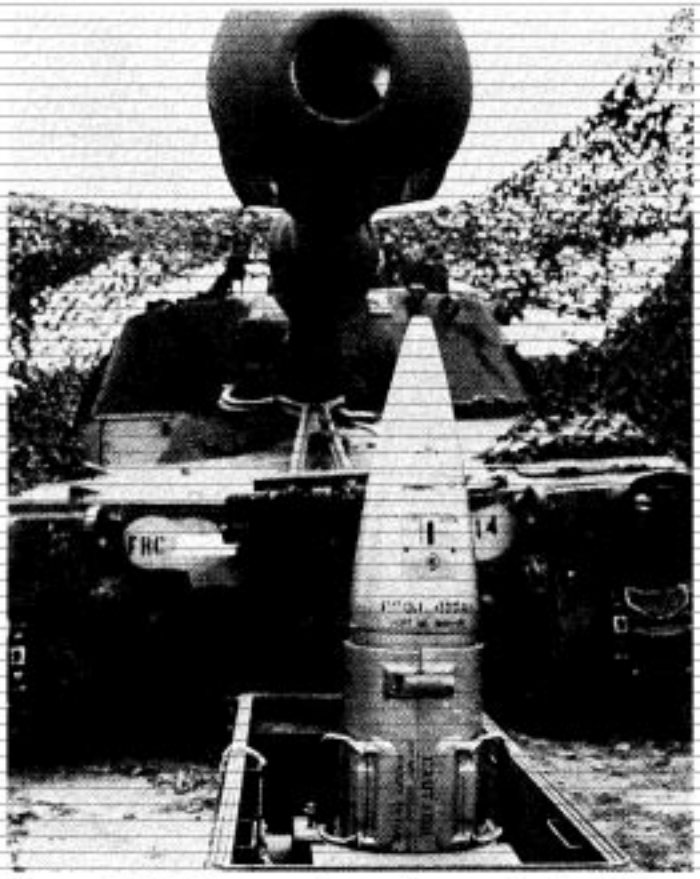

Figure 3.11 155mm nuclear artillery projectile with inert warhead.

FUNCTION:	Warhead for the M454 155mm Artillery Fired Atomic Projectile (AFAP).
WARHEAD MODIFICATIONS:	W48 Mod 1 deployed[1]
SPECIFICATIONS:	
Yield:	one sub kiloton yield option[2] "very small"; probably 0.1 Kt; often incorrectly referred to as 1 Kt[3]
Weight:	119.5 lb[4]
Dimensions:	M467 container dimensions are: length, 57 in; width, 22 in; height, 21 in[7]
Length:	34 in [5]
Diameter:	6 in[6]
Materials:	probably plutonium fission weapon
SAFEGUARDS AND ARMING FEATURES:	mechanical combination lock PAL, no command disable feature;[8] variable time (VT)/ mechanical fuze[9]
DEVELOPMENT:	
Laboratory:	LLNL
History:	
Aug 1957	Lab assignment (Phase 3)
1963	initial deployment (Phase 5)[10]
Production Period:	1962-late 1960s
DEPLOYMENT:	
Number Deployed:	approximately 3000 (1983)
Delivery Systems:	dual capable M198 and M109 155mm howitzers; older 155mm howitzers in NATO and U.S. use
Service:	Army and Marine Corps
Allied User:	Greece, Italy, Netherlands, Turkey, United Kingdom, West Germany, Belgium(?)
Location:	United States, Greece, Italy, Turkey, West Germany, South Korea

Retirement Plans: to be replaced by the W82 enhanced radiation projectile starting in 1986.[11]

COMMENTS: The yield of the W48 is lower than that of the W33.[12] The projectile has a more limited range (1.6-14.0 km),[13] is not considered accurate, and is not ballistically exact to 155mm conventional rounds.[14] M455 is training atomic projectile for M454.

1 U.S. Army, *Nuclear Weapons Maintenance Specialist, Soldier's Manual*, FM 9-55C4 (June 1980), p. 3-43.
2 *Nuclear Weapons and Foreign Policy*, p. 201; SASC, FY 1982 DOD, Part 7, p. 3886.
3 *Military Applications of Nuclear Technology*, Part 1, p. 10.
4 Weight stenciled on "inert" projectile shown in Figure 3.11; the M-454 projectile which contains the W48 warhead weighs 128 pounds, according to U.S. Army, *Special Ammunition Unit Operations*, FM 9-47 (October 1975), p. C-4.
5 Information provided by U.S. Army Armament Research and Development Command, Dover, NJ.
6 Ibid.
7 U.S. Navy, *Loading and Underway Replenishment of Nuclear Weapons*, NWP 14-1, Rev. A (November 1979), p. 1-7; and U.S. Army, *Special Ammunition Unit Operations*, op. cit., p. C-4.
8 United Nations, op. cit., p. 271.
9 ACDA, FY 1980 ACIS, p. 151.
10 *Tactical Nuclear Weapons* (SIPRI), p. 131.
11 JCS, FY 1981, p. 47.
12 ACDA, FY 1981 ACIS, p. 280.
13 SASC, FY 1982 DOD, Part 7, p. 3886.
14 HASC, FY 1981 DOD, Part 4, Book 2, p. 2305.

W50

Figure 3.12 PERSHING 1a (MGM-31A/B) missile.

FUNCTION:	Warhead for the PERSHING 1a (MGM-31) tactical ballistic missile
WARHEAD MODIFICATIONS:	Mod 1 deployed in 1963 and retired in 1978; present warhead is Mod 2; three warhead sections (M28, M141, and M142) with warheads of three different yields.[1]
SPECIFICATIONS:	
Yield:	three yield options[2] in three warhead sections, reportedly of 60, 200, and 400 Kt[3]
Weight:	less than 697 lb[4]
Dimensions:	dimensions of the M483 shipping container for the warhead section are: length, 168 in; width, 52.5 in; height, 53 in;[5] length of warhead section is 146.7 in[6]
Materials:	possibly D-T boosted fission weapon[7]
SAFEGUARDS AND ARMING FEATURES:	unknown
DEVELOPMENT:	
Laboratory:	LANL
History:	
1958	Lab assignment (Phase 3)
1963	initial deployment of Mod 1 (Phase 5)[8]
Production Period:	1960s
DEPLOYMENT:	
Number Deployed:	approximately 410 (1983)
Delivery Systems:	mobile missile transporter-erector-launcher (TEL) vehicle
Service:	Army
Allied User:	West Germany (Air Force)
Location:	United States, West Germany

Retirement Plans: Mod 1 retired in 1978; current warhead planned to be replaced by W85 on PERSHING II starting in December 1983. PERSHING 1a in the U.S. Army will be replaced by the longer-range PERSHING II which will carry the W85 warhead. Future of missiles in West German Air Force is still uncertain, but development of PERSHING II Reduced Range (RR) missile (P1b) is proceeding for possible use by West Germany.

COMMENTS: M70 and M95 are training warheads for P1a.

Figure 3.13 PERSHING 1a missile in down position, with warhead section container to right.

1 U.S. Army, *List of Applicable Publications for PERSHING 1a Field Artillery Missile System*, TM 9-1425-380-L (February 1972), p. 2-5.
2 *Military Applications of Nuclear Technology, Part 1*, p. 9. ACDA, FY 1979 ACIS, p. 115.
3 *Tactical Nuclear Weapons: European Perspectives* (SIPRI, London: Taylor and Francis, Ltd., 1978), p. 111.
4 The M28/M141/M142 nuclear warhead sections which contain the W50 weigh 667 pounds. U.S. Army, *Special Ammunition Unit Operations*, op. cit., p. C-5.
5 Ibid.
6 Information provided by Pershing Program Office, Redstone Arsenal, AL.
7 U.S. Army, *Nuclear Weapons Maintenance Specialist, Soldier's Manual*, FM 9-55G4 (June 1980), pp. 3-30 - 3-31.
8 *Tactical Nuclear Weapons*, op. cit.

B53

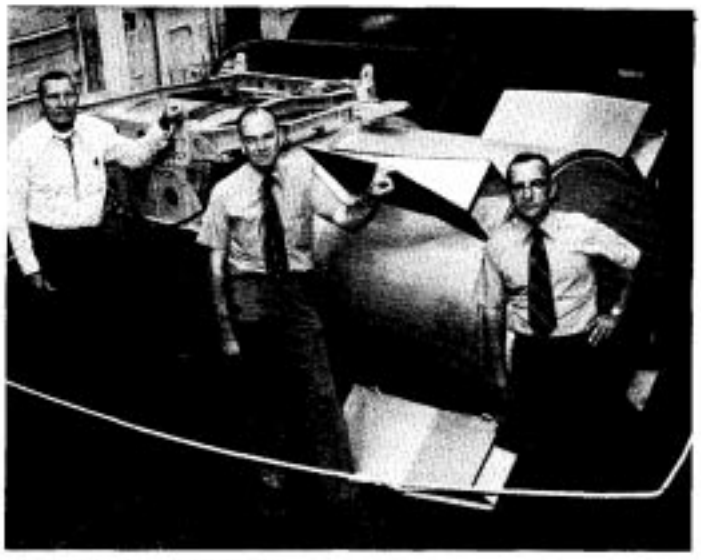

Figure 3.14 B53 bomb.

FUNCTION: High yield thermonuclear, B-52 internally carried, heavy strategic bomb (see also W53)

WARHEAD MODIFICATIONS: reportedly in two configurations

SPECIFICATIONS:

Yield: 9 Mt[2]

Weight: 8850 lb[2]

Dimensions:

Length: 12 ft 4 in

Diameter: 50 in[3]

Materials: all oralloy (no plutonium) weapon;[4] lithium-6 deuteride as fusion material

SAFEGUARDS AND ARMING FEATURES: does not provide the same degree of security and safety as the newer B61 and B83 bombs.[5]

FUZING AND DELIVERY MODE: fuzing option must be selected on the ground by maintenance personnel.[6] Airburst, contact burst, laydown,[7] free fall, or retarded delivery.

DEVELOPMENT:

Laboratory: LANL

History:

1958 Lab assignment (Phase 3)

1962 initial deployment (Phase 5)

Production Period: 1961-late 1960s

DEPLOYMENT:

Number Deployed: approximately 150 (1983)

Delivery System: B-52[8]

Service: Air Force

Allied User: none

Location: United States

Retirement Plans: B53 will be phased out as B83 and ALCMs equip the strategic bomber force.

COMMENTS: B53 warhead is similar to W53, the warhead in the Mk-6 reentry vehicle carried by the TITAN II missile. Bomb has 5 parachutes—three each 48 ft, one 16 ft, and one 5 ft "pilot" chute. Free fall delivery could be accomplished by blowing out parachute can and jettisoning all chutes.

1 SASC, FY 1983 DOD, Part 7, p. 4172.
2 Fact Sheet prepared by National Atomic Museum, Albuquerque, NM.
3 Ibid.
4 SASC, FY 1982 DOE, p. 282.
5 ACDA, FY 1980 ACIS, p. 169.
6 *Military Applications of Nuclear Technology*, Part 1, p. 7.
7 ACDA, FY 1980 ACIS, p. 169; Fact Sheet prepared by National Atomic Museum, Albuquerque, NM.
8 Also formerly carried by B-58, B-70, and B-47 bombers.

W53

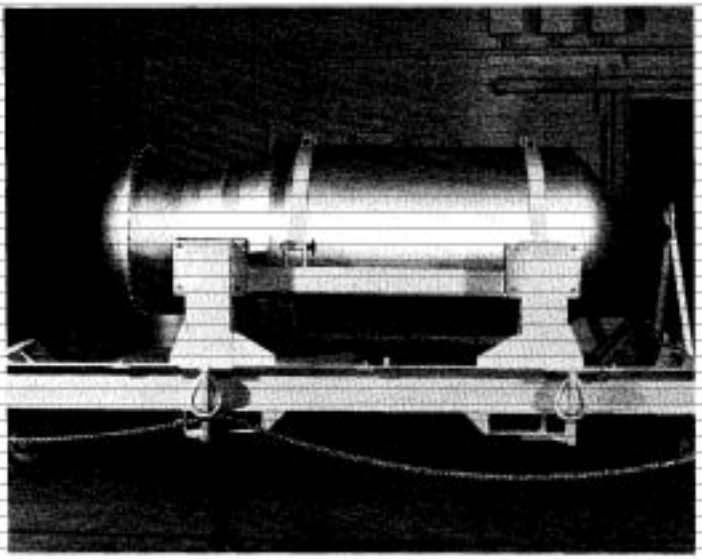

Figure 3.15 W53 warhead.

FUNCTION:	High yield thermonuclear warhead in the Mk-6 reentry vehicle deployed on TITAN II ICBMs (see also B53)
WARHEAD MODIFICATIONS:	none known
SPECIFICATIONS:	
Yield:	9 Mt
Weight:	8275-8800 lb; 8140 lb[1]
Dimensions:	slightly smaller configuration than the B53 bomb
Length:	102 in overall[2]
Diameter:	36.52 in at warhead mid-section[3]
Materials:	all oralloy system (no plutonium);[4] lithium-6 deuteride for fusion; standard HE (probably cyclotol) (75 percent RDX) as primary HE[5]
SAFEGUARDS AND ARMING FEATURES:	unknown
DEVELOPMENT:	
Laboratory:	LANL
History:	
1960	Lab assignment (Phase 3)
1962	initial deployment (Phase 5)
Oct 1982	retirement of TITAN II missiles (one per month) begins
Production Period:	1961-mid 1960s
DEPLOYMENT:	
Number Deployed:	65 total (1982);[6] 52 active missiles deployed in silos prior to beginning of retirement program in October 1982; 49 deployed (January 1983)
Delivery System:	TITAN IIs in underground silos
Service:	Air Force
Allied User:	none
Location:	Kansas, Arizona, Arkansas
Retirement Plans:	TITAN II missile is being retired under the Reagan Administration Strategic Program with the first missile withdrawal started in October 1982, with one missile withdrawn per month thereafter.[7]
COMMENTS:	W53 warhead is similar to basic warhead used in the B53 bomb.[8] Mk-6 has three-target selection capability and elaborate penetration aids.[9]

1 Mk-6 RV weighs 3700 kg. Jane's Weapon Systems.
2 Measurements given in inventory card at National Atomic Museum, Albuquerque, NM. Author's measurement at the museum is 104 inches for overall length.
3 Ibid.
4 SASC, FY 1982 DOE, p. 262.
5 Letter from P.R. Wagner, PANTEX, to J.F. Burke, 23 May 1979.
6 USAF, Missile Procurement Justification, FY 1983 (January 1982), p. 184.
7 HASC, FY 1983 DOD, Part 2, p. 163.
8 Display at National Atomic Museum, Albuquerque, NM.
9 Projected Strategic Offensive Weapons Inventories of the U.S. and U.S.S.R. An Unclassified Estimate, CRS 77-56F (24 March 1977), p. 150.

W54

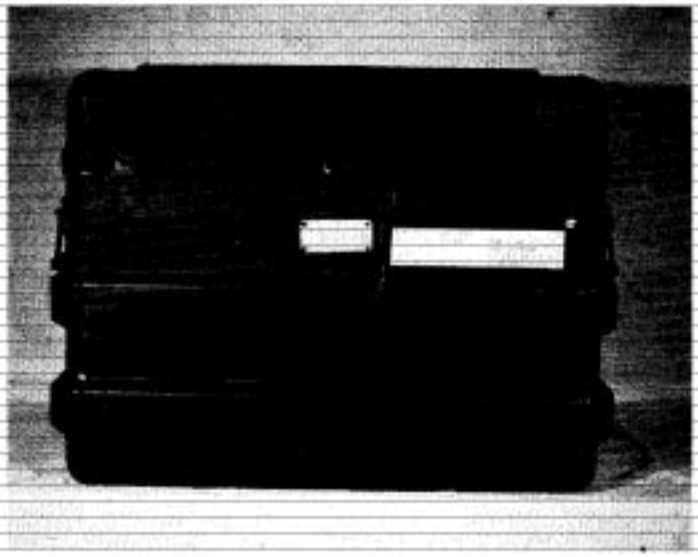

Figure 3.16 Container for W54 **Special Atomic Demolition Munition (SADM).**

FUNCTION:	Low yield warhead once used in several configurations, currently used in the Special Atomic Demolition Munition (SADM)
WARHEAD MODIFICATIONS:	two separate configurations, M129 and M159 "atomic demolition charges" are known.
SPECIFICATIONS:	
Yield:	very low; variable yield options of SADM in .01-1 Kt range, probably two yields; DAVY CROCKETT (W54-2) had a yield on the order of 0.25 Kt;[1]
Weight:	warhead weighs 58.6 lb;[2] ADM containing W54 weighs less than 163 lb[3]
Dimensions:	dimensions of the SADM shipping container (H913) are: length, 35 in; width, 26.2 in; height, 26.6 in[4]
Materials:	probably plutonium fission weapon
SAFEGUARDS AND ARMING FEATURES:	mechanical combination lock PAL,[5] M96 firing device, internal timer, M3 and M4 coder-transmitters, M5 decoder-receiver.
DEVELOPMENT:	
Laboratory:	LANL
History:	
1960	Lab assignment (Phase 3) (SADM)
1964	initial deployment (Phase 5) (SADM)
Production Period:	1960-1963 (DAVY CROCKETT); 1963-late 1960s (SADM)
DEPLOYMENT:	
Number Deployed:	approximately 300 (1983)
Delivery System:	can be carried in a backpack by a single soldier
Service:	Army and Marine Corps
Allied User:	some NATO nations are trained to use SADM.
Location:	United States, Italy, West Germany, South Korea (?)
Retirement Plans:	no new ADMs are known to be in research and development at this time.
COMMENTS:	W54 was used as the warhead for the FALCON missile (W54-0) and DAVY CROCKETT (W54-2) rocket, retired from active service in 1972 and 1971, respectively. W54 is also identified as the B54.

1 The "hypothetical" yield given by U.S. Army, *Operation and Employment of the Davy Crockett Battlefield Missile, XM-28/29*, FM 9-11 (June 1963).

2 As listed in DNA, "Motion Picture Catalog," January 1981; the DAVY CROCKETT weight, which also used the W54 (Mod 2) is 51 lb; the warhead was designed by LASL and has also been referred to as weighing "less than 50 lbs," in John McPhee, *The Curve of Binding Energy*, (New York: Farrar, Straus and Giroux, 1974), p. 8.

3 The loaded weight of the H913 container for the SADM is 162-163 lb. U.S. Navy, *Loading and Underway Replenishment of Nuclear Weapons*, NWP 14-1, Rev. A (November 1979), p.1-7; and U.S. Army, *Special Ammunition Unit Operations*, FM 9-47 (October 1970), p. C-1.

4 *Ibid.*; Dimensions of DAVY CROCKETT were, maximum diameter: 11 in; length: 25.5 in (excluding fins); measurements of display at National Atomic Museum, Albuquerque, NM.

5 U.S. Army, *Nuclear Weapons Maintenance Specialist, Soldier's Manual*, FM 9-55G4 (June 1980), pp. 3-66.

W55

Figure 3.17 SUBROC (UUM-44A) launch.

FUNCTION:	Low yield warhead contained in the Mk-57 warhead section for the SUBROC (UUM-44A) ASW depth charge rocket system, a nuclear-only weapon aboard attack submarines
WARHEAD MODIFICATIONS:	none known
SPECIFICATIONS:	
Yield:	1-5 Kt range, often referred to as 1Kt[1]
Weight:	less than 675 lb[2]
Dimensions:	dimensions of the SUBROC shipping container (H863) are: length, 49 in; width, 21 in; height, 23 in;[3] the diameter of the missile is 13 in[4]
Materials:	probably fission weapon
SAFEGUARDS AND ARMING FEATURES:	depth pressure fuze
DEVELOPMENT:	
Laboratory:	LLNL
History:	
Mar 1959	Lab assignment (Phase 3)
1965	initial deployment (Phase 5)
Production Period:	1964-1968, 1972-1974[5]
DEPLOYMENT:	
Number Deployed:	approximately 400 (1983)
Delivery System:	63 attack submarines (SUBROC capable)[6]
Service:	Navy
Allied User:	none
Location:	submarines homeported in Pearl Harbor, HI; Groton, CT; San Diego, CA; Charleston, SC; and Norfolk, VA
Retirement Plans:	to be replaced by the Subsurface Delivered ASW Standoff Weapon in the late 1980s
COMMENTS:	SUBROC is launched from a torpedo tube, emerges from underwater and reenters the water to attack submerged submarines.

1 United Nations, 1980, op. cit., p. 22.
2 The loaded weight of the H863 container for the SUBROC W55 warhead is 675 lbs. U.S. Navy, *Loading and Underway Replenishment of Nuclear Weapons*, NWP 14-1, Rev. A (November 1979), p. 1-7.
3 Ibid.
4 Measurements of external diameter of warhead section of missile on display at National Atomic Museum, Albuquerque, NM.
5 After producing SUBROCs from 1964-1968, the production line was reopened in 1972; SASC, FY 1982 DOD, Part 7, p. 3880.
6 SAC, FY 1983 DOD, Part 1, p. 300.

W56

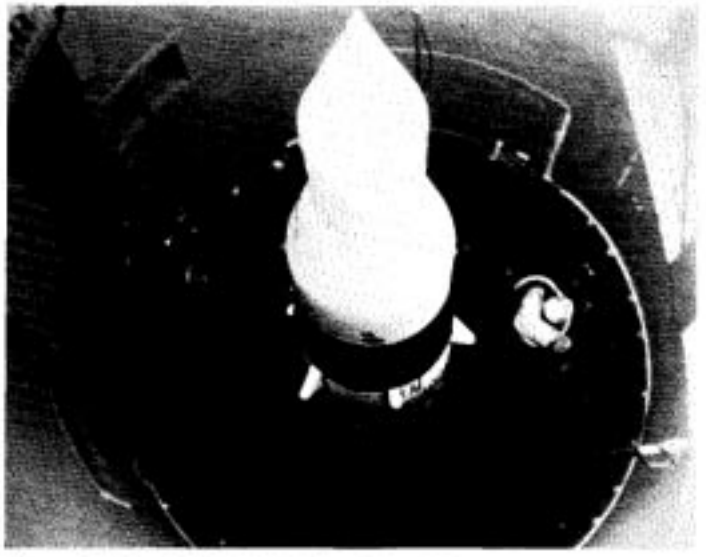

Figure 3.18 MINUTEMAN II (LGM-30F) missile in silo.

FUNCTION:	High yield thermonuclear warhead in the Mk-11 reentry vehicle on the MINUTEMAN II ICBM
WARHEAD MODIFICATIONS:	Mod 1 initially deployed; it has since been modified, hardened and upgraded to Mod 4.[1]
SPECIFICATIONS:	
Yield:	1.2 Mt;[2] 1-2 Mt range often referenced[3]
Weight:	1600 lb; 2200 lb
Dimensions:	unknown
Materials:	plutonium as fissile material; lithium-6 deuteride as fusion material
SAFEGUARDS AND ARMING FEATURES:	unknown
DEVELOPMENT:	
Laboratory:	LLNL
History:	
Dec 1960	Lab assignment (Phase 3)
1965	initial deployment (Phase 5)
Production Period:	unknown
DEPLOYMENT:	
Number Deployed:	approximately 540 (1983), 450 MM IIs actively deployed with one W56 warhead per missile
Delivery System:	MINUTEMAN IIs in underground silos
Service:	Air Force
Allied User:	none
Location:	Montana, Missouri, South Dakota
Retirement Plans:	Fifty MM II missiles are being replaced by MM III under the Reagan Strategic program. The remainder will probably be withdrawn with planned deployment of the MX missile, starting in 1986.
COMMENTS:	Mk-11C reentry vehicle is latest modification with eight target selection capability, penetration aids (Mk-1 or Mk-1A canister), and hardened against nuclear weapons effects.[4]

1 SASC, FY 1979 ERDA, p. 111.
2 AW&ST, 16 June 1980, p. 178.
3 Military Balance 1980-1981, p. 88; Heritage Foundation, *SALT Handbook*, p. 75 lists 1-2 Mt; Collins, op. cit., p. 446, and *Projected Strategic Offensive Weapons Inventories of the U.S. and U.S.S.R. An Unclassified Estimate*, CRS, p. 151, list 1 Mt. 2 Megatons is also referenced in *The World's Missile Systems*, 6th Ed., p. 288 and *Jane's Weapons Systems*; appears high based upon yield-to-weight ratio.
4 *Projected Strategic Offensive Weapons Inventories of the U.S. and U.S.S.R.*, op. cit., p. 151.

B57

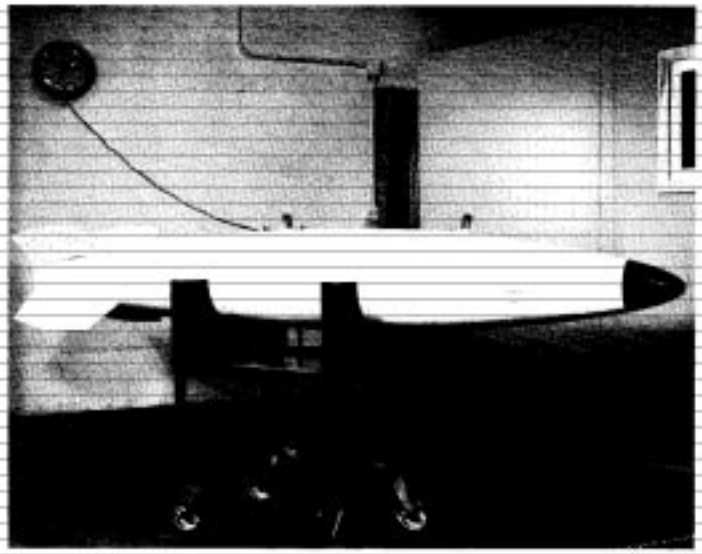

Figure 3.19 B57 bomb.

FUNCTION:	Lightweight, multi-purpose nuclear depth charge and nuclear bomb used for anti-submarine warfare (ASW) and land warfare.
WARHEAD MODIFICATIONS:	Mod 0 retired in 1967; Mod 1 presently deployed
SPECIFICATIONS:	
Yield:	sub Kt-20 Kt range; variable yield options; often referred to as 5-10 Kt[1]
Weight:	under 710 lb;[2] 500-510 lb[3]
Dimensions:	
Length:	less than 119 in[4]
Diameter:	14.75 in[5]
Materials:	unknown, probably fission weapon
SAFEGUARDS AND ARMING FEATURES:	does not provide the same degree of security and safety as the newer B61 and B83.[6]
FUZING AND DELIVERY MODE:	air or surface burst;[7] laydown;[8] over the shoulder and low or medium angle loft; minimum altitude for laydown is 300-600 ft;[9] depth pressure fuze for underwater detonations.
DEVELOPMENT:	
Laboratory:	LANL
History:	
1960	Lab assignment (Phase 3)
1964	initial deployment (Phase 5)
Production Period:	1960s
DEPLOYMENT:	
Number Deployed:	approximately 1000 (1963); B57s for tactical (non ASW) use are being reduced in overall numbers as the B61 enters the stockpile.[10]
Delivery Systems:	S-3, P-3, SH-3 maritime patrol aircraft and helicopters;[11] allied maritime patrol aircraft; wide variety of tactical aircraft.
Service:	Marine Corps and Navy
Allied User:	some NATO naval aviation components (Netherlands, United Kingdom, West Germany, *et al.*) are nuclear capable and trained to use nuclear depth bombs.[12]

3

B57

Location:[13]	aircraft carriers; United States, United Kingdom, Europe, Pacific region.
Retirement Plans:	to be replaced with the Air Delivered ASW Weapon in the late 1980s.
COMMENTS:	practice bombs are designated BDU-12 and BDU-19.

1 United Nations, 1980, op. cit., p. 22.
2 The B57 with the H841 shipping frame weighs 710 lb; U.S. Navy, *Loading and Underway Replenishment of Nuclear Weapons*, NWP 14-1, Rev. A (November 1979), p. 1-9.
3 F-4C *Flight Manual* (1 September 1963) lists weight as 500 lb; *NATOPS Flight Manual* (A-7C/A-7E) cites 510 lb.
4 U.S. Navy, *Loading and Underway Replenishment of Nuclear Weapons*, op. cit. The dimensions of the B57 in the H841 shipping frame mounted on the H1012 dolly are: length, 119 in; width, 37 in; height, 33 in.
5 National Atomic Museum, Albuquerque, NM.
6 ACDA, FY 1980 ACIS, p. 169.
7 *Military Applications of Nuclear Technology*, Part 1, p. 15.
8 ACDA, FY 1980 ACIS, p. 169.
9 ACDA, FY 1979 ACIS, p. 92.
10 HASC, FY 1981 DOD, Part 4, Book 2, p. 2318.
11 JCS, FY 1981, p. 48.
12 SASC, FY 1980 DOD, Part 6, p. 3428.
13 B57 bombs are deployed to Europe and the Pacific; AFM 50-5, Volume II, p. 3-87.

B61

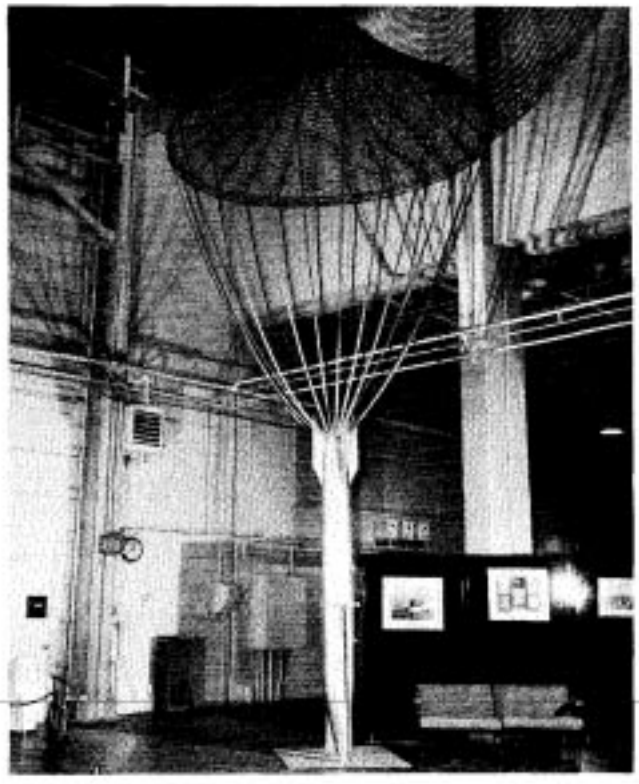

Figure 3.20 B61 bomb with parachute drogue deployed.

FUNCTION: Lightweight, multipurpose thermonuclear "modern tactical bomb" in 6 modifications used on a wide variety of aircraft, including strategic bombers.

WARHEAD MODIFICATIONS: Mods 0-5 with differing safety features and delivery capabilities

SPECIFICATIONS:

Yield: four yield options,[1] 100-500 Kt range; possibly low (10 Kt) option; maximum of "a few hundred kilotons"[2]

Weight: less than 840 lb;[3] 718 lb;[4] 765 lb[5]

Dimensions:

Length: 142 in[6]

Diameter: 13.4 in[7]

Materials: oralloy as fissile material;[8] probably D-T boosted; primary HE of B61-0, 1, and 2 is probably PBX 9404. B61-3/4 utilize (PBX 9502) IHE[9]

SAFEGUARDS AND ARMING FEATURES:[10]

B61-0: CAT B PAL;[11] no command disable; no enhanced electrical safety

B61-1: No PAL;[12] no command disable; no enhanced electrical safety

B61-2: CAT D PAL; inertial command disable;[13] no enhanced electrical safety

B61-3: CAT F PAL;[14] command disable;[15] weak ling/strong link driven by unique signal generator[16]

B61-4: CAT F PAL;[17] command disable, weak link/strong link driven by unique signal generator[18]

B61-5: CAT D PAL; nonviolent command disable, no enhanced electrical safety;[19] weak link/strong link switches driven by unique signal generator[20]

All Mods of the B61 are one-point safe by the present criterion.[21]

Funds in FY 1982 DOE budget were to begin retrofit of B61-0/1 with new safety and command and control features.[22] All forward deployed B61 bombs were planned to be upgraded to B61-3/4, slated to begin in FY 1983.[23]

3

B61

FUZING AND DELIVERY MODE:	In-flight fuzing selection and yield by merely turning a dial.[24] Can be delivered from as low as 50 feet;[25] B61 Mods 3/5: full fuzing options including time delay fuze;[26] laydown mode/retarded delivery; ground burst/air burst. B61 Mods 3/4: free fall, contact burst, or parachute retarded.[27] Can be delivered at supersonic speeds. "Penetration and environment sensing devices built into" B61 bombs.[28]
Accuracy:	highest accuracy, better than 600 ft CEP[29]
DEVELOPMENT:	
Laboratory:	LANL
History:	
1963	Lab assignment (Phase 3)[30]
Jan 1968	initial deployment of B61-0 (Phase 5)[31]
Feb 1969	initial deployment of B61-1 (Phase 5)[32]
Jun 1975	initial deployment of B61-2 (Phase 5)[33]
1976	Lab assignment of B61-3 (Phase 3)[34]
1976	Lab assignment of B61-4 (Phase 3)[35]
1977	Lab assignment of B61-5 (Phase 3)[36]
1979	initial deployment of B61-3 (Phase 5)[37]
Production Period:[38]	
B61-0:	production completed June 1969
B61-1:	production completed April 1971
B61-2:	production continued through FY 1978[39]
B61-3:	full scale production, FY 1981-present
B61-4:	full scale production, FY 1981-present
B61-5:	production completed FY 1979; in production (Phase 6) in early 1979[40]
DEPLOYMENT:	approximately 3000 (1983)
Number Deployed:	
Delivery Systems:	usable on any U.S. aircraft that can deliver a nuclear bomb,[41] both strategic and tactical aircraft: A-4, A-6, A-7, F-4, F-16, F-111, FB-111, B-52; planned for use on the B-1B.[42]
Service:	Air Force, Marine Corps, Navy
Allied User:	Belgium, Greece, Italy, Netherlands, Turkey, West Germany
Location:[43]	United States, Aircraft carriers, Belgium, Greece, Italy, Netherlands, Turkey, United Kingdom, West Germany, South Korea

COMMENTS:

B61-1 is reported to be a strategic version carried on B-52 and FB-111 aircraft. B61 Mods 3-5 are used for NATO delivery systems.[44] Practice mods of the B61 are BDU-36, BDU-38 and BDU-39E. B61 was designated TX-61 during development.

1 ACDA, FY 1979 ACIS, p. 92.
2 *Military Applications of Nuclear Technology*, Part 1, p. 7.
3 The weight of the B61 and the H1125 bomb cradle is 840 lb: U.S. Navy, *Loading and Underway Replenishment of Nuclear Weapons*, NWP 14-1, Rev. A (November 1979), p. 1-5.
4 GAO, Draft Study for B-1.
5 "The kevlar-29 parachute can slow the 765 lb [B61] vehicle from 1000 mph to 35 mph in two seconds"; caption of photograph at the National Atomic Museum, Albuquerque, NM.
6 U.S. Navy, *Loading and Underway Replenishment of Nuclear Weapons*, op. cit. The dimensions of the B61 and the H1125 bomb cradle are: length, 142 in; width, 33 in; height, 34 in.
7 Measurements taken at the National Atomic Museum, Albuquerque, NM.
8 *Military Applications of Nuclear Technology*, Part 1, pp. 52-53; later production B61s may use different materials than others; *Military Applications of Nuclear Technology*, Part 2, pp. 39-40.
9 HASC, FY 1982 DOE, p. 217; SASC, FY 1979 DOE, pp. 43-47.
10 HASC, FY 1980, DOE, p. 138; also HAC, FY 1982 EWDA, Part 7, p. 279; and also SASC, FY 1979, DOE, pp. 43, 46-47; ACDA, FY 1979 ACIS, p. 92; HASC, FY 1980 DOE, p. 140.
11 SASC, FY 1979 DOE, p. 46.
12 ACDA, FY 1979 ACIS, p. 92; ACDA, FY 1980 ACIS, p. 169.
13 ACDA, FY 1979 ACIS, lists with (p. 92); ACDA, FY 1980 ACIS, lists without (p.169); see also HASC, FY 1980 DOE, p. 140; SASC, FY 1978 ERDA, p. 109.
14 SASC, FY 1979 DOE, p. 58.
15 ACDA, FY 1979 ACIS, lists with (p. 92); ACDA, FY 1980 ACIS, lists without (p.169); see also HASC, FY 1980 DOE, p. 140; SASC, FY 1978 ERDA, p. 109.
16 SASC, FY 1979 DOE, p. 47.
17 SASC, FY 1979 DOE, p. 58.
18 SASC, FY 1979 DOE, p. 47.
19 ACDA, FY 1979 ACIS, lists with (p. 92); ACDA, FY 1980 ACIS, lists without (p.169); see also HASC, FY 1980 DOE, p. 140; SASC, FY 1978 ERDA, p. 109.
20 SASC, FY 1979 DOE, p. 47.
21 One-point safe by the present criterion means that "in the event of a detonation initiated at any one point in the high explosive system, the probability of achieving a nuclear yield greater than 4 pounds of TNT equivalent shall not exceed one in one million"; ACDA, FY 1979 ACIS, p. 92; ACDA, FY 1980 ACIS, p. 169.
22 HAC, FY 1982 EWDA, Part 7, p. 279; SASC, FY 1982 DOD, Part 7, p. 3880.
23 DOD, FY 1983 RDA, p. VII-14.
24 *Military Applications of Nuclear Technology*, Part 1, p. 7.
25 ACDA, FY 1980 ACIS, p. 169.
26 ACDA, FY 1979 ACIS, p. 86; SASC, FY 1980 DOE, p. 165.
27 HASC, FY 1982 DOE, p. 217.
28 ACDA, FY 1980 ACIS, p. 171.
29 *Aerospace Daily*, 28 December 1978, p. 293.
30 HASC, FY 1980 DOE, p. 137; SASC, FY 1980 DOE, p. 164.
31 ACDA, FY 1980 ACIS, p. 169.
32 Ibid.
33 Ibid.
34 HASC, FY 1980 DOE, p. 137; SASC, FY 1980 DOE, p. 164.
35 Ibid.
36 Ibid.
37 Ibid.
38 SAC, FY 1981 EWDA, Part 2, p. 825.
39 SASC, FY 1978 ERDA, p. 37.
40 HASC, FY 1980 DOE, p. 137; SASC, FY 1980 DOE, p. 164.
41 HAC, FY 1980 EWDA, Part 7, p. 2655.
42 GAO, Draft Study for B-1.
43 B61 bombs are deployed in both Europe and the Pacific region: AFM 50-5, Volume II, p. 3-87.
44 ACDA, FY 1979 ACIS, p. 93.

W62

Figure 3.21 Mock-up of Mk-12 reentry vehicle, which contains W62 warhead.

FUNCTION: Warhead in the Mk-12 multiple independently targetable reentry vehicle (MIRV) on a portion of the MINUTEMAN III ICBM force.

WARHEAD MODIFICATIONS: none

SPECIFICATIONS:

Yield: 170 Kt (each missile carries 2 or 3 W62 at 170 Kt each), also reported as 200 Kt[1]

Weight: less than 800 lb; 733 lb

Dimensions: unknown

Materials: plutonium as fissile component,[2] probably D-T boosted[3]

SAFEGUARDS AND ARMING FEATURES: unknown

DEVELOPMENT:

Laboratory: LLNL

History:

June 1964	Lab assignment (Phase 3)
June 1970	initial deployment (Phase 5)

Production Period: circa 1969-FY 1978[4]

DEPLOYMENT:

Number Deployed: approximately 900 (1983); more than 750 (250 MM IIIs with Mk-12 MIRVs) deployed with active forces (after 1982), 150 additional Mk-12s will be added to the active force as 50 MM IIIs replace MM IIs during 1983-1985.[5]

Delivery System: MINUTEMAN III ICBMs in underground silos

Service: Air Force

Allied User: none

Location: Montana, North Dakota, Wyoming, Nebraska, Colorado

Retirement Plans: between 1980 and 1983 W62s on 300 of 550 MM IIIs will be replaced by W78s on Mk-12A reentry vehicles. W62 warheads are retired as the W78 is being built into the new Mk-12A RV.[6]

COMMENTS: U.S. has 123 extra MM IIIs in storage as of March 1982, for tests and spares.[7] These are probably supplied with W62 warheads.[8]

1 *Jane's Weapons Systems.*
2 *Military Applications of Nuclear Technology*, Part 1, p. 26.
3 AFM 50-5, Volume II, p. 2-87.
4 SASC, FY 1978 ERDA, p. 37.
5 SASC, FY 1983 DOD, Part 7, p. 4972.
6 SASC, FY 1981 DOE, p. 195.
7 Michael Getler, *Washington Post*, 5 May 1981, p. A12.
8 AF Public Affairs, information given to authors.

W68

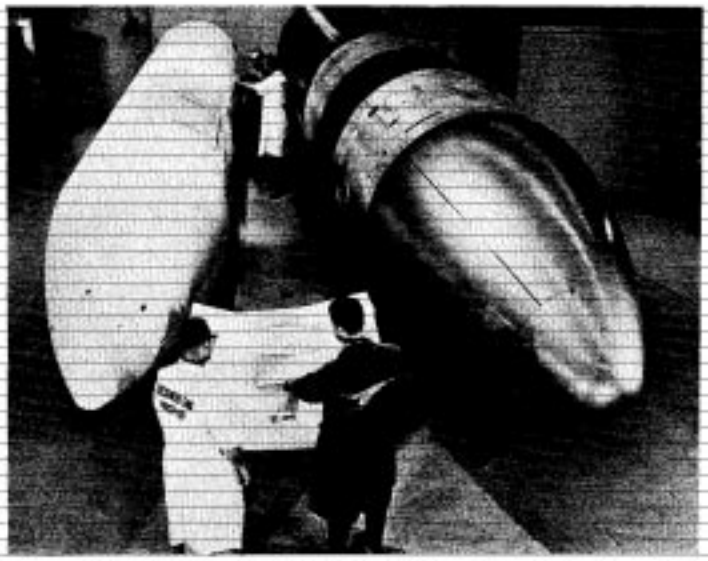

Figure 3.22 POLARIS A3 (UGM-27C) missile, left, shown with its replacement, the **POSEIDON C3 (UGM-73A)** missile, right. POSEIDON is 3 feet longer and 1 foot 6 inches larger in diameter than POLARIS.

FUNCTION:	Warhead in the Mk-3 multiple independently targetable reentry vehicle (MIRV) on the POSEIDON C3 SLBM
WARHEAD MODIFICATIONS:	none
SPECIFICATIONS:	
Yield:	40-50 Kt (each missile can carry up to 14 W68; 10 is average)[1]
Weight:	367 lb
Dimensions:	unknown
Materials:	plutonium as fissile material; probably D-T boosted;[2] LX-09 and LX-10 as primary HE[3]
SAFEGUARDS AND ARMING FEATURES:	unknown
DEVELOPMENT:	
Laboratory:	LLNL
History:	
Dec 1966	Lab assignment (Phase 3)
Mar 1971	initial deployment (Phase 5)
Production Period:	1970-late 1970s
DEPLOYMENT:	
Number Deployed:	approximately 3480 (1983); as high as 4256 possible remaining in stockpile (19 POSEIDON submarines with 304 C3 missiles, with as many as 4256 warheads)[4]
Delivery System:	POSEIDON C3 SLBM on ballistic missile submarines, each of which carries 16 missiles
Service:	Navy
Allied User:	none
Location:	submarines homeported and refitted in Holyloch, U.K.; Groton, CT; Charleston, SC; Kings Bay, GA
Retirement Plans:	TRIDENT I C4 missiles carrying W76 warheads have been backfitted onto 12 of 31 POSEIDON SSBNs, replacing POSEIDON C3/W68s

3

W68

COMMENTS: Development costs for the W68 were $131 million.* (See TRIDENT I missile and POSEIDON submarine.) A POSEIDON missile was accidentally dropped during a winching operation at Holy Loch, Scotland on 2 November 1981.

1 The C3 missile has been tested with 14 Mk-3 MIRVs. The actual loading is less. The 1981 SIPRI Yearbook assumes 10 W68/Mk-3 MIRVs per C3 missile. Paul H. Nitze indicates 8-10 MIRVs per C3 missile and uses an average of nine.

2 Military Applications of Nuclear Technology: Part 1, p. 26; ACDA, FY 1983 ACIS, p. 41; ACDA, FY 1981 ACIS, p. 60; SAC, FY 1980 DOD, Part 4, p. 1039.

3 LX-09 was originally used as the primary HE in the W68. Production was completed in June 1975. Due to problems encountered with LX-09, DOE subsequently began replacing LX-09 with LX-10 when weapons were returned to PANTEX for routine maintenance. letter from David G. Jackson, DOE Albuquerque Operations Office, to Thomas B. Cochran, 26 October 1981. On 30 March 1977, 3 men were killed in an accident at the PANTEX Plant, while working in a bay containing two explosives: LX-09 and LX-14. An investigation by DOE indicated that LX-09 was probably the explosive that initially detonated, probable cause being an error in machining or handling of the explosive billet which was being worked on a lathe. It was reported (Dick Stanley, "Working With the Bomb," *Atlanta Constitution*, November 7, 1982, pp. 1, A12) that the explosion was 414 lb TNT-equivalent from 120 pounds of LX-09. DOE claims that the decision to replace LX-09 was entirely unrelated to the question of sensitivity and safety, but was due to evidence from tests that the plastic binding components of the LX-09 released minute quantities of plasticizer which, over the lifetime of the warhead, could conceivably affect other warhead components, resulting in a degradation of the reliability of the warhead; DOE, "Report on the Sensitivity of the High Explosives in Poseidon Warheads," December 1981. Because of the high sensitivity of LX-09, this DOE claim has been questioned in an analysis by Norman Solomon; letter to Representative Ronald V. Dellums, 8 January 1982. "Several hundred" W68 warheads (in 1981) still contained LX-09, to be replaced by LX-10 during the next three to five years. Norman Soloman, Pacific News Service, San Francisco Examiner and Chronicle, 18 October 1981, p. A18. Quote attributed to Maj. Gen. William W. Hoover, Director OMA, DOE. Hoover is also quoted as saying some warheads containing LX-09 will remain in deployment for another "three to five years."

4 This figure assumes full loading of all POSEIDON missiles with the maximum of 14 warheads. Although "force loading" of deployed warheads on operational submarines is less, conversion of 12 POSEIDON submarines (192 missiles, circa 2000 warheads) to TRIDENT probably results in a large number of warheads in the stockpile, pending continued retirement.

5 HASC, FY 1979 DOD, Part 9, p. 6697.

W69

Figure 3.23 Short-Range Attack Missiles (SRAM) (AGM-69) mounted in bomb bay of B-52 bomber.

FUNCTION:	Warhead for the Short Range Attack Missile (SRAM) (AGM-69) carried aboard B-52 and FB-111 strategic bombers
WARHEAD MODIFICATIONS:	none
SPECIFICATIONS:	
Yield:	170-200 Kt range[1]
Weight:	reportedly greater than the W80[2]
Dimensions:	unknown
Materials:	plutonium as fissile material[3]
SAFEGUARDS AND ARMING FEATURES:	unknown
DEVELOPMENT:	
Laboratory:	LANL
History:	
1967	Lab assignment (Phase 3)
1970	initial deployment (Phase 5)
Production Period:	1970-1976
DEPLOYMENT:	
Number Deployed:	1140 authorized missiles in 16 B-52G/H squadrons and 2 FB-111 squadrons[4] (1983); total number in stockpile is probably more
Delivery Systems:	B-52G/H and FB-111
Service:	Air Force
Allied User:	none
Location:	SAC bomber bases in United States (see Table 4.4)
Retirement Plans:	to be replaced by Advanced Strategic Air-Launched Missile with a new warhead in the late 1980s to early 1990s.
COMMENTS:	SRAM is a supersonic air-to-surface missile with a range of 200 km. Two SRAMs are carried on FB-111, and up to 20 are carried on B-52 bombers.

1 Yield estimated to be in the range of the W62; *Air Force Magazine*, May 1976, p. 124; see also *The World's Missile Systems*, 8th Ed., p. 116.
2 AWAST, 22 November 1976, p. 15.
3 Military Applications of Nuclear Technology, Part 1, p. 26.
4 HAC, FY 1982 DOD, Part 3, p. 101.

W70

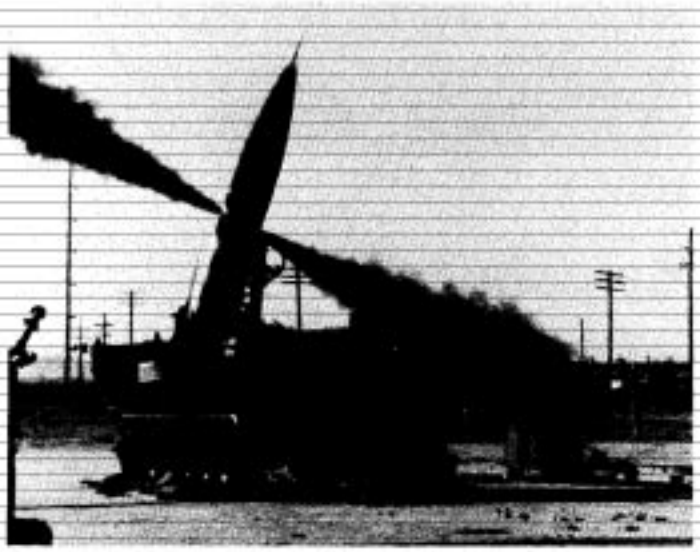

Figure 3.24 LANCE (MGM-52) missile at moment of ignition.

FUNCTION: Warhead in the Army LANCE (MGM-52) short-range, highly mobile, guided surface-to-surface tactical ballistic missile.

WARHEAD MODIFICATIONS: W70-1: presently deployed, selectable fission yield; W70-2: presently deployed, improved selectable fission yield;[1] W70-3: presently deployed, enhanced radiation version;[2] W70-4: dual capable fission/ER version, with insertable tritium reservoir to convert to enhanced radiation yield, deferred in favor of the W70-3

SPECIFICATIONS:

Yield:	W70-1/2: sub 1-100 Kt[3] in three yield options;[4] 10 Kt often referenced as typical fission yield;[5] 50 Kt as intermediate yield; W70-3: Two yield options, one slightly less than 1 Kt, the other slightly more than 1 Kt, both consisting of about 40 percent fission and 60 percent fusion.[6] A program was revealed in FY 1980 to give the LANCE (W70-1/2) warhead "a more useful spread of yields."[7]
Weight:	211 kg;[8] 450 lb;[9] 465 lb[10]
Dimensions:	
Length:	97 in[11]
Diameter:	22 in[12]
Materials:	plutonium as fissile material; Mod 3 (ER version) is tritium weapon. Non-ER versions (Mods 1/2) are probably D-T boosted fission warheads.
SAFEGUARDS AND ARMING FEATURES:	inertial nonviolent command disable system,[13] Cat D PAL built into the warhead section,[14] radiofrequency shielded against electronic countermeasures.[15] Nuclear explosion is initiated by the M1140 fuze.[16]

DEVELOPMENT:

Laboratory:	LLNL
History:	
Apr 1969	Lab assignment of W70-1 (Phase 3)
1973	initial deployment of W70-1 (Phase 5)
Apr 1976	Lab assignment of W70-3/4 (Phase 3)[17]
Oct 1978	production activities begin on W70-3 ER warhead[18]
1981	initial deployment of W70-3 (Phase 5)[19]

3

W70

Production Period:	1971-1977 (W70-1/2); 1981-1982 (W70-3)
DEPLOYMENT:	
Number Deployed:	approximately 945 (1983); at least 340 warheads for approximately 100 launchers in NATO plus missiles and 12 launchers in United States and test versions;[20] some 380 W70-3 ER warheads produced in 1981-1982.[21]
Delivery System:	dual capable LANCE missile launcher on tracked vehicles
Service:	Army
Allied User:	Belgium, Italy, Netherlands, West Germany, United Kingdom
Location:	United States, Netherlands, Italy, West Germany
COMMENTS:	nuclear warhead fitted into M234 nuclear warhead section; warhead section has external access cover for PAL connector, hazard indicator, command disable system, and sequential timer access cover. Warhead container is M511E2 with PAL connector.[22] Warhead section is of aluminum construction covered with an ablative skin that burns off in layers, preventing the warhead from overheating.

1 According to one source, the W70-3 was originally designed to "replace" the W70-2 warheads deployed in Europe; Col. William E. Serchak, "Artillery Fired Atomic Projectiles—A Field Artilleryman's Viewpoint," *Field Artillery Journal*, March-April 1980, pp. 7-12.
2 "Production of improved LANCE warheads, with ER/RB features, began earlier this year"; DOD, FY 1983 RDA, p. VII-12.
3 ACDA, FY 1982 ACIS, p. 353; *Nuclear Weapons and Foreign Policy*, p. 201; Kaplan, *Scientific American*, op. cit. p. 46; George B. Kistiakowsky, "The Folly of the Neutron Bomb," *Atlantic*, June 1978, p. 9; *Tactical Nuclear Weapons: European Perspectives* (SIPRI, London: Taylor and Francis, 1978) p. 111; Fred Kaplan, "The Neutron Bomb," *The Bulletin of the Atomic Scientists*, October 1981, p. 7.
4 *Military Applications of Nuclear Technology*, Part 1, p. 9; Field Artillery Lance Missile Gunnery, FM 6-40-4 (15 June 1979), p. 2-4. The three yields are contained in warheads designated M234A, M234B, and M234C.
5 "Lance," *Armies & Weapons*, 42, April 1970, pp. 55-62.
6 Fred Kaplan, "The Neutron Bomb," *The Bulletin of the Atomic Scientists*, October 1981, p. 7.
7 U.S. Army, "Equipping the United States Army, A Statement to the Congress on the FY 1980 Army RDTE and Procurement Appropriations," n.d., p. 28.
8 "Lance," *Armies & Weapons*, 42, op. cit., pp. 55-62.
9 U.S. Army, "Equipping the United States Army, A Statement to the Congress on the FY 1980 Army RDTE and Procurement Appropriations," n.d., p. 28.
10 *The World's Missile Systems*, 6th Ed., p. 284; *Field Artillery Battalion, Lance*, FM 6-42, p. 2-6; *System Description for Lance Guided Missile System*, TM 9-1425-485-10-1, p. 1-12.
11 *Field Artillery Battalion, Lance*, p. 2-6; TM 9-1425-484-10-1, p. 1-12.
12 Ibid.
13 SASC, FY 1978 ERDA, p. 109.
14 ACDA, FY 1982 ACIS, p. 244; *Field Artillery Battalion, Lance*, FM 6-42, p. 2-6; ACDA, FY 1980 ACIS, p. 151.
15 *Field Artillery Battalion, Lance*, p. 2-6; TM 9-1425-484-10-1, p. 1-12.
16 *Field Artillery Lance Missile Gunnery*, FM 6-40-4 (15 June 1979), p. 1-2.
17 SASC, FY 1979 DOE, p. 35; production activities on the W70-3 were halted in October 1977, and then began again in October 1978. HASC, FY 1980 DOE, p. 100.
18 HASC, FY 1980 DOE, p. 100.
19 SASC, FY 1981 DOE, p. 149.
20 DOD FY 1980 Annual Report, p. 137; ACDA, FY 1982 ACIS, p. 294.
21 Walter Pincus, *Washington Post*, 9 August 1981, p A8.
22 TM 9-1425-485-10-1, p. 1-35.

W76

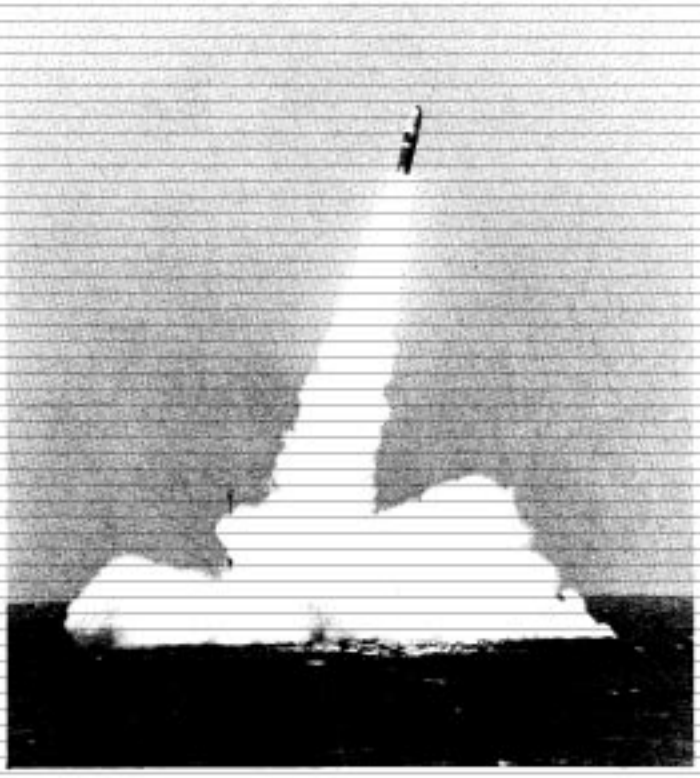

Figure 3.25 TRIDENT I C4 (UGM-93A) missile launch.

FUNCTION:	Warhead for the Mk-4 multiple independently targetable reentry vehicle (MIRV) on the TRIDENT I C4 (UGM-93A) SLBM
WARHEAD MODIFICATIONS:	none
SPECIFICATIONS:	
Yield:	100 Kt
Weight:	362.5 lb
Dimensions:	unknown
Materials:	probably plutonium as fissile material; possibly D-T boosted[1]
SAFEGUARDS AND ARMING FEATURES:	unknown
DEVELOPMENT:	
Laboratory:	LANL
History:	
1973[2]	Lab assignment (Phase 3)
1978	initial deployment (Phase 5)
Production Period:	1977-present (1983)
DEPLOYMENT:	
Number Deployed:	approximately 2028 (1983); 3600 planned; circa 5696 warheads planned before TRIDENT II procurement decision in October 1981;[3] 12 POSEIDONs backfitted with C4 plus 9 TRIDENTs planned as minimum TRIDENT I missile force[4]
Delivery Systems:	TRIDENT I C4 SLBM on POSEIDON and TRIDENT ballistic missile submarines[5]
Service:	Navy
Allied User:	none
Location:	TRIDENT missile submarines homeported in Charleston, SC; Kings Bay, GA; and Groton, CT
COMMENTS:	development costs for the W76 were $128 million.[6]

1. Military Applications of Nuclear Technology, Part 1, p. 25.
2. HASC, FY 1980 DOE, p. 137; SASC, FY 1980 DOE, p. 384.
3. 712 missiles with 8 warheads each.
4. See also discussion under Chapter Five, "TRIDENT I (C4) Missile," for further details on deployment.
5. JCS, FY 1981, p. 43. See also Chapter Five, for information on TRIDENT I (C4) missile.
6. HASC, FY 1979 DOD, Part 9, p. 6667.

W78

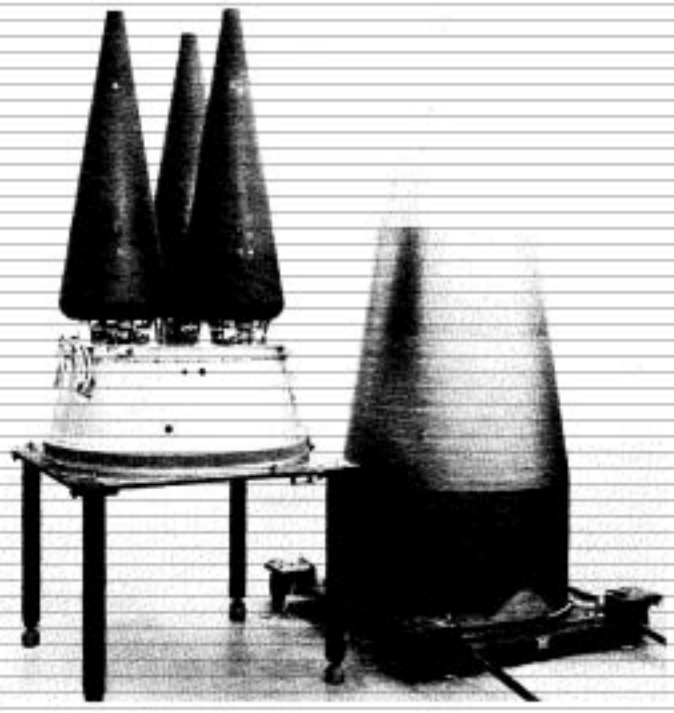

Figure 3.25 Three Mk-12A reentry vehicles mounted on bus, with MINUTEMAN III shroud, right.

FUNCTION:	Warhead for the Mk-12A multiple independently targetable reentry vehicle (MIRV) deployed on a portion of the MINUTEMAN III ICBM force.
WARHEAD MODIFICATIONS:	none
SPECIFICATIONS:	
Yield:	335 Kt[1] (MM III with Mk-12A carries 3 W78)
Weight:	less than 800 lb
Dimensions:	
Length:	less than 181.3 cm[2]
Diameter:	54.3 cm (Mk-12A base diameter)
Materials:	plutonium as fissile material; probably lithium-6 deuteride for fusion; no IHE[3]
SAFEGUARDS AND ARMING FEATURES:	unknown
DEVELOPMENT:	
Laboratory:	LANL
History:	
Jul 1974	Lab assignment (Phase 3)[4]
FY 1977	development engineering completed[5]
Sep 1979	first production unit
Jan 1980	initial deployment (Phase 5)[6]
FY 1981	W78 reported to be experiencing production delays[7]
Production Period:	FY 1979-FY 1983[8]
DEPLOYMENT:	
Number Planned:	1083 stockpiled as of January 1983;[9] program completed in 1983 with 300 missiles (900 warheads active)[10]
Delivery System:	MINUTEMAN III ICBMs in underground silos
Service:	Air Force

3

W78

Allied User:	none
Location:	Minot AFB, ND; Grand Forks AFB, ND[11]
COMMENTS:	Increased yield of Mk-12A is to offset "the continued Soviet hardening program."[12] W78/Mk-12A was previously planned as baseline warhead on MX missile, with production scheduled to begin in FY 1986.[13] In January 1982 the W87/Mk-21 (formerly ABRV) was designated the baseline RV for the MX, chosen over the W78.[14] W78 is also option as warhead for TRIDENT II missile. Mk-12A has more fuzing options than the Mk-12.[15]

1 AW&ST, 16 June 1980, p. 178; some references give 350 Kt, which is within uncertainty limits of warhead yield.
2 Length of Mk-12A reentry vehicle body.
3 SASC, Strategic Force Modernization Programs, p. 103; HAC, FY 1983 DOD, Part 4, p. 587.
4 HASC, FY 1980 DOE, p. 137; SASC, FY 1980 DOE, p. 164.
5 ACDA, FY 1980 ACIS, p. 2; ACDA, FY 1982 ACIS, p. 5; ACDA, FY 1983 ACIS, p. 5.
6 JCS, FY 1982, p. 68.
7 SASC, FY 1981 DOE, p. 37.
8 SASC, FY 1981 DOE, p. 104; SASC, FY 1982 DOD, Part 7, p. 3987.
9 SASC, FY 1982 DOD, Part 7, pp. 3986-3987.
10 SASC, FY 1983 DOD, Part 7, p. 4414.
11 HAC, FY 1982 DOD, Part 3, p. 225; SAC, FY 1981 DOD, Part 5, p. 1536.
12 JCS, FY 1981, p. 41.
13 HASC, FY 1982 DOE, p. 30.
14 ACDA, FY 1983 ACIS, pp. 6-7.
15 HAC, FY 1982 DOD, Part 1, p. 192; SAC, FY 1982 DOD, Part 1, p. 522.

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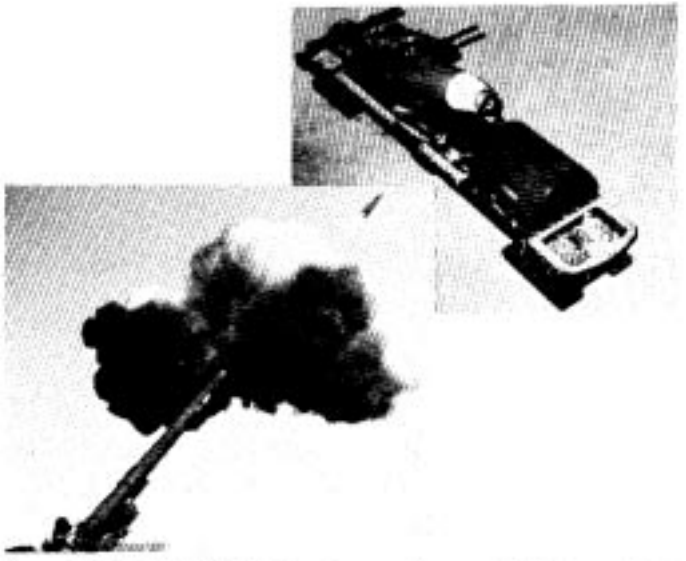

Figure 3.27 M753 8-inch nuclear artillery projectile in container, raised for insertion of fuse. **Inset, M110** gun firing M753 projectile during test.

FUNCTION: Enhanced radiation warhead for the M753 improved Artillery Fired Atomic Projectile (AFAP) for 8-inch (203mm) artillery.

WARHEAD MODIFICATIONS: W79-0: dual capable fission/ER version, cancelled in favor of ER version; W79-1: currently deployed enhanced radiation version with insertable ER components[1]

SPECIFICATIONS:

Yield:

W79-0:	up to 10 Kt[2] selectable yield
W79-1:	probably 1 Kt; three yield options ranging from substantially under 1 Kt to about 2 Kt; the lowest yield option will be 50 percent fission and 50 percent fusion, the highest yield option will be 70 or 75 percent fusion.[3] "More yield options" than W33[4]
Weight:	approximately 215 lb
Dimensions:	
Length:	43 in[5]
Diameter:	8 in
Materials:	plutonium and tritium weapon replacing W33 oralloy weapon[6]

SAFEGUARDS AND ARMING FEATURES: Category D PAL built into the warhead section, command disable feature integrated into the M613 projectile storage container;[7] "easier to handle in the field ... modern safety devices not found in the older generation of 8-inch projectiles;"[8] nonviolent explosive destruct system (NEDS) under development for W79 (1974-1977) before program was terminated; one point safe.[9] Fuzing includes "target sensor," electronic programmer, and timing and memory assembly.[10]

DEVELOPMENT:

Laboratory:	LLNL[11]
History:	
Dec 1973	program study complete (Phase 2)[12]
Jan 1975	Lab assignment (Phase 3)[13]
Jan 1977	President Ford approves Stockpile Memorandum with W79 as ER weapon[14]
Oct 1978	production activities begin on W79 ER warhead[15]
1980	production engineering completed (Phase 4)[16]
Jul 1981	initial deployment (Phase 5)[17]
Production Period:	1981-present (1983)

DEPLOYMENT:

Number Deployed:	approximately 120-300 deployed (1983); 800 planned for production[18]
Delivery Systems:	dual capable 8-inch howitzers, including the standard M110 and older M115 in Allied use[19]

3

W79

Service:	Army and Marine Corps
Allied User:	Belgium, Greece, Italy, Netherlands, Turkey, West Germany, United Kingdom (current W33 users)
Location:	Warheads will be stored at Seneca Army Depot, New York, and not deployed outside U.S., pending approval of NATO allies; South Korea (?).

COMMENTS: M-753 projectile includes a rocket assist which doubles the range of the present projectile from 18 km to 29 km.[20] The projectile is ballistically similar to a conventional 8-inch high explosive round, thus eliminating the need for a spotting round as in the W33/M422.[21] The round requires no field assembly and includes improved fuzing[22] with a more accurate height of burst.[23] Training rounds include M173 "Type X," M174 "Type W," and M64 explosive ordnance disposal variants.

1. ACDA, FY 1981 ACIS, pp. 274-275; ACDA, FY 1982 ACIS, p. 247; SASC, FY 1980 DOD, Part 7, p. 4397.
2. Kaplan, Scientific American, op. cit., p. 40, reports the following yields: Without ER: 5-10 Kt; With ER: 1-2 Kt. The 5-10 Kt may be the W33 yield, however.
3. Fred Kaplan, "The Neutron Bomb," The Bulletin of the Atomic Scientists, October 1981, p. 7. See also, George Kistiakowsky, "The Folly of the Neutron Bomb," Atlantic, June 1978, p. 8; SASC, FY 1981 DOD, Part 1, p. 411, refers to a "2-3 Kt RB/ER Warhead."
4. DOD, FY 1981 RDA, p. VII-5.
5. Information supplied to the authors by U.S. Army Armament Research and Development Command, Dover, NJ.
6. JCAE, FY 1977 ERDA Authorization Hearing before Joint Committee on Atomic Energy, February-March 1976, Part 3, pp. 1380-82; Military Applications of Nuclear Technology, Part 1, p. 28; ACDA, FY 1979 ACIS, p. 153; ACDA, FY 1981 ACIS, p. 275.
7. ACDA, FY 1981 ACIS, p. 274-275.
8. JCS, FY 1982, p. 78; DOD, FY 1980 RDA, p. VII-12.
9. ACDA, FY 1979 ACIS, p. 130.
10. Information supplied to the authors by U.S. Army Armament Research and Development Command, Dover, NJ.
11. Contractors for the nuclear projectile include Motorola Corp., Scottsdale, AZ; Sandia Corp., Livermore, CA and Albuquerque, NM; Chamberlain Manufacturing Corp., Waterloo, IA; and Ferrulmatics, Inc., Patterson, NJ; USA, Army Weapon Systems, 80, n.d., p. 84. The electrical system is provided by Sandia Laboratories, Livermore, CA, and fuze design by Harry Diamond Laboratory, U.S. Army.
12. JCAE, FY 1977 ERDA Authorization Hearing before Joint Committee on Atomic Energy, February-March 1976, Part 3, pp. 1380-82; Military Applications of Nuclear Technology, Part 1, p. 28; ACDA, FY 1979 ACIS, p. 153; ACDA, FY 1981 ACIS, p. 275.
13. SASC, FY 1979 DOE, p. 35; production activities on the W79 were halted in October 1977, and began again in October 1978; HASC, FY 1980 DOE, p. 100.
14. SASC, FY 1979 DOE, p. 35.
15. HASC, FY 1980 DOE, p. 100.
16. SAC, FY 1981 EWDA, p. 818.
17. JCS, FY 1982, p. 78; DOD, FY 1980 RDA, p. VII-12.
18. Walter Pincus, Washington Post, 9 August 1981, p. A8; the number of projectiles deployed is related to the number of 155mm shells also produced; ACDA, FY 1979 ACIS, p. 131.
19. Information supplied to the authors by U.S. Army Armament Research and Development Command, Dover, NJ.
20. SASC, FY 1982 DOE, Part 7, p. 3881; HASC, FY 1982 DOE, p. 451; DOD, FY 1981 RDA, p. VII-5, refers to 18 km as range of present howitzer; JCS, FY 1982, p. 78, refers to 14 km as present range.
21. ACDA, FY 1981 ACIS, pp. 274-275.
22. DOD, FY 1981 RDA, p. VII-5.
23. ACDA, FY 1980 ACIS, p. 153.

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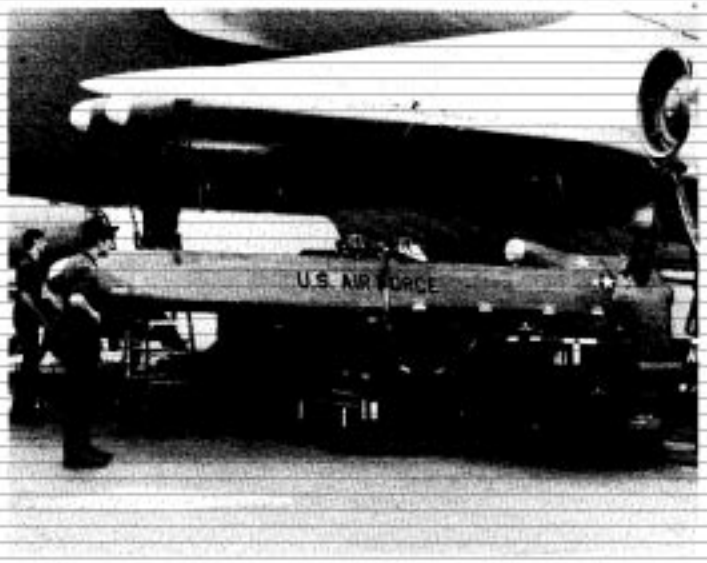

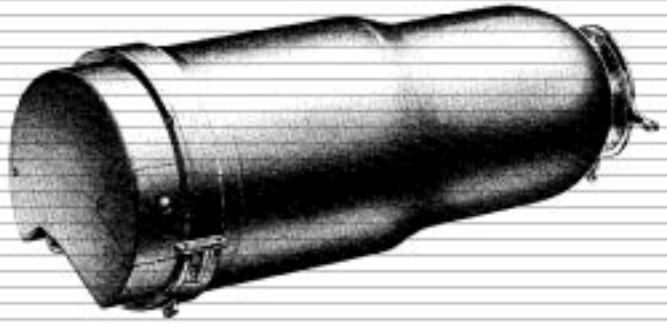

Figure 3.28 Top, **Air-launched Cruise Missiles (AGM-86B)** being mounted on B-52 bomber. Missile in top foreground shows opening for **W80** nuclear warhead, shown at bottom.

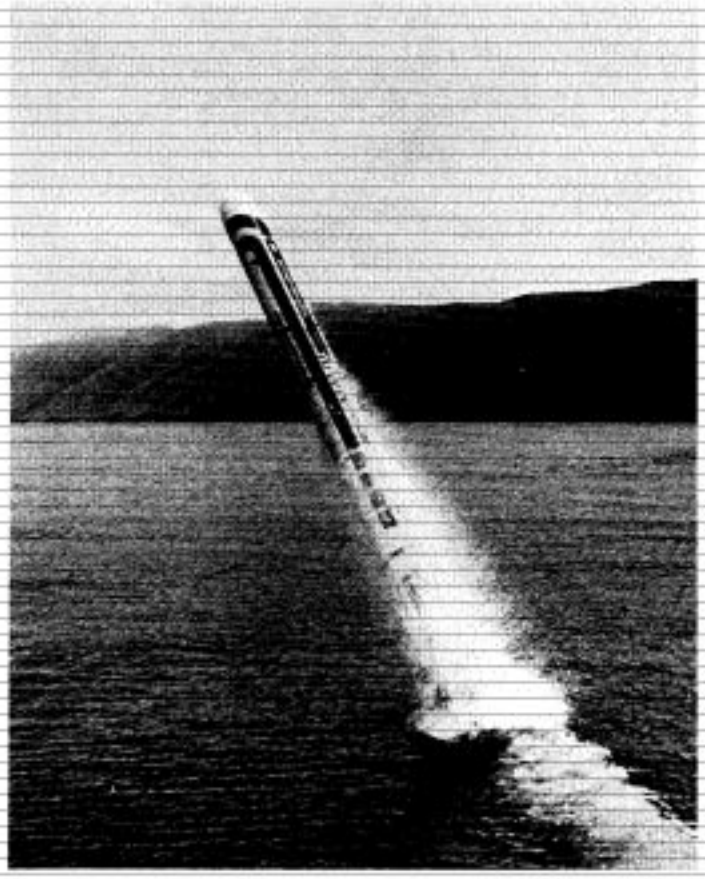

Figure 3.29 TOMAHAWK (BGM-109) Sea-launched Cruise Missile.

FUNCTION:	Common warhead to be used in the strategic Air Force Air-Launched Cruise Missile (ALCM) (AGM-86B) and the Navy TOMAHAWK Sea-Launched Cruise Missile (SLCM) (BGM-109).
WARHEAD MODIFICATIONS:	Mod 0: Sea-Launched Cruise Missile; Mod 1: Air-Launched Cruise Missile

SPECIFICATIONS:

Yield:	selectable yield;[1] circa 200 Kt;[2] 250 Kt also referenced[3]
Weight:	270 lb;[4] total cruise missile weighs 3000 lb;[5] 3144 lb[6]
Dimensions:	
Length:	20 ft 9 in
Diameter:	27.3 in
Materials:	oralloy as fissile material; supergrade plutonium in Mod 0;[7] probably oralloy in Mod 1; tritium;[8] IHE (PBX-9502) as primary HE[9]

3

W80

SAFEGUARDS AND ARMING FEATURES: weak link/strong link exclusion region for the warhead electrical system.[10] CAT D PAL;[11] Mod 0 will use low ngs (neutron/gram/second) plutonium to produce low intrinsic radiation for personnel protection for use on submarines;[12] coded switch system; unique signal generator

DEVELOPMENT:

Laboratory: LANL

History:

1976	Lab assignment (Phase 3) for ALCM[13]
FY 1978	W80 warhead test program completed[14]
1980	Lab assignment (Phase 3) for SLCM[15]
1980	production engineering (Phase 4) for ALCM[16]
Sep 1981	initial deployment (Phase 5) for ALCM
FY 1985	production of ALCM ceases with transition to advanced ALCM

Production Period:

ALCM:	1979-1985[17]
SLCM:	1983-

DEPLOYMENT:

Number Deployed: approximately 350 (end 1982); ALCM is being produced at a rate of 40 per month;[18] plans are to purchase 4348 ALCMs and Advanced Cruise Missiles for B-52 and B-1 force;[19] 1499 ALCMs planned before change to Advanced Cruise Missiles in early 1983; 3994 SLCM planned, 1000 of which will be nuclear armed.[20]

Delivery Systems:

ALCM:	B-52G/H, FB-111, B-1B
SLCM:	sized to fit 21-inch torpedo tubes and general purpose launchers on surface ships and submarines, vertical launching system (VLS) under development

Service:

ALCM:	Air Force
SLCM:	Navy

Allied User: none

Location:

ALCM:	nine bomber bases (see Chapter Four)

COMMENTS: Warhead is essentially the same for each missile (ALCM and SLCM), major differences being warhead-to-missile mounting features and materials used.[21] Basic warhead design is a modification of the B61 bomb.[22] Ground-Launched Cruise Missile (GLCM) will use a different warhead, the W84. The W80 was originally intended as a replacement warhead for the SRAM.[23] It is under consideration as a warhead for the ASALM.[24]

1. ACDA, FY 1980 ACIS, p. 27; SASC, FY 1980 DOD, Part 3, p. 934; also refers to "single yield."
2. *Military Balance, 1980-1981*, p. 3.
3. AW&ST, 22 November 1976, p. 15.
4. Kosta Tsipis, "Cruise Missiles," *Scientific American*, February 1977.
5. CRS, Cruise Missiles, (IB 81080), p. 1.
6. Air Force fact sheets.
7. SASC, FY 1980 DOE, p. 160.
8. HASC, FY 1981 DOD, Part 4, Book 2, p. 1706.
9. HASC, FY 1982 DOE, p. 217; ACDA, FY 1983 ACIS, p. 68.
10. DOE, FY 1982 Revised [Reagan] Budget. Reproduced in HAC, FY 1982 EWDA, Part 5, p. 34.
11. SFRC/HIRC, Joint Committee Print, *Analysis of Arms Control Impact Statements Submitted in Connection with the Fiscal Year 1978 Budget Request*, April 1977, p. 96.
12. SASC, FY 1979 DOE, p. 59; SASC, FY 1980 DOE, p. 190.
13. HASC, FY 1980 DOE, p. 137; SASC, FY 1980 DOE, p. 184.
14. ACDA, FY 1980 ACIS, p. 29.
15. SAC, FY 1981 EWDA, p. 618.
16. Ibid.
17. Deliveries were slated to begin in Fiscal Year 1980; ACDA, FY 1980 ACIS, p. 39.
18. AW&ST, 17 January 1983, p. 101.
19. Former plans were to procure 3618 ALCMs for B-52 force. 3780 operational ALCMs will be used in the 4368 total buy; HAC, FY 1983 DOD, Part 4, p. 587.
20. Michael Getler, *Washington Post*, 19 January 1983, p. A15.
21. HASC, FY 1982 DOE, p. 202.
22. HASC, FY 1982 DOE, p. 207.
23. SFRC/HIRC, Joint Committee Print, *Analysis of Arms Control Impact Statements Submitted in Connection with the Fiscal Year 1978 Budget Request*, April 1977, p. 96.
24. ACDA, FY 1980 ACIS, p. 39.