Chapter Nine
Army Nuclear Weapons

The Army uses a wide variety of nuclear weapon systems—medium range PERSHING 1a and short-range LANCE surface-to-surface missiles, NIKE-HERCULES surface-to-air missiles, 155mm and 8-inch (203mm) artillery, and atomic demolition munitions (nuclear land mines). The HONEST JOHN surface-to-surface rocket, although withdrawn from active U.S. use, is nuclear armed with some NATO allies. Army nuclear weapons are deployed with U.S. combat units throughout the United States, Europe, in South Korea, and among allied military forces. They vary in range from manually emplaced land mines to 460 miles, and in yield from sub (0.01) to 400 kilotons.

The PERSHING 1a is the longest range and highest yield Army nuclear weapon currently deployed. One hundred and eighty launchers, with more than 300 missiles, all armed with W50 nuclear warheads, are deployed in West Germany with the U.S. Army and the West German Air Force. First deployed in 1962 to replace the SERGEANT missile, the PERSHING represented an increase in range, accuracy, and reliability. A replacement system for the PERSHING 1a, the PERSHING II, is now planned for initial deployment in December 1983. Originally designed as a more accurate and reliable missile with similar range to the PERSHING 1a, the PERSHING II was subsequently made long-range (1800 km) with a small yield warhead (W85). The deployment of the new PERSHING II missile has become very controversial. It is uncertain whether the full complement of missiles will eventually be deployed and whether the current West German PERSHING 1a will be replaced. Another PERSHING missile, a short-range and accurate “fallback” system designated PERSHING 1b, is also under development for deployment with the West German Air Force, or for U.S. deployment in Europe should arms control negotiations successfully eliminate the long-range missiles.

More widely deployed than PERSHING is the short-range corps support LANCE 125 km range missile, first deployed in 1972, and equipped with the W70 nuclear warhead (as well as a conventional warhead). Approximately 100 LANCE launchers and 945 nuclear warheads are currently operational in the U.S. Army, and nuclear armed with U.S. warheads in the Belgian, British, Dutch, Italian, and West German armies. LANCE replaced HONEST JOHN in all of these countries, more than doubling the range and accuracy over the older missile, and providing greater mobility and reliability. A new warhead for the LANCE, an enhanced radiation version of the W70 (Mod 3) produced in 1981-1983, is being stored in the U.S. and awaits shipment to Europe. The HONEST JOHN short-range free-flight rocket, first deployed in 1954, remains deployed with W31 nuclear warheads in the Greek and Turkish armies. No plans are currently known for the replacement of HONEST JOHN in the above forces with the LANCE, but they will be obsolete in the late 1980s and impossible to support. A nuclear armed LANCE replacement is under development, called the Corps Support Weapon System, as part of the Army-Air Force Joint Tactical Missile System program to investigate and develop new medium-range battlefield weapons with greater accuracy and flexibility.

The NIKE-HERCULES is the only land-based nuclear armed surface-to-air missile in the U.S. military. Approximately 500 warheads and launchers are deployed in Europe. Nuclear warheads are supplied to the following five countries for their NIKE-HERCULES: Belgium, Greece, Italy, the Netherlands, and West Germany. South Korean NIKE-HERCULES may also be supplied with nuclear warheads. The missile was originally deployed as a strategic system to defend the United States against massed bomber attacks, but has since been withdrawn from that role and is now only deployed in Europe and South Korea to defend the rear area and key installations against tactical aircraft. The NIKE-HERCULES is a dual capable system, armed with conventional warheads or the W31 nuclear warhead. It can also be used in the surface-to-surface role.

First deployed in 1958, the NIKE-HERCULES has a number of operational limitations associated with slow rate of fire and guidance and is gradually being withdrawn from use. Some nuclear warheads have already been withdrawn as NIKE-HERCULES batteries are being converted to conventional warheads only. The development of the more accurate and versatile conventionally armed PATRIOT surface-to-air missile, starting in 1984, will completely replace the NIKE-HERCULES.
Army Nuclear Weapons

HERCULES, initially in U.S. forces and eventually in other NATO forces.

Nuclear artillery is widely deployed within the U.S. Army and Marine Corps and with the following seven NATO armies: Belgium, Greece, Italy, the Netherlands, Turkey, the United Kingdom, and West Germany. Some 5000 nuclear artillery warheads are deployed. Two nuclear projectiles—M422 203mm projectile with W33 nuclear warhead and M454 155mm projectile with W48 warhead—are currently deployed in Europe. One new projectile—M753 203mm projectile with W79 enhanced radiation warhead—is in production, but is being stored in the United States.

Numerous nuclear capable artillery guns are currently operational. The most common are the M109 self-propelled 155mm howitzer and the M110 self-propelled 203mm guns. Originally fielded in 1956, the W33/M422 nuclear projectile is the oldest nuclear warhead deployed. Its safety, reliability, and usefulness have been widely questioned. However, since the replacement for the W33 was finally limited to an enhanced radiation design in 1982, it is unlikely that it will be deployed to Europe. A new 155mm nuclear projectile—the W82/M785—is also under development, with an enhanced radiation yield. It is planned for initial deployment in 1987.

The smallest nuclear weapons are atomic demolition munitions (ADMs) (nuclear land mines). Two types are currently deployed with both the U.S. Army and Marine Corps. A number of NATO units, including at least British, Dutch, and West German units, are also trained to emplace and fire ADMS. The Medium Atomic Demolition Munition (MADM) is the more commonly available. First deployed in 1965, it weighs about 400 pounds, and is assigned to ADM engineer units within combat divisions and corps. The Special Atomic Demolition Munition (SADM) is less common than the MADM, smaller (some 150 pounds), and more portable, designed for use by special forces and commando units for emplacement and detonation behind enemy lines. Although replacements for the ADMS have been discussed occasionally, there is currently no plan to replace them with new nuclear systems.  

HONEST JOHN Missile

Missiles and Rockets

HONEST JOHN (MGR-1B)

Figure 9.1 HONEST JOHN (MGR-1B) missile.

DESCRIPTION:

Short-range, free-flight (un-guided), mobile, nuclear capable surface-to-surface, solid propellant, ballistic rocket used by the Greek and Turkish Armies, and the Army National Guard.

CONTRACTORS:

McDonnell-Douglas (prime/missile)
Hercules (rocket motor)
Thiokol (stabilization rockets)
Emerson Electric (missile)

SPECIFICATIONS:

(MGR-1B)
Length: 24 ft 9.5 in (7.6 m) (297 in)
Diameter: 30 in (762 mm)
Stages: 1
Weight at Launch: 4332 lb
Propulsion: solid propellant rocket motor

Speed: Mach 1.5
Guidance: spin stabilization with two pairs of spin rockets which are ignited automatically as the rocket leaves the launcher
Range: minimum range approximately 5000-6200 meters; maximum range of B version, 38 km

DUAL CAPABLE:

yes

NUCLEAR WARHEADS:

one W31 in M47 and M48 nuclear warhead sections; 1-20 Kt range (see W31)

DEPLOYMENT:

Launch Platform:
M386 self-propelled truck launcher, M289 self-propelled launcher and M33 towed launcher
Number Deployed:
about 200 nuclear versions remaining (1983); as many as six reload missiles per launcher estimated deployed
Location:
Greece, Turkey; probably some stored in U.S.; possible nuclear warheads in South Korea

HISTORY:

IOC:
1951
1906
1954
firing tests of HONEST JOHN began
MGR-1B enters service

TARGETING:

Types:
tactical targets, headquarters, command post, masses of armor, enemy short range nuclear weapons
HONEST JOHN Missile

Selection Capability: impact, low air and high air options with capability for selection of height of burst to 2000 meter maximum.

Accuracy/CEP: one nm; low level winds have a considerable effect on both the range and accuracy. Large vertical probable error.

COMMENTS: HONEST JOHN has been replaced by LANCE missiles in all NATO armies except in Greece and Turkey. MGR-1B modification incorporated reduction in length and improvement in performance. The HONEST JOHN must be warmed with special electric blankets for 24-48 hours prior to firing; this enables it to attain a predetermined temperature (77°F) for proper and even propellant burn.

---

2 FM 6-61, op. cit., p. 5.
5 USA, Field Artillery Honest John Gunnery, FM 6-61, op. cit., p. 5.
6 USA, Field Artillery Honest John Gunnery, FM 6-61, op. cit., p. 5.
9 FM 6-61, op. cit., p. 5.
LANCE (MGM-52C)

**Speed:**
Mach 3

**Guidance:**
inertial with mid-course correction made by distance measuring equipment from ground station via radio link; AN/DJW-48 missile guidance set; directional control, automatic meteorological compensation guidance system (DC-AUTOMET) (weight: 36 lb)

**Range:**
5-125 km

**Ceiling:**
1350 m (minimum range), 45,700 m (maximum range)

**DUAL CAPABLE:**
yes

**NUCLEAR WARHEADS:**
one W70 in M234 nuclear warhead section; five different warhead sections for missile, two tactical (one nuclear, one nonnuclear), two trainers and one practice; 1-100 Kt range (fission mods); circa 1 Kt (ER mod) (see W70)

**DEPLOYMENT:**
Launch Platform:
M752 self-propelled launcher tracked launch platform, with 55 km/h speed and amphibious capability, carries one missile; the M740 launcher zero length is a towed launcher with the basic launch fixture of the M752 for use in special operations such as airborne missions

**Number Deployed:**
approximately 945 nuclear missiles (1983); 2133 missiles procured; 1450 missiles in Army inventory

**DESCRIPTION:**
Short-range, Army all-weather, highly mobile, guided nuclear-capable surface-to-surface ballistic missile.

**CONTRACTORS:**
LTV Corporation
Warren, MI (prime/missile)
Farm Machinery Corporation (launcher)
Rocketdyne (motor)
LTV/American Bosch Armco/Systron-Doner Corp. (guidance)

**SPECIFICATIONS:**
(MGM-52C)
Length: 248 in
Diameter: 22.2 in
Stages: 1
Weight at Launch: 2900 lb (nuclear missile); 2834 lb
Propulsion: storable prepackaged liquid
P8E-6 motor, 46,450 lb thrust (maximum)

![LANCE (MGM-52C) missile on mobile launcher.](image)
The accuracy of a nuclear armed LANCE missile is portrayed, showing diminished accuracy at longer ranges.

Location: six battalions with 6 launchers each deployed with U.S. Army in West Germany; 2 battalions in the U.S. at Fort Sill, OK; with British, Belgian, Dutch, Italian, and West German armies.

HISTORY:
- IOC: Nov 1962
- 1965: basic LANCE program begins
- 1967: first test firing of basic LANCE
- 1971: development of improved LANCE begins
- 1972: first test firing of improved LANCE
- 1976: production begins
- 1978: first firing of conventional LANCE warhead
- 1979: LANCE begins deployment with NATO armies
- 1980: production of LANCE missile completed
- 1981: adaption kits for installation of Mods 3 and 4 on LANCE procured

TARGETING:
- Types: command posts, logistical elements, troop concentrations, transportation elements, chokepoints, missile units, forward airfields, fixed air defense sites, critical terrain features (defiles, bridgeheads, main supply routes). Because of its large CEP, LANCE cannot be effectively used for targets on or near the FEBA.

Selection Capability: five heights of burst: ground (impact), air low, air low/ground backup, air high, or air high/ground backup.
LANCE Missile

Retargeting: short reaction time (15 minutes) due to storable propellant, simplified prefire checkout;¹⁶ rate of fire is 4 missiles per hour, eight missiles per day¹⁷

Accuracy/CEP: (see Figure 9.3)

COST:
Unit Cost:
1977 & prior $142,000 (FY 1981) (flyaway);
$516,000 (FY 1981) (program);
$215,300 (FY 1978)
1978 360 76.9
1979 ? 78.2
1980 - 4.1
1981 - 11.4

Total Appropriation
FY Number Procured ($ million)
1977 & prior 1574¹⁴ 1028.8
1978 360 76.9
1979 ? 78.2
1980 - 4.1
1981 - 11.4

COMMENTS: LANCE has replaced HONEST JOHN and SERGEANT missiles in the U.S. Army and NATO Armies on a less than one-for-one basis. The FMC M688 auxiliary vehicle carries a load hoist and two reserve missiles. Both the M752 and M688 are mounted on the M667 basic vehicle. LANCE missile is composed of three main sub-sections: the missile main assemblage, the warhead section, and four control surfaces (fins). The M29 large control surfaces are used with the M234 nuclear warhead and provide aerodynamic stability to the missile by maintaining axial spin during flight. The launcher has an on-carriage traverse limitation of 285 mils with the nuclear warhead. Reliability of system is 90 percent of properly checked ready to fire missiles, 95 percent of properly fired rounds.¹⁹

⁴ TM 9-1425-485-10-1, op. cit., pp. 1-11, 1-45; in USA, Field Artillery Battalion, Lance, FM 9-42, w/Ch. 1, 29 December 1980, p. 2-1, the range is given as 6-75 km in non-nuclear configuration and 6-115 km in the nuclear configuration at sea level. If the launcher altitude is greater than 3000 meters, the maximum ranges are extended to 60 km and 133 km respectively; Military Balance lists range as 8-75 km in non-nuclear configuration and 8-115 km in the nuclear configuration at sea level. If the launcher altitude is greater than 1000 meters, the maximum ranges are extended to 80 km and 133 km respectively; The World’s Missile Systems, 6th Ed., p. 284, lists range as 3-70 mi.
⁶ Warhead section is stored and shipped in the M511 container. The container is environmentally sealed, RF shielded, and pressure and humidity controlled. It has a small door to provide access to the CDS and PAL device without opening the container. FM 6-42, op. cit., p. 2-12.
⁹ One of these battalions is earmarked for non-European contingencies: ACDA, FY 1980 ACIS, p. 153.
¹⁰ ACDA, FY 1982 ACIS, p. 244.
¹¹ "Lance," Armies 6 Weapons, No. 42, April 1978, pp. 81-82.
¹² ACDA, FY 1982 ACIS, p. 245.
¹⁴ FM 6-42, op. cit., p. 4-5.
¹⁵ USA, Field Artillery Lance Missile Gunnery, FM 8-40-4, 15 June 1979, p. 2-4, and 0-1. Examples of HOBs in feet given in the manual are 232 ft for Air Low and 840 ft for Air High.
NIKE-HERCULES (MiM-14)

DESCRIPTION: Medium-range, fixed, guided, surface-to-air nuclear-capable missile used by the Army in West Germany and widely deployed in the following NATO countries: Belgium, Greece, Italy, Netherlands, and West Germany.


SPECIFICATIONS:
- Length: 41 ft 6 in (498 in)³
- Diameter: 31.5 in²
- Stages: 2

Weight at Launch: 10,400 lb
Propulsion: solid propellant with four boosters, solid sustainer
Speed: Mach 3.3
Guidance: radio command
Range: 75-100 mi;³ 120-160 km;⁴ 140 km surface-to-surface range⁵
DUAL CAPABLE: yes
NUCLEAR WARHEADS: one W31, 1 Kt range (see W31)
DEPLOYMENT: fixed launchers at fixed locations
Number Deployed: 500 nuclear warheads (1983), circa 200 launchers
Location: Greece, Italy, West Germany (U.S., Belgian, Dutch, and German NIKE-HERCULES are deployed in West Germany)⁶
**NIKE-HERCULES Missile**

<table>
<thead>
<tr>
<th>HISTORY:</th>
<th>COMMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOC: 1958</td>
<td>Conventional warheads can be used, but the system was designed to break up formations of attacking bombers with nuclear warheads. Nuclear warheads are being reduced in Europe. Concurrent with PATRIOT deployment, NIKE-HERCULES will be phased out by FY 1985. Launchers in nuclear role have already been reduced in the German and Greek forces. U.S. NIKE-HERCULES Battalion has 576 men.</td>
</tr>
</tbody>
</table>

| TARGETING: | |
| Types: aircraft, secondary surface-to-surface missions | |
| Selection Capability: Target is acquired by acquisition radars and then tracked by target tracking radars which issue command, guidance, and detonation instructions to the missile’s computer and warhead. |
PERSHING 1a (MGM-31A/B)

**SPECIFICATIONS:**
- **Length:** 34 ft 6 in (10.39 m)
- **Diameter:** 39.4 in; 1016 mm
- **Stages:** 2
- **Weight at Launch:** 10,273 lb
- **Propulsion:** solid propellant rocket motors
- **Speed:** Mach 8
- **Guidance:** inertially guided from RV separation to target
- **Range:** up to 460 mi (740 km); 160-720 km; 115-460 mi; 185-740 km

**DUAL CAPABLE:** no

**NUCLEAR WARHEADS:**
- one W50 warhead, in three warhead sections, with three yields: 60, 200, 400 Kt (see W50)

**DEPLOYMENT:**
- battalion personnel strength is 1368 men
- Launch Platform: M757 truck/TEL (5 ton, 8x8) (originally deployed on M474 tracked vehicles), air transportable in C-130, C-141, and C-5
- Number Deployed: some 800+ missiles procured; 180+ launchers deployed (108 U.S. launchers in West Germany and 72 West German launchers); approximately one reload per launcher available; approximately 13 missiles are returned to the U.S. annually from West Germany and fired for training

**DESCRIPTION:** Medium-range, two-stage guided surface-to-surface, mobile, nuclear ballistic missile used by the Army and the West German Air Force.

**CONTRACTORS:**
- Martin Marietta Corporation Orlando, FL (prime/missile)
- Thiokol Chemical Corporation (powerplant)
- Oregon Metallurgical (jet vanes)
- Singer (hydraulic actuator)
- Gulton (static inverter)
- Intercontinental (motor case)
- H.L. Thompson (nozzle)
- Bendix (guidance)
- Ford Motor Company (transporter)
- Sperry Rand (fusing and arming)
PERSHING 1a Missile

Figure 9.7  Launch sequence of PERSHING 1a.

Location:  
U.S. Army and West German Air Force battalions/squadrons at Schwabisch Gmuend (US); Neckars Ulm (US); Neu Ulm (US); Landsberg Lech (FRG); Geilenkirchen/Tevren (FRG); each battalion also includes a permanent "combat alert site" where launchers are on alert.

HISTORY:  
IOC:  
Jan 1958  
program initiated to replace REDSTONE missile
Jan 1960  
testing of PERSHING began
Jun 1962  
first PERSHING battalion activated at Fort Sill, Oklahoma
Apr 1964  
first battalion deployed to West Germany
1965  
PERSHING assigned a limited QRA mission in Europe

changeover from P1 to P1a for U.S. Army units completed and assumption of full QRA mission
changeover from P1 to P1a for West German units completed
missile is outfitted with new digital guidance and high reliability components
sequential launch adaptor, which permits three missiles to be launched before shifting power and air supply cables, and an automatic reference system, is deployed allowing launch from non-presurveyed sites
NATO endorses deployment of 108 PERSHING 1ls to replace U.S. PERSHING 1s in West Germany
PERSHING 1a Missile

Dec 1983 PERSHING IIs planned for initial deployment in West Germany

TARGETING:

Types: nuclear delivery units, command and control posts, airfields, command headquarters

Accuracy/CEP: 0.2 nm (450 m); 0.5 nm; 82 ft;

400 m at max range

COST: $3.117 m (FY 1978)

COMMENTS: PERSHING 1a upgrade replaced tracked vehicles with wheeled vehicles, added new support equipment increasing rate of fire, improved erector-launcher and systems reliability. The major innovation was the incorporation of the ability to fire from unsurveyed firing positions. Missile was unchanged. PERSHING 1a is planned to be replaced by the PERSHING II by 1985 in U.S. Forces. The PERSHING missile is the only U.S. delivery system currently dedicated solely to the tactical delivery of nuclear weapons.

<table>
<thead>
<tr>
<th>FY</th>
<th>Number Procured</th>
<th>Total Appropriation ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td></td>
<td>78.1</td>
</tr>
<tr>
<td>1980</td>
<td></td>
<td>79.0</td>
</tr>
<tr>
<td>1981</td>
<td></td>
<td>11.6</td>
</tr>
</tbody>
</table>

1 Much of the descriptive information was provided to the authors by the Pershing Program Office, USAMICOM, Redstone Arsenal, AL.
2 The World's Missile Systems, 6th Ed., p. 290
3 Ibid.
5 Missiles of the World, p. 88.
PERSHING II

PERSHING II (PII) is a new land mobile surface-to-surface ballistic missile being developed as the follow-on replacement for the medium-range PERSHING Ia (Pla). PII is designed to provide a significant increase in range, greater accuracy, and reduction in yield over the PERSHING 1a missile. With its longer range, it will be capable of striking targets on Soviet territory from its bases in West Germany. Greatly increased accuracy is achieved by using a maneuvering RV equipped with terminal guidance radar.

The major innovation of PERSHING II is its all-weather Radar Area Correlation Guidance (RADAG) which takes radar "pictures" of the target area, compares them with digital information stored in the RV's computer, and makes course adjustments until the pictures correspond and the warhead hits the target.

The PERSHING II missile originated as a short-range design with higher reliability and accuracy than the PERSHING 1a.1 In 1977, the extended-range missile was adopted with an alternative reduced-range missile (designated PERSHING RR or PERSHING 1b) being maintained as an option.2 The PERSHING II currently has two configurations: (1) a two-stage missile with a second stage propulsion section and (2) a single-stage missile consisting only of the first stage.

The Air Force has also proposed a Medium Range Ballistic Missile (MRBM)3 as a competitor or follow-on to the GLCM and PERSHING. The MRBM under consideration was a longer range, road mobile, MIRVed missile. A feasibility study concerning the MRBM was completed by the Air Force in March 1979. A number of systems were considered as an MRBM candidate, including a two-stage MINUTEMAN III with modifications to guidance and reentry systems. The MRBM, however, was shelved in favor of the PERSHING II.

Planned deployment of PII includes a brigade of three U.S. battalions, containing four firing batteries (9 launchers each), which each have three firing platoons. Pla's are currently deployed overseas with U.S. Army and West German Air Force units in West Germany. A total of 108 PII launchers will initially be deployed in West Germany, replacing U.S. launchers on a one-for-one basis.

PERSHING II operations will include one platoon (3 launchers) of each battalion on "quick reaction alert" (QRA) at all times. During wartime, batteries would disperse into wooded areas and launchers would be set up requiring only a clear space of six feet diameter above the missile to fire.4 After a missile is fired, the unit would quickly relocate to another area and set up again to refire.5 "Combat alert sites" (QRA sites) are not considered to be survivable and missiles must reach "covert field firing positions" to avoid detection and target acquisition.6

In the FY 1982 budget process the W86 earth penetration warhead (EPW) for the PERSHING II was cancelled by DOD. Because the PII had become a long-range system designed to meet NATO requirements, the need for an EPW was no longer thought justified. The short-range system first envisioned five years earlier had different targets for which the EPW was thought important.7

---

1 Martin Marietta began promoting a PERSHING II two-stage 400 nm missile and single-stage variant which would allow two missiles per launcher in 1977; see "Pershing, Pershing 1a, Pershing II: Evolution of a Total Weapon System," November 1977.
3 HAC, FY 1980 DOD, Part 2, pp. 442-444.
4 HAC, FY 1983 DOD, Part 4, p. 422.
5 HAC, FY 1983 DOD, Part 4, p. 766.
PERSHING II

DESCRIPTION: Two-stage, solid propellant, medium-range, highly accurate, low yield, ballistic missile for use in Europe.

CONTRACTORS:
- Martin Marietta Aerospace Orlando, FL (prime)
- Goodyear Aerospace Corporation Akron, OH (guidance)
- Singer Co., Kearfott Div. Little Falls, NJ (inertial measuring system)
- Bendix Corporation Teterboro, NJ (computers and power supplies)

SPECIFICATIONS:
- Length: 413.5 in
- Diameter: 39.4 in
- Stages: 2
- Weight at Launch: 15,873 lb; 10,143 lb; 16,400 lb
- Propulsion: solid
- Speed: Mach 8

Hercules, Inc.
Salt Lake City, UT (propulsion)

Figure 9.8 PERSHING II missile launch.
Figure 9.9 Flight sequence of PERSHING II missile, showing radar scanning to increase accuracy.

Figure 9.10 Comparison of PERSHING Ia and PERSHING II missiles.

Guidance: boost guided phase inertial equipment; all-weather radar area correlation (RADAG) terminal guidance. Radar guidance compares a prestored map of the target area with return signals, generating course changes in the RV.

Location: PII Battalions (12 batteries) will be located at Neu Ulm, Neckars Ulm, and Schwabisch Gmuend, West Germany; one training battalion (4 and 2/3 batteries) will be located at Fort Sill, OK

HISTORY:
IOC: December 1983

Throwweight/Payload: 1470 lb; 650 lb payload comparable to P1a

Range: 1300 km; 1500-1800 km

DUAL CAPABLE: no

NUCLEAR WARHEADS: one W85, 5-50 Kt range (see W85)

DEPLOYMENT:
Launch Platform: PERSHING II will use the Pla erector-launcher with upgraded ground support equipment.

Number Planned: approximately 384 missiles; PII will reportedly replace U.S. P1a missiles on a one-for-one basis

Number Planned: approximately 384 missiles; PII will reportedly replace U.S. P1a missiles on a one-for-one basis

PII system requirements document approved and PII Advanced Development initiated

PII program is directed to work toward the extended-range variant by the Secretary of Defense

PII program is directed to work toward the extended-range variant by the Secretary of Defense

HISTORY:
IOC: December 1983

Throwweight/Payload: 1470 lb; 650 lb payload comparable to P1a

Range: 1300 km; 1500-1800 km

DUAL CAPABLE: no

NUCLEAR WARHEADS: one W85, 5-50 Kt range (see W85)

DEPLOYMENT:
Launch Platform: PERSHING II will use the Pla erector-launcher with upgraded ground support equipment.

Number Planned: approximately 384 missiles; PII will reportedly replace U.S. P1a missiles on a one-for-one basis

PII program is directed to work toward the extended-range variant by the Secretary of Defense

PII program is directed to work toward the extended-range variant by the Secretary of Defense

294 Nuclear Weapons Databook, Volume I
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 1978</td>
<td>PII program approved to enter FSED and a planned 57-month Engineering Development program³⁵</td>
<td>PII replacement of U.S. P1a's completed³⁵</td>
</tr>
<tr>
<td>Feb 1979</td>
<td>engineering development begins</td>
<td></td>
</tr>
<tr>
<td>Aug 1979</td>
<td>Secretary of Defense directs Army to plan for August 1983 IOC²⁰</td>
<td></td>
</tr>
<tr>
<td>Dec 1979</td>
<td>NATO endorses deployment of 108 PII and readjusts IOC to match GLCM IOC</td>
<td></td>
</tr>
<tr>
<td>Feb 1980</td>
<td>President assigns PII DX-status, highest national priority for development²¹</td>
<td>Retargeting: rapid retargeting capability; immediate retargeting with target data available, can generate new target data immediately²⁷</td>
</tr>
<tr>
<td></td>
<td>President approves Program of Cooperation with West Germany to develop P1a follow-on²²</td>
<td></td>
</tr>
<tr>
<td>Apr 1982</td>
<td>first planned flight test is cancelled</td>
<td>Accuracy/CEP: 45 m; 20-45 m CEP objective; RADAG correlates returns from an initial 350 square nm area surrounding the target with a prestored reference map of the target area, obtains several such correlations during terminal descent, and updates the inertial position of the RV²⁸</td>
</tr>
<tr>
<td>Jun 1982</td>
<td>full production contract awarded in accelerated concurrent development and production program</td>
<td></td>
</tr>
<tr>
<td>Jul 1982</td>
<td>first flight test of PII is unsuccessful²⁹</td>
<td></td>
</tr>
<tr>
<td>Dec 1983</td>
<td>initial deployment in West Germany²⁹</td>
<td></td>
</tr>
</tbody>
</table>
**PERSHING II Missile**

**COST:**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number Procured</th>
<th>Total Appropriation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 1977 &amp; prior</td>
<td>-</td>
<td>63,322</td>
</tr>
<tr>
<td>FY 1980 &amp; prior</td>
<td>-</td>
<td>255.7</td>
</tr>
<tr>
<td>FY 1981 &amp; prior</td>
<td>-</td>
<td>408.0</td>
</tr>
<tr>
<td>FY 1983</td>
<td>21</td>
<td>372.2</td>
</tr>
<tr>
<td>FY 1984</td>
<td>95</td>
<td>457.4</td>
</tr>
<tr>
<td>FY 1985</td>
<td>104</td>
<td>447.3</td>
</tr>
<tr>
<td>FY 1986</td>
<td>77</td>
<td>?</td>
</tr>
</tbody>
</table>

**Program Cost:**
- Development: $625.7 m
- Procurement: $927.3 m
- Operating/Support: $2781.3 m (FY 1980)
- Development: $691.6 m
- Procurement: $2120.8 m (FY 1983)
- $2737.6 m (Dec 1982)

**COMMENTS:**
- PII will use same ground support equipment as P1a system.
- Option for a short-range, single-stage version of PERSHING II (known as PERSHING II RR (reduced-range) or PERSHING 1b to meet requirements to replace West German P1a's is being maintained. The short-range PERSHING II is also considered for deployment to U.S. Army units if the long-range missile is rejected.

1 Much of the descriptive information was provided to the authors by the Pershing Program Office, USAMCOM, Redstone Arsenal, AL.
3 Ibid.
5 Pershing Program Office, Redstone Arsenal, AL.
6 ACDA, FY 1979 ACIS, p. 115.
9 ACDA, FY 1981 ACIS, p. 245.
11 DOD, FY 1982 Annual Report, p. 56, lists the unclassified F11 range as 1000 km. The true range is classified.
13 16-29/L "battery sets" will be procured comprising 8 launchers, 6 missiles, 4 platoon control centers and other ground support equipment per battery set; HAC, FY 1982 DOD, Part 1, p. 782.
14 Of the approximately 204 missiles planned, approximately 23 will be for operational purposes (basic load and reloads/spares). 24 will be maintenance missiles and the remainder will be for 10 years of weapons testing; HAC, FY 1982 DOD, Part 1, p. 782, 764.
16 SASC, FY 1982 DOD, Part 1, p. 3003; IOC is defined as 3 launchers and 13 missiles; HAC, FY 1983 DOD, Part 4, p. 431.
18 Ibid.
19 Ibid.
20 HAC, FY 1983 DOD, Part 4, p. 442.
22 Ibid.
25 Ibid.
27 SASC, FY 1980 DOD, Part 8, p. 3499: new radar reference scenes for targets which have not been preplanned will be generated in the field by the Battalion Reference Scene Generation Facility, utilizing a Defense Mapping Agency data base; HAC, FY 1982 DOD, Part 3, p. 422.
32 ACDA, FY 1983 ACIS, p. 117.
34 20 missiles were requested, but only 21 were authorized due to cost overrun; HAC, FY 1983 DOD, Part 4, p. 398.
35 HAC, FY 1983 DOD, Part 3, p. 782; $915.9 million was requested for 91 missiles, but only $715 million was appropriated; DOD, FY 1984 Annual Report, p. 253.
37 HAC, FY 1983 DOD, Part 4, p. 443.
W85

FUNCTION: Air burst/surface burst warhead being developed for the PERSHING II long-range theater ballistic missile system.

WARHEAD MODIFICATIONS: none

SPECIFICATIONS:
- Yield: selectable; low Kt; 5-50 Kt
- Weight: less than 1600 lb
- Dimensions: Length: 41.7 in; Diameter: 12.4 in
- Materials: oralloy warhead; contains IHE

SAFEGUARDS AND ARMING FEATURES:
- CAT F PAL: airburst and surface burst; launch requires PAL, warhead intent (safety), and missile ignition enabling coded signals

DEVELOPMENT:
- Laboratory: LANL
- History: 1979 Lab assignment (Phase 3) through FY 1983 (initial deployment (Phase 5)

Production Period: 1983

DEPLOYMENT:
- 108 PERSHING II launchers are scheduled to be deployed in West Germany beginning in 1983; some 384 missiles will be deployed.

SERVICE: Army

Allied User: none

Location: West Germany

COMMENTS: W85 will be an adaptation of the already developed B61 Mod 4 bomb. Also considered as possible candidates for PPI were an adaptation of the W70 Mod 1 or Mod 2, and W80. Warhead section is a welded aluminum monocoque structure overwrapped with a rubber modified silica phenolic heatshield. Warhead and electrical connections including the safe and arm fuze (SAF) system are mounted inside the warhead section.

1 ACDA, FY 1985 ACIS, p. 263; SASC, FY 1985 DOD, Part 7, p. 368
3 Weight of reentry vehicle, AWST, 2 August 1982, p. 20
4 Information provided to authors by Pershing Program Office, USAMICOM, Redstone Arsenal, AL
5 Ibid.
6 HASC, FY 1982 DOD, p. 100
7 HASC, FY 1983 DOD, p. 217
8 DOD Budget Justification, FY 1983, p. 51; remained in Phase 3 during FY 1986; SASC, FY 1981 EWDA, p. 615

9 Funds for production of W85 are included in FY 1982 DOE Budget.
10 West Germany, presently equipped with the PERSHING I system, has not yet decided on a replacement system.
12 ACDA, FY 1979 ACIS, p. 115
13 SASC, FY 1979 DOD, p. 50
Corps Support Weapon System

The replacement for the LANCE missile, the Corps Support Weapon System (CSWS), often designated LANCE II or Improved LANCE, is currently under development and planned for the early 1990s. The new missile is envisioned as an all-weather, dual capable, air transportable replacement with an improved CEP and rate of fire. The CSWS would be deployed at the Corps level with the mission of interdicting enemy surface-to-air missile systems and second echelon ground forces at a range of 120-140 miles, with precision conventional, nuclear (enhanced radiation), and chemical warheads. The CSWS will have the capability of striking targets three times further, five times more accurately, and with a higher rate of fire than the present LANCE. An antiarmor capability, by deploying terminally guided submunitions and advanced target acquisition and guidance systems, is also planned.

The CSWS is part of the larger Army-Air Force Joint Tactical Missile System (JTACMS) program to develop standoff weapons to attack moving rear echelon targets deep behind enemy lines. The JTACMS will use Assault Breaker technology, developed under the Defense Advanced Research Projects Agency (DARPA) program, to develop a surface-to-surface weapon system for conventional and nuclear "deep battlefield interdiction." Two delivery modes are under investigation within JTACMS: air-launched (the Air Force's Conventional Standoff Weapon) and ground-launched (the Army's CSWS). The JTACMS program originates with the Assault Breaker program started in 1978 to develop new standoff weapons for second echelon armor strikes. Assault Breaker (and now JTACMS) examined alternatives such as derivatives of Multiple Launch Rocket System (MLRS), PATRIOT, and LANCE as capable of carrying new warheads and being compatible with new guidance and target acquisition systems. The LANCE

Figure 9.11 U.S. Army Assault Breaker prototype missile, similar in design to the nuclear armed Corps Support Weapon System.
replacement, originally designated the Nuclear Corps Support Missile System, was an original part of the Assault Breaker concept.

The merging of the Army and Air Force programs in FY 1982 led to a slowing down of the CSWS program pending a clearer definition of requirements and operational concepts. The joint development program incorporates the Air Force and Army development programs and takes advantage of common guidance, propulsion, conventional warheads, and electronic components. Procurement plans, according to one report, are now for some 5500 missiles for the Army, with an accelerated IOC of 1986-1987.

Competitor missiles for CSWS include the T22, a LANCE missile variant being developed by Vought and first tested in August 1979; the T16, a PATRIOT missile variant being developed by Martin Marietta with a nuclear warhead and surface-to-surface capability; and the T19, a "generic" missile capable of both Army and Air Force use. A nuclear warhead for the CSWS is being developed. According to one report, it would range from 10-40 Kt and would incorporate enhanced radiation features.

### COST:

<table>
<thead>
<tr>
<th>FY</th>
<th>Number Procured</th>
<th>Total Appropriation ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td></td>
<td>7.6</td>
</tr>
<tr>
<td>1982</td>
<td></td>
<td>11.8</td>
</tr>
<tr>
<td>1983</td>
<td></td>
<td>6.1</td>
</tr>
<tr>
<td>1984</td>
<td></td>
<td>50.2</td>
</tr>
<tr>
<td>1985</td>
<td></td>
<td>126.5</td>
</tr>
</tbody>
</table>

---

8 AW&ST, 1 November 1982, p. 77.
10 AW&ST, 1 November 1982, p. 77.
Nuclear Artillery

Nuclear artillery is one of the most widely dispersed and numerous of weapons. From 1953, when the mammoth 280mm cannon was first sent to West Germany, until today, six nuclear artillery warhead types have been produced, and virtually every large artillery gun has become capable of firing nuclear rounds. Nuclear artillery is now in the midst of a major modernization, with guns and projectiles being upgraded and replaced.

The U.S. Army has over 3500 nuclear capable artillery guns deployed: 748 MI14 155mm guns, 2200 MI09 155mm guns, and 1046 MI10 8-inch (203mm) guns.1 Nuclear artillery is also used in the Marine Corps. The seven NATO allies with nuclear artillery—Belgium, Greece, Italy, the Netherlands, Turkey, United Kingdom, and West Germany—all use U.S.-designed artillery, particularly the standard MI09 and MI10 guns, but also deploy a number of obsolete guns (see Table 9.1).

Approximately 5000 nuclear artillery shells are estimated to be deployed, and of these, most are in Europe. Nuclear artillery is low yield, with the explosive capacity of the warheads varying from about 0.1 kiloton (for the W48) to about 12 Kt (for the W33). Three warhead types are currently deployed—the 1-12 Kt W33 8-inch fission warhead, the 0.1 kiloton W48 155mm fission warhead, and the 1-2 Kt W79 8-inch enhanced radiation warhead (see Chapter Three). The projectiles are always fired as air bursts2 with accuracies (for W48 and W33) of 40, 100, and 172 meters CEP at “short, medium, and long range.”3

Both 155mm and 203mm guns are being increasingly adapted in military formation, with the replacement of both 105mm and 175mm non-nuclear capable guns. In addition, there has been an increase in the number of guns in combat units both as a measure to generally increase firepower, and as an increase following the retirement of HONEST JOHN rockets from divisions.4

Figure 9.12 The first live nuclear artillery test, Shot Grable, on 25 May, 1953. A 280mm nuclear artillery shell with an explosive yield of 15 Kt was exploded in an airburst over the Nevada Test Site.

1 HASC, FY 1979 DOD, Part 3, Book 1, p. 773.
2 Military Applications of Nuclear Technology, Part 1, p. 13; Part 2, p. 33.
3 Ibid., Part 2, p. 43.
Two new nuclear capable 155mm guns are beginning to enter the U.S. and NATO armies: a new long-range towed howitzer (M198) equipping light Army units and the Marines, and a European-designed and produced gun—FH-70/SP-70—available in towed and self-propelled designs. The SP-70 is the self-propelled design which features a high rate of fire, an automatic loader, and improved survivability and mobility. Older M1, M44, and M109 guns will be withdrawn from Italian, British, and West German units as newer FH-70/SP-70 guns are deployed in the mid-1980s. U.S. production lines for M109A2 and M198 will be open in FY 1984 and beyond, primarily for reserve forces.5

The 155mm artillery unit can contain 18-24 guns, organized with three batteries of either six or eight guns. An eight inch artillery unit is organized as either a 12, 18, or 24 howitzer battalion with two or three batteries, and four to six sections of four guns, the basic firing element. Self propelled artillery is assigned to mechanized and armored units for support, while towed artillery is assigned to infantry and other light units. Nuclear artillery warheads are maintained available to the firing element, stored in special two-and-one-half ton trucks, each with a one-and-one-half ton trailer.6

The range and design of nuclear artillery is beginning to reach practical limits, with restraints in noise, target acquisition, accuracy, and reliability.7 The newest guns and barrels have ranges of 30 km, with older M109 and M110 guns being converted with new longer tubes and muzzle brakes (and designated A1 and A2 versions). The new tubes—33 vs. 20 caliber in the M109 and 37 vs. 25 caliber in the M110—increase muzzle velocity and range from 18 to 30 km for 155mm guns and from 14 to 30 km for 8-inch guns. Nuclear artillery projectiles are also becoming more sophisticated (and expensive), incorporating timing and memory assemblies, fuze subcomponents, power supplies, electronic programmers, target sensors, and rocket motors in the shell (see Future Artillery).

Future artillery guns are being examined to provide "important capabilities for responding rapidly and accurately to fire missions" and "reduced emplacement" times.8 The new weapon is envisioned to have short recoil cycle time, burst rate-of-fire, automatic ammunition handling, loading and resupply, and automated position location and weapons alignment. During 1978, the Defense Nuclear Agency initiated a study to determine the feasibility of Long Range Cannon Artillery, an 8-inch, 80 km, nuclear capable shell for the mid-1980s. A Division Support Weapon System is also being developed by FMC. It will be a 155mm, 45 caliber, automatic loading gun.

### Table 9.1

<table>
<thead>
<tr>
<th>Nuclear Artillery Guns</th>
<th>Type</th>
<th>Country in Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>155mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-2</td>
<td>Italy, Turkey</td>
<td></td>
</tr>
<tr>
<td>M59</td>
<td>Turkey</td>
<td></td>
</tr>
<tr>
<td>M115 (M1)</td>
<td>Italy (M1A1), Turkey, United States, West Germany</td>
<td></td>
</tr>
<tr>
<td>M44 SP</td>
<td>Belgium, Italy, Turkey</td>
<td></td>
</tr>
<tr>
<td>M109 SP</td>
<td>Belgium, Greece, Italy, Netherlands (M109A1), Turkey, United Kingdom, United States, West Germany (M109G)</td>
<td></td>
</tr>
<tr>
<td>M198</td>
<td>United States</td>
<td></td>
</tr>
<tr>
<td>FH-70/SP-70</td>
<td>Italy, United Kingdom, West Germany</td>
<td></td>
</tr>
<tr>
<td>8-inch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M115</td>
<td>Belgium, Greece, Italy, Netherlands, Turkey</td>
<td></td>
</tr>
<tr>
<td>M55 SP</td>
<td>Italy</td>
<td></td>
</tr>
<tr>
<td>M110 SP</td>
<td>Belgium, Greece, Netherlands, Turkey, United Kingdom, United States, West Germany</td>
<td></td>
</tr>
</tbody>
</table>


---

5 DOD, FY 1984 Annual Report, p. 133.
8 Information provided by the Cannon Artillery Weapons System Project Manager.
M109 155mm Gun

**DESCRIPTION:** Heavy, self-propelled 155mm artillery gun used by the U.S. Army, Marine Corps, NATO, and allied armies.

**MODIFICATIONS:** M109A1(SP), M109A2(SP), M109A3(SP), M109G(SP)

**CONTRACTORS:** Bowen-McLaughlin-York (final assembly), Detroit Diesel (engine), Cadillac Division, General Motors Corp. (development)

**SPECIFICATIONS:**
- Max Range: 14,600 m (initial); 18,100 m (A1); 24,000 m (A2); 30,000 m (A3 and upgraded A2)
- Weight: 52,461 lb (initial); 53,060 lb (A1); 54,700 lb (A2)
- Weight of HE Round: 95-104 lb
- Rate of Fire: 4/min (first 3 min); 1/min thereafter
- Crew: 6
- Prime Mover: armored tracked vehicle, max speed 35 mph (roads), amphibious to 42 inches of water (with kit); air transportable (C-5A)
M109 155mm Gun

NUCLEAR WARHEADS:

| Comments: Basic M109 carried 20 caliber (156 in) gun; A1 and later versions upgraded to 33 caliber (238 in) gun; M109A3 is the name for the retrofitted M109A1; M109A2 improves gun mount design, hydraulic components, safety features, and ammunition stowage (36 rounds); in full scale production; new production M109A1s and later versions contain crew safety and ammunition stowage improvements. |
| W48, 0.1 Kt yield (see W48); compatible with W82 |

DEPLOYMENT:

| Number Deployed: |
| 1608 (Army) (1978); 2100 (Army); 2200 (Army) (1983) |
| Location: |
| United States, Europe, South Korea, Japan (Okinawa) |
| Allied User: |
| West Germany (M109G) (gun modified by Rheinmetall); Italy (M109G), Netherlands, Belgium, South Korea |

HISTORY:

| IOC: |
| 1969 |
| 1953 development of M109 began |

COST:

| M109(A2) |

| Total Appropriation |
| Number Procured | ($ million) |
| FY | |
| 1960 & prior | ? | 474.5 |
| 1981 | 0 | 27.3 |
| 1982 | 0 | ? |

M198 155mm Gun

DESCRIPTION:
Medium, towed 155mm artillery gun used by light units of the Army and Marine Corps

SPECIFICATIONS:
Max Range: 18,000 m², 30,000 m (rocket assisted projectiles)

MODIFICATIONS:
none

CONTRACTORS:
Rock Island Arsenal II, (gun mounts and final assembly)
Condec Corp., Greenwich, CT (carriages)
 Watervliet Arsenal, NY (cannon)
Numax Electronics, Hauppauge, NY (fire control)

Weight: 15,795 lb
Weight of HE Round: 95-104 lb
Rate of Fire: 4/min (first 3 min); 20/hr thereafter
Prime Mover: M813 5-ton truck, speed 34 mph (roads); helicopter and air transportable; fordable to 30 inches of water
Crew: 11

Figure 9.14 M198 155mm towed gun.
**M198 155mm Gun**

<table>
<thead>
<tr>
<th>NUCLEAR WARHEADS:</th>
<th>W48, 0.1 Kt yield (see W40); compatible with W82</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>DEPLOYMENT:</th>
<th>Number Deployed: 468 (Army) (1983)²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
<td>United States, Japan (Okinawa), South Korea</td>
</tr>
<tr>
<td>Allied User:</td>
<td>none known</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HISTORY:</th>
<th>IOC: 1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968</td>
<td>development of M198 begins</td>
</tr>
</tbody>
</table>

**COST:**

<table>
<thead>
<tr>
<th>FY</th>
<th>Number Procured</th>
<th>Total Appropriation ($) million</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980 &amp; prior</td>
<td>0</td>
<td>138.0</td>
</tr>
<tr>
<td>1981</td>
<td>0</td>
<td>44.9</td>
</tr>
<tr>
<td>1982</td>
<td>-</td>
<td>?</td>
</tr>
</tbody>
</table>

**COMMENTS:** - M198 is used by United States airborne and light infantry units, replacing the M114.

---

³ USA, Army Weapons Systems, 80, n.d.
⁴ With standard ammunition.

---

Nuclear Weapons Databook, Volume I  305
M110 8-inch (203mm) Gun

DESCRIPTION: Heavy, self-propelled 8-inch (203mm) artillery howitzer used by the Army, Marine Corps, NATO, and allied armies.

MODIFICATIONS: M110A1(SP), M110A2(SP)

CONTRACTORS: Bowen-McLaughlin-York, York, PA (final assembly) Detroit Diesel (engine) Pacific Car and Foundry Renton, WA (NBC protection system)

SPECIFICATIONS:
- Max Range: 16,600 m (initial); 20,600 m (A1); 29,000 m (A2)
- Weight: 58,500 lb (initial); 60,100 lb (A1); 62,500 lb (A2)
- Weight of HE Round: 228 lb
- Rate of Fire: 1 every 2 min
- Crew: 13
- Prime Mover: tracked vehicle; speed 9 mph (cross country); 34 mph (roads); fordable to 42 inches of water; air transportable (C-5A)

NUCLEAR WARHEADS: W33, sub-12 Kt (see W33); compatible with W79 (see W79)
### M110 8-inch (203mm) Gun

#### DEPLOYMENT:
- **Number Deployed:** 720 (Army) (1978); 1046 (Army) (1983)
- **Location:** United States, Europe, South Korea, Japan (Okinawa)
- **Allied User:** Belgium, Italy, Netherlands, United Kingdom, West Germany

#### HISTORY:
- **IOC:** 1961
- **1983:** in full scale production (A2)

#### COST:
- **M110(A2)**

<table>
<thead>
<tr>
<th>FY</th>
<th>Number Procured</th>
<th>Total Appropriation ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980 &amp; prior</td>
<td>?</td>
<td>252.3</td>
</tr>
<tr>
<td>1981</td>
<td>0</td>
<td>11.3</td>
</tr>
<tr>
<td>1982</td>
<td>0</td>
<td>?</td>
</tr>
</tbody>
</table>

#### COMMENTS:
- A1 version carried 25 caliber gun, no muzzle brake; A2 gun incorporated muzzle brake, longer (37 caliber) cannon; conversion of M110A1s to A2 configuration by field installation of muzzle brakes is in progress. M110 is deployed with 12-24 guns per battalion.

---

Future Nuclear Artillery

The W82 155mm nuclear artillery projectile is currently under development, with a planned deployment date of late-1986. The development program went largely unfunded during most of the Carter Administration, but has been brought to full funding in the Reagan budgets. The new projectile will have an enhanced radiation capability. The W82 thus will be the third neutron weapon in the stockpile, joining the W70-3 and W79 already in production.

Development of a new 155mm nuclear projectile began in 1969 when the Army argued that a modernized artillery shell was needed to replace the W48. Development of the W74 began that year and continued until 1973 when the Joint Committee on Atomic Energy terminated the program due to excessive cost and the use of obsolete (non "neutron bomb") technology. Army requests to reinitiate the 155mm development were denied by Congress in 1975 and 1976, but in 1977 a new analysis of modernization requirements led to Congressional authorization and appropriation of funds to reinitiate a research program. The new projectile (W82), with an improved fission yield component design, has the technical capability for conversion to enhanced radiation yield in the field. This projectile continued in development until 1979 when Secretary of Defense Brown directed a 67 percent cut in the fiscal year 1981 budget request, and then zeroed out fiscal year 1982 funds. The 155mm nuclear artillery shell presently in research and development, however, has again risen in cost. That factor, along with the political implications of the enhanced radiation yield, make the weapon controversial.

Much controversy within the nuclear weapons program has been created over whether the new warhead should be fission yield, enhanced radiation yield, or both. Although technically the warhead is capable of accepting an ER option, it has been referred to in some official reports as having a fission yield. According to some reports, the proposal to build the warhead as an ER warhead had been dropped, but it appears that planning and development continued with the intent of at least having an ER capability.

Compared to the W74, which was cancelled by Congress in 1973, the features of the W82 are not impressive. W74 was designed for two yields, larger than the 0.1 kiloton W48. The W82 yield also exceeds that of the W48. The W74 reportedly had a CEP of 20, 60, and 110 meters at short, medium and long ranges, comparable to the W82. The W74, when cancelled by Congress, cost $452,000 each, and the W82 cost is now estimated at close to $3 million each. The huge cost can be largely attributed to the more expensive enhanced radiation design, with its tritium requirements.

Table 9.2
Comparison of Old and New 155mm Nuclear Artillery Shells

<table>
<thead>
<tr>
<th></th>
<th>W48</th>
<th>W82</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users:</td>
<td>Army, Marine</td>
<td>Army, Marine</td>
</tr>
<tr>
<td>Corps:</td>
<td>NATO</td>
<td>Corps, NATO</td>
</tr>
<tr>
<td>Yield:</td>
<td>0.1 kiloton</td>
<td>less than 2 kilotons</td>
</tr>
<tr>
<td>Type:</td>
<td>pure fission</td>
<td>enhanced radiation</td>
</tr>
<tr>
<td>Range:</td>
<td>16 km</td>
<td>30 km</td>
</tr>
<tr>
<td>Weight:</td>
<td>126 lb</td>
<td>95 lb</td>
</tr>
<tr>
<td>Materials:</td>
<td>plutonium</td>
<td>plutonium and tritium</td>
</tr>
<tr>
<td>Cost:</td>
<td>less than $200,000 each</td>
<td>circa $2.5-3.0 million each</td>
</tr>
<tr>
<td>Development:</td>
<td>Aug-1957</td>
<td>1969</td>
</tr>
<tr>
<td>First Deployed:</td>
<td>1963</td>
<td>1964</td>
</tr>
<tr>
<td>Number:</td>
<td>3000</td>
<td>1000+ planned</td>
</tr>
<tr>
<td>Locations:</td>
<td>US, Europe, South Korea</td>
<td>US</td>
</tr>
</tbody>
</table>

1 HASC, FY 1983 DOD, Part 5, p. 605.
3 Some estimates put the cost per projectile at $3 million.
5 JCS, FY 1985, p. 78.
9 Ibid.
**FUNCTION:** Warhead for the XM-785 Artillery Fired Atomic Projectile (AFAP) for 155mm artillery, to replace the current W48/M454 AFAP.

**WARHEAD MODIFICATIONS:** Warhead is built in components, allowing easy conversion from fission yield to enhanced radiation yield.

**SPECIFICATIONS:**
- **Yield:** less than 2 Kt; exceeds that of the 0.1 Kt W48, capable of accepting an ER option convertible in the field
- **Weight:** circa 95 lb, ballistically similar to M549 rocket assist projectile (RAP) conventional round
- **Dimensions:**
  - Length: 34.3 in
  - Diameter: 6 in
- **Materials:** if fission yield, probably with plutonium, utilizing large amounts of tritium for ER version

**SAFEGUARDS AND ARMING FEATURES:**
- Category D PAL, nonviolent command disable in M617 storage container; improved radar fuzing for more accurate height of burst

**DEVELOPMENT:**
- **Laboratory:** LLNL
- **History:**
  - IOC: May 1976
  - Sep 1977: Lab assignment (Phase 3)
  - Dec 1980: production engineering (Phase 4)
  - 1986: feasibility study completed (Phase 2)
- **Production Period:** 1986-
- **DEPLOYMENT:**
  - **Number Planned:** 1000 initially (1983); as many as 2500 overall
  - **Delivery System:** dual capable M196 and M109/A1/A2/A3 155mm howitzers; older 155mm howitzers
  - **Service:** Army and Marine Corps
  - **Allied User:** NATO artillery units; the projectile is "compatible with the new family of howitzers being developed by the NATO allies"

**Location:** United States, Greece, Italy, West Germany, Turkey, South Korea
W82

COMMENTS: Reagan FY 1982 DOD budget requested $44.4 million for the W82.12 The FY 1982 supplemental request for DOE also requested $7.5 million to initiate construction on W82 production facilities.13 W82 eliminates "current projectile deficiencies in range, vulnerability, fuzing, and yield."15 It includes a rocket assist module which extends the range over that of the M-454 AFAP. The range will be up to 30 km (in the new M-198 howitzer) and 24 km in the M-109A1 howitzer, compared to 16 km for the present projectile.16 It is ballistically similar to a conventional round, precluding the need for a special spotting round.17 The new projectile is more accurate than the W48, with same accuracy as the current conventional round.18 Chamberlain Manufacturing Co. received an Army contract on 21 March 1980 for $6 million for development of XM-785 components. Training rounds include XM820 "Type X" and XM841 "Type W."
Atomic Demolition Munitions and Earth Penetration Weapons

The Army (and Marine Corps) currently have two atomic demolitions munitions (ADMs) deployed: the Medium ADM (MADM) and the Special ADM (SADM) (see Chapter Three for technical description). The MADM is a 1-15 Kt nuclear land mine weighing some 400 pounds, first deployed in 1965. The SADM is a sub-1 Kt nuclear land mine weighing some 150 pounds, first deployed in 1964. MADM is emplaced by engineer teams and carried by jeeps and helicopters. SADM is man portable and emplaced by special forces and commandos teams behind enemy lines. Approximately 600 ADMs are estimated to be deployed, mostly in Europe, South Korea, Guam, and the United States. ADM teams are earmarked to provide ADM support in Allied corps sectors in Central Europe and Italy. A number of NATO engineer units (British, Dutch, and West German) are also trained to emplace ADMs.

ADMs are emplaced in chambers in the ground, on bridges, or in tunnels and dams, and are detonated by timer or remote command. They would be used primarily to disrupt the movement of enemy forces and to make them concentrate in a mass to bypass obstacles (and thus create other targets for nuclear weapons). SADMs would be emplaced behind enemy lines, particularly at airfields, command posts, transportation, communications and industrial terminals, and petroleum supplies.

Work on the next generation of earth penetration weapons (EPW)/demolition munition nuclear weapons has been ongoing since the 1970s. High explosive tests that simulate the effects of low yield buried nuclear munitions on structural targets have been conducted to determine future ADM/EPW requirements. A Tactical Earth Penetrator Warhead compatible with Army missiles was proposed in 1976 and was eventually designed as the W86 EPW for the PERSHING II missile.

The W86 earth penetration warhead was a small diameter, single yield design. Laboratory (Phase 3) work began in 1979 with the idea of supplementing ADMS by providing a remote delivery capability to create barriers and a means of attacking hard, point, and subsurface targets with maximum damage and minimum fallout. The W86 warhead was designed to dive about nine stories underground before exploding, to destroy point targets that require earthshock or cratering as the primary damage mechanism.

During the PERSHING II DSARC II deliberations (February 1979), the Army conducted a study examining EPW needs and effectiveness and, given its potential benefits, recommended to continue its development. The EPW program was then cancelled in January 1981 because the carrying missile had changed from its original battlefield mission in 1976 to a long-range missile with different targets. Cancellation was also due to budget constraints. Development of the warhead was then completed and the technology was put on the shelf pending a future requirement.

Another weapon, the Shallow Burst Munition—a nuclear device used at shallow depths which would provide air blast kills with reductions in thermal and nuclear radiation—was examined during 1976 but was rejected in Phase 1.

A replacement for the current MADM system has also been considered in the form of a modified B61 bomb, designated the Nuclear Cratering Explosive (NCE). The number of ADMS will be gradually reduced as improved conventional capabilities are achieved. Currently there are no plans to replace them with new nuclear systems. It appears that, at least for the present, there are no plans to produce a new ADM or EPW system.

Figure 9.16 Medium Atomic Demolition Munition (MADM) mock-up.
## Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ABM System</strong></td>
<td>A system to counter strategic ballistic missiles in flight, and consisting of: 1) ABM interceptors; 2) ABM launchers; 3) ABM radars, which are radars constructed and deployed for an ABM role, or of a type tested in an ABM mode.</td>
</tr>
<tr>
<td><strong>Air-Breathing of Missile</strong></td>
<td>A missile with an engine requiring the intake of air for combustion of its fuel, as in a ramjet or turbojet. (To be contrasted with the rocket-powered missile, which carries its own oxidizer and can operate beyond the atmosphere.)</td>
</tr>
<tr>
<td><strong>Airburst</strong></td>
<td>An explosion of a nuclear warhead above the surface as distinguished from an explosion on contact with the surface or after penetration. Also, the explosion of a nuclear weapon in the air, at height greater than the maximum radius of the fireball.</td>
</tr>
<tr>
<td><strong>Air Defense</strong></td>
<td>Defensive measures designed to destroy attacking enemy aircraft or missiles in the earth's envelope of atmosphere, or to nullify or reduce the effectiveness of such attack.</td>
</tr>
<tr>
<td><strong>Air-Launched Cruise Missile (ALCM)</strong></td>
<td>A cruise missile transported aloft by a carrier aircraft and launched from that aircraft in flight.</td>
</tr>
<tr>
<td><strong>Air-to-Air Missile (AAM)</strong></td>
<td>A missile launched from an aircraft at a target above the surface.</td>
</tr>
<tr>
<td><strong>Air-to-Surface Missile (ASM)</strong></td>
<td>A missile launched from an aircraft to impact on a surface target.</td>
</tr>
<tr>
<td><strong>Anti-Ballistic Missile (ABM)</strong></td>
<td>A defense missile used to intercept and destroy or otherwise neutralize an attacking ballistic missile in the upper reaches of the atmosphere and beyond (endoaotmospere and exoaotmospere).</td>
</tr>
<tr>
<td><strong>Anti-Submarine Warfare (ASW)</strong></td>
<td>Operations conducted with the intention of denying the enemy the effective use of submarines.</td>
</tr>
<tr>
<td><strong>Arming</strong></td>
<td>As applied to weapons and ammunition, the changing from a safe condition to a state of readiness for initiation.</td>
</tr>
<tr>
<td><strong>Atomic Bomb</strong></td>
<td>An explosive projectile (usually, a gravity bomb) whose warhead contains nuclear-fissionable radioactive materials as the explosive charge, producing nuclear fusion or fission effects to destroy a target. More narrowly, a fission bomb (see), as distinguished from fusion, or hydrogen bomb.</td>
</tr>
<tr>
<td><strong>Atomic Demolition Munition (ADM)</strong></td>
<td>Nuclear device designed to be detonated on or below the surface, or under water, to block, deny and/or canalize enemy forces.</td>
</tr>
<tr>
<td><strong>Avionics</strong></td>
<td>The application of electronics to aviation and astronautics.</td>
</tr>
<tr>
<td><strong>Ballistic Missile</strong></td>
<td>Any missile designed to follow the trajectory that results when it is acted upon predominantly by gravity and aerodynamic drag after thrust is terminated. Ballistic missiles typically operate outside the atmosphere for a substantial portion of their flight path and are unpowered during most of the flight.</td>
</tr>
<tr>
<td>Terms</td>
<td>Glossary</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Ballistic Missile Defense (BMD):</td>
<td>Measures for defending against an attack by ballistic missiles: for example, a system composed of antiballistic missiles and radar and control equipment designed to intercept and destroy attacking ballistic missiles before they reach their targets.</td>
</tr>
<tr>
<td>Ballistic Trajectory:</td>
<td>The trajectory traced after the propulsive force is terminated and the body is acted upon only by gravity and aerodynamic drag.</td>
</tr>
</tbody>
</table>
| Beam Rider/Riding: | 1. A missile guided by a radar, radio, or laser beam.  
   2. A missile guided by an electronic beam. |
| Blast: | The brief and rapid movement of air vapor or fluid away from a center of outward pressure, as in an explosion or in the combustion of rocket fuel; the pressure accompanying this movement. This term is commonly used for “explosion,” but the two terms may be distinguished. |
| Bomber (Light, Medium, Heavy): | 1. Light: A bomber designed for a tactical operating radius of under 1000 nautical miles at design gross weight and design bomb load.  
   2. Medium: A bomber designed for a tactical operating radius of between 1000 and 2500 nautical miles at design gross weight and design bomb load.  
   3. Heavy: A bomber designed for a tactical operating radius over 2500 nautical miles at design gross weight and design bomb load. |
<p>| Booster: | An auxiliary or initial propulsion system which travels with a missile or aircraft and which may or may not be separated from the parent craft when its impulse has been delivered. A booster system may contain or consist of one or more units. |
| Bus: | The projectile of a missile, with multiple reentry vehicles (MRVs), including the RVs, guidance system, propellant, and thrust device for altering the ballistic flight path so that RVs can be ejected sequentially toward respective targets. Also known as post-boost vehicle (PBV). |
| Circular Error Probable (CEP): | A measure of the delivery accuracy of a weapon system. It is the radius of a circle around a target of such size that a weapon aimed at the center has a 50% probability of falling within the circle. |
| Collateral Damage: | Physical harm inflicted by intent or otherwise on persons and property as a result of attack (specifically, nuclear attack) on a primary military target. |
| Combat Radius: | The maximum distance which an operational aircraft characteristically armed for a combat mission can fly unrefueled from its starting point and return safely, allowing for fuel expenditure involved in combat action typical of the mission profile. |
| Command Disable System (CDS): | A device integrated in a storage container to disable a nuclear warhead by destroying critical components. Cannot be activated until a code is inserted. |
| Counterforce: | The employment of strategic air and missile forces in an effort to destroy, or render impotent, military capabilities of an enemy force. |
| Countervalue: | The employment of strategic air or missile forces to attack selected enemy population centers, industries, and resources and installations which constitute the social fabric of the nation. |</p>
<table>
<thead>
<tr>
<th>Terms</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cruise Missile</td>
<td>A guided missile which uses aerodynamic lift to offset gravity and propulsion to counteract drag. A cruise missile's flight path remains within the Earth's atmosphere.</td>
</tr>
<tr>
<td>Cruise Missile Carrier</td>
<td>An aircraft equipped for launching a cruise missile.</td>
</tr>
<tr>
<td>Decoy</td>
<td>A model, electromagnetic reflector, or other device accompanying a nuclear weapon delivery vehicle in order to mislead enemy defensive systems so as to increase the probability of penetration and weapon delivery.</td>
</tr>
<tr>
<td>Delivery System</td>
<td>An aerospace vehicle considered as a whole, with all associated components, and integral with launchers and other installations employed in transporting, launching, targeting, guiding, and delivering on target its nuclear weapon(s).</td>
</tr>
<tr>
<td>Dual-Capable Weapons</td>
<td>Weapons, weapons systems, or vehicles capable of selective equipage with nuclear or non-nuclear munitions.</td>
</tr>
<tr>
<td>Electromagnetic Pulse (EMP)</td>
<td>The electromagnetic radiation from a nuclear explosion, caused by Compton-recoil electrons and photoelectrons from photons scattered in the materials of the nuclear device, in a surrounding medium. The resulting electric and magnetic fields may couple with military systems to produce damaging current and voltage source.</td>
</tr>
<tr>
<td>Equivalent Megatonnage (EMT)</td>
<td>A measure used to compare the destructive potential of differing combinations of nuclear warhead yield against relatively soft countervalue targets. EMT is computed from the expression: $EMT = NY^x$, where $N =$ number of actual warheads of yield $Y; Y =$ yield of the actual warheads in megatons; and $x =$ scaling.</td>
</tr>
<tr>
<td>Exoatmosphere</td>
<td>Higher than about 40 nautical miles above sea level.</td>
</tr>
<tr>
<td>Externally Observable Differences:</td>
<td>Externally observable design features used to distinguish between those heavy bombers of current types (and air-launched cruise missiles) which are capable of performing a particular SALT-limited function and those which are not. These differences need not be functionally related but must be a physical design feature which is externally observable.</td>
</tr>
<tr>
<td>Fallout</td>
<td>The precipitation to earth of radioactive particulate matter from a nuclear cloud; also applied to the particulate matter itself.</td>
</tr>
<tr>
<td>Fighter-Bomber</td>
<td>Tactical aircraft configured for ground attack and interdiction as well as for air combat. As dual-capable systems, fighter-bombers (such as F-111s) constitute a non-central system with potential for strategic missions.</td>
</tr>
<tr>
<td>Fission</td>
<td>The process whereby the nucleus of a particular heavy element splits into (generally) two nuclei of lighter elements, with the release of substantial amounts of energy.</td>
</tr>
<tr>
<td>Glossary Terms</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td><strong>Fission Weapon</strong>: Nuclear warhead whose material is uranium or plutonium which is brought to a critical mass under pressure from a chemical explosive detonation to create an explosion that produces blast, thermal radiation, and nuclear radiation. The complete fission of one pound of fissionable material would have a yield equivalent to 8000 tons of TNT. Commonly known as atomic bomb.</td>
<td></td>
</tr>
<tr>
<td><strong>Fusion Weapon</strong>: Nuclear warhead containing fusion materials (e.g., deuterium and tritium) which are brought to critical density and temperature conditions by use of a primary fission reaction (thermonuclear) in order to initiate and sustain a rapid fusion process, which in turn creates an explosion that produces blast, thermal radiation, and nuclear radiation. The complete fusion of one pound of fusion material is equivalent to 36,000 tons of TNT. Commonly known as hydrogen bomb.</td>
<td></td>
</tr>
<tr>
<td><strong>Forward Based Systems</strong>: A term introduced by the U.S.S.R. to refer to those U.S. nuclear systems based in third countries or on aircraft carriers and capable of delivering a nuclear strike against the territory of the U.S.S.R.</td>
<td></td>
</tr>
<tr>
<td><strong>Ground Alert</strong>: That status in which aircraft on the ground/deck are fully serviced and armed, with combat crews in readiness to take off within a specified short period of time (usually 15 minutes) after receipt of a mission order.</td>
<td></td>
</tr>
<tr>
<td><strong>Fractionation</strong>: The division of the payload of a missile into several warheads. The use of a MIRV payload is an example of fractionation.</td>
<td></td>
</tr>
<tr>
<td><strong>Guidance</strong>: The entire process by which target intelligence information received by the guided missile is used to effect proper flight control to cause timely direction changes for effective target interception.</td>
<td></td>
</tr>
<tr>
<td><strong>Functionally Related Observable Differences (FROD)</strong>: The means by which SALT II provides for distinguishing between those aircraft which are capable of performing certain SALT-limited functions and those which are not. FRODs are differences in the observable features of airplanes which specifically determine whether or not these airplanes can perform the mission of a heavy bomber, or whether or not they can perform the mission of a bomber equipped for cruise missiles of a range in excess of 600 km, or whether or not they can perform the mission of a bomber equipped for Air-to-Surface Ballistic Missiles (ASBMs).</td>
<td></td>
</tr>
<tr>
<td><strong>Guided Missile</strong>: An unmanned vehicle moving above the surface of the earth, whose trajectory or flight path is capable of being altered by an external or internal mechanism.</td>
<td></td>
</tr>
<tr>
<td><strong>Half-Life</strong>: The time required for the activity of a given radioactive species to decrease to half of its initial value due to radioactive decay. The half-life is a characteristic property of each radioactive species and is independent of its amount or condition. The half-life of tritium is 12.3 years.</td>
<td></td>
</tr>
<tr>
<td><strong>Hard Target</strong>: Any weapon site, command and control facility, production center, blast shelter or other strategic target which has been hardened for protection against the effects of nuclear attack.</td>
<td></td>
</tr>
<tr>
<td><strong>Fusion</strong>: The process accompanied by the release of tremendous amounts of energy, whereby the nuclei of light elements combine to form the nucleus of a heavier element.</td>
<td></td>
</tr>
</tbody>
</table>
Glossary

Terms

Height of Burst (HOB):
1. The vertical distance from the earth's surface or target to the point of burst.
2. For nuclear weapons, the optimum height of burst for a particular target (or area) is that at which it is estimated a weapon of a specific energy yield will produce a certain desired effect over the maximum possible area.

High Explosive (HE):
Generally applied to the bursting charges for bombs, projectiles, grenades, mines, and demolition charges.

Homing:
The technique of tracking along a position line toward the point of origin of a radio, radar or other navigation aid.

Homing Overlay Experiment (HOE):
The HOE is designed to demonstrate the ability of optics to acquire targets in flight; isolate RVs from accompanying chaff, penetration aids, and booster fragments; and guide the missile to intercept with a goal of a miss distance small enough to permit RV destruction by other than nuclear means. HOE would demonstrate the capability and illustrate the advantages of exoatmospheric, non-nuclear intercept at relatively long ranges.

Howitzer:
A cannon which combines certain characteristics of guns and mortars. The howitzer delivers projectiles with medium velocities, by either low or high trajectories.

Hydrogen Bomb:
A nuclear weapon in which part of the explosive energy is obtained from nuclear fusion (or thermonuclear) reaction.

Inertial Confinement:
A concept for attaining the density and temperature condition that will produce nuclear fusion by use of lasers or other high power sources to compress and heat small pellets containing fusible fuel. The energy released is in the form of fast neutrons, X-rays, charged particles, and debris, and can be used in much the same way as the energy output of any other fusion (or fission) process.

Inertial Guidance:
A guidance system designed to project a missile over a predetermined path, wherein the path of the missile is adjusted after launch by devices wholly within the missile and independent of outside information. The system measures and converts accelerations experienced to distance traveled in a certain direction.

Initial Operational Capability (IOC):
The date when the first combat missile unit is equipped and trained, and logistic support established to permit performance of combat missions in the field. An initial operational capability date is associated with each new missile system as a target date for delivery of combat equipment, repair parts, maintenance equipment, and publications, plus supply of trained personnel.

Intercontinental Ballistic Missile (ICBM):
A land-based fixed or mobile rocket-propelled vehicle capable of delivering a warhead to intercontinental ranges. Once they are outside the atmosphere, ICBMs fly to a target on an elliptical trajectory. An ICBM consists of a booster, one or more reentry vehicles, possibly penetration aids, and, in the case of a MIRVed missile, a post-boost vehicle.

Intermediate Range Ballistic Missile (IRBM):
A ballistic missile, with a range capability from about 1500 to 3000 nautical miles.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiloton (Kt)</td>
<td>A unit of measure of a nuclear weapon's yield, equivalent to the explosive energy of one thousand tons of TNT. Thirteen kilotons was the approximate yield of the atomic bomb detonated at Hiroshima.</td>
</tr>
<tr>
<td>Kiloton Weapon</td>
<td>A nuclear weapon, the yield of which is measured in terms of thousands of tons of trinitrotoluene (TNT) explosive equivalents, producing yields from 1 to 999 kilotons.</td>
</tr>
<tr>
<td>Launch Weight</td>
<td>The weight of the fully loaded missile itself at the time of launch. This would include the aggregate post-boost vehicle (PBV) and the payload.</td>
</tr>
<tr>
<td>Laydown</td>
<td>Weapons employment from an aircraft where a delayed fuzing and arming of the warhead permits low-level delivery and safe escape.</td>
</tr>
<tr>
<td>Mach Number</td>
<td>The ratio of the velocity of a body to that of sound in the surrounding medium.</td>
</tr>
<tr>
<td>Maneuverable Reentry Vehicle (MaRV)</td>
<td>A reentry vehicle capable of performing preplanned flight maneuvers during the reentry phase.</td>
</tr>
<tr>
<td>Maximum Range</td>
<td>The greatest distance a weapon can fire without consideration of dispersion, or the greatest distance a weapon system can fly.</td>
</tr>
<tr>
<td>Medium-Range Ballistic Missile (MRBM)</td>
<td>A ballistic missile with a range capability from about 600 to 1500 nautical miles.</td>
</tr>
<tr>
<td>Megaton (Mt)</td>
<td>A unit of measurement for nuclear yield equivalent to the energy released from one million tons of TNT.</td>
</tr>
<tr>
<td>Midcourse Guidance</td>
<td>The guidance applied to a missile between termination of the launching phase and the start of the terminal phase of flight.</td>
</tr>
<tr>
<td>&quot;Mod&quot; Designator Number</td>
<td>Modifications made to the major assembly design of a weapon system. Mod-0 is the first version of a weapon design, with subsequent modifications of the weapon design numbered consecutively.</td>
</tr>
<tr>
<td>Multiple Independently-Targetable Reentry Vehicle (MIRV)</td>
<td>Multiple reentry vehicles carried by a ballistic missile, each of which can be directed to a separate and arbitrarily located target. A MIRVed missile employs a post-boost vehicle (PBV) or other warhead dispensing mechanism. The dispensing and targeting mechanism maneuvers to achieve successive desired positions and velocities to dispense each RV on a trajectory to attack the desired target. Alternately, the RVs might themselves maneuver toward their targets after they reenter the atmosphere.</td>
</tr>
<tr>
<td>Multiple Reentry Vehicle (MRV)</td>
<td>The reentry vehicle of a ballistic missile equipped with multiple warheads where the missile does not have the capability of independently targeting the reentry vehicles—as distinct from a missile equipped for MIRVs.</td>
</tr>
<tr>
<td>Nuclear Radiation</td>
<td>Particulate and electromagnetic radiation emitted from atomic nuclei in various nuclear processes. The important nuclear radiations, from the weapons effects standpoint, are alpha and beta particles, gamma rays, and neutrons.</td>
</tr>
<tr>
<td>Nuclear Weapon</td>
<td>A device in which the explosion results from the energy released by nuclear reactions involving atomic nuclei; either fission, fusion, or both.</td>
</tr>
<tr>
<td>Nuclear Yield</td>
<td>The energy released in the detonation of a nuclear weapon, measured in terms of kilotons or megatons of trinitrotoluene explosive (TNT) required to produce the same energy release. Yields are categorized as: Very Low—less than 1 kiloton; Low—1 kiloton to 10 kilotons; Medium—over 10 kilotons to 50 kilotons; High—over 50 kilotons to 500 kilotons; Very High—over 500 kilotons.</td>
</tr>
<tr>
<td>Optimum Height</td>
<td>The height of an explosive which will produce the maximum effect against a given target.</td>
</tr>
</tbody>
</table>
## Glossary

### Terms

<p>| <strong>Over Pressure</strong>: The pressure resulting from the blast wave of an explosion. It is referred to as “positive” when it exceeds atmospheric pressure and “negative” during the passage of the wave, when resulting pressures are less than atmospheric pressure. |
| <strong>Payload</strong>: Weapons and penetration aids carried by a delivery vehicle. In the case of a ballistic missile, the RV(s) and antiballistic missile penetration aids placed on ballistic trajectories by the main propulsion stages or the PBV: in the case of a bomber, those bombs, missiles, or penaids carried internally or attached to the wing or fuselage. |
| <strong>Penetration Aids Devices employed by offensive (Active and Passive):</strong> weapon systems, such as ballistic missiles and bombers, to increase the probability of penetrating enemy defenses. They are frequently designed to simulate or to mask an aircraft or ballistic missile warhead in order to mislead enemy radar and/or divert defensive antiaircraft or antimissile fire. |
| <strong>Permissive Action Link (PAL):</strong> A coded switch which serves as a mechanical supplement to the administrative controls exercised over nuclear weapons employment. When installed, they make weapon-enabling, or access to the warhead itself, dependent upon possession of the code. |
| <strong>Personnel Reliability Program (PRP):</strong> Program in which individuals who have responsibilities in the nuclear release process are kept under scrutiny to determine if behavior affects the conduct of the work. |
| <strong>Post-Boost Vehicle (PBV):</strong> That part of a missile which carries the reentry and thrust devices for altering the ballistic flight path so that the reentry vehicles can be dispensed sequentially toward different targets (MIRVs). Ballistic missiles with single RVs also might use a PBV to increase the accuracy of the RV by placing it more precisely into the desired trajectory. |
| <strong>Projectile</strong>: An object projected by an applied exterior force and continuing in motion, as an artillery shell. |
| <strong>Propellant</strong>: That which provides the energy required for propelling a projectile. Specifically, an explosive charge for propelling a bullet, shell or the like; also a fuel, either solid or liquid, for propelling a rocket or missile. |
| <strong>Radar</strong>: Radio Detection And Ranging equipment that determines the distance and usually the direction of objects by transmission and return of electromagnetic energy. |
| <strong>Radar Cross-Section (RCS):</strong> The image produced by radar signals reflected from a given target surface. Because the size of the image is a function not only of the target's size, but of structural shape and the refractory characteristics of its materials as well, radar cross-section is an important design characteristic for air and space vehicles. |
| <strong>Radius of Action</strong>: The maximum distance a ship, aircraft, or vehicle can travel away from its base along a given course with normal combat load and return without refueling, allowing for all safety and operating factors. |
| <strong>Ramjet</strong>: A jet propulsion engine containing neither compression nor turbine, which depends for its operation on the air compression accomplished by the forward motion of the engine. |</p>
<table>
<thead>
<tr>
<th>Glossary Terms</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range:</td>
<td>1. The distance between any given point and an object or target.</td>
</tr>
<tr>
<td></td>
<td>2. Extent or distance limiting the operation or action of something, such as the range of an aircraft, ship, or gun.</td>
</tr>
<tr>
<td></td>
<td>3. The distance which can be covered over a hard surface by a ground vehicle, with its rated payload, using the fuel in its tank and in cans normally carried as part of the ground vehicle equipment.</td>
</tr>
<tr>
<td></td>
<td>4. Area equipped for practice in shooting at targets.</td>
</tr>
<tr>
<td>Reduced Blast/Enhanced Radiation</td>
<td>A nuclear weapon designed to produce significantly more and/or higher energy output(s) of neutron, X-ray, gamma rays, or a combination thereof than a normal weapon of the same total yield.</td>
</tr>
<tr>
<td>Weapon (RB/ER):</td>
<td></td>
</tr>
<tr>
<td>Reentry Vehicle (RV):</td>
<td>That portion of a ballistic missile which carries the nuclear warhead. It is called a reentry vehicle because it reenters the earth’s atmosphere in the terminal portion of the missile trajectory.</td>
</tr>
<tr>
<td>Residual Radiation:</td>
<td>Nuclear radiation caused by fallout, radioactive material dispersed artificially, or irradiation which results from a nuclear explosion and persists longer than one minute after burst.</td>
</tr>
<tr>
<td>SAFEGUARD:</td>
<td>A ballistic missile defense primarily designed to protect U.S. land-based retaliatory forces against direct attack, and protect the U.S. against a possible accidental launch or small attack. The principal subsystems were the SPRINT and SPAR-TAN missiles, Missile Site Radar, Perimeter Acquisition Radar, and the Data Processing System.</td>
</tr>
<tr>
<td>Stockpile:</td>
<td>Nuclear storage. Also, the total number of nuclear weapons which a nation maintains in storage at all locations and potentially available for deployment.</td>
</tr>
<tr>
<td>Strategic Forces:</td>
<td>Nuclear weapons and delivery systems designed for nuclear attack against strategic targets or for active defense against such an attack: bombers, missile systems, and strategic interceptors. Commonly refers to offensive weapons in the U.S. and the U.S.S.R. that can deliver a nuclear strike on each other or a third party.</td>
</tr>
<tr>
<td>Strategic Offense:</td>
<td>Forces and measures existing to mount a nuclear attack against enemy strategic targets, designed to destroy the enemy’s war-making capacity.</td>
</tr>
<tr>
<td>Sub-Kiloton Weapon:</td>
<td>A nuclear weapon producing a yield below one kiloton.</td>
</tr>
</tbody>
</table>
### Glossary

**Terms**

<p>| <strong>Submarine-Launched Ballistic Missile (SLBM):</strong> | <strong>A ballistic missile carried in and launched from a submarine, which affords mobility and concealment for a missile force. The SALT II Treaty includes the following definition: &quot;submarine-launched ballistic missile (SLBM) launchers are launchers of ballistic missiles installed on any nuclear-powered submarine or launchers of modern-ballistic-missiles-installed on any submarine, regardless of its type.&quot; [Article II (2)]</strong> |
| <strong>Surface-to-Air Missile (SAM):</strong> | <strong>A surface-launched missile designed to operate against a target above the surface.</strong> |
| <strong>Surface-to-Surface Missile (SSM):</strong> | <strong>A surface-launched missile designed to operate against a target on the surface.</strong> |
| <strong>Tactical Nuclear (Forces, Weapons):</strong> | <strong>The use of nuclear weapons by land, sea, or air forces against opposing forces. Also supporting installations or facilities, in support of operations, which contribute to the accomplishment of a military mission of limited scope, or in support of the military commander's scheme of maneuver, usually limited to the area of military operations.</strong> |
| <strong>Terminal Guidance:</strong> | <strong>The guidance applied to a missile between mid-course guidance and its arrival in the vicinity of the target.</strong> |
| <strong>Terrain Contour Matching (TERCOM):</strong> | <strong>Guidance system, presently employed in cruise missiles, which correlates preprogrammed contour map data with the terrain being overflown, in order to take periodic fixes and adjust the flight path accordingly. TERCOM improves the accuracy provided by inertial guidance alone.</strong> |
| <strong>Theater:</strong> | <strong>The geographical area outside the continental United States for which a commander of a unified or specified command has been assigned military responsibility.</strong> |
| <strong>Thermonuclear Weapon:</strong> | <strong>A weapon in which very high temperatures are used to bring about the fusion of light nuclei, such as those of hydrogen isotopes (e.g., deuterium and tritium), with the accompanying release of energy. The high temperatures required are obtained by means of an atomic (fusion) explosion.</strong> |
| <strong>Throw-Weight:</strong> | <strong>Ballistic missile throw-weight is the useful weight which is placed on a trajectory toward the target by the boost or main propulsion stages of the missile. For the purposes of SALT II, throw-weight is defined as the sum of the weight of:</strong> |
|  |  | • the RV or RVs; |
|  |  | • any PBV or similar device for releasing or targeting one or more RVs; and |
|  |  | • any antiballistic missile penetration aids, including their release devices.** |
| <strong>Transporter-Erector-Launcher (TEL):</strong> | <strong>The vehicle designed to move a land-based mobile missile within its shelter and to break through the overhead cover, raise the missile into firing position, and serve as a platform for the launch of the missile.</strong> |
| <strong>Triad:</strong> | <strong>The tripartite U.S. strategic deterrent force, which consists of land-based ICBMs, submarine-launched ballistic missiles, and strategic bombers. The capabilities and characteristics of each system complement the others. Disproportionate reliance on any one system is avoided, so that the ends of deterrence and stability are served, and the risks of technological surprise are reduced.</strong> |
| <strong>Turbojet Engine:</strong> | <strong>A jet engine whose air is supplied by a turbine driven compressor, the turbine being activated by exhaust gases.</strong> |</p>
<table>
<thead>
<tr>
<th>Terms</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warhead:</td>
<td>The part of a missile, projectile, torpedo, rocket, or other munition which contains either the nuclear or the thermonuclear system, high explosive system, chemical or biological agents, or inert materials, intended to inflict damage.</td>
</tr>
<tr>
<td>Yield:</td>
<td>The energy released in an explosion. The energy released in the detonation of a nuclear weapon is generally measured in terms of the kilotons (Kt) or megatons (Mt) of TNT required to produce the same energy release.</td>
</tr>
</tbody>
</table>
## Glossary of Abbreviations and Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAM</td>
<td>Air-to-Air Missile</td>
</tr>
<tr>
<td>AB</td>
<td>Airbase</td>
</tr>
<tr>
<td>ABM</td>
<td>Anti-Ballistic Missile</td>
</tr>
<tr>
<td>ABRES</td>
<td>Advanced Ballistic Reentry Systems</td>
</tr>
<tr>
<td>ABRV</td>
<td>Advanced Ballistic Reentry Vehicle</td>
</tr>
<tr>
<td>ACDA</td>
<td>Arms Control and Disarmament Agency</td>
</tr>
<tr>
<td>ACIS</td>
<td>Arms Control Impact Statement</td>
</tr>
<tr>
<td>ACMT</td>
<td>Advanced Cruise Missile Technology</td>
</tr>
<tr>
<td>AD</td>
<td>Destroyer Tender (Ship)</td>
</tr>
<tr>
<td>ADCOM</td>
<td>Aerospace Defense Command</td>
</tr>
<tr>
<td>ADM</td>
<td>Atomic Demolition Munition</td>
</tr>
<tr>
<td>AE</td>
<td>Ammunition Ship</td>
</tr>
<tr>
<td>AEC</td>
<td>Atomic Energy Commission</td>
</tr>
<tr>
<td>AFAP</td>
<td>Artillery-Fired Atomic Projectile</td>
</tr>
<tr>
<td>AFB</td>
<td>Air Force Base</td>
</tr>
<tr>
<td>AFM</td>
<td>Air Force Manual</td>
</tr>
<tr>
<td>AFR</td>
<td>Air Force Regulation</td>
</tr>
<tr>
<td>AGM</td>
<td>Air-to-Surface Missile</td>
</tr>
<tr>
<td>AIR</td>
<td>Air-to-Air Missile</td>
</tr>
<tr>
<td>AIRS</td>
<td>Advanced Inertial Reference Sphere</td>
</tr>
<tr>
<td>ALBM</td>
<td>Air-Launched Ballistic Missile</td>
</tr>
<tr>
<td>ALC</td>
<td>Air Logistics Center</td>
</tr>
<tr>
<td>ALGM</td>
<td>Air-Launched Cruise Missile</td>
</tr>
<tr>
<td>AMAC</td>
<td>Airborne Monitoring and Control System</td>
</tr>
<tr>
<td>AMSA</td>
<td>Advanced Manned Strategic Aircraft</td>
</tr>
<tr>
<td>ANG</td>
<td>Air National Guard</td>
</tr>
<tr>
<td>ANGB</td>
<td>Air National Guard Base</td>
</tr>
<tr>
<td>AOE</td>
<td>Ammunition Ship</td>
</tr>
<tr>
<td>AP</td>
<td>Airport</td>
</tr>
<tr>
<td>AMarV</td>
<td>Advanced Maneuvering Reentry Vehicle</td>
</tr>
<tr>
<td>AS</td>
<td>Submarine Tender (Ship)</td>
</tr>
<tr>
<td>ASALM</td>
<td>Advanced Strategic Air-Launched Missile</td>
</tr>
<tr>
<td>ASAT</td>
<td>Anti-Satellite</td>
</tr>
<tr>
<td>ASBM</td>
<td>Air-to-Surface Ballistic Missile</td>
</tr>
<tr>
<td>ASW</td>
<td>Air-to-Surface Missile</td>
</tr>
<tr>
<td>ASWSOW</td>
<td>Advanced Strategic Missile System</td>
</tr>
<tr>
<td>ATB</td>
<td>Anti-Submarine Rocket</td>
</tr>
<tr>
<td>ATBM</td>
<td>Anti-Submarine Warfare</td>
</tr>
<tr>
<td>ATP</td>
<td>Anti-Submarine Warfare Stand-Off Weapon</td>
</tr>
<tr>
<td>AW&amp;ST</td>
<td>Aviation Week &amp; Space Technology</td>
</tr>
<tr>
<td>AWACS</td>
<td>Airborne Warning and Control System</td>
</tr>
<tr>
<td>BB</td>
<td>Battleship</td>
</tr>
<tr>
<td>BDM</td>
<td>Bomber Defense Missile</td>
</tr>
<tr>
<td>BMD</td>
<td>Ballistic Missile Defense</td>
</tr>
<tr>
<td>CANTRAC</td>
<td>Catalog of Navy Training Activities</td>
</tr>
<tr>
<td>CDSS</td>
<td>Command Disable System</td>
</tr>
<tr>
<td>CEP</td>
<td>Circular Error Probable</td>
</tr>
<tr>
<td>CG</td>
<td>Guided Missile Cruiser</td>
</tr>
<tr>
<td>CGN</td>
<td>Nuclear Powered Guided Missile Cruiser</td>
</tr>
</tbody>
</table>
## Glossary
### Abbreviations and Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>cm</td>
<td>Centimeter</td>
</tr>
<tr>
<td>CMCA</td>
<td>Cruise Missile Carrier Aircraft</td>
</tr>
<tr>
<td>CMI</td>
<td>Cruise Missile Integration</td>
</tr>
<tr>
<td>CMP</td>
<td>Counter Military Potential</td>
</tr>
<tr>
<td>CONUS</td>
<td>Continental United States</td>
</tr>
<tr>
<td>CSB</td>
<td>Closely Spaced Basing</td>
</tr>
<tr>
<td>CSWS</td>
<td>Corps Support Weapon System</td>
</tr>
<tr>
<td>CV</td>
<td>Aircraft Carrier</td>
</tr>
<tr>
<td>DARPA</td>
<td>Defense Advanced Research Projects Agency</td>
</tr>
<tr>
<td>DD</td>
<td>Destroyer</td>
</tr>
<tr>
<td>DDG</td>
<td>Guided Missile Destroyer</td>
</tr>
<tr>
<td>DOD</td>
<td>Department of Defense</td>
</tr>
<tr>
<td>DOE</td>
<td>Department of Energy</td>
</tr>
<tr>
<td>DSARC</td>
<td>Defense Systems Acquisition Review Council</td>
</tr>
<tr>
<td>DU</td>
<td>Depleted Uranium</td>
</tr>
<tr>
<td>ECM</td>
<td>Electronic Counter Measure</td>
</tr>
<tr>
<td>EMP</td>
<td>Electro-Magnetic Pulse</td>
</tr>
<tr>
<td>EMT</td>
<td>Equivalent Megatonnage</td>
</tr>
<tr>
<td>EPW</td>
<td>Earth Penetrator Weapon/Warhead</td>
</tr>
<tr>
<td>ER</td>
<td>Enhanced Radiation (&quot;Neutron Bomb&quot;)</td>
</tr>
<tr>
<td>ERB</td>
<td>Extended-Range Bomb</td>
</tr>
<tr>
<td>ERDA</td>
<td>Energy Research and Development Administration</td>
</tr>
<tr>
<td>EWDA</td>
<td>Energy and Water Development Appropriations</td>
</tr>
<tr>
<td>FBM</td>
<td>Fleet Ballistic Missile</td>
</tr>
<tr>
<td>FBS</td>
<td>Forward Based Systems</td>
</tr>
<tr>
<td>FEBA</td>
<td>Forward Edge of the Battle Area</td>
</tr>
<tr>
<td>FF</td>
<td>Frigate</td>
</tr>
<tr>
<td>FFG</td>
<td>Guided Missile Frigate</td>
</tr>
<tr>
<td>FM</td>
<td>Field Manual</td>
</tr>
<tr>
<td>FRG</td>
<td>Federal Republic of Germany</td>
</tr>
<tr>
<td>FROD</td>
<td>Functionally Related Observable Difference</td>
</tr>
<tr>
<td>ft</td>
<td>Feet</td>
</tr>
<tr>
<td>FUFO</td>
<td>Full Fuzing Option</td>
</tr>
<tr>
<td>FY</td>
<td>Fiscal Year</td>
</tr>
<tr>
<td>GAO</td>
<td>General Accounting Office</td>
</tr>
<tr>
<td>GLCM</td>
<td>Ground-Launched Cruise Missile</td>
</tr>
<tr>
<td>HAC</td>
<td>House Appropriations Committee</td>
</tr>
<tr>
<td>HASC</td>
<td>House Armed Services Committee</td>
</tr>
<tr>
<td>HE</td>
<td>High Explosive</td>
</tr>
<tr>
<td>HEU</td>
<td>Highly Enriched Uranium</td>
</tr>
<tr>
<td>HOB</td>
<td>Height Of Burst</td>
</tr>
<tr>
<td>HOE</td>
<td>Homing Overlay Experiment</td>
</tr>
<tr>
<td>IAP</td>
<td>Improved Accuracy Program</td>
</tr>
<tr>
<td>ICBM</td>
<td>Intercontinental Ballistic Missile</td>
</tr>
<tr>
<td>IHE</td>
<td>Inertial Guidance System</td>
</tr>
<tr>
<td>in</td>
<td>Inch</td>
</tr>
<tr>
<td>IOC</td>
<td>Initial Operational Capability</td>
</tr>
<tr>
<td>IR</td>
<td>Infrared</td>
</tr>
<tr>
<td>IRBM</td>
<td>Intermediate-Range Ballistic Missile</td>
</tr>
<tr>
<td>JCMPO</td>
<td>Joint Cruise Missile Program Office</td>
</tr>
<tr>
<td>JCS</td>
<td>Joint Chiefs of Staff</td>
</tr>
<tr>
<td>JTACMS</td>
<td>Joint Tactical Missile System</td>
</tr>
<tr>
<td>kg</td>
<td>Kilogram</td>
</tr>
<tr>
<td>km</td>
<td>Kilometer</td>
</tr>
<tr>
<td>Kt</td>
<td>Kiloton</td>
</tr>
<tr>
<td>LANL</td>
<td>Los Alamos National Laboratory</td>
</tr>
<tr>
<td>LLNL</td>
<td>Lawrence Livermore National Laboratory</td>
</tr>
<tr>
<td>LoADS</td>
<td>Low Altitude Defense System</td>
</tr>
<tr>
<td>LRCA</td>
<td>Long-Range Combat Aircraft</td>
</tr>
<tr>
<td>LRTNF</td>
<td>Long-Range Theater Nuclear Forces</td>
</tr>
<tr>
<td>m</td>
<td>Meter, million</td>
</tr>
<tr>
<td>MADM</td>
<td>Medium Atomic Demolition Munition</td>
</tr>
<tr>
<td>MAPS</td>
<td>Multiple Aim Point System</td>
</tr>
<tr>
<td>MaRV</td>
<td>Maneuvering Re-entry Vehicle</td>
</tr>
</tbody>
</table>
# Glossary

Abbreviations and Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
<th>Abbreviation</th>
<th>Description</th>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCAS</td>
<td>Marine Corps Air Station</td>
<td>RB/ER</td>
<td>Reduced Blast/Enhanced Radiation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mi</td>
<td>Statute Mile</td>
<td>RCS</td>
<td>Radar Cross Section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIRV</td>
<td>Multiple Independently Targeted Re-entry Vehicle</td>
<td>RDA</td>
<td>Research, Development, and Acquisition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MLRS</td>
<td>Multiple Launch Rocket System</td>
<td>RDT&amp;E</td>
<td>Research, Development, Test, and Evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MPM</td>
<td>Multipurpose Missile</td>
<td>RR</td>
<td>Reduced-Range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MPS</td>
<td>Multiple Protective Shelter</td>
<td>RV</td>
<td>Re-entry Vehicle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRASM</td>
<td>Medium-Range Air-to-Surface Missile</td>
<td>SAC</td>
<td>Senate Appropriations Committee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRBM</td>
<td>Medium-Range Ballistic Missile</td>
<td>SAC</td>
<td>Strategic Air Command</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRV</td>
<td>Multiple Re-entry Vehicle</td>
<td>SACEUR</td>
<td>Supreme Allied Command Europe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mt</td>
<td>Megaton</td>
<td>SADM</td>
<td>Special Atomic Demolition Munition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT</td>
<td>Metric Ton</td>
<td>SALT</td>
<td>Strategic Arms Limitation Treaty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MX</td>
<td>Missile Experimental</td>
<td>SAM</td>
<td>Surface-to-Air Missile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAS</td>
<td>Naval Air Station</td>
<td>SASC</td>
<td>Senate Armed Services Committee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NATO</td>
<td>North Atlantic Treaty Organization</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nm</td>
<td>Nautical Mile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NORAD</td>
<td>North American Aerospace Defense Command</td>
<td>SICBM</td>
<td>Small Intercontinental Ballistic Missile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OAS</td>
<td>Offensive Avionics System</td>
<td>SLBM</td>
<td>Submarine-Launched Ballistic Missile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OSD</td>
<td>Office of the Secretary of Defense</td>
<td>SLCM</td>
<td>Sea-Launched Cruise Missile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI1a</td>
<td>PERSHING 1a Missile</td>
<td>SLEP</td>
<td>Service Life Extension Program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PII</td>
<td>PERSHING II Missile</td>
<td>SNDV</td>
<td>Strategic Nuclear Delivery Vehicle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAA</td>
<td>Primary Airvehicle Authorized</td>
<td>SNM</td>
<td>Special Nuclear Materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAL</td>
<td>Permissive Action Link</td>
<td>SRAM</td>
<td>Short-Range Attack Missile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBV</td>
<td>Post-Boost Vehicle</td>
<td>SRBM</td>
<td>Short-Range Ballistic Missile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PGRV</td>
<td>Precision Guided Re-entry Vehicle</td>
<td>SSBN</td>
<td>Nuclear Powered Ballistic Missile Submarine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POC</td>
<td>Program of Cooperation</td>
<td>SSM</td>
<td>Surface-to-Surface Missile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POL</td>
<td>Petroleum, Oil, and Lubricants</td>
<td>SSN</td>
<td>Nuclear-Powered Attack Submarine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRP</td>
<td>Personnel Reliability Program</td>
<td>STP</td>
<td>Systems Technology Program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>QRA</td>
<td>Quick Reaction Alert</td>
<td>SUAWACS</td>
<td>Soviet Union AWACS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RADAG</td>
<td>Radar Area Correlation Guidance</td>
<td>SUBROC</td>
<td>Submarine Rocket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAF</td>
<td>Royal Air Force</td>
<td>SUM</td>
<td>Shallow Underwater Mobile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAP</td>
<td>Rocked Assisted Projectile</td>
<td>TAC</td>
<td>Tactical Air Command</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

326 Nuclear Weapons Databook, Volume I
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TASM</td>
<td>TOMAHAWK Anti-Ship Missile</td>
<td>UE</td>
<td>Unit Equipment</td>
</tr>
<tr>
<td>TEL</td>
<td>Transporter-Erector-Launcher</td>
<td>UGM</td>
<td>Underwater-to-Surface Missile</td>
</tr>
<tr>
<td>TERCOM</td>
<td>Terrain Contour Matching</td>
<td>USA</td>
<td>United States Army</td>
</tr>
<tr>
<td>TLAM/C</td>
<td>TOMAHAWK Land-Attack Missile/Conventional</td>
<td>USAF</td>
<td>United States Air Force</td>
</tr>
<tr>
<td>TLAM/N</td>
<td>TOMAHAWK Land-Attack Missile/Nuclear</td>
<td>USN</td>
<td>United States Navy</td>
</tr>
<tr>
<td>TNF</td>
<td>Theater Nuclear Forces</td>
<td>VHSIC</td>
<td>Very High Speed Integrated Circuits</td>
</tr>
<tr>
<td>TNW</td>
<td>Theater Nuclear War</td>
<td>VLA</td>
<td>Vertical Launch ASROC</td>
</tr>
<tr>
<td>TY</td>
<td>Then Year</td>
<td>VLS</td>
<td>Vertical Launching System</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W</td>
<td>Warhead</td>
</tr>
</tbody>
</table>
Index

A-1 (SKYRAIDER), 210
A-6 (INTRUDER), 5, 42, 49, 66, 90, 92, 199—200, 202, 203, 207—
208, 244, 251, 252, 253
A-7 (CORSAIR II), 5, 42, 49, 66, 92, 199, 200, 202, 203, 209—210,
225, 244, 251—253
Adak Naval Station, AK, 82
Advanced Ballistic Reentry Systems (ABRES), 108, 109, 324
Advanced Ballistic Reentry Vehicle (ABRV), 76, 103, 105, 108, 109,
121, 125—127, 133, 145, 324. See also Missile Reentry Vehicle
Advanced Cruise Missile, 16, 17, 80, 172—181—192
Advanced Cruise Missile Technology (ACMT) program, 16, 18, 173,
175, 191, 192
Advanced Fighter Technology Integration, 204
Advanced Maneuvering Reentry Vehicle (AMaRV), 106, 108—110,
See also Missile Reentry Vehicle
Advanced Manned Strategic Aircraft (AMSA), 156
Advanced Mobile ICBM, 18
Advanced Strategic Air-Launched Missile (ASALM), 17, 18, 39,
71, 80, 155, 193—195, 245, 264, 272. See also Counter SAUWACS
Lethal Neutralization System, 193, 195
to replace SRAM, 18, 193–194
Advanced Strategic Missile System (ASMS), 108, 109
Advanced Tactical Air-Delivered Weapon, 16, 18, 202
Advanced Tactical Fighter, 203—204, 219, 222
Advanced Technology Bomber (ATB) "Stealth," 17, 106, 153, 159,
182, 172—173, 191, 194, 203
Advanced Technology Cruise Missile: See Advanced Cruise
Missile Technology.
AEGIS anti-air defense system, 246, 257, 258, 272, 275, 277. See also
Ticonderoga class cruisers
Air-Force General, 111, 113, 181, 184, 186, 188, 275
Aeronca, Inc., 161
Aerospace Defense Command (ADCOM), 214
Airborne Launch Control System (ALCS), 119
Air burst/ground burst, 42, 43, 58, 63, 268
Airfield, retired, 10, 43, 50, 58
Aircraft carriers (CV), 92, 94, 205, 206, 207, 209, 223, 236, 238, 239,
244, 245, 246, 251—255, 257
Aircraft Monitoring and Control System (AMAC), 198
AirResearch Manufacturing Co., 161, 176, 269
Air Force, 5, 7–8, 18, 27–41, 43–49, 58, 59, 62, 66, 68, 71, 75, 79, 80,
83, 86, 89, 103, 105, 107, 108, 111, 112, 116, 119, 120, 121, 122,
125, 127, 128, 130, 131, 132, 150, 151, 154, 155, 162, 163, 168, 172,
173, 175, 176, 181, 183, 191, 192, 193, 195, 199, 200, 202, 203, 210,
286, 299
strategic role of, 84—86
training locations, 85
warheads used by, 89
weapons locations, 85
Air-Launched Cruise Missiles (ALCM), 3, 8, 12, 16, 17, 18, 38, 39, 58,
79, 83, 88, 101, 105, 106, 149, 150, 156, 159, 160, 172,
173—176, 191—195, 194, 314
subcontractors, 176
Air-Logistics Centers (ALC), 85
Air National Guard, 86, 88, 109, 200, 210, 214, 217, 220, 231
Air-to-air missiles, 41, 168, 194, 231, 314. See also GENIE, PHOENIX
Air-to-surface missiles: See B-52, FB-111 Bombers, Short Range
Attack Missiles
Alameda Naval Air Station, CA, 82, 94
Almogordo, NM, Trinity site, 7, 9, 31
Allied countries, 4, 38, 41, 43, 46, 47, 48, 53, 54, 56, 60, 63, 66, 73,
78, 84—87, 106, 202, 210, 216, 222, 226, 228, 234, 241, 280,
281, 282, 283, 286, 289—292, 296, 300, 301, 302, 303, 306,
307, 309, 311. See also Europe, NATO
Aluminum Co. of America, 176
Ammunition ship (AE), 92
Ammunition Assault Ships (LPH), 89, 244, 245
Ammunition Transport Docks (LPD), 89
Anadyne-Kropp, 176
Anderson AFB, Guam, 86
Anti-air missiles, 4, 5, 52, 89, 273, 275, 277, 287. See also NIKE-
HERCULES
Anti-Ballistic Missiles (ABM), 15, 18, 38, 110, 128, 163—167, 276, 314.
See also Low Altitude Defense System, SAFEGUARD, SENTRY
Anti-satellite missile (ASAT), 218
Anti-ship cruise missile, See HARPOON, TOMAHAWK
Anti-submarine aircraft, 3, 5, 199, 234—240. See also P-3; ORION,
S-3 VIKING
Anti-submarine helicopters, 5, 63, 92, 94, 236—240. See also SH-3D/H, SH-60
Anti-submarine Rocket (ASROC), 3, 5, 8, 39, 51, 92, 94, 189, 244,
246, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265—268, 271
Anti-Submarine Warfare (ASW), 3, 8, 18, 19, 63, 79, 265, 271
air-delivered weapons, 16, 18, 39, 64, 266
standoff weapons (ASWSOW), 244, 246, 265, 266, 271
SUBROC, 3, 5, 8, 39, 61, 94, 244, 246, 247, 248, 269—270
surface-delivered weapons, 16, 18, 39, 51, 245
Apra Harbor, Guam, 94
ARMADILLO carrier and launcher, 132–133
Armed Services and Appropriations Committee, Conference
Report, 16
Armored Box Launcher, 183, 187, 256, 264
Army, 4, 5, 7—9, 34, 35, 38, 38, 47, 53, 54, 55, 56, 57, 60, 72, 73, 78,
200—311
artillery used by, 88, 281
elimination of non-nuclear weapons in, 88
National Guard, 46, 262
nuclear weapons: deployed by, 280—311
locations of, 87
training centers, 88
units, 89, 91

Nuclear Weapons Databook, Volume I. 331
Index

A-1 (SKYRAIDER), 210
A-4 (SKYHAWK), 5, 42, 49, 66, 90, 94, 198, 203, 207, 205, 206, 210, 212, 253
A-6 (INTRUDER), 5, 42, 49, 66, 90, 92, 199—200, 202, 203, 207—208, 244, 251, 252, 253
A-7 (CORSAIR II), 5, 42, 49, 66, 92, 199, 200, 202, 203, 209—210, 225, 244, 251—253
Adak Naval Station, AK, 82
Advanced Ballistic Reentry Systems (ABRES), 108, 209, 324
Advanced Ballistic Reentry Vehicle (ABRV), 76, 103, 105, 108, 109, 121, 125, 126—127, 133, 145, 324. See also Missile Reentry Vehicle
Advanced Cruise Missile, 16, 17, 80, 172, 181—192
Advanced Cruise Missile Technology (ACMT) program, 16, 18, 173, 175, 191, 203
Advanced Fighter Technology Integration, 204
Advanced Maneuvering Reentry Vehicle (AMRV), 106, 109—110. See also Missile Reentry Vehicle
Advanced Manned Strategic Aircraft (AMSA), 156
Advanced Mobile ICBM, 18
Advanced Strategic Air-Launched Missile (ASALM), 17, 18, 39, 71, 80, 155, 191—195, 245, 264, 272. See also Counter SUAWACS
Lethal Neutralization System, 193, 195
Act to replace SRAM. 18, 193—194
Advanced Strategic Missile System (ASMS), 108, 109
Advanced Tactical Air-Delivered Weapon, 16, 18, 202
Advanced Tactical Fighter, 203—204, 219, 222
Advanced Technology Bomber (ATB) "Stealth," 17, 106, 153, 159, 182, 192—193, 194, 203
Advanced Technology Cruise Missile: See Advanced Cruise Missile Technology.
AEGIS anti-air defense system, 246, 257, 258, 272, 275, 277. See also Ticonderoga class cruisers
Aerojet General, 111, 113, 116, 124, 136, 155, 275
Aeronca, Inc., 161
Aerospace Defense Command (ADCOM), 214
Airborne Launch Control System (ALCS), 119
Air burst/ground burst. 42, 43, 58, 63, 207
Aircraft, retired. 10, 43, 50, 58
Aircraft carriers (CV), 92, 94, 205, 206, 207, 209, 223, 236, 238, 239, 244, 245, 246, 251—255, 257
Aircraft Monitoring and Control System (AMAC), 198
AirResearch Manufacturing Co., 161, 176, 269
strategic role of, 84—86
training locations. 85
warheads used by, 39
weapons location, 85, 87
subcontractors: 176
Air-Logistics Centers (ALC), 85
Air National Guard, 88, 89, 100, 109, 210, 214, 216, 227, 230, 231
Air-to-air missiles, 41, 168, 194, 231, 314. See also GENIE, PHOENIX
Air-to-surface missiles: See B-52, FB-111 Bombers, Short Range Attack Missiles
Alameda Naval Air Station, CA, 82, 94
Almagordo, NM, Trinity site, 7, 9, 31
Allied countries, 4, 38, 41, 43, 48, 47, 49, 53, 54, 56, 60, 63, 66, 73, 78, 94—97, 180, 202, 210, 216, 222, 226, 228, 244, 246, 280, 281, 282, 283, 286, 289—292, 296, 300, 301, 302, 303, 306, 307, 309, 311. See also Europe, NATO
Aluminum Co. of America, 376
Ammunition ship (AE), 92
Amphibious Assault Ships (LPH), 89, 244, 245
Amphibious Transport Docks (LPD), 89
Anadyne-Kropp, 176
Anderson AFB, Guam, 80
Anti-air missiles, 4, 5, 52, 89, 207, 275, 277, 287. See also NIKE-HERCULES
Anti-Ballistic Missiles (ABM), 15, 18, 38, 110, 129, 163—167, 276, 314. See also Low Altitude Defense System, SAFEGUARD, SENTRY
Anti-satellite missile (ASAT), 218
Anti-ship cruise missile, See HARPOON, TOMAHAWK
Anti-submarine aircraft, 3, 5, 199, 234—240. See also P-3, ORION, S-3 VIKING
Anti-submarine helicopters, 5, 63, 92, 94, 234—240. See also SH-3D, H, SH-60F
Anti-Submarine Rocket (ASROC), 3, 5, 8, 39, 51, 92, 94, 199, 244, 246, 255, 256, 257, 259, 260, 261, 262, 263, 264, 265—268, 271
Anti-Submarine Warfare (ASW), 3, 5, 51, 8, 263, 79, 265, 271
air-delivered weapons, 16, 18, 39, 64, 266
standoff weapons (ASWSOW), 244, 246, 265, 271
S.R.SUBROC 3, 5, 8, 39, 61, 94, 244, 246, 247, 248, 269—270
surface-delivered weapons, 16, 18, 39, 51, 245
Agra Harbor, Guam, 94
ARMADILLO carrier and launcher, 132, 133
Armed Services and Appropriations Committee, Conference Report, 16
Armed Services, 183, 187, 256, 264
Army, 4, 5, 7—9, 34, 35, 38, 47, 53, 54, 55, 58, 57, 60, 72, 73, 78, 200—311
artillery used by, 88, 281
elimination of non-nuclear weapons, 88
National Guard, 46, 262
nuclear weapons: deployed by, 280—311
locations of, 87
training centers, 88
units, 90, 91
warheads, 39
strategic role of, 86 — 89
Technical Proficiency Inspection, 83
Artillery Fired Atomic Projectile (AFAP), 47, 54, 77, 309, 310. See also Nuclear artillery
Asia, SAC bases in, 11, 97
ASROC, See Anti-Submarine Rocket (ASROC).
Assault breaker program, 298 — 299
ASTOR torpedo, 8, 10, 12, 264, 265
Atlantic City AP, NJ, 82, 88
Atlantic Command, 83
Atlantic Fleet Nuclear Weapons Training Group, Norfolk, VA, 93
Atlantic Research Corp., 173, 275
Atlas D, 11, 12 — 102
Atomic Demolition Munitions (ADM), 2, 3, 5, 7, 8, 11, 89, 90, 91, 96, 280, 281, 311
deployed in West Germany, 89
See also Medium Atomic Demolition Munitions, Special Atomic Demolition Munitions
Atomic Energy Commission (AEC), 6, 14
Attack submarines (SSN), 5, 82, 244 — 250, 269. See also HARPOON, SUBmarine ROCKets, TOMAHAWK
AV-8A/B (HARRIER), 90, 91, 199, 202, 203, 206, 208, 211 — 212
AVCO Corp., 113, 124, 161
Avionica, 241
B-1 bomber (A/B), 42, 66, 80, 106, 156 — 161, 172, 174, 175, 194, 198, 199, 200
B-52 bomber (GI H), xiv, 3, 4, 17, 42, 49, 58, 66, 70, 80, 101, 102, 148 — 151, 154 — 157, 162, 174 — 175, 177, 178, 189, 194, 199, 200
B-58 HUSTLER, 10, 156
B-70, 156
B.F. Goodrich Co., 161
Bagotville, Canada, deployment of CF-18, 202, 203, 206, 208, 211 — 212
Canada, 41, 94, 95, 163, 199, 213 — 214, 224
Cannon AFB, NM, 233
Cannon, Lou, 133
Capability Inspection, Air Force, 83
Carl Vinson class aircraft carriers, 251, 252
Cary, John, 100, 112, 115, 119
Cecil Field NAS, 124, 161
Coffin, Thomas B., 70
Command data buffer, 114, 116
Command disable, 30, 49, 54, 65, 72, 77, 160, 162, 200
Closely Spaced Basing: Dense Pack (CSB), 120, 125, 129, 131
Cockburn, Thomas B., 70
Cohen, S.T., 28
Collins, John, 100, 112, 115, 119
Command data buffer, 114, 116
Command disable, 30, 49, 54, 65, 72, 77, 160, 162, 200
Closely Spaced Basing: Dense Pack (CSB), 120, 125, 129, 131
Cockburn, Thomas B., 70
Cohen, S.T., 28
Collins, John, 100, 112, 115, 119
Command data buffer, 114, 116
Command disable, 30, 49, 54, 65, 72, 77, 160, 162, 200
Closely Spaced Basing: Dense Pack (CSB), 120, 125, 129, 131
Cockburn, Thomas B., 70
Cohen, S.T., 28
Collins, John, 100, 112, 115, 119
Command data buffer, 114, 116
Command disable, 30, 49, 54, 65, 72, 77, 160, 162, 200
Closely Spaced Basing: Dense Pack (CSB), 120, 125, 129, 131
Cockburn, Thomas B., 70
Cohen, S.T., 28
Collins, John, 100, 112, 115, 119
Command data buffer, 114, 116
Command disable, 30, 49, 54, 65, 72, 77, 160, 162, 200
Closely Spaced Basing: Dense Pack (CSB), 120, 125, 129, 131
Cockburn, Thomas B., 70
Cohen, S.T., 28
Collins, John, 100, 112, 115, 119
Command data buffer, 114, 116
Command disable, 30, 49, 54, 65, 72, 77, 160, 162, 200
Index

Commission on Strategic Forces (Scowcroft Commission), 120, 129, 132, 133
Comox, Canada, deployment of CF-101B, 214
Computer Development Corp., 165
Concord Weapons Station, CA, 82, 93
Condec Corp., 304
Congress: funding for warheads, 16
Consolidated Control Corp., 176
Consolidated Guidance, stockpile recommendations, 83
Continuous Patrol Aircraft (CPA), 129, 130-131
Contractors: See individual contractor names under warhead and delivery system fact sheets
Conventional standoff weapon, 290
CORPORAL, 7, 11
Corps Support Command, 88
Corps Support Weapon System (CSWS), 16, 18, 280, 298-299
Counter SUWACS, 183, 185
Critical mass, 24 — 25. See also Fission
Cruise Missile Carrier Aircraft (CMCA), 156, 157
Cruise missiles, xiv, 2, 9, 16, 172 — 195, 256, 276. See also Advanced Cruise Missile, Air-Launched Cruise Missile, Ground-Launched Cruise Missile, Sea-Launched Cruise Missile, TOMAHAWK
Cruisers (CG: CCN), 51, 92, 93, 94, 244, 245, 255, 256, 257-260, 267, 275, 276
Crane Co., 181
"Custodial units" in allied countries, 36, 94
Cutler Hammer, 161
Cyclotol, 41, 42, 45, 59
Damascus, AK, silo accident, 112
Davis-Monthan AFB, AZ, 82, 87, 112
Davy Crockett, 8, 10, 12, 33, 36, 60
Defense Advanced Research Projects Agency (DARPA): See Department of Defense (DOD)
Defensive forces. See Anti-Ballistic Missiles, Ballistic Missile Defense, Strategic Defense System
Deep Basing (DB), alternative for MX, 129, 130
DEA, Inc., 176
Delco Electronics, 111, 154, 194, 220
Denmark, 46, 222
Department of Defense (DOD), 6, 14, 15, 17, 89, 110, 193, 231, 244, 245, 296
Defense Advanced Research Projects Agency (DARPA), 29, 191 — 192
Directed Energy Program, 29
Joint Cruise Missile Project Office, 172
and nuclear weapons stockpile, 38
statements on nuclear weapons, 13, 272
stockpile memorandum, 83
Department of Energy (DOE), 14, 15, 17, 245
PANTEX plant, Amarillo, TX, 85, 87, 93
relationship to DOD, 14
report on POSEIDON warheads, 70
responsibility for nuclear weapons, 14
Depth charges, xiv, 2, 8, 61, 63 — 64, 246
Derivative Fighter Aircraft, 19, 219, 222
Desired Ground Zoros (DGZ), 112
Destroyer Tender (AD), 92
Destroyers (DD: DDG), 51, 92, 244, 245, 267
Detriot Diesel, 209, 234, 302-306
Deuteron: 22, 23, 26, 27, 35
DeWitt, Hugh E., 29
DING DONG, 169
Division Support Weapon System, 301
Dock Landing Ships (LSD), 89
Dolan, Philip J., xiv, 22, 25
Drell, Sidney D., 147
D-T boosted fission, 27, 56, 65, 68, 69, 72. See also deuterium, tritium
D-T reaction, 22, 23, 27. See also deuterium, tritium
Duff, Robert T., 32
Dyess AFB, TX, 82, 86, 150
Dynamics Research Corp., 124
Eagle Picher Industries, 176
Earle Weapons Station, NJ, 82
Earth Penetration Warhead (EPW), 292, 231
Economics Technology Association, 124
Eglin AFB, FL, 218
Eielson AFB, AK, 82
Eilers, D., 32
Eisenhower, Dwight D., and ballistic missile development, 12
El Toro MCAS, CA, 206, 208, 212, 224
Electric Boat, 104
Electrical safety on warheads, 30 — 31
Electromagnetic pulse (EMP), 29
Electronics Space Systems Corp., 165
Ellington AFB, TX, 82, 88
Ellsworth AFB, SD, 80, 87, 114, 170
Elmendorf AFB, AK, 62, 88, 216, 218
Emergency Rocket Communications System (ERCS), 115
Emerson Electric, 282
Eniwetok Atoll, 28, 27, 34
Enhanced radiation weapons (ER), 14 — 15, 28 — 29, 306
warheads for, 19, 55, 72, 73, 278, 300
yield of, 28 — 29
Environmental Sensing Device (ESD), 30
Etrich Western, 124
Europe, 43, 45, 50, 64, 84
and SAC bases, 11
See also Allied countries, NATO
Explosive Technology, 176
Extended Range Bomb (ERB), 202
F-4 (PHANTOM II), 4, 5, 18, 41, 42, 49, 66, 86, 90, 92, 94, 163, 168, 199, 200, 202, 203, 215 — 216, 219, 221, 222, 225, 231, 251, 252, 253
F-14, 202, 203, 216, 251, 252
F-15 (EAGLE), 4, 5, 18, 19, 41, 66, 157, 163, 168, 199, 202, 203, 217 — 219, 222, 231
Nuclear Weapons Databook, Volume I 333
Index

F-15E. 203, 204, 219
F-16 (FIGHTING FALCON), 5, 18, 19, 49, 66, 85, 86, 94, 157, 199, 200, 202, 203, 204, 220—222, 229, 231
F-16A. 204, 220
F-16E. 203, 204, 220, 222
F-18 A-18 (HORNET), 5, 18, 90, 92, 94, 163, 199, 202, 203, 204, 210, 214, 223—225, 252
F-89J. 168
F-100 (SUPERSABRE), 5, 42, 94, 199, 202, 226-227
F-101. 41, 86, 213-214
F-102. 231
F-104 (STARFIGHTER), 5, 42, 94, 199, 202, 228-229, 242
F-106 (DELTADART), 4, 18, 41, 86, 163, 168, 199, 202, 216, 219, 222, 230-231
F-111. 5, 19, 49, 66, 86, 156, 199, 200, 202, 203, 219, 222, 232-233
FB-111. 4, 17, 49, 66, 67, 71, 80, 85, 101, 102, 103, 106, 152-153, 154, 155, 156, 194, 199, 200
F.E. Warren AFB, WY, 82, 87, 118, 129
Fairchild Corp., 222
Fairchild AFB, WA, 82, 86, 176
FALCON missile. 8, 12, 60
Farm Machinery Corp., 284
FAT MAN. 6, 10, 11, 13, 25, 26, 32, 47
Federation of European Nations: See West Germany
Ferrulmatics Inc., 78
FH-701 SP-70 artillery gun, 301
Fiat. 241
First strike capabilities, xiv
Fissile materials. 14, 23, 25, 30, 32, 49, 62, 85, 86, 89, 91, 71, 72, 74, 75, 77, 80, 85, 101, 102, 103, 106, 152-153, 154, 155, 156, 194, 199, 200
availability of. 6, 13
core, 24-27
for MX missile, 125, 127
Fission, nuclear. 22-26
Fissionable material. 23-24
Fission warheads. 41, 45, 47, 51, 52, 54, 56, 60, 61, 72, 74, 77
Fleet attack SSN. 248
Florennes, Belgium, 180
Force loadings. 4
Ford, Gerald, 77
Ford Motor Co., 289
Fort Bliss, TX, 288
Fort Sill, OK. 285, 290, 294
Fractional crit, 25
Free flight rocket. 4
Fresno Air Terminal, CA. 82, 88
Freights (FF). 51, 244, 245, 246, 255, 256, 263, 266, 267
Fuels, thermonuclear, 22-29
Fuji National, 124
Fusion weapons. 6, 22, 24, 26-35, 42, 49, 58, 59, 62. See also Thermonuclear weapons
G & H Technology, 176
Gadget nuclear explosive device. 31, 32
Gaeta, Naples, Italy, 94
Garrett Corp., 161, 197
Garwin, Richard, 28, 147
Geilenkirchen, Tevren, West Germany, 290
Gelb, Leslie, 133
General Motors. 302
General Precision, 154
GENIE. 5, 7, 18, 39, 41, 86, 188-190, 199, 213, 216, 218, 230, 231
George AFB, CA, 82
Getler, Michael, 68, 80, 141
Ghedi-Torre, Italy, 229
Glassstone, Samuel, xiv, 22, 25
Goodyear Aerospace Corp., 181
285, 286, 287, 288
Goodyear Tire & Rubber Co., 181
Gould, Inc., 271
Grand Falls Intl. Airport, MT, 82
Grand Forks AFB, ND. 76, 82, 86, 118, 164, 167, 176
Gray, Colin S., 112, 137
Great Falls IAF, MT, 86
Greece. 39, 46, 47, 54, 86, 78, 94, 95, 96, 199, 210, 216, 228, 280, 281, 282, 283, 286, 288, 301, 309
Greenham Common, UK, 180
Greenwood, Ted, 22
Griffiss AFB, NY, 86, 88, 176
Griffiths, David R., 153
Ground-Launched Cruise Missiles (GLCM). 9, 15, 16, 18, 80, 72, 73, 179—181, 183, 189, 202, 295
Groton, CT, submarine base, 94, 134, 138, 269
Groves, Major General Leslie, 31
Grumman Aerospace, 207, 208
HARPOON cruise missile, 19, 173, 174, 188—190, 203, 235, 236, 244, 247, 249, 250, 255—258, 260—267
Harris Corp., 161
Harry Diamond Lab, 78
HAWK missile. 19, 95
Hector Field Air National Guard Base, ND. 82, 88
Helicopter Anti-Submarine Squadron (HS), 92
Helicopter Combat Support Squadron (HC), 92
Helicopter Mine Countermeasures Squadron (HM), 92
Henningsson, Durham and Richardson, 124
Hercules, Inc., 113, 124, 136, 141, 191, 282, 287
Hi Shear Corp., 176
Hickman AFB, HI, 82
HIGH CARD, 169
334 Nuclear Weapons Databook, Volume I
Index

Malik, John, 32
Malinstrom AFB, MT, 82, 87, 114, 118
M.A.N. Corp., 173
Maneuvering Reentry Vehicle (MaRV), 16, 18, 108—110, 145. See also Missile reentry vehicle
March AFB, CA, 82, 86
Marconi-Elliot Corp., 220
Mare Island Naval Shipyard, CA, 134
Martin Corp., 2—9, 36, 39, 42, 49, 53, 54, 60, 63, 66, 78, 88—92, 103, 205, 207, 211, 215, 223, 244, 260, 261, 300, 301, 302, 304, 306, 308, 309, 311
Air stations:

MCAS Cherry Point, NC, 206, 208, 212
MCAS El Toro, CA, 206, 208, 212, 224
MCAS Iwakuni, Japan, 206, 208

nuclear capable aircraft, 90, 205, 207, 211, 215, 223

Mk-1, 107
Mk-1A, 115
Mk-2, 107
Mk-3 (MIRV), 68, 103—105, 107, 134, 137
Mk-4 (MIRV), 3, 74, 103, 107, 134, 139
Mk-5, 18, 105, 107
Mk-6, 3, 59, 102, 107, 111
Mk-11, 62, 107, 114, 115
Mk-11C, 3, 62, 107, 113, 115, 156
Mk-12, 3, 39, 60, 102, 107, 116—119
Mk-17, 107
Mk-18, 107
Mk-19, 107
Mk-20, 107
Mk-21, (ABRV), 18, 76, 102, 103, 105, 108, 109, 121, 125, 126, 127, 133, 145
Mk-80, 108
Mk-81, 108
Mk-500 EVADER, 108, 109, 110, 142, 143
Mk-600, 105, 108, 110
Multiple Reentry Vehicle (MRV), on submarines, 103—105

Mediterranean. US aircraft in, 208, 210, 251

Medium Atomic Demolition Munition (MADM), 5, 8, 39, 52—53, 91, 95, 96, 281, 311
Medium Range Ballistic Missile (MRBM), 292
Megatonnage in current nuclear stockpile, 5
Menasco, Inc., 161
Mercury, NV, 123
Messerschmitt, 241
Microcom Corp., 176
Mike device, 26, 34
Miller, Judith, 29
Minot AFB, ND, 76, 82, 86, 87, 88, 118
MINUTEMAN I missile, 8, 11, 102, 115, 118, 130
MINUTEMAN II missile, 3, 4, 6, 8, 9, 52, 83, 85, 86, 87, 101, 102, 103, 109, 113—115, 118—121
MINUTEMAN III missile, 3, 4, 6, 9, 15, 17, 34, 38, 39, 62, 75, 83, 85, 86, 87, 101, 102, 103, 110, 113—115, 118—121
MIDGETMAN. See Small ICBM
Missile launchers, shipboard, 205

Missile reentry vehicles (RV), 102, 106—110. See also Advanced Ballistic Reentry System (ABRES), Advanced Ballistic Reentry Vehicle (ABRV)

Development and chronology, 108
Maneuvering Reentry Vehicle (MaRV), 16, 18, 108—110, 145
Mk-1, 107
Mk-1A, 115
Mk-2, 107
Mk-3 (MIRV), 68, 103—105, 107, 134, 137
Mk-4 (MIRV), 3, 74, 103, 107, 134, 139
Mk-5, 18, 105, 107
Mk-6, 3, 59, 102, 107, 111
Mk-11, 62, 107, 114, 115
Mk-11C, 3, 62, 107, 113, 115, 156
Mk-12, 3, 39, 60, 102, 107, 116—119
Mk-17, 107
Mk-18, 107
Mk-19, 107
Mk-20, 107
Mk-21. (ABRV), 18, 76, 102, 103, 105, 108, 109, 121, 125, 126, 127, 133, 145
Mk-80, 108
Mk-81, 108
Mk-500 EVADER, 108, 109, 110, 142, 143
Mk-600, 105, 108, 110
Multiple Reentry Vehicle (MRV), on submarines, 103—105

Precision Guided Reentry Vehicle (PGRV), 106—110
MIT Labs, 136, 142, 165

Lincoln Laboratory, 165

Mood, AFB, GA, 216
Motorola Corp., 78, 275
Mountain Home AFB, ID, 233

Multiple Independently Targeted Reentry Vehicle (MIRV), 68, 69, 70, 74, 100, 107, 116, 121, 136, 137, 139, 142
Multiple Launch Rocket System (MLRS), 298
Multiple Protective Shelter (MPS), 128, 130, 147

Multiple Reentry Vehicle (MRV), 107. See also Missile reentry vehicles

Multipurpose Missile (MPM), 193

MX/PEACEKEEPER missile, 9, 15—19, 38, 102, 103, 107, 108, 109, 120—127, 166, 177

with ABRV, 121, 125, 126, 127

basing, 128—132
costs of, 122
contractors, 128

chronology of development, 125

and Soviet missile silos, xv

stress testing of, 19

validation test of, 123

warhead and RV system, 109, 125—127

Nagasaki, 6, 7, 9, 26, 32, 36

National Atomic Museum, Albuquerque, NM, 41, 43, 48, 50, 51, 64, 67, 69

National Guard, 46, 86, 230. See also Air National Guard, Army

National Guard

Naval Air Development Center, Warminster, PA., 271

Naval Air Stations (NAS):
- Alameda, CA, 82, 94
- Atsugi, Japan, 210
- Barbers Point, HI, 82, 235
- Brunswick, ME, 235
- Cecil Field, FL, 82, 210, 235, 237
- Jacksonville, FL, 82, 235, 238, 240
- Lemoore, CA, 82, 210, 224
- Miramar NAS, CA, 235
- Moffett Field, CA, 82, 235
- North Island, CA, 82, 235, 237, 238, 240
- Oceana NAS, VA, 82, 208, 216
- Whidbey Island, WA, 82, 208

Naval bases for ships and submarines, 94

Naval Coastal Systems Center, Panama City, FL, 271

Naval Detachment, Army Ammunition Plant, McAlister, OK, 93

Naval Ocean Surveillance Center, San Diego, CA, 271

Naval Ordnance Laboratory, White Oak, MD, 269

Naval Ordnance Station, Indianhead, MD, 93

Naval Surface Weapons Center, Silver Spring, MD, 173, 271

Naval Underwater Systems Center, Newport, RI, 271

Naval Weapons Stations:
- Charleston, SC, 82, 93, 94, 135
- China Lake, CA, 271
- Concord, CA, 82, 93
- Pearl Harbor HI, 93, 94, 269
- Seal Beach, CA, 82, 93
- Yorktown, VA, 82, 93

Navy, 5, 7-9, 12, 19, 33, 49, 51, 53, 54, 63, 66, 69, 74, 80, 82, 83, 91, 94, 107, 163, 172, 206, 207, 209, 210, 215, 216, 223, 224, 234, 235, 236, 238, 239, 244 – 278

Navy Laboratories. See footnote 10, p. 271

Nellis AFB, NV, 82, 85

Neptune anti-submarine aircraft, 10, 94

Netherlands, 45, 47, 54, 63, 73, 78, 84, 85, 180, 190, 218, 222, 229, 234, 235, 280, 281, 287, 300, 301, 303, 307

Neutron bomb. See Enhanced Radiation weapons

Nevada Test Site, 29, 300

New bombers, 156 – 162

Newport Naval Base, RI, 94

Newport News, VA, 334

Newport News Shipbuilding Co., 253

New Strategic Air-Launched Missile Warhead, 16, 18, 183. See also Lethal Neutralization System

Neyman, M.B., 22

Niagara Falls IAP, NY, 68

NIKE-HERCULES surface-to-air missile, 4, 19, 89, 90, 95

Nitze, Paul, 70, 112, 115, 119, 137, 143

Norfolk Naval Base, VA, 82, 94

North America SAC bases in, 11

North American Aerospace Defense Command (NORAD), 94

North American Corp., 226

Northrop, 124, 223

Nuclear, 5, 7-9, 12, 19, 33, 49, 51, 53, 54, 63, 66, 69, 74, 80, 82, 83, 91, 94, 107, 163, 172, 206, 207, 209, 210, 215, 216, 223, 224, 234, 235, 236, 238, 239, 244 – 278

Nuclear certified unit, 82

Nuclear consent switch, 198

Nuclear Cratering Explosives (NCE), 311

Nuclear land mines. See Atomic Demolition Munitions

Nuclear Powered Ballistic Missile Submarine (SSBN), 103 – 105, 134 – 135, 138 – 141, 147. See also POLARIS, POSEIDON, TRIDENT


Nuclear weapons: aircraft and bombs, 198 – 242

allocation by service branch, 39, 83

average age of warheads in stockpile, 12, 40

development of, 3 – 20

estimated production through 1995, 16

inactive, 10 – 11

safety and control features of, 30 – 31

seven phases of, 14, 17

variable yield, 31, 38. See also selectable yield

See also Warheads

Nuclear weapons:
- aircraft and bombs, 198 – 242
- Army, 7-9, 88 – 91, 280 – 311
- accidents, 12 – 13
- cruise missiles, 172 – 195
- defined, 22
- delivery systems, inactive, 10 – 11
- design, 27 – 28

Navy, 92, 244 – 278

research and miniaturization trends, 14

safety considerations in design, 12, 30 – 31

by service branch, 82 – 97

stockpile, 3, 7 – 15, 38 – 60

Netherlands, 45, 47, 54, 63, 73, 78, 84, 85, 180, 190, 218, 222, 229, 234, 235, 280, 281, 287, 300, 301, 303, 307
Index

- strategic: 2, 14, 109-169
- tactical: 3, 5, 19-20
- technicians: cost of training: 84
- theater: 2-3
- Nuclear Weapons Acceptance Inspection (NWAI): 83
- Nuclear Weapons Deployment Plan: 83
- Nuclear Weapons Development Guidance: 83
- Nuclear Weapons Stockpile Memorandum: 83
- Nuclear Weapons Support Command: 86
- Numax Electronics: 304

- Ohio NAS, VA: 82
- Ogden ALC, Hill AFB, UT: 85
- Oliver Hazard Perry class frigates: 255, 263, 267
- One point safe: 65, 67, 77, 200, 201
- Operation Ivy: 26
- Oppenheimer, Robert: 32
- Oregon Metallurgical: 289
- Oralloy: 34, 41, 45, 49, 58, 59, 65, 77, 79, 126, 182, 200, 277, 297
- Orndoff, John D.: 25
- Osan AB, South Korea: 216
- Outer Air Battle missile: 193
- P-3 ORION: 5, 63, 92, 188, 199, 234-235
- Pacific Fleet Nuclear Weapons Training Group, North Island, CA: 93
- Pacific Car and Foundry: 306
- Pacific region: 83, 84
- Pearl Harbor Naval Base, HI: 82, 93, 94, 269
- Peacekeeper: 255, 299
- Per Udsen Co., Denmark: 222
- Pensioner: 161
- Pittsburg Plate & Glass Inc.: 161
- Plattsburgh AFB, NY: 82, 86, 153
- Portsmouth Naval Shipyard, NH: 134
- Portugal: 210
- Poseidon C3 missile system: 3, 4, 8, 17, 69-70, 93, 102-105, 134, 136, 137
- Poseidon submarines: 17, 69-70, 74, 83-85, 103-105, 134-135, 137
- Post boost vehicle: 120
- Precision Guided Reentry Vehicle (PGRV): 108
- Programs of Cooperation (POC): 94, 326
- Pyrotec Devices: 176
- Quick Reaction Alert (QRA): 180, 181, 233, 290, 292, 326
- Radar Area Correlation Guidance (RAG): 292, 294, 295, 326
- Radiation, used in thermonuclear weapon design: 37
- Ralph M. Parsons Co.: 124
- Randaon AB, West Germany: 216
- Rapid Deployment Force: 83
- Rayfins, George W.: 22
- Raytheon Co.: 136, 142
- RCA, Princeton Lab: 136
- Reagan Administration: 2, 59, 62, 103, 105, 134, 136, 137
- 164, 175, 177, 186, 246, 251, 256, 306, 310
- President's Commission on Strategic Forces: 129, 132, 133
- Redstone missile: 8, 12, 200
- Reentry vehicles: See Missile reentry vehicles
- REGUS cruise missile: 7, 10-12, 172
- Replenishment Oiler: 92
- Rimini AB, Italy: 229
- Robins AFB, GA: 82, 86
- Rock Island Arsenal, IL: 304
- Rocketdyne Division: 113, 158, 162, 165, 198
- Autonetics Division: 116, 136, 154
- Rocketydyne Division: 124, 284
- Rolls Royce: 210, 211, 241
- Rosemont Corp.: 176
- Rosenberg, David A.: 15, 32
- Rosenkrantz, Robert B.: 48
- Ruina, Jack: 22
S-3 VIKING. 5, 63, 92, 94, 199, 236—237, 244, 251, 253
SABCA Corp.: Belgium. 222
Sadilenko, K.M.: 22
SALT (Strategic Arms Limitation Talks). 109, 143
SAFEGUARD ABM system. 36, 103—105
San Antonio ALC: Kelly AFB, TX, 85
San Diego Naval Base, CA. 82, 94, 269
Sandia National Laboratories, 78, 202
Sandia Corporation: 31, 124, 201
Savannah River reactor, 5, 11
SCAD program. 175
Schlesinger, James: 125
Science Applications: 124
Scoville, Herbert, Jr.: 28, 29
Sea-based missile systems. 103—105. See also Submarine Launched Ballistic Missile (SLBM) POSEIDON, TRIDENT
SEAHAWK. See SH-60 (SEAHAWK)
Sea-Launched Cruise Missiles (SLCM), 9, 16, 18—20, 100, 172—173, 184—187, 244—264. See also HARPOON, TOMAHAWK
Seal Beach Weapons Station, CA, 82, 93
Selden, Robert W.: 22
Selectable yield: 31, 77, 79, 297
Selridge ANGB, MI: 82, 88
Senate Appropriations Committee. 13, 15, 16, 326
Seneca Army Depot. NY, 78, 82, 87
SENTRY: 15—16, 164—167
Serber, R.: 22
SERGEANT missile: 8, 11, 12, 19, 297
Service Life Extension Program (SLEP): 251
Seymour Johnson AFB, NC: 82, 86, 216
Shallow Burst Munition: 311
Shallow Underwater Missile system (SUM): 128, 147, 174
Shaw AFB, SC: 221
Shepherd AFB, TX: 85
Sherwin, Martin: 31
Shot George: 27
SICBM. See Small ICBM
Sierra Army Depot, CA: 82, 87
Sierracin Corp.: 161
Solomon, Norman: 70
South Korea: 6, 47, 50, 53—60, 68, 73, 94—95, 97, 280, 282, 283, 302, 305, 307, 308, 309—311
Soviet Union: 2, 11, 34, 193, 222
Spangdahlem AB: West Germany: 218
SPARTAN missile: 9, 11, 163—164
Special Atomic Demolition Munitions (SADM): 3, 5, 8, 33, 34, 60, 81, 281, 311, 326. See also W54
Sperry Corp.: 101
Sperry Rand: 269
Sperry Systems: 136
Sperry Vickers Co.: 161
Spruance class destroyers, 185, 186, 256, 257, 268
SRAM. See Short Range Attack Missile (SRAM)
SSBN-X program: 147
Stainless Steel Products Co.: 161
STANDARD 1, 272
STANDARD 2, 9, 189, 244, 248, 255, 256, 257, 259, 261, 262, 272—278
STANDARD ER: 244, 245, 260, 262, 265, 272, 276
STANDARD MR: 244, 258, 260, 261, 263, 272, 276
“Stealth.” See Advanced Tactical Bomber (ATB)
Sterrer Engineering and Manufacturing Co.: 161
Stewart-Warner Electronics Division: 154
Strol-X: 104
Strategic ALCM Launcher (SAL): 156
Strategic Air Command (SAC): 11, 83, 85, 105, 125, 150, 152, 153, 160, 172, 214
Strategic bomber forces, 105—106. See also B-52, FB-111, B-1 bomber basing locations: 86
Strategic Defense System: 163—169. See also Anti-Ballistic Missiles, Ballistic Missile Defense
Strategic interception forces, basing of: 88
"Strategic Missile Systems 2000." 100
Strategic nuclear forces: 100—105
Strategic Reserve Force: 100—173
Strategic weapons development, 16—19
STRIKE EAGLE: 203, 204, 210
Sturgeon class submarines, 186, 247, 271
Subic Bay Naval Base, Philippines: 94
Subcritical mass: 24—26
Submarine Launched Ballistic Missile (SLBM): 2, 100, 101, 103—105, 144, 266. See also POSEIDON, TRIDENT
Submarine rocket (SUBROC): 3, 5, 8, 81, 92, 94, 244, 246, 247, 249, 268—270, 326
ANALOG fire control system: 270
Submarine tender (AS): 92
Subsonic Cruise Armed Decoy (SCAD): 172, 175
Sunstrand Aviation Corp.: 161
Sunstrand Data Control: 161
Subsurface Delivered ASW Standoff Weapons: 16
Super oralloy bomb: 34
Supercritical mass: 24—26
Surface-to-air missiles (SAM): 5, 52, 69, 273, 275, 277, 287, 326.
See also NIKE-HERCULES, PATRIOT, STANDARD, TERRIER
Surface-to-surface missiles (SSM): 4, 5, 45, 60, 72, 75, 170, 273, 275, 282, 284, 289. See also HONEST JOHN, LANCE, PERSHING
Ground-Launched Cruise Missile (GLCM)
System Development Corp.: 185
System Operational Range: 178
Systems Science and Software: 124
Index

Sylvania Electric Products Co., 136
Systron-Donner Corp., 284

T-38, 299
T-39, 299
T-22, 299
Tactical Air Command (TAC), 86, 214
Tactical Air to Surface Munition (TASM), 18, 202
Tactical Fighter Derivative program, 203
Tactical nuclear weapons:
  definition, 3
  weapons development, 19–20
Taegu AB, South Korea, 216
Taiwan, 46
TALOS surface-to-air missiles, 10, 20, 272
Tamper, 25, 26, 28
Tank Landing Ship (LST), 89
TARTAR surface-to-air missile, 272, 275–277
TASC, 124
Taylor, John W.R., 169
Taylor, Michael J.H., 125
Taylor, Theodore, 34
Teal Dawn, 191, 192
Teledyne, 188
Teledyne Brown Engineering, 165, 166
Teledyne Ryan, 148
Teller, Edward, 22, 27, 29
Terminal Guided and Extended Range missile (TIGER) I & II, 202
Terrain Contour Matching (TERCOM), 179, 184, 186
TERRIER missile, 3, 4, 5, 8, 12, 52–53, 92, 94, 189, 244, 246, 251, 252
255, 264, 265, 267–272—275, 277
Texas Instruments, 188
Theater warheads:
  definition, 2
  weapons development, 19–20
Thermonuclear weapons, 6, 9, 11, 26–28. See also Nuclear weapons; fusion weapons
Thiokol Chemical, 113, 116, 124, 142, 154, 168, 268, 282, 287
Third generation weapons, 29
THOR, 8, 12
Thule, Greenland; nuclear accident in, 12
Ticonderoga class cruisers, 188, 244, 246, 255, 256, 257—260
Tinker AFB, OK, 82, 85
TITAN missile, 64, 66, 112
TITAN I, 8, 11, 12, 102, 107
TITAN II, 3, 4, 12, 34, 58, 59, 83, 86, 87, 100, 101, 102, 103, 207, 111–112, 120
  locations, 112
  MK-6 reentry vehicle, 100
  replacement of, 103
TOMAHAWK (SLCM), 79, 80, 172, 178, 181, 183—187, 189, 191, 244—247, 249, 256, 255, 256, 258, 260, 261, 262, 264, 265–266, 270. See also Sea-Launched Cruise Missile
TORNADO, 5, 19, 94, 169, 202, 229, 241—242
Torrejon AB, Spain, 216
TRESTLE EMP simulator, 29

"Triad." 100, 101, 125
TRIDENT:
  TRIDENT I C4 missile, 3, 4, 9, 16, 17, 18, 74, 92, 102, 103, 104, 105, 107, 110, 113, 134, 137, 138—139, 141, 142—143, 144—146, 147, 169
  TRIDENT II D5 missile, 18, 19, 18, 69—70, 74, 76, 100, 103, 104, 105, 106, 109, 126, 128, 138, 139, 144—146
  TRIDENT submarine, 17, 74, 93, 103, 104, 105, 138—140, 145, 146
  See also Ohio class submarine
TRIDENT Submarine Base, 82
Trinity test, 7, 24, 28, 31
Tritium (T), 14, 22, 28, 31, 42, 48, 49, 56, 65, 66, 72, 74, 77, 79, 98, 99, 202
TRW, Inc., 116, 124, 161, 165, 166
Tsipis, Kosta, 80, 178
Turbo-Union, 241
Turkey, 39, 45, 46, 47, 54, 57, 78, 94, 95, 216, 226, 280, 281, 282, 283, 300, 301, 306
Tyndall AFB, FL, 82

Ultra Systems Inc., 124
Underground testing of nuclear weapons, 14
Undersea Long Range Missile System (ULRS), 103, 104
Unidynamic, 173, 176
United Aircraft Products, Inc., 161
United Kingdom, 47, 54, 66, 68, 73, 78, 84, 95, 104, 145, 180, 241, 280, 281, 285, 300, 301, 307
US weapon locations in:
  RAF Greenhams Common, 180
  RAF Lakenheath, 233
  RAF Moleysworth, 180
  RAF Upper Heyford, 233
United Nations; report on nuclear weapons, 51
United States Air Forces Europe (USAFE), 86
United States:
  naval bases, 94, 135, 139
  missile locations in, 74, 76, 82, 112, 114, 118
  SAC bomber bases, 71, 81, 82, 86, 154
  Strategic Interceptor Force bases, 38
  warheads located in: 47, 50, 53, 54, 55, 58, 59, 60, 61, 62, 64, 66, 68, 69, 73, 74, 76
United Technologies, 176, 194, 230
Universal Match Corp., 154
University of Houston, 124
Uranium (U), 22—28, 32, 38. See also Orilloy
USS Adams, 255, 262, 266
USS Agerholm, 264
USS Alabama, 149
USS America, 252
USS Ashitabula, 92
USS Bainbridge, 255, 260
USS Beaufort, 255, 260
USS Ben Franklin, 103, 134, 137
USS Bonhomme Richard, 238, 262, 263, 266
USS Brooks, 255, 262, 263, 267, 268
USS Burke, 186, 246, 255, 256, 261—262
USS California, 185, 255, 260
USS Carl Vinson, 251, 252
USS Constellation, 252

340 Nuclear Weapons Databook, Volume I
Vertical Launch ASROC (VLA): 240, 255, 256, 261, 262, 263, 266, 267, 268
Very High Speed Integrated Circuits (VHSIC), 203
Vickers Aerospace Co., 161
Virginia class cruisers, 183, 186, 206, 276
Vitro Labs, 136, 173
Volkel AB, Netherlands, 229
Vought Corp., 161, 192, 200, 208, 299
Wagner, Richard, 29, 41, 43
Waltke Weapons Storage, 17, 82
WALLEYE missile, 202
Warheads: See also Nuclear warheads
Warheads, active:
W23, 3, 4, 7, 12, 18, 36, 39, 41, 83, 85, 95, 100, 106, 202, 218, 283
W32, 3, 4, 5, 7, 10, 11, 31, 36, 39, 42, 44, 83, 85, 95, 105, 149, 153, 159, 181, 189, 200, 206, 210, 216, 227, 229, 242, 253
W31, 3, 4, 5, 7, 12, 13, 16, 36, 39, 45, 46, 83, 84, 95, 280, 282, 287
W30, 3, 4, 5, 7, 12, 13, 16, 26, 36, 39, 47, 48, 55, 78, 83, 96, 95, 281, 300, 306
B43, 3, 4, 5, 8, 39, 43, 49, 50, 63, 85, 86, 90, 92, 93, 94, 95, 149, 153, 196, 199, 200, 206, 208, 210, 216, 221, 227, 229, 233, 242, 244, 251, 267, 271
W44, 3, 4, 5, 8, 19, 36, 39, 51, 83, 94, 94, 244, 267, 271
W45, 3, 5, 6, 10, 19, 20, 36, 39, 52, 53, 83, 94, 95, 244, 272, 273
W48, 3, 5, 6, 12, 19, 36, 39, 54, 55, 83, 90, 95, 261, 300, 303, 305, 308, 309, 310
W50, 3, 4, 5, 8, 12, 39, 56, 57, 83, 94, 95, 289
B53, 3, 4, 5, 13, 36, 39, 43, 56, 83, 85, 90, 199, 200
W53, 3, 4, 5, 8, 36, 39, 59, 83, 105, 107, 111, 149
W54, 3, 4, 5, 10, 12, 33, 34, 36, 38, 39, 60, 63, 86
W59, 2, 3, 4, 5, 8, 99, 61, 244, 299, 271
W60, 3, 4, 8, 99, 62, 83, 102, 107, 113
B57, 3, 4, 5, 8, 19, 36, 39, 63, 64, 83, 86, 95, 92, 93, 94, 95, 105, 149, 198, 199, 205, 206, 208, 210, 216, 221, 224, 227, 233, 235, 237, 238, 240, 242, 244, 241, 253, 255, 269, 271
B61, 3, 4, 5, 6, 16, 31, 38, 39, 63, 67, 83, 85, 86, 90, 91, 94, 95, 105, 149, 159, 163, 168, 198, 202, 205, 206, 210, 212, 221, 224, 229, 233, 242, 244, 251, 253, 278, 297, 311
W62, 3, 4, 8, 99, 68, 71, 83, 100, 102, 107, 116, 118
W68, 3, 4, 6, 39, 68, 70, 71, 83, 103, 107, 124, 137, 154
W69, 3, 4, 9, 39, 71, 83, 86, 149, 154, 159
W70, 3, 4, 5, 9, 13, 39, 59, 72, 73, 83, 94, 95, 280, 284, 287
W76, 3, 4, 9, 15, 16, 17, 36, 39, 74, 83, 103, 107, 144, 142
W78, 3, 4, 9, 15, 36, 39, 68, 75, 78, 83, 102, 107, 111, 116, 118, 122, 124, 125, 126, 127, 133, 145
W79, 3, 4, 9, 15, 16, 19, 38, 39, 48, 77, 78, 83, 86, 281, 300, 306
W80, 3, 4, 16, 17, 18, 19, 20, 36, 39, 39, 79, 80, 83, 100, 149, 150, 159, 172, 175, 185, 191, 194, 244, 297
Warheads, retired: 7, 11, 32, 35, 38, 47, 107, 39, 90, 206, 210, 281, 308
B83, 9, 15, 16, 18, 19, 38, 43, 49, 58, 149, 153, 159, 169—202, 216, 233
Index

W84. 9. 16. 18. 19. 36, 38. 80, 172. 179. 182—183
W85. 9. 16. 18. 36, 38. 39, 133, 294, 297
W87. 9, 15, 16. 18. 36, 38. 39, 103, 105, 109, 120, 121, 122, 126—127. 133
Watervliet Arsenal. NY. 304
Weak link: strong link. 30. 80. 200
Weinberg. A.M.: 22
Wellman Dynamics Corp. 176
West German Air Force. 280, 289. 290, 291
West Germany. 47. 53—54, 56—57. 60, 63, 66, 78, 88, 89, 94, 95, 100, 229, 241, 280, 281, 285, 287—292, 294—297, 300—302
American bases in:
Biburg AB. 218
Buchel AB. 229
Hahn AB. 231
Memmingen AB. 229
Neckars Ulm. 290
Neu Ulm. 290
Norvenich AB. 229
Ramstein AB. 216
Schwabisch Gmuend AB. 290
Spangdahlem AB. 216
Tuescheim. 180
Western Electric Corp. 136. 287
Westinghouse Electric Corp. 124, 136. 149, 161, 173, 220
West Lock Weapons Storage. HI. 82
Whiteman AFB. MO. 82, 114, 115
Wilson. E.P. 22
Williams International. 173, 176, 181
Wilson. George. 178, 276
Woensdrecht, Netherlands. 180
Woensdrecht. FRG. 180
Wurtsmith AFB. MI. 82. 176
X-ray laser. 29
Yield-to-weight ratio. 22, 23, 32, 34, 35, 36
York. Herbert. 29, 34
Yorktown Naval Weapons Station. VA. 82, 93