
8

Chapter Eight
Naval Nuclear Weapons

The current program to modernize and expand U.S. Naval forces includes a wide variety of nuclear weapons systems. The build-up, according to the Department of Defense, seeks "increased and more diversified offensive striking power . . . increased attention to air defense . . . [and] improvements in anti-submarine warfare."[1] The plan is to build-up to a "600-ship Navy" concentrating on "deployable battle forces." Numerous new ships will be built, centered around aircraft carrier battle groups, surface groups, and attack submarines. New, more capable anti-air warfare ships, such as the TICONDEROGA (CG-47) class cruiser and BURKE (DDG-51) class destroyers, will be deployed. New nuclear weapons and launching systems, as well as nuclear capable aircraft carrier based forces, form a major part of the program.

As of March 1983, the nuclear armed ships of the U.S. Navy consisted of all 13 aircraft carriers, one battleship, all 28 cruisers, all 71 destroyers, 73 of 96 nuclear attack submarines, and 61 of 87 frigates.[2] Nuclear weapons deployed within the Navy (see Table 8.1) include anti-submarine warfare rockets (both surface (ASROC with W44) and subsurface launched (SUBROC with W55)), anti-air missiles (TERRIER with W45), and bombs and depth charges (B43, B57, and B61) used by a variety of aircraft and helicopters, both carrier and land based (see Chapters Four and Seven).[3]

The various nuclear weapons systems that are under development or are being considered for tactical naval nuclear warfare include:

- A new surface-to-air missile nuclear warhead (W81) for the STANDARD-2 missile, soon to enter production.
- A long-range, land-attack nuclear armed Sea-Launched Cruise Missile (TOMAHAWK with W80-0), about to be deployed.
- A new ASW Standoff Weapon for submarines, under development since 1976.

Table 8.1
Nuclear Capable Ships and Submarines

Ship type	Nuclear Weapon*	Nuclear Weapons Supply and Transportation
Attack submarines	SUBROC, [HARPOON], [TOMAHAWK]	None
Aircraft carriers (A-6, A-7, S-3, SH-3)	B43, B57, B61, TERRIER	Limited supply for Battle Group
Battleships	ASROC, [STANDARD-2], [HARPOON], [TOMAHAWK]	None
Cruisers	ASROC, TERRIER/ [STANDARD-2ER], [HARPOON]	None
Destroyers (SH-3)	ASROC, TERRIER/ [STANDARD-2ER], B57, [TOMAHAWK]	None
Frigates	ASROC, [STANDARD-MR], [HARPOON]	None
Amphibious ships	None	Supply for Marine Corps
Supply ships	None	Resupply for Naval Ships

* Brackets indicate weapon is not yet nuclear armed.

1. DOD, FY 1984 Annual Report, p. 139.
2. Strategic submarines which carry ballistic missiles are part of the strategic force and are described in Chapter Five.
3. HASC, FY 1980 DOE, p. 84.

Table 8.2

U.S. Naval Forces (1983)

	SHIPS			AIRCRAFT		
	Active	Reserved	Nuclear Armed	Active	Reserved	Nuclear Armed
Strategic Ballistic Missile Forces	38	—	—	—	—	—
33 Strategic Submarines	33	—	33	—	—	—
5 Support Ships	5	—	—	—	—	—
Battle Group Forces	124	—	—	1350	152	?
13 Carriers with 14 Air Wings	13	—	13	1350	152	?
28 Cruisers, 74 Destroyers	99	3	102	—	—	—
Attack Submarines/Anti-Submarine Forces	96	—	73	—	—	—
5 Diesel, 91 Nuclear Subs	96	—	73	—	—	—
24 Patrol Squadrons (+13 Reserve)	—	—	—	320	115	435
Amphibious Warfare Forces Lift	59	5	—	—	—	—
3 Marine Divisions (+1 Reserve)	3	1	4	—	—	—
3 Marine Air Wing (+1 Reserve)	3	1	4	1120	215	?
Convoy Escort	87	4	61	—	—	—
87 Frigates with LAMPS (+4 Reserve)	87	4	61	—	—	—
6 Patrol Combatants	6	—	—	—	—	—
Mine Warfare Force						
3 Minesweepers	3	—	—	18	—	—
Logistics/Combat Support	70	—	—	53	—	—
Training/Utility	—	—	—	1370	134	—

Source: SASC, FY 1983 DOD, Part 8, p. 3601, U.S. Navy.

- A new surface and air delivered ASW nuclear warhead for use from surface ships or patrol aircraft, being developed,
- A nuclear Air-to-Air Missile warhead feasibility study by DOD and DOE (for the PHOENIX air-to-air missile), underway since FY 1982,[4]
- A long-range anti-air missile based on the Advanced Strategic Air-Launched Missile (ASALM), being designed for the vertical launching system,
- An Improved Nuclear Torpedo, which has been considered,[5]
- A nuclear armed HARPOON under continuing consideration, as the HARPOON continues widespread deployment,[6] and
- A Naval nuclear projectile for shipboard artillery, which has been considered.[7]

The TOMAHAWK cruise missile represents the most significant increase in nuclear capabilities within tactical naval forces. Although designated a part of the "strategic reserve force" (see Chapter Six), it is also planned as an anti-ship and land attack weapon (in both nuclear and conventional configurations) in support of naval and amphibious operations. The nuclear armed land attack version will be initially deployed in the summer

4. DOD, FY 1983 RDA, p. VII-14; DOD, FY 1984 RDA, p. V-12.
5. SASC, FY 1979 ERDA, p. 30.
6. Development work on a nuclear warhead for HARPOON began in 1975 (see Chapter Six).
7. SASC, FY 1980 DOD, Part 2, p. 833.

of 1984 aboard attack submarines and on the battleship *New Jersey*.

TERRIER armed anti-aircraft cruisers and destroyers will be upgraded starting in 1984 with the nuclear armed STANDARD-2 missile as part of an increase in anti-air capabilities. The TICONDEROGA (CG-47) and BURKE (DDG-51) anti-air oriented ships will be armed with the STANDARD-2. The ASROC and SUBROC weapons will be replaced by two long-range ASW weapons starting in the mid and late 1980s—the Vertical Launch ASROC (VLA) for surface ship launch from the new Vertical Launching System (VLS) and the submarine ASW Standoff Weapon (ASWSOW) to replace the Submarine Rocket (SUBROC) deployed on attack submarines. According to a FY 1984 DOD report, "study continues on other aspects of current naval nuclear capabilites—strike, anti-surface, anti-submarine, and anti-air."[8]

The development of new naval tactical nuclear warheads has been controversial. A number of comprehensive studies of Navy tactical nuclear weapons and the utility of nuclear weapons in a war at sea have been conducted. These reviews originally followed a Presidentially-directed examination of the utility and arms control impact of the new naval nuclear warheads under development in FY 1979.[9] A considerable program developed during the mid-1970s for new naval nuclear weapons. In 1978, Secretary of Defense Brown precluded the Navy from spending any more money on these weapons pending outcome of the studies.[10] During 1978, 1979, and 1980, studies were conducted by the Under Secretary of Defense for Policy and the Center for Naval Analysis (for the Chief of Naval Operations) and came to contradictory conclusions.[11] The final Defense Department determination, completed on 2 January 1981,[12] concluded that developments in naval nuclear weapons should proceed.

The Reagan Naval Program

When the Reagan Administration took office, Naval forces numbered 479 ships, and plans were approved to increase shipbuilding to attain a level of over 614 ships by the 1990s.[13] Minimum force objectives of 15 battle groups, 100 attack submarines, four battleships, 100-110 frigates, and "adequate numbers of AEGIS-capable and AEGIS-interactive battlegroup escorts" were established.[14] By FY 1990, 13 aircraft carriers, 218 surface combatants, and 91 nuclear attack submarines will be in the force. This is an increase of one carrier, 31 surface combatants and four submarines over the FY 1981 inventory.[15]

The current five year shipbuilding plans call for three new aircraft carriers, reactivating four World War II era battleships, continued building of the LOS ANGELES class (SSN-688) attack submarines and conversion to attack configuration of eight old POLARIS submarines, continued construction of the TICONDEROGA (CG-47) class cruisers, and initiation of building a new BURKE (DDG-51) class of destroyers. Offensive striking power will continue to be concentrated in large aircraft carriers with aircraft capable of delivering nuclear bombs and depth charges, and their accompanying ships (carrier battle groups) which carry the entire range of anti-air and anti-submarine weapons. Two aircraft carriers were funded in the FY 1983 budget and the "service life extension program" will continue to upgrade older carriers. The Navy's goal is to increase the number of carrier battle groups to 15, from the current 13.

According to the Navy, "considerable effort to spread our (offensive) capability among a variety of warship platforms" is being made.[16] The reactivation of four IOWA class battleships during the 1980s will be a major addition to offensive naval forces, making it "the most effective offensive surface combatant in any navy today excluding our carriers."[17] Armed with anti-air and anti-submarine nuclear weapons, and both the HARPOON and TOMAHAWK cruise missiles, these ships will form the nucleus of naval task forces, operating independently of aircraft carriers. Installing vertical launch TOMAHAWK in the LOS ANGELES (SSN-688) class attack submarine as well as giving "virtually every surface combatant its own cruise missile capability" will further increase offensive capabilities.[18]

8. DOD, FY 1984 RDA, p. V-12.
9. SASC, FY 1980 DOD, Part 6, p. 2849.
10. SASC, FY 1982 DOD, Part 7, p. 3897.
11. HAC, FY 1980 DOD, Part 2, p. 283; HASC, FY 1981 DOD, Part 4, Book 2, p. 2281.
12. SASC, FY 1982 DOD, Part 7, p. 3897.
13. HASC, FY 1983 DOD, Part 4, p. 33.
14. SASC, FY 1983 DOD, Part 6, p. 3631.
15. Ibid., p. 3632.
16. SASC, FY 1983 DOD, Part 6, p. 3601.
17. HASC, FY 1983 DOD, Part 4, p. 28.
18. Ibid.

Attack Submarines

The Navy attack submarine force (SSNs) numbers 96 submarines (March 1983), and comprises 14 classes (11 nuclear and 3 diesel) built between 1952 and the present. A force total of 100 nuclear attack submarines is planned for the 1980s.[1] There are no additional non-nuclear submarine classes presently planned. Virtually all of the operational (non-training) submarines, except five, are nuclear powered and more than half carry nuclear weapons. Five of the nuclear attack submarine classes are SUBROC capable.[2] Seventy-three are armed with the nuclear SUBROC anti-submarine missile. Even though primarily an ASW weapon, all submarines have 21-inch torpedo tubes capable of accommodating the HARPOON and nuclear armed TOMAHAWK cruise missiles.

The latest model attack submarine class, the LOS ANGELES (SSN-688), continues under construction, with 21 deployed as of March 1983, 39 authorized through FY 1983, and 56 planned in the current shipbuilding (FY 1984-1988) program.[3] Sixteen new submarines of this class are planned under current shipbuilding plans: three in 1984, four in FY 1985 and 1986, and five in FY 1987 and 1988.

The LOS ANGELES class incorporates a larger nuclear propulsion plant than earlier submarines and contains improved sonar, electronics, and quieting equipment. It also includes a more extensive weapons capability than any other submarine, with HARPOON being added and TOMAHAWK planned.[4] Initially, TOMAHAWK will be fired from torpedo tubes, but new construction submarines starting with SSN-719 will incorporate 12 bow mounted tubes for the vertical launching system in the front part of the submarine.[5] The older STURGEON (SSN-637) class submarines will also receive TOMAHAWK, although not the vertical launch system.

The high cost of the LOS ANGELES class attack submarines and numerous contract and production problems has led to various proposals to examine alter-

Table 8.3

Nuclear Capable Attack Submarines[1]

	Class[2]				
	LOS ANGELES (SSN-688)	**LIPSCOMB (SSN-685)**	**NARWHAL (SSN-671)**	**STURGEON (SSN-637)**	**PERMIT[4] (SSN-594)**
NUMBER DEPLOYED:[3]	21[5]	1	1	37	13
NUCLEAR WEAPONS:	SUBROC [HARPOON] [TOMAHAWK]	SUBROC [HARPOON]	SUBROC [HARPOON]	SUBROC [TOMAHAWK]	SUBROC [HARPOON]
TORPEDO TUBES:	4 21-inch	4 21-inch	4 21-inch	4 21-inch	4 21-inch
SPECIFICATIONS:					
Length:	360 ft	365 ft	314 ft	—	—
Displacement:	6000 t [surface] 6900 t [submerged]	5900 t [surface] 8480 t [submerged]	4450 t [surface] 5350 t [submerged]	3640 t [surface] 4650 t [submerged]	3740-3800 t [surface] 4300-4800 t [submerged]
Draught:	32 ft 4 in	—	26 ft	29 ft 6 in	25 ft
Speed:	30+ knots [submerged]	circa 18 knots [surface] circa 25 knots [submerged]	circa 25 knots [surface] circa 30 knots [submerged]	circa 20 knots [surface] circa 30 knots [submerged]	circa 20 knots [surface] circa 30 knots [submerged]
Crew:	127	120	120	121-134	120
IOC:	1976	1974	1969	1967	1962

1. All submarines have 21-inch torpedo tubes capable of firing HARPOON and TOMAHAWK cruise missiles. TOMAHAWK will be deployed with nuclear warheads in mid-1984. HARPOON is still under consideration as a nuclear system [see Chapter Six].
2. TULIBEE, SKIPJACK, and SKATE classes, and converted POLARIS, do not carry nuclear weapons.
3. As of March 1983.
4. Only SSN-688 and before (12 submarines) are SUBROC armed; HAC, FY 1983 DOD, Part 2, p. 166.
5. Lead ship of the class, the *Thresher*, was lost at sea on 10 April 1963.

1. HASC, FY 1983 DOD, Part 4, p. 228.
2. LOS ANGELES, LIPSCOMB, NARWHAL, STURGEON, and PERMIT classes.
3. HASC, FY 1983 DOD, Part 4, p. 229; DOD, FY 1984 Annual Report, p. 149.
4. By March 1981, 20 submarines are converted to carry the HARPOON; HAC, FY 1982 EWDA, Part 2, p. 393.
5. DOD, FY 1984 Annual Report, p. 144.

natives. A smaller and slightly slower, more specialized submarine—designated FA-SSN (fleet attack SSN)—was examined during the Carter Administration, but has received little attention in the Reagan Administration. Instead, a new submarine "to capture the latest advances in technology" is in the preliminary stages of research, with initial construction envisioned for the late 1980s.[4]

4. Ibid., p. 180.

LOS ANGELES Class Submarines (SSN-688)

Figure 8.1 U.S.S. Los Angeles (SSN-688) attack submarine.

DESCRIPTION:	High-speed, nuclear powered, attack submarine.
CONTRACTORS:	Newport News Shipbuilding Newport News, VA Electric Boat Division, General Dynamics Groton, CT
SPECIFICATIONS:	
Length:	360 ft
Displacement:	6000 t (surface); 6900 t (submerged)
Draught:	32 ft 4 in
Propulsion:	water-cooled pressurized (S6G) nuclear reactor; core life of 10-13 years
Speed:	30+ knots (submerged)
Crew:	127 personnel
Armament:	4 21-inch torpedo tubes
NUCLEAR WEAPONS:[1]	SUBROC (W55);[2] HARPOON capable; TOMAHAWK cruise missile from torpedo tubes; will incorporate 12 vertical launching system tubes starting with SSN-719[3]

8

LOS ANGELES Class Submarine

Fire Control:	Mk-113-10, Mk-117; new sonar and fire control system reduces time required to compute passive ranges
DEPLOYMENT:	
Number Deployed:	21 (March 1983); at least 42 anticipated
HISTORY:	
IOC:	1976
FY 1970	first SSN-688 authorized
Nov 1976	SSN-688 delivered to Navy
end 1981	15 SSN-688 class commissioned[4]
COST:	
Program Cost:	$29,375.6 m (Dec 1982)
Unit Cost:	$500-$600 m

FY	Number Procured	Total Appropriation ($ million)
1978 & prior	32	6960.3[5]
1979	1	
1980	2	863.3
1981	2	1139.5
1982	2	1612.7
1983	2	1688.3
1984	3	2174.1
1985	4	3057.2

COMMENTS: SSN-688 class was a follow on to the SSN-637 class. New submarines (SSN-721 hull and later) will incorporate 12 vertical launch system tubes in the existing forward main ballast tank area for TOMAHAWK and other future weapons.[6]

1. The HARPOON designed for use in the SSN-688 has no potential nuclear capability; ACDA, FY 1979 ACIS, p. 168.
2. ACDA, FY 1979 ACIS, p. 164.
3. SSN-719 and thereafter will incorporate VLS; SASC, FY 1980 DOD, Part 2, p. 990; DOD, FY 1984 Annual Report, p. 144.
4. JCS, FY 1982, pp. 89-90.
5. ACDA, FY 1979 ACIS, p. 165.
6. HASC, FY 1982 DOD, Part 3, pp. 174-176.

Aircraft Carriers

U.S. aircraft carriers are the world's largest warships. They serve as floating airfields and contain the most complete array of offensive and defensive weapons. The Navy operates 13 aircraft carriers, four of which are nuclear powered (one carrier is undergoing an extensive modernization and is out of commission). The ships are multi-mission attack platforms from which 80-100 aircraft and helicopters operate. Three also have nuclear capable TERRIER surface-to-air missile systems. At any one time, four carriers are forward deployed: in the Mediterranean Sea, the Far East, and the Indian Ocean. The Reagan Administration's naval program has led to revived support for the nuclear-powered large deck carrier. The nuclear powered carriers have an estimated steaming life of some 13 years and one million miles before refueling. The original nuclear powered carrier, the *Enterprise* (CVN-65), was commissioned in 1961 and has eight nuclear reactors. The three later carriers, *Nimitz* (CVN-68), *Eisenhower* (CVN-69), and *Carl Vinson* (CVN-70), each have two reactors.

A number of the older carriers are slated to undergo a "service life extension program" (SLEP) to add 15 additional years of operation. The *Saratoga* (CV-60) is the first ship to undergo SLEP and will be completed in FY 1983. The second carrier, the *Forrestal* (CV-59), will begin SLEP in FY 1985, and one carrier will enter the SLEP every two years thereafter. Three additional nuclear powered aircraft carriers of the NIMITZ class (CVN-71, CVN-72, and CVN-73) are under construction. The last two were included in the FY 1983 Defense Budget and will be deployed in 1990 and 1992, respectively. Another NIMITZ class ship is planned for the FY 1988 budget. Both the *Midway* (CV-41) and *Coral Sea* (CV-43), carriers which saw service in the Second World War, will probably be retired in 1990. The Navy's goal, with new construction and SLEP and taking retirements into account, is to have 15 carriers by the 1990s.

The typical carrier air wing is composed of 90 aircraft, including A-6 and A-7 attack aircraft, F-4 or F-14 fighter aircraft and interceptors, E-2 early warning aircraft, S-3 anti-submarine patrol aircraft, SH-3 anti-submarine patrol helicopters, and a variety of transport, refueling, and intelligence collection planes (see Chapter Seven for descriptions of nuclear capable aircraft). Naval aircraft—A-6, A-7, and F-4—are currently certified to carry B43, B57, and B61 nuclear bombs. These range in yield from five kilotons to over one megaton. The B57 is also a nuclear depth bomb carried aboard the S-3 and SH-3. No nuclear armed air-to-air or air-to-surface missiles are now deployed, although a nuclear warhead for the

Table 8.4

Nuclear Capable Aircraft Carriers

	Class				
	NIMITZ	**ENTERPRISE**	**KITTY HAWK**	**FORRESTAL**	**MIDWAY**
NUMBER DEPLOYED:	3[1]	1	4	4[2]	2
NUCLEAR WEAPONS:	B43, B57, B61	B43, B57, B61	B43, B57, B61 (TERRIER)	B43, B57, B61	B43, B57, B61
SPECIFICATIONS:					
Length:	1092 ft	1123 ft	1047-1062 ft	1039-1046 ft	979 ft
Displacement (t):					
(standard)	81,600	75,700	61,000	60,000	52,500
(combat load)	93,400	89,600	80,800-82,000	78,000	64,000
Nuclear Reactors:	2 A4W	8 A2W	—	—	—
Speed (knots):	30+	30+	30+	33	33
Crew:	3073-3131	3157	2879-2924	2865-2911	2523-2613
Air Wing Personnel:	2627	2626	2500	2400	1945
IOC:	1975	1961	1981	1955	1945
COST (S million):	—	451.3	263.8 avg.	200.6 avg.	?

1 Three ships of the NIMITZ class (CVN-71, CVN-72, and CVN-73) are also under construction.

2 The *Saratoga* is undergoing service life extension and is out of commission.

Table 8.5

Nuclear Weapons and Systems on Aircraft Carriers

	TERRIER	A-6*	A-7*	S-3**	SH-3**
Carl Vinson		x	x	x	x
Nimitz		x	x	x	x
Dwight D. Eisenhower		x	x	x	x
Enterprise		x	x	x	x
Kitty Hawk	x	x	x	x	x
Constellation	x	x	x	x	x
America	x	x	x	x	x
John F. Kennedy		x	x	x	x
Forrestal[1]		x	x	x	x
Saratoga[2]		x	x	x	x
Ranger		x	x	x	x
Independance		x	x	x	x
Midway		x	x		
Coral Sea		x	x		

* Attack planes carry B43, B57, and B61 nuclear bombs.
** ASW planes (and SH-3 helicopter) carry B57 bomb. New version of S-3 (S-3B) will carry HARPOON.

1. The *Forrestal* will enter service life extension in FY 1985.
2. The *Saratoga* is undergoing service life extension and out of commission until FY 1983.

PHOENIX air-to-air missile, carried aboard F-14 long-range interceptors, is being developed.

Future developments in the weaponry aboard aircraft carriers include the introduction of F-18 aircraft to replace A-7 and F-4 aircraft, adoption of the SH-60B LAMPS helicopter for carrier use (designated SH-60F) to replace the SH-3, and modernization of the S-3 with an S-3B starting in the late 1980s.

NIMITZ Class Aircraft Carriers (CVN-68)

Figure 8.2 U.S.S. *Nimitz* (CVN-68) with F-4 PHANTOM, A-7 CORSAIR, and A-6 INTRUDER nuclear capable aircraft aboard.

DESCRIPTION:	Large deck, nuclear powered, multi-mission Attack Aircraft Carrier.
CONTRACTORS:	Newport News Shipbuilding Company
SPECIFICATIONS:	
Length:	1092 ft
Displacement:	81,600 t (standard); 93,400 t (combat load)
Draught:	37 ft
Propulsion:	2 water-cooled pressurized (A4W) nuclear reactors
Speed:	30+ knots
Crew:	3073-3131 (ship); 2627 (air wing)
NUCLEAR WEAPONS:	B28, B43, B61 nuclear bombs; B57 nuclear depth charges/ bombs
NUCLEAR CAPABLE AIRCRAFT:	A-6, A-7, S-3, SH-3; Marine Corps A-4 and A-6 also periodically operate off aircraft carriers
DEPLOYMENT:	
Number deployed:	3 (1983)
HISTORY:	
IOC:	1975

8

NIMITZ Class Aircraft Carriers

COST:
CVN-71 Program: $2564.4 m (Dec 1982);
CVN-72/73 Programs: $7267.2 m (Dec 1982)

FY	Number Procured	Total Acquisition ($ million)
1982	-	554.5
1983	2	6554.1
1984	1	98.2

Surface Combatant Ships

The wide variety of naval warfare responsibilities requires a mix of surface combatants, designed either for single or multiple tasks such as strike, anti-air, anti-ship, or anti-submarine warfare. Surface combatants are used as part of battle groups supporting aircraft carriers, surface action groups centered around the newly reactivated battleships, amphibious forces, convoys, and underway replenishment groups. There are currently four different types of surface combatants: battleships, cruisers, destroyers, and frigates. Battleships are the largest surface warships except for aircraft carriers and provide offensive strike with a wide variety of missile systems and guns. They can also operate in offensive support of amphibious operations. Cruisers and destroyers take part in all naval operations and can team together to form surface action groups or operate independently. These ships are designed to operate in a "high threat" environment with a wide array of both offensive and self-defense weapons, command and control facilites, engineering redundancy, and endurance. Frigates, the smallest of the surface combatants and less capable and more costly than cruisers or destroyers, are designed as open ocean escorts for anti-submarine warfare.

Two nuclear weapon systems are currently deployed with surface combatant ships: the anti-submarine warfare ASROC missile and the TERRIER surface-to-air missile. Both weapons are being upgraded with new nuclear armed replacements. The ASROC will be replaced with the vertical launch ASROC (VLA) for deployment on those ships which will incorporate the vertical launching system. The TERRIER will be replaced by the STANDARD-2 nuclear air defense missile, which will supply the current TERRIER armed ships and will arm other destroyers and cruisers.

Table 8.6
Nuclear Capable Surface Ships (1983)

Type / Class	Number of Ships	Nuclear Weapons*
Battleships	1	[HARPOON], [TOMAHAWK]
Cruisers	(28)	
TICONDEROGA	1	ASROC, [HARPOON], [TOMAHAWK], [STANDARD]
VIRGINIA	4	ASROC
CALIFORNIA	2	ASROC
TRUXTON	1	ASROC, TERRIER/[STANDARD-ER]
BELKNAP	1	ASROC, [HARPOON] TERRIER/[STANDARD-ER]
JOSEPHUS DANIELS	6	ASROC, TERRIER/[STANDARD-2ER], [HARPOON]
BAINBRIDGE	1	ASROC, [HARPOON] TERRIER/[STANDARD-ER]
LEAHY	9	ASROC, TERRIER/[STANDARD-ER]
LONG BEACH	1	ASROC, TERRIER/[STANDARD-ER]
Destroyers	(71)	
BURKE (DDG-51)	0	[VL ASROC], [STANDARD-ER], [HARPOON], [TOMAHAWK]
KIDD	4	ASROC, [HARPOON]
FARRAGUT	10	ASROC, TERRIER/[STANDARD-ER]
DECATUR	1	ASROC
CHARLES F. ADAMS	23	ASROC
SPRUANCE	31	ASROC, SH-3 Helicopter (B57)
FORREST SHERMAN	2	ASROC
Frigates	(87)	
OLIVER HAZZARD PERRY	26	[HARPOON]
BROOKE	6	ASROC
KNOX	42	ASROC, [HARPOON]
GARCIA	10	ASROC
GLOVER	1	ASROC
BRONSTEIN	2	ASROC
Patrol Combatants	(6)	
PEGASUS	6	[HARPOON]

* Potential and future nuclear weapons are indicated in brackets.

Two anti-ship and anti-land cruise missiles—HARPOON and TOMAHAWK—are also planned for widespread deployment. Although the HARPOON will be the most widely deployed, plans to arm this short-range cruise missile with a nuclear warhead seem to have been deferred. The dual capable TOMAHAWK cruise missile, which will begin deployment in 1984, is planned for a large number of surface ships.

The present shipbuilding plan (FY 1984-1988) includes 24 new surface combatants and three battleship reactivations. The largest program is for the TICONDEROGA (CG-47) class cruiser, three of which are planned for every year except for 1988 when two are planned. One SPRUANCE (DD-963) class destroyer will be built in FY 1988. A new class of ship, the BURKE (DDG-51) class destroyer, will begin construction in FY 1985. One ship is planned for that year, three in FY 1987, and five in 1988. Nuclear powered cruisers will stabilize at six ships including those already under construction. The requirement exists for 27 TICONDEROGA (CG-47) class cruisers. Other newer destroyers will include four KIDD (DDG-993) class ships originally ordered by Iran, and 37 SPRUANCE (DD-963) class ships. Frigate requirements total 101 ships, although the present five year shipbuilding program does not include any new construction.[1]

Battleship Reactivation

The Reagan Administration has instituted a plan to reactivate four World War II era IOWA class battleships and outfit them with nuclear armed TOMAHAWK and potentially nuclear armed HARPOON cruise missiles, as well as with anti-air and anti-submarine weapons. The four 59,000-ton battleships are the *New Jersey* (BB-62), the *Iowa* (BB-61), *Missouri* (BB-63), and *Wisconsin* (BB-64). All of the ships were commissioned in 1943-1944, and were in combat during World War II and Korea. The *New Jersey* was reactivated in 1968-1969 during the Vietnam War. The reactivation of these ships will mean a significant increase in surface ship strike capabilities. They will operate as the lead ships of surface groups or as part of an amphibious assault operation.

Eventually the nuclear capbility of the heavily armed ships will be improved when three of the nine 16-inch guns and armored boxed launchers on the battleships are removed and the vertical launching system (VLS) is installed (see Vertical Launching System later in this chapter). The VLS will have the capability of firing a variety of nuclear armed missiles, including STANDARD-2, vertical launch ASROC, HARPOON, and TOMAHAWK. Initially, 32-60 missiles will be carried for the VLS, with long term plans to equip firing modules for 320-400 missiles.[2]

The first of the reactivated ships, the *New Jersey*, was commissioned in December 1982. Its first deployment, scheduled for early 1983, will test the HARPOON and TOMAHAWK missiles which are deployed in armored boxed launchers. The *Iowa*, the next ship to be reactivated, was funded in FY 1983, and plans are to fund the third ship, the *Missouri*, in FY 1985, and the fourth ship, the *Wisconsin*, in FY 1986.[3] Battleship reactivation will cost $1876.6 million as of 31 December 1982.

Figure 8.3 U.S.S. *New Jersey* (BB-62) battleship.

1 HAC, FY 1983 DOD, Part 4, p. 122.
2 AW&ST, 2 March 1981, p. 15.
3 DOD, FY 1984 Annual Report, p. 143.

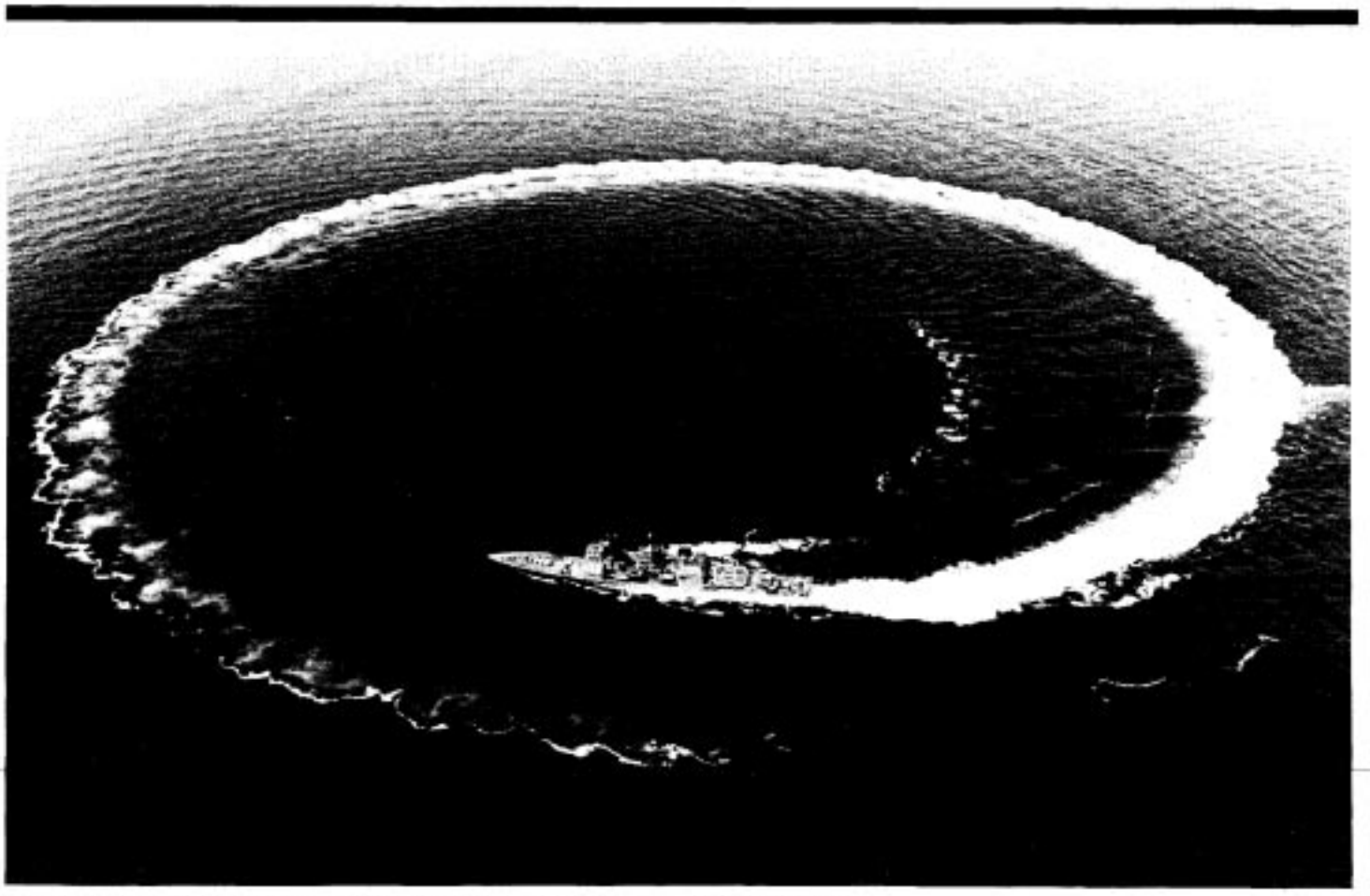


Figure 8.4 U.S.S. *Ticonderoga* (CG-47) on high speed maneuvers during sea trials.

TICONDEROGA Class Cruisers (CG-47)

The TICONDEROGA is a new class of cruiser employing the hull and gas turbine propulsion system of the SPRUANCE (DD-963) class destroyer and the new AEGIS fire control and anti-air defense system. The TICONDEROGA ships will be the most heavily armed cruisers in the Navy. Although their primary mission will be to provide air-defense for carrier task groups, they will also be highly capable of mounting attacks against land, surface ships, and submarines. The TICONDEROGA class will operate with aircraft carrier task/battle groups, amphibious task groups, underway replenishment groups, or convoys.

The primary weapon for the AEGIS system is the nuclear capable STANDARD-2 (SM2) missile system. The ship also carries the nuclear armed ASROC and the potentially nuclear capable HARPOON anti-ship missile. Conventional weapon systems include the PHALANX anti-aircraft gun, two 5-inch deck guns, and depth charges. Two SEAHAWK surveillance and ASW helicopters are also carried.

TICONDEROGA Class Cruisers (CG-47)

Figure 8.5 U.S.S. *Ticonderoga* (CG-47) cruiser.

DESCRIPTION:	Specialized anti-aircraft, but also anti-ship or land attack battle group, guided missile escorts.
CONTRACTORS:	Litton/Ingalls Pascagoula, MS General Electric (propulsion)
SPECIFICATIONS:	
Length:	563 ft 4 in
Displacement:	9100 tons
Draught:	31 ft
Propulsion:	gas turbines
Speed:	30+ knots
Crew:	360
NUCLEAR WEAPONS:	ASROC;[1] HARPOON, TOMAHAWK capable, STANDARD-2MR;[2] 122 missiles in vertical launching system, excluding first five ships of class[3]
Fire Control:	Mk-7 AEGIS; Mk-99 missile directors, Mk-116 ASW
DEPLOYMENT:	
Number Deployed:	1 (1983); 25 by the early 1990s[4]
HISTORY:	
IOC:	Jan 1983

Jan 1980	keel of *Ticonderoga* (CG-47) laid

COST:

Program Cost: $23,033.1 m (Dec 1982)

FY	Number Procured	Total Appropriation ($ million)
1980	1	834.4
1981	2	1941.5
1982	3	2927.7
1983	3	2926.8
1984	3	3707.3

COMMENTS: Later TICONDEROGA class ships (CG-52 on) will have two Ex-41 vertical launch sytems in place of Mk-26 launchers.

1. CG-47/48 will fire ASROC from deck Mk-26 launcher; CG-49 and later ships will fire vertical-launch ASROC (VLA) from Ex-41 vertical launcher.
2. HARPOON is fired from Mk-141 launchers in CG-47/48; STANDARD-MR is fired from Mk-26 Mod 1; all will be converted for firing from Ex-41 vertical launcher in later ships.
3. VLS will be included in all but the first five CG-47 class cruisers; DOD, FY 1984 Annual Report, p. 144.
4. HASC, FY 1983 DOD, Part 4, p. 89.

Table 8.7

Nuclear Capable Cruisers

	Class				
	TICONDEROGA (CG-47)	**VIRGINIA (CGN-38)**	**CALIFORNIA (CGN-36)**	**TRUXTON (CGN-35)**	**LONG BEACH (CGN-9)**
NUMBER DEPLOYED	1	4	2	1	1
NUCLEAR WEAPONS	ASROC [STANDARD-MR] [HARPOON] [TOMAHAWK]	ASROC [STANDARD-MR] [HARPOON] [TOMAHAWK]	ASROC [STANDARD-MR] [HARPOON] [TOMAHAWK]	ASROC TERRIER [STANDARD-2ER] [HARPOON]	ASROC TERRIER [STANDARD-2ER] [HARPOON]
SPECIFICATIONS					
Length:	563 ft 4 in	585 ft	596 ft	564 ft	721 ft
Displacement: [combat]	9100 t	11,000 t	10,150 t	9200 t	17,350 t
Speed:	30+ knots	30+ knots	30+ knots	30+ knots	30+ knots
Crew:	360	519	533	538	983
IOC	1983	1976	1974	1967	1961

	Class			
	BELKNAP (CG-26)	**JOSEPHUS DANIELS (CG-27)**	**BAINBRIDGE (CGN-25)**	**LEAHY (CG-16)**
NUMBER DEPLOYED	1	8	1	9
NUCLEAR WEAPONS	ASROC TERRIER [STANDARD-2ER] [HARPOON]	ASROC TERRIER [STANDARD-2ER] [HARPOON]	ASROC TERRIER [STANDARD-2ER] [HARPOON]	ASROC TERRIER [STANDARD-2ER]
SPECIFICATIONS				
Length:	547 ft	547 ft	565 ft	533 ft
Displacement: [combat]	7930 t	7930 t	8580 t	7800 t
Speed:	33 knots	33 knots	30+ knots	32 knots
Crew:	418	418	circa 480	circa 415
IOC	1964	1965	1962	1962

BURKE Class Destroyers (DDG-51)

DESCRIPTION: Guided missile area anti-air specialized destroyer with anti-submarine, anti-air, and anti-ship missions.

CONTRACTORS: Not yet chosen

SPECIFICATIONS:

Length:	circa 500 ft
Displacement:	8500 t[1]
Draught:	unknown
Propulsion:	gas turbine
Speed:	circa 30 knots
Crew:	304
NUCLEAR WEAPONS:	two vertical launcher systems; VL ASROC, STANDARD-2 (MR), TOMAHAWK,[2] cannister launch HARPOON (eight)
Fire Control:	Mk-99 missile directors

DEPLOYMENT:

Number Planned:	49,[3] 60,[4] 63[5]

HISTORY:

IOC:	1995
FY 1985	construction slated to begin on first DDG-51 ship

COST:

Program Cost:	$10,953.5 m (Dec 1982)
Unit Cost:	$729 m[6]

FY	Number Procured	Total Appropriaton ($ million)
1982	-	52.9
1983	-	138.3
1984	-	210.5
1985	1	1493.5

COMMENTS: BURKE class is planned replacement for a number of destroyers and cruisers scheduled for retirement by 2000; CG-16, CG-26, DDG-2 and DDG-37 classes. Ship will be deployed as part of battle groups, battleship surface action groups, amphibious groups, and underway replenishment groups.[7]

1 HASC, FY 1983 DOD, Part 4, p. 73.
2 SASC, FY 1983 DOD, Part 6, p. 3815.
3 Norman Polmar: Ships and Aircraft of the U.S. Fleet, 12th Ed., op. cit., p. 99.
4 DOD; FY 1984 Annual Report, p. 146.
5 Ibid., p. 122.
6 HASC, FY 1983 DOD, Part 4, p. 151.
7 HASC, FY 1983 DOD, Part 4, p. 122.

8

Nuclear Capable Destroyers

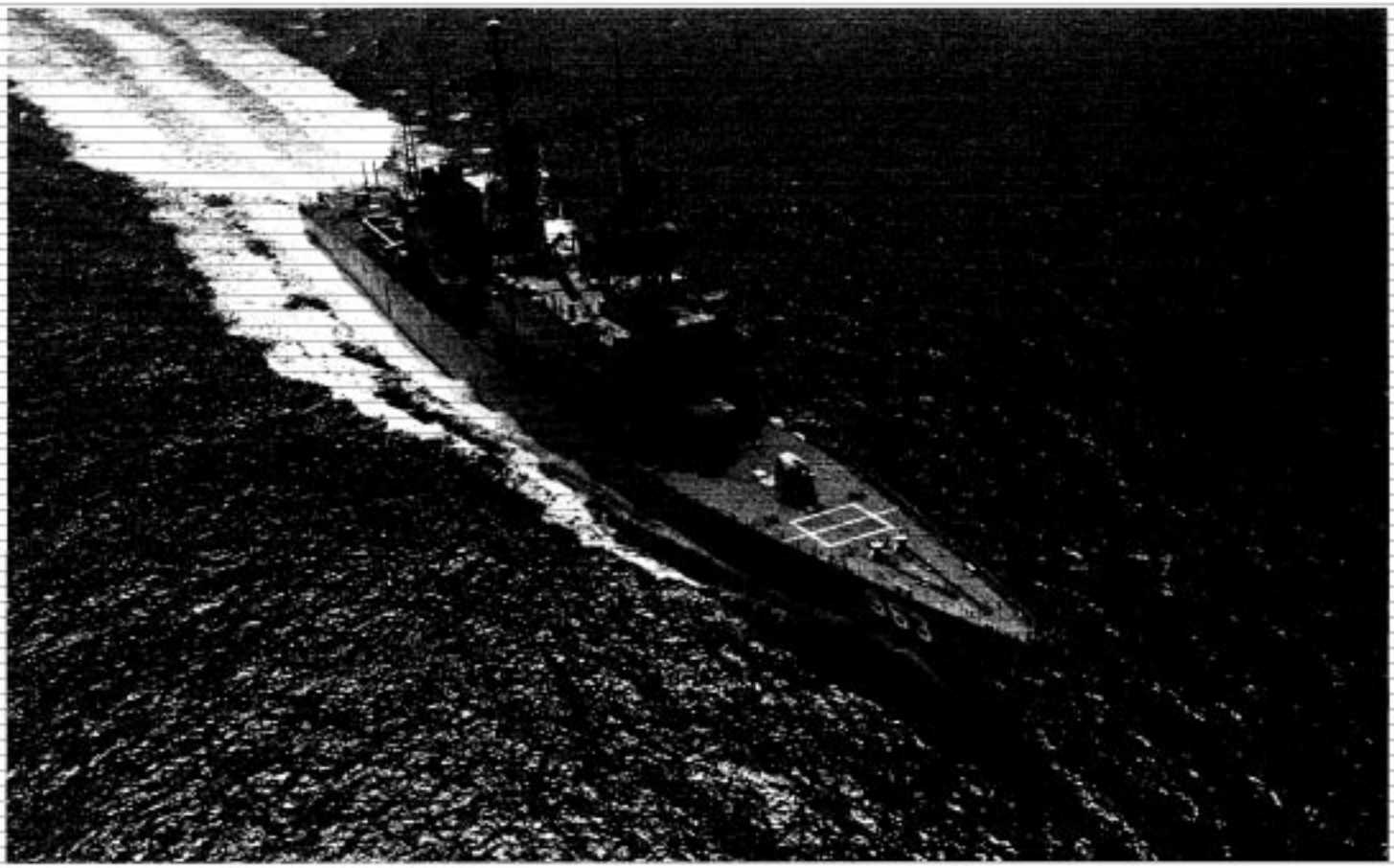


Figure 8.6 U.S.S. *Spruance* (DD-963) destroyer.

Table 8.8
Nuclear Capable Destroyers

	Class						
	BURKE (DDG-51)	**KIDD (DDG-993)**	**FARRAGUT (DDG-37)**	**DECATUR (DDG-31)**	**ADAMS (DDG-2)**	**SPRUANCE (DD-963)**	**FORREST SHERMAN (DD-931)**
NUMBER DEPLOYED:	—	4	10	1	23	31	2
NUCLEAR WEAPONS:	[VL ASROC] [HARPOON] [STANDARD] [TOMAHAWK]	ASROC [HARPOON]	ASROC [HARPOON] [STANDARD-2ER]	ASROC	ASROC [HARPOON]	ASROC [HARPOON]	ASROC
SPECIFICATIONS:							
Length:	circa 500 ft	563 ft	512 ft	407 ft	437 ft	563 ft	418-425 ft
Displacement:	8500 t	8140 t	5800 t	4150 t	3370 t	7800 t	4050 t
Speed:	circa 30 knots	30+ knots	33 knots	32.5 knots	31.5 knots	30+ knots	32.5 knots
Crew:	circa 325	338	399	333-344	333-350	288-302	319-332
IOC:	1995	1981	1960	1967	1960	1975	1955

OLIVER HAZARD PERRY Class Frigates (FFG-7)

DESCRIPTION:	Open ocean escort ships for convoys, naval ships, and amphibious groups.	Fire Control:	Mk-13 weapon direction system, Mk-92 weapon fire control system
CONTRACTORS:	Bath Iron Works Todd Shipyards San Pedro, CA; Seattle, WA	**DEPLOYMENT:** Number Deployed:	26 (1983); 53 planned through FY 1984-1988 shipbuilding plan
SPECIFICATIONS:		**HISTORY:**	
Length:	445 ft	IOC:	1977
Displacement:	3710 t	Jun 1976	keel of *Oliver Hazard Perry* laid
Draught:	24 ft 6 in		
		FY 1984	no new FFG-7 class frigates requested, ending procurement program
Propulsion:	gas turbines		
Speed:	28 knots (sustained)		
		COST:	
Crew:	179	Program Cost:	$9822.3 m (Dec 1982)
NUCLEAR WEAPONS:	HARPOON, STANDARD-MR		

Table 8.9
Nuclear Capable Frigates

	Class					
	OLIVER HAZARD PERRY (FFG-7)	**BROOKE (FFG-1)**	**GLOVER (FF01098)**	**KNOX (FF-1952)**	**GARCIA (FF-1040)**	**BRONSTEIN (FF-1037)**
NUMBER DEPLOYED:	26	6	1	42	10	2
NUCLEAR WEAPONS:	[STANDARD-MR] [HARPOON]	ASROC [STANDARD-MR]	ASROC	ASROC [HARPOON]	ASROC	ASROC
SPECIFICATIONS:						
Length:	445 ft	414 ft	414 ft	438 ft	414 ft	371 ft
Displacement:	3710 t	3245 t	3426 t	4100 t	3400 t	2650 t
Speed:	28 knots	27 knots	27 knots	27+ knots	27 knots	24 knots
Crew:	179	253-256	316	257-266	258-270	209
IOC:	1977	1966	1965	1969	1964	1963

8

Naval Nuclear Missile Systems

Naval Nuclear Missile Systems

The nuclear armed ASROC and TERRIER naval missiles, and potential and future nuclear armed missiles (HARPOON, STANDARD-2, and TOMAHAWK), are fired from a variety of shipboard launchers. These launchers weigh between 9000-500,000 pounds, and carry from four to 60 missiles (see Table 8.10). They are designed as either launcher "boxes" in which a small number of missiles are stored and launched from within the tubes of a self-contained unit, or from either single or twin "rail" launchers in which below deck "magazines" of missiles are fed up to the launcher rails and then fired. Another launcher, called an armored box launcher, is being specially configured for TOMAHAWK Sea-Launched Cruise Missiles.

Vertical Launching System:[1]

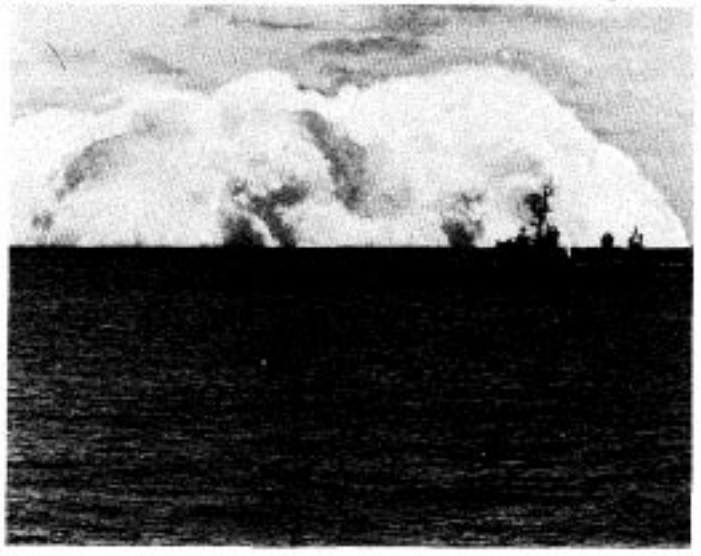
A new modular magazine and launch system designed to carry and launch nuclear capable STANDARD-2, vertical launch ASROC, ASW Standoff Weapon, HARPOON, and TOMAHAWK missiles below deck is being developed by the Navy and Martin Marietta for installation in a wide variety of ships (see Table 8.11). The Vertical Launching System (VLS) Ex-41 design allows for a higher number of missiles to be available for fire than with rail and box launchers; a simultaneous anti-ship, anti-air and anti-submarine capability; increased magazine size; reduced manning; increased rate of fire for surface-to-air missiles; reduced reaction time; improved reliability; and enhanced survivability over the current shipboard launchers.[2]

The VLS can be arranged in basic eight-cell modules with eight modules and 61 missiles comprising a ship's magazine. Seven modules would be for missiles and one would contain a crane module with only five cells, allowing for underway replenishment and reload. The VLS would be built into the ship and be flush with the deck. Each cell would carry and launch one missile. The missile would be shipped and launched from a canister which would fit into the cell. The canister would be reusable. The 61-missile VLS (Ex-41) magazine is designed to fit into the same space as the 44-missile Mk-26 Mod 1 guided missile launching system.

The surface ship VLS launcher required lengthening the launcher by three feet to accommodate TOMAHAWK. VLS would allow for naval missiles of 259 inches long, 22 inches in diameter, and weighing 2500 pounds. Martin Marietta has developed a derivative of the Advanced Strategic Air-Launched Missile (ASALM) with booster and folding fins as an "outer air battle missile" for firing from VLS against enemy jammers and cruise missile aircraft.[3]

Anti-Submarine Nuclear Weapon Systems

Although a nuclear armed torpedo (ASTOR) was once developed as a last ditch defensive weapon for submarines, the short range of torpedos fired in the water meant that the launching submarine might not escape



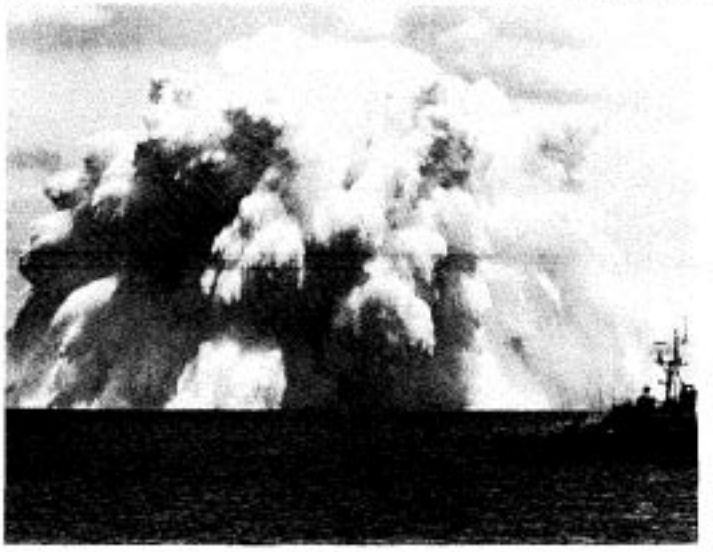


Figure 8.7 Destroyer U.S.S. *Agerholm* (DD-826) after firing a nuclear-armed **ASROC (RUR-5A)** missile during exercise Swordfish on 11 May 1962. The surface effects of the underwater nuclear blast are seen (left), and the peak is seen (right).

1 AWAST, 30 March 1981, p. 24; HASC, FY 1981 DOD, Part 4, Book 2, pp. 1438-1446.
2 DOD, FY 1984 Annual Report, p. 146.
3 Information provided by Martin Marietta.

Table 8.10

Nuclear Capable Shipboard Missile Launchers[1]

Type	Missiles*	Configuration	Ships
Mk-9 Mod 1	60 TERRIER	Twin	CG-6-7
Mk-10 Mod 0	40 TERRIER/[STANDARD-ER]	Twin	DDG-37-46
Mk-10 Mod 1	40 TERRIER/[STANDARD-ER]	Twin	CGN-9
Mk-10 Mod 2	80 TERRIER/[STANDARD-ER]	Twin	CGN-9
Mk-10 Mods 3-4	40 TERRIER/[STANDARD-ER]	Twin	CV-63, -64, -66
Mk-10 Mods 5-6	40 TERRIER/[STANDARD-ER]	Twin	CG-16-24, CGN-25
Mk-10 Mod 7	60 TERRIER/[STANDARD-ER]/ASROC	Twin	CG-26-34, CGN-25
Mk-10 Mod 8	60 TERRIER/[STANDARD-ER]/ASROC	Twin	CGN-35
Mk-11 Mod 0	[42 HARPOON]	Twin	DDG-2-14
Mk-13 Mod 4	[40 HARPOON]	Single	FFG-7
Mk-16 Mods 1-6	8 ASROC[2]	8-Tube	CG, DD, FF
Mk-26 Mod 0	[24] ASROC	Twin	CGN-38-41
Mk-26 Mod 1	[44] ASROC	Twin	CGN-38-41, DDG-47
Mk-26 Mod 2	[84] ASROC	Twin	CGN-42 Class
Mk-112	[HARPOON]		
Mk-140 Mod 0	[4 HARPOON]	4-Tube	PHM-1, 3-6
Mk-141 Mod 0	[4 HARPOON]/[TOMAHAWK]	4-Tube	CG, DD
Ex-41	[TOMAHAWK] [ASW Standoff Weapon] [STANDARD-2]	Vertical Launching System	BB, SSN-719-, CG-52-, DD-963, DDG-51

* Brackets indicate weapon is not yet nuclear capable.
1. *Ships and Aircraft of the U.S. Fleet*, 11th Ed., p. 299.
2. Reloads available in some ships.

the effects of a nearby nuclear explosion. The destructive capability of nuclear weapons meant that a new type of nuclear weapon had to be developed for anti-submarine warfare (ASW). The new weapon, combining the launch characteristics of a torpedo with the free flight performance of a guided missile, resulted in longer range than that of a torpedo, whether fired from a surface ship or underwater from a submarine. SUBROC was the first tactical weapon system to use the new concept of underwater launch followed by rocket motor ignition, guided ballistic out-of-water airborne trajectory, and then water entry and underwater detonation.[1]

Today two nuclear armed ASW rocket are deployed: the SUBROC and the surface ship-launched ASROC. Both weapons are armed with low yield nuclear warheads. While the ASROC is dual capable, the SUBROC is only nuclear armed. A third ASW nuclear weapon, the low yield B57 nuclear depth bomb (see Chapter Three), is carried by the land-based P-3 aircraft and the aircraft carrier-based S-3 and SH-3.

Two new long-range ASW weapons to replace ASROC and SUBROC are being developed. They will enable naval forces to continue to destroy enemy submarines yet remain outside the range of enemy torpedos. The Vertical Launch ASROC (VLA) program was started in FY 1984 to convert the ASROC for launching from the new vertical launching system by 1987 or 1988.[2] VLA will provide an updated anti-submarine warfare rocket for vertical launch capable of faster reaction, greater range, and increased kill probability than the current ASROC. A new submarine ASW Standoff Weapon (ASWSOW) is also being developed to replace SUBROC deployed with attack submarines. The ASWSOW is projected for 1989-1990. Beginning in 1984, the number of SUBROC armed attack submarines will begin to decrease from the present strength of about 64.[3] SUBROC phaseout will take place over an extended period, due to rocket motor burnout and lack of nuclear warheads.[4]

1. Information provided by Goodyear Aerospace and contained in Goodyear *Profile*, Vol. VII, No. 1, 1969; Fall 1981.
2. DOD: FY 1984 Annual Report, p. 158; SASC: FY 1983 DOD, Part 6, p. 4074.
3. SASC, FY 1983 DOD, Part 6, p. 4075.
4. HASC, FY 1983 DOD, Part 4, p. 254.

Table 8.11

Vertical Launching System Platforms

Ship Type	Number of Missiles	Type	Schedule
Battleships	36-60	TOMAHAWK	initial loading
(Reactivated)	320-400	TOMAHAWK	long term loading
		VL ASROC	
		STANDARD-2	
		HARPOON	
Cruisers			
CG-47 class	122	HARPOON	all but first five
	(61 + 61)	STANDARD-2	starting in FY 1988
		TOMAHAWK	
		VL ASROC	
CGN-36/38 class		VL ASROC	
Destroyers			
DDG-51 class	90	TOMAHAWK	FY 1990 IOC
	(61 + 29)	VL ASROC	
DDG-993 class		VL ASROC	
DD-963 class	61	TOMAHAWK	retrofitted in all,
		VL ASROC	starting in 1985
Frigates			
FF-1052 class	VL ASROC		
Submarines			
SSN-688 class	12	TOMAHAWK	retrofit by 1985
		ASW Weapon	
SSN-719 class	12	TOMAHAWK	fitted in SSN-719 and
		ASW Weapon	later, first delivery due in 1985

Two nuclear warhead development programs for anti-submarine warfare are in Phase 2, Feasibility Study, within DOE for FY 1984. The first is a subsurface delivered ASW Standoff Weapon warhead for the ASWSOW, and the second is a surface and air delivered anti-submarine warfare weapon, earmarked as a new common warhead for a B57 replacement and an ASROC replacement.

ASROC (RUR-5A)

Figure 8.8 ASROC (RUR-5A) missile being fired from U.S.S. *Brooke* (DDG-1).

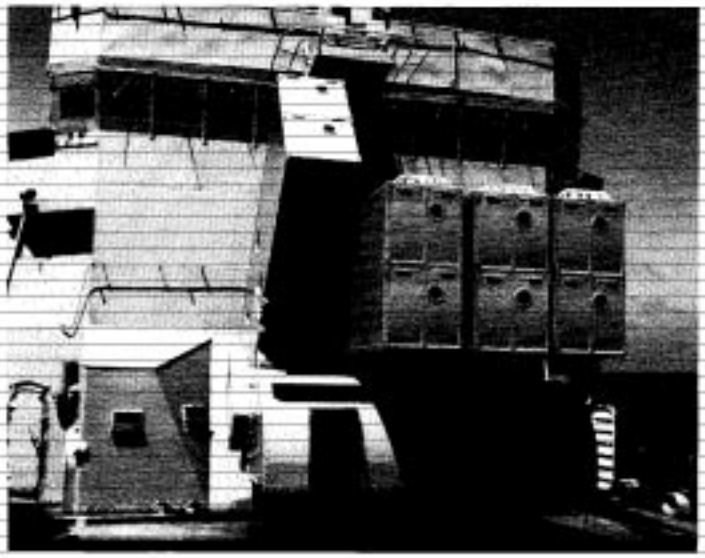


Figure 8.9 Mk-16 eight tube box launcher aboard Naval ship. This launcher is capable of firing the ASROC or HARPOON missiles.

DESCRIPTION:	Widely deployed ship-launched, unguided, range-controlled nuclear capable Anti-Submarine ROCket (ASROC) depth charge.
CONTRACTORS:	Honeywell, Inc. (prime) Naval Weapons Center (nuclear depth charge section)
SPECIFICATIONS:	
Length:	15 ft (180 in)
Diameter:	12 in[1]
Stages:	1
Weight at Launch:	under 1000 lb; 570 lb[2]
Propulsion:	solid propellant rocket motor
Guidance:	unguided in flight, depth charge descends to predetermined depth before detonating
Throwweight/ Payload:	unknown
Range:	1-6 nm[3]
DUAL CAPABLE:	yes
NUCLEAR WARHEADS:	one W44 on Mk-17 nuclear depth charge; 1 Kt range (see W44)
DEPLOYMENT:	
Launch Platform:	Mk-112 and other TERRIER launchers
Number Deployed:	850 nuclear warheads (1983)
Location:	aboard 65 frigates (FF, FFG), 78 destroyers (DD, DDG), and 27 cruisers (CG, CGN);[4] fitted to all Navy major surface ships until the OLIVER HAZARD PERRY class (FFG-7) frigates
HISTORY:	
IOC:	1961
1956	development began
Retirement Plans:	to be replaced with the Vertical Launch ASROC (VLA)

8

ASROC Missile

TARGETING:

Types: primarily submarines, also capable against surface ships and land targets

COST:

FY	Number Procured	Total Appropriation ($ million)
1980	-	11.9
1981	-	5.3
1982	-	3.9[3]

COMMENTS:

Enroute to target, the nuclear armed ASROC sheds its rocket motor at a predetermined signal and a steel band holding the airframe together is severed by a small explosive charge, allowing the depth charge to drop into the water.[5] Vertical Launch ASROC will be procured for CG-47, CGN-36/38, DD-963, DDG-993, DDG-51 and FF-1052 classes.

1 *The World's Missile Systems*, 6th Ed., p. 324.
2 Ibid.
3 Ibid.

4 Norman Polmar, 12th Ed. op. cit.; ASROC is carried on some 61 frigates: 2 BRONSTEIN, 10 GARCIA, 42 KNOX, 1 GLOVER, and 6 BROOKE class; 71 Destroyers: 4 KIDD, 30 FARRAGUT, 1 DECATUR, 23 ADAMS, 31 SPRUANCE, and 2 SHERMAN class; and all 28 cruisers.
5 HASC, FY 1982 DOD, Part 3, p. 321.
6 *Missiles of the World*, p. 15.

SUBROC (UUM-44A)

Figure 8.10 SUBROC (UUM-44A) missile being loaded into attack submarine.

DESCRIPTION: Short-range, inertially guided, SUBmarine launched range-controlled nuclear depth charge anti-submarine ROCket; SUBROC breaks the surface of the water, travels through the air and reenters the water to attack submarines.

CONTRACTORS:
Goodyear Aerospace Corporation
Akron, OH; Litchfield Park, AZ
(prime)
AiResearch
Los Angeles, CA
(auxiliary power)
Singer-Librascope
Glendale, CA
(fire control)
Singer Kearfott
Little Falls, NJ
(guidance)
Thiokol Corp.
Elkton, MD
(propulsion)
Naval Ordnance Laboratory
White Oak, MD
(concept feasibility/technical direction)

SPECIFICATIONS:

Length:	22 ft (264 in)[1]
Diameter:	21 in
Stages:	1
Weight at Launch:	4000 lb[2]
Propulsion:	solid fuel TE-260G boost motor
Speed:	supersonic
Guidance:	inertial guidance on depth charge; depth charge also controlled by small fins;[3] analog fire control system[4]
Range:	25-35 mi[5]
DUAL CAPABLE:	no[6]
NUCLEAR WARHEAD:	one W55; 1-5 Kt range (see W55)

DEPLOYMENT:

Launch Platform:	torpedo tube on 73 of 96 attack submarines (SSN-688, -685, -671, -637 and -594 classes)[7]
Number Deployed:	approximately 400 (1983); 4-6 SUBROC/submarines on patrol
Location:	submarines homeported in Pearl Harbor, HI; Groton, CT; San Diego, CA; Charleston, SC; and Norfolk, VA

8

SUBROC Missile

HISTORY:	
IOC:	1965
1958	Goodyear awarded first development contract for SUBROC
1964-1968	SUBROC produced
1972-1974	production line reopened[8]
1977-1981	224 SUBROC motors refurbished, adding 15 years service life[9]
FY 1982	service life extension of SUBROC proposed[10]
Retirement Plans:	plans are to phase out SUBROC with nuclear armed Subsurface Delivered ASW Standoff Weapon starting in 1989; "must be retired in the nineties,"[11] some earlier phase out will occur in certain submarines as the TOMAHAWK SLCM is deployed;[12] last submarines to phase out SUBROC will be SSN-594 and -637 classes[13]
TARGETING:	
Types:	submarines primary targets; surface ships secondary; can also be used for subsurface-to-surface missions against land[14]
Selection Capability:	fire control system computes course, speed and range to target; missile velocity is determined by distance to target; at proper point, rocket motor separates from depth bomb, which continues toward target aided by aerodynamic fins, inertial guidance and depth fuze[15]
Retargeting:	unknown
Accuracy/CEP:	can destroy enemy submarines if explosion occurs within 3-4 miles
COMMENTS:	SUBROC was first tactical weapon capable of underwater launch, rocket motor ignition, guided airborne trajectory, and underwater detonation. SUBROC warhead, rocket motors, and fire control system require significant rework and upgrade to continue system in service.[16] SUBROC, reported in short supply in the Navy,[17] is beginning phase out in FY 1983[18] and will be phased out over an extended period.[19] SSN-594 and -637 classes will carry SUBROC until retirement, other classes will give up SUBROC with deployment of TOMAHAWK.

1 *The World's Missile Systems*, 6th Ed., p. 330; much longer range than torpedos.
2 *Ibid.*
3 *Ibid.*
4 SUBROC uses an ANALOG fire control system which is incompatible with SSNs-700 and later, equipped with all-digital fire control; HAC, FY 1983 DOD, Part 2, p. 166.
5 *Ibid.*
6 JCS, FY 1981, p. 48.
7 Norman Polmar, 12th Edition, op. cit., p. 18, states 66; SAC, FY 1983 DOD, Part 1, p. 300, states 63 subs are SUBROC capable; analog fire control system is not compatible with the all digital system in the late model 688 class SSNs; HAC, FY 1980 DOD, Part 6, p. 1111; HASC, FY 1982 DOD, Part 3, p. 176; SASC, FY 1983 DOD, Part 6, p. 3710.
8 SASC, FY 1982 DOD, Part 7, p. 3896.
9 HAC, FY 1983 DOD, Part 2, p. 166.
10 HASC, FY 1982 DOD, Part 2, p. 777.
11 SASC, FY 1983 DOD, Part 6, p. 4040.
12 SASC, FY 1983 DOD, Part 6, p. 3674.
13 HASC, FY 1983 DOD, Part 4, p. 254.
14 *Military Applications of Nuclear Technology*, Part 1, p. 22.
15 Goodyear Aerospace, "SUBROC, Flying Torpedo, Stalks Its Prey: From Sea to Shining Sea," Profile, Spring 1969.
16 HAC, FY 1980 DOD, Part 6, p. 1111.
17 HASC, FY 1982 DOD, Part 3, p. 176.
18 SAC, FY 1983 DOD, Part 1, p. 300.
19 SAC, FY 1983 DOD, Part 1, p. 699.

ASW Standoff Weapon

A new Anti-Submarine Warfare Standoff Weapon (ASWSOW) is being developed by the U.S. Navy to "counter the threat posed by hardened, deep-diving Soviet submarines using sophisticated countermeasures."[1] The program, an outgrowth of a FY 1980 Joint DOE/DOD/Navy Tactical Nuclear Anti-Submarine Warfare Phase 1 Study, will incorporate state-of-the-art weapons and guidance possibilities, new concepts of employment, and nuclear safety design. The nuclear warhead was initially designed to emphasize commonality to replace the various warheads (W55, B57, and W44) currently being used aboard ships, submarines, and aircraft for nuclear ASW.[2]

A feasibility study to determine the nuclear warhead for the Common ASW Standoff Weapon for deployment near the end of the decade was initiated by DOD and DOE in FY 1981.[3] The DOE FY 1984 Budget request, however, included a distinct new warhead development program for a new ASW weapon. Called the "subsurface delivered ASW Standoff Weapon" warhead, the nuclear warhead was evidently separated from the ASROC and B57 replacement programs for the ASW standoff weapon when two separate programs were once again established.

The ASW Standoff Weapon program was initiated in FY 1980.[4] In February 1980, Boeing Aerospace Company, Seattle, Washington, won a four-way competition and was awarded a $10 million contract to continue to develop the missile.[5] The amended FY 1982 Reagan defense budget restored full funding to the ASW Standoff Weapon program after it had been cut in half by the Carter Administration.[6] Development funding for FY 1982 was $35.4 million, $20.2 million was planned for FY 1983, and $28.0 was requested for FY 1984.[7] Development cost is estimated as $500-600 million (FY 1980).[8] Life cycle costs for deploying 1000 missiles aboard attack submarines were estimated, before program restructuring to include surface ships, at $2.6 billion. Inclusion of surface ships could increase program costs by $2 billion.[9]

Until October 1981, the standoff weapon was being developed primarily for STURGEON (SSN-637) and LOS ANGELES (SSN-688) class attack submarines. In October 1981, the program was restructured as the Common ASW Standoff Weapon to provide for deployment of a common weapon aboard surface ships as well as submarines. Boeing and Gould, Incorporated were contracted to conduct engineering development.[10]

The FY 1984 Defense budget request contained another change in the ASWSOW program. The weapon was again referred to as a SUBROC replacment, with the introduction of the Vertical Launch ASROC (VLA) as the current ASROC replacement, at least in the short term.

The ASW Standoff Weapon will be a dual capable all-digital, long-range, quick reaction missile.[11] It will have increased range over the SUBROC and will use state-of-the-art targeting capabilities.[12] The standoff weapon is being studied to permit the engagement of enemy submarines at or near maximum range of future sensors, including over-the-horizon.

1 JCS, FY 1981, p. 48.
2 HAC, FY 1980 DOD, Part 6, p. 1112.
3 DOD, FY 1983 RDA, p. VII-14; SASC, FY 1982 DOD, Part 7, p. 3882.
4 SASC, FY 1980 DOD, Part 6, p. 4043.
5 AW&ST, 4 May 1981, p. 19.
6 SAC, FY 1982 DOD, Part 1, p. 486.
7 DOD, FY 1984 Annual Report, p. 153.
8 SASC, FY 1980 DOD, Part 6, p. 2974.
9 GAO, "Improving the Effectiveness and Acquisition Management of Selected Weapon Systems," 14 May 1982, GAO/MASAD-82-34, pp. 52-55.
10 Six Navy laboratories are also involved in Common ASW Standoff Weapon development: Naval Underwater Systems Center, Newport RI; Naval Weapons Center, China Lake, CA; Naval Surface Weapons Center, Silver Spring, MD; Naval Ocean Surveillance Center, San Diego, CA; Naval Air Development Center, Warminster, PA; and Naval Coastal Systems Center, Panama City, FL; SASC, FY 1980 DOD, Part 6, p. 2964.
11 SAC, FY 1983 DOD, Part 1, p. 100.
12 SASC, FY 1980 DOD, Part 6, p. 2967.

8

Anti-Air Weapons Systems

Anti-Air Nuclear Weapon Systems

The Navy currently has one nuclear armed surface-to-air missile deployed: the TERRIER with the W45 warhead. Originally deployed in November 1955 aboard the cruiser *Boston* (CAG-1), TERRIER was developed in numerous modifications. Now obsolescent, it is retained in only the nuclear version. All conventional TERRIERs have been withdrawn.[1] TERRIER is deployed aboard three aircraft carriers and 31 cruisers and destroyers.

The TERRIER (and other naval surface-to-air missiles such as TARTAR and TALOS) has been almost completely replaced by the STANDARD missile, which underwent development in 1968 to standardize TERRIER and TARTAR. Today, four basic versions of the STANDARD missile are deployed: STANDARD-1 medium range (MR), STANDARD-1 extended range (ER), STANDARD-2 medium range (MR), and STANDARD-2 extended range (ER). The STANDARD-2ER, which began deployment in FY 1982, is compatible with the TERRIER fire control system and has been designated as the replacement missile for the remaining TERRIER missiles.

The W81 nuclear warhead for the SM-2 missile has been in development since 1978. According to the FY 1984 *DOD Research Development and Acquisition* Report, "progress continues on the DOD/DOE warhead development program to provide a nuclear option for the STANDARD missile (SM-2). The nuclear option provides a complementary capability to the conventional warhead to defend against the multi-threat array available to the Soviet Union to attack the U.S. fleet, particularly high-speed, air-to-surface missiles launched from the BACKFIRE bomber."[2] The warhead is planned for deployment in 1987. The nuclear version of the SM-2 missile—designated SM-2(N)—will be compatible primarily with the STANDARD/AEGIS and STANDARD/TARTAR systems.[3]

STANDARD missile improvements continue under the SM-2 Block II program completed in 1983. SM-2 Block II is a high-speed, mid-course correction guided missile which "will provide a quantum improvement in capability" over the SM-2 Block I for AEGIS class (CG-47) cruisers and TERRIER for other cruisers and destroyers.[4] A STANDARD-3 has also been examined with "considerable effort" expended during FY 1983 to define its characteristics and technology as the "next generation surface-to-air missile."[5] The cost of a new missile, however, was considered prohibitive, and an evolutionary upgrade of SM-2 Block II—designated SM-2 Block III—was instead proposed. Martin Marietta has also proposed converting the Advanced Strategic Air-Launched Missile (ASALM) as a long-range "outer air battle missile" for use on ships equipped with the vertical launching system.

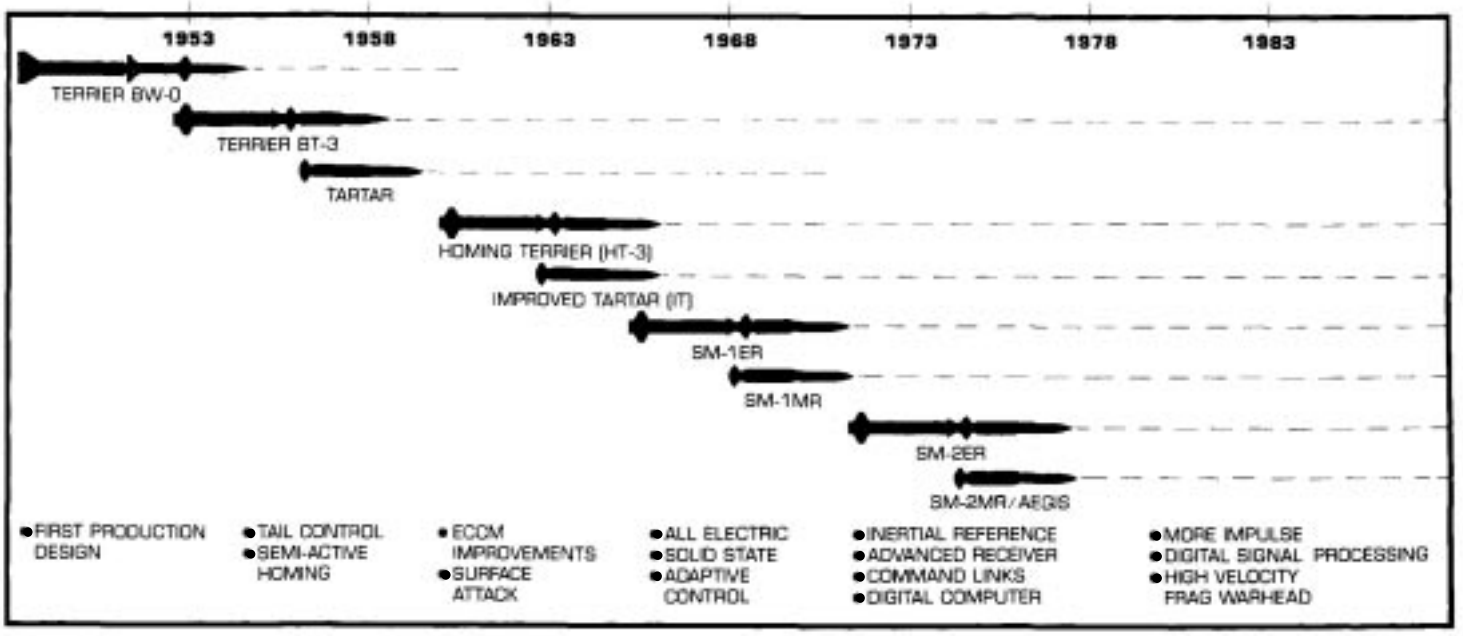


Figure 8.11 Anti-Air Nuclear Weapon Systems.

1 The W45 nuclear warhead, according to one source, was originally deployed to provide "the lethality for achieving the full effectiveness of a surface-to-surface mission." General Dynamics, "Evolution of a Missile Family: 1949-1976," January 1967, p. 6.
2 DOD, FY 1984 RDA, p. V-12.
3 HASC, FY 1983 DOD, Part 3, p. 112.
4 SASC, FY 1983 DOD, Part 6, p. 3805.
5 SASC, FY 1983 DOD, Part 6, pp. 3655, 3708, 3804-3805.

TERRIER (RIM-2)

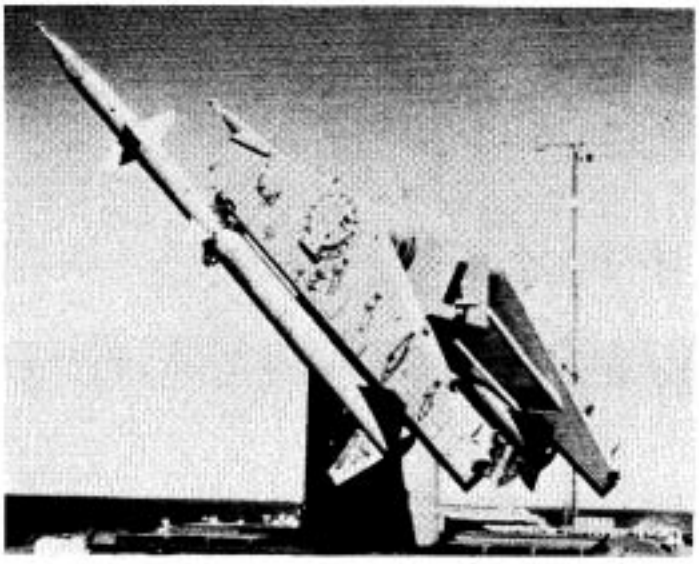


Figure 8.12 TERRIER (RIM-2) missiles on launcher.

DESCRIPTION:	Short-range, surface-to-surface and surface-to-air nuclear missile aboard surface ships and some aircraft carriers in the Navy. The only remaining TERRIER missiles in the inventory are nuclear armed.[1]
CONTRACTORS:	General Dynamics Pomona, CA (prime/guidance) Allegany Ballistics Laboratory (motors) Atlantic Research (booster)
SPECIFICATIONS:[2]	(RIM-2F)
Length:	26.3 ft; (314 in) (with booster)
Diameter:	13.5 in
Stages:	2
Weight at Launch:	3093 lb; 3000 lb[3]
Propulsion:	solid propellant fuel with booster
Speed:	Mach 2.5
Guidance:	target detected and tracked, missile readied and launcher aimed; beam-riding with semi-active terminal radar homing, proximity fuzing
Range:	20 nm+; 21.5 mi[4]
DUAL CAPABLE:	yes[5]
NUCLEAR WARHEADS:	one W45-0; 1 Kt range (see W45)
DEPLOYMENT:	
Launch Platform:	Mk-10 twin rail launchers loaded by automatic magazine; carried aboard 31 cruisers and destroyers, and 3 aircraft carriers.[6]
Number Deployed:	approximately 310 nuclear warheads (1983)
HISTORY:	
IOC:	1956[7]
1951	TERRIER program begins
1958	TERRIER BT-3A(N) version is fielded, first to carry a nuclear warhead[8]
1963	Advanced TERRIER with beam-riding homing guidance deployed
Retirement Plans:	nuclear TERRIER will be replaced by the W81/STANDARD-2, which uses the same launcher.
TARGETING:	
Types:	aircraft, land targets,[9] limited anti cruise missile, and limited anti-ship capability[10]

8

TERRIER Missile

COMMENTS: Currently deployed version is BT-3A(N). TERRIER is the system name also associated with the shipboard fire control sytem which fires long-range STANDARD and TERRIER missiles.

1 HASC, FY 1982 DOD, Part 2, p. 788.
2 The World's Missile Systems, 8th Ed., p. 236.
3 Missiles of the World, p. 5.
4 The World's Missile Systems, op. cit.
5 Only RIM-2D (nuclear version) is retained; see also HASC, FY 1982 DOD, Part 2, p. 788.
6 SASC, FY 1981 DOD, Part 4, p. 2518.
7 The TERRIER version fielded in 1956 was the BT-3 (B-Beam rider, T-Tail Control, 3-Third version), developed for the supersonic threat.
8 BT-3A version added surface-to-surface capability by adding an end-burning sustainer motor which doubled the range of the missile. Nuclear warhead was added "for achieving the full effectiveness of a surface-to-surface mission." General Dynamics, "Evolution of a Missile Family," January 1976, p. 6.
9 ACDA, FY 1980 ACIS, p. 272.
10 HASC, FY 1980 DOE, p. 84; HASC, FY 1981 DOD, Part 4, Book 2, p. 2310.

STANDARD-2 (SM-2) (RIM-67B)[1]

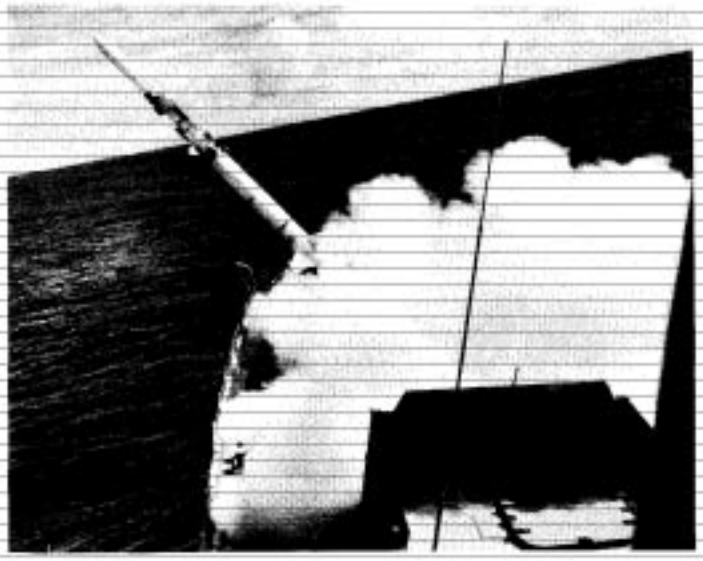


Figure 8.13 STANDARD-2 (RIM-67B) missile being fired from U.S.S. *Wainwright* (CG-28).

DESCRIPTION:	Navy shipboard supersonic surface-to-air and surface-to-surface missile, with four versions, two of which will have a nuclear warhead (and designated SM-2(N)).
CONTRACTORS:	General Dynamics Pomona, CA (prime/guidance) Aerojet & Hercules (propulsion) Atlantic Research (booster) Motorola (fuze)
SPECIFICATIONS[2]:	(SM-2ER only)
Length:	26 ft 7 in (319 in)
Diameter:	1.1 ft (13.5 in)
Stages:	2
Weight at Launch:	2996 lb
Propulsion:	solid propellant rocket motor with booster
Speed:	Mach 2.5
Guidance:	command/inertial; mid-course guidance updates, semi-active radar terminal homing on illuminated target,[3] inertial reference system, ECM
Range:	65 mi
DUAL CAPABLE:	yes[4]
NUCLEAR WARHEADS:	one W81; low Kt (see W81)
DEPLOYMENT:	STANDARD missiles are deployed on cruisers and destroyers equipped with AEGIS, TERRIER, or TARTAR fire control systems.[5] The SM-2ER was the replacement for the nuclear armed TERRIER missile,[6] but the medium-range STANDARD (SM-2MR) has also been designated as nuclear capable.[7]
Launch Platform:	CG-16 and CG-26 class cruisers, CGNs and DDG-37 class ships[8]
Number Planned:	2044 SM-2 planned for procurement[9]
HISTORY:	
IOC:	1968 (SM-1); 1978 (SM-2); 1982 (SM-2ER)
1968	SM-1 program started
Jun 1972	SM-2 missile program development begins
Nov 1972	first flight
1980	full production begins on SM-2ER missile
FY 1981	nuclear SM-2 funded in caretaker status[10]
FY 1982	integration of designed warhead and fuze into SM-2ER[11]

8

STANDARD-2 Missile

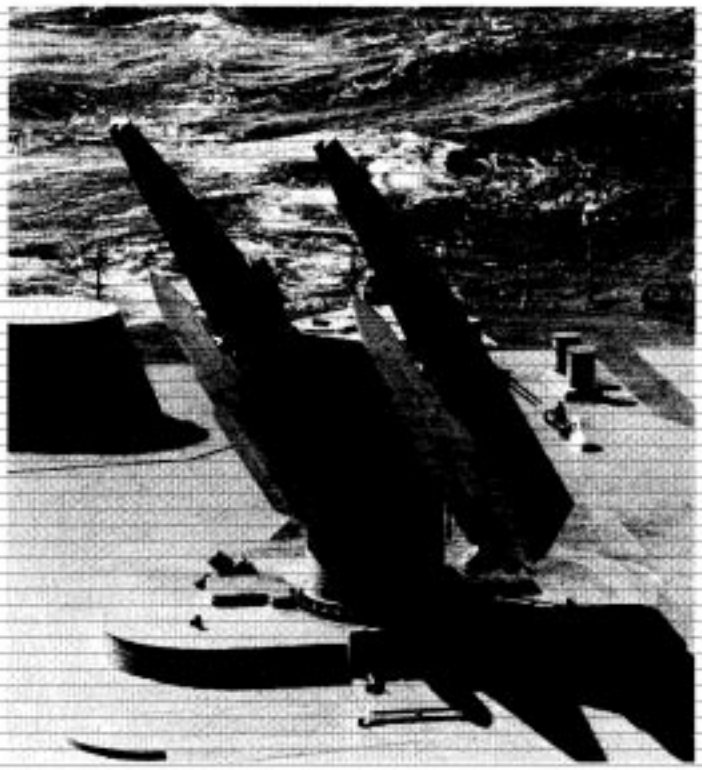


Figure 8.14 STANDARD-2MR missiles on shipboard launcher.

FY 1983	target detecting device, nuclear safety studies, and warfare doctrine funded[12]
FY 1984	flight test of electronic fuzing and arming package of nuclear armed SM-2ER[13]

TARGETING:

Types:	aircraft, nuclear armed anti-ship cruise missiles, surface ships[14]
Selection Capability:	unknown
Retargeting:	unknown
Accuracy/CEP:	unknown

COST:[15]

Unit Cost: $643,000 (flyaway) (FY 1978)

FY	Number Procured	Total Appropriation ($ million)
1979 & prior		462.7
1980	55	50.8
1981	275	144.8
1982	375	222.3
1983	375	302.8
1984	450	347.3

COMMENTS: SM-2N is being proposed by the Navy as an "antiballistic" missile system to protect Navy ships against high-altitude, nuclear armed cruise missiles (e.g., the Soviet AS-4 cruise missile).[16] In FY 1983 Congressional hearings on the defense budget, it was revealed that the nuclear armed SM-2 program was being expanded to include SM-2MR (medium range) as well as ER (extended range) missiles.[17] Due to its small size (half that of current nuclear capable TERRIER), SM-2 can be carried by TARTAR-equipped ships (VIRGINIA class cruisers), giving them a nuclear AAW capability for the first time. This will result in an increase in the number of ships carrying nuclear weapons.[18]

1 The nuclear version of the STANDARD missile is designated SM-2(N).
2 The World's Missile Systems, 6th Ed., p. 228.
3 HASC, FY 1981 DOD, Part 4, Book 2, p. 2315.
4 The nuclear warhead will be "an integral nuclear ordnance section configured for use with both extended-range and medium-range versions of the STANDARD missile, completely alternate and interchangeable with the conventional ordnance section"). HASC, FY 1983 DOD, Part 5, pp. 112-113.
5 ACDA, FY 1981 ACIS, p. 307.
6 AW&ST, 9 March 1981, p. 137.
7 HASC, FY 1980 DOD, Part 3, p. 113.
8 ACDA, FY 1981 ACIS, p. 379.
9 U.S. Missile Data Book, 1980, 4th Ed., p. 2-104.
10 JCS, FY 1981, p. 48.
11 HASC, FY 1982 DOD, Part 2, p. 66.
12 HASC, FY 1983 DOD, Part 3, p. 113.
13 HASC, FY 1982 DOD, Part 2, p. 66.
14 HASC, FY 1980 DOE, p. 141; HASC, FY 1982 DOD, Part 2, p. 66.
15 ACDA, FY 1981 ACIS, p. 384.
16 Wilson, George C., "Floating Antimissile System Sails Smoothly," Washington Post, 8 February 1981, p. A2; also, ACDA, op. cit., p. 382; HASC, FY 1982 DOD, Part 2, p. 66.
17 HASC, FY 1983 DOD, Part 3, p. 113.
18 ACDA, FY 1980 ACIS, p. 189.

W81

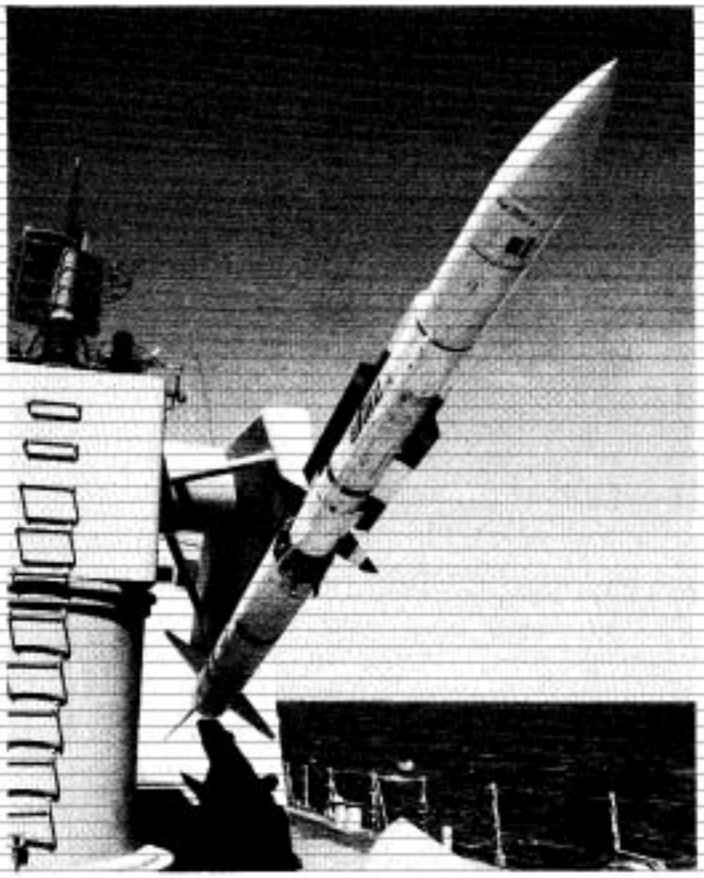


Figure 8.15 STANDARD-2 (RIM-67B) missile on launcher. The W81 warhead will be fitted to the STANDARD missile.

FUNCTION:	Warhead for the STANDARD-2 (SM-2) surface-to-air and surface-to-surface system.
WARHEAD MODIFICATIONS:	none
SPECIFICATIONS:	
Yield:	low Kt fission[1]
Weight:	unknown
Dimensions:	unknown
Materials:	reportedly uses oralloy as fissile material; IHE (PBX-9502)[2]
SAFEGUARDS AND ARMING FEATURES:	CAT F PAL
DEVELOPMENT:	
Laboratory:	LANL[3]
History:	
IOC:	FY 1987[4]
1975 and prior	DOE/DOD Phase 1 and Phase 2 studies completed[5]
1977	Phase 2 engineering development initiated[6]
1978[7]	Lab assignment (Phase 3) (through 1983)
1979-1980	OSD defers development funds for W81[8]
FY 1980	W81 funded in Phase 3 at $2.016 million[9]
FY 1987	initial deployment (Phase 5)
Production Period:	1984[10]
DEPLOYMENT:	
Number Planned:	approximately 350 (1983)[11]
Delivery System:	dual capable STANDARD SM-2 on shipboard launchers and eventually in vertical launching system
Service:	Navy
Allied User:	none
Location:	SM-2 is used on a variety of surface combatants with the TERRIER, TARTAR, and AEGIS air defense systems.

8

W81

COMMENTS:

W81 is modification of the B61 "primary" already in the stockpile and tested.[12] The nuclear warhead section is "completely alternate and interchangeable with the conventional ordnance section."[13] The development funds for SM-2(N) were deferred by OSD in 1979 and 1980. Program funding for 1981 was zero with the program maintained in a caretaker status.[14] The FY 1983 DOE budget request included funds to initiate construction of production facilities for the W81 warhead.[15]

1 An enhanced radiation warhead for the W81 was under consideration but was rejected by the Secretary of Defense in 1978. It was, however, switched back to a fission weapon in 1979 mostly due to availability; the exact yield had still not been determined as of March 1982: HASC, FY 1983 DOD, Part 5, pp. 893-894.
2 HASC, FY 1982 DOE, p. 217; AW&ST, 22 March 1982, p. 19.
3 ACDA, FY 1981 ACIS, p. 380.
4 AW&ST, 6 December 1982, p. 17.
5 HASC, FY 1983 DOD, Part 3, p. 113.
6 Ibid.
7 HASC, FY 1980 DOE, p. 137; SASC, FY 1980 DOE, p. 164.
8 SASC, FY 1980 DOD, Part 6, p. 2350.
9 Ibid.
10 HAC, FY 1982 DOE, EWDA, Part 7, p. 367; SAC, FY 1981 EWDA, p. 818.
11 This number was estimated before the program was expanded beyond the SM-2ER version.
12 ACDA, FY 1980 ACIS, p. 186; HASC, FY 1983 DOD, Part 5, p. 693.
13 HASC, FY 1983 DOD, Part 3, p. 113.
14 HASC, FY 1981 DOD, Part 4, Book 2, p. 2315.
15 DOE Justification, FY 1983, p. 50.