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Nuclear Warships and Naval Nuclear Weapons: A Complete Inventory

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Introduction

The nuclear arms race at sea is longstanding, and accelerating. The United States and the Soviet Union have deployed nuclear weapons at sea for over 25 years, France and the United Kingdom for some 20 years. China's first nuclear weapons on submarines appeared in 1983. All of the nuclear powers have ongoing nuclear research and development programs and are producing new naval nuclear weapons, as well as the ships, aircraft, and missiles that carry or launch nuclear warheads. Until now arms control only has addressed the numbers of "strategic" nuclear weapons at sea: ballistic missile submarines and submarine-launched ballistic missiles. There are no constraints on the thousands of non-strategic naval nuclear weapons.

During the past decade the wide geographic spread of the naval arms race has evoked increasing public interest. A growing number of countries around the world have become involved in the arms race at sea through port calls, joint exercises, maneuvers, and overflights. The routine and widespread presence of nuclear weapons with naval forces has made these operations more and more controversial.

The purpose of this **Neptune Paper** is to provide basic information on the nuclear capabilities of the five nuclear powers. Section I is divided into six parts. The first is an overview of naval nuclear weapons systems. Subsequent parts enumerate the fleet organization, nuclear-capable ships, nuclear-capable aircraft, and the nuclear-related naval shore infrastructure of each country. In Section II, Appendices A - E provide a comprehensive listing of the nuclear-capable and nuclear-powered ships of each of the five nuclear navies. Appendix F gives a brief introduction to ship nomenclature. Appendix G is an alphabetical listing of ships by name (or class where names are not known), with their nuclear capability, and Appendix H is a quick reference glossary of nuclear-capable ships, aircraft and weapon systems.

Approximately 16,000 nuclear weapons are earmarked for use by the U.S., Soviet, U.K., French and Chinese navies, about 30 percent of the world's total nuclear arsenal. The U.S. and Soviet navies are the most heavily "nuclearized" of these nuclear weapons states. Seventy percent of the total U.S. fleet has a nuclear weapons capability, either in a combat or support role, while virtually all of the Soviet Union's principal warships are nuclear-capable. The other three fleets have a much smaller proportion of nuclear-capable ships. Some 32 percent of the United Kingdom's; 12 percent of France's; and two percent of China's major warships and submarines are nuclear-capable.

Naval nuclear weapons vary from non-strategic short-range nuclear torpedoes to strategic intercontinental ballistic missiles. Their explosive power ranges from less than one kiloton (1,000 tons of TNT equivalent) to over 1,000 kilotons. Nuclear weapons can be launched from submarines, surface ships and aircraft. As of the end of 1987, 1,101 ships and submarines, and over 3,250 aircraft, can fire, transport or service one or more of these nuclear weapons.

All five nuclear navies deploy long-range submarine-launched ballistic missiles (SLBMs) on nuclear- or conventionally-powered ballistic missile submarines; SLBMs constitute 59 percent of all sea-based nuclear weapons. Seventeen types of ballistic missile submarines carry 14 different types of missiles, and several more types of submarines and missiles are under development. There are currently 1,792 SLBMs armed with some 9,487 nuclear warheads, making up approximately 40 percent of the world total of land- and sea-based strategic nuclear warheads.

An estimated 6,400 non-strategic nuclear warheads – more than one quarter of the world's total non-strategic nuclear arsenal – are for the use of naval forces. Anti-submarine warfare (ASW) nuclear weapons are the largest category. The U.S., Soviet and U.K. navies stockpile nearly 3,300 nuclear ASW warheads for use on eight different types of weapons (torpedoes, depth bombs, missiles), representing 21 percent of all nuclear warheads with naval roles. Anti-submarine nuclear weapons are deployed on surface ships, submarines, and maritime patrol aircraft and helicopters – 2,044 platforms in total.[1] As of the end of 1987, 411 ships are capable of firing nearly 900 ASW nuclear weapons; 364 submarines can be armed with about 1,000 ASW nuclear weapons and 1,269 land- and sea-based ASW aircraft and helicopters have almost 1,450 nuclear depth bombs at their disposal.

The third largest category of naval nuclear weapons are bombs and air-to-surface missiles delivered by aircraft for attacks on surface ships or shore targets. As of the end of 1987, the five nuclear navies deploy over 1,950 aircraft (bombers, attack planes, fighters) with nearly 2,000 surface and land attack nuclear weapons. This category represents approximately 12 percent of the nuclear warheads with naval roles. Fifteen different types of aircraft with naval missions can deliver at least six types of nuclear bombs and four types of nuclear air-to-surface missiles.

Sea-launched cruise missiles (SLCMs) for attacks on ships or land strikes are the fourth largest category of naval nuclear weapons. The U.S. and Soviet navies currently have about 550 nuclear sea-launched cruise missiles (three percent of total naval nuclear weapons) of seven different types. Nuclear-armed SLCMs currently are deployed on 75 surface ships and 94 submarines (169 total platforms). This number is expected to double in the next ten years as both the U.S. and Soviet Union expand their long-range SLCM capabilities.

The fifth largest category of naval nuclear weapons are surface-to-air missiles (SAMs) deployed on surface ships for anti-air warfare (AAW). The U.S. and Soviet navies stockpile some 550 nuclear AAW warheads (three percent of total naval nuclear weapons) to arm four types of SAMs. Nuclear-armed SAMs are deployed on 95 surface ships.

Finally, the Soviet Union also deploys ten ships with approximately 100 warheads for their nuclear-capable 152mm artillery guns and about 100 warheads for use on shore-based anti-ship missiles.

Naval Nuclear Weapons as of December 1987

	United States	Soviet Union	United Kingdom	France	China	Total
Strategic Missile Warheads	**5,632**	**3,447**	**128**	**256**	**24**	**9,487**
Non-strategic Warheads						
Sea-Launched Cruise missiles	150	398	0	0	0	548
Anti-submarine weapons	1,760	1,401	136	0	0	3,297
Anti-air weapons	285	256	0	0	0	541
Aircraft delivered weapons (not ASW)[2]	1,450	450	62	36[3]	-[4]	1,998
Naval artillery	0	100	0	0	0	100
Coastal missiles	0	100	0	0	0	100
Subtotal	**3,645**	**2,705**	**198**	**36**	**0**	**6,584**
Total	**9,277**	**6,152**	**326**	**292**	**24**	**16,071**

Nuclear-Capable Ships, Submarines and Aircraft as of December 1987

	United States	Soviet Union	United Kingdom	France	China	Total
Submarines						
Ballistic missile	36	77	4	6	2[5]	125
Cruise missile	0	63	0	0	0	63
Attack	69[6]	199	0	0	0	268
Subtotal	**105**	**339**	**4**	**6**	**2**	**456**
Surface Ships						
Aircraft carriers	19[7]	5	3	2	0	29
Battleships	3	0	0	0	0	3
Cruisers	36	39	0	0	0	75
Destroyers	64	69	12	0	0	145
Frigates	65	118	8	0	0	191
Patrol combatants	0	63	0	0	0	63
Support ships	106[8]	29	4	0	0	139
Subtotal	**293**	**323**	**27**	**2**	**0**	**645**
Total ships	**398**	**662**	**31**	**8**	**2**	**1,101**
Aircraft						
Attack aircraft	1,124	555	86	36	150	1,951
Anti-submarine	662	400	185	0	0	1,247
Subtotal	**1,786**	**955**	**271**	**36**	**150**	**3,198**[9]
Grand Total	**2,184**	**1,617**	**302**	**44**	**152**	**4,299**

In addition to the nuclear weapons, approximately 544 nuclear power reactors are located at sea. The Soviet Union uses 342 reactors to run its fleet of nuclear-powered submarines, cruisers and ice-breakers.[10] Most Soviet submarines have two reactors each (a few have just one), and the cruisers and ice-breakers have two each. The United States has 169 nuclear reactors in its nuclear-powered submarines, aircraft carriers, cruisers and a single submersible research vessel. All of the U.S. submarines have one reactor each, while the cruisers have two. Four aircraft carriers have two each and one aircraft carrier has eight reactors. The United Kingdom has one reactor on each of its 19 nuclear-powered submarines. Similarly, France's nine nuclear-powered submarines and China's five nuclear-powered submarines each have one reactor.

Nuclear Reactors on Naval Vessels as of December 1987

Nuclear Powered Ship Types	United States	Soviet Union	United Kingdom	France	China	Total
Ballistic Missile Submarines	36	124	4	6	2	172
Cruise Missile Submarines	0	70	0	0	0	70
Attack Submarines	98	136	15	3	3	255
Aircraft Carriers	16	0	0	0	0	16
Cruisers	18	4	0	0	0	22
Other[11]	1	8	0	0	0	9
Total	**169**	**342**	**19**	**9**	**5**	**544**

I. Naval Nuclear Weapons

Naval nuclear weapons have strategic and non-strategic roles, depending on their range and inclusion in the nuclear powers' operational plans for waging war. Strategic weapons have intercontinental range (thousands of miles) and are part of prepared central nuclear warfighting plans. Virtually all submarine-launched ballistic missiles are considered strategic weapons.[12] Non-strategic nuclear weapons would be used according to the needs of theater commanders in Europe, the Middle East, the Atlantic or Pacific. These weapons generally have a shorter range (less than 1,500 miles) than strategic weapons. Some, such as the Tomahawk land-attack sea-launched cruise missiles, the Soviets Union's SS-N-12 and SS-N-19 sea-launched cruise missiles, aircraft carrier-based nuclear weapons and long-range Soviet Naval Aviation bombers often are referred to as theater weapons. Short-range weapons (tens of miles) used in local defense or strike operations, such as anti-submarine missiles or surface-to-air missiles, often are called "sea control" or "tactical" nuclear weapons.[13]

1. Submarine-launched Ballistic Missiles (SLBMs)

All five nuclear navies deploy submarine-launched ballistic missiles. About 43 percent of all U.S. strategic nuclear weapons are on submarine-launched ballistic missiles, while for the Soviet Union the proportion is about 30 percent. French and U.K. submarine-launched ballistic missiles carry the majority of their countries' strategic nuclear warheads.

The United States

The U.S. deploys the Poseidon C3 and Trident I C4 submarine-launched ballistic missiles and has the Trident II D5 submarine-launched ballistic missile under development.

The **Poseidon C3** missile (UGM-73A) is a two–stage, solid propellent missile. It replaced Polaris A2/A3 submarine-launched ballistic missiles on converted Poseidon submarines and first became operational on the USS James Madison (SSBN-627) in March 1971. The last submarine received Poseidon C3s in 1977, and the missile currently is deployed on 16 submarines: eight Lafayette (SSBN-619) class, two James Madison (SSBN-627) class, and six Benjamin Franklin (SSBN-640) class.

Each Poseidon missile can be armed with six to fourteen W68/Mk3 warheads/multiple independently-targetable reentry vehicles. Generally, however, each missile is counted as carrying ten warheads. The W68 warhead was first produced in 1970, and 2,700 are in the U.S. nuclear stockpile.[14] The warheads have the explosive power of 40 kilotons each. The missile is inertially guided and has an accuracy (circular error of probability)[15] of 0.25 -0.3 nautical miles (0.46 - 0.72 kilometers). Its explosive power, targeting ability and accuracy make it useful for attacking mostly "soft" targets such as military airfields, bases, and command and communications installations. It has a range of 2,400 to 2,800 nautical miles (4,500 to 5,200 kilometers) with ten reentry vehicles, or 2,200 nautical miles (4,000 kilometers) with 14 reentry vehicles. Six-hundred-nineteen operational missiles were procured.[16]

The **Trident I C4** missile (UGM-93A) is a three–stage, solid propellent missile. It is deployed on converted Poseidon ballistic missile submarines and new Ohio class Trident submarines. The first Poseidon SSBN backfitted with Trident I C4 became operational in 1979, the last in 1983. Twelve James Madison (SSBN-627) class and Benjamin Franklin (SSBN-640) class ballistic missile submarines were converted. The missile also is deployed on the first eight Ohio (SSBN-726) submarines. The last of 474 missiles was delivered to the U.S. Navy in 1986.[17]

Each missile can be armed with eight W76/Mk-4 warheads/multiple independently-targetable reentry vehicles; the warheads have the explosive power of 100 kilotons each. First produced in 1978, 3,200 W76 warheads are now in the U.S. nuclear stockpile.[18] The missile has stellar-aided inertial digital computer guidance, and its accuracy (circular error of probability) is 0.125-0.27 nautical miles (0.23-0.50 kilometers). The missile has little hard target capability, but can attack "moderately hard" targets such as bomber bases or heavy industry. Its range is 4,200 nautical miles (7,800 kilometers) at full payload and is greater with fewer reentry vehicles.[19] The longer range of this missile compared to earlier submarine-launched ballistic missiles means that submarines carrying this missile do not have to be based overseas to achieve reasonable amounts of time on station within range of their targets.

The **Trident II D5** missile is a three–stage, solid propellent missile. Its first test firing took place on January 15, 1987, from Cape Canaveral, Florida. The U.S. Navy plans to have 19 to 25 more test launches from Cape Canaveral and ten from submarines before it deploys the missile in December 1989.[20] It is scheduled to become operational on the ninth Ohio class submarine: USS Tennessee (SSBN-734). It will be deployed on subsequent Ohio class submarines and backfitted on the first eight submarines during the 1990s, replacing Trident I C4 missiles. By the year 2000, all of the approximately 20 Trident submarines scheduled to be in the U.S. fleet will carry the Trident II D5 missile. The U.S. Navy claims the Trident II D5 provides the U.S. "sea-based strategic force with greatly improved deterrent capability," since the D5 will give the U.S. "the capability to hold at risk the full spectrum of Soviet targets, including those ... which the Soviets value most."[21]

The Trident II D5 missile will be able to carry either the W88/Mk5 or the W76/Mk4 warhead/multiple independently-targetable reentry vehicle. The W88 high-yield warhead for the Trident II missile is currently under development by the U.S. Department of Energy. Each missile could carry eight W88/Mk5 warheads/multiple independently-targetable reentry vehicles, with each warhead having the explosive power of 475 kilotons. The missile also could carry ten to twelve of the

W76/Mk4 warheads/multiple independently-targetable reentry vehicles that are currently on Trident I missiles. (Although each missile can carry only one type of warhead, each submarine could carry a mixture of missiles with different warheads.) Under the START arms control negotiations, the U.S. and Soviet Union have agreed that the Trident II missile will be counted as carrying eight warheads.

The Trident II missile will be equipped with stellar-aided inertial digital computer guidance with NAVSTAR satellite reception and could have a terminally-guided maneuverable reentry vehicle. The Trident II D5 will be more than twice as accurate as the Trident I C4:[22] the circular error of probability will be 0.07-0.10 nautical miles (0.13-0.19 kilometers). The Trident II D5 also has a greater range and payload: 4,000 nautical miles (7,400 kilometers) with a full payload, or 6,000 nautical miles (11,100 kilometers) with a reduced number of reentry vehicles. With the W88/Mk5 warhead/reentry vehicles, the missile will be able to attack hardened Soviet targets without decreasing its range or the submarine's patrol area.[23] For a force of 20 Trident submarines, an estimated 872 missiles would be needed at a cost of $36.6 billion (including the warheads).[24]

The Soviet Union

The Soviet Union has seven different types of submarine-launched ballistic missiles on 77 ballistic missile submarines. The 968 missiles are thought to be armed with 3,447 nuclear warheads, broken down as follows:

- 39 SS-N-5 with 39 warheads
- 272 SS-N-6 with 544 warheads
- 292 SS-N-8 with 292 warheads
- 12 SS-N-17 with 12 warheads
- 224 SS-N-18 with 1,568 warheads
- 81 SS-N-20 with 800 warheads
- 48 SS-N-23 with 192 warheads

The **SS-N-5** Sark is a single stage, liquid propellent missile. It first became operational in 1963 and is deployed on 13 Golf II class SSBs in the Baltic Sea and the Sea of Japan. Each missile carries a single warhead with the explosive power of 1,200-2,000 kilotons. Because the missile has a range of 750 nautical miles (1,400 kilometers), it is not considered part of strategic forces (and was not SALT accountable). The missile is inertially guided and has an accuracy (circular error of probability) of 1-2 nautical miles.

The **SS-N-6 Serb** is a single stage, liquid fuel missile. It currently is deployed on 17 Yankee I class SSBNs. The current modification of the missile (Mod 3) carries two warheads on multiple reentry vehicles (not independently targetable) and became operational in 1973. The missile has a range of 1,600 nautical miles (3,000 kilometers), and its two warheads have the explosive power of 375-1,000 kilotons each. The missile is inertially guided and has an accuracy (circular error of probability) of about one nautical mile.

The **SS-N-8 Sawfly** is a single stage, liquid fuel single warhead missile. It is deployed on 24 submarines: one Golf III class, one Hotel III class, 18 Delta I class, and four Delta II class.[25] The SS-N-8 first became operational in 1973. Each missile carries a single warhead with the explosive power of 1,000-1,500 kilotons. The missile has a range of 4,900 nautical miles (9,100 kilometers), is inertially guided, and has an accuracy (circular error of probability) of about 0.8 nautical miles.

The solid fuel **SS-N-17 Snipe** is deployed on a single Yankee II class SSBN, which was converted from a Yankee I in 1977. The missile itself may not have reached operational status until 1980. Each missile carries a single 500-1,000 kiloton warhead and has a range of 2,100 nautical miles (3,900 kilometers). The missile is inertially guided and has an accuracy (circular error of probability) of 0.75-0.8 nautical miles.

The **SS-N-18 Stingray** is a two stage, liquid propellent multi-warhead missile, and was the first Soviet submarine-launched missile with multiple independently targetable reentry vehicles (MIRVs). It currently is deployed on 14 Delta III class SSBNs. The SS-N-18 first became operational in 1977-1978, and is deployed in three modifications: Mod 1 with three warheads, Mod 2 with a single warhead, and Mod 3 with up to seven warheads. The average loading of SS-N-18 missiles is assumed to be seven warheads under agreed U.S. and Soviet counting rules for START negotiations.

The SS-N-18 Mods 1 and 3 missiles carry warheads that each have an explosive power of 200-500 kilotons. The Mod 2 missiles carry a larger warhead with an explosive power of 450-1,000 kilotons. The SS-N-18 Mods 1 and 3 missiles with multiple reentry vehicles have a range of 3,500 nautical miles (6,500 kilometers). The single warhead Mod 2 has an extended range of 4,300 nautical miles (8,000 kilometers). The missile is inertially guided and has an accuracy (circular error of probability) of 0.5-0.76 nautical miles.

The **SS-N-20 Sturgeon** is a three stage, solid fuel multiple warhead missile that is deployed on four operational Typhoon class SSBNs and a single Golf V class test submarine. First operational in 1983, the missile is still in production. Each missile is counted as carrying ten 100-200 kiloton warheads under agreed U.S. and Soviet counting rules for START negotiations. The SS-N-20 missile is inertially guided and has an accuracy (circular error of probability) of about 0.3 nautical miles. It has a range of 4,500 nautical miles (8,300 kilometers). A modified version of the SS-N-20 reportedly is under develop-

ment for deployment in the 1990s on Typhoon class SSBNs.

The **SS-N-23 Skiff** is the newest Soviet SLBM, a three stage, liquid fuel multiple warhead missile. It is deployed on three Delta IV SSBNs and is still in production. The SS-N-23 first became operational in early 1986.[26] Each missile is counted as carrying four 100 kiloton warheads under agreed U.S. and Soviet counting rules for START negotiations. The inertially guided missile has a greater accuracy than the SS-N-18 and may be backfitted into Delta III class submarines in place of older SS-N-18s. A follow-on to the SS-N-23 is also reportedly under development.

The United Kingdom

The United Kingdom deploys the Polaris A3-TK submarine-launched ballistic missile on four ballistic missile submarines, and plans to replace this missile with the U.S. manufactured Trident II.

The **Polaris A3-TK** is a two stage, guided missile containing a Chevaline reentry vehicle system, allowing it to carry up to three (but commonly two) multiple reentry vehicles that are not independently targetable. The Chevaline modernization program began in 1974, and a new front-end was deployed in 1982 on HMS Renown, replacing the Polaris A3 reentry vehicles. All four submarines were equipped with the new front-ends by 1987. The missile has a range of 2,500 nautical miles (4,700 kilometers) and each warhead has an estimated yield of 40 kilotons.[27] In 1987 new engines for the Polaris missiles were installed at a total cost of £437 million, allowing them to function until the Trident II is deployed.[28] A refurbishment of the Chevaline front-end attached to the Polaris missile started in January 1988. The work will extend "over a number of years," and could be the last major work done to the Polaris/Chevaline system before it is replaced by the Trident missile.[29]

The **Trident II D5** missile is scheduled to replace the Polaris in the mid-1990s. The Trident II D5 missile will be purchased from the U.S., although it was commonly understood that the missiles would be armed with U.K. designed and built warheads. However, a recent study by the U.K. National Audit Office contradicts this position by stating, "Most of the expenditure on development and production [of the U.K. Trident warhead] is incurred in the U.S."[30] It is thought that the U.K. Trident missile nominally will carry eight multiple independently retargetable warheads, although individual missiles may carry up to 14 warheads. Deployment of the Trident missile will increase the number of warheads per submarine from the present 32 to at least 128.

France

France deploys three submarine-launched ballistic missiles – the M20, M4A, and the M4 (modified) – and is developing two additional types.

The **M20** is a two stage, solid propellent, inertially guided 1,600 nautical mile (3,000 kilometer) range missile armed with a single 1,000 kiloton TN-61 nuclear warhead. Sixty-four of these missiles are deployed on four ballistic missile submarines. The M20 was first deployed in 1977 as a replacement for the M2. It will be replaced by the M4 (modified) on all submarines except Le Redoutable by 1992.[31]

The **M4A** is a three stage, solid propellant, inertially guided, 2,200-2,700 nautical mile (4,000-5,000 kilometer) range missile armed with six multiple-independently targetable reentry vehicles. Each of the TN-70 warheads has an explosive yield of 150 kilotons. Sixteen missiles carrying some 96 warheads presently are deployed on a single ballistic missile submarine: L'Inflexible. Development of the M4A as a replacement for the M20 began in 1975, and it was first deployed in 1985. L'Inflexible will be the only submarine with the M4A. All subsequent replacements of the M20 missiles on the Redoutable class will be with the M4 (modified) missile with improved TN-71 warheads.[32]

The **M4 (modified)** is a three stage, solid propellant, inertially guided, 3,200 nautical mile (6,000 kilometer) range missile armed with one to six multiple-independently targetable reentry vehicles with 150 kiloton TN-71 warheads.[33] The M4 (modified) was first deployed in 1987. It can achieve a greater range than the M4 by using the lighter TN-71 warhead and by mounting fewer than six warheads on the missile. Le Tonnant was the first submarine to receive it, but all M4 equipped ballistic missile submarines eventually will be modified to carry it.

In 1986, development began on another version of the M4 to carry a TN-75 warhead for the first of the new generation of ballistic missile submarines. The M4s on the new submarines will in turn be replaced by M5 missiles, equipped with 8-12 light and compact MIRVed TN-76 warheads. The first M5 missiles are scheduled to appear on board the third submarine in the SNLE-NG program, which should be operational in 1999.[34]

China

China's only reported submarine-launched ballistic missile is the **CSS-N-3**.[35] The CSS-N-3 is a two stage solid fuel missile with an estimated maximum range of 1,800 nautical miles (3,300 kilometers).[36] It can carry a single warhead with an estimated yield of 200-1,000 kilotons. It was designed to be deployed on the Xia class ballistic missile submarines, but also can be fired from a single testing and training Golf class SSB.[37] Under development for more than ten years, the missile's first underwater launch took place on October 12, 1982.[38] It was first deployed on sea trials in 1983. Two Xia class submarines are armed with 24 CSS-N-3s, and more missiles are under construction.[39]

2. Sea-launched Cruise Missiles (SLCMs)

The U.S. Navy deploys a single nuclear-armed sea-launched cruise missile, while the Soviet Union deploys six different nuclear-armed types. In the 1950s the U.S. had a major long-range nuclear-armed SLCM program which was abandoned in favor of the Polaris submarine-launched ballistic missile. The Soviet Union has deployed nuclear-armed SLCMs since 1960.

The United States

The U.S. nuclear-armed **Tomahawk sea-launched cruise missile** (BGM-109A) is a subsonic–guided, submarine or surface ship launched, land-attack missile.[40] It carries one W80-0 warhead with an explosive power of 5-150 kilotons. About 150 warheads are estimated to be in the U.S. stockpile as of the end of 1987[41] and in the next five years 500 TLAM/Ns will be deployed with the U.S. Navy.[42] A total of 758 nuclear versions are to be deployed by the late 1990s.

The nuclear-armed Tomahawk was first deployed on ships and submarines in June 1984. As of December 1987, 31 submarines (25 SSN-688s and six SSN-637s) and 17 surface ships (three battleships, four nuclear-powered cruisers, three Ticonderoga class cruisers, and seven Spruance class destroyers) are certified to launch and carry some, but not necessarily all, variants of Tomahawk.[43] Some "135 submarines, battleships, cruisers, and destroyers will be capable of putting nearly 2,000 TLAMs" of all variants to sea by 1992.[44] And, by the mid- to late-1990s, TLAM/Ns (along with non-nuclear Tomahawk versions) will equip a total of 198 surface ships and submarines, including: four Iowa (BB-61) class battleships; one Long Beach (CGN-9) and four Virginia (CGN-38) class nuclear-powered cruisers; 22 Ticonderoga (CG-47) class cruisers (hulls CG-52 and later); 31 Spruance (DD-963) class destroyers; 29 Arleigh Burke (DDG-51) class destroyers; and 68 Los Angeles (SSN-688) and 39 Sturgeon (SSN-637) class nuclear-powered submarines.[45] Tomahawks can be launched from submarine torpedo tubes, armored box launchers, and vertical (and capsule) launching systems.[46]

The Tomahawk land-attack SLCMs have an inertial and terrain matching guidance system (TERCOM) and an accuracy (circular error of probability) of about 30 meters. The missile is propelled by a solid booster for launch and a small turbofan engine for cruise flight. The TLAM/N's range is 1,350 nautical miles (2,500 kilometers).[47] A total of 4,068 SLCMs of all variants are to be produced, 3,994 for fleet use and 74 for research, development, testing and evaluation.[48]

The Soviet Union

The Soviet Navy deploys six different types of nuclear-capable sea-launched cruise missiles: the SS-N-3 Shaddock/Sepal, the SS-N-7 Starbright, the SS-N-9 Siren, the SS-N-12 Sandbox, the SS-N-19 Shipwreck, and the SS-N-22 Sunburn. All of the SLCMs are thought to be dual-capable, i.e., they can fire both conventional and nuclear warheads. As of 1987, Soviet ships and submarines have the capacity to carry a total of 942 of these SLCMs, and it is estimated that the Soviet Navy possesses 398 of the nuclear versions.[49] The long-range SS-N-21 Sampson was just entering service at the end of the year.

The oldest and most numerous SLCM deployed in the Soviet Navy is the **SS-N-3**, which was first deployed in 1960. The SS-N-3 is deployed in two versions: the submarine launched SS-N-3a/c Shaddock, and the surface launched SS-N-3b Sepal. With a range of 250 nautical miles (460 kilometers), it was also the longest range cruise missile until the introduction of the SS-N-12 in 1976. It is estimated that there are a total of 228 SS-N-3 missiles deployed with 120 nuclear warheads. The SS-N-3a/c is deployed on Echo II and Juliett class cruise missile submarines, and the SS-N-3b is deployed on Kresta I and Kynda class cruisers. SS-N-3s on Echo II class submarines are being replaced by SS-N-12s.

The **SS-N-7 Starbright** was deployed in 1968 on Charlie I (and possibly Charlie II and Papa) cruise missile submarines. It was the first Soviet SLCM capable of submerged launch from a submarine. Some 90 of the 30 nautical mile (56 kilometer) range missiles and 44 nuclear warheads are deployed. The short-range missile has anti-ship missions.

After the SS-N-3, the **SS-N-9 Siren** is the most numerous SLCM deployed in the Soviet Navy. First deployed in 1969, the missile arms Charlie II and Papa class cruise missile submarines, Nanuchka I and III class patrol combatants, and Sarancha class patrol combatant hydrofoils. Some 208 missiles are operational with 78 nuclear warheads. The range of the SS-N-9 is 60 nautical miles (110 kilometers).

The **SS-N-12 Sandbox** is (along with the newer SS-N-19) the longest range Soviet SLCM, arming the Kiev class aircraft carriers, Slava cruisers, and modified Echo II class cruise missile submarines. Some 200 of the 300 nautical mile (550 kilometer) range missiles are deployed with 76 nuclear warheads. About 15 of 26 Echo II class submarines are reported to be converted from the SS-N-3 to launch the SS-N-12.

The **SS-N-19 Shipwreck**, which was deployed in 1980, has a range of 300 nautical miles (550 kilometers). It is fired from two of the Soviet Navy's most heavily armed ships -- the Kirov class cruisers and Oscar class cruise missile submarines. It is estimated that some 136 missiles and 56 nuclear warheads are to be deployed.

The subsonic **SS-N-21 Sampson**, a 1,600 nautical mile (3,000 kilometer) range missile, is similar to the U.S. Tomahawk.[50] It was first deployed in late 1987 in the Northern Fleet and possibly in the Pacific Fleet. Akula, Victor III, and converted Yankee class SSNs have been used in flight testing. Another possible launch platform is the Sierra class SSN.

The **SS-N-22 Sunburn**, deployed in 1981, arms the Sovremennyy class destroyers and Tarantul III class patrol combatants. The 60 nautical mile (100 kilometer) range missile is an improved SS-N-9 and is optimized for anti-ship strikes. Some 80 missiles are deployed with a total of 24 nuclear warheads for their use.

The Soviet Union has one long-range nuclear-armed SLCM under development that at the end of 1987 was to become operational at any time: the large, supersonic **SS-NX-24**. The SS-NX-24 SLCM is undergoing testing on a converted Yankee class SSGN and is likely to be deployed on that class or on the large Oscar class cruise missile submarines.[51]

Sea-launched Cruise Missiles of the Soviet Union

Type	Platform	Missiles Deployed	Nuclear Warheads
SS-N-3a/c Shaddock	Juliett, Echo II	148	104
SS-N-3b Sepal	Kynda, Kresta I	80	16
SS-N-7 Starbright	Charlie I, Papa	90	44
SS-N-9 Siren	Charlie II, Papa Nanuchka, Sarancha	208	78
SS-N-12 Sandbox	Kiev, Slava, Echo II	200	76
SS-N-19 Shipwreck	Kirov, Oscar	136	56
SS-N-21 Sampson	Akula, Sierra, Victor III conv. Yankee	–	–
SS-N-22 Sunburn	Sovremennyy Tarantul III	80	24
SS-NX-24	conv. Yankee, Oscar	–	–
Total		**942**	**398**

3. Anti-submarine Warfare Nuclear Weapons

The United States

The U.S. stockpiles 1,760 non-strategic anti-submarine warfare (ASW) nuclear warheads for three types of weapons: SUBROC, ASROC and the B57 nuclear depth bomb.

The **SUBROC** missile (SUBmarine ROCket, model designation UUM-44A) is a 20 to 30 nautical mile (40 to 56 kilometer) range, inertially guided, submarine-launched nuclear depth charge. The SUBROC breaks the surface of the water, travels through the air and reenters the water to attack an enemy submarine. There are no conventional versions of the missile, which carries a 1-5 kiloton W55 nuclear warhead. The U.S. stockpile contains 285 SUBROC warheads.[52] SUBROC-capable submarines on patrol are thought to carry 4-6 of the rockets. The SUBROC originally was developed in the late 1950s and was first deployed in 1965. It is scheduled to begin retirement in 1989, to be replaced by the Sea Lance anti-submarine standoff weapon .[53]

The **Sea Lance** anti-submarine standoff weapon (ASW/SOW) will have a longer range than the SUBROC, including over-the-horizon targeting to take full advantage of sensor capabilities.[54] It seemingly was programmed to enter the fleet in 1992.[55] Now development has been deferred until a "significant number of new submarines are available to utilize the missile's increased range,"[56] thus the missile's fleet introduction also will be delayed. A non-nuclear light weight Mk-50 torpedo is the currently planned armament for the Sea Lance. The U.S. Navy would like to develop a nuclear warhead for the Sea Lance, but has been unable to convince the Congress to fund it. The decision on whether to develop a nuclear depth charge payload is planned for 1990.[57]

The **ASROC** (Anti-Submarine ROCket, model designation RUR-5) is a surface ship-launched anti-submarine rocket fired from a trainable eight cell launcher or from launching rails that also can fire anti-ship or surface-to-air missiles. The 0.9 - 5 nautical mile (1.8 - 9 kilometer) range missile can be fitted with either a one kiloton W44 nuclear warhead or a conventional Mk-46 acoustic homing torpedo. It has been operational since 1961, and 575 W44 ASROC warheads currently are in the U.S. stockpile.[58] The ASROC is deployed on 159 surface ships including 32 cruisers (all cruisers except the four VLS equipped Ticonderoga class), 62 destroyers (all destroyers except the two VLS equipped Spruance class and four Kidd class ships), and 65 frigates (all frigates except the Oliver Hazard Perry class). The VLS outfitted ships have temporarily lost their ASROC capability since the VLS cannot fire the current design ASROC. However a conventionally armed vertical launch ASROC (VLA), to enter the fleet in 1990, is under development.[59] The VLA will be an acoustically terminal-guided, surface-to-submarine missile with a range of approximately ten nautical miles (18 kilometers) and will be armed with a lightweight torpedo. The 22 Ticonderoga class cruisers, 29 Arleigh Burke class destroyers, and 24 Spruance

class destroyers to be equipped with VLSs will receive the vertical launch ASROC.

The **B57** is a lightweight multi-purpose nuclear bomb that can be used as a nuclear depth bomb for anti-submarine warfare. Its yield is in the sub-kiloton to 20 kiloton range, and approximately 900 of the anti-submarine warfare version are in the stockpile. It can be delivered by S-3A Viking, SH-3D/H Sea King, and P-3B/C Orion anti-submarine aircraft.

The Soviet Union

The Soviet Navy has a total of about 1,400 nuclear anti-submarine warfare warheads on five different types of weapons: nuclear torpedoes, a submarine rocket nuclear depth bomb, a submarine launched ASW missile, a ballistic rocket, and air delivered nuclear depth bombs.

A **nuclear-tipped torpedo** deployed on diesel submarines beginning in 1957-1958 was the first nuclear weapon deployed with the Soviet Navy. Today, 576 standard 21-inch (533mm) nuclear torpedoes of two types are estimated to be deployed on virtually all Soviet nuclear-capable surface ships and submarines.[60] Two incidents involving Soviet attack submarines indicate they are routinely deployed. The first reportedly occurred in December 1972, when a nuclear-powered submarine from the Northern Fleet had an accident while on patrol off the east coast of North America. The accident occurred in the forward section of the submarine and was caused, according to intelligence reports of the U.S. Central Intelligence Agency, by a radiation leak from a nuclear-armed torpedo.[61] The second occurred in October 1981, when a Whiskey class attack submarine ran aground near the Karlskrona naval base in Sweden. Swedish Defence Ministry authorities detected the presence of Uranium-138, leading them to conclude that the submarine probably had "one or more nuclear weapons aboard."[62]

The Soviet Union also deploys three types of nuclear-armed missiles and rockets for anti-submarine missions: the FRAS-1 nuclear rocket, the SS-N-15 Starfish nuclear depth bomb, and the SS-N-16 Stallion dual-capable ASW missile.[63]

Twin SUW-N-1 launchers with **FRAS-1** (Free Rocket Anti-Submarine) rockets are deployed on Kiev and Moskva class surface ships. The missile is a nuclear-only variant of the Soviet Army's FROG-7 short-range rocket. It is estimated that 25 missiles with nuclear warheads are deployed.

The submarine-launched **SS-N-15 Starfish** rocket propelled nuclear depth bomb was deployed in 1973 and is similar to the U.S. Navy's SUBROC.[64] It is fired from either 21- or 26-inch torpedo tubes and is carried on Typhoon, Charlie I/II, Oscar, Victor I/II, Alfa, Sierra, Mike, and Akula class submarines. Romeo and Tango class diesel attack submarines also may be capable of firing the SS-N-15.

The **SS-N-16 Stallion** ASW missile has a longer range than the SS-N-15 (64 versus 20 nautical mile [120 versus 37 kilometers]), and is able to carry a nuclear or conventional torpedo. First deployed in 1979, it is thought to be deployed on the Typhoon, Oscar, Victor II/III, Sierra, Mike, and Akula classes. There are an estimated 400 nuclear warheads in the Soviet stockpile for SS-N-15s and SS-N-16s, with each submarine being allocated an average of four.

The Soviet Navy also deploys an **ASW nuclear depth bomb**, which is deliverable by three types of land-based fixed wing aircraft and two ship-based helicopters. There are 200 land-based aircraft, comprised of about 95 Be-12 Mail, 55 Tu-142 Bear F, and 60 Il-38 May patrol planes; and 190 Hormone A and Helix A helicopters. It is estimated that there are 400 nuclear depth bombs, or about one per nuclear-capable airplane and helicopter. These aircraft also may be capable of delivering nuclear torpedoes and mines.

The United Kingdom

The United Kingdom possesses some 140 nuclear depth bombs for anti-submarine warfare. They are believed to be a lower yield version of the U.K. WE-177 nuclear gravity bomb. U.K. Nimrod aircraft also are certified to deliver the U.S. B57 lightweight nuclear depth bomb.

4. Anti-air Warfare Nuclear Weapons

The United States

The U.S. deploys one non-strategic nuclear surface-to-air missile; the **Terrier** (RIM-2F), a ship-board missile with limited surface-to-surface capability. Several versions have been fielded since it first was deployed in 1956, but the only remaining Terrier missiles in the inventory are 25 nautical mile (47 kilometer) range nuclear-armed versions, which carry a one kiloton W45-0 warhead. There are 285 W45 Terrier warheads currently in the U.S. stockpile.[65] When it is time to fire, a target is detected and tracked, the missile readied and the launcher aimed. Once launched the missile rides the targeting beam and uses semi-active terminal radar homing. It is fired from Mk-10 twin rail launchers loaded by automatic magazine and is carried aboard 31 cruisers and destroyers, including nine Leahy (CG-16), nine Belknap (CG-26), one Long Beach (CGN-9), one Bainbridge (CGN-25) and one Truxtun (CGN-35) class cruisers, and ten Farragut (DDG-37) class destroyers.

Conventional Terrier missiles were replaced by Standard missiles (SM-2s) in the 1970s. A similar substitution was considered for nuclear Terrier missiles since a W81 nuclear warhead also has been considered for the SM-2 missile. The U.S. Navy argued that a nuclear-armed Standard-2 missile (SM-2(N)) was needed because it would deter "Soviet use of nuclear weapons at sea by increasing the probability that such an attack on the U.S. fleet would fail."[66] At the beginning of 1986,

the U.S. Department of Defense claimed a nuclear Standard missile (SM-2(N)) would be deployed in the early 1990s.[67] The U.S. Congress, however, deleted funds for the nuclear Standard missile program for FY 1987,[68] and the Navy did not request research and development funds for FY 1988 or FY 1989.[69] As of February 1988, the program appears to be terminated.

The Soviet Union

The Soviet Navy operates three types of nuclear-capable surface-to-air missiles: the **SA-N-1 Goa**, the **SA-N-3 Goblet**, and the **SA-N-6 Grumble**.[70] It is estimated that a total of 256 nuclear versions exist, four per ship on five aircraft carriers, 29 cruisers, and 30 destroyers. The 12 nautical mile (22 kilometer) range SA-N-1 Goa is deployed on Kresta I, Kynda, Kanin, Kashin SAM, and Kotlin class cruisers and destroyers. The 20 nautical mile (37 kilometer) range SA-N-3 Goblet is deployed on the Moskva and Kiev class carriers and the Kresta II and Kara class cruisers.[71] The 35 nautical mile (65 kilometer) range SA-N-6 Grumble, which is a derivative of the land-based SA-10 surface-to-air missile deployed in strategic defense forces, is deployed on one ship of the Kara class, and newer Kirov and Slava class cruisers.

5. Anti-surface Warfare and Land-attack Nuclear Weapons

The U.S., Soviet, U.K. and French navies deploy air-delivered nuclear weapons for anti-surface warfare (ASUW) and land-attack missions. (Chinese land-based naval aviation may have a surface strike nuclear mission.) Air-delivered weapons are used tactically for the sea control/sea denial missions of anti-surface warfare and for power projection missions of strikes ashore, as well as for theater strikes.

The United States

U.S. Naval and Marine Corps aircraft can deliver three types of nuclear weapons for attacks on surface targets. The **B43** is a high-yield (1,000 kiloton) nuclear bomb capable of being delivered by A-4M, A-6E and A-7E attack aircraft. The **B57** is a lightweight multi-purpose nuclear bomb used for surface strikes (and, as noted, can be a nuclear depth bomb used for anti-submarine warfare). Its yield is in the sub-kiloton to 20 kiloton range. It can be delivered by A-4M, A-6E, A-7E, and F/A-18 fighter/attack aircraft. The **B61** is a lightweight, multipurpose thermonuclear "modern tactical bomb" in six modifications. Its higher yields can range from 100 to 345 kilotons and its low yields could be near one kiloton. It can be delivered by A-4M, A-6E, A-7E, and F/A-18 attack aircraft. A significantly improved gravity bomb for the carrier aircraft is under development, scheduled to enter production in the 1990s.[72] This **Nuclear/Depth Strike Bomb** (NDSB), "with modern safety and security features, is planned to replace the 28-year-old B57 tactical strike bombs and B57 depth bombs,"[73] for delivery by carrier (and also patrol) aircraft. According to the U.S. Department of Defense, "This commonality will allow smaller aircraft carrier bomb loadouts than would otherwise be possible with separate tactical strike and depth bombs, thereby reducing overall stockpile numbers of fleet strike and depth bombs."[74] The NDSB also will replace B43, B61-2, and B61-5 U.S. Navy tactical strike bombs.[75]

The Soviet Union

The Soviet Navy relies heavily on air-launched nuclear weapons for its offensive capabilities. Anti-ship and land-attack nuclear weapons include nuclear bombs and nuclear-armed anti-ship air-to-surface missiles (ASMs). Four primary ASM types currently are deployed with nuclear warheads: the AS-2 Kipper, the AS-4 Kitchen, the AS-5 Kelt, and the AS-6 Kingfish.[76] All are dual-capable. It is estimated that some 450 nuclear versions are deployed, arming about 400 naval Backfire and Badger bombers and Fitter C fighters.[77] The number of nuclear bombs deployed on naval aircraft is not known.

The 100-115 nautical mile (185-210 kilometer) range **AS-2 Kipper**, deployed on Badger bombers in 1961, is the oldest missile and is being phased out of service. The **AS-4 Kitchen**, introduced in 1967, is carried on the Backfire-B naval bombers. This 150-300 nautical mile (280-560 kilometer) range missile is the primary anti-ship weapon of Soviet Naval Aviation Backfire bombers. The 100-120 nautical mile (180-220 kilometer) range **AS-5 Kelt** carried on the Badger-C/G, first deployed in 1965, is replacing the AS-2. The 150-250 nautical mile (280-460 kilometer) range **AS-6 Kingfish**, first deployed in 1970, is also carried on the Badger-C/G. It also is reportedly carried by Backfire bombers, although this has never been confirmed visually.

In addition to the Soviet Naval Aviation bombers, the AS-4 Kitchen is carried on newly converted Bear G bombers, many of which are assigned maritime missions. The **AS-15 Kent** long-range air-launched cruise missile, introduced in 1984 and deployed on Bear-H bombers of Strategic Aviation, also is assigned maritime missions.

The United Kingdom

The Royal Navy has approximately 50 **WE-177 nuclear bombs** for non-strategic naval surface strike missions. The bombs have a variable yield of 5 to 200 kilotons.

France

Gravity bombs and air-to-surface missiles are used by French naval aviation. The gravity bombs stored on the Clemenceau class aircraft carriers for use by their Super Etendard aircraft include the **ANT-52**, reported to have an explosive power between 25 and 30 kilotons, and a 6 to 8 kiloton **low-yield bomb**.[78]

The supersonic air-to-surface missile, the **Air-Sol-Moyenne-Portée** (ASMP), carries a TN-80 300 kiloton warhead and has a range of 30-130 nautical miles (60-250 kilometers).[79] It will replace the ANT-52 gravity bomb used by the Super Etendard, and could serve either prestrategic or strategic purposes. An inertial navigation system guides the missile, but the missile has no terminal homing capability. When attacking mobile targets, such as ships, the missile does not identify its target and aim for it, but rather explodes at a point determined at launch and thus relies on its nuclear warhead to assure the destruction of the target. The ASMP is a dual-service program used by naval Super Etendard as well as French Air Force aircraft. The Super Etendards are undergoing modification to reach initial operational capability in 1988. Fifty-three aircraft are expected to carry the missile, some operating from the two aircraft carriers, the others from land bases.

II. Nuclear-capable Ships and Aircraft of the United States

The U.S. Navy had 568 commissioned ships as of October 1987.[80] Three-hundred-ninety-eight of these ships, nearly 70 percent, are nuclear-capable. About 374 ships are principal combatant warships, attack submarines and ballistic missile submarines; some 287 (77 percent) of these ships do, or could, carry nuclear weapons (see Appendix A). The remaining 194 or so ships consist of amphibious warfare ships for Marine Corps operations, small patrol combatants, and various support and service ships. Nuclear weapons could be transported or serviced by 111 (approximately 57 percent) of these ships. The U.S. Navy also owns six types of nuclear-capable aircraft, five operating from ships and one from land, while the Marine Corps operates two more.

A. Fleet Organization

U.S. Navy ships are assigned to the Atlantic Fleet or Pacific Fleet. Ships in the Atlantic Fleet are homeported on the east and Gulf coasts of the United States, while Pacific Fleet ships are homeported on the Pacific coast of the United States, Hawaii and Japan. Administratively, ships are assigned to "type" organizations (i.e., surface, submarine, or air in the case of aircraft carriers), and then into smaller groups and squadrons. The administrative organization permits the U.S. Navy to more easily service the ships, as they have relatively similar characteristics and needs.

However, when the U.S. Navy sends ships to sea to participate in military operations, the ships are assigned to operational commands. These include the four numbered fleets – Second, Third, Sixth and Seventh – and battlegroups subordinated to the fleets.[81] The Second Fleet is headquartered in Norfolk, Virginia, and its ships operate in the Atlantic Ocean. The Third Fleet is headquartered in Pearl Harbor, Hawaii, and its ships operate in the northern and eastern Pacific. The Sixth Fleet is headquartered in Gaeta, Italy and its ships operate in the Mediterranean and Black Seas. The Seventh Fleet is headquartered at Yokosuka, Japan, and its ships operate in the western Pacific and Indian Ocean. Ships and submarines generally are rotated between their homeports and assignments to forward deployed fleets.[82]

B. Nuclear-capable Ships[83]

1. Ballistic Missile Submarines (SSBNs)

The present force consists of 36 submarines – 16 with Poseidon missiles and 20 with Trident I missiles – loaded with 640 total missiles and 5,632 nuclear warheads. Not all these submarines are operational at any given time because of overhauls, repairs, and sea trials. In the spring of 1987, for example, about 26 of the submarines were fully operational.[84]

Poseidon submarines have 16 launch tubes for Poseidon C3 submarine-launched ballistic missiles (SLBMs). The submarines were commissioned from 1963 to 1967, and displace 8,250 tons submerged. They originally were armed with Polaris missiles and then converted from 1969 to 1977 to carry Poseidon missiles. Two submarines currently are slated for decommissioning. The Andrew Jackson (SSBN 619) was to be overhauled in 1988, but the Congress denied funding, which means it will be decommissioned in 1988.[85] A second submarine, the John Adams (SSBN 620), was to start overhaul in late 1988. The Navy, however, changed its plans and instead will decomission the ship in 1989 as a cost cutting measure.[86] The remaining Poseidon submarines will reach the end of their roughly 30 year service lives starting in 1993, and all of them will be retired by the year 2000 (although they may be retired earlier for arms control or other reasons).[87]

Twelve Poseidon submarines have been converted to carry 16 Trident I C4 SLBMs and became operational with this missile between 1979 and 1983. Newer Ohio class submarines[88] carry 24 Trident I C4 missiles, compared to 16 on the Poseidon submarines. The Ohio class submarines are designed to be quieter and more reliable, spending about 66 percent of their life cycle at sea as opposed to 55 percent for the Poseidon submarines.[89] They also are more than twice as large, displacing 18,700 tons submerged.

Construction of the Ohio class began in the mid-1970s and the first ship, the USS Ohio (SSBN-726) was commissioned in 1981. The ninth submarine of the class, the USS Tennessee (SSBN-734), is scheduled to go on sea trials in September 1988, and to enter the fleet in late 1989.[90] Six more are under construction. The U.S. Navy plans to buy one Trident submarine a year from FY 1988 to FY 1992.[91] The U.S. Navy has not decided on a total number of Trident submarines, saying the number is dependent on arms control agreements and other factors. The Navy has stated, however, that 20 Ohio class submarines would be the minimum needed to replace the ageing Poseidon fleet,[92] and the Department of Defense lists 40 SSBNs as the maximum SSBN force goal.[93]

The Poseidon submarines operate out of Charleston, South Carolina, and Holy Loch, Scotland. The converted Trident I C4 submarines operate out of Kings Bay, Georgia, while the Ohio class submarines are stationed in Bangor, Washington.[94] The first squadron of Ohio class submarines with the Trident II D5 missile will be based at King's Bay.

U.S. ballistic missile submarines operate regularly in the Arctic, north Atlantic, and north Pacific Oceans and the Mediterranean Sea. About 30 percent of the force is "on station" in day-to-day alert while another 25 to 30 percent is in transit or on training missions.[95] To maximize their time at sea, submarines are assigned two crews("blue" and "gold") that alternate in manning the submarine. An average submarine patrol lasts about two months.[96] The submarine then returns to port for about 30 days to exchange crews, reprovision, and carry out repairs before returning to sea. In 1986, ballistic missile submarines conducted 88 deterrent patrols,[97] bringing the total number of patrols since 1960 to more than 2,460.[98]

2. Attack Submarines

As of December 1987, the U.S. had 98 nuclear-powered attack submarines (SSNs) and will have 100 by 1990. Their primary mission is to find and destroy other submarines, but they also can attack surface ships, conduct reconnaissance, attack shore targets and mine waterways. Sixty-one of the SSNs (about 62 percent) are capable of firing nuclear weapons, either the SUBROC anti-submarine missile for attacking other submarines, or nuclear-armed Tomahawk land-attack sea-launched cruise missiles for striking targets on land.[99] Seven of the older submarines and the two converted Polaris submarines are not nuclear-capable.

The oldest classes of nuclear-capable attack submarines include 13 Permit (SSN-594), 37 Sturgeon (SSN-637), one Narwhal (SSN-671), and one Lipscomb (SSN-685) (the last two are "single-ship" classes). They were commissioned between 1962 and 1974,[100] and range from 4,200 to 6,480 tons submerged. The latest class of attack submarines, the Los Angeles (SSN-688) class, was developed in the late 1960s and early 1970s. The first ship, commissioned in 1976, displaces 6,900 tons submerged. By October 1987, 37[101] of the Los Angeles class were delivered and 19 additional submarines were authorized and under construction.[102] The U.S. Navy wants a total of 68-69 Los Angeles submarines. Since 1985 the U.S. Navy has produced an improved version of the Los Angeles submarine, the first of which was launched in December 1986. These improved submarines are quieter, can operate in the Arctic, have a capsule launch system (CLS) for missiles and, according to the U.S. Navy, can destroy twice as many Soviet submarines as the earlier version of the Los Angeles class – 5-6 Soviet submarines eliminated for every improved Los Angeles class submarine lost.[103]

The U.S. Navy also is developing the next class of attack submarines, called the Seawolf (SSN-21).[104] According to the U.S. Navy, it is needed to counter Soviet improvements, preserve submarine superiority into the "foreseeable future," and maintain a force goal of 100 SSNs. The lead ship is scheduled to be delivered in 1994[105] and will be larger and even more capable than the improved Los Angeles (SSN-688) class submarines. It will be quieter, have a higher tactical speed, and carry more weapons (including Tomahawk SLCMs and the Sea Lance, a replacement for the SUBROC to enter the fleet in the 1990s). Overall, according to the U.S. Navy, it will have "three times the mission effectiveness of the improved SSN-688."[106] The U.S. Navy plans to buy 28 Seawolf class submarines by the year 2000.[107]

Attack submarines are homeported at Pearl Harbor, Hawaii, and San Diego, California in the Pacific; and at Charleston, South Carolina; Norfolk, Virginia; and Groton, Connecticut, in the Atlantic. As of December 1987, 41 nuclear-powered submarines (nuclear and non-nuclear-capable) are in the Pacific, and 57 are in the Atlantic. A typical submarine patrol lasts 75-80 days; however, they have been known to operate submerged for more than 100 days.[108] On average, 50 percent of their time is spent away from port.[109]

Nuclear-capable attack submarines could carry either SUBROCs or Tomahawk land-attack SLCMs. In 1982, 64 attack submarines were capable of firing the SUBROC,[110] but by 1987 this number had declined to 38. These 38 submarines are equipped with the SUBROC-compatible Mk 113 or Mk 117 fire control systems, and include: five Los Angeles (SSN-688) class, 18 Sturgeon (SSN-637) class, 13 Permit (SSN-594) class, one Narwhal (SSN-671) and one Lipscomb (SSN-685). Other submarines of the Los Angeles and Sturgeon class cannot fire the SUBROC. This is because a new fire control system, the Combat Control System (CCS) Mk 1 is installed (or being installed) on 51 submarines and, with its current software, is incompatible with the SUBROC missile.[111] The number of SUBROC capable submarines will continue to decline, first as the Los Angeles and Sturgeon class submarines with Mk 113 and Mk 117 fire control systems upgrade to the CCS Mk 1, and then as the SUBROC begins retirement in 1989 and is replaced by the new Sea Lance ASW stand-off weapon. Until the SUBROC is completely retired, a SUBROC capability will be retained on the Permit class submarines with the Mk 117 fire control system, and possibly some Sturgeon class submarines.

The first nuclear-armed land-attack Tomahawk SLCM became operational on submarines in June 1984. As of December 1987, 31 attack submarines -- 25 Los Angeles (SSN-688) class and six Sturgeon (SSN-637) class -- were certified to fire some, but not necessarily all, Tomahawk variants.[112] This number will increase as the 51 submarines equipped (or soon to be equipped) with the CCS Mk 1 are certified. Tomahawk SLCMs eventually will arm 107 submarines (69 Los Angeles, 37 Sturgeon, 1 Narwhal and 1 Lipscomb) by 1995.[113] Los Angeles class submarines SSN-688 to SSN-718 and the Sturgeon class submarines will be able to carry eight SLCMs internally, to be fired from torpedo tubes. Los Angeles class submarines SSN-719 and after have a capsule launch system (CLS) installed in the bow that can carry 12 SLCMs.[114]

3. Aircraft Carriers

Aircraft carriers (CV/CVNs) are the U.S Navy's largest warships and range from 64,000 to 91,400 tons at full load. They are mobile floating airfields, whose aircraft are able to attack targets up to 1,000 nautical miles (1,900 kilometers) away.[115] Their complement of aircraft can conduct anti-surface, anti-air, anti-submarine, and electronic warfare, reconnaissance, and land strikes. The U.S. currently has 14 deployable aircraft carriers distributed among the following classes.[116] two Midway (CV-41) class; four Forrestal (CV-59) class; two Kitty Hawk (CV-63) class; one John F. Kennedy (CV-67) class; one Enterprise (CVN-65) class; and four Nimitz (CVN-68) class. Five of these are nuclear-powered: the Enterprise (CVN-65) has eight nuclear reactors and the four Nimitz (CVN-68) class ships have two reactors each. The latest Nimitz class carrier, USS Theodore Roosevelt (CVN-71) was commissioned in 1986. Two more Nimitz class ships, USS Abraham Lincoln (CVN-72) and USS George Washington (CVN-73), are to be delivered in 1989 and 1991 respectively.[117] The U.S. Navy's goal is to have 15 deployable aircraft carriers as the centerpiece of the 600 ship fleet. This should be achieved by 1990.[118]

Aircraft carriers deploy with 85-95 aircraft on board. These aircraft include: F/A-18 Hornets for surface attack and air-to-air combat; F-14 Tomcats for air-to-air combat; A-6E Intruders and A-7E Corsairs for attack missions; S-3A Viking jets and SH-3D/H Sea King helicopters for anti-submarine warfare; EA-6B Prowlers for electronic warfare; KA-6D aerial refueling tankers; and E-2C Hawkeyes for airborne early warning and command and control. Several electronic reconnaissance and logistic planes also are usually on board.

The F/A-18s, KA-6s,[119] A-7Es, S-3As, and SH-3D/Hs are nuclear-capable. The aircraft carrier "stores" B43, B57 and B61 nuclear bombs for surface attacks by the attack aircraft, and B57 nuclear depth bombs for the ASW aircraft. Aircraft carriers routinely carry about 100 nuclear weapons.

As of December 1987, six aircraft carriers are assigned to the Pacific Fleet and eight to the Atlantic Fleet. Pacific based aircraft carriers currently are homeported in Yokosuka, Japan, (the Midway (CV-41)); and Alameda (San Francisco), and North Island (San Diego), California. The Nimitz's (CV-68) homeport recently was changed to Everett, Washington, as part of the U.S. Navy's strategic homeporting plan. In the Atlantic, carriers are stationed at Norfolk, Virginia, and Mayport, Florida. (A training carrier, the Lexington (AVT-16) is located at Pensacola, Florida.)

Aircraft carriers operate world-wide and typically spend six months[120] in forward deployment before being relieved by another carrier. Four aircraft carriers generally are forward deployed at any given time, divided among the Mediterranean Sea, Indian Ocean and Western Pacific. The other carriers are either in overhaul or participating in exercises and training off the east and west coasts of the United States. When underway, carriers are accompanied by several escort ships, forming carrier battlegroups (CVBGs). The escort ships provide additional protection to the carrier from air, surface and submarine attacks, and in turn, the carriers' planes give similar protection to the escort ships. In peacetime, a carrier battlegroup usually consists of one carrier, 1-2 cruisers, 2-3 destroyers, and 1-3 attack submarines, plus support ships. In wartime, 2-4 carriers would operate together along with proportionately more escort ships.[121]

4. Battleships

Battleships (BBs) are the second largest ships in the U.S. Navy. Originally commissioned at the end of World War II, all were deactivated by the end of the 1950s (although the USS New Jersey was reactivated briefly for use in the Vietnam War). The Reagan Administration, however, started a battleship reactivation program as a relatively quick, inexpensive way to add ships and firepower to the fleet.[122] The U.S. has three active battleships: the USS Iowa (BB-61), USS New Jersey (BB-62), and USS Missouri (BB-63). A fourth, the USS Wisconsin (BB-64), is undergoing renovation and will be delivered in 1988.[123] Battleships can carry one nuclear weapon system: Tomahawk land-attack SLCMs.[124] Each can be armed with 32 Tomahawk SLCMs in eight armored box launchers of four missiles each.

Battleships have several missions, according to the U.S. Navy. As the capital ship in battleship battlegroups (BBBGs) they can substitute for carrier battlegroups to ease the peacetime deployment schedules of carriers. For example, battleships have participated in operations off Nicaragua and the Persian Gulf, and the Iowa exercised in the Baltic Sea in 1986. They also can operate with carrier battlegroups in battles at sea or amphibious operations, providing support with their 16-inch guns and Tomahawk SLCMs.[125] The New Jersey played the latter role off Lebanon in 1982 in support of the Marines stationed in Beirut. In wartime, one battleship would operate with the Sixth Fleet in the Mediterranean, one would deploy with the Second Fleet in the Atlantic, and two would be assigned to the Seventh Fleet for use in the western Pacific and Indian Ocean.[126]

Currently the New Jersey (BB-62) and Missouri (BB-63) are homeported at Long Beach, California, while the Iowa (BB-61) is based at Norfolk, Virginia. The U.S. Navy's strategic homeporting plan calls for stationing the USS Iowa at Staten Island, New York; the USS Missouri in San Francisco, California; and the USS Wisconsin in Corpus Christi, Texas.

5. Cruisers

As of December 1987, the U.S. Navy had 36 nuclear-capable cruisers (CG/CGNs), which range in size from 7,800 to 11,000 tons at full load. The oldest classes, commissioned between 1961 and 1974, include nine Leahy (CG-16), nine Belknap

(CG-26), one Long Beach (CGN-9), one Bainbridge (CGN-25), one Truxtun (CGN-35), two California (CGN-36), and four Virginia (CGN-38) class cruisers. The nine nuclear-powered cruisers (designated CGNs) have two nuclear reactors each. The first ship in the latest class, the USS Ticonderoga (CG-47),[127] was commissioned in 1983. As of December 1987, nine Ticonderoga class cruisers were operational (with several more to enter the fleet annually) and the rest of the 27 total planned ships (a further 18) were authorized.[128] The U.S. Navy says it needs 45 cruisers in its 600 ship fleet.[129]

Cruisers perform anti-air, anti-surface, and anti-submarine warfare missions, and can support amphibious operations. They can operate as escort ships in carrier or battleship battlegroups, or for convoy protection. They also can operate independently or with destroyers to form their own surface action groups.

Three nuclear weapon systems can be deployed on cruisers: the ASROC anti-submarine rocket, the Terrier surface-to-air missile, and the Tomahawk nuclear land-attack cruise missile. All cruisers, (32 ships total) except Ticonderoga class hull numbers CG-52 and after, can fire ASROC missiles either from launcher rails or a dedicated eight cell box launcher.[130] Terrier missiles can be launched from the 21 ships of the Leahy, Belknap, Long Beach, Bainbridge and Truxtun classes.

Four nuclear-powered cruisers can launch Tomahawk sea-launched cruise missiles from armored box launchers. These include the USS Long Beach and three Virginia class cruisers (the fourth Virginia class cruiser is to be converted to carry Tomahawks in 1988). Four Ticonderoga class cruisers also can carry Tomahawks. These are CG-52 and later ships outfitted with vertical launch systems (VLS) that nominally carry 26 Tomahawk SLCMs.[131] Three of these ships were certified to carry Tomahawks as of December 1987.[132] Eventually 22 Ticonderoga class cruisers will be so equipped.[133]

6. Destroyers

Sixty-four of the U.S. Navy's 68 destroyers (DD/DDGs) are nuclear-capable.[134] These ships are divided among three classes: ten Farragut (DDG-37), 23 Charles F. Adams (DDG-2), and 31 Spruance (DD-963) class ships. These destroyers were commissioned from 1960 to 1983 and range in size from 4,500 to 7,865 tons at full load. A new Arleigh Burke (DDG-51) class is under construction; the first ship will be delivered in 1990. Twenty-nine Burke class ships will be constructed, replacing the Adams (DDG-2) and Farragut (DDG-37) classes.[135] The U.S. Navy would like to have 70 destroyers in its 600 ship fleet.[136]

Destroyers, like cruisers, are multi-mission ships that can perform anti-air, anti-surface, and anti-submarine warfare, as well as provide support to amphibious operations. Guided missile destroyers are optimized for anti-air warfare, while the Spruance (DD-963) class has a strong anti-submarine warfare capability. Destroyers operate as escort ships in carrier or battleship battlegroups, or independently in escorting convoys of logistic ships. They also can operate independently or with cruisers to form their own surface action groups.

Three nuclear weapon systems can be deployed on destroyers: ASROC, Terrier, and Tomahawk SLCMs. Sixty-six[137] destroyers can fire ASROC missiles from dedicated eight cell box launchers or rail launchers. Terriers can be fired from the ten Farragut (DDG-37) class ships. Currently seven Spruance class ships each can carry eight Tomahawks in two armored box launchers. Twenty-four more are being backfitted with 61 cell vertical launching systems, (VLS) allowing each to carry a nominal load of 45 Tomahawk missiles.[138] The Arleigh Burke (DDG-51) class will be outfitted with one 61 cell and one 29 cell VLS and will carry a nominal load of 28 Tomahawks each.[139]

7. Frigates

Sixty-five of the 115 active and reserve frigates (FF/FFGs) – all frigates except the Oliver Hazard Perry (FFG-7) class ships – are nuclear-capable. These include two Bronstein (FF-1037), ten Garcia (FF-1040), 46 Knox (FF-1052), one Glover (FF-1098), and six Brooke (FFG-1) class ships. Frigates range in size from 2,650 to 4,100 tons at full load and were commissioned from 1963 to 1974. (The non-nuclear-capable Oliver Hazard Perry class is still under construction; the last ship in the program (FFG-61) is to be delivered in 1988-89). The number of nuclear-capable frigates in the fleet will decline as sixteen older frigates (the ten Garcia and six Brooke class ships) are scheduled to be retired, eight each in 1988 and 1989, due to lack of money.[140]

One nuclear-capable weapon system, the ASROC, can be deployed on frigates. ASROCs are launched from dedicated eight cell box launchers. The main task of frigates is to protect military or civilian convoys of ships, particularly to provide protection from submarines.[141]

8. Amphibious Warfare Ships

The U.S. Navy operates 63 major active and reserve amphibious warfare ships as well as several hundred smaller associated landing craft. According to one U.S. Navy publication, "Selected amphibious ships can store and transport a variety of air-delivered nuclear weapons as well as all ground tactical nuclear weapons for which the USMC [U.S. Marine Corps] has a capability."[142] Another U.S. Navy instruction adds that, "Transportation of nuclear weapons is authorized in amphibious type ships, generally as a 'transhipment' capability," because most spaces "with few exceptions, have not been specifically designed for nuclear weapon or ammunition storage." In particular it notes, "Fleet Commanders in Chief may authorize transportation of nuclear weapons in commissioned amphibious ships," and moreover, "shall specify the num-

bers and types of weapons to be placed in such ships for any given exercise, operation or deployment." Even so this publication allows that, "In emergency situations ships which are not currently nuclear weapons qualified may be used to transport nuclear weapons." Finally it cautions, "Nuclear weapons shall not normally be retained on board amphibious ships beyond the time actually required for exercise, operation, or deployment. Specifically, amphibious ships shall not be utilized as contingency storage facilities for nuclear weapons."[143]

There are seven types of amphibious ships capable of transporting nuclear weapons for the Marine Corps: general purpose amphibious assault ships (LHA), helicopter amphibious assault ships (LPH), amphibious transport docks (LPD), amphibious cargo ships (LKA), dock landing ships (LSD), tank landing ships (LST), and amphibious command and control ships (LCC). An eighth type, a new amphibious assault ship class, designated LHDs, is under construction.

The largest ships carry helicopters, AV-8B short-takeoff and landing fighters, troops, weapons, materiel, and the transport craft that ferry troops and materiel to shore for amphibious landings. The five Tarawa (LHA-1) class general purpose amphibious assault ships and seven Iwo Jima (LPH-2) class helicopter amphibious assault ships are, in effect, small aircraft carriers (respectively, 39,300 and 18,000 tons at full load) that serve as the lead ships of amphibious task forces. They are equipped with a complement of transport and attack helicopters and they also can operate nuclear-capable AV-8B Harrier II attack vertical take-off and landing jets.[144] The ships can carry nuclear bombs for the AV-8B Harrier attack aircraft, or nuclear projectiles for use ashore by Marine Corps 155mm and 8-inch (203mm) artillery.

In 1984, Congress appropriated money for a new class of amphibious assault ships (designated LHDs). The first ship in this class, the Wasp (LHD-1) is to enter the fleet in the spring of 1989, and the next two ships are authorized. The Navy will ask for authorization for the fourth and fifth ship in FY 1989 and FY 1991 respectively. Additional ships are planned to replace the LPHs, which are are scheduled to be retired in the mid-1990s.[145] The Wasp class ships will displace 40,600 tons at full load and have capabilities similar to the LHAs[146] in operating Harrier jets and transporting nuclear weapons.

Other amphibious assault ships – amphibious transport docks (LPD), amphibious cargo ships (LKA), dock landing ships (LSD)[147] and tank landing ships (LST – carry troops, materiel, or smaller landing craft for conveying troops and materiel ashore. Similarly, they can transport nuclear weapons for use by land-based Marine units. Amphibious command and control ships (LCC) also can be used to transport nuclear weapons if necessary. The nuclear weapons can be transported ashore by smaller tracked landing vehicles or helicopters, with helicopters being the preferred mode of transportation.[148]

9. Support Ships

Several classes of support and logistic ships can maintain or transport nuclear weapons. According to the U.S. Navy, "Destroyer tenders (ADs) have the capability for storage, assembly, and issue of ASROC to delivery ships."[149] There are nine active destroyer tenders in the fleet. The three ships in the oldest class were commissioned from 1940 to 1944, and the six ships in the newest classes from 1967 to 1983. They range in size from 18,000 to 22,500 tons at full load. Destroyer tenders support the ASROC capable cruisers, destroyers, and frigates, and also provide support for Terrier missiles and warheads.[150]

Submarine tenders (ASs) have similar capabilies with respect to SUBROC, Poseidon and Trident missiles.[151] As of December 1987, there are 12 active submarine tenders divided among six classes. They were commissioned between 1941 and 1981, and range in size from 16,230 to 23,000 tons at full load. Typically, submarine tenders are docked in port and service submarines moored alongside.

Three submarine tenders support ballistic missile submarines, and nine support attack submarines. The ballistic missile submarine tenders have facilities for servicing submarine-launched ballistic missiles, reentry vehicles and warheads. One is based at Holy Loch, Scotland, to support the forward deployed Poseidon ballistic missile submarines.[152] This tender is supplied by one Military Sealift Command cargo ship (TAK) converted to carry ballistic missiles and other submarine equipment (the need for this TAK will disappear in the late 1990s when the U.S. Navy achieves an all-Trident missile force based in the U.S).[153] The other ballistic missile submarine tenders are homeported in Charleston, South Carolina and King's Bay, Georgia.

The attack submarine tenders support SUBROC missiles and seven also can currently support Tomahawk SLCMs.[154] Attack submarine tenders are homeported at New London, Connecticut; Norfolk, Virginia; San Diego, California; Charleston, South Carolina; La Maddalena, Italy; and Guam.

According to the U.S. Navy, "Ammunition ships [AEs] and most fast combat support ships [AOEs] are capable of transporting, storing, and providing underway replenishment for all Navy weapons except Polaris and Poseidon." Replenishment oilers (AORs) also "have an emergency capability for transporting and providing underway replenishment for all Navy weapons except Polaris and Poseidon."[155] Underway replenishment ships, in addition, "may be ordered to load Marine Corps," nuclear weapons, "for transport to amphibious forces."[156]

The multi-product fast combat support ships (AOEs) and replenishment oilers (AORs) operate at sea as an integral part of a carrier battlegroup. Fleet oilers (AOs), ammunition ships (AEs) and stores ships (AFSs) operate in escorted un-

derway replenishment groups shuttling fuel, ammunition, and stores to and from advanced logistic bases or consolidation points at sea. These shuttle ships in turn are supplied by merchant tanker and cargo ship deliveries from the United States. If an AOE or AOR is not available for a carrier battlegroup, AOs or AEs may be used to replace it.[157]

Underway transfer of nuclear weapons may occur either through connected replenishment (CONREP), where supply ships are joined to the ship to be supplied, and cables and slings are used for transferring containers; or by vertical replenishment (VERTREP) depending on the availability of CH-46[158] or CH-53 helicopters.[159] If the operational situation demands, small craft also can be used to transfer nuclear weapons, but this is the least desirable and the most hazardous method of transfer.[160] Transfers of nuclear weapons are "generally made between support ships and combatants, but an exchange or consolidation could be ordered between ships of the same type," for example, from aircraft carrier to aircraft carrier using the underway replenishment ships as a conveyor.[161] The U.S. Navy warns that, "The transfer of nuclear weapons at sea presents one of the most hazardous of all shipboard operations. It contains all the dangers found in conventional ammunition transfer plus the grave consequences of accidental loss or contamination."[162]

C. Nuclear-capable Naval and Marine Corps Aircraft

The U.S. Navy and Marine Corps possess nearly 1,800 nuclear-capable aircraft and helicopters that can deliver nuclear weapons.[163] The aircraft are optimized for either anti-submarine or strike warfare missions (including attacks on surface ships, targets ashore or in support of amphibious operations), although they can have secondary missions. These aircraft are divided among the active and reserve U.S. Navy and Marine Corps forces. Marine Corps aircraft are based primarily on land (often outside the United States) to support Marine Corps operations; however, some Marine Corps squadrons periodically deploy on U.S. Navy aircraft carriers to supplement a carrier air wing.

1. U.S. Navy Aircraft Squadrons

Nuclear-capable naval aircraft include: A-6E Intruders and A-7E Corsair attack jets for bomb or missile strikes on surface targets on land or at sea; F/A-18 Hornet fighter/attack jets used for either air-to-air combat or surface strikes; S-3A/B Viking jets; SH-3D/H Sea King helicopters; and P-3B/C Orion turboprops, whose primary mission is anti-submarine warfare. The A-6s, A-7s, F/A-18s, S-3s, and SH-3s are known as "sea-based air" because they would perform their missions while embarked on an aircraft carrier as part of the carrier's air wing. The P-3 Orions are land-based naval aviation, conducting ocean anti-submarine warfare patrols from bases around the world.

U.S. Navy aircraft are organized in squadrons of similar aircraft.[164] There are approximately 27 active attack squadrons (designated VA), each consisting of ten A-6E[165] or 12 A-7E aircraft. These are supplemented by four reserve squadrons equipped with 12 A-7 aircraft each. (In addition to the active and reserve squadrons, there are four fleet "readiness" training squadrons whose aircraft could be rotated into active squadrons during wartime). When ashore A-6 squadrons are based at NAS Oceana, Virginia and NAS Whidbey Island, Washington. A-7s are at NAS Cecil Field, Florida, and NAS Lemoore, California. Reserve attack A-7 squadrons are at NAS Cecil Field, Florida; NAS New Orleans, Louisiana; NAS Atlanta, Georgia; NAS Alameda, California; and NAS Point Mugu, California. The number of A-7 squadrons currently is declining as F/A-18 squadrons replace them.

There are approximately 16 fighter/attack squadrons (designated VFA) consisting of 12 F/A-18s each. F/A-18s are based at NAS Cecil Field, Florida, and NAS Lemoore, California. The squadrons assigned to the aircraft carrier USS Midway (CV-41) are stationed at NAF Atsugi, Japan. In addition, there are two reserve and two fleet readiness and training squadrons at NAS Lemoore. The number of F/A-18 squadrons will continue to increase, as the U.S. Navy plans to have 24 F/A-18 squadrons by 1992.[166]

There are 12 carrier-based jet anti-submarine squadrons (designated VS) consisting of ten S-3As each. In addition, there is one fleet readiness squadron and another squadron for training crews in the transition to S-3Bs. S-3s are based at NAS Cecil Field, Florida, and NAS North Island, California.

There are 14 carrier-based helicopter anti-submarine warfare squadrons (designated HS) consisting of six SH-3s each. In addition, there are two reserve squadrons and two fleet readiness squadrons. The active squadrons are stationed at NAS Jacksonville, Florida, and NAS North Island, California. The two reserve squadrons are at NAS Jacksonville, Florida, and NAS Alameda, California.

The "sea-based" aircraft deploy as part of a carrier air wing (designated CVW). As of the end of 1987, there are 14 active and two reserve carrier air wings. Commissioning of the fourteenth active carrier air wing (CVW-10) took place in 1987 and the second reserve air wing will be modernized by FY 1990. Due to fiscal contraints, however, the fourteenth carrier air wing now is scheduled to be deactivated in FY 1989.[167] Thus the U.S. Navy will have 13 active and two reserve air wings for its carrier force.

Each carrier air wing is made up of several squadrons. A typical carrier air wing contains some 86-95 aircraft, which includes two squadrons of A-7s or F/A-18s (24 aircraft), one squadron of A-6s (14 aircraft),[168] one squadron of S-3s (ten aircraft) and one squadron of SH-3s (6 helicopters). The air wing also would include non-nuclear-capable F-14 fighter/interceptors (24 aircraft), EA-6 electronic warfare jets (4 aircraft), E-2C airborne early warning planes (4 aircraft) and several

miscellaneous electronic reconnaissance and transport aircraft. This carrier air wing mixture is changing as F/A-18s enter the fleet to replace A-7s. The U.S. Navy is introducing a nominal new air wing of 86 aircraft: 20 F-14s, 18 F/A-18s, 20 A-6s, ten S-3s, eight SH-60Fs (a replacement for the SH-3, due to become operational in 1989), five E-2Cs and five EA-6Bs. The two oldest aircraft carriers, the USS Midway and the USS Coral Sea, cannot support F-14s and will have four squadrons of F/A-18s instead.[169] They also do not operate S-3A aircraft.

There are 24 active and 13 reserve land-based patrol squadrons (designated VP) consisting of nine P-3s each. (In addition there are two fleet readiness squadrons that have about 20 aircraft each.) The active P-3 squadrons are based at NAS Brunswick, Maine; NAS Jacksonville, Florida; NAS Moffett Field near San Francisco, California; and NAS Barber's Point on Oahu, Hawaii. Reserve squadrons are based at NAS Glenview, Illinois; NAS Jacksonville, Florida; NAS Willow Grove, Pennsylvania; NAS Point Mugu, California; NAS Millington, Tennessee; NAF Washington, D.C. (i.e., Andrews AFB, Maryland); NAS Whidbey Island, Washington; NAS Moffett Field, California; NAS South Weymouth, Massachusetts; NAF Mt. Clemens, Michigan; and NAS New Orleans, Louisiana. P-3s also regularly deploy overseas. Their main forward operating bases are in Bermuda, the Azores, Puerto Rico, Ascension Island, Spain, Italy, Iceland, Oman, Diego Garcia, the Philippines, Japan, Alaska, and Guam. Aircraft occasionally operate from other countries as well.

2. Marine Corps Aircraft Squadrons

Although the Marine Corps is part of the U.S. Navy, it possesses separate aircraft. Some of its aircraft, however, are the same models used by the U.S. Navy, and sometimes these planes deploy as part of carrier air wings. The nuclear-capable aircraft in the Marine Corps inventory are A-4M Skyhawks, A-6E Intruders, AV-8B Harrier IIs, and F/A-18 Hornets. The Marine Corps, like the U.S. Navy, also has aircraft for logistical transport of nuclear weapons.

A-4s are assigned to four active and five reserve Marine Corps attack squadrons (designated VMA). The four active squadrons have 19 A-4Ms each and are divided between Marine Corps Air Station (MCAS) El Toro, California and MCAS Cherry Point, North Carolina. NAS Memphis, Tennessee; NAS Willow Grove, Pennsylvania; NAS Alameda, California; NAS Cecil Field, Florida; and NAS South Weymouth, Massachusetts, each have one reserve squadron of A-4F/Ms.

Five active Marine Corps all-weather attack squadrons (designated VMAAW) fly ten A-6E aircraft each. Two squadrons are based at MCAS Cherry Point and three are at MCAS El Toro, California.

AV-8Bs constitute four more active attack squadrons (designated VMA) of 20 aircraft each. Three squadrons are based at MCAS Cherry Point, North Carolina, and one is at MCAS Yuma, Arizona. There also is one training squadron based at MCAS Cherry Point that has about 18 combat-capable AV-8Bs. By 1993, eight AV-8B squadrons with 20 aircraft each are scheduled to be operational,[170] replacing the four remaining active A-4M squadrons. Plans also are underway to replace reserve A-4 squadrons with AV-8Bs.[171]

F/A-18s currently compose six active Marine Corps fighter-attack squadrons (designated VMFA) of 12 aircraft each. Three squadrons are based at MCAS Beaufort, South Carolina, and three at MCAS El Toro, California. A two seat-version of the F/A-18 is being deployed, and the Marine Corps will increase the size of each squadron to 16 aircraft composed of eight single- and eight two-seated aircraft to take advantage of their capabilities.[172]

3. Nuclear-capable U.S. Navy and Marine Corps Aircraft

The A-4M Skyhawk is a Marine Corps,[173] all-weather, day-night, single-seat, single-engine, dual-capable light attack aircraft. The Skyhawk series originated in 1953; the latest version is the A-4M. Some non-nuclear-capable A-4Fs remain in reserve squadrons, but are to be replaced soon by A-4Ms.[174] The A-4M is used for surface strikes in support of amphibious warfare operations, and operates as part of a Marine Air Wing. It has a combat radius of 1,700 nautical miles (3,200 kilometers) with external fuel tanks.[175] It can carry up to 10,000 lbs. of weapons and deliver the B43, B57 or B61 nuclear bomb. Approximately 104 A-4Ms are in the Marine Corp operational inventory. This number will decrease as squadrons are replaced by AV-8Bs.

The A-6E Intruder is a U.S. Navy and Marine Corps, all-weather, two-seat, twin-engine, turbojet, dual-capable, medium attack aircraft. The A-6 is designed to operate from aircraft carriers. It has an integrated attack/navigation computer system to locate targets while at a low altitude and is able to destroy sea or land targets with conventional or nuclear weapons under day and night, all-weather conditions without a visual reference to the target. The first flight of an A-6E was in 1970, and it first deployed in squadrons in 1972. Normally one squadron is assigned to a carrier air wing.[176] Approximately 280 A-6Es are in the operational inventory. The A–6E can carry up to 18,000 lbs. of weapons and deliver the B43, B57 and B61 nuclear bombs. It has a 900 nautical mile (1,700 kilometers) combat radius that can be extended to 2,818 nautical miles (5,300 kilometers) with external fuel pods.[177] An A-6F variant with improved avionics, new engines and greater weapons capability was under development. The U.S. Congress, however, denied funding for further development and procurement of the aircraft in FY 1988,[178] and the Department of Defense terminated the program in its FY 1989 budget. Money will be made available for upgrading a limited number of A-6Es to allow the A-6E to remain useful until the advanced tactical aircraft (ATA) "completely replaces it in the next century."[179]

and Pearl Harbor, Hawaii are the next largest homeports with approximately 60 and 40 ships respectively. More ships are homeported in Bangor, Washington, near Seattle; Alameda, California, near San Francisco; Long Beach, California, near Los Angeles; Mayport, Florida, near Jacksonville; New London, Connecticut; and Newport, Rhode Island. Though U.S. ships make regular port calls to overseas facilities such as Subic Bay, Philippines; Gaeta, Italy; and Rota, Spain, there is only one major permanent overseas homeport for combat ships at Yokosuka, Japan.

The U.S. Navy is implementing a Strategic Homeporting Plan that will add Everett, Washington near Seattle; San Francisco, California; Staten Island in New York City; Corpus Christi, Texas; Mobile, Alabama; Pascagoula, Mississippi; and Pensacola, Florida to the list of nuclear-capable ship homeports. Battleships are scheduled to be homeported in San Francisco, Staten Island, and Corpus Christi, while aircraft carriers will be homeported in Everett and Pensacola.[196]

The U.S. Navy and Marine Corps have 18 major nuclear weapons storage sites in the United States and overseas. Most are located near major naval stations for support of ships and aircraft. There are numerous other shore facilities that do not store nuclear weapons, but are part of the naval nuclear infrastructure. These facilities include test and training ranges for nuclear-capable units, communications complexes used by nuclear units, intelligence gathering facilities, and headquarters. Some locations such as Holy Loch, Scotland, routinely have submarines or ships with nuclear weapons docked in port and so become de facto storage locations, although no weapons are stored on land.[197]

In the Pacific, Naval Air Station (NAS) Adak, Alaska, stores B57 nuclear depth bombs for use by P-3 Orion anti-submarine aircraft. The Strategic Weapons Facility Pacific, Silverdale near Bangor, Washington, stores Trident I warheads in support of the Trident submarines homeported at Bangor. Naval Weapons Station Concord, near San Francisco, California, supports seven homeported ammunition ships of the Pacific Fleet as well as NAS Alameda and NAS Moffett Field. Weapons stored include nuclear bombs for U.S. Navy and Marine Corps aircraft, artillery warheads and atomic demolition munitions for the Marines, and nuclear depth bombs for NAS Moffett Field's P-3 Orions. NAS North Island, Coronado, near San Diego, California, stores nuclear weapons for ships in the San Diego area, including nuclear bombs, Terrier warheads, and nuclear depth bombs. Naval Weapons Station, Laplaya Annex, in Point Loma near San Diego, also supports attack submarines in San Diego, and stores SUBROC and Tomahawk warheads. West Loch, Pearl Harbor, Oahu, Hawaii, is the main nuclear weapons storage site of Naval Magazine Lualualei and provides support for the ships, submarines, and Marines at Pearl Harbor. U.S. Navy and Marine Corps bombs, ASROC and SUBROC warheads are stored there. NAS Barbers Point, Oahu, Hawaii, stores B57 nuclear depth bombs for use by P-3 Orions. Naval Magazine Santa Rita, Guam, is the main nuclear weapons storage site in the western Pacific, supporting U.S. Navy and Marine Corps units, and storing artillery projectiles, bombs, and nuclear depth bombs.

In the Atlantic, NAS Brunswick, Maine, stores B57 nuclear depth bombs for use by P-3 Orions. Naval Weapons Station Earle (Colts Neck), New Jersey, stores nuclear warheads for the Atlantic Fleet ammunition ships. Naval Weapons Station Yorktown, near Norfolk, Virginia, stores nuclear weapons for naval units in the Norfolk area, including U.S. Navy and Marine Corps bombs, ASROCs, SUBROCs, Terriers, Tomahawks, nuclear depth bombs, and Marine Corps artillery warheads and atomic demolition munitions. Naval Weapons Station Charleston, South Carolina, located on the west bank of the Cooper River about 25 miles outside of Charleston, services a wide variety of nuclear weapons, including SUBROCs and ASROCs as well as Poseidon and Trident I warheads for submarines in overhaul and storage. Naval Submarine Support Base, Kings Bay, Georgia, stores Trident I ballistic missiles and warheads. "Yellow Water," Florida (near NAS Jacksonville and Naval Station Mayport) stores Navy bombs, ASROC warheads, and B57 nuclear depth bombs for use by Mayport ships and P-3 Orions. Overseas, NAS Sigonella, Sicily;[198] Naval Aviation Weapons Facility Detachment, Machrihanish, United Kingdom;[199] and Naval Aviation Weapons Facility, St. Mawgan, United Kingdom,[200] store B57 nuclear depth bombs for use by land-based antisubmarine warfare aircraft.

III. Nuclear-capable Ships and Aircraft of the Soviet Union

The Soviet Navy consisted of 2,134 ships and submarines as of March 1987, and is the largest navy in terms of numbers of vessels. About 631 of these ships and submarines are principal combat ships, while the remainder are minor patrol vessels and support ships that are not capable of open ocean operations. A total of 294 surface warships (including 63 patrol combatants) and 339 submarines can carry a nuclear-capable weapons system.[201]

Like U.S. naval nuclear forces, Soviet forces are split between strategic and non-strategic forces. There are 77 ballistic missile submarines. Except for 13, all are accountable under SALT and START as strategic forces. In addition, according to the U.S. Joint Chiefs of Staff, "The Soviet Navy maintains an extensive sea-based nonstrategic nuclear force comprising both antisurface warfare (ASUW) and ASW systems. The Soviets maintain an inventory of nuclear-armed air and surface missiles, as well as torpedoes and depth bombs."[202] The U.S. Department of Defense's 1987 Soviet Military Power report states that, "the newest versions of both [nuclear torpedo and depth bomb] entered service in the early 1980s."[203]

Soviet naval nuclear weapons include seven types of submarine-launched ballistic missiles, six anti-ship sea-launched cruise missiles, four air-launched air-to-surface missiles, three anti-submarine warfare missiles, three different types of surface-to-air missiles, nuclear depth bombs, nuclear torpedoes, nuclear artillery projectiles, and possibly nuclear mines. With

The A-7E Corsair is an all-weather, single-seat, single-engine, turbofan, dual-capable, light attack aircraft designed to operate from aircraft carriers. First deliveries of the A-7E began in 1969 and the last of 596 A-7Es were delivered to the U.S. Navy in 1981. Two squadrons of 12 aircraft each are usually in a carrier air wing. Approximately 240 aircraft are in the active inventory, but the total number of aircraft and squadrons continues to decline as they are replaced by the F/A-18s. The A-7E can carry up to 15,000 lbs. of weapons and can deliver the B43, B57 and B61 nuclear bombs. It has a combat radius of 430 nautical miles (800 kilometers) or 550 nautical miles (1,000 kilometers) with external fuel pods.[180]

The AV-8B Harrier II is a Marine Corps, limited-weather, single-seat, single-engine, subsonic, turbofan, dual-capable, light attack aircraft. It is used primarily for close air support of Marine amphibious operations, and can operate from LHAs and LPHs, or from austere forward bases ashore. The AV-8B was procured to replace older non-nuclear-capable AV-8A/Cs. The first AV-8Bs were delivered to the Marine Corps in 1983 and by 1987 they had replaced the four AV-8A/C Marine Corps squadrons. There are currently about 100 of the aircraft in the Marine Corps inventory. By 1993, the Marine Corps wanted to have 300 AV-8Bs and 28 TAV-8B trainers for eight squadrons consisting of 20 aircraft each and one training squadron.[181] Due to fiscal constraints, however, the Marine Corps will not achieve this number of aircraft, although all the programmed squadrons will be fully filled out.[182] It can carry up to 9,200 lbs of weapons[183] and can deliver the B61 nuclear bomb. It has a combat radius of 700 nautical miles (1,300 kilometers).[184]

The F/A-18 Hornet is a U.S. Navy and Marine Corps single- or dual-seat, twin engine, dual-mission jet fighter and attack aircraft. The fighter and attack versions are identical except for interchangeable external equipment. Conversion from one mode to the other takes less than one hour. It is replacing the F-4, A-4 and A-7 aircraft and can operate from aircraft carriers and shore bases. The first production aircraft was delivered in 1980 and the first U.S. Navy combat squadron became operational in 1983. It can carry up to 16,000 lbs. of ordnance and deliver the B57 and B61 nuclear bombs. It has a 460 nautical mile (860 kilometer) fighter combat radius and a 662 nautical mile (1,230 kilometer) attack combat radius.[185] Increased capability aircraft purchased after FY 1986 are designated F/A-18C for single–seat and F/A-18D for dual-seat versions. The U.S. Navy and Marine Corps F/A-18A/B/C/D inventory is about 400 aircraft. Currently, the U.S. Navy plans to buy 1,157 aircraft for U.S. Navy and Marine Corps use by the mid-1990s.[186]

The P-3 Orion is a U.S. Navy all-weather, twelve-crew, four-engine, turboprop, long-range, maritime patrol aircraft. Its primary mission is anti-submarine warfare, and its secondary missions include surface surveillance, mining and logistics support. The P-3 was developed from the commercial Lockheed "Electra" design in the 1950s to replace the P-2 Neptune maritime patrol plane. The ASW P-3 is deployed in three versions: P-3A, P-3B or P-3C, but only the P-3B and P-3Cs are nuclear-capable.[187] P-3As became operational in 1961 and P-3Cs in 1969. The P-3Cs also have had several improvements known as Updates. Update III entered fleet service in May 1984 and Update IV is under development to enter the fleet in the 1990s.[188] Most of the 24 active squadrons fly P-3Cs (the rest fly P-3Bs) and by 1991 they should be all-equipped with P-3Cs. The 13 reserve squadrons fly P-3As and P-3Bs. About 347 P-3B/C aircraft are in the operational inventory.[189] P-3s can spend 10-14 hours flying 1,300 to 1,500 nautical miles (2,400 to 2,800 kilometers) on patrol, where they use sonobuoys, radar, forward-looking infrared sensors and magnetic anomaly detectors to locate and identify submarines. For ASW they can be armed with B57 nuclear depth bombs or conventional light-weight Mk-46 ASW torpedoes. A Long-Range Air ASW Capability Aircraft (LRAACA) is planned to replace the P-3s in the 1990s. It will be designed to carry larger payloads and should have a radius of operation of 1,600 nautical miles (3,000 kilometers).[190]

The S-3A Viking is a four person crew, all-weather, high-endurance, carrier-based, long-range, twin-engine, jet aircraft. Its prime mission is anti-submarine warfare. Secondary missions include surface surveillance and mining. It replaced the S-2 Tracker in the mid to late 1970s as aircraft carriers' fixed-wing ASW aircraft. S-3As can remain aloft for seven hours and remain on station for three hours at 300 nautical miles (560 kilometers) from the aircraft carrier. They generally patrol several hundred miles from aircraft, carriers providing an outer ASW screen. The S-3 uses sonobuoys, forward-looking infrared sensors, and a magnetic anomaly detector to locate and identify submarines. It can be armed with B57 nuclear depth bombs or Mk-46 light-weight torpedoes as well as other missiles, conventional bombs, or mines.[191] One squadron is deployed on each aircraft carrier except the USS Midway and USS Coral Sea,[192] and 187 are in the inventory. The planes are no longer in production, but a planned Weapons System Improvement Program (WSIP) is converting 160 S-3As to S-3Bs.[193]

SH-3D/H Sea Kings are twin-engine, four crew, all-weather, carrier-based, anti-submarine warfare helicopters.[194] They are the current U.S. Navy inner zone (about 40 nautical miles/75 kilometers) anti-submarine warfare helicopter for the protection of aircraft carriers. Equipped with a variable-depth active dipping sonar, sonobuoys, and a magnetic anomaly detector, the SH-3D/Hs have a 280 nautical mile (520 kilometer) radius at 120 knots.[195] SH-3D/Hs can be armed with one B57 nuclear depth bomb, or two conventional Mk-46 torpedoes or depth-bombs. Although they no longer are in production, approximately 128 operational aircraft remain in the inventory. They will be replaced by the SH-60F over a period of five to six years in the early 1990s.

D. Homeports of Nuclear-capable Ships and Shore Locations of Naval Nuclear Weapons

U.S. Navy ships are based, or "homeported," in eleven major areas. The two largest homeports are in San Diego, California and Norfolk, Virginia. Each has over a 100 ships at a number of different installations. Charleston, South Carolina,

only five "aircraft carriers" (none capable of handling conventional take-off and landing aircraft), land-based Soviet Naval Aviation (SNA) constitutes a considerable portion of Soviet offensive maritime power. SNA operates ten types of nuclear-capable aircraft and helicopters, which among them are able to deliver nuclear bombs, depth bombs, and air-to-surface missiles.

Since 1980, eleven new classes of Soviet nuclear-capable submarines and surface combatants with six different new nuclear-capable weapon systems have been introduced.[204]

A. Fleet Organization and Missions

The Soviet Navy is organized into four Fleets: Northern (Atlantic Ocean) (NORFLT), Pacific Ocean (PACFLT), Baltic, and Black Sea. Ships in the Northern Fleet are homeported on and around the Kola peninsula. Headquarters for NORFLT is at Severomorsk. Ships in the Pacific Ocean Fleet are homeported on the Kamchatka peninsula and at Far East coastal bases near Vladivostok and around the Sea of Okhotsk. PACFLT headquarters is at Vladivostok. Headquarters for the Baltic Fleet is at Kaliningrad, and for the Black Sea Fleet at Sevastopol.

The Pacific Ocean Fleet is the largest of the four fleets, comprising two aircraft carriers, 84 principal surface combatants, 121 smaller combatants, 90 auxiliaries, and 122 submarines (including 34 ballistic missile submarines). About 560 aircraft are assigned to naval aviation in the Pacific.

The Northern Fleet is the second largest fleet, composed of one aircraft carrier, 75 principal surface combatants, 88 smaller combatants, 95 auxiliaries and 170 submarines (including 37 ballistic missile submarines). Some 446 aircraft are assigned to naval aviation in the Northern Fleet.

The Baltic Fleet is composed of 44 principal surface combatants, 96 other combatant ships, 45 auxiliaries, and 48 submarines (including six Golf II class ballistic missile submarines). Naval aviation in the Baltic Fleet is assigned some 282 aircraft. The Black Sea Fleet/Caspian Flotilla is comprised of one aircraft carrier, 76 principal surface combatants, 74 smaller combatants, and 35 attack submarines.[205] Some 468 aircraft are assigned to the Black Sea Fleet.

During wartime, the Fleet commanders would become naval component commanders of Soviet joint commands, and naval operations would fall under one of five "theaters of military operations" (known as TVDs). These currently consist of Northwestern, Western, Southern, Southwestern, and Far Eastern commands, or three "oceanic" TVDs: Arctic, Atlantic, and Pacific commands. Arctic and north Atlantic operations would fall under the Northwestern TVD; central Atlantic and Baltic operations against NATO would fall under the Western TVD; Black Sea and Mediterranean Sea operations would fall under the Southern TVD; Indian Ocean and Middle Eastern operations would fall under the Southwestern TVD; and Pacific Ocean operations would fall under the Far Eastern TVD. According to U.S. Naval intelligence, "the bulk of the SSBNs would probably be preserved as a significant component of the Soviet Supreme High Command's strategic nuclear reserve," and would not be assigned directly to the TVDs.[206]

Nuclear-powered attack submarines are the most important tactical elements of the Soviet Navy and participate in its main missions: defense of the homeland against attack, protection of Soviet offensive (ballistic missile submarine) forces, and support of offensive naval operations. The diesel submarines support similar missions, but because of their more limited range and their inability to operate underwater for long periods of time, are likely to be used in coastal areas, enclosed seas (e.g., Baltic and Mediterranean) and in support of local ground force operations.[207]

The primary mission of the Black and Baltic Sea Fleets is to support Warsaw Pact ground forces.[208] Only in the Baltic and Black Seas are there alliance operational naval considerations. Soviet, East German and Polish naval units in the Baltic reportedly are under the joint command of the "Allied Socialist Fleets in the Baltic."[209] The Bulgarian Navy is essentially integrated into the Soviet Black Sea Fleet for local operations.

The secondary mission of the Black Sea Fleet would be to support Soviet naval forces in the Mediterranean. According to the U.S. Navy's Director of Naval Intelligence, "Soviet Mediterranean forces, backed up by land-based strike air, would also attempt to destroy U.S. and French carriers as well as SLCM platforms outside striking distance of the Crimea."[210]

Nuclear-Capable Warships and Submarines of the Soviet Union (1987)

Type	Number	Nuclear Weapons
Ballistic Missile Submarines	77	SS-N-5, 6, 8, 17, 18, 20, 23, SS-N-15/16, torpedoes
Cruise Missile Submarines	63	SS-N-3, 7, 9, 12, 19, SS-N-15/16, torpedoes
Attack Submarines	199	SS-N-15/16, torpedoes
Aircraft Carriers	5	FRAS-1, SS-N-12, ASW helicopters, SA-N-3, torpedoes

Type	Number	Nuclear Weapons
Cruisers	39	SS-N-3, 12, 19, SA-N-1, 3, 6, torpedoes, naval artillery, ASW helicopters
Destroyers	69	SS-N-22, SA-N-1, torpedoes, ASW helicopters
Frigates	118	torpedoes
Patrol Combatants	63	SS-N-9, 22, torpedoes
Total	**633** [211]	

B. Nuclear-capable Ships

1. Ballistic Missile Submarines

The present Soviet ballistic missile submarine force consists of 77 submarines of 11 different classes. The oldest class entered service in 1958 and the two newest classes, the Delta IV and Typhoon, are still in production. They range in size from 2,700 to 25,000 tons submerged. Depending on the class, ballistic missile submarines can carry from one to 20 missiles. Together, the submarines are loaded with 968 missiles and can fire approximately 3,447 nuclear warheads.[212] All of the submarines, with the exception of the Golf II class, have 21-inch torpedo tubes and also are capable of firing nuclear torpedoes. Approximately 15 percent, i.e., about ten submarines, are operational at any time.

There are three classes of diesel powered submarines: Golf II, Golf III, and Golf V.[213] None of these submarines is considered to be a part of "strategic" forces. The single Golf III is a test and training platform for the SS-N-8 submarine-launched ballistic missile (SLBM) and the single Golf V is a test and training submarine for the SS-N-20 SLBM. The 13 Golf II class submarines carry the SS-N-5 missile, which because of its short range is oriented toward regional strike missions. Six of the Golf II submarines are stationed in the Baltic Sea and seven are in the Sea of Japan.

The remaining 62 submarines are nuclear-powered and often are referred to as "modern" strategic submarines. All of the modern submarines are homeported in the Northern or Pacific Fleets. Two of the eight nuclear-powered classes are unique types: One Hotel III was the test platform for the SS-N-8 missile, and one Yankee II was converted from a Yankee I to fire a test solid-propellent ballistic missile, the SS-N-17.

Three major classes make up the front-line force: Yankee I, Delta I/II/III/IV and Typhoon. Currently there are 17 Yankee I class submarines, each carrying 16 SS-N-6 missiles with two multiple reentry vehicles (MRVs), giving a total of 544 warheads. As newer submarines are deployed, the Soviets have been retiring Yankee I class submarines in accordance with the provisions of the abandoned SALT II Treaty. Since 1978, 15 Yankee Is have been removed from service. Two have been converted to attack submarine configuration and one to a test platform for the SS-NX-24 sea-launched cruise missile.

There are 39 Delta submarines made up of four types. Eighteen Delta I submarines carry 12 SS-N-8 missiles each, for a total of 216 warheads. Four Delta II submarines carry 16 SS-N-8 missiles, with a total of 64 warheads. Fourteen Delta IIIs carry 16 multiple warhead SS-N-18 missiles, giving a total 1,568 warheads. Three of the new Delta IV submarines, first deployed in 1985, carry 16 multiple warhead SS-N-23 missiles, for a total of 192 warheads. The SS-N-23, which became operational in 1986, has a greater range and accuracy than the SS-N-18 deployed on Delta III class submarines. The missile is likely to be backfitted into some Delta IIIs.[214] The fourth submarine of the Delta IV class was launched in early 1987, and more submarines are in production.

An even larger submarine type than the Delta, the Typhoon class (25,000 tons submerged), was deployed in 1983, and four are currently operational. The Typhoons carry 20 SS-N-20s, the first Soviet solid-fuel SLBM equipped with multiple independently targetable reentry vehicles (MIRVs). Together, the four Typhoons carry 80 multiple warhead SS-N-20 missiles, for a total of 800 warheads. In addition, special 26-inch tubes in the pressure hull are capable of firing the SS-N-15 nuclear depth bomb or the SS-N-16 ASW missile. A fifth Typhoon was launched in 1986, and the U.S. Navy expects two to three more to be built.[215]

2. Cruise Missile Submarines

The Soviet Navy currently has 63 cruise missile submarines (SSG/SSGNs) in seven different classes, capable of carrying 502 nuclear-capable sea-launched cruise missiles of five different types. The oldest class entered service in 1961, and the newest class (Oscar) is still in production. They range in size from 3,750 to 14,500 tons submerged. All of the newer cruise missile submarines are assigned to the Northern Fleet. Some Charlie I, Echo II and Juliett class submarines are allocated

to the Pacific Fleet,[216] and Juliett class submarines also are deployed with the Baltic and Black Sea Fleets. All classes of Soviet cruise missile submarines are nuclear-powered, except for the diesel/electric-powered Juliett class.

All of the cruise missile submarines are capable of firing nuclear torpedoes from their standard 21-inch torpedo tubes, as well as launching cruise missiles from separate launchers. Charlie I, Papa, and Charlie II class submarines also can fire the SS-N-15 nuclear depth bomb. The Oscar class can fire both the SS-N-15 nuclear depth bomb and the SS-N-16 ASW missile.

The Juliett and Echo II class submarines, introduced in 1961-1962, carry the SS-N-3a/c. Juliett submarines can carry four missiles and Echo IIs can carry eight. Modification of the Echo II class submarines to carry eight SS-N-12s in place of the SS-N-3s is continuing. Fifteen reportedly were refitted to fire the SS-N-12 by 1986, and the rest presumably will be upgraded.[217]

The Charlie I class submarines and a single Papa class carry SS-N-7 missiles, although the Papa submarine also may be capable of carrying the SS-N-9. Six submarines of the Charlie II class each carry eight SS-N-9 missiles. The Papa submarine can fire ten missiles.

Four operational Oscar class submarines are capable of firing 24 SS-N-19 long-range cruise missiles and are the most capable and heavily armed Soviet anti-ship platform. They first entered service in 1981, and are still in production. A single converted Yankee ballistic missile submarine has been designated a cruise missile submarine and is the test platform for the yet to be deployed SS-NX-24 long-range SLCM.[218] The Yankee is likely to carry 12 SS-NX-24 missiles. A new nuclear-powered submarine also is expected to be deployed as a launch platform for the SS-NX-24.[219]

3. Attack Submarines

The Soviet Navy currently operates 71 nuclear-powered and 128 diesel-powered attack submarines. The oldest class entered service in 1951, and several classes are still in production. They range in size from 1,350 to 9,700 tons submerged. All of these attack submarines have 21-inch torpedo tubes and therefore can fire the standard nuclear torpedo. In addition, Romeo, Tango, Victor I/II/III, Alfa, Sierra, Mike, and Akula class submarines carry either the SS-N-15 nuclear depth bomb or the SS-N-16 dual-capable ASW missile. Carriage of these weapons may require a 26-inch torpedo tube and special fire control systems. With deployment of the SS-N-21 Sampson in late 1987, attack submarines are capable of launching sea-launched cruise missiles from their torpedo tubes (as can U.S. attack submarines). Victor III, Sierra, Akula and converted Yankee classes all are candidates to deliver the SS-N-21.[220]

Three new attack submarine classes have appeared in the last two years: Akula, Mike, and Sierra. Two submarines each of the Sierra and Akula classes, first introduced in 1986-1987, have been launched, but neither class has entered serial production.[221] The Mike class submarine appears to be one-of-a-kind.

According to the U.S. Navy, the Victor III class nuclear-powered submarines and the Kilo class diesel-powered submarines remain in production; the Kilo class at three shipyards.[222] In addition, Yankee class ballistic missile submarines are being converted to attack submarines; two already have been deployed.

4. Aircraft Carriers

The Soviet Navy has five aircraft carriers: three Kiev class guided missile V/STOL aircraft carriers (CVHGs), and two Moskva class aviation cruisers (CHGs). The ships are much smaller than U.S. front line aircraft carriers and only the Kiev class can embark fixed wing aircraft. In addition, the aircraft are all short take-off and landing designs. Conventional take-off jet aircraft are unable to operate off Soviet aircraft carriers.

The three Kiev class ships carry a number of nuclear weapons: eight SS-N-12 sea-launched cruise missiles (with eight reload missiles), one twin SUW-N-1 with FRAS-1 nuclear-only ballistic rockets, 72 SA-N-3 surface-to-air missiles, and ten 21-inch torpedo tubes. The Kiev class ships with their angled flight decks also can embark about 30 aircraft: 12 Yak-36 Forger short take-off and landing (STOL) fighters, and up to 24 Ka-25 Hormone A/B or Ka-27 Helix A helicopters. These aircraft are capable of delivering nuclear bombs and depth bombs. A fourth and final Kiev class carrier, the Baku, is in sea trials and probably will be deployed in 1989.

Two Moskva class ships were introduced in 1967 and are homeported in the Black Sea. They are not capable of launching cruise missiles or carrying fixed wing aircraft, but carry one twin SUW-N-1 with FRAS-1 nuclear-only ballistic rockets and 44 SA-N-3 surface-to-air missiles. In addition, the Moskva class ships embark about 14 Ka-25 Hormone A anti-submarine helicopters. These helicopters are capable of delivering nuclear depth bombs.

The Soviets have at least two large-deck (65,000-70,000 ton) "Kremlin" class aircraft carriers under construction at the Nikolayev Shipyard in the Black Sea. The keel of the first aircraft carrier, tentatively identified as the Brezhnev, was laid in January 1983, and the ship will be deployed about 1995. These aircraft carriers ultimately will be able to accommodate some 35-60 aircraft, but it appears that initially they will be restricted to short take-off and landing fighters and Ka-27 Helix helicopters.[223] This, according to the U.S. Navy, is due to problems the Soviets evidently have experienced with "catapult design, manufacturing, installation, and maintenance," and "there is thus a possibility the first unit may initially appear

similar to an enlarged Kiev with a vertical short take off and landing (VSTOL)/helo or short take off/arrested landing (STOAL) air wing. Once catapult problems are solved, retrofit and upgrade of the older unit(s) could be accomplished."[224]

5. Cruisers

The Soviet Navy operates 39 cruisers, all nuclear-armed. One class, the Kirov, is nuclear-powered, while the rest are conventionally-powered. The cruisers can deliver sea-launched cruise missiles, nuclear torpedoes, and surface-to-air missiles, as well as embark anti-submarine warfare helicopters.

The newest cruiser is the Kirov class. Two of the cruisers are operational, a third is fitting out, and a fourth is under construction in the Baltic.[225] The Kirov was the first surface combatant to deploy with the Soviet Navy's longest range SAM system, the SA-N-6, and its newest long-range SLCM, the SS-N-19. The ships carry 20 SS-N-19s in vertical launchers, as well as 96 SA-N-6 surface-to-air missiles, and are outfitted with eight 21-inch torpedo tubes. The Kirov also is capable of carrying up to three Ka-25 Hormone or Ka-27 Helix helicopters, which can deliver nuclear depth bombs.

The second cruiser production program is the conventionally-powered Slava, which became operational in 1981. Two Slava class cruisers are currently operational, a third is fitting out, and a fourth is under construction.[226] The Slava can launch 16 SS-N-12 sea-launched cruise missiles and 64 SA-N-6 surface-to-air missiles from vertical launchers, and has ten 21-inch torpedo tubes.

Besides the two classes of cruisers that are under construction, there are five older nuclear-capable classes: Kara, Kresta I, Kresta II, Kynda, and Sverdlov. The seven Kara class cruisers were deployed between 1973 and 1980, and mount 72 SA-N-3 surface-to-air missiles and ten 21-inch torpedo tubes. They also carry a single Ka-25 Hormone A that can deliver nuclear depth bombs. The four Kresta I class cruisers became operational between 1967 and 1969, can launch four SS-N-3b sea-launched cruise missiles and 44 SA-N-1 surface-to-air missiles, and have ten 21-inch torpedo tubes. One Ka-25 Hormone A can be carried. The ten Kresta II cruisers entered service from 1969 to 1978, and have ten 21-inch torpedo tubes, 72 SA-N-3 surface-to-air missiles, and carry a single nuclear-capable Ka-25 Hormone A. Four Kynda class cruisers, deployed from 1962 to 1965, can launch 16 SS-N-3b sea-launched cruise missiles (eight are reloads), 24 SA-N-1 surface-to-air missiles, and also have six 21-inch torpedo tubes. Finally, ten older Sverdlov class cruisers deployed from 1951 to 1955 may be nuclear-capable because of their 12 152mm artillery guns.[227]

6. Destroyers

The Soviet Navy has 69 nuclear-capable destroyers spread among 11 classes. The destroyers all carry 21-inch torpedo tubes and some of the older ships carry surface-to-air missiles, while others carry sea-launched cruise missiles. The newest Udaloy class can carry two Ka-27 Helix A anti-submarine helicopters.

Two classes of destroyers, both first deployed in 1981, are currently under construction: the Sovremennyy class and the Udaloy class. Seven Sovremennyy ships are active, the eighth ship is fitting out and four more are under construction. The Sovremennyy boats carry eight SS-N-22 sea-launched cruise missiles and four 21-inch torpedo tubes. Eight Udaloy class ships are active, and three more are launched but still under construction. The Udaloy class carries eight "long-range cruise missile-delivered ASW weapons"[228] and eight 21–inch torpedo tubes.

The nine older classes of destroyers all carry 21-inch torpedo tubes. The single ship of the Kildin class can fire the SS-N-1 sea-launched cruise missile, but the missile is thought to be inactive. Six Kanin class and seven SAM Kotlin class ships each can carry 16 SA-N-1 surface-to-air missiles. Twelve Kashin class and six Modified Kashin class destroyers can deliver 36 SA-N-1s.

7. Frigates and Patrol Combatants

One hundred–eighteen frigates and 63 patrol combatants of the Soviet Navy are nuclear-capable. The 118 frigates of four classes and 31 guided missile patrol combatants of the Turya class all carry 21-inch torpedo tubes. Seventeen Nanuchka I class and nine Nanuchka III class guided missile patrol combatants carry six SS-N-9 sea-launched cruise missiles. Five Tarantul III class patrol combatants carry four SS-N-22 sea-launched cruise missiles, and a single Sarancha class guided missile patrol combatant (hydrofoil) carries four SS-N-9 sea-launched cruise missiles.

8. Support Ships

The Soviet Union has 29 auxiliary naval ships that are capable of nuclear weapons support, i.e., either transportation, maintenance, or supply.[229] Sixteen ships are missile tenders (AEM) that transport ballistic and cruise missiles to Soviet bases, ships, and submarines. A single large replenishment oiler (Berezina class) can provide underway weapons support to submarines. Twelve submarine tenders (AS) also provide underway and moored transport and supply for attack submarines. These Ugra and Don class submarine tenders can support as many as 12 submarines at sea with supplies, fuel, water, and spare torpedoes. No Soviet amphibious ships or landing craft are thought to be capable of transporting nuclear weapons, and there are no ground-launched nuclear weapons assigned to Naval Infantry.

C. Nuclear-capable Aircraft

Soviet Naval Aviation (SNA) "possesses a significant portion of the cruise missile combat power in the Soviet inventory,"[230] comprising about 1,756 aircraft.

The Backfire A/B/C (Tu-26) is an all-weather, twin-engine, dual-capable medium range bomber. It was introduced in 1974, and currently is deployed in the Black Sea, Baltic, and Pacific Ocean Fleets. Older Badger bombers are being replaced with the newest variant of the supersonic Backfire medium range bomber – the Backfire C – which became operational in SNA in 1986. The Backfire can be armed with nuclear bombs or dual-capable AS-4 air-to-surface missiles. Some 290 are deployed in the Soviet military, 160 with Strategic Aviation and 130 with SNA.

The Badger A/C/G (Tu-16) is a twin-engine, dual-capable medium range bomber. It was introduced into the SNA in 1955 and is being partially replaced by the Backfire. The Badger can deliver nuclear bombs and fire the AS-2, AS-5 and AS-6 air-to-surface missiles. The Soviet military has some 475 Badgers; 275 are assigned to SNA, and 190 are bomber versions.

The Blinder A (Tu-22) is a twin-engine, dual-capable medium range bomber. It was first deployed in 1962. About 185 Blinders of all types are deployed by the Soviet Union, 50 with SNA. SNA Blinders do not carry missiles.[231]

The Fitter C (Su-20) is a swing wing, single seat, medium range fighter suited for the support of amphibious forces and "antiship attacks against fast and highly maneuverable small combatants."[232] Fitters are assigned to the Soviet Air Force and SNA. Approximately 100 Fitter Cs are assigned to SNA. SNA has two Fitter C fighter bomber units, one in the Baltic Fleet and one in the Pacific Fleet.

The Fencer E (Su-24) is a strike and reconnaissance version of the long-range Fencer fighter and was first introduced in the Baltic Fleet of SNA in 1986. The dual-seat, twin engine aircraft can perform both strike and reconnaissance missions at nearly twice the range of the Fitter.[233]

The Mail (Be-12) is a land-based maritime patrol and anti-submarine warfare aircraft. It was introduced in 1966 and about 95 are active in the Soviet Navy.

The May (Il-38) is a land-based long-range maritime patrol and anti-submarine warfare aircraft. About 60 are operationally deployed, and they make regular visits to South Yemen, Libya, and Syria.

The Bear F (Tu-142) is a land-based long-range, turboprop maritime patrol and anti-submarine warfare aircraft. First introduced in 1970, and subsequently upgraded, some 55 are deployed in the Soviet Navy. The planes operate from Cuba, Angola, and Vietnam.

Soviet Naval Aviation also includes two ship-based anti-submarine warfare helicopters capable of delivering nuclear depth bombs: the Ka-25 Hormone A, introduced in 1967, and the Ka-27 Helix A, introduced in 1982. According to the U.S. Navy, "all new major combatants are capable of carrying the Soviet's newest ASW helo – the Helix A."[234]

IV. Nuclear-capable Ships and Aircraft of the United Kingdom

The Royal Navy has more than 135 warships. The 84 major combatants include: four Polaris nuclear-powered ballistic missile submarines, 15 nuclear-powered attack submarines,[235] 13 diesel patrol submarines, and 52 surface ships. Approximately 32 percent of these are nuclear-capable, including the four Polaris ballistic missile submarines, three aircraft carriers and 23 destroyers and frigates. Only the ballistic missile submarines, however, actually launch nuclear weapons. The other ships store weapons to be used by their embarked planes and helicopters. The United Kingdom possesses the only non-U.S. naval tactical nuclear weapons assigned to NATO. The Royal Navy and Royal Air Force also operate about 271 nuclear-capable aircraft with naval missions.[236]

The single largest category of U.K. naval nuclear weapons is the stockpile of warheads for the 128 Polaris submarine-launched ballistic missiles. Nuclear depth bombs and free-fall bombs assigned to selected carrier-based helicopters and Sea Harrier aircraft, as well as to land-based Buccaneers in the maritime strike role, make up the remainder of the stockpile. (Nuclear-capable Nimrods would use U.S. B57 nuclear depth bombs, not those of the U.K.)

A. Fleet Organization and Missions

The Fleet of the Royal Navy is organized into three flotillas and two commands, each made up of several squadrons. The First and Second Flotillas are composed of squadrons of destroyers and frigates, whose primary task is to escort aircraft carriers or convoys. The Third Flotilla is made up of the anti-submarine warfare carriers and the amphibious assault ship, the largest surface ships in the Royal Navy. The Submarine Command is composed of four squadrons: 1st Squadron of patrol submarines at Gosport, 2nd Squadron of attack submarines at Devonport, 3rd Squadron of attack and patrol submarines at Faslane, and the 10th Squadron of Polaris submarines at Faslane. Mine Countermeasures Command is in charge of minesweepers and smaller coastal patrol vessels.

When acting unilaterally, the Royal Navy remains under the U.K. command structure and operational plans. However, during NATO exercises or in a crisis or war involving NATO forces, the control of U.K. naval forces in open ocean operations is transferred to NATO's Supreme Allied Commander Atlantic (SACLANT).[237] The senior U.K. naval officer, CINCFLEET in Northwood, U.K., is commander of naval, submarine and maritime air forces in the Eastern Atlantic (CINCEASTLANT) area during NATO operations, as well as Commander-in-Chief of the English Channel area command (CINCHAN).

The Royal Navy has no forces exclusively for operations outside of NATO. However, recently up to three Royal Navy destroyers or frigates (two of which are nuclear-capable), plus assorted minesweepers and support ships, have been deployed and conduct exercises in the Persian Gulf. Small naval garrisons remain in Hong Kong, Diego Garcia in the Indian Ocean, the Falkland Islands, and the West Indies.

The Royal Navy supplements its residual overseas presence with occasional global deployments of task forces. Nuclear-capable Royal Navy task forces were deployed in 1980, 1983-84 and in 1986. During "Global 86," a Royal Navy task group carried out an unprecedented circumnavigation of the globe, conducted four major exercises including the first-ever participation in the large U.S. Pacific Fleet exercise "Rimpac," and visited 21 countries.

Nuclear-capable Buccaneer attack aircraft, Nimrod anti-submarine aircraft, and various helicopters also conduct anti-submarine warfare training at the U.S. Atlantic Undersea Test and Evaluation Center in the Bahamas, and Nimrod aircraft deploy periodically overseas.

The Royal Navy's anti-submarine warfare capability is its main contribution to NATO naval forces. Former U.S. Secretary of the Navy John Lehman stated that the United States counts on the Royal Navy "to provide 70% of the ready NATO forces for protection of shipping against the Soviet threat" in the eastern Atlantic.[238] The three Royal Navy Invincible class aircraft carriers, and destroyer and frigate escorts, provide specialized anti-submarine warfare task groups and form NATO's Anti-submarine Striking Force Atlantic.

These anti-submarine warfare forces coordinate with U.S. Navy carrier battlegroups to constitute NATO's offensive force, the Striking Fleet Atlantic (STRKFLTLANT). The anti-submarine warfare task forces seek and destroy Soviet attack submarines with Sea King and Lynx helicopters launched from the carriers, Type 24 Destroyers and Type 22 frigates, and could use nuclear depth bombs. The nuclear-capable RAF Nimrod anti-submarine warfare aircraft also could support the task forces.

The Royal Navy's nuclear- and diesel-powered submarines also contribute to NATO's anti-submarine warfare. The United Kingdom provides the only European SSN fleet assigned to NATO. It currently is comprised of 15 nuclear-powered attack submarines and soon will be expanded to 18 submarines. NATO plans call for allied submarines to help defend the Greenland-Iceland-United Kingdom (GIUK) gap and coastal areas,[239] thus freeing U.S. attack submarines to go forward into Soviet waters. Although U.K. attack submarines play an important role in NATO's strategy, they are not nuclear-capable like Soviet and some U.S. attack submarines.

B. Nuclear-capable Ships

1. Ballistic Missile Submarines

The four U.K. Polaris ballistic missile submarines -- HMS Resolution, HMS Repulse, HMS Renown, and HMS Revenge -- were commissioned between 1967 and 1969. They originally were armed with U.S. Polaris A-3 missiles, each carrying three U.K. warheads. Now each carries sixteen Polaris A3-TK (Chevaline) missiles with two multiple reentry vehicles (MRVs). The 128 warheads stockpiled for these missiles comprise the United Kingdom's entire strategic nuclear arsenal.[240] The 10th Squadron of the Submarine Command is responsible for three of the submarines that are operational at any given time. Of these three submarines, only one or two are on active patrol (often only one), while the third is involved in training and resupply at Faslane. A fourth submarine is usually out of service undergoing maintenance at the Rosyth shipyard. Since the first patrol of the HMS Resolution in 1968, the SSBN fleet has completed an estimated 183 operational patrols as of January 1988, and has an average at-sea availability of 54 percent.[241]

The United Kingdom currently is constructing a new Vanguard class of four submarines to replace the existing Resolution class.[242] The first was ordered in 1986, and will be commissioned in 1992 to enter service in the mid-1990s. These submarines are expected to be about twice the size of the current Resolution class (displacing 15,500 vs. 8,400 tons submerged) and carry 16 Trident II missiles.

The Resolution class submarines are based at Faslane on the Clyde Estuary in Scotland. The submarines each have two crews that rotate on twelve-week cycles, four weeks of trials and maintenance and eight weeks on patrol. They routinely are under control of NATO and targeted in accordance with NATO plans, although U.K. independent targeting plans also exist. The submarines transit north between Scotland and Ireland into the Atlantic Ocean to a specified "block" of water in the northern Atlantic, where they patrol.[243] This patrol area is always cleared with the U.S. Commander Submarines Atlantic (COMSUBLANT) Representative in the Royal Navy Polaris command center at Northwood, Middlesex. This serves to coordinate the United States' and U.K. SSBN operations and patrol areas when the countries are acting in unison,

and the "prevention of mutual interference" when they are acting apart.[244] If the Royal Navy's SSBN is ordered to transfer to another patrol area, other NATO and French submarines will be warned of its intended course, and will clear a lane about 4 nautical miles (8 kilometers) each side of its path.[245]

2. Aircraft Carriers

The Royal Navy has three nuclear-capable aircraft carriers: HMS Invincible (R05), HMS Illustrious (R06) and HMS Ark Royal (R07), all homeported at Portsmouth. These ships displace about 19,800 tons at full load and were commissioned between 1980 and 1985. They usually embark some 14 to 17 aircraft in peacetime: one squadron of five to eight Sea Harrier vertical/short take-off and landing (V/STOL) jets, one squadron of nine Sea King anti-submarine warfare helicopters, and a few airborne early warning Sea King helicopters.[246]

These aircraft carriers are certified for carrying nuclear weapons in peacetime as well as in wartime. They carry WE-177 nuclear bombs for delivery by the Sea Harrier aircraft, and U.K.-built anti-submarine nuclear depth bombs[247] for use by the Sea King anti-submarine warfare helicopters. It is believed that each vessel is allocated about three to five WE-177 bombs and some three to five nuclear depth bombs.[248]

Although the Sea Harriers provide the carriers with some anti-air and surface strike capability, the carriers and their escorts are mainly optimized for anti-submarine warfare. As such, in a war with the Soviet Union they are expected to fulfill the NATO requirement of protecting carrier battlegroups against Soviet submarines and supporting control of the Norwegian Sea.

3. Destroyers

Twelve of the Royal Navy's thirteen destroyers are nuclear-capable.[249] They are Type 42 destroyers and are divided into three "Batches," with each Batch containing progressively more modernized capabilities. The eight ships in Batch 1 and Batch 2 were commissioned between 1976 and 1982, and displace 4,100 tons at full load. (Two more of these ships, HMS Sheffield and HMS Coventry, were lost during the Falklands War.) The four Batch 3 ships are about 52 feet (16 meters) longer than the other eight ships, and displace 5,350 tons at full load. They were commissioned from 1982 to 1985.[250] Four of the Type 42s are homeported at Rosyth and the others are at Portsmouth.

These ships are certified for nuclear weapons carriage in wartime, but reportedly not in peacetime. Batch 1 and 2 vessels embark one nuclear-capable Lynx anti-submarine helicopter, while Batch 3 ships can deploy two. All can carry nuclear depth bombs.

4. Frigates

Eight of the thirty-four frigates in the Royal Navy are nuclear-capable.[251] These eight ships belong to the Type 22 frigate class. The Type 22 class, in turn, consists of: four Batch 1 ships commissioned between 1979 and 1982, displacing 4,200 tons full load; and four Batch 2 ships commissioned between 1983 and 1987, displacing 4,800 tons full load. These ships are homeported at Devonport, Plymouth, Devon. Six more Type 22 frigates are on order or under construction, including two more Batch 2 ships and four of the new Batch 3 ships. All six ships are expected to be commissioned in 1988-1989.

The Type 22 frigates are reportedly certified to carry nuclear weapons in both wartime and peacetime. The four Batch 1 ships can carry two Lynx anti-submarine helicopters, but usually embark one. The Batch 2 ships can carry either two Lynx or one Sea King helicopter, as will the Batch 3 ships under construction.[252] Each ship is allocated two to three nuclear depth-bombs for use by the anti-submarine helicopters.

A new class of frigate, the Type 23 Duke class, is planned for operation in the 1990s. Four Batch 1 ships of this class already have been ordered, with the first of the class, HMS Norfolk, due for commissioning in 1989. Another eight of the Batch 1 ships are expected to be ordered in the next few years, to be followed by an additional eight of a modernized variant, bringing the total to around 20 Type 23s.[253] The Type 23 will operate the Sea King or the nuclear-capable ASW variant of the new EH-101 helicopter.

5. Support Ships

Four Royal Fleet Auxiliary (RFA) ships – HMS Fort Grange, HMS Fort Austin, HMS Resource, and HMS Regent – have a nuclear capability. They are used for at sea replenishment of warships and are nuclear certified for peacetime operations. Since a number of nuclear-certified ships are based at homeports that do not have nuclear certification (Portsmouth, for example), the auxiliary ships are used to off-load nuclear weapons from warships before their arrival in port and on-load them after they depart. The RFAs take part in the Royal Navy's worldwide operations.

C. Nuclear-capable Aircraft

The Buccaneer S.2B is a Royal Air Force, two-seat, two-engine, turbofan, dual-capable, maritime strike aircraft. The first flight of a Buccaneer prototype took place in 1958; the Buccaneer Mk.1 entered the force in 1962, and the first Buccaneer S.2Bs were delivered in 1969.[254] The Buccaneer S.2B can carry conventional arms as well as WE-177 nuclear bombs in the internal bomb bay for anti-shipping and land attacks. It has a typical strike range of 2,000 nautical miles (3,700

kilometers).[255] Twenty-five of the 52 Buccaneer S.2Bs are operational at RAF Lossiemouth, Grampian, Scotland, with Squadrons 12 and 208 of Number 18 Group. Another 18 are in the reserve and nine more are undergoing conversion from S.2A variants formerly based in West Germany.[256]

The Nimrod MR.2 is a Royal Air Force all-weather, four-engine, turbofan, dual-capable, maritime patrol aircraft. It has a primary mission of maritime patrol and a secondary mission of anti-submarine warfare. The first flight of the Nimrod MR.1 prototype was in 1967, and the first MR.2 was delivered to the RAF in 1979.[257] It can carry U.S. B57 nuclear depth bombs, as well as conventional weapons. It has a range of 5,000 nautical miles (9,265 kilometers). Thirty-one Nimrod Mk.2s belong to RAF Group Number 18 and are spread among four squadrons and one Operational Conversion Unit (OCU). Each squadron has about six aircraft available with several more undergoing maintenance. Three squadrons – the 120th, 201st, and 206th – are based at RAF Kinloss, Grampian, Scotland. Another squadron, the 42nd, is located at St. Mawgan, Cornwall with some five nuclear-capable Nimrods. Three more Nimrods in Operational Conversion Unit 236 are located at St. Mawgan and would become Squadron 38 during mobilization. Of these planes, all are capable of carrying U.S. nuclear depth bombs. Sixteen Nimrods were fitted with aerial refueling probes and are designated MR.2Ps.[258]

The Sea Harrier FRS.1 is a Royal Navy, single-seat, single-engine, light attack jet. It is a carrier-based plane used for air-intercept and strike warfare. The first Royal Air Force prototype flew in 1966 and the naval version was delivered in 1977.[259] It can carry a variety of conventional weapons for air-to-air or air-to-surface attack as well as the WE-177 nuclear bomb. The Sea Harrier's trademark characteristic is its vertical/short take-off and landing capability (V/STOL), and it has a range of 760 nautical miles (1,400 kilometers). Thirty-four aircraft are deployed with two squadrons (800, 801) and one training squadron (899). Each aircraft carrier normally embarks one squadron. When not at sea these squadrons are located at Royal NAS Yeovilton, Ilchester, Somerset.

The Lynx HAS.2/3 is a Royal Navy, one-crew, dual-engine, light ship-based helicopter. It is designed for anti-submarine warfare, with secondary anti-ship missions. The first Lynx flew in 1971 and currently about 78 helicopters are deployed with three squadrons. Squadron 702 has Lynx HAS.2/3s and does air crew training. Squadrons 815 and 829 have about 35 Lynx HAS.2s each. The Lynx can carry one nuclear depth bomb, as well as conventional torpedoes and anti-ship missiles. It has a range of 320 nautical miles (590 kilometers)[260] and is deployed on Type 42 destroyers and Type 22 frigates, each ship usually carrying one Lynx helicopter in peacetime. However the Batch 3 Type 42 destroyers and all the Type 22 frigates could carry two Lynx helicopters each in wartime. When not at sea Lynx helicopters are located at Royal NAS Portsmouth.

The Sea King HAS.5 is a Royal Navy, dual-engine, medium ship-based helicopter primarily used for anti-submarine warfare. It is a U.K. produced version of the U.S. Navy's Sea King helicopter. The first U.K. version flew in 1969.[261] It can carry nuclear depth bombs as well as conventional torpedoes and depth bombs and has a range of 660 nautical miles (1,230 kilometers). Seventy-six HAS.5 helicopters are deployed with seven squadrons. Fifty-six of these 76 helicopters are operational in the ASW role; 20 are used for ASW training. The aircraft carriers usually embark one squadron of nine aircraft, while the Type 22 frigates Batches 2 and 3 could embark one Sea King helicopter each. When not at sea, six Sea King squadrons are based at Royal NAS Culdrose, Helston, Cornwall and one (Squadron 819) is at Prestwick, Strahclyde, Scotland. Two non-nuclear-capable variants exist: the Mk4s, which are used for the delivery of commandos, and the AEW Mk2s, which are Sea King HAS.2s that have been converted to airborne early warning helicopters.

D. Bases for Nuclear-capable Ships and Aircraft, and Shore Locations of Nuclear Weapons

There are numerous facilities in the nuclear infrastructure that support the United Kingdom's naval nuclear weapons, including command, control and communication, research, testing, training, and war planning facilities. An estimated 18 complexes in the United Kingdom contain nuclear-capable ships and aircraft or store nuclear weapons.

Four homeports support nuclear-capable ships. The Royal Navy's four Polaris submarines are homeported in Faslane, Gareloch, Strathclyde, Scotland. The three aircraft carriers as well as eight Type 42 destroyers are homeported at Portsmouth. The four other Type 42 Destroyers are at Rosyth and the Type 22 frigates are at Devonport.

Nuclear-capable aircraft are located at seven bases. Royal Navy Sea Harriers are at Royal NAS Yeovilton, Ilchester, Somerset; Lynx helicopters are at Royal NAS Portsmouth; and Sea King helicopters are at Royal NAS Culdrose, Helston, Cornwall and Prestwick, Strathclyde, Scotland (for anti-submarine protection of the submarine bases). Royal Air Force Buccaneers are based at RAF Lossiemouth, Grampian, Scotland; and Nimrods are at RAF Kinloss, Grampian and St. Mawgan, Cornwall.

Nuclear warheads for U.K. naval forces are located at about seven locations from Scotland to Cornwall. Polaris missiles and their warheads are stored at Coulport, Loch Long, Strathclyde, and maintained and overhauled at Burghfield, Berkshire, where other Royal Navy warheads are serviced as well. Nuclear depth bombs probably are stored in the Royal Navy Armament Depot at Dean Hill, Salisbury, Wiltshire and the depots at Bull Point and Ernesettle, both near Plymouth, Devon. Nuclear gravity bombs possibly are stored at RAF Lossiemouth, Scotland. RAF Kinloss, Scotland, also is a possible wartime nuclear weapons storage base.

Outside the United Kingdom, the Royal Navy still retains several bases used by nuclear-capable naval forces. Gibraltar is a dockyard and temporary homeport for Royal Navy ships, some of which are nuclear-capable, on rotational assignment

to NATO forces in the Mediterranean Sea. Port Stanley in the Falklands had nuclear-capable navy Sea Kings deployed in 1983, which were withdrawn in 1987. Nuclear-capable Nimrods deploy periodically to Kindley NAS (Bermuda), Keflavik (Iceland), Gibralter, to Ascension Island in the Atlantic, to the U.K. air base in Akrotiri, Cyprus, and to Oman and Australia for anti-submarine warfare training.

V. Nuclear-capable Ships and Aircraft of France

The French Navy has more than 150 warships. Some 67 of these are major combatants, including six nuclear-powered ballistic missile submarines, 14 conventionally-powered (diesel/electric) attack submarines, three nuclear-powered attack submarines, two aircraft carriers, one cruiser, 16 destroyers and about 25 frigate class ships.[262] Eight of these ships are nuclear-capable: the six ballistic missile submarines and two aircraft carriers. Nuclear-capable French naval aviation consists of 36 Super Etendard aircraft.[263] France's other land-based aircraft with naval missions and sea-based anti-submarine warfare helicopters are not reported to have a nuclear capability.

France's nuclear doctrine closely links tactical/theater nuclear weapons (called prestrategic weapons by the French) such as those of the Super Etendard with strategic nuclear weapons. French nuclear attacks are characterized as involving two "waves." The first wave would be the simultaneous use of all the prestrategic nuclear weapons belonging to the Navy, Army and Air Force. In the second wave, if the first failed to stop the enemy from further escalation, strategic nuclear weapons would be used.

The French doctrine is a product of its "limited" (relative to the superpowers) nuclear capability combined with its ostensible independence from NATO. As French nuclear weapons increase in numbers, capability and diversity, and as France strengthens its ties with NATO, it may move away from this strategy. For example, the French Navy's nuclear weapons program will increase the numbers of warheads on SLBMs seven times from 80 warheads in 1984, when the five ballistic missile submarines were equipped with M20 missiles, to 592 warheads when the new generation submarine is at sea in 1994 and all seven submarines are equipped with M4 missiles. This will provide substantial new flexibility for nuclear targeting and doctrine, and perhaps result in a change in the two-wave strategy.

A. Fleet Organization and Missions

The Marine Nationale is divided into five major commands: La Force Océanique Strategic (FOST), Mediterranean Forces, Atlantic Forces, Naval Forces Pacific Ocean, and Naval Forces Indian Ocean. FOST controls the SSBN fleet that operates out of Ile Longue, Brest, and is independent of the other naval commands. The Mediterranean fleet is based at Toulon and includes the two nuclear-capable aircraft carriers as well as sundry other non-nuclear-capable surface ships, minor combatants, nuclear-powered attack submarines, and naval air forces. A similar assortment of non-nuclear ships, submarines and aircraft is controlled by the commander of the Atlantic fleet, and operates out of Brest, Landivisiau, and Hyeres. The commander of the Pacific forces is based in Papeete, French Polynesia. He commands a dozen or more smaller non-nuclear combatants and auxiliary ships and protects the French Nuclear Test Center in the Pacific. Finally, the Indian Ocean forces' commander is based on board a fleet tanker and controls about a dozen smaller non-nuclear combatants and support ships, as well as contingency deployments such as those ships currently in the Gulf of Oman protecting French shipping in the Persian Gulf. Only the FOST and Mediterranean Fleet regularly are assigned the nuclear-capable ships, although the aircraft carriers can be deployed into other sea areas.

French nuclear-capable aircraft carriers range worldwide. France patrols the third largest area in the world after the United States and Soviet Union.[264] Moreover, France stresses the need for continued training for a variety of scenarios. Such interests and preparation allow France to engage in a wide range of naval operations – for example, a carrier task group, centered on the aircraft carrier Foch, operated off Lebanon in 1983 and was activated after the U.S. attacks on Libya, and both carriers recently have deployed to the Persian Gulf. Carriers also have deployed in the Gulf of Guinea off the west coast of Africa, and near Ethiopia and South Yemen.[265]

B. Nuclear-capable Ships

1. Ballistic Missile Submarines

France has six nuclear-powered ballistic missile submarines, each displacing 8,940 tons submerged.[266] They entered active service between 1971 and 1985. Each ship is armed with 16 submarine-launched ballistic missiles. Four submarines – Le Redoutable, Le Terrible, Le Foudroyant, and L'Indomptable – currently carry the single-warhead M20 missile. The newest submarine, L'Inflexible, carries the new M4A six-warhead MIRVed SLBM, and another, Le Tonnant, carries the new M4 (modified) 4-6 warhead MIRVed SLBM. By 1992, all ships will receive the M4 (modified) submarine-launched ballistic missile except Le Redoutable, which is considered too old to be worth modifying. This will increase the number of warheads carried on the six submarines' 96 SLBMs from the current 256 to 496.

A new class of French SSBNs is under construction, to enter service in 1994 and replace Le Redoutable before it retires in 1997. The first of this "New Generation" (SNLE-NG) class of ballistic missile submarines, Le Triomphant, will displace 14,200 tons submerged, have a length of 455 feet (138 meters), and a crew of 100 (compared to 138 in current Redoutable

class ballistic missile submarines).[267] Le Triomphant, the seventh French SSBN, also will have 16 missiles tubes, and at first will carry a new version of the M4 missile, armed with the "almost invisible" TN-75 warhead, which started development in 1986.[268] The M4s on the new generation ballistic missile submarines will in turn start being replaced by the M5 SLBM before the end of the century.

French ballistic missile submarines, like their U.S. and U.K. counterparts, each have two crews to maximize time on patrol.[269] The submarines typically spend two months on patrol and then return to Brest for a few days to exchange crews before going back to sea. Significant naval activity takes place around Brest to protect the submarines as they come and go.[270] The submarines equipped with shorter-range M20 missiles must move into the Norwegian Sea to be able to strike their targets in the Soviet Union, but the submarines armed with new longer-range M4 missiles will be able to reach their targets while patrolling near France.[271] The 172nd patrol of the FOST began with Le Terrible at the end of February 1986, and by January 1988 an estimated 200 patrols will have been completed.

2. Aircraft Carriers

France is the only country, besides the United States, to operate conventional take-off and landing aircraft carriers. France has two nuclear-capable Clemenceau class aircraft carriers, the Clemenceau (R98) and the Foch (R99). These are the French Navy's only nuclear-capable surface ships.[272] The Clemenceau achieved operational capability in 1961, but it was not outfitted for carrying nuclear weapons for its aircraft until 1978, when the nuclear-capable Super Etendard was deployed.[273] The Clemenceau can carry nuclear gravity bombs or the Air-Sol-Moyenne-Portée (ASMP) air-to-surface missile for the use of its Super Etendard aircraft. The Foch similarly was modified to carry the ANT-52 and ASMP missile and became nuclear-capable in 1981.

These aircraft carriers displace about 32,780 tons at full load[274] and can embark 40 assorted aircraft:[275] two squadrons of nuclear-capable Super Etendard strike aircraft, one squadron of F-8E Crusader interceptors, Alize anti-submarine warfare aircraft, and several helicopters for search, rescue and daytime transport.[276] The mixture and numbers of aircraft give these ships a multiple mission capability, allowing them to conduct anti-air warfare, anti-submarine operations, and surface strikes at sea and ashore.

French plans allow for one carrier at sea, and one in refit or assisted maintenance while its air group is ashore training or re-equipping. In time of tension or war, however, the second carrier can be deployed; for example, in 1987 both carriers were active in the Persian Gulf region.

Although the Clemenceau carriers will retire in the 1990s, France intends to retain a carrier capability into the next century. In 1980 the French Defense Council approved the construction of two replacement nuclear-powered aircraft carriers,[277] although just one is on order to date. These Charles-de-Gaulle class carriers will displace 36,000 tons at full load[278] and will be powered by two nuclear reactors. They will carry approximately 40 aircraft and store nuclear ASMP air-to-surface missiles for aircraft delivery.[279] The first ship is to reach operational capability in 1996.

C. Nuclear-capable Aircraft

The sea-based tactical bomber force (aviation embarquée) is the most recently formed contingent of French tactical nuclear forces. It consists of one type of nuclear-capable aircraft, the Super Etendard, which is a single-seat, single-engine, all-weather, attack/fighter aircraft. Its primary role is sea strike or ground attack, with a secondary fighter role. The Super Etendard was the first French aircraft designed with inertial navigation capability from its inception.[280] The plane has a top speed of over Mach 1 in high level flight[281] and a 370 nautical mile (700 kilometer) practical combat radius.[282] The Super Etendard project began in 1973 and the plane was deployed in 1978.[283] Eighty-five aircraft were manufactured and France currently has 56. Theoretically all are nuclear-capable, although only 36 are formally declared to be so. They can carry one ANT-52 or a smaller-yield nuclear bomb. France also has allocated funds to modify approximately 50 Super Etendards to carry one nuclear ASMP air-to-surface missile each. Plans call for updating 43 aircraft between 1984 and 1988, with the rest to be updated after 1988.[284]

Of the 56 aircraft deployed, some 36[285] are active and the rest are in reserve. They are organized into three squadrons of about 15 aircraft each.[286] The 11F and 14F squadrons operate out of Landivisiau while the 17F squadron is based at Hyeres. The ASMP was installed on 11F Squadron's Super Etendards beginning in 1985, with full operational capability to be achieved on both 11F and 17F squadrons in 1988.[287] Operational control of the embarked aviation, with particular regard to the aircraft carriers, is vested in ALPA (Commandant l'Aviation Embarquee et le groupe des Porte-Avions), who is based at Toulon. At sea, ALPA flies his flag on one of the two aircraft carriers.[288]

D. Naval Nuclear Shore Infrastructure

As with the other nuclear powers, there is a relatively extensive command and control, research and development, and maintenance infrastructure that directs and supports French naval nuclear weapons. Yet only two ports and two naval air stations host French nuclear-capable ships and aircraft. The ballistic missile submarines operate out of Ile Longue (Brest, Finistère), which also has storage facilities for missiles and TN-61 warheads, and the two aircraft carriers are homeported in Toulon. Naval aviation has two squadrons of Super Etendards, the 11F and 14F, based at Landivisiau NAS, Finistère,

and the third, the 17F, is at Hyeres NAS, Var, near Toulon. Nuclear weapons for these aircraft are stored at two air bases of the tactical air force (FATAC): Istres (Air Base 125), Bouches-du-Rhone and Luxeuil (Air Base 116), Haute-Saone, (and also on the aircraft carriers).

VI. Nuclear-capable Ships and Aircraft of China

The Chinese Navy (People's Liberation Army Navy (PLAN)) consists of some 2,000 ships and is the second-largest fleet in the world after the Soviet Navy. Yet it contains the least number of nuclear-capable ships of the five nuclear powers' navies – two Xia class nuclear-powered ballistic missile submarines and one Golf class test/training conventionally-powered ballistic missile submarine. Additionally, there are 150 land-based aircraft that potentially could have nuclear weapons missions.

The only major surface warships in the large Chinese fleet are the 38 destroyers and frigates. The Chinese Navy does not have any aircraft carriers, battleships or cruisers, and the vast majority of the Chinese fleet are minor combatants – patrol, amphibious warfare, and mine warfare ships, along with supply and service craft. None of these ships has any reported nuclear capability.[289] The submarine force, excluding the Xia and Golf submarines, is composed of approximately 114 non-nuclear-capable submarines; all except four are conventionally-powered attack submarines.[290] Of the remaining four, one is a conventionally-powered Romeo class cruise missile submarine, and three are nuclear-powered Han class attack submarines.[291]

A. Fleet Organization and Missions

The Chinese Navy is organized into three fleets: the North Sea Fleet at Qingdao, the East Sea Fleet at Shanghai, and the South Sea Fleet at Zhanjiang. The central headquarters for the PLAN is in Beijing.[292] The North Sea fleet is responsible for defending Beijing and the northeast coast against seaward attacks from the Yellow Sea. It confronts the fleets of the two Koreas and Japan, as well as the home waters of the Soviet fleet in the western Pacific. The East Sea fleet protects the Shanghai region and is responsible for waters adjacent to Taiwan. The South Sea fleet is responsible for defending Hainan island and the southern coast, and faces the Gulf of Tonkin and the Soviet naval forces based at Cam Ranh Bay, Vietnam.[293] The Chinese navy is primarily a coastal defense fleet. It typically has operated in waters contiguous to China, and has very little if any sustained open ocean capability. Its first overseas port calls were made to Pakistan, Sri Lanka and Bangladesh from November 1985 to January 1986, with a destroyer and a supply ship.[294]

B. Nuclear-capable Ships

The nuclear-capable ships in the Chinese navy are the Xia class nuclear-powered and one Golf class conventionally-powered ballistic missile submarines.

Xia class submarines reportedly displace 8,000 tons at full load and each carries 12 CSS-N-3 missiles. Two Xia class submarines are believed to have been built, three more may be currently under construction, and a total of 6-12 submarines possibly could be produced. Under development for fifteen years (a reliable nuclear power plant was a significant technical problem to be solved in its construction), the first Xia class submarine was launched in 1981 and went on sea trials in 1983. By 1986 Chinese officials were suggesting it was operational.[295] These two submarines are believed to be armed with operational missiles.[296]

The Golf class submarine was constructed from Soviet parts in 1964 and has served as a test and training ship for ballistic missile and submarine crews. It can carry two missiles and could possibly be used in a crisis as an operational launcher.[297]

Chinese ballistic missile submarines would be vulnerable to Soviet (or U.S.) ASW forces if they patrolled too far away from Chinese waters. It is therefore more likely that the ballistic missile submarines will deploy near the Chinese coast in the Bohai Gulf where they can be protected by other Chinese forces, including land-based naval aircraft.[298]

C. Nuclear-capable Naval Aviation

The status of Chinese naval aviation's nuclear mission is uncertain; it may limited or non-existent. The total naval aviation force consists of about 850 aircraft, 700 of which are fighters, helicopters and transports, with no known nuclear mission or capability. The remaining 150 aircraft are mostly B-6/Tu-16 Badgers (20-30), and B-5/Il-28 Beagles (more than 130).[299] The Chinese Air Force also deploys B-5 and B-6 bombers and trains with nuclear gravity bombs. The naval B-5s and B-6s also may have a nuclear mission because the nuclear gravity bombs that are available for the Air Force bombers are theoretically available for the Navy planes.[300] However, there is no evidence to suggest the Chinese train for naval nuclear missions. Naval aviation seemingly does not give nuclear bombing a high priority, as the aircraft mainly have an air defense mission, with anti-ship torpedo and bombing tasks as secondary missions. For the anti-ship mission the Chinese put more emphasis on torpedoes, conventional gravity bombs, and anti-ship cruise missiles than on naval nuclear bombing.

Notes

1 Two non-nuclear countries, Italy and the Netherlands, operate anti-submarine warfare aircraft (22 total) which are certified to deliver U.S. nuclear depth bombs. These planes are included in this total.
2 Includes air-launched anti-ship missiles.
3 In addition to nuclear bombs, France is deploying the ASMP surface-to-air missile. As of December 1987, there are no estimates on the total number that will be deployed for naval use.
4 Chinese naval aviation may be assigned nuclear bombs.
5 China has one Golf class SSB used for testing and training, that also could be nuclear capable.
6 This number includes all possible nuclear-capable submarines. The actual number of submarines that are certified and are not in overhaul is probably closer to 61.
7 Includes 14 aircraft carriers and the five largest amphibious assault ships (LHAs).
8 In addition to support ships, this number includes amphibious warfare ships other than the amphibious assault ships (LHAs).
9 Italy and the Netherlands operate an additional 22 nuclear-capable anti-submarine warfare aircraft, not included in this total.
10 The Soviet Union has leased one of its Charlie class SSGNs to India. Indian naval personnel also have been reported as undergoing nuclear-powered submarine training in the Soviet Union since 1984; Jane's Defence Weekly, "Indian SSN Departs Vladivostock Submarine Base," 23 January 1988, p. 116. In addition to the Indian government, the Japanese, Canadian, Brazilian and Argentinean governments have expressed an interest in building or acquiring SSNs; Jane's Defence Weekly, "India and Brazil Take First Steps in Acquiring SSNs," 19 December 1987, p. 1399; Paul Beaver and Cpt. Richard Sharpe, "New Members for SSN Club," Jane's Defence Weekly, 9 January 1988, p. 11; William M. Arkin, Neptune Papers No. 1: The Nuclear Arms Race At Sea, October 1987, p. 16.
11 Ice-breakers and naval research vessels.
12 The U.S. has 400 Poseidon strategic warheads assigned for NATO use, and the Soviet Union has 13 Golf II SSBs with shorter range SS-N-5 SLBMs that are assigned regional roles.
13 Sea control involves obtaining the complete freedom of movement of friendly forces at sea. Sea denial is the opposite of this: denying the opponent freedom of movement. Sea control and sea denial are further broken down into several "naval warfare tasks," and tactical nuclear weapons can be used for three of these: anti-air warfare (AAW), anti-submarine warfare (ASW) and anti-surface warfare (ASUW).
14 As of December 1987. Warhead numbers from Thomas B. Cochran, William M. Arkin, Robert S. Norris, The Bomb Book: The Nuclear Arms Race in Facts and Figures (Natural Resources Defense Council: Washington, D.C., December 1987), p. 4.
15 Circular error of probability (also sometimes referred to as "circular error probable") is a measure of the 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 of the target has a 50% probability of falling within the circle.
16 Thomas Cochran, William Arkin, Milton Hoening, Nuclear Weapons Databook, Volume I: U.S. Nuclear Forces and Capabilities (Natural Resources Defense Council/Ballinger Co., 1984), pp. 142-143.
17 Armed Forces Journal International, July 1986, p. 30.
18 Thomas B. Cochran, William M. Arkin, Robert S. Norris, The Bomb Book: The Nuclear Arms Race in Facts and Figures (Natural Resources Defense Council: Washington, D.C., December 1987), p. 4.
19 Nuclear Weapons Databook: Volume I, op. cit., pp. 142-143.
20 Navy Times, January 26, 1987; Aviation Week and Space Technology, January 26, 1987, p. 20.
21 HAC, FY 1986 EWDA, Part 7, p. 414.
22 Dr. Lawrence Woodruff, Statement on Nuclear Force Modernization, before HASC, March 10, 1987, p. 14.
23 Ibid., p. 15.
24 Robert S. Norris, "Counterforce at Sea," Arms Control Today, September 1985, pp. 5-10.
25 Neither the Golf III nor Hotel III submarines were SALT accountable, but the six launchers on each submarine were SALT accountable.
26 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 9.
27 William Arkin, Andrew Burrows, Thomas Cochran, Richard Fieldhouse, Robert Norris, Jeffrey Sands, "Nuclear Weapons," Chapter 1 in Stockholm International Peace Research Institute (SIPRI), 1987 Yearbook: World Armaments and Disarmaments (Oxford University Press, 1987), p. 25 (hereafter 1987 Yearbook).
28 SIPRI, 1987 Yearbook, p. 27; Mark Daly, "Chevaline Refurbishment to Begin This Month," Jane's Defence Weekly, 16 January 1988, p. 54.
29 Mark Daly, ibid.
30 U.K. National Audit Office, Ministry of Defence and Property Service Agency: Control and Management of the Trident Program, published by HMSO, London, 14 July 1987, p. 18.
31 "News and Comments from France," 18 November 1981; Captain John Hyland USN, "France's Nuclear Reach," Proceedings, March 1987, p. 84.
32 The Inflexible's missiles also will receive the improved warhead -- dockyard space and budgets permitting.
33 The TN-71 is said to compare with the better U.S. ballistic missiles in terms of survival and penetration capability, (CEA, Rapport Annuel 1985, pp. 77-79) whereas the older TN-70 is comparable in terms of the weight/yield ratio; CEA, 'Informations non classifiées sur l'armement nucléaire Francais', 26 June 1986 and, CEA, 'Regard sur l'avenir du CEA', Notes d'Information, January-February 1986, p. 7.
34 "France opens new shipyard for next-generation SSBNs," Jane's Defence Weekly, 7 November 1987, p. 1024.
35 'CSS-N' stands for Chinese surface-to-surface, naval missile.
36 Estimates on its maximum range vary because the missile has never been fired at full range. Though the range of the missile technically makes it an intermediate range missile, it serves a "strategic" function.
37 Richard Fieldhouse, "Chinese Nuclear Weapons: an Overview," Chapter 5 in SIPRI, 1986 Yearbook: World Armaments and Disarmament (Oxford University Press, 1986), p. 109.
38 Prior land and surface launches of the missile as part of the test and development program may have occurred.
39 SIPRI, 1987 Yearbook, p. 35.

40 Abbreviated as TLAM/N, for Tomahawk Land-Attack/Nuclear. The U.S. SLCM comes in three basic versions: a conventionally-armed anti-ship (TASM); a conventionally-armed land-attack (TLAM/C); and the nuclear-armed land-attack (TLAM/N). The TASM has passive and active radar search for target guidance to attack surface ships. The TLAM/C can have a high-explosive warhead or sub-munitions dispenser while the TASM has a high-explosive warhead. The TASM's range is 250+ nautical miles and the TLAM/C's range is 600+ nautical miles; U.S. Navy, Office of Information, Navy Fact File, 8th Ed., (NAVSO P-3002), October 1987, p. V-2.

41 Thomas B. Cochran, William M. Arkin, Robert S. Norris, The Bomb Book: The Nuclear Arms Race in Facts and Figures (Natural Resources Defense Council: Washington, D.C., December 1987), p. 32.

42 Woodruff, op. cit., p. 31. By the end of September 1987 the Navy had purchased 338 TLAM/Ns. In FY 1988 the Navy plans to buy 19. Cruise missiles are delivered to the Navy approximately 18 months after they are purchased; Navy Cruise Missile Project Office, December 1987 phone conversation.

43 Navy Cruise Missile Project Office, December 1987 phone conversation.

44 Secretary of Defense Frank Carlucci, Annual Report to Congress FY 1989, p. 195.

45 HAC, FY 1987 DOD, Part 4, p. 164. The 39 Sturgeon submarine total includes the two single-ship class Narwhal and Lipscomb SSNs. This total does not include Seawolf (SSN-21) class submarines that will begin to enter the fleet in 1994.

46 Armored box launchers contain four Tomahawks each and are used to fire Tomahawks from the battleships, nuclear-powered cruisers, and seven Spruance (DD-963) class destroyers. Vertical launch systems (VLS) are modular units containing rectangular (8x8) arrangements of 64 cells, 61 of which are for missiles and three of which are taken up by a support crane. The top is fitted flush with the deck of surface ships, with the rest of the VLS and their missiles extending vertically into ship; Martin Marietta, Co., Vertical Launching System, p. 1. In addition to the standard 64 cell VLS, a "half-size" VLS of 32 cells (29 for missiles) will be deployed on the Arleigh Burke (DDG-51) class destroyers under construction. The Navy is outfitting 24 Spruance class destroyers, Ticonderoga class cruisers (hull numbers 52 and after), and all Burke class destroyers with VLSs. They also can fire non-nuclear Standard SM-2 surface-to-air missiles and will be able to fire vertical launch ASROCs. Capsule launching systems (CLS) are 12 vertical launch tubes installed in Los Angeles class submarines, hull numbers 719 and later for launching Tomahawk SLCMs. CLSs also could contain non-nuclear Harpoon anti-ship missiles; HASC, FY 1988/89 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 51.

47 "Tomahawk Cruise Missile Facts," Joint Cruise Missile Project Office, 1987.

48 HAC, FY 1987 DOD, Part 4, p. 167.

49 This total is calculated based upon the following: an average of two nuclear-armed SLCMs per nuclear-capable surface ship except the larger Kiev and Kirov classes, which are armed with four; and an average of four nuclear-armed SLCMs per nuclear-capable cruise missile submarine, except for the Oscar class, which is armed with 12. The number of nuclear-armed SLCMs at sea may be higher or lower depending on operational missions. This estimate for all Soviet SLCM capable ships and submarines is to determine the approximate total size of the Soviet stockpile. Since the SLCMs are large and all of the ships and submarines fire them from special launchers, it is assumed that there are no operational reloads.

50 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 10.

51 HAC, FY 1986 DOD, Part 2, p. 908.

52 Thomas B. Cochran, William M. Arkin, Robert S. Norris, The Bomb Book: The Nuclear Arms Race in Facts and Figures (Natural Resources Defense Council: Washington, D.C., December 1987), p. 32. There are more than 285 SUBROC missiles, however, since "extra" missiles are used for testing, training, maintenance, etc.

53 HAC, FY 1987 DOD, Part 1, p. 442.

54 Nuclear Weapons Databook: Volume I, op. cit., p. 271; U.S., Department of the Navy, RDT&E Descriptive Summary FY 1986, "Submarine Anti-Submarine Warfare Standoff Weapon;" U.S. Secretary of Defense Caspar Weinberger, Annual Report to Congress FY 1987, p. 177.

55 Interview with Vice Admiral Bruce DeMars, Deputy Chief of Naval Operations for Submarine Warfare, "Coming Soon: 'the Super Sub' of the 1990s," Seapower, August 1987, p. 20.

56 Secretary of Defense Frank Carlucci, Annual Report to Congress FY 1989, p. 198.

57 U.S. Secretary of Defense Caspar Weinberger, Annual Report to Congress FY 1987, p. 177; Vice Admiral William Rowden, Commander Naval Sea Systems Command, stated, "The decision not to develop a nuclear payload version will be revisited at the production decision point of the MK 50 Only Program in December 1990;" HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials, p. 216. Although Congress has refused to fund a new warhead for the Sea Lance, work on the missile itself continues. It is possible that an off-the-shelf warhead could be used on the Sea Lance even if a new warhead is not developed.

58 Thomas B. Cochran, William M. Arkin, Robert S. Norris, The Bomb Book: The Nuclear Arms Race in Facts and Figures, (Natural Resources Defense Council: Washington, D.C., December 1987), p. 32. More ASROC missiles than nuclear ASROC warheads exist since the missile is dual-capable and widely deployed on surface ships, and "extra" missiles are used for training, testing, maintenance, etc.

59 Proceedings, June 1987, p. 81. Potential nuclear warhead development for the VLA was cancelled; SIPRI, 1987 Yearbook, p. 13.

60 The two types include the Type 65 and the ET-80 nuclear-armed torpedoes; U.S. Joint Chiefs of Staff, United States Military Posture FY 1989, p. 54. This estimate is based upon an average of one nuclear torpedo per ship and submarine capable of carrying 21-inch torpedoes. The number of nuclear torpedoes actually loaded in the platforms that are at sea at any time could be higher.

61 U.S. Central Intelligence Agency, Intelligence Report, "Soviet Submarine Accidents (DOI: 1971-1973)"; partially declassified and released under the Freedom of Information Act, p. 2.

62 Frank J. Prial, "Sweden to Release Soviet Sub: Finds Signs of Nuclear Arms," New York Times, 6 November 1981, p. 1; Leonard Downie, Jr., "Soviet Sub 'probably' Has A-Arms, Sweden Says," Washington Post, 6 November 1981, p. 1.

63 Some reports credit the SS-N-14 Silex anti-submarine and anti-ship missile (once called the SS-N-10) with a nuclear depth charge payload. The weapon, however, is not believed to be nuclear-armed.

64 The Soviets reportedly benefitted by copying the design of the SUBROC; Department of Defense, Soviet Acquisition of Militarily Significant Western Technology: An Overview, September 1985, p. 31.

65 Thomas B. Cochran, William M. Arkin, Robert S. Norris, The Bomb Book: The Nuclear Arms Race in Facts and Figures (Natural Resources Defense Council: Washington, D.C., December 1987), p. 32. There are more Terrier missiles than warheads; "extra" missiles exist for testing, training, maintenance, etc.

66 HAC, FY 1986 EWDA, Part 7, p. 411.

67 Secretary of Defense Caspar Weinberger, Annual Report to Congress FY 1987, p. 228.

68 SIPRI, 1987 Yearbook, p. 14.

69 Department of Defense, Department of Defense Budget for Fiscal Years 1988 and 1989: R,D,T & E Programs (R-1), January 1987, p. N-9.

70 According to U.S. Naval Intelligence, "a wide variety of naval weapons ... have nuclear capability, including ... certain anti-aircraft weapons;" SASC, FY 1984 DOD, Part 6, pp. 2971-2972. The SA-N-2 Guideline and the SA-N-7 Gadfly could be nuclear-capable as well.

71 This missile is thought to be nuclear-capable. However, it is derived from the non-nuclear land-based SA-6 Gainful.

72 Secretary of Defense Caspar Weinberger, Annual Report to Congress FY 1988, p. 218.

73 SASC, FY 1988/1989 DOD, Part 4, p. 2456.

74 Ibid.

75 SIPRI, 1987 Yearbook, p. 14.

76 John M. Collins and Bernard C. Victory, U.S./Soviet Military Balance: Statistical Trends, 1977-1986 (As of January 1, 1987) (U.S. Congressional Research Service, 87-745-S), p. 27 report that the short-range AS-9 Kyle (which is carried by Backfire, Badger, and Fitter-C aircraft of SNA) is also nuclear-capable.

77 The Fencer E strike and reconnaissance fighter assigned to Soviet Naval Aviation also may be nuclear-capable.

78 SIPRI, 1987 Yearbook, pp. 30-31.

79 The missile has three main flight profiles: high-altitude, high-speed (Mach 3); low-altitude, lower-speed (Mach 2) and low-altitude, sea-skimming trajectory. The range of the missiles varies with the type of flight. The first profile allows a maximum range of some 130 nautical miles; the second gives a range of about 40 nautical miles; and the third for attacks on ships yields a range of about 30 nautical miles. These missile ranges are in addition to the Super Etendard aircraft's operational range. Ezio Bonsignore, "A New Element in France's Nuclear Deterrent: the ASMP Cruise Missile," NATO's Sixteen Nations, August 1987, p. 64.

80 Ships being built or authorized were to allow the Navy to achieve its goal of a 600 ship fleet by 1989; Admiral Carlisle Trost, Chief of Naval Operations, report to Congress on Posture and Fiscal Year 1988-1989 Budget of the United States Navy, p. 31. However, due to fiscal constraints, a number of ships are being retired. Thus the Navy will have 580 deployable ships at the end of FY 1989, and does not anticipate reaching a 600 ship navy until FY 1992; Secretary of Defense Frank Carlucci, Annual Report to Congress FY 1989, p. 191.

81 Operational control of SSBNs is an exception. They remain controlled by the fleet (Atlantic or Pacific) Commanders-in-Chief.

82 One major exception is the aircraft carrier Midway, which is permanently forward deployed at Yokosuka, Japan, as part of the Seventh Fleet.

83 Numbers of ships from U.S. Navy, U.S. Naval Ship Battle Forces, 11 December 1987, (U), except for numbers of SSBNs. SSBN numbers from Vice Admiral Bruce DeMars, Deputy Chief of Naval Operations Submarine Warfare, 10 March 1987 statement, p. 6.

84 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 300.

85 U.S. Congress, National Defense Authorization Act for Fiscal Years 1988 and 1989: Conference Report to Accompany H.R. 1748, (Report 100-446), November 17, 1987, p. 630.

86 Assistant Secretary of Defense (Public Affairs), News Release: Amended FY 1988/FY 1989 Department of Defense Budget, No. 81-88, 18 February, 1988.

87 SASC, Strategic Force Modernization Programs Hearings, October and November 1981, pp. 172 and 179-80; HAC, FY 1986 EWDA, Part 7, p. 414.

88 Like any other naval ship, the name and hull number of the first ship in a class of ships identifies a submarine. Thus Poseidon submarines can be referred to as one of three classes: Lafayette (SSBN-619) class (with 8 submarines), James Madison (SSBN-627) class (with 8 submarines), and Benjamin Franklin (SSBN-640) class (with 12 submarines). Trident submarines also are known as Ohio (SSBN-726) class submarines after the first ship in their class.

89 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, pp. 264, 302; HASC, FY 1984 DOD, Part 4, p. 227.

90 Secretary of Defense Frank Carlucci, Annual Report to Congress FY 1989, pp. 235-236. The Trident II D-5 submarine-launched ballistic missile will be deployed on this and subsequent submarines, and will be retrofitted on the first eight Ohio class submarines during the 1990s.

91 Vice Admiral William Rowden, Commander Naval Sea Systems Command, 5 March 1987 statement, p. 10. Admiral Carlisle Trost, FY 1988-89 Posture Statement, figure 15.

92 Secretary of the Navy John F. Lehman, U.S. Navy FY 1988-89 Posture Statement, 24 February 1987, p. 12.

93 Secretary of Defense Frank Carlucci, Annual Report to Congress FY 1989, p. 192.

94 HASC, FY 1985 DOD, Part 3, p. 117; SASC, FY 1986 DOD, Part 7, p. 3841.

95 William Arkin and Richard Fieldhouse, Nuclear Battlefields: Global Links in the Arms Race (Ballinger Co.: Cambridge, MA, 1985), p. 45.

96 SASC, FY 1986 DOD, Part 7, p. 3840. Trident submarines spend 70 days on patrol, with a 25 day refit period before returning to sea; Vice Admiral Bruce DeMars, Seapower, August 1987, p. 21.

97 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 300.

98 HASC, FY 1987 DOD, RDT&E, p. 353; 2,379 patrols up to 1985 plus 88 in 1986.

99 As there are two nuclear-capable weapons systems on submarines, and the submarines and weapons are in transition, an exact calculation of the number of nuclear-capable attack submarines is difficult. The numbers can change on a month to month basis as submarines enter overhauls, undergo conversions, and return to the fleet, and as new submarines enter the fleet. Also, the status of weapons systems varies. As of December 1987, of the 98 SSNs, 51 have been, or are shortly being, converted to a Tomahawk SLCM capability, but only 31 of these 51 are Tomahawk certified submarines. Thirty-eight of the remaining SSNs are possibly SUBROC-capable; but some of these are in overhaul and some will receive the new SUBROC-incompatible Combat Control System (CCS) Mk 1. Thus the current probable number of SUBROC-capable submarines is closer to 30. Finally, there are the seven old SSNs and two converted SSBNs that are not nuclear-capable. Overall, the number of operational nuclear-capable submarines, as of the end of 1987, was about 61.

100 Sturgeon submarines are being modernized to extend their useful life to the year 2000; HASC, FY 1987 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 110. In the mid-1990s the U.S. submarine force will consist primarily of Sturgeon, Los Angeles, and improved Los Angeles class submarines, with Seawolf (SSN-21) submarines beginning to enter the fleet.

101 Department of the Navy, U.S. Naval Ship Battle Forces, 30 September 1987 (U).

102 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 191.

103 HASC, FY 1987 DOD Seapower and Strategic and Critical Materials Subcommittee, pp. 80-82; Admiral Carlisle Trost, FY 1988-89 Posture Statement, p. 91.

104 In a break with traditional numbering patterns the Navy decided to call the ship the SSN-21 class to help market the submarine. The "21" is meant to stand for the 21st century.

105 Admiral Carlisle Trost, FY 1988-89 Posture Statement.

106 Vice Admiral Bruce DeMars, Deputy Chief of Naval Operations for Submarine Warfare, 1987 Statement, op. cit., p. 18.

107 The U.S. General Accounting Office estimates the procurement and life cycle costs for these submarines to be $61.7 billion in FY 1985 dollars. The first ship is expected to cost $1.6 billion to construct, and the cost is to fall to $1 billion each by the fifth; John Landchido's statement, "Status of the Navy's New Seawolf Attack Submarine and Its New Combat System," GAO/T-NSIAD 87-14, March 24, 1987, p. 2.

108 HASC, FY 1984 DOD, Part 4, p. 222.

109 Ibid.

110 SASC, FY 1983 DOD, Part 6, p. 4075.

111 The CCS Mk 1 allows submarines to fire Tomahawks. The CCS Mk 1 Mod 0 version is operational, while CCS Mk 1 Mod 1 and Mod 2 versions and software upgrades for all Mods are under development. Overall, in the 1980s and extending into the early 1990s the Navy has had, and will have, trouble creating complete commonality between the fire control systems on attack submarines and the various nuclear and non-nuclear weapons submarines can carry. The Navy hopes to achieve complete commonality by 1992.

112 U.S. Navy Cruise Missile Projects Office, December 1987 phone conversation. By the end of 1985, 15 submarines were Tomahawk certified for some but not necessarily all variants; HAC, FY 1987 DOD, Part 4, p. 132. This increased to 21 submarines so certified by the end of 1986; Rear Admiral Blose, Director Cruise Missile Project, 12 March 1987 statement before HASC on Tomahawk Weapon System, p. 1. These numbers do not include any of the Los Angeles (SSN-688) class with the capsule launching system, since the CLS is still undergoing operational evaluation (until 1988-89). Consequently the submarines were not Tomahawk certified as of December 1987.

113 HASC, FY 1987 DOD, Procurement of Aircraft, Missiles, p. 968. This total does not include the 28 Seawolfs (SSN-21) armed with Tomahawks that will begin entering the fleet in 1994.

114 They also could carry up to eight internal Tomahawks; HASC, FY 1987 DOD, Procurement of Aircraft, Missiles, p. 979.

115 U.S. Army War College, "Forces/Capabilities Handbook, Organizations, Vol. I," 1 August 1986, p. 3-13; released under the Freedom of Information Act.

116 A "fifteenth" carrier, Kitty Hawk (CV-63), is undergoing extensive overhaul and modernization in a service life extension program (SLEP). Four other carriers are programmed for SLEP in future years: Constellation (CV-64), Ranger (CV-61), America (CV-66), John F. Kennedy (CV-67); Vice Admiral William Rowden, Commander Naval Sea Systems Command, 5 March 1987 Statement before HASC, p. 19.

117 Vice Admiral William Rowden, 5 March 1987 statement, ibid., p. 11.

118 Vice Admiral Joseph Metcalf, Deputy Chief of Naval Operations for Surface Warfare, 19 February 1986 statement before HASC, p. 9. To maintain 15 carriers well into the next century, the Navy is starting to buy two more Nimitz class carriers in 1987-88 to be delivered in the 1990s.

119 Two versions of the A-6, the A-6Es and the KA-6Ds, are nuclear-capable, but only the A-6E would be expected to be outfitted to deliver nuclear bombs.

120 HASC, FY 1984 DOD, Part 4, p. 222.

121 SASC, FY 1985 DOD, Part 8, p. 3857.

122 The Navy argued that the cost to reactivate the ships, about $320 million each, equaled the cost of a new frigate; Navy memorandum to correspondents, July 24, 1981.

123 Vice Admiral William Rowden, 5 March 1987 statement, op. cit., p. 19.

124 Other major conventional weapons on battleships include Harpoon anti-ship missiles for attacks on ships and targets ashore and their trademark 16-inch guns.

125 HAC, FY 1982 DOD, Part 1, p. 600; HAC, FY 1986 DOD, Part 4, p. 433.

126 Secretary of Defense Frank Carlucci, Annual Report to Congress FY 1989, p. 193.

127 Ticonderoga cruisers often are called Aegis cruisers after the name of the anti-air warfare system they carry.

128 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 193. U.S. Congress, National Defense Authorization Act for Fiscal Years 1988 and 1989: Conference Report to Accompany H.R. 1748, (Report 100-446), November 17, 1987, p. 322.

129 SASC, FY 1985 DOD, Part 8, p. 3856.

130 The vertical launch system (VLS) is fitted on CG-52 and subsequent ships. The VLS cannot fire the current ASROC. A non-nuclear vertical launch ASROC (VLA) will be fired from these ships when it begins deployment in 1990.

131 HASC, FY 1984 DOD, Part 2, p. 361.

132 U.S. Navy Cruise Missile Projects Office, Public Affairs, December 1987 phone conversation.

133 HASC, FY 1987 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 170.

134 The four Kidd (DDG-993) class destroyers originally were built for the Shah of Iran. After his overthrow, the U.S. Navy acquired these ships. They evidently were not constructed with the space or equipment for nuclear weapons.

135 Vice Admiral Rowden, 5 March 1987 statement, op. cit., p. 12.

136 SASC, FY 1985 DOD, Part 8, p. 3856.

137 When the VLS is installed in the Spruance class ships the Mk16 ASROC launcher is removed. Until 1990, when the vertical launch ASROC begins to enter the fleet, the VLS equipped ships will be without ASROCs.

138 HASC, FY 1985 DOD, Part 2, p. 361.

139 Ibid.

140 Secretary of Defense Frank Carlucci, Annual Report to Congress FY 1989, p. 191.

141 The non-nuclear-capable Oliver Hazard Perry (FFG-7) class guided missile frigates have an extended anti-air warfare capability in addition to their anti-submarine and anti-surface capability.

142 Department of the Navy, Nuclear Warfare Operations (U) NWP 28 (Rev.D), November 1980, p. 4-9; partially declassified and released under the Freedom of Information Act.

143 Department of the Navy, OPNAV Instruction C8110.19 "Loading of Nuclear Weapons in Amphibious Shipping; Standards for (U)," September 19, 1969, pp. 1-2; partially declassified and released under the Freedom of Information Act. (Though the instruction was originally issued in 1969, it remains current as of 1987.)

144 The LHAs can operate AV-8Bs day and night, and in all-weather. The LPHs can operate AV-8Bs only during the day and when there is reasonable visibility.

145 Secretary of Defense Frank Carlucci, Annual Report to Congress FY 1989, p. 195.

146 SASC, FY 1986 DOD, Part 8, pp. 4639 and 4646.

147 A new class of LSDs, the Whidbey Island (LSD-41) class, is under construction. Three ships have been delivered and eight have been funded; HAC, FY 1988 DOD, Part 7, p. 303.

148 Commander, Amphibious Group Eastern Pacific, COMPHIBGRUEASTPAC Instruction 3401.1 "Movement and Storage of Nuclear Weapons During Amphibious Operations, (U)" 24 June 1980, pp. 5-6; released under the Freedom of Information Act.
149 Department of the Navy, Nuclear Warfare Operations (U) NWP 28 (Rev.D), November 1980, p. 4-8, op. cit.
150 Currently ADs are not providing Tomahawk SLCM support to surface ships; U.S. Navy, Naval Sea Systems Command, January 1988 phone conversation.
151 Department of the Navy, Nuclear Warfare Operations (U) NWP 28 (Rev.D), November 1980, op. cit.
152 Forward deployed strategic missile submarine tenders once were stationed in Guam and Rota, Spain to support SSBN squadrons armed with Polaris and Poseidon missiles. When these missiles were replaced with Poseidon and Trident I missiles, the squadrons moved back to the United States with their strategic submarine tenders.
153 SASC, FY 1985 DOD, Part 8, p. 4267.
154 U.S. Navy Cruise Missile Project Office, December 1987 phone conversation.
155 Department of the Navy, Nuclear Warfare Operations (U) NWP 28 (Rev.D), November 1980, op. cit.
156 Department of the Navy, Loading and Underway Replenishment of Nuclear Weapons (U) NWP 14-1 (Rev. A), November 1979, p. 2-25; released under the Freedom of Information Act.
157 SASC, FY 1986 DOD, Part 8, p. 4472.
158 The CH-46 is the primary helicopter carried and used for VERTREP by underway replenishment ships. It can carry nuclear weapons internally or externally. Department of the Navy, Loading and Underway Replenishment of Nuclear Weapons (U) NWP 14-1 (Rev. A), November 1979, p. 5-1, op. cit.
159 Helicopters also can be used for ship-to-shore or shore-to-ship transport; Department of the Navy, Loading and Underway Replenishment of Nuclear Weapons (U) NWP 14-1 (Rev. A), November 1979, pp. 3-1 and 5-1, op. cit.
160 Ibid., p. 4-4.
161 Ibid., p. 3-2.
162 Ibid., p. 3-1.
163 Thomas Cochran, William Arkin, and Robert Norris, The Bomb Book, op. cit., December 1987, p. 29. This total only includes aircraft that perform nuclear weapon attacks. The total would be higher if planes and helicopters that have a nuclear weapons logistical mission were included.
164 Location and status of planes and squadrons as of October, 1987, derived from Department of the Navy, Allowances and Location of Naval Aircraft (U), OPNAV Notice C3110, 31 March 1984 (released under the Freedom of Information Act); information from Naval Air Stations (released under the Freedom of Information Act); Standard Naval Distribution List, Part 1, 1 November 1986; U.S. Navy, October 1987 phone conversation; and authors' estimates.
165 The A-6E squadrons also contain four KA-6D tankers.
166 HAC, FY 1988 DOD, Part 7, p. 271.
167 Secretary of Defense Frank Carlucci, Annual Report to Congress FY 1989, p. 207.
168 Ten A-6Es and four KA-6Ds. As noted, both are nuclear-capable, but only the A-6E has delivery of conventional or nuclear weapons as its primary mission; Department of the Navy, Nuclear Warfare Operations (U) NWP 28 (Rev.D), November 1980, p. 4-9, op. cit
169 SASC, FY 1985, Part 8, p. 3857.
170 Marine Corps Gazette, September 1987, p. 6.
171 Ibid.
172 HAC, FY 1987 DOD, Part 4, p. 18.
173 The A-4 was also a U.S. Navy plane, but the last Navy squadron was disbanded in 1975.
174 TA-4F trainer aircraft also have the capability to deliver B43, B57 and B61 nuclear bombs, but this is not their primary mission; Department of the Navy, Nuclear Warfare Operations (U) NWP 28 (Rev.D), November 1980, p. 4-9, op. cit.
175 U.S. Army War College, "Forces Capabilities Handbook, Vol II: Weapons Systems," 1 August 1986, p. 4-3; released under the Freedom of Information Act.
176 The A-6E squadron also is assigned the four KA-6D aerial refueler tanker aircraft. The KA-6Ds also have a capability to deliver B43, B57 and B61 nuclear bombs, though delivering nuclear (or conventional) weapons is not their primary mission. There is a non-nuclear-capable A-6 variant: the EA-6B Prowler electronic warfare aircraft; Department of the Navy, Nuclear Warfare Operations (U) NWP 28 (Rev.D), November 1980, p. 4-9, op. cit.
177 U.S. Army War College, op. cit., p. 3-32.
178 U.S. Congress, National Defense Authorization Act for Fiscal Years 1988 and 1989: Conference Report to Accompany H.R. 1748, (Report 100-446), November 17, 1987, pp. 306-308.
179 Secretary of Defense Frank Carlucci, Annual Report to Congress FY 1989, p. 209.
180 U.S. Army War College, op. cit., p. 3-31.
181 Marine Corps Gazette, September 1987, p. 6.
182 Secretary of Defense Frank Carlucci, Annual Report to Congress FY 1989, p. 209.
183 U.S. Army War College, op. cit., 4-5.
184 Ibid., p. 4-5.
185 Ibid., p. 3-30.
186 HAC, FY 1988 DOD, Part 7, p. 271.
187 Department of the Navy, Nuclear Warfare Operations (U) NWP 28 (Rev.D), November 1980, p. 4-9; There also are other non-nuclear-capable P-3 variants – EP-3A/B/Es, RP-3A/Ds, TP-3As and VP-3s – used for electronic reconnaissance, research and testing, training, and staff transport. Some P-3 A/Bs also are assigned to research, testing and development commands and are not part of ASW nuclear-capable squadrons.
188 HAC, FY 1987 DOD, Part 4, p. 9.
189 In addition to the U.S. P-3s, the Dutch operate 13 P-3Cs which could use U.S. B57 nuclear depth bombs. Italy deploys 9 Atlantique ASW maritime patrol aircraft, which also can use U.S. B57 nuclear depth bombs.
190 Secretary of Defense Frank Carlucci, Annual Report to Congress FY 1989, p. 197.
191 U.S. Army War College, op cit., p. 3-36.
192 "U.S. Navy Air Wings," memo from U.S. Navy, October 1987.
193 HASC, FY 1987 DOD, Procurement of Aircraft, Missiles, p. 1056. Moreover, the S-3 is being considered for conversion to a new carrier based electronic reconnaissance plane, to replace the aging EA-3B Skywarriors.

194 There are several versions of the Sea King that are not nuclear-capable: SH-3Gs, UH-3As, HH-3As, and VH-3A/Ds, are used for utility and transport, search and rescue, and executive transportation purposes. The Navy operates two more ASW helicopters from ships, both of which also are not nuclear-capable. These are the SH-2F Sea Sprite LAMPS Mk I and the SH-60B Seahawk LAMPS Mk III helicopters (LAMPS stands for light-airborne-multi-purpose-system, which actually consists of the sensor, communication, and processing systems on the host ship, as well as the helicopter itself). These helicopters can operate from some cruisers, destroyers and frigates. The Sea Sprite can carry torpedoes and the Seahawk can carry torpedoes and depth bombs. A nuclear-capable version of the SH-60B, the SH-60F, is under development, for use on aircraft carriers to replace the SH-3D/H helicopters. Moreover there are numerous logistic helicopters (CH-46 and CH-53s) that provide routine logistical transport of nuclear weapons.

195 U.S. Army War College, op cit., p. 3-37.

196 U.S. Navy letter, 18 February 1987, with strategic homeporting ship distribution.

197 List of storage locations from William Arkin and Richard Fieldhouse, Nuclear Battlefields, op. cit., Appendix A.

198 Stores nuclear depth bombs for use by P-3 Orions, Italian Atlantiques based at Catania and U.K. Nimrods.

199 Under the control of U.S. Commander Eastern Atlantic. The facility supports U.S. and Dutch P-3 Orions, and possibly U.K. Nimrod operations.

200 Under the control of U.S. Commander Eastern Atlantic. The facility stores nuclear warheads for U.S. and Dutch P-3 Orion, and U.K. Nimrod aircraft.

201 This includes five aircraft carriers, 39 cruisers, 69 destroyers, 118 frigates, and 63 patrol combatants; 77 ballistic missile submarines, 63 cruise missile submarines, and 199 attack submarines. U.S. Department of Defense, Soviet Military Power, 1987, p. 43 states that, "Some 288 surface warships, 340 submarines, and about 30 other combatant ships carry at least one of these systems."

202 U.S. Joint Chiefs of Staff, United States Military Posture FY 1989, p. 54.

203 U.S. Department of Defense, Soviet Military Power, 1987, p. 43. The older nuclear-armed torpedo is the Type 65 and the newer one is the ET-80; Joint Chiefs of Staff, United States Military Posture FY 1989, p. 54.

204 This includes seven new classes of submarines: Typhoon and Delta IV SSBNs, Oscar SSGNs, and Kilo, Akula, Mike, and Sierra attack submarines. Four classes of surface combatants include Kirov and Slava cruisers, and Sovremennyy and Udaloy destroyers. New nuclear weapons include: SS-N-20 and SS-N-23 submarine-launched ballistic missiles, SS-N-19 and SS-N-22 sea-launched cruise missiles, and new surface-to-air missiles.

205 The land-locked Caspian Flotilla is comprised of five principal surface combatants and 29 other combatants.

206 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 4.

207 HAC, FY 1986 DOD, Part 2, p. 910.

208 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 6.

209 Dr. Milan Vego, "Command and Control of the Warsaw Pact Navies," Proceedings, September 1987, pp. 115-117.

210 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 5.

211 An additional 29 support ships have nuclear-weapons related roles.

212 The 39 warheads on the Golf II class submarines are not normally considered strategic forces. The strategic SLBM force is therefore normally referred to as including 3,408 warheads.

213 Except for the Typhoon ballistic-missile submarines, all Soviet submarine class names come from U.S.-NATO intelligence community letter designations. The letter designations, in turn, usually are replaced by words. For example, Golf for G, Hotel for H, November for N. The exception is the Typhoon class, whose designation is derived from "Tayfun," the Soviet name for the submarine.

214 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 9.

215 Ibid.

216 One of the Charlie class submarines has been leased to India.

217 Six Echo II class submarines had been modified by 1984. Modification results in a bulge on either side of the sail and a bulge at the forward ends of the missile tubes abreast of the sail; Jean Labayle Couhat, Combat Fleets of the World, 1984/85, p. 701.

218 U.S. Department of Defense, Soviet Military Power, 1985, p. 35.

219 Statement of Robert M. Gates, Chairman, National Intelligence Council, and Deputy Director for Intelligence, CIA, and Lawrence K. Gershin, National Intelligence Council, before a joint session of SASC and SAC, 26 June 1985, Chart II; HAC, FY 1986 DOD, Part 2, p. 908.

220 The missile was first tested on a modified Victor III from the Northern Fleet and was fired from the submarine for the first time in 1987; HAC, FY 1986 DOD, Part 2, p. 914.

221 U.S. Department of Defense, Soviet Military Power, 1987, p. 67; HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 10.

222 Ibid.

223 Carrier aircraft trials and testing have been taking place at the Saki naval airfield on the Crimean peninsula. The Su-27, MiG-29 and Su-25 are being evaluated at the test center; U.S. Department of Defense, Soviet Military Power,1985, pp. 99-101.

224 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, pp. 11-12.

225 Ibid., p. 12.

226 Ibid., p. 13.

227 The Admiral Senyavin has six guns and the Zhdanov has nine guns instead of the standard 12.

228 U.S. Department of Defense, Soviet Military Power, 1986, p. 84.

229 An additional 12 ships are Special Liquids Tankers (AOS) capable of transporting radioactive waste and submarine-launched ballistic missile fuel, and two are repair ships (AR) that transport nuclear materials supporting nuclear reactors on ships and submarines.

230 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 13.

231 Norman Polmar, Guide to the Soviet Navy (Annapolis, MD: Naval Institute Press, 1986), p. 420.

232 U.S. Department of Defense, Soviet Military Power, 1987, p. 88.

233 HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 14.

234 "Current Naval Intelligence Issues by the Office of Naval Intelligence," March 1987, p. 8.

235 There is one nuclear reactor on each nuclear-powered submarine.

236 Includes operational, reserve, training and pipeline aircraft. Nuclear-capable aircraft with naval missions include some 34 Royal Navy Sea Harriers and 52 Royal Air Force Buccaneer attack aircraft (86 total) for strikes against surface targets, and about 78 Lynx and 76 Sea King helicopters and 31 Nimrod patrol planes (185 total) for anti-submarine warfare. The helicopters and Sea Harriers can perform their missions from ships or shore bases. The Buccaneers and Nimrods are solely land-based. However, only one-third of the naval aviation aircraft may be assigned warheads.

237 SACLANT is always a U.S. Admiral who also commands the U.S. Navy Atlantic Fleet (CINCLANT) headquartered at Norfolk, Virginia. Under the NATO command structure the Royal Navy's main operational commander – CINCFLEET – is also the deputy to SACLANT.

238 HASC, hearings on The 600-Ship Navy and the Maritime Strategy, June 24, September 5, 6 and 10, 1985, p. 279.

239 HAC, FY 1984 DOD, Part 2, pp. 641-642.

240 Some sources put the total Polaris warhead stockpile at 80 warheads.

241 SIPRI, 1986 Yearbook, p. 61.

242 U.K. ballistic missile submarines have a service life of about 25 years, and therefore will be up for retirement in the mid-1990s.

243 William Arkin and Richard Fieldhouse, Nuclear Battlefields, op. cit., p. 47.

244 U.S. Atlantic Command, USCINCLANT/CINCLANTFLT/CINCWESTLANT/COMOCEANLANT, Staff Organization and Regulations, Staff Instruction 5200.1Q, 8 February 1985, p. 2-6-18; released under the Freedom of Information Act.

245 "Designated Lanes' for NATO Submarines," Jane's Defence Weekly, 31 October 1987, p. 980.

246 An "enhanced" air group on board for the Falkland War included 24 planes: 12 Sea Harriers, six Royal Air Force Harriers, and six anti-submarine helicopters; HASC, FY 1984 DOD, Part 5, p. 786 (Lessons of the Falklands report).

247 A low-yield variation of the WE-177.

248 Malcolm Spaven, "Royal Navy nuclear-capable ships, 1985-86," Armament & Disarmament Information Unit, University of Sussex, unpublished, 1985.

249 The one remaining non-nuclear-capable destroyer is the Type 82 HMS Bristol (D23), outfitted as a command ship.

250 Paul Beaver, Modern Royal Navy Warships, (Patrick Stephans: Wellingborough, Northamptonshire, 1987), pp. 37-50.

251 The non-nuclear frigates include: six Type 21 Amazon class, 18 Leander class, and two Rothesay Type 12 class. The two Type 12 class are scheduled to be retired in 1988.

252 Future Batch 2 and 3 ships also will be able to operate the new nuclear-capable EH 101 ASW helicopter (IOC mid-1990s). The first Royal Navy frigate designed to operate the EH 101 is the Batch 2 Type 22 vessel HMS Brave (which became operational in April 1977).

253 "RN planning for 20 Type 23 frigates," Jane's Defence Weekly, 5 September 1987, p. 413.

254 U.S. Defense Intelligence Agency, "Aircraft Handbook - Free World (U). Volume 1: Fighters, Ground Attack, and Miscellaneous Tactical Aircraft (U)," DST-1300H-001-85-Vol 1-Chg 1, 4 February 1986, p. 336; partially declassified and released under the Freedom of Information Act; Maurice Allward, "Blackburn's Buccaneer," Air Pictorial, October 1985, p. 383.

255 Maurice Allward, ibid., p. 383.

256 SIPRI, 1987 Yearbook, p. 25.

257 DIA, "Aircraft Handbook - Free World (U). Volume 2: Bombers, Transports, and Miscellaneous Support Aircraft (U)," DST-1300H-001-85-Vol 2-Chg 1, 2 October 1986, p. 108; partially declassified and released under the Freedom of Information Act.

258 "Nimrod Capabilities Enhanced," Air International, April 1983, p. 175.

259 Martin Brice, Royal Navy Handbook (Ian Allen Ltd.: London) 1985, p. 89. However the Royal Air Force version of the Sea Harrier, the GR-3 (and the future GR-5), are not nuclear-capable.

260 Paul Beaver, Modern Royal Navy Warships, op. cit., p. 130.

261 Martin Brice, op. cit., p. 85.

262 International Institute for Strategic Studies, The Military Balance: 1987-1988, pp. 61-62; "French Defense Forces," ICA, July 1987, pp. 76-77; Lieutenant de Vaisseau Robert L. Cogné, (French Naval Reserve, Ret.), "France's Global Reach," Proceedings, March 1987, p. 78.

263 The 36 Super Etendards are carrier-based aviation and are used for maritime strike and surface attacks. Another 20 are based ashore with similar roles, but are not thought to be nuclear-capable.

264 Paul Beaver, "The long arm of the French Navy," Jane's Defence Weekly, 18 October 1986, pp. 899-901.

265 John A. Burgess, "La Marine," Proceedings, March 1985, p. 94.

266 Defense Intelligence Agency, Joint Imagery Interpretation Keys Structure (JIIKS), Volume XIII: Submarines, DIAM 57-7, 15 April 1983; released under the Freedom of Information Act.

267 "France opens new shipyard for next-generation SSBNs," Jane's Defence Weekly, 7 November 1987, p. 1024.

268 Assemblée Nationale, Rapport no. 393, sur le projet de loi de finances pour 1987, au nom de la commission des finances, de l'éconmie général et du plan, Annexe no. 39: Défense, Titres V et VI, 12 November 1986, p. 38.

269 Even during the conversion to M4 missiles, four will be available for active patrols, allowing three to be kept at sea at all times.

270 Robert Cogné, op. cit., p. 78.

271 Captain John J. Hyland, USN, "France's Nuclear Reach," Proceedings, March 1987, p. 83.

272 In the late 1970s the French purportedly were researching a sea-to-sea nuclear missile to be mounted on French surface warships. Work concerned the miniaturization of warheads, so that they could be launched by the MM 38 Exocet or Otomat missiles. The program was low-scale, and it is not known if it still exists. Both of France's carriers have undergone modernization programs that include modifications necessary to handle the ASMP nuclear air-to-surface missile for Super Etendard aircraft.

273 Reports state that completed work on the Clemenceau cost 170 million francs. Clemenceau was modified to allow operation of the Super Etendard, which also involved installing infrastructure for storage of the ANT-52 nuclear bombs; "Work on the French Navy's Ships," Aviation & Marine International, February 1979, p. 19. Another publication states that the Clemenceau had her magazines modified to store tactical nuclear weapons in a 1977-78 refit; Floyd D. Kennedy, "French Naval Nuclear Capabilities," National Defense, October 1980, p. 28.

274 SIRPA, "Marine Nationale: principaux materials en service," brochure, no date.

275 Ibid.

276 ICA, op. cit. p. 76. These ships are about half the size of and carry half as many aircraft as the largest U.S. Nimitz class aircraft carriers.

277 Patricia Chilton, "French Nuclear Weapons," in Jolyon Howorth and Patricia Chilton (Eds.), Defence and Dissent in Contemporary France (Croom Helm: London 1984) p. 151.

278 DCN, "PAN: Porte Aeronefs Nucleaires," brochure, Paris, October 1984.

279 Ibid.

280 Defense Intelligence Agency, "Aircraft Handbook - Free World (U). Volume 1: Fighters, Ground Attack, and Miscellaneous Tactical Aircraft (U)," DST-1300H-001-85-Vol 1-Chg 1, 14 February 1986, p. 6; partially declassified and released under the Freedom of Information Act.

281 SIRPA, op. cit.

282 SIRPA, op. cit, and, Patricia Chilton, op. cit. p. 150.

283 The plane originally was designed to replace the Dassault-Breguet Etendard IVM, IVP, and the F-8 Crusader aircraft in Marine Nationale service. Now the Super Etendard serves as the strike fighter on the French carriers Clemenceau and Foch. The Super Etendard grew out of a company proposal to replace the Etendard IVM following cancellation of the Jaguar M (naval version of the Jaguar) in 1973. It is one of the few military aircraft in the world today that has been in actual combat. It conducted anti-shipping missions in the Falklands (for Argentina) and the Persian Gulf (for Iraq), and ground attack missions in Lebanon (for France). Its combat effectiveness can be attributed to its avionics and weapons package; Defense Intelligence Agency, "Super Etendard Weapon System (U)," DST-1320S-712-85, 21 February 1985, pp. 1 and 11; partially declassified and released under the Freedom of Information Act.

284 "French to Equip Etendards With ASMP Missile," Aviation Week and Space Technology, 8 August 1983, p. 20.

285 Patricia Chilton, op. cit., p. 150.

286 Tim Wrixon, "Super Etendard leads in technology," Jane's Defence Weekly, 5 January 1985, pp. 19.

287 Defense Intelligence Agency, "Super Etendard Weapon System (U)," DST-1320S-712-85, 21 February 1985, p. 40; partially declassified and released under the Freedom of Information Act.

288 Paul Beaver, "The long arm of the French Navy," op. cit.

289 Defense Intelligence Agency, Unclassified Communist Naval Order of Battle, (DDB-1200-124-86), April 1986, pp. 5, 11-12, and 20 (released under the Freedom of Information Act); Kenneth G. Weiss, Dragon at Sea: China's Navy in Strategy and Diplomacy, Center for Naval Analysis, December 1985, p. A-1 (released under the Freedom of Information Act); Richard Fieldhouse, "Chinese Nuclear Weapons: An Overview," SIPRI Yearbook 1986, (Oxford University Press, 1986) pp. 97-113.

290 Unclassified Communist Order of Battle, ibid., p. 11.

291 Chinese SSNs and SSBNs are powered by one nuclear reactor each.

292 Kenneth G. Weiss, op. cit., p. 4.

293 Harlan W. Jencks, From Muskets to Missiles: Politics and Professionalism in the Chinese Army, 1945-1981 (Westview Press; Boulder, CO) p. 160.

294 Kenneth G. Weiss, op. cit., pp. 5-6. On the return trip, these ships were part of the PLAN's and the U.S. Navy's first "passing exercise," which lasted for several hours in the South China Sea.

295 SIPRI, 1987 Yearbook, p. 36.

296 SIPRI, 1986 Yearbook, p. 109.

297 Ibid.

298 Kenneth G. Weiss, op. cit., p. 11.

299 The bombers are organized into three shore-based divisions. Unclassified Communist Naval Order of Battle, op. cit., p. 20. The Defense Intelligence Agency also lists 150 bombers with naval aviation and indicates this total includes some Bat bombers.

300 SIPRI, 1986 Yearbook, pp. 107-108.

Abbreviations used in notes (See Appendix H for other abbreviations):

CEA:	Commissariat à L'Energie Atomique
DCN:	Direction des Constructions Navales
DIA:	Defense Intelligence Agency
DOD:	U.S. Department of Defense
EWDA:	Energy and Water Development Appropriations
FY:	Fiscal Year (1 October to 30 September)
HAC:	U.S. Congress, House Appropriations Committee
HASC:	U.S. Congress, House Armed Services Committee
HMSO:	Her Majesty's Stationery Office
ICA:	International Combat Arms
IOC:	Initial Operational Capability
RDT&E:	Research, Development, Testing & Evaluation
SAC:	U.S. Congress, Senate Appropriations Committee
SASC:	U.S. Congress, Senate Armed Services Committee
SIPRI:	Stockholm International Peace Research Institute
SIRPA:	Service d'Information et de Relations Publiques des Armées
(U):	unclassified

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Weapon(s)
Nuclear-powered Ballistic Missile Submarines (SSBN)[1]				
LAFAYETTE class	8	1963-64		
Lafayette (SSBN 616)			Holy Loch, UK[2]	16 Poseidon C3 SLBM
Alexander Hamilton (SSBN 617)			(Bremerton, WA)[3]	16 Poseidon C3 SLBM
Andrew Jackson (SSBN 619)[4]			Holy Loch, UK	16 Poseidon C3 SLBM
John Adams (SSBN 620)[5]			Charleston, SC	16 Poseidon C3 SLBM
James Monroe (SSBN 622)[6]			Charleston, SC	16 Poseidon C3 SLBM
Woodrow Wilson (SSBN 624)			Charleston, SC	16 Poseidon C3 SLBM
Henry Clay (SSBN 625)[7]			(Charleston, SC)	16 Poseidon C3 SLBM
Daniel Webster (SSBN 626)[8]			Holy Loch, UK	16 Poseidon C3 SLBM
JAMES MADISON class	8	1964		
James Madison (SSBN 627)			King's Bay, GA	16 Trident I C4 SLBM
Tecumseh (SSBN 628)			Charleston, SC	16 Poseidon C3 SLBM
Daniel Boone (SSBN 629)			Charleston, SC	16 Trident I C4 SLBM
John C. Calhoun (SSBN 630)			King's Bay, GA	16 Trident I C4 SLBM
Ulysses S. Grant (SSBN 631)			Holy Loch, UK	16 Poseidon C3 SLBM
Von Steuben (SSBN 632)			King's Bay, GA	16 Trident I C4 SLBM
Casimir Pulaski (SSBN 633)			King's Bay, GA	16 Trident I C4 SLBM
Stonewall Jackson (SSBN 634)			Charleston, SC	16 Trident I C4 SLBM
BENJAMIN FRANKLIN class	12	1965-67		
Benjamin Franklin (SSBN 640)			(Charleston, SC)	16 Trident I C4 SLBM
Simon Bolivar (SSBN 641)			(Portsmouth, NH)	16 Trident I C4 SLBM
Kamehameha (SSBN 642)			Holy Loch, UK	16 Poseidon C3 SLBM
George Bancroft (SSBN 643)			(Charleston, SC)	16 Trident I C4 SLBM
Lewis and Clark (SSBN 644)			Charleston, SC	16 Poseidon C3 SLBM
James K. Polk (SSBN 645)[9]			(Portsmouth, NH)	16 Poseidon C3 SLBM
George C. Marshall (SSBN 654)			Holy Loch, UK	16 Poseidon C3 SLBM
Henry L. Stimson (SSBN 655)			King's Bay, GA	16 Trident I C4 SLBM
George Washington Carver (SSBN 656)			Holy Loch, UK	16 Poseidon C3 SLBM
Francis Scott Key (SSBN 657)			King's Bay, GA	16 Trident I C4 SLBM
Mariano G. Vallejo (SSBN 658)			King's Bay, GA	16 Trident I C4 SLBM
Will Rogers (SSBN 659)			Holy Loch, UK	16 Poseidon C3 SLBM
OHIO class	8(+6)[10]	1981-		
Ohio (SSBN 726)			Bangor, WA	24 Trident I C4 SLBM
Michigan (SSBN 727)			Bangor, WA	24 Trident I C4 SLBM
Florida (SSBN 728)			Bangor, WA	24 Trident I C4 SLBM
Georgia (SSBN 729)			Bangor, WA	24 Trident I C4 SLBM

1 There are 36 nuclear reactors on SSBNs. One reactor powers each SSBN.

2 Seven or eight Poseidon SSBNs are in Submarine Squadron 14 and operate out of Holy Loch, Scotland, although their crews are homeported in Groton, CT. The other five or so operational Poseidon SSBNs not in Submarine Squadron 14 operate out of Charleston, SC under the administrative control of Submarine Squadron 18. The other Poseidon submarines are in overhaul. All the Trident I SSBNs based on the East Coast, when operational, operate out of the submarine base at King's Bay, GA, but their crews are homeported at Charleston, SC. East coast operational Trident I submarines are under the administrative control of Submarine Squadron 16 headquartered at King's Bay. Typically seven to eight of the total 12 Trident I East coast submarines are under Submarine Squadron 16. The other four to five may be undergoing repairs or overhauls under the administrative oversight of Submarine Group 6 in Charleston, SC or the shipyard performing the overhaul.

3 The homeports of SSBNs in extended overhauls as of December 1987 are in parentheses. Extended overhauls (approximately 20 to 30 months) of SSBNs are done at Portsmouth, Norfolk, Charleston, or Puget Sound Naval Shipyards; HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 246.

4 This ship was scheduled to enter extended overhaul in early 1988, but now will be decommissioned in 1988; Assistant Secretary of Defense (Public Affairs), News Release: Amended FY 1988/FY 1989 Department of Defense Budget, No. 81-88, 18 February 1988.

5 This ship was scheduled to enter extended overhaul in Fall 1988, but now will be decommissioned in 1989; Assistant Secretary of Defense (Public Affairs), News Release: Amended FY 1988/FY 1989 Department of Defense Budget, No. 81-88, 18 February 1988.

6 Scheduled to enter overhaul in October, 1989; HASC, FY 1988/1989 DOD Operation and Maintenance, p. 628.

7 Scheduled to enter overhaul in November, 1989; HASC, FY 1988/1989 DOD Operation and Maintenance, p. 628.

8 Scheduled to enter overhaul in March, 1990; HASC, FY 1988/1989 DOD Operation and Maintenance, p. 628.

9 To finish overhaul in late 1987; HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 246.

10 Ships authorized and under construction indicated in parentheses. Names and hull numbers of ships given when known, along with their nuclear weapon capability.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Weapon(s)
? Henry M. Jackson (SSBN 730)			Bangor, WA	24 Trident I C4 SLBM
Alabama (SSBN 731)			Bangor, WA	24 Trident I C4 SLBM
Alaska (SSBN 732)			Bangor, WA	24 Trident I C4 SLBM
Nevada (SSBN 733) + Pennsylvania (734)			Bangor, WA	24 Trident I C4 SLBM
Tennessee (SSBN 735))			(King's Bay, GA)	(24 Trident II D5 SLBM)
(under construction)[11]			↓	(24 Trident II D5 SLBM)
West Virginia SSBN 736				
USS KENTUCKY SSBN 737				
USS MARYLAND SSBN 738				

Ballistic Missile Submarine Summary

Total Ballistic Missile Submarines: 36

Total Ballistic Missiles: 640 /Warheads: 5632

Poseidon C3 SLBM: 256 /Warheads: 2560

Trident I C4 SLBM: 384 /Warheads: 3072

Total Submarines with Poseidon C3 SLBM: 16 with Trident I C4 SLBM: 20

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Weapon(s)
Nuclear-capable Nuclear-powered Attack Submarines (SSN)[12]				
PERMIT class[13]	13	1962-67		
Permit (SSN 594)			San Diego, CA	4-6 SUBROC
Plunger (SSN 595)			San Diego, CA	4-6 SUBROC
Barb (SSN 596)			San Diego, CA	4-6 SUBROC
Pollack (SSN 603)			(Vallejo, CA)[14]	4-6 SUBROC
Haddo (SSN 604)			San Diego, CA	4-6 SUBROC
Jack (SSN 605)			New London, CT	4-6 SUBROC
Tinosa (SSN 606)			New London, CT	4-6 SUBROC
Dace (SSN 607)[15]			New London, CT	4-6 SUBROC
Guardfish (SSN 612)			San Diego, CA	4-6 SUBROC
Flasher (SSN 613)			San Diego, CA	4-6 SUBROC
Greenling (SSN 614)			New London, CT	4-6 SUBROC
Gato (SSN 615)			(Portsmouth, NH)	4-6 SUBROC
Haddock (SSN 621)			San Diego, CA	4-6 SUBROC
STURGEON class[16]	37	1967-75		
Sturgeon (SSN 637)			Charleston, SC	TOMAHAWK
Whale (SSN 638)			Groton, CT	TOMAHAWK
Tautog (SSN 639)			(Bremerton, WA)	TOMAHAWK
Grayling (SSN 646)			(Vallejo, CA)	TOMAHAWK
Pogy (SSN 647)			San Diego, CA	4-6 SUBROC
Aspro (SSN 648)			(Vallejo, CA)	TOMAHAWK
Sunfish (SSN 649)			Charleston, SC	4-6 SUBROC
Pargo (SSN 650)			(Bremerton, WA)	TOMAHAWK

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11 Five more ships are authorized as of March 1987. In addition to the six Trident submarines under construction, the Navy seeks funds for an additional Trident submarine a year in FY 1988-FY 1992; HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 745.

12 There are 98 nuclear reactors on nuclear and non-nuclear weapon capable SSNs. One reactor powers each SSN.

13 All Permit class submarines are equipped with the SUBROC compatible Mk 117 fire control system. They will not be converted to carry the non-SUBROC compatible CCS Mk 1 combat control system, and so will retain their SUBROC capability until the missile is retired.

14 The homeports of attack submarines in overhaul as of December 1987 are indicated by parentheses. These will change as submarines leave (and others enter) overhaul.

15 To be deactivated on 27 February 1988; Navy Times, 25 January 1988.

16 Sturgeon and Los Angeles class submarines without the capsule launching system have a nominal load of eight TOMAHAWKs. They are carried internally and launched through the torpedo tubes. Two of the eight nominally are nuclear-armed TOMAHAWKs (TLAM/Ns). Eighteen of the Sturgeon class submarines still have the Mk 117 fire control system which is compatible with the SUBROC. These remain listed as being able to carry SUBROCs, yet some are scheduled to be converted to the non-SUBROC-compatible CCS Mk 1 combat control system and in the near future will lose their SUBROC capability and gain a TOMAHAWK capability. Their SUBROCs are included in the submarine and missile totals. The remaining 19 Sturgeon class submarines have been or are undergoing conversion to obtain TOMAHAWK capability, and although all 19 are listed as TOMAHAWK-capable, only six submarines are TOMAHAWK-certified as of December 1987. Asterisks indicate confirmed TOMAHAWK-certified submarines.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Weapon(s)
Queenfish (SSN 651)			Pearl Harbor, HI	4-6 SUBROC
Puffer (SSN 652)			Pearl Harbor, HI	TOMAHAWK
Ray (SSN 653)			Charleston, SC	TOMAHAWK*
Sand Lance (SSN 660)			Charleston, SC	4-6 SUBROC
Lapon (SSN 661)			Norfolk, VA	4-6 SUBROC
Gurnard (SSN 662)			San Diego, CA	TOMAHAWK
Hammerhead (SSN 663)			(Vallejo, CA)	TOMAHAWK
Sea Devil (SSN 664)			Charleston, SC	4-6 SUBROC
Guitarro (SSN 665)			San Diego, CA	TOMAHAWK
Hawkbill (SSN 666)			Pearl Harbor, HI	4-6 SUBROC
Bergall (SSN 667)			Norfolk, VA	TOMAHAWK
Spadefish (SSN 668)			(Norfolk, VA)	TOMAHAWK
Seahorse (SSN 669)			(Bremerton, WA)	TOMAHAWK
Finback (SSN 670)			(Norfolk, VA)	TOMAHAWK
Pintado (SSN 672)			San Diego, CA	4-6 SUBROC
Flying Fish (SSN 673)			(Bremerton, WA)	TOMAHAWK
Trepang (SSN 674)			New London, CT	4-6 SUBROC
Bluefish (SSN 675)			(Portsmouth, NH)	4-6 SUBROC
Billfish (SSN 676)			New London, CT	4-6 SUBROC
Drum (SSN 677)			San Diego, CA	TOMAHAWK
Archerfish (SSN 678)			Groton, CT	4-6 SUBROC
Silversides (SSN 679)			Norfolk, VA	TOMAHAWK
William H. Bates (SSN 680)			San Diego, CA	4-6 SUBROC
Batfish (SSN 681)			Charleston, SC	4-6 SUBROC
Tunny (SSN 682)			Pearl Harbor, HI	4-6 SUBROC
Parche (SSN 683)			(Vallejo, CA)	TOMAHAWK
Cavalla (SSN 684)			Pearl Harbor, HI	4-6 SUBROC
L. Mendel Rivers (SSN 686)			Charleston, SC	4-6 SUBROC
Richard B. Russell (SSN 687)			(Vallejo, CA)	4-6 SUBROC
NARWHAL class[17]	1	1969		
Narwhal (SSN 671)			Charleston, SC	4-6 SUBROC
GLENARD P. LIPSCOMB class	1	1974		
Glenard P. Lipscomb (SSN 685)			Norfolk, VA	4-6 SUBROC
LOS ANGELES class[18]	37(+19)	1976-		
Los Angeles (SSN 688)			Pearl Harbor, HI	TOMAHAWK
Baton Rouge (SSN 689)			Norfolk, VA	TOMAHAWK*
Philadelphia (SSN 690)			Groton, CT	TOMAHAWK
Memphis (SSN 691)			Norfolk, VA	TOMAHAWK
Omaha (SSN 692)			Pearl Harbor, HI	TOMAHAWK
Cincinnati (SSN 693)			Norfolk, VA	TOMAHAWK
Groton (SSN 694)			Groton, CT	TOMAHAWK
Birmingham (SSN 695)			Pearl Harbor, HI	TOMAHAWK
New York City (SSN 696)			Pearl Harbor, HI	TOMAHAWK
Indianapolis (SSN 697)			(Pearl Harbor, HI)	TOMAHAWK
Bremerton (SSN 698)			Pearl Harbor, HI	4-6 SUBROC
Jacksonville (SSN 699)			Norfolk, VA	4-6 SUBROC
Dallas (SSN 700)			Groton, CT	4-6 SUBROC

17 Narwhal and Lipscomb submarines have the Mk 117 fire control system and therefore are SUBROC-capable.

18 As of December 1987, just five of the Los Angeles class still have a fire control system compatible with the SUBROC (three with the Mk 117 and two with the Mk 113). These ships still are listed as being able to carry SUBROCs, yet they are scheduled to be converted to the non-SUBROC-compatible CCS Mk 1 combat control system and in the near future will lose their SUBROC capability and gain a TOMAHAWK capability. The six submarines with capsule launch systems can carry TOMAHAWKs, but are not yet TOMAHAWK-certified. The remaining 26 submarines are TOMAHAWK-capable, but only 25 of these submarines are TOMAHAWK-certified as of December 1987. Although all 26 are listed as TOMAHAWK-capable, only 25 are added into the ship and missile totals. Asterisks indicate individual submarines which have been confirmed as TOMAHAWK-certified.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Weapon(s)
La Jolla (SSN 701)			San Diego, CA	TOMAHAWK*
Phoenix (SSN 702)			Norfolk, VA	4-6 SUBROC
Boston (SSN 703)			Groton, CT	TOMAHAWK
Baltimore (SSN 704)			Norfolk, VA	TOMAHAWK*
City of Corpus Christi (SSN 705)			Groton, CT	TOMAHAWK
Albuquerque (SSN 706)			Groton, CT	TOMAHAWK
Portsmouth (SSN 707)			San Diego, CA	TOMAHAWK
Minneapolis-Saint Paul (SSN 708)			Norfolk, VA	TOMAHAWK*
Hyman G. Rickover (SSN 709)			Norfolk, VA	TOMAHAWK*
Augusta (SSN 710)			Groton, CT	TOMAHAWK
San Francisco (SSN 711)			Pearl Harbor, HI	4-6 SUBROC
Atlanta (SSN 712)			Norfolk, VA	TOMAHAWK*
Houston (SSN 713)			San Diego, CA	TOMAHAWK
Norfolk (SSN 714)			Norfolk, VA	TOMAHAWK*
Buffalo (SSN 715)			Pearl Harbor, HI	TOMAHAWK
Salt Lake City (SSN 716)			San Diego, CA	TOMAHAWK
Olympia (SSN 717)			Pearl Harbor, HI	TOMAHAWK
Honolulu (SSN 718)			Pearl Harbor, HI	TOMAHAWK
Providence (SSN 719)			Groton, CT	TOMAHAWK[19]
Pittsburgh (SSN 720)			Groton, CT	TOMAHAWK
Chicago (SSN 721)			Norfolk, VA	TOMAHAWK
Key West (SSN 722)			Norfolk, VA	TOMAHAWK
(Oklahoma City (SSN 723))[20]				(TOMAHAWK)
Louisville (SSN 724)			San Diego, CA	TOMAHAWK
Helena (SSN 725)			Groton, CT	TOMAHAWK
(Newport News (SSN 750))				(TOMAHAWK)
(San Juan (SSN 751))				(TOMAHAWK
(Pasadena (SSN 752))				(TOMAHAWK)
(Albany (SSN 753))				(TOMAHAWK)
(Topeka (SSN 754))				(TOMAHAWK)
(Miami (SSN 755))				(TOMAHAWK)
(Scranton (SSN 756))				(TOMAHAWK)
(Asheville (SSN 757))				(TOMAHAWK)
(under construction)[21]				(TOMAHAWK)
SEAWOLF class	–	(1994-)		
(Seawolf (SSN 21))				(TOMAHAWK)
(27 more planned)				

Attack Submarine Summary

Total nuclear-capable attack submarines: 69[22]
Total SUBROC-capable attack submarines: 38
Total SUBROCs: 152-228
Total TOMAHAWK-capable attack submarines: 31[23]
Total TOMAHAWK TLAM/N SLCMs on submarines: 62

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19 SSN-719 and after have 12 TOMAHAWKS in a CLS, and theoretically can carry 8 TOMAHAWKs internally; HASC, FY 1985 DOD, Part 2, p. 361. None of these submarines is certified for carrying TOMAHAWKs yet, as the CLS still is undergoing operational evaluation as of December 1987, but they should become operational in 1988-1989. Although they are listed as TOMAHAWK-capable, they are not added to the TOMAHAWK missile and warhead totals.

20 Submarines authorized and under construction indicated by parentheses. Hull numbers 726 to 749 reserved for Trident SSBNs, hence the gap between SSN 725 and SSN 750.

21 Ten more ships are authorized. The Navy wants to buy an additional three SSN 688s in FY 1988; two each in Fiscal Years 1989, 1990 and 1991; and one in 1992; HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 745.

22 This number includes the 31 TOMAHAWK-certified submarines and all possible SUBROC-capable submarines. The number of actual operational/certified SUBROC submarines, however, is probably somewhat less than 38 and closer to 30.

23 Only the 31 SSNs (25 SSN-688s and six SSN-637s) that are TOMAHAWK-certified as of December 1987 are included in the totals. The number of certified submarines will increase in the future -- three-quarters of the attack submarine force is to be TOMAHAWK-certified by 1991; HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 306.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Capable Aircraft
Aircraft Carriers (CV)				
MIDWAY class	2	1945-47		
Midway (CV 41)			Yokosuka, JA	36 F/A-18s, 10 A-6Es, 6 SH-3Hs[24]
Coral Sea (CV 43)			Norfolk, VA	36 F/A-18s, 12 A-6Es, 6 SH-3Hs
FORRESTAL class	4	1955-59		
Forrestal (CV 59)			Mayport, FL	24 A-7Es, 10 A-6Es, 10 S-3As, 6 SH-3Hs
Saratoga (CV 60)			Mayport, FL	24 A-7Es, 10 A-6Es, 10 S-3As, 6 SH-3Hs
Ranger (CV 61)			San Diego, CA	24 A-6Es, 10 S-3As, 6 SH-3Hs
Independence (CV 62)			(Philadelphia, PA)	24 F/A-18s,10 A-6Es, 10 S-3As, 6 SH-3Hs[25]
KITTY HAWK class	2	1961-65		
Kitty Hawk (CV 63)			(Philadelphia, PA)	Starting SLEP in 1988
Constellation (CV 64)			San Diego, CA	24 F/A-18s, 10 A-6Es, 10 S-3As, 6 SH-3Hs
America (CV 66)			Norfolk, VA	24 F/A-18s, 10 A-6Es, 10 S-3As, 6 SH-3Hs
JOHN F. KENNEDY class	1	1968		
John F. Kennedy (CV 67)			Norfolk, VA	24 A-6Es, 10 S-3As, 6 SH-3Hs
Nuclear-powered Aircraft Carriers (CVN)[26]				
ENTERPRISE class	1	1961		
Enterprise (CVN 65)			Alameda, CA	24 A-7Es, 10 A-6Es, 10 S-3As, 6 SH-3Hs
NIMITZ class	4 (+2)	1972–		
Nimitz (CVN 68)			Bremerton, WA[27]	24 A-7Es, 10 A-6Es, 10 S-3As, 6 SH-3Hs
Dwight D. Eisenhower (CVN 69)			Norfolk, VA	24 A-7Es, 10 A-6Es, 10 S-3As, 6 SH-3Hs
Carl Vinson (CVN 70)			Alameda, CA	24 A-7Es, 10 A-6Es, 10 S-3As, 6 SH-3Hs
Theodore Roosevelt (CVN 71)			Norfolk, VA	20 F/A-18s, 16 A-6Es, 10 S-3As, 6 SH-3Hs
(Abraham Lincoln (CVN 72))[28]				
(George Washington (CVN 73))				

Aircraft Carrier Summary

Number of Deployable Carriers: 14

Total number of nuclear-capable aircraft in active carrier air wings: 686[29]

F/A-18 Hornets: 164

A-6E Intruders: 174

A-7E Corsairs: 144

S-3A Vikings: 120

SH-3H Sea Kings: 84

Number of nuclear (B43, B57, B61) bombs: 1,800 (100 per carrier, total of 1,400 for carriers)

Number of nuclear depth (B57) bombs: 900 (25-50 per carrier)

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24 Aircraft numbers as of October 1987 based on information provided by the U.S. Navy, Chief of Naval Operations (OP-508).

25 Finishing Service Life Extension Program (SLEP). The SLEP is an extensive multi-year overhaul designed to upgrade a carrier's capability and extend its service life beyond the normal 20 to 30 year service life of ships. The Independence is due to finish its SLEP in the spring of 1988, and will move to a new homeport. The Kitty Hawk moved to Philadelphia to position itself for SLEP in mid-1987 and officially will start SLEP in January 1988. The Independence's aircraft are included in the aircraft totals since it soon will become operational. The Kitty Hawk's aircraft are not included as it is the next ship to enter SLEP and the SLEP carrier cannot be considered deployable.

26 There are 16 nuclear reactors total on the CVNs. Eight reactors power the Enterprise. Two reactors power each NIMITZ class CVN.

27 The Nimitz's homeport is expected to move to a facility presently under development at Everett, WA as part of the Navy's Strategic Homeporting Plan.

28 The two aircraft carriers authorized and under construction are indicated by parentheses. CVN 72 is to enter the fleet in 1989 and CVN 73 in 1991. In addition, the Navy is receiving funding for long-lead-time items for two more nuclear-powered carriers to replace the aged Midway class carriers in the mid- to late 1990's.

29 The Navy owns more of these aircraft types than are deployed in the carrier air wings. These additional aircraft include those in fleet readiness squadrons, in the maintenance pipeline, and those used for research and development.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Weapon(s)
Battleships (BB)				
IOWA class	3 (+1)	1982-		8 TOMAHAWK (TLAM/N) SLCM[30]
Iowa (BB 61)			Norfolk, VA[31]	
New Jersey (BB 62)			Long Beach, CA	
Missouri (BB 63)			Long Beach, CA	
(Wisconsin (BB 64))[32]			(Corpus Christi, TX)	

Battleship Summary
Total battleships with TOMAHAWK SLCM: 3[33]
Total TOMAHAWK TLAM/N SLCM: 24

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Weapon(s)
Cruisers (CG)				
LEAHY class	9	1962-64		3 ASROC, 9 Terrier[34]
Leahy (CG 16)			Long Beach, CA	
Harry E. Yarnell (CG 17)			Norfolk, VA	
Worden (CG 18)			Pearl Harbor, HI	
Dale (CG 19)			Mayport, FL	
Richmond K. Turner (CG 20)			Charleston, SC	
Gridley (CG 21)			San Diego, CA	
England (CG 22)			San Diego, CA	
Halsey (CG 23)			San Diego, CA	
Reeves (CG 24)			Yokosuka, JA	
BELKNAP class	9	1964-67		3 ASROC, 9 Terrier[35]
Belknap (CG 26)			Gaeta, IT	
Josephus Daniels (CG 27)			Norfolk, VA	
Wainwright (CG 28)			Charleston, SC	
Jouett (CG 29)			San Diego, CA	
Horne (CG 30)			San Diego, CA	
Sterett (CG 31)			Subic Bay, PH	
William H. Standley (CG 32)			San Diego, CA	
Fox (CG 33)			San Diego, CA	
Biddle (CG 34)			Norfolk, VA	
TICONDEROGA class	9 (+13)	1983-		
Ticonderoga (CG 47)			Norfolk, VA	3 ASROC[36]
Yorktown (CG 48)			Norfolk, VA	3 ASROC
Vincennes (CG 49)			San Diego, CA	3 ASROC
Valley Forge (CG 50)			San Diego, CA	3 ASROC

30 Eight four-celled armored box launchers (ABLs) hold 32 TOMAHAWKs in the battleships. Nominal nuclear-armed TOMAHAWK (TLAM/N) loading is eight per ship.
31 The U.S. Navy's Strategic Homeporting Plan calls for the USS Iowa to be homeported at Staten Island, NY; the USS Missouri in San Francisco, CA; and the USS Wisconsin in Corpus Christi, TX. The USS New Jersey will remain in Long Beach.
32 Finishing reactivation and scheduled to be delivered to the U.S. Navy in August 1988; HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 201.
33 All three operational battleships are certified for nuclear Tomahawk SLCMs.
34 Leahy class fires ASROC from a dedicated eight-tube Mk16 launcher, and Terriers from two twin Mk10 rail launchers. Nominal nuclear-armed ASROC loading is three and nominal Terrier loading is nine for all ASROC and/or Terrier equipped cruisers and destroyers.
35 Belknap class fires ASROC and Terriers from one twin Mk10 Mod 7 rail launcher.
36 CG 47-51 fire ASROCs from two twin Mk26 Mod 1 rail launchers (as well as non-nuclear SM-2 SAM missiles). These first five ships of the Ticonderoga class do not fire TOMAHAWKs.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Weapon(s)
Thomas S. Gates (CG 51)			Norfolk, VA	3 ASROC
Bunker Hill (CG 52)			San Diego, CA[37]	6 TOMAHAWK (TLAM/N) SLCM[38]
Mobile Bay (CG 53)			Mayport, FL	6 TOMAHAWK (TLAM/N) SLCM
Antietam (CG 54)			Long Beach, CA	6 TOMAHAWK (TLAM/N) SLCM
Leyte Gulf (CG 55)			Mayport, FL	6 TOMAHAWK (TLAM/N) SLCM
(San Jacinto (CG 56))[39]				(6 TOMAHAWK (TLAM/N) SLCM)
(Lake Champlain (CG 57))				(6 TOMAHAWK (TLAM/N) SLCM)
(Philippine Sea (CG 58))				(6 TOMAHAWK (TLAM/N) SLCM)
(Princeton (CG 59))			(Long Beach, CA)	(6 TOMAHAWK (TLAM/N) SLCM)
(Normandy (CG 60))				(6 TOMAHAWK (TLAM/N) SLCM)
(Monterey (CG 61))				(6 TOMAHAWK (TLAM/N) SLCM)
(Chancellorsville (CG 62))				(6 TOMAHAWK (TLAM/N) SLCM)
(Chosin (CG 65))				(6 TOMAHAWK (TLAM/N) SLCM)
(Hue City (CG 66))				(6 TOMAHAWK (TLAM/N) SLCM)
(Shiloh (CG 67))				(6 TOMAHAWK (TLAM/N) SLCM)
(Anzio (CG 68))				(6 TOMAHAWK (TLAM/N) SLCM)
(under construction)[40]				(6 TOMAHAWK (TLAM/N) SLCM)
Nuclear-powered Cruisers (CGN)[41]				
LONG BEACH class	1	1961		
Long Beach (CGN 09)			Bremerton, WA	3 ASROC, 2 TOMAHAWK (TLAM/N) SLCM, 9 Terrier[42]
BAINBRIDGE class	1	1962		
Bainbridge (CGN 25)			Norfolk, VA	3 ASROC, 9 Terrier[43]
TRUXTUN class	1	1967		
Truxtun (CGN 35)			San Diego, CA	3 ASROC, 9 Terrier[44]
CALIFORNIA class	2	1974-75		3 ASROC[45]
California (CGN 36)			Alameda, CA	
South Carolina (CGN 37)			Norfolk, VA	
VIRGINIA class	4	1976-80		3 ASROC[46]
Virginia (CGN 38)			Norfolk, VA	2 TOMAHAWK (TLAM/N) SLCM[47]
Texas (CGN 39)			Alameda, CA	
Mississippi (CGN 40)			Norfolk, VA	
Arkansas (CGN 41)			Alameda, CA	

37 Homeport to move to Yokosuka, Japan in 1988.

38 CG-52 and later have two 61 cell VLSs, nominally loaded with 26 TOMAHAWKs; HASC, FY 1985 DOD, Part 2, p. 361. Of these 26 TOMAHAWKs, six TLAM/Ns is the nominal load. These VLS ships do not have ASROCs since their VLS cannot fire existing ASROCs. However, they will receive a non-nuclear ASROC capability when a vertical launch ASROC is deployed in 1990; Proceedings, June 1987, p. 81. These ships also fire non–nuclear SM–2 SAMs.

39 Ships authorized and under construction indicated by parentheses.

40 All of the planned 27 CG-47 cruisers have been authorized; U.S. Congress, National Defense Authorization Act for Fiscal Years 1988 and 1989: Conference Report to Accompany H.R. 1748, (Report 100-446), November 17, 1987, p. 322.

41 There are 18 nuclear reactors on CGNs; two reactors power each CGN.

42 ASROCs fired from dedicated eight-tube Mk16 launcher. Eight TOMAHAWKs are carried in two four-celled armored box launchers (ABLs). Of these eight, two TLAM/Ns are the nominal load. Terriers fired from two twin Mk10 Mod 1/2 rail launchers.

43 ASROCs fired from dedicated eight-tube Mk16 launcher. Terriers fired from two twin Mk10 Mod 5/6 rail launchers.

44 ASROCs and Terriers fired from one twin Mk10 Mod 8 rail launcher.

45 California class fires ASROCs from dedicated eight-tube Mk16 launcher.

46 Virginia class fires ASROCs from forward twin Mk26 Mod0/1 rail launcher.

47 Two ABLs hold eight TOMAHAWKs in the Virginia class cruisers. They also have a SLCM magazine; HASC, FY 1985 DOD, Part 2, p. 361. Of these eight, two TLAM/Ns are the nominal load. The USS Arkansas will be converted to carry TOMAHAWKs in ABLs in FY 1988.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Cruiser Summary

Total nuclear-capable cruisers: 36
Total cruisers with Terrier SAM: 21
Total Terriers: 189
Total cruisers with ASROC ASW rockets: 32
Total nuclear-armed ASROCs: 96
Total cruisers with TOMAHAWK SLCM: 8
Total TOMAHAWK TLAM/N SLCMs on cruisers: 32[48]

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Weapon(s)
Destroyers (DD)				
SPRUANCE class	31	1975-83		3 ASROC[49]
Spruance (DD 963)			Mayport, FL	11 TOMAHAWK TLAM/N SLCM[50] (no ASROCs)
Paul F. Foster (DD 964)			(Portland, OR)	3 ASROC
Kinkaid (DD 965)			San Diego, CA	3 ASROC
Hewitt (DD 966)[51]			San Diego, CA	3 ASROC
Elliot (DD 967)			San Diego, CA	3 ASROC
Arthur W. Radford (DD 968)			Norfolk, VA	3 ASROC
Peterson (DD 969)			Norfolk, VA	
Caron (DD 970)			Norfolk, VA	3 ASROC
David R. Ray (DD 971)			San Diego, CA	3 ASROC
Oldendorf (DD 972)			Yokosuka, JA	3 ASROC
John Young (DD 973)			San Diego, CA	3 ASROC
Comte de Grasse (DD 974)			Norfolk, VA	3 ASROC, 2 TOMAHAWK (TLAM/N) SLCM
O'Brien (DD 975)			San Diego, CA	3 ASROC
Merrill (DD 976)			San Diego, CA	3 ASROC, 2 TOMAHAWK (TLAM/N) SLCM
Briscoe (DD 977)			Norfolk, VA	3 ASROC
Stump (DD 978)			Norfolk, VA	3 ASROC
Conolly (DD 979)			Norfolk, VA	3 ASROC, 2 TOMAHAWK (TLAM/N) SLCM
Moosbrugger (DD 980)			Charleston, SC	3 ASROC
John Hancock (DD 981)			Mayport, FL	3 ASROC
Nicholson (DD 982)			Charleston, SC	3 ASROC
John Rodgers (DD 983)			Charleston, SC	3 ASROC, 2 TOMAHAWK (TLAM/N) SLCM
Leftwich (DD 984)			Pearl Harbor, HI	3 ASROC, 2 TOMAHAWK (TLAM/N) SLCM
Cushing (DD 985)			San Diego, CA	3 ASROC
Harry W. Hill (DD 986)			San Diego, CA	3 ASROC
O'Bannon (DD 987)			Charleston, SC	3 ASROC
Thorn (DD 988)			Charleston, SC	3 ASROC

48 Cruisers are certified for some but not necessarily all TOMAHAWK variants. TOMAHAWK-capable cruiser total does not include the one Virginia class cruiser to be converted in FY 1988; it does include the one CG-47 that is commissioned, but not yet TOMAHAWK-certified as of December 1987.

49 Spruance class fires ASROCs from dedicated eight-tube Mk16 launcher. All Spruance class ships are equipped with ASROCs, except the two ships that have VLSs (DD-963 and DD-991). When the VLS is installed the Mk16 launcher is removed, thus the ships with VLS are without ASROCs until the non-nuclear vertical launch ASROC is deployed; SASC, FY 1988 DOD, Part 1, p. 491. Ships that have TOMAHAWKs are indicated.

50 Eleven TOMAHAWK TLAM/Ns are the nominal loading for ships with VLS. Two ships are currently equipped with VLSs, but as of December 1987 are not yet TOMAHAWK-certified. Each Spruance class VLS consists of one unit with 61 cells. Forty-five TOMAHAWKs of all variants are the nominal load for Spruance class VLSs; HASC, FY 1985 DOD, Part 2, p. 361. In addition to the two VLS ships, seven of the Spruance class already are equipped with eight TOMAHAWKs carried in two four-celled armored box launchers. Of these eight, two TLAM/Ns are the nominal load for each of these seven ships. The 22 remaining ships are being converted to carry VLSs. The backfit of VLSs into the Spruance class is scheduled to be completed by 1992; SASC, FY 1988 DOD, Part 1, p. 490.

51 Next Spruance class ship to be outfitted with a VLS.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Weapon(s)
Deyo (DD 989)			Charleston, SC	3 ASROC, 2 TOMAHAWK (TLAM/N) SLCM
Ingersoll (DD 990)			Pearl Harbor, HI	3 ASROC, 2 TOMAHAWK (TLAM/N) SLCM
Fife (DD 991)			San Diego, CA[52]	11 TOMAHAWK (TLAM/N) SLCM (no ASROCs)
Fletcher (DD 992)			San Diego, CA	3 ASROC
Hayler (DD 997)			Norfolk, VA	3 ASROC
Guided Missile Destroyers (DDG)				
CHARLES F. ADAMS class	23	1960-64		3 ASROC[53]
Charles F. Adams (DDG 02)			Mayport, FL	
John King (DDG 03)			Norfolk, VA	
Lawrence (DDG 04)			Norfolk, VA	
Claude V. Ricketts (DDG 05)			Norfolk, VA	
Barney (DDG 06)			Norfolk, VA	
Henry B. Wilson (DDG 07)			San Diego, CA	
Lynde McCormick (DDG 08)			San Diego, CA	
Towers (DDG 09)			Yokosuka, JA	
Sampson (DDG 10)			Mayport, FL	
Sellers (DDG 11)			Charleston, SC	
Robison (DDG 12)			San Diego, CA	
Hoel (DDG 13)			San Diego, CA	
Buchanan (DDG 14)			San Diego, CA	
Berkeley (DDG 15)			San Diego, CA	
Joseph Strauss (DDG 16)			Pearl Harbor, HI	
Conyngham (DDG 17)			Norfolk, VA	
Semmes (DDG 18)			Charleston, SC	
Tattnall (DDG 19)			Mayport, FL	
Goldsborough (DDG 20)			Pearl Harbor, HI	
Cochrane (DDG 21)			Yokosuka, JA	
Benjamin Stoddert (DDG 22)			Pearl Harbor, HI	
Richard E. Byrd (DDG 23)			Norfolk, VA	
Waddell (DDG 24)			San Diego, CA	
FARRAGUT class	10	1960-61		3 ASROC, 9 Terrier[54]
Farragut (DDG 37)			Norfolk, VA	
Luce (DDG 38)			Mayport, FL	
MacDonough (DDG 39)			Charleston, SC	
Coontz (DDG 40)			Norfolk, VA	
King (DDG 41)			Norfolk, VA	
Mahan (DDG 42)			Charleston, SC	
Dahlgren (DDG 43)			Norfolk, VA	
William V. Pratt (DDG 44)			Charleston, SC	
Dewey (DDG 45)			Charleston, SC	
Preble (DDG 46)			Norfolk, VA	

52 Homeport to move to Yokosuka, Japan in 1988.
53 Adams class fires ASROCs from dedicated eight-tube Mk16 launcher.
54 Farragut class fires ASROCs from a dedicated eight-tube Mk16 launcher. Terriers are fired from one twin Mk10 Mod 0 rail launcher.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Weapon(s)
ARLEIGH BURKE class	–	(FY 1990-)[55]		(TOMAHAWK)[56]
(Arleigh Burke (DDG 51))				
(John Barry (DDG 52))				
(John Paul Jones (DDG 53))				
(Curtis Wilbur (DDG 54))				
(25 more planned)				

Destroyer Summary

Total Nuclear-Capable Destroyers: 64[57]
Total Destroyers with Terrier SAM: 10
Total Terriers: 90
Total Destroyers with ASROC ASW Rocket: 62
Total nuclear-armed ASROCs: 186
Total Destroyers with TOMAHAWK SLCM: 9
Total TOMAHAWK TLAM/N SLCMs on destroyers: 36[58]

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Weapon(s)
Frigates (FF)				
BRONSTEIN class	2	1963		3 ASROC[59]
Bronstein (FF 1037)			San Diego, CA	
McCloy (FF 1038)			Norfolk, VA	
GARCIA class	10	1964-68		3 ASROC
Garcia (FF 1040)			Charleston, SC	
Bradley (FF 1041)			San Diego, CA	
Edward McDonnell (FF 1043)			Mayport, FL	
Brumby (FF 1044)			(Portland, ME)	
Davidson (FF 1045)			Pearl Harbor, HI	
Voge (FF 1047)			Mayport, FL	
Sample (FF 1048)			Pearl Harbor, HI	
Koelsch (FF 1049)			Mayport, FL	
Albert David (FF 1050)			San Diego, CA	
O'Callahan (FF 1051)			San Diego, CA	
KNOX class	46	1969-74		3 ASROC
Knox (FF 1052)			Yokosuka, JA	
Roark (FF 1053)			San Francisco, CA	
Gray (FF 1054)			San Francisco, CA	
Hepburn (FF 1055)			San Diego, CA	
Connole (FF 1056)			Newport, RI	
Rathburne (FF 1057)			Pearl Harbor, HI	
Meyerkord (FF 1058)			San Diego, CA	
W.S. Sims (FF 1059)			Mayport, FL	
Lang (FF 1060)			San Francisco, CA	

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55 Three Arleigh Burke destroyers are authorized and under construction. The Navy plans to have 29 of these ships and is seeking funding for three ships each in FYs 1988, 1989, and 1990; five in FY 1991; and six in FY 1992; HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 745.

56 Arleigh Burke class destroyers will be equipped with one 61 cell VLS and one "half-size" VLS of 29 cells. They will have a nominal TOMAHAWK loading of 28; HASC, FY 1985 DOD, Part 2, p. 361.

57 Totals include the two VLS ships, even though they are not certified for TOMAHAWK as of December 1987.

58 The seven Spruance class ships with ABLs are certified for some, but not necessarily all, variants of TOMAHAWKs. This total includes the seven ABL ships and the two uncertified converted VLS ships.

59 All nuclear-capable frigates fire ASROC from a dedicated eight-tube Mk 16 launcher.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Nuclear Weapon(s)
Patterson (FF 1061)			Philadelphia, PA	
Whipple (FF 1062)			Pearl Harbor, HI	
Reasoner (FF 1063)			San Diego, CA	
Lockwood (FF 1064)			Yokosuka, JA	
Stein (FF 1065)			San Diego, CA	
Marvin Shields (FF 1066)			San Diego, CA	
Francis Hammond (FF 1067)			Yokosuka, JA	
Vreeland (FF 1068)			Mayport, FL	
Bagley (FF 1069)			San Diego, CA	
Downes (FF 1070)			San Diego, CA	
Badger (FF 1071)			Pearl Harbor, HI	
Blakely (FF 1072)			Charleston, SC	
Robert E. Peary (FF 1073)			Pearl Harbor, HI	
Harold E. Holt (FF 1074)			Pearl Harbor, HI	
Trippe (FF 1075)			(Boston, MA)	
Fanning (FF 1076)			San Diego, CA	
Ouellet (FF 1077)			Pearl Harbor, HI	
Joseph Hewes (FF 1078)			Charleston, SC	
Bowen (FF 1079)			Charleston, SC	
Paul (FF 1080)			Mayport, FL	
Aylwin (FF 1081)			Norfolk, VA	
Elmer Montgomery (FF 1082)			Mayport, FL	
Cook (FF 1083)			San Diego, CA	
McCardless (FF 1084)			Norfolk, VA	
Donald B. Beary (FF 1085)			Norfolk, VA	
Brewton (FF 1086)			Pearl Harbor, HI	
Kirk (FF 1087)			Yokosuka, JA	
Barbey (FF 1088)			San Diego, CA	
Jesse L. Brown (FF 1089)			Charleston, SC	
Ainsworth (FF 1090)			Norfolk, VA	
Miller (FF 1091)			Newport, RI	
Thomas C. Hart (FF 1092)			Norfolk, VA	
Capodanno (FF 1093)			Newport, RI	
Pharris (FF 1094)			Norfolk, VA	
Truett (FF 1095)			Norfolk, VA	
Valdez (FF 1096)			Newport, RI	
Moinester (FF 1097)			Norfolk, VA	
GLOVER class	1	1965		3 ASROC
Glover (FF 1098)			Norfolk, VA	
Guided Missile Frigates (FFG)				
BROOKE class	6	1966-68		3 ASROC
Brooke (FFG 01)			San Diego, CA	
Ramsey (FFG 02)			San Diego, CA	
Schofield (FFG 03)			San Diego, CA	
Talbot (FFG 04)			Mayport, FL	
Richard L. Page (FFG 05)			Norfolk, VA	
Julius A. Furer (FFG 06)			Philadelphia, PA	

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Frigate Summary
Total Nuclear-Capable Frigates: 65
Total frigates with ASROC ASW rocket: 65
Total nuclear-armed ASROCs: 195

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Remarks
Amphibious Warfare Ships[60]				
Amphibious Assault Ships				
TARAWA class	5	1976-80		AV-8B II Harrier V/STOL aircraft; transports various Marine Corps nuclear weapons
Tarawa (LHA 01)			Long Beach, CA	
Saipan (LHA 02)			(Philadelphia, PA)	
Belleau Wood (LHA 03)			San Diego, CA	
Nassau (LHA 04)			Norfolk, VA	
Peleliu (LHA 05)			Long Beach, CA	
IWO JIMA class	7	1961-70		AV-8B II Harrier V/STOL aircraft; transports various Marine Corps nuclear weapons
Iwo Jima (LPH 02)			Norfolk, VA	
Okinawa (LPH 03)			San Diego, CA	
Guadalcanal (LPH 07)			Norfolk, VA	
Guam (LPH 09)			Norfolk, VA	
Tripoli (LPH 10)			San Diego, CA	
New Orleans (LPH 11)			San Diego, CA	
Inchon (LPH 12)			Norfolk, VA	
(WASP class)[61]	–	(1989-)		AV-8B II Harrier V/STOL aircraft; transports various Marine Corps nuclear weapons
(Wasp (LHD 1))				
(Essex (LHD 2))				
(Kearsage (LHD 3))[62]				
Amphibious Cargo Ships (LKA)				
CHARLESTON class	5	1968-70		AV-8B II Harrier V/STOL aircraft; transports various Marine Corps nuclear weapons
Charleston (LKA 113)			Norfolk, VA	
Durham (LKA 114)			San Diego, CA	
Mobile (LKA 115)			Long Beach, CA	
Saint Louis (LKA 116)			Sasebo, JA	
El Paso (LKA 117)			Norfolk, VA	
Amphibious Transport Docks (LPD)				
RALEIGH class	2	1962-63		transports various Marine Corps nuclear weapons
Raleigh (LPD 01)			Norfolk, VA	
Vancouver (LPD 02)			San Francisco, CA	
AUSTIN class	11	1965-71		transports various Marine Corps nuclear weapons
Austin (LPD 04)			Norfolk, VA	
Ogden (LPD 05)			Long Beach, CA	
Duluth (LPD 06)			San Diego, CA	
Cleveland (LPD 07)			San Diego, CA	
Dubuque (LPD 08)			Sasebo, JA	
Denver (LPD 09)			San Diego, CA	

60 Amphibious warfare ships can be used to transport nuclear weapons for Marine Corps use ashore. Ships able to operate nuclear-capable AV-8B Harrier aircraft also can carry nuclear bombs. Selected Marine Corps ships are certified for nuclear weapons transport. The rest of the ships are nuclear-capable, but are not nuclear-weapons-certified and would be used to transport nuclear weapons on a contingent or emergency basis (See Section I for more discussion).

61 Ships under construction or planned are in parentheses.

62 The U.S. Navy wants funding for three additional Wasp class ships, one each in FYs 1988, 1989 and 1991; HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 745.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Remarks
Juneau (LPD 10)			San Diego, CA	
Shreveport (LPD 12)			Norfolk, VA	
Nashville (LPD 13)			Norfolk, VA	
Trenton (LPD 14)			Norfolk, VA	
Ponce (LPD 15)			Norfolk, VA	
Dock Landing Ships (LSD)				
THOMASTON class	3	1956		transports various Marine Corps nuclear weapons
Spiegel Grove (LSD 32)			Little Creek, Norfolk, VA	
Alamo (LSD 33)			San Diego, CA	
Hermitage (LSD 34)			Little Creek, Norfolk, VA	
ANCHORAGE class	5	1969-72		transports various Marine Corps nuclear weapons
Anchorage (LSD 36)			Long Beach, CA	
Portland (LSD 37)			Little Creek, Norfolk, VA	
Pensacola (LSD 38)			Little Creek, Norfolk, VA	
Mount Vernon (LSD 39)			Long Beach, CA	
Fort Fisher (LSD 40)			San Diego, CA	
WHIDBEY ISLAND class[63]	3 (+5)	1984-		transports various Marine Corps nuclear weapons
Whidbey Island (LSD 41)			Little Creek, Norfolk, VA	
Germantown (LSD 42)			San Diego, CA	
Fort McHenry (LSD 43)			San Diego, CA	
(Gunston Hall (LSD 44)) (under construction)				
Tank Landing Ships (LST)				
NEWPORT class	20	1969-72		transports various Marine Corps nuclear weapons
Newport (LST 1179)			Little Creek, Norfolk, VA	
Manitowoc (LST 1180)			Little Creek, Norfolk, VA	
Sumter (LST 1181)			Little Creek, Norfolk, VA	
Fresno (LST 1182)			Long Beach, CA	
Peoria (LST 1183)			San Diego, CA	
Frederick (LST 1184)			San Diego, CA	
Schenectady (LST 1185)			San Diego, CA	
Cayuga (LST 1186)			San Diego, CA	
Tuscaloosa (LST 1187)			San Diego, CA	
Saginaw (LST 1188)			Little Creek, Norfolk, VA	
San Bernardino (LST 1189)			Sasebo, JA	
Boulder (LST 1190)			Little Creek, Norfolk, VA	
Racine (LST 1191)			Long Beach, CA	
Spartanburg County (LST 1192)			Little Creek, Norfolk, VA	
Fairfax County (LST 1193)			Little Creek, Norfolk, VA	
La Moure County (LST 1194)			Little Creek, Norfolk, VA	
Barbour County (LST 1195)			San Diego, CA	
Harlan County (LST 1196)			Little Creek, Norfolk, VA	
Barnstable County (LST 1197)			Little Creek, Norfolk, VA	
Bristol County (LST 1198)			San Diego, CA	
Amphibious Command Ships (LCC)				
BLUE RIDGE class	2	1970-71		transports various Marine Corps nuclear weapons
Blue Ridge (LCC 19)			Yokosuka, JA	
Mount Whitney (LCC 20)			Norfolk, VA	

63 Five more ships authorized. The U.S. Navy also plans to buy a cargo variant of the LSD-41 class ships; HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 195.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Amphibious Warfare Ship Summary

Total Nuclear-capable Amphibious Warfare Ships: 63
Amphibious Command Ships: 2
Amphibious Assault Ships: 12
Amphibious Cargo Ships: 5
Amphibious Transport Docks: 13
Dock Landing Ships: 11
Tank Landing Ships: 20

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Remarks
Support Ships[64]				
Ballistic Missile Cargo Supply Ships (TAK)				
NORWALK class	1			
Marshfield (TAK 282)		1970	none assigned	Can carry 16 Poseidon missiles in hold and transport nuclear warheads[65]
VEGA class	1			
Vega (TAK 286)		1983	none assigned	Can carry 16 Trident I missiles in hold and transport nuclear warheads
Destroyer Tenders (AD)[66]				
DIXIE class	3	1940-44		
Prairie (AD 15)			Long Beach, CA	
Sierra (AD 18)			Charleston, SC	
Yosemite (AD 19)			Mayport, FL	
SAMUEL GOMPERS class	2	1966-68		
Samuel Gompers (AD 37)			Alameda, CA	
Puget Sound (AD 38)			Norfolk, VA	
YELLOWSTONE class	4	1980-83		
Yellowstone (AD 41)			Norfolk, VA	
Acadia (AD 42)			San Diego, CA	
Cape Cod (AD 43)			San Diego, CA	
Shenandoah (AD 44)			Norfolk, VA	
Ammunition Ships (AE)[67]				
SURIBACHI class	2	1956-57		Helicopter landing area only
Suribachi (AE 21)			Earle, NJ	
Mauna Kea (AE 22)			Concord, CA	
NITRO class	3	1959		Helicopter landing area only
Nitro (AE 23)			Earle, NJ	
Pyro (AE 24)			Concord, CA	
Haleakala (AE 25)			Concord, CA	
KILAUEA class[68]	7	1968-72		
Butte (AE 27)			Earle, NJ	2 CH-46 transport helicopters

64 Other non-nuclear-capable support ships include: Combat Store Ships (AFS) which can be part of underway replenishment groups, but only carry provisions, dry stores or refrigerated products; Military Sealift Command ships designated by a "T" before their ship class abbreviation, (e.g. TAE) except for the ballistic missiles cargo supply ships (TAKs); and Fleet Oilers (AOs) of the Cimarron class.

65 The Marshfield is a primary logistic link between the continental U.S. and "advanced FBM [fleet ballistic missile] sites," i.e. Holy Loch, Scotland; SASC, FY 1985 DOD, Part 8, p. 4267.

66 "Destroyer tenders (ADs) have the capability for storage, assembly, and issue of ASROC to delivery ships." Department of the Navy, Nuclear Warfare Operations (U) NWP 28 (Rev.D), November 1980, p. 4-8; partially declassified and released under the Freedom of Information Act.

67 "Ammunition ships [AEs] and most fast combat support ships [AOEs] are capable of transporting, storing, and providing underway replenishment for all Navy weapons except Polaris and Poseidon," Department of the Navy, Nuclear Warfare Operations (U) NWP 28 (Rev.D), November 1980, p. 4-8; partially declassified and released under the Freedom of Information Act.

68 Lead ship in this class, USS Kilauea (TAE 26) was converted to a Military Sealift Command ship and is no longer nuclear-capable.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Remarks
Santa Barbara (AE 28)			Charleston, SC	
Mount Hood (AE 29)			Concord, CA	
Flint (AE 32)			Concord, CA	
Shasta (AE 33)			Concord, CA	
Mount Baker (AE 34)			Charleston, SC	
Kiska (AE 35)			Concord, CA	
Fast Combat Support Ships (AOE)				
SACRAMENTO class	4 (+2)	1964-70		
Sacramento (AOE 1)			Bremerton, WA	2 CH-46 transport helicopters
Camden (AOE 2)			Bremerton, WA	
Seattle (AOE 3)			Norfolk, VA	
Detroit (AOE 4)			Norfolk, VA	
(under construction)[69]				
Fleet Oilers (AO)[70]				
ASHTABULA class	2	1945		Helicopter landing area only
Caloosahatchee (AO 098)			Norfolk, VA	
Canisteo (AO 099)			Norfolk, VA	
Replenishment Oilers (AOR)[71]				
WICHITA class	7	1969-70		
Wichita (AOR 1)			Oakland, CA	2 CH-46 transport helicopters
Milwaukee (AOR 2)			Norfolk, VA	
Kansas City (AOR 3)			Oakland, CA	
Savannah (AOR 4)			Norfolk, VA	
Wabash (AOR 5)			Long Beach, CA	
Kalamazoo (AOR 6)			Norfolk, VA	
Roanoke (AOR 7)			Long Beach, CA	
Submarine Tenders (AS)[72]				
FULTON class	2	1941-43		
Fulton (AS 11)			New London, CT	Provide TOMAHAWK SLCM support[73]
Orion (AS 18)			Maddalena ?	Provide TOMAHAWK (TLAM/N) SLCM support[74]
PROTEUS class	1	1944		
Proteus (AS 19)			Guam, GU	
HUNLEY class	2	1962-63		
Hunley (AS 31)			Norfolk, VA	Being converted to SSN tender[75]
Holland (AS 32)			Charleston, SC	Supports Poseidon missiles/warheads

69 Two more ships are authorized. In addition, the Navy plans to ask for funding for one more AOE in FY 1989 and two in FY 1991; HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 198.

70 The two Ashtabula (AO 98) class fleet oilers can be used to transport ammunition as well as fuels and other stores. Although this is not their prime mission, they could be used for contingency transport of nuclear weapons. The Cimarron (AO 177) class fleet oilers (not listed) only transport fuels, dry stores and provisions, and would not be used for the transport of nuclear (or conventional) weapons.

71 Replenishment oilers (AORs), "have an emergency capability for transporting and providing underway replenishment for all Navy weapons except Polaris and Poseidon," Department of the Navy, Nuclear Warfare Operations (U) NWP 28 (Rev.D), November 1980, p. 4-8; partially declassified and released under the Freedom of Information Act.

72 Submarine tenders (ASs) have the capability for storage, assembly, and issue of SUBROC, Poseidon and Tridents to delivery ships; Department of the Navy, Nuclear Warfare Operations (U) NWP 28 (Rev.D), November 1980, p. 4-8; partially declassified and released under the Freedom of Information Act.

73 Chief of Naval Operations, "Fiscal Year (FY 83) Fleet Modernization Program (FMP) for Execution," OPNAV Instruction 4720.91, 16 June 1982, p. 40; released through the Freedom of Information Act. "Currently being trained to handle CLS"; HAC, FY 1987 DOD, Part 4, p. 156.

74 Chief of Naval Operations, "Fiscal Year (FY 85) Fleet Modernization Program (FMP) for Execution," OPNAV Instruction 4720.94, 17 August 1984, p. 65; released through the Freedom of Information Act.

75 The Hunley was a SSBN tender, but currently is undergoing conversion to support SSNs; U.S. Navy, phone conversation, January 1988.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Remarks
SIMON LAKE class	2	1964-65		
Simon Lake (AS 33)			Holy Loch, UK	Supports Poseidon and Trident I missiles/warheads[76]
Canopus (AS 34)			Kings Bay, GA	Supports Trident I missiles/warheads
L. Y. SPEAR class	2	1970-71		
L. Y. Spear (AS 36)			Norfolk, VA	
Dixon (AS 37)			San Diego, CA	Provide TOMAHAWK (TLAM/N) SLCM support[77]
EMORY S. LAND class	3	1979-81		
Emory S. Land (AS 39)			Norfolk, VA	
Frank Cable (AS 40)			Charleston, SC	Provide TOMAHAWK (TLAM/N) SLCM support[78]
McKee (AS 41)			San Diego, CA	Provide TOMAHAWK (TLAM/N) SLCM support[79]

Support Ship Summary

Total nuclear-capable support ships: 48
Ballistic Missile Cargo Supply Ships: 2
Destroyer Tenders: 9
Ammunition Ships: 12
Fleet Oilers: 2
Fast Combat Support Ships: 4
Replenishment Oilers: 7
Submarine Tenders: 12

Ship Name and Hull Number	Number Deployed	Years Commissioned	Homeport	Remarks
Non-Nuclear-capable Nuclear-powered Ships[80]				None of these ships are nuclear weapons capable
Attack Submarines (SSN)[81]				
SKATE class	2	1958		
Swordfish (SSN 579)[82]			Pearl Harbor, HI	
Sargo (SSN 583)			Pearl Harbor, HI	
SKIPJACK class	4	1959-61		
Skipjack (SSN 585)			Groton, CT	

76 HASC, FY 1984 DOD, Part 4, p. 208.
77 Chief of Naval Operations, "Fiscal Year (FY 84) Fleet Modernization Program (FMP) for Execution," OPNAV Instruction 4720.92, 3 June 1983, p. 75; released through the Freedom of Information Act.
78 Chief of Naval Operations, "Fiscal Year (FY 84) Fleet Modernization Program (FMP) for Execution," OPNAV Instruction 4720.92, 3 June 1983, p. 76; released through the Freedom of Information Act.
79 Chief of Naval Operations, "Fiscal Year (FY 85) Fleet Modernization Program (FMP) for Execution," OPNAV Instruction 4720.94, 17 August 1984, p. 67; released through the Freedom of Information Act. "Currently being trained to handle CLS"; HAC, FY 1987 DOD, Part 4, p. 156.
80 These ships are powered by one nuclear reactor each.
81 The non-nuclear-capable nuclear-powered attack submarines are not considered to be front line submarines. They will be up for retirement in the 1990s.
82 To be decommissioned in 1988-89; Navy Times, 23 November 1987.

APPENDIX A: Nuclear-capable and Nuclear-powered Ships of the United States

Ship Name and Hull Number	Number Deployed	Years Commis-sioned	Homeport	Remarks
Scamp (SSN 588)			Groton, CT	
Sculpin (SSN 590)			Groton, CT	
Shark (SSN 591)			Groton, CT	
TULLIBEE class	1	1960		
Tullibee (SSN 597)			(Portsmouth, NH)	
ETHAN ALLEN class[83]	2			
Sam Houston (SSN 609)			Pearl Harbor, HI	
John Marshall (SSN 611)			Norfolk, VA	
Research Vessels				
NR-1 class submersible	1	1969		
NR-1			Groton, CT	

83 These submarines were formerly SSBNs, but have been converted to SSNs and outfitted to transport special operation forces.

APPENDIX B: Nuclear-capable and Nuclear-powered Ships of the Soviet Union

Ship Type	Number Deployed	Years Built	Fleet	Nuclear Delivery System(s) and/or Nuclear Weapon(s)
Ballistic Missile Submarines (SSB)				
GOLF II class (names unknown)	13	1958-62	6 Baltic Fleet 7 Sea of Japan, Pacific Fleet	3 SS-N-5 SLBM
GOLF III class (name unknown)	1	1973	1 Northern Fleet	6 SS-N-8 SLBM 6 21-inch torpedo tubes
GOLF V class (name unknown)	1	1974-75	1 Black Sea Fleet	1 SS-N-20 SLBM[84] 6 21-inch torpedo tubes
Nuclear-powered Ballistic Missile Submarines (SSBN)[85]				
YANKEE I class (names unknown)	17[86]	1967–74	9 Northern Fleet 7 Pacific Fleet	16 SS–N– SLBM 6 21-inch torpedo tubes
HOTEL III class (name unknown)	1	1969-70	1 Northern Fleet	6 SS-N-8 SLBM 6 21-inch torpedo tubes
DELTA I class (names unknown)	18	1972-77	9 Northern Fleet 9 Pacific Fleet	12 SS-N-8 SLBM 6 21-inch torpedo tubes
DELTA II class (names unknown)	4	1974-75	4 Northern Fleet	16 SS-N-8 SLBM 6 21-inch torpedo tubes
DELTA III class (names unknown)	14	1975-82	7 Northern Fleet 7 Pacific Fleet	16 SS-N-18 SLBM 6 21-inch torpedo tubes
YANKEE II class (name unknown)	1	1977	1 Northern Fleet	12 SS-N-17 SLBM 6 21-inch torpedo tubes
TYPHOON class (names unknown) (under construction)	4	1983-	4 Iokanga, Northern Fleet	20 SS-N-20 SLBM possibly 2 26-inch tubes in pressure hull for SS-N-15 or SS-N-16 6 or 8 21-inch torpedo tubes
DELTA IV class (names unknown) (under construction)	3	1985-[87]	3 Northern Fleet	16 SS-N-23 SLBM 6 21-inch torpedo tubes

Ballistic Missile Submarine Summary

Total Ballistic Missile Submarines: 77
Total Ballistic Missiles: 968 /Warheads: 3447
SS-N-5: 39 /Warheads: 39
SS-N-6: 272 /Warheads: 544
SS-N-8: 292 /Warheads: 292
SS-N-17: 12 /Warheads: 12
SS-N-18: 224 /Warheads: 1568
SS-N-20: 81 /Warheads: 800
SS-N-23: 48 /Warheads: 192
Total submarines carrying nuclear-capable ASW weapons: 4
Total nuclear-capable ASW weapons: 16
Total submarines carrying nuclear-capable torpedoes: 64
Nuclear torpedoes: 64

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84 The SS-N-20 missile on this ship is not thought to be nuclear-armed.
85 There are 124 nuclear reactors on the SSBNs. Two nuclear reactors power each SSBN.
86 Yankee I class SSBNs continue to be retired as Delta IV and Typhoon submarines are activated.
87 The SS-N-23 missile did not become operational until 1986; HASC, FY 1988/1989 DOD Seapower and Strategic and Critical Materials Subcommittee, p. 9.

APPENDIX B: Nuclear-capable and Nuclear-powered Ships of the Soviet Union

Ship Type	Number Deployed	Years Built	Fleet	Nuclear Delivery System(s) and/or Nuclear Weapon(s)
Cruise Missile Attack Submarines (SSG)[88]				
JULIETT class (names unknown)	15	1961-69	11 in Northern and Pacific Fleets 3 Baltic Fleet 1 Black Sea Fleet	4 SS-N-3a SLCM 6 21-inch torpedo tubes
Nuclear-powered Cruise Missile Attack Submarines (SSGN)[89]				
ECHO II class (names unknown)	26	1962-68	Northern Fleet Pacific Fleet	8 SS-N-3a/c or SS-N-12 SLCM[90] 6 21-inch torpedo tubes
CHARLIE I class (names unknown)	10[91]	1968-73	8 Northern Fleet 2 Pacific Fleet	8 SS-N-7 SLCM SS-N-15 nuclear depth bomb 6 21-inch torpedo tubes
PAPA class (name unknown)	1	1973	Northern Fleet	10 SS-N-7 or SS-N-9 SLCM SS-N-15 nuclear depth bomb 6 21-inch torpedo tubes
CHARLIE II class (names unknown)	6	1973-82	Northern Fleet	8 SS-N-9 SLCM[92] SS-N-15 nuclear depth bomb 6 21-inch torpedo tubes
OSCAR class (names unknown) (under construction)	4	1981-	Northern Fleet	24 SS-N-19 SLCM[93] SS-N-15 nuclear depth bomb SS-N-16 ASW missile 6 or 8 21-inch torpedo tubes
YANKEE class (name unknown) (under construction)	(1)[94]	1984-	Northern Fleet	Candidate for 12 SS-NX-24 SLCM 6 21-inch torpedo tubes

Cruise Missile Submarine Summary

Total Cruise Missile Submarines: 63
Total Nuclear-capable Cruise Missiles: 502 /Warheads: 280
SS-N-3 missiles: 148 /Warheads: 104
SS-N-7 missiles: 90 /Warheads: 44
SS-N-9 missiles: 48 /Warheads: 24
SS-N-12 missiles: 120 /Warheads: 60
SS-N-19 missiles: 96/Warheads: 48
Total submarines carrying nuclear-capable ASW weapons: 22
Total nuclear-capable ASW weapons: 88
Total submarines carrying nuclear-capable torpedoes: 63
Nuclear torpedoes: 63

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88 Seven WHISKEY Long Bin and two WHISKEY Twin Cylinder class SSGs with SS-N-3 SLCM and nuclear-capable torpedoes were retired in 1985.
89 There are 70 nuclear reactors on the SSGNs. One nuclear reactor powers each CHARLIE I/II SSGN, two reactors power each of the remaining SSGNs.
90 About 15 of the ECHO II class SSGNs reportedly had been refitted to fire the SS-N-12 SLCM by 1986.
91 DIA, "Unclassified Communist Naval Orders of Battle," DDB-1200-124-86, April 1986 (released under the FOIA) reports 16 Charlie I and II class submarines, one less than most sources. There are ten Charlie Is and six Charlie IIs. One of these Charlie class submarines has been leased to India, and has been named the Chakra; Jane's Defence Weekly, "Indian SSN Departs Vladivostock Submarine Base," 23 January 1988, p. 116.
92 The SS-N-7 SLCM possibly is deployed on some Charlie II class SSGNs.
93 OSCAR class SSGNs are probable candidates for the SS-NX-24 SLCM when it is deployed.
94 Not yet fully operational with SS-NX-24 SLCM.

APPENDIX B: Nuclear-capable and Nuclear-powered Ships of the Soviet Union

Ship Type	Number Deployed	Years Built	Fleet	Nuclear Delivery System(s) and/or Nuclear Weapon(s)
Attack Submarines (SS)[95]				
WHISKEY class (names unknown)	49[96]	1951-57	Baltic Fleet others unknown	4 21-inch torpedo tubes
ZULU class (name unknown)	1	1952-55	unknown	10 21-inch torpedo tubes
ROMEO class (names unknown)	4	1958-62	unknown	possible SS-N-15 nuclear depth bomb 8 21-inch torpedo tubes
FOXTROT class (names unknown)	43	1958-67	Northern Fleet Pacific Fleet others unknown	6 21-inch torpedo tubes
TANGO class (names unknown)	20	1973-82	Northern Fleet others unknown	possible SS-N-15 nuclear depth bomb 8 21-inch torpedo tubes
KILO class (names unknown) (under construction)	11	1980-	Pacific Fleet Northern Fleet others unknown	6 21-inch torpedo tubes
Nuclear-powered Attack Submarines (SSN)[97]				
NOVEMBER class (names unknown)	12	1958-64	Northern Fleet others unknown	6 21-inch torpedo tubes
HOTEL II class (names unknown)	4	1959-62	unknown	6 21-inch torpedo tubes
VICTOR I class (names unknown)	16	1967-75	unknown	SS-N-15 nuclear depth bomb 6 21-inch torpedo tubes
ECHO I class (names unknown)	3[98]	1970-74	Pacific Fleet	6 21-inch torpedo tubes
VICTOR II class (names unknown)	7	1972-78	Pacific Fleet others unknown	SS-N-15 nuclear depth bomb SS-N-16 ASW missile 6 21-inch torpedo tubes
ALFA class (names unknown)	6	1978-83	Northern Fleet	SS-N-15 nuclear depth bomb 6 21-inch torpedo tubes
VICTOR III class (names unknown)	17	1979-86	Northern Fleet Pacific Fleet others unknown	candidate for SS-N-21 SLCM[99] SS-N-16 ASW missile 2 or 6 21-inch torpedo tubes[100]

95 Four BRAVO class target training submarines with six 21-inch torpedo tubes also could be nuclear-armed.
96 Of the 236 WHISKEY class submarines originally produced, about 60-70 additional submarines are believed to be in inactive reserve.
97 There are 136 nuclear reactors on the SSNs. Two nuclear reactors power each SSN, except for the ALFAs which have one reactor each.
98 These are converted from SS-N-3 cruise missile submarines built 1960-1962.
99 A modified VICTOR III in the Northern Fleet was used as a test platform for the SS-N-21.
100 Four of the torpedo tubes may be 26-inch rather than 21-inch for the SS-N-16 ASW missile.

APPENDIX B: Nuclear-capable and Nuclear-powered Ships of the Soviet Union

Ship Type	Number Deployed	Years Built	Fleet	Nuclear Delivery System(s) and/or Nuclear Weapon(s)
SIERRA class (namea unknown) (under construction)	2	1986-	Northern Fleet	candidate for SS-N-21 SLCM SS-N-15 nuclear depth bomb SS-N-16 ASW missile 6 21- or 26-inch torpedo tubes
MIKE class (name unknown)	1[102]	1986	Northern Fleet	SS-N-15 nuclear depth bomb SS-N-16 ASW missile 6 21- or 26-inch torpedo tubes
AKULA class (name unknown) (under construction)	1	1987-	Pacific Fleet	candidate for SS-N-21 SLCM SS-N-15 nuclear depth bomb SS-N-16 ASW missile 6 21- or 26-inch torpedo tubes

Attack Submarine Summary

Total Attack Submarines: 199
Total submarines carrying nuclear-capable ASW weapons: 74
Total nuclear-capable ASW weapons: 296
Total submarines carrying nuclear-capable torpedoes: 199
Nuclear torpedoes: 199

Ship Type	Number Deployed	Years Built	Fleet	Nuclear Delivery System(s) and/or Nuclear Weapon(s)
Nuclear-powered Aircraft Carriers (CVN)				
KREMLIN class (Brezhnev) – – – (under construction)	–	1985-		35-60 aircraft, including SU-27 Flanker, MiG-29 Fulcrum, Ka-27 Helix helicopters; possible nuclear bombs or nuclear depth bombs
Guided Missile V/STOL Aircraft Carriers (CVHG)				
KIEV class	3	1975-87		8 SS-N-12 SLCM (with 8 reloads) 1 twin SUW-N-1 with FRAS-1 nuclear only ballistic rockets 72 SA-N-3 SAMs 30 aircraft, including 12 Yak-36 Forger STOL, up to 24 helicopters, either Ka-25 Hormone A/Bs or Ka-27 Helix A; possible nuclear bombs or nuclear depth bombs 10 21-inch torpedo tubes
Kiev			Northern Fleet	
Minsk			Vladivostok	
Novorossiysk			Vladivostok	
Baku (sea trials March 1987)			unknown	
Guided Missile Aviation Cruisers (CHG)				
MOSKVA class	2	1967-68		1 twin SUW-N-1 with FRAS-1 nuclear–only ballistic rockets 44 SA-N-3 SAMs 14 Ka-25 Hormone helicopters; possible nuclear depth bombs
Moskva			Black Sea Fleet	
Leningrad			Black Sea Fleet	

102 A second MIKE class submarine has not been launched and it does not appear the submarine will enter serial production.

APPENDIX B: Nuclear-capable and Nuclear-powered Ships of the Soviet Union

Aircraft Carrier Summary

Total Aircraft Carriers: 5
Total Aircraft Carriers with SLCMs: 3
Total SS-N-12 Cruise Missiles: 48 /Warheads: 12[103]
Total Yak-36 aircraft: 36
Total Aircraft Carriers with nuclear ASW weapons: 5
Total Ka-25/Ka-27 anti-submarine helicopters: 100
Total ASW nuclear depth bombs: 100
Total nuclear-capable FRAS-1 ASW rockets: 8 /Warheads: 25
Total carriers carrying nuclear-capable torpedoes: 3
Nuclear torpedoes: 3
Total Aircraft Carriers with surface-to-air missiles: 5
Total nuclear-capable SA-N-3 missiles: 304 /Warheads: 20

Ship Type	Number Deployed	Years Built	Fleet	Nuclear Delivery System(s) and/or Nuclear Weapon(s)
Nuclear-powered Guided Missile Cruisers (CGN)[104]				
KIROV class	2[105]	1980-		20 SS-N-19 SLCM
Kirov			Northern Fleet	8 21-inch torpedo tubes
Frunze			Pacific Fleet	96 SA-N-6 SAMs
(under construction)				3 Ka-25 Hormone or Ka-27 Helix helicopters; possible nuclear depth bombs
Guided Missile Cruisers (CG)				
KYNDA class	4	1962-65		8 SS-N-3b SLCM (+8 reloads)
Groznyy			Baltic Fleet	6 21-inch torpedo tubes
Admiral Fokin			Pacific Fleet	24 SA-N-1 SAMs
Admiral Golovko			Black Sea Fleet	
Varyag			Pacific Fleet	
KRESTA I class	4	1967-69		4 SS-N-3b SLCM
Admiral Zozulya			Northern Fleet	44 SA-N-1 SAMs
Vladivostok			Pacific Fleet	10 21-inch torpedo tubes
Vitse Admiral Drozd			Northern Fleet	1 Ka-25 Hormone B for targeting
Sevastopol			Pacific Fleet	
KRESTA II class	10	1969-78		10 21-inch torpedo tubes
Kronshtadt			Northern Fleet	72 SA-N-3 SAMs
Admiral Isakov			Northern Fleet	1 Ka-25 Hormone A; probable nuclear depth bombs
Admiral Nakhimov			Baltic Fleet	
Admiral Makarov			Northern Fleet	
Marshal Voroshilov			Pacific Fleet	
Admiral Oktyabrskiy			Pacific Fleet	
Admiral Isachenkov			Baltic Fleet	
Marshal Timoshenko			Northern Fleet	
Vasiliy Chapayev			Pacific Fleet	
Admiral Yumashev			Northern Fleet	
KARA class	7	1973-80		72 SA-N-3 SAMs
Nikolayev			Black Sea Fleet	10 21-inch torpedo tubes

103 There are more SS-N-12 missiles than SS-N-12 nuclear warheads because the missile is dual-capable. The 'extra' missile, although nuclear capable, would be armed with conventional warheads. This also applies to other dual capable weapons systems, where the number of weapons is larger than the number of nuclear warheads shown.
104 There are 4 nuclear reactors on the CGNs. Two reactors power each ship.
105 Two additional KIROV class cruisers under construction or fitting out, March 1987.

APPENDIX B: Nuclear-capable and Nuclear-powered Ships of the Soviet Union

Ship Type	Number Deployed	Years Built	Fleet	Nuclear Delivery System(s) and/or Nuclear Weapon(s)
Ochakov			Black Sea Fleet	1 Ka-25 Hormone A; probable nuclear depth bombs
Kerch			Black Sea Fleet	
Azov[106]			Black Sea Fleet	
Petropavlovsk			Pacific Fleet	
Tashkent			Pacific Fleet	
Tallinn			Pacific Fleet	
SLAVA class[107]	2[108]	1981-		16 SS-N-12 SLCM[109]
Slava			1 Black Sea Fleet	10 21-inch torpedo tubes
(name unknown)			1 Northern Fleet	64 SA-N-6 SAMs in vertical launchers
(under construction)				
Light Cruisers (CL)				
SVERDLOV class	10[110]	1951–55		12 152mm artillery guns; except Admiral Senyavin (6 guns) and Zhdanov (9 guns)
Admiral Senyavin[111]			Pacific Fleet	
Zhdanov			Black Sea Fleet	
Sverdlov			Baltic Fleet (reserve)	
Aleksandr Nevskiy			Northern Fleet	
Admiral Lazarev			Pacific Fleet (reserve)	
Admiral Ushakov			Black Sea Fleet	
Aleksandr Suvorov			Pacific Fleet	
Mikhail Kutuzov			Black Sea Fleet	
Dmitriy Pozharskiy			Pacific Fleet	
Murmansk			Northern Fleet	

Cruiser Summary

Total Cruisers: 39
Total Cruisers with SLCMs: 12
Total SS-N-3 Cruise Missiles: 80/Warheads: 16
Total SS-N-12 Cruise Missiles: 32/Warheads: 4
Total SS-N-19 Cruise Missiles: 40/Warheads: 8
Total Ka-25/Ka-27 anti-submarine helicopters: 23
Total ASW nuclear depth bombs: 23
Total Cruisers with surface-to-air missiles: 29
Total nuclear-capable surface-to-air missiles: 1816/Warheads: 116
Total cruisers carrying nuclear-capable torpedoes: 29
Nuclear torpedoes: 29
Total nuclear-capable naval artillery guns: 120/Warheads: 100

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106 Azov is a test ship for SAMs, has 8 SA-N-6 and no torpedo tubes.
107 Originally referred to as KRASINA class
108 Two additional SLAVA class cruisers under construction or fitting out, March 1987
109 A single Ka-25 Hormone B helicopter is also embarked to assist in over-the-horizon targeting.
110 John M Collins (U.S./Soviet Military Balance: Statistical Trends: 1977-1986 (as of January 1, 1987), Congressional Research Service, September 1, 1987, p. 47) lists 9 SVERDLOV class.
111 The Admiral Senyavin and Zhdanov ships were converted into command cruisers in 1971-1972.

APPENDIX B: Nuclear-capable and Nuclear-powered Ships of the Soviet Union

Ship Type	Number Deployed	Years Built	Fleet	Nuclear Delivery System(s) and/or Nuclear Weapon(s)
Guided Missile Destroyers (DDG)				
SKORYY class	2[112]	1949-53	unknown	5 or 10 21-inch torpedo tubes
2 unnamed				
KOTLIN class	17	1955-58	unknown	5 or 10 21-inch torpedo tubes
Speshnyy				
Byvalyy				
Burlivyy				
Moskovskiy Komsomolets				
Spokoynyy				
Svedushchiy				
Vdokhnovennyy				
Vyzyvayushchiy				
Vliyatelnyy				
Blagorodnyy				
Blestyashchiy				
Svetlyy				
Veskiy				
Naporistiy				
Dalnyvostochnyy Komsomolets				
Plamennyy				
Vyderzhannyy				
SAM KOTLIN class	6[113]	1955-62	1 Northern Fleet	5 21-inch torpedo tubes
(Skromnyy)			1 Baltic Fleet	16 SA-N-1 SAMs
(Nesokrushimyy)			3 Black Sea Fleet	
(Nakhodchivyy)			2 Pacific Fleet	
(Vozbuzhdennyy)				
(Skrytnyy)				
(Nastoychivyy)				
(Soznatel'nyy)				
(Bravyy)				
MOD KILDIN class	3	1958-59		4 21-inch torpedo tubes
Bedovyy			Black Sea Fleet	
Neulovimyy			Black Sea Fleet	
Prozorlivyy			Baltic Fleet	
KILDIN class	1	1959		(9 SS-N-1 SLCM)[114]
Neuderzhimyy			Pacific Fleet	(4 21-inch torpedo tubes)
KANIN class	6	1959-61	4 Northern Fleet	10 21-inch torpedo tubes
Gremyashchiy			2 Pacific Fleet	16 SA-N-1 SAMs
Zhguchiy				
Gordyy				
Upornyy				
Derzkiy				
Zorkiy				
Boikiy				
Gnevnyy[115]				

112 Twenty Skoryy class destroyers were produced from 1949-1953; two now are thought to be active.
113 Six ships are thought to be active; two of the named ships are in the reserves.
114 This is the last ship equipped with the SS-N-1 SLCM, and the missile is thought to be inactive; Polmar, Guide to the Soviet Navy, 1986, p. 211.
115 Two ships of this class were decommissioned in 1984-1985; Polmar, Guide to the Soviet Navy, 1986, p. 208.

APPENDIX B: Nuclear-capable and Nuclear-powered Ships of the Soviet Union

Ship Type	Number Deployed	Years Built	Fleet	Nuclear Delivery System(s) and/or Nuclear Weapon(s)
KASHIN class	12	1962-72		5 21-inch torpedo tubes
Komsomolets Ukrainyy			1 Northern Fleet	36 SA-N-1 SAMs[116]
Soobrazitel'nyy			1 Baltic Fleet	
Obraztsovyy			7 Black Sea Fleet	
Odarennyy			3 Pacific Fleet	
Steregushchiy				
Krasnyy Kavkaz				
Reshitelnyy				
Strogiy				
Smetlivvy				
Krasnyy Krym				
Sposobnyy				
Skoryy				
MODIFIED[117] KASHIN class	6	1964-73	3 Northern Fleet	5 21-inch torpedo tubes
Ognevoy			2 Baltic Fleet	36 SA-N-1 SAMs
Slavnyy			1 Black Sea Fleet	
Stroynyy				
Smyshlennyy				
Smel'yy				
Sderzhanoyy				
CONVERTED KASHIN class	1	1965		5 21-inch torpedo tubes
Provornyy[118]				
SOVREMENNYY class	7[119]	1981-	3 Northern Fleet	8 SS-N-22 SLCM[120]
Sovremennyy			1 Baltic Fleet	4 21-inch torpedo tubes
Otchayannyy			1 Pacific Fleet	
Otlichnyy			2 unknown	
Osomotritel'nyy				
Bezuprechnyy				
(2 names unknown)				
(under construction)				
UDALOY class	8[121]	1981-	3 Northern Fleet	8 21-inch torpedo tubes
Udaloy	4		Baltic Fleet	8 "long-range cruise missile-delivered ASW weapons"[122] 2 Ka–27 Helix A helicopters; possible nuclear depth bombs
Vitse Admiral Kulakov				
Marshal Vasil'yevskiy				
Admiral Zakharov				
Admiral Spiridonov				
Admiral Tributs				
Marshall Shaposhnikov				
(name unknown)				
(under construction)				

116 One additional non-nuclear ship (Prevornyy) has been converted as a test ship for the SA-N-7 SAM.
117 Modifications were made between 1973 and 1980; Polmar, p. 204.
118 Converted 1981; Polmar, p. 202.
119 Unit 8 fitting out and four more under construction; HASC, FY 1988/1989 DOD Seapower, p. 13.
120 A single Ka-25 Hormone B helicopter is embarked for over-the-horizon targeting.
121 Unit nine launched and two more being built, March 1987.
122 DOD, Soviet Military Power, 1986, p. 84.

APPENDIX B: Nuclear-capable and Nuclear-powered Ships of the Soviet Union

Destroyer Summary

Total Destroyers: 69
Total Destroyers with SLCMs: 8
Total SS-N-22 Cruise Missiles: 56/Warheads: 14
Total Ka-25/Ka-27 anti-submarine helicopters: 16
Total ASW nuclear depth bombs: 16
Total Destroyers with surface-to-air missiles: 30
Total nuclear-capable surface-to-air missiles: 840/Warheads: 120
Total destroyers carrying nuclear-capable torpedoes: 69
Nuclear torpedoes: 69

Ship Type	Number Deployed	Years Built	Fleet	Nuclear Delivery System(s) and/or Nuclear Weapon(s)
Guided Missile Frigates (FFG)[123]				
RIGA class (10 unknown names) Arkhangel'skiy Komsomolets Astrakhan'skiy Komsomolets Bars Barsuk Bobr Byk Gepard Giena Gruziy Komsomolets Kobchik Krasnodarskiy Komsomolets Kunitsa Leopard Lev Lisa Litviy Komsomolets Medved Pantera Rys Rosomakha Shakal Tigr Turman Volk Voron Yaguar	35	1955-1956	All four fleets	2 or 3 21-inch torpedo tubes
GRISHA I/III/IV/V class (16 Grisha I) (30 Grisha III) (1 Grisha IV) (1 Grisha V) (under construction)	51	1968-	All four fleets	4 21-inch torpedo tubes
KRIVAK I class Bditel'nyy Bodryy Dostoynyy	21	1970-82	8 Northern Fleet[124] 11 Pacific Fleet 6 Baltic Fleet 7 Black Sea Fleet	8 21-inch torpedo tubes

123 Thirty-four Krivak III and nine Grisha II frigates also carry 21-inch torpedo tubes but are assigned to the KGB Maritime Border Troops and are not thought to be nuclear-armed.
124 This fleet distribution includes KRIVAK II class ships as well.

APPENDIX B: Nuclear-capable and Nuclear-powered Ships of the Soviet Union

Ship Type	Number Deployed	Years Built	Fleet	Nuclear Delivery System(s) and/or Nuclear Weapon(s)
Svirepyy				
Doblestnyy				
Sil'nyy				
Storozhevoy				
Razumnyy				
Razyashchiy				
Deyatel'nyy				
Druzhnyy				
Retivyy				
Zharkyy				
Leningradskiy Komsomolets				
Letuchiy				
Bezzavetnyy				
Pylkiy				
Zadornyy				
Bezukoriznennyy				
Ladnyy				
Poryvistyy				
KRIVAK II class	11	1975-82		8 21-inch torpedo tubes
Rezvyy				
Rezkiy				
Grozyashchiy				
Razitel'nyy				
Bessmennyy				
Neukrotimyy				
Gordelivyy				
Gromkiy				
R'yanyy				
Revnostnyy				
Pytlivvy				

Frigate Summary

Total Frigates: 118

Total frigates carrying nuclear-capable torpedoes: 118

Nuclear torpedoes: 118

Ship Type	Number Deployed	Years Built	Fleet	Nuclear Delivery System(s) and/or Nuclear Weapon(s)
Guided Missile Patrol Combatants (PGG)				
NANUCHKA I class	17	1969-76	unknown	6 SS-N-9 SLCM
(6 unknown names)				
Burun				
Grad				
Molniya				
Musson				
Raduga				
Shkval				
Shtorm				
Tayfun				
Tsiklon				
Zarnitsa				
Zub				

APPENDIX B: Nuclear-capable and Nuclear-powered Ships of the Soviet Union

Ship Type	Number Deployed	Years Built	Fleet	Nuclear Delivery System(s) and/or Nuclear Weapon(s)
NANUCHKA III class (names unknown) (under construction)	9[125]	1977-	Baltic Fleet	6 SS-N-9 SLCM
TARANTUL III class[126] (names unknown) (under construction)	5	1981-	unknown	4 SS-N-22 SLCM
TURYA class (names unknown)	31	1974-79	unknown	4 21-inch torpedo tubes
Guided Missile Patrol Combatants (Hydrofoil) (PGGH)				
SARANCHA class (name unknown)	1	1977	unknown	4 SS-N-9 SLCM

Patrol Combatants Summary

Total nuclear-capable Patrol Combatants: 63
Total Patrol Combatants with SLCMs: 35
Total SS-N-9 Cruise Missiles: 160 /Warheads: 54
Total SS-N-22 Cruise Missiles: 20 /Warheads: 10
Total patrol combatants carrying nuclear-capable torpedoes: 31
Nuclear torpedoes: 31

Ship Type	Number Deployed	Years Built	Fleet	Remarks
Support Ships				
Missile Transport/Missile Tenders (AEM)				
AMGA class Amga Vetluga Daugava	3	1973-1981	unknown	Ballistic missile transport for submarines
LAMA class General Riyabakov Voronezh (PM-872) PM-44 PM-93 PM-131 PM-150 PB-625	7	1963-1979	unknown	Cruise missile transport for ships and submarines
ANDIZHAN class Venta (ex-Lakhta) Vilyuy (ex-Posyet)	2[127]	1958-1960	unknown	Cruise missile and surface-to-air missile transport; helicopter landing deck
MP 6 class Bureya Khoper	2[128]	1958-1960	Baltic Fleet	SS-N-5 ballistic missile transport; compartments for three missiles
MELITOPOL class Indirka Fort Sheverenko	2	1950s	unknown	missile transport

125 John M. Collins, op. cit., p. 47.
126 TARANTUL I and II class ships also may be converted to SS-N-22 SLCM. TARANTUL II class is in production.
127 These ships are former merchant ships converted in the mid-1970s. Three others of the class are naval cargo ships and do not transport missiles.
128 These are converted landing ships. Three other ships of the class are cargo ships and do not transport ballistic missiles.

APPENDIX B: Nuclear-capable and Nuclear-powered Ships of the Soviet Union

Ship Type	Number Deployed	Years Built	Fleet	Remarks
Special Liquids Tankers (AOS)				
LUZA class Alambay Araguvy Barguzin Don Kana Selenga	6	1960s	unknown	Transport of SLBM liquid fuel
URAL class Ural	1	1969	unknown	Nuclear waste transport
VALA class TNT-11 TNT-12 TNT-19 TNT-29 (name unknown)	5	1960s	unknown	Nuclear waste transport
Repair Ships (AR)				
MALINA class PM-63 PM-74	2	1984-1985	Pacific Fleet	Nuclear materials transport for supporting nuclear reactors on ships and submarines
Replenishment Oiler (AOR)				
BEREZINA class Berezina	1	1978	Black Sea	Submarine weapons support
Submarine Support Ships/Submarine Tenders (AS)				
"BRYKIN" class Alexander Brykin	1	1988-	Northern Fleet	Strategic FBM submarine tender.[129] Can carry at least 16 SS-N-20 SLBMs, and has capability for at sea transfer to Typhoon class SSBNs[130]
UGRA class Ivan Kolyshkin Ivan Kucherenko Ivan Vakhrameev Tobol Volga (name unknown)	6	1963-1972	Pacific Fleet; others unknown	Possible nuclear torpedo transport; Ivan Kolyshkin has helicopter hangar for Ka-25 Hormone C, all others have landing decks
DON class Dmitriy Galkin Fyodor Vidyaev Kamchatskiy Komsomolets Magadanskiy Komsomolets Magomed Gadziev Viktor Kotel'nikov	6	1958-1961	Pacific Fleet; others unknown	Possible nuclear torpedo transport; Viktor Kotel'nikov and Magadanskiy have landing decks

129 DOD, Soviet Military Power, 1987, p. 95.
130 Jane's Defence Weekly, "Soviet Missile Ship in Barents Sea," 23 January 1988, p. 99.

APPENDIX B: Nuclear-capable and Nuclear-powered Ships of the Soviet Union

Ship Type	Number Deployed	Years Built	Fleet	Remarks
Non-Nuclear-capable Nuclear-powered Ships				None of these ships are nuclear weapons capable
Nuclear-powered Icebreakers (AGBN)[131]				
TAIMYR class (under construction)	(2)[132]	1988-1989	Northern Fleet	
ARKTIKA class Leonid Brezhnev Sibir' Rossiya (under construction)	3	1975-	Northern Fleet	
LENIN class Lenin	1	1959	Northern Fleet	

131 There are 8 nuclear reactors on the Icebreakers. Two nuclear reactors power each Icebreaker.
132 Two ships are under construction at the Wartsila Shipyard, Helsinki, Finland. The nuclear reactor will be added at the Baltic Shipyard in Leningrad.

APPENDIX C: Nuclear-capable and Nuclear-powered Ships of the United Kingdom

Ship Name and Hull Number	Number Deployed	Years Entered Service	Homeport	Nuclear Weapon(s)
Nuclear-powered Ballistic Missile Submarines (SSBN)[133]				
RESOLUTION Class	4	1967-69		16 Polaris A3-TK Chevaline SLBM
HMS Resolution (S22)			Faslane	
HMS Repulse (S23)			Faslane	
HMS Renown (S26)			Faslane	
HMS Revenge (S27)			Faslane	
VANGUARD class		mid-1990s		
(HMS Vanguard)			(Faslane)	(16 Trident II D5 SLBM)
(3 more planned)				

Ballistic Missile Summary
Total Ballistic Missile Submarines: 4
Total Ballistic Missiles: 64 /Warheads: 192

Ship Name and Hull Number	Number Deployed	Years Entered Service	Homeport	Nuclear-capable Aircraft and Weapon(s)
Aircraft Carriers (CV)				
INVINCIBLE Class	3	1980-85		
HMS Invincible (R05)			Portsmouth	5 Sea Harrier V/STOL jets; 9 Sea King ASW helicopters; stores 3-5 nuclear strike bombs and 3-5 nuclear depth bombs.
HMS Illustrious (R06)			Portsmouth	
HMS Ark Royal (R07)			Portsmouth	

Aircraft Carrier Summary
Total Aircraft Carriers: 3
Total Sea Harriers: 15
Total ASW helicopters: 27
Total nuclear strike bombs: 9-15
Total nuclear depth bombs: 9-15

Ship Name and Hull Number	Number Deployed	Years Entered Service	Homeport	Nuclear-capable Aircraft and Weapon(s)
Destroyers (DD)				
TYPE 42 class	12			
Batch 1		1976-79		1-2 Lynx ASW helicopters; nuclear depth bombs.
HMS Birmingham (D86)			Portsmouth	
HMS Newcastle (D87)			Portsmouth	
HMS Glasgow (D88)			Rosyth	
HMS Cardiff (D10)			Portsmouth	

133 One nuclear reactor powers each SSBN.

APPENDIX C: Nuclear-capable and Nuclear-powered Ships of the United Kingdom

Ship Name and Hull Number	Number Deployed	Years Entered Service	Homeport	Nuclear-capable Aircraft and Weapon(s)
Batch 2		1980-82		
HMS Exeter (D89)			Portsmouth	
HMS Southampton (D90)			Portsmouth	
HMS Nottingham (D91)			Portsmouth	
HMS Liverpool (D92)			Rosyth	
Batch 3		1982-85		
HMS Manchester (D95)			Portsmouth	
HMS Gloucester (D96)			Portsmouth	
HMS Edinburgh (D97)			Rosyth	
HMS York (D98)			Rosyth	

Destroyer Summary
Total nuclear-capable destroyers: 12
Total Lynx helicopters: 12-24

Ship Name and Hull Number	Number Deployed	Years Entered Service	Homeport	Nuclear-capable Aircraft and Weapon(s)
Frigates (FF)				
TYPE 22 class	8(+6)			
Batch 1		1979-82		
HMS Broadsword (F88)			Devonport	1-2 Lynx ASW helicopters; nuclear depth bombs
HMS Battleaxe (F89)			Devonport	
HMS Brilliant (F90)			Devonport	
HMS Brazen (F91)			Devonport	
Batch 2		1983-88		
HMS Boxer (F92)			Devonport	
HMS Beaver (F93)			Devonport	
HMS Brave (F94)			Devonport	
HMS London (F95)			Devonport	
(HMS Coventry (F98))[134]				
(HMS Sheffield (F96))				
Batch 3		1987-89		
(HMS Cornwall (F99))				1-2 Lynx or 1 Sea King ASW helicopter; nuclear depth bombs
(HMS Cumberland (F85))				
(HMS Campbletown (F86))				
(HMS Chatham (F87))				
TYPE 23 class	4	1990s		(Sea King or EH-101 helicopter)
(HMS Norfolk)[135]				

Frigate Summary
Total built nuclear-capable frigates: 8
Total Lynx helicopters: 8-16

134 Planned ships indicated by parentheses.
135 Three more Batch 1s are on order, eight more Batch 1s are planned and eight more of a modernized variant are planned.

APPENDIX C: Nuclear-capable and Nuclear-powered Ships of the United Kingdom

Ship Name and Hull Number	Number Deployed	Years Entered Service	Homeport	Remarks
Support Ships				
Fleet Replenishment Ships				
FORT class	2	1978-79		nuclear weapons logistical transport/support
RFA Fort Grange (A385)			n.a.	
RFA Fort Austin (A386)			n.a.	
RESOURCE class	2	1967		nuclear weapons logistical transport/support
RFA Resource (A480)			n.a	
RFA Regent (A486)			n.a.	

Support Ship Summary

Total nuclear-capable support ships: 4

Ship Name and Hull Number	Number Deployed	Years Entered Service	Homeport	Remarks
Non-Nuclear-capable Nuclear-powered Ships				None of these ships are nuclear weapons capable
Attack Submarines (SSN)[136]				
TRAFALGAR class	4(+3)[137]	1983-		
Trafalgar (S107)			Devonport	
Turbulent (S87)			Devonport	
Tireless (S88)			Devonport	
Torbay (S90)			Faslane	
(Trenchant (S91))				
(Talent (S92))				
(Triumph (S93))				
SWIFTSURE class	6	1973-81		
Swiftsure (S126)			Devonport	
Sovereign (S108)			Devonport	
Superb (S109)			Devonport	
Sceptre (S104)			Devonport	
Spartan (S105)			Devonport	
Splendid (S106)			Devonport	
CHURCHILL class	3	1970-71		
Churchill (S46)			Faslane	
Courageous (S50)			Faslane	
Conqueror (S48)			Faslane	
VALIANT class	2	1966-67		
Valiant (S102)			Faslane	
Warspite (S103)			Faslane	

136 Each SSN is powered by one nuclear reactor.

137 A new generation of SSNs not significantly different in size from the Trafalgar class is planned. The first will be ordered before the last of the Trident SSBNs is built (i.e., before 1994) and will enter the fleet in the mid- to late 1990s; Jane's Defence Weekly, "Details Emerge of Royal Navy's Next Generation of SSNs," 17 October 1987, p. 859.

APPENDIX D: Nuclear-capable and Nuclear-powered Ships of France

Ship Name and Hull Number	Number Deployed	Years Entered Service	Homeport	Nuclear Weapon(s)
Nuclear-powered Ballistic Missile Submarines (SSBN)[138]				
REDOUTABLE class	5	1971-80		
Le Redoutable (S611)			Ile Longue	16 M20 SLBM
Le Terrible (S612)			Ile Longue	16 M20 SLBM
Le Foudroyant (S610)			Ile Longue	16 M20 SLBM
L'Indomptable (S613)			Ile Longue	16 M20 SLBM
Le Tonnant (S614)			Ile Longue	16 M4 (modified) SLBM
INFLEXIBLE class[139]	1			
L'Inflexible		1985	Ile Longue	16 M4A SLBM
NEW GENERATION class		1994		
(Le Triomphant)				(M4 SLBM)
(two more planned)				(M4, M5 SLBM)

Ballistic Missile Submarine Summary
Total Ballistic Missile Submarines: 6
Total ballistic missiles: 96/Warheads: 256
Total M20 SLBM: 64/Warheads: 64
Total M4 SLBM: 16/Warheads: 96
Total M4 (modified) SLBM: 16/Warheads: 96

Ship Name and Hull Number	Number Deployed	Years Entered Service	Homeport	Nuclear-capable Aircraft and Weapon(s)
Aircraft Carriers (CV)				
CLEMENCEAU class	2	1961-63		30 Super Etendard aircraft.[140]
Clemenceau (R98)			Toulon	Carries ANT-52 and lower-yield gravity
Foch (R99)			Toulon	bombs, and ASMP air–to–surface missiles
Nuclear-powered Aircraft Carriers (CVN)[141]				
CHARLES DE GAULLE class		1996-		
(Charles de Gaulle)				(Super Etendards, and a new "avion
(second ship unknown)				de combat" Marine aircraft)

Aircraft Carrier Summary
Total Aircraft Carriers: 2
Total Super Etendard aircraft: 30
Total nuclear bombs: 16-36

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138 Abbreviated as SNLE in French for "sous-marin nucléaire lanceur d'engins." One nuclear reactor powers each submarine.
139 Similar to Redoutable class, but considered an intermediate class between the Redoutable and the new generation SSBN.
140 Based on two squadrons of 15 aircraft each. The number of Etendards on a carrier can vary depending on the carrier's mission, whether both carriers are deployed simultaneously, the availability of aircraft, and other reasons.
141 To be powered by two nuclear reactors each. Abbreviated as PAN in French for "porte-avions nucléaire".

APPENDIX D: Nuclear-capable and Nuclear-powered Ships of France

Ship Name and Hull Number	Number Deployed	Years Entered Service	Homeport	Remarks
Non-Nuclear-capable Nuclear-powered Ships				None of these ships are nuclear weapons capable
Attack Submarines (SSN)[142]				
RUBIS class	3(+5)	1983-		
Rubis			Toulon	
Saphir			Toulon	
Casablanca			Toulon	
(five more under construction)			(Toulon)	

142 One nuclear reactor powers each submarine.

APPENDIX E: Nuclear-capable and Nuclear-powered Ships of China

Ship Name and Hull Number	Number Deployed	Years Entered Service	Fleet	Nuclear Weapon(s)
Nuclear-powered Ballistic Missile Submarines (SSBN)				
XIA class (names unknown)	2	1983-	East Sea Fleet	12 CSS-N-3 SLBM
Ballistic Missile Submarines (SSB)				
GOLF class[143] (name unknown)	1	1964	–	CSS-N-3 SLBM
Non-Nuclear-capable Nuclear-powered Attack Submarines (SSN)				
HAN class (names unknown)	3	1971-	North Sea Fleet	None

143 The Golf class submarine is used for testing and training, but in a crisis could be armed with two SLBMs.

APPENDIX F: Ship Nomenclature

Individual ships of all navies can be identified or referred to by their type, hull-number, name, class and sometimes by their weapon systems. Often one or more of these characteristics, with no particular consistency, is used by governments or the media to distinguish ships. The major types of ships are given two- to four-letter designations by the U.S. Navy and are in common usage in Western reporting. These are:

Aircraft carrier	CV
Aircraft carrier (anti-submarine warfare)	CVS
Aircraft carrier (guided missile, V/STOL)	CVHG
Aircraft carrier (nuclear-powered)	CVN
Battleship	BB
Cruiser (guided missile, aviation)	CHG
Cruiser (guided missile, nuclear-powered)	CGN
Cruiser (guided missile)	CG
Cruiser (light)	CL
Destroyer	DD
Destroyer (guided missile)	DDG
Frigate	FF
Frigate (guided missile)	FFG
Submarine (attack)	SS
Submarine (attack, nuclear-powered)	SSN
Submarine (ballistic missile, nuclear-powered)	SSBN
Submarine (ballistic missile)	SSB
Submarine (cruise missile, nuclear-powered)	SSGN
Submarine (cruise missile)	SSG

Logistic and support ships have an "A" as the first letter of their abbreviation. The amphibious warfare ships' abbreviations all are preceded by the letter "L" and Patrol combatants by a "P." For example:

Ammunition Ship	AE
Amphibious Assault Ships	LHA/LPH/LHD
Amphibious Cargo Ship	LKA
Amphibious Command Ship	LCC
Amphibious Transport Dock	LPD
Destroyer Tender	AD
Dock Landing Ship	LSD
Fast Combat Support Ship	AOE
Fleet oiler	AO
Missile tender	AEM
Patrol Combatant (guided missile, hydrofoil)	PGGH
Patrol Combatant (guided missile)	PGG
Repair Ship	AR
Replenishment Oiler	AOR
Submarine Tender	AS
Tank Landing Ship	LST
Tanker (special liquids)	AOS

U.S. Navy ships often are identified by their abbreviation and hull number; for example, SSN-688 is the hull number of the USS Los Angeles nuclear-powered attack submarine. With some exceptions, ships of a particular type are numbered consecutively as they are constructed. Thus, SSN-688 is approximately the 688th submarine built by the U.S. Navy. The U.S. Navy does not, however, have 688 submarines, since this number includes submarines built before World War I. These earlier ships, of course, are not in the fleet.

Ships of the same type also can be referred to as part of a "class." A class is composed of ships based on the same design that have similar equipment and missions. Ships of a class are called after the first ship in that class and its hull number. For example, the USS Los Angeles (SSN-688) is the first ship of its class of nuclear-powered attack submarines. And thus,

the USS Baton Rouge (SSN-689) and subsequent submarines, until a new class is built, are referred to as Los Angeles class or SSN-688 class submarines. Usually there are several ships in one class, but there also are several "one-ship" classes; for example, the USS Long Beach (CGN-9) is the only cruiser in the Long Beach class.

Ships also have individual names. Thus the SSN-688 is named the USS Los Angeles; CG-47 is the USS Ticonderoga; BB-61 is the USS Iowa, etc. The naming of ships in the same class usually follows a pattern. For example the Los Angeles class submarines mostly are named after U.S. cities; Ohio class submarines mainly are named after U.S. states; and Ticonderoga class cruisers are named after famous U.S. battles, etc.

Finally, ships can be referred to by their weapons system. Thus Ticonderoga (CG-47) class cruisers often are called Aegis cruisers because of the Aegis air-defense weapon system they carry. And, Ohio (SSBN-726) class ballistic missile submarines frequently are called Trident submarines because they carry Trident submarine-launched ballistic missiles.

Royal Navy ships usually are identified in a manner similar to the U.S. Navy's. Each ship is given a unique name and "pennant" number (similar to the hull number in the U.S. Navy), such as the HMS Birmingham (D86).[144] Ship classes are named after the first ship in the class or the ship design; for example, the HMS Invincible (R05) was the first of the Invincible class aircraft carriers, and Type 22 frigates are known by their design name. Submarine classes are sometimes abbreviated according to the first letter of the name of the first submarine, since usually all the submarines' names in the same class start with the same letter; for example all Resolution class SSBN names begin with "R," and so can be referred to as R-class submarines. Ships also can be known after the type of weapon they carry; for example, Polaris submarines.

French submarines have individual names and hull numbers and generally are called after the first ship in the class or by their name. The same applies for French surface ships. The French designation for nuclear-powered ballistic missile submarines is SNLE (sous-marin nucléaire lanceur d'engins) and for nuclear-powered aircraft carriers is PAN (porte-avion nucléaire).

Since in most cases the names of Soviet and Chinese surface ships are not known, Western reports identify the ships by the name of the class they belong to. The class name is an arbitrarily given NATO name and may or may not correspond to the actual Soviet or Chinese name for the first ship in the class. In some cases, however, the names of the largest surface ships are known, and they may be used in news and official reports. Individual submarine names are not known and submarines are called after the first ship in their class, again a NATO-given name (except in the case of Typhoon SSBNs, whose name is based on the Russian name for the submarines). Soviet ships are assigned hull numbers, but these generally are not reported in the West or used to identify ships.

144 HMS stands for His or Her Majesty's Ship.

APPENDIX G: Alphabetical List of Nuclear-capable and Nuclear-powered Ships and Submarines

This alphabetical list of ships by name, noting each ship's nuclear capability, is provided for "quick reference." The text and Appendices A through E should be consulted for more detailed descriptions.

For the United States (US), all nuclear-capable and nuclear-powered ships in commission are listed along with their type and hull number. This method is used for the United Kingdom (UK) and France (FR), with the addition of planned nuclear-capable or nuclear-powered ships when their names are known. For the Soviet Union (USSR), the names or identification number of surface ships are listed when known. Since the individual names of Soviet submarines are not known, they are listed by their NATO-designated class (e.g., GOLF class USSR (SSB), and the same applies to China's submarines). If a Soviet ship is a candidate for a nuclear weapons system, or there are unconfirmed reports that a ship has a nuclear weapons capability, that weapon system is enclosed in parentheses.

Ship, country, hull-number/designation	Nuclear weapons capability
Acadia US (AD 42)	Service/logistics of nuclear weapons
Admiral Fokin USSR (CG)	SS-N-3b, nuclear torpedoes, SA-N-1 SAMs
Admiral Golovko USSR (CG)	SS-N-3b, nuclear torpedoes, SA-N-1 SAMs
Admiral Isachenkov USSR (CG)	nuclear torpedoes, SA-N-3 SAMs, helicopter (nuclear depth bombs)
Admiral Isakov USSR (CG)	nuclear torpedoes, SA-N-3 SAMs, helicopter (nuclear depth bombs)
Admiral Lazarev USSR (CG)	artillery guns
Admiral Makarov USSR (CG)	nuclear torpedoes, SA-N-3 SAMs, helicopter (nuclear depth bombs)
Admiral Nakhimov USSR (CG)	nuclear torpedoes, SA-N-3 SAMs, helicopter (nuclear depth bombs)
Admiral Oktyabrskiy USSR (CG)	nuclear torpedoes, SA-N-3 SAMs, helicopter (nuclear depth bombs)
Admiral Senyavin USSR (CG)	artillery guns
Admiral Spiridonov USSR (DDG)	nuclear torpedoes, SLCMs, helicopters (nuclear depth bombs)
Admiral Tributs USSR (DDG)	nuclear torpedoes, SLCMs, helicopters (nuclear depth bombs)
Admiral Ushakov USSR (CG)	artillery guns
Admiral Yumashev USSR (CG)	nuclear torpedoes, SA-N-3 SAMs, helicopter (nuclear depth bombs)
Admiral Zozulya USSR (CG)	SS-N-3b SLCM, SA-N-1, nuclear torpedoes
Ainsworth US (FF 1090)	ASROC
AKULA class USSR (SSN)	(SS-N-21 SLCM), SS-N-15 nuclear depth bomb, SS-N-16 ASW missile, nuclear torpedoes
Alabama US (SSBN 731)	Trident I C-4 SLBM
Alambay USSR (AOS)	Transports SLBM liquid fuel
Alamo US (LSD 33)	Transports Marine Corps weapons
Alaska US (SSBN 732)	Trident I C-4 SLBM
Albert David US (FF 1050)	ASROC
Albuquerque US (SSN 706)	TOMAHAWK
Aleksandr Nevskiy USSR (CG)	artillery guns
Aleksandr Suvorov USSR (CG)	artillery guns
Alexander Brykin USSR (AS)	supports strategic SSBNs
Alexander Hamilton US (SSBN 617)	Poseidon C-3 SLBM
ALFA class USSR (SSN)	SS-N-15 nuclear depth bombs, nuclear torpedoes
America US (CV 66)	Aircraft and nuclear bombs
Amga USSR (AEM)	Transports SLBMs for SSB/Ns
Anchorage US (LSD 36)	Transports Marine Corps weapons
Andrew Jackson US (SSBN 619)	Poseidon C-3 SLBM
Antietam US (CG 54)	TOMAHAWK
Araguvy USSR (AOS)	Transports SLBM liquid fuel
Archerfish US (SSN 678)	SUBROC
Ark Royal UK (R07)	Aircraft and nuclear bombs
Arkansas US (CGN 41)	ASROC
Arkhangel'skiy Komsomolets USSR (FFG)	nuclear torpedoes
Arthur W. Radford US (DD 968)	ASROC
Aspro US (SSN 648)	TOMAHAWK
Astrakhan'skiy Komsomolets USSR (FFG)	nuclear torpedoes
Atlanta US (SSN 712)	TOMAHAWK
Augusta US (SSN 710)	TOMAHAWK
Austin US (LPD 04)	Transports Marine Corps weapons
Aylwin US (FF 1081)	ASROC
Azov USSR (CG)	SA-N-6 SAMs, helicopters (nuclear depth bombs)
Badger US (FF 1071)	ASROC
Bagley US (FF 1069)	ASROC
Bainbridge US (CGN 25)	ASROC, Terrier

APPENDIX G: Alphabetical List of Nuclear-capable and Nuclear-powered Ships and Submarines

Ship, country, hull-number/designation	Nuclear weapons capability
Baku USSR (CVHG)	SS-N-12 SLCM, FRAS-1, SA-N-3 SAMs, aircraft (nuclear bombs and/or nuclear depth bombs)
Baltimore US (SSN 704)	TOMAHAWK
Barb US (SSN 596)	SUBROC
Barbey US (FF 1088)	ASROC
Barbour County US (LST 1195)	Transports Marine Corps weapons
Barguzin USSR (AOS)	Transports SLBM liquid fuel
Barney US (DDG 06)	ASROC
Barnstable County US (LST 1197)	Transports Marine Corps weapons
Bars USSR (FFG)	nuclear torpedoes
Barsuk USSR (FFG)	nuclear torpedoes
Batfish US (SSN 681)	SUBROC
Baton Rouge US (SSN 689)	TOMAHAWK
Battleaxe UK (F89)	ASW helicopters and nuclear-depth bombs
Bditel'nyy USSR (FFG)	nuclear torpedoes
Beaver UK (F93)	ASW helicopters and nuclear-depth bombs
Bedovyy USSR (DDG)	nuclear torpedoes
Belknap US (CG 26)	ASROC, Terrier
Belleau Wood US (LHA 03)	Aircraft and Marine Corps nuclear weapons
Benjamin Franklin US (SSBN 640)	Trident I C-4 SLBM
Benjamin Stoddert US (DDG 22)	ASROC
Berezina USSR (AOR)	Submarine weapons support
Bergall US (SSN 667)	TOMAHAWK
Berkeley US (DDG 15)	ASROC
Bessmennyy USSR (FFG)	nuclear torpedoes
Bezukoriznennyy USSR (FFG)	nuclear torpedoes
Bezuprechnyy USSR (DDG)	SS-N-22 SLCM, nuclear torpedoes
Bezzavetnyy USSR (FFG)	nuclear torpedoes
Biddle US (CG 34)	ASROC, Terrier
Billfish US (SSN 676)	SUBROC
Birmingham UK (D86)	ASW helicopters and nuclear-depth bombs
Birmingham US (SSN 695)	TOMAHAWK
Blagorodnyy USSR (DDG)	nuclear torpedoes
Blakely US (FF 1072)	ASROC
Blestyashchiy USSR (DDG)	nuclear torpedoes
Blue Ridge US (LCC 19)	Transports Marine Corps weapons
Bluefish US (SSN 675)	SUBROC
Bobr USSR (FFG)	nuclear torpedoes
Bodryy USSR (FFG)	nuclear torpedoes
Boikiy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Boston US (SSN 703)	TOMAHAWK
Boulder US (LST 1190)	Transports Marine Corps weapons
Bowen US (FF 1079)	ASROC
Boxer UK (F92)	ASW helicopters and nuclear-depth bombs
Bradley US (FF 1041)	ASROC
Brave UK (F94)	ASW helicopters and nuclear-depth bombs
Bravyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Brazen UK (F91)	ASW helicopters and nuclear-depth bombs
Bremerton US (SSN 698)	SUBROC
Brewton US (FF 1086)	ASROC
Brezhnev USSR (CVN)	Aircraft (nuclear bombs and/or nuclear depth bombs)
Brilliant UK (F90)	ASW helicopters and nuclear-depth bombs
Briscoe US (DD 977)	ASROC
Bristol County US (LST 1198)	Transports Marine Corps weapons
Broadsword UK (F88)	ASW helicopters and nuclear-depth bombs
Bronstein US (FF 1037)	ASROC
Brooke US (FFG 01)	ASROC
Brumby US (FF 1044)	ASROC
Buchanan US (DDG 14)	ASROC
Buffalo US (SSN 715)	TOMAHAWK

APPENDIX G: Alphabetical List of Nuclear-capable and Nuclear-powered Ships and Submarines

Ship, country, hull-number/designation	Nuclear weapons capability
Bunker Hill US (CG 52)	TOMAHAWK
Bureya USSR (AEM)	Transports SS-N-5 SLBM
Burlivyy USSR (DDG)	nuclear torpedoes
Burun USSR (PGG)	SS-N-9 SLCM
Butte US (AE 27)	Service/logistics of nuclear weapons
Byk USSR (FFG)	nuclear torpedoes
Byvalyy USSR (DDG)	nuclear torpedoes
California US (CGN 36)	ASROC
Caloosahatchee US (AO 098)	Service/logistics of nuclear weapons
Camden US (AOE 2)	Service/logistics of nuclear weapons
Campbeltown UK (F86)	ASW helicopters and nuclear-depth bombs
Canisteo US (AO 099)	Service/logistics of nuclear weapons
Canopus US (AS 34)	Service/logistics of nuclear weapons
Cape Cod US (AD 43)	Service/logistics of nuclear weapons
Capodanno US (FF 1093)	ASROC
Cardiff UK (D10)	ASW helicopters and nuclear-depth bombs
Carl Vinson US (CVN 70)	Aircraft and nuclear bombs
Caron US (DD 970)	ASROC
Casablanca FR (SSN)	nuclear powered/not nuclear weapons capable
Casimir Pulaski US (SSBN 633)	Trident I C-4 SLBM
Cavalla US (SSN 684)	SUBROC
Cayuga US (LST 1186)	Transports Marine Corps weapons
Charles F. Adams US (DDG 02)	ASROC
Charleston US (LKA 113)	Transports Marine Corps weapons
CHARLIE I class USSR (SSGN)	SS-N-7 SLCM, SS-N-15 nuclear depth bomb, nuclear torpedoes
CHARLIE II class USSR (SSGN)	SS-N-9 SLCM, SS-N-15 nuclear depth bomb, nuclear torpedoes
Chatham UK (F87)	ASW helicopters and nuclear-depth bombs
Chicago US (SSN 721)	TOMAHAWK
Churchill UK (S46)	nuclear powered/not nuclear weapons capable
Cincinnati US (SSN 693)	TOMAHAWK
City of Corpus Christi US (SSN 705)	TOMAHAWK
Claude V. Ricketts US (DDG 05)	ASROC
Clemenceau FR (R98)	Aircraft, nuclear bombs, ASMP air-to-surface missile
Cleveland US (LPD 07)	Transports Marine Corps weapons
Cochrane US (DDG 21)	ASROC
Comte de Grasse US (DD 974)	ASROC, TOMAHAWK
Connole US (FF 1056)	ASROC
Conolly US (DD 979)	ASROC, TOMAHAWK
Conqueror UK (S48)	nuclear powered/not nuclear weapons capable
Constellation US (CV 64)	Aircraft and nuclear bombs
Conyngham US (DDG 17)	ASROC
Cook US (FF 1083)	ASROC
Coontz US (DDG 40)	ASROC, Terrier
Coral Sea US (CV 43)	Aircraft and nuclear bombs
Cornwall UK (F99)	ASW helicopters and nuclear-depth bombs
Courageous UK (S50)	nuclear powered/not nuclear weapons capable
Coventry UK (F98)	ASW helicopters and nuclear-depth bombs
Cumberland UK (F85)	ASW helicopters and nuclear-depth bombs
Cushing US (DD 985)	ASROC
Dace US (SSN 607)	SUBROC
Dahlgren US (DDG 43)	ASROC, Terrier
Dale US (CG 19)	ASROC, Terrier
Dallas US (SSN 700)	SUBROC
Dalnyvostochnyy Komsomolets USSR (DDG)	nuclear torpedoes
Daniel Boone US (SSBN 629)	Trident I C-4 SLBM
Daniel Webster US (SSBN 626)	Poseidon C-3 SLBM
Daugava USSR (AEM)	Transports SLBMs for SSB/Ns
David R. Ray US (DD 971)	ASROC
Davidson US (FF 1045)	ASROC
DELTA I class USSR (SSBN)	SS-N-8 SLBM, nuclear torpedoes

APPENDIX G: Alphabetical List of Nuclear-capable and Nuclear-powered Ships and Submarines

Ship, country, hull-number/designation	Nuclear weapons capability
DELTA II class USSR (SSBN)	SS-N-8 SLBM, nuclear torpedoes
DELTA III class USSR (SSBN)	SS-N-18 SLBM, nuclear torpedoes
DELTA IV class USSR (SSBN)	SS-N-23 SLBM, nuclear torpedoes
Denver US (LPD 09)	Transports Marine Corps weapons
Derzkiy USSR (DDG	nuclear torpedoes, SA-N-1 SAMs
Detroit US (AOE 4)	Service/logistics of nuclear weapons
Dewey US (DDG 45)	ASROC, Terrier
Deyatel'nyy USSR (FFG)	nuclear torpedoes
Deyo US (DD 989)	ASROC, TOMAHAWK
Dixon US (AS 37)	Service/logistics of nuclear weapons
Dmitriy Galkin USSR (AS)	nuclear transport
Dmitriy Pozharskiy USSR (CG)	artillery guns
Doblestnyy USSR (FFG)	nuclear torpedoes
Don USSR (AOS)	Transports SLBM liquid fuel
Donald B. Beary US (FF 1085)	ASROC
Dostoynyy USSR (FFG)	nuclear torpedoes
Downes US (FF 1070)	ASROC
Drum US (SSN 677)	TOMAHAWK
Druzhnyy USSR (FFG)	nuclear torpedoes
Dubuque US (LPD 08)	Transports Marine Corps weapons
Duluth US (LPD 06)	Transports Marine Corps weapons
Durham US (LKA 114)	Transports Marine Corps weapons
Dwight D. Eisenhower US (CVN 69)	Aircraft and nuclear bombs
ECHO I class USSR (SSN)	nuclear torpedoes
ECHO II class USSR (SSGN)	SS-N-3a/c or SS-N-12 SLCM, nuclear torpedoes
Edinburgh UK (D97)	ASW helicopters and nuclear-depth bombs
Edward McDonnell US (FF 1043)	ASROC
El Paso US (LKA 117)	Transports Marine Corps weapons
Elliot US (DD 967)	ASROC
Elmer Montgomery US (FF 1082)	ASROC
Emory S. Land US (AS 39)	Service/logistics of nuclear weapons
England US (CG 22)	ASROC, Terrier
Enterprise US (CVN 65)	Aircraft and nuclear bombs
Exeter UK (D89)	ASW helicopters and nuclear-depth bombs
Fairfax County US (LST 1193)	Transports Marine Corps weapons
Fanning US (FF 1076)	ASROC
Farragut US (DDG 37)	ASROC, Terrier
Fife US (DD 991)	TOMAHAWK
Finback US (SSN 670)	TOMAHAWK
Flasher US (SSN 613)	SUBROC
Fletcher US (DD 992)	ASROC
Flint US (AE 32)	Service/logistics of nuclear weapons
Florida US (SSBN 728)	Trident I C-4 SLBM
Flying Fish US (SSN 673)	TOMAHAWK
Foch FR (R99)	Aircraft, nuclear bombs, ASMP air-to-surface missile
Forrestal US (CV 59)	Aircraft and nuclear bombs
Fort Austin UK (A386)	Logistic support
Fort Fisher US (LSD 40)	Transports Marine Corps weapons
Fort Grange UK (A385)	Logistic support
Fort McHenry US (LSD 43)	Transports Marine Corps weapons
Fort Sheverenko USSR (AEM)	Transports missiles
Foudroyant FR (S610)	M20 SLBM
Fox US (CG 33)	ASROC, Terrier
FOXTROT class USSR (SS)	nuclear torpedoes
Francis Hammond US (FF 1067)	ASROC
Francis Scott Key US (SSBN 657)	Trident I C-4 SLBM
Frank Cable US (AS 40)	Service/logistics of nuclear weapons
Frederick US (LST 1184)	Transports Marine Corps weapons
Fresno US (LST 1182)	Transports Marine Corps weapons

APPENDIX G: Alphabetical List of Nuclear-capable and Nuclear-powered Ships and Submarines

Ship, country, hull-number/designation	Nuclear weapons capability
Frunze USSR (CGN)	SS-N-19 SLCM, nuclear torpedoes, SA-N-6 SAMs, helicopters (nuclear depth bombs)
Fulton US (AS 11)	Service/logistics of nuclear weapons
Fyodor Vidyaev USSR (AS)	nuclear transport
Garcia US (FF 1040)	ASROC
Gato US (SSN 615)	SUBROC
General Riyabakov USSR (AEM)	Transports SLCMs for ships and submarines
George Bancroft US (SSBN 643)	Trident I C-4 SLBM
George C. Marshall US (SSBN 654)	Poseidon C-3 SLBM
George Washington Carver US (SSBN 656)	Poseidon C-3 SLBM
Georgia US (SSBN 729)	Trident I C-4 SLBM
Gepard USSR (FFG)	nuclear torpedoes
Germantown US (LSD 42)	Transports Marine Corps weapons
Giena USSR (FFG)	nuclear torpedoes
Glasgow UK (D88)	ASW helicopters and nuclear-depth bombs
Glenard P. Lipscomb US (SSN 685)	SUBROC
Gloucester UK (D96)	ASW helicopters and nuclear-depth bombs
Glover US (FF 1098)	ASROC
Gnevnyy USSR DDG	nuclear torpedoes, SA-N-1 SAMs
Goldsborough US (DDG 20)	ASROC
GOLF class China (SSB)	Test/training ship for SLBMs
GOLF II class USSR (SSB)	SS-N-5 SLBM
GOLF III class USSR (SSB)	SS-N-8 SLBM, nuclear torpedoes
GOLF V class USSR (SSB)	SS-N-20 SLBM, nuclear torpedoes
Gordelivyy USSR (FFG)	nuclear torpedoes
Gordyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Grad USSR (PGG)	SS-N-9 SLCM
Gray US (FF 1054)	ASROC
Grayling US (SSN 646)	TOMAHAWK
Greenling US (SSN 614)	SUBROC
Gremyashchiy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Gridley US (CG 21)	ASROC, Terrier
GRISHA I class USSR (FFG)	nuclear torpedoes
GRISHA III class USSR (FFG)	nuclear torpedoes
GRISHA IV class USSR (FFG)	nuclear torpedoes
GRISHA V class USSR (FFG)	nuclear torpedoes
Gromkiy USSR (FFG)	nuclear torpedoes
Groton US (SSN 694)	TOMAHAWK
Groznyy USSR (CG)	SS-N-3b, nuclear torpedoes, SA-N-1 SAMs
Grozyashchiy USSR (FFG)	nuclear torpedoes
Gruziy Komsomolets USSR (FFG)	nuclear torpedoes
Guadalcanal US (LPH 07)	Aircraft and Marine Corps nuclear weapons
Guam US (LPH 09)	Aircraft and Marine Corps nuclear weapons
Guardfish US (SSN 612)	SUBROC
Guitarro US (SSN 665)	TOMAHAWK
Gurnard US (SSN 662)	TOMAHAWK
Haddo US (SSN 604)	SUBROC
Haddock US (SSN 621)	SUBROC
Haleakala US (AE 25)	Service/logistics of nuclear weapons
Halsey US (CG 23)	ASROC, Terrier
Hammerhead US (SSN 663)	TOMAHAWK
HAN class China (SSN)	nuclear powered/not nuclear weapons capable
Harlan County US (LST 1196)	Transports Marine Corps weapons
Harold E. Holt US (FF 1074)	ASROC
Harry E. Yarnell US (CG 17)	ASROC, Terrier
Harry W. Hill US (DD 986)	ASROC
Hawkbill US (SSN 666)	SUBROC
Hayler US (DD 997)	ASROC
Helena US (SSN 725)	TOMAHAWK
Henry B. Wilson US (DDG 07)	ASROC
Henry Clay US (SSBN 625)	Poseidon C-3 SLBM

APPENDIX G: Alphabetical List of Nuclear-capable and Nuclear-powered Ships and Submarines

Ship, country, hull-number/designation	Nuclear weapons capability
Henry L. Stimson US (SSBN 655)	Trident I C-4 SLBM
Henry M. Jackson US (SSBN 730)	Trident I C-4 SLBM
Hepburn US (FF 1055)	ASROC
Hermitage US (LSD 34)	Transports Marine Corps weapons
Hewitt US (DD 966)	ASROC
Hoel US (DDG 13)	ASROC
Holland US (AS 32)	Service/logistics of nuclear weapons
Honolulu US (SSN 718)	TOMAHAWK
Horne US (CG 30)	ASROC, Terrier
HOTEL II class USSR (SSN)	nuclear torpedoes
HOTEL III class USSR (SSBN)	SS-N-8 SLBM, nuclear torpedoes
Houston US (SSN 713)	TOMAHAWK
Hunley US (AS 31)	Service/logistics of nuclear weapons
Hyman G. Rickover US (SSN 709)	TOMAHAWK
Illustrious UK (R06)	Aircraft and nuclear bombs
Inchon US (LPH 12)	Aircraft and Marine Corps nuclear weapons
Independence US (CV 62)	Aircraft and nuclear bombs
Indianapolis US (SSN 697)	TOMAHAWK
Indirka USSR (AEM)	Transports missiles
Indomptable FR (S613)	M20 SLBM
Inflexible FR	M4A SLBM
Ingersoll US (DD 990)	ASROC, TOMAHAWK
Invincible UK (R05)	Aircraft and nuclear bombs
Iowa US (BB 61)	TOMAHAWK
Ivan Kolyshkin USSR (AS)	nuclear transport
Ivan Kucherenko USSR (AS)	nuclear transport
Ivan Vakhrameev USSR (AS)	nuclear transport
Iwo Jima US (LPH 02)	Aircraft and Marine Corps nuclear weapons
Jack US (SSN 605)	SUBROC
Jacksonville US (SSN 699)	SUBROC
James K. Polk US (SSBN 645)	Poseidon C-3 SLBM
James Madison US (SSBN 627)	Trident I C-4 SLBM
James Monroe US (SSBN 622)	Poseidon C-3 SLBM
Jesse L. Brown US (FF 1089)	ASROC
John Adams US (SSBN 620)	Poseidon C-3 SLBM
John C. Calhoun US (SSBN 630)	Trident I C-4 SLBM
John F. Kennedy US (CV 67)	Aircraft and nuclear bombs
John Hancock US (DD 981)	ASROC
John King US (DDG 03)	ASROC
John Marshall US (SSN 611)	nuclear powered/not nuclear weapons capable
John Rodgers US (DD 983)	ASROC, TOMAHAWK
John Young US (DD 973)	ASROC
Joseph Hewes US (FF 1078)	ASROC
Joseph Strauss US (DDG 16)	ASROC
Josephus Daniels US (CG 27)	ASROC, Terrier
Jouett US (CG 29)	ASROC, Terrier
JULIETT class USSR (SSG)	SS-N-3a SLCM, nuclear torpedoes
Juneau US (LPD 10)	Transports Marine Corps weapons
Kalamazoo US (AOR 6)	Service/logistics of nuclear weapons
Kamchatskiy Komsomolets USSR (AS)	nuclear transport
Kamehameha US (SSBN 642)	Poseidon C-3 SLBM
Kana USSR (AOS)	Transports SLBM liquid fuel
Kansas City US (AOR 3)	Service/logistics of nuclear weapons
Kerch USSR (CG)	SA-N-3 SAMs, nuclear torpedoes, helicopters (nuclear depth bombs)
Key West US (SSN 722)	TOMAHAWK
Khoper USSR (AEM)	Transports SS-N-5 SLBMs
Kiev USSR (CVHG)	SS-N-12 SLCM, FRAS-1, SA-N-3 SAMs, aircraft (nuclear bombs and/or nuclear depth bombs)
KILO class USSR (SS)	nuclear torpedoes
King US (DDG 41)	ASROC, Terrier
Kinkaid US (DD 965)	ASROC

APPENDIX G: Alphabetical List of Nuclear-capable and Nuclear-powered Ships and Submarines

Ship, country, hull-number/designation	Nuclear weapons capability
Kirk US (FF 1087)	ASROC
Kirov USSR (CGN)	SS-N-19 SLCM, nuclear torpedoes, SA-N-6 SAMs, helicopters (nuclear depth bombs)
Kiska US (AE 35)	Service/logistics of nuclear weapons
Kitty Hawk US (CV 63)	Aircraft and nuclear bombs
Knox US (FF 1052)	ASROC
Kobchik USSR (FFG)	nuclear torpedoes
Koelsch US (FF 1049)	ASROC
Komsomolets Ukrainyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Krasnodarskiy Komsomolets USSR (FFG)	nuclear torpedoes
Krasnyy Kavkaz USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Krasnyy Krym USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Kronshtadt USSR (CG)	nuclear torpedoes, SA-N-3 SAMs, helicopter (nuclear depth bombs)
Kunitsa USSR (FFG)	nuclear torpedoes
L. Mendel Rivers US (SSN 686)	SUBROC
L. Y. Spear US (AS 36)	Service/logistics of nuclear weapons
La Jolla US (SSN 701)	TOMAHAWK
La Moure County US (LST 1194)	Transports Marine Corps weapons
Ladnyy USSR (FFG)	nuclear torpedoes
Lafayette US (SSBN 616)	Poseidon C-3 SLBM
Lang US (FF 1060)	ASROC
Lapon US (SSN 661)	SUBROC
Lawrence US (DDG 04)	ASROC
Leahy US (CG 16)	ASROC, Terrier
Leftwich US (DD 984)	ASROC, TOMAHAWK
Lenin USSR (AGBN)	nuclear-powered ice breaker
Leningrad USSR (CHG)	FRAS-1, SA-N-3 SAMs, helicopters (nuclear depth bombs)
Leningradskiy Komsomolets USSR (FFG)	nuclear torpedoes
Leonid Brezhnev USSR (AGBN)	nuclear-powered ice breaker
Leopard USSR (FFG)	nuclear torpedoes
Letuchiy USSR (FFG)	nuclear torpedoes
Lev USSR (FFG)	nuclear torpedoes
Lewis and Clark US (SSBN 644)	Poseidon C-3 SLBM
Leyte Gulf US (CG 55)	TOMAHAWK
Lisa USSR (FFG)	nuclear torpedoes
Litviy Komsomolets USSR (FFG)	nuclear torpedoes
Liverpool UK (D92)	ASW helicopters and nuclear-depth bombs
Lockwood US (FF 1064)	ASROC
London UK (F95)	ASW helicopters and nuclear-depth bombs
Long Beach US (CGN 09)	ASROC, TOMAHAWK, Terrier
Los Angeles US (SSN 688)	TOMAHAWK
Louisville US (SSN 724)	TOMAHAWK
Luce US (DDG 38)	ASROC, Terrier
Lynde McCormick US (DDG 08)	ASROC
MacDonough US (DDG 39)	ASROC, Terrier
Magadanskiy Komsomolets USSR (AS)	nuclear transport
Magomed Gadziev USSR (AS)	nuclear transport
Mahan US (DDG 42)	ASROC, Terrier
Manchester UK (D95)	ASW helicopters and nuclear-depth bombs
Manitowoc US (LST 1180)	Transports Marine Corps weapons
Mariano G. Vallejo US (SSBN 658)	Trident I C-4 SLBM
Marshal Shaposhnikov USSR (DDG)	nuclear torpedoes, SLCMs, helicopters (nuclear depth bombs)
Marshal Timoshenko USSR (CG)	nuclear torpedoes, SA-N-3 SAMs, helicopter, (nuclear depth bombs)
Marshal Vasil'yevskiy USSR (DDG)	nuclear torpedoes, SLCMs, helicopters (nuclear depth bombs)
Marshal Voroshilov USSR (CG)	nuclear torpedoes, SA-N-3 SAMs, helicopter, (nuclear depth bombs)
Marshfield US (TAK 282)	Logistic support
Marvin Shields US (FF 1066)	ASROC
Mauna Kea US (AE 22)	Service/logistics of nuclear weapons
McCandless US (FF 1084)	ASROC
McCloy US (FF 1038)	ASROC

APPENDIX G: Alphabetical List of Nuclear-capable and Nuclear-powered Ships and Submarines

Ship, country, hull-number/designation	Nuclear weapons capability
McKee US (AS 41)	Service/logistics of nuclear weapons
Medved USSR (FFG)	nuclear torpedoes
Memphis US (SSN 691)	TOMAHAWK
Merrill US (DD 976)	ASROC, TOMAHAWK
Meyerkord US (FF 1058)	ASROC
Michigan US (SSBN 727)	Trident I C-4 SLBM
Midway US (CV 41)	Aircraft and nuclear bombs
MIKE class USSR (SSN)	SS-N-15 nuclear depth bomb, SS-N-16 ASW missile, nuclear torpedoes
Mikhail Kutuzov USSR (CG)	artillery guns
Miller US (FF 1091)	ASROC
Milwaukee US (AOR 2)	Service/logistics of nuclear weapons
Minneapolis-Saint Paul US (SSN 708)	TOMAHAWK
Minsk USSR (CVHG)	SS-N-12 SLCM, FRAS-1, SA-N-3 SAMs, aircraft (nuclear bombs and/or nuclear depth bombs)
Mississippi US (CGN 40)	ASROC
Missouri US (BB 63)	TOMAHAWK
Mobile US (LKA 115)	Transports Marine Corps weapons
Moinester US (FF 1097)	ASROC
Molniya USSR (PGG)	SS-N-9 SLCM
Moosbrugger US (DD 980)	ASROC
Moskovskiy Komsomolets USSR (DDG)	nuclear torpedoes
Moskva USSR (CHG)	FRAS-1, SA-N-3 SAMs, helicopters (nuclear depth bombs)
Mount Baker US (AE 34)	Service/logistics of nuclear weapons
Mount Hood US (AE 29)	Service/logistics of nuclear weapons
Mount Vernon US (LSD 39)	Transports Marine Corps weapons
Mount Whitney US (LCC 20)	Transports Marine Corps weapons
Murmansk USSR (CG)	artillery guns
Musson USSR (PGG)	SS-N-9 SLCM
Nakhodchivyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
NANUCHKA III class USSR (PGG)	SS-N-9 SLCM
Naporistiy USSR (DDG)	nuclear torpedoes
Narwhal US (SSN 671)	SUBROC
Nashville US (LPD 13)	Transports Marine Corps weapons
Nassau US (LHA 04)	Aircraft and Marine Corps nuclear weapons
Nastoychivyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Nesokrushimyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Neuderzhimyy USSR (DDG)	nuclear torpedoes, (SS-N-1 SLCM)
Neukrotimyy USSR (FFG)	nuclear torpedoes
Neulovimyy USSR (DDG)	nuclear torpedoes
Nevada US (SSBN 733)	Trident I C-4 SLBM
New Jersey US (BB 62)	TOMAHAWK
New Orleans US (LPH 11)	Aircraft and Marine Corps nuclear weapons
New York City US (SSN 696)	TOMAHAWK
Newcastle UK (D87)	ASW helicopters and nuclear-depth bombs
Newport US (LST 1179)	Transports Marine Corps weapons
Nicholson US (DD 982)	ASROC
Nikolayev USSR (CG)	SA-N-3 SAMs, nuclear torpedoes, helicopters (nuclear depth bombs)
Nitro US (AE 23)	Service/logistics of nuclear weapons
Norfolk US (SSN 714)	TOMAHAWK
Nottingham UK (D91)	ASW helicopters and nuclear-depth bombs
NOVEMBER class USSR (SSN)	nuclear torpedoes
Novorossiysk USSR (CVHG)	SS-N-12 SLCM, FRAS-1, SA-N-3 SAMs, aircraft (nuclear bombs and/or nuclear depth bombs)
NR-1 US	nuclear powered/not nuclear weapons capable
O'Bannon US (DD 987)	ASROC
O'Brien US (DD 975)	ASROC
O'Callahan US (FF 1051)	ASROC
Obraztsovyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Ochakov USSR (CG)	SA-N-3 SAMs, nuclear torpedoes, helicopters (nuclear depth bombs)
Odarennyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs

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Ship, country, hull-number/designation	Nuclear weapons capability
Ogden US (LPD 05)	Transports Marine Corps weapons
Ognevoy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Ohio US (SSBN 726)	Trident I C-4 SLBM
Okinawa US (LPH 03)	Aircraft and Marine Corps nuclear weapons
Oldendorf US (DD 972)	ASROC
Olympia US (SSN 717)	TOMAHAWK
Omaha US (SSN 692)	TOMAHAWK
Orion US (AS 18)	Service/logistics of nuclear weapons
OSCAR class USSR (SSGN)	SS-N-19 SLCM, SS-N-15 nuclear depth bomb, SS-N-16 ASW missile, nuclear torpedoes
Osomotritel'nyy USSR (DDG)	SS-N-22 SLCM, nuclear torpedoes
Otchayannyy USSR (DDG)	SS-N-22 SLCM, nuclear torpedoes
Otlichnyy USSR (DDG)	SS-N-22 SLCM, nuclear torpedoes
Ouellet US (FF 1077)	ASROC
Pantera USSR (FFG)	nuclear torpedoes
PAPA class USSR (SSGN)	SS-N-7 or SS-N-9 SLCM, SS-N-15 nuclear depth bomb, nuclear torpedoes
Parche US (SSN 683)	TOMAHAWK
Pargo US (SSN 650)	TOMAHAWK
Patterson US (FF 1061)	ASROC
Paul F. Foster US (DD 964)	ASROC
Paul US (FF 1080)	ASROC
PB-625 USSR (AEM)	Transports SLCMs for ships and submarines
Peleliu US (LHA 05)	Aircraft and Marine Corps nuclear weapons
Pensacola US (LSD 38)	Transports Marine Corps weapons
Peoria US (LST 1183)	Transports Marine Corps weapons
Permit US (SSN 594)	SUBROC
Peterson US (DD 969)	ASROC
Petropavlovsk USSR (CG)	SA-N-3 SAMs, nuclear torpedoes, helicopters (nuclear depth bombs)
Pharris US (FF 1094)	ASROC
Philadelphia US (SSN 690)	TOMAHAWK
Phoenix US (SSN 702)	SUBROC
Pintado US (SSN 672)	SUBROC
Pittsburgh US (SSN 720)	TOMAHAWK
Plamennyy USSR (DDG)	nuclear torpedoes
Plunger US (SSN 595)	SUBROC
PM-131 USSR (AEM)	Transports SLCMs for ships and submarines
PM-150 USSR (AEM)	Transports SLCMs for ships and submarines
PM-44 USSR (AEM)	Transports SLCMs for ships and submarines
PM-63 USSR (AR)	Nuclear material support for ship and submarine nuclear reactors
PM-74 USSR (AR)	Nuclear material support for ship and submarine nuclear reactors
PM-93 USSR (AEM)	Transports SLCMs for ships and submarines
Pogy US (SSN 647)	SUBROC
Pollack US (SSN 603)	SUBROC
Ponce US (LPD 15)	Transports Marine Corps weapons
Portland US (LSD 37)	Transports Marine Corps weapons
Portsmouth US (SSN 707)	TOMAHAWK
Poryvistyy USSR (FFG)	nuclear torpedoes
Prairie US (AD 15)	Service/logistics of nuclear weapons
Preble US (DDG 46)	ASROC, Terrier
Proteus US (AS 19)	Service/logistics of nuclear weapons
Providence US (SSN 719)	TOMAHAWK
Provornyy USSR (DDG)	nuclear torpedoes
Prozorlivyy USSR (DDG)	nuclear torpedoes
Puffer US (SSN 652)	TOMAHAWK
Puget Sound US (AD 38)	Service/logistics of nuclear weapons
Pylkiy USSR (FFG)	nuclear torpedoes
Pyro US (AE 24)	Service/logistics of nuclear weapons
Pytlivvy USSR (FFG)	nuclear torpedoes
Queenfish US (SSN 651)	SUBROC
R'yanyy USSR (FFG)	nuclear torpedoes

Ship, country, hull-number/designation	Nuclear weapons capability
Racine US (LST 1191)	Transports Marine Corps weapons
Raduga USSR (PGG)	SS-N-9 SLCM
Raleigh US (LPD 01)	Transports Marine Corps weapons
Ramsey US (FFG 02)	ASROC
Ranger US (CV 61)	Aircraft and nuclear bombs
Rathburne US (FF 1057)	ASROC
Ray US (SSN 653)	TOMAHAWK
Razitel'nyy USSR (FFG)	nuclear torpedoes
Razumnyy USSR (FFG)	nuclear torpedoes
Razyashchiy USSR (FFG)	nuclear torpedoes
Reasoner US (FF 1063)	ASROC
Redoutable FR (S611)	M20 SLBM
Reeves US (CG 24)	ASROC, Terrier
Regent UK (A486)	Logistic support
Renown UK (S26)	Polaris A3-TK Chevaline
Repulse UK (S23)	Polaris A3-TK Chevaline
Reshitelnyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Resolution UK (S22)	Polaris A3-TK Chevaline
Resource UK (A480)	Logistic support
Retivyy USSR (FFG)	nuclear torpedoes
Revenge UK (S27)	Polaris A3-TK Chevaline
Revnostnyy USSR (FFG)	nuclear torpedoes
Rezkiy USSR (FFG)	nuclear torpedoes
Rezvyy USSR (FFG)	nuclear torpedoes
Richard B. Russell US (SSN 687)	SUBROC
Richard E. Byrd US (DDG 23)	ASROC
Richmond K. Turner US (CG 20)	ASROC, Terrier
Roanoke US (AOR 7)	Service/logistics of nuclear weapons
Roark US (FF 1053)	ASROC
Robert E. Peary US (FF 1073)	ASROC
Robison US (DDG 12)	ASROC
ROMEO class USSR (SS)	(SS-N-15 nuclear depth bomb), nuclear torpedoes
Rossiya USSR (AGBN)	nuclear-powered ice breaker
Rubis FR (SSN)	nuclear powered/not nuclear weapons capable
Rys Rosomakha USSR (FFG)	nuclear torpedoes
Sacramento US (AOE 1)	Service/logistics of nuclear weapons
Saginaw US (LST 1188)	Transports Marine Corps weapons
Saint Louis US (LKA 116)	Transports Marine Corps weapons
Saipan US (LHA 02)	Aircraft and Marine Corps nuclear weapons
Salt Lake City US (SSN 716)	TOMAHAWK
Sam Houston US (SSN 609)	nuclear powered/not nuclear weapons capable
Sample US (FF 1048)	ASROC
Sampson US (DDG 10)	ASROC
Samuel Gompers US (AD 37)	Service/logistics of nuclear weapons
San Bernardino US (LST 1189)	Transports Marine Corps weapons
San Francisco US (SSN 711)	SUBROC
Sand Lance US (SSN 660)	SUBROC
Santa Barbara US (AE 28)	Service/logistics of nuclear weapons
Saphir FR (SSN)	nuclear powered/not nuclear weapons capable
SARANCHA class USSR (PGGH)	SS-N-9 SLCM
Saratoga US (CV 60)	Aircraft and nuclear bombs
Sargo (SSN 583)	nuclear powered/not nuclear weapons capable
Savannah US (AOR 4)	Service/logistics of nuclear weapons
Scamp US (SSN 588)	nuclear powered/not nuclear weapons capable
Sceptre UK (S104)	nuclear powered/not nuclear weapons capable
Schenectady US (LST 1185)	Transports Marine Corps weapons
Schofield US (FFG 03)	ASROC
Sculpin US (SSN 590)	nuclear powered/not nuclear weapons capable
Sderzhanoyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Sea Devil US (SSN 664)	SUBROC

APPENDIX G: Alphabetical List of Nuclear-capable and Nuclear-powered Ships and Submarines

Ship, country, hull-number/designation	Nuclear weapons capability
Seahorse US (SSN 669)	TOMAHAWK
Seattle US (AOE 3)	Service/logistics of nuclear weapons
Selenga USSR (AOS)	Transports SLBM liquid fuel
Sellers US (DDG 11)	ASROC
Semmes US (DDG 18)	ASROC
Sevastopol USSR (CG)	SS-N-3b SLCM, SA-N-1, nuclear torpedoes
Shakal USSR (FFG)	nuclear torpedoes
Shark US (SSN 591)	nuclear powered/not nuclear weapons capable
Shasta US (AE 33)	Service/logistics of nuclear weapons
Sheffield UK (F96)	ASW helicopters and nuclear-depth bombs
Shenandoah US (AD 44)	Service/logistics of nuclear weapons
Shkval USSR (PGG)	SS-N-9 SLCM
Shreveport US (LPD 12)	Transports Marine Corps weapons
Shtorm USSR (PGG)	SS-N-9 SLCM
Sibir' USSR (AGBN)	nuclear-powered ice breaker
SIERRA class USSR (SSN)	(SS-N-21 SLCM), SS-N-15 nuclear depth bomb, SS-N-16 ASW missile, nuclear torpedoes
Sierra US (AD 18)	Service/logistics of nuclear weapons
Sil'nyy USSR (FFG)	nuclear torpedoes
Silversides US (SSN 679)	TOMAHAWK
Simon Bolivar US (SSBN 641)	Trident I C-4 SLBM
Simon Lake US (AS 33)	Service/logistics of nuclear weapons
Skipjack US (SSN 585)	nuclear powered/not nuclear weapons capable
Skoryy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Skromnyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Skrytnyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
SLAVA class USSR (CG)	SS-N-12 SLCM, nuclear torpedoes, SA-N-6
Slava USSR (CG)	SS-N-12 SLCM, nuclear torpedoes, SA-N-6
Slavnyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Smel'yy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Smetlivvy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Smyshlennyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Soobrazitel'nyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
South Carolina US (CGN 37)	ASROC
Southampton UK (D90)	ASW helicopters and nuclear-depth bombs
Sovereign UK (S108)	nuclear powered/not nuclear weapons capable
Sovremennyy USSR (DDG)	SS-N-22 SLCM, nuclear torpedoes
Soznatel'nyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Spadefish US (SSN 668)	TOMAHAWK
Spartan UK (S105)	nuclear powered/not nuclear weapons capable
Spartanburg County US (LST 1192)	Transports Marine Corps weapons
Speshnyy USSR (DDG)	nuclear torpedoes
Spiegel Grove US (LSD 32)	Transports Marine Corps weapons
Splendid UK (S106)	nuclear powered/not nuclear weapons capable
Spokoynyy USSR (DDG)	nuclear torpedoes
Sposobnyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Spruance US (DD 963)	TOMAHAWK
Stein US (FF 1065)	ASROC
Steregushchiy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Sterett US (CG 31)	ASROC, Terrier
Stonewall Jackson US (SSBN 634)	Trident I C-4 SLBM
Storozhevoy USSR (FFG)	nuclear torpedoes
Strogiy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Stroynyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Stump US (DD 978)	ASROC
Sturgeon US (SSN 637)	TOMAHAWK
Sumter US (LST 1181)	Transports Marine Corps weapons
Sunfish US (SSN 649)	SUBROC
Superb UK (S109)	nuclear powered/not nuclear weapons capable
Suribachi US (AE 21)	Service/logistics of nuclear weapons

APPENDIX G: Alphabetical List of Nuclear-capable and Nuclear-powered Ships and Submarines

Ship, country, hull-number/designation	Nuclear weapons capability
Svedushchiy USSR (DDG)	nuclear torpedoes
Sverdlov USSR (CG)	artillery guns
Svetlyy USSR (DDG)	nuclear torpedoes
Svirepyy USSR (FFG)	nuclear torpedoes
Swiftsure UK (S126)	nuclear powered/not nuclear weapons capable
Swordfish US (SSN 579)	nuclear powered/not nuclear weapons capable
Talbot US (FFG 04)	ASROC
Talent UK (S92)	nuclear powered/not nuclear weapons capable
Tallinn USSR (CG)	SA-N-3 SAMs, nuclear torpedoes, helicopters (nuclear depth bombs)
TANGO class USSR (SS)	(SS-N-15 nuclear depth bomb), nuclear torpedoes
TARANTUL III class USSR (PGG)	SS-N-22 SLCM
Tarawa US (LHA 01)	Aircraft and Marine Corps nuclear weapons
Tashkent USSR (CG)	SA-N-3 SAMs, nuclear torpedoes, helicopters (nuclear depth bombs)
Tattnall US (DDG 19)	ASROC
Tautog US (SSN 639)	TOMAHAWK
Tayfun USSR (PGG)	SS-N-9 SLCM
Tecumseh US (SSBN 628)	Poseidon C-3 SLBM
Terrible FR (S612)	M20 SLBM
Texas US (CGN 39)	ASROC, TOMAHAWK
Thomas C. Hart US (FF 1092)	ASROC
Thorn US (DD 988)	ASROC
Ticonderoga US (CG 47)	ASROC
Tigr USSR (FFG)	nuclear torpedoes
Tinosa US (SSN 606)	SUBROC
Tireless UK (S88)	nuclear powered/not nuclear weapons capable
TNT-11 USSR	Nuclear waste transport
TNT-12 USSR	Nuclear waste transport
TNT-19 USSR	Nuclear waste transport
TNT-29 USSR	Nuclear waste transport
Tobol USSR (AS)	nuclear transport
Tonnant FR (S614)	M4 (modified) SLBM
Torbay UK (S90)	nuclear powered/not nuclear weapons capable
Towers US (DDG 09)	ASROC
Trafalgar UK (S107)	nuclear powered/not nuclear weapons capable
Trenchant UK (S91)	nuclear powered/not nuclear weapons capable
Trenton US (LPD 14)	Transports Marine Corps weapons
Trepang US (SSN 674)	SUBROC
Tripoli US (LPH 10)	Aircraft and Marine Corps nuclear weapons
Trippe US (FF 1075)	ASROC
Triumph UK (S93)	nuclear powered/not nuclear weapons capable
Truett US (FF 1095)	ASROC
Truxtun US (CGN 35)	ASROC, Terrier
Tsiklon USSR (PGG)	SS-N-9 SLCM
Tullibee US (SSN 597)	nuclear powered/not nuclear weapons capable
Tunny US (SSN 682)	SUBROC
Turbulent UK (S87)	nuclear powered/not nuclear weapons capable
Turman USSR (FFG)	nuclear torpedoes
TURYA class USSR (PGG)	nuclear torpedoes
Tuscaloosa US (LST 1187)	Transports Marine Corps weapons
TYPHOON class USSR (SSBN)	SS-N-20 SLBM, (SS-N-15 or SS-N-16), nuclear torpedoes
Udaloy USSR (DDG)	nuclear torpedoes, SLCMs, helicopters (nuclear depth bombs)
Ulysses S. Grant US (SSBN 631)	Poseidon C-3 SLBM
Upornyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Ural USSR	Nuclear waste transport
Valdez US (FF 1096)	ASROC
Valiant UK (S102)	nuclear powered/not nuclear weapons capable
Valley Forge US (CG 50)	ASROC
Vancouver US (LPD 02)	Transports Marine Corps weapons
Vanguard UK (SSBN)	Trident II SLBM
Varyag USSR (CG)	SS-N-3b, nuclear torpedoes, SA-N-1 SAMs

APPENDIX G: Alphabetical List of Nuclear-capable and Nuclear-powered Ships and Submarines

Ship, country, hull-number/designation	Nuclear weapons capability
Vasiliy Chapayev USSR (CG)	nuclear torpedoes, SA-N-3 SAMs, helicopter, (nuclear depth bombs)
Vdokhnovennyy USSR (DDG)	nuclear torpedoes
Vega US (TAK 286)	Logistic support
Venta USSR (AEM)	Transports SLCMs and SAMs
Veskiy USSR (DDG)	nuclear torpedoes
Vetluga USSR (AEM)	Transports SLBMs for SSB/Ns
VICTOR I class USSR (SSN)	SS-N-15 nuclear depth bomb, nuclear torpedoes
VICTOR II class USSR (SSN)	SS-N-15 nuclear depth bomb, SS-N-16 ASW missile, nuclear torpedoes
VICTOR III class USSR (SSN)	(SS-N-21 SLCM), SS-N-16 ASW missile, nuclear torpedoes
Viktor Kotel'nikov USSR (AS)	nuclear transport
Vilyuy USSR (AEM)	Transports SLCMs and SAMs
Vincennes US (CG 49)	ASROC
Virginia US (CGN 38)	ASROC, TOMAHAWK
Vitse Admiral Drozd USSR (CG)	SS-N-3b SLCM, SA-N-1, nuclear torpedoes
Vitse Admiral Kulakov USSR (DDG)	nuclear torpedoes, SLCMs, helicopters (nuclear depth bombs)
Vladivostok USSR (CG)	SS-N-3b SLCM, SA-N-1, nuclear torpedoes
Vliyatelnyy USSR (DDG)	nuclear torpedoes
Voge US (FF 1047)	ASROC
Volga USSR (AS)	nuclear transport
Volk USSR (FFG)	nuclear torpedoes
Von Steuben US (SSBN 632)	Trident I C-4 SLBM
Voron USSR (FFG)	nuclear torpedoes
Voronezh (PM-872) USSR (AEM)	Transports SLCMs for ships and submarines
Vozbuzhdennyy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Vreeland US (FF 1068)	ASROC
Vyderzhannyy USSR (DDG)	nuclear torpedoes
Vyzyvayushchiy USSR (DDG)	nuclear torpedoes
W.S. Sims US (FF 1059)	ASROC
Wabash US (AOR 5)	Service/logistics of nuclear weapons
Waddell US (DDG 24)	ASROC
Wainwright US (CG 28)	ASROC, Terrier
Warspite UK (S103)	nuclear powered/not nuclear weapons capable
Whale US (SSN 638)	TOMAHAWK
Whidbey Island US (LSD 41)	Transports Marine Corps weapons
Whipple US (FF 1062)	ASROC
WHISKEY class USSR (SS)	nuclear torpedoes
Wichita US (AOR 1)	Service/logistics of nuclear weapons
Will Rogers US (SSBN 659)	Poseidon C-3 SLBM
William H. Standley US (CG 32)	ASROC, Terrier
William H. Bates US (SSN 680)	SUBROC
William V. Pratt US (DDG 44)	ASROC, Terrier
Woodrow Wilson US (SSBN 624)	Poseidon C-3 SLBM
Worden US (CG 18)	ASROC, Terrier
XIA class China (SSBN)	CSS-N-3 SLBMs
Yaguar USSR (FFG)	nuclear torpedoes
YANKEE class USSR (SSN)	(SS-N-21 SLCM), nuclear torpedoes
YANKEE class USSR (SSGN)	(12 SS-NX-24 SLCM), nuclear torpedoes
YANKEE I class USSR (SSBN)	SS-N-6 SLBM, nuclear torpedoes
YANKEE II class USSR (SSBN)	SS-N-17 SLBM, nuclear torpedoes
Yellowstone US (AD 41)	Service/logistics of nuclear weapons
York UK (D98)	ASW helicopters and nuclear-depth bombs
Yorktown US (CG 48)	ASROC
Yosemite US (AD 19)	Service/logistics of nuclear weapons
Zadornyy USSR (FFG)	nuclear torpedoes
Zarnitsa USSR (PGG)	SS-N-9 SLCM
Zharkyy USSR (FFG)	nuclear torpedoes
Zhdanov USSR (CG)	artillery guns
Zhguchiy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Zorkiy USSR (DDG)	nuclear torpedoes, SA-N-1 SAMs
Zub USSR (PGG)	SS-N-9 SLCM
Zulu class USSR (SS)	nuclear torpedoes

APPENDIX H: Glossary of Nuclear-capable Ships and Aircraft, and Naval Nuclear Weapons

This glossary summarizes weapon systems fully described in the main text. Included are:

a) ship classes with their country, type of class, and nuclear weapons carried or nuclear-weapons related activity;
b) aircraft with their country, type of aircraft, and nuclear weapons capability;
c) nuclear weapons with their country, type of weapon, and designated ship or aircraft.

Soviet and Chinese ship classes, weapons and aircraft are listed by their NATO designations.

A-4M Skyhawk: U.S. currently operational light attack aircraft; can deliver B43, B57, or B61 nuclear bombs.

A-6E Intruder: U.S. currently operational medium attack aircraft; can deliver B43, B57, or B61 nuclear bombs.

A-7E Corsair: U.S. currently operational light attack aircraft; can deliver B43, B57, or B61 nuclear bombs.

ABL: Armored Box Launcher.

Akula class submarines: Soviet currently operational SSNs; armed with nuclear torpedoes, and SS-N-15 and SS-N-16 ASW weapons; candidate for SS-N-21 SLCM.

Alfa class submarines: Soviet currently operational SSNs; armed with nuclear torpedoes and SS-N-15 nuclear depth bomb.

Amga class missile transport ships: Soviet currently operational; transports SLBMs for submarines.

Anchorage class dock landing ships: U.S. currently operational; logistical transport of Marine Corps nuclear weapons.

Andizhan class missile transport ships: Soviet currently operational; transports SLCMs and SAMs.

ANT-52: French currently operational nuclear gravity bomb; can be delivered by Super Etendard aircraft.

Arktika class nuclear-powered ice breakers: Soviet currently operational.

Arleigh Burke class destroyers: U.S., under construction; to be armed with Tomahawk SLCMs.

Armored Box Launcher (ABL): Large rectangular boxes which contain four Tomahawks each; used to fire Tomahawks from the battleships, nuclear-powered cruisers, and seven Spruance (DD-963) class destroyers.

AS-2 Kipper: Soviet currently operational anti-ship, air-to-surface missile, deployed on Badger bombers.

AS-4 Kitchen: Soviet currently operational anti-ship, air-to-surface missile, deployed on Backfire-B naval bombers and Bear G bombers.

AS-5 Kelt: Soviet currently operational anti-ship, air-to-surface missile, deployed on Badger-C/G bombers.

AS-6 Kingfish: Soviet currently operational anti-ship, air-to-surface missile, deployed on Badger-C/G bombers, and reportedly Backfire bombers.

AS-15 Kent: Soviet currently operational long-range air-launched cruise missile, deployed on Bear-H bombers of Strategic Aviation, which also are assigned maritime missions.

Ashtabula class fleet oilers: U.S. currently operational; logistical transport of nuclear weapons.

ASM: Anti-ship missile.

ASCM: Anti-ship cruise missile.

ASMP (air-sol-moyenne-portée): French currently operational nuclear-armed air-to-surface missile delivered by Super Etendard aircraft.

ASROC: U.S. currently operational nuclear- or conventionally-armed anti-submarine weapon deployed on cruisers, destroyers and some frigates.

Austin class amphibious transport docks: U.S. currently operational; logistical transport of Marine Corps nuclear weapons.

AV-8B Harrier: U.S. currently operational light attack aircraft; can deliver B61 nuclear bombs.

B-5 Beagle: Chinese currently operational naval aviation bomber; may have a nuclear maritime mission.

B-6 Badger: Chinese currently operational naval aviation bomber; may have a nuclear maritime mission.

B43: U.S. currently operational high-yield nuclear gravity bomb; can be delivered by A-4M, A-6E and A-7E aircraft for surface attacks.

B57: U.S. currently operational low-yield multipurpose nuclear depth charge and nuclear bomb used for anti-submarine warfare or surface attacks; can be delivered by S-3A, SH-3D/H, P-3A/B/C, A-4M, A-6E, A-7E, and F/A-18 aircraft.

B61: U.S. currently operational lightweight nuclear gravity bomb with six modifications; can be delivered by A-4M, A-6E, and A-7E aircraft.

Backfire A/B/C (Tu-26): Soviet currently operational medium range bomber; armed with nuclear bombs or dual capable AS-4 air-to-surface missiles.

Badger A/C/G (Tu-16): Soviet currently operational medium range bomber; armed with nuclear bombs or AS-2, AS-5, and AS-6 air-to-surface missiles.

Bainbridge cruiser: U.S. currently operational single-ship nuclear-powered cruiser class; armed with ASROCs and Terriers.

Bear F (Tu-142): Soviet currently operational long-range land-based maritime patrol and anti-submarine warfare aircraft; armed with nuclear depth bombs.

APPENDIX H: Glossary of Nuclear-capable Ships and Aircraft, and Naval Nuclear Weapons

Belknap class cruisers: U.S. currently operational; armed with ASROCs and Terriers.

Benjamin Franklin class submarines: U.S. currently operational SSBNs; armed with Poseidon C3 or Trident I C4 SLBMs.

Berezina replenishment oiler: Soviet currently operational single-ship class; supports submarine weapons.

Blinder A (Tu-22): Soviet currently operational medium range bomber; armed with nuclear bombs.

Blue Ridge class amphibious command ships: U.S. currently operational; logistical transport of Marine Corps nuclear weapons.

Brykin submarine tender: Soviet currently operational single-ship class; supports SSBNs.

Bronstein class frigates: U.S. currently operational; armed with ASROCs.

Brooke class frigates: U.S. currently operational; armed with ASROCs.

Buccaneer S.2B: U.K. currently operational maritime strike aircraft; can deliver WE-177 nuclear bombs.

California class cruisers: U.S. currently operational nuclear-powered cruisers; armed with ASROCs.

Capsule Launch System (CLS): 12 vertical launch tubes installed in Los Angeles class submarines, hull numbers 719 and later, for launching Tomahawk SLCMs. CLSs also could contain non-nuclear Harpoon anti-ship missiles.

Charles Adams class destroyers: U.S. currently operational; armed with ASROCs.

Charleston class amphibious cargo ships: U.S. currently operational; logistical transport of Marine Corps nuclear weapons.

Charlie I class submarines: Soviet currently operational SSGNs; armed with SS-N-7 SLCM, SS-N-15 nuclear depth bomb, nuclear torpedoes.

Charlie II class submarines: Soviet currently operational SSGNs; armed with SS-N-7 or SS-N-9 SLCMs, SS-N-15 nuclear depth bomb, nuclear torpedoes.

Churchill class submarines: U.K. currently operational non-nuclear-capable SSNs.

Clemenceau class aircraft carriers: French currently operational; stores nuclear bombs or air-to-surface missiles (ASMP) for embarked aircraft.

CLS: Capsule Launch System.

CSS-N-3: Chinese currently operational SLBM deployed on SSBNs.

Delta I class submarines: Soviet currently operational SSBNs; armed with SS-N-8 SLBMs, nuclear torpedoes.

Delta II class submarines: Soviet currently operational SSBNs; armed with SS-N-8 SLBMs, nuclear torpedoes.

Delta III class submarines: Soviet currently operational SSBNs; armed with SS-N-18 SLBMs, nuclear torpedoes.

Delta IV class submarines: Soviet currently operational SSBNs; armed with SS-N-23 SLBMs, nuclear torpedoes.

Dixie class destroyer tenders: U.S. currently operational; logistical support of nuclear weapons and surface ships.

Don class submarine tenders: Soviet currently operational; nuclear transport, supports submarines.

Echo I class submarines: Soviet currently operational SSNs; armed with nuclear torpedoes.

Echo II class submarines: Soviet currently operational SSGNs; armed with SS-N-3a or SS-N-12 SLCMs.

EH-101: U.K. future anti-submarine warfare helicopter; will be able to deliver nuclear depth bombs.

Emory S. Land submarine tenders: U.S. currently operational; service of attack submarines and their nuclear weapons.

Enterprise aircraft carrier: U.S. currently operational single-ship class; can storeB43, B57, and B61 nuclear bombs.

ET-80 torpedo: Soviet currently operational nuclear-armed torpedo.

Ethan Allen class submarines: U.S. currently operational non-nuclear-capable SSNs; converted from SSBNs.

F/A-18 Hornet: U.S. currently operational fighter-attack aircraft; can deliver B57 and B61 nuclear bombs.

Farragut class destroyers: U.S. currently operational; armed with ASROCs and Terriers.

Fencer E (Su-24): Soviet currently operational strike and reconnaissance aircraft; armed with nuclear bombs.

Fitter C (Su-20): Soviet currently operational fighter; armed with nuclear bombs.

Forrestal class aircraft carriers: U.S. currently operational; can store B43, B57, and B61 nuclear bombs.

Foxtrot class submarines: Soviet currently operational SSs; armed with nuclear torpedoes.

FRAS-1 rocket: Soviet currently operational tactical nuclear anti-submarine weapon fired from twin SUW-N-1 launchers, deployed on aircraft carriers and cruisers.

Fulton class submarine tenders: U.S. currently operational; service of attack submarines and their nuclear weapons.

Garcia class frigates: U.S. currently operational; armed with ASROCs.

Glover class frigates: U.S. currently operational; armed with ASROCs.

Golf class: Chinese currently operational SSB; used for training/testing, can be armed with CSS-N-3 SLBMs.

Golf II class submarines: Soviet currently operational SSB; armed with SS-N-5 SLBMs.

Golf III submarine: Soviet currently operational single-ship SSB class; armed with SS-N-8 SLBMs, nuclear torpedoes.

Golf V submarines: Soviet currently operational single-ship SSB class; armed with SS-N-20 SLBM, nuclear torpedoes.

Grisha I/III/IV/V classes guided missile frigates: Soviet currently operational; armed with nuclear torpedoes.

Han class submarines: Chinese currently operational non-nuclear-capable SSNs.

Hotel II class submarines: Soviet currently operational SSNs; armed with nuclear torpedoes.

Hotel III submarine: Soviet currently operational single-ship SSBN class; armed with SS-N-8 SLBMs, nuclear torpedoes.

Hunley class submarine tenders: U.S. currently operational; service of SSBNs and SLBMs.

Inflexible class submarines: French currently operational SSBNs; armed with M4A SLBMs.

Invincible class aircraft carriers: U.K. currently operational; stores nuclear strike and depth bombs for use by embarked airraft.

Iowa class battleships: U.S. currently operational; armed with Tomahawks.

Iwo Jima class amphibious assault ships: U.S. currently operational; logistical transport of Marine Corps nuclear weapons.

James Madison class submarines: U.S. currently operational SSBNs; armed with Poseidon C3 or Trident I C4 SLBMs.

John F. Kennedy aircraft carrier: U.S. currently operational single-ship class; can store B43, B57, and B61 nuclear bombs.

Juliett class submarines: Soviet currently operational SSGs; armed with SS-N-3a SLCMs, nuclear torpedoes.

Ka-25 Hormone A: Soviet currently operational ship-based ASW helicopter; armed with nuclear depth bombs.

Ka-27 Helix A: Soviet currently operational ship-based ASW helicopter; armed with nuclear depth bombs.

Kanin class guided missile destroyers: Soviet currently operational; armed with SA-N-1 SAMs, nuclear torpedoes.

Kara class guided missile cruisers: Soviet currently operational; armed with SA-N-3 SAMs, nuclear torpedoes; helicopters; probable nuclear depth bombs.

Kashin class guided missile destroyers: Soviet currently operational; armed with SA-N-1 SAMs, nuclear torpedoes.

Kashin converted class guided missile destroyers: Soviet currently operational; armed with nuclear torpedoes.

Kashin modified class guided missile destroyers: Soviet currently operational; armed with SA-N-1 SAMs, nuclear torpedoes.

Kiev class guided missile aircraft carriers: Soviet currently operational; armed with STOL aircraft and helicopters; possible nuclear bombs or nuclear depth bombs; SS-N-12 SLCMs, FRAS-1 ASW rockets, SA-N-3 SAMs, nuclear torpedoes.

Kilauea class ammunition ships: U.S. currently operational; logistical transport of nuclear weapons.

Kildin class guided missile destroyers: Soviet currently operational; armed with SS-N-1 SLCMs, nuclear torpedoes.

Kilo class submarines: Soviet currently operational SS; armed with nuclear torpedoes.

Kirov class nuclear-powered guided missile cruisers: Soviet currently operational; armed with SS-N-19 SLCMs, nuclear torpedoes, SA-N-6 SAMs; helicopters; possible nuclear depth bombs.

Kitty Hawk class aircraft carriers: U.S. currently operational; can store B43, B57, and B61 nuclear bombs.

Knox class frigates: U.S. currently operational; armed with ASROCs.

Kotlin class guided missile destroyers: Soviet currently operational; armed with nuclear torpedoes.

Kremlin class aircraft carriers: Soviet under construction; aircraft and possible nuclear bombs or nuclear depth bombs.

Kresta I class guided missile cruisers: Soviet currently operational; armed with SS-N-3b SLCMs, SA-N-1 SAMs, nuclear torpedoes.

Kresta II class guided missile cruisers: Soviet currently operational; armed with SA-N-3 SAMs, nuclear torpedoes; helicopter; probable nuclear depth bombs.

Krivak I class guided missile frigates: Soviet currently operational; armed with nuclear torpedoes.

Krivak II class guided missile frigates: Soviet currently operational; armed with nuclear torpedoes.

Kynda class guided missile cruisers: Soviet currently operational; armed with SS-N-3b SLCMs, SA-N-1 SAMs, nuclear torpedoes.

L.Y. Spear submarine tenders: U.S. currently operational; service of attack submarines and their nuclear weapons.

Lafayette class submarines: U.S. currently operational SSBNs; armed with Poseidon C3 SLBMs.

Lama class missile transport ships: Soviet currently operational; transports SLCMs for ships and submarines.

Leahy class cruisers: U.S. currently operational; armed with ASROCs and Terriers.

Lenin class nuclear-powered ice breaker: Soviet currently operational; nuclear powered ship.

Lipscomb submarine: U.S. currently operational single-ship SSN class; may carry SUBROCs.

Long Beach cruiser: U.S. currently operational single-ship nuclear-powered cruiser class; armed with ASROCs, Tomahawks, and Terriers.

Los Angeles class submarines: U.S. currently operational SSNs; may carry SUBROCs or Tomahawks.

Luza class special liquids tanker: Soviet currently operational; transports SLBM liquid fuel.

Lynx HAS.2/3: U.K. currently operational anti-submarine warfare helicopter; can deliver nuclear depth bombs.

M20: French currently operational SLBM deployed on SSBNs.

M4 (modified): French currently operational SLBM deployed on SSBNs.

M4A: French currently operational SLBM deployed on SSBNs.

M5: French future SLBM to be deployed on SSBNs.

Mail (Be-12): Soviet currently operational land-based maritime patrol and anti-submarine warfare aircraft; armed with nuclear depth bombs.

Malina class repair ships: Soviet currently operational; transports nuclear materials for support of nuclear reactors on ships and submarines.

May (Il-38): Soviet currently operational long-range land-based maritime patrol and anti-submarine warfare aircraft; armed with nuclear depth bombs.

Melitopol class missile transport ships: Soviet currently operational; transports missiles.

Midway class aircraft carriers: U.S. currently operational; can store B43, B57, and B61 nuclear bombs.

Mike submarine: Soviet currently operational single-ship SSN class; armed with nuclear torpedoes, and SS-N-15 and SS-N-16 ASW weapons.

Mod Kildin class guided missile destroyers: Soviet currently operational; armed with nuclear torpedoes.

Moskva class guided missile aviation cruisers: Soviet currently operational; armed with FRAS-1 ASW rockets, SA-N-3 SAMs; helicopters; possible nuclear depth bombs.

MP 6 class missile transport ships: Soviet currently operational; transports SS-N-5 SLBMs.

Nanuchka I class guided missile patrol combatants: Soviet currently operational; armed with SS-N-9 SLCM.

Nanuchka III class guided missile patrol combatants: Soviet currently operational; armed with SS-N-9 SLCM.

Narwhal submarine: U.S. currently operational single-ship SSN class; may carry SUBROCs.

New Generation submarines: French future SSBNs; to be armed with M4 or M5 SLBMs.

Newport class tank landing ships: U.S. currently operational; logistical transport of Marine Corps nuclear weapons.

Nimitz class aircraft carriers: U.S. currently operational; can store B43, B57, and B61 nuclear bombs.

Nimrod MR.2: U.K. currently operational maritime patrol aircraft; can deliver U.S. B57 nuclear depth bombs.

Nitro class ammunition ships: U.S. currently operational; logistical transport of nuclear weapons.

Norwalk class ballistic missile cargo supply ships: U.S. currently operational; logistical support of SLBMs and SSBNs.

November class submarines: Soviet currently operational SSNs; armed with nuclear torpedoes.

NR-1 submersible: U.S. currently operational non-nuclear-capable nuclear-powered research vessel.

Nuclear depth bombs: Soviet currently operational air-dropped nuclear depth bombs, delivered by Be-12 Mail, Tu-142 Bear F, and Il-38 May patrol planes, and Hormone A and Helix A helicopters (see B57 for U.S. equivalent).

Nuclear Depth/Strike bomb: U.S. under development nuclear gravity bomb, to replace B43, B57, and B61-2 and B61-5.

Nuclear torpedoes: Soviet currently operational nuclear weapon deployed on virtually all nuclear-capable Soviet surface ships and submarines, includes the Type 65 and ET-80 topedoes.

Ohio class submarines: U.S. currently operational SSBNs; armed with Trident I C4 missiles. Will receive Trident II D5 missiles starting in 1989.

Oscar class submarines: Soviet currently operational SSGNs; armed with SS-N-19 SLCM, SS-N-15 and SS-N-16 ASW weapons, nuclear torpedoes.

P-3 Orion: U.S. currently operational maritime patrol aircraft; can deliver B57 nuclear depth bombs.

Papa submarine: Soviet currently operational single-ship SSGN class; armed with SS-N-7 or SS-N-9 SLCMs, SS-N-15 nuclear depth bomb, nuclear torpedoes.

Permit class submarines: U.S. currently operational SSNs; may carry SUBROCs.

Polaris A3-TK: U.K. currently operational SLBM deployed on SSBNs.

Poseidon C3: U.S. currently operational SLBM deployed on SSBNs.

Poseidon submarines: U.S. currently operational SSBNs carrying either Poseidon C3 or Trident I C4 SLBMs; includes submarines of the Lafayette, James Madison and Benjamin Franklin classes.

Proteus submarine tender: U.S. currently operational single-ship class; service of attack submarines and their nuclear weapons.

Raleigh class amphibious transport docks: U.S. currently operational; logistical transport of Marine Corps nuclear weapons.

Redoutable class submarines: French currently operational SSBNs; armed with M20 or M4 (modified) SLBMs.

Resolution class submarines: U.K. currently operational SSBNs; armed with Polaris A3-TK Chevaline SLBMs.

Riga class guided missile frigates: Soviet currently operational; armed with nuclear torpedoes.

Romeo class submarines: Soviet currently operational SSs; armed with nuclear torpedoes and possibly with the SS-N-15 nuclear depth bomb.

Rubis class submarines: French currently operational non-nuclear-capable SSNs.

S-3A Viking: U.S. currently operational anti-submarine warfare aircraft; can deliver B57 nuclear depth bombs.

SA-N-1 Goa: Soviet currently operational surface-to-air missile, deployed on some destroyers and cruisers.

SA-N-3 Goblet: Soviet currently operational surface-to-air missile, deployed on some cruisers.

SA-N-6 Grumble: Soviet currently operational surface-to-air missile, deployed on some cruisers.

Sacramento class fast combat support ships: U.S. currently operational; logistical transport of nuclear weapons.

SAM: surface-to-air missile.

SAM Kotlin class guided missile destroyers: Soviet currently operational; armed with SA-N-1 SAMs, nuclear torpedoes.

Samuel Gompers class destroyer tenders: U.S. currently operational; logistical support of nuclear weapons and surface ships.

Sarancha class guided missile hydrofoil patrol combatant: Soviet currently operational; armed with SS-N-9 SLCM.

Sea Harrier FRS.1: U.K. currently operational light attack jet; can deliver WE-177 nuclear bombs.

Sea King HAS.5: U.K. currently operational anti-submarine warfare helicopter; can deliver nuclear depth bombs.

Sea Lance: U.S. future anti-submarine stand-off weapon; will replace the SUBROC on attack submarines; to be conventionally armed or possibly will have a nuclear warhead.

Seawolf submarines: U.S. future SSN class; to be armed with Tomahawk and Sea Lance missiles.

SH-3D/H Sea King: U.S. currently operational anti-submarine warfare helicopter; can deliver B57 nuclear depth bombs.

Sierra class submarines: Soviet currently operational SSNs; armed with nuclear torpedoes, and SS-N-15 and SS-N-16 ASW weapons; candidate for SS-N-21 SLCM.

Simon Lake class submarine tenders: U.S. currently operational; service of SSBNs and SLBMs.

Skate class submarines: U.S. currently operational non-nuclear-capable SSNs.

Skipjack class submarines: U.S. currently operational non-nuclear-capable SSNs.

Skoryy class guided missile destroyers: Soviet currently operational; armed with nuclear torpedoes.

Slava class guided missile cruiser: Soviet currently operational; armed with SS-N-12 SLCMs, nuclear torpedoes, SA-N-6 SAMs.

SLBM: submarine-launched ballistic missile.

SLCM: sea-launched cruise missile.

Sovremennyy class guided missile destroyers: Soviet currently operational; armed with SS-N-22 SLCMs, nuclear torpedoes.

Spruance class destroyers: U.S. currently operational; armed with ASROCs and Tomahawks.

SS-N-3a/c Shaddock: Soviet currently operational SLCM deployed on some SSG/Ns.

SS-N-3b Sepal: Soviet currently operational SLCM deployed on some cruisers.

SS-N-5 Sark: Soviet currently operational SLBM deployed on SSBs.

SS-N-6 Serb: Soviet currently operational SLBM deployed on SSBNs.

SS-N-7 Starbright: Soviet currently operational SLCM deployed on some SSGNs.

SS-N-8 Sawfly: Soviet currently operational SLBM deployed on SSB/Ns.

SS-N-9 Siren: Soviet currently operational SLCM deployed on some SSGNs and some patrol combatants.

SS-N-12 Sandbox: Soviet currently operational SLCM deployed on aircraft carriers, some cruisers, and some SSGNs.

SS-N-15 Starfish: Soviet currently operational rocket-propelled nuclear depth bomb (similar to U.S. SUBROC), deployed on some SSBNs, SSGNs, and SSNs, and may be on SSs.

SS-N-16 Stallion: Soviet currently operational rocket-propelled dual-capable tactical anti-submarine weapon, deployed on SSBNs, SSGNs, and SSNs.

SS-N-17 Snipe: Soviet currently operational SLBM deployed on a SSBN.

SS-N-18 Stingray: Soviet currently operational SLBM deployed on SSBNs.

SS-N-19 Shipwreck: Soviet currently operational SLCM deployed on cruisers and SSGNs.

SS-N-20 Sturgeon: Soviet currently operational SLBM deployed on SSBNs.

SS-N-21 Sampson: Soviet currently operational SLCM delployed on some SSNs.

SS-N-22 Sunburn: Soviet currently operational SLCM deployed on some destroyers and patrol combatants.

SS-N-23 Skiff: Soviet currently operational SLBM deployed on SSBNs.

SS-NX-24: Soviet future SLCM to be deployed on some SSGNs.

Sturgeon class submarines: U.S. currently operational SSNs; may carry SUBROCs or Tomahawks.

SUBROC: U.S. currently operational tactical nuclear-armed anti-submarine weapon deployed on some SSNs.

Super Etendard: French currently operational attack/fighter aircraft; can deliver the nuclear ASMP air-to-surface missile or ANT-52 nuclear bomb.

Suribachi class ammunition ships: U.S. currently operational; logistical transport of nuclear weapons.

Sverdlov class light cruisers: Soviet currently operational; armed with nuclear-capable artillery guns

Swiftsure class submarines: U.K. currently operational non-nuclear-capable SSNs.

Taimyr class nuclear-powered ice breakers: Soviet under construction; nuclear-powered ship.

Tango class submarines: Soviet currently operational SS; armed with nuclear torpedoes and possibly with SS-N-15 nuclear depth bomb.

Tarantul III class guided missile patrol combatants: Soviet currently operational; armed with SS-N-22 SLCM.

Tarawa class amphibious assault ships: U.S. currently operational; logistical transport of Marine Corps nuclear weapons.

Terrier: U.S. currently operational nuclear-armed tactical anti-air surface-to-air missile deployed on some cruisers and destroyers.

Thomaston class dock landing ships: U.S. currently operational; logistical transport of Marine Corps nuclear weapons.

APPENDIX H: Glossary of Nuclear-capable Ships and Aircraft, and Naval Nuclear Weapons

TLAM/N: Tomahawk Land-Attack Missile, Nuclear.

Tomahawk: U.S. currently operational SLCM deployed on some nuclear-powered attack submarines, battleships, cruisers, and destroyers; nuclear or conventionally armed.

Trafalgar class submarines: U.K. currently operational non-nuclear-capable SSNs.

Trident I C4: U.S. currently operational SLBM deployed on SSBNs.

Trident II D5: U.S. future SLBM to be deployed on Trident SSBNs. Also to be sold to the U.K. for deployment on U.K. SSBNs.

Trident submarines: U.S. currently operational SSBNs carrying Trident I C4 missiles, includes submarines of the James Madison, Benjamin Franklin, and Ohio classes. The Ohio submarines will receive Trident II D5 SLBMs starting in 1989.

Truxtun cruiser: U.S. currently operational single-ship nuclear-powered cruiser class; armed with ASROCs and Terriers.

Tullibee submarine: U.S. currently operational single-ship non-nuclear-capable SSN class.

Turya class guided missile patrol combatants: Soviet currently operational; armed with nuclear torpedoes.

Type 22 class frigates: U.K. currently operational; stores nuclear depth bombs for embarked helicopters.

Type 23 Duke class frigates: U.K. under construction; will store nuclear depth bombs for embarked helicopters.

Type 42 class destroyers: U.K. currently operational; stores nuclear depth bombs for embarked helicopters.

Type 65 torpedo: Soviet currently operational nuclear-armed torpedo.

Typhoon class submarines: Soviet currently operational SSBNs; armed with SS-N-20 SLBMs and could use SS-N-15 or SS-N-16 ASW weapons.

Udaloy class guided missile destroyers: Soviet currently operational; armed with ASW weapons, nuclear torpedoes; helicopters; possible nuclear depth bombs.

Ugra class submarine tenders: Soviet currently operational; nuclear transport, supports submarines.

Ural special liquid tanker: Soviet currently operational single-ship class; can transport nuclear waste.

Vala class special liquid tankers: Soviet currently operational; can transport nuclear waste.

Vega class ballistic missile cargo supply ships: U.S. currently operational; logistical support of SLBMs and SSBNs.

Valiant class submarines: U.K. currently operational non-nuclear-capable SSNs.

Vertical launch ASROC (VLA): U.S. future anti-submarine weapon to be deployed on vertical launch equipped ships; to be conventionally armed.

Vertical Launch System (VLS): For the U.S. navy VLSs consist of modular units containing rectangular (8x8) arrangements of 64 cells, 61 of which are for missiles and three of which are taken up by a support crane. The top is fitted flush with the deck of surface ships, with the rest of the VLS and their missiles extending vertically into ship. In addition to the standard 64 cell VLS, a "half-size" VLS of 32 cells (29 for missiles) will be deployed on the Arleigh Burke (DDG-51) class destroyers under construction. The U.S. Navy is outfitting 24 Spruance class destroyers, Ticonderoga class cruisers (hull numbers 52 and after), and all Burke class destroyers with VLSs. They can also fire non-nuclear Standard SM-2 surface-to-air missiles and will be able to fire vertical launch ASROCs.

Victor I class submarines: Soviet currently operational SSNs; armed with nuclear torpedoes and SS-N-15 nuclear depth bomb.

Victor II class submarines: Soviet currently operational SSNs; armed with nuclear torpedoes and, SS-N-15 and SS-N-16 ASW weapons.

Victor III class submarines: Soviet currently operational SSNs; armed with nuclear torpedoes and SS-N-16 ASW missile; candidate for SS-N-21 SLCM.

Virginia class cruisers: U.S. currently operational nuclear-powered cruiser class; armed with ASROCs and Tomahawks.

VLS: Vertical Launch System.

Wasp class amphibious assault ships: U.S. under construction; logistical transport of nuclear weapons.

WE-177: U.K. currently operational nuclear gravity bomb; can be delivered by Sea Harrier and RAF Buccaneer aircraft.

Whidbey Island class dock landing ships: U.S. currently operational; logistical transport of Marine Corps nuclear weapons.

Whiskey class submarines: Soviet currently operational SSs; armed with nuclear torpedoes.

Wichita class replenishment oilers: U.S. currently operational; logistical transport of nuclear weapons.

Xia class submarines: Chinese currently operational SSBNs; armed with CSS-N-3 SLBMs.

Yankee class cruise missile submarine: Soviet currently operational SSGN; converted Yankee SSBN; armed with SS-NX-24 SLCM.

Yankee class attack submarines: Soviet currently operational SSNs; converted Yankee SSBNs; armed with nuclear torpedoes; candidate for SS-N-21 SLCM.

Yankee I class submarines: Soviet currently operational SSBNs; armed with SS-N-6 SLBMs, nuclear torpedoes.

Yankee II submarine: Soviet currently operational single-ship SSBN class; armed with SS-N-17, nuclear torpedoes.

Yellowstone class destroyer tenders: U.S. currently operational; logistical support of nuclear weapons and surface ships.

Zulu class submarine: Soviet currently operational SS; armed with nuclear torpedoes.

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