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Basic Ship Types & Their Uses, Part 2

by

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Ships come in a large number of types predicated on their purpose. They come in small sizes of under 100 feet (32.8m), up to over 1400 feet (427m). In this brief course we will explain various ship types and their uses, what characteristics distinguish them, and how to recognize them when you see them. Part 2 covers military and various law enforcement vessels. Two of the distinguishing characteristics of the vessels shown in this course is that most of them are painted some shade of gray as camouflage, and they all have a large number painted near the bow and often a smaller copy near the stern. This makes them a bit harder to tell apart. The ships described here are:

Aircraft Carriers
Amphibious Assault Carriers
Amphibious Assault Ships
Battleships
Cruisers
Destroyers
Frigates
Littoral Combat Ships
Corvettes
Patrol Boats
Landing Craft

Basic Ship Types & Their Uses (Part 2)
A SunCam online continuing education course

Aircraft Carriers



Figure 1: Artist Rendering of HMS Queen Elizabeth II Carrier Strike Group of the British Royal Navy

A typical carrier strike group of Western fleets consists of an aircraft carrier, a cruiser, several destroyers, frigates, submarines, tanker and replenishment ships, and aircraft, which include various fighter and fighter-bomber jets, electronic surveillance aircraft, and unmanned aerial vehicles (UAV's). The U.S. Navy carrier strike groups are larger than the Royal Navy one shown above, as they have a much smaller navy than we do. The United States has 20 aircraft carriers, but 9 strike groups, any 1/3 of them at any time on patrol, with the rest either on the way to or from the groups on patrol or in the fleet base undergoing maintenance. U.S. Navy aircraft carriers are nuclear powered, and they are all on the Nimitz Class design. Only United States and France operate nuclear-powered aircraft carriers. The new replacement Gerald Ford Class is undergoing development work as I write this, several years overdue for full commission due to problems with multiple new technology battle support systems. As of late 2021, three more have been contracted, with 10 planned up to 2058. Also as of 2021, there are an estimated 45 aircraft carriers operated worldwide by France, Japan, Russia, China, Italy, India, Egypt, the United Kingdom, South Korea, Australia, Thailand, and Spain. Most of these countries operate 1 or 2 carriers, with some in reserve. China has purchased 4 retired aircraft carriers for study, built 1, and is projected to have 5 or 6 by the 2030's.

Not all aircraft carriers are large, angled-deck flattops like the U.S. versions. The U.S. invented the angled deck layout so that they can land 1 and launch 2 aircraft at the same time, which make for an extremely expensive ship; prior to this, all carriers had narrower, straight decks that launched planes at the forward end and the planes on the aft end one at a time. Most

Basic Ship Types & Their Uses (Part 2)
A SunCam online continuing education course

other aircraft carriers are either straight deck flattops, some with a short takeoff jet ski ramp at the forward end, or they are a combination of a cruiser with a flight deck to one side.



Figure 2: U.S.S. Eisenhower Taking on aircraft fuel from the fast replenishment ship USNS Arctic. The Eisenhower is one of 10 nuclear-powered aircraft carriers in the U.S. Navy



Figure 3: Russian Admiral Kuznetsov with ski-jump bow. This is an old Soviet-era ship that has a poor mechanical reliability record.



Basic Ship Types & Their Uses (Part 2)
 A SunCam online continuing education course



Figure 4: Soviet Era Kiev Class Aircraft Carrier/Cruiser, of which the Chinese now own three. Amphibious Assault Carriers

Amphibious Assault Carriers, unlike regular aircraft carriers, are more focused operations of transport and attack helicopters, F35B-type or Harrier vertical launch jets and MV-22B Osprey tilt-rotor propeller aircraft, and carry thousands of Marines, their landing craft, and vehicles to do amphibious assault from the sea of beaches and harbor installations. These ships are all straight-deck type vessels, similar to our WWII era aircraft carriers. The U.S. Navy has 2 classes of these, the LHA (Landing Helicopter Assault) Class, and LHD (Landing Helicopter Dock) Class. There are currently 11 LHA6 class ships planned, with 2 in commission, and 1 being built. The early LHA6 class ships will not have a well deck for landing craft, being more focused on air operations, but the later ships will carry LCAC hovercraft and LCU landing craft. All of the LHA6 class ships are gas-turbine powered, so that the same fuel for the aircraft can also be used to run the ship and the LCACs. There are currently 7 active Wasp Class LHD ships. These ships are an earlier design than the LHA6 class, but they are similar in purpose in that they support the same air and LCAC hovercraft operations. The LHDs however, are steam turbine powered.



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A SunCam online continuing education course



Figure 5: U.S.S. America, LHA 6



Figure 6: U.S.S. Wasp, LHD 1 in foreground, an amphibious assault ship in the left background.

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A SunCam online continuing education course



Figure 7: Stern view of Australian amphibious assault ship HMAS Adelaide. Note the large stern door, helicopter hangar, and landing craft entering the well deck,



Figure 8: LPD17 Class Amphibious Assault Ship

Amphibious Assault Ships (not carriers)

Amphibious Assault ships that are not aircraft carriers, as distinguished by their boxy superstructure, lack of a carrier-type flat top flight deck, a helicopter landing platform aft of the superstructure, and a large opening door at the stern to support landing craft operations. Examples like the LPD (Landing Platform Dock) ship shown above, go in closer to shore than the carriers do, and they carry the landing craft that are large enough to carry tanks, cargo trucks,



Basic Ship Types & Their Uses (Part 2)
A SunCam online continuing education course

and other large and heavy battlefield vehicles ashore. There are currently 26 planned vessels, with 11 completed so far and 2 being built. These replace all the older classes of this type in the U.S. Navy. Ships of this type can carry Expeditionary Fighting Vehicles (EFVs), LCAC hovercraft, and future shore delivery vehicles such as the Ship To Shore Connector (SSC) hovercraft being designed to replace the LCACs, which are near the end of their useful lives. I worked on the design of the LHA1 class and LCAC hovercraft in the 1980's so we are all getting pretty old! The masts and superstructure of these ships are designed for low radar signature, self-defense with surface to air missiles, Tomahawk land attack missiles, and extensive computer and battle management radio communications so that they can serve as an expeditionary force flagship.

Many foreign navies also operate amphibious assault ships. the French "Mistral" class, and Spain's "Juan Carlos I", and South Korea's ROKS "Dokdo" are all currently active, while Australia has two "Canberra" class ships based on the Juan Carlos design. China, Turkey, Italy, and Russia also operate these types of ships.

Another type of amphibious assault ship is an LSM (Landing Ship Medium), or LST (Landing Ship Tank). These ships are smaller than LPD and LHA/LHD types, and they have a bow door that opens at the beach to disembark tanks and other large vehicles.



Figure 9: A South Korean LSM at the beach.

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A SunCam online continuing education course



Figure 10: M48 tank drives ashore from a South Korean LSM

Battleships

Battleships are obsolete these days, having been soundly defeated by carrier-based aircraft and submarines during World War II. However, several are now museum ships, and they warrant mention as a former pinnacle of naval warships. These were the mightiest ships on the seas during the period of about 1890 to 1945. The purpose of battleships was always sea and shore bombardment with the largest guns ever put to sea. Japan built the two largest battleships in history, the “Yamato” and “Musashi”, and a third was converted to an aircraft carrier. The two former ships were sunk by aircraft, and third by a submarine.

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A SunCam online continuing education course



Figure 11: Battleships Yamato and Musashi in Truk Lagoon



Figure 12: Iowa Class battleship firing a salvo of (9) 16 inch and (6) 5” guns

The largest battleships built by the U.S. Navy were the four Iowa Class ships “Iowa”, “Missouri”, “New Jersey”, and “Wisconsin”, and all four are now museum ships. The New Jersey and Iowa were reactivated from long term storage in the early 1980’s for use in bombarding shore targets in the eastern Mediterranean Sea during the terrorist problems in Lebanon, but only saw limited duty, as it was determined that bombardment by cruisers was more

Basic Ship Types & Their Uses (Part 2)
A SunCam online continuing education course

cost effective. The United States and many other countries have preserved these types of ships as museums, with some as old as the Spanish American War in 1898 and HMS Warrior from 1860.



Figure 13: CG 47 Class Cruiser

Cruisers

Cruisers were originally a smaller class of battleship, in the 500-600 foot long range, and they were similarly used until the end of World War II. With the paramount advantage that aircraft showed in that conflict and the obsolescence of the battleship, the cruiser has become the largest combatant ship in the fleet and the primary purpose of the cruiser shifted to shore bombardment and fleet air defense. The CG 47 Class cruiser of the U.S. Navy is one such example. It is 567 feet long x 55 feet wide. Although it looks lightly armed, consists of (2) 5" guns with automated loading and superior fire control, 2 vertical launch missile magazines holding a mix of 122 missiles including Tomahawk land attack, 5 different anti-aircraft type, 1 anti-submarine type, and Harpoon anti-ship missiles, (2) 25mm guns, (2) Phalanx gatling guns, (2) 3x50 caliber machine guns, and (2) MK 32 triple torpedo tubes, plus (2) anti-submarine helicopters. The hexagonal plates on the forward and aft superstructures are fixed array radar antenna for the AEGIS radar system, which can detect 360 degrees around the ship at all times, 100 targets at 100 miles range, and can fire on 7 at once. The AEGIS system is also capable of anti-ballistic missile defense, and both the U.S. and Japan use the system in that role because of tensions with North Korea.

Cruisers are similar to guided missile destroyers, and they are classified as displacing more than 9750 long tons. The Ticonderoga Class is built on a Spruance Class Destroyer hull, and so are the Kidd Class, but some call the latter a cruiser because it has more sophisticated air



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A SunCam online continuing education course

defense than the Spruance destroyer had. As of 2020, on the United States, Russia's Slava Class, China's Type 055, and Taiwan's Kidd Class are the only cruisers operating. Again, I worked on the design and construction of the Ticonderoga (CG47) itself, which went for scrapping in September 2020, and the Kidd Class, so we're getting old!



Figure 14: Russian Moskva Class Guided Missile Cruiser. Note banks of anti-ship missiles

Destroyers

Destroyers are the jack-of-all-trades of the fleet. They do shore bombardment, anti-aircraft defense, extensive anti-submarine defense, amphibious assault support, rescue work, you name it. They typically have a tall bridge in the forward part of the ship.



Basic Ship Types & Their Uses (Part 2)
A SunCam online continuing education course



Figure 15 Arleigh Burke Class destroyer

The U.S. Navy Arleigh Burke Class is the current destroyer type being built. There are 89 planned to be built, with 68 in operation as of April 2020. They employ a slightly shorter hull than the CG47 at 505-509 feet, with a wider beam at 66 feet, for improved seakeeping and transverse stability. They also have the same AEGIS fixed array radar system and similar armament for fleet air, anti-ship, and anti-submarine protection, and will replace the CG47 cruisers in these duties as they are decommissioned later this decade. They employ stealth shaping of the superstructure for reduced radar detection, and a lower superstructure for improved transverse stability. The superstructure on these ships is steel rather than aluminum as in older vessels, due to lessons learned from metal fatigue experience and battle damage due to fires in the 1984 Falkland Islands war.

There are over 112 ships in various navies now using the AEGIS air defense system on their destroyers and frigates, with over 60 more planned, including the navies of the U.S., Australia, Canada, Japan, South Korea, Norway, and Spain.

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A SunCam online continuing education course



Figure 16: Canadian Guided Missile Destroyer. These are used for protecting larger ships, anti-aircraft defense, and land and sea attack.



Figure 17: Hobart Class Australian Destroyer



Basic Ship Types & Their Uses (Part 2)
A SunCam online continuing education course



Figure 18: Japanese Kongo Class Destroyer

Frigates

Frigates are smaller and more lightly armed than destroyers. These ships are in the 400-500 foot range in length, and about 60-65 feet wide. They are the outer ring of the carrier group in U.S. Navy strategy, like the pawns on a chessboard. The U.S. Navy has plans to build 20 of these ships (the Constellation Class) to replace the Littoral Combat Ships, which have had several problematical operational issues. The Constellation Class, in design, is 495 feet long x 65 feet wide. Their missions are to destroy other ships over the horizon, detect enemy submarines, defend convoy ships, employ active and passive electronic warfare systems, and to defend against swarming small boat attacks, as are attempted in the Persian Gulf. These are inexpensive ships compared to the others, and they are affordable by many smaller foreign navies who have minor naval and force projection issues compared to the big three navies.



Basic Ship Types & Their Uses (Part 2)
A SunCam online continuing education course



Figure 19: U.S. Navy FFG7 Class Frigate. These are no longer in service in the U.S., but several have been sold or given to various foreign navies such as Pakistan, Poland, Turkey, Egypt, and Bahrain. The others have been sunk as targets, scrapped, or decommissioned, awaiting disposal. The U.S.S. Stark, which was damaged by a bomb-laden watercraft in the Persian Gulf, was one of these.



Figure 20: Chinese Frigates in London on a goodwill tour.



Basic Ship Types & Their Uses (Part 2)
A SunCam online continuing education course

Littoral Combat Ships

Littoral Combat Ships are a class of two types of vessels, each built by a different shipyard, that have been a problematical testbed for many new technologies. They are comparable to Corvette type vessels in other navies. These are specifically U.S. Navy ships, and as with many attempts by the navy to develop useful shallow water vessels, these have been only marginally successful. The two types are a trimaran built by Austal Marine in Mobile, Alabama, and a monohull built by Fincantieri Marinette Marine in Sturgeon Bay, Wisconsin. Each has a mission to be “networked, agile, stealthy surface combatants capable of defeating anti-access and asymmetric threats in the littorals”, whatever that means. Each has the capabilities of a small attack transport, with a flight deck for two helicopters, a stern ramp for operating small boats, and the cargo volume and payload to deliver a small assault force with fighting vehicles to a roll on-roll off port facility. They are lightly armed with guns and air defense missiles and are equipped with autonomous air, surface, and underwater vehicles. The Navy was supposed to decide between the two for a build contract award, but they decided instead to build many of each.



Figure 21: U.S.S. Independence, LCS2



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A SunCam online continuing education course



Figure 22: U.S.S. Fort Worth, LCS3

Due to the aluminum metal fatigue problems of the trimaran, the gearbox connecting the engines in the monohull, and many reliability problems, the planned build number of 52 has been cut to 40. Furthermore, the first two of each LCS type are being decommissioned early and relabeled as training craft. For some reason the others have been upgraded to being called frigates, with plans to upgrade their survivability in a conflict, and a new, more combat-worthy and survivable frigate (the Constellation Class) is being designed and the first two have been contracted for. It looks like the Navy keeps throwing good money after bad to suit the politicians on these.

Corvettes

The Corvette is the smallest of warships, and they largely serve in foreign navies rather than ours. They typically measure between 180-420 feet long, making them smaller than frigates but larger than patrol boats. They are usually armed with medium- and small-caliber guns, surface-to-surface and surface-to-air missiles, and anti-submarine weapons. Many can accommodate a small or medium anti-submarine warfare helicopter. Countries that operate these are Argentina, Brazil, China, Bangladesh, India, Pakistan, the Philippines, Singapore, South Korea, Indonesia, Malaysia, Egypt, Bulgaria, Romania, Turkey, Israel, Italy, Iran, United Arab Emirates, Germany, Norway, Poland, Portugal, Russia, and Sweden.



Basic Ship Types & Their Uses (Part 2)
A SunCam online continuing education course



Figure 23: Russian Corvette



Figure 24: Bulgarian Navy Corvette



Basic Ship Types & Their Uses (Part 2)
A SunCam online continuing education course

Patrol Boats



Figure 25: U.S. Navy Cyclone Class Patrol Craft

Patrol craft are small, lightly armed vessels that function in both law enforcement duties such as anti-smuggling, and support of SEAL and other small assault teams on clandestine missions. They also escort cargo ships, have very limited anti-submarine capabilities, but may operate autonomous air, surface, and underwater vehicles. They generally are used for patrolling coastal areas, harbors, and other shallow-water areas.

The Cyclone Class is a group of 11 existing vessels built from 1992-1994, 10 of which are used by the U.S. Navy, and 1 by the Philippine Navy. These are 179 feet long x 25 feet wide. Like the trimaran LCS ships, they have been subject to metal fatigue issues and were only designed for a 15-year life, but as of 2015 several were still patrolling in the Persian Gulf.

Other navies around the world use patrol vessels for low intensity conflict areas, and there are hundreds if not thousands of them.



Basic Ship Types & Their Uses (Part 2)
A SunCam online continuing education course



Figure 26: Omani Patrol Vessel



Figure 27: Typical small Patrol Boats

Landing Craft

Landing craft are used all over the world to carry troops, equipment, vehicles, and supplies to the beach from larger ships offshore. Various types include LCV (Landing Craft Vehicle), LCM (Landing Craft Medium), LCU (Landing Craft Utility), LCAC (Landing Craft Air Cushion), SSC (Ship to Shore Connector, a successor to the LCAC). They vary in size from

Basic Ship Types & Their Uses (Part 2)
A SunCam online continuing education course

about 50-150 feet long. A standard flat bottom landing craft can deliver to about 15% of the world's beaches because they are limited by the beach slope; the hovercraft type can access about 70% of the world's beaches, and it can drive right up onto them rather than sit in the shallows like conventional craft. All landing craft have a bow ramp that drops down to allow troops, tanks, and vehicles to get off on the beach. They all usually have light armament like a couple of heavy machine guns for defense, and some are capable of mounting other weapons like grenade launchers and 20mm cannons.



Figure 28: Typical Landing Craft carrying troops.



Figure 29: LCU2000 Class Landing Craft



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Figure 30: U.S. Navy LCAC Hovercraft

Submarines

Submarines are a special type of submersible ship that is primarily used for warfare, but also for exploration of the oceans and passenger excursions. The first submarines were war machines, and they started as one-man vessels such as the “Turtle”, evolving in the 19th century to multi-manned, human-powered vessels such as the Confederate “C.L. Hunley”, then to gasoline and diesel, then atomic-powered vessels and air-independent diesel and Stirling engine-powered subs we have today. Military submarines are used for many types of missions where stealth and invisibility are need most: sinking other submarines and ships, landing spies, SEAL teams, and assault troops on enemy shores, undersea salvage and sabotage, reconnaissance, lifesaving of downed fliers and sailors, land attack with missiles. The submarines that do this are known as “Fast Attack Subs”. The submarines whose sole mission is to provide a first or a second -strike nuclear missile attack are called Ballistic Missile Subs or “boomers”. These military submarines can be as large as over 500 feet (152m) long, larger than almost any ship that participated in World War II except the aircraft carriers and battleships. Up until the advent of nuclear propulsion, submarines were always required to surface regularly to charge the batteries and clear the breathing air in the hull. However, with nuclear propulsion, they often do 90+ day patrols entirely underwater, and only come in when they run out of food! The diesel-electric subs are sometimes painted gray above the waterline because of the time they had to spent on the surface charging batteries; the modern subs are usually painted black because it makes them harder to see from aircraft while constantly submerged..

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Figure 31: WWII Era Attack Submarine



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Figure 32: a Russian “Kilo” diesel Attack submarine. These are very silent on battery power and are almost undetectable.



Figure 33: Model of a French Nuclear Ballistic Missile Submarine. Note the nozzle around the propeller.



Figure 34: American Ohio Class Ballistic Missile Submarine. This is our current class of ballistic missile submarines. Each sub carries 24 MIRV nuclear missiles with up to 8 independently targetable warheads on each missile, although only 4 are carried per the SALT Treaty. The first four Ohio Class subs were converted to carrying 154 land attack missiles, 7 in a missile tube, plus torpedoes as part of the warhead reductions agreed to in the SALT Treaty. A new replacement, the Columbia Class, is currently in design



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Figure 35: Russian Typhoon Class Ballistic Missile Submarine. Only one of these is still in operation, and a replacement class is now being designed. This has a side-by-side double pressure hull design which makes her very difficult to sink and provides luxurious living space for the crew; it even includes a sauna with sunlamps!



Figure 36: American Virginia Class Fast Attack Submarine. This is our current class of Fast Attack submarines that are being built.



Basic Ship Types & Their Uses (Part 2)
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Figure 37: Los Angeles Class Fast Attack Submarine. This has been the main class of attack subs since the 1990's.

Russian and American submarines are fundamentally different in design. The Russian subs have a sail structure (the part with the fins on it above) that is faired into the deck edges, and so do the British. Our subs have a teardrop-section cylinder for a sail, which is not as hydrodynamically efficient as a faired one, but it allows deck space to walk around the sail when the sub is surfaced. The Russian subs also have a higher reserve stability after damage than ours, because they have double hulls along almost their full length, whereas ours have a single skin pressure hull on the outside for about 5/8 the length of the sub in the middle, with the ballast tanks forward and aft in the doubled parts. Our nuclear reactors are much safer than the Russian ones, however because we weld the tops on instead of having gaskets and an opening lid, which has failed to seal the reactor in several Russian accidents. Our subs also have more and better lead radiation shielding, and an all-volunteer crew instead of draftees like in the Russian Navy. The British, however, are widely reputed to be the best submariners in the world, and our senior officers under command training in their subs on a regular basis.