hidden assets
evolution of the submarine
submarines in australia
collins class project
collins class submarines
submarine construction
role of submarines
relative complexity of submarines
submarines of the future
While it is widely considered that William Borne designed the first submarine in 1578, it was Leonardo da Vinci (1452-1519) who initially developed the idea of a military vessel that could submerge under water to attack enemy ships. However, it wasn’t until 1776 that the first submarine to make an attack on an enemy ship was built. Named the Turtle, it was designed by David Bushnell and was built with the intention of breaking the British naval blockade in New York Harbor during the American Revolution. Operated by Sergeant Ezra Lee, the Turtle made an unsuccessful attack on a British ship on 7 September 1776.

Several more submarines were attempted over the years, but it wasn’t until the beginning of the 20th century that modern day submarine warfare was born. At the start of World War I, submarines were still in their infancy. Considered to be ‘unethical’ and not fitting into the conventional rules of war, few foresaw the watershed in naval warfare that submarines were to bring about. Once their true capabilities were realised, submarines had a substantial impact on World War I: sinking ships, laying mines, blockading ports and providing escorts to trans-Atlantic convoys.

During World War II, submarine technology advanced significantly. The Germans, who were operating U-boats in the Atlantic Ocean, developed the ‘snorkel’ (allowing the boat to recharge its batteries while staying submerged). The Japanese were the first nation to utilise the ‘midget subs’, most famously when they launched their attack on Pearl Harbor (in the Pacific Ocean) in 1941. These submarines were also used to attack shipping in Sydney Harbour on 31 May 1942.
With the end of the Cold War, far fewer submarines were commissioned. In 2000, 47 nations were operating more than 700 submarines — over 300 of which were nuclear-powered.

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During the first Gulf War submarines were used to launch a number of Tomahawk missile attacks, but during the second Gulf War the United States deployed far more submarines with greater capabilities. These were heavily involved in strike missions.

The United States continued to build more advanced submarines, able to operate weapons in any sea conditions: from under arctic ice to operating in shallow water.

In 2004, the United States commissioned the first Virginia Class attack submarine, designed specifically for littoral and estuarine waters. This submarine does not have a periscope, but instead uses a high resolution digital camera. It is also capable of going to great depths, getting in close to the shore in shallow water and launching unmanned submarines. All of these advancements have been designed with the added intention of fighting terrorism.

From 1945 to 1991, the Cold War dictated much of the advancement in military capabilities. Many features of the German U-Boats were incorporated into future designs of the allied forces. When the United States launched the first nuclear powered boat in 1955 (USS Nautilus), the submarine was transformed from a surface ship that could submerge briefly, to a fully underwater vessel which could stay submerged for extended periods of time.

During the Cold War, the United States’ strategy relied heavily on its ability to control the seas. Apart from performing traditional roles, submarines were also capable of launching ballistic missiles should the need arise. The United States was more dominant in this underwater strategy than Russia, which proved vital in deterring the nuclear war that had been a constant threat for more than 40 years.

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The first Australian submarines, the AE1 and the AE2, were commissioned into the Royal Australian Navy in 1914. They were deployed during World War I, but both were lost during combat. The fate of the AE1 has never been determined. The AE2 was the first submarine to break through the Turkish defences before sustaining irreparable damage and sinking on 30 April 1915.

In 1919, six J Class submarines were commissioned into the Royal Australian Navy. The second-hand boats, received from the Royal Navy, were in such bad condition they were immediately placed into refit on reaching Sydney. Even after extensive work, the boats spent very little time in the water and, except for J7, all were decommissioned in 1924.

Under the Royal Australian Navy’s post World War I development program, two submarines – HMAS Otway and HMAS Oxley – were ordered from the Royal Navy. They arrived in Sydney in 1929, but due to maintenance problems and the depressed economy they were returned to Britain in 1931.

During World War II, the Royal Australian Navy obtained the ex-Dutch submarine K9, which was used for training surface ships in submarine detection.

It wasn’t until four initial Oberon Class submarines were commissioned that Australia began to build a strong submarine fleet. While the Obersons were not involved in any conflict while in service, their presence was invaluable to the Royal Australian Navy. They were built by Scotts Shipbuilding at Greenock in Scotland with the first of the boats, HMAS Oxley, commissioned in March 1967. This was followed by HMAS Otway, in March 1968; HMAS Ovens, in April 1969; and HMAS Onslow, December 1969. Oxley’s arrival in Sydney coincided with the commissioning of the submarine base HMAS Platypus, at Neutral Bay, Sydney. In 1977 and 1978 two more submarines were commissioned, HMAS Orion and HMAS Obina.
The Collins Class project was established by the Royal Australian Navy in 1982. The new design was required to meet the unique needs of the Navy, which were dictated by, among other things, Australia’s geographic location. The submarines would be required to travel great distances, operate in varying environments, have state-of-the-art weapons systems, and perform traditional submarine functions using the most advanced technology available. The submarines would also be required to protect Australia through their very existence, acting as a deterrent to any enemy forces.

It was decided that large conventional submarines would be acquired. The Collins Class is the second largest non-nuclear powered submarine in the world.

In 1987, the newly formed Australian Submarine Corporation (ASC) began the task of designing and building the most sophisticated, conventional submarine in the world. ASC began construction of the first Collins Class submarine in 1990 and delivered it in 1996. The sixth and final boat was delivered to the Royal Australian Navy in 2003.
The names of the Collins Class submarines commemorate the memory of six members of the Royal Australian Navy who served their country with distinction: Vice-Admiral Sir John Collins KBE CB RAN, Rear-Admiral Harold Bruce Farncomb CB DSO MD RAN, Captain Hector McDonald Lewis Water DSO RAN, Captain Emile Frank Verhaeux DSO RAN, Ordinary Seaman Edward Sheean and Lieutenant Commander Robert “Oscar” Rankin RAN. The latter four died while serving their country during World War II.

Due to the high level of skills required to build and maintain such complex military systems, ASC employs over 250 engineering and technical specialists from all over the world, covering a broad range of technical disciplines.

In 2003, ASC was awarded the 25 year, $3.5 billion Through-Life Support contract, for maintenance and enhancement of the Collins Class over their lifespan.

ASC is formally recognised as the design authority for the Collins Class.
The Collins Class has a diameter of approximately 8 metres with a displacement of 3,000 tonnes. They are designed to be as near noiseless as advanced technology can achieve. The control and monitoring of shipboard functions are handled by the ship-wide integrated ship control, management and monitoring system. The system uses special and general purpose processors linked by two sets of redundant serial data buses. In addition, the system provides a high level of automation, thus allowing the crew size to be significantly smaller than other conventional submarines.

The Collins Class’ manoeuvrability functions include four aft control surfaces individually actuated to provide superior manoeuvrability and inherent redundancy. The submarines are deep diving and can travel at speeds greater than 20 knots (submerged) and 10 knots (surfaced).

The submarines have six forward torpedo tubes and are able to carry up to 22 torpedoes or anti-ship missiles, or up to 44 mines in place of torpedoes. They are also able to employ sophisticated countermeasures which provide automatic detection, direction finding and identification of radar signals. The Collins Class has some of the most technologically advanced sonar systems, decoy methods and radars.

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**Specifications**

- **Length:** 78 metres
- **Diameter:** 8 metres
- **Displacement:** 3,000 tonnes
- **Propulsion:** Diesel-electric
- **Crew:** 42, including 6 officers and 36 submariners
- **Weapons:** Mk48 torpedoes and sub-harpoon missiles

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**Features**

- Diesel-electric propulsion
- High-capability batteries, long range and high endurance
- High performance hull form, automated controls and exceptional manoeuvrability
- High shock resistance, optimal noise suppression and low magnetic signature
- State-of-the-art combat system
- Efficient weapons handling and discharge systems

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The Collins Class project required specification, integration and installation of equipment and material from over 150 major contractors and hundreds of smaller suppliers. Most modules of the submarines were constructed off-site and then shipped to ASC for integration.

Key parameters for equipment included electrical power, cooling, noise, shock resistance, weight and electromagnetic characteristics, all under rigorous configuration management as data was distributed between the various suppliers during the design phase.

A completed submarine is a system of systems. A Collins Class submarine contains 108 integrated systems which are linked structurally, mechanically, electrically, hydraulically, pneumatically and electronically. All of these systems need power and cooling, and many need to communicate with each other in order to achieve full operational capability.

submarine outfitting statistics

- Piping: 23,500 metres
- Major cable lengths: 7,000 metres
- Cable connections: 200,000
- Cable: 75,000 metres
- Batteries: 400 tonnes
Submarines are the least visible of all military assets. While this makes them highly secretive in nature, it also makes them highly valuable. They provide several different functions to navies, many of which affect other military operations.

Designed to be virtually undetectable, submarines are able to patrol the world’s oceans - even in hostile territory. This allows them to gather intelligence, undertake surveillance and carry out reconnaissance missions. They are able to monitor the air, land and sea (both above the surface and below). Submarines act as force multipliers; forcing foreign military to launch several vessels in response to even the threat of a single submarine.

During times of war, submarines are crucial in controlling the seas. They detect and destroy hostile submarines and surface ships, blockade foreign ports and restrict ocean transport. They provide intelligence and underwater protection for surface ships and are able to detect and lay mines more efficiently than any other navy vessel. Submarines provide a means to land Special Forces in hostile regions and, if fitted with suitable weapons, are able to strike land targets.

While most commonly known for the role they play in navies, submarines are also used for a variety of functions in the private sector. The most common are scientific submarines, which explore the world’s oceans to further research and to locate sunken ships. Submarines can also be used for tourism, while unmanned submarines (which are very small and operated remotely from the surface) are used to perform work which is too deep or too dangerous for divers, such as on an oil rig.
The Collins Class submarines are the most complex military vessel built in Australia to date. The submarines are ten times more complicated than a frigate, even though both are approximately 3,000 tonnes displacement. Over 33,000 drawings and 5000 work orders were produced before the build process began, and once work started, each submarine took 2.5 million hours to assemble.
Submarine technology is constantly evolving. Future advancements will allow submarines of tomorrow to be far more efficient and effective warships. While designers are looking at ways to improve current models, entirely new concepts are also being developed.

One of these concepts is a miniature submarine which is remotely operated and equipped with sensors such as the periscope and sonar system. This miniature submarine will feed information back to the ‘mothership’, which can remain a safe distance away.

Other ideas include: ways to accommodate for a greater variety of weapons, sonar systems that allow the submarine to be further away from its target, and air-independent propulsion, which will allow submarines to stay submerged for weeks at a time. Improvements to hull strength are also being researched in order to develop a design that can withstand a direct hit from today’s conventional weapons.
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