## Torpedoes

The Collins Class can discharge Mk48 torpedoes. The torpedoes are six metres in length and weigh about two tonnes. In a submarine, the torpedo is first loaded in a torpedo tube, then prepared for launch and fed target data from the combat system. Once the torpedo is discharged from the submarine, an engine on board the torpedo activates and provides its own propulsion. The combat system onboard the submarine guides the torpedo via an electrical guidance wire. When the torpedo reaches the desired point beneath the target vessel an explosive charge within the torpedo is detonated.

The Collins Class submarines are currently undergoing upgrades to receive heavyweight torpedo and replacement combat system capabilities.

HMAS *Waller* is the first submarine in the world to successfully fire the new Mk48 Mod 7 heavyweight torpedo, sinking a decommissioned warship off the coast of Hawaii during a military exercise.

*The six torpedo tubes can easily be seen on the front of HMAS Rankin.*

## Submariner training

ASC provides training services to submariners at the Submarine Training Systems Centre at HMAS *Stirling* in Western Australia.

By working closely with the Royal Australian Navy, ASC ensures submariners have the high level skills required to work on and operate a Collins Class submarine.

But trainee submariners don't just sit in a classroom. Simulators are used to replicate the duties they would carry out while at sea.

During a 12 month period, ASC will typically train 85-100 trainee submariners, provide operational training for submarine crews, and provide Collins Class familiarisation training for Defence and ASC personnel.

## Life on board a submarine

The crew of a Collins Class submarine work on six hour shifts. This means that they work for six hours, have six hours off and then go back to work. When they are off duty, crew members are able to sleep or just relax. The crew sleeps in three tiered bunks, two bunks per cabin (six beds). The senior crew (officers, senior sailors) have separate areas to the junior sailors. Officers and senior sailors' accommodation, wardroom and mess are located on the upper platform. The junior sailors' accommodation, mess area (with built in entertainment system), showers and cabins are located in the accommodation area on the lower platform.

The crew eat everyday food and the galley (kitchen) provides food to all messes (food halls). The crew's mess is located adjacent to the galley on the lower platform.

## How do I become a submariner?

Submariners are part of the elite arm of the Royal Australian Navy (RAN). It is now possible to apply for direct entry to the submarine service.

New recruits attend the RAN Submarine Training Systems Centre in Western Australia. Here they are rigorously tested for endurance, capability and the ability to cope with the living conditions of a submarine.

Being a submariner is demanding and you will be pushed to your limits but it is a rewarding career.

As a qualified submariner your annual wage will be made up of a base salary plus allowances. Retention bonuses may also be offered to encourage you to stay in the submarine force.

You can learn more at www.defencejobs.gov.au/submariners

# On board a submarine

ASC

www.asc.com.au

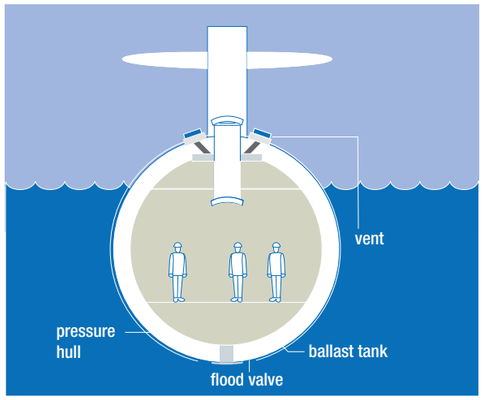
## How do submarines work?

Ships are able to float on the surface of the ocean because the weight of the water they displace (push out of the way) is equal to the weight of the ship. This means that if a ship weighs 3000 tonnes, then it will push 3000 tonnes of water out of the way. This creates a force (buoyant force) that acts against gravity and keeps the ship afloat.

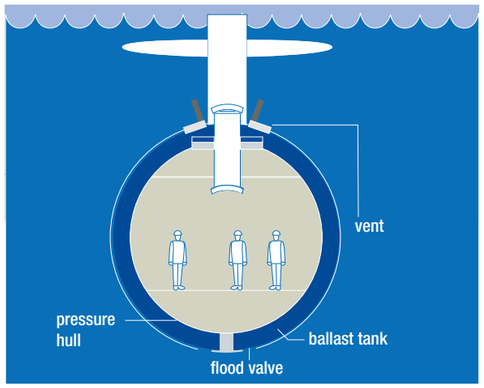
Submarines are able to control how they float with special tanks called ballast tanks. It's like when you have a ball in the swimming pool and you try to keep it underwater, it always wants to rise to the surface. But if you put a hole in it so it can fill with water, the ball will sink. It's the same with ballast tanks.

To dive, the ballast tanks are opened and flooded with seawater. This reduces the submarine's buoyancy and it sinks. The captain uses pumps to make the submarine neutrally buoyant and once the submarine is at the right depth, the captain uses control surfaces (which are a bit like plane wings) to control the direction the submarine is travelling in.

To surface, compressed air is pumped into the ballast tanks, which forces the water out, allowing the submarine to once again become more buoyant. In an emergency, the ballast tanks can be filled very quickly with air to bring the submarine to the surface far more rapidly than normal.




*This simplified diagram shows a submarine's ballast tanks filled with air, allowing it to float on the surface. Not all submarines have ballast tanks around the hull. The Collins Class, for example, has ballast tanks located inside the hull.*




*In this diagram, the ballast tanks are filled with water, allowing the submarine to submerge.*

## Batteries

Submarines either have nuclear power or batteries as their main power source. Non-nuclear submarines are propelled by electric power, which is stored in huge batteries. Like any battery, once it runs out of power it needs to be recharged. Non-nuclear submarines use diesel engines to recharge the batteries.

On diesel submarines, like the Collins Class, batteries are recharged by running the diesel engine. The engine requires oxygen and fuel to run, so the submarine comes up almost to the surface and raises a snorkel mast. This allows the submarine to take in air, while staying under the surface, just as you can when you snorkel in a pool or at the beach. Nuclear submarines are able to stay submerged for much longer than diesel submarines, because nuclear reactors do not need oxygen or fuel to create power.

## Sonar

When travelling under water, submarines use a sonar (sound navigation and ranging) device to listen to what is going on in the water. Sonar devices listen to sound waves which travel through the water and bounce off objects. In a submarine, an active sonar sends out a 'ping' sound, which bounces off the object and allows the onboard computers to determine how far away the object is.