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Submarine development in the 20th century

an address to the Institute on 28 June 2011 by
Rear Admiral Chris Wood, CB, RN (Ret'd)



Admiral Wood explains the evolution of British and Australian submarines during the 20th century.

Key words: submarines; 20th century evolution; Australia; Britain, Germany.

Britain and Australia have been involved in the submarine business since it all began in 1901 and my purpose is to trace the development of their participation in underwater warfare during the last century.

To put things into perspective, though, we need to go back several centuries during which quite a few embryo scientists and engineers tried their hand at designing a vessel that could dive and re-surface after attacking enemy sailing ships in harbour. Their efforts frequently met with disaster, but many lessons were learnt in the process, especially during the North American conflicts of the 17th and 18th centuries. Much later, in 1879, an English country parson called George Garrett produced a 30-ton beast, which he named *Resurgam*. His design included one of the first examples of what became known as a conning tower. Unfortunately, *Resurgam* foundered under tow and sank, but she had achieved submerged propulsion for 4 hours at 2-3 knots using a semi-closed-cycle steam engine. So the race was on for a credible and controllable design.

Holland Submarines

An intrepid Irish-American inventor, John Philip Holland, came up with a workable submarine solution. By 1895, Holland was confident enough to tender his design for consideration by a number of navies that were interested in underwater warfare. The Americans, in particular, became convinced of the need. But he met outright opposition in London from some members of the Admiralty Board. One senior admiral sourly stated that it was not an occupation for 'gentlemen', and went on to suggest that, in wartime, the crews of captured submarines should be treated as pirates and hanged!

So Mr Holland went back to America where he developed his design to an advanced and very successful degree. The Holland-class submarine emerged and was chosen in 1900 by the British (who ordered five) and American governments to be their first true submersible warship. Her vital statistics were: length 54 feet; beam 10 feet; surface displacement 64 tons; and a crew of 7. Her power for propulsion and battery re-charging was provided by a 45 horse-power petrol engine, giving about 8 knots on the surface, and a 50 horse-power electric motor, which drove her at up to 5 knots dived. Her armament was a single, pre-loaded, 18-inch diameter torpedo tube, with two reload torpedoes behind – stowed internally up forward. Her maximum safe diving depth was

100 feet, beyond which it was calculated that her pressure hull would collapse.

Conditions on board were dire once the hatch was shut. The Holland was almost impossibly cramped; much of the machinery was inaccessible; there was virtually no stowage space for personal gear or belongings; there were no toilet facilities, apart from a bucket up forward; petrol and chlorine fumes, coupled with severely reduced oxygen, led to foul atmospheric conditions and sickness; and there was a constant, serious threat of a petrol explosion. There were no proper lookout facilities. Crude control mechanisms frequently resulted in involuntary porpoising, leading to either inadvertent surfacing or dangerous depth excursions. It is a wonder that they attracted any volunteers at all, but they did, apparently without much difficulty.

British Submarines of Classes A to V

The five Holland boats were replaced alphabetically by the A, B and C classes, each of six to eight boats, and each class progressively larger than its predecessor. They were gradually fitted with two or more torpedo tubes, but they were all still powered by dangerous petrol engines. The first A boat in 1904 looked more like a self-propelled surfboard than a 70-foot hull containing 10 or more souls beneath the surface. Tragically, she succumbed to an internal explosion, a fate which overtook several others in those early years.

It was not until the D class of 1909 that diesel fuel (less volatile and much safer) was introduced, along with external ballast tanks and many other safety and control innovations. Meanwhile, in other countries such as France and Germany, new and more effective submarine designs were also being developed. In 1906, the German government ordered 'Unterseeboot Eins' (U Boat No. 1) whose successors were to bring Britain almost to its knees in the latter stages of World War I by devastating its merchant marine trade. Britain herself had 55 submarines in service when the Great War started in 1914 – mostly of the C and D classes. But already in early production were the famous E class of which 57 were to be built during that war.

In 1913, *AE1* became the very first Australian submarine to be commissioned. She and her sister submarine, *AE2*, were the only two built specifically for the Royal Australian Navy (RAN) at that time. They were part-Royal Navy and part-RAN manned and they sailed, with

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