Canada and Modern Submarines

Peter T. Haydon

Submarines have always been highly controversial in Canada. From politicians, to bureaucrats, to special interest groups, and within the navy itself, the submarine has its opponents and advocates. Opposition derives mainly from two schools of belief: first, that the navy doesn't need them to do its job; and second, that the inherent stealth of submarines is not compatible with the non-offensive Canadian way of using the military. Left over false images of German U-boats and Cold War nuclear submarine cat and mouse games still cloud many minds. Advocates obviously accept the inclusion of modern submarines in the Canadian fleet in both practice and theory. That said, and historical arguments put aside because they distort the present argument, the real difference between the two schools of thought comes down to the level of understanding of modern submarine capabilities and the associated technology.

The 21st Century Submarine

Modern submarines – those designed and built in the 21st century and incorporating the latest technology – are as technologically sophisticated as a spacecraft. Some older technology may be included especially where it is still as good as anything else on the market, but it is the way in which individual systems are integrated into the complete system, a system of systems if you prefer, that establishes a submarine's degree of modernity.

The propulsion and power generation capacity of modern submarines creates two distinct types: nuclear-powered and non-nuclear-powered. A non-nuclear-powered submarine can have operational systems as modern as a nuclear-powered submarine but lacks the endurance, speed and versatility. At one time we talked about 'conventional' submarines, meaning that they relied on a diesel-electric system for propulsion and power generation; with recent advances in air-independent propulsion (AIP) and battery technology, the concept of 'conventional' is meaningless.

The basic operational characteristics of modern submarines are endurance, stealth, freedom of movement and versatility. Packaged together these characteristics provide strategic and operational superiority at sea in both close and distant defence against attack. Those characteristics also give submarines the edge in sea control and power projection operations, as well as in intelligence gathering especially with the use of unmanned underwater vehicles (UUVs).

I'll use four examples of non-nuclear submarines currently in production to help explain the technological advances that have been made in recent years. And discuss two modern nuclear-powered submarines to give an overview of those very different platforms.

The German Type 212A submarine has acquired a reputation as one of the most modern non-nuclear submarines in the world. It displaces about 1,800 metric tonnes and the design is under constant improvement as new technologies are incorporated.

Credit: Björn Wilke/ German Navy

Germany's new Type 212 U-boat U35 (S185) undergoing tests and trials.

U-36 has just been commissioned and will be followed by two nearly identical sister ships. They will also be equipped with the HDW air-independent fuel cell propulsion system which has already given excellent results in operations with the submarines of the first batch. U-32 showed this in April 2013 when on the way to participate in naval exercises in the United States it produced a new record for non-nuclear submarines with an 18-day submerged transit without snorkeling.

Changes planned for the next (second) batch include:

- a network-centric warfare compatible communications system;
- an integrated command, sensor and weapons control system;
- modern sonar arrays;
- replacement of one periscope by an optronics mast (i.e., a telescopic mast supporting several digital optical/ electronic devices in lieu of a traditional periscope);
- an antenna buoy to enable communication from deep;
- a lock system to allow swimmers (i.e., Special Operations Forces) to exit and re-enter the submarine while dived; and
- habitability changes to enable worldwide operations.

The cost for a new Type 212A is thought to be about US$600M which seems fairly standard for European-built, modern submarines.

Also with a surface displacement of about 1,800 metric tonnes, the Swedish A-26 is intended primarily for littoral operations, although it is also able to conduct open ocean patrols. In addition to standard torpedo tubes, it has a 6 x 1.5 metre multi-mission lock system that makes it easy for swimmers to enter and exit the submarine, and is also large enough to allow the launch and retrieval of UUVs, which are expected

to play a larger role in future submarine operations especially in surveillance. The A-26 is equipped with a Kockums Stirling AIP system that allows it to remain underwater for up to 18 days at relatively slow speeds. Cost data for the A-26 are not available.

The Japanese *Soryu*-class submarines are diesel-electric submarines that entered service with the Japan Maritime Self-Defense Force in 2009. At 2,900 metric tonnes surface displacement the *Soryu*-class submarines are the largest built in post-war Japan and are Japan's first AIP submarines, using a system based on Kockums Stirling engines built by Kawasaki Heavy Industries. At roughly $US540M each, they are large, expensive submarines able to fire torpedoes and Harpoon missiles. The last submarines in the class (the 11th and 12th) will have greater underwater endurance through the use of lithium-ion batteries.

Variants of the French *Scorpene*-class of diesel-electric submarines, displacing around 1,600 metric tonnes are able to fire torpedoes and Exocet missiles, and lay mines. They are also in use in India, Brazil, Malaysia and Chile, with Poland showing interest. Some of the later Indian-built version of the submarine will be fitted with AIP. Like its counterparts in other navies, *Scorpene* is proving to be a versatile submarine hull into which modern technologies can be installed.

The *Virginia*- and *Astute*-classes of nuclear-powered submarines epitomize the modern submarine by having virtually unlimited range and endurance with high underwater speed. They are limited only by their weapon load and the need for fresh food. The British *Astute*-class at 7,400 tonnes is slightly smaller than its American counterpart but both submarines are able to fire torpedoes and cruise missiles. Of the two, the *Virginia*-class is more technologically sophisticated, using a propulsor (pump jet) instead of a multi-bladed propeller and fitted with a fly-by-wire ship control system. At UK£1.5B ($US2.16B) each, *Astute*-class submarines are very expensive, partly due to cost overruns and unforeseen expenses. The numerically larger *Virginia*-class will cost about US$1.5B per submarine.

I have not included either Russian or Chinese submarine development in the discussion because it is difficult to obtain reliable information. Even though ambitious building programs for a new Russian submarine fleet were announced recently, a lot of scepticism exists over Russia's ability to complete the building programs due to lack of money and materials.

A Modern Submarine for Canada

A discussion on the need for modern submarines for Canada cannot be based on technology and what that technology can do for national security despite the fact that technology is a major factor in the equation. As we saw in 1987-89 discussions about submarines, regardless of the logic of acquiring submarines, political issues invariably determine the final outcome. This is unfortunate. We live in a complex era where threats to national security are diverse and largely unpredictable. To avoid being caught unprepared, Canada needs to begin moving to a position where national security decisions are made outside the fog of partisan politics or the mandate of a specific government. That said, the question still remains, why does Canada need submarines?

Here, some simple facts to frame the answer to that question:

- Despite fiscal problems, Canada is an economic and moral world leader and, as such, Canada has an obligation to help maintain order in the world.
- That obligation requires, if not demands, that Canada share the burden of maintaining order in the world including the use of force when necessary.
- Idealistic notions of trying to share the burden through peacekeeping and the provision of aid are as delusional as they are ineffective in the initial phases of crisis management.
- No one can predict where or when the next crisis will occur or what impact it will have on world security; anyone who thinks they can is either a fool or a charlatan.
- The uncertainty of world order today requires that states maintain versatile, combat-capable and rapidly deployable military forces. As we should have learned from the Syrian War, crises must be contained before they spread.
- Through their inherent mobility and flexibility, navies and other sea-based forces will nearly always be the first responders to global crises.
- In many cases, a submarine can be the first vessel on scene to act as eyes and ears for the main force. The British use of submarines in the 1982 Falklands War showed that the rapid deployment of submarines can provide a significant strategic advantage.

If we assume that strategic analysis concludes that modern submarines would be useful additions to the Canadian fleet, the next question is what sort of submarine? The decision comes from answers to three basic questions:

1. Will the new submarines be required to operate freely throughout the Arctic?
2. In a period of enhanced national vigilance (when a new threat to Canada from the sea is considered possible) how much of Canada's vast ocean space must be kept under surveillance and at what distance from shore?
3. Could Canadian submarines make a significant contribution to allied and combined security operations?

The answers to these questions essentially determine the endurance and versatility requirements: nuclear-powered or non-nuclear-powered. The choice of which sensors and weapons as well as other capabilities such as multi-mission lock will

be driven by consideration of the following questions:

- How and where will the submarine be employed?
- How many are required?
- What are the national fiscal constraints?
- Where will they be built or from where will they be acquired?
- Will there be requirements for new national infrastructure?
- What will be the industrial and scientific benefits from a submarine program?
- Do the technologies pose any environmental concerns?
- What are the expected levels of political and public support?

None of this is new. The RCN has run a political and bureaucratic gauntlet for every submarine acquisition proposal since the late 1950s. Had the Naval Staff of the day spent more time answering these questions, political rejection of their plan would not have been so damaging to the overall naval force plan.

Conclusion

It boils down to a single question, can a modern non-nuclear-powered submarine, such as the German U-36, substitute for a nuclear-powered submarine which the 1987 analysis argued was necessary for Canada's future maritime security?

I do not intend to answer that question or the other questions posed in this essay, it would take an entire edition of *Canadian Naval Review* to do so; rather, I offer them up for others to address publicly.

Peter Haydon is a retired RCN officer and a Senior Research Fellow at the Centre for Foreign Policy Studies at Dalhousie University.