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CLANCY

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SUBMARINE

*A Guided Tour*

*Inside a Nuclear Warship*

*Written with John Gresham*



BERKLEY BOOKS, NEW YORK



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*This book is dedicated to  
the families, friends, and loved ones of submariners,  
who return that love, as well as their love of God and country,  
by going down into the sea in steel boats.*

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# Foreword

The transformation of Tom Clancy's wonderful fictional account of submarining in *The Hunt for Red October* to the reality of actual modern nuclear submarine capabilities and operations is long overdue. Now he brings a unique account of the nuclear-powered submarine, a vital component of naval power to the public for the first time. This book explains the world of undersea warfare, from how people live within a steel tube for months at a time, to the many arrows a submarine puts in the quiver of national military power.

Twice in this century submarine warfare has threatened the existence of major powers. Submarines have always been a flexible and adaptable national asset, capable of many roles and missions. The submarines of World War I and II had some inherent stealth and could submerge to conduct attacks, but this property was limited by a lack of sustained power while under the sea's surface. The advent of nuclear propulsion made the submarine a truly stealthy platform. A so-called stealth aircraft can still be seen by the naked eye. A nuclear-powered submarine is truly invisible and not readily detectable. It is the original stealth machine and can remain undetected indefinitely. From this enduring covertness springs the awesome power of the modern submarine. Through the advances of ballistic and cruise missile technology the strategic nuclear deterrence mission and land attack capability have become an integral part of this military power. For decades the principal mission of a submarine has been to sink ships and submarines. Today, the nuclear-powered submarine's ability to affect events on land is one of its dominant features.

With Tom Clancy as our tour guide, let us view the submarine's history, its missions, the people and their families, the training, the boat itself with all its compartments and systems, and consider what these can do. If you spend years on the bridge of a submarine, as I have, you will notice how the dolphins that "ride" the crest of the exhilaratingly beautiful bow wave along the tear-shaped submarine hull do so at different positions for different classes or shapes of submarines. Why? I have always wondered. This tour you are about to take will come close to answering such questions, which are inherent to the mystique of a submarine.

I may not agree with all of the points present herein, but I do believe that upon completion of your tour you will understand why the submarine is the only naval platform that combines stealth, surprise, survivability, mobility, and endurance in a single unit. The employment of these characteristics provides a nation with a formidable maritime power, which should be understood by the public.

—Vice Admiral Roger Bacon, USN  
Deputy Chief of Naval Operations for Undersea Warfare  
January 1993

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# Introduction

*Submarine.* The very word implies stealth and deadliness. Of all the conventional weapons used by the world's armed forces these days, none is more effective or dangerous than the nuclear attack submarine (SSN). Since its creation in the United States some forty years ago, the SSN has become the most feared weapon in the oceans of the world. The modern SSN is a stealth platform with 70 percent of the world's surface under which to hide, its endurance determined not by fuel but by the amount of food that may be crammed into the hull, and its operational limitations determined more by the skill of the commander and crew than by external factors.

Understanding the capabilities of the modern nuclear-powered attack submarine requires a certain sophistication on the part of both a potential adversary and a visitor. Visually, a submarine is the least impressive of physical artifacts. Its hull does not bristle with weapons and sensors as do surface warships, and for one to see its imposing bulk, it must be in drydock. On those rare moments when a submarine is visible, this most lethal of ships appears no more threatening than a huge sea turtle. Yet despite that, the true capabilities of the modern SSN are most easily understood in terms of myth: the modern equivalent, a science fiction movie. Here is a creature that, like Ridley Scott's "Alien," appears when it wishes, destroys what it wishes, and disappears immediately to strike again when it wishes. Defense against such a threat requires constant vigilance, and even then, this will be ineffective much of the time. Thus the real impact of the nuclear submarine is as much psychological as physical.

In April 1982, the Monday after Argentina's seizure of the Falkland Islands, I happened to have lunch with a submarine officer and so got my first hint of what an SSN could do. The Royal Navy, my friend told me, would very soon declare that one of its boats was in the area of the disputed rocks. No one would be able to dispute the claim, which, my friend went on, would probably be false. "But the only way you know for sure that a sub is out there is when ships start disappearing, and that's an expensive way to find out." This is precisely what happened, of course. The mere possibility that the Royal Navy had one or more of its superbly commanded SSNs in the area immediately forced Argentina to reevaluate its position, and the Argentinean Navy, a lead player in the decision to seize the islands, was soon rendered impotent by its inability to confirm, deny, or deal with the mere possibility that an SSN *might* be lurking in the area.

As a practical matter, the Falkland Islands War was determined at that point. Ownership of an island is determined by control of the seas around it, and Argentina could not control the sea. The Royal Navy's SSNs prevented that, the first step in the RN's campaign to establish its own sea-control posture, making a successful invasion possible. The sinking of the cruiser *General Belgrano* was the unnecessary confirmation of what should have been obvious. While the nuclear-powered attack submarine may not be the most useful warship in the world since it cannot perform every traditional navy mission, it can deny an adversary the ability to execute *any* mission at sea.

"Here be monsters," the charts of ancient mariners used to say. They weren't right then, but current charts, especially those on surface warships, might profitably be marked to show that outside the thirty-fathom curve, yes, there be monsters. Nuclear-powered monsters.

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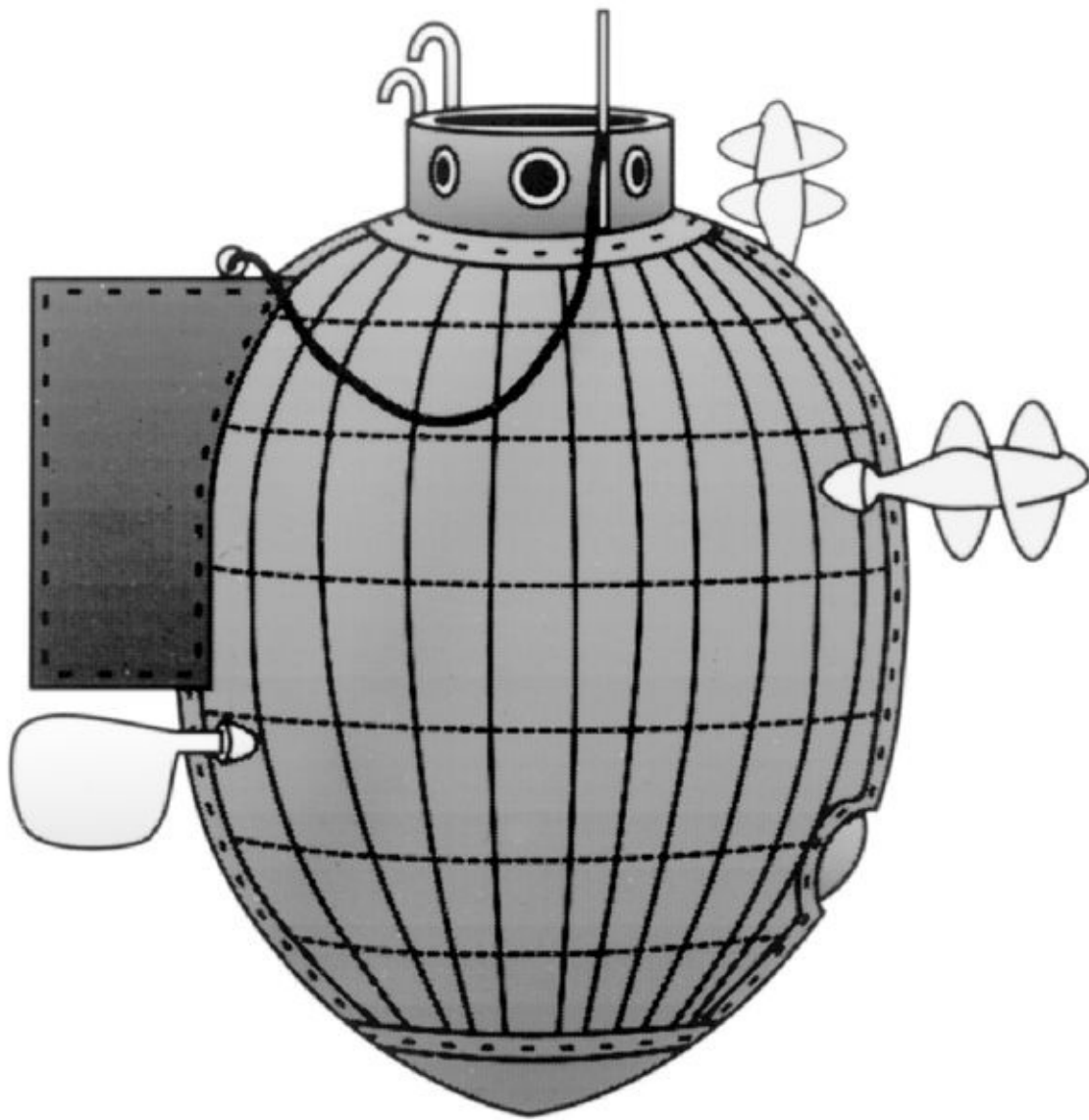
# The Silent Service

## Early History

When tracing the roots of the modern submarine, one is usually faced with a number of different places to start. Legend has it that Alexander the Great descended into the ocean in 332 B.C. near the city of Tyre, in a primitive diving bell. The great mind of Leonardo da Vinci is said to have created a primitive submersible boat of wooden frame design covered in goatskins, with oars providing propulsion through waterproof sweeps. A British contribution to early submarine concepts came in the late 1500s from William Bourne, a carpenter and gunmaker. It included the concept of double hull construction, as well as ballast and trim systems. The first concept for a military submarine came from a Dutch physicist, Cornelius van Drebbel. In addition to actually building and demonstrating a primitive submersible, he proposed a design specifically created to destroy other ships.

It was the United States (albeit still colonies in rebellion) that created the first workable military submarine design. In 1776, a Yale University student named David Bushnell designed the appropriately named *Turtle*. The *Turtle* was an egg-shaped submersible boat that had the ability to sneak up on a ship, submerge under the intended victim, bore a drill bit with a waterproof time bomb attached into the bottom of the hull, and escape before the bomb was detonated by a clockwork fuse. It was propelled by a hand-cranked screw, and had room for one overworked crewman.

On the night of September 6, 1776, Sergeant Ezra Lee of the Continental Army took the *Turtle* to attack HMS *Eagle* of the British squadron blockading Boston. But when he maneuvered underneath the ship, he was unable to attach his bomb. During his escape, he was followed by British soldiers in a rowboat. In a frantic escape, he released the bomb, which <sup>2</sup> exploded literally in the faces of his pursuers. Though all parties escaped unhurt, it was a promising start to the modern military submarine.



This early submarine, the *Turtle*, was used in 1776 by the Continental Army to attack the HMS *Eagle* of the British blockade squadron outside of Boston.

*JACK RYAN ENTERPRISES, LTD.*

A more substantive advance was the *Nautilus*, designed by the American Robert Fulton, who would go on to design the first steam-boat. The *Nautilus* was a distinct improvement over the *Turtle* in that it cruised under the intended victim, towing the explosive bomb or torpedo, as it was then called, until the bomb contacted the target and detonated with a contact fuse. The design was an exceptional success, destroying a number of target vessels in test runs. The French, who were sufficiently impressed to award Fulton a contract, actually considered for a time using it in the planned invasion of Britain. By 1804 Fulton was demonstrating the boat to the British, who despised the idea for its underhanded nature and, more importantly, its potential to sweep British ships from coastal zones. In the end, Fulton returned to America to begin work on his steamboats.



The CSS *Hunley*, the first submarine to sink an enemy warship, the USS *Housatonic*, in 1864. JAC RYAN ENTERPRISES, LTD.

It remained for the Americans to create a submarine that would actually sink an enemy vessel in wartime. In 1863 a submersible boat was designed by Confederate army officer Horace Hunley. His boat, the CSS *H. L. Hunley*, was propelled by eight men turning a hand-cranked propeller. For armament, an explosive mine or torpedo was secured to a long spar protruding out in front of the *Hunley*. The idea was for the *Hunley* to ram the spar torpedo into the side of a target ship, where it would be detonated.

Unfortunately the *Hunley* was difficult to handle, and several crews, along with her designer, were killed during test dives. Nevertheless on October 17, 1864, the *Hunley* attacked the Union steam corvette *Housatonic* in the harbor at Charleston, South Carolina. In the ensuing attack the *Hunley* sank the *Housatonic*, although she herself was also sunk. A submarine had finally drawn blood in combat.

Over the next four decades a number of different submarine designs evolved in various European countries. In the 1880s a really practical design was built in America by an Irish immigrant, John Holland. Originally backed by the Fenian Society (an early North American free Ireland society), it was designed to allow Irish separatists to attack units of the British fleet. In 1900 Holland won a submarine design competition held by the U.S. Navy. From this contract came the USS *Holland* (SS-1), the first practical combat submarine. The *Holland* included such innovative features as self-propelled torpedoes fired from a reloadable tube, a battery-powered electric motor for submerged operations, and an advanced hull shape to allow it to move efficiently through the seas. The design was so successful that the U.S. Navy eventually bought a total of seven Holland-designed boats. Ironically, the British even bought some of the Holland boats for the Royal Navy. Holland's company, the Electric Boat Company, continues to build submarines as part of General Dynamics Corporation.



German submarine U-58 alongside USS *Fanning* (DD-37) to have her crew removed after being forced to surface November 17, 1917. *OFFICIAL U.S. NAVY PHOTO*

## World War I

The period before World War I saw a number of innovations in military submarines. This included the development of diesel engines, improved periscopes and torpedoes, and the development of wireless technology, which allowed them to be directed from shore bases. Within a month of the outbreak of World War I, the German *Unterseeboot* fleet, or U-boats as they came to be called, were sinking British naval units in the North Sea. In one well-known incident the elderly U-9 sank three British armored cruisers, causing over 1,400 casualties. Throughout the war, both the Allies and the Central Powers took a toll of each other's warships, especially in the Gallipoli Campaign in the Dardanelles.

During World War I the Germans consistently led the world in the production of new U-boats. But the international rules concerning attacks on merchant ships kept the Germans from fully utilizing their potential. Germany feared that unrestricted submarine warfare, with the practice of not warning the victim, might bring the United States into the war. By 1915 the need to isolate Britain from her sources of war supplies caused Kaiser Wilhelm to declare unrestricted submarine warfare an active policy. Soon German submarines were taking a huge toll of merchant shipping and threatening to win the war against Britain all on their own. But after the ocean liner *Lusitania* was sunk by U-20 in 1915 the United States entered the war on the side of the Allies. It would take two more years for the Allies to win the war and beat back the U-boat threat.

So important was the submarine in World War I that a whole new form of naval conflict, antisubmarine warfare (ASW), was born. From it came techniques such as the convoy and the Q-ship (armed merchant decoy), as well as weapons and sensors such as the antisubmarine detect

(ASDIC/sonar), and the depth charge. And so deadly had the U-boats been that Germany was specifically banned from having them under the Treaty of Versailles. The victors of World War I split up the remaining U-boats for examination and testing. That might have been the end of military submarines except that the seeds of World War II were contained in the Treaty of Versailles, and the military submarine would continue to develop.

## World War II

During the period between the world wars, submarine development continued at a steady pace. In the United States and Britain efforts were concentrated on the creation of long-range “fleet” submarines designed to support the battle fleets, while nations such as Japan, Russia, and Italy developed submarines more for coastal defense. Once Adolf Hitler had risen to power, Germany secretly began to rebuild its dreaded fleet of U-boats, in direct violation of the Treaty of Versailles. By the beginning of World War II, a number of improvements were made to the submarines themselves, such as torpedoes with magnetic fuses and sonars, and even small radar sets. And in Germany, the United States, and England, naval leaders had evolved very specific plans on how to best use the improvements.

By the outbreak of war in 1939, Germany had deployed her small fleet of U-boats at sea. Within hours, the U-30 sank the ocean liner *Athena*, signaling another round of unrestricted submarine warfare. Within a few weeks of the opening of hostilities, the U-boats had sunk a number of British warships and merchant vessels. The British responded with a series of patrols by their own fleet of submarines, damaging several German cruisers and sinking several U-boats. In addition, mindful of the damage inflicted upon merchant shipping in World War I, the British immediately instituted a system of transatlantic convoys and began to build up their ASW forces. But German fortunes soared with the capture of France and Norway in 1940, and once these prizes had been won, U-boats could be based much closer to the convoy lanes supplying Britain. The Battle of the Atlantic was on and would not be completely decided until the end of the war in 1945.



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