

THE SUBMARINE PARADOX



S A M P L E

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*How the Most Destructive Machine Ever Built
Was Designed Never to Be Used*

by Sample

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Based on “Submarines Are WAY Scariest Than You Think...Here’s Why” by Johnny Harris, published on YouTube: youtube.com/watch?v=AecFpnj383A

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Names and dates marked † draw on general historical knowledge rather than the source and are listed in the Verification Notes. Figures for military capabilities are approximate, and many are classified. Fleet counts are time-sensitive.

This book is for general information and education.

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Introduction

The ocean is calm. Nothing on the surface, no ship, no wake. Then something breaks through the water, hangs there for a moment as if it is about to topple back into the sea, and ignites.

It is a rocket. It climbs about 1,000 kilometres above the Earth, into space, and steers by the stars. Then it falls back toward a target thousands of kilometres away. It came from a machine that was sitting under that calm water the whole time, and nobody on the surface knew it was there.

That machine is a submarine. The largest of them are 48,000-ton vessels carrying a couple of hundred people, cruising around 250 metres below the surface. Pulled out of the water and set on land, one would look like a building. Right now, as you read this, a number of them are out there. Their whole purpose is to stay unseen.

One of these submarines carries enough nuclear weapons to more or less end life on the planet as we know it. That is not a figure of speech. Chapter 1 does the arithmetic.

What this book promises

This book explains how humans arrived at that fact, and why it is less mad than it sounds.

Its argument is simple. Every major step in submarine history solved one problem: how to stay hidden. The early boats could go under but could not stay under. Diesel boats could fight, but they had to surface every couple of days and give themselves away. The nuclear reactor removed that limit. After that, the whole effort went into silence, because a weapon nobody can find is a weapon nobody dares to test. The result is a paradox. The most destructive machine ever built exists so that it never has to be used.

Who it is for

This book is for the curious general reader. You don't need a military background. Maybe you have seen a headline about rising submarine activity, Russia rearming its fleet, or Chinese and Iranian boats, and wondered what is actually out there and why it matters. Every technical idea is explained from the ground up.

What it will not cover

This book leaves some things out:

- It is not a technical manual.
- It does not cover how navies hunt submarines, how a hidden boat receives orders, or daily life on a long patrol.
- It does not compare every nation's fleet.
- It does not claim to know what remains classified. Much of the subject is secret by design, and where the real numbers are hidden, the book says so.

A note on the text: a few names and dates come from general historical knowledge rather than from the source this

book is based on. Each one is marked with a dagger (†) and listed in the Verification Notes at the back.

Start with the missile, because everything else in the story exists to put it where it is.

CHAPTER 1

One Submarine, Twenty-Four Missiles

The introduction left you with a claim: one submarine can end life as we know it. This chapter shows the working.

Most people picture a submarine as a boat that fires torpedoes at other boats. That picture misses what makes the modern ballistic missile submarine the defining weapon of its age. This chapter follows one missile from launch to impact, then multiplies it.

The machine

Take the American Ohio class, built in the Cold War. Seen in cross-section, it is enormous: a floating building with a kitchen and sleeping quarters, and a nuclear reactor at the back doing its work. The crew sleep close to a row of large vertical tubes. There are 24 of them.

Ask a submariner what is inside those tubes and you will hear a standard line: “We cannot confirm or deny whether or not the missiles inside of these silos carry nuclear weapons.” Everyone understands what that means. This is where the nukes are.

The boat also carries torpedoes and other smaller weapons. They are not what makes it matter. The tubes are.

The flight of one missile

A missile's journey has distinct stages.

Boost phase. The missile is pushed out of the tube and up through the water. It breaks the surface, seems to hang for an instant, and then its engine takes over. It climbs into the sky and builds up enormous momentum. Then the engines cut out.

Midcourse phase. From here, the missile flies on momentum alone, following the laws of physics. It is at the edge of space, about 1,000 kilometres above the Earth. It checks its position against the stars, then makes small corrections to keep itself precisely on course for its target.

The warheads. On the front of the missile sit cone-shaped warheads. These are the most powerful weapons humans have ever made. One missile can carry up to 12. As the missile passes its highest point and starts to descend, it releases them one by one, each at exactly the right time and velocity. They re-enter the atmosphere and fall toward separate targets. Those targets can be as far as 1,500 kilometres apart, roughly the distance between Iceland and Norway.

Impact. Each warhead is roughly six times more powerful than the bombs dropped on Japan at the end of the Second World War.

How far can the missile reach? The Navy does not publish that number, because it is classified. Figures run from up-

wards of 6,400 kilometres, which is wider than the entire United States, to as much as roughly 12,000 kilometres.

The arithmetic

Now multiply:

- One missile carries up to 12 warheads, each aimed at a different place.
- One submarine carries 24 missiles.
- In principle, that is up to 288 warheads from a single boat.
- Each warhead is roughly six times the Japan bombs.

This book does not pretend to know how any real submarine is loaded on any given day. That is secret, and the maximums are not necessarily what is carried. But the capacity alone explains the claim in the introduction. One boat, sitting silently somewhere in the ocean, holds enough to turn entire countries to dust.

The case: one launch, start to finish

Follow a single launch from an Ohio-class boat, using only the stages above.

The situation: the submarine is somewhere in the open ocean, about 250 metres down, with no one on the surface aware of it.

The action: a missile leaves one of the 24 tubes, rises through the water and breaks the surface. For a moment it looks as if it will fall back. Then the engine fires and it climbs. At the edge of space, with its engines off, it sights

the stars and adjusts its course. On the way down it releases its warheads one after another, each toward its own target, spread across a distance like Iceland to Norway.

The result: one missile has struck up to 12 separate places. Twenty-three more remain in the tubes.

What would have gone wrong: the entire sequence depends on the boat never having been found. A submarine that is tracked can be destroyed before that first missile leaves the tube. Chapters 3 to 5 are the story of how submarines stopped being findable.

The common misconception

The common mistake is to think of a submarine as a warship that happens to travel underwater, a hunter of other ships. Some submarines are exactly that, and Chapter 7 covers them. But the ballistic missile submarine is something else: a hidden launch pad that can reach space and hit targets on another continent. Judge it by what it carries and where it can send it, not by what it looks like.

Better still, think of it as a location problem. The danger is not only the missiles. It is that nobody knows where they are.

You can now explain, stage by stage, what one submarine can do and why its capacity is so alarming. The next question is how humans spent centuries failing to build one, and what stopped them.

CHAPTER 2

The Problem of Air

Chapter 1 showed what a modern submarine can do. Here is why it took centuries to build one.

The idea of a boat that travels underwater is ancient, and for most of history it barely worked. It helps to know which problem kept defeating the early inventors, because it is the same problem that shapes every submarine afloat today.

An old dream

Old artwork shows Alexander the Great lowered beneath the sea in a large glass barrel. The legend is roughly two thousand years old. Even then, people imagined a vessel that could carry a person under the water and bring them back.

Many centuries later, Leonardo da Vinci, who seemed to sketch nearly everything that could be invented, drew his own underwater boat. It looked something like a large mechanical fish. He also kept the drawings secret. His reason was that he feared “the evil nature of men who practice assassination at the bottom of the sea.” He foresaw that an underwater boat would be used for war. He was right.

The first working boats

The first boat known to have actually navigated underwater was built by a Dutchman, generally identified as Cornelis Drebbel†.

About 150 years later, in what was about to become the United States, George Washington paid for a submarine for his army. It was called the Turtle, because it looked like two turtle shells joined together, with one man sealed inside. The rebels tried to use it in their war against the British. It never achieved anything useful, and in the end it sank. But it proved a person could be sent underwater on purpose, in wartime, and that paved the way for what came next.

The case: the bomb on a stick

The American Civil War produced the most vivid early example of what submarines would become. It also shows what was still missing.

The situation: the Confederacy built a submarine†, known as the H. L. Hunley†, that was powered by a crew of men turning a crank by hand. Its weapon was a spar torpedo. That sounds sophisticated, but it was a bomb on the end of a pole about 15 feet long.

The action: the crew worked their way under a Union ship†, the USS Housatonic†, pushed the bomb into it and set it off.

The result: the attack sank the Union ship, and the submarine sank too. It was a real attack in a real war, and it destroyed a target. It also destroyed itself.

What went wrong is the lesson of this whole chapter. The boat could get underwater and reach its enemy, but it had nothing that could keep a submarine working and alive once it was down there. It was powered by human muscle, with no way to strike from a distance and no margin for error.

What these boats had in common

Line up the glass barrel, the mechanical fish, the Dutch boat, the Turtle and the hand-cranked Civil War sub. Every one of them could, at least in theory, get underwater. None of them could stay there and do useful work. Every boat of this era hit the same limits:

- The people inside needed air.
- The power had to come from human arms.
- The weapons had to be delivered at arm's length.

Nothing in this era solved the air problem. It would take a new kind of engine, a century of war and eventually the splitting of the atom before a submarine could stay hidden for as long as it needed to.

The common misconception

The easy mistake is to think submarine history is a story about learning to dive. Diving was the easy part. The hard part was everything that had to keep working once the boat was under: breathing, power and the ability to attack without destroying yourself.

Read the rest of submarine history with that in mind. Each breakthrough you meet from here on is really a way of staying under longer.

You can now explain why the early submarines failed even when they worked, and name the single limit they all shared. The next chapter shows the engine that nearly solved it, and why “nearly” was not good enough.

CHAPTER 3

Forty-Eight Hours

Chapter 2 identified the limit every early submarine shared. This chapter covers the engine that almost broke it.

The diesel engine turned the submarine from a curiosity into a weapon that shaped world wars. But it came with a built-in countdown that forced every boat back to the surface, where it could be seen.

Diesel and batteries

In Germany in the 1800s, Rudolf Diesel invented an engine that changed a great many industries. It worked by compressing air and fuel until the mixture exploded, and those explosions drove the machinery.

German engineers saw a use for it underwater. Run the diesel engines to charge a large bank of batteries, then use the batteries to power the submarine while it is submerged. That was a vast improvement on a hand crank.

The catch was air. A diesel engine has to take in air to run, and it has to push out exhaust. You cannot run it underwater. So the submarine could only stay down as long as its batteries lasted: at most around 48 hours. After that it had to come up, run its engines, recharge and, in doing so, reveal where it was.

The U-boat

By the early 1900s the great empires were looking for ways to use their new industrial technology against one another, and they were getting good at submarines. Boats carried more and more batteries. They gained sonar and radar, so they could sense what was around them underwater. They gained radios and encryption devices, so they could communicate while submerged, which matters enormously in a war.

The Germans called their boats Unterseeboote, “undersea boats”, shortened to U-boats. During the First World War† they adopted what they called unrestricted submarine warfare. The phrase is sterile. In practice it meant sneaking up on civilian ships and sinking them without warning, killing the people on board.

As a technology, the U-boat was light years ahead of the Turtle and the bomb on a stick. As a use of that technology, it was horrific. Both things are true.

The case: the 48-hour clock

Run a diesel submarine through a single cycle.

The situation: a U-boat is submerged and hunting, running silently on battery power.

The action: the batteries drain. Within about 48 hours, the boat has no choice. It must rise, run its noisy engines to recharge and push out its exhaust.

The result: for that stretch, the boat is exposed. Imagine a game of Battleship in which, every few turns, you must flip your board around and show your opponent exactly where you are.

What went wrong, and what engineers tried: they added a pair of tubes, later known as a snorkel†. The boat could stay mostly underwater while the tubes reached the surface, drawing air down and pushing exhaust out. It helped a little. But the engines still had to run, and they were still noisy. Needing to do that every 48 hours remained a huge limit on how useful these boats could be.

The war ends, and the technology changes hands

After the Second World War†, Germany lost and surrendered. The U-boats left behind were divided among the victors: the United States, the United Kingdom and the Soviet Union. All three discovered that German submarine technology was excellent. By building on it, they could skip decades of their own development.

That hand-over sets up the next chapter. Two wartime allies, the United States and the Soviet Union, now eyed each other with suspicion. Each knew the other had German technology, and each quietly resolved to get far ahead. It became a secretive investment race, the Cold War, and it produced the submarines we know today.

The common misconception

It is tempting to dismiss diesel-era submarines as primitive. They were not. They had sonar, radar, radio and encryption,

and they were lethal. The flaw was not a lack of sophistication. It was dependence on the surface. A boat that must surface on a schedule can be predicted, and a boat that can be predicted can be found.

When you judge any stealth technology, ask how often it has to reveal itself, not how impressive it is. That question explains the next great leap.

You can now explain how diesel power worked, what the 48-hour limit meant in practice and how the technology passed to the future Cold War rivals. The next chapter shows the idea that ended the countdown for good.

CHAPTER 4

A Power Plant Under the Sea

Chapter 3 ended with the 48-hour countdown still running. This chapter is about the machine that stopped it.

Every submarine up to the 1950s was tied to the surface by its need for air. The fix was to put a nuclear power plant inside the hull. The idea sounded mad, it met fierce resistance, and it changed naval warfare.

Energy without air

By the middle of the twentieth century, humans had learned to split atoms. That released enormous amounts of energy. It could be used to blow things up, and it could also be used to generate electricity.

The crucial detail for submarines was that nuclear energy does not need air. No intake, no exhaust, no surfacing to breathe.

The case: Rickover goes over everyone's head

The situation: it is the 1950s. Hyman Rickover, a Russian-born officer in the US Navy and a submarine man, grasps what this means. If you can make electricity without air, you can build a submarine that never has to come up to run its engines.

The action: he proposes putting a nuclear reactor, a full power plant, inside a submarine, so as to get ahead of the Soviets. He meets heavy pushback, for obvious reasons: this is a reactor inside a sealed, armed vessel. He refuses to drop it. He goes over the heads of one superior after another until he reaches the Chief of Naval Operations, and puts the idea to him directly.

The result: it works. The US government sets out to fit a full nuclear reactor inside its submarines, and succeeds. One archival narration boasted that such a boat could go around the world on a core of uranium only slightly larger than a golf ball, and predicted it might change naval strategy as much as the airplane had changed war.

What would have gone wrong: if Rickover had taken his superiors' first no as final, the idea would have stalled at the level where it met resistance. His full story is far longer and stranger than there is room for here, and it rewards further reading.

How the reactor runs the boat

Look at a Sturgeon-class submarine, a US Navy boat of the 1960s. The reactor sits toward the back. It splits atoms, and that produces a great deal of heat. The heat warms water, and the heated water drives the turbines and the large propeller. Spinning turbines generate electricity, so the boat has power to spare.

That abundant power did more than move the submarine:

- **Oxygen.** The submarine is surrounded by water, H_2O . With enough electricity you can split that water apart

and keep the oxygen for the crew to breathe. The reactor, in effect, makes the air.

- **Fresh water.** The same power removes the salt from seawater. The crew get drinking water, and even showers, hundreds of metres below the surface.
- **Endurance.** Diesel boats needed constant refuelling and regular trips to the surface. A nuclear submarine could run underwater for 20 years without refuelling.

In theory, a nuclear boat could stay down for decades. In practice there is one supply the reactor cannot make: food for the people on board. The limit on how long a submarine stays hidden stopped being the machine and became the crew.

What changed

Rickover was right. With the reactor on board, submarines became far more useful. A boat could slip around the ocean and never give away its position. The 48-hour countdown from Chapter 3 was gone.

That set up the question that defines the rest of this book. If a submarine can stay hidden more or less indefinitely, what should it carry? The Cold War answer was the missile tubes of Chapter 1.

The common misconception

People tend to think of a submarine's reactor as its engine and nothing more. That undersells it. The reactor made the air, made the drinking water and removed the need to re-

fuel for decades. It was propulsion and life support in one. Remove it, and you are back to the 48-hour clock.

So when you ask what makes a submarine hard to find, start with the reactor. Every other quieting measure matters only because the boat no longer has to surface.

You can now explain why nuclear power, not better hulls or bigger batteries, was the real turning point, and what it gave a crew beyond speed. The next chapter covers what navies did once a boat could stay hidden forever: they made it silent.

CHAPTER 5

The Silent Service

Chapter 4 gave the submarine unlimited time underwater. This chapter shows why that was only worth having if the boat was also silent.

A submarine that never surfaces can still be heard. Once reactors removed the need to come up, the contest moved to sound. The quietest boat wins.

Why silence became everything

Recall the logic of Chapter 1. A boat carrying 24 missiles is decisive only if nobody knows where it is. Land-based missiles are powerful, and so are weapons carried on aircraft, but both can be seen. A submarine moving quietly through the world's oceans, able to launch at any moment, gives its owner something rarer: surprise.

Its enemy has no idea where it is. They know only that it is somewhere within range, all the time. So they must behave as if it is everywhere, a few button presses away from launch. It is the logic of a panopticon, the prison design in which inmates cannot see the guard and so must assume they are always being watched†.

That psychological hold works on one condition: the submarine is never noticed. So the next phase of submarine development focused on silence.

How a submarine is made quiet

Navies attacked noise at every level:

- **The hull.** Submarines were coated with rubber tiles so that sonar pulses would not bounce back as strongly.
- **The propeller.** A submarine's propeller is huge, bigger than most people imagine. Engineers reshaped these giant propellers until they were impossibly quiet.
- **The machinery.** Inside, heavy equipment was mounted on rubber pads to dampen any vibration that could be detected or heard.
- **The galley.** Even the cooks took precautions. Mixing bowls and spatulas were made of, or coated in, sound-deadening material, so that a bowl knocked against a counter would not send vibration out through the hull.

Navies also went beyond sound, making boats resistant to magnetic detection. The aim at every layer is the same: to be undetectable.

The case: the rubber spatula

The galley is the clearest example of how far the idea goes.

The situation: a cook on a missile submarine is preparing a meal for a crew of a couple of hundred people, in a steel hull hundreds of metres down.

The action: every tool the cook reaches for, bowl and spatula alike, has been chosen or treated to deaden sound.

The result: the ordinary clatter of a kitchen, which no surface ship would think twice about, never travels out into the water.

What would have gone wrong: one careless metal bowl against a metal surface is a sharp, unnatural sound in the quiet of the deep ocean. Rubber tiles and a silent propeller are wasted if the kitchen gives the boat away. Silence is only as good as its loudest moment.

The silent service

Submariners take pride in all this. They call their branch the silent service. There is some wounded pride in the name, too. Submarine crews get far less recognition than the more visible parts of the military, because what they do is lurk in the deep carrying out an essential defence mission that no one is meant to know about. Staying unnoticed is literally the job.

The common misconception

The usual assumption is that stealth is a matter of shape or special coatings on the outside of the vessel. The coatings matter, but on a submarine stealth is a discipline that runs through the whole boat, from the hull tiles to the engine mounts to the cook's utensils. It depends on the habits of a couple of hundred people as much as on the engineering.

So think of silence as a property of the whole boat. The weakest point sets the level for everything else.

You can now explain why silence became the central design goal once submarines could stay down, and list the measures, large and small, that achieve it. The next chapter turns to what else a silent boat on the sea floor can do: listen.

CHAPTER 6

Listening at the Bottom of the Sea

Chapter 5 showed how a submarine learned to stay unheard. This chapter shows what a silent boat can overhear.

The same qualities that make a submarine a good hiding place for missiles make it an excellent spy. It can reach places nobody else can, and it can stay there without being noticed.

The cables no one could reach

Much of the world's communication travels through cables laid along the ocean floor. That is true of the internet today, but these cables are much older than the internet. They lie on the seabed linking the whole world, and they were long assumed to be safe for a simple reason: nobody could get to them. Nobody goes to the bottom of the ocean.

Except submarines. They have unique access to those cables.

The case: the tap in the Soviet east

The situation: in the early 1970s, American intelligence agencies teamed up with the Navy. The plan was for sub-

marines to search the ocean floor for Soviet communication cables, tap into them and listen.

The action: they found one. It lay 120 metres below the surface, off the eastern coast of the Soviet Union, in the Sea of Okhotsk†, connecting two Soviet naval bases. The operation, later known as Ivy Bells†, attached a recording device to the cable, in effect a tape recorder on the sea floor.

The result: the United States was now listening to Soviet military personnel discussing all kinds of military matters. None of it was encrypted, because nobody on the Soviet side imagined anyone could dive down and find that cable.

The planners were careful. They fixed the device to the cable only loosely. If the Soviets ever lifted the cable for maintenance, the device would simply fall off, and no one would ever know they had been overheard. The tapes did fill up, so divers had to go down, collect the device, remove the recordings and load fresh tapes. They did this about once a month.

What went wrong: the flaw was not at the bottom of the sea. It was a person. An employee of the NSA, the US National Security Agency, was paid \$35,000 by the Soviets to tell them about the operation, and it was exposed. The engineering was careful enough never to be found. The secret failed because someone who knew it sold it.

Spying today

Submarines still do a great deal of spying. They often carry Navy SEALs, special forces divers who can leave the boat

underwater. What they do after that is not public, for obvious reasons.

There is evidence that US and UK intelligence agencies still tap undersea cables, including the fibre-optic cables that carry the internet, and that they do so routinely. The documents leaked by Edward Snowden are the place to start for anyone who wants the detail. The broad point needs no leak to prove it: countries spy on one another all the time, and submarines are one of their best tools for it.

The common misconception

The mistake is to assume that anything hard to reach is safe. The Soviet engineers who left that cable traffic unencrypted made exactly that assumption, and it failed the moment someone built a vehicle that could reach the seabed quietly. A submarine turns “nobody can get there” into “nobody will know we were there.”

The better assumption, for a communications planner, is that distance and depth are not protection. If something matters, protect the message itself.

You can now explain why submarines are natural spies, walk through how the Soviet cable tap worked and why it ended, and connect it to the cable spying of recent years. The last chapter brings everything together: the weapons, the silence and the paradox that one never-used fleet keeps the peace.

CHAPTER 7

The Weapon Built Never to Be Used

Chapter 6 showed the submarine as a spy. This chapter shows it as what it mostly is: a threat designed to keep the peace.

A weapon is normally judged by what it does when used. The ballistic missile submarine has to be judged by what it prevents. This chapter explains how mutual, invisible threat kept the great powers from fighting each other, and what the fleet looks like now.

Deterrence

By the height of the Cold War, the United States and the Soviet Union could both launch nuclear missiles from submarines. Each side had, in effect, a gun pointed at the other that it could not see.

The irony is that this kept the two powers from ever going to war with each other directly. Each was too afraid of how easily the other could strike back from its hidden submarines, destroying both sides. That is deterrence, and it remains one of the main forces keeping great powers out of war with one another.

This is why the United States keeps an entire fleet of submarines whose only mission is to go out into the ocean, disappear and wait, silently, ready to make good on a single message: if you attack us, we are always ready to respond.

The case: the boats that just disappear

The situation: one of the United States' 14 ballistic missile submarines leaves port.

The action: it does, deliberately, nothing visible. It does not hunt ships or chase headlines. It submerges, goes silent and keeps its position unknown, for months at a time.

The result: every rival planner has to count that boat as present and ready. Nobody can rule out a response, so nobody can plan a first strike that escapes one. The threat does its work while the boat is merely out there.

What would have gone wrong: if the boat could be tracked, the logic would fall apart. A found submarine can be targeted, and a threat that can be removed deters no one. Everything in Chapters 3 to 5, the reactor, the rubber tiles, the quiet propeller, the rubber spatula, serves this one moment of not being found.

The fleet today

According to the US Navy's own website, the United States has 71 submarines. Of these:

- 53 are fast attack submarines.
- 14 are ballistic missile submarines, the deterrent boats.
- 4 are guided missile submarines.

Other sources put the total at 68. Much of this is classified, and that gap is typical of the subject: the broad picture is known, the specifics are not. Treat any count as a snapshot of the date it was published.

The types do very different work. Fast attack submarines are built for closer-range action. They make heavy use of cruise missiles, launched through large tubes. These missiles have jet engines and onboard computers for navigation. They are far more precise than a ballistic missile and still travel a long way: around 2,400 kilometres, at about 800 kilometres an hour. News reports show how they are used. One Russian announcement described 26 cruise missiles launched in a single day. Another report described 59 Tomahawk cruise missiles hitting a Syrian air base.

But the boat that defines the age is still the ballistic missile submarine of Chapter 1, the Ohio class with its 24 tubes.

Nor is this only an American story. Headlines regularly report increased submarine activity, Russia rearming its fleet, and Chinese and Iranian submarines. Several countries can load nuclear weapons onto submarines that are, at any given moment, somewhere in the ocean.

The record so far

Since the Second World War, no one has used nuclear weapons in any conflict. There have been many threats, some of them recent. So far, these weapons have stayed a deterrent rather than something anyone uses. The hope, and it is only a hope, is that it stays that way.

The common misconception

The instinct is to think that weapons exist to be fired, so a fleet of nuclear submarines must be a fleet waiting to be used. The deterrent boats invert that. They succeed every day they are not used. Their value lies in the certainty that they could be.

To understand them, count the wars they are meant to prevent, not the targets they could hit.

You can now explain how deterrence works, why stealth sits at its centre, and what the known shape of today's fleet is, including where the numbers run out. The conclusion turns to what this strange achievement says about us.

Conclusion: Making Impossible Things Possible

A couple of hundred people live for months at a time inside a sealed steel building, hundreds of metres under the sea. They breathe air made from seawater, drink water taken from seawater, and run on power from atoms split inside the same hull. Next to their bunks sit enough weapons to turn whole countries to dust. They are there so that those weapons are never fired.

That is the paradox of modern conflict, and the submarine is its purest form. For two thousand years the problem was staying under. Then it was staying under long enough. Then it was staying under unheard. Every answer served the same end. A weapon that cannot be found cannot be removed, and a weapon that cannot be removed makes attacking its owner unthinkable.

It would be easy to end on dread. The facts in this book are frightening: a missile that steers by the stars, a warhead roughly six times the power of the Japan bombs, up to 12 of them on one missile, and 24 missiles in one boat.

But look at the same facts another way. Humans took nuclear fission and put it inside an underwater vessel. They built rockets that fly to the edge of space, check the stars and land where they were aimed. They did it out of fear,

suspicion and rivalry, to gain an edge and to be stronger than the other side. Still, they did it. Things that should have been impossible were made to work.

That points somewhere hopeful. The same capability, turned toward priorities other than power and conflict, is still there. The minds that solved air, endurance and silence in a steel hull under the sea could solve other problems, ones that help more people live better lives.

The submarine is proof of what people can build when they put their minds to it. What they choose to build next is still open.

Action Plan: Reading the Hidden Fleet

This book is about understanding rather than doing, so this plan is a sequence for turning what you have read into lasting understanding. Work through it in order.

1. Re-run the arithmetic yourself. Without looking back, write down the chain from Chapter 1: warheads per missile, missiles per boat, the rough power of each warhead compared with the Japan bombs, and the distance the warheads can spread. If you can rebuild it from memory, you can explain the stakes to anyone.

2. Draw the timeline of the air problem. On one page, list each stage of submarine history covered here: glass barrel, da Vinci, the Dutch boat, the Turtle, the hand-cranked Civil War boat, diesel and batteries, the snorkel tubes, the reactor. Beside each, write in one line how long it could stay under and what forced it back up.

3. Read further on Hyman Rickover. His campaign to put a reactor in a submarine is told here in a few paragraphs. A full biography or a serious history of the US nuclear navy will show how one stubborn officer changed naval strategy.

4. Check today's numbers against Chapter 7. Look up the fleet figures the US Navy currently publishes and compare them with the 71 (and the alternative 68) given here. Note

the date you checked. Counts change, and much of the subject is classified.

5. Read a headline with fresh eyes. The next time you see a report of increased submarine activity, ask three questions from this book: What kind of boat is it (attack, guided missile or ballistic missile)? Does the report say anything about where it is, and if so, why was that information released? And what is the message, a threat or a reassurance?

6. Follow the cable story forward. Read reputable reporting on the Snowden documents and undersea cables to see how the logic of Chapter 6 carried from the Cold War into the internet age.

7. Explain the paradox to someone else. In two minutes, explain to a friend why the most destructive weapon ever built is judged a success every day it is not used. If they get it, so do you.

Verification Notes

Items marked † in the text come from general historical knowledge, not from the source this book adapts. Each should be checked before publication.

- **Cornelis Drebbel†** (Chapter 2): the source identifies the first known underwater boat's builder only as Dutch.
- **H. L. Hunley† and USS Housatonic†** (Chapter 2): the source describes the Confederate hand-cranked submarine and its Union target without naming them.
- **First World War†** (Chapter 3): the source does not name the war in which Germany adopted unrestricted submarine warfare.
- **Snorkel†** (Chapter 3): the source describes “two little tubes” without naming them.
- **Second World War†** (Chapter 3): the source does not name the war after which the U-boats were divided among the United States, the United Kingdom and the Soviet Union.
- **Panopticon definition†** (Chapter 5): the source uses the term; the explanation of the prison design is added.
- **Sea of Okhotsk† and Ivy Bells†** (Chapter 6): the source places the cable in “this eastern part of Russia” and does not name the operation.

Other points to check:

- **Missile range** (Chapter 1): the source gives both “upwards of 6,400 km” and “up to like 12,000 km”. Both are reported as a range.
- **288 warheads** (Chapter 1): this is arithmetic from two stated maximums (12×24), not a stated figure.
- **48,000 tons** (Introduction): the source’s link between this figure and Russia’s Typhoon class is implied, not explicit.
- **Fleet counts** (Chapter 7): the counts are attributed to the US Navy website on an unstated date. They are time-sensitive.
- **News figures** (Chapter 7): the 26 Russian cruise missiles and the 59 Tomahawks come from undated news clips.
- **“Roughly six times”** (Chapter 1): compares each warhead with the bombs dropped on Japan. It is stated as approximate.