



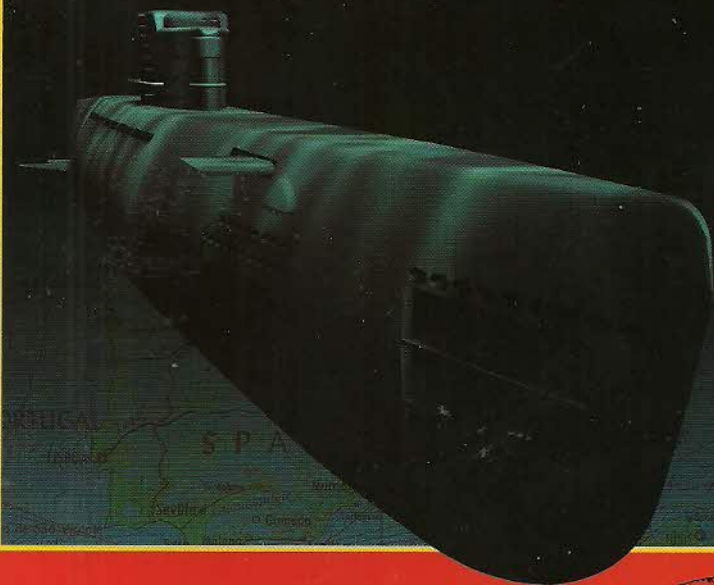
GRIPPING W.W.II  
U-BOAT COMBAT

NEW WEAPONS  
NEW WATERS



# ACES of the DEEP

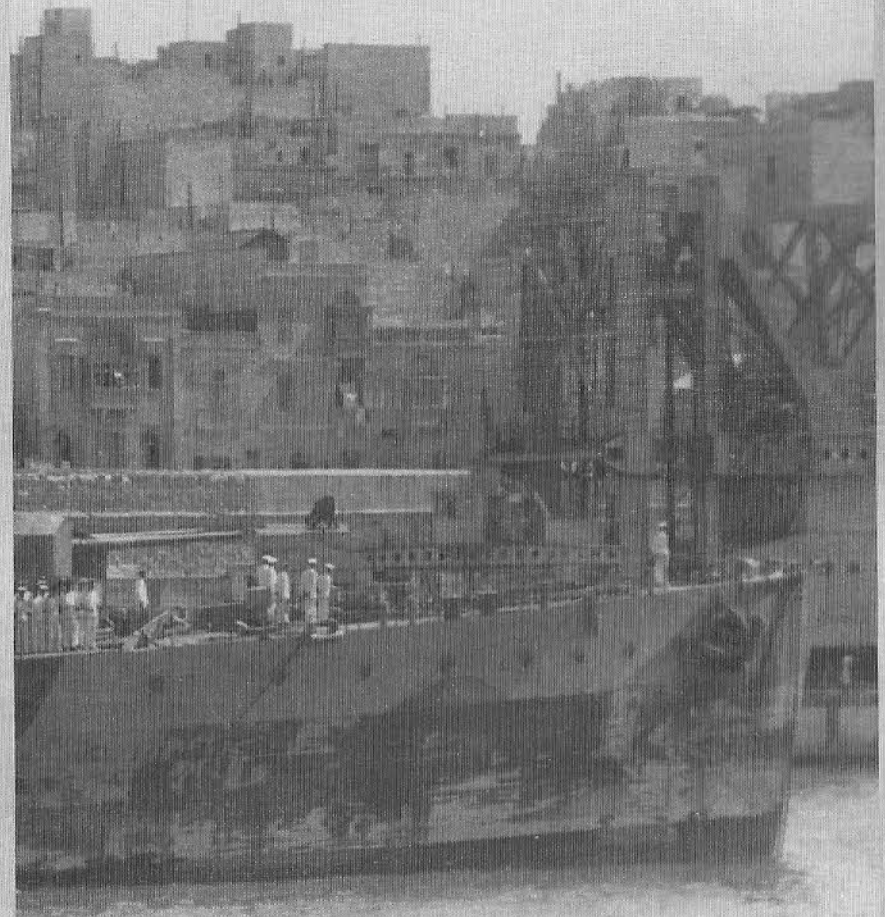
EXPANSION DISK



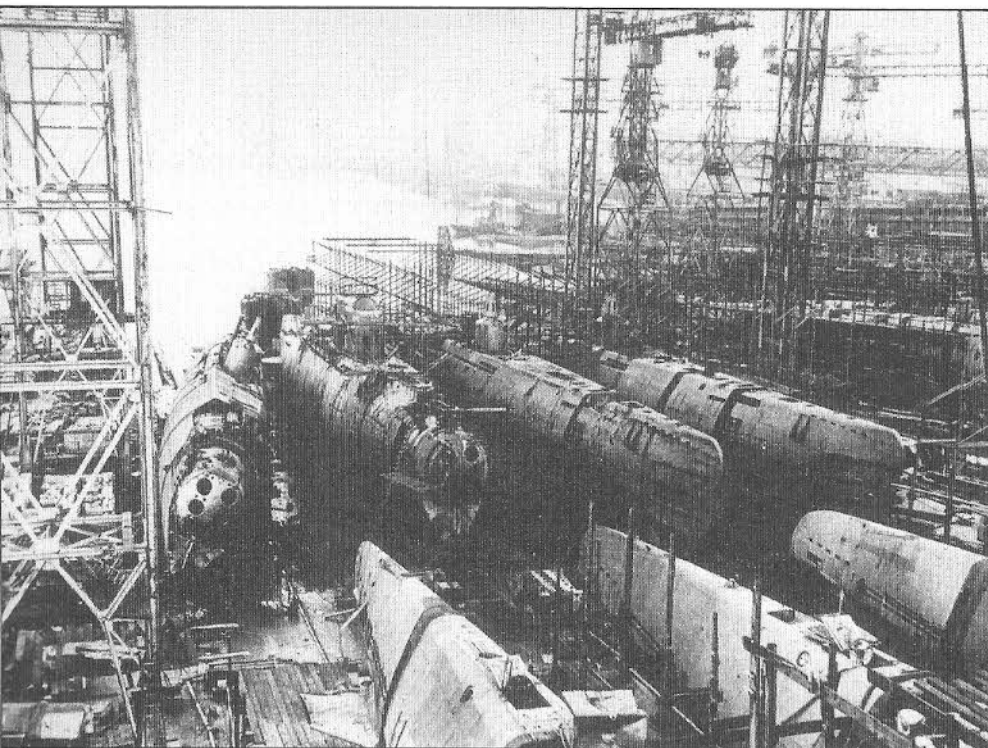
**Dynamix**  
PART OF THE SIERRA FAMILY

# ACES of the DEEP

EXPANSION DISK



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National Archives

Type XXI U-boats under construction at the Deschimag submarine yard, Bremen.

Preceding page: A British light cruiser, part of a convoy escort entering the Grand Harbor at Malta.

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## Welcome to the *Aces of the Deep* Expansion Disk

**ACES of the DEEP**  
EXPANSION DISK

The *Aces of the Deep* Expansion Disk adds to the selection of missions, U-boats, torpedoes, and patrol areas you have encountered in the *Aces of the Deep* (AOD) simulation.

This guide will help you install the Expansion Disk and learn its features. To learn how to play *Aces of the Deep*, or to find customer service and technical help, refer to your *Aces of the Deep* manual.

### System Requirements

Before you can install this expansion disk, you must have already installed *Aces of the Deep* or *Aces of the Deep CD*. Installing the expansion disk will require about 4 megabytes (MB) of hard disk space.

### Installation

1. After starting your PC, insert your *Aces of the Deep* Expansion Disk into the appropriate drive.
2. Type the appropriate drive name (usually **A:**) and press [ENTER].
3. Type **install** [ENTER].
4. Follow the on-screen instructions to install the expansion files to the correct directory on your hard drive.

After installation, start **AOD** or **AODCD** as before.

### Customer Service Updates:

For Sierra/Dynamix software sales and returns, write Sierra On-Line Direct Sales, P.O. Box 3404, Salinas CA, 93912 (mark returns ATTN: Returns).

The Direct Sales fax is 408-644-2018.

You can now call 206-644-4343 to reach Automated Technical Support or a Technical Support Representative.

Sierra now provides on-line technical support via CompuServe, America Online, and the Sierra BBS only.

To reach the Sierra/Dynamix forum on CompuServe, use GO SIERRA.



# New Features

After installing the expansion disk, the new features will be fully integrated with the simulation.

## Mediterranean Historic Missions

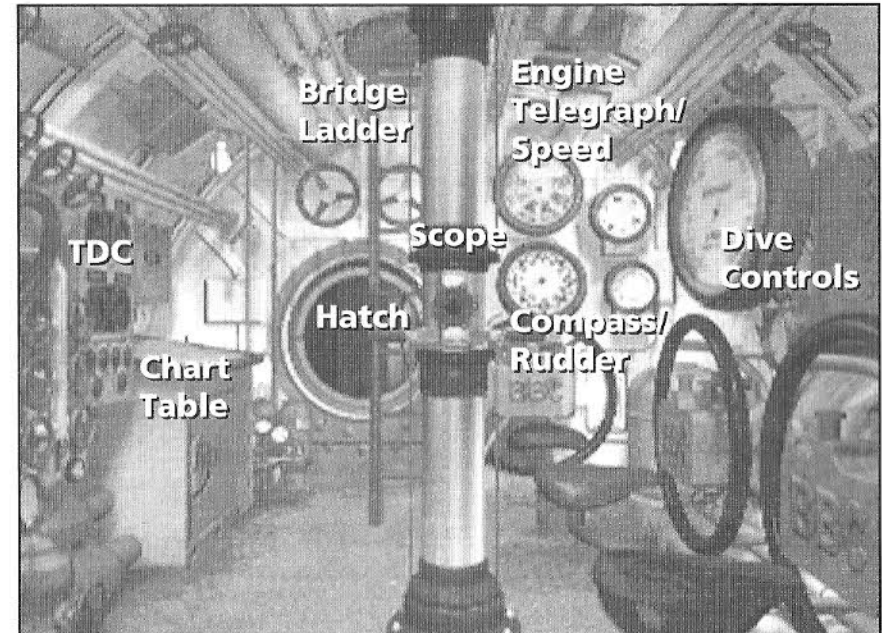
There are six new Historic Missions that take place in the Mediterranean. To undertake one of these missions, first select **SINGLE MISSION** from the main menu, and then open the Historic Missions screen. Click on a mission title to preview it and see if it is set in the Mediterranean. To begin the highlighted mission, press the **SELECT** button. Remember, the conditions for historic missions are pre-determined—if history is to change, it's up to you.

## Mediterranean Careers

You will not be ordered to the Mediterranean during your career, but you may navigate to and enter the Mediterranean on your own at any time. Once you enter the Mediterranean, however, the eastbound current through the Straights of Gibraltar will make it practically impossible to leave again in that U-boat. (You still may be transferred out of the Mediterranean to a new Atlantic command.) Use the current and the cover of darkness to enter through the Straights. Before June 1940, there will be no Mediterranean bases—you will have to try to return to a French base for refueling and new torpedoes. After June 1940, you can end missions at La Spezia, Italy, and after January 1942, at Salamis, Greece.

## New Gauges

All U-boats have two new gauges, available by pressing [G], or from the Chief Engineer Voice Tube menu as **BUOYANCY GAUGES**. The gauge on the left shows the compressed air available for blowing ballast tanks. The one on the right shows the level of water in the boat.



The Type XXI Control Room.

## Type XXI U-boat

In this simulation, the Type XXI U-boat becomes available in Careers in January, 1943. (Historically, design work began on the XXI in late 1942, but it was not deployed operationally until April 1945, just before the end of the war.) To take command of one in a Single Mission, select **TYPE XXI** from the U-boat Type menu in the Convoy Encounter or Warship Encounter menu screens.

You may be assigned a Type XXI in any Career that lasts past January 1943, if your performance merits it. Keep in mind that Type XXIs are extremely costly, and only the most accomplished and privileged commanders will be assigned to one. See the "Type XXI" section starting on page 22 for more.

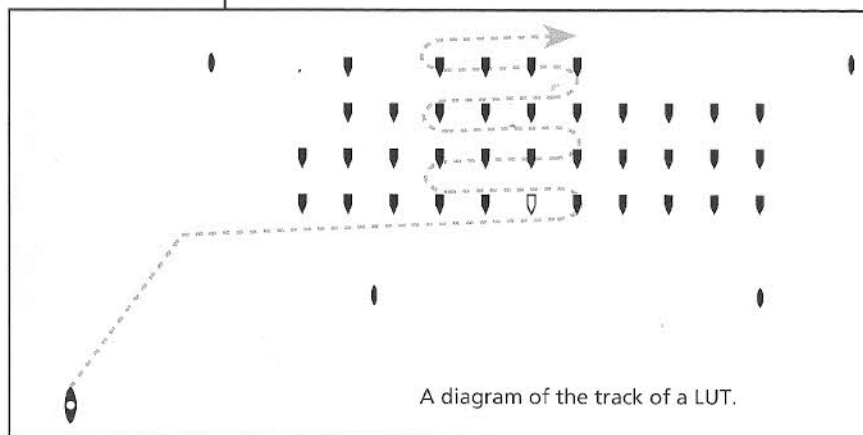
## New Torpedoes

This expansion disk provides two new torpedo types for use with the Type XXI U-boat exclusively. Check the Torpedo Room [F6] once the mission begins to see how many of each you have on board.

### T VI LUT (G7e) Pattern Running Torpedo

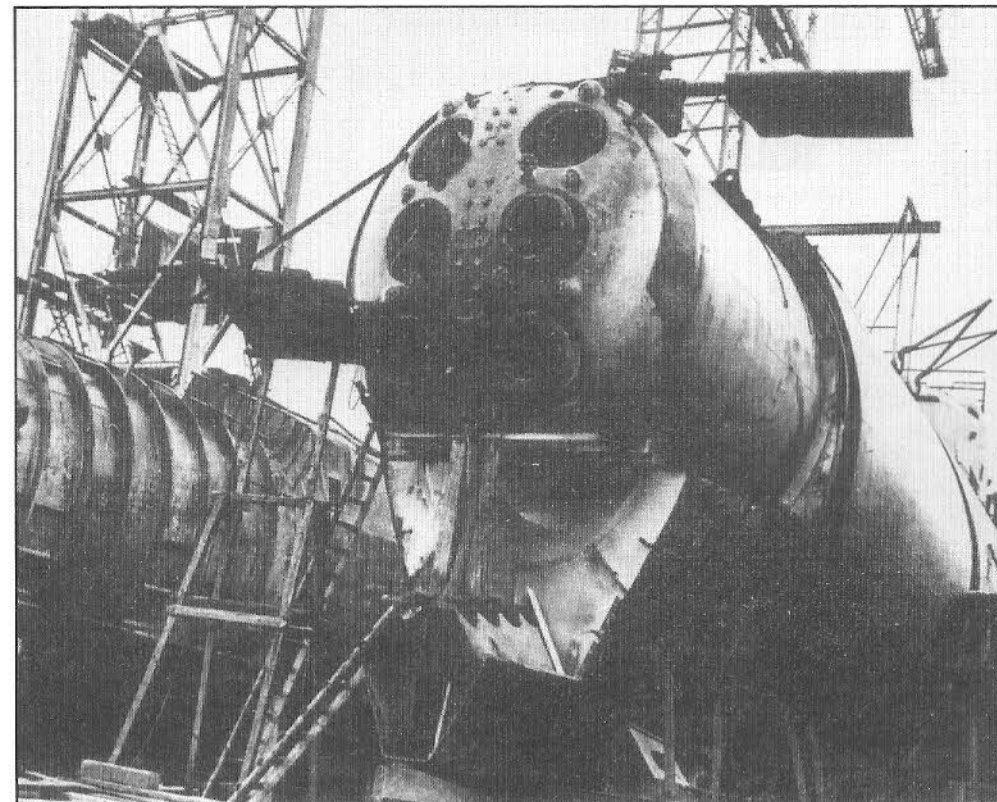
Range/Speed: 7.5 km at 30 kt

Warhead: 300 kg



The LUT (Lagen Unabhängiger, or "position-independent," Torpedo), is an improvement on the earlier FAT. Its programmable approach pattern includes a second run leg and angle, which allows it to cut across the course of the convoy from any firing angle, and provides a much better chance of hitting a target. The Type XXI can fire the LUT on a sound bearing only, from depths down to 100 meters.

Program the LUT's run pattern using the Torpedo Room's PROGRAM LUT window. For best effect, you want the final zigzag pattern to cut directly across the convoy's course.



National Archives

### T XI Gnat II (G7es) Acoustic Homing Torpedo

Range/Speed: 5.7 km at 24 kt

Warhead: 274 kg

The "Gnat II" acoustic homing torpedo tracks a wider range of ship noises than the Gnat I, and is less likely to be distracted by Allied noise decoys. The Gnat II also can be fired by the Type XXI on a sound bearing while submerged. (Historically, the Gnat II was never tested in combat, but it promised to be much more deadly than its predecessor.)

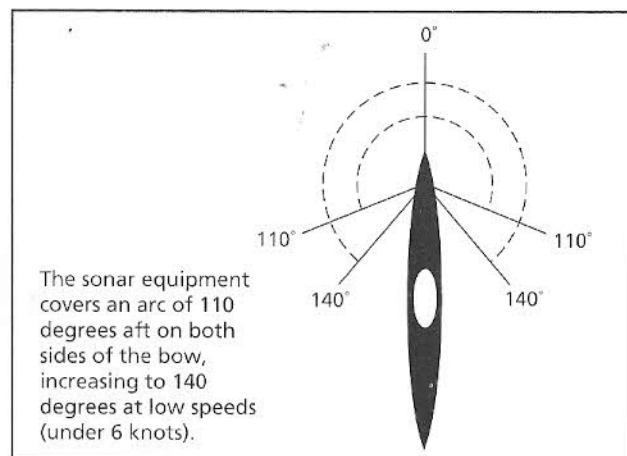
The forward end of a Type XXI without the external hull in place. The six bow torpedo tubes are clearly visible at the front of the pressure hull.



Sonar button

## Sonar

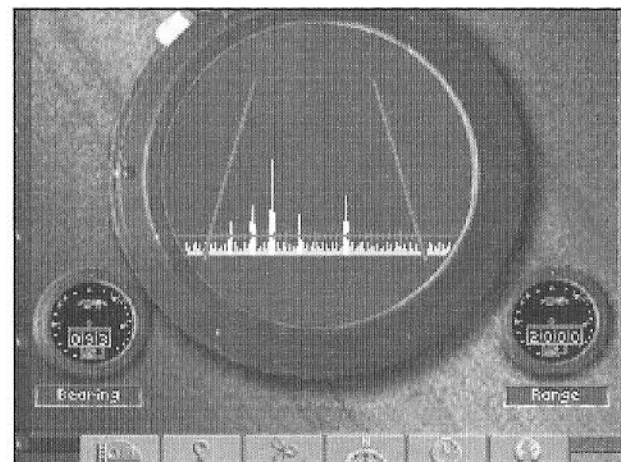
Type XXI U-boats are equipped with an active sonar. Mounted in the front of the conning tower, the SU "Nibelung" sonar allows you to actively "ping" with sound impulses to detect and fire on surface targets while submerged. The equipment can determine target ranges accurately at over 8 kilometers, at submerged speeds of up to 11 knots. It covers an arc of 110 degrees aft on both sides of the bow, increasing to 140 degrees at low speeds (under 6 knots).



Note: Sonar is not effective at speeds over 11 knots. Keep in mind that active sonar is inherently noisy: using it will alert Allied ships to your presence, and continued use can pinpoint your location for the escorts.

When used in conjunction with the superb GHG passive listening hydrophone, the Type XXI's listening and location system is decades ahead of any other sonar system in the world. Use the sonar contact to aim acoustic homing or pattern-running torpedoes accurately while safely submerged.

To use the sonar, go to the [F5] Tactical Chart display. Rely on your hydrophones for an initial "passive" contact. Click on the hydrophone bearing line to the target you want. The line will turn blue. Turn the sub towards the hydrophone contact, and then click the sonar "ping" icon below the chart. If the sonar impulse finds a contact, the contact's bearing and range will be fed into your TDC (Torpedo Data Computer).



## Radar

Type XXI U-boats are also equipped with radar. In contrast to the sonar suite, the U-boat radar equipment is several years behind Allied gear. Nonetheless, the "Hohentwiel" antenna and its associated transmitter/receiver provide you with some early warning of enemy ships and aircraft. It can reliably detect surface targets at ranges of up to 7.5 km, and aircraft out to about 10 km.

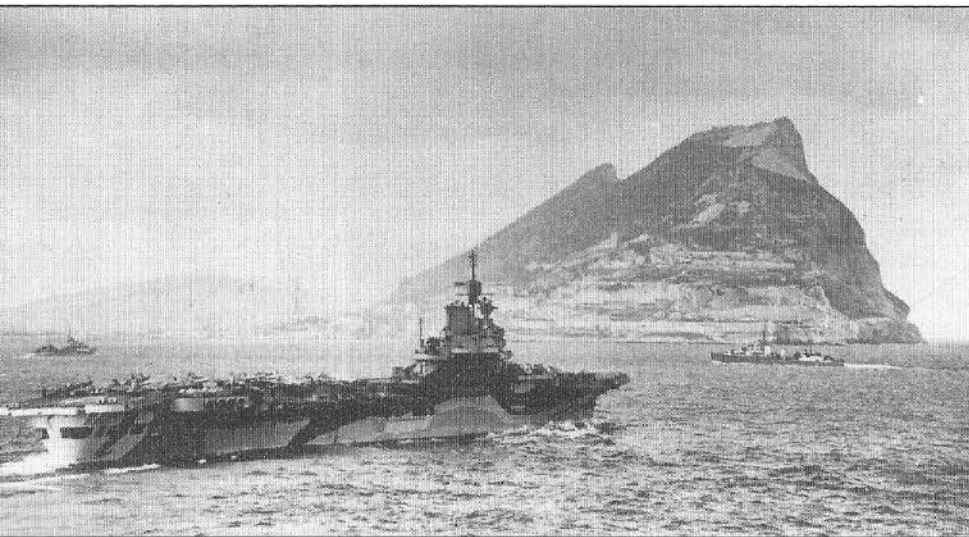
Activate the radar via the Watch Officer Voice Tube menu, or by pressing [R]. (Radar will not work while you are submerged, even at periscope depth.)

Once you start the radar, it sweeps the entire horizon automatically, and reveals contacts as signal "spikes" on the green band display. The spike size shows the size of the contact(s). The spike's location on the green band indicates approximate range. (From left to right, the band represents ranges of 0-10 kilometers in half-kilometer increments.) The readout at the bottom left provides the closest contact's absolute (compass) bearing. The readout at the lower right shows the range to the nearest contact in meters. The radar will continue to operate until you dive, or go to another screen.

Note: Activate the radar by pressing [R], or from the Watch Officer Voice Tube menu.

Note: Allied HF/DF radio detection gear can intercept the radar signal at greater range than the radar can detect a target. Using it is a calculated risk, especially in the heavily guarded North Atlantic.





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Aircraft carrier *HMS Formidable* exercising with destroyers off Gibraltar, 1943. Thanks to forces like this, the Mediterranean was a one-way trip for German subs.

## Historical Overview

### The Other U-boat War

The German U-boat Command (*Befehlshaber der U-boote*—BdU) had many good reasons not to send U-boats into the Mediterranean.

In the first place, operations in the Mediterranean detracted from the effort in the Atlantic, which the U-boat Command felt was the decisive theater of the war. To maintain 20 boats on patrol in the Mediterranean, for instance, required that over 40 boats be assigned to that theater. Up to one half of the boats committed would normally be in transit on their way to or from the patrol area, not to mention those boats undergoing normal maintenance at their bases. Passage into the Mediterranean also meant inevitable losses in transit. The High Command would have to send extra boats into the Mediterranean to make up for expected

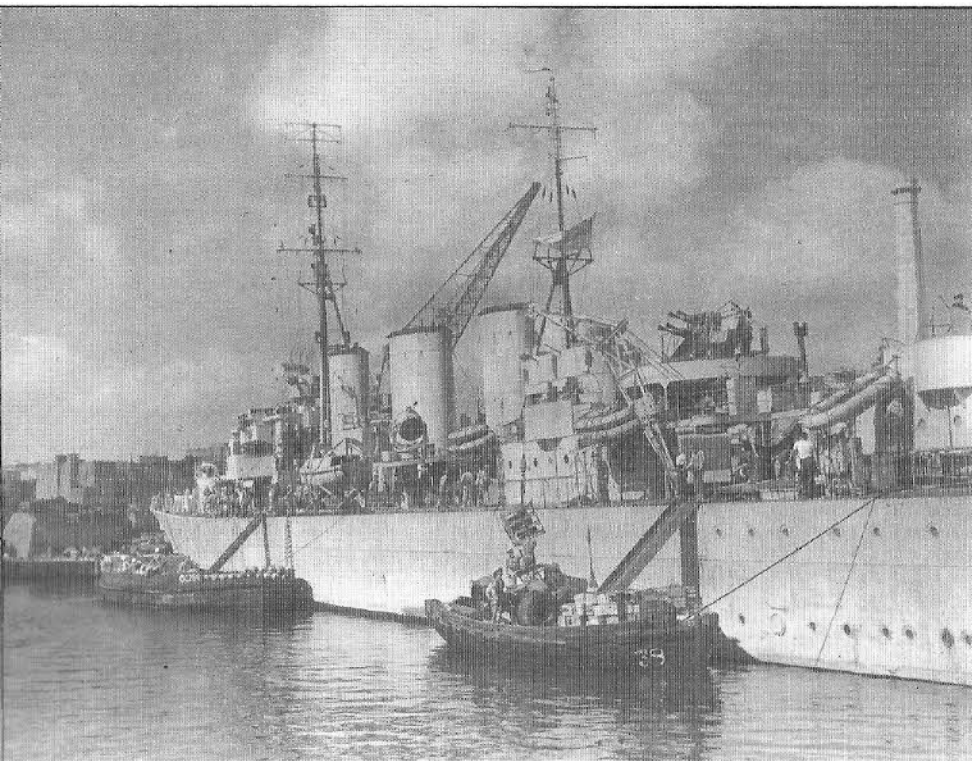


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losses. Even if there had been enough boats for the Atlantic campaign (which there were not), siphoning 40 or 50 boats into another theater would cripple that effort.

BdU also felt that the Mediterranean was a trap for submarines. Passing through the narrow Straights of Gibraltar into the Mediterranean was difficult, but leaving the Mediterranean via that 15-mile-wide gauntlet was virtually impossible. A very strong current (about 7 knots) ran west to east through the Straights. Boats entering the Mediterranean could use this current to advantage, but boats attempting to leave could not do so submerged, since the current equaled the best submerged speed of a U-boat. A surface transit west to east past the heavily guarded British base at Gibraltar, even at night, was just barely possible. Heading the other direction meant that U-boats were slow even on the surface, and would be unlikely to escape the strong air

*HMS Indomitable* guarding a Malta-bound convoy, August 1942. This picture was taken from another carrier, *HMS Victorious*.

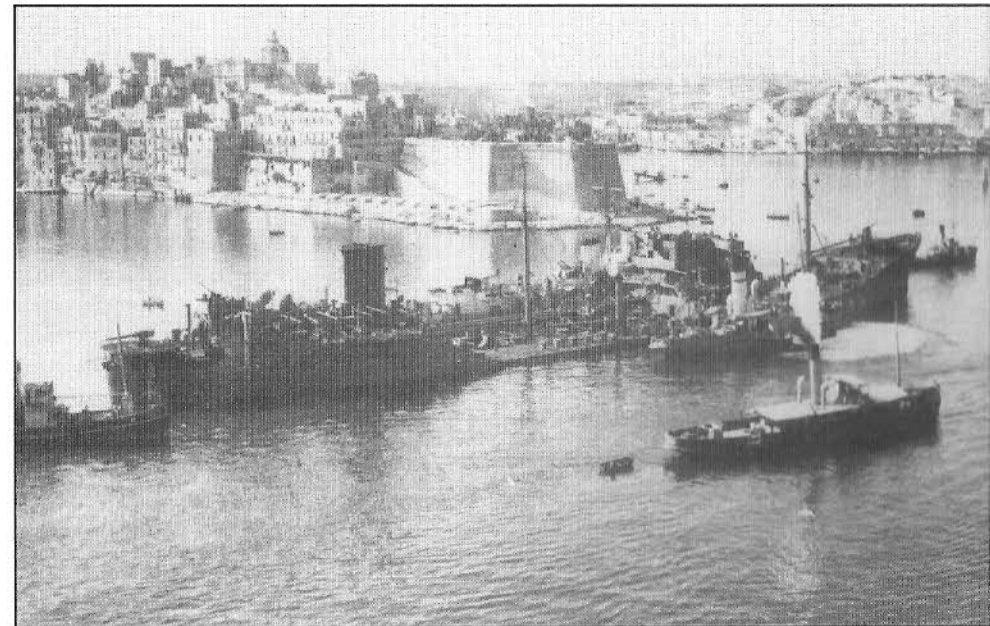


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The British mine-laying cruiser *HMS Welshman* unloading supplies at Malta, 1942. Malta was the strategic key to the central Mediterranean.

and sea patrols in and around the Straights. These conditions meant that any boat that entered the Mediterranean, even to help overcome a temporary crisis, was permanently lost to the Atlantic campaign.

Once inside the Mediterranean, conditions were still not favorable for U-boat operations. For one thing, there were few merchant vessels in the wartime Mediterranean, and those encountered were likely to be small. Convoys were few, and those that sailed did so under very heavy escort, which usually included aircraft carriers. There were plenty of warships to shoot at, but these were always difficult targets because of their high speed and strong escorts. Furthermore, the Mediterranean Sea itself was small and shallow, and its waters were clear. It was therefore more difficult for U-boats to



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hide from pursuit. Finally, none of the operational zones of the Mediterranean were outside the range of Allied aircraft. U-boats were subject to attack from the air whenever they were on the surface.

These considerations prompted U-boat Headquarters to protest vigorously when, early in September, 1941, Hitler ordered the High Command of the Navy to send U-boats into the Mediterranean. The strategic situation in that theater, however, in particular the critical need to maintain supply lines to Rommel's Afrika Korps, outweighed BdU's concerns. The Germans also sent a strong air flotilla to Sicily to help neutralize the British base at Malta, from which many of the ships and planes that were attacking German supply lines sortied. At the end of September, the first six Atlantic U-boats entered the Mediterranean Sea. Four more followed early in November. Command arrangements were quickly set up, and U-boat bases established in southern France, Italy, and Greece.

The American tanker *S.S. Ohio* limps into Malta, August 1942. En route with desperately needed aviation fuel, she was bombed and torpedoed by German planes, and had a dive bomber crash into her as well. Her captain, D. W. Mason, was presented with the highest civilian honor: the George Cross.



## The Battleship Killers: Italian Frogmen in WWII

For the most part, the Italian navy was ineffective in World War II. But one branch of the Italian underwater service performed brilliantly: Italian frogmen were the best in the world. In the days before SCUBA gear, Italian swimmers, miniature submarine operators, and suit divers set the standard for operations in this medium.

Two operations in particular illustrate their skill. For years, frogman teams spied on and infiltrated the British base at Gibraltar from the neutral Spanish harbor of Algeciras across the bay. From underwater doors in an Italian merchant vessel interned in Algeciras harbor, Italian frogmen swam into Gibraltar to spy and place explosive charges. While several ships were reportedly damaged by these operations, the real accomplishment was the ongoing intelligence on British fleet and cargo movements in this heavily guarded base.

Far more spectacular was the attack against the main British fleet base at Alexandria, Egypt. On the night of December 19, 1941, the Italian submarine *Scire*, under the command of Prince Borghese, approached the British base and launched three "Maiali" miniature submarines. SLC 222, piloted by Lieutenant V. Martellotta, penetrated the harbor and attached itself and its explosive charge to the tanker *Sagona*. SLC 221, with Lieutenant L. Durand de la Penne, approached and attacked the battleship *Valiant*, while SLC 223 under Lieutenant A. Marceglia found the battleship *Queen Elizabeth*. The resulting explosions sent both battleships to the bottom of the harbor, while the third explosion damaged the *Sagona* and the destroyer *Jervis*. With one stroke, the Italian frogmen crippled the British fleet in the eastern Mediterranean. The sunken vessels were later raised and repaired, but it was years before they rejoined the fleet.

German naval strategy had always considered the Mediterranean an Italian area of responsibility, and it was the naval and submarine forces of Italy that had been carrying on the sea war against the British Mediterranean Fleet. The Italian surface fleet, however, was no match for its British counterpart. Italy's submarine forces, although more professional than the surface navy, suffered from poor equipment and lacked an aggressive doctrine. Italian submarines, for example, did not have a diesel air intake tube leading to the conning tower, relying instead on air valves located on the hull. In heavy weather, the Italian subs were forced to leave the conning tower hatch open to provide an adequate supply of air to the diesel engines. When water entered the boat through this open hatch, it often damaged

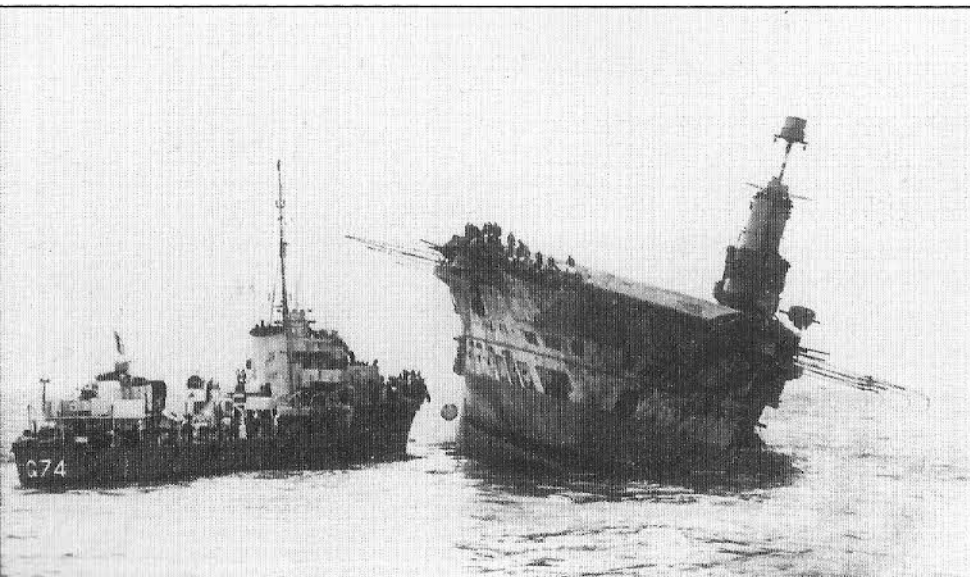


Imperial War Museum

equipment aboard, especially electrical equipment. Despite these handicaps, the Italian submarine force had waged fairly effective war against the Allied fleets, sinking three light cruisers, two destroyers, and a British submarine, as well as nine of the scarce merchant vessels. In addition, another light cruiser, one other destroyer, and two more merchant ships were damaged in the year before the introduction of German submarine forces into the Mediterranean.

The dispatch of experienced German U-boats and crews to the Mediterranean had an immediate effect. On November 13, *U-81* (Leutnant Guggenberger), operating east of Gibraltar, found the British carrier *Ark Royal* and sank her with a single torpedo hit. Twelve days later, *U-331* under Leutnant Freiherr von Tiesenhausen located the battleship *Barham* in the eastern Mediterranean and put a salvo of torpedoes into her, causing the battleship to capsize and explode with great loss of life. By the end of the year, the German submariners had added a light cruiser, a corvette, and 12 merchant ships to their total. These losses, coupled with the effective interdiction campaign mounted by the German air forces in Sicily, mine-laying efforts directed

*HMS Ark Royal* listing to starboard as a result of the torpedo from *U-81*. Despite a gallant effort on the part of her crew, this most famous of all British carriers finally sank almost within sight of Gibraltar Harbor and safety.

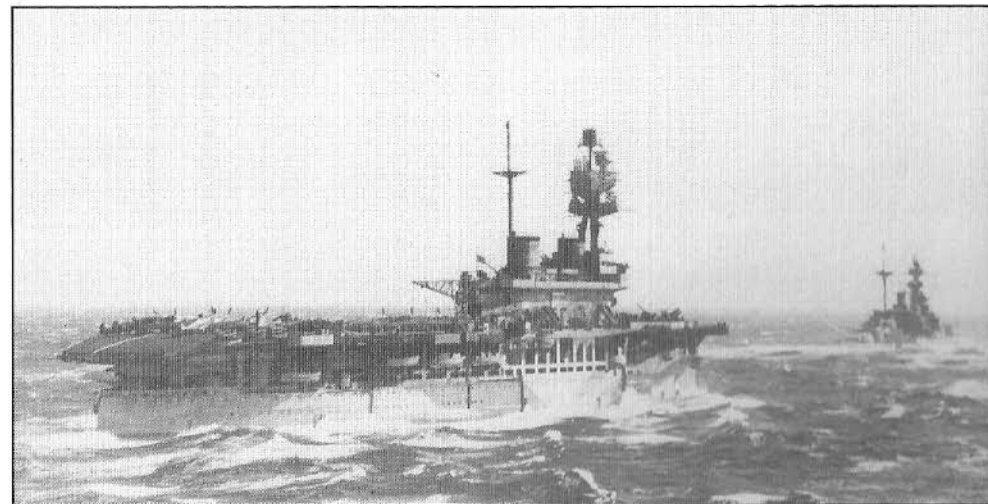


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November 14, 1941. A destroyer comes alongside *HMS Ark Royal* to remove the last of her crew.

at Allied ports, and further contributions by the Italian forces, took much of the pressure off Rommel's supply lines. By January 1942, the Afrika Korps was ready to resume the offensive.

The naval situation in the Mediterranean was in stalemate for much of 1942. The U-boats, now in greater numbers than ever before, continued to prey on Allied merchants and warships. In August, for example, *U-73* got a lucky salvo off against the 22,600-ton British carrier *Eagle*, sinking her. The Allies, on the other hand, patiently built up their forces, including large numbers of radar-equipped patrol aircraft. They also resumed their attacks on the supply lines to the German and Italian armies fighting in Africa. Axis supply shortages began to occur, and gradually got worse. The great battles in the Western Desert led to a German advance almost to Alexandria, the main British fleet base in the eastern Mediterranean. The British army held, however, and began to ready itself for a counterattack. The longer German supply lines caused by the advance were once again vulnerable, and by November the supply situation for the Afrika Korps was growing desperate.

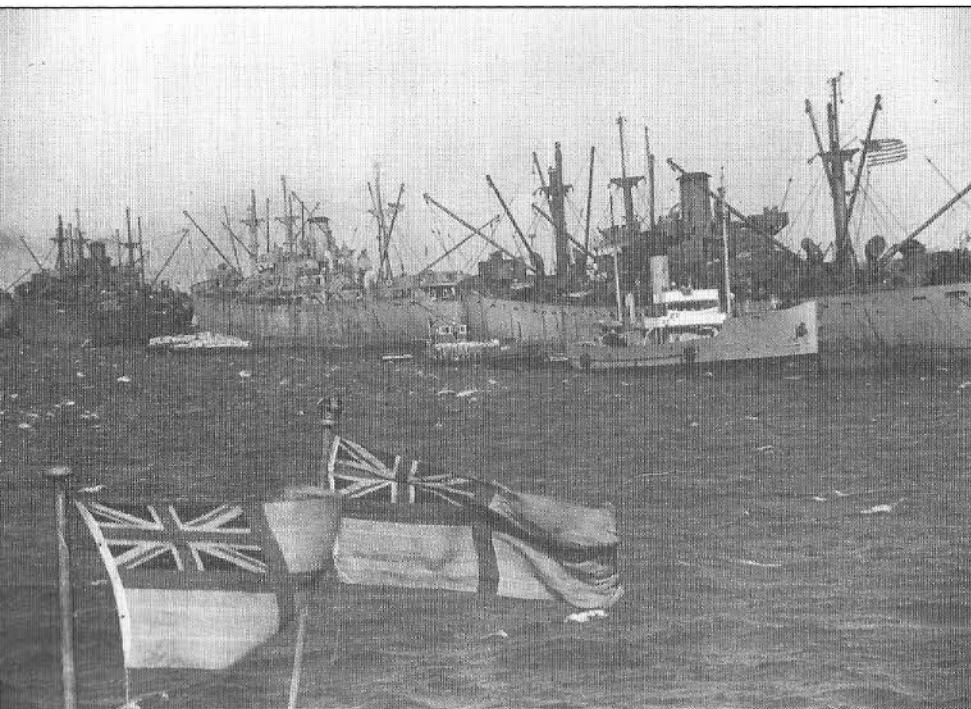


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November, 1942, was the turning point for the war in the Mediterranean. In late October, the British Eighth Army under General Montgomery launched a massive and meticulously prepared attack against the German and Italian forces before Alexandria. By November 4, the Allied army had breached the Axis front, forcing the decimated Afrika Korps into head-long retreat, and ending the threat to Egypt. As the German forces retreated towards Tunisia, more and more of the North African coast came under Allied control. The Allies quickly established air and sea bases in this area, making submarine operations in the eastern Mediterranean difficult.

As the German and Italian armies were being driven from the eastern Mediterranean, a new threat developed far to the west. On November 8, the Allies mounted a massive amphibious landing on French North Africa from Morocco to Algeria. Operation Torch, as this landing was known, came as a complete surprise to the Germans, who had to scramble to bring forces to bear against this new threat. The primary response came from the U-boat arm. All available submarines were vectored against the landing sites. The goal was to disrupt the supplies to the Allied armies in the west. This

The British carrier *HMS Eagle* and a battleship of the Queen Elizabeth class at sea, 1942.



Imperial War Museum

Merchant ships in the harbor at Algiers unloading cargo into lighters, January 1943.

would give the German High Command time to fortify and reinforce Tunisia, maintaining this position as a bridgehead into Africa and preventing the Allies from establishing control of the entire North African coast. The effort failed, however, and the Allied armies quickly closed in on Tunisia. By May, 1943 the Axis armies there were forced to surrender.

The loss of the North African coast made U-boat operations in the Mediterranean more difficult than ever. There were now dozens of Allied air bases stretching the length of the sea, from which hundreds of radar-equipped planes sortied to hunt U-boats. It was also clear that the Allies planned further operations. In July came Operation Husky, the Allied invasion of Sicily. Despite hard fighting and a well-conducted defense, Messina, the last Axis position on the island, fell to advancing American armored units by August 17. In the face of overwhelming Allied air and sea superiority, the



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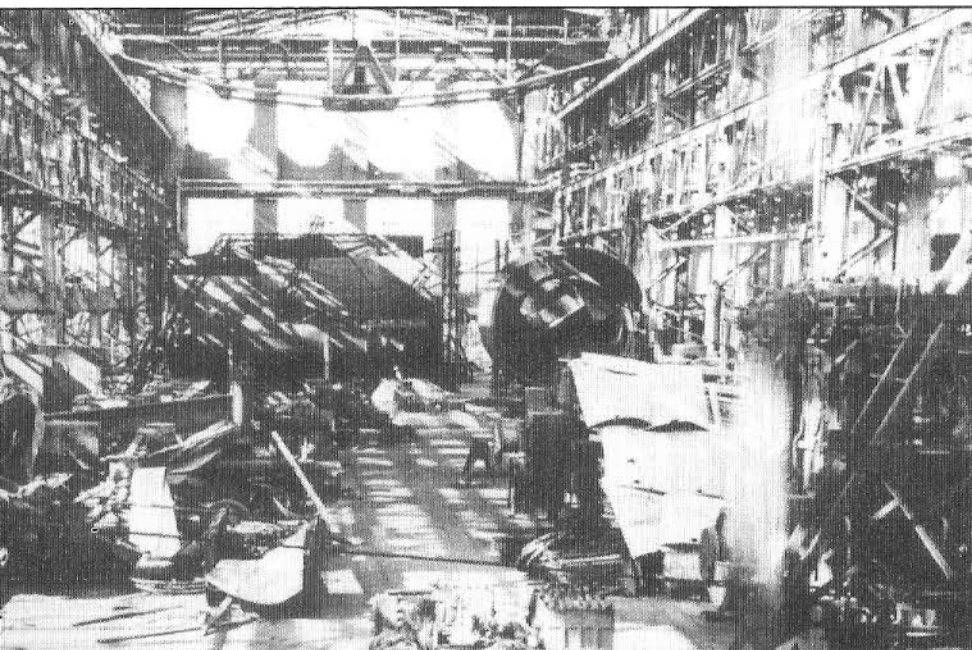
German defenders successfully evacuated across the Straits of Messina to Italy.

One of the primary results of the loss of Sicily was political. Benito Mussolini, who had been in power in Italy since 1923, was forced to resign. Italian politicians and military leaders now began to negotiate with the Allies for an Italian surrender. By September 3, the documents were signed, but the announcement was delayed to prevent a German takeover of Italy. Word leaked to the Germans, however, and the German army quickly established itself in key positions in Italy, disarming and sometimes interning the Italian army. That same day, the first Allied landings in Italy took place.

Allied air and naval strength in the Mediterranean was now overwhelming. U-boat operations from La Spezia and Salamis could be carried out only with the greatest difficulty, and successful attacks on shipping or on naval forces were becoming rare. The grim German resistance to the Allied advances in Italy prolonged the U-boat campaign, but by May, 1944, with the fall of

July 10, 1943. British soldiers unloading stores onto a Sicilian beach as part of Operation Husky, the invasion of Sicily.





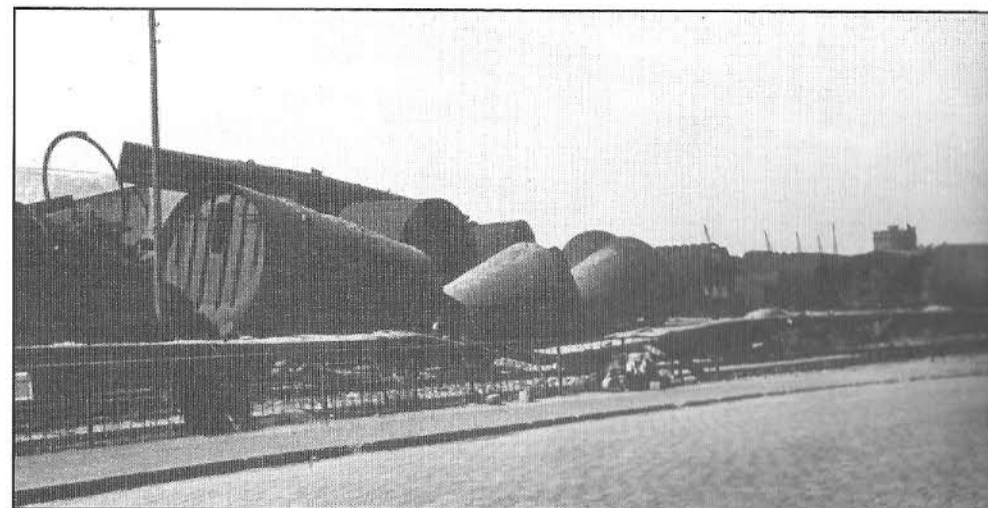
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A Type XXI hull section at the back of an assembly plant. Because Allied bombing often interfered with the transport of the various hull sections from their places of manufacture to the assembly yard, shipyards were forced to hand-build spare hull sections to replace those delayed or destroyed in transport.

Rome imminent, it was clear that there was nothing further to be gained by submarine operations in the Mediterranean. The last U-boat attack in the Mediterranean took place on May 19, 1944, when Kapitänleutnant (Lieutenant Commander) Luhrs in *U-453* attacked and sank the 7,147-ton British freighter *Fort Missanabie*.

Despite some tactical successes, the U-boat campaign in the Mediterranean must be judged a failure. The strategic task of the U-boat force was to cut the sea routes that linked Britain to the wider world. U-boats were designed to sink merchant vessels, and there were precious few of these targets available in the Mediterranean. The Allies could absorb the warship losses there because of their tremendous superiority over the naval forces of the Axis. Operations in the Mediterranean made only a minimal contribution to the main task, and compromised the Atlantic battle.

To give but one example of how this diversion affected the larger campaign, consider the situation at

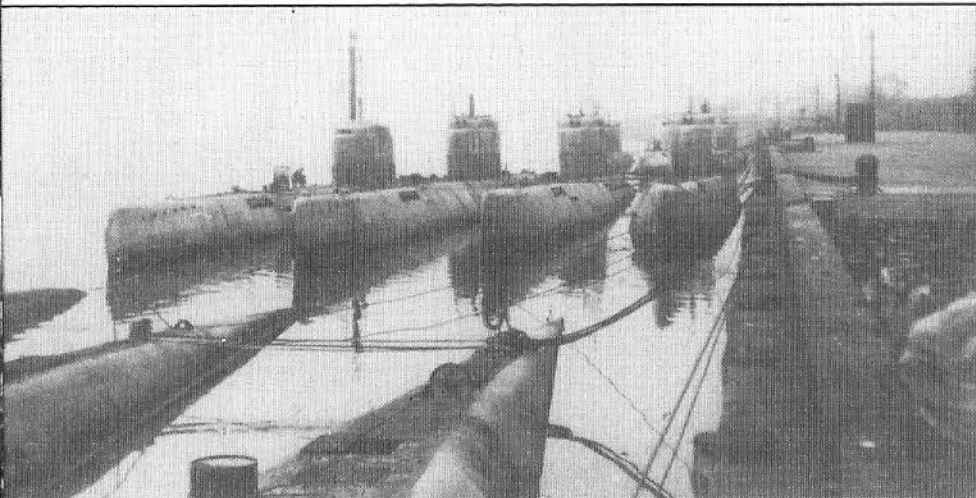


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Type XXI U-boat hull sections at the Blohm and Voss shipyard, Hamburg. Allied bombing seriously interfered with Type XXI construction and assembly.

the start of Operation Drumbeat, the campaign against shipping along the American east coast which opened in January, 1942. Because of commitments in the Mediterranean and the area just west of Gibraltar, the U-boat Force was able to send only five boats against the United States. During a time when every U-boat dispatched west against the U.S. coast was setting new records for sinkings, almost 40 U-boats, some of them the large Type IXs, were tied down in relatively unprofitable operations in and near the Mediterranean. The highest sinking totals of the war were established by a force that never exceeded 12 boats in the operational area. Had extra boats been available for operations in the Atlantic, sinkings would surely have been greater.

Germany needed to concentrate all of its resources on the decisive front. The Mediterranean U-boats were continually harassed from the air and sea, and despite some successes sinking Allied warships, they made almost no contribution to the tonnage war against the merchant convoys. In sending U-boats to the Mediterranean, Germany essentially blunted one of the most effective strategic weapons it possessed.



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Surrendered Type XXI U-boats at Loch Ryan, Scotland in 1945.

## Type XXI: The First True Submarine

### Type XXI

*Crew:* 57

*Length:* 76.7 m

*Displacement:* 1,621 tons surfaced, 1,819 tons submerged

*Top Speed:* 15.6 kt surfaced, 17.2 kt submerged

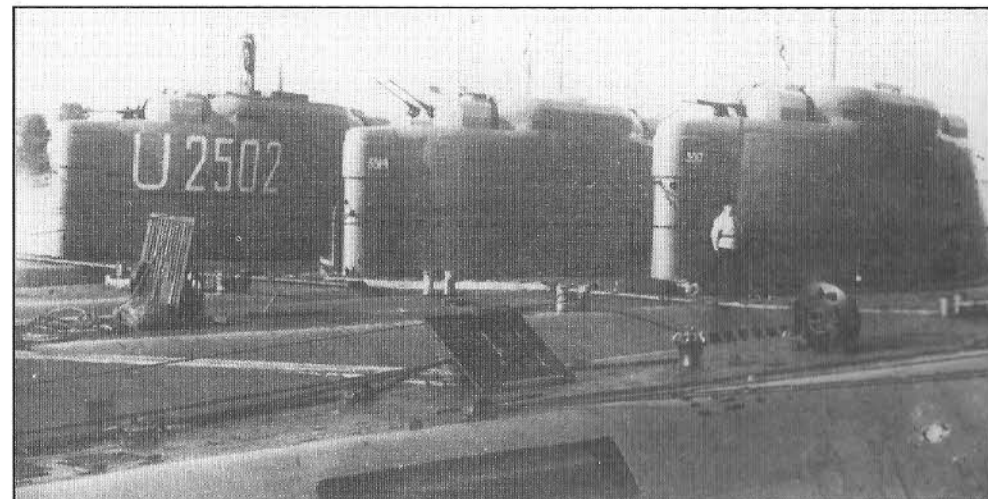
*Range:* 11,150 nm at 12 kt surfaced, 285 nm at 6 kt submerged

*Dive Depth:* 200 meters (test depth)

*Torpedo Tubes:* 6 (bow)

*Guns:* 2 twin 2-cm. antiaircraft cannon

The Type XXI U-boat was the first submarine designed to spend most of its time underwater. Besides the improved underwater performance due to its huge battery capacity, the Type XXI had new and improved active and passive sonar systems, a radar set, a hydraulic semi-automatic torpedo loading system, turreted antiaircraft guns, new torpedoes, a schnorkel for underwater battery recharging, and the ability to fire its weapons on sound bearings alone from depths to 100 meters. In addition, the Type XXI could dive to previously



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unheard-of depths (over 300 meters). With its batteries fully charged, the Type XXI could travel underwater at its top speed for four hours. It also featured several improvements to crew comfort, including a large freezer, showers, and a heating and air conditioning system. Far ahead of its time, this revolutionary craft entered production too late to fire a torpedo in anger. When the war ended, however, over 100 of them were in various stages of training and fitting out. The story of its development poses one of the most interesting "might-have-beens" of the war.

By late 1941, it was already clear that the U-boats were losing ground to increasingly numerous and sophisticated Allied escort forces. In particular, the slow underwater speed and short submerged endurance of the Type VII and IX boats were handicaps that would soon doom the U-boat fleet. Continued success in the Battle of the Atlantic would require new submarine designs capable of high underwater speeds.

German scientists and engineers had been working on the problem for years, and had already proposed several new technological solutions. The most promising of these was the brainchild of Professor Hellmuth Walter—the use of hydrogen peroxide as a fuel. Walter

Another view of the Type XXI boats in Allied hands at Loch Ryan. From left to right, they are U-2502, U-3514, and U-3017.



National Archives

A late-model Walter boat destroyed by Allied bombing. Several different hydrogen peroxide-fueled designs were built, but none became operational.

designed a closed-cycle hydrogen peroxide engine for submarine use that promised fantastic increases in underwater speed. As early as 1939, Admiral Dönitz, head of the U-boat arm, approved an experimental project to build a small hydrogen peroxide boat. This prototype (named V80) attained unprecedented submerged speeds of up to 26 knots.

With the success of V80 apparent, permission was given to build larger prototypes. But the hydrogen peroxide system was not without problems. Chief among these was hydrogen peroxide's extreme corrosiveness, which caused great difficulties in handling and storing the material. The containers for the chemical, for example, had to be lined with rubber to prevent damage to the tanks. The Walter system also required huge amounts of the chemical, which meant that any operational design would have to be huge as well. Even the

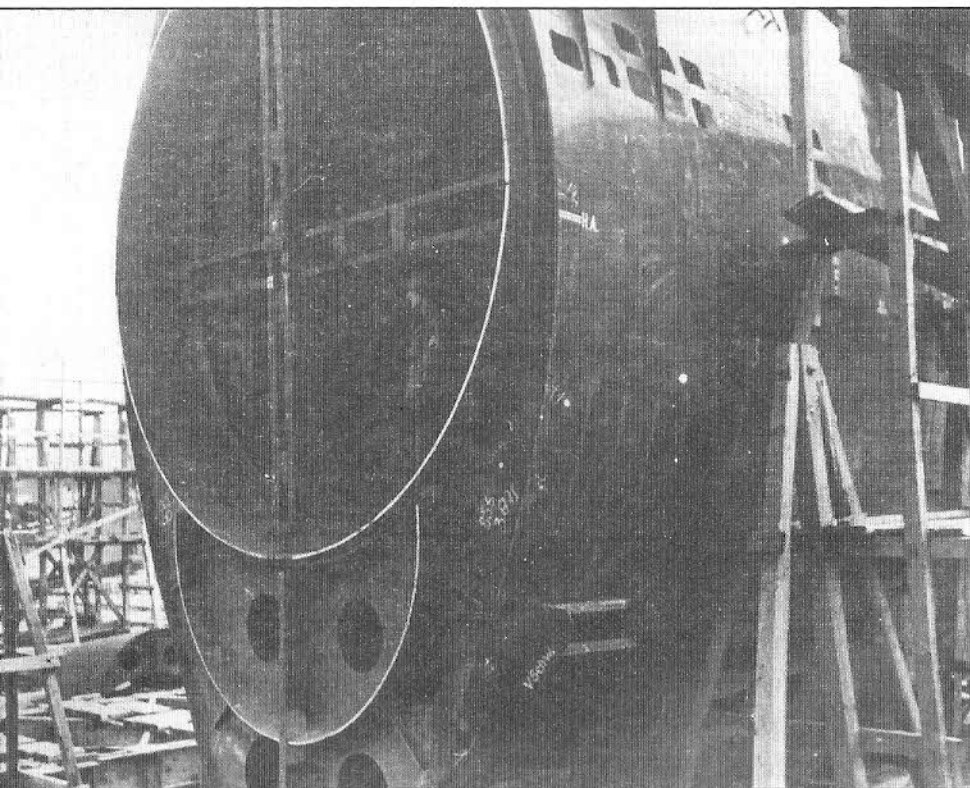
production of the hydrogen peroxide itself was a problem. Germany had only one facility capable of manufacturing industrial quantities of hydrogen peroxide, and the output was far too small to provide fuel for a vast fleet of submarines. If the Walter system was to be used, a great deal more plant capacity would have to be constructed.

The Walter prototype was shown to the commander of the German navy in February, 1942, but aroused little interest. The main objection from the naval staff was that the shipyards were already fully employed in constructing proven U-boats such as the Types VII and IX. The staff resisted the idea of switching construction to an untried experimental design. To resolve the outstanding issues of design and construction, Admiral Dönitz called a meeting at his Paris headquarters for November, 1942.

At this meeting, Professor Walter presented his design for a full-sized operational U-boat that would use his hydrogen peroxide system for propulsion. To overcome the fuel storage problems, Walter designed a vessel with two pressure hulls, one above the other in a "figure 8" structure. The lower level would serve as a single huge hydrogen peroxide tank, while the upper hull would contain crew, weapons, and machinery. Although technically feasible, it was quickly apparent that there would have to be a great deal of further work on the Walter design before it would produce an operational U-boat. Germany simply did not have the industrial capacity to build conventional boats to meet immediate wartime needs, as well as new designs using unproven and complex technologies.

This meeting might have ended the attempt to develop high-speed U-boats. However, two engineers at the meeting, Schürer and Bröcking, suggested an alternative. If all the submarine force wanted was more underwater power, why not simply fill the lower part of the Walter double-hull design with conventional storage batteries? A quick calculation demonstrated the



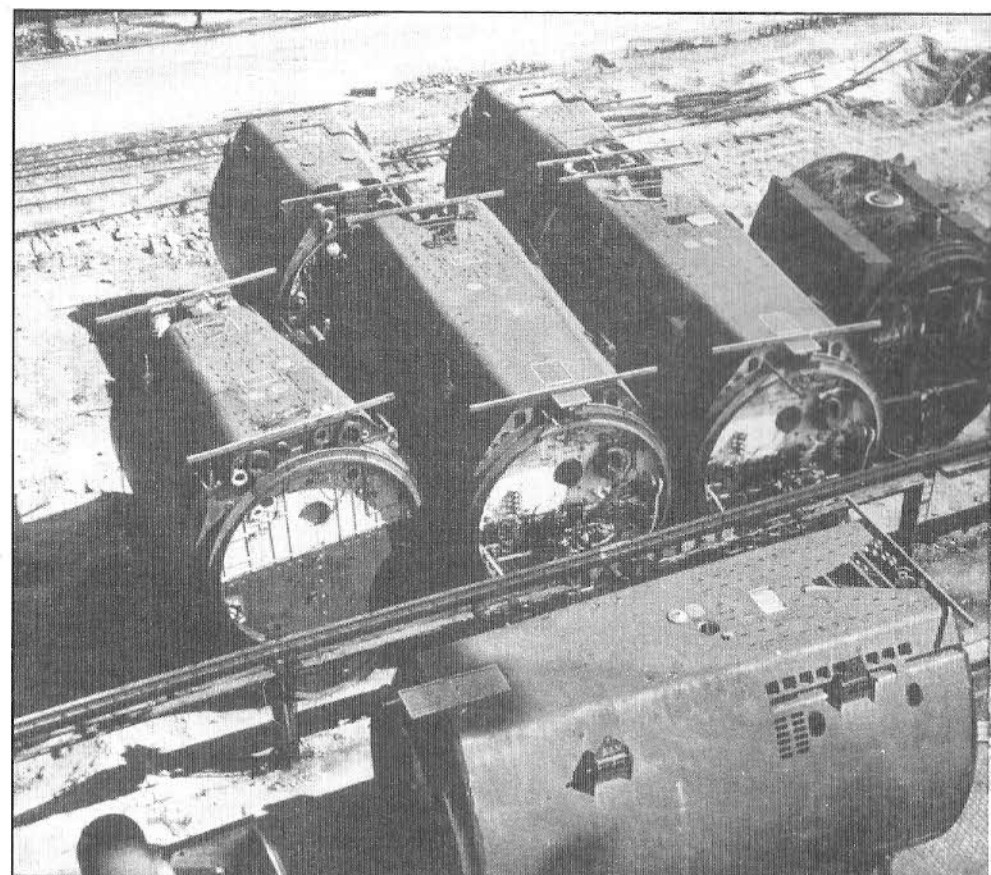


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One of the hull sections of a Type XXI U-boat at the Blohm and Voss shipyard, Hamburg. The "figure 8" pressure hull configuration characteristic of the Type XXI is clearly visible.

feasibility of the idea. The theoretical work was completed by January, 1943, and a detailed plan and a set of working drawings were ready by July. On Friday, August 13, 1943, permission was granted to start production.

The new design, now officially known as the Type XXI, included several other innovations in addition to the new battery layout. The torpedo loading procedure was to be partially mechanized with a new hydraulic loader, which would greatly reduce torpedo reloading times. The torpedo tubes were modified to allow firing weapons at depths to 100 meters, and several new torpedo designs proposed to make use of them. A new depth-keeping system was installed that used water pressure to help regulate depth. Crew comfort was improved with the addition of large freezers to help keep food fresh. Also in the works was a new electronic

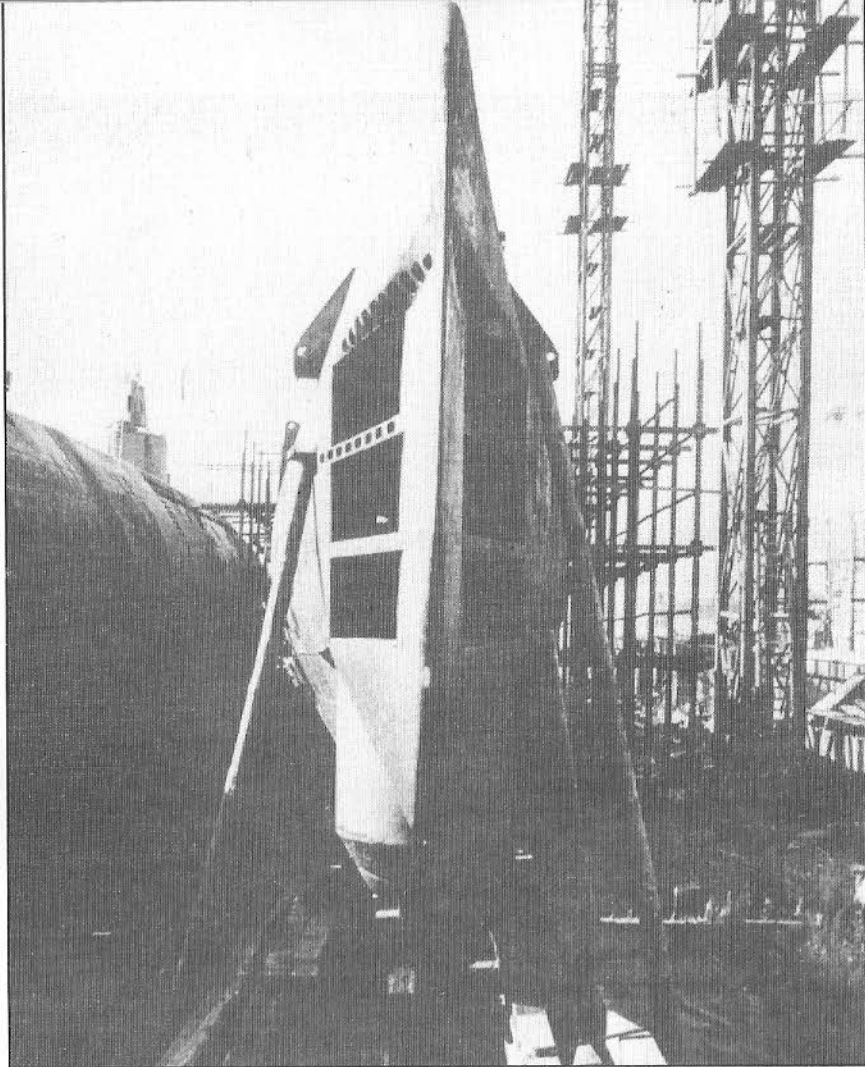


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sensor suite, including radar, radar warning receivers, new underwater listening gear, and an active sonar.

All of these innovations added to the projected construction time of the boat, however. Admiral Dönitz, unhappy with the current schedules, contacted the new Reich Armaments Minister, Albert Speer, to see if the schedules could be accelerated. The Armaments Ministry proposed a new assembly-line construction method, in which the various sections of each new boat would be constructed at a number of sites, and then transported to the shipyards by barge for final assembly and welding. These widely-scattered production lines also would be less vulnerable to Allied bombing, which was already starting to interfere with production of many materials.

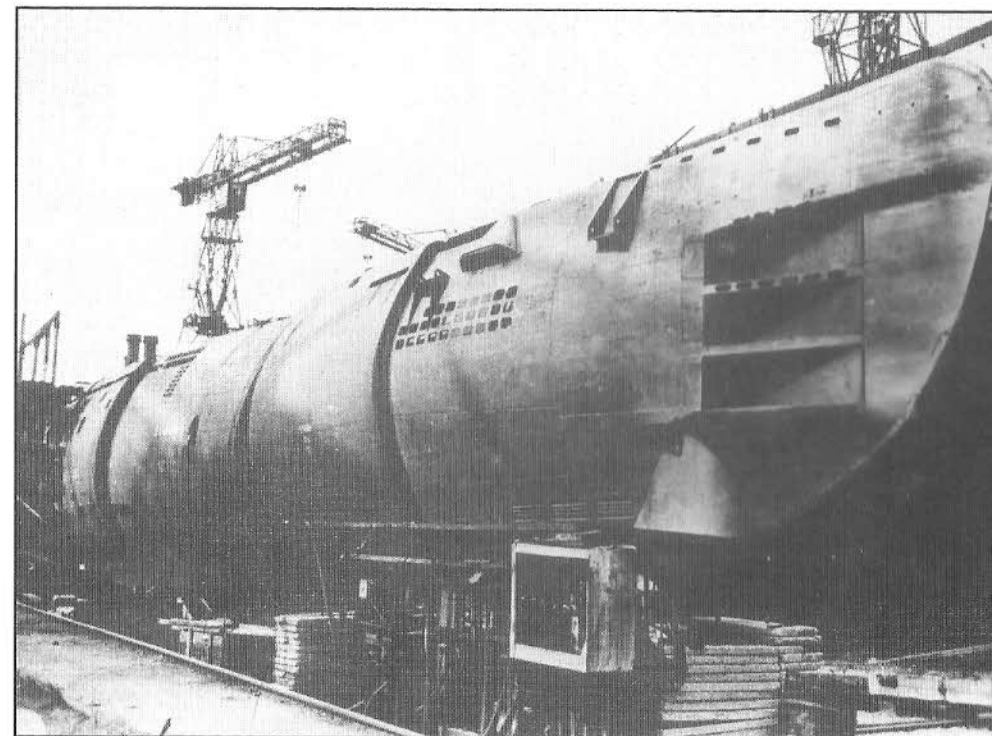
Unassembled hull sections for the Type XXI U-boats. The assembly-line construction technique adopted for the Type XXI made it possible to build these large craft in a fraction of the time it took to construct earlier models.



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The business end of an uncompleted Type XXI at the U-boat assembly facility in Hamburg, 1945.

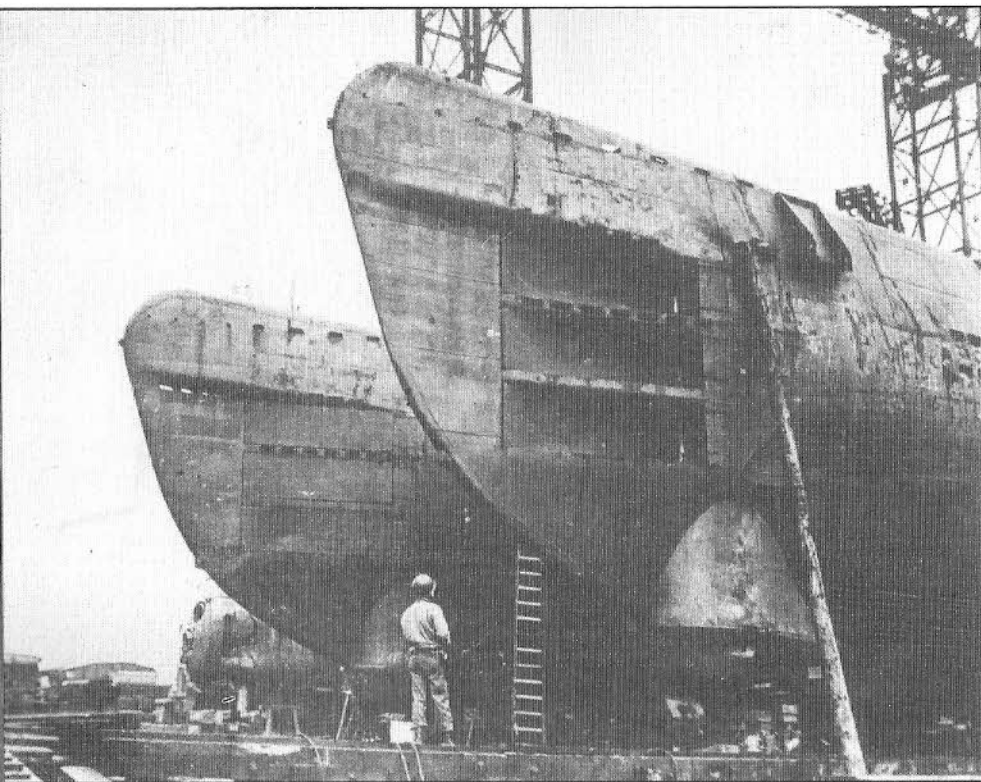
On May 12, 1944, considerably ahead of the original production schedule, the first Type XXI U-boat (*U-2507*) was launched at the Blohm and Voss shipyard in Hamburg. There were a number of teething troubles associated with the new boat, largely because no prototype had been constructed. The first several boats to come off the ways were therefore used to test the concept and suggest changes and refinements that could be applied to boats still under construction. Considerable time was spent training crews and working up each boat before assigning it to combat duty.



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The various hull sections of this Type XXI are in place, but not yet welded together.

The first operational Type XXI U-boat, *U-2511*, commanded by Korvettenkapitän Adalbert Schnee, was not ready to sortie until March 18, 1945. Minor damage and incidental problems kept *U-2511* in port in Norway for a further month and a half. The boat did not actually put to sea until the end of April, just days before the end of the war. KK Schnee received the surrender order of May 4, 1945, while at sea. When he ran across a British flotilla protecting the cruiser *Norfolk*, however, Schnee could not resist mounting a mock attack. The high underwater speed and very quiet operation of *U-2511* made it easy to penetrate the heavy escort screen. Schnee approached the cruiser until it filled his periscope, then broke off the attack and dove away to safety.



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Two Type XXI U-boats in the shipyard. Below the torpedo tubes is the "Balkon Gerät" underwater listening array.

The Type XXI U-boat was the first true submarine—the first capable of operating underwater for most of its mission. There is no way to know what impact this magnificent design would have had on the Battle of the Atlantic had it been available earlier. Allied merchant ship construction would probably have been able to cope with the losses inflicted by a small to moderate number of Type XXIs. When the war ended, however, the German navy had commissioned over 100 of the new boats, with many more on the way. Large numbers of Type XXIs, if available early enough in the war, might have made the Atlantic impassable to convoys, and forced England to eventually negotiate for peace. Without them, however, Germany could not hope to stem the torrent of merchant ships bringing Allied bombs, planes, and troops within reach of its heartland.

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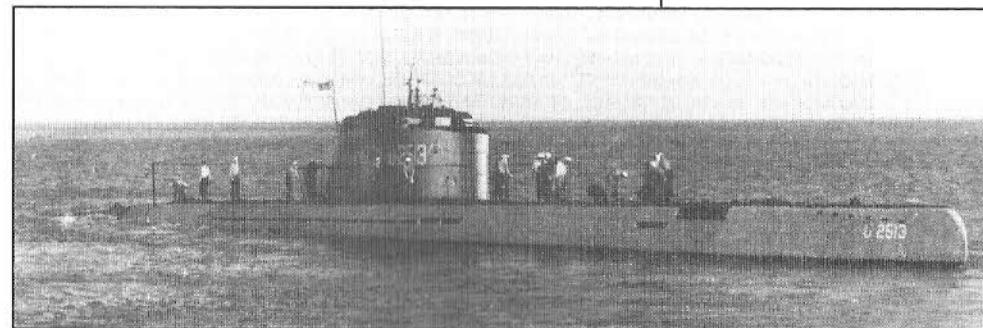
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U-2513, a Type XXI U-boat, in American hands at Key West after the war. Captured Type XXI U-boats had a major influence on post-war submarine designs in all the Allied countries.



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