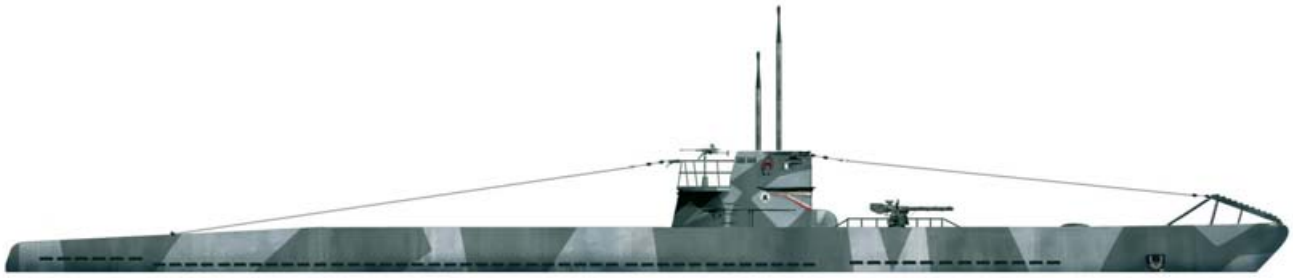


New Vanguard

OSPREY
PUBLISHING

Kriegsmarine U-boats 1939–45 (1)



Gordon Williamson • Illustrated by Ian Palmer

© Osprey Publishing • www.ospreypublishing.com

New Vanguard • 51

Kriegsmarine U-boats 1939–45 (1)



Gordon Williamson • Illustrated by Ian Palmer

KRIEGSMARINE U-BOATS 1939-45 (1)

INTRODUCTION

Amongst the many onerous terms of the Armistice that Germany signed in 1918 was a demand that all German U-boats were to be surrendered to Great Britain and additionally that all boats still under construction were to be destroyed or dismantled. Germany was also prohibited from building any other submarines, to include merchant vessels, in the future. These demands were subsequently ratified in terms of Articles 188, 189 and 191 of the Treaty of Versailles signed on 28 June 1919. Existing U-boats at the time of signing were distributed to Great Britain, the United States, France, Italy and Japan, where they were the subject of intensive study.

Fortunately for Germany the Allies, though demanding the surrender of all U-boats, seem to have overlooked the huge repository of technical expertise and knowledge represented by the documentary records of the German submarine construction industry. There had been no demand for these records to be surrendered. These essential records were subsequently transferred to the new submarine section of the Torpedo and Mine Inspectorate of the new Reichsmarine – the navy of the Weimar Republic and from there ultimately to the Reich Archives.

Before long, though prohibited from actually building submarines, Germany was actively marketing her expertise in this field, selling U-boat designs to Japan and working in cooperation with shipyards in Argentina,

A Type VII U-boat in heavy seas, seen from the flak platform of another of the same class.



3

Italy and Sweden. In order to avoid political problems that might come from being seen to be acting against the spirit of the Versailles Treaty, a cover firm, NV Ingenieurskantoor voor Scheepsbouw (IvS), was set up in Holland in July 1922. Although legal technicalities prevented the opening of the company's office in The Hague until 1925, the firm was run until that time directly from Germaniawerft's office in Kiel.

Secretly funded by the German Navy, IvS manufactured two submarines for Turkey, the design of which was closely based on the Type UBIII of the Kaiserliche Marine. Both were launched in 1927, with the contracts worded in such a way that IvS personnel were involved with crew selection and training, and were permitted to take part in the boats' service trials. The Germans thus gained first-hand knowledge of how their design behaved in practice.

In 1932, the Germans decided on a reconstruction programme designed to provide the nation with a modern navy. This programme included provision for a small fleet of eight medium-sized (500-ton) submarines, though this number was later increased to 16. A year later, in 1933, a school for training U-boat crews was established, ironically under the title of 'anti-submarine defence school' (Unterseebootsabwehrschule) at Kiel.

Three mine-laying submarines were also ordered by Finland, again based on an earlier design, this time the Type UCIII, but greatly improved. The boats were built in Finnish shipyards, but with intensive involvement of German technicians who once again participated in their sea trials. Two further orders were received from the Finns, one for a small 115-ton vessel, and one for a larger 250-ton boat, very similar to what would become the MVBII. The last of these, the *Vesikko*, launched in May 1933, had her hand-over to the Finnish Navy deliberately delayed until January 1936 so that she could be used for the purpose of training future U-boat crews. The *Vesikko* is still preserved today.

Germany now began to develop designs for submarines for her own navy. These projected designs, for the purpose of subterfuge, were referred to as Motorenversuchsboote (MVB) or 'Experimental Motor Boats'. Deutsche Werke in Kiel was selected to build the new boats, and a new U-boat base was to be constructed at Kiel-Wik.

Component materials began to be surreptitiously gathered at Deutsche Werke's Kiel base, ready for the order to begin production. The programme envisaged the following types being built:

- | | |
|------|---|
| 1934 | two large 800-ton boats and two small 250-ton boats |
| 1935 | four small 250-ton boats |
| 1936 | two large 800-ton boats and six small 250-ton boats |
| 1937 | two large 800-ton boats and six small 250-ton boats |

U-9 running on the surface. Her crew is dressed in the leather clothing widely worn by U-boat crews. Note in this photograph that the Iron Cross motif, carried by U-9 in honour of the original U-9 of the Imperial Navy, has been fitted to the tower.



Each small boat was costed at between 1 and 1.5 million marks, including preparation costs, and each large boat at between 4 and 4.5 million marks. The larger boats were designated as MVBIA and the smaller as MVBIIA.

The Anglo-German Naval Agreement of 1934 had agreed a proportional parity of 3:1 between the two countries. With Great Britain's submarine fleet totalling just over 50,000 tons, this would allow Germany (had the construction of U-boats been permitted at all) a fleet totalling around 17,500 tons. This was initially perceived as being 20 of the MVBIA type and six of the smaller MVBIIA type. In fact, however, naval theory was much in favour of large numbers of the smaller type being more effective than a smaller number of large boats. A figure of around ten of the larger boats and 18 of the smaller was arrived at, still leaving Germany well within her theoretical tonnage allowance.

All of this was somewhat academic, however, as Germany still was not in a position where she was allowed to build submarines of any type. Hitler, who had come to power in January 1933, still harboured hopes of an accord with Great Britain and did not wish his political plans to be upset by any discovery that Germany was building prohibited U-boats. Permission to begin construction was therefore withheld for the time being.

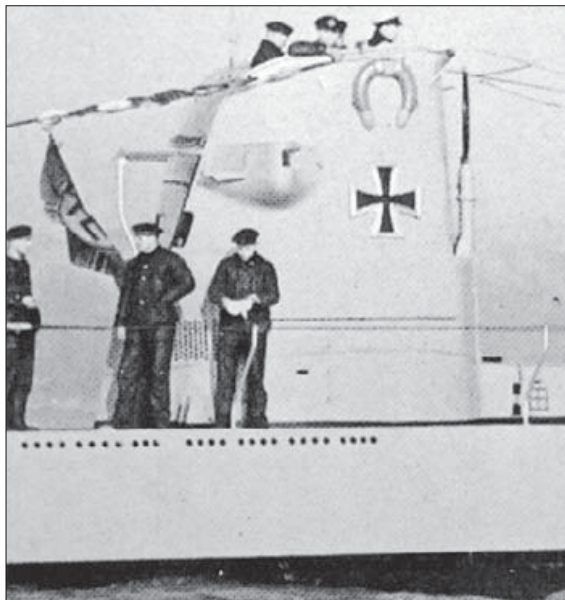
Meanwhile, the Unterseebootsabwehrschule continued with its theoretical training for future U-boat crews, and design work on other models also progressed. An improved version of the MVBII, the MVBIIIB was designed, with a lengthened hull to provide additional fuel bunkering and thus extended endurance. With three approved designs, it was clear that Deutsche Werke alone could not build sufficient numbers rapidly enough to meet demands, and the decision was taken to distribute the various types to additional shipbuilders. Deutsche Werke at Kiel would build the MVBIIA, Deschimag-AG Weser the MVBIA and Germaniawerft the MVBIIIB. By the autumn of 1934 sufficient materials and components had been stockpiled for construction to begin, but still Hitler held back, not approving the commencement of work until 1 February 1935.

Stern view of the Type IIB. Just abaft the conning tower is the crew access hatch into the interior. On the second boat from shore, a crewman can just be seen exiting from this hatch. The stern flagstaff is held in a fitting that also contains the stern navigation light.



Further models had been considered, including the MVBIII, a large development of the MVBIA, which would serve as a minelayer as well as carrying two motor torpedo boats; the MVBIV, which would be a seagoing workshop/supply/repair submarine serving the main combat units of the U-boat fleet; the MVBV, which was to have a new propulsion system designed by Walter; and finally the MVBVI, which was to have a new design of steam-driven engine. All of these types were ultimately rejected in favour of the MVBVII, a medium 500-ton design destined to become the Type VII, the backbone of the U-boat fleet during the Second World War. Once again, this latest model was to be based upon the successful UBIII design of the First World War.

Although the MVBII was subsequently further developed to produce the IIC and IID variants, its further development potential was limited. The MVBVII, basically an enlarged MVBII, was a far more versatile design and was further transformed into a bewildering number of variants and sub-variants through the course of the Second World War. The first orders for the building of the MVBVII type were issued in January 1935, just two months before Hitler formally repudiated the terms of the Treaty of Versailles and rearmament began in earnest. Around this time the 'MVB' prefix was dropped.



Close-up of the conning tower of U-9. The Iron Cross emblem was removed on the outbreak of war. The horseshoe-shaped object just above the Iron Cross is, in fact, a life preserver.

THE TYPE I

One of the least successful of U-boat designs, only two Type IAs were ever built. Constructed by the Deschimag yard, U-25 and U-26 were to be the only boats of their type, though this model was a direct forebear of the later, much more successful Type IX.

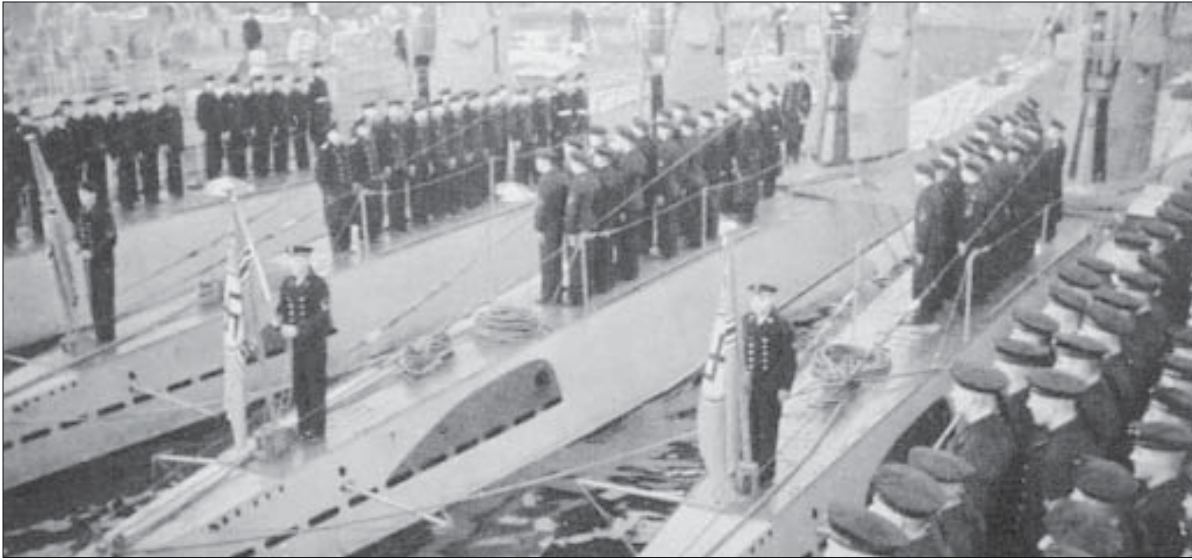
SPECIFICATIONS

Length	72.4 m
Beam	6.2 m
Draft	4.3 m
Displacement	862 tons surfaced, 983 tons submerged
Speed	17.8 knots surfaced, 8.3 knots submerged
Endurance	6,700 nautical miles surfaced, 78 nautical miles submerged
Powerplant	2 x 1,540 bhp MAN diesels coupled with 2 x 500 bhp electric motors
Armament	6 torpedo tubes (4 bow, 2 stern), 14 torpedoes 1 x 10.5 cm gun 1 x 2 cm gun
Crew	43

Operational Use

The two boats of this type were used predominantly on training duties until 1940 when the general shortage of available boats required their

RIGHT A pre-war photo, dating from around 1936, of U-25, the first of the Type IA boats. Note the very pale grey paint scheme used post-war. The net cutter at the bow of most U-boats was removed prior to the outbreak of war. Normally, the jump wire was attached to the top point of the net cutter where this was fitted, but in this case has been attached to the decking near to the bow. The safety railings were normally only fitted when in port.



ABOVE Type IIAs with their crews mustered on deck in their best blues as the new war flag of the navy, the Reichskriegsflagge, is ceremoniously raised for the first time on 7 November 1935. Note the dark-painted portion of the hull side near the stern. The round hole at the forward end of this is the diesel exhaust vent. The dark-painted area was to disguise unsightly exhaust staining to the pale grey hull.

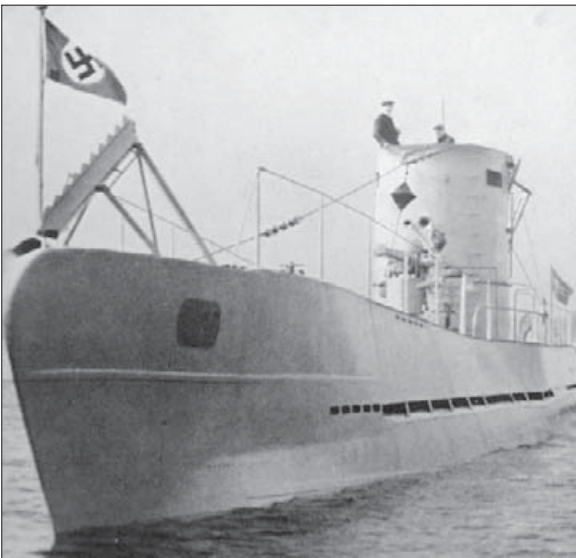
use in combat. In fact, both boats were relatively successful in terms of their combat successes.

U-25 carried out a total of five war cruises, sinking eight enemy ships totalling some 50,250 tons. Her first (pre-war) commander was Korvettenkapitän Eberhardt Godt who was eventually to become Commander-in-Chief U-boat Operations in the late stages of the war. His successor as commander was Korvettenkapitän Victor Schütze, who would become one of Germany's top U-boat 'aces' with a total of 35 ships (180,000 tons) sunk. Passing through a recently laid enemy minefield on 3 August 1940, she struck one of the mines and sank with all hands.

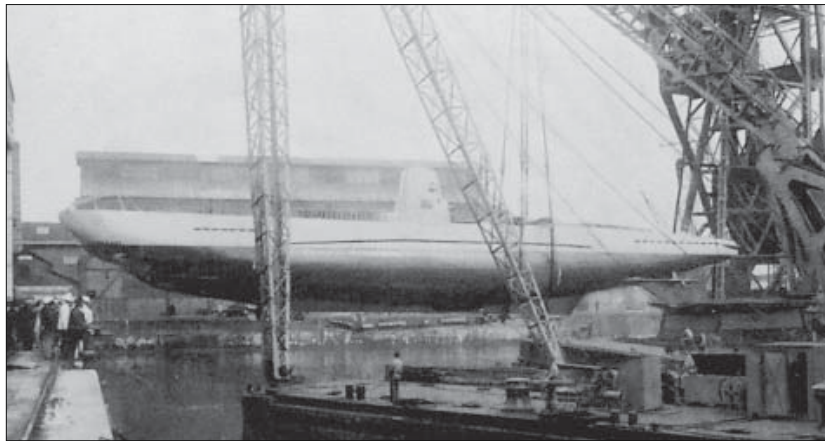
U-26 carried out eight war cruises. On her first cruise, she was employed on minelaying duties, and was rewarded by the sinking of three merchant ships and the damaging of one British warship by mines laid by her. On her second cruise she became the first U-boat of the war to enter

the Mediterranean, though the remainder of the cruise was uneventful. Her third cruise saw her add a further three merchant ships to her score in a brief sortie into the Atlantic. The fourth cruise saw her being used for transport duties during the Norwegian Campaign, though she sank a 5,200-ton merchantman during her return trip from one of her transport sorties. After three more uneventful patrols, U-26 set off on her eighth war cruise on 20 June 1940. Three merchantmen were sunk on 30 June, and on the next day an attack damaged a further merchant ship. The attack was followed by a severe depth-charging from two British warships that forced U-26 to the surface where she was bombed by a Sunderland flying boat. The crew were forced to scuttle her, the majority being rescued by their attackers.

Despite both boats having relatively successful, if short, combat careers, they were technically



not particularly good sea boats, especially when considering that they were intended as ocean-going rather than coastal vessels. Their stability was poor, their diving speed slow, and their manoeuvrability under water not impressive. Nevertheless, with 13 war cruises and 18 ships sunk between them, the Type IAs had acquitted themselves well.



One of the diminutive Type IIB boats being lowered into the water by crane. Their light weight and small size permitted this style of launching, as compared to the larger boats which were normally built on a slipway in a manner similar to conventional craft.

THE TYPE II

The Type II was a natural enough progression from the UB coastal types of the Kaiserliche Marine in the First World War. Small, cheap and easy to build, they could be produced in a remarkably short time. Based on the CV-707 export design produced for Finland between the wars, the Type II made excellent training vessels, but due to their small size and tendency to roll heavily when on the surface they were rather contemptuously referred to as *Einbäume* or 'canoes' by the Germans. Nevertheless, several of this type acquitted themselves well in combat operations as well as in training, and a number of variant types were produced. All carried just three bow torpedo tubes in an unusual inverted triangle arrangement with one each to port and starboard and a third below them on the boat's centre line.

Type IIA

A total of just six Type IIAs were built.

SPECIFICATIONS

Length	40.9 m
Beam	4.1 m
Draft	3.8 m
Displacement	254 tons surfaced, 301 tons submerged
Speed	13 knots surfaced, 6.9 knots submerged
Endurance	2,000 nautical miles surfaced, 71 nautical miles submerged
Powerplant	2 x 350 bhp MWM diesels coupled with 2 x 180 bhp electric motors
Armament	3 bow torpedo tubes, 6 torpedoes carried
	1 x 2 cm flak gun
Crew	25

Type IIB

The Type IIB was basically a lengthened version of the IIA, the additional hull capacity allowing a greater fuel load to be carried, thus enhancing the boat's endurance. Five seconds were also shaved off the critical time taken to dive the boat, a reduction from 35 to 30 seconds. A total of 20 Type IIBs were built, the largest number of any sub-type.

SPECIFICATIONS

Length	42.7 m
Beam	4.1 m
Draft	3.9 m
Displacement	279 tons surfaced, 329 tons submerged
Speed	13 knots surfaced, 7 knots submerged
Endurance	3,900 nautical miles surfaced, 71 nautical miles submerged
Powerplant	2 x 350 bhp MWM diesels coupled with 2 x 180 bhp electric motors
Armament	3 bow torpedo tubes, 6 torpedoes carried 1 x 2 cm flak gun
Crew	25

Type IIC

Once again, this boat was simply a lengthened version of its immediate predecessor, with increased bunkering. The Type IIC also had a lengthened control room and a second periscope. The Type IIC can easily be identified on photographs by the flush front to the tower, rather than the stepped front found on the IIA and IIB. Only eight Type IICs were built.

SPECIFICATIONS

Length	43.9 m
Beam	4.1 m
Draft	3.8 m
Displacement	291 tons surfaced, 341 tons submerged
Speed	12 knots surfaced, 7 knots submerged
Endurance	4,200 nautical miles surfaced, 71 nautical miles submerged
Powerplant	2 x 350 bhp MWM diesels coupled with 2 x 205 bhp electric motors
Armament	3 bow torpedo tubes, 6 torpedoes carried 1 x 2 cm flak gun
Crew	25

Type IID

The Type IID, but for its small size, might almost pass for a Type VII with its enlarged conning tower with rear flak platform, and its distinctive saddle tanks. It had greatly increased range, and more up-to-date self-compensating fuel bunkers. 16 Type IIDs were manufactured.

SPECIFICATIONS

Length	44.0 m
Beam	5.0 m
Draft	3.9 m
Displacement	314 tons surfaced, 364 tons submerged
Speed	12.7 knots surfaced, 7.4 knots submerged
Endurance	5,680 nautical miles surfaced, 71 nautical miles submerged
Powerplant	2 x 350 bhp MWM diesels coupled with 2 x 205 bhp electric motors
Armament	3 bow torpedo tubes, 6 torpedoes carried 1 x 2 cm flak gun
Crew	25

Operational Use

Ideally, all of the Type II vessels would have been relegated to training

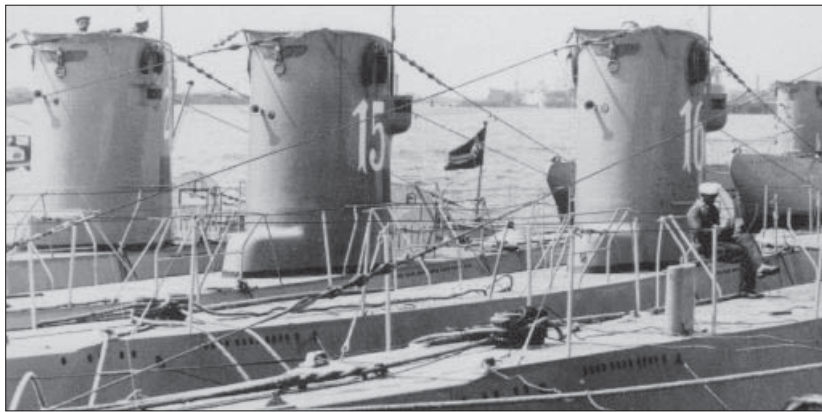
duties by the outbreak of war in September 1939. However, as Germany was nowhere near its intended submarine strength by this point, the need for operational Frontboote meant that many Type IIs had to be pressed into combat service. As the number of available Type VII and Type IX vessels increased, so Type IIs were released from combat service, once again for use with the training flotillas. By mid-1941, all Type IIAs and Type IIBs had been returned to training duty. Almost all of the Type IICs were used during the invasion of Norway before they too were gradually released back to the training flotillas.

Of the six Type IIA boats, U-1 was sunk by a mine, and all of the others took part in support operations in the invasion of Norway with U-2, U-5 and U-6 returning thereafter to training duties. U-3 had a slightly more eventful career, carrying out five war cruises and sinking two enemy ships before being relegated to training duties. U-4 took part in four war cruises, sinking three enemy ships and a British submarine, HMS *Thistle*, before joining the training flotilla.

Of the 18 Type IIB boats, many returned to training duties after the invasion of Norway. A total of 150 war cruises were carried out by these small coastal boats, however, with 97 enemy merchant ships and nine enemy warships being sunk. Though small, they had served their purpose well.

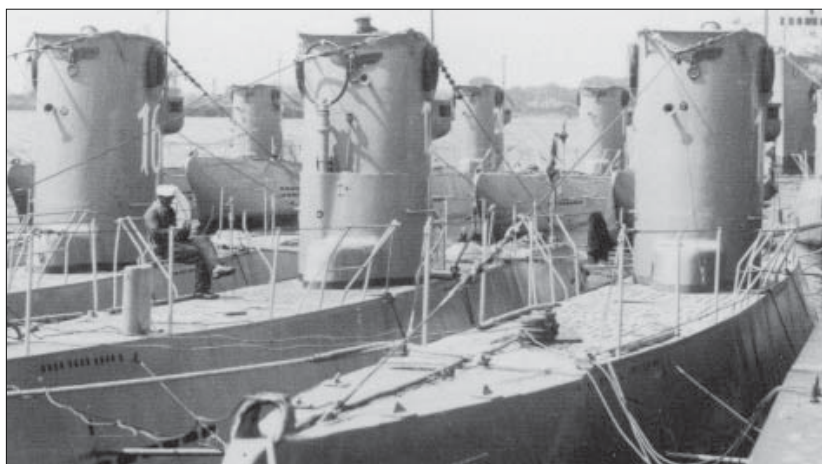
Six of the Type IIB vessels (U-9, U-18, U-19, U-20, U-22 and U-23) were despatched to the Eastern Front for service in the Black Sea against Soviet shipping. The diminutive size of these boats allowed them to be partially dismantled and loaded onto barges to be transferred as far as possible along inland waterways, then loaded onto large flatbed trailers and transported by road. These obsolescent boats succeeded in sinking a number of enemy ships. As fortunes on the Eastern Front went into reverse, it became impossible to consider taking them back to Germany by the same route. They were offered to Turkey and, on this being refused, were scuttled to prevent them falling into Soviet hands.

Of the eight Type IIC boats that were built, only one (U-63) was lost to



ABOVE This photograph shows U-2 (a Type IIA) at extreme left, next to U-15 and U-16, both Type IIBs. Note the flush front of the conning tower on the Type IIA and early Type IIBs, making the two visually very similar. The projecting housing on the side of the tower for the navigation lights is the only significant difference in appearance.

BELOW Three Type IIBs. The centre boat, U-12, built by Germaniawerft, has a stepped front to the tower, on which is fitted a DF loop. The other two boats pictured are Type IIBs from Deutsche Werke, with flush front to the tower.





An early pre-war photo of a Type IIB, possibly U-9, shows the extremely narrow hull which gave these boats their nickname of 'canoes'.

enemy action. All of the others eventually returned to training duties after the type had completed a total of 56 war cruises and sunk 57 enemy ships, including three warships.

A total of 16 Type IIDs were produced, many of which went directly into the training flotillas and saw no action whatsoever. Those that did participate in combat sorties completed a total of 36 war cruises, resulting in 27 enemy ships being sunk, including three warships. One was lost to a depth-charge attack by enemy destroyers and one was sunk by an enemy submarine. The others all served out the war in the various training flotillas.

THE TYPE VII

General Description

The Type VII was a single-hulled boat, the pressure hull in places forming the outer hull of the boat. It differed principally from earlier designs in that its bunkering was contained within the pressure hull rather than in saddle tanks, giving additional protection to the precious fuel. A single central ballast tank was provided, together with bow and stern ballast tanks outwith the pressure hull, and two large saddle tanks on either side of the hull. Outside the pressure hull was a streamlined external casing, the area between the two being free-flooding. Between the deck and the top of the pressure hull a considerable amount of ducting and trunking was fitted, as well as the mounting for the deck gun, ready-ammunition locker for the deck gun, a small dinghy and, ultimately, storage for spare torpedoes. All could be accessed via hatches or by removal of deck plating. An 8.8 cm naval gun was fitted on the foredeck just in front of the conning tower and a 2 cm flak gun just aft.

Type VIIA

The first variant to be produced was the Type VIIA, of which ten were completed. These were allocated the numbers U-27 through to U-36. Four were built by Germaniawerft and six by AG Weser. Construction began in February 1935 with the first boat (U-33) of the type launched on 11 June 1936.

One of the most instantly recognisable visual characteristics of the Type VIIA was the hump of the external stern torpedo tube, clearly visible on the aft decking.

SPECIFICATIONS

Length	64.5 m
Beam	5.8 m
Draft	4.4 m
Displacement	626 tons surfaced, 745 tons submerged
Speed	16 knots surfaced, 8 knots submerged
Endurance	4,300 nautical miles surfaced, 90 nautical miles submerged
Powerplant	2 x 1,160 bhp diesels coupled with 2 x 375 bhp electric motors
Armament	5 torpedo tubes (4 bow, 1 stern) 1 x 8.8 cm gun 1 x 2 cm gun
Crew	44

Type VIIB

The Type VIIB was a marked improvement over the initial variant. It was given twin rather than single rudders to improve its turning circle, and the external stern torpedo tube of the VIIA was brought inside the pressure hull, firing out between the two rudders. The boat was given an increase in length of two metres to provide additional bunkering, and additional fuel was now also carried in special fuel cells within the saddle tanks. These cells were self-compensating – as fuel was drawn from the top of the tank, sea water entered at the bottom, compensating for the loss in weight. Compensating tanks were also installed to help prevent the boat rolling when on the surface. Finally, turbochargers were fitted to the diesel engines to provide a modest increase in speed. All of these changes increased the size and weight of the boat significantly.

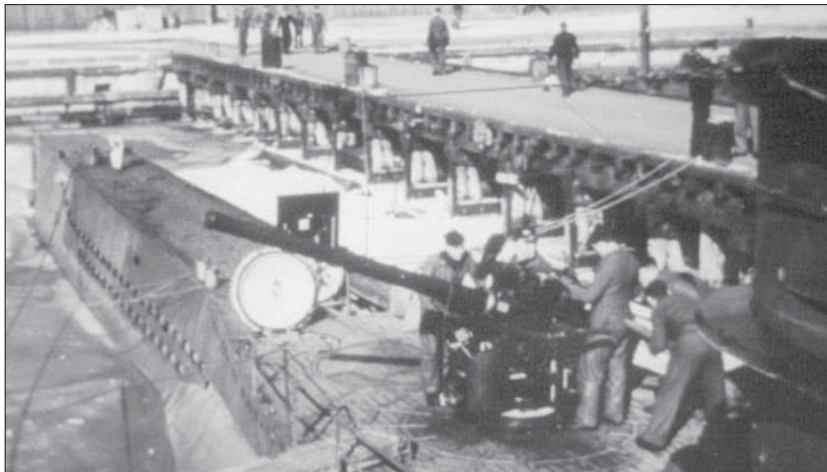
A total of 24 Type VIIBs were built: the first seven (U-45 to U-51) by Germaniawerft, a second tranche of four, also from Germaniawerft, and a third tranche consisting of four boats each from Germaniawerft, Vulcan, with five from Flenderwerft.

SPECIFICATIONS

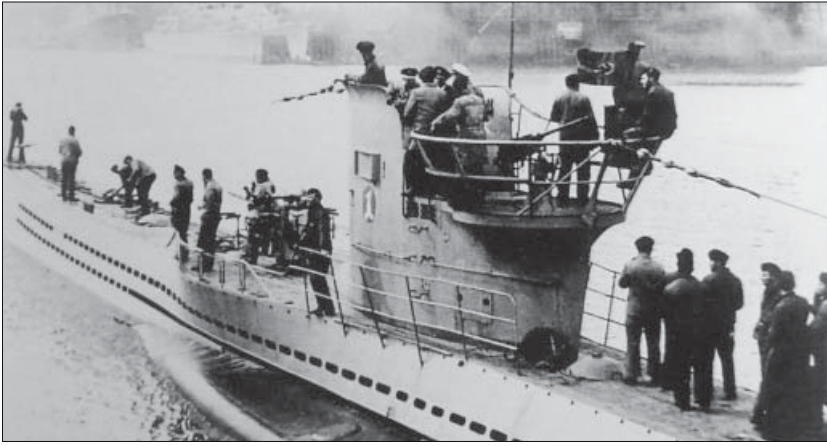
Length	66.5 m
Beam	6.2 m
Draft	4.7 m
Displacement	753 tons surfaced, 857 tons submerged
Speed	17.2 knots surfaced, 8 knots submerged
Endurance	6,500 nautical miles surfaced, 90 nautical miles submerged
Powerplant	2 x 1,400 bhp diesels coupled with 2 x 375 bhp electric motors
Armament	5 torpedo tubes (4 bow, 1 stern) 1 x 8.8 cm gun 1 x 2 cm gun 15 mines
Crew	44

Type VIIC

The third and most significant variant of the Type VII was the 'C'. It was originally proposed as a vessel for the new sonar search equipment known as the Such-Gerät (S-Gerät), with an increase in length to both the control room and the conning tower to accommodate the necessary



The gun crew of a Type VIIC go through their loading drills whilst in port. Just in front of and to the left of the gun can be seen the white interior of the raised ready-ammunition locker hatch. This provided a small supply of readily accessible ammunition for the 8.8 cm deck gun whilst further supplies were brought up from the boat's magazine.



U-30, a Type VIIA, returns to base after a war cruise. This boat is generally credited with starting the fashion of painting an emblem on the side of the conning tower. Note the single central stern jump wire; most boats had two, one to port and one to starboard. The very dark grey colour of the saddle tanks is once again apparent.

equipment. Other smaller, but nevertheless welcome, modifications were also incorporated. A small buoyancy tank was fitted within the saddle tanks, which could also be flooded to improve diving time. A new filtration system for the diesel engines, a new diesel rather than electric-powered compressor for the air tanks – to ease demands on the electrical system – and more modern

electrical switching systems were all added to this model.

SPECIFICATIONS

Length	67.1 m
Beam	6.2 m
Draft	4.8 m
Displacement	761 tons surfaced, 865 tons submerged
Speed	17 knots surfaced, 7.6 knots submerged
Endurance	6,500 nautical miles surfaced, 80 nautical miles submerged
Powerplant	2 x 1,400 bhp diesels coupled with 2 x 375 bhp electric motors
Armament	5 torpedo tubes (4 bow, 1 stern) 1 x 8.8 cm gun 1 x 2 cm gun
Crew	44

Type VIIC/41

The first major sub-variant of this type was the VIIC/41. This variant featured extensive replacement of existing electrical equipment by newer, more compact models. The weight thus saved (some 11 tons overall) was utilised in thickening the steel plate used for the pressure hull by a further 2.5 mm, thus allowing an increase in diving capabilities from a maximum depth of 250 m to 300 m. The bow was also lengthened slightly to increase seaworthiness.

SPECIFICATIONS

Length	67.2 m
Beam	6.2 m
Draft	4.8 m
Displacement	759 tons surfaced, 860 tons submerged
Speed	17 knots surfaced, 7.6 knots submerged
Endurance	6,500 nautical miles surfaced, 80 nautical miles submerged
Powerplant	2 x 1,400 bhp diesels coupled with 2 x 375 bhp electric motors
Armament	5 torpedo tubes (4 bow, 1 stern) 1 x 8.8 cm gun 1 x 2 cm gun
Crew	44

Type VIIC/42

This projected sub-variant was an attempt to improve speed further by adding additional turbochargers, coupled with an increase in length to give greater fuel storage capabilities. Armour-plate was to be used rather than normal steel for the pressure hull, taking the maximum depth possible up to 500 m. None of this type was ever completed.

Type VIIC/43

Another design that got no further than the drawing board, this was essentially a Type VIIC/42 with armament upgraded to provide six rather than four bow torpedo tubes.



Type VIID

This version of the versatile VII design was a minelayer. The hull of the basic Type VII was extended by almost ten metres, just aft of the control room, to provide five vertical mine shafts. Additional benefits of the extension in hull length included space for additional fuel and extra trim tanks. These boats also had the luxury of refrigerated food storage. The full torpedo and gun armament of the standard Type VII was retained. On the down side, the additional weight and length, to say nothing of the raised decking required for the mine shafts, reduced overall speed and handling qualities, though overall endurance was increased.

U-boat ace Kapitänleutnant Gunther Prien on the bridge of U-47. This was an early Type VIIA boat. Note the outward flare of the conning tower edge common to most early Type VIIs and later replaced by a more effective form of spray deflector. Also visible are the snorting bull emblem adopted by Prien as his boat's emblem and the attachment points at the side of the tower for the jump wires.

SPECIFICATIONS

Length	76.9 m
Beam	6.4 m
Draft	5.0 m
Displacement	965 tons surfaced, 1,080 tons submerged
Speed	16 knots surfaced, 7.3 knots submerged
Endurance	8,100 nautical miles surfaced, 69 nautical miles submerged
Powerplant	2 x 1,400 bhp diesels coupled with 2 x 375 bhp electric motors
Armament	5 torpedo tubes (4 bow, 1 stern) 1 x 8.8 cm gun 1 x 2 cm gun 15 mines
Crew	44

Type VIIE

A design project only, this version was to have been fitted with a new type of two-stroke V12 lightweight diesel engine made by the Deutz firm. The project was abandoned before any could be built.

Type VIIF

The Type VIIF was a modification of the basic Type VII design similar to that of the VIID, in that a 10.5 m additional length of hull was inserted just abaft the control room. This allowed an extra 24 torpedoes to be carried, as well as additional refrigerated food storage and two extra crew members. The VIIF was to act as a resupply boat, carrying additional torpedoes to front-line boats that had expended their ammunition.

Only four of this type were eventually built (U-1059 to U-1062), all produced by Germaniawerft.

SPECIFICATIONS

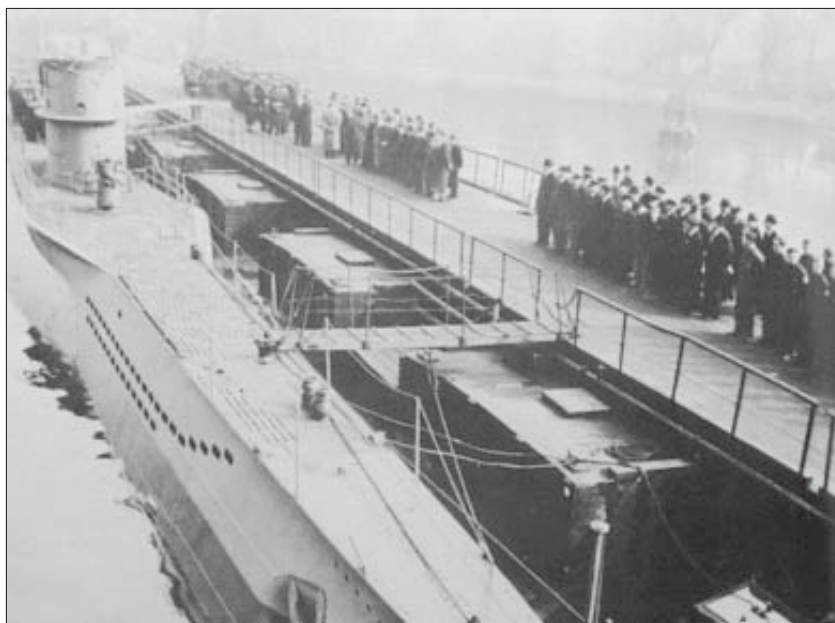
Length	77.6 m
Beam	7.3 m
Draft	4.9 m
Displacement	1,084 tons surfaced, 1,181 tons submerged
Speed	16.9 knots surfaced, 7.9 knots submerged
Endurance	9,500 nautical miles surfaced, 75 nautical miles submerged
Powerplant	2 x 1,400 bhp diesels coupled with 2 x 375 bhp electric motors
Armament	5 torpedo tubes (4 bow, 1 stern) 1 x 8.8 cm gun 1 x 2 cm gun
Crew	46

Type VIIC variants

Of all of the Type VII models, none saw as much modification and improvement to the basic design as did the most common model of all, the Type VIIC. The variants mentioned above relate principally to internal modifications, which would not be obvious from photographs of the boats themselves. However, one major series of modifications that became necessary during the course of the war, and which drastically altered the appearance of each type, was made to the conning tower.

As Allied anti-submarine measures improved, the use of aircraft against U-boats took on a considerable significance and it quickly became apparent that the single 2 cm anti-aircraft gun carried on the basic Type VII was woefully inadequate. In fact, no matter how much the flak armament was beefed up, few U-boats would risk taking on enemy aircraft (although in several recorded cases, when left with no option but to remain on the surface, U-boats did take on enemy aircraft, and succeeded in shooting them down).

U-431, a newly launched Type VIIC, shows to good advantage the hull shape of the Type VII with its narrow foredeck, widening around the conning tower, to narrow again towards the stern and the bulge of the saddle tanks. The demarcation between the light grey upper works and the dark grey scheme below the waterline is also clearly visible.



The various conning tower configurations, beginning with the basic circular platform to the rear of the tower, with its single 2 cm flak gun, were given numeric codes, the basic configuration being known as *Turm 0*.

The first major attempt to beef up flak defences was to widen the platform somewhat, and replace the single 2 cm flak gun with two twin 2 cm machine gun mounts.

Turm 1 This design was to see a second, lower, platform fitted to the rear

of the conning tower (generally known to U-boat men as the 'Wintergarden') on which would be fitted a twin 2 cm flak. This design was approved in June 1942.

Turm 2 Due to problems with the supply of the new weapons required for the Turm 1 design, a second new tower configuration was introduced in which the original round upper platform was joined by a similar lower platform, both of which were fitted with a single 2 cm flak gun. Installation of this type commenced in December 1942.

Turm 3 This little-used configuration saw two single 2 cm flak guns mounted side by side on the upper platform and was used only on the Type VIID.

Turm 4 This, destined to become the most common configuration, had two twin 2 cm guns fitted on a widened upper platform, and a single four-barrelled 2 cm flak gun, the *Flakvierling*, on the lower. The *Flakvierling* was gradually replaced by a single-barrelled 3.7 cm flak gun.

Turm 5 An experimental model, fitted to only one U-boat (U-362), this configuration had two twin 2 cm flak guns on the upper platform, a single twin 2 cm flak gun on the lower, and a fourth twin 2 cm gun on a special platform built on to the front of the tower.

Turm 6 Another little-used model, only two boats received this modification. This configuration had a single-barrelled 3.7 cm flak gun on the lower platform, two twin 2 cm flak guns on the upper, and a single twin 2 cm in front of the tower on a separate pedestal. Only U-673 and U-973 were so converted.

Turm 7 A 'concept' only and never actually built, this tower would have seen twin 3.7 cm flak guns on platforms both to the rear and in front of the tower.

Flak Boats A small number of boats (seven only) were ordered to be converted into Flak Boats, and given heavy anti-aircraft armament to allow them to take on enemy aircraft on relatively even terms. U-441 was given a *Flakvierling* on a mount in front of the tower, another on the upper platform at the rear of the tower, as well as a 3.7 cm flak gun on the rear lower platform. Although U-441 succeeded in shooting down a Sunderland flying boat, the adverse effect of the new bridge structure on diving times and handling, combined with the heavy armament now being installed on standard boats, saw the order cancelled with all Flak Boats to be reconverted back to Turm 4 configuration.

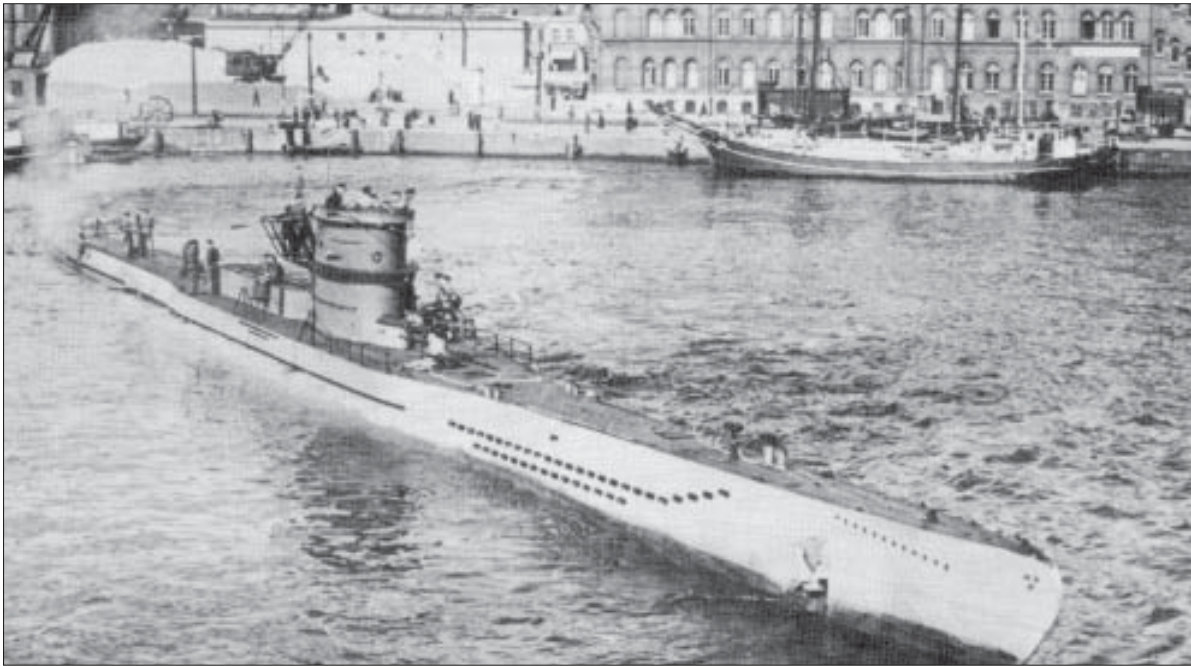
Internal Description

The 'core' of any submarine is, of course, its pressure hull. In the case of the Type VII this was of circular section, tubular in the centre



U-377, a Type VIIC, seen here after her bridge conversion. The armoured shelters, intended to give bridge crew some protection against enemy fire, can be seen welded to either side of the forward part of the tower. The deck gun has been removed and an extended 'wintergarden' platform fitted to the rear of the tower to take the upgraded flak armament. (Jak P. Mallmann-Showell)

RIGHT The two early Type VIIC boats shown here both have the basic conning tower configuration known as 'Turm 0', with a single circular platform for the 2 cm flak gun. Note the heavy staining around the exhaust outlet on the outer boat whilst the inner boat's hull paintwork still appears to be in pristine condition suggesting a newly commissioned boat or recent overhaul. The bollards to which the mooring ropes are attached were retractable when the boat was travelling underwater to reduce drag.



ABOVE A type VIID minelayer is identifiable by the raised casing abaft the conning tower.

section, and then tapering slightly towards the bow and stern. The pressure hull was made from welded rolled steel up to 2.2 cm thick. The whole consisted of six sections, plus a bow and stern end cap. Around this pressure hull was built the external casing, an area which was free flooding and was used to accommodate ventilation trunking and for storage.

Starting from the bow, the first compartment was the forward torpedo room, into which the four bow torpedo tubes penetrated by some four metres. To the ceiling was attached a hoist used for manoeuvring the torpedoes into the tubes, and the angled torpedo loading hatch. To the rear of the compartment were located three sets of two-tier bunks on each side. Compressed air cylinders were located below the bottom bunk, as were collapsible tables for the use of the junior ratings who occupied this compartment. Under the decking there was storage space for two additional torpedoes and under these, the bow trim tanks.

After passing through the first bulkhead, the next compartment in line was the senior non-commissioned ranks' accommodation, comprising two sets of two-tier bunks each side.

A further bulkhead followed before reaching the officer accommodation. Again, two sets of two-tier bunks were provided but as only three officers were normally carried, one of these was usually stowed. A small table was provided on the port side.



Then came the commander's bunk. He was the only man on board afforded a modicum of privacy, provided by a simple curtain at the entry to his 'quarters'. Directly across the walkway were located the radio room and sound detector room, giving the operators of these essential pieces of equipment instant access to the commanding officer. Under the decking of this area were stored the forward batteries as well as ammunition for the deck gun.

Reaching the central portion of the boat, the hub of activity was the control room, or *Zentral*, with a heavy pressurised bulkhead at either end. On the starboard side from the bow end, were located the boat's main helm, the diving planes, the navigator's table and the auxiliary bilge pumps. On the port side were the periscope motor, the main vent controls, the main bilge pump and a drinking water tank. In the centre of the compartment were the periscope tubes, the main optics for the sky, or navigation, periscope being located in the control room.

Above the control room was the conning tower. In it was a tiny space, the commander's attack station. Within this tiny compartment were the optics for the attack periscope, the attack computer, the compass and the exit hatch to the exterior of the conning tower. Under the decking of the *Zentral* were fitted ballast tanks and fuel bunkers.

Passing through the rear control room bulkhead, the next compartment was the junior non-commissioned ranks' accommodation, consisting of two pairs of twin bunks each side. Towards the rear of this compartment, on one side was the boat's tiny galley and on the other the aft w.c. and food storage pantry. The aft batteries were stored under the deck plates of this area.

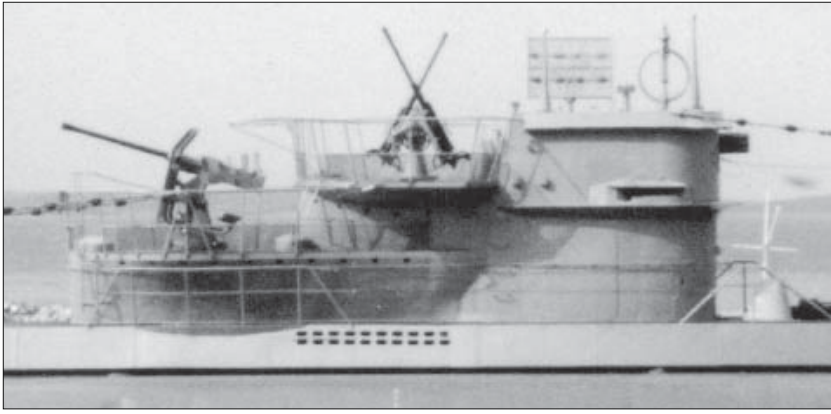
The next bulkhead led through to the engine room. Within this small space were located the boat's two diesel engines on their massive founds, with only a narrow passageway in between. A further bulkhead allowed passage into the motor room in which were located the boat's two electric motors, coupled to the same shafts as the diesels. Also contained in this compartment were a compressor for the boat's modest refrigerated storage, the main electrical control panels and the stern torpedo tube, which fired out between the boat's twin rudders. Beneath the deck plating in this area were the stern trim tanks.

External fittings

The U-boat's external decking was covered in wood planking, with a 1 cm gap between planks to allow for drainage. Wood was used to avoid the degree of icing up in winter conditions that would have been encountered with metal decking.



Looking towards the stern from the upper tower flak platform on a late-war Type VIIC. Clearly visible is the four-barrelled 2 cm *Flakvierling*, a weapon only fitted to a limited number of U-boats.



U-995, currently the only complete, restored Type VIIC extant, is mounted on concrete pedestals on the beach at Laboe adjacent to the German Naval Memorial and is open to visitors. This boat features a 'textbook' Turm 4 arrangement with two twin 2 cm flak guns on the upper platform, and a 3.7 cm flak gun on the lower.

A view inside the bow compartment shows just how cramped living conditions were on an operational U-boat. The chains hanging down in the foreground are part of the torpedo hoist.



The area between the outer casing and pressure hull was free flooding, and along the side of the outer casing of any Type VII will be seen numerous draining slots. The exact number and positioning of these varied from manufacturer to manufacturer. In the area between pressure hull and outer casing, in the forward portion of the boat, was located a storage

tube for a spare torpedo. On some boats this was replaced by a series of watertight containers for life rafts.

Moving away from the bow, there was an angled torpedo loading hatch leading from the outer deck to the pressure hull. This allowed the torpedo to be taken into the boat nose first, facing the tube into which it would be loaded. Beyond the torpedo loading hatch was a watertight storage container with a small amount of ammunition for the deck gun. This allowed the gun to be brought into action swiftly, while the remainder of the ammunition was brought up through the boat from the ammunition storage under the deck plating on the *Zentral*.

On outer decking itself at the forward point some early boats still had the serrated net cutter fitted to First World War boats, but by the outbreak of the Second World War most of these had been removed. Retractable bollards were fitted near the bow and stern, with additional pairs, port and starboard approximately mid-way between the bow/stern and the conning tower. A retractable capstan winch and retractable hydrophone array were also mounted on the foredeck.

The conning tower, as has already been discussed, was one of the areas in which considerable differences may be found from boat to boat and at

different stages throughout the war. In general, the front and sides of the tower were screened up to a height of some 1.5 m to give the crew some measure of protection against the elements. The rear of the bridge was open, leading onto the aft platform which was surrounded by a safety railing. On the bridge itself were the mounts that supported the periscopes, a pedestal mount for the UZO (*Uberswasserzieloptik*) torpedo aiming device, a binnacle and, on the starboard wall of the tower,

a slot to house the retractable direction-finding loop. Later examples of the Type VII had the snorkel fitting mounted on the port side of the tower.

The afterdeck was relatively featureless. Apart from the small stern torpedo loading hatch, the space under the rear decking was devoted almost entirely to trunking. The trunking, which passed through the free-flooding area under the afterdeck, led up through the conning tower casing to the rear outer tower wall. Types VIIA and VIIB had large trunking running up the outside face of the tower, but by the VIIC model this was contained within the tower casing.

A single thick antenna cable ran from the most forward point of the bow to just before the conning tower, where it split, one fork running to a locating point either side of the top of the tower wall. From here, one antenna cable ran down to an anchor point on each side near the stern.



The diving planes controls in the *Zentral* of a Type VII U-boat. The large dial just to left of centre is the depth gauge.

Construction Details

DESCHIMAG, BREMEN

VIIA U-27 to U-32 6 boats
(This firm concentrated on the Type IX.)

GERMANIAWERFT, KIEL

VIIA U-33 to U-36 4 boats
VIIB U-45 to U-55 11 boats
VIIB U-99 to U-102 4 boats
VIIC U-69 to U-72 4 boats
VIIC U-93 to U-98 6 boats
VIIC U-201 to U-212 12 boats
VIIC U-221 to U-232 12 boats
VIIC U-235 to U-250 16 boats
VIIC U-1051 to U-1058 8 boats
VIIC U-1063 to U-1065 3 boats
Total 80 boats

BREMER VULCAN, VEGESACK

VIIB U-73 to U-76 4 boats
VIIC U-77 to U-82 6 boats
VIIC U-132 to U-136 5 boats
VIIC U-251 to U-300 50 boats
VIIC U-1271 to U-1279 9 boats
Total 74 boats

DANZIGERWERFT, DANZIG

VIIC U-401 to U-430 30 boats
VIIC U-1161 to U-1172 12 boats
Total 42 boats

FLENDERWERFT, LUBECK

VIIB U-83 to U-87 5 boats
VIIC U-88 to U-92 5 boats
VIIC U-301 to U-330 30 boats
VIIC U-903 to U-904 2 boats
Total 42 boats

NORDSEE WERKE, EMDEN

VIIC U-331 to U-350 20 boats
VIIC U-1101 to U-1110 10 boats
Total 30 boats

FLENSBURGER SCHIFFSBAU, FLENSBURG

VIIC U-351 to U-370 20 boats
VIIC U-1301 to U-1308 8 boats
Total 28 boats

HOWALDTS WERKE, KIEL

VIIC U-371 to U-400 30 boats
VIIC U-651 to U-683 33 boats
VIIC U-1131 to U-1132 2 boats
Total 65 boats

STÜLCKEN SOHN, HAMBURG

VIIC U-701 to U-722 22 boats
VIIC U-905 to U-908 4 boats
Total 26 boats

SCHICHAUWERFT, DANZIG

VIIC U-431 to U-450	20 boats
VIIC U-731 to U-750	20 boats
VIIC U-825 to U-828	4 boats
VIIC U-1191 to U-1210	20 boats
Total	64 boats

DEUTSCHE WERKE, KIEL

VIIC U-451 to U-458	8 boats
VIIC U-465 to U-486	22 boats
Total	30 boats

BLOHM & VOSS, HAMBURG

VIIC U-551 to U-650	100 boats
VIIC U-951 to U-1031	81 boats
Total	181 boats

KRIEGSMARINERWERFT, WILHELMSHAVEN

VIIC U-751 to U-779	29 boats
---------------------	----------

ODER WERKE, STETTIN

VIIC U-821 to U-822	2 boats
---------------------	---------

VULCAN, STETTIN

VIIC U-901	1 boat
------------	--------

NEPTUNWERFT, ROSTOCK

VIIC U-921 to U-930	10 boats
---------------------	----------

These represent only boats that were actually completed. Others were laid down, but never completed, or were broken up or the order for their manufacture was cancelled.

Operational Use

Many operational flotillas used a variety of different U-boat types through the course of the war, where others seemed to use a specific type predominantly, if not exclusively. The following flotillas are those in which use of the Type VII predominated:

1 Unterseebootsflotille	Types VIIB, VIIC and VIID
3 Unterseebootsflotille	Types VIIB and VIIC
6 Unterseebootsflotille	Types VIIB and VIIC
7 Unterseebootsflotille	Various Type VIIs
9 Unterseebootsflotille	Types VIIC and VIID
11 Unterseebootsflotille	Type VIIC
13 Unterseebootsflotille	Type VIIC
14 Unterseebootsflotille	Type VIIC

With just over 700 examples built, the Type VII was by far the most successful of all the U-boat types. It fitted well with the decision taken that Germany would build a large fleet of small- to medium-sized boats rather than a small fleet of large boats. Despite its modest size, and relative ease of construction, it proved itself a reliable design, capable of operating throughout the Atlantic, its capabilities restricted only by the amount of fuel/munitions it could carry.

The Type VII had a faster diving speed than the larger Type IX, a critical factor that endeared it to its crews, as did its capability of diving, on occasion, much deeper than its recommended safe maximum depth without mishap. The biggest 'downside' for the crews was the extremely cramped interior. Space was at an absolute premium and conditions within these boats could become extremely uncomfortable very quickly. However, to many U-boat men, even though the Type IX was more spacious and thus more comfortable, its slow diving speed and thus greater vulnerability when caught on the surface made the Type VII a relatively 'safer' boat.

Without doubt, the Type VII in its many guises was by far the most influential submarine in the U-boat war. Through the course of the war,

over 2,600 war cruises were undertaken in the Type VII boats. During the course of these cruises, around 1,365 enemy ships were sunk, that total including 190 warships. From the total of just over 700 Type VIIs that were built, over 400 were sunk by enemy action. In the great majority of these cases, the boats were lost with all hands. Of the total of approximately 30,000 U-boat men who lost their lives in the Second World War, around 22,000, or 73 per cent, were serving on the Type VII.

The capabilities of the Type VII boat in the hands of an expert commander are easily established by a quick review of some of the most successful U-boat commanders of the Second World War, and the types of boats in which they operated.

On 17 September 1939, the Type VIIA U-29 under the command of Kapitänleutnant Otto Schuhart struck the first major blow against the Royal Navy when the aircraft carrier HMS *Courageous* was intercepted and sunk in the waters off the west coast of Ireland. Schuhart went on to accumulate a total of 12 enemy ships totalling some 83,700 tons before being given a shore command. He was decorated with the Knight's Cross and survived the war to serve in the West German Bundesmarine.

The first truly spectacular U-boat success of the Second World War, however, came on 14 October 1939 when Kapitänleutnant Gunther Prien succeeded in penetrating the fleet anchorage at Scapa Flow, and torpedoed and sank the battleship HMS *Royal Oak*. Although this warship was obsolete and its loss to the Royal Navy would have no major effect on the combat capabilities of the British fleet, the mere fact that a U-boat had penetrated what was considered to be a safe anchorage and sunk a major surface warship with considerable loss of life, and had then escaped unscathed, was a major propaganda disaster for Britain, and one which Germany exploited to the full. Coming hard on the heels of the sinking of the *Courageous*, it was a serious blow to the morale of the Royal Navy. Prien's entire crew was decorated with the Iron Cross and Prien himself with the Knight's Cross of the Iron Cross.

Prien's boat, the U-47, was an early Type VIIB that continued to serve him well. Prien quickly established that his success at Scapa Flow was no fluke as his score of tonnage sunk rapidly rose. Prien sank a total of 31 ships, some 192,000 tons, before U-47 was attacked and sunk by the destroyer HMS *Wolverine* on 8 March 1941. There were no survivors. Prien had added the Oakleaves to his Knight's Cross on 20 October 1940.

A contemporary of Prien, Kapitänleutnant Joachim Schepke, also commanded a Type VIIB, the U-100. Unlike Prien, there were no spectacular warship sinkings in his tally, but rather a steady and remorseless list of merchantman after merchantman sent to the bottom. He was decorated with the Knight's Cross of the Iron Cross on



A U-boat commander and his L.I. (Leitender Ingenieur) stroll along the foredeck of their Type VIIC. The insulator blocks on the jump wires can be clearly seen. Note also the closed hatch for the ready-ammunition locker for the 8.8 cm deck gun just ahead of the commander.

24 September 1940 and added the Oakleaves on 20 December 1941. His boat was finally forced to the surface and rammed by the destroyer HMS *Vanoc* on 17 March 1941. Schepke was on the bridge at the time, and was crushed against the periscope mount by the impact and dragged down with the sinking U-boat. At the time of his death he had sunk 37 ships totalling over 145,000 tons.

The third and by far the most successful of the Type VIIB 'aces' was Fregattenkapitän Otto Kretschmer. Kretschmer's quiet, serious demeanour earned him the nickname 'Silent Otto'. In command of U-99, however, his combat career was anything but 'quiet'. On his very first war cruise, Kretschmer sank eleven enemy ships. He was awarded the Knight's Cross on 4 August 1940 and added the Oakleaves on 4 November of that same year. His score continued to rise, reaching 56 ships for a total of 313,600 tons sunk. Kretschmer finally met his match when he succumbed to a joint attack by the destroyers *Vanoc* and *Walker* on 17 March 1941, in the same convoy battle in which Schepke was killed. Fortunately, the majority of U-99's crew, including Kretschmer himself, were able to abandon their stricken U-boat safely and spent the remainder of the war in a POW camp. Whilst in captivity Kretschmer learned that he had been decorated with the Swords to his Knight's Cross with Oakleaves on 26 December 1941. Kretschmer's total tonnage sunk, which was never surpassed, made him the highest-scoring U-boat ace of the Second World War. This highly respected sailor survived the war and, when the German Navy was re-formed, returned to the service and eventually retired with the rank of Flotillenadmiral.

Amongst those who achieved great success with the Type VIIC, there are two main types of ace, the tonnage aces and the warship killers. One of the most famed Type VIICs is undoubtedly U-96, the subject of the

acclaimed movie *Das Boot*. Whilst the film is based on a real boat, the account is fictionalised and not altogether accurate. In the film, the boat's commander dies, but in reality the factual commander, Fregattenkapitän Heinrich Lehmann-Willenbrock, went on to even greater success and survived the war. Like the fictional captain, Lehmann-Willenbrock was decorated with the Knight's Cross of the Iron Cross, receiving his award on 26 February 1941. Lehmann-Willenbrock also received the Oakleaves, on 31 December 1941, and went on to sink a total of 25 enemy ships, for a total tonnage of 183,000 before

Though the rear flak platform on early Type VIICs looks relatively small, this photo of the assembled crew of U-46 shows just how many crewmen it could accommodate. U-boat crewmen rarely had the opportunity to wear their best blues. Photos such as this were usually taken on the day the boat was commissioned, or to celebrate a special event, as here, with the award of the Knight's Cross to the boat's captain, Kapitänleutnant Engelbert Endrass.



moving to a shore posting, in command of first the 9th then the 11th U-boat Flotillas.

The list of highly successful tonnage aces included Korvettenkapitän Adalbert Schnee, who sank a total of 24 enemy ships totalling 88,995 tons with his Type VIIC U-boat, U-201. Schnee was awarded the Knight's Cross on 30 August 1941 and the Oakleaves on 15 July 1942. Schnee (whose name in German means 'snow') was known for the emblem of a snowman on the conning tower of his boat. He was one of the first to be given command of one of the new Type XXI U-boats (U-2511). Although he only put to sea on his first operational cruise in the closing days of the war, and was unable to achieve any contact with the enemy before the order to cease hostilities was transmitted, he did carry out a successful dummy attack run on a group of British warships and escaped totally undetected.

Another of the great Type VIIC tonnage aces was Fregattenkapitän Erich Topp, whose conning tower emblem of a prancing devil painted in red earned U-552 the nickname of the 'Red Devil Boat'. Topp was decorated with the Knight's Cross on 20 June 1941, the Oakleaves on 11 April 1942 and the Swords on 17 August 1942. His eventual total of enemy ships sunk was 35, for a total of 192,600 tons. Amongst his kills was the destroyer USS *Reuben James*. Like Schnee, Erich Topp was given command of one of the latest Type XXI boats in the closing stages of the war. Schnee also joined the re-formed German Navy after the war and eventually retired with the rank of Konteradmiral. In 2000, this highly respected sailor, who over the years had made innumerable historians and researchers welcome to his home, was dismayed to discover that one 'guest' had stolen many of his decorations as well as his bejewelled naval Honour Dagger.

Several of the great Type VIIC aces earned their Knight's Cross, not by sinking huge tonnages of enemy merchant ships, but by spectacular sinkings of major enemy warships. Amongst these was Kapitänleutnant Hans Diedrich von Tiesenhausen, commander of U-331. Although this commander, operating in the Mediterranean sank but two ships, his total tonnage score was 40,435. The reason for the high tonnage with just two ships was that one of these was the battleship HMS *Barham*, torpedoed and sunk by von Tiesenhausen on 25 November 1941. His other sinking was a 9,000-ton freighter, the *Leedstown*. He was awarded the Knight's Cross for his sinking of the *Barham* on 27 January 1942. On 17 November 1942, U-331 was attacked and sunk by Swordfish torpedo bombers from the aircraft carrier HMS *Formidable*. Von Tiesenhausen and 15 of his crew were rescued and spent the remainder of the war in captivity.



ABOVE A view from the bows of the same late-war Type VIIC as in the previous photograph. Note the lack of deck gun in Type VIIIs from the second half of the war, the emphasis thereafter being on anti-aircraft armament. Unusually, this boat seems to be moving along some narrow inland waterway.

BELOW A Type VIIC on training exercises in the Baltic. Note how narrow is the width of deck available for passing along the side of the tower. The Type IX was, by comparison, far more spacious.



- [read *Heat and Mass Transfer: Fundamentals and Applications \(5th Edition\)*](#)
- [click *My Name Is Daphne Fairfax pdf, azw \(kindle\)*](#)
- [download *The Runaway Princess \(Princess, Book 1\) for free*](#)
- [read *The Filmmaker's Guide to Final Cut Pro Workflow* online](#)
- [read online *A House Not Meant to Stand* online](#)

- <http://conexdx.com/library/Heat-and-Mass-Transfer--Fundamentals-and-Applications--5th-Edition-.pdf>
- <http://wind-in-herleshausen.de/?freebooks/My-Name-Is-Daphne-Fairfax.pdf>
- <http://monkeybubblemedia.com/lib/The-Routledge-Handbook-of-Language-Learning-and-Technology--Routledge-Handbooks-in-Applied-Linguistics-.pdf>
- <http://test.markblaustein.com/library/The-Rough-Guide-to-Bolivia.pdf>
- <http://korplast.gr/lib/A-House-Not-Meant-to-Stand.pdf>