
































1



2

Battle of the Atlantic		
Belligerents		
 United Kingdom	 Poland	 Germany
 Canada	 Brazil	 Italy
 United States	 Netherlands	
 Free France	 Norway	
Commanders and leaders		
 AoF Sir Dudley Pound, RN	 Großadmiral Erich Raeder	
 Adm. Sir Martin Dunbar-Nasmith, RN	 Großadmiral Karl Dönitz	
 Adm. Sir Percy Noble, RN	 Adm. H.F. von Friedeburg	
 Adm. Sir Max Horton, RN	 LTG Martin Harlinghausen, Luftwaffe	
 ACM Sir Frederick Bowhill, RAF	 Adm. Günther Lütjens †	
 ACM Sir Philip de la Ferté, RAF	 Korvettenkapitän Robert Gysae, U98,177	
 AM Sir John Slessor, RAF	 Adm. Angelo Parona, Regia Marina	
 Radm. Leonard W. Murray, RCN	 Adm. Romolo Polacchini, Regia Marina	
 Adm. Royal E. Ingersoll, USN		
 Adm. Jonas H. Ingram, USN		
Casualties		
<ul style="list-style-type: none"> • 36,200 sailors killed • 36,000 merchant seamen killed • 3,500 merchant vessels; 175 warships • 741 RAF Coastal Command Aircraft lost 	<ul style="list-style-type: none"> • ~30,000 U-boat sailors killed • 783 submarines lost; 47 warships lost • ~500 killed • 17 submarines lost 	

3

Battle of the Atlantic – Introduction	
<ul style="list-style-type: none"> • The Battle of the Atlantic was the longest continuous military campaign in World War II, running from 1939 to the defeat of Germany in 1945. • At its height from mid-1940 through to the end of 1943; it was a major part of the Naval history of World War II. • At its core was the Allied naval blockade of Germany, announced the day after the declaration of war, and Germany's subsequent counter-blockade. • The Battle of the Atlantic pitted U-boats and other warships of the <i>Kriegsmarine</i> (Navy) and aircraft of the <i>Luftwaffe</i> (Air Force) against the Royal Canadian Navy, Royal Navy, United States Navy, and Allied merchant shipping. • In essence, the Battle of the Atlantic became a tonnage war: the Allies struggled to supply Britain and the Axis attempt to stem the flow of merchant shipping that enabled Britain to keep fighting. • The CIC Uboat forces Karl Donitz strived to implement the German ‘tonnage war’ strategy. Donitz declared his objective as being: 	

4

INTRODUCTION

"the destruction of British controlled shipping where ever they could be found, with the least risk to the Uboats. It didn't matter whether the ships were large, medium or small, laden or empty, close or distant from the battlefronts. The goal was to sink merchant ships at a rate much faster than the British could replace them with new ships".

Thereby whittling down existing tonnage to a decisively unworkable level.



- The defeat of the U-boat threat was a prerequisite for pushing back the Axis and so eventually in Jan43 became a top allied priority. The Battle of the Atlantic has been called the "longest, largest, and most complex" naval battle in history.
- This battle would be decided by which side could endure the various trials the longest.

5

SETTING THE SCENE



Notoriously ignorant of naval strategy and tactics, and prone to seasickness, Adolf Hitler pays a rare visit to a warship.



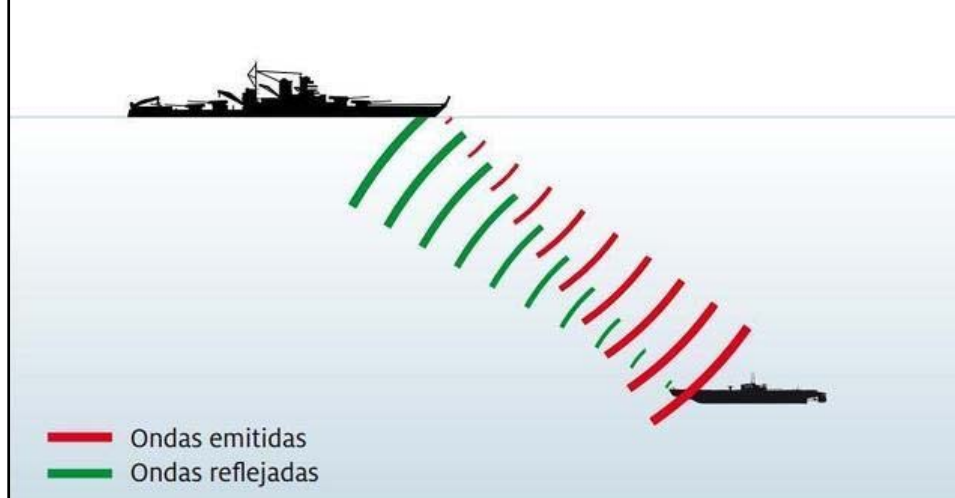
6

BRITAINS PLIGHT

- As an island nation, the United Kingdom is highly dependent on imported goods. Britain required more than a million tons of imported material per week in order to be able to survive and fight.
- The UK economy in high gear could produce all the weapons, ships, aircraft, guns, tanks that its mobilised population could man on any battlefield.
- However it could only do this by importing all its non-ferous metals, rubber, oil, some machine tools and half of its food. Most importantly American wheat and powdered milk was a staple at that time – so starvation became a distinct possibility.
- At wars start the UK had the worlds largest merchant fleet of 4000 vessels (1000 large costal and 3000 ocean going vessels) – average tonnage of the ships was 5000. To protect this fleet the UK had 220 vessels equipped with ASDIC – 165 destroyers, 35 sloops/corvettes and 20 trawlers – a ratio of 14:1 (merchants/warships).

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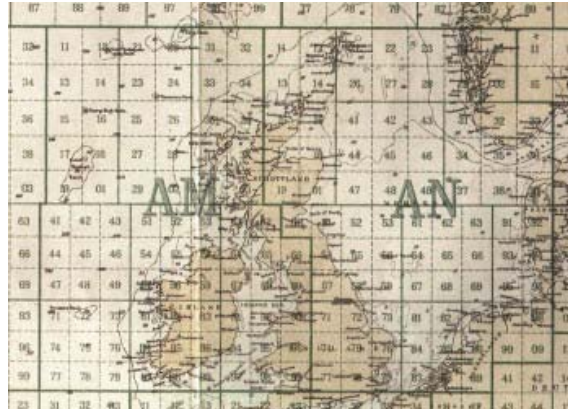
ASDIC – Allied Submarine Detection Investigation Committee




8

KEY COMPONENTS


- Convoys
- Uboats
- Surface Escorts
- Surveillance & Attack aircraft
- ASW Weapons
- Radio Intelligence
- Crypto analysis
- Command systems





9



GERMANY – PRE-WAR



- Kriegsmarine commanders were severely unprepared for the beginning of WWII, in pre-war conferences with Hitler they were provided with guidance that war would begin in 1944. Two plans were presented one by Karl Donitz emphasising a fleet of 300 Uboats and the other Plan Z which envisaged a balanced fleet capable of taking on the British navy. In mid 1938 Hitler chose Plan Z and so the Kriegsmarine commanders began a long term plan to build a balanced fleet sufficient to challenge the UK surface fleet.
- Plan Z called for - 10 X BB, 3 X BC, 15 X Pocket BB, 33 X CA, 4 X CV, 68 X DD, 250 X SS.
- In Sep 1939 Germany had 57 U-boat's (30 short range coastal & 27 ocean going boats). Donitz had calculated that he needed a fleet of 300 U-boat's in order to strangle Britain into submission, he was not to achieve this number of U-boat's until July 1942. This number of boats would enable him to maintain 140 on operations – the remainder would be refitting, resting, training and in transit to operational areas.

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KRIEGSMARINE – WARS OUTBREAK

- At the outbreak of hostilities the Kriegsmarine comprised:
2 x BC, 3 X Pocket BB, 9 x CA, 20 X DD, 57 X SS. In construction were 2 X BB, 1 X CV and 1 X CA



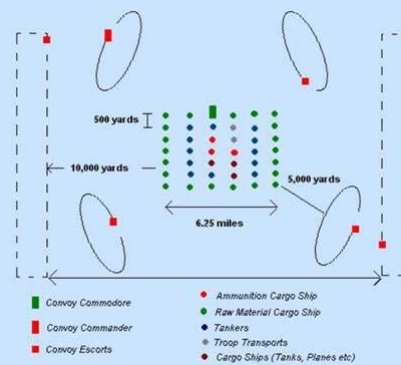
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CONVOY



A convoy of merchant ships preparing to sail to Britain from Halifax, Nova Scotia
(Image courtesy of merchantships.tripod.com)

TYPICAL CONVOY DIAGRAM



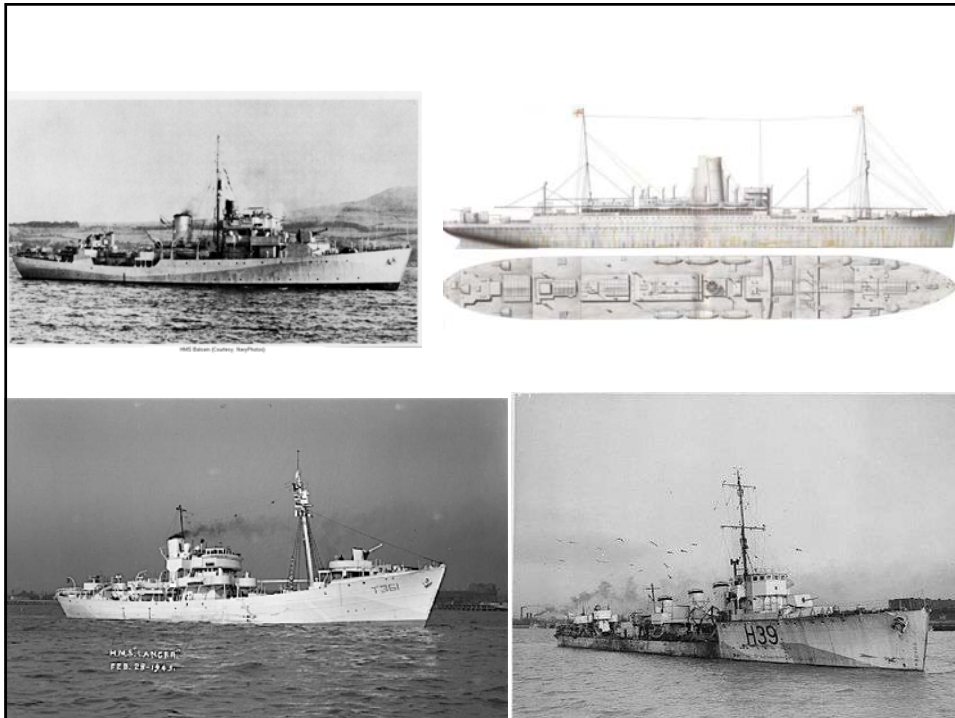
12

THE PROTAGONISTS

- The main protagonists during the convoy battles were the escorts and the Uboats. Escort example: Flower Class corvette, it was adapted from a whale catcher (more suited to inshore duties) weighed 1000 tons, could be built in small shipyards, had long range, a top speed of 16 kts, and was armed with depth charges. Over 400 of these ships were built during WWII. Construction programs added 200 escorts a year between 1941-1945.



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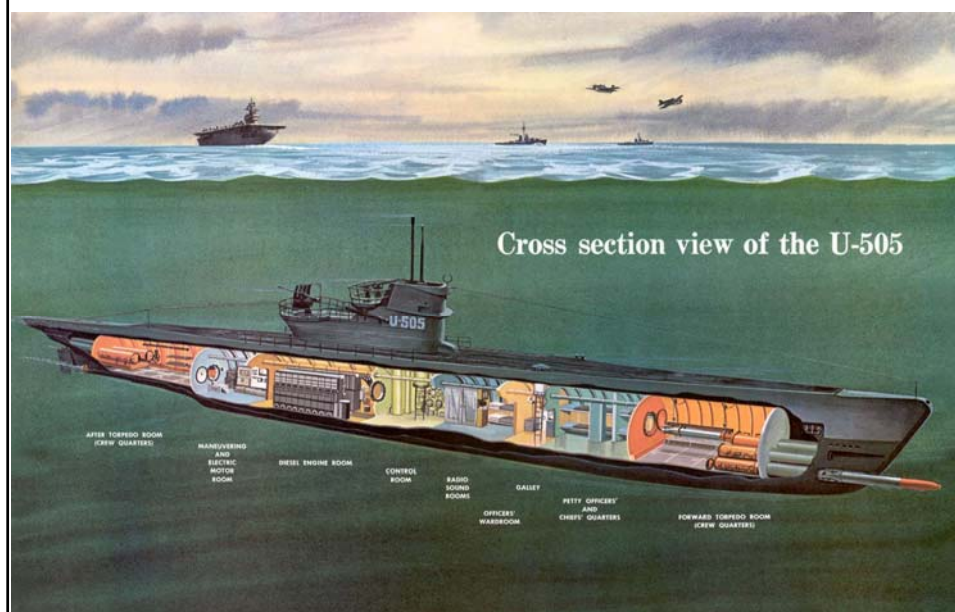
THE PROTAGONISTS – CONT.

- The Type VII submarine was the main Uboat used over 700 were built during WWII – also pictured is a FW Condor long range patrol aircraft and JU88. The Uboats were surface craft designed to submerge for up to 24 hours in emergencies and when attacking covertly. The disadvantage to being submerged was that a submarine could only make up to 7 kts and had limited time with which to remain under the water. On the surface a Uboat could make 17 kts at full speed, thus outrunning some of the early escort vessels if so desired.

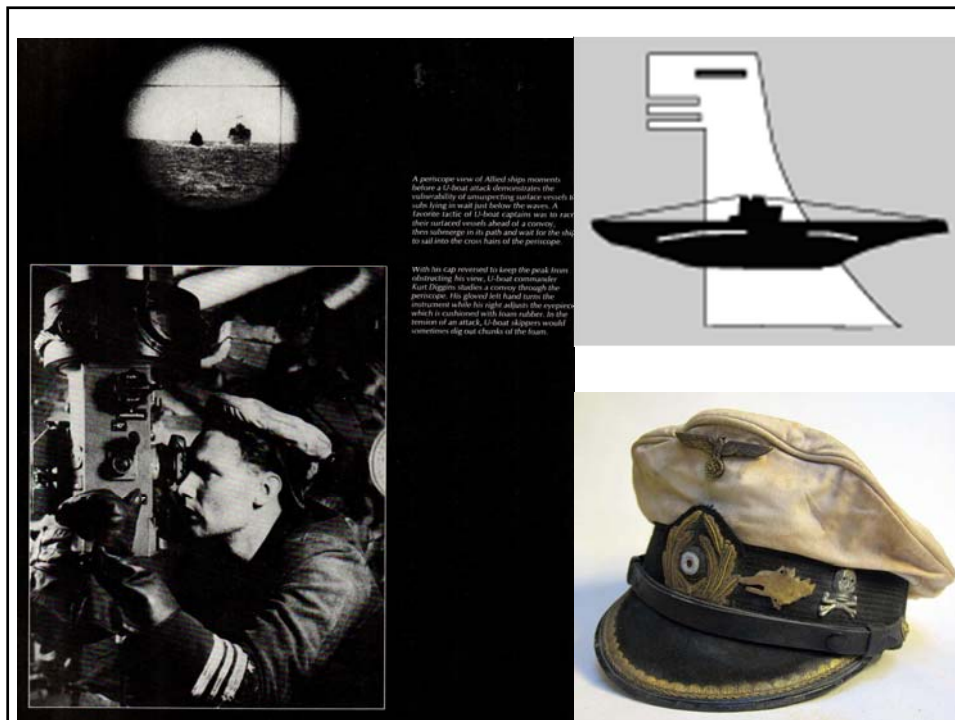


15

DAS BOOT



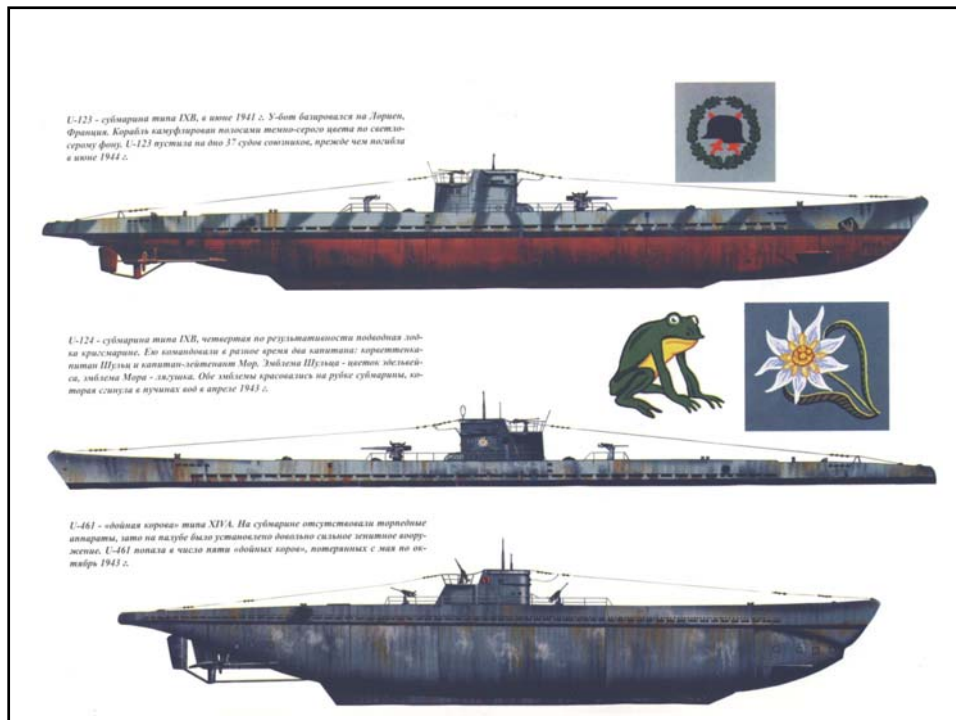
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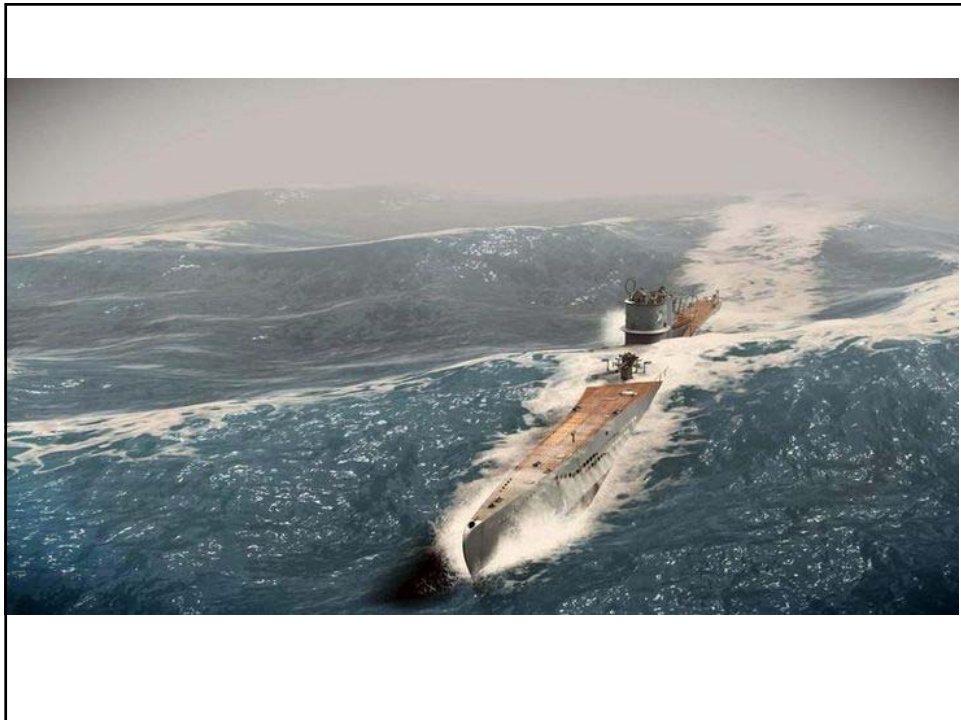
UBOAT – VII & IX

	TYPE VII	TYPE IX
Top Speed	17	17
Submerged Speed	7	7
Range	6,500 miles	8 – 11,000 miles
Dive to	650 ft	650 ft
Underwater Endurance	24 hrs	24 hrs
Range underwater	80 Miles @ 4 kts	80 Miles @ 4 kts
Gun	1 X 88 mm	1 X 105mm
Torpedoes	14	22
	Bow 4 tubes	Bow 4 tubes
	Stern 1 tube	Stern 2 tubes
Lavatory	1	1
Crew	44	55

20



21



22



WAR BEGINS

23

1939 – 1941 OPENING PHASES

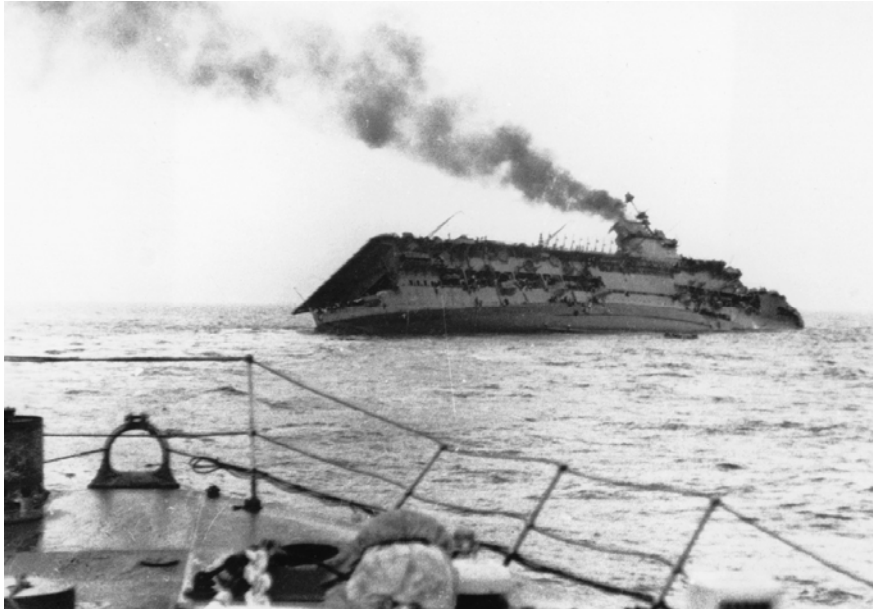
- Unable to challenge the Royal Navy in regard to capital ships, the Kriegsmarine began a campaign against Allied shipping with the goal of cutting off Britain from the supplies needed to wage war. Overseen by Grand Admiral Erich Raeder, German naval forces sought to employ a mix of surface raiders and U-boats.



- Though he favoured the surface fleet, which would come to include the battleships Bismarck and Tirpitz. Raeder was challenged by his U-boat chief, then-Commodore Karl Donitz, regarding the use of U-boats.
- Initially ordered to seek out British warships, Donitz's U-boats had early success sinking the old battleship HMS Royal Oak at Scapa Flow and the carrier HMS Courageous off Ireland.

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SINKING – HMS COURAGEOUS by U29, 17 Sep 39



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INITIAL TACTICS

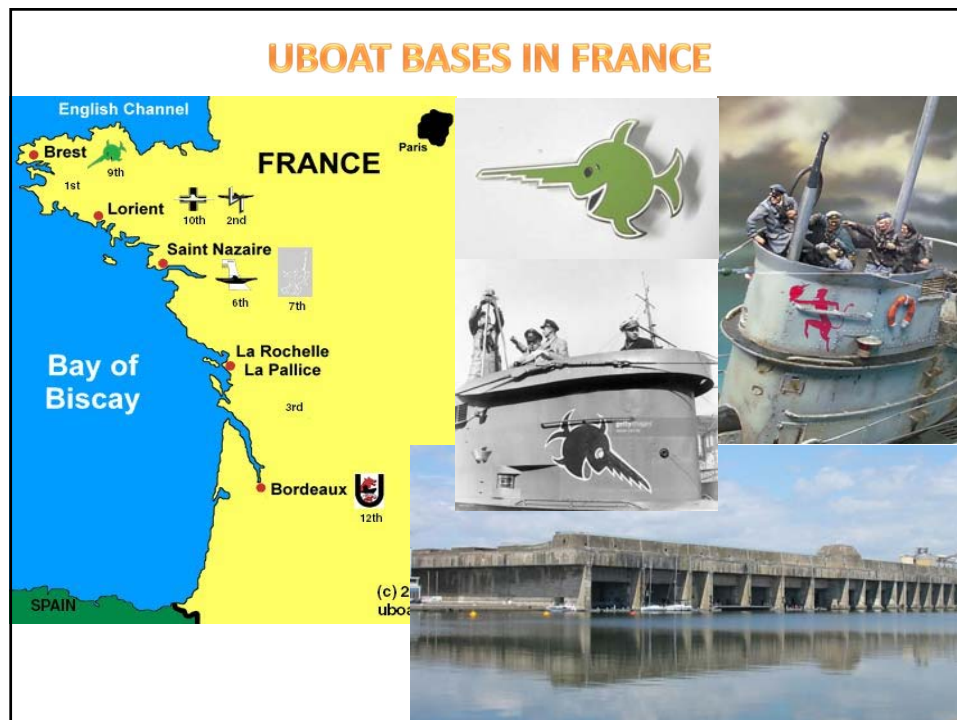
- Initially Uboats operated individually, being assigned a sector in the ocean with which to patrol. A typical attack would involve an Uboat getting in front of the target whilst remaining within visual sighting. The Uboat would then submerge in front of its prey, using the sea to conceal itself and attack with torpedoes during daylight whilst submerged. A Uboat combat patrol lasted as long as both fuel and torpedoes were available. The majority of initial victims were individual ships which were sailing independently.
- Convoys were arranged for vessels sailing the main routes, initially convoys did not have dedicated escorts. A convoy would depart Halifax escorted by the Royal Canadian Navy (Western Local Escort Force) up to a few hundred miles where it would depart the escorts and make its way through the mid Atlantic, unescorted till it arrived near the Western Approaches to Britain.
- When Uboat sinkings increased escorts were assigned for the entire journey but this didn't happen till Jan 42, there were never enough escorts to fully protect convoys. Avoidance of Uboats was the main strategy used by Allied commanders.

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1939 – 1941 OPENING PHASES (Cont.)

- Despite some early surface fleet victories, Donitz vigorously advocated for using groups of U-boats, known as "wolf packs," to attack the Atlantic convoys that were resupplying Britain. Though the German surface raiders scored some early successes, they drew the attention of the Royal Navy who sought to destroy them or keep them in port. Engagements such as the Battle of the River Plate (1939) and the Battle of the Denmark Strait (1941) saw the British respond to this threat.
- With the fall of France in June 1940, Donitz gained new bases on the Bay of Biscay from which his U-boats could operate.

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1939 – 1941 OPENING PHASES (Cont)

- Spreading into the Atlantic, the U-boats began attacking British convoys in packs. These multi-ship groups were further directed by intelligence gleaned from the breaking of the British Naval Cypher No. 3. Armed with the approximate location of an approaching convoy, the wolf pack would deploy in a long line across its anticipated path.
- When a U-boat sighted the convoy, it would radio its location and coordination of the attack would commence. Once all of the U-boats were in position, the wolf pack would strike. Typically conducted at night, these initial 'wolf pack' assaults could involve up to six U-boats attacking on the surface, forcing the convoy escorts to deal with multiple threats from several directions whilst their ASDIC was ineffectual at detecting the prowling 'wolves' on the surface.

29

1939 – 1941 OPENING PHASES (Cont)

- Through the remainder of 1940 and into 1941, the U-boats enjoyed tremendous success and inflicted heavy losses on Allied shipping. As a result, it became known as the "Happy Time" ("*Die Glückliche Zeit*") among the U-boat crews. Claiming over 270 Allied vessels during this period, U-boat commanders such as Otto Kretschmer, Günther Prien, and Joachim Schepke became celebrities in Germany. Key battles in the second half of 1940 included convoys, Losses:
 - HX72 - 11 of 43 ships, escorted by one Armed Merchant Cruiser Jervis Bay
 - SC7 - 20 of 35 ships, escorted by one sloop
 - HX79 - 12 of 49 ships, escorted by two Armed Merchant Cruisers and
 - HX90 - 11 of 41 ships, escorted by one Armed Merchant Cruiser.

30

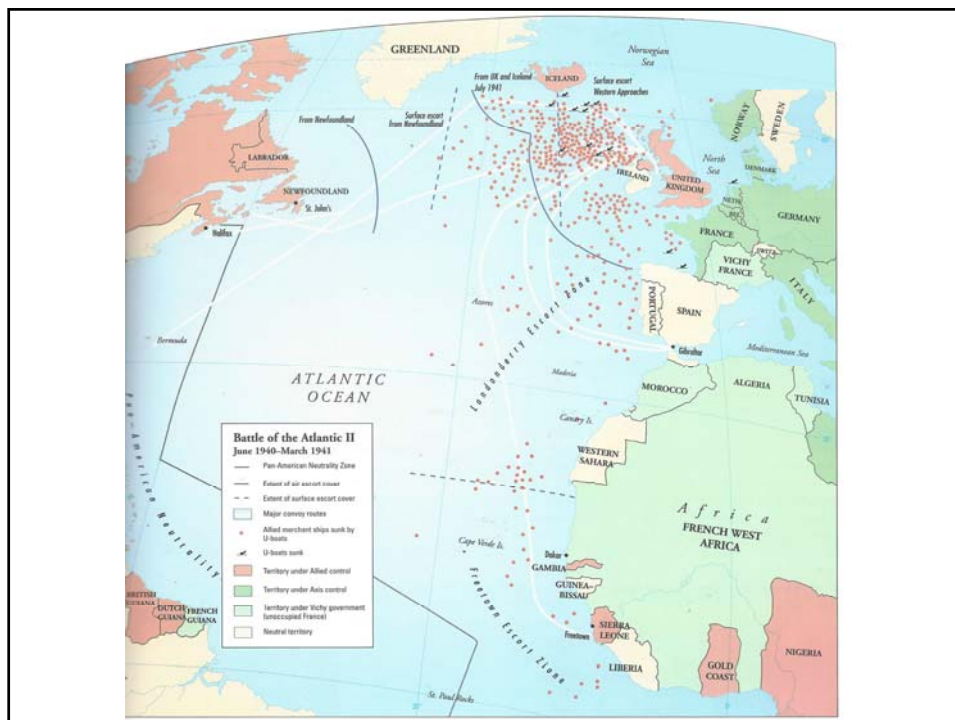
THE TOP TWENTY U-BOAT SKIPPERS¹

1939–1945

German U-boat skippers sank about 2,900 Allied ships of about 14.6 million gross tons in World War II. Twenty skippers accounted for about 20 percent of all sinkings and about 23 percent of the tonnage. In detail:

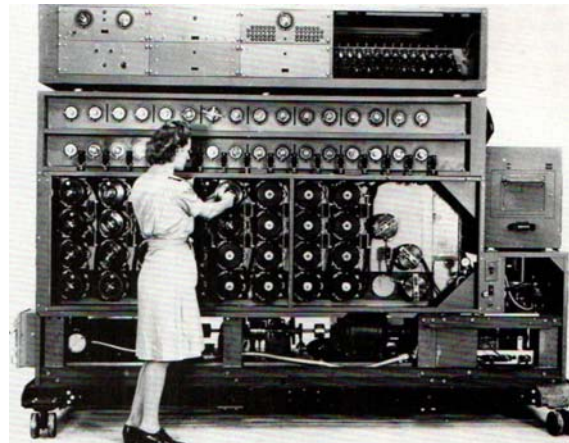
SKIPPER	SHIPS SUNK	TONNAGE	U-BOAT(S)
Otto Kretschmer	42½	238,327	U-23, U-99
Wolfgang Lüth	47	229,000	U-9, U-138, U-43, U-181
Günther Prien	32⅓	211,393	U-47
Viktor Schütze	36	187,279	U-25, U-103
Erich Topp	34	185,434	U-57, U-552
Herbert Schultze	28	183,432	U-48
Heinrich Lehmann-Willenbrock	25	183,223	U-5, U-96, U-256
Karl-Friedrich Merten	27	170,163	U-68
Heinrich Liebe	31½	171,003	U-38
Heinrich Bleichrodt	28	162,491	U-48, U-109
Georg Lassen	26	156,082	U-160
Joachim Schepke	37	155,882	U-3, U-19, U-100
Carl Emmermann	27	152,904	U-172
Ernst Kals	21	150,991	U-130
Werner Henke	25½	160,081	U-515
Adolf Piening	26	141,521	U-155
Robert Gysae	24	139,413	U-98, U-177
Engelbert Endrass	25	137,990	U-46, U-567
Johann Mohr	29	135,067	U-124
Klaus Scholtz	26	130,667	U-108
Totals:	597⅙	3,377,349	

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Radio Intelligence and Code Breaking



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IMPORTANCE OF INTELLIGENCE

- During the Battle of the Atlantic both sides used Naval Intelligence to a great extent, via radio intercepts. Both sides managed to 'crack' the others codes at various times and so an information war developed where each side was gaining useful intelligence to direct strategies.
- The trick being, not to reveal how much you knew of the other sides plans.
- Enigma Cypher machine used by all arms of the German military, comprising a machine with 3 wheels and (setting changed daily) combined with cypher code books which changed monthly.



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IMPORTANCE OF INTELLIGENCE – (Cont.)

- 9 May 1941 – U110 was captured intact by the Royal Navy including a 3 wheel Enigma Machine and code books.
- This intelligence was delivered to U.K. codebreakers at Bletchley Park and in the Summer (Jun-Aug 41) a flood of 'Ultra' (Special Intelligence) became available. In London Naval Intelligence set up a Uboat Operations Room called 'The Citadel' and began continuous tracking of individual operational Uboats. The main effect to the battle of the Atlantic was that this 'Ultra' intelligence enabled the re-routing of convoys to simply avoid the Uboat threat.
- In Spring of 1941 German codebreakers at B-Deinst began reading Allied Cypher Number 3; this code was used by USA, UK and Canada for North Atlantic convoy ops.

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INTELLIGENCE

- 1 Feb 42 – The flow of Ultra intelligence suddenly ceases when a new 4 wheel Enigma machine (called Triton) was introduced.
- By Sep 1942 B-Dienst was providing an accurate daily picture of Allied convoy sailings and routes, sufficient to enable Donitz to use this information tactically. But despite the B-Dienst intelligence coup, for various reasons between Sep – Oct 42, the Uboats were only able to make notable attacks on only 6 of 35 convoys that sailed to and from the UK. Sinking only 57 of 1700 merchant ships (causing a casualty rate of 3%, Eastbound 2%).
- On October 30, 1942 crewmen from HMAS Petard salvaged Enigma material from U559 as she foundered off Port Said. This allowed the codebreakers to break TRITON, a feat credited to [Alan Turing](#). By December 1942, Enigma decrypts were again disclosing U-boat patrol positions, and shipping losses declined dramatically once more.



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War Timeline – Sep 1939 to Dec 1941

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SIGNIFICANT INCIDENTS INFLUENCING THE BATTLE OF THE ATLANTIC to 1941

- 3 Sep 39 – U30 sinks the Athenia without warning (Hitler furious as Restricted Uboat Ops orders in place).
- 17 Sep 39 – HMS Courageous sunk
- 26 Sep 39 – Graff Spee given orders to begin surface raiding and her sister ship Deuchland. Sinks X9 merchants ships in the South Atlantic and Indian Oceans. On 13 Dec 39 engaged by X3 CA off of the River Plate. After the 90 min. engagement ended by the Allies, Graff Spee enters the neutral port of Montivideo in Uruguay on 14 Dec 39. Following successful Allied deception plan Capt Langsdorff scuttles Graff Spee outside of shipping lanes 17 Dec 39 (the first good news for the Allies of the War).
- 14 Oct 39 – Sinking of HMS Royal Oak in Scapa Flow killing 834 men.

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SIGNIFICANT INCIDENTS INFLUENCING THE BATTLE OF THE ATLANTIC to 1941 - (Cont)

- Feb41 – Scharnhorst and Gneisenau sortie into the North Atlantic sinking 22 merchants in six weeks. Adm Scheer deploys to the North Atlantic and Hipper to the African coast, secret raiders begin deploying and the Luftwaffe sinks 27 ships.
- 11 Mar 41 – U.S.A. formally becomes the 'Arsenal of Democracy' with the signing of the Lend Lease act enabling the supply of military equipment without upfront payment to nations experiencing war from aggressor nations.
- Mar41 – X3 of the best Uboat commanders were lost within two weeks of each other:
 Gunther Prein – who sank Royal Oak – 33 kills, Joachim Schepke – killed by convoy escort – 37 kills, Otto Kretschmer – captured – 44 kills.
- May 41 – Bismarck sorties, eventually sunk

39

SIGNIFICANT INCIDENTS INFLUENCING THE BATTLE OF THE ATLANTIC to 1941 - (Cont)

- 31Oct41 – USS Reuben James becomes the first US warship sunk by Germany - triggering the unofficial joining of the USN into The Battle of the Atlantic.
- Nov41 – Uboat happy time ends due to multiple factors; extremely poor weather in the North Atlantic, the release of forces screening UK from the threat of German invasion, the final arrival of all X50 WWI destroyers agreed between Churchill and Roosevelt.
- 7 Dec 41 – Japanese air attack on Pearl Harbour – five days later Hitler declares war on the USA in support of its Axis Ally Japan.

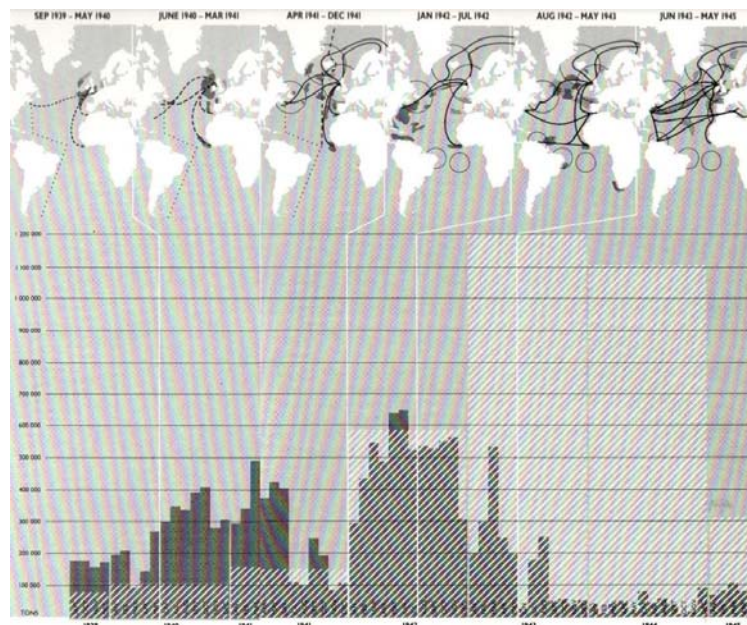
40

The End of the Beginning

- Unfortunately for Germany in the critical years 1939 to 1941 the tonnage war failed in its objective for multiple reasons:
 - There were not enough Uboats – e.g. one year after the beginning of the war Donitz still only had 57 Uboats.
 - The Uboats themselves had shortcomings (they were not true submarines) so that they were not suitable for the task
 - Whilst the Uboats managed to sink 5.3 million tons up to 1941, the Commonwealth more than made up for these losses. Through new construction and acquisition of shipping from the USA, German-occupied nations (Norway, France, Belgium, The Nederland's, Greece and by captured Axis shipping).
 - At the end of 1941 the British controlled merchant fleet was larger by about three million tons than it was in 1939.

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Tonnage lost – Tonnage built



42



USA ENTERS THE WAR

43

OPERATION 'DRUM BEAT' – THE UBOAT OFFENSIVE OFF THE USA EAST COAST

- After the USA formally entered the war in December 1941, Donitz decided to continue the 'tonnage war' by striking at the Americas for about eight months. Donitz dispatched U-boats to the American East coast and Caribbean under the name Operation Drumbeat. By the 12 Jan 42 there were nine Type IX Uboats on station off major US ports, the U-boats began enjoying a second "happy time" as they took advantage of unescorted American merchant ships as well as the US' failure to implement a coastal black-out. In Jan 42, 48 merchants were sunk by March the total number had risen to 95. As losses mounted, the U.S. implemented a convoy system in May 1942. With convoys operating on the American coast, Donitz withdrew his U-boats back to the mid-Atlantic that summer.



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1942

- Between December 1941 and August 1942 around 600 Allied ships totalling about 3 million tons were sunk.
- Unfortunately for the Germans, American shipyards were now mass producing ships including 'Liberty Ships' at prodigious rates – not only replacing losses but swelling the Allied fleet to unimagined tonnage levels. (Under) Liberty Ship 7,200 tons 15+ kts speed



45

Ship loss/production early 1943

1943	Ships Lost	Gross Tons	Ships Built	Gross tons
January	37	203,128	106	647,000
February	63	359,328	132	792,000
March	108	627,377	149	1,005,000
April	56	327,943	159	1,076,000
Total	264	1,517,776	546	3,520,000

46

Late 1942 and onwards



- Through the fall, losses continued to mount on both sides as the escorts and U-boats clashed. In November 1942, Admiral Sir Max Horton became commander-in-chief of the Western Approaches Command. As additional escort vessels became available, he formed separate forces which were tasked with supporting the convoy escorts. As they were not tied to defending a convoy, these groups were able to specifically hunt U-boats.



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Late 1942 and onwards

- Of the 1664 ships lost by the Allies to all causes during 1942, in all theatres - 1160 ships are lost to Uboats. Half of the losses attributed to Uboats occur in the North American theatre.
- Torch Landing – between late fall 1942 (Sep – Nov) and May 1945 12300 ships in about 300 convoys crossed the mid Atlantic east to west, losing 25 merchants – a loss rate of .002%



48

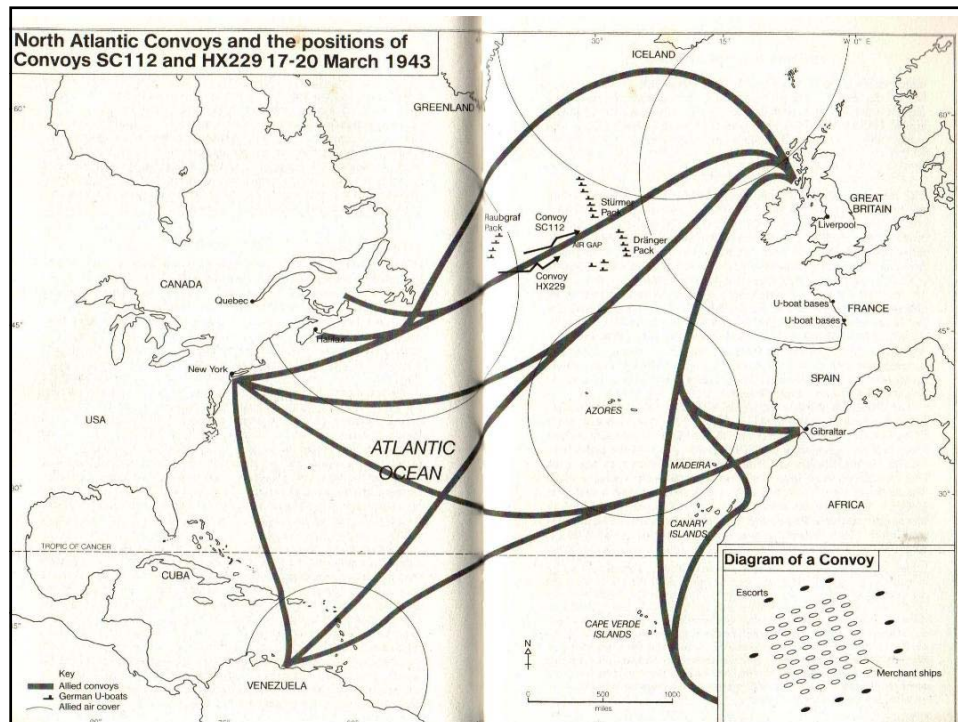
The Crescendo is Near

49

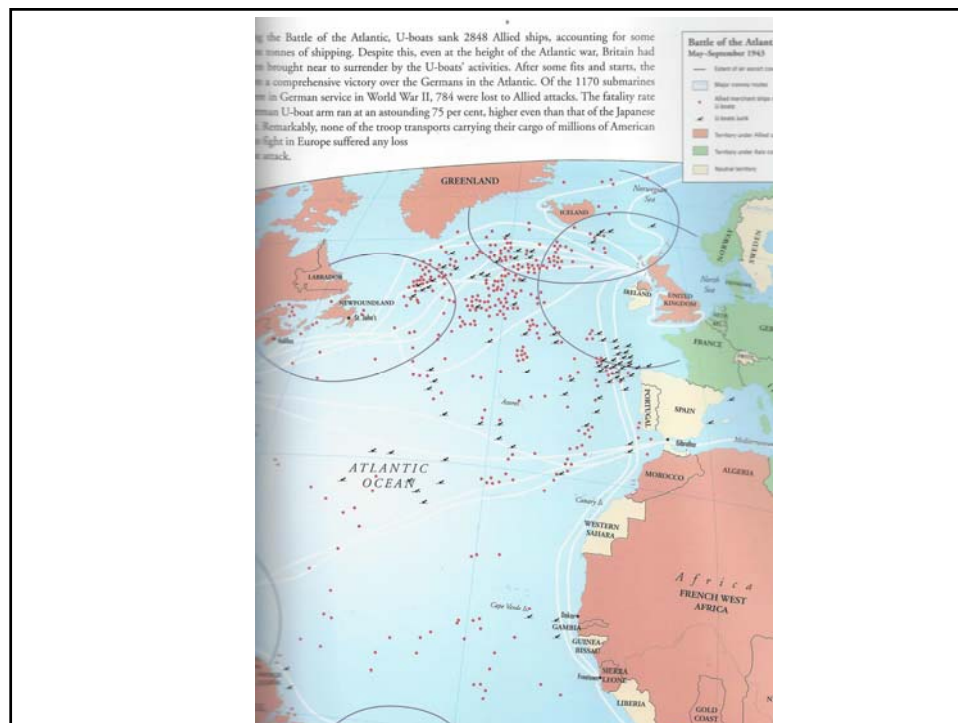
1943

- In January 1943 Roosevelt and Churchill meet at Casablanca and agree to invade Sicily that summer and France the following year. To enact their plan they need a smooth flow of supplies which at the present time are being threatened. They agree that this threat (Uboats) must be destroyed as a top priority.
- In the winter and early spring of 1943, the convoy battles continued with increasing ferocity. Almost 400 Uboats are now available to Donitz. As Allied shipping losses mounted, the supply situation in Britain began to reach critical levels.
- After the near disaster of convoys SC122 & HX229 in late March 1943. The cabinet ASW Committee decides that "we can no longer rely on avoiding the Uboat packs and, hence we shall have to fight the convoys through them".
- Though losing U-boats in March, the Germany strategy of sinking ships faster than the Allies could build them appeared to be succeeding.

50



51



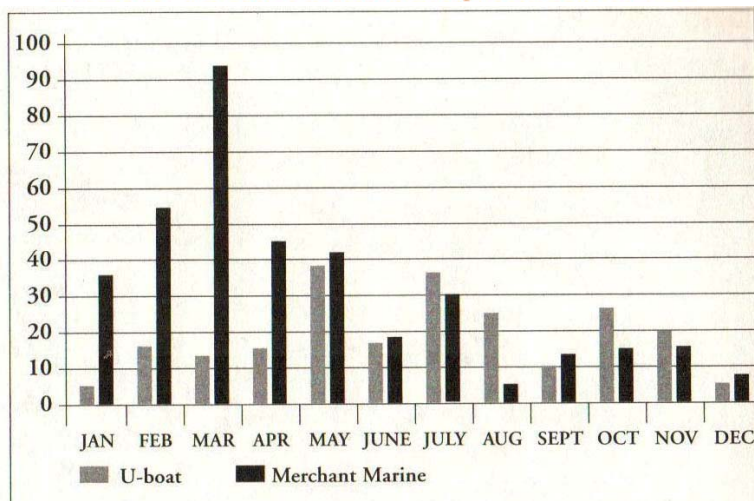
52

1943 - Continued

- The heavy ship losses of Mar43, proved to be a false dawn as the tide rapidly turned in April and May. Though Allied losses dropped in April, the campaign pivoted on the defense of convoy ONS 5. Attacked by 30 U-boats it lost thirteen ships in exchange for six of Donitz's boats.
- Two weeks later, convoy SC 130 repelled German attacks and sunk five U-boats while taking no losses. The rapid turn in Allied fortunes was the result of the integration of several technologies which had become available in the preceding months. These included the Hedgehog anti-submarine mortar, Radio Direction Finding, continued advances in reading German radio traffic, enhanced radar (cavity magnetron), and the Leigh Light.

53

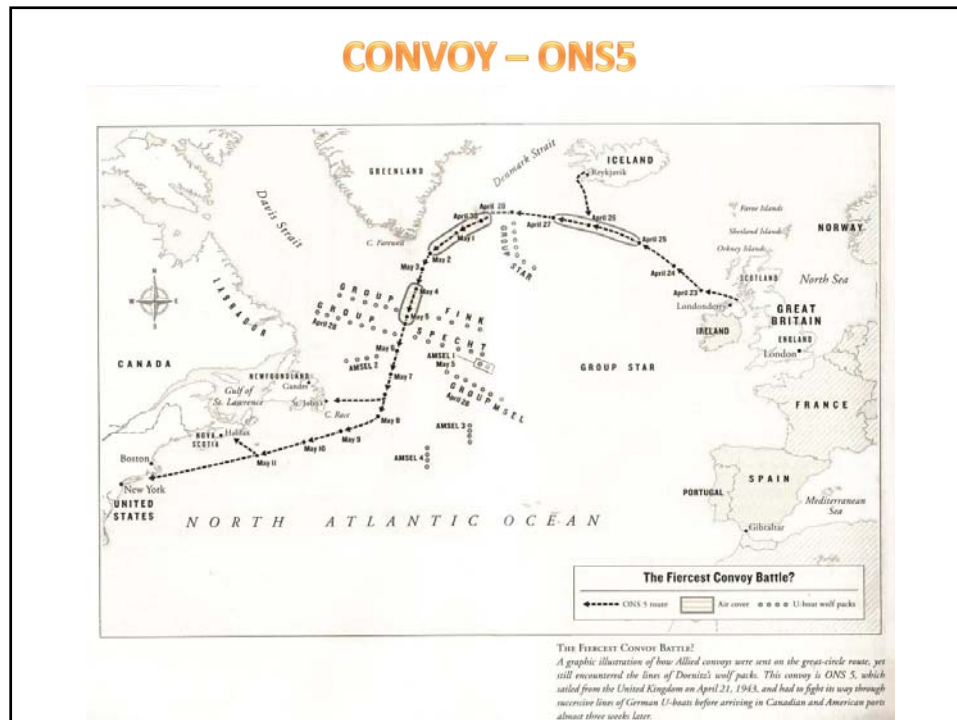
UBOAT Vs Merchant ship losses 1943



U-BOAT VS. MERCHANT SHIP LOSSES IN THE NORTH ATLANTIC, 1943

The dramatic rise in U-boat losses and decline in Allied merchant ship losses during the critical months of 1943 are well captured here.

54



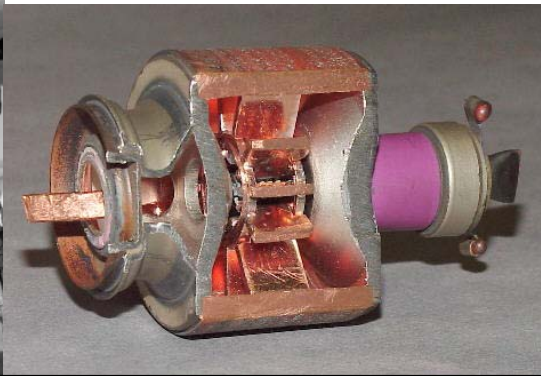
55

Allied innovation influencing the battle

- ◆ Aircraft support increases rapidly – RCAF & Coastal Command
- ◆ A couple of Support Groups are formed with very fast destroyers (from the Grand fleet – Kriegsmarine bottled up)
- ◆ New escort carriers begin to appear
- ◆ Newer corvettes and frigates become available
- ◆ More HF/DF mast available even for small ships
- ◆ The 10cm radar becomes available
- ◆ Leigh lights fitted to aircraft operating in the Bay of Biscay
- ◆ Hedgehog and more powerful depth charges become available and the Allies introduce a homing torpedo

56

LIEGH LIGHT & CAVITY MAGNATRON



57

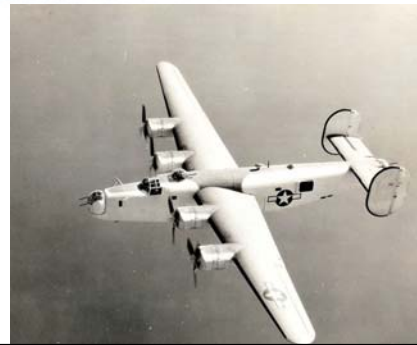
EXTRA LONG RANGE ASW AIRCRAFT



58

B24 – The best ASW aircraft of them all

Used for anti-submarine operations over the Bay of Biscay and attacks on shipping off the coast of France, this Liberator GR.Mk V flew with No. 224 Squadron. The squadron was based at St Eval, Cornwall, from April 1943 to September 1944.



59



60

HEDGEHOG

- 24 x 30 Kg Bomblets
- All launched simultaneously
- Circular pattern – bombs spaced approx. the width of a Uboat apart
- Bombs arm upon entering the water
- Only explode if they hit a target



61

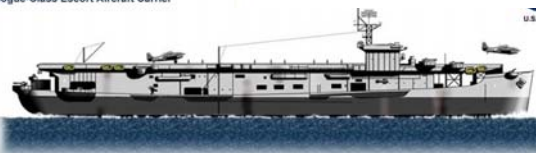
ESCORT CARRIERS



USS Card (CVE-11)
Bogue-Class Escort Aircraft Carrier



From 1942, Allied escort carriers, such as the *Card* shown here, were stationed in or near convoys to provide additional protection from U-boats. The carriers, in turn, were protected by several anti-submarine, fighter, or destroyer escorts.



War
DRAWINGS

62

HUFF DUFF

- High Frequency Direction Finder
- Range 15 miles
- Multiple platforms – provide triangulation



63

The battle won

- Dubbed "Black May" by the Germans, May 1943 saw Donitz lose 34 U-boats in the Atlantic in exchange for 34 Allied ships. At one point in early May 43, the Allies intercept this message from Donitz:
 "If there is anyone who thinks that combating convoys is no longer possible, he is weak and no true Uboat captain".
- 24 May 43 – Due to excessive Uboat losses, Donitz is forced to order the withdrawal of remaining Uboats from Atlantic operations.
- The Atlantic air gap was now closed, airpower proved decisive.
- The outcome of the battle was a strategic victory for the Allies—the German blockade failed—but at great cost: 3,500 merchant ships and 175 warships were sunk in the Atlantic for the loss of 783 U-boats (the majority being Type VII of which 700 were built). Of the U-boats, 519 were sunk by British, Canadian, or other allied forces, while 175 were destroyed by American forces; 15 were destroyed by Soviets and 73 were scuttled by their crews before the end of the war for various causes.^[5]

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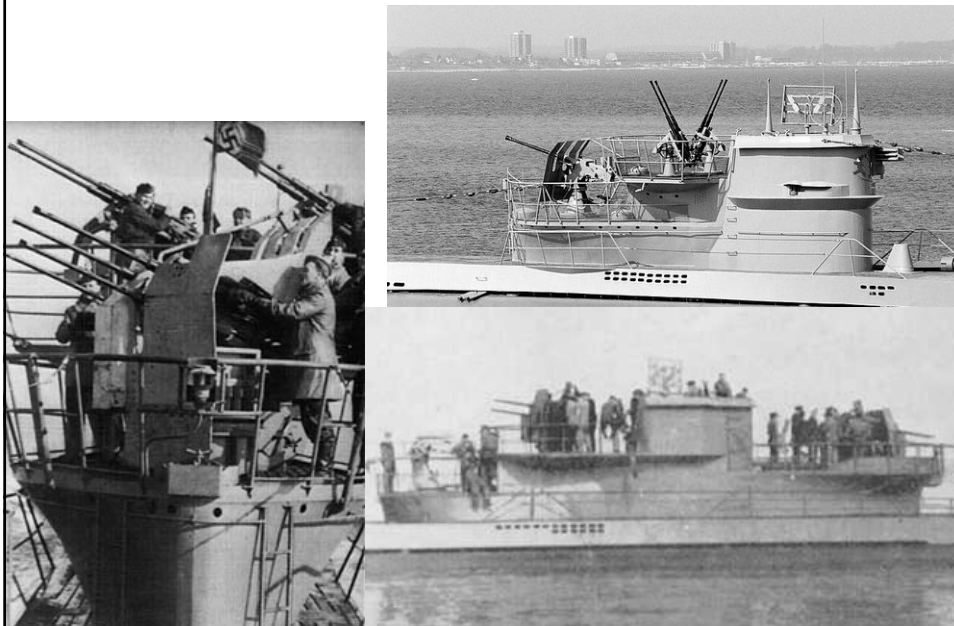
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LOSS RATIO

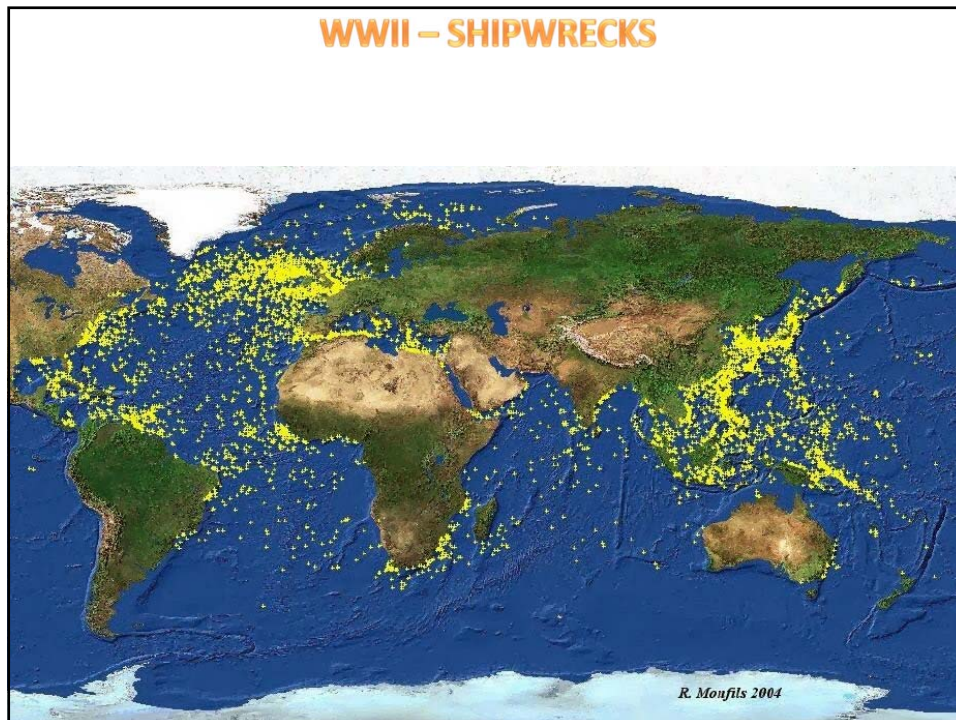
DATE	LOSS RATIO MERCHANTS/UBOAT
WWI	32/1
By June 1941	12.5/1
By December 1941	13/1
By December 1942	10/1
By March 1943	7/1
By May 1943	1/1
Between May 1943 – May 1945	1/1.5

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FLAK - UBOATS



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69

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- Hitler's U-boat War: The Hunted – Clay Blair, Random House 1998
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- The Price of Admiralty – John Keegan, Hutchison 1988

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