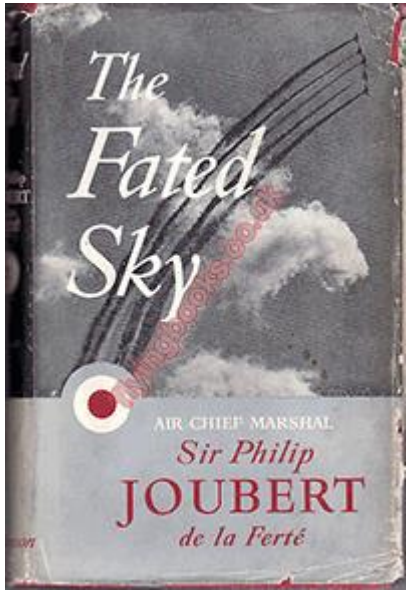
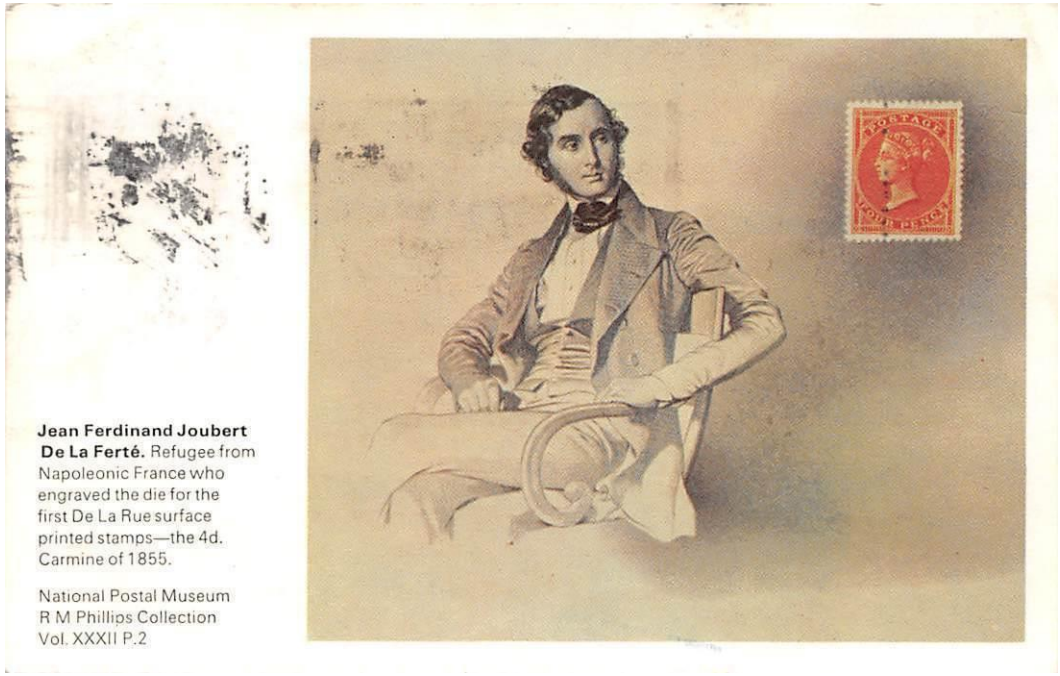
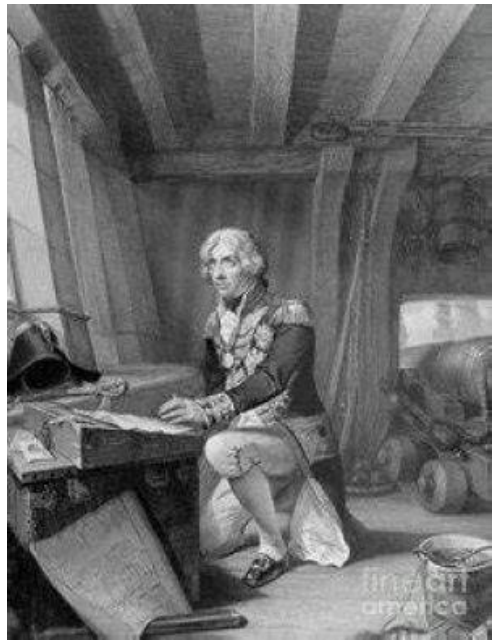
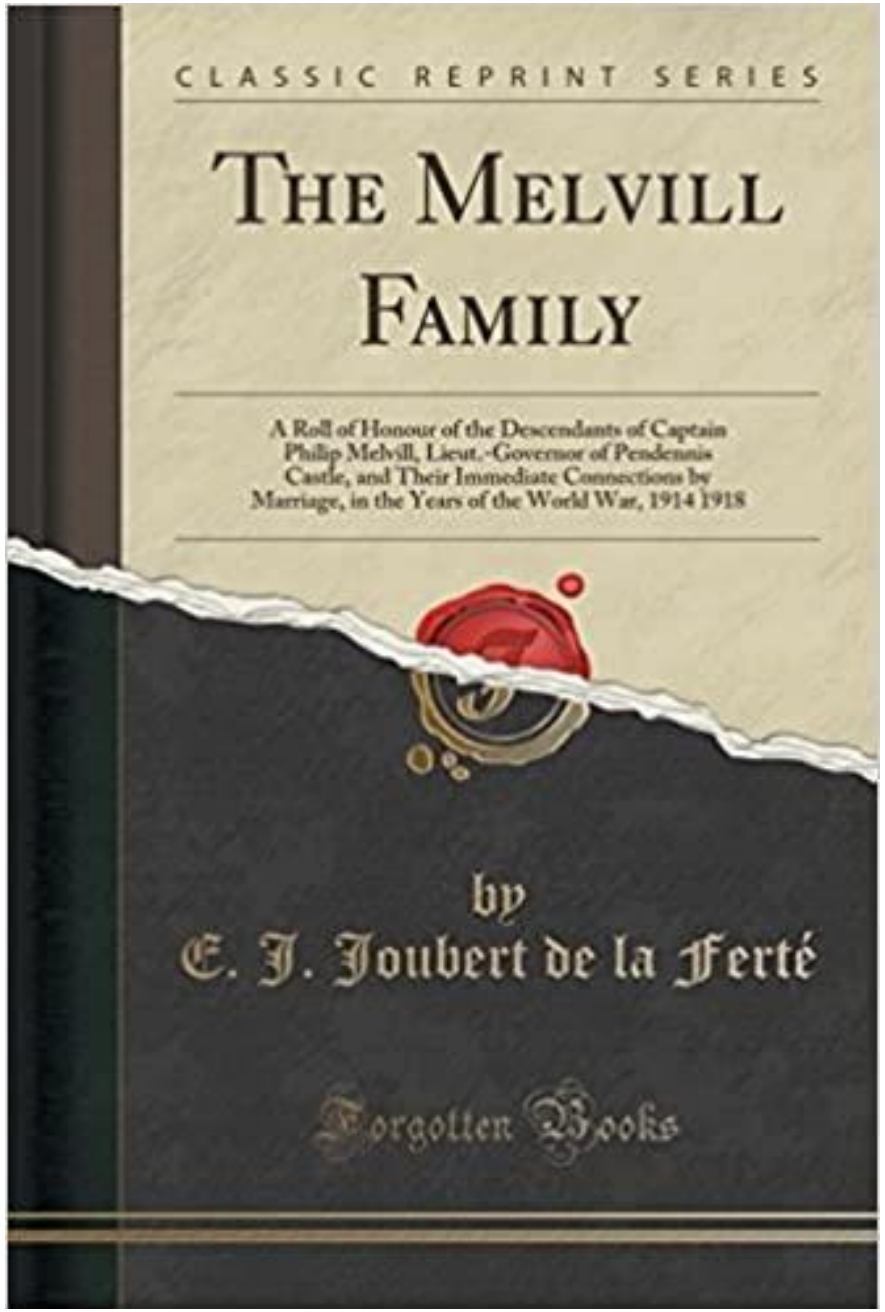
Philip Joubert de la Ferte, Coastal Command & the Battle of the Atlantic (1939-1945).



Jean Ferdinand Joubert de la Ferte (1810-1884)- Paris trained engraver in London 1840-1884.





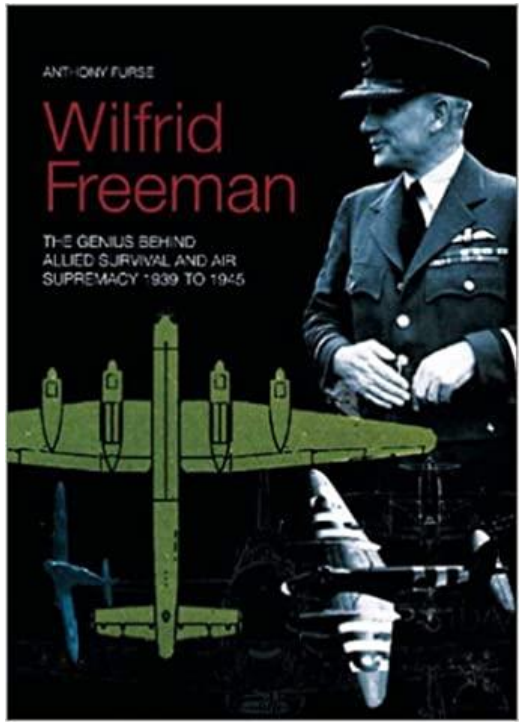


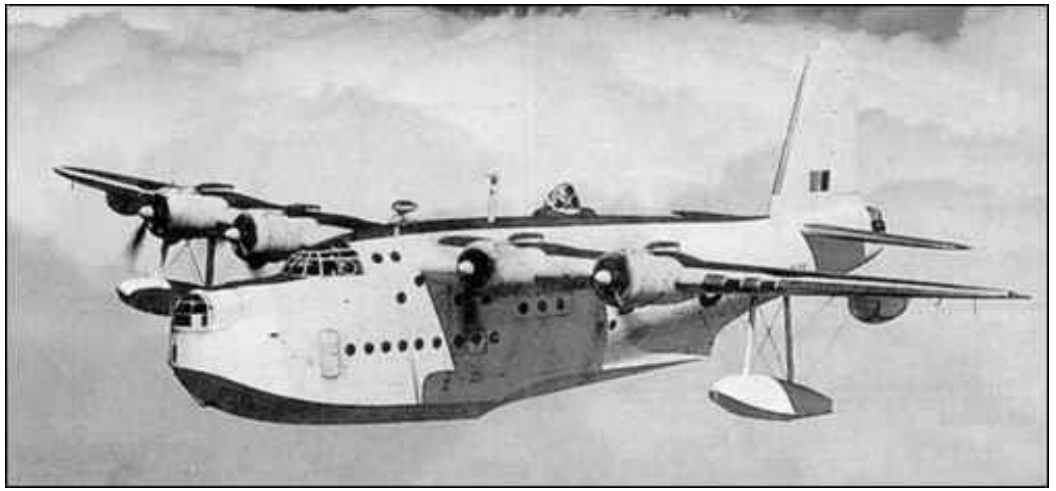
Brigade Surgeon Charles Henry Joubert de la Ferte MB. Lond. FRCS (1846-1935)- IMS Calcutta.

Philip Joubert born in Darjeeling 1887.

Philip Joubert serves with RFC in WW1 & reached Air rank with RAF by 1930 as Commandant of the RAF Staff College, Andover.

RAF Rearmament 1936-1939: Philip Joubert C in C Coastal Command 1937-the 3rd wheel.





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late December 1939

MEMORANDUM ON RADIOPHYSICS

(Prepared by Mr. R.A. Watson Watt (Director of Communications Development, Air Ministry) and Professor J.P. Madsen in collaboration with Group-Captain Leedham (Deputy Director of Communications Development, Air Ministry) and Messrs. Dixon and Morley of the Radio Communications Directorate, Air Ministry. This memorandum was presented to Sir Philip Joubert de la Ferte and communicated to the Secretary of State for Air, Sir Kingsley Wood. It forms the basis of recommendations from the Air Ministry to the Governments of Australia and New Zealand).

I. INTRODUCTION

PRE-WAR SCHEME.

As one result of an interview between the Secretary of State for Air and the High Commissioners of Canada, Australia, New Zealand and South Africa, a physicist from Australia visited this country to examine our work in Radiophysics. The Australian Government, having received his verbal and written reports, appointed a Radiophysics Advisory Board, under the Chairmanship of Professor J.P.V. Madsen, Professor of Electrical Engineering in the University of Sydney and Chairman of the Radio Research Board of Australia. The Board is constituted as follows :-

Professor J.P.V. Madsen - Chairman.
Admiral Sir Ragnar Colvin.
Lieutenant-General E.K. Squires.
Air Vice-Marshal S.J. Goble (to be replaced by Air Chief Marshal Sir Charles Burnett).
Sir Harry Brown (representing the Postmaster-General of Australia) (to be replaced by Mr. D. McVey).
Sir David Rivett (representing the Council for Scientific and Industrial Research).
Mr. G.A. Cook - Secretary.

The Board decided to set up a preliminary organisation to provide for research, development and possible production in different degrees of military emergency. A radiophysics research building will be completed in March 1940, as a suitably isolated part of a larger group of research buildings. A staff of approximately 12 radiophysicist-engineers has been appointed, the leader of this group being Dr. D.F. Martyn, who is the physicist referred to in the first lines of this memorandum. This initial structure was designed to provide for :-

1. Instruction and training of staff in the technical use of radiophysical equipment.
2. Adaptations of Radiophysics to suit the particular needs of Australia and New Zealand.
3. Research on special parts of Radiophysics decided in consultation with Great Britain.
4. Training of personnel for operating equipment.
5. Assistance to neighbours, particularly New Zealand.
6. Planning for possible production in emergency.
7. Application of Radiophysics technique to the needs of Civil Aviation and industry.

This last consideration was taken by the Board, whose recommendations were accepted by the Government, as justifying a permanent rather than a war emergency organisation in respect of personnel, equipment and buildings.

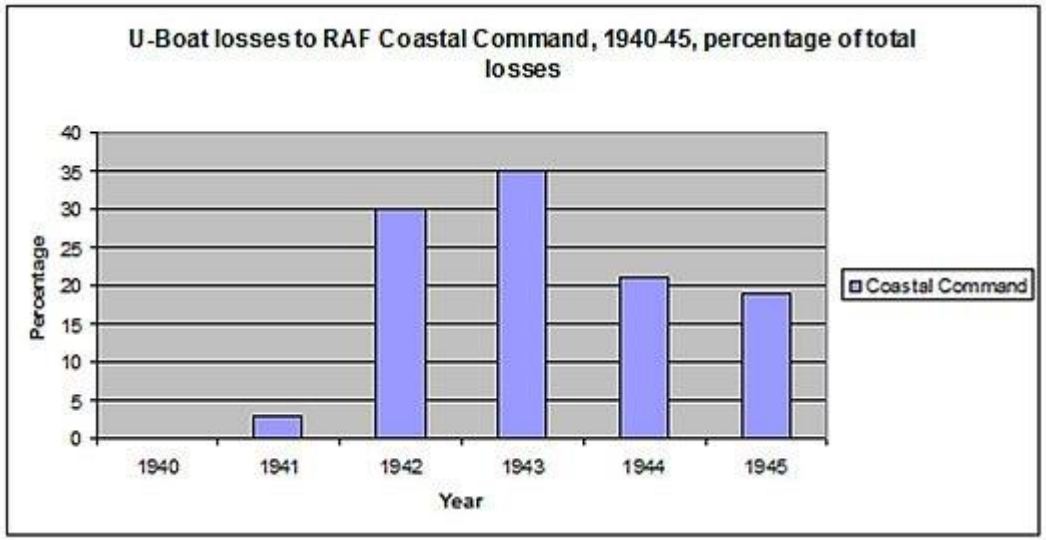
J P V Madsen in London January 1940 to recast RDF program for Australia with Watson-Watt.

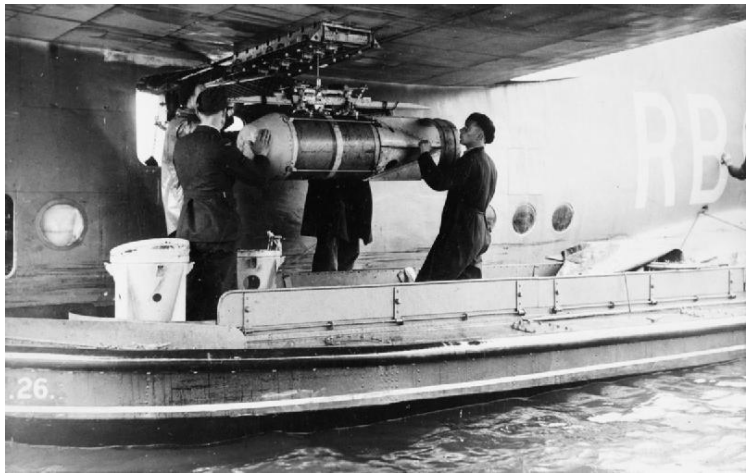
Philip Joubert returns to Coastal Command June 1941-January 1943. OR analysis by P. Blackett.

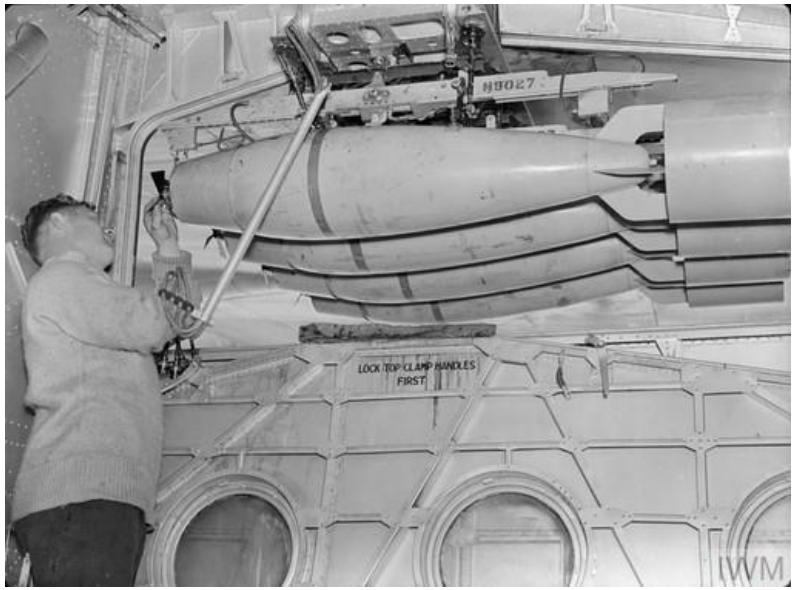
COASTAL COMMAND ASW AIRCRAFT BASED IN THE BRITISH ISLES JUNE-JULY 1941[1]

TYPE	NO.	ENGINES	LOAD BOMBS/DCS	RADIUS NAUT. MI.	SORTIES PER MONTH
Catalina	30	2	16/250-lb.	900	85
Sunderland	20	4	8/250-lb.	700	40
Wellington	20	2	12/250-lb.	550	70
Whitley	40	2	6/250-lb.	500	170
Hudson	100	2	3/250-lb.	450	570
Total	210[2]				

1. Source: Monthly Anti-Submarine Rpt. June and July 1941. ADM. 199/1245. "The Air Offensive Against U-boats," 6/1/42.
2. Does not include Blenheims, Beaufighters, and Ansons.







Australian Scientific Research
Liaison Office,
Australia House,
Strand,
London, W.C.2.

16th September, 1941.

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My dear Rivett,

I have just received your letters of the 5th and 7th August, and am glad to hear that everything is shaping so well in spite of difficulties.

At this end I have been looking more particularly into matters of general policy, particularly where they concern Australia. As the result of a discussion with Admiral Murray, of the Signal Department, Admiralty, a cable is being sent officially to the Naval Board, Melbourne, indicating that Admiralty have now defined their policy in regard to wavelength, fixing upon values of 1½ m. and 10 cm., and from now on discarding the 50 cm. This fits in admirably with the programme which we have been planning in Australia.

Next, I was anxious to find out what had been done by a certain Inter-Services and Dominions Policy R.D.F. Committee. I found that unfortunately the work of this Committee had been in abeyance for some time due to the transfer of its chairman, Sir Philip Joubert, to Coastal Command work. Sir Frank Smith helped me run this body to earth, and as I made contact with it I was pleased to find that Tizard had taken over the chairmanship. I had a long conference with him yesterday afternoon, and a ring from him this afternoon, when he informed me that matters we are concerned with were discussed by that Committee this morning and will be taken up seriously, probably at a higher level, bringing the High Commissioner into the picture.) What we really want to know is the steps which would be taken in the event of Japan coming into the picture, and the responsibility which Australia might be called upon to carry in such an event, particularly in regard to equipment of ships, aircraft and defended areas in Singapore, Malaya and the Dutch East Indies. I am sure that Australia can render great service in this direction, provided we are given sufficient warning. I am looking forward to a full discussion on these matters, the result of which should be to enable one to obtain a clear set-out of the problem in the first place, and early warning of the requirements necessary to meet the situation should it occur.

In addition to these matters, I am now turning my attention more particularly to an examination of operational research work. This is a new phase of work which has come about through the introduction of R.D.F., and it is in these matters that Tizard has himself been playing a rather important role. Blackett also appears to be taking an active part in it. It involves such problems as operational methods for the employment of aircraft fitted with R.D.F. for spotting ships and submarines. It is tied up also, of course, with normal communication methods established between such craft and suitable bases, and deals with the question of operating a number of such craft at the one time.

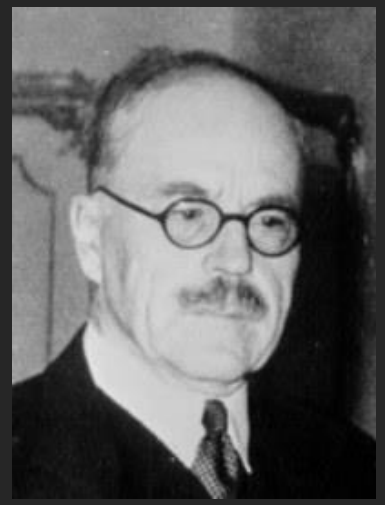
It is considered necessary to take up this study from the scientific aspect as well as from the purely service point of view, and a good deal of economy and increased efficiency is being obtained by such operational research. I propose to devote a good deal of my time between now and November to dealing with this aspect of things, from the point of view of all Services,

(Sgd.)

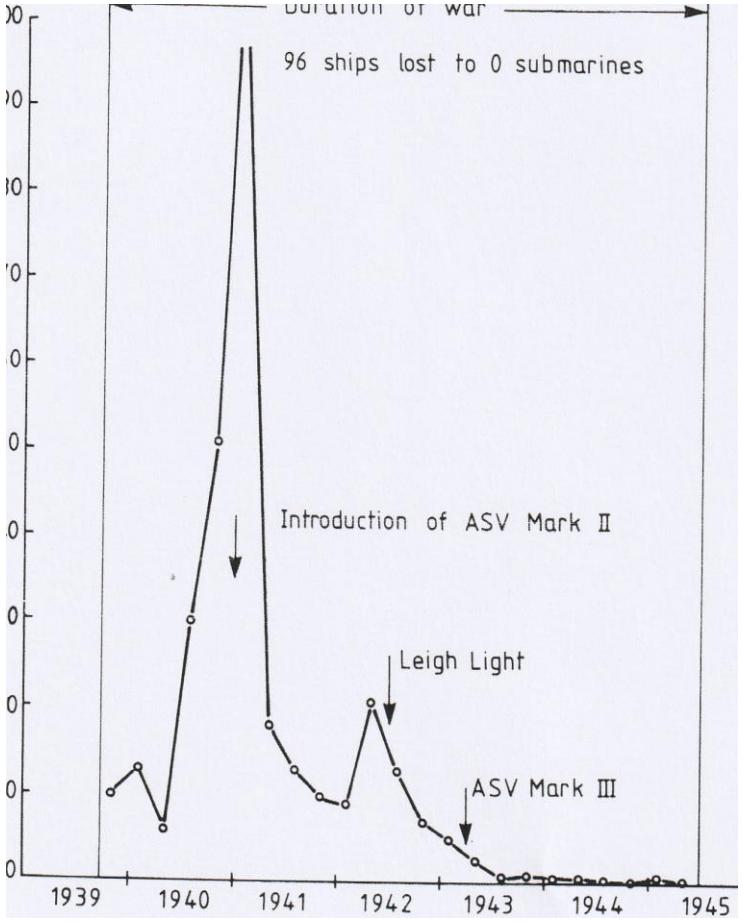
J.P.V.M.

Sir David Rivett, KCMG.,
Council for Scientific and Industrial Research,
314, Albert Street,
East Melbourne, C.2.

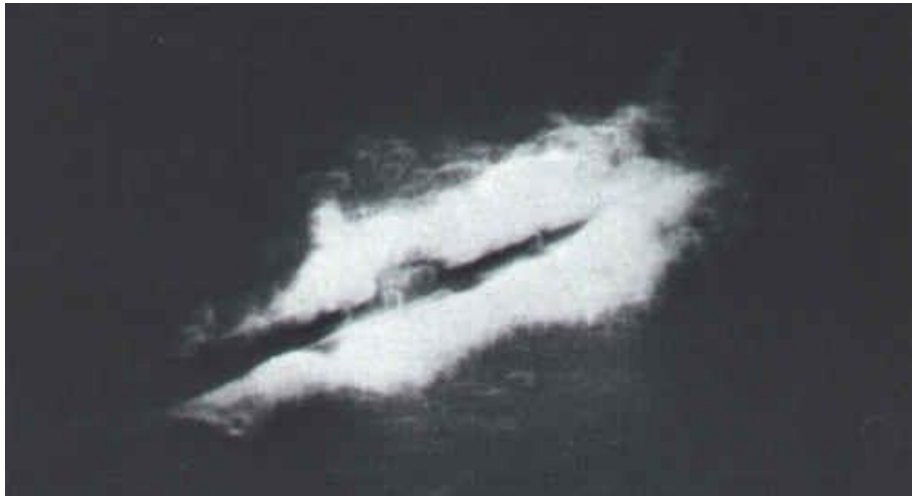
J P V Madsen in London May-October 1941. H. Tizard. & OR.



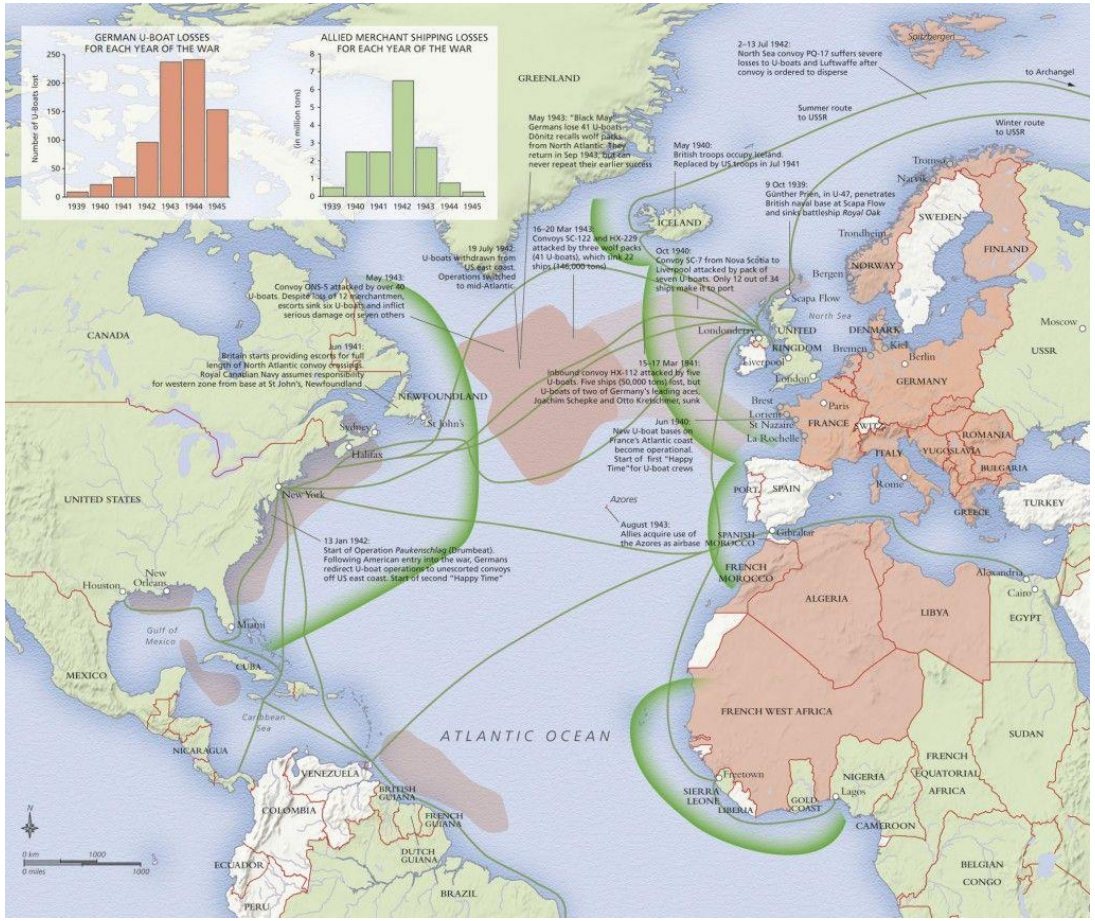
Joubert RDF initiatives & B-24 Liberators.

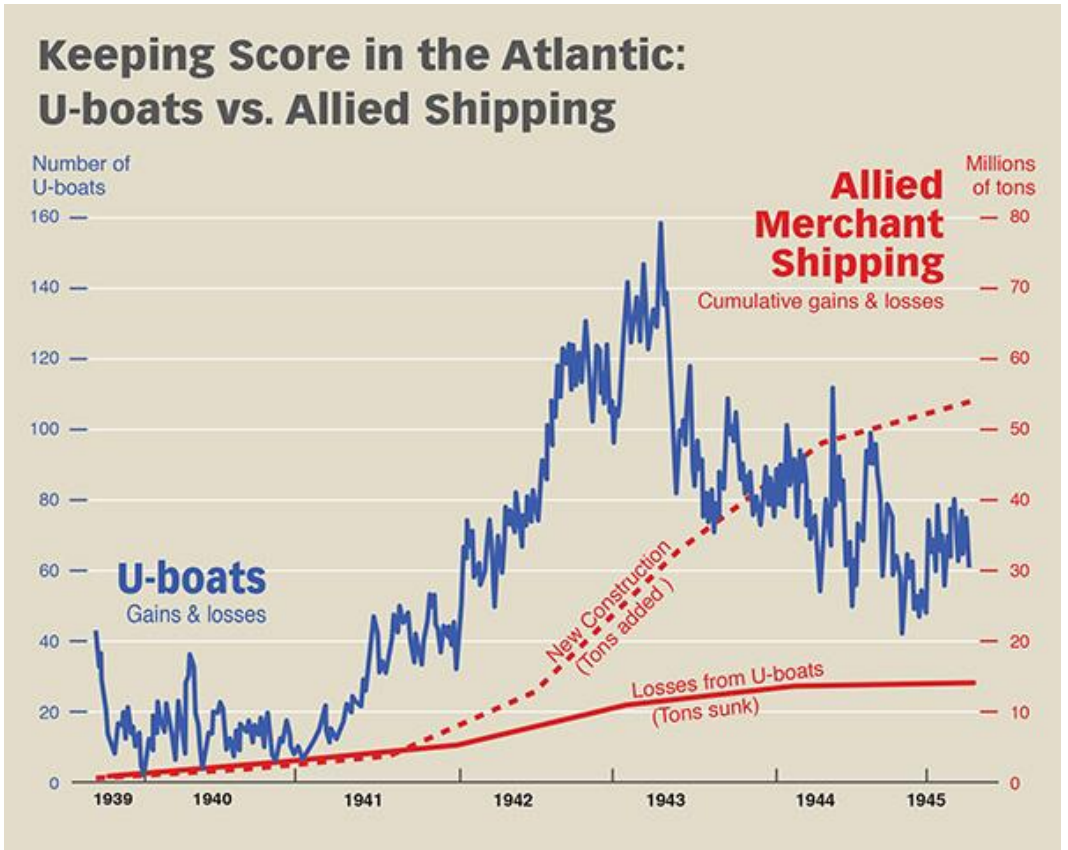


Wellington & Leigh Light 1941.



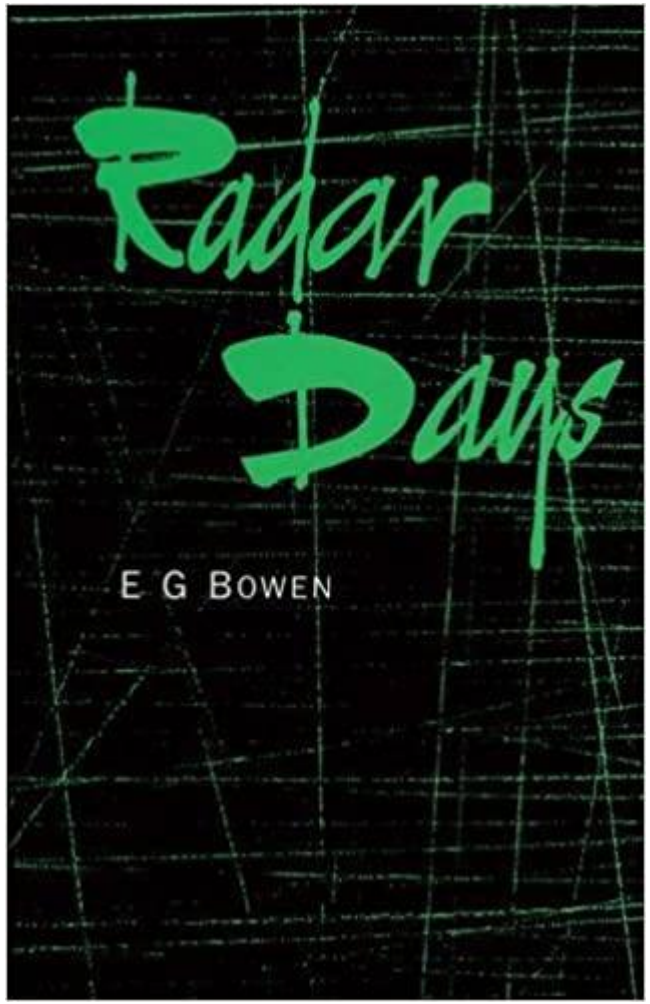
The Atlantic Gap.



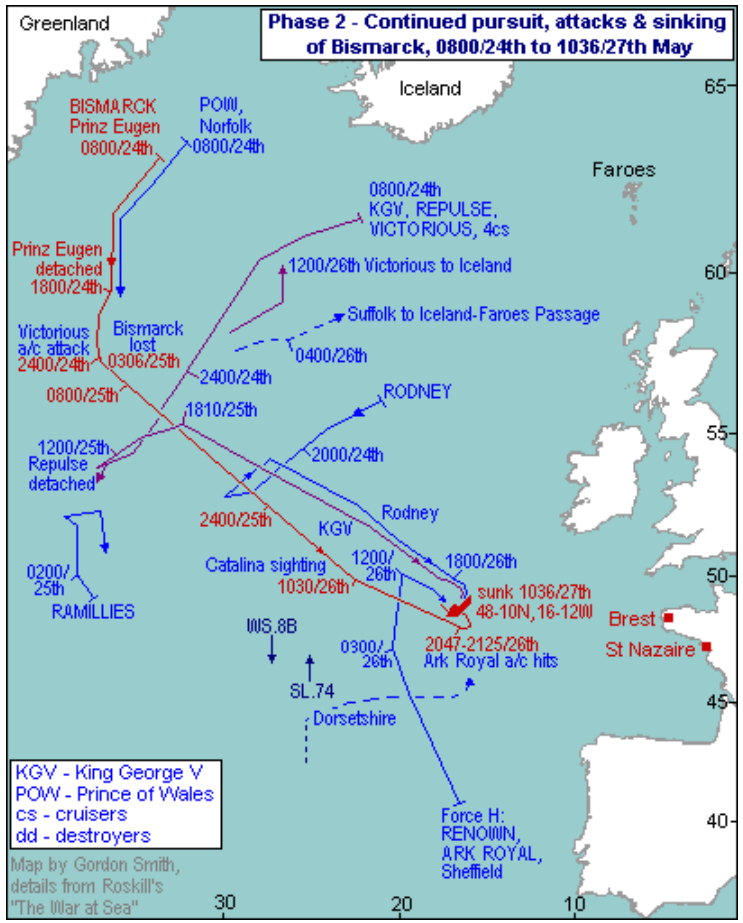


Combined Operations Liverpool & Halifax.

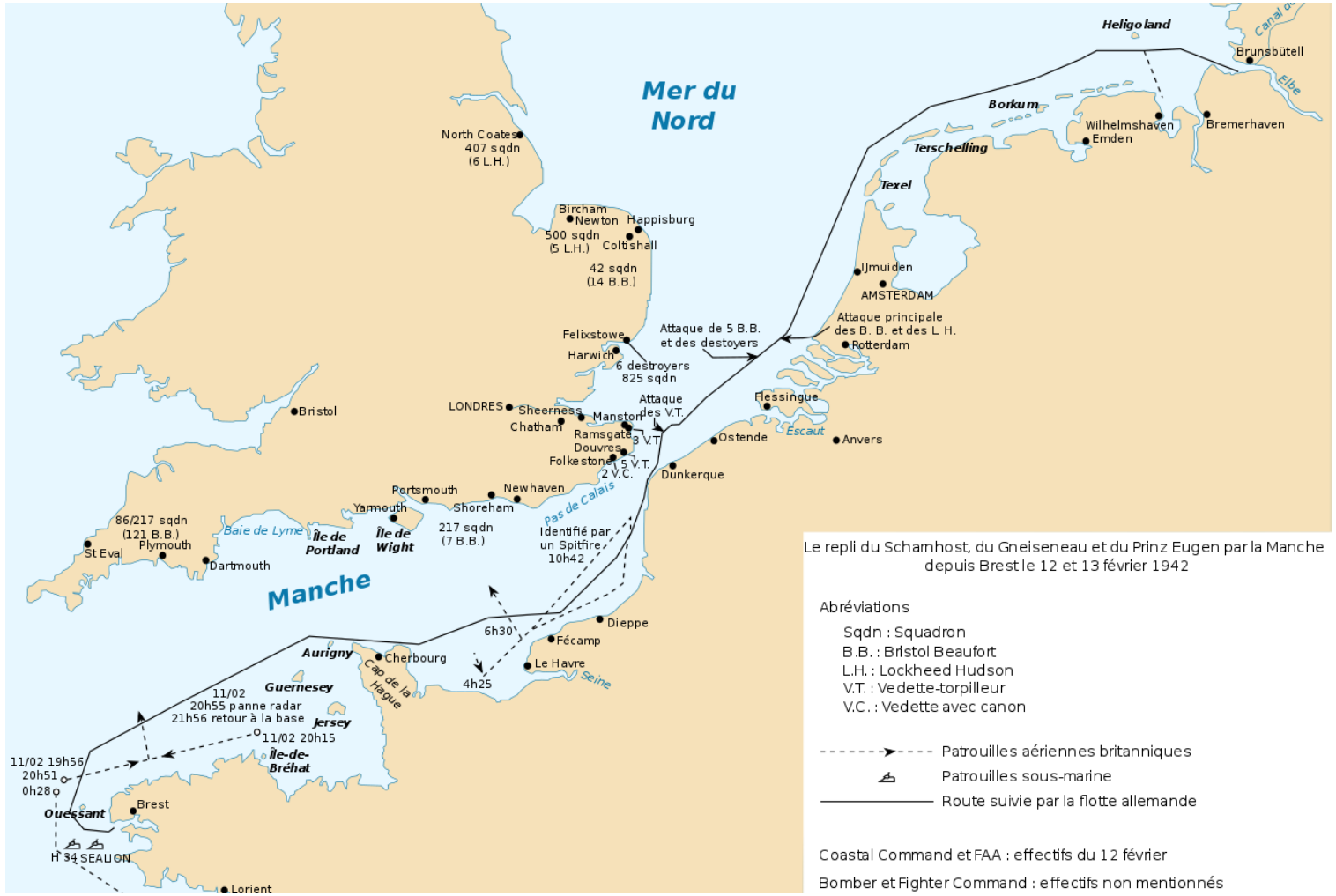
Coastal Command's vast area of Operations. "Taffy" Bowen pioneer of Airborne radar.



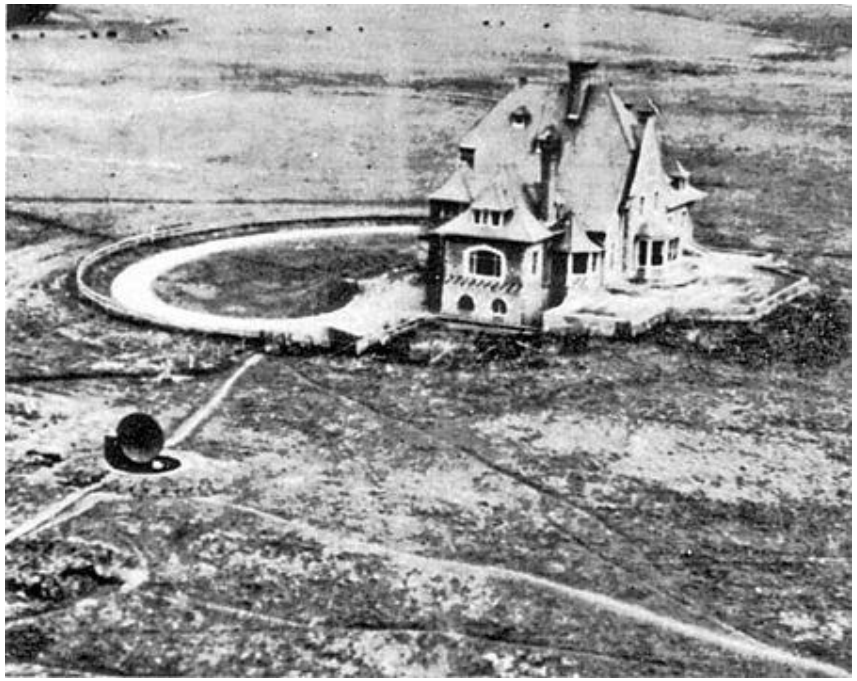
Coastal Command, Bismarck. 27 May 1941.



Channel Dash Failure by RAF & RN Feb.1942. 3 Coastal Command Beaufort Torpedo Bomber Sqdns.



Coastal Command PRU & Tirpitz, Bruneval.



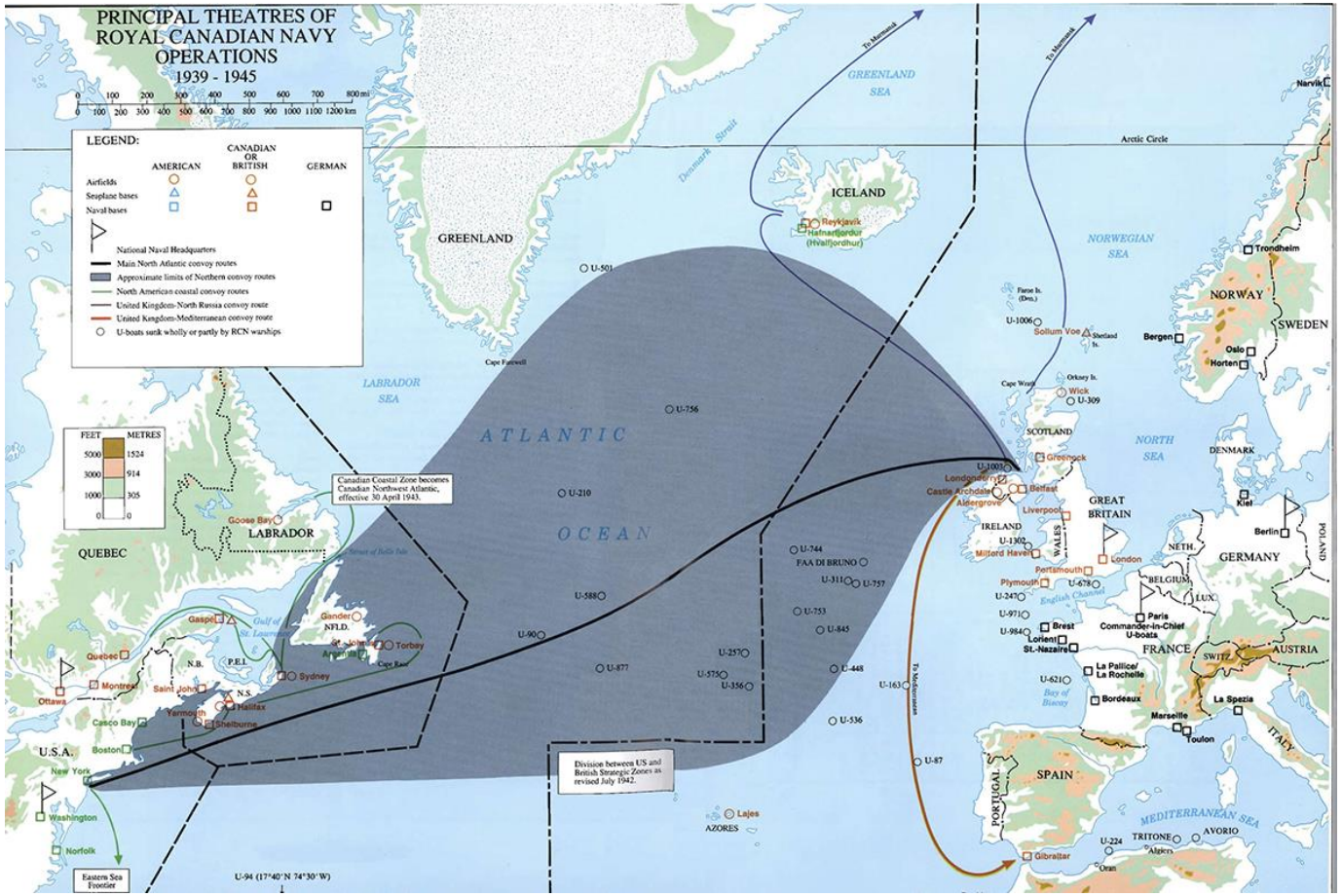
B-24 for Coastal Command allocation 1943

Leigh Light & ASV Mk III (10cm). B-24.

Canadian Navy Halifax, Nova Scotia.

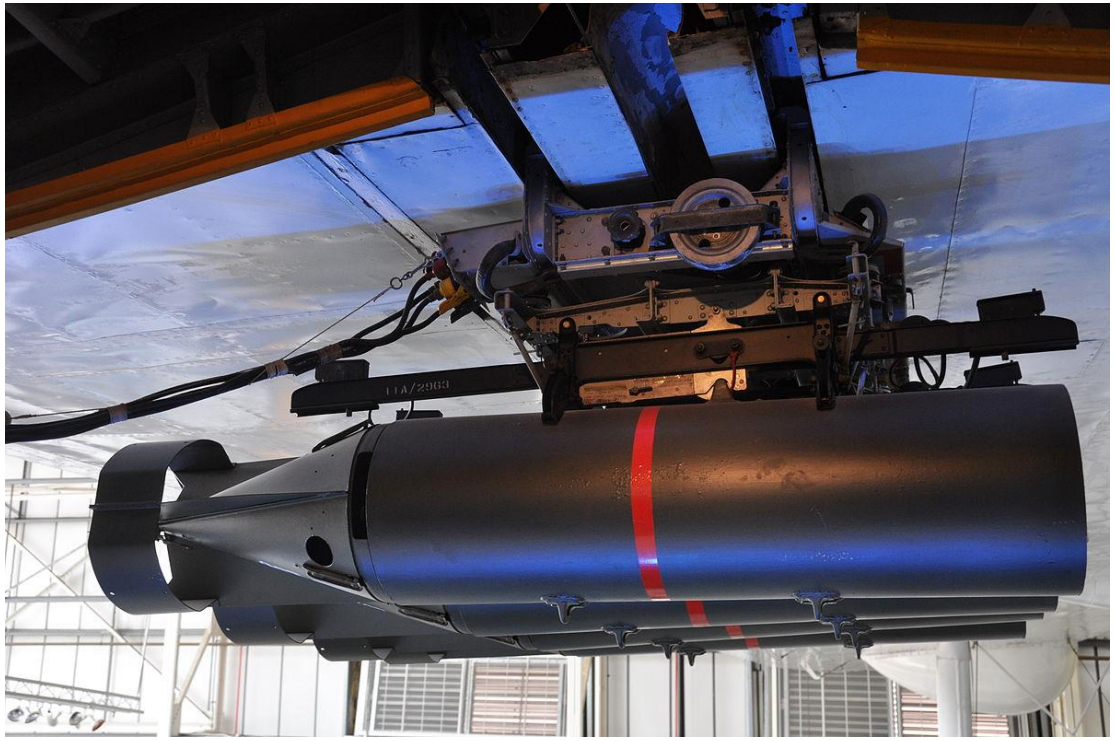
Escort carriers prove their worth December 1941.(Convoy HG-76 from Gibraltar).

Canada covers the centre of the Atlantic Gap.

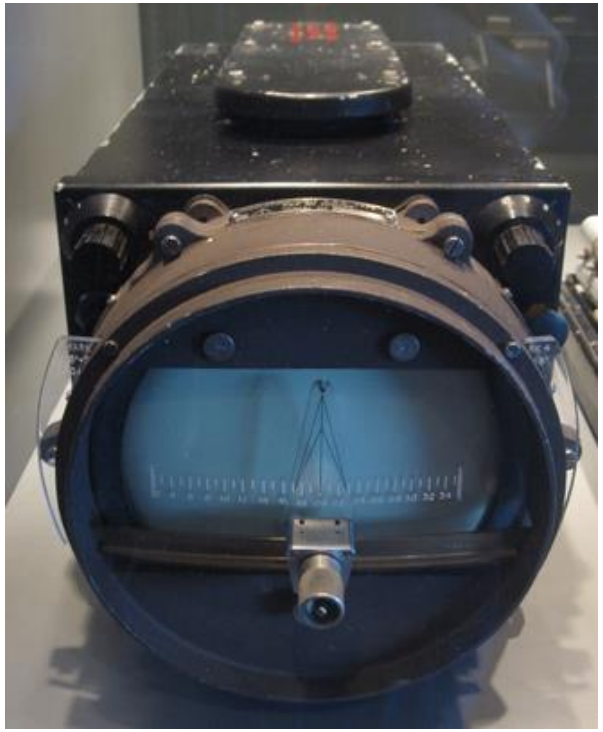


Depth Charges,torpedoes, Beaufighter Strike Wings.

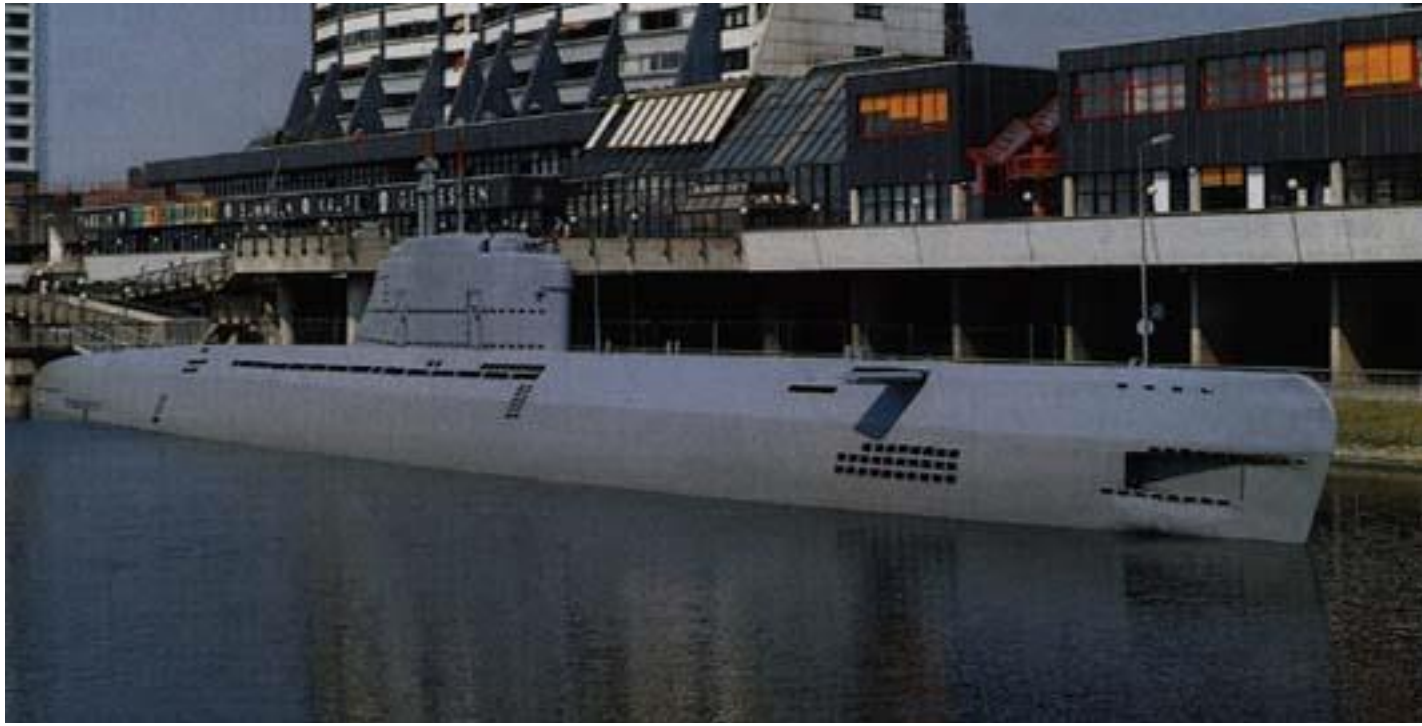
Hudson 250 lb A/S bombs & Sunderland Wing loaded DC/Bombs.

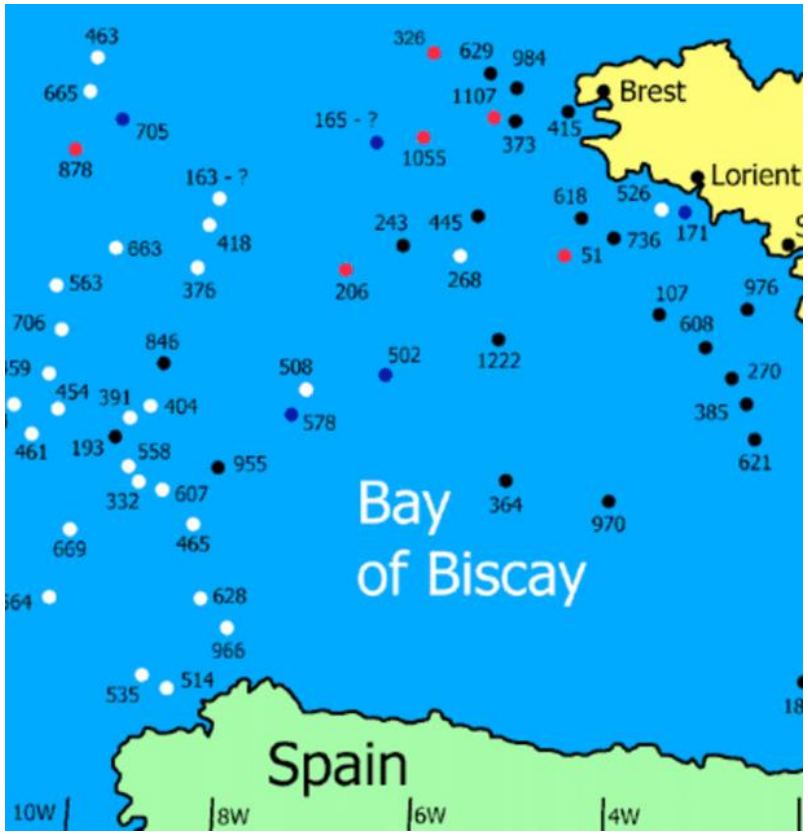


Asdic & “Huff Duff” in Allied Navies.



German Type VII & Elektro Submarines

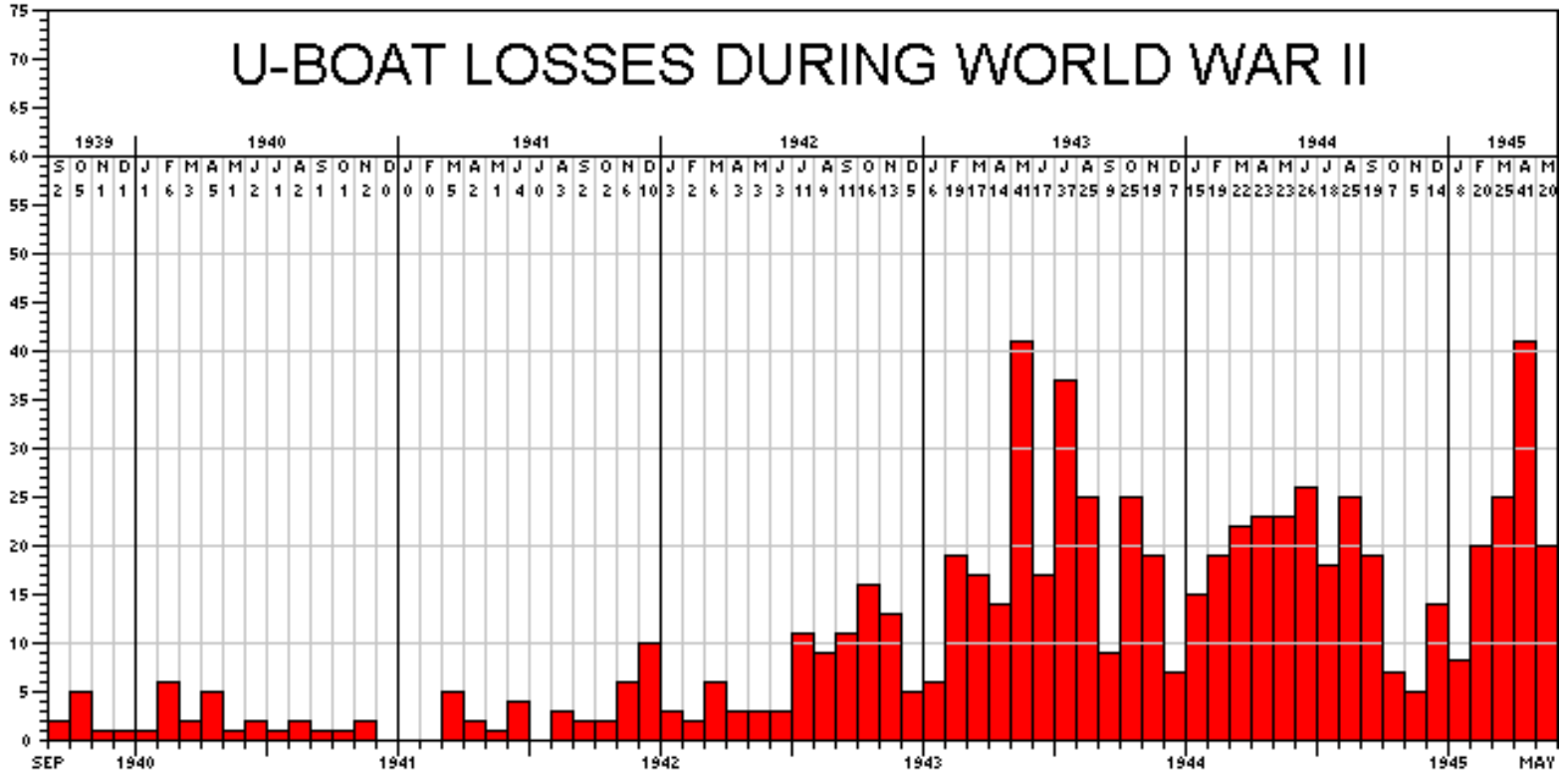


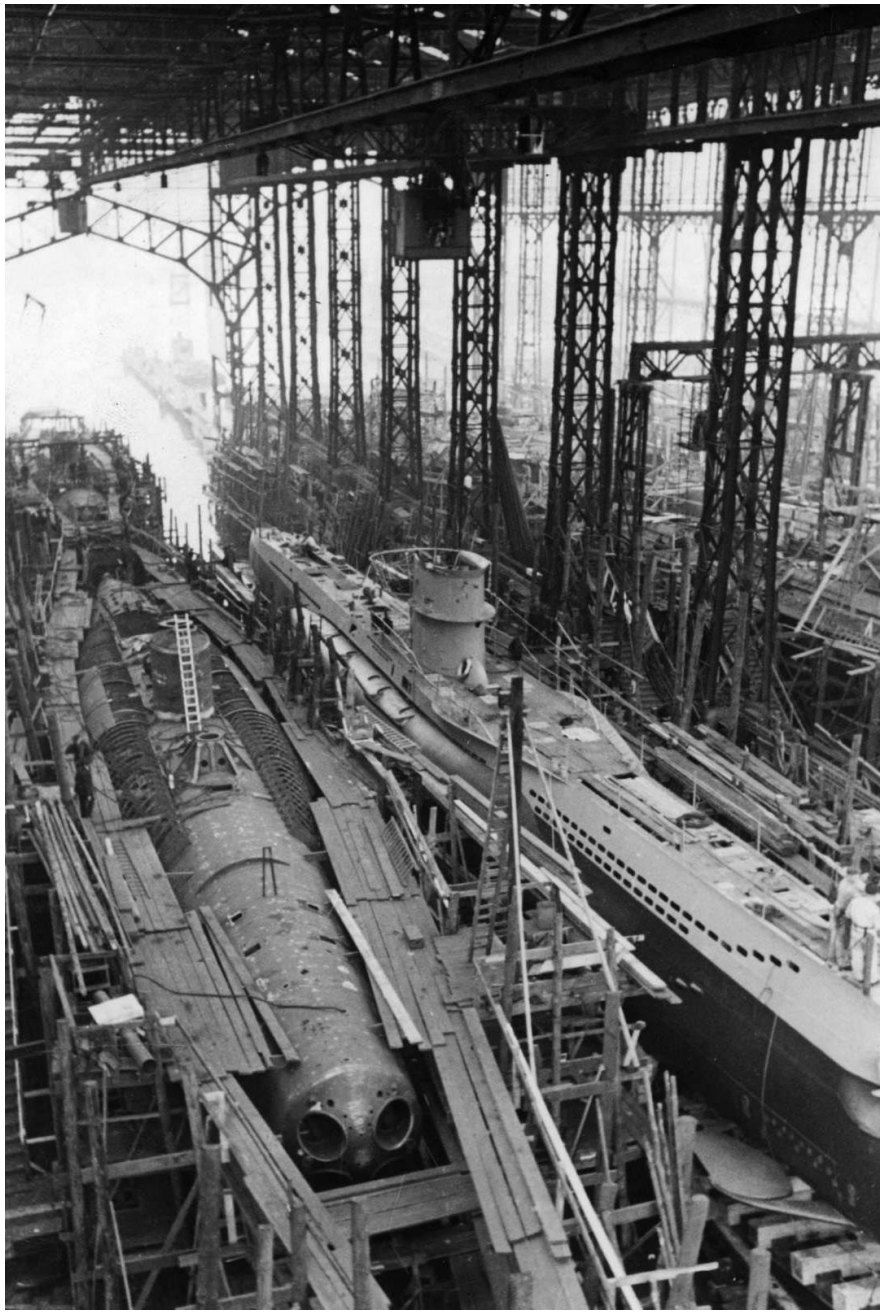


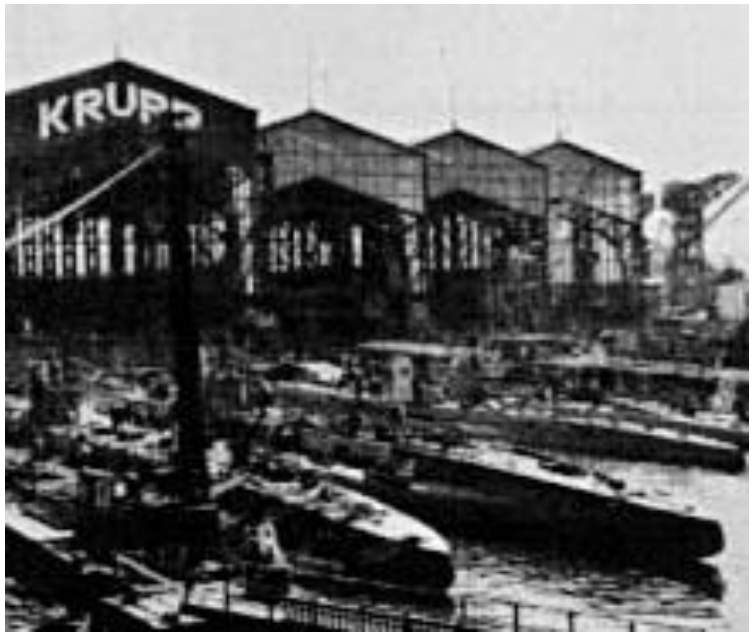
German submarine pens & Bay of Biscay.

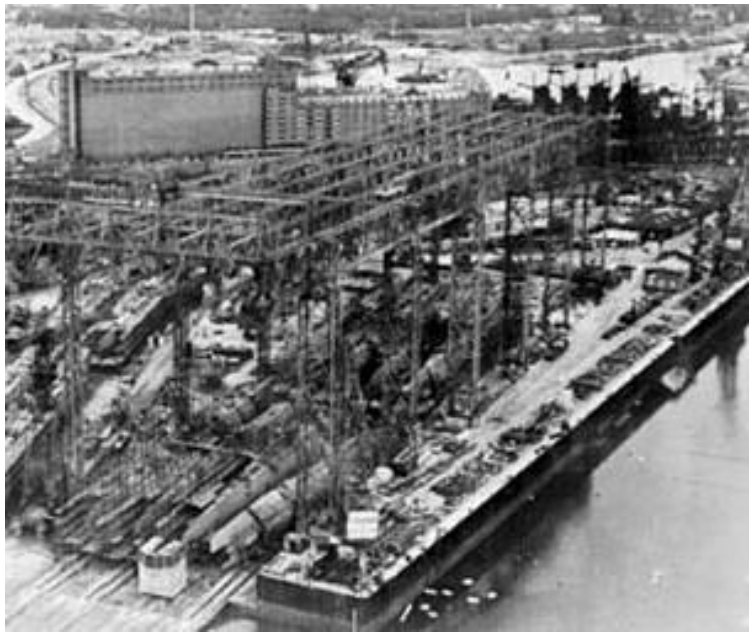
German acoustic torpedo & radio ops.

RN Western Approaches & U boat losses.



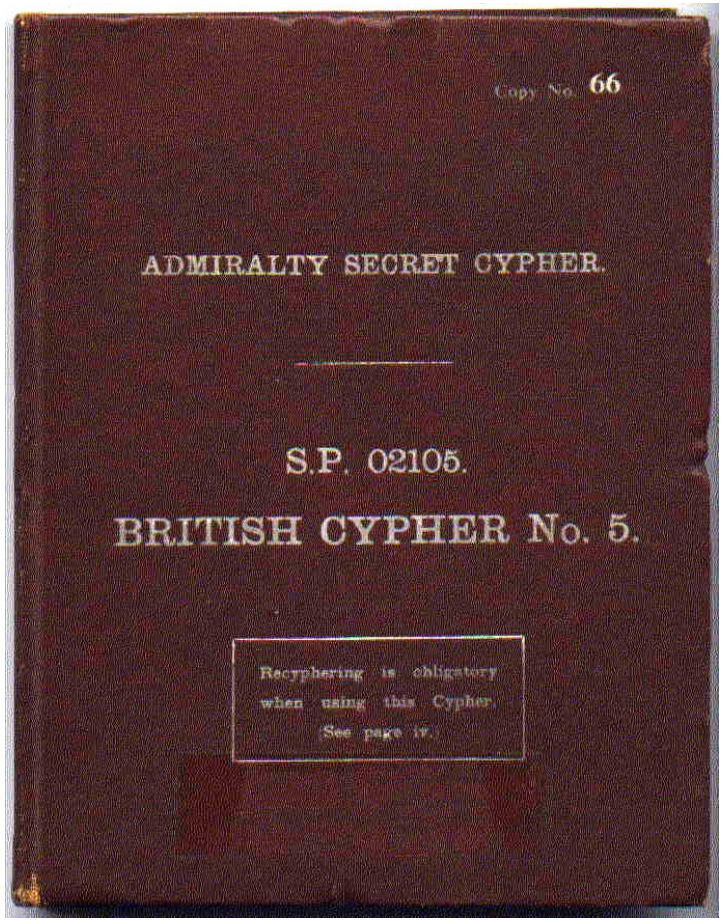


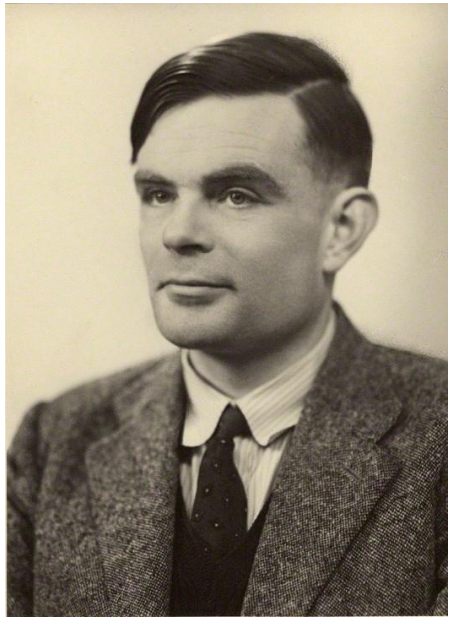


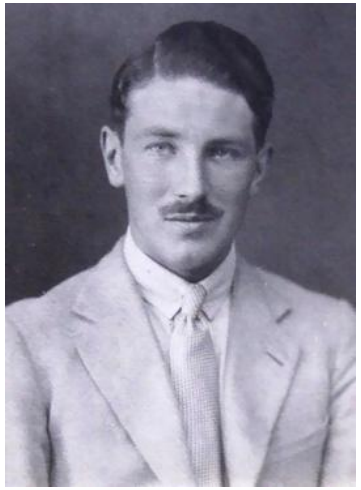


German U Boat Production & training in the Hamburg/Baltic region.

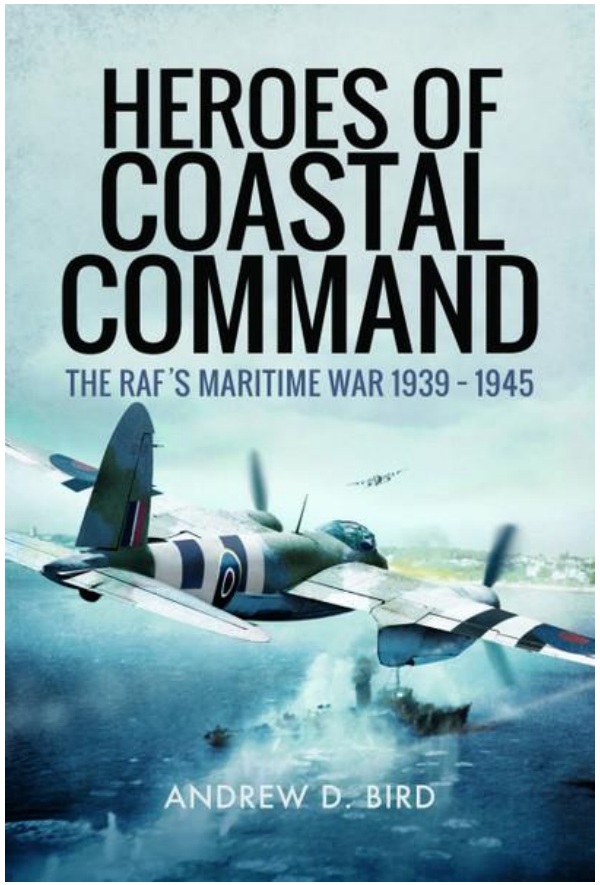
Code breaking by Germans & Allies.

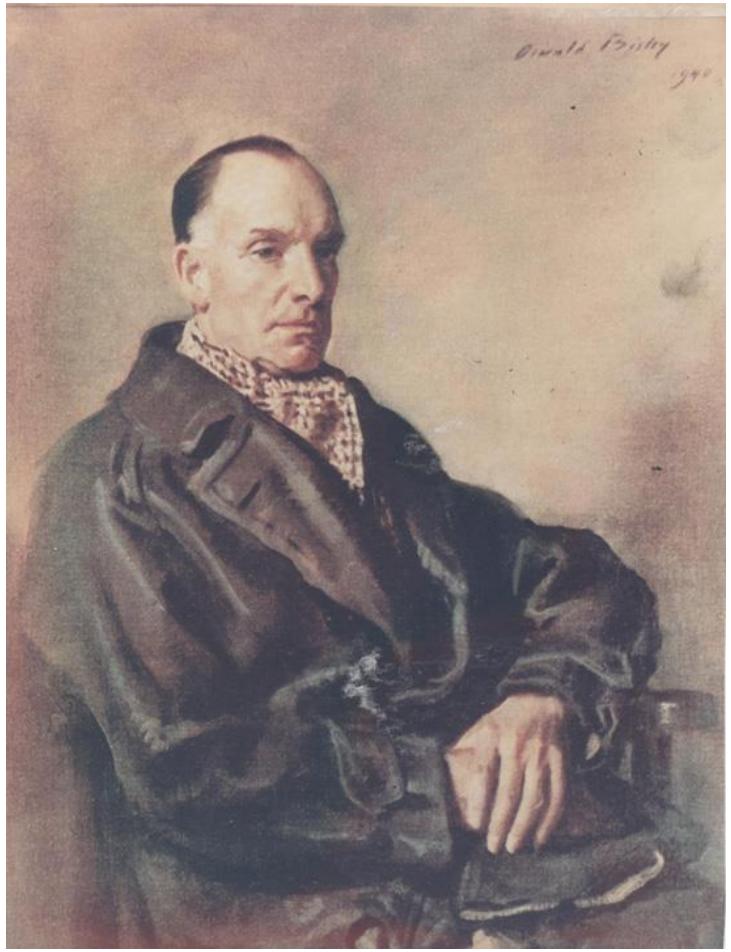




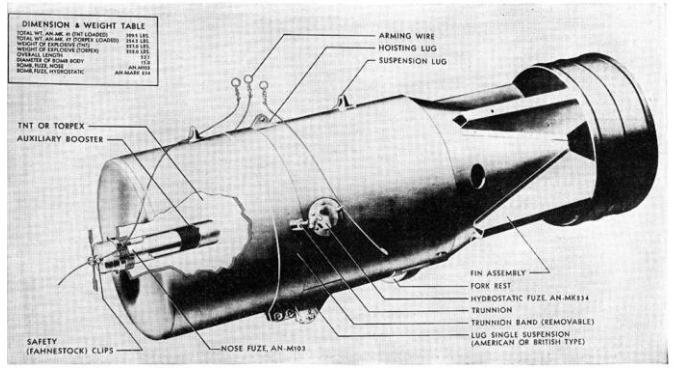


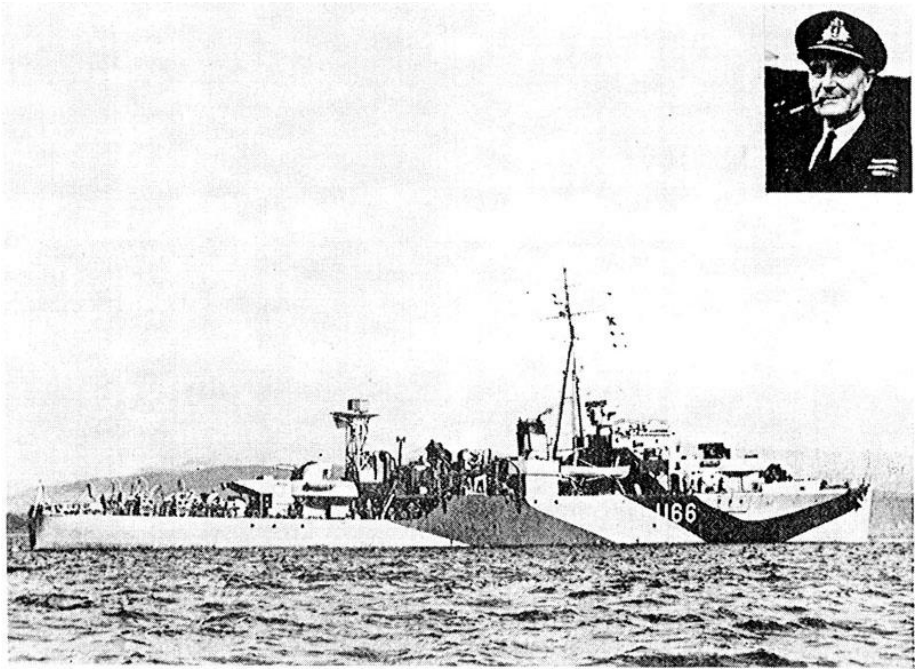
The heroes of Coastal Command, Allied Navies & Merchant seaman on convoy duty.





US Navy “neutral patrols” from October1939.
HMS Starling from April 1943 U-Boat hunter.
“Johnnie”Walker.





Philip Joubert de la Ferte, RDF, Coastal Command & the Battle of the Atlantic (1939-1945).

Prepared by R. W. Madsen, June 2020.

Introduction.

J P V Madsen with George Munro of the Australian Radio Research Board travelled to London by Qantas C Class Short flying boat in late December 1939 to deal with an Australian security problem that was thought to exist in the UK & then to recast the Australian & New Zealand wartime RDF program with Watson-Watt. The prepared Memorandum on Radiophysics was submitted to Air Marshall Sir Philip Joubert de la Ferte who was on Special Duties (RDF) for the RAF as Chairman of the" Interservices & Dominion RDF Policy Committee" & also to the Secretary of State for Air, Sir Kingsley Wood. (slide 7.)

By the time of JPVM's return to London in June 1941 on Scientific Liaison work, Philip Joubert had returned as AOC (Air Officer Commanding) of Coastal Command & he had already arranged for Patrick Blackett FRS to commence an Operations Research analysis of the Coastal Command operations in order to make the best possible use of RDF against the German U-boats. In September 1941 JPVM from London advised David Rivett at CSIRO in Melbourne (slide 9) that he was looking into this OR work by Blackett & that he was in contact with Sir Henry Tizard who had become the new Chairman of the "Interservice & Dominion RDF Policy Committee".

From 1935 when the RAF commenced re armament activities, Joubert saw Coastal Command as having a role for anti-submarine work but this view was not shared at Cabinet level or in the Fighter/Bomber Command leadership or in the RN which was relying on the ASDIC equipment developed from WWI experience, & in fact the RN was mainly interested in wresting control of the Fleet Air Arm Service away from the RAF & to the Admiralty. This lack of foresight for an ASW role also existed in the United States probably until as late as the end of 1942 & in the Fall of 1943 the AAF (Army Air Force) ASW Mission (Anti Submarine Warfare) was transferred to the Navy following a dispute with the AAF & 77 Liberators of the ASW Command were swapped.

By the end of 1940 Germany had commissioned some 68 new U-boats during 1939 & 1940 of which an average of 25 were operational at sea & had caused the loss of 96 allied ships but for the loss of no U-boats at which rate Britain would soon be faced with losing the war. The role of Coastal Command at this time urgently had to move from anti-shipping to ASW (Anti Submarine Warfare) using the fastest long range aircraft it could obtain which were mainly the Short Sunderland, the US Consolidated Catalina & the Vickers Wellington. Other aircraft of shorter range such as the Hudson were also available using 250 lb depth charges. It became clear in Britain & in Australia that the ASV Mk I radar needed considerable improvement for operational use & it was not until late 1941 that ASV MkII came into use, followed by the use of the Leigh light which was very effective in night attacks on U-boats. The very effective long range Consolidated B-24 Liberator (VLR- Very Long Range) was only made available to Coastal Command for ASW fitted with ASV Mk II in small numbers in late 1941 but requests for further B-24s was not met for about another 12 months. (ASV Mk II was a 1.5 metre radar which was produced in large numbers by the Allies including Australia & was superior to the set under development in Sydney by Radiophysics.). The very poor Anti -Shipping role of British RAF & RN forces however was starkly made apparent in February 1942 by the very successful German "Channel Dash" of 3 major capital ships from Brest through the English Channel without the loss of any ships.(slide 16.)

During Philip Joubert's 2nd tenure as AOC Coastal Command (June 1941-January 1943) considerable improvement in Coastal Command operations was made but it was in May 1943 that ASW by

Combined Operations of the RN & RAF Coastal Command which effectively defeated the U-boats with a loss of 40 U-boats that month & the remaining were ordered back to their bases in June & were vulnerable in the next 2 months crossing the Bay of Biscay. Coastal Command accounted for around 30-35% of these U-boat losses in 1942 & 1943.

Australian RAAF personnel served as part of Coastal Command in Sunderlands (No 10 Squadron, No 461 Squadron) & Torpedo Beaufighters (No 455 Squadron). The Australian Sidney Cotton is noted for his service as a pioneer for Photo Reconnaissance adopted by the RAF in a number of Squadrons such as Coastal Command No 540.with Mosquitos operating from Scotland.

Slide 1. Philip Joubert de la Ferte, Coastal Command & the Battle of the Atlantic (1939-1945).

Air Chief Marshal Sir Philip Bennett Joubert de la Ferte KCB (1887-1965) served with the RFC (Royal Flying Corps) then the RAF (Royal Air Force) from 1913 to 1945. As a gifted commander he quickly gained promotions & wide experience in air operations & made contact with many leading personalities in the very early days of military aviation & of the development of the competing RNAS (Royal Naval Air Service) with this 3rd service supporting the Army & Navy each with different priorities. After WW1 from 1922, he had the opportunity as a teacher & then as commandant of the RAF Staff College at Andover to further lucidly present & encourage new ideas in a relaxed social environment for future leaders.

During WW2 in the Battle of Britain in 1940 he broadcast on BBC Radio a war commentary & on Friday 16th October 1942 a film opened at the Plaza Theatre Piccadilly presenting Coastal Command Operations to the public flying in Sunderlands from a fictitious base “Port Ferry Bay” in Scotland. After the war in 1948 there was a BBC TV documentary on Coastal Command based on hundreds of hours of flying time in Sunderlands, Wellingtons, Beaufighters & Hudsons. In 1954 Joubert was again adviser to a BBC series “War in the Air”. Joubert in the post war period published some 6 books including an account of Coastal Command, an autobiography, a story of ground crews (The Fated Sky, Birds & Fishes, The Forgotten Ones, Fun & Games, Rocket, The Third Service).

There is at least one lengthy oral history available on the internet made by Joubert in 1963 for the Royal Aeronautical Society dealing with the early period of the RFC, RNAS & RAF.

Slide 2. Jean Ferdinand Joubert de la Ferte (1810-1884)- Paris trained engraver working in London 1840-1884.

Jean Ferdinand Joubert was born in Paris on September 15, 1810. & was naturalized in England in 1855. Grandfather of Philip Bennett Joubert de la Ferte.

Ferdinand Joubert as an engraver was a superlative craftsman who was engraving for illustrations in Paris from 1830 & in 1840 exhibited in the Paris Salon in the year he migrated to England. In 1842 he married Francis Emelia Bennett in a small town near Derby. Joubert was the most accomplished & influential of the postage stamp engravers of the mid nineteenth century & was responsible for the classic heads of Queen Victoria in the De la Rue issues from 1855 onwards. The GB fourpenny carmine engraving fee was paid to Joubert by the Board of Inland Revenue & the die is held in the British Postal Museum. From 1856 until 1877 Joubert worked as De La Rue’s Chief Engraver & his engravings were used as the central themes of innumerable colonial & foreign issues by De La Rue, including for the Confederate States in the American Civil War.

Joubert had a studio in 36 Porchester Terrace in London for producing the very popular albumen carte-de-visite photographs in the 1860’s of which some 56 are held in the National Portrait Gallery.

A hand coloured albumen photograph of Queen Victoria's 2nd son Prince Alfred in 1860 is shown. Joubert also made a photograph of King Edward VII on Sept. 3, 1862.

Joubert was also an inventor including a process he devised to burn on enamel to have a permanent picture as a stain glass window.

The engraving of Nelson at Prayer before Trafalgar in 1805 by Joubert was published on May 24, 1854 after a painting by Thomas Jones Barker, however there is no record of the current existence of this painting or how it presented. The National Maritime Museum , Greenwich, The Victoria & Albert Museum & the British Museum have copies of the print & proof before title information. Two prayers by Nelson, who gave considerable support to his Chaplains on board his ships to encourage the crew are remembered each year on the anniversary of Trafalgar. The first prayer is on Victory before departing Portsmouth & the 2nd, as represented in the engraving, is on the morning of the Trafalgar Battle.

Slide 3. Brigade Surgeon Charles Henry Joubert de la Ferte MB. Lond. FRCS (1846-1935)- IMS Calcutta.

Philip Bennett Joubert de la Ferte was the 4th child of Charles Henry Joubert (1846-1935) & Eliza Jane Joubert (Melvill) {1853-1942} & was born in Darjeeling, a sanitarium depot for the IMS.(Indian Medical Service). It appears that Charles Henry Joubert was the only child of Jean Ferdinand & Francis Emelia Joubert.

Charles Henry Joubert qualified as a Batchelor of Medicine from London University & then as a Fellow of the Royal College of Surgeons & by 1880 he is recorded as being a Deputy Surgeon General (Colonel) with the IMS Calcutta, associated with the Eden Hospital. From 1863 Joseph Lister's discovery of antiseptic techniques initially using carbolic acid gradually gained acceptance which revolutionized surgery & in the 1890's Joubert was contributing papers on abdominal surgery in the Indian Medical Gazette. By 1908 Joubert had retired to Weybridge in England & was contributing to the British Medical Journal based on his experiences in India.

Eliza Jane Joubert in 1920 was the proud editor/ author of a "Melvill Roll of Honour "book setting out the accomplishments of her Melvill family relatives in the recent WW1 as well as during the 1800's in India. Eliza also includes the WW1 service of her two sons, Philip Bennett & John Claude in the RFC (Royal Flying Corps.). Eliza was the eldest daughter of Philip Sandys Melvill (1827-1906) CSI (Companion of the Order of the Star of India) & Eliza Johanna who were in Bengal with the Civil Service & who were married in 1851.

Slide 4. Philip Joubert born in Darjeeling 1887.

Philip Bennett Joubert at an early stage was sent to England for his education firstly at Elstree School noted for its tutoring methods & then to Harrow. On leaving school he qualified as a lieutenant in the British Army from the Military Academy at Woolwich.

Philip's grandfather Philip Sandys Melvill (1827-1906), was educated at Rugby & the East India Company College (for 16-18 year olds) to be trained as an administrator before going to India in 1846 & retired in 1882.- his father (also a Philip) in turn had served in India on the military side of the East India Company & was a Fellow of the Royal Geographical Society.

Slide 5. Philip Joubert serves with the RFC in WW1 & reached Air Rank with the RAF by 1930 as Commandant of the RAF Staff College, Andover.

In 1963 Philip Joubert gave a lengthy oral history of his experiences with the RFC (Royal Flying Corps) & the RNAS (Royal Naval Air Service) during WW1 & subsequent developments especially commenting on personalities such as Lord Trenchard, Lord Kitchener, Winston Churchill, Lord Haldane, Henry Brooke Popham & brothers John & Geoffrey Salmond who rose to Air rank. He also referred to the early flying experiments of Sir George Cayley (1773-1857).

On August 19, 1914 Philip Joubert flew one of the 1st RFC operations of the war as a reconnaissance mission over Mons & escaped being badly shot up & was MID (mentioned in despatches). Subsequently he was Officer Commanding a number of RFC Wings on the Western Front & in 1918 was in charge of the RFC in Italy. Various biplane aircraft were used in Joubert's Flights & Wings. The Be 2 (1912-1918) used initially by Philip Joubert as a 2 seater front line reconnaissance plane was built by the Royal Aircraft Factory. The Sopwith Pup (1916-1918) built by the Sopwith Aviation Company was succeeded by the Sopwith Camel fighter in 1917.

Joubert attended the Central Flying School in April 1913 & the photo of Philip Joubert is from his Royal Aero Club pilots licence.

Slide 6. RAF re-armament 1936-1939: Philip Joubert C in C Coastal Command 1937- the 3rd Wheel.

Hitlers rearmament from 1934 in building up an enormous air force including the Heinkel 111 twin engine bomber, Messerschmidt Bf 109 fighters & Junkers Ju 87 Stukas were tested by the German Condor Legion in the Spanish Civil War (1936-1939). In England Sir Henry Tizard in December 1934 set up a small committee for the scientific survey of air defence to consider ways of detecting approaching aircraft such as bombers & fighters. The RDF story in England begins with the Daventry Experiment using a BBC transmitter in February 1935 where Watson -Watt was able to successfully demonstrate the principle of radio wave reflection from aircraft. The very rapid subsequent research & development of radar (RDF) leading to the Chain Home network by 1939 is dealt with by "Taffy Bowen" in his excellent book "Radar Days" (1987) & includes the birth of British airborne radar at this time also.

On July 4, 1938 Bowen gave a demonstration of ship detection to Philip Joubert (as C in C Coastal Command) & Watson-Wat,t using an airborne radar set flying in an Anson to spot the Esbjerg "butter boat" from Denmark. Many such demonstrations of airborne radar were given to other C in C's.

A significant figure in the rearmament of the RAF from 1936 is Air Marshal Sir Wilfrid Freeman who in the previous 3 years had been Joubert's successor as commandant at the RAF Staff College. Freeman's involvement with fighter & bomber aircraft extended right the way through from design to production, however the possible roles for Coastal Command in the defence of Britain were overlooked by Cabinet , the RAF Fighter & Bomber Command Leadership as well as the RN which was mainly interested in getting control of the Fleet Air Arm under the Admiralty away from the Air Force which did not eventually happen until the Spring of 1939. The lessons of the U-boat war in 1914-18 (of 12 mil. tons of shipping losses) had resolved themselves into a reliance on Asdic & ignored the prospect of U-boat attacks on the surface.Coastal Command in the rearmament phase was not recognized as having a clearly defined role or having the resources to carry out anti-submarine warfare despite Joubert's efforts as C in C.

In 1933 the Air Ministry issued a specification R 2/33 for a long range reconnaissance plane & this was suitably met by modifying the Short Bros. C Class Empire flying boat first introduced in February 1937 into the Short Sunderland, first flown in October 1937 & introduced into service in 1938. In the US, Consolidated introduced the PBY Catalina which came into US Navy service in October 1936.

Both the Sunderland & Catalina were to give Coastal Command a range of around 1000 miles which improved Coastal Command operations as their numbers were built up however it was not until another Consolidated aircraft -the B-24 Liberator, was acquired in good numbers that a Very Long Range (VLR) bomber capability for Coastal Command became available after mid 1941 when an initial allocation of 9 Liberators with ASV Mk II radar proved their value, but much larger numbers of the Liberator at this time may have crushed the U -boat menace & huge shipping losses.

Slide 7. J P V Madsen in London January 1940 to recast the RDF program for Australia with Watson-Watt.

In late December 1939 Prof. J P V Madsen flew to London by Qantas Empire flying boat with George Munro of the Australian Radio Research Board to recast the Australian RDF position in the circumstance of Britain now being at war. A memorandum was prepared by JPVM & Watson-Watt in January 1940 setting out that Australia would be a definite sub centre for RDF research & production of RDF equipment to a main centre in the UK & recognizing the prospect of Germany over running Britain. The Memorandum was submitted to Air Marshall Sir Philip Joubert who was then on "Special Duties" with the RAF including the position of Chairman of the "Interservices & Dominion RDF Policy Committee". The Memorandum at the highest level, went to the Secretary of State for Air, Sir Kingsley Wood (1881-1943). Kingsley Wood from March 1938 over the next 2 years oversaw an increase in aircraft production in Britain from 80/month to 546 / month.

Slide 8. Philip Joubert returns to Coastal Command June 1941- January 1943. Operations Research Analysis by Patrick Blackett FRS.

German U-boats available for operational use at the start of the war averaged 20 with production & crew training for new submarines planned to increase by 50 in 1940 & 199 in 1941. (In total some 1156 U-boats were built during the war in 19 yards located in 11 cities from Hamburg/Wilhelmshaven & around the Baltic). Probably the worst 2 days in the Battle of the Atlantic for Britain were convoys SC-7 & HX-79 homeward bound for Liverpool from New York/ Halifax which suffered 32 ships sunk by U-boat attack on 16-19 October 1940. During 1941 U-boats attacked some 11 convoys with the loss on average of 10 ships/ convoy. One bright spot for the British at this time was the capture by the RN of U-110 south of Iceland with its Enigma Machine, rotors & cypher codes on May 9, 1941.

Air Marshall Sir Frederick Bowhill (1880-1960) was C in C of Coastal Command for 3 ½ years to June 1941 at which time the order of operations of Coastal Command included 4 Groups viz. No 15, 16, 17 & 18 (RAAF Sqdn 10 was part of Group 15 at Pembroke Dock-Sunderlands). On June 6, 1941 Philip Joubert returned as C in C Coastal Command with some 210 aircraft whose main armament was the 250 lb depth charge but with no U-boat kills to its credit. In order to identify how RDF could be best used to greatly improve Coastal Command performance Joubert in May 1941 had arranged for Patrick Blackett FRS to commence an Operations Research Analysis looking into all aspects. Blackett had RN experience in WW I but had taken up Physics at Cambridge University under Rutherford after WW1 & was first involved with RDF on Tizards' Committee in 1935 & had developed a thoroughly scientific approach to examine how best to carry out military operations. Blackett & his small team examined a very large number of Flight Reports & found that 170 hours of ground crew manpower produced 1 hour of operational flying time & that more than 200 hours of flying time were needed to produce 1 attack on a surfaced submarine which in early 1941 only had a probability of 2%-3% chance of a kill. The low "attack kill" probability had to be improved where the typical depth charge stick being used comprised 6 X 250 lb depth charges. Six main recommendations were put forward by Blackett: 1). The depth timing setting for the depth charge explosion should be made shallower to

25 ft as the current setting of 100 ft was too deep. 2). The lethal radius of depth charges was 5-6 metres & more charges of 100 lb torpex may be preferable, but in the end 250 lb was still found to be effective. 3). Timing errors by pilots in aiming ahead of the target were being made & this was proved correct by the installation of cameras in planes proved the OR analysis as being correct. 4). The orientation of the stick was considered & it was not until much later that the best orientation was that of the track of the U-boat.. 5). To best use radar for attack the height should be around 2,000 ft (4,000 ft for searching) with camouflage white painting of the underside of aircraft to reduce detection-resulting in a 30% improvement in submarines attacked. 6). Increase the spacing of the depth charge stick from 12 metres to 33 metres. A significant factor in all this was the need to improve training in the use of ASV Mk II as ¾ of frontline ASV aircraft were not being used properly & navigation by aircraft crew which was found to be appallingly bad. The use of binoculars for daytime spotting was also recommended. Planned maintenance & flying operations were introduced by Joubert as well as the Beaufighter torpedo version for Coastal Command.

Depth charges in a Sunderland are shown on racks which are retracted into the fuselage through a hatch.

The introduction of the Leigh Light which had been demonstrated on a Coastal Command Wellington in March 1941 was a great improvement for night attacks on U Boats.

By February 1942 Joubert had the following Groups: No. 15 (Hudson, Liberator, Sunderland, Catalina & Spitfire) in Northern Ireland. No.16 (Beaufighter & Spitfire PRU) in Norfolk -Kings Lynn. No.17. Training Units. No.18. Beaufort, Sunderland, Mosquito, Catalina) in Scotland. No.19. (Sunderland - including RAAF Sqdn 10, Wellington, Liberator, Fortress, Hudson) in St Eval , Cornwall/Devon. Also aircraft at Gibraltar & Iceland (Sunderland, Catalina, Hudson, Swordfish). Group 19 covered a very large area of U-boat operations, especially the Bay of Biscay with submarines leaving & returning to the 3 main bases established in France by the Germans.

In 1941 the effectiveness of the B-24 Liberator was demonstrated but no additional units became available to Coastal Command until over a year later.

Throughout 1942 U-Boats in Wolf packs of 6 then 15 U-boats attacked 22 convoys with an average loss of 8 ships per convoy (ONS-67, 8 ships sunk, 21/2/1942: PQ-17,24 ships sunk, 1/7/1942: SC-107, 15 ships sunk,30/10/1942: SL-125, 12 ships sunk, 27/10/1942: ONS-154, 14 ships sunk, 26/12/1942).

In the second half of 1942, U-Boats were being lost at an average rate of 10 per month of which 30% have been calculated as due to Coastal Command, however the major turning point was in May 1943 when some 40 U-Boats were lost which was some 4 months after Joubert was replaced as C in C Coastal Command by Sir John Slessor in February 1943 who had at his disposal 60 squadrons including 2 B-24 Squadrons. Slessor is noted for the use of Combined Operations in the Atlantic with the VLR Liberators & it was during this time ASV Mk III (10cm) was introduced.

Throughout 1940-45 Coastal Command flew 240,000 operations, sank 212 U-Boats & 366 German transport vessels & rescued 5,721 Allied airman but lost 2,060 aircraft & 5,866 personnel.

Slide. No.9. J P V Madsen in London May-October 1941. Sir Henry Tizard & Operations Research.

J P V Madsen's Scientific Liaison Mission to the US & Britain in 1941 was a direct follow on from the "Tizard Mission" to the US from Britain in September 1940 & in London in September 1941 JPVM was happy to refer back to Sir David Rivett at CSIRO in Melbourne that he had a very good meeting with Tizard as the new Chairman of the "Interservice & Dominion RDF Policy Committee" having taken over from Philip Joubert who had gone to Coastal Command with Patrick Blackett doing the

very valuable work with Operations Research which JPVM was in the process of following up. Of significance to JPVM at this time were the intentions of the British for the defence of Singapore & operations in the Dutch East Indies & Australia as far as the use of RDF was concerned & the part Australia could play, but of course the rapid advance of the Japanese attack in December 1941 & January 1942 changed all of that. Sir Frank Smith who is mentioned was known to JPVM through his association with the National Physical Laboratory electrical side.

Slide 10. Joubert RDF Initiatives & B-24 Liberators.

In August 1939 the US Army Air Corps ordered 38 B24-A (Liberators) of which 20 were released for direct purchase to the RAF. On delivery in mid 1941 the RAF found them unsuitable for night bombing & sent 12 to Scotland for conversion to the anti submarine role in Coastal Command by fitting with ASV & were then sent to 15 Group No.120 Sqdn Northern Ireland. The Liberators shown in the photograph at Aldergrove Northern Ireland have ASV MkII which appear to be a later version than the original conversion & in fact may be different aircraft, as it has been mentioned that a number of Liberators which had service with the US Army Air Force were sent to Britain & were reconditioned in 1941. Sqdn 120 from Nutts Corner/ Aldergrove near Belfast was the only Coastal Command Sqdn flying VLR Liberators in February 1943 with 5 Mk I & 12 Mk III. The Sqdn sank 14 U-boats (4 in late 1942 & 10 between February & June 1943).

The graph of the ratio of ships to submarine losses has been prepared by Taffy Bowen & indicates that up to the end of 1940 96 ships had been lost but no submarines but that the ratio greatly improves with the introduction of ASV Mk II, the Leigh Light & ASV Mk III.

Slide 11. Wellington & Leigh Light.

Sqdn Leader Humphry de Verde Leigh working in an administrative role in Coastal Command (who had some RFC/naval submarine experience in WW1) proposed to his AOC, Sir Frederick Bowhill that a powerful searchlight (2 mil candlepower) he had devised should be fitted to aircraft to facilitate night attacks with ASV. In March 1941 it was tested in a Wellington which already had a generator on board & then on May 4, 1941 it was successfully tested against a British submarine. It was not used operationally until 1942 but after its use over the Bay of Biscay from August 1942 U boats preferred to stay on the surface so they could see their attackers. The Leigh Light, as it became known, came in a number of different versions (B-24, Wellington, Catalina) & also with battery packs.

Slide 12. The Atlantic Gap.

The fast HX convoys from New York to Liverpool via Halifax Nova Scotia travelled at 9-13 knots whilst the slow SC convoys travelled at 8 knots or less. Ships at 13 knots or more travelled independently until late in 1943 when CU convoys sailed at 14 knots. New York to Halifax is approximately 900 miles & Halifax to Liverpool approximately 3,000 miles & the air route from Gander in Newfoundland to Northern Ireland is approximately 2,200 miles. Reykjavik in Iceland in the north & centre of the convoy routes is about 1,000 miles distant. The largest convoy, HX 300 to Liverpool via New York, with 167 ships left on July 17, 1944 & arrived without incident on August 3, 1944.

The “Atlantic Gap” was the centre 1/3 of the Halifax-Liverpool route of about 1,000 miles which typically would take 4-5 days to cross during which time ships would be especially vulnerable to U-boat attack with no air cover until the VLR Liberators were introduced & which had a speed of 205 mph.& the “Gap” at times reduced to around 300 miles. As was found in WW1, the presence of

Allied air cover was cause for U-boats to submerge & within 45 seconds could be at a depth of 25-150 feet depending on the manouvre.

The number of U-boats which were operational each month & which could be on patrol for several weeks or even months is shown by the blue line. The Type VII C U-boat had a range of 8,500 miles at 17.7 knots surfaced & could travel at 7.6 knots submerged .The maximum submerged range was 80 nm at 4 knots & had 14 torpedoes. Radio reception worked up to a submerged depth of around 30 feet. A target of 100 U-boats in operation was reached in August 1942 but it was in May 1943 that the loss of 40 U-boats forced a withdrawal of all U-boats back to their bases & the Atlantic Gap was closed with VLR Liberators of RCAF operational in Newfoundland. (It was in July of 1943 that the devastating fire storm Bomber Command raids on Hamburg using "window" to confuse the German radar defences were carried out & for the first time it was thought that if a number of other major German cities suffered the same fate then the war would have been lost).

The Allied shipping losses were to eventually reach 13.5 mil tons,(2,600 ships) just a bit more than in WW1, but the production of Liberty Ship replacements & new tonnage from the beginning of 1943 clearly indicates that the "Battle of the Atlantic" was being won by the Allies.(In WW1 in 1914 Germany started with 24 U-boats, built 330 & lost 177 due to mines, depth charges & Q ships but managed to sink 12.9 mil tons.)

Slide 13. Combined Operations Liverpool & Halifax.

On February 7, 1941 Combined Operations moved from Plymouth to Derby House in Liverpool with Admiral Percy Noble C in C Western Approaches until November 19, 1942 when Admiral Max Horton was appointed. In February 1941 the HQ for Coastal Command Group 15 was also moved to Liverpool. The Underground Combined Operations HQ in Derby House has some 100 rooms of 30,000 sq feet which can be visited as a museum recreating the facility in WW2 built as protection from Luftwaffe bombing raids. The 3 foot reinforced Central Command Area comprises the Operations Room with the C in C 's office located above with a large viewing window to view the current status and the following rooms: Radio room, Message Receiving room, Combined HQ main telephone Switchboard, Cyphers, Royal Navy Radio Room, RAF Plotting Room, RAF Radio, Notice Board for AOC, C in C, Cabinet, Lots of Maps on walls.

The Western Approaches Command on January 1, 1941 consisted of 4 Escort Groups in Greenock, 5 Escort Groups & a Sloop Division at Liverpool & 2 Escort Groups in Londonderry. Each Group comprised 2-3 Destroyers & 6 Corvettes from Autumn 1940. Non RN Escort Groups (Canadian, Free French, Polish & Norwegian) contributed to this with increases during the year particularly at Londonderry by a total of a further 11 Escort Groups. By 1945 the RCN represented ½ the total based at Londonderry. Greenock on the River Clyde was the main assembly point for the Atlantic Convoys.

From October 1939 to January 1942 a Halifax Escort Force with heavy battleships, cruisers & submarines operated to protect convoys from surface raiders which were seen as the main threat rather than U-boats. In November 1940 the RCAF ordered a batch of 50 Catalina/(Cansos) from Consolidated which were delivered to the Eastern Air Command over 6 months from August 1941 to Sqdn 116 (BR-Bomber Reconnaissance) for convoy patrols. Lockheed Hudson aircraft were also used by the RCAF for anti-submarine patrols.

Slide 14. Coastal Command's vast area of operations. "Taffy" Bowen pioneer of Airborne radar.

The Operations Room of Coastal Command HQ at Eastbury Park, Northwood London in 1944 is shown with WAAF plotters & clerks recording details on the map covering 10 million square miles from West Africa & the Azores to Iceland. The map shows positions of convoys, individual warships, aircraft & U-boats. (The WAAF on the ladder had a safety harness). Coastal Command moved to Eastbury Park in 1939.

Weather in all of Coastal Command operations was probably the greatest enemy for air crew who could be on a sortie lasting 14-16 hours & at low altitude (1,200-5,000 feet). In January 1942 Joubert ordered that the maximum time of a sortie should be 14 hours to reduce fatigue & resultant problems. At this time Joubert knew that only 20% of his aircraft were operational. Obtaining & training of crew was a major problem in 1942 as experienced aircrew were siphoned off to Malta for anti-shipping operations against German & Italian shipping supplying Rommel. It was found that mixing of inexperienced crew (25%) with experienced crew did not work as accidents increased but the situation had improved by the end of the year.In Coastal Command a tour for aircrew was 800-1,000 hours during which time personnel became mentally & physically exhausted. In June 1942 Cabinet was advised that Coastal Command only had 39 Liberators & Joubert requested 3 additional land based squadrons & 10 flying boat squadrons, which was in addition to the 496 aircraft then in Coastal Command.(By February 1943 Coastal Command had 850 aircraft).

Joubert's introduction to ASV radar by "Taffy Bowen" was in July 1938 & the Mk I ASV introduced in 1940 to Coastal Command was far from satisfactory with poor design, poor serviceability , the lack of test equipment & the total absence of training. ASV Mk I was essentially only for ship detection whereas ASV Mk II could detect submarines at night which kept U-Boats submerged. ASV Mk II was a considerable improvement & came into service in Coastal Command late in 1940 & by the summer of 1941 there were some 100 ASV equipped aircraft (Hudsons in the North Sea, Sunderlands & Wellingtons over the Bay of Biscay & Whitleys over the north west approaches). ASV Mk II could detect a surfaced submarine at 10-15 miles using the forward & sideways looking antenna & aircraft would fly 10 miles to one side of a convoy sweeping a 20 mile path & be back for another sweep before a submarine could cross the distance. The early Liberator models (II & III) using ASV Mk II, out of Nutts Corner from June 1941, only had a range of about 600 miles & it was not until September 1942 that 5 VLR Liberators became operational. In December 1942 2 Liberators from Nutts Corner (Sqdn 120) at 750 miles were able to disrupt 4 U-Boats attacking Convoy HG-76 in the air gap of a homeward bound convoy from Gibraltar.

Bowen's book "Radar Days", published in 1987, highlights the significance that ASV radar in the 1.5 metre & 10 cm wavelengths played in defeating the German U-boat campaign of the "Battle of the Atlantic" 1939-1945.

Slide 15. Coastal Command & Bismarck, May 1941.

Blohm & Voss in Hamburg built many U-boats & also the battleship Bismarck which was commissioned in August 1940 & commenced its only offensive campaign of 8 days in May 1941 sinking the Hood but suffered some damage. An RN cruiser shadowing the Bismarck with Type 271 radar lost contact & a search by Coastal Command Catalinas from Loch Erne in Norther Ireland commenced early on the morning of May 26. Bismarck was sighted at 1010 by RAF P.O Dennis Briggs & USN Ensign Leonard B "Tuck" Smith & came under fire at 2,000 feet but got off a contact report & returned back to base after 18 hours at 2130 having been relieved by a 2nd Catalina. A radar equipped Swordfish from an RN Aircraft carrier led other Swordfish with torpedoes & managed a lucky hit on Bismarck's steering gear leading to her destruction on May 27 th. Ensign Smith was on loan to the RAF from the USN for training in the newly acquired Catalinas. The Catalina flown by

Smith & Briggs is shown -the shrapnel damage to the hull suffered from Bismarck fire was able to be plugged before landing It is noted that the C in C Coastal Command, ACM Sir Frederick Bowhill (1880-1960), used his shipping experience to set the search areas for the Catalinas in the search for the Bismarck.

Slide 16. The "Channel Dash" failure by RAF & RN 11-13 February 1942.

The very well executed "Channel Dash" plan by the German Navy & Luftwaffe on 11-13 February in moving 2 battleships (Scharnhorst & Gneisenau) & a heavy cruiser (Prinz Eugen) from Brest in France back to northern German ports was a tactical victory but a strategic loss for the Germans but a severe defeat for both the RN & RAF. The German ships had left Brest at 9.14 pm on February 11 & were approaching the Straits of Dover 12 hours later without being detected due to a failure of Coastal Command reconnaissance & success by creeping German jamming of RAF radar over several days.

Joubert had sent an appreciation to Fighter & Bomber Commands that a sortie from Brest could be expected any time after the 10th of February. Coastal Command Groups were alerted & 42 Sqdn ordered to fly 14 Beaufighters south to Norfolk but were delayed until the next day by snow in East Anglia. 9 of the Beaufighters flew south with torpedoes & 6 of these flew towards the Dutch coast & attacked the ships with torpedoes but with no effect-the other 3 had already attacked , possibly against British destroyers. 2 Beaufighters from 217 Sqdn set off independently from Manston & with ASV contact on Scharnhorst attacked at 5.10 & 6.00 pm. Beaufighters at St. Eval Cornwall arrived in East Anglia at 5.00 pm & pressed on in darkening visibility & saw 4 German mine sweepers & 2 Beaufighters lost to flak or bad weather. The 3 Coastal Command Beaufort Sqdns available had been located at Leuchars, Scotland, Portsmouth & St. Eval, Cornwall.

As it turned out the 3 German capital ships suffered mine damage requiring extensive repair or was torpedoed later & the other threat in the form of Tirpitz which had greatly affected the allocation of RN & RAF resources changed the Allied view of surface raiders on convoys. In the subsequent Enquiry of the debacle, Joubert (who blamed the neglect of anti-shipping aviation) proposed that all anti-shipping forces should come under Coastal Command but this was not accepted.

Slide 17. Coastal Command PRU ,Tirpitz & Bruneval February 1942.

In September 1939 the RAF took over the civilian photographic unit headed by the Australian Sidney Cotton who had been using a civilian Lockheed aircraft to perform clandestine photographic reconnaissance over Europe. In November 1940 it became the No. 1 PRU until October 1942 when its individual Flights became Squadrons redesignated as No.s 540, 541, 542, 543 & 544. No. 540 came under Coastal Command based at Leuchars in Scotland using Mosquitos especially to cover Norway & the movements of the Tirpitz (sister ship of Bismarck) which had moved to fjords near Trondheim in January 1941 from Wilhelmshaven where it had been built. Photo reconnaissance details were of particular interest to RN Naval Intelligence headed by Admiral John Godfrey (1888-1970) in the years 1939-1942. In February 1942 a Coastal Command Spitfire obtained the photograph of the German Wurzburg radar at Bruneval which was subsequently successfully raided by Commandoes to obtain vital components & the performance specifications of the Wurzburg determined. Meteorological flights were also conducted in many areas especially up to the end of 1942 by Coastal Command aircraft.

Slide 18. B-24 Allocation to Coastal Command 1943.

At the Casablanca Conference in January 1943, Roosevelt & Churchill agreed to increase the allocation of B-24's going to Coastal Command which Coastal Command had been requesting for over 12 months. The Consolidated factory at Fort Worth in Texas is shown with B-24's in US camouflage markings. In the fall of 1943 the aircraft of the US ASW Mission were transferred to the US Navy following a dispute over ASW with the US Army Airforce which was 12 months after the formation of the AAF Anti-Submarine Command. By 1943 Coastal Command was finally getting the recognition for its ASW role & the manpower / training levels compared to Bomber Command were also being revised from the qualified crew stripping practices in 1942.

Slide 19. Leigh Light & ASV Mk III (10 cm) on B-24.

ASV Mk III (10 cm) with Leigh Light was first used on a Wellington in March 1943 & completely confused U-Boats which could no longer detect a 1.5 metre signal on their Metox receiver. The ASV Mk III at the chin of the RAF Liberator is shown & a Leigh Light which was mounted under the right wing of a Liberator. The Leigh Light was a 24 inch, 2.0 mil candle power searchlight.

Slide 20. Canadian Navy Halifax , Nova Scotia.

Convoys from New York would sail to Halifax before crossing the Atlantic to Liverpool. For convoy escort duties the RN had ordered 145 Flower Class corvettes from small commercial merchant ship yards around the UK in 1939 pre-war & a further 48 by the end of 1939. The RCN ordered 70 original Flower class & a further 34 modified type from Canadian ship builders of which 10 were lost during the course of the war. Corvettes could do 16 knots which was not fast & the main tactic to deal with U-boats was to depth charge & ram. Equipment on corvettes eventually came to include Type 271 (10cm) radar for surface detection, HF/DF (Huff Duff) direction finding radio, ASDIC , DC projector & on the original type, mine sweeping equipment. Modified RCN type corvettes had an anti-aircraft pom-pom.

Slide 21. Convoy HG-76 from Gibraltar: Escort carriers prove their worth December 1941.

It was necessary to close the Gibraltar-UK air gap & in December 1941 convoy HG-76 comprising 32 merchant ships & a strong escort of 17 warships including the escort carrier HMS Audacity with 8 Grumman Martlets & a number of destroyers, sloops & corvettes came under attack from 5 U-boats in a wolf pack. A number of Luftwaffe Kondor long range aircraft were part of the attack over the 3 days 19-21 December 1941 & 2 Liberators of 120 Sqdn were also able to reach the convoy which lost 2 merchant ships but destroyed 5 U-boats & shot down 2 Focke Wolf Kondors. The outcome proved beyond doubt the value of escort carriers against the U-boat. US ship yards (mainly Kaiser in Washington state) built some 130 escort carriers of which 34 were lent to the RN under Lend Lease & were commissioned during 1942. In the case of the RN ships, modifications were made in Vancouver BC before going into service with the RN. Besides the Martlet, the RN used the naval versions of the Spitfire & Hurricane on escort carriers.

Slide 22. Canada covers the centre of the Atlantic Gap.

During the war the RCN grew from 3,500 to 10,000 men largely involved with the Battle of the Atlantic. The RCN carried out 25,343 escort voyages delivering 164.8 mil tons of cargo & was responsible for 52 U-boat losses at a cost of 24 RCN warships & 59 Canadian merchant ships. The area of RCN operations is shown on the map. No 10 & 11 squadrons RCAF from September 1939 flew Hudson & Douglas Digby aircraft from Nova Scotia & in 1943 Liberators from Torbay & Gander in Newfoundland in the anti-submarine maritime role. By 1943 other RCAF squadrons with Cansos & Sunderlands operating from other bases, including Northern Ireland, were having success in

attacking U-boats. The first successful U-boat attack for EAC (Eastern Command) was by a Hudson on July 31, 1942.

Slides 23/24. Beaufighter & Anti-Submarine armaments (250 lb).

Joubert saw the Beaufighter as a multi role, rugged & fast aircraft that could be used against German shipping especially on the Norwegian routes. Torpedoes were expensive & their allocation was more to the Fleet Air Arm rather than Coastal Command, however by September 1942 it was agreed that by April 1943 ,15 Squadrons of Beaufighters were to be created into Strike Wings. The 1st Squadrons (Nos 143, 236,254) were introduced in November 1942 but after suffering severe losses were withdrawn to undergo intensive training & were able to return in April 1943 with success.

The 250 lb Depth Charge (probably as shown in the Hudson) was found to have a lethal radius probably up to 19 feet. & with Torpex was found to be a very effective A/S weapon. Hudson aircraft were used by Coastal Command & the RCAF & the bomb bay arrangement can be seen. In June 1943 a new acoustic torpedo (Mark 24 Mine-FIDO) was introduced & 2 U-boats sunk soon after. Results of trials using Mark III Liberators of a new low level bombsight considered by Joubert's Anti Submarine Committee suggested the new sight would take too long to zero in on the target.

Slide 25. ASDIC & "Huff Duff" HF/DF in Allied Navies.

ASDIC was first developed in the UK & France towards the end of WW1 especially noting the work of E Rutherford & W H Bragg on sound detection of submarines & Paul Langevin in France with active sonar & quartz, details of which were passed on to the US. In the interwar period the UK did a great deal of development work to have some 5 different types suited to various craft. In 1940 these advances were passed to the US who had done very little up to 1940 but further rapid progress both in the US (SONAR) & UK was made to overcome difficulties involving the exact position to release depth charges. Over reliance on what was expected of ASDIC by the RN at the expense of an anti submarine role by Coastal Command to overcome the U-boat threat is seen as a serious error of judgement.

The HF/DF "Huff Duff" radio direction finding technique was developed by Watson -Watt in 1926 whilst he was working with the British Radio Research Board & equipment was provided by him to JPVM's Aust. Radio Research Board in 1928 to determine the effect of atmospherics (lightning) on radio transmissions in Australia. By 1942 HF/DF equipment (cathode ray receiver displays & suitable aerials) was being supplied to RN vessels to detect even very quick bursts of U boat radio transmissions & from that, the position of the U-boat could be fixed for escort ships or Coastal Command planes to deal with.

Slide 26. Type VII & Elektro Submarines.

568 of the Type VII C (Atlantic Boat) workhorse U-Boat were commissioned & 118 of the Type XXI Elektro boats were built in Hamburg & Bremen during 1943-45. The Type XXI was a big advance on the Type VII with 3 times the electrical power which only needed to be recharged every 2-3 days for 3-5 hours using the Schnorchel but operationally came too late in the war. It had a range of 15,500 miles & a hydraulic torpedo reload system for 23 torpedoes.

Many other types of U-boats were used as supply boats, mine layers & torpedo transports out of a total of some 1,156 U-Boats built.

Slide 27. German Submarine Pens & the Bay of Biscay.

Germany quickly built 3 U Boat bases in France in 1940 at Brest, Lorient & St. Nazaire with access to the Atlantic through the Bay of Biscay. The pens were heavily reinforced & were successfully protected & despite offensive U-Boat operations by Coastal Command from 1941-1942 real success did not come until June-July 1943 when U Boats were recalled after the Black Month of May 1943 at which time 40 U Boats were lost due to a combination of ASV Mk III 10 cm radar, Leigh Light, Huff Duff , Code Breaking & effective depth charges. U -Boat patrols during the war from French bases & transiting the Bay of Biscay were approximately 50% of the total (3,140) & the rest evenly from Norway (Bergen, Trondheim, Narvik) & Germany (Kiel & Wilhelmshaven). It was an average of 100 U-Boats per month transiting the Bay of Biscay from 1942.

RAAF Sunderland "U" of 461 Squadron sank the transport U-Boat U-461 on July 30, 1943 (as shown in the painting) in the Bay of Biscay at the time when U-Boats were remaining on the surface to transit the Bay of Biscay & shoot it out if attacked by Coastal Command from Group 19 aircraft based in Cornwall. (In July 1943, 86 U-Boats were sighted & 16 sunk for the loss of 14 aircraft). In July 1942 a detachment of Lancasters on loan to Coastal Command from Bomber Command Squadron No 61, was stationed at St. Eval for operations over the Bay of Biscay & on July 17th a Lancaster destroyed a U-Boat.

Slide 28. German acoustic torpedo & radio operations.

Wilhelm Tranow (1891-) was head of the English Section of German Naval Intelligence during WW11 as a cryptanalyst who was involved in intercepting, evaluating & deciphering of enemy crypts. He had experience from WWI & in the interwar period & in March 1940 penetrated the British Merchant Navy Code.In the following month he penetrated the RN Administrative Cipher. In October 1941 B-Dienst broke the British Naval Combined Cypher No. 3 which was used to encrypt all communications for Allied North Atlantic convoys. In February 1942 Tranow's team broke the 4 digit US-British-Canadian Convoy Cipher , Naval Cipher No.3, however by November 1943, B-Dienst in Berlin could no longer penetrate Allied Ciphers.

Deciphered convoy information was radioed to U-Boats from radio towers in Lorient & also the much more powerful transmitter tower in Sainte Assise in France. Messages were repeated at 2, 6, 12,24 hours & if critically important 2 days later. Messages taking 15-30 minutes were at the rate of 20-30 per day. U-boat radio operators were required to copy all messages & account for them by serial number to their captain. Messages could be received at periscope depth & even down to 40 feet. Message types included convoy sightings, short messages on fuel & convoy speed data, weather reports & long signals. U-Boats were required to retransmit messages received for other U-Boats to copy.

The standard 21 inch German U-Boat torpedo during the war was an electric G7e which from mid 1942 had increased battery capacity giving it a range of 7,500 metres at 30 knots. Acoustic homing torpedoes were introduced from March 1943 but U-Boats had to be very careful as the loudest noise source could be the U-Boat itself.

Slide 29. RN Western Approaches & U-Boat Losses.

Sir Percy Noble was succeeded by Sir Max Horton (1883-1951) as Admiral in Command of Western Approaches in November 1942. Horton's combative personality & experience in the submarine service suited this position. The U-Boat losses shown are by all causes but especially in May & July 1943 which indicate the turning point in the Battle of the Atlantic to finally favour the Allies. Both Noble & Horton are seen as crucial figures in this Battle.

Slide 30. German U-Boat Production & Training in the Hamburg/ Baltic Region.

German U-Boat production during the war of 1,156 commissioned (1940: 50, 1941: 199, 1942: 238, 1943: 286, 1944:229, 1945: 91) were produced in 19 yards in 11 cities in the Hamburg-Baltic region assembled from equipment all over Germany, however 73% of this production was concentrated in the Hamburg-Bremen-Kiel area. Training of U-Boat crews (1940: 54, 1941: 250, 1942: 350 crews) occurred near Kiel involving 2 training flotillas.

In the Spring & Autumn of 1942, Bomber Command attempted to disrupt U-Boat production by bombing the MAN diesel engine factories in Mannheim & Stuttgart as well as the Zeiss periscope factory but with little effect. The "Hamburg Catastrophe" of 25 July 1943- 2 August 1943 did have an effect on shipbuilding but from the Summer of 1943 the Germans used thousands upon thousands of slave & POW labour to work on U-Boat production but the main disruption occurred from bomb damage to railways & waterways used to transport sections of the Elektro Boats.

Near the end of WW1 the Admiralty in 1918 was considering a bombing raid on the small town of Hagen in the Ruhr where batteries for U-Boats were manufactured. Hagen is situated in a deep valley & the cramped layout of the factory gave no suitable visual aiming points for both day or night raids. These plans did not go ahead in WW1 but if an effective raid had been carried out by Bomber Command in WWII on Hagen & Hannover submarine battery factories, then a powerful strategy in conjunction with the actions at sea would have defeated the U Boat threat. Sporadic attacks were made by Mosquitos on the Hagen factory but apparently to no serious disruptive effect.

Slide 31. Code breaking by Germans & Allies.

The operations of the German B-Dienst in Berlin were greatly assisted by the capture of code books on British merchantmen captured by German raiders, particularly the Atlantis, operating in the South Atlantic & Indian Oceans in 1940. On July 11, 1940 from the "City of Baghdad" Atlantis captured current BAMS (British Allied Merchant Shipping) codes & call signs for merchant vessels & Admiralty sailing instructions. On November 11, 1940 Atlantis captured from the "Automedan" extremely valuable documents including the new Fleet Codes & BAMS codes the details of which were passed back to Berlin.

On February 26, 1943 the strange behaviour of a German wolf pack diverting from convoy SC 122 to HX 229 gave concern that Allied Codes had been broken & in June 1943 a new British Cypher No 5. was introduced & remained secure.

On May 9, 1941 U-110 was depth charged and abandoned by its crew thinking that it was sinking but a boarding party from HMS Bulldog was able to get aboard & retrieve the boats code books, ciphers & Naval Enigma machine which was passed to Alan Turing & Gordon Welchman at Bletchley Park which led to very advanced decoding equipment, "Bombes", to decipher intercepted messages firstly using the Enigma 3 rotor machine. After a gap of 10 months starting from February 1942, it was not until the 4 rotor machine was finally broken in December 1942 (following vital documentation bravely obtained by two RN seaman from U 559 in the Mediterranean.). The use of Ultra material from Bletchley Park was an invaluable contribution to the Battle of the Atlantic.

Slide 32. The Heroes of Coastal Command, Allied Navies & Merchant Seaman on Convoy Duty.

Throughout the war Coastal Command sank 212 U-Boats & 366 German transport ships (512, 000 tons) & rescued 10,663 personnel including 5,721 aircrew,(4,665 non aircrew, 277 enemy) however the loss of personnel killed in action (5,866) & aircraft lost (2,060) was considerable.

Sir Geoffrey de Havilland's extremely versatile Mosquito or "Wooden Wonder" was 1st test flown by Geoffrey Jnr on November 11, 1940 & was introduced into the RAF on November 15, 1941. De Havilland's design concept was defended by Sir Wilfrid Freeman against orders to scrap it & was coined "Freeman's Folly" at that time. Coastal Command by February 1943 was operating squadrons of Mosquitoes at Group 16 (Norfolk) & Group 18 (Scotland) which became equipped with rockets to attack German convoys transiting between Norway & Germany.

The forward throwing "Hedgehog" spigot mortar came into service in 1942 in many ships but its acceptance by crews did not happen until later in 1943 after some excellent crew training & the kill rate improved considerably. In WW2 out of 5,174 depth charge attacks there were 85 kills compared to the "Hedgehog" which had 47 kills out of 268 attacks.

Slide 33. U S "Neutral Patrols" from October 1939 & HMS Starling."Johnnie Walker".

In October 1939 Roosevelt declares a U S Neutrality Zone but actively supports British shipping in both the North & South Atlantic. A US patrol aircraft is shown in November 1941 covering Convoy WS-12 to Cape Town. A US Catalina with depth charges is shown.

The most successful Anti Submarine Warfare commander during the Battle of the Atlantic was Captain Frederic Walker (1896-1944) with a credit of 14 U-Boats. Walker was given his 1st Sloop command in October 1941 & in mid 1943 was given command of 6 sloops including his new HMS Starling. Walker was noted for his creeping & barrage attacks using 2 & 3 sloops in concert. Walker was successful in the Bay of Biscay as well as the Atlantic- he died in July 1944 of exhaustion . The US 325 LB Depth Charge.