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Perisher
its evolution 1917-2017 and the Submarine Commanding Officer

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ERRATA CORRIGE

Page	Line	Note	ERRATA	CORRIGE
11	20		BAE: British Aerospace	BAE: BAE Systems Plc

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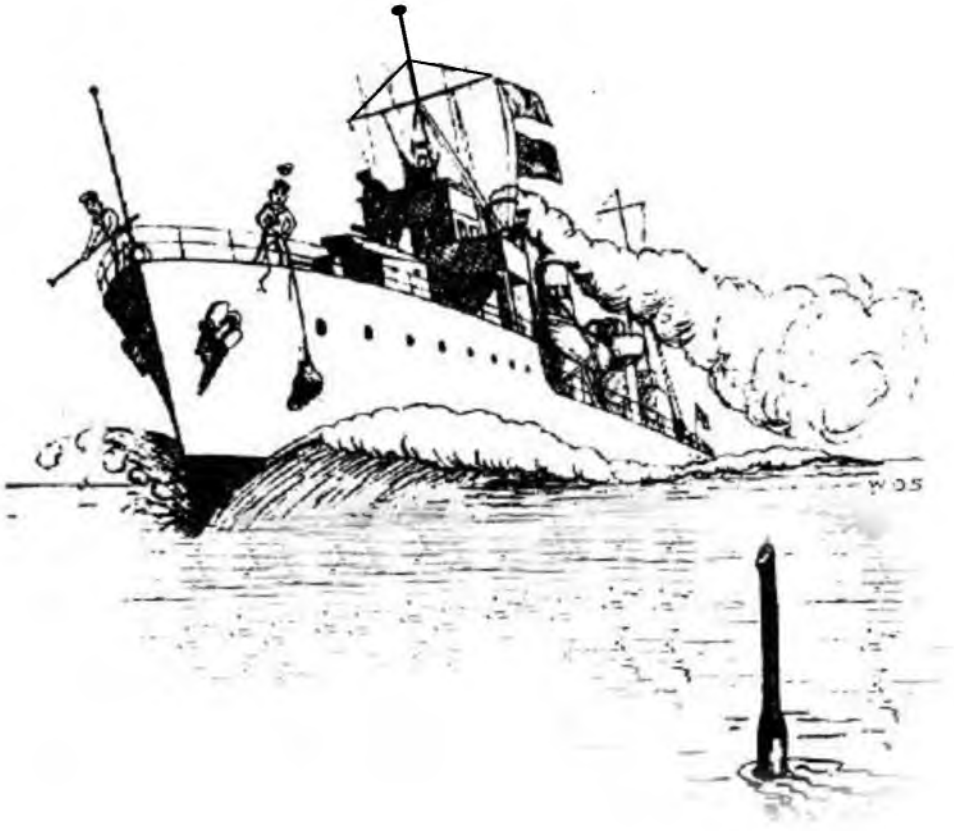
Perisher:
its evolution 1917-2017
and the
Submarine Commanding Officer



David Parry

A thesis submitted for the Degree of Doctor of Philosophy, 2022

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The cover image is from a party invitation of the last Perisher before World War Two in July 1939.

"The genuine masters of their craft – I say this confidently from my experience of ships — have thought of nothing but of doing the best by the vessel under their charge. To forget oneself, to surrender all personal feelings in the service of that fine art, is the only way for a seaman to faithfully discharge of his trust."

Joseph Conrad, The Mirror of the Sea

"Trained invisibly year by year, from ship to ship, from station to station, in war and in peace, the seaman insensibly develops his special character, acquires the art of taking a proper risk from what he has seen others do, and learns how to act in moments of great responsibility without feeling that responsibility, or at any rate never overmuch…"

Admiral of the Fleet Lord Chatfield, The Navy and Defence

"The submariner must be a navigator an electrician, a torpedo man, a gunnery type, and even a bit of a plumber. He must know men and get on with them. He must use initiative and tact and learn how to enjoy hard living. He must accept responsibility young and not misuse it. There is every reason why he should join and delight in joining submarines, but the greatest joy of all is companionship, unity, and feeling that he is one of a team which only as CO can he let them down. The supreme moment, the moment of truth for the CO, is in his attack. Then, his judgement and actions alone can bring success, failure, or death. He has no one to hold his hand, advise, or correct a fatal move. His eye alone can see, and his instincts sense the correct and only tactic to pursue. On him rests all responsibility. When he feels the faith of his ship's company behind him, he knows that they trust him and will carry out or even anticipate his slightest command, then indeed, he is a proud man."

Captain William Fell, Teacher 1930-1932 and 1935-1937

Abstract

The Royal Navy's Submarine Command Course, or 'Perisher', is a unique course, training, assessing and qualifying officers for submarine command. Submarine command is unique, challenging and demanding; the epitome of mission command, with no succour, referral or support in an environment that is also unique. It is therefore essential that those 'in command' are proven to be worthy and capable of their appointment. Perisher has assured that capability for over 100-years and this thesis aims to reveal Perisher's heretofore unresearched, unwritten and thereby unknown history of evolution that has enabled its success. The focus is the submarine commanding officer or CO and because the submarine is also the epitome of technical innovation, the nexus between innovation and the CO is integral. To colour-in the blank historical canvas the thesis starts with original research into the culture of the Submarine Service, what is meant by being 'in command' of a submarine, including its modus operandi under mission command, and defining Perisher's aims and objectives.

The evolution of Perisher is in recognisable periods, reflected in the thesis chapters. The earliest days following the submarine's introduction into the Royal Navy, when submarine command was an autodidactic existence with COs learning from their peers and by experimentation, provides the background to the First World War. By 1917 circumstances had conflated to create the Periscope School and the Periscope Course to train and qualify COs. By the end of the war the CO's characteristics, which continue today, were fully formed. The early part of the 1919-1939 interwar period, was a difficult time, but one that saw many CO-generated innovations. The later part saw new submarines and technological innovations just in time for the Second World War which was to prove the most intense evolutionary period for Perisher as it responded with alacrity to wartime demands by being shortened, moving to Scotland, and expanding to two parallel 10-week courses. The post-1945 to 1969 period saw Perisher provide many other navies with COs, notably the Australians, Canadians and Dutch. It also saw two evolutions, the first, perhaps more of a revolution, was in 1968 when Commander Sandy Woodward codified the art of attacking with arithmetical-based methods and secondly, the emphasis began to evolve from purely 'periscope eye' attacking toward the development of a sense of safety and tactical prowess in students. The evolution enabled a more exacting test of a student's ability to cope with pressure and stress, allowing him to exhibit decision-making abilities while stretching his risk-taking to learn his limitations. In the 1970s-1980s, two parallel courses satisfied the demand for COs from an expanding diesel-nuclear submarine fleet using SSKs and then in 1989, an SSN. Along the way, Perisher's Shibboleths are explored. The final evolutionary period, 1990-2017, was a long one that continues today. The major evolutions in the 1990s were the all-nuclear Perisher, following the demise of the Royal Navy's diesel submarines, and an adjusted selection process and curriculum to meet the requirements of a reducing all-nuclear submarine fleet, a changing battlespace, new weapons and tactics, and the influence of societal change.

Throughout, the thesis demonstrates how Perisher has shaped the submarine commanding officer and he, in return, has shaped Perisher. Its contribution to the understanding of submarine command opens possibilities for further study of both culture and command at similar levels of responsibility of which there is presently a lacuna.

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Abbreviations

2SL: Second Sea Lord
AC: Attack Coordinator
ADCAP: Advanced Capability (US Mark 48 torpedo)
AFO: Admiralty Fleet Order
AHPS: Artificial Horizon Periscope Sextant
AIB: Admiralty Interview Board
ALN: Radio Mast designation
ARA: Armada de la República Argentina
ARL: All Round Look – a regular sweep around the horizon for safety
ARL: Admiralty Research Laboratory
A/S: Anti-Submarine or Attack Teacher
ASW: Anti-Submarine Warfare
ASuW: Anti-Surface Warfare
ATB: Angle-on-the-bow
AUTEC: Atlantic Underwater Test and Evaluation Center
AUWE: Admiralty Underwater Weapons Establishment
AVS: Radio Aerial designation
AWO: Advanced Warfare Officer
BAE: British Aerospace
Banyans: Parties, usually on a beach but often on the submarine's casing
BOA: Bearings Only Analysis
BRNC: Britannia Royal Naval College
BUTEC: British Underwater Test and Evaluation Centre
BQR: American Sonar designation
CAC: Churchill Archive Centre
CB: Confidential Book
CBE: Commander of the British Empire
CEP: Contact Evaluation Plot
CCF: Command Competency Form
CLS: Conical Log Spiral (Very High-Frequency radio aerial)
CO: Commanding Officer
Cockfight: The tactical sea weeks of Perisher
COCOQC: Commanding Officer Commanding Officers Qualifying Course
COCQEX: The periscope, sea safety training, weeks of Perisher
CODC(D): Commanding Officers Designate Course, Diesel
CORQC: commanding Officers Requalifying Course
COSMCC: Commanding Officer Submarine Command Course
COQC: Commanding Officers Qualifying Course
CoS: Chief of Staff
CSMCC: Canadian Submarine Commanding Officers Course
CQ1/2: Command Qualified
CSST: Captain Submarine Sea Training
DA: Director/Deflection Angle – the angle to 'aim off' so that weapon hits the target
DAT: HMS *Dolphin* or Fort Blockhouse Attack Teacher
DCA/B/D/H: Digital Submarine (Command System) First/Second/Third/Eighth
DL: Doctor of Letters
DSC: Distinguished Service Cross
DSO: Distinguished Service Oder (* indicates a second award of the same medal)
ESM: Electronic Counter Measure
EQ: Emotional quotient
F.d.U.AusB: Führer der U-Ausbildungsflottillen
FAA: Fleet Air Arm
FNO: Frigate Navigator's Course
FOSM: Flag Officer Submarines
FOST: Flag Officer Sea Training
FSL: First Sea Lord
GARTU: Gyro Angle Re-Transmission Unit
GNAT: German Naval Acoustic Torpedo
G: Gunnery specialist
GL: General List
GS: General Service – the surface Navy

HKU: Höheres Kommando der Unterseebootsausbildung
HMCS: His/Her Majesty's Canadian Ship
HMNLS: Her/His Majesty's Netherlands Ship
HMS: His/Her Majesty's Ship
HTP: Hydrogen Test Peroxide
RHlN: Royal Hellenic Navy
HTTP: Hydrogen Peroxide
ICS: Inspecting Captain Submarines
ISTAR: Intelligence, Surveillance, Target Acquisition and Reconnaissance
IQ: Intelligence quotient
IWO: German First Lieutenant
JASS: Joint Ant-Submarine School
JMC: Joint Maritime Course
LOP: Local Operations Plot
LRMP: Long Range Maritime Patrol (Aircraft)
MAIB: Maritime Accident Investigation Board
MBE: Member British Empire
MDU: Mine Detection Unit
MiD: Mentioned in Despatches
Mod: Modification
MoD: Ministry of Defence
MTB: Motor Torpedo Boat
MTC: Maritime Tactical Course
N: Specialist Navigator
†N: Advanced (dagger) Specialist Navigator
NATO: North Atlantic Treaty Organisation
NLSMCC: Netherlands Submarine Command Course
NORSMCC: Norwegian Submarine Command Course
OBE: Order British Empire
OOW: Officer of the Watch
OCRAT: Officer commanding Rothesay Attack Teacher
OJAR: Officers' Joint Appraisal Report
OTC: Officers Training Course
Part III: The final part of a trainee's submarine qualification
PCO: Principal Control Officer/Prospective Commanding Officer
PD: Periscope Depth
PIM: Position Intended Movement
PJT: Pre-Joining Training
PJT(N): Pre-Joining Training Nuclear
POSTD: Petty Officer Steward
PTSD: Post Traumatic Stress Syndrome
PWO: Principal Warfare Officer
QRRN: Queen's Regulations Royal Navy
RAF: Royal Air Force
RAN: Royal Australian Navy
RANVR: Royal Australian Navy Volunteer Reserve
RA(S)/RASM: Rear Admiral Submarines
RAT: Rothesay Attack Teacher
RCN: Royal Canadian Navy
RCNVR: Royal Canadian Navy Volunteer Reserve
RDF: Revolving Directional Hydrophone
RDN: Royal Danish Navy
RFA: Royal Fleet Auxiliary
RHLN: Royal Hellenic Navy
RN: Royal Navy
RNAS: Royal Navy Air Service
RNLN: Royal Netherland Navy
RNoN: Royal Norwegian Navy
RNR: Royal Navy Reserve
RNSM: Royal Navy Submarine Museum
RNSVR: Royal Navy Supplementary Reserve
RNVR: Royal Navy Volunteer Reserve
RNZNVR: Royal New Zealand Navy Volunteer Reserve

SAB: Submarine Advisory Board
SASB: Sea Appointments Selection Board
SCTT: Submarine Command Team Trainer
SDR: Strategic Defence Review
SGM: Submarine General Memorandum
SL: Supplementary List
SM: Submarine(s)
SM3: Third Submarine Squadron
SMCC: Submarine Command Course
SM(CQ): Submarine Command Qualified
SMCQO: Submarine Command Qualified
SMOCM: Submarine Officers Career Manager
SNAPS: Ship's Navigation and Plotting Table
SNCP: Special Naval Control Programme
SOCT: Submarine Officer Continuation Training
SSBN: Nuclear Ballistic Submarine
SSGN: Guided Missile Nuclear Submarine
SSK: Conventional (Diesel) Submarine
SSN: Nuclear Submarine
SST: Submarine Sound Telegraphy
SSTO: Senior Stores and Transport Officer
SSX: Submarine versus submarine exercises
STANAVFORLANT: Standing Naval Force A; antic
STD: Submarine Torpedo Director
STDG: Submarine Tactical Development Group
STWG: Submarine Tactical and Weapons Group
SUBAIR: Submarine-Aircraft operations
T: Torpedo specialist and electrical specialist qualified at HMS *Vernon*
TAS: Torpedo Anti-Submarine specialist
TBP: Time Bearing Plot
TCC: Torpedo Control Calculator
TCCO: Torpedo Control Calculator Operator
TCSS: Torpedo Control System Submarines
TDC: American Torpedo Data Computer Mark III
TGCU: Torpedo Guidance Control Unit
TLAM: Tomahawk Land Attack Missile
TNA: Training Needs Analysis
TNA: The National Archives
TOFI: Torpedo Order and Firing Instrument
TOI: Torpedo Order Indicator
TPK: Target Position Keeper
TRW: Torpedorichtungs-Weiseranlage
TSU: Tube Selection Unit (TSU)
TSU: Target Set Up
URNU: University Royal Navy Unit
USN: United States Navy
VA(S): Vice Admiral Submarines
VO: Voluntary outflow
WECDIS: Warship Electronic Chart Display and Information System
WRNS: Women's Royal Naval Service
XO: Executive Officer
XODC(N): Executive Officer Designate Course, Nuclear

1. Introduction

On 23 October 1917 Lieutenant Paul Eddis joined the new Periscope School based on HMS *Thames* in Portsmouth for a course in submarine periscope attacking. This was to become known as the Perisher. Just five days later, on 28 October he left to command the submarine *E38*. Eddis had not been to sea since August 1915, for he had been the First Lieutenant of the *E13* when she had a compass failure trying to break into the Baltic and ran aground on the Danish shore where she was shelled by German destroyers and 15 of her crew were killed. The commanding officer, Lieutenant Commander Geoffrey Layton, and Eddis, along with the surviving crew members were interned by the Danes. Layton and Eddis escaped back to the UK whereupon Eddis went first to HMS *Dolphin* in July 1917 and then the Periscope School.[1] An interesting story, but its point is that in 1917 it needed just five days periscope attack training for an officer to be appointed in command of a submarine. In 2017, an officer was on the Submarine Command Course, or SMCC as Perisher was now formally called, for five months. The course had evolved although not linearly as it responded to the vicissitudes, exigencies and imperatives that made up the needs of the Royal Navy's Submarine Service in both war and peace. That evolution between 1917 and 2017, the Perisher's centenary, is the subject of this thesis. The denouement to Eddis' story is that he died in command of the *L24* in 1924 after a collision with the battleship HMS *Resolution*. Perhaps five days training was insufficient to ensure that he was a *safe* commanding officer.

[1] Roy Bainton, *Honoured By Strangers*, (Shrewsbury: Airlife, 2002), 65-6; Michael Wilson, *Baltic Assignment*, (Leo Cooper: London, 1985), 80-4; TNA ADM 196/145/90 Eddis' Service Record; https://www.thedanishscheme.co.uk/Articles/Story%20E13%20english.pdf

Arcane, Unique and Elite

The history of the Periscope School precedes its start date in 1917. It begins with the first commanding officers, or COs, learning their craft to which is added the First World War experiences that led Commodore Sydney Hall, the Inspecting Commodore Submarines (ICS), to request Admiralty approval for the establishment of the School. The years as the Submarine Commanding Officers' Qualifying Course (COQC) to its 2017 format as the SMCC followed.

Recent research into the training of Royal Australian Navy (RAN) submarine COs identifies Perisher as:

> *"… subject to a number of constraints. It isn't about strategy, which is assumed to emerge mysteriously from the corridors of the Admiralty. The commander's task is to find the best way to achieve given objectives. Nor is it about the nuts and bolts of running a submarine, such as logistics, equipment inspection, onboard maintenance and the like, which are ultimately the commander's responsibility."*[2]

This quotation establishes important boundaries of this study: it confines itself to the Submarine Service avoiding wider issues of British naval strategy, only touching on operations for illustration or explanation. The soft qualities of command — presence, character, personality, leadership, confidence, capability and others — have remained a constant and Perisher has evolved to teach and assess them. It has been outlined as "*an exploration of a student's character, personality and command competency*",[3] "*a character and judgement course not a skills course*",[4] "*a philosophy and the state of mind that weans the man to command*",[5] "*a psychological game*",[6] "[a] *psychological experiment in a real-life laboratory*".[7] The inference is clear, Perisher is primarily, but not exclusively, about personal qualities which are, of course, inherently subjective. In describing his perception of the naval officer Admiral of the Fleet Lord Chatfield inadvertently summed up much that Perisher is about,

> *"… in war and in peace, the seaman insensibly develops his special character, acquires the art of taking a proper risk from what he has seen others do, and learns how to act in moments of great responsibility without feeling that responsibility, or at any rate never overmuch…"8*

[2] Email Professor Paul Davidson May 2019. He is also a Commander RANR at the Australian Staff College.
[3] Australian Forum
[4] Matt Parr interview February 2020.
[5] RNSM A 2014/016, Biggs's notes
[6] Mark Stanhope, interview February 2019.
[7] Email Herman De Groot July 2020. Head of the Dutch Submarine Service.
[8] Admiral of the Fleet Lord Chatfield *The Navy and Defence*, London, Heinemann, 1942220.

At the same time technology which, "*is more to mariners than life. It is home*",[9] and because the knowledge of technology "*is a key element in understanding the operational successes and failures of the submarine conflict*",[10] the innovation-rich technology of the submarine, that the submarine CO has assimilated and Perisher has evolved to accommodate, plays an important but supporting role in the thesis.[11]

Perisher is denied any appearance of being an ordinary course, that would be unworthy of its importance, longevity and reputation, for Perisher is influential and nuanced. It is a unique training pathway with an acclaimed, sometimes mystical, international reputation for excellence delivering a unique type of naval officer. This is not an idle claim. Other organisations both military and civilian have command selection processes. Some, like special forces selection or flying training, have higher failure rates or periods of greater mental intensity. None, however, have the continuity of stress from critical decision-making under pressure in a risk-rich environment accompanied by the ever-present threat and close embrace of the underwater environment — all under the constant invigilation of the course commanding officer, colloquially known as 'Teacher', whose job is to assess, and singularly decide upon an officer's capability to be a submarine commanding officer, delivering either a 'pass' or the finality of failure. Collectively, they make Perisher unique in the annals of the military and deserving to be called 'The Franchise of the Deep'[12] — a difference from all other command courses that is vigorously advocated by Admiral of the Fleet the Lord Boyce who, as a former Chief of the Defence Staff, is uniquely placed to compare it with all types of military command.[13] Out of the hundreds of thousands who have served in the Royal Navy over the 100 years that Perisher has formed the backbone of a Submarine Service that has produced 13 VCs and countless other awards, Perisher has qualified just 1,165 RN officers and 365 officers of Commonwealth, and other navies. That is elitism by any standards, and naval historiography demands this thesis to provide its new dimension in the history of the Royal Navy.[14]

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[9] Roger W Barnett, *Navy Strategic Culture; why the Navy thinks differently*, (Annapolis MD: Naval Institute Press 2009), 74

[10] Rear Admiral David Cooke in Jean Hood (Ed), *Submarine*, (London: Conway, 2007),6.

[11] See: David Parry, *History of Submarine Periscopes, History of Submarine Sonar, History of Submarine Radar, History of Submarine Command Systems, and History of Attack Teachers* at Barrow Submariners http://msubs.co.uk/and https://www.rnsubmusfriends.org.uk/.

[12] Peter Hennessy and James Jinks, '*The Silent Deep'*, (Penguin: London, 2016), 7. 'The Franchise of the Deep' is a paraphrasing of an Alan Bennett quote of 1991.

[13] Admiral of the Fleet Lord Boyce interview November 2019.

[14] Andrew Gordon, *The Rules of the Game*, (London: John Murray,1996); Robert L Davison, *The Challenges of Command*, London, Routledge, 2011 and Mike Farquharsen-Roberts, *Royal Naval Officers from War to War 1918-1939*, London: Palgrove MacMillan, 2015, all add their own new dimensions but make no mention of submarine commanding officers, the Periscope School or Perisher.

The route to Perisher and submarine command is deeply embedded within British submarine custom, culture and practice, with the latter so abstruse that even the practitioners of the art, the submarine COs, find difficulty in articulating a common explanation and definition. For that reason alone Perisher needs academic examination as to how it has evolved to achieve its dominant position in submarine lore and its international repute.

The submarine CO's job is arcane, and it is unique because of its underwater dimension and the isolation of the role that developed the 'One-Man-Band' appellation. That moniker grew with the primacy of the periscope as a sensor, but its implication is no less apposite today. Captain Herman de Groot RNLN describes it thus:

> *"The submarine CO takes his weapon system all over the globe and is the epitome of mission command. His reason for being is to solve things on his own without the consultation options other commanders have. Although the submarine CO cannot do a thing without his crew, all actions go through him, he is the true Spider-Man in the middle of his web."*[15]

The surface ship CO is supported by specialists who lighten his load to ensure the ship can 'float, move, fight'. The submarine CO's isolation at the periscope may have more recently morphed into the 'command team' but he retains that close involvement with every aspect of the boat, the entrepreneurial independence of command and the proclivity of stealth. Add to that the nuclear dimension and the cheek-by-jowl existence that lays bare a CO's idiosyncrasies and the case is compelling.

Like all military organisations, the RN's Submarine Service has been shaped by war, trial, experience, failure, accident, experiment, personality, convention, society, threats, the sea, weapons, technology, tradition and, uniquely in its case, Perisher, a course that, throughout its evolution, has retained its underlying principle to test command worthiness as a constant. To junior submarine officers Perisher is aspirational, perhaps feared, to submarine ships' companies it is a badge of confidence in their captains, to other navies it has been coveted and copied.

This thesis aims to show how the course evolved in response to the changing needs of the Submarine Service. Evolution took many forms but its most obvious manifestation has been the number of Perisher students relative to submarines in commission. This is shown in Figures 1.1 and 1.2 from which the obvious question to ask is why, when the submarine fleet diminished between the wars and from the 1960s, did the numbers of Perisher passes not reduce accordingly.

[15] Email Herman de Groot February 2019.

Figure 1.1: Comparison of:
No. of Submarines in Commission with No. of Perisher Passes

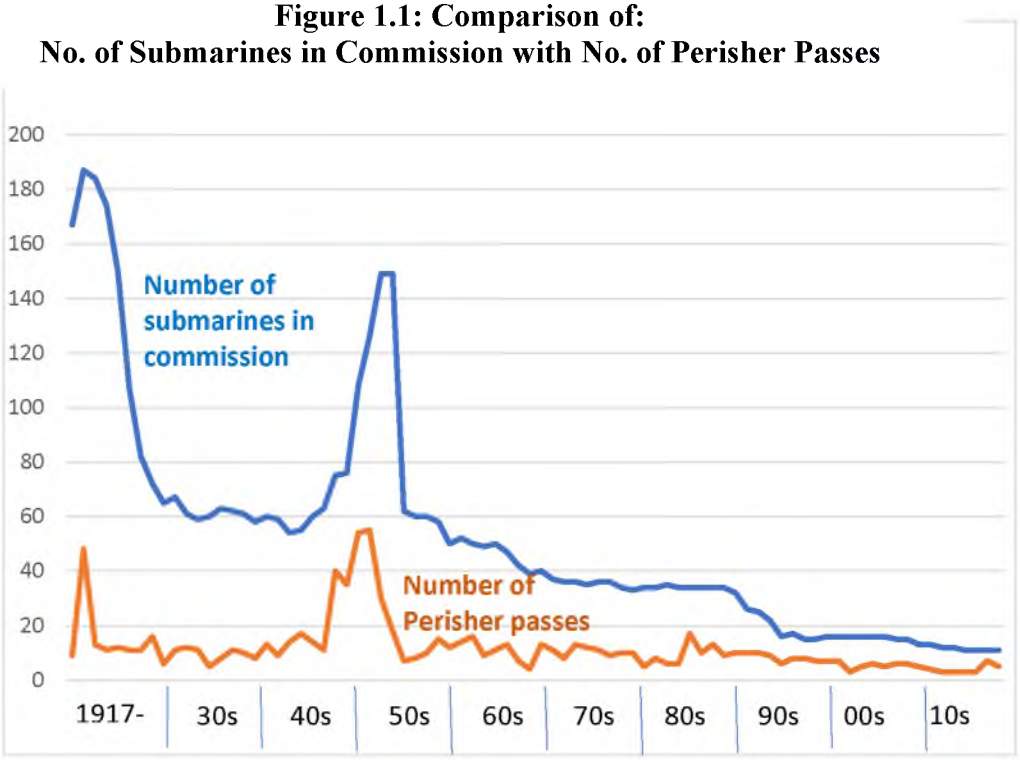
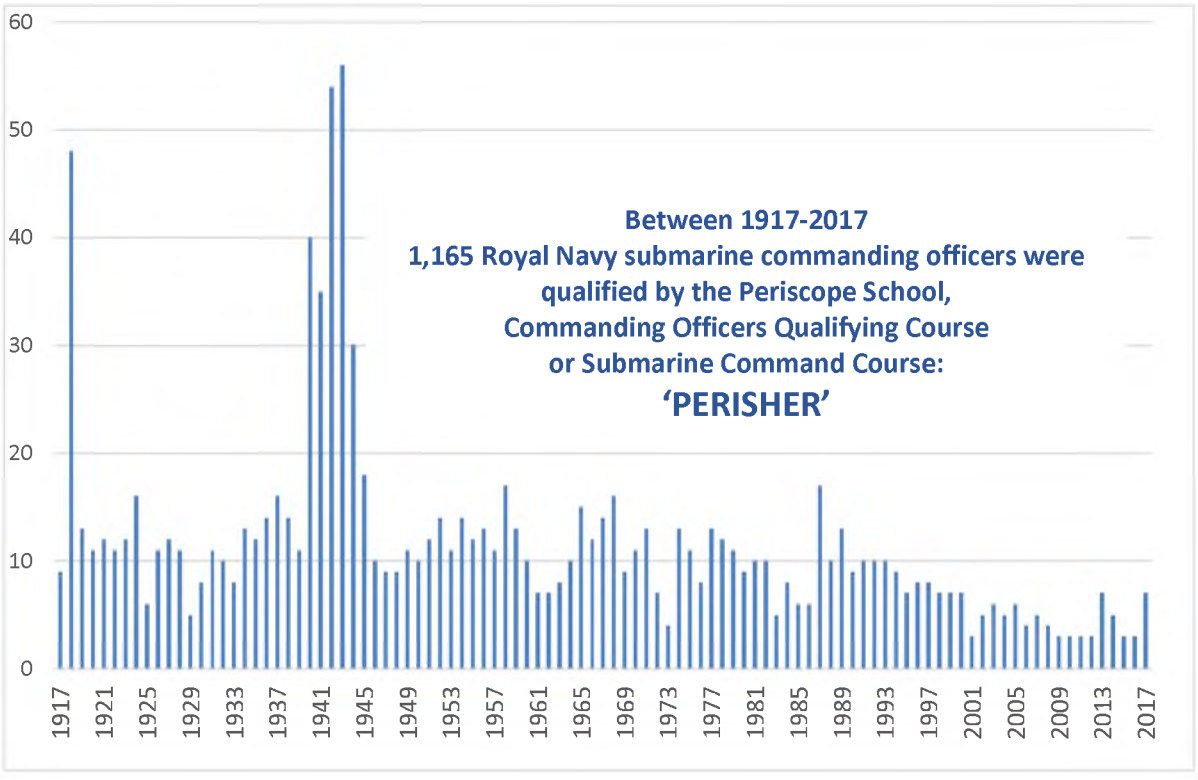


Figure 1.2: Numbers of Submarine Commanding Officers Qualified by Perisher



The answer is because between the wars the reserve flotillas had COs and submarine COs had to return to General Service (GS) for two years creating a requirement for more COs than operational boats, and after 1960 the introduction of the nuclear submarine brought an increased demand for submarine command qualified officers, two for each nuclear boat, and the growing number of shore-based staff jobs needing command experience.

The Aims of the Thesis

This thesis is unique in several ways. Its subject, Perisher, is a unique course that trains and assesses submarine commanding officers for their unique job. Other naval courses have been addressed elsewhere[16] but not Perisher, so even if the manner of the research is not unique its outcome is, it is the first time that the practice of a naval culture in a historical context has been linked so directly to the theory of social science, and it is the first time that submarine command has been analysed. It is not the first time that oral history has been used in similar research, but the quantity of that oral history is unparalleled, and the archives and literature have never been searched for Perisher material. Finally, the closeness of association between author and subject matter is again, probably unique, and certainly critical to its conclusion. The thesis cannot fail, therefore, to leave an original and unique record of a naval course that is at the epicentre of submarine culture and operational capability.

The criteria for assessment of an officer's capability have changed over time and, like the course itself, have evolved. The thesis plots and explores these changes to provide an understanding of how a submarine commanding officer is trained, shaped and assessed. It quantifies the mystique and international reputation for excellence that the course is accredited. Lambert suggests we: "*look beyond the unique genius of one man* [Nelson] *and see how mere mortals exercised leadership and command in the most complex and demanding of environments*".[17] His reference was to other Admirals and their battles, but the expression is equally applicable to the Submarine Service where the 'mere mortals' are submarine commanding officers, and 'the most complex and demanding of environments' is, of course, that of the submarine. That is what this thesis does, it is an analysis of a singular type of naval

[16] B. B. Scofield, *Navigation and Direction: The Story of HMS Dryad*, (London: Mason, 1977) for the Navigators; Edgar Dudley Webb, *HMS Vernon: A Short History from 1930 to 1955*, (Portsmouth: Wardroom Mess Committee, 1956) for the Torpedo and Anti-Submarine courses and Captain Barrie Kent, *Signal! A History of Signalling in the Royal Navy*, (Clanfield: Hyden House, 1993) for the Communicators.
[17] Andrew Lambert, *Admirals: The Naval Commanders Who Made Britain Great*, (London: Faber and Faber), xviii

commanding officer, it identifies how the submarine CO has been formed over the 100 years of Perisher. In naval historiography that is unusual. There is little written about what Hardy was doing while Nelson was signalling his Fleet, what Chatfield was doing while Beatty was swearing at his ships and what Cunningham's captains were doing as his aircraft stunned the Italians at Taranto. Perhaps the nearest we get to know is from the vivid pens of wartime COs. But we will know from this work why and how Horton, Holbrook, Wanklyn, Tomlinson, Linton, Fieldhouse, Woodward, Boyce and Wreford-Brown were successful.[18] As the thesis provides a unique record of Perisher, it also provides a benchmark and a challenge to future naval historians by suggesting opportunities to study naval culture in greater granularity, perhaps with the help of the social scientists. It throws down the gauntlet to study other commanding officers in other ships, their training, stresses, risks and decision-making rather than the Admirals and their strategic adventures that are the attraction of so many naval historians. If we are to understand naval command we cannot leave it with the Admirals, we need to know what it means to be in command of a ship. This thesis starts that process.

Literature Review

The development, operations and technology of submarines are well covered by British naval history. Training, less so, and Perisher, except for fleeting references, a few pages at the most, is absent. If this is true for the training of RN submarine COs, it is even worse for other navies. There are good reasons for this for Perisher is a unique naval course dealing with the abstruse and arcane subject of submarine command. If historians know about Perisher, they either fail to recognise its significance or consider it unworthy of study leaving a lacuna that presents difficulties producing any comparable study of Perisher literature and danger of appearing negative. Some examples from the principal histories and historians of the Royal Navy illustrate the fact. Arthur Marder dedicates just one chapter to submarines in his five volumes and then it is about the U-boat peril.[19] Stephen Roskill has six chapters about naval aviation and none about submarines.[20] In two general Royal Navy history books by Eric Grove, carriers dominate with only one chapter about submarines in the principal Cold War history, *Vanguard to Trident* — and this only a narrative of submarine development.[21] In *The Royal Navy since 1815,* he donates less than a page out of 50 pages in his post-1945 chapter to submarines,

[18] All submarine COs of different eras referred to in the thesis.
[19] Arthur J. Marder, Five Volumes, *From the Dreadnought to Scapa Flow*, (Annapolis: Naval Institute Press, 1965).
[20] Stephen Roskill, *Naval Policy Between the Wars Vol 1 & Vol 2*, (Seaforth: Barnsley, 1968).
[21] Eric J. Grove, *Vanguard to Trident*, (Annapolis MD: USNI, 1987).

despite the growing fleet of nuclear boats and their utility as the front line of the Cold War, the Falklands War, and the continuous deterrent.[22]

The submarine in Royal Navy history

Discussion of early British submarines draws on Reginald Bacon, Roger Keyes and Richard Compton-Hall complemented by Nicholas Lambert's work for the Naval Records Society's.[23] Although crafted at different times for different reasons, collectively they tell of the submarine's development during the pre-Periscope School era if not the conception of the School. The interesting part they play, however, is that they sometimes address the submarine CO: Bacon with his CO desiderata, Keyes' reflections on his COs, Compton-Hall's input from personal experience as a submarine CO, and Lambert's personnel-specific references.

The seminal source for interwar naval history and policy is Roskill who addresses submarines in the policy sense only.[24] Interwar developments, especially relating to the China-stationed Fourth Flotilla are mentioned by BB Schofield, Christopher Bell, Bryan Ranft's more technically biased collection, with contributions from Eric Grove, and James Goldrick on policy.[25] The PhD theses of Michael Dash and Devin Henry add to the background of the period, but both their focus and content neglect the submarine CO and exclude the Perisher.[26] The submarine discussion becomes even more sparse with Millett and Murray's trilogy on military effectiveness where submarines barely get a mention as if they did not participate in two world wars,[27] and Geoffrey Till allows just 12 lines plus one or two passing comments in a 28-page appraisal of the interwar years that is otherwise dominated by the capital ship and aircraft carrier/aircraft debate.[28] Farquharson-Roberts' coverage of Royal Naval officers in the

[22] Eric J. Grove, *The Royal Navy*, (London: Palgrove,2005).

[23] Admiral Sir Reginald Bacon, *From 1900 Onward*, (London: Hutchinson, 1940); Admiral of the Fleet Sir Roger Keyes, Volume 1, *The Narrow Seas to The Dardanelles 1910-1915*, (London: Butterworth, 1934-5); Richard Compton-Hall, *Submarine Boats: The beginnings of underwater warfare*, (London: Conway, 1983); Nicholas Lambert, (Ed), *The Submarine Service 1900-1918*, (Ashgate: Navy Records Society, 2001); Nicholas A Lambert, *Sir John Fisher's Naval Revolution*, (Columbia SC: University of South Carolina Press, 2002).

[24] Roskill, Naval Policy; BB Schofield, *British Sea Power: Naval Policy in the 20th Century*, (London: Batsford, 1967).

[25] Christopher M Bell, *The Royal Navy, Sea Power and Strategy Between the Wars*, (London: Macmillan, 2000); Bryan Ranft, (Ed), *Technical Change and British Naval Policy 1816-1939*, (London: Hodder and Stanton, 1977); Eric Grove, 'British Submarine Policy in the Inter-War, 1918-1939' in Edmonds, Martin (Ed), *100 Years of The Trade*, (Lancaster:, CDSS 2001); James Goldrick, 'Buying Time: British Submarine Capability in the Far East, 1919-1940', *Global War Studies* 11 (3) 2014.

[26] Michael Dash, *British submarine policy 1853-1918*, PhD thesis, King's College London, 1990; Devin Henry, *British Submarine Development and Policy 1918 – 1939*, PhD thesis, King's College London, undated.

[27] Allan R. Millett and Williamson Murray, *Military Effectiveness Vols I, 1I and III First World War, Interwar Period, Second World War*, (London: Allen & Unwin, 1988).

[28] Geoffrey Till, 'Retrenchment Rethinking Revival 1919-1939' in JR Hill (Ed), *The Oxford Illustrated History of the Royal Navy*, London, BCA, 199, 319-47.

interwar years is another good example of the submarine lacuna, if a surprising one. The book is an intensely detailed analysis of many facets in the life of naval officers between the two world wars, with one exception, the submariners who only get fleeting references. Even the brief three-paragraph section on 'The Submarine Service — The Trade (SM)' in his thesis from which the book was written has been deleted. This despite differences between the GS officer corps and the submariners, the obvious one being that, because of Perisher, submariners managed to fill all their commanding officer billets in the Second World War while GS struggled.[29]

Many submarine histories combine the technical and operational, interleaved by the occasional anecdote. Examples are William Jameson's coverage of the early submarine years, Alistair Mars' of the Second World War that has a few insights that surprise, and more recently Iain Ballantyne's of the Cold War.[30] Informative as these references may be, they view the submarine as an artefact. That the submarine's development, successes and failures are the product of the men who served in them, and notably their COs, is lost to these historians; training of the CO and Perisher is absent. Any real insight into the submarine CO of the period comes from George Menzies' diaries provided by his son, Gavin Menzies, himself an ex-CO.[31]

Any Perisher related substance comes from anecdotal memoirs of men of the time. For the First World War, there are C L Kerr, William Guy, John Graham Bower (otherwise Klaxon), and H G Stoker – all provide self-effacing, unpretentious but fascinating insights into early submarine command. They are accompanied and complemented by C G Brodie's, Naval Review articles and the coverage of specific campaigns with Mark Harris' early North Sea war, Victor Rudenno's detailed coverage of the Dardanelles/Sea of Marmara operations and for the Baltic, Roy Bainton's biography of Francis Cromie, Michael Wilson's well-researched story of the Baltic campaign and Leslie Ashmore's memoir, each contributing a different insightful snippet into CO selection and training.[32]

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[29] Michael Atholl Farquharson-Roberts, *To The Nadir And Back: The Executive Branch of the Royal Navy 1918-1939*, PhD Thesis, University of Exeter 2012.

[30] William Jameson, *The Most Formidable Thing*, (London: Hart-David,1965); Alistair Mars, *British Submarines at War 1939-1945*, (London: William Kimber,1971); Iain Ballantyne, *The Deadly Trade*, (London: Weidenfield &Nicolson, 2018.)

[31] Sadly Gavin Menzies died in May 2020. His father's diaries are now in the RNSM archive.

[32] Commander C L Kerr, *All in a Day's Work*, (London: Rich & Cowan, 1939); William Guy, *By Guess and by God*, (London: Hutchinson, 1930); Klaxon, (John Graham Bower), *Dead Reckoning*, (London: Rich & Cowan, 1933) and *The story of our submarines*, (Blackwood: London, 1919; Commander H G Stoker, *Straws in the Wind*, (London: Herbert Jenkins, 1925); SeaGee alias C G Brodie, 'Some Early Submariners', *Naval Review 1962-50-4, 1963-51-1 and 1963-51-2*; Mark Harris, *Harwich Submarines*, (Warwick: Helion, 2021); Victor Rudenno,

The lack of relevant interwar memoirs changes with the Second World War when some informative memoirs relate to the authors' Perisher experience. GWG Simpson provides one of the best, while Edward Young, the first Royal Navy Volunteer Reserve officer (RNVR) to command a submarine, and the Canadian, Frederick Sherwood, whose contribution is particularly relevant for he was one of only two people ever to re-take Perisher, make more than the average contribution. Mervyn Wingfield and Hugh Mackenzie, both also give glimpses while other authors, like Alistair Mars and Jim Allaway, the biographer of David Wanklyn of the *Upholder,* touch upon the course. The 'Bible' of Second World War submarine operations is Hezlet's comprehensive study, which provides a valuable cross-reference and a review of both the pre-war Perisher and the state of the submarine CO cadre. Without explanation, Hezlet never returns to the subject of Perisher despite its importance and barely acknowledges the submarines involved in Perisher training.[33]

Dominating the post-1945 literature is Peter Hennessy and James Jinks' seminal history of Cold War submarine operations that has the most extensive coverage of Perisher of all secondary sources. As good as its commentary is, however, it lacks analysis and granularity concerning Perisher. It draws on and is complemented by other sources like John Coote, who understates his participation in the Cold War and Sam Fry[34] with his dissenting voice towards Perisher, both interesting and informative autobiographies. The Hennessy-Jinks *opus magnum* misses out on Matthew Todd's privately published autobiography[35] given to the author by the 94-year-old whose views on his 1951 Perisher (and Alistair Mars) are illuminating. Sadly, he died not long after the interview. More recent literature tends to pay greater attention to Perisher reflecting the changes in both course and its status. Jim Ring supplies anecdotal insights on Perisher from the stories of five COs, Richard Woodman and Dan Conley take a contentious look at events and Iain Ballantyne has written informatively. Collectively they suggest Perisher has a different place in the experiences of post-1945 COs as the oral history confirms. [36]

Gallipoli, (New Haven, CT: Yale University, 2008); Bainton, *Honoured By*; Wilson, *Baltic Assignment*; Leslie H Ashmore, *Forgotten Flotilla*, (Portsmouth: Manuscript and Royal Navy Submarine Museum, 2001).

[33] George Simpson, *Periscope View*, (Barnsley: Seaforth, 1972); Edward Young, *One of Our Submarines*, (London: Rupert Hart-Davis, 1952); Frederick H Sherwood, *It's Not the Ships, (*Abbotsford BC, Lifewriters, 2014); Mervyn Wingfield, *Wingfield At War*, (Dunbeat: Whittles, 2012); Vice Admiral Sir Hugh Mackenzie, *Sword of Damocles*, (Stroud: Alan Sutton, 1995); Alistair Mars, *HMS Thule Intercepts*, (London: Elek Books, 1956); Alastair Mars, *Unbroken*, (London: Frederick Muller, 1953); Jim Allaway, *Hero of the Upholder*, (Shrewsbury: AirLife, 1991); Vice Admiral Sir Arthur Hezlet, *British and Allied Submarines Operations in World War II Volumes 1 and 2*, (Gosport: Royal Navy Submarine Museum, 2001).

[34] Hennessy & Jinks, *The Silent Deep*; Captain John Coote, *Submariner*, (London: Norton,1991); Sam Fry, *Fruitful Rewarding Years*, (Stanhope: The Memoir Club, 2006).

[35] Matthew Todd, *A Long Time Underwater*, (private memoirs, 2014).

[36] Jim Ring, *We Come Unseen*, (London: Faber, 2001); Dan Conley & Richard Woodman, *Cold War Command*, (Barnsley: Seaforth, 2014): Iain Ballantyne, *Hunter Killers*, (London: Orion, 2013).

Culture and Command

Central to the understanding of Perisher is where Perisher is positioned culturally and the nuances of submarine command. In these respects there is greater fortune with sources. Culture is first addressed; a concept that receives much attention from naval historians. Yet there is a paradox, great interest but an absence of explanation. Roger Barnett explains this condition in the sense that culture is a concept and those who think about naval matters are comfortable with concepts which being unbounded, enables flexibility. He exposes the dangers of definition: "*To define a concept is to kill it; to conceptualise a definition is to undermine its meaning and value*".[37] Examination of core naval historiography exemplifies this. Marder describes many attributes of naval culture but offers no definition.[38] Similarly, NAM Rodger, in a trilogy of texts rich in cultural information mentions just the "*culture of seamanship"* explicitly.[39] Other examples are Peter Hore, Marder again, Grove and Roskill, the latter a study in national and institutional culture without saying so.[40] Even Andrew Gordon's seminal text, *The Rules of the Game*, an exemplar of Victorian and Edwardian naval culture, avoids any discussion as to what culture is.[41] The situation is the same with the literature dealing specifically with submarines, (but not so U-boats).[42] Studies associated with submarines touch on cultural aspects but fail to address either culture, the submarine commanding officer or Perisher.[43]

Social science, though, provides useful tools. Starting at the national level is Slawomir Magala and Brendan McSweeney's use of Hofstede's model with concerns about the pseudo-scientific treatment of national culture. The work of Joseph Soeters, Donna J Winslow and Alise Weibull[44] provides an easy-to-understand analogy that enables tabulation of relevant

[37] Barnett, *Navy Strategic*, 9-21
[38] Marder, *From The Dreadnought*, passim.
[39] NAM Rodger, *The Command of the Ocean: a naval history of Britain 1649-1815*, (London: Penguin, 2004), *The Wooden World: an anatomy of the Georgian Navy*, (London: Fontana, 1988) and *The Safeguard of the Sea: a naval history of Britain*, (London: Harper Collins, 1997).
[40] Peter Hore, *The Habit of Victory: the story of the Royal Navy 1545-1945*, (London: Sidgwick & Jackson, 2005); Arthur J Marder, *From the Dardanelles to Oran* (Barnsley: Seaforth, 1974); Grove, *The Royal Navy*; Roskill, *Naval Policy*.
[41] Gordon, *The Rules*.
[42] Michael L Hadley, *Count Not The Dead*, (Montreal: McGillQueens, 1995), is a study of U-boat culture.
[43] Dash, *British submarine*; DJM Doull, *The Impact of Individual and Group Behaviour on the Performance of Submarines and the Associated Implications for Submarine Team Training*, MDA Dissertation: Cranfield University, 2008; Devin, *British Submarine*; Farquharson-Roberts, *To The Nadir*.
[44] Slawomir Magala, *Cross-culture Competence*, (Abingdon: Routledge, 2005); Brendan McSweeney, 'Hofstede's model of national culture differences and their consequences: A triumph of faith- a failure of analysis', *Human Relations 2002*; 55; 89; Joseph L Soeters Donna J Winslow and Alise Weibull, 'Military Culture', Guiseppe Caforio (Ed), *Handbook of the Sociology of the Military*, (Online: Springer, 2003).

organisational culture and in support is the oft-quoted in a military cultural context,[45] Edgar Schein and the commonsensical Stephen Linstead.[46] The sociological concept of subculture was forged by sociologists such as Donald Roy's autobiographic experiences, Alvin Gouldner and Barry Turner who first used the term 'industrial subculture'. Turner includes the importance of humour in culture, a common theme of both Linstead and Andrew St George in his review of naval leadership.[47] Two social scientists, Bierly and Spender, discuss a nuclear submarine as a high-reliability organisation in a cultural context but much of their article explains about life in a submarine so their audience can understand their thesis. While their vision of the military culture questionably includes the use of artefactual minutiae they make two important points for this thesis: the uniqueness of submarine culture and that organisational culture develops through learning.[48]

Finally, any discussion of submarine culture must include the recent submarine-culture-focused text of Duncan Redford[49] who explores submarine culture through a many-angled political, public and the arts analysis of what he identifies as a 'corporate culture'. But he readily admits that his book, (and thesis), is "*about how the British* [public] *understood submarines*".[50] This thesis, however, contributes to the understanding of naval culture through how submariners, and explicitly the submarine CO, understand submarines, so the differences limit Redford's work in relation to this study.

Secondly, 'command' is understood but nebulous and a search for clarification, definition and the meaning of command in a submarine context, ventures into both exciting and disappointing sources. The exciting places are the memoirs of wartime COs like CC Anderson's alleviation of horror with humour, Roger Hill's and Brian Laverty's reality of fear, Nicholas Montserrat's picturesque descriptions and the practicality of Bob Whinney and Peter

[45] For example: Victoria Nolan, *Military Leadership and the Evolution of the British Army's Approach to Small Wars*, PhD Thesis King's College London, undated and Eitan Shamir, *Military Culture and Mission Command (Auftragstaktik) A Case of Adoption and Adaption*, PhD Thesis, King's College London, 2008.
[46] Edgar H. Schein, *Organizational Culture and Leadership* (San Francisco: Jossey-Bass, 2004); Stephen Linstead and Robert Grafton-Small, 'On Reading Organizational Culture', *Organization Studies* 1992 13/3.
[47] Donald F. Roy, 'Banana Time: Job Satisfaction and Informal Interaction', *Human Organization.18/4*; Alvin Gouldner, *Wildcat Strike*, (New York: Harper, 1965); Barry H Turner, *Exploring the Industrial Subculture*, (London: Macmillan, 1971); Linstead, 'Jokers Wild: The Importance of Humour in the Maintenance of organizational Culture', *Sociological Review 33/4, 741-767*; Andrew St George, *Royal Navy Way of Leadership*, (London: Penguin Random House, 2012) and 'Leadership lessons from the Royal Navy', *McKinsey Quarterly* January 2013
[48] Paul E Bierly and J C Spender, 'Culture and High Reliability Organizations: The Case of the Nuclear Submarine', *Journal of Management* 1995 Vol. 21 No. 4, 639-656.
[49] Duncan Redford, *The Submarine: A Cultural History from the Great War to Nuclear Combat*, (London: Tauris, 2010) and his thesis *The Cultural Impact of Submarines on Britain 1900-1977*, PhD thesis, King's College, London, 2006.
[50] Redford, *The Submarine*, xv.

Gretton relating their escort duties,[51] complemented by the personal reminiscences of Jeremy Larken and Peter Dingemans, COs respectively of the Landing Ships *Fearless* and *Intrepid* during the Falklands War.[52] These are surface ship COs, (Larken was a submariner commanding a surface ship), so while their testimony is relevant, it is to the memoirs of the submarine COs that we turn to get an idea of Perisher and some factual details,[53] albeit brief, but they sadly do not match the eloquence of their surface ship peers when talking about command. (Mars must be treated with slight caution based on the evidence of Matthew Todd who was his navigator in the *Thule*. According to Todd, Mars gets facts wrong and embellishes others for dramatic effect – he wanted to sell his books). American submariners fare no better. Herbert Mandel's memoir, despite his title embracing both submarines and command, is little more than an interesting autobiography missing any characteristics of command and James Stavridis and William Mack provide some well-researched references on command in their first chapter useful for the command attributes table in Chapter Two, but thereafter their book is a CO's Handbook rather like that of Rory O'Conor from an earlier time. Sadly, the effervescent Eugene Fluckey denies us self-reflection in his submarine command narrative.[54]

Ideas on command can be drawn from John Keegan,[55] who provides a framework extracted for the command attributes table, recognised and embellished in Ryan Ramsey's unpublished paper[56] when he was Teacher. Martin Van Creveld looks at command from the systems and organisational aspect which is useful for the General or Admiral but not the submarine CO,[57] while Gordon examines such matters but of an earlier era.[58] An excellent treatise on the practice of command is from the experienced General Rupert Smith, who scythes through the command

[51] Rear Admiral CC Anderson, *Seagulls in my Belfry*, (Bishop Auckland; Pentland Press, 1997); Roger Hill, DSO DSC, *Destroyer Captain*, (Penzance: Periscope, 1975); Brian Laverty, *In Which They Served*,(London: Conway,2008); Nicholas Monsarrat, *Monsarrat at Sea*, (London: Cassell, 1975); Bob Whinney, *The U-Boat Peril; An Anti-Submarine Commander's War*, (London: Blandford, 1986); Peter Gretton, *Convoy Escort Commander*, (London: Cassell, 1964).

[52] Jeremy Larken, *The Falklands Campaign – personal reflections*, confidential private papers; Captain Peter Dingemans, 'Leadership in the Falklands Campaign', *Naval Review* 1983-71-2.

[53] Ben Bryant, *Submarine Command*, (London: William Kimber, 1958); William King, *The Stick and the Stars*, (London: Hutchinson, 1958; Alistair Mars, *HMS Thule Intercepts*, (London: Elek Books, 1956), *Unbroken*, (London: Frederick Muller, 1953); Hugh Mackenzie, *Sword of Damocles*, (Stroud: Alan Sutton, 1995); Ian McGeoch, *An Affair of Chances*, (London: Imperial War Museum, 1991); Frederick Sherwood, *It's Not the Ships, (*Abbotsford BC: Lifewriters, 2014); George Simpson, *Periscope View*, (Barnsley: Seaforth, 1972).

[54] Captain Herbert I. Mandel, *Submarine Captain and Command at Sea*, (Naples FL: Collage, 2005); Captain James Stavridis and Vice Admiral William P Mack, *Command at Sea*, (Annapolis ML: Naval Institute Press, 1999); Captain Rory O'Conor, *Running a Big Ship*, (Oxford: Casemate, 2017); Admiral Eugene B Fluckey, *Thunder Below*, (Urbana: University of Illinois, 1992).

[55] John Keegan, *The Mask Of Command a study of generalship*, (London: Pimlico, 2004).

[56] Ryan Ramsey, *A Guide to Submarine Command*, unpublished paper.

[57] Martin Van Creveld, *Command in War*, (Cambridge MA: Harvard University Press, 1985).

[58] Gordon, *The Rules.*

prolix to provide an insightful appreciation again extracted for the command attributes table.[59] Robert Davison ignores the submarine story and therefore, sadly, the conception of the Periscope School, anyway, he finishes his analysis almost at the same time the Perisher starts[60] whereas Mike Farquharsen-Roberts takes up his analysis at about the same time as Davison stops. Farquharson-Roberts is keen on examinations for destroyer command but surprisingly for such a thorough book ignores Perisher which, over the period he covers, qualified 285 submarine commanding officers.[61] Anthony King's more recent exploration of command produces a tendentious thesis of military command morphing to mirror the commercial world.[62] He takes a brief look at naval command to benchmark his generalship argument but alas it is all too brief, and he omits the submarine which may have provided him with a different view.

The thesis explores the relationship between command and leadership, [63] a more familiar subject especially well-served by the work of St George's leadership studies supported by oral evidence all who contribute to an understanding of the maxim 'leadership can live without command, but command cannot live without leadership'[64] from which the section gets its title: 'Command and Leadership, twins but not identical'. Yet another aspect of submarine command is the modern term 'mission command' (formerly 'independent ship'). To explore and explain this aspect of submarine command the thesis visits formal US and NATO documents in a bid for a definition and looks to eminent historians for a naval explanation[65] which only really comes from a practical Royal Navy information booklet.[66]

Technology and Innovation

The third subject addressed is innovation, in which respect the submarine is the epitome of continual technical innovation whose assimilation is inevitably the responsibility of the CO and hence a theme of this thesis. This phenomenon needs explanation and for this, a start is

[59] Rupert Smith, *The Utility of Force, The Art of War in the Modern World*, (London: Allen Lane, 2005).
[60] Robert L Davison, *The Challenges of Command*, (London: Routledge, 2011).
[61] Farquharsen-Roberts, *Royal Naval*.
[62] Anthony King, *Command The Twenty-First-Century General*, (Cambridge: Cambridge University, 2019),
[63] Michael Stephen Young, Vic Dulewicz, ·*Command, Leadership and Management Competencies, Predicting Superior Performance in the Royal Navy*, (Henley: Henley Management College, 2003); Helen Doe and Richard Harding (Eds), *Naval leadership and Management, 1650-1950*, (Woodridge: Brydell Press,2012); Mike Young, 'A model of command, leadership and management competency in the British Royal Navy', *Leadership & Organisation Development Journal* April 2005.
[64] Fort Blockhouse Forum.
[65] Keegan, *The Mask*; Lambert, *Nelson*; Mandel, *Submarine Command*; Matthias Strohn, *The German Army and the Defence of the Reich*, (Cambridge: Cambridge University Press, 2011); MoD Joint Doctrine Publication 0-0.1, UK Terminology Supplement to NATO Terms, 2019 Edition A; Edward A Smith, 'Network-Centric Warfare', *Naval War College Review*, 54/1, 2001; Norman Friedman, *Network-centric Warfare*, (Annapolis MD: Naval Institute Press, 2009); 'Carneades', 'The Death of Mission Command', *Naval Review* 2007-95-3.
[66] Royal Navy Mission Command booklet, *A View from the Fleet Battlestaff*, undated but between 2002-05.

Barry Posen who contends that new technology is grafted on to old doctrines. In the context of submarines, this may be so with the evolutionary development of sensors like the periscope but it is untrue with advanced technologies like the towed array that enabled new doctrines to be developed from within the Submarine Service. Surprisingly, even though Posen's focus is the military, he makes no mention of the U-boat campaigns or anti-submarine campaigns, two of the most innovative campaigns in both world wars.[67] Stephen Rosen similarly disregards submarine innovation for, like Williamson Murray and Allen Millett he prefers air defence and aircraft carriers.[68] Thomas Hone, Mark Mandeles and Norman Friedman are too focused on the carrier as a vessel to explore wider naval innovation even though Friedman, who has written extensively about submarines, must have been aware of submarine analogies.[69] Richard Harding tries to alleviate the issue by unusually including a chapter on the fast submarine 1945-1954, a short, and unsuccessful period in the history of submarines.[70] The nexus between culture and technical innovation is introduced through the work of John Kuehn,[71] but technical details are the subject of specialist literature and specialist historians who provide much excellent detail, dates, capabilities, frequencies, positions etc but fail to include the human element; the submarine artefact again. Karl Lautenschläger is an exemplar when he says, "*between 1913 and 1943 saw little significant development in new applications of technology or in new capabilities,"* forgetting the innovations in design, periscopes, command tools, plotting tables, torpedoes, asdics and not least radar. At least he concedes*, "The one new development was in the advent of acoustics.*"[72] Neither type of historian bothers with the assimilation and integration of technologies in submarines so how do they think submarines succeeded? Holger H. Herwig is a good example. While his article is dedicated to innovation and submarines, any discussion of training in, or assimilation of, innovation by submariners is absent.[73] Maybe submarine innovation is just too arcane, too difficult and the person charged with assimilation is the submarine CO about whom they know little.

[67] Barry R. Posen, *The Sources of Military Doctrine*, (Cornell NY, Cornell University press, 1986), 54-8.
[68] Stephen Peter Rosen, 'Understanding Military Innovation', *International Security* 13/1, 134-168; Williamson R. Murray and Allan R. Millett, *Military Innovation in the Interwar Period*, (Cambridge: Cambridge University Press, 1996).
[69] Thomas Hone, Norman Friedman, and Mark David Mandeles, *Innovation in Carrier Aviation*, (Annapolis ML: Naval War College Press, 2011).
[70] Richard Harding, *The Royal Navy, 1930-2000 Innovation and Defence*, (London: Frank Cass, 2005).
[71] John T Kuehn, *Agents of Innovation*, (Annapolis MD: Naval Institute Press, 2013).
[72] Karl Lautenschläger, 'The Submarine in Naval Warfare, 1901-2001', *International Security*, 11/3, 122.
[73] Holger H. Herwig, 'Innovation Ignored: The submarine problem', in Murray and Millett (Eds), *Military Innovation*, 227-64.

While Ackermann's *Encyclopaedia* provides the best record of the dates of British submarines,[74] and Friedman provides exhaustive detail in three voluminous submarine books,[75] many of the technologies have a lead publication: John Merrill, complemented by the RNSM's BR 3053 'Periscopes' provides a history of the submarine periscope, although the detail and nuances of the British innovations are missing;[76] Roger Branfill-Cook covers torpedoes stopping, however, at the Mark 8 first introduced in 1927, but fortunately the TNA and oral history supplement for later weapons;[77] Willem Hackmann's history of asdic/sonar stops at the pre-nuclear stage but again the TNA and oral history fill the lacuna;[78] F A Kingsley's (Ed) technical treatise on radar,[79] is supported by RNSM files while John Wise provides the only authoritative appreciation of electronic support measures.[80] Lastly, providing additional material is Compton-Hall's coverage of the Second World War submarine.[81]

Perisher on TV

The contrast between naval historiography and the lack of interest in Perisher contrasts starkly with its depiction on television which has twice been attracted to the subject and consequently brought Perisher to the public's attention. The first television programme from a submarine at sea was in 1956 with Alan Wicker narrating from the *Talent* where the CO was a forthright character, and in responding to Wicker it was probably the first time the 'f-word' had been heard on TV.[82] Since then, submarines have made many cameo appearances for a variety of reasons in many contexts. The Perisher, however, has received special attention, the first time in 1984 when BBC television produced a six-part documentary called *Million Pound Captains*. The senior Teacher, Dai Evans, became a television 'star' being recognised in restaurants like a TV celebrity.[83] A second four-part series *How to Command a Nuclear Submarine* with Jim Perks as Teacher was made in 2008. Together, they provide an informative visual record of Perisher with much of the emotion, pressure and stress evident. This thesis provides the detail.

[74] Paul Ackermann, *Encyclopaedia of,* passim.
[75] Norman Friedman, *Submarine Design and development,* (Annapolis MD: Naval Institute Press, 1984), *British Submarines in Two World Wars, (*Barnsley: Seaforth, 2019), and *Naval Radar*, (London: Conway, 1981), *British Submarines in the Cold War Era*, (Barnsley: Seaforth, 2020).
[76] John Merrill, *Looking Around: A Short history of submarine periscopes*, (Bushey Heath: Strong, 2002).
[77] Roger Branfill-Cook, *Torpedo,* (Barnsley: Seaforth, 2014).
[78] Willem Hackmann, *Seek and Strike: sonar, anti-submarine warfare and the Royal Navy 1914-54,* (London: HMSO, 1984).
[79] F A Kingsley, *Radar the Developments of Equipments for the Royal Navy 1935-45,* (Basingstoke: MacMillan, 1995).
[80] John C. Wise, *The Navy is Listening Volumes 1 and 2,* (Gosport: Beta Print,2020).
[81] Compton-Hall, *Underwater War*; (Penzance: Periscope,1989). For the nuances see David Parry, '*Histories'* at Barrow Submariners http://msubs.co.uk/.
[82] Chris Belton interview October 2019.
[83] Jock McLees interview March 2019.

Methodology

The main part of the study is based on the traditional mix of primary and secondary literature with archival materials being searched exclusively for Perisher information for the first time. For the period 1901-1945, the principal archives have been the National Archives, Kew (TNA) and the Royal Navy Submarine Museum (RNSM); the TNA's First World War ADM 139 series being an example. Most important is how these archival records were often used as a signpost to further research. Three examples serve to illustrate the point, the first from RNSM A 1945/4 Section V known as 'Growler's Book',[84] where a heretofore unknown revelation that Perisher ran from Fowey linked to Wingfield's autobiography which in turn led to the local Fowey historians' surprise. RNSM A 1945/32 is a collection of Perisher course records that, when analysed, provide much information and the occasional surprise such as James Barwood's pass following an earlier failure. Comparative analysis of the RNSM, Australian and Barrow Submariners records identified that Barwood was qualified after a Requalifying Course (CORQC). He was the first of only two ever to have taken a Perisher course twice. Another name, John Harvey, appears in the CORQC of 1939 without apparently passing an earlier Perisher. Harvey went on to sink an Italian destroyer and command throughout the war but received no awards, a mystery resolved only after further RNSM and TNA searches, Hugh Mackenzie's memoirs, Matthew Todd's recall at interview of 'Ginger' Harvey and finally Harvey's daughter's revelation of a human story more appropriate for the dinner table than the pages of this study.

Other archives have proved useful to varying degrees: University of Glasgow; Churchill College, Cambridge; HMS Collingwood Heritage Centre; and the obscure Redbridge Museum. From 1945, the archival material reduces considerably. In the first instance because it simply was not produced, for example, there is no post-1945 equivalent of RNSM A 1945/22 which relates the 1939-1945 Perisher in some detail, and the Teachers' turnover notes, RNSM A 2014/016, started in 1968, fell into disuse. At the same time, what Perisher individual course notes, written by the Teachers, that do survive refer to papers and studies that disappeared when the Navy digitised its Registries in the 1990s and what should have been available was sent to archive in Swadlincote. There, it is preserved under a commercial contract and the best

[84] RNSM A 1945/4 Growler' Book. Growler's book describes much of what happened administratively during the Second World War but who Growler was is unclear. Two names predominate as candidates: Commander John Mitford, Drafting Officer at Dolphin throughout the war; and Commander Evelyn Felton, who appears to have finished RNSM A 1945/4 but pays tribute to 'Growler'.

endeavours of the Navy have failed to find any relevant files giving birth to the supposition that they may have been weeded and/or destroyed.

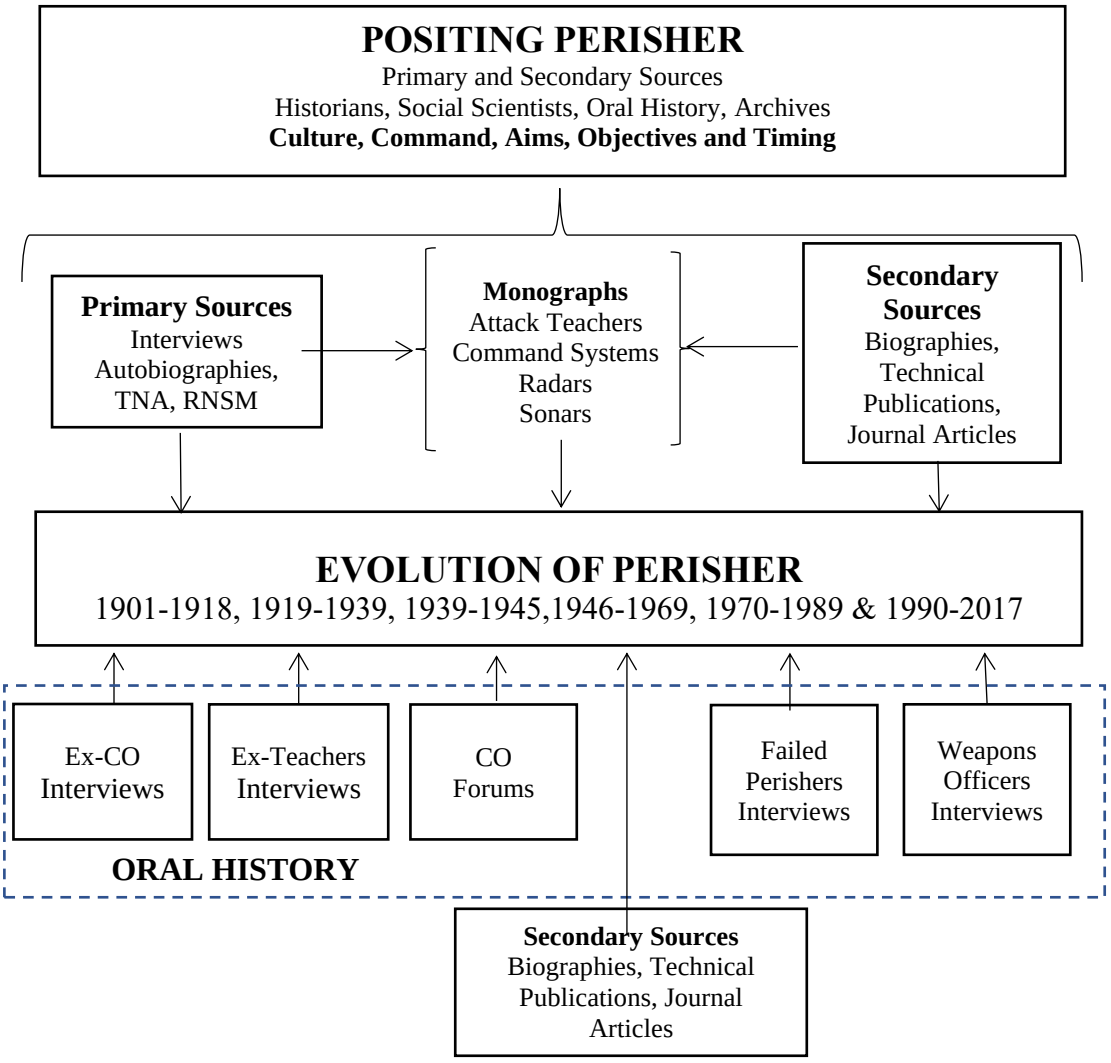
The primary contribution to the history of the post-1945 period is, therefore, by default, oral history from which the thesis draws heavily while cognisance of the practices and ethical principles of the Oral History Society,[85] the experience and warnings of others and especially the limitations of memory failure or influence.[86] With the consistency of the interviews, however, concerns were exiguous. Fortunately, many Teachers and COs, going back to the late 1940s are (or were) still alive so limited archival material has been supplemented by oral history, the extent of which far exceeds any other known naval history study. Of the 157 people who have contributed to this research, 117 provided oral history through interviews or attendance at Forums. They include the 99-year-old Captain 'Tubby' Crawford, (First Lieutenant to David Wanklyn VC in the *Upholder* and later the Malta-based CO of the *Unseen*), 94-year-old Lieutenant Commander Matthew Todd,[87] the spirited 92-year-old Rear Admiral Tony Whetstone, Admiral of the Fleet the Lord Boyce, four Admirals, four Vice Admirals, 15 Rear Admirals, 16 Commodores, 29 Captains and 29 Commanders/Lieutenant Commanders. Of the 36 available Teachers, 29 (80%), have been interviewed with 32 submarine COs attending Forums in Devonport, Gosport, London, Faslane and on a telecon Forum with Australia. Other interviews and input have included: submariners, Royal Marine and Army officers, psychiatrists, commercial pilots, scientists and a wide correspondence from Australia, Canada, Italy, Netherlands, Norway, Pakistan, Portugal and Russia.

Perisher is an arcane subject that enables its votaries to hold others in a trap of opaque mystique — if you have not experienced it, you cannot understand it. Penetration demands the duopoly of experience and training and that is where the author's background has been so advantageous and unique. Having completed Perisher in 1978 and subsequently commanded submarines, dues have been paid to the club. This brought easy access and instant rapport to the Perisher alumni so that jargon, nuance and acronym needed neither introduction nor explanation although caution and care had to be employed so that personal experience and opinion did not intrude on objectivity. The pleasant downside was the occasional seduction for the interviewee to go 'off-piste' with a warm reward that so many interviewees found their interviews pleasurable, often cathartic. It has been a privilege to interview nonagenarians and

[85] A specialist Oral History Society interview course was attended.
[86] Paul Thompson, *The Voices of the Past: Oral History*, (Oxford: OUP, 2000), 3rd Edition; Laura Rowe, *At The Sign of the Foul Anchor, Discipline and Morale in the Royal Navy during the First World War*, PhD thesis King's College London, 2008, Appendix III.
[87] Both Crawford and Todd have sadly both subsequently died.

Perisher students alike, their witness has been essential to post-1945 history. Regrettably, due to a lack of resources, recordings and transcripts cannot be archived and will be deleted. Interviewees were informed of this and offered copies.

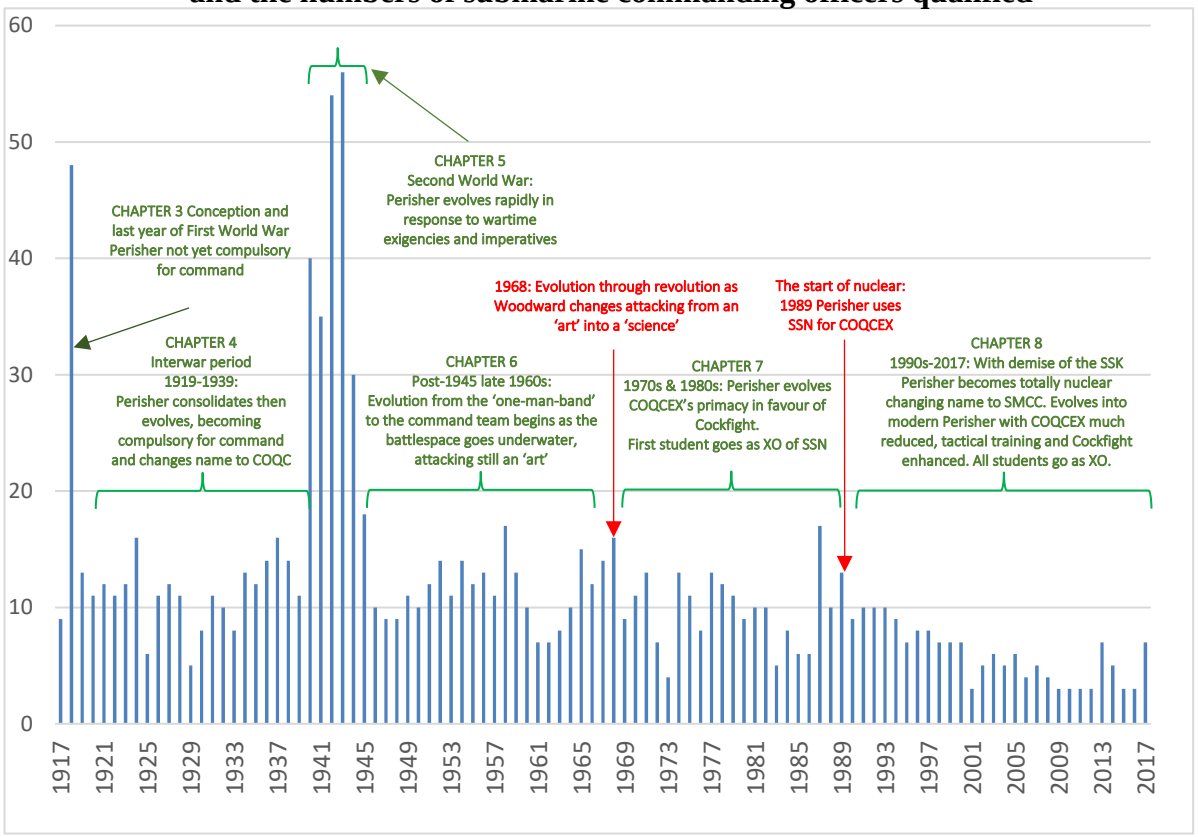
Figure 1.3: The Research Methodology



Before embarking on the main part of the study, and for the understanding of that study, it has been necessary to position Perisher in four ways: where Perisher sits in the wider cultural hierarchy to clarify the influences by drawing on social science concepts, uncommon in historical works; making source comparisons to clarify what submarine 'command' means, and lay bare the nuances; drawing on oral history for its aims and objectives; and use of both archive and oral history to determine where Perisher sits within the submarine officer's career. These aspects are all covered in Chapter Two, Positing Perisher.

Following its conception, the history and the evolution of Perisher are in five recognisable periods shown in Figure 1.4 each covered by a chapter that relates the changes, innovation, and organisation to show how Perisher adapts to meet the needs of the Submarine Service.

Figure 1.4: Perisher's Evolutionary Periods and the numbers of submarine commanding officers qualified



Chapters Three, Four and Five cover the history from the antecedents to the Periscope School to the end of the Second World War. Chapter Three is vital to understanding how the submarine CO was initially shaped, the influence of technology, and then why the Periscope School was conceived. Whereas Chapter Four covers the interwar period relating the dispiriting effect of the Geddes Axe (today's peace dividend) followed by a sorrowful submarine building programme, confused policy, training and employment, but at the same time Perisher's evolution into permanence and a prerequisite for command becoming the COQC. Then Chapter Five covers how Perisher responded and evolved during the Second World War, how its expansive and rapid evolution met the imperatives of this intense period of history.

Chapters Six, Seven and Eight cover the post-war, Cold War and post-Cold War periods. Post-war period difficulties are followed by the introduction of new diesel submarines and the first nuclear submarine HMS *Dreadnought*. Perisher's landmark 'evolution through revolution' comes in 1968 followed by the decades 1970s-1980s and the start of the evolution from an

attacking course to a tactical course that brought with it a shift in student assessment and the first nuclear Perisher boat in 1989. The chapter makes a diversion from the Perisher narrative to explore and explain the assessment criteria. The post-Cold War evolution from an SSK-based Perisher to a full nuclear Perisher and the consequential departure of non-RN students is in Chapter Eight. It was during this time that Perisher suffered its worst event with the sinking of the fishing vessel *Antares* but then began a steady evolution of curriculum to become the modern Perisher of 2017.

Finally, Chapter Nine collates, reviews and summarises providing a broader analysis but finer assessment.

Minutiae

The use of acronyms

It is axiomatic that a profession or specialised subject will develop cryptic references, neologism-based language and acronyms. The Navy is a major miscreant in this regard and my sympathies and apologies for their necessary use.

Submarine Numbers

Numbers provide quantification. Officer numbers are from the best source cited. Submarine numbers vary often because of differences in how to count reserves. Even the Navy List is inconsistent in this regard. The only source to quantify every boat's full life is Ackermann who is therefore used here.[88]

Names and Ranks

Names and ranks are sensitive issues. In a study of this nature, with word limitations, the constant repeating of ranks would have a debilitating effect. Rank is therefore only quoted to make a point, and once introduced by first and surname, the former is then dropped.

Language

Language construct complies with Submarine Service convention. For example, when it is appropriate to say 'submarine' or 'boat'.

[88] Ackermann, *Encyclopaedia*.

2. Positing Perisher

Perisher is central to the Submarine Service, a vital organ of submarine culture that is itself part of the wider Royal Navy culture, a nebulous concept with some flagstaff rallying points like the Britannia Royal Naval College's main entrance "*It is on the Navy, under the providence of God, that our wealth, prosperity and peace depend*" or Admiral Andrew Cunningham's inspirational "*It takes the Navy three years to build a ship. It will take three hundred years to build a new tradition."*[1] How can scholarship account for such power of emotion?

Equally powerful, Perisher has been described as, "*the beating heart of the Submarine Service,"*[2] and the *"centre of gravity.*"[3] Its uniqueness is a major contributor to a 'private navy' subculture, developed before the First World War and continued in part ever since, a culture that has endowed the Submarine Service with an independence that enabled it to be seen as being "*professional in a manner like no other part of the Navy*".[4] Perisher teaches and assesses to ensure that the submarine CO will meet the unique demands of his position:

> *"Command of a submarine is special in the best of times and outright out of this world at the worst of times. … His reason for being is to solve things on his own without the consultation options other commanders have …"*[5]

It is a Perisher's alumni maxim that 'to know Perisher you need to do Perisher'. That understanding of the nuances, and how Perisher evolved to meet contemporary needs and imperatives is the substance of this thesis. The nexus between submarine culture and command is explored here:

> *"The military leader… does not command just as he or she pleases, nor simply by the demands of the immediate strategic circumstances, but instead according to well established ideas, norms, and values inherited from the past that characterise the organisation within which he leads".*[6]

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[1] Winston Churchill, *The Second World War Volume III, "The Grand Alliance*", (London: Houghton Miffin, 1948), 265.
[2] Andy Bower interview May 2020.
[3] Hardern Report, XSM Officer Cadre Manning Review, dated 31 March 2009, Section 4, Part 4, Paragraph 51.
[4] Roskill, *Naval Policy Vol 1* 536-7; Whinney, *U-Boat Peril*, 42.
[5] Email De Groot.
[6] Jeffrey W Legro, 'The Culture and Command Conundrum, in Culture and Command Strategic Policy Studies 3' *Proceedings of the Conferences held at Britannia Royal Naval College September 1998*, (Exeter: Exeter University, 2000), 11.

The first part of the chapter posits Perisher's cultural lineage by drawing from social science to explain how Perisher is the central generator and preserver of Submarine Service culture. But command, like culture, is a nebulous attribute so the second part of the chapter brings form and definition to submarine command. Finally, we need to know what Perisher sets out to achieve but Perisher's aims and objectives were never documented over the 100 years. That task is accomplished here.

Perisher's Cultural Lineage

Clarifying naval culture

Culture, in the military context, is complex[7] and too often ill-defined but a light touch on the tiller of social science provides some foundation to its explanation in the naval and specifically the submarine context

Why is this important? First, because cultures can be treated in a pseudo-scientific way[8] and may be treated as the source rather than a carrier of values. Linstead uses the metaphor of the Scottish tartan, invented by a Lancastrian to sell more cloth but now recognised as *the* national artefact. Secondly, the submariner comes from, and returns to, the wider Navy through promotion or failure, and non-operational aspects of the submarine officer's life are shaped by naval culture, most especially his terms of service. The naval and submarine cultures therefore interact and like all military cultures, are subject to change.[9] Third, the submarine is the embodiment of technological innovation, "*like a carefully machined weapon*",[10] where sensors, ship's systems and propulsion unite. Organisational culture or determinism will invariably assimilate technological innovation — and occasionally reject it.[11] Whichever, technological assimilation is an intrinsic part of the submarine CO's life, examples being the periscope and sonar. The imperative for stealth, however, initially rejected radar. Lastly, understanding culture at the level of Perisher is about junior officers, not navies, fleets or admirals; it is about submariners and how the Submarine Service evolved its own culture with Perisher as its embodiment and part of its DNA. Much has been written about the submarine's operational participation in the Royal Navy's order of battle and it is not the intention here to go over well-trodden ground, for, by the time the Periscope School was introduced, British submarines had

[7] Williamson Murray, 'Does Military Culture Matter?', *Orbis* 43/1, 27-42.
[8] McSweeney, 'Hofstede's Model', 89-118.
[9] Murray, 'Does Military', 27-42.
[10] John Reeve and David Stevens (Eds), *The Face of Naval Battle*, (Crows Nest NSW Australia: Allen & Unwin, 2013), 192.
[11] Redford, '*The Cultural'*, 13; Terry Terriff, 'Warrior and Innovator: Military Change and Organizational Culture in the US Marine Corps', *Defence Studies* 6:2, 219.

seen action in many theatres so that by the end of the First World War, the submarine culture and the character of the submarine commanding officer had been formed.

For a clear definition of what a culture is, we need to draw from social science and Redford's 'corporate culture' is a good introduction.[12] A useful definition of 'corporate culture' by Linstead is "*devised by management and transmitted, marketed sold or imposed on the rest of the organisation*".[13] Another social scientist, Schein, echoes Linstead: "… *cultures begin with leaders who impose their own values and assumptions on a group*".[14] The common use of the word 'impose' is not what Redford had in mind but it is just what the first ICS, Captain Reginald Bacon, did when he imposed an ethos on the embryonic Submarine Service. Redford is right in the sense that there is a 'corporate culture' of submarines when viewed in a commercial-corporate sense and Caforio identifies a place for a corporate culture within the military when it is within the bureaucracy of a headquarters[15] — "*Command centres quickly adopt personalities*",[16] military headquarters are "*machines for command*".[17] But its extension to other military organisations requires caution, especially within the context of submarines. The submarine CO and his command team striving to conduct an attack from within the confines of a submarine's Control Room is a different context to Redford's historical submarine symbolism and one that deserves a more appropriate definition.[18]

Bacon's imposed precepts endured in the sustained storytelling of the Navy,[19] what Andrew St George labels 'Keep spinning dits', ('dit' is naval slang for anecdote), which he identifies as how the Navy maintains its collective memory, through storytelling, supported by a formal memory of artefacts.[20] In this way, the Submarine Service fulfilled Schein's criteria for an organisational culture to evolve,[21] and as it forged its own identity as an organically-developed, organisational culture, it met with Linstead's definition: "*the culture which grows or emerges within the organisation and which emphasises the creativity of organisational members as*

[12] Redford, *The Submarine*, passim.
[13] Stephen Linstead and Robert Grafton-Small, 'On Reading Organizational Culture', *Organization Studies* 1992 13/3, 333.
[14] Schein, *Organizational Culture*, 225. Schein is also used extensively in a military context e.g. Nolan, '*Military Leadership'* and Shamir, '*Military Culture'*.
[15] Giuseppe Caforio (Ed), *Handbook of the Sociology of the Military*, (Online: Springer, 2003), 246.
[16] Larken, 'Falklands Campaign'.
[17] King, *Command The*, x.
[18] Redford, *The Submarine*, 19-55. Redford dedicates 35 pages to Fleet Reviews but he fails to address the seamanship and nuclear safety aspects. Michael Lewis, *Spithead*, (London: George Allen, 1972), 176, commits nuclear submarines to the sidelines at the 1969 fleet review.
[19] David M. Boje, *Storytelling Organizations*, (London: SAGE, 2008).
[20] Andrew St George, 'Leadership lessons from the Royal Navy', *McKinsey Quarterly* January 2013
[21] Edgar H Schein, 'What You Need to Know About Organizational Culture', *Training and Development Journal*, January 1986, 30-33. His requirements are: history; stability, shared problems; embracing invention, discovering, developing and learned lessons taught to new members.

culture makers, [the COs?] *perhaps resisting or ironically evaluating the dominant culture*."[22] (The last phrase may well explain the unknown: why the Submarine Service was given the derogatory moniker 'The Trade' in its early days). The Navy irrefutably conceived the Submarine Service granting the unquestionable right to its own organisational culture although it may be, as Kier says, "*difficult to assess, since it* [organisational culture] *depends on nods, winks, and general attitudes long past*."[23] This much is obvious, but it means that the Submarine Service has an organisational subculture, (a most unfortunate but necessary pun), rather than a corporate culture. There are, of course, other subcultures within the Navy and the most obvious parallel to the Submarine Service may be the similarly newly formed Royal Naval Air Service (RNAS) which, like the submariners, had high morale, an indicator of a healthy culture.[24] But the RNAS was merged into the Royal Air Force and from 1921 the Royal Navy started a long battle to regain control of its air arm.[25] The first RNAS flag officer was appointed in 1931 and the RNAS returned to Royal Naval ownership in 1938 to become the Fleet Air Arm (FAA) just in time for the Second World War. (If the Submarine Service was 'The Trade', the FAA was 'The Branch').[26] With different upbringing, a distributed organisation rather than a collective Flotilla, different cultural artefacts like ranks and badges, different administration between pilots (part of the Air Service) and observers (belonging to the Navy, they stood watches when embarked), different command structures (aircrew were shipborne, subordinate to the captain) and most importantly, no equivalent of Perisher for Squadron COs, a comparison is difficult.[27]

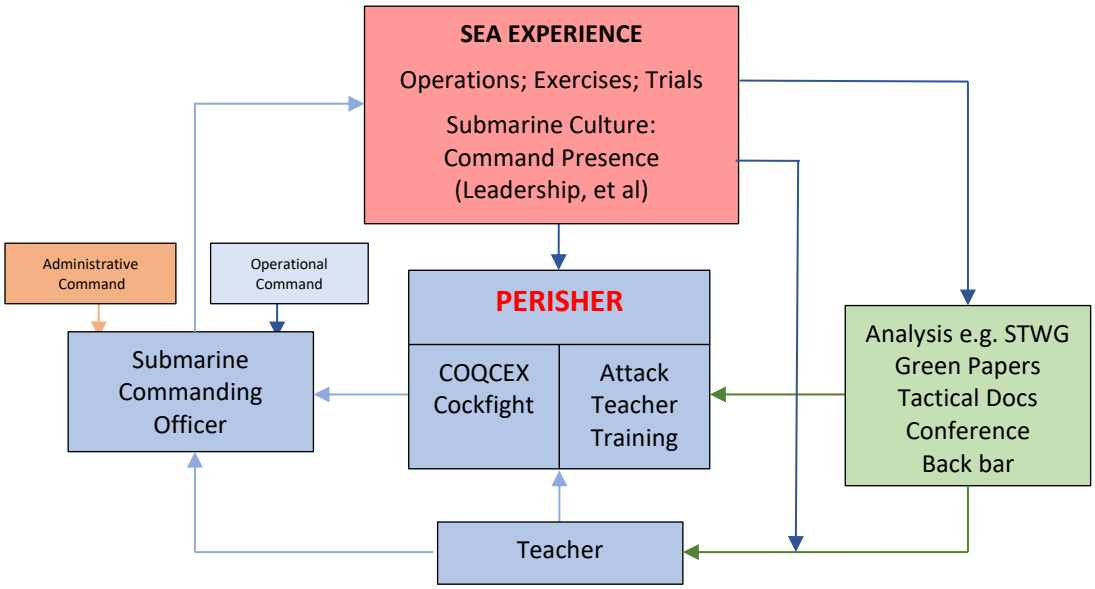
The Perisher cycle

Organisational culture has a learning process, "*the culture ... of the organization is both the consequence of the organization's prior experience and learning, and the basis for its continuing capacity to learn.*"[28] This is as applicable to the Submarine Service subculture as any other. Schein further qualifies organisational learning as what an organisation "*can or cannot do will depend very much upon the actual content of its culture and how that culture*

[22] Linstead and Small, 'On Reading', 333; Montgomery McFate, 'Being There: US Navy organizational culture and the forward presence debate', *Defense & Security Analysis 36/1*, 44; Soeters et al, 'Military Culture'; Schein, 'What You Need', 30; Terriff, 'Warrior and', 216.
[23] Schein, 'What You Need', 30: Elisabeth Kier, *Imagining War*, (Princeton NJ: Princeton University Press, 1997), 28.
[24] Millett and Murray, *Military Effectiveness Vol 1*, 60.
[25] Captain John Wells, *The Royal Navy* (Stroud: Alan Sutton, 1994), 148-9.
[26] Hastings, Operation Pedestal, 77.
[27] Ibid.
[28] Edgar H Schein, '*Organizational Culture: What is New?'*, Working Paper #3912 July 1996 at https://core.ac.uk/download/pdf/4380287.pdf.

aligns or integrates the various sub-cultures of its sub-systems.[29]" Within the Submarine Service, the culture is strong and iterative through Perisher, as Figure 2.1 illustrates.

Figure 2.1: The Perisher-Sea Cycle



What is learned at sea, both the tactical and the softer command attributes, are perpetuated through Teacher inculcating them into his students. The students then take the attributes to their commands and the learning process starts again. Again, St George points out that the power of the Navy's approach is "*the focus on what individuals did in situations big and small, thereby providing inspiration for new challenges*."[30] Effectively, in Perisher's case, this is a closed-loop based on sea experience with only administrative issues the non-operational external influence. Even the Navy's culture finds it difficult to impose, leaving the Submarine Service to develop its 'private navy' ethos. The cycle is not dissimilar in GS but more complex with the influences of the specialist and tactical schools, and one particularly important difference: no Perisher, the practical test of capability. (Notwithstanding that specialist courses and the Principal Warfare Officers (PWO) course have their practical parts, they lack the edge of Perisher leading to 'command'.) The cycle has been understood and accepted by submariners, if not articulated, throughout Perisher's history and is a reason why so many Teachers were sensitive to changing it.

[29] Schein, '*Organizational Culture'*.
[30] St George, 'Leadership lessons'.

The cultural matrix

To visualise and position the Navy's organisational culture and the Submarine Service's subculture the work of Soeters *et al* benefits from a matrix-model rather than the 'onion skin' tried by others.[31] The 'Y-axis 2.1is a hierarchy of cultures with the macro-National culture rightly superior[32] and the Services mentioned individually but positioned as a group at the 'Occupational' culture level for, as Terriff states: "*National military organisations have cultures that are distinct from the broader society they serve*,"[33] — they are institutions.[34] They are also organisations: "*The Navy as a whole has an organisational culture, as does each branch of military service, as does each sub-community*."[35] A sub-community in this context is the Submarine Service and its organisational subculture. Perisher appears as a micro-culture separated from the RN organisational culture by the intervention of the Submarine Service. We are now four levels down from National culture and devolved from its socio-political to the political-strategic of the institution to the strategic-tactical of the Submarine Service to the tactical-personal microculture of the submarine. The latter is the level of cultural interest of this thesis.

Soeters *et al* use a musical analogy 'X-axis to explain culture: choral unison, a symphony orchestra and a jazz band. Naval equivalents are the 'all-one-company' ethos of ship and submarine,[36] subcultures collectively presenting a unified RN culture – 'different ships, different cap tallies' but one Navy,[37] and each Service "[having] *its own culture but … distinct from those sister* [S]*ervices*".[38] The Navy, singularly, has a dual strategic-political culture, of war-fighting and statecraft.[39] The former is obvious, an aircraft carrier is the manifestation of the latter, but sometimes a deployed nuclear submarine as was the case of the *Dreadnought* in

[31] Soeters *et al*, 'Military Culture'; Group Captain FIN Monahan OBE DF, *The Origins of The Organisational Culture of The Royal Air Force*, PhD Thesis University of Birmingham, 2018, uses an 'onion ring' model to describe a similar concept in the RAF.
[32] Professor Stephen Linstead, Personal Communication April 2021; See, McSweeney, 'Hofstede's Model', 55, 89; Duncan Redford and James Davey, 'The Naval Hero and British National Identity', in Duncan Redford, (Ed) *Maritime History and Identity*, (London: I.B.Tauris, 2014), 1-13.
[33] Terriff, 'Warrior and', 217.
[34] Stephen Linstead interview April 2021; Charles C Moskos & Frank R Wood, *The Military, More Than Just a Job?,* (Oxford: Brasseys, 1988). 22; Nicki Lisa Coles, *What is a Total Institution* at https://www.thoughtco.com/total-institution-30267 identifies the institution as further down the matrix model at the individual ship level. Empirically this is wrong. A ship has a micro-culture but it is part of, and influenced by, the greater institution.
[35] McFate, 'Being there', 44, even though he was referring to the USN.
[36] David Charlton, private papers.
[37] Kier, *Imagining War*, 149.
[38] Soeters et al, 'Military Culture', 238.
[39] Barnett, *Navy Strategic*, 9-21; McFate, 'Being there', 43.

1977 to deter an earlier potential Falklands invasion.[40] Although known within the Submarine Service, it was only made public many years later.

Table 2.1: Positing Perisher Within Cultures

	Integration Analogy: CHORAL 'all-one-company'	**Differentiation** Analogy: SYMPHONY 'unified RN culture'	**Fragmentation** Analogy: JAZZ 'distinctive cultures'
National Culture	Singing National Anthem	Dealing with a national pandemic	Countries and Regions of United Kingdom
Collective Occupational [Institutional] Culture			**Royal Navy** Army Royal Air Force (Civilian Services e.g. Police) National Institutions, distinguished by: 1. Communal Life 2. Hierarchy 3. Discipline[2]
Individual [Organisational] Service Culture		**Royal Navy**	
Organisational Subculture	**Submarine Service** (Big ships; Small ships; Fleet Air Arm)		
Micro culture	**Perisher** (Specialists; officer cliques)		

Joseph L Soeters Donna J Winslow and Alise Weibull, Military Culture, Guiseppe Caforio (Ed); *Handbook of the Sociology of the Military*, (Online: Springer, 2003); Montgomery McFate, Being There: US Navy organizational culture and the forward presence debate, *Defense & Security Analysis 36/1*

Soeters *et al's* work has its limitations, however, for the research was confined to officer training academies and so in the UK case, Dartmouth, Sandhurst and Cranwell where stricter discipline prevails. Consequently, they conclude that "*Military life in the United Kingdom apparently is steeped in military discipline*",[41] wrongly suggesting that initial training discipline is continued into operational units. They also failed to identify that difference when they analyse the three distinguishing features of the military: Communal Life, Hierarchy, and Discipline. Especially on the latter, they failed to recognise the expected self-discipline within the Submarine Service and the continuous 'enabling' hierarchy that they only associate with 'Hot' operations, but which is an essential part of submarine culture, 'hot' or not. Nonetheless, the work has the benefit of positing Perisher and having done so, we can move from the theory to the observed.

[40] BBC News, Wednesday 1 January 2005. Although known within the Submarine Service, it was only made public many years later.
[41]. Soeters et al, 'Military Culture', 238

Innovation and culture

This thesis spans 100 years replete with innovations of all types: propulsion, sensors and doctrine. Some technologies are shared with GS, others are the preserve of the submarine and become the province of the submarine CO. Both Murray and Kuehn create a link to their three levels of war-making the connection between organisational culture and innovation as strategic, operational and tactical[42] in Table 2.2. Murray recognises innovation's non-linearity where a small change may produce a big result, (the 'Is-Was', hand-held attacking tool is an example[43]), and Kuehn associates a connection with the highest strategic levels.

Table 2.2: Innovation Relationships

Context	Technological change	Strategy
Procedures	Operational change	Operations
Equipment	Technical change	Tactics

Williamson Murray and Allan R Millett (Eds), *Military Innovation in the Interwar Period*, (Cambridge: Cambridge University Press, 1996), 305; JohnT. Kuehn, *Agents of Innovation*, (Annapolis MD: Naval Institute Press, 2013),

These levels are explicit in the Soeters *et al* matrix so the innovation relationship table can be added to the matrix to show the relationship between organisations within the Service, their cultures and innovation. (Table 2.3).

Murray uses Dowding's radar-based, Air Defences as an example of revolutionary technological innovation, asdic/sonar is a near submarine equivalent, but it was the submarine COs who devised the best ways to assimilate the asdic in passive mode. And so it has continued with examples given later. Radar, however, had a different reception in British submarines. While radar was a game-changer to the air force and surface ships, the submariners' stealth and survivability culture gave radar a wary reception, rejection even, and even once accepted, it was used to varying effects. It is to the submarine CO, therefore, that this thesis defers in innovative matters and that is why technology is such an important part of Perisher.

[42] Murray and Millett (Eds), *Military Innovation*, 305; John T. Kuehn, *Agents of Innovation*, (Annapolis MD: Naval Institute Press, 2013), 5.
[43] See Chapter Four.

Table 2.3: Positing Perisher Within Cultures				
	Integration Analogy: CHORAL 'all-one-company'	**Differentiation** Analogy: SYMPHONY 'unified RN culture'	**Fragmentation** Analogy: JAZZ 'distinctive cultures'	**Innovations**
National Culture	Singing National Anthem	Dealing with a national pandemic	Countries and Regions of United Kingdom	
Collective Occupational [Institutional] Culture			**Royal Navy**[1] Army Royal Air Force (Police, Fire, Ambulance, NHS) National Institutions, distinguished by: 1. Communal Life 2. Hierarchy 3. Discipline[2]	
Organisational [Individual Service] Culture		**Royal Navy**		Contextual Technological Change **Strategy**
Organisational Subculture		**Submarine Service** (Big ships; Small ships; Fleet Air Arm)		Procedural Operational Change **Operations**
Micro culture		**Perisher** (Specialists; officer cliques)		Equipment Technical change **Tactical**

From the work of: Joseph L Soeters Donna J Winslow and Alise Weibull, Military Culture, Guiseppe Caforio (Ed), *Handbook of the Sociology of the Military*, (Online: Springer, 2003); Montgomery McFate, Being There: US Navy organizational culture and the forward presence debate, *Defense & Security Analysis 36/1;* Williamson Murray, Innovation: Past and Future in Williamson Murray and Allen R. Millet, *Military Innovation in the Interwar Period*, (Cambridge: Cambridge University Press, 1996); John T. Kuehn, *Agents of Innovation,* (Annapolis MD: Naval Institute Press, 2013).

Submarine Service culture

What then of a Submarine Service culture and who or what does it embrace? This is ethnography, the purpose of which according to Michael Rosen is to "*decode, translate, and interpret the behaviours and attached meaning systems of those occupying and creating the social system*".[44] To achieve this we must identify what is meant by the Submarine Service.

The Submarine Service is first and foremost people. Of course, the panoply of depot ships, shore facilities, and training schools are also all part of the Submarine Service, but it is only people who can create a culture. In the case of the Submarine Service, it is the commanding officers who primarily both create and conserve the culture. They create the culture when in command, inculcate it into the next generation through Perisher and ensure its continuation as they are promoted to command flotillas and squadrons. While they may have the exclusive

[44] Michael Rosen, 'Coming to terms with the field understanding and doing organizational ethnography', *Journal of Management Studies* 28/1 1991, 12.

power to conserve culture they are not alone in its creation, that is an 'all-hands' task, regardless of rank or specialisation. That may not be unique, but it can be argued that the exceptionalness of the environmental threat and cheek-by-jowl living, not for days but months — a period that can create a village out of 120 souls — is unique. An eminent Cold War submariner describes the culture thus: " *the solid confidence we all had in each other, and in everyone's ability to do their own job and to know quite a lot about how to do everybody else's – very much a feature of the submarine ethos and of the democratic nature of the training process."*[45] The job of commanding a submarine is unique; submarine culture is unique.

Early submarine culture

At the time of the Submarine Service's conception the Navy's culture "*was a key component of national identity and within this structure the battleship dominated British maritime thinking — strategically, operationally, tactically and socially.*"[46] New battleships were named after Nelson's ships in anticipation of a second Trafalgar conserving a culture that obfuscated Nelson's imperfections.[47] (*Dreadnought, Superb, Vanguard* and *Conqueror* all went on to become submarine names while *Neptune* is now the only submarine base). Naval culture was also imbued with an offensive spirit, a sense of honour and chivalry, and a moral purpose.[48] Naval officers had been inculcated with such perceptions and conceptions since their earliest Dartmouth days[49] along with a squirearchy of class and deference to authority.[50] It makes those who defied these naval mores and opted for submarines a special breed.

By 1914 the Navy had supreme confidence in its pre-eminence, and the British public shared that confidence, having a national regard of the Navy as a guardian of liberty: "navies = liberal form of power = good, while armies are the opposite".[51] With the battleship dominant in this equation it is not surprising that submarines struggled for recognition. The submarine was "*stealthy and secretive,*" not fair play at all and initially destined for defence. [52] Attack practice

[45] Rear Admiral Fred Scourse CB MBE MA FREng FIET, SEA-CHANGE A personal account of a career in naval and defence engineering in the late 20th century, October 2020. © Churchill Archives Centre.
[46] Redford, *The Submarine*, 59.
[47] Andrew Lambert, *Nelson Britannia's God of War*, (London: Faber and Faber, 2004), 346.
[48] Richard Dunley, *Britain and the Mine 1900-1915, Culture, Strategy and International Law*, (London: Palgrove MacMillan, 2018), 9-18.
[49] Cole, *Total Institution*.
[50] Gordon, *The Rules*, passim; Mansoor, *Military Organizations*, 331.
[51] Lambert, *Nelson*, 347; Corbin Williamson, 'The Royal Navy 1900-1945', Learning from Disappointment in Peter R. Mansoor and Williamson Murray (Eds), *The Culture of Military Organizations,* (Cambridge: Cambridge University Press, 2019), 323. The formula is from Jeremy Black, *A Post-Imperial power? Britain and the Royal Navy*, (Amsterdam: Elsevier on behalf of Foreign Policy Research Institute, 2005).
[52] Redford, *The Submarine*, 88; Richard Dunley, 'Anti-Submarine Warfare in the Pre-First World War Royal Navy: A Cultural Failure?', *War in History 27/4*, 2020, 620-21.

was confined to warships as the national, naval, legal and chivalric codes prohibited any consideration of action against the mercantile marine.

There is an apocryphal story of an early submarine CO who, in response to the challenge "*What on earth are you doing?*" from the surface ship he was working with, replied "*Learning a lot*!"[53] Glib as the retort was, it reflected the early submarine days and the "*great school for adventurers*".[54] Bacon's foremost imposed ethos was safety, then adventure, autodidactic development, a degree of informality, mutual respect, technical knowledge, and an enabling leadership culture, all of which continue today. In a surface ship a sailor may know his department, in a submarine it is all departments and all compartments.

In 1912, the First Sea Lord (FSL), Admiral Sir Arthur Wilson, decided that submarines should be brought into "*close touch and co-operation with the fleet*"[55] so he appointed Captain Roger Keyes as ICS. Keyes inherited "*a highly selected body of officers and men, credited in the Navy generally"*[56]; the Submarine Service culture had established itself. Keyes made the submarine flotilla battle-ready: "*British submarine officers* […]*were young, they were already familiar with their boats, they have impudence born of sure courage, and in the tighter situations they kept their heads*",[57] while their peers in battleships were bereft of responsibility and initiative in comparison to submarine command. It is not surprising, therefore, as the Navy went to war, the submariners had *"an inclination to regard themselves as almost a separate service*".[58] It was into this new culture that the Periscope School was to be introduced.

Interwar years submarine culture

The early interwar years saw the Navy and Submarine Service generally, having a "*very thin time of it*"[59] with the slow release of hostilities only ratings,[60] a disassembling fleet with mixed messages about the future of submarines,[61] and endemic redundancy programmes especially of Lieutenants and Lieutenant Commanders.[62] The Navy was largely obsolescent, battleship-

[53] Commander Geoff Tall, 'The history of the Royal Navy submarine service', *RUSI Journal* 146/3, 41-45.
[54] E Keble Chatterton, *Amazing Adventure*, (London: Hurst & Blackett, 1935), 53.
[55] Sir Roger Keyes, *The Naval Memoirs: The Narrow Seas to the Dardanelles 1910-1915*, (London: Thornton Butterworth, 1934-5), 24.
[56] Ibid, 25.
[57] Carr, *By Guess*, 17.
[58] Keyes, *Naval Memoirs*, 25
[59] Lewis, *Spithead*, 174.
[60] Geoffrey Bennett, *Freeing the Baltic*, (Edinburgh: Birlinn, 2002), 201; Steve R Dunn, *Battle in the Baltic*, (Barnsley: Seaforth, 2020), 209
[61] Murray and Millett, *Military Innovation*, 242; Roskill, *Naval Policy Vol 1*, 412-7; Marder, *The Influence*, 438-9; Anderson, *Seagulls*, 28; Geoffrey Till, 'Retrenchment Rethinking Revival 1919-1939' in JR Hill (Ed), *The Oxford Illustrated History of the Royal Navy*, (London: BCA, 1995), 319-47.
[62] NMRN Historical Information Services, Information Sheet No. 096. The rank had been introduced in 1827 but only made substantive in 1914.

centric and re-fighting the Battle of Jutland[63] - "*a belief in the continuing value of major surface units … as the final arbiters of naval warfare*",[64] even though the idea was to avoid another Jutland,[65] and divided by the Jellicoe:Beatty argument.[66] Yet the mores of Dartmouth and public schools produced idealism, total dedication and complete acceptance of the Service over own interests. Protocols and privileges — an Executive Midshipman could take precedence over an Engineer Commander in certain circumstances[67] — were even extended to wives who were expected to follow the same rules. The lower deck, on the other hand, unschooled in the glories of the Navy's history, endured a subservient position with "*remarkable fortitude, a certain cynical philosophy and a deliciously sardonic sense of humour*". That is until the sailor was disregarded too far, and the mutinies of the submarine depot ship *Lucia* and Invergordon resulted in 1931 to mark the morale nadir.[68]

From 1932 conditions of service in a wide range of conditions started to improve with the economy. Most First World War lessons had been learned so that the 1939 Fighting Instructions could provide the directive "*divisional commanders have full authority to manoeuvre the divisions so as best to achieve the destruction of the enemy*" – a *volte-face* from the pre-Jutland Grand Fleet orders of the First World War,[69] yet submarines still lacked night-fighting and risk-taking practice.

Taking the pulse of the Submarine Service during the early interwar years with a dearth of literature written about or by submariners during the period means we must rely on the indicators that suggest submariners may have weathered the early interwar years' storm. If the submarine CO sought promotion, he was obliged to get a recommendation from a two year sabbatical in GS in (invariably) a battleship where the activities and responsibilities open to him were mundane in the extreme, ranging from being Officer of the Watch at sea to running sailing races or worse.[70] As a Lieutenant Commander fresh from command it must have been frustrating and boring but it had to be endured and many did for, despite a low promotion rate,

[63] Anderson, *Seagulls*, 26-29; Till, *Retrenchment Rethinking*, 335; Murray and Millett, *Military Innovation*, 244.
[64] Williamson, *The Royal*, 321; Arthur Marder, 'The Influence of History on Sea Power: The Royal Navy and the Lessons of 1914-1918', *Pacific Historical Review 41/4*, 1972, 428
[65] Till, 'Retrenchment Rethinking', 343.
[66] Lisle A Rose, *Power at Sea 1919-1945*, (Colombia MS: University of Missouri Press, 2007), 115; Corelli Barnett, *Engage the Enemy More Closely*, (London: Faber, 2013), 49.
[67] TNA ADM 182 AFO 3241/25 Known as 'The Great Betrayal' the AFO withdrew the right to command from engineer officers.
[68] Anderson, *Seagulls*, 26-29; Charles E. Scurrell, *The Devonport Mutiny*, (London: Maritime Heritage Society, 2002); Farquharson-Roberts, *To The Nadir*, 132-31 and 124-136.
[69] David MacGregor, 'The Use, Misuse, and Non-Use of History: The Royal Navy and the Operational Lessons of the First World War', *Journal of Military History 56 (4)*, 1992, 603-615; Marder, *Dardanelles to Oran*, 33-63. Marder credits the Tactical School with many of the lessons learned.
[70] Captain Rory O'Conor, *Running a Big Ship on 'Ten Commandments'*, (Oxford: Casemate, 2017), 41.

by 1939 there were six submarine qualified flag officers, 13 Captains, most with war experience, and 34 Commanders. The 44 Lieutenant Commanders/Lieutenants 'in command' clearly had better prospects. A second indicator is that no submariners appear to have been involved in the *Lucia* mutiny, but the effect of a separate submarine culture may have exacerbated the situation as the Board of Enquiry identified:

> *"…there are two distinct bodies of men living side by side but subject to quite different conditions both as regards to employment and pay…it is almost impossible to prevent the ship's company ratings from forming the impression that their interests are neglected."*[71]

Mostly, however, it was the actions of the submarine officers themselves that indicate a better morale. These were the sheer numbers of innovations, not advanced technologies but innovations of practicality examined in Chapter Four.[72] Then the Fourth Flotilla on the China Station was held to be the epitome of submarine professionalism balanced by a good 'games' healthy lifestyle (shooting, and regular team sports) and excellent social life. The culture was very much 'work hard:play hard'.[73] The Home Flotillas would have no opportunity for shooting at places like Wai-hai-wei but it is not too much of a stretch to suggest that its culture may have been similar to the well-chronicled small ship culture. We know from Anderson that small ship culture was also 'work hard:play hard', it was also 'hard-working:hard drinking' but not the two together. Hard days at sea were followed by weekend partying when the formalities and protocols of the big ships would be relaxed as a due return for the effort given.[74]

Perisher evolved to become more organised, formalised as the 'Commanding Officers' Qualifying Course', reflecting the necessity to pass the course for submarine command, and gaining its pivotal position within the Submarine Service culture. One benefit was that submarine CO's billets were fully complemented throughout the Second World War by proven (mostly) competent officers whereas, by comparison, GS had a critical shortage of commanding officers.[75]

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[71] TNA ADM 156/104 Court of Enquiry into collective refusal of duty and insubordination on HMS *Lucia*; Michael Farquharson-Roberts, 'HMS *Lucia* Mutiny: A Failure of the Royal Navy's Internal Communications', *RUSI Journal* Volume 154/2; Charles M. Scurrell, *The Devonport Mutiny* (London: Maritime Heritage Society, 2002).

[72] RNSM A 1977/ 23/22/174/C8 Museum for Submarine Attack Instruments.

[73] Captain George Menzies, personal diaries; RNSM Anecdotal evidence and photographic record of Lieutenant JFA Crews who served in the *Osiris* under Lieutenant Commander H C Cumberbatch (grandfather of the actor Benedict Cumberbatch).

[74] Anderson, *Seagulls*, 26-36.

[75] Farquharson-Roberts, *Royal Naval*, 203-9; Mansoor, *Military Organizations*, 339.

The wartime submarine culture

War with Germany was met with enthusiasm by those who volunteered for the new 'Supplementary Reserve' (RNSVR) and stoicism by the young serving naval officers.[76] The large influx of Reserve (RNR) and RNVR officers was prepared for organisationally but not culturally.[77] Inevitably, there were frictions, "*traditional stupid and childish feud between the Royal Naval Reserve and the Royal Naval Volunteer Reserve~~and anyone who doubts that lack of one initial could make such a whale of a difference should take a parallel alphabetical rift between the R.N. and the R.N.R. and try it on for size*".[78] It seems that the Submarine Service was largely welcoming of the reservists and the meritocratic culture meant that as early as 1943, 'VR' officers were in command of submarines. Their three years' submarine experience was half that normally expected in peacetime.

As the reservists put on their uniforms the submariners took theirs off at sea where, unofficially, a 'pirate rig' of typically old slacks and rugby shirts, or just a sarong in the Far East, was allowed. This obviated the necessity for badges of rank, replacing one Schein artefact with another to add to the rolled neck white submarine sweater, a privilege guarded carefully by submariners. Contemporary photographs often show the submarine sweater, but rarely the unofficial pirate rig. Abhorrent as the pirate rig must have been to some naval officers it was no indicator of lack of discipline, quite the reverse as, on a day's submarine familiarisation, Monsarrat was able to touch the heart of submarine culture: "*one could not help being struck by the adroitness and the marked competence of everyone aboard.*"[79]

Central to that competence was the CO, and his competence was borne out of Perisher which was to undergo the most testing time in its history. Not only did Perisher evolve in response to the imperatives of war, it embraced the experiences of war and ensured they were passed on to the next generation of submarine COs. The relevance of the Perisher cycle in Figure 2.1 in capturing and regenerating submariners' operational and technical knowledge into its culture could not have been stronger. Monsarrat recognised the cultural relationship between submariner and technology: "*nothing much seemed to happen and yet, when one looked round the control-room, every lever and wheel and knob had been closed up by a crew which slipped into place like pieces of the same machinery*".[80] The Submarine Service received many

[76] Anderson, *Seagulls*, 61; Brian Lavery, *In Which They Served*, (London: Conway, 2008), 11; Nicholas Monsarrat, *Monsarrat at Sea*, (London, Cassell, 1975), 5; Farquharsen-Roberts, *Royal Naval*, 220.
[77] Tall, 'The History'.
[78] Monsarrat, *Monsarrat at*, (London, Cassell, 1975), 279.
[79] Ibid, 24.
[80] Ibid, 24.

innovations in the lead up to, and during the war and their reception were examples of cultural assimilation. Then came radar, poorly introduced with a characteristic that jarred directly with the submariners' risk-wary culture: it transmitted! Once the benefits were realised, however, radar did get accepted if never fully accomplishing its potential until after the war.

Submarine culture post-1945

The immediate post-1945 Navy paints a gloomy picture of an unhappy place to be with disposals, old ships, poor conditions of service, low retention and withdrawal from overseas bases. The aircraft carrier was preeminent amid opposition from the RAF which ultimately ended in the cancellation of the new carrier programme in 1966. Meanwhile, submarine interests were poorly looked after until 1947 when the battlespace moved underwater thus moving the submarine to the forefront of British naval planning although whether it ceased to be a 'private Navy' is questionable.[81]

Two identifiable groups developed within the Submarine Service: the majority who settled down to the professionalism of the peacetime Navy, and a heavy-drinking group. At the same time, a few COs with inadequate character and command attributes slipped through the Perisher net. They were known for their bullying and poor decision-making. The fault, Forsyth avers, was Perisher focusing purely on attacking in the 1940s and 1950s ignoring other command skills.[82] Goldrick suggests three possible causes: behaviour inculcated institutionally during early training, bitterness at missing out on the wartime glory, or they were simply in the wrong job.[83] A Naval Review contributor agreed with Goldrick's first proposition:

> *"*[cadets] *were disciplined as if they were delinquents, regimented as if they were both unreliable and untrustworthy and deprived of all means of exercising initiative or expressing character or originality. … its effects on the service have been to say the least, unfortunate".*[84]

Such charges are *prima facie*, however, and whatever the reasons, such extremes of character were considered acceptable and not a cause to fail Perisher.[85] As Perisher evolved and the drinking culture was working its way out, the *Artemis* sank alongside at *Dolphin* in 1971 to cause a shake-up of submarine sea training. The organisation that evolved strongly influenced the Submarine Service culture enabling submariners, throughout the Cold War, to become as operationally proficient as the wartime submariners, but with submarines and technologies

[81] Tall, 'The History'.
[82] Emails Dick Husk and Rob Forsyth various dates 2019.
[83] Admiral James Goldrick, *The Naval Command Culture: A Retrospective*, published privately.
[84] Manoel, 'Dartmouth 1931-1935', *Naval Review* 1965-53-3.
[85] Belton interview.

unimaginable to their 1940's peers. Lavery observed, "*the Royal Navy of today* [2008] *is closer to that of 1942 than that of 1939, or even 1950*".

The culture (and Perisher) that evolved continued many Bacon precepts: the 'all-one-company' and 'team spirit' ethos, and, of course, the focus on safety enhanced by the nuclear presence[86] with the submarine badge, introduced in 1971, as the symbol of egalitarian unity across all ranks.[87] Two of the strongest cultural characteristics demand special mention the first being the self-discipline that enables a multi-dimensional trust between peers, subordinates and superiors within a submarine. That trust, whose focal point is always the CO, is not awarded automatically, but earned by example, action and experience. Trust in turn, brings two great benefits, the reduction of unnecessary rules and mutual respect. The epitome of the first is Perisher which has always been conducted on trust; the reason why it has never been, or had to be, documented. Mutual respect is one of those indefinable intangibles immediately evident through the demeanour and language used by all onboard. The second characteristic is the familial culture. Here, submariners have an advantage over larger surface ships for, with a crew of typically 120-130, they are well within the limits of Dunbar's relationship number of 150.[88] Within a ship, departmental culture tends to be stovepipe in nature by specialisation,[89] in submarine culture these stovepipes disappear through proximity and the higher ship-knowledge of submariners. It is noteworthy that, when interviewing for this thesis, every submariner interviewee identified as a 'submariner', before their professional specialisation.

A final, common aspect of naval culture is never touched upon by historians. It has, however, great meaning for those serving; it is 'happiness' and the importance of having a 'happy ship', for a happy ship is invariably an efficient ship and officers and sailors alike want to serve in an efficient and happy ship. The concept seeps into literature: "*His idea of a crack ship was… A taut but happy ship, an efficient man-of-war*".[90] 'Happiness' in naval culture is unavoidable, especially in submarines, "*The central quality of effective submarine teams is defined as 'happiness'*,"[91] for if there is happiness there is harmony and team spirit. If not,

[86] All Forums and Jeremy Larken interview February 2020 and David Charlton interview September 2019.
[87] Frank Grenier interview September 2018: Redford, *The Submarine*, 179-82; Redford misses the egalitarianism by equating the badge to flying qualification 'wings'. Frank Grenier knew the aim of the badge because he designed it.
[88] Robin Dunbar, 'What is Dunbar's Number?', *New Scientist*, at https://www.newscientist.com/definition/dunbars-number/; 150 is the maximum number for comfortable relationships.
[89] A common experience of submariners who commanded surface ships.
[90] Patrick O'Brian, *The Far Side of the World*, (London: Harper Collins, 2003) 160.
[91] Doull, *The Impact*.

friction can be exacerbated by proximity.[92] All the attributes of naval culture go into making a happy ship from training to the ship's employment, from conditions of service to the captain's personality, "*It is the captain, invariably, who sets the mood of a vessel; a gloomy captain means a gloomy ship*."[93] St George found three underpinning cultural attributes of the Navy: cheerfulness, 'dits', referred to earlier, and banter, (playful, gently-mocking, generally well-meaning). Cheerfulness and happiness are synonymous, and humour is the twin of happiness. Linstead's two types of humour are 'standardised/canned' humour and 'situation/spontaneous' humour[94] and it is not too hard to see how those are represented in 'dits' from the quips and wit of the stereotypical sailor. Monsarrat saw happiness as characteristic of a 'good' ship, identifying that happiness "*grows out of innumerable small things. It is as potent as love. Multiplied it explains the Royal Navy*".[95]

The evidence for cultural high morale and 'happiness' is evident in the Faslane-centric Submarine Service: maintenance of the requisite high readiness SSN's out of a depleted Flotilla would have been unachievable without high morale; the care over the move of Plymouth-based boats to Faslane resulted in harmony rather than a retention threat; and perhaps the best indicator has been the recruiting to submarines from the FAA, the Royal Marines and engineers from GS. Overall, recruitment in 2012-2017 increased from 77% to 95% and the outflow rate reduced from an unsustainable 16% to 2½%, better than anywhere else in defence.[96]

The last word on submarine culture goes to an Engineer, not a CO:

> *"The bedrock of an effective twenty-first century submarine is the professionalism and competence of the individuals within [the command] team. A high level of professional competence builds confidence within the individual, which in turn allows feelings of 'comfort' and 'satisfaction' to be experienced; necessary antecedents of 'happiness' in the high-risk environment of a submarine. Individual 'confidence', and therefore 'happiness', will also be leveraged by each individual's perception of the qualities of the other team members. Principally, the belief that those around you are professionally competent has a strong positive influence in this regard, and reflects the established culture of professional competence that has characterised the submarine service since its inception."*[97]

[92] Anderson, *Seagulls*, 28
[93] St George, 'Leadership lessons'.
[94] S A Linstead, 'Jokers Wild – the importance of humour in the maintenance of organizational culture', *Sociological Review 33/4*, 1985, 741-767.
[95] Monsarrat, *Monsarrat at*, 117-8. The other characteristics were cleanliness, dependability and alertness.
[96] Weale interview.
[97] Doull, *The Impact*.

‘In Command’ In Its Place

The definition and spectrum of command

Just as culture is a nebulous concept, often used but infrequently explained, so too is command, although in the military context command is vocational.[98] Culture is layered, so too command. The cultural level for this thesis is the Submarine Service and its perpetuation through Perisher, so too the command level is the submarine CO where, again, Perisher is the perpetrator.

Definitions of command are hard to come by. While explaining the ‘art’ of command, with a reminder that it is “*essentially aristocratic*”, a booklet given to new commanding officers, ‘Your Ship’, does not even include a definition.[99] For that, we can look to the Americans and a definition indicating the complexities of command:

> *“Command includes the authority and responsibility for effectively using available resources and for planning the employment of, organizing, directing, coordinating, and controlling military forces for the accomplishment of assigned missions. It also includes responsibility for health, welfare, morale, and discipline of assigned personnel”.*[100]

A less detailed description, rather than definition, is someone who has “*The authority vested in an individual of the armed forces for the direction, coordination, and control of military forces*”[101] in which context, *“An Admiral* [is] *the officer charged with the supreme command of the Navy*” with “*The … authority to direct the movement of navies whether in contact with the enemy or in theatre wide operations*”.[102] Nothing about the attributes of command, however.

The Civilian Services do no better. The National Fire Chiefs Council’s, Operational Guidance provides responsibilities for the four levels of command[103] as do the Police with the Gold, Silver, Bronze command structure[104] but neither offers any explanation that can help understand either civilian or military command. Perhaps this is not surprising for:

> *“Military command is a function created and evolved so that it works in conflict. The obligation to obey … is of a different order of magnitude to the civil equivalent. So, in exercising command – in peace or war – its wartime context is ever present, although generally unspoken.”*[105]

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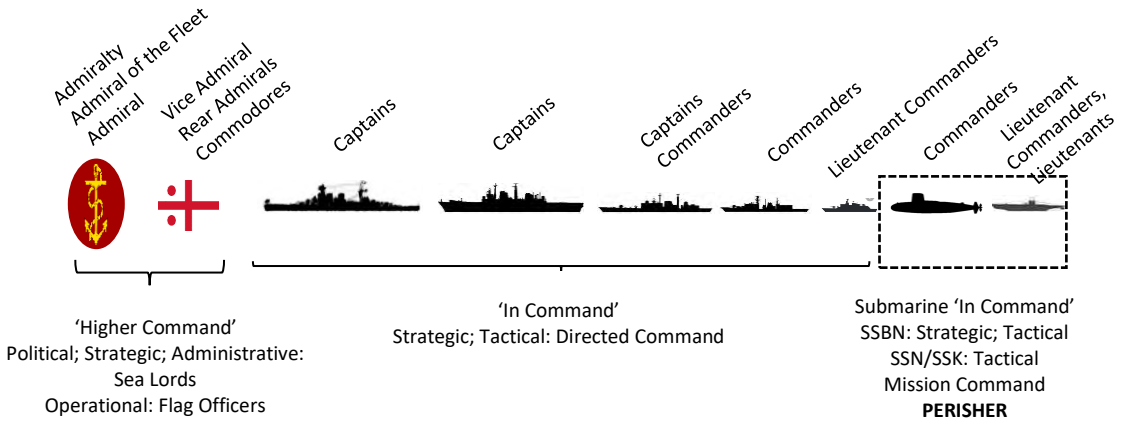
[98] ‘Carneades’, ‘The Death’.
[99] ‘Your Ship’, an undated booklet (probably 1940s) still issued in the 1980s.
[100] Richard M. Swain and Albert C. Pierce, *The Armed Forces Officer*, (Washington DC: National Defense University Press, 2017), 83. The quote is from the US Air Force Leadership Manual.
[101] NATO Definition of command, MoD, Future of Command and Control, Joint Concept Note 2/17.
[102] Ibid.
[103] National Fire Chiefs Council, National Organisational Guidance, Levels of Command, https://www.nationalfirechiefsorg/
[104] College of Policing, Operations, Command Structure, https://profdev.college.police.uk/
[105] Email James Burnell-Nugent, June 2021.

'Command' has many contexts some of the more familiar being strategic, administrative, operational and tactical command. There are also directed and mission command, subsets of operational command, and finally 'in command', used when an officer is appointed to command of a ship or submarine. This latter application of command has attached history. To 'command' a Sixth-rate ship, the smallest in the 17th century Navy, an officer had to pass the examination for Master at Trinity House. He became 'Master and Commander' although he may have been a Lieutenant. When commanding a bigger warship the officer was a 'Post Captain', an 'Office' (from whence came 'officer') that has morphed into today's 'Command'. For completion, in 1795 'Master' became redundant and the rank of Commander took on a different connotation. Lieutenant Commander became associated with a senior Lieutenant during the 19th century with the 'half-stripe' added in 1875 and substantiation in 1914.[106]

At the top of the naval chain of command was the Board of Admiralty, now the Admiralty Board, with the FSL, an Admiral,[107] as the senior naval member at the "*highest echelons of command*",[108] "*operat*[ing] *in the margins were politics and strategy intersect".*[109] The command chain then works its way downwards to the most junior officers 'in command' of the smallest warships to provide a hierarchy of command. With the singular exception of Captain David Russell, as CO of the *Vanguard* in 1993, the submarine officers 'in command' have been Lieutenants or Lieutenant Commanders and only occasionally Commanders until nuclear submarines when a Commander 'in command' became standard. These are the ranks and levels of 'Command' that concerns this thesis.

Figure 2.2: The Spectrum of Command



[106] Michael Lewis, *England's Sea-Officers*, (London: George Allen & Unwin, 1939), 56, 199-204.
[107] Rodger, *The Command*, 631.
[108] John Horsfield, *The Art of Leadership in War*, (London: Greenwood Press, 1980), xi.
[109] Lambert, 'Admirals: Command', 72-75.

The attributes of 'command'

A brief overview of the attributes of 'command' complements the hierarchy for, "*just as the levels of war are different so are the demands of command at each level"*[110] the 'command' enjoyed by an Admiral of the Fleet is different from a Lieutenant 'in command' of a submarine although there are inevitably attributes of command that permeate the command structure. To help, we can draw from different perspectives. In the case of Table 2.4, John Keegan's Sandhurst work brings the study of disparate generalship mapped alongside the thoughts of the experienced General Sir Rupert Smith, and three naval sources: Andrew St George, a management academic who spent three years studying leadership in the Royal Navy, Captain James Stavridis, a United States Navy (USN) surface ship CO, later Supreme Allied Commander Europe, and the submarine COs interviewed for this study.[111]

The first recognisable feature of the table is that it reinforces a common use of 'command' but not commonality, and therefore no one set of common attributes. The first two attributes, which share the most commonality, can be summed up by someone with command and leadership experience in a different sphere as "Determination, Dedication, Discipline and Desire".[112] Secondly, there are many individually identified attributes emphasising the complexity of 'command'. Interesting is that the naval officers of both groups identify 'command presence,' a term absent elsewhere although Keegan's imperatives come near without mentioning the term.[113] Command attributes are therefore multi-faceted, multi-levelled and lack consensus which suggests there are many ways to effect command.

Anthony King, identifies how generalship is morphing from the hierarchical to mirror corporate enterprise leadership, "*distributed, pervasive, invited from all members, and instilled in the culture of successful enterprises*"[114] He uses General Stanley McChrystal's reformation of the US Army command processes in Iraq as an example with what he calls a 'shared consciousness' where McChrystal was "*not so much the pinnacle of an organisational*

[110] Smith, *The Utility*, 65.
[111] Keegan, *The Mask*; Smith, *The Utility*; St George, *Royal Navy*; Captain James Stavridis, *Command at Sea*, (Annapolis ML: Naval Institute Press, 1999); Fort Blockhouse Forum.
[112] Attributed to François Pinaar, Republic of South Africa Rugby World Cup winning captain, 1995.
[113] Keegan, *The Mask*, 311-351.
[114] Anthony King, *Command: The Twenty-First-Century General*, (Cambridge: Cambridge University Press, 2019), 9.

hierarchy but rather a node at the centre of a network",[115] much as Field Marshal Slim compared an army to a clock with the general as the mainspring[116] or Admiral Sir Mark Stanhope's analogy of submarine command as being the hub of a wheel, with the job of the CO being to keep the wheel turning smoothly. [117] King identifies that naval command may also

Table 2.4: Comparison of Command Attributes

An historian's view[1]	**The submarine CO's view[2]**	**An American view[3]**	**Andrew St George conclusions[4]**	**An Army view[5]**
	Determination	Tenacity	Commitment*	Will to triumph
	Self-discipline	Composure	Discipline*	Discipline
Example: personal presence	*Command presence*	Command presence		
Action: knowing and seeing			Decision-making: instinctive and strategic	Decision-making
	Integrity	Integrity	Integrity*, ethics, morality	
	Courage	Physical courage	Courage*	
	Cheerfulness	Humour	Cheerfulness	
	Leadership			Leadership
	Excellence		Professional expertise, judgement, insight	
	Perseverance; stamina	Endurance		
	Management	Managerial ability		
	Character			Character
*Kinship***: mystification				
*Prescription***: communication				
*Sanctions***: praise and punishment				
			Clarity	
				Comradeship
				Self-confidence
				Confidence in Commander
				Morale
		Ship handling		
		Training the XO		
		Enthusiasm		
		Common sense		
	Unselfishness			
	Humility			
			Respect for others*	
			Loyalty*	

* Considered six core values of the Royal Navy
** Prerequisite of command.
1. Keegan, *The Mask.*
2. Fort Blockhouse Forum.
3. Stavridis, *Command at Sea.*
4. St George, *Royal Navy*.
5. Smith, *The Utility.*

[115] King, *Command*, 11.
[116] Field Marshall Viscount Slim, *Defeat into Victory*, (London: Pan, 2009), 213.
[117] Stanhope interview.

be going through a transformation similar to the military, enabled by technology. King's comparison, however, stops at the surface ship, and he does not refer to the submarine where he may have drawn a different conclusion.[118]

Two Rear Admirals, Peter Dingemans, an anti-submarine specialist(TAS) and Jeremy Larken, a submariner, employ the realities of battle in the Falklands War when they commanded the sister assault ships *Intrepid* and *Fearless* respectively. Dingemans' leadership viewpoint attributes relate to Table 2.4 with the interesting additions of Preparation, Faith, Delegation and Morale. He believes that the qualities required today for command and leadership are no different to those required over earlier centuries.[119] Larken reflects on how the isolation of command is a force for good allowing thinking time. He too then juxtapositions command and leadership, emphasising Dingemans' attribute of preparation.[120]

Yet another comparison shows similarities in three different professions: the Fire Service, commercial pilots and the Submarine Service. The matrices, which Ramsey adapted to submarines, and are an Appendix, provide further confirmation of the complexity of command through the introduction of three further attributes: teamwork, communications and situation awareness. The absence of the latter from the earlier contributors is surprising, for it is an essential attribute for many naval activities and most certainly the submarine CO. Indeed, for Perisher it is a prerequisite for passing, as all Teachers interviewed made clear. Almost equally important is leadership.

Command and Leadership, twins but not identical

Though naval historians do not purposely conflate command and leadership they often leave it to the reader to disassemble the two. St George, however, carefully distinguishes between command, leadership and management identifying 12 leadership qualities many of which map on to those of command and hence the trap of conflation,[121] and at the same time demonstrating that leadership can live without command, but command cannot live without leadership, or at least, not for long, for leadership amplifies command authority.[122]

Nelson may have seen leadership and management as the same thing although they were not common terms in his day, whereas a future FSL, Admiral Sir Jonathan Band, distinguished

[118] King, *Command*, 445-48. See 'Submarine Command is Mission Command'.
[119] Dingemans, 'Leadership in'.
[120] Larken, 'Falklands Campaign'.
[121] St George, *Royal Navy*, ix, 55-62: Capacity for Judgement and Decision-Making, Cheerfulness, Clarity and Vision, Communication skills, Confidence, Humanity and Humility, Innovation, Integrity, Moral and Physical Courage, Professional Knowledge, Stamina and Trust; 'Carneades', 'The Death'. The Royal Navy now has a Command, Leadership, Management (CLM) organisation.
[122] Australian Defence Doctrine Publication 00.1 Command and Control.

leadership as an instigator of change and management as maintaining the status quo.[123] The delineation now seems to be more common[124] which is useful, for while leadership is a major attribute of command, it is not command, and nor is command leadership. Smith brings clarity to the difference: "*the commander says 'go on', the leader says 'come on*,'"[125] leadership is not imposed like command, "*it is actually welcomed and wanted by the led*".[126] Lambert makes clear that "*Command is an intellectual task, qualified by morality, leadership is the reverse.*"[127] Horsfield, illustrates the differences between military and naval leadership being that Admirals 'command' [and lead] from ships and as a consequence Nelson and Jellicoe received encomiums from the lower deck.[128] Generals, on the other hand, are at headquarters: "*divisional headquarters emerged* [in the First World War] *as a permanent institution with a standardised structure*".[129] Wellington tried to make himself visible, "*The site of his long nose amongst us on a battle morning was worth 10,000 men, any day of the week*,"[130] but Haig was an absent landlord.[131] This does not mean to say that naval leadership is better than military leadership, but different because of the context.

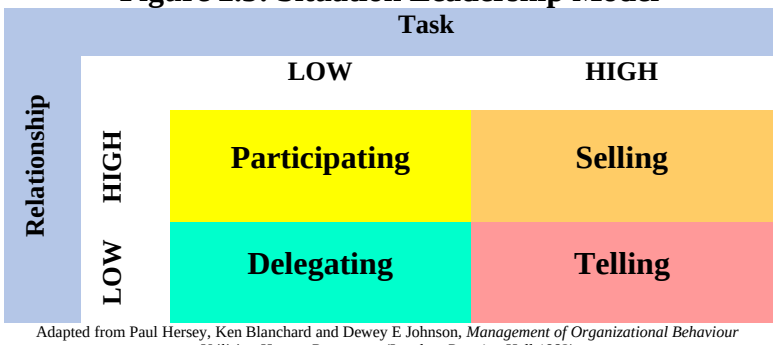
Leadership is an abstract quality with a litany of literature and leadership models. The doyen is Peter Drucker, who famously said that "*Leadership is of upmost importance, indeed there is no substitute for i*t" he then went on to say that "*leadership can neither be taught nor learned*".[132] In this he echoed what was taught to a Second World War naval officer: "[Leadership] *is one attribute which cannot be learnt in a classroom or from a textbook*".[133] At the *Sceptre's* decommissioning dinner in 2010, the past COs were asked about leadership training at Dartmouth. There was silence.[134] The reason was that Admiralty Interview Board (AIB) assessed leadership was presumed innate and so there was no need to teach further (and

[123] Stephanie Jones & Jonathan Gosling, *Nelson's Way: Leadership Lessons from the Great Commander* (London: Nicholas Brealey, 2005), 133 & 205; 'Carneades', 'The Death'.
[124] Michael Stephen Young, Vic Dulewicz, *·Command, Leadership and Management Competencies, Predicting Superior Performance in the Royal Navy*, (Henley: Henley Management College, 2003); Helen Doe and Richard Harding (Eds), *Naval leadership and Management, 1650-1950*, (Woodridge: Brydell Press,2012); Mike Young, 'A model of command, leadership and management competency in the British Royal Navy', *Leadership & Organisation Development Journal* April 2005.
[125] Smith, *The Utility*, 65.
[126] Larken, 'Falklands Campaign'.
[127] Lambert, 'Admirals: Command', 72-75
[128] Horsfield, *The Art*, 15-22; Sir Nicholas Harris, *The Dispatches and Letters of Vice-Admiral Lord Viscount Nelson, 1795-97* (London: Colburn, 845), 397; Allan C. Macfarlane, *A Naval Travesty: The Dismissal of Admiral Sir John Jellicoe, 1917*, PhD Thesis University of St Andrews 2014, 183.
[129] King, *Command*, 90.
[130] Serve to Lead, Royal Military Academy, Sandhurst, Booklet to young officers, 25.
[131] Horsfield, *The Art*, 15-22.
[132] www. tanveernaseer.com/peter-drucker-leadership-marketing acquired August 2020.
[133] Brian Lavery, *The Royal Navy Officer's Pocket-Book 1944*, (London: Osprey, 1944), 15.
[134] David Perfect interview October 2018.

presumably Dartmouth staff were votaries of Drucker). Officers today receive extensive leadership training identified as a complex helix,[135] but, unanimously, more leadership is learned onboard a submarine than in a classroom[136] and by the time of Perisher leadership skills are expected to be honed, for they are part of the command recommendation. All submarine COs interviewed who had commanded surface ships commented on the difference in command and leadership. A surface ship's departments are silo-based, consequently command is more devolved and leadership different which puts some submariners at an experience disadvantage and there have been failures.[137]

The most applicable leadership model to submarine command according to Jake Moores is 'Situation Leadership'[138] where a CO has to adapt his leadership to the circumstances. Applicable examples of Figure 2.3 are: Delegation during maintenance, Participation resolving an inter-departmental issue, Selling the mission or tactical intent, and Telling: during an operation. Thus the submarine CO alters his leadership style (and his command style) to suit the circumstances.

Figure 2.3: Situation Leadership Model



Adapted from Paul Hersey, Ken Blanchard and Dewey E Johnson, *Management of Organizational Behaviour Utilizing Human Resources*, (London: Prentice-Hall,1982)

Horsfield recognises the model, if not the submarine application, and the relationships: "*Leadership is not an exercise of intrinsic qualities that can be applied to every situation. Moreover, it is much more than a display of individual qualities in vacuo. It is by definition very much of a societal activity."* He emphasises the importance of the naval leader's relationship with his officers and men.[139]

[135] St George, *Royal Navy*, 74-75.
[136] Fort Blockhouse Forum.
[137] Boyce interview; Email James Goldrick September 2021, the RAN has had a similar experience with submariners in command of surface ships.
[138] Paul Hersey, Ken Blanchard and Dewey E Johnson, *Management of Organizational Behaviour Utilizing Human Resources*, (London: Prentice-Hall,1982); Jake Moores interview February 2019. Moores was a submarine CO, Captain of BRNC and is now a Visiting Professor at Exeter University lecturing in leadership.
[139] Horsfield *The Art*, 160.

The uniqueness of submarine command

As seen from the many and disparate attributes in Figure 2.3, command is an intangible yet discernible, abstruse gestalt, a jigsaw of the attributes identified in the table. The public face of command is the attribute known as 'command presence': how strength of character, personality, technical knowledge and tactical capability come together. These are common to all naval command in varying degrees but Teachers want to see command presence in a Perisher student for a good reason: submarine command is different, it is unique.

When Foreign Secretary, Henry Temple, 2nd Viscount Palmerston reputedly said "*If I want a thing done well in a distant part of the world, if I require a man with a good head, a good heart and plenty of common sense, I always send for a Captain in the Royal Navy*"[140] he was invoking the isolation of command experienced by a captain on a foreign station. That isolated position has been and still is mirrored by submarine COs of all nations from the earliest days as the German wartime U-boat ace, Reinhard Hardegen, explains in terse terms: "*I had my precise orders about where I must go … I couldn't get any instructions from Headquarters because in that situation tactical decisions have to be taken at the scene, not far away onshore*."[141] This explanation is not universally recognised today, and the Submarine Service is periodically asked why Perisher is needed. Commodore Submarine Flotilla, Jim Perks answers that he needs Perisher to be confident that his COs when acting independently, unsupported and incommunicado, will act appropriately, safely and within their limitations while achieving their mission's aim.[142] This is an assertion forcibly espoused by Lord Boyce who, as Chief of the Defence Staff, was witness to military command across the three Services. "*Nowhere else*", he says," *is there such reliance on one person for the safety of both lives and ship*"[143] reinforcing, perhaps, another U-boat commander who said, "*On a big ship you are a nobody, but when you are captain of a* [submarine] *and have the confidence of your crew, you are almost God*".[144] That confidence is an impalpable reason for Perisher; ships companies like their COs to have gone through the rigours of Perisher, indeed they take pride that 'God' has been proved competent. Mark Stanhope, another Admiral who has experienced and witnessed the full range of military command, explains the unique nature of submarine command and the need for Perisher:

[140] Rear Admiral Sir William Jameson, KBE CB, *The Fleet that Jack Built*, (Penzance: Periscope, 1962), 15.
[141] *Korvettenkapitän* Hardegen, in Hood, (Ed) *Submarine*, 47.
[142] Jim Perks interview December 2019.
[143] Boyce interview.
[144] Simon Parkin, *A Game of Birds and Wolves*, (London: Hodder & Stoughton, 2019), 17.

> *"…the unique nature of commanding in the third dimension of depth, where the threshold of disaster in both peace and war is immediate, demands that the CO has at his fingertips for instantaneous recall and decision all that concerns safety be it navigational, material, operational, mechanical or human. These skills can only be confirmed through examination under pressure."*[145]

These quotations lay out the reasons for the longevity of Perisher: submarine command was, and remains, isolated, challenging and demanding, there is no succour, referral or support, it is unique and it is therefore essential that those appointed are proven to be worthy and capable. These are serious explanations written by men experienced in submarine command. In a lighter vein are the humorous if acerbic observations of Eric Thompson from his unusual career as both weapons and nuclear engineer:

> *"… testosterone, ambition, egotism, authoritarianism, haemorrhoids, God complexes, sleep denial, lack of oxygen, lack of female company, suppressed homosexuality, alcohol and nicotine withdrawal symptoms, distrust of others for your own safety, obnoxious personal issues like smelly feet and damned difficult jobs …[T]here was also latent fear", he continues, "risk from so many different forms of hazard: collision, fire, flooding, grounding, sinking, poisonous gas, weapon or battery explosion, electrocution, and radioactivity as well in nuclear boats. All of these hazards were present without going to war. Add on top of all that the responsibility of command, the safety of the submarine and the lives of 70-120 men, the exigencies of an operation and the maybe nearness of an unfriendly submarine or ship whose unknown intentions can within seconds turn a comfortable, benign situation into one that is dangerously threatening. And there is no ability to 'call home'; the submarine CO is on his own and the Perisher needs to ensure he is capable of being so."*[146]

That is why there is a Perisher. Apart from submarine command, they also describe another type of 'command', 'mission command'.

Submarine command is mission command

All professions and specialist subjects develop technicalities and jargon that are a mystery to the outsider. Submarines are an exemplar. James Jinks spent many hours in the *Tireless'* Control Room during Perisher in 2012, fascinated but finding it difficult to understand much of the activity[147] having matters explained as "*almost the last bastion of mission command*"[148] a term introduced into the RN in 1987.[149] Ryan Ramsey's first precept was that "*Command is about people*," a vital link to culture. He emphasises the necessity of acting in a mission command environment, "*you will need to be fully aware of your Commander's intent and*

[145] Stanhope interview.
[146] Eric Thompson, *On Her Majesty's Nuclear Service*, (Casemate: Oxford, 2018), 44-5.
[147] Discussions with James Jinks 2019-2021.
[148] Peter Hennessey and James Jinks, *The Silent Deep*, (London: Penguin, 2016), 11.
[149] RN Mission Command, 'A View'.

objectives, understanding the background requirements of any military task you may be asked to carry out."[150] He then draws on Keegan's imperatives of command arguing their applicability today.[151]

Although the practice of mission command in the naval context stretches back to the age-of-sail providing a link between Hawke, Jervis, Nelson and especially Thomas Cochrane and the submariner,[152] the concept of mission command originates with the Prussian Army called *Auftragstaktik* with the rejection of tactical doctrine rigidity in favour of flexibility and openness.[153] This needed both leaders and soldiers trained to use initiative and flexibility rather than rigidly follow regulations.[154] Smith defines mission command as a common doctrine with "*coherence of view, interpretation and expression from the strategic to the tactical levels*",[155] the commander needs confidence that his subordinates have this coherence — echoing Commodore Perks. The formal Joint Services definition is:

> *"A style of command that seeks to convey understanding to subordinates about the intentions of the higher commander and their place within his plan, enabling them to carry out missions with the maximum freedom of action and appropriate resources."*[156]

In the early 2000s, the Fleet Battlestaff produced a booklet explaining Mission Command showing that the Navy was alive to the continuation of the concept despite the sophistication of communications, a riposte to King's conjecture about naval operations. With constabulary duties in mind, the booklet points out that with the diversity of capability and opportunity, all ships are likely to have to employ mission command and how the ease of communications need not interfere.[157] Although the booklet does not mention it, as Ramsey pointed out, submarines generally operate under mission command with the advantage over other parts of the Navy and military in that the coherence that Smith refers to, is tested and assessed during Perisher. The

[150] Ramsey, *A Guide*.
[151] Keegan, *The Mask*, 311-338; Keegan attributes to, or points out, the absence of the imperatives in a select group of four: Alexander- heroic; Wellington – anti-heroic; Grant -unheroic and Hitler false heroic.
[152] David Erskine (Ed), *Augustus Hervey's Journal*, (London: W Kimber, 1953); Arthur Herman, *To Rule The Waves*, (London: Hodder & Stoughton, 2005); Christopher Hibbert, *Nelson: A Personal History*, (London: Viking, 1994); Andrew Lambert, *Nelson Britannia's God of War*, (London: Faber and Faber, 2004) and 'Admirals: Command, Leadership and Genius', *RUSI Journal* 154/1; Michael A. Palmer, *Command at Sea*, (Cambridge MA: Harvard University Press, 2007); N A M Rodger, *The Command of the Ocean: a naval history of Britain 1649-1815*, (London: Penguin, 2004); Chris Ware, *Admiral Byng: His Rise and Execution* (Barnsley: Pen and Sword, 2009); Thomas, Tenth Earl of Dundonald, *The Autobiography of a Seaman Volumes I and II*, (London: Constable, 1998); Robert Harvey, *Cochrane, The Life and Exploits of a Fighting Captain*, (New York: Carroll & Graf, 2001): David Cordingly, *Cochrane the Dauntless*, (London: Bloomsbury, 2007).
[153] Strohn, *The German*, 14.
[154] Ibid, 114.
[155] Smith, *The Utility*, 65.
[156] MoD Joint Doctrine Publication 0-0.1; RN Mission Command, 'A View', 1.
[157] RN Mission Command, *A View*, 3.

obverse of mission command can be called directed command which is the more usual doctrine of surface ships in company with an officer in operational and/or tactical command and constant communications. The apotheosis was probably Jutland based on the flag hoist, today its complexity is matched by network-centric warfare and C4ISTAR[158] with the Battlestaff booklet warning of over-direction when it quotes the disaster of convoy PQ17.[159]

Mission command was certainly recognised if not named as such in the Second World War even reaching submarine fiction: "*There is nothing a* [submarine] *captain likes so much as independent cruising, this is the nearest to freedom as can be obtained in a disciplined service and it allows a certain amount of scope for independent action*."[160] Herbert Mandel, an experienced wartime destroyer-man and submariner, identifies mission command as the skill and courage of destroyer and submarine COs.[161] Larken sees it through Nelson's principles of his 'Band of Brothers' as the antidote to the old maxim 'the plan does not survive the first shot', based of course, on Nelson's Trafalgar memorandum, a document that Lambert avers is known, relevant and practised today.[162] There are, therefore, different opinions of mission command.[163] A more grounded view comes from Admiral James Burnell-Nugent who agrees with Lambert. When Commander-in-Chief Fleet in 2005, he carried a precis of the memorandum reflecting the kernel of Nelson's doctrine as an aide-memoire for his five pillars of mission command[164] Both Michael Palmer's study of command and Van Creveld's study of command from a systems organisational viewpoint[165] conclude in favour of mission command arguing that communication innovations, as a panacea to control, has its hopes dashed by the introduction of a new element in the fog of war. Another riposte to King? Palmer does, however, introduce the caveat of the necessity for "*well-trained and well-indoctrinated men and women*" who can be relied upon for the "*talents, judgement, and initiative*".[166] It is the latter that Perisher delivers.

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[158] Smith, 'Network-Centric'; Friedman, *Network-centric*; 'Carneades', 'The Death'. C4ISTAR : Command, Control, Communications, Computing, Intelligence, Surveillance, Targetting, Acquisition and Reconnaissance.
[159] David Irving, *The Destruction of Convoy PQ17*, (London: Cassell,1968); Milan Vego, 'The Destruction of Convoy PQ17: 27 June-10 July 1942', *Naval War College Review* 69/3, 2016. PQ17 was wrongly ordered to scatter by the FSL, because of flawed intelligence about the German battleship *Tirpitz*.
[160] Hackforth-Jones, *Submarine Alone, A Story of HMS Steadfast*, (London: Hodder & Stoughton, 1941), 48.
[161] Mandel, *Submarine Command*, 161.
[162] Lambert, *Nelson*, 361.
[163] The US Army's definitions are a rich blend of battleplans, models and metaphors: ADP 6-0 Mission Command, (Washington DC: Headquarters Department of the Army, 2012); Nathan K Finney and Jonathan P Klug (Eds), *Mission Command in the 21st Century*, (Fort Leavenworth KS: The Army Press, 2016).
[164] St George, *Royal Navy*, 3; Email Burnell-Nugent. Burnell-Nugents' questions are: What is the ultimate objective (the intent)? 2. What means are available (the resources)? 3. Do the means enable the way (the strategy)? 4. As circumstances alter, is there a better way (the contingency)? 5. How do we influence our people to follow (the inspiration)?
[165] Creveld, *Command in War*.
[166] Palmer, *Command at Sea*, 319-322.

Perisher's Aims, Objectives and Timing

The two final elements in positing Perisher are to, first, identify Perisher's Aims and Objectives and secondly, because Perisher is such an important career course for the submariner, its time within an officer's career is critical; too early and he has insufficient experience, too late, and it probably means that he did not have the command recommendations at the appropriate time hinting at an inadequacy.

Aim and Objectives

Asking the purpose of Perisher is an easy question, and until 1945 there was an easy answer, for Perisher was an attacking course and a student was judged on 'periscope eye'. Post-1945, the question became more searching as the battle went underwater, the emphasis shifted from periscope attacking to the wider tactical problem and the criteria for assessment changed. The difficulty manifested in the similarity of lexicon but lack of a standard answer. One Teacher suggested that Perisher was to justify the selection process i.e. justify an officer's recommendation for command.[167] As a supposition that may be contestable, but it has merit even if the justification was more nuanced than first appears. Perisher's 'Objectives' were more complex. Perisher is a command course and, as has been seen, command is complex. Some COs see the course as *preparation* for command,[168] while Teachers more commonly see it as an *assessment* of command capability. The words most frequently used in reply to the question were 'command presence', 'safety' and 'limitations', and every Teacher interviewed emphasised the relationship between a student knowing his limitations and being safe. Put most simply: obeying limitations is safe; exceeding limitations is unsafe. Command, safety and limitations are therefore peers in the course context and to achieve them a balance of teaching and assessing is necessary. There was an element of variation in this balance although the mean was somewhere between 50:50 and 75:25 in favour of teaching. When, in the 1990s, the RNLN documented their Perisher (NLSMCC) for ISO 9001 they identified four parts to the course: Teaching; Direct Coaching; Indirect Coaching; and Observing [Assessing]. For this study, however, it is possible to balance teaching and assessment within both the Aim and Objectives of Perisher:

> Aim:
> To provide the Submarine Service with suitably trained, assessed and qualified submarine commanding officers.

[167] Fort Blockhouse Forum.
[168] First and Second Devonport Forums.

Objectives:

1. To prepare a student for submarine command [Teaching and Direct Coaching]
2. To assess a student's suitability as a safe and effective submarine commanding officer [Indirect Coaching and Observing/Assessing]

One extant, demonstrably wordier definition is in the 'Review of the Submarine Command Course' staff paper of 2019. Although the Review's objectives are extensive, dealing with matters outside the scope of this study, the definition of Aim reached here fits well with:

> *"In accordance with BRd 9275(3) Ch 18, the aim of SMCC is to prepare Submarine Warfare Officers for challenging command assignments in submarines, the foundations of which are based on deep tactical knowledge, advanced leadership skills, and the ability to consistently achieve the highest standards of personal integrity and professional conduct commensurate with those defined by the ethos and war-fighting capability of the Royal Navy Submarine Service."*[169]

The Review's first objective of Perisher is also relevant: "*to train, coach and evaluate the tactical knowledge and leadership skills of the SMCC Students*" suggesting sufficient commonality to confirm the credence of the definitions forged here. The NLSMCC Aim, however, is an even better witness: "*to teach and assess the expertise, skills and attitude which are necessary to command a (conventional) submarine in times of peace, crisis and war*."[170] It is towards these ends that Perisher has evolved.

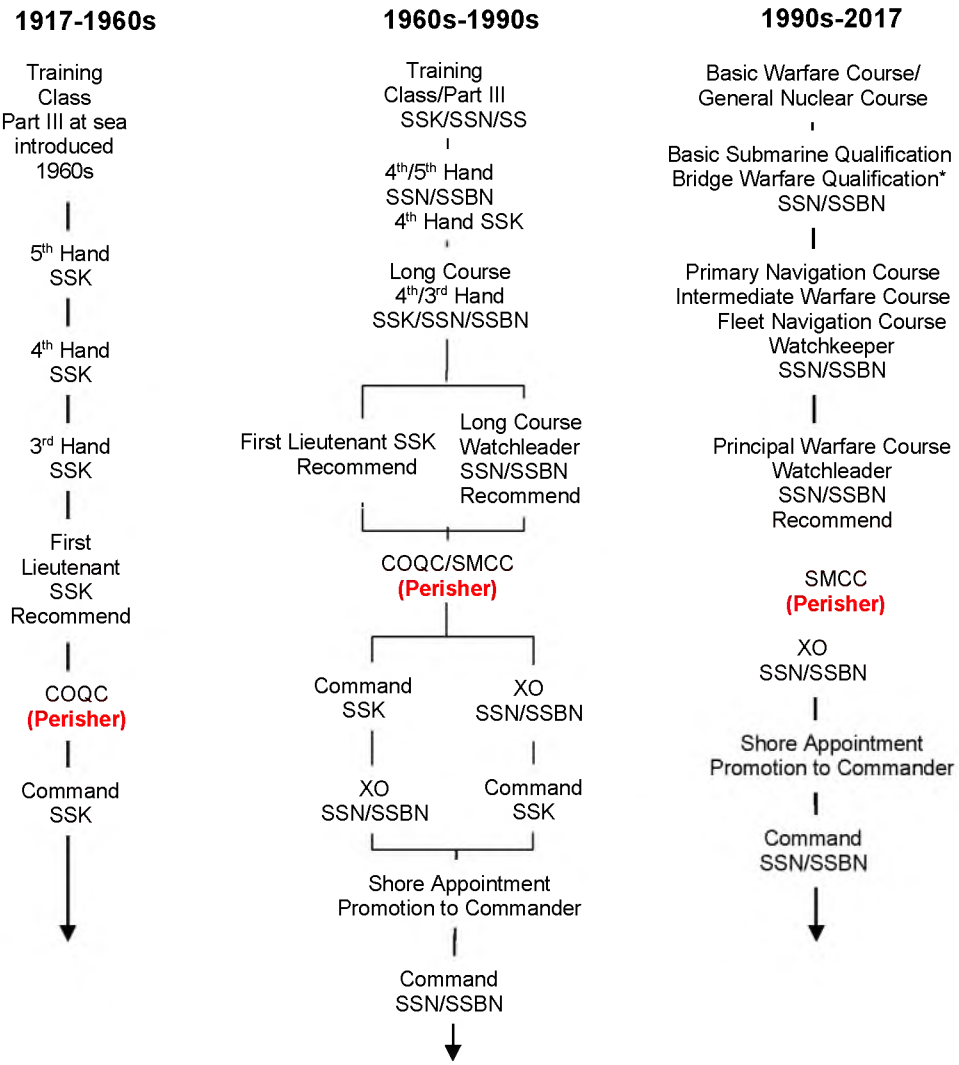
Timing of Perisher in the career progression

Figure 2.4 shows how Perisher has fitted an officer's career path and how it has varied over time, to be examined in more detail throughout this thesis.

For the first half of Perisher's life the career progression was clear and simple, an officer worked his way up the submarine officer job chain from the Officers' Training Class (OTC) to First Lieutenant from whence he was given a command recommendation. This continued when nuclear submarines first appeared, with an officer returning to an SSK for at least a short period before Perisher, but gradually, officers who were Watch Leaders in SSNs and SSBNs started to go from their nuclear submarine straight to Perisher. For some, this was a disadvantage if they were short of periscope time which is used less in an SSN and little indeed in an SSBN. Of course, when the SSKs disappeared, all officers had to go from their SSN or SSBN billet directly to Perisher, now SMCC.

[169] BRd 2 The Queen's Regulations for the Royal Navy Version 6 April 2017.
[170] RNLN NLSMCC Information letter.

Figure 2.4: Career Progression



The period until the 1960s was SSK only, as the 1990s-2017 is only nuclear. The more complex career progression is in the 1960s-1990s period of the Cold War and a mixed SSK/SSN/SSBN fleet. This was a period of growth with billet availability having to be balanced with the ambition to ensure that ex nuclear watch leaders, especially those from SSBNs, had some time, ideally as 1st Lt, in an SSK before Perisher to give them familiarity and confidence in an endeavour to help ensure success.

In summary, by employing some simple social science and analysis of the work of historians, military and naval commanders and submarine COs, we arrive at a clearer perspective of the two 'nebulous' concepts of culture and command in the context of the submarine and Perisher,

so that Perisher is positioned culturally, submarine command is identified, and the aims, objectives and career path of Perisher are defined.

Perisher's micro-culture, positioned at the foot of the cultural hierarchy, plays its part in the perpetuity of the Submarine Service's culture, a subculture of naval culture, by Teacher inculcating, *inter alia* but primarily, sea experience into the Perisher students. As COs, they, in their turn, take what they learn on Perisher back to sea, where their own sea experience in command is added and then, as they reach higher command within the Submarine Service, they ensure the continuance of the culture. The Submarine Service subculture is identified from its initial imposition by Bacon to its establishment by the end of the First World War, its resilience through the interwar years, the trials of the Second World War and into the modern era where the precepts of Bacon survive. The submarine is the epitome of innovation, so the Submarine Service culture has an inexorable engagement with the assimilation of technology, be it propulsion, sensors or doctrine and it is with sea experience that the technology is assimilated — mostly, radar had a difficult introduction.

Submarine command is identified as being different from all other forms of command; it is unique. The imperatives of the proximity of submarine life in its risk-rich environment, the independence of mission command and the ever-present 'third dimension' are the primary factors in that supposition. Submarine command is difficult to define and there is no ready consensus, but 'command presence' is the principal attribute that Teachers look for in a student. There is a nexus between culture and command, and another between command and leadership although the latter two are often conflated. Command needs the right cultural environment and leadership to be effective and the way command is executed contributes to the culture. Perisher provides the link.

3. Beginnings to 1918

The early years of any new organisation are critical to its future success. This was certainly the case with the Submarine Service which experienced prejudice and innovation in equal measure[1] while the first ICS, Captain Reginald Bacon, imposed an ethos and precepts that continue today. The first part of this chapter covers this period that embraces the acquisition of the first Holland boats, the establishment of the old composite screw sloop *Dolphin* "*fitted as a base for Submarines*" in 1907 at the Army's 'fortifications' at Fort Blockhouse in Gosport,[2] and the extraordinary rate of evolution of seventeen classes of submarine over just 17 years before the end of the First World War.[3]

Figure 3.1: The composite screw sloop HMS Dolphin as a depot ship.
The *Dolphin*, launched in 1882 alongside the submarine jetty at Fort Blockhouse, was used as an accommodation ship for the submariners from 1907. The shore base at Fort Blockhouse took her name while the ship survived as a school ship in Leith until 1977. The shore base HMS *Dolphin* became the *alma mater* of the Submarine Service.
Images-RNSM

While the period has received much attention from the policy, strategic and technical perspectives,[4] the critical path in the submarine's early history, the submarine commanding officer's (CO) development, is first explored here. They were special men, who assimilated the new technology, learning to use the periscope and master the attack problem. While often blighted by risk-aversion and a lack of understanding by the wider Navy, they took the submarine from irrelevance to an established position in the order of battle so that, when the First World War came, they were ready: "*British submarine officers* […]*were young, they were already familiar with their boats, they have impudence born of sure courage, and in the tighter*

[1] It's nickname 'The Trade' was pejorative.
[2] RNSM, Royal Navy Submarines 1901-1911.
[3] Ackermann, *Encyclopaedia*, passim.
[4] Lambert, *The Submarine*; Marder, *From The*; Friedman, Norman, *British Submarines in Two World Wars*, Barnsley, Seaforth,2019.

situations they kept their heads."[5] They had learned their trade, but with too little practice, tactical advice and formal training.

The operational exploits of British submarines are well covered elsewhere.[6] The second part of this chapter, therefore, covers the heretofore unknown genesis of the Periscope School with its conception in 1917. This new history, which dispels earlier myths around Perisher, is accompanied by the assimilation of early technological innovation, especially the all-important attack teacher. Comparisons with German training and an examination of the effectiveness of the early School gauge the British efforts. In doing so, the chapter outlines how the character and profile of the submarine commanding officer were formed.

The Early Years

The early influence

Bacon's appointment in 1900 was a clever appointment of a clever man and as he nursed the infant Service through its earliest days he gave every indication of living up to his encomiast, Admiral Jackie Fisher, then FSL, who thought him "*to be the cleverest officer in the Navy*".[7] Maurice Hankey, the Cabinet Secretary, was equally eulogistic, attributing Bacon with being of "*extraordinary ingenuity, technical ability, and driving power*."[8] If Fisher's belief in the submarine awards him the sobriquet 'god-father' of the Submarine Service,[9] Bacon was the 'midwife'. He was a 'T' [Torpedo] specialist and therefore well-versed in the technicalities of torpedoes and electricity and had gained a first-class pass for all his Lieutenant's exams.[10] Taking control of the submarine programme suited Bacon's technical, inventive brain and very soon he was correcting fundamental design errors eventually taking the boats away from Vickers to Portsmouth so that he and his newly recruited submarine crews could fix the problems themselves.[11]

Bacon was relieved in 1904 by Captain Edgar Lees, who had a technical bent and would later run the Whitehead torpedo works at Weymouth.[12] Next came Captain Sydney Hall, who was in the job for four years, 1906-1910,[13] until he was sacked by the FSL, Admiral Arthur

[5] Carr, *By Guess*, 17.
[6] Ashmore, *Forgotten Flotilla*; Baignton, *Honoured by*; Bower, *The Story*; Carr, *By Guess*; Friedman, *British Submarines* and *Fighting the*; Kerr, *All In*; Rudenno, *Gallipoli*; Harris, *Harwich Submarines*, et al.
[7] Ruddick F Mackay, *Fisher of Kilverstone*, (London: Clarendon, 1973), 297.
[8] Marder, *Volume IV*, 316.
[9] Admiral of the Fleet Lord Fisher, *Records*, (London: Hodder & Stoughton), 172-188; Lambert, *Submarine Service*, xvi.
[10] TNA ADM 196/20/469 Bacon's Service Record.
[11] Bacon, *1900 Onward*, 64.
[12] Dash, *British Submarine*.
[13] TNA ADM 196/43/255 Hall's personal records.

Wilson, for 'flirting' with Yarrow Shipbuilders who wanted to enter the submarine export market.[14] Churchill considered Hall "*A d—d sight too pertinacious*"[15] but Hall would return to the job as Commodore in 1915 and remain there for the war. The last incumbent, and perhaps the best-known, was Commodore Roger Keyes who relieved Hall and then was, in turn, relieved by Hall. Keyes' occupancy was contentious. A man of celerity he lacked submarine expertise and a technological bent, so to fill the gaps in his knowledge he appointed some of the best brains of the day to a Submarine Advisory Committee.[16]

Conception, birth and early guardians of the Submarine Service can therefore be pinpointed, the Submarine Service's pejorative moniker cannot. Nobody *really* knows how it came to be called 'The Trade' but Kipling had a try although other than saying " '*What else could you call it? The trade's 'the trade,' of course*"[17] he too failed.

Bacon imposed on the Submarine Service a subculture of the Navy. He started with careful thought to the future COs. As far as he was concerned:

> *"The captains of boats:*
>
> *1) should be young,*
>
> *2) be good rough navigators,*
>
> *3) hard-headed and careful,*
>
> *4) have a good general electric and Whitehead [torpedo] knowledge".*[18]

Bacon's idea was that "*promising*" officers should join submarines for technical training: "*to take to pieces and put together every portion of the fittings of the boat, pack joints, grind valves, drive an oil engine, and work practically with accumulators*." The officers would then be "*sifted*" to select those capable of being captains of boats. In 1903 he wrote that he wanted, "*The rashful officer* [by presumption the younger officer] *who is more likely to seize an opportunity and press into action than the more cautious* [the older officer] *who will wait for a better chance*."[19] He qualified rashness, because *prima facie* it contradicts his philosophy of caution, and emphasises his point by reflecting his own experience in Torpedo Boats:

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[14] Lambert, *Sir John*,.277; Dash, *British Submarine*.
[15] Winston S Churchill, *Companion Volume II Part 2*, (London: Heineman, 1969) 365.
[16] Lambert, *The Submarine*, The Committee consisted of: Commander A P Addison, later Director of Dockyards; Commander J C J Little, later Admiralty Board member; Lieutenant Commander Charles Craven, later MD, Vickers Armstrong Ltd; Engineer Commander R W Skelton, a future Engineer-in-Chief; and Mr (later Sir) A W Johns, later Director of Naval Construction.
[17] Rudyard Kipling, *Sea Warfare*, (London: Uniform, 2015),72.
[18] TNA ADM 116/3093 Naval Necessities: Memorandum [probably Bacon] on The Training of Officers and Men for Submarines.
[19] RNSM A1945/4 quoting Captain Bacon's report to Admiral Fisher 1903.

> *"I therefore do not anticipate that captains of Boats who have been to sea,*[20] *subsequent to their training, will return to the Boats and be as good in command as those who have lately been trained. […] the younger man, whose mind has not been biased by experience, will regard the risks less, and the object to be gained more […] it is a grasp of the immediate initiative, and not the arguments of an experienced, and too evenly balanced mind, that stamps the man as a success." Fisher, C in C Portsmouth, comments "this is absolutely correct…."* [21]

Thirteen officers applied for the six billets[22] but only one, the 25-year-old Lieutenant Forster Arnold-Forster, described by his Captain at *Vernon* as "*a keen mechanic*",[23] was a torpedo specialist therefore knowledgeable about Whitehead torpedoes and electrics.[24] Later, they had to be a 'T' or have a first-class certificate in their Lieutenant's torpedo examination or a recommendation from their ship's 'T' specialist.[25] The paucity of volunteers could have been due to the career risk associated with the prevalent prejudice or secrecy, submarines were *very* new and anything to do with submarines was 'special service'.[26] This was despite the additional money that would increase a Lieutenant's pay. For example, in 1914 a new Lieutenant's daily rate of pay was £0.10s.0d, submarine pay was £0.6s.0d and command pay another £0.1s.0d, collectively a 70% increase in pay.[27] To quantify the additional pay Bacon compared their responsibilities to those in a destroyer:

> *"…the responsibilities of the Officer in a Submarine [the CO] are much greater than those in a destroyer […] to manage his vessel in two planes, to aim and fire his torpedoes, and keep his vessel clear of disaster. […] In the case of a D-class submarine I maintain responsibility is out of all proportion to that of a destroyer"*[28]

Certainly, some of the early submarine officers, like Martin Nasmith, Max Horton and Charles Little[29] were to show themselves as being technically astute. A technical background was certainly useful, for an officer would soon find himself as a 'Second Captain' responsible for the maintenance of engines, batteries, motors, torpedoes and electrics. Some officers, less technical than the 'T' specialists, slipped through the net and some were "*as mad as hatters*" as Charles Brodie illustrated in an amusing anecdote about such an officer, more 'salt-horse'

[20] See Chapter 4 'An enforced return to General Service'.
[21] TNA ADM 1/7644 Inspecting Captain of Submarines to C-in-C Portsmouth 8 May 1904.
[22] Lambert, *Submarine Service*, xviii.
[23] TNA ADM 1/7522 A postscript by Captain C G Robinson dated 7 May 1901.
[24] The Navy List, however, does not credit Arnold-Forster with the 'T' specialist qualification.
[25] Bower, *Dead Reckoning*, 2.
[26] RNSM, Royal Navy Submarines 1901-1911; Bacon, *1900 Onwards*, 60.
[27] Richard MacKay, *Damned Un-English Sailors*, (Penzance: Periscope, 2009), 152; Navy List 1916.
[28] TNA ADM 16/1122 Report dated 19 May 1910.
[29] All later Admirals and Nasmith became Dunbar-Nasmith.

than technical who, utilising his greater knowledge of the spit-and-polish Navy, had the battery plates withdrawn and scrubbed with a wire brush and caustic soda to get rid of the white spots.[30] Exceptions apart, in 1903, Bacon wrote a panegyric to the submariner exposing the rigours and dangers of the job:

> *"they were boxed up in a confined space, practically cut off from outside help, rolling and pitching sharply and considerably, with the incessant roar of the breaking seas all around the hull, suddenly finding the appliances they trust, and whose scientific action they only partially understand, evidently going wrong. Pungent and irritating fumes the exact nature of which they are ignorant are given off and affecting their eyes and throats — naturally talks of explosions and poisoning in submarine boats, so assiduously obligated by our sensational press must have occurred to their minds. Yet through all this unknown they keep their heads and preserved excellent discipline. Surely it is occasions such as this that shine a prophetic light on what the behaviour of our personnel will be in our time."*[31] *[sic]*

Figure 3.2: Sergeant Johnny Cartoon
The pride which submarine officers had in their knowledge of their submarines is exemplified in this oft-repeated cartoon of unknown origins with the two conflicting caricatures.

The caption reads: "Visitor 'By the way. I suppose you've got some sort of Sergeant Johhny who understand all about these thing'umies, What!'
Image: RNSM

Given the exceptional training the junior officer received and the prodigious responsibilities of a submarine CO, Bacon suggested the letter 'S' as an appropriate accreditation in the Navy Lists. Rather than 'S', 'SB'(Submarine Boats) appeared in 1906/7 changed in 1927 to 'SM (Submarines)'. [32]

The strain "*both on mind and constitution*" that Bacon anticipated as a reason for officers to stay in submarines for only two years was prescient if underestimating the resilience of

[30] C G (alias SeaGee) Brodie, 'Some Early Submariners', *Naval Review* 1962-50-4.
[31] TNA ADM 1/7644 letter dated 3 August 1903.
[32] *Navy Lists* 1907 and 1927.

submarine officers. It would mean a high turnover rate and demand a large cadre of volunteer officers[33] but by 1910 Hall was losing a quarter of his officers each year, (4% killed; 2% incapacitated; 20% discharged 'unsuitable' or at own request).[34] Concerns over volunteers was a problem to revisit the Submarine Service.

The solution was officers joining submarines following Lieutenant's courses with a watchkeeping certificate. They would then serve five or six years progressing from Third Hand to First Lieutenant until selection for command in their late 20s or early 30s. They became, as Percy Scott was to call them "*a flotilla of submarines commanded by dashing young officers, of whom we (the British Navy) have plenty*"[35]

Nonetheless, in the very early days, Bacon had to overcome the exuberance of his adventurous young officers by insisting on the necessity to progress cautiously, step-by-step.[36] One gimmick he employed was to have a brass plaque engraved with the words 'No one of us is infallible, even the youngest' passed between COs as they offended the safety precept.[37] Ever since, safety has been a byword in submarine culture especially during Perisher where the primary test is a CO's ability to operate his submarine safely.

The assimilation of innovation

The new classes of submarine, each with an increased capability, were progressive commands for the earliest COs, "*a great school for adventurers*",[38] and by 1914 they were in command of the new, much bigger 'overseas' submarines. These were the eight D-class boats, five times the size of the Hollands, now with a diesel engine rather than petrol. Their improved habitability meant the Navy had a submarine where the crew's endurance could match that of the boat. With two propeller shafts, external saddle tanks, two 18-inch vertical bow tubes (for streamlining), a stern tube and a wireless office designed-in (the mast was raised and lowered on the surface by hand),[39] and a radius of action double that of the petrol-driven C-class, the D-class set the model for the next 40 years. The D4 had the first submarine gun, a 12 pounder (three-inch) but the principal weapon was, of course, the torpedo: first the Mark IV introduced in 1895 (initially no gyroscope), then the Mark VI with a bigger 200lb warhead,

[33] Lambert, *The Submarine Service*, x8.
[34] TNA ADM 116/1122 Report dated 19 May 1910.
[35] Admiral Sir Percy Scott Daily Mail 2 June 1914.
[36] TNA ADM 1/7725 Inspecting Captain of Submarines to Commander-in-Chief at Portsmouth dated 31 May 1903.
[37] Bacon, *1900 Onward*, 67.
[38] E Keble Chatterton, *Amazing Adventure*, (London: Hurst & Blackett, 1935), 53.
[39] Harris, *Harwich Submarines*, 49. The mast was invented by the submarine CO Charles Benning and not a scientist.

followed by the Mark VII torpedoes with a 320lb warhead, capable of 5000 yards at 35 knots introduced in 1909.[40]

The early COs' careers paralleled this progressive submarine development: Martin Nasmith's six commands went from the *A4* to the later *J4*, bigger and better with each command as did Max Horton's seven commands and Noel Laurence commanding four firsts of class.[41] The policy continued with a newly qualified CO in a training boat to find his feet before a larger operational submarine. These COs, who began their careers with the Service under Bacon's 'corporate culture', would also rely on a Bacon development: the periscope.

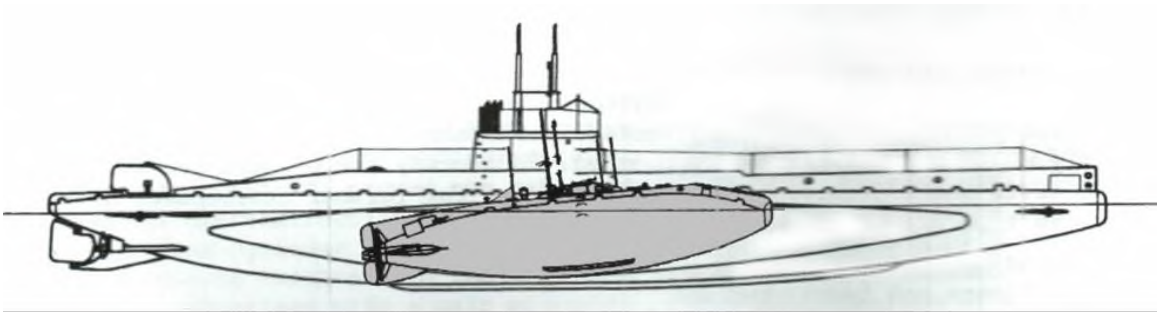

Figure 3.3 Comparison of the D and Holland classes of submarine
In eight years, submarines had grown from just 122 tons to 620 tons as shown by the comparison of a Holland class alongside the D-class here.
Paul Ackermann, *Encyclopaedia of British Submarines* 1901-1955 (Penzance: Periscope Publishing, 1989)

Without periscopes, the first submarines had had to broach so the crew could peer through a small three-inch plate glass viewing port. Bacon's solution to this problem was a tube fitted with prisms at top and bottom. The device was fitted to the first two Holland boats, but it was fixed so the submarine still had to 'porpoise' to see above water. The image was vertical when looking on the beam and inverted when looking astern[42] but, contrary to some commentators, Bacon had "*simply corrected* [this] *by using a specially constructed eyepiece*".[43] Improvements led to a rudimentary periscope held up by stays when upright with a ball and socket at its foot for lowering.[44]

The real development came from the optical designer Sir Howard Grubb who patented Bacon's ideas to produce the forerunner of all future optical periscopes in 1901.[45] Bacon boasted that "*Course can be accurately kept by Sir Howard Grubb's periscope",*[46] and Captain

[40] Roer Branfill-Cook, *Torpedo*, Appendix.
[41] Barrie Downer, *Submarine Commanding Officers, 'The Perisher' 1901-2018*, unpublished.
[42] Keyes, *Narrow Seas*, 30-1 says "*in the early boats the submarine captain had to attack a target which he saw upside down".* No early submariner comments on the issue.
[43] Bacon, *1900 Onwards*, 55.
[44] RNSM BR 3053, Chapter 22, 22.3 Periscopes.
[45] Merrill, *Looking around*, 15.
[46] Ibid, 16.

Cable USN, the Electric Boat Company representative at Vickers, recognising its importance, took the design back to the United States.[47]

Rather than fixed, Grubb's periscopes were raised and lowered and began to be fitted in the C-class, the first to have two periscopes:

> *"The reason for this is because the range of vision of this instrument is barely 60 degrees, and thus [...] it is impossible for the officer in command of the submarine to keep constantly in view a certain portion of the surface when the vessel is submerged. The two periscopes obviate this difficulty".*[48]

Both periscopes were hand raised "*one for the Captain, a 12-13 feet long periscope fitted through the conning tower, and the other, a 21 foot, periscope just aft of the conning tower with an external standard for the first time, for the look-out man continuously sweeping the horizon*"[49] suggesting that the importance of the 'All Round Look' (ARL) had been realised.[50] The *C21-C38* reverted to a single longer periscope with a space created in the battery tank, the conception of the 'periscope well'.[51] The benefit of the longer periscope was a deeper periscope depth and therefore a reduced risk of being 'run-over'. The D-class also had two periscopes and the jerky hand-raising was solved by electric motors.[52] These were the periscopes on which First World War COs developed their 'periscope eye' although this was not an exact science, optics were poor and relative bearings were related to a magnetic compass whose deviation varied with the state of machinery,[53] leading to the expression 'By Guess and By God'.[54]

The origin of hydrophones[55] began with the *Titanic* disaster, the subsequent development of underwater navigational aids, a Canadian radio engineer, Reginald Fessenden,[56] and his hydrophone transducer[57] transmitting sound through the water at 540 Hz. Sound signalling trials with bells fitted on Light Vessels in 1913 were outstandingly successful leading to

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[47] Bacon, *1900 Onwards*, 55.
[48] Charles William Domville-Fife and Ommaney Hopkins, *Submarines of The World's Navies*, (London: Frances Griffiths, 1911), 23.
[49] RNSM BR 3043, The Development of HM Submarines, 22-3.
[50] G Hackforth-Jones, 'First Command' in *Best Stories of the Navy*, (London: Faber & Faber, undated).The earliest that can be associated with the establishment of the ARL is 1926 when Hackforth-Jones took the Periscope Course.
[51] RNSM BR 3053, Chapter 22, 22-3 *Periscopes.*
[52] Ibid.
[53] Bacon, *1900 Onwards*, 58-59. Compasses had wrongly been declared useless in submarines because Bacon had fixed the variation problem.
[54] Carr, *By Guess*, An Introductory Note.
[55] Willem Hackmann, *Seek and Strike, Sonar, anti-submarine warfare and the Royal Navy 1914-54*. (London: HMSO, 1984), 5; 'Hydrophone' comes from the medical world (a small rubber bag attached to a stethoscope). Alisha Gray (who invented the telephone independently from Bell) named the underwater microphone a hydrophone when working on an underwater bell and microphone system.
[56] 'The Submarine Signal Company', *The Journal of the Acoustical Society of America* 137, 2273 (2015).
[57] RNSM BR 3043, Submarines, 29.3.

hydrophone-fitted submarines finding they could use the new capability of 'sound telegraphy' known as S/T, sometimes S.S/T and later SST to communicate using underwater morse.[58] The hydrophones and SST were operated by the telegraphists, who had the post-nominal HL for Hydrophone Listener, for two reasons: Morse code ('F' in Morse was used for SST ranging) and the wireless amplifier was used to amplify the hydrophones signal. There were two headphone extensions, one for the CO and one in the fore-ends away from machinery noises.[59] It was monotonous work resulting in operator fatigue and the necessity for frequent changes of operator so telegraphists often found themselves 'watch and watch about'. [60]

Manoeuvres, limitations in exercising

'Manoeuvres' (today 'Exercises') were a way to develop and test tactics. Until 1910 it was mandatory for a submarine on Manoeuvres to be accompanied by a ship flying a large red flag, to warn ships to keep one mile clear.[61] The red flag practice was reportedly the result of an embarrassing event in Torbay when an A-class submarine was caught in the fishing trawl of a yachtsman and his two lady crew members. The red flag caused another incident when Lieutenant Tom Triggs, in the *A6*, mistook a large red beach umbrella for the target's red flag and fired his torpedo on to Sandown Bay beach.[62]

In March 1904 during a set of Manoeuvres with an unwritten agenda to find the antidote to the submarine there were a series of set-piece actions at the end of which it was concluded that destroyers could intimidate submarines by steering directly for their periscopes.[63] This was a masterpiece of creative umpiring for during the first day the submariners had used some dummy periscopes (a trick that would be used again in the Sea of Marmara during the First World War). The destroyers were deceived until they realised there was no periscope 'feather'. The submariners then used white collars to simulate the wake. [64] A Naval Review edition later challenged the Manoeuvres with being predetermined,[65] however, the submarines were able to

[58] Gary L Frost, 'Inventing Schemes and Strategies: The Making and Selling of the Fressenden Oscillator', *Technology and Culture*, Vol42. No.3 July 2001, 462-488.
[59] TNA ADM 186/450, CB1757 DTM Department, Handbook of Hydrophones In Submarines 1926.
[60] Barrow Submariners Association, http://rnsubs.co.uk/dits-bits/articles/development/asdic.html acquired April 2018.
[61] Compton-Hall, *Submarines* page 17; RNSM A 2007/558 Officers War Experiences Training Lessons Learned. Suggestions were made after the war to have the submarine show a red flag in exercises to aid tracking and plot integration.
[62] RNSM A 1989/154 Memoir of Robert Ross Turner. The dates are unknown. The second episode is wrongly related in Keith Hall, *Submariners*, (Stroud: Tempus Publishing, 2006), 34 where Hall states that the error was the cause of the periscope presenting an upside-down view, but this had been eradicated by Bacon much earlier.
[63] Lambert, *Naval Revolution*, 83-4.
[64] Bacon, *1900 Onward*, 74.
[65] Sydney Hall, (Anon), 'The influence of the submarine on naval policy III', *Naval Review 1914-2-3.*

practice their inchoate tactics against destroyers at high speed.[66] Francis Cromie,[67] for example, showed the ability of a submarine to penetrate a screen without being attacked by a guarding destroyer. Unfortunately, the *A1* was lost on the last day while attacking the cruiser *Juno* because periscopes and the finer points of 'periscope eye' like the rigours of the ARL interval were in their infancy. She was run down and sunk by the liner *Berwick Castle*[68] following which an additional lower hatch was added in the conning tower, a practice that survives to today together with the procedure for shutting the upper and lower 'lids'. The innovation soon proved its value when the *A9* collided with the coaster *Coath* off Plymouth in February 1906 and the 'lower' lid' prevented any water entering the boat following the damage to the conning tower.[69]

Two further Manoeuvres were held that year. The first, in May 1904, was organised by Fisher, as Commander-in-Chief, Portsmouth, who left conduct to the submarine and destroyer Captains. Their joint report concluded that "*the balance of power to inflict damage lies with the submarine*." And that "*no method by which destroyers can inflict injury on s.m. boats with certainty, has yet been devised*. [*sic*].[70] In August, Manoeuvres in the Irish Sea had eight submarines and numerous destroyers taking part. Bacon arranged for the Holland boats to operate on the surface at night and in doing so they managed to 'sink' five destroyers without being detected. Although successful, the tactic was considered dangerous and, together with the *A1's* loss, caused restrictive 'Rules' to be introduced such as no night-time action, no counter-attacking and especially no ducking under a ship, rules that restricted both sides, but especially the submarine COs in learning how to operate their vessels aggressively. Only in 1913 were submarines finally allowed to penetrate a destroyer screen and while ducking under a ship was recognised as a risk, it was not formally prohibited, enabling an important element of submarining just in time before the war.[71] The *A1* accident also meant anti-submarine research stopping until 1910 when a committee was set up to consider defence against submarines discussing, *inter alia*, zigzagging, stalking by submarines and the mounting of guns

[66] Fisher Papers 1/12 Captain Sydney Hall to Admiral Lord Fisher July 1913.
[67] Later Captain Cromie. An unsung hero, he commanded the British submarine flotilla in the Baltic Sea only to be murdered on the staircase of the British Embassy in Petrograd (St Petersburg) in 1918 acting as the de facto British representative in Russia.
[68] Merrill, *Looking around*, Note 5 states that A1's periscope was non-rotatable and that may have contributed to the accident. His assertion, however, is not qualified and Bacon, in his earliest periscope experiments, realised the requirement for rotation.
[69] Murray Fraser Seuter, The Evolution of the Submarine Boat, Mine and Torpedo, from the Sixteenth Century to the Present Time, (London: J. Griffin, 1907), 158.
[70] RNSM A 1065/04 HMS Thames — Report of Manoeuvres dated 6 June 1904.
[71] Lambert, *Naval Revolution*, 85-6.

on submarines.[72] Despite these considerations, by 1914 the only real way of detecting a submarine was with the human eye and the only way of sinking it was by either shellfire or ramming allowing the German U-boats great success until the convoy system was introduced in 1917.

In 1908, for the first time since the loss of *A1*, submarines were given the chance to attack a capital ship, the *Dreadnought*. Unfortunately, it went badly: Brodie's periscope flooded and he was embarrassed by pursuing the wrong target as a result, although there is some suspicion that the *Dreadnought* cheated.[73] The 1910 Manoeuvres showed the capability of the new 'overseas' submarines when the *D1*, acting independently, went from Portsmouth to Scotland where she 'torpedoed' two cruisers of the Blue Fleet, a round trip of 30 days with the crew living onboard.[74] Despite an attendant incredulity to the potential of the submarine, during the 1912 Manoeuvres, Geoffrey Layton in the *D2* penetrated the Firth of Forth and 'sank' his own depot ship.[75] Layton was followed by Horton in the *D6* who 'sank' two warships before surfacing alongside the battlecruiser *Indefatigable* telling the incredulous, peppery Captain Arthur Leveson, "*I've sunk you*." This was too much for Leveson: to have a 22,000-ton battlecruiser sunk by a 600-ton submarine commanded by a Lieutenant was unbelievable and inappropriate, it threatened the dynamics between the ranks, and so Horton was berated but avoided being disciplined.[76]

Manoeuvres' rules obfuscated the full potential of the submarine leaving a residual disbelief in its capability. For example, a submarine had to surface after making an attack and stay on the surface for half an hour 'out-of-action' and even as late as 1913 submarines returned to port rather than exercise at night.[77] Yet that same year, the D-and E-class 'overseas' submarines had proved their effectiveness when the Blue Fleet lost 40% of its capital ships to submarines working a cycle of eight days on patrol followed by a fortnight in harbour proving an ability to blockade a hostile port.[78] Obversely, the unrealism of being obliged to surface after an attack denied the submarines the chance to practice evasion and the surface ships attacking, and

[72] RH Gibson and Maurice Prendergast, *The German Submarine War 1914-1918*, (London: Constable, 1931), 24 cited in Brassey's Naval Annual, 1919, p.131; Brodie, 'Early Submariners III'. Gibson makes the comment that there was no record of a submarine sinking another submarine by gunfire. Zigzagging, originally known as "Tangoing," had not yet become an anti-submarine tactic.

[74] TNA ADM 1/8128 Inspecting Captain of Submarines 5 August 1910.
[75] William Jameson, *Submariners VC*, (Letchworth: Garden City, 1965), 109.
[76] W S Chalmers, *Max Horton and the Western Approaches*, (London: Hodder and Stoughton, 1954), 9-10.
[77] RNSM A 1985/42 Rear-Admiral VHS Haggard Submarines 1913-1915.
[78] CAC CBR0014/FISR 1/12 Captain Sydney Hall to Admiral Lord Fisher, July 1913.

neither surface ships nor submarines were prepared for the vigours of an extensive war in all weathers. As Bower pointed out:

> *"there is a large difference between a peacetime practice attack and the wartime real attack. The latter is usually unexpected and the conditions of weather can be anything. Such will be the concentration during a war attack that the CO will probably remember very little whereas in a practice attack the whole thing can be plotted for analysis afterwards and reasons for actions discussed with knowledge of what really happened."*[79]

The sad lessons of these events were that many lives were to be lost as 'Levesonesque' perceptions held until *Kapitänleutnant* Otto Weddigen in the *U9* brought the message home so forcefully with the sinking of the old cruisers *Aboukir, Hogue* and *Cressy* on 22 September 1914: Weddigen did not surface after torpedoing the *Aboukir*![80] And the purblindness that submarines were capable of penetrating harbours was to later cause problems at Scapa Flow in 1914.[81] Recognition of the submarine's potential had been dismissed:

> *"It is very difficult to make people think in anything but terms of Dreadnoughts […] It is a perfectly hateful idea to senior officers of the Navy that a submarine should dominate waters in which Dreadnought proudly sails."*[82]

The art of attacking and the attack teacher is born

The torpedo attack is the essence of the submarine. In explaining it, some officers used a shooting analogy: "*If he* [the CO] *was a good shot at partridges, etc, he probably became a good attacker in a submarine in quick time*".[83] Another, using the same analogy, explained the differences being that a submarine CO was only allowed to take glances and that the target would have altered course in between.[84] These illustrative analogies were, however, simplistic, for attacking was, and remains, a more complex mathematical problem as the trigonometry at Figure 3.4 indicates. Similar to naval gunnery, it differs because the submarine CO only gets one shot, a reload takes a long time, and he is likely to be immediately counter-attacked, whereas the gunnery ship fires many shells over short periods and can exit the action rapidly. In the simplest mathematical terms, the submarine CO has to match his weapon's speed across to the target's speed across, (WSA=TSA), just like the hunting analogies where the hunter has to match the speed and direction of his shot to arrive at the same place as the bird. To do this you aim ahead of your target, known as the Deflection Angle (DA). The hunter guesses, the

[79] Bower, *Dead Reckoning*, 124.
[80] Gibson and Prendergast, *The German Submarine War*, 7-9.
[81] https://uboat.net/wwi/men/commanders/121.html. U-18 tried to enter in November 1914 and U-116 in October 1918. Both boats were sunk
[82] Sydney Hall, (Anon), 'The Influence of the Submarine on Naval Policy I', *Naval Review,* 1913-1-3.
[83] RNSM A 1983/22 Reminiscences of Captain Oswald Hallifax.
[84] Ashmore, *Forgotten Flotilla*, 196.

submarine CO works it out mathematically, using his estimations of the target's range, course and speed. It sounds simple, but it is difficult, exacerbated, as Harry Oram points out, in the submarine sense by the CO only being able to see his target fleetingly:

> *"indistinct glimpses of the target from which to build up an evanescent mental picture of the surface situation and on this slender basis he had to get the submarine into a firing position before the fleeting opportunity pass him by."*[85]

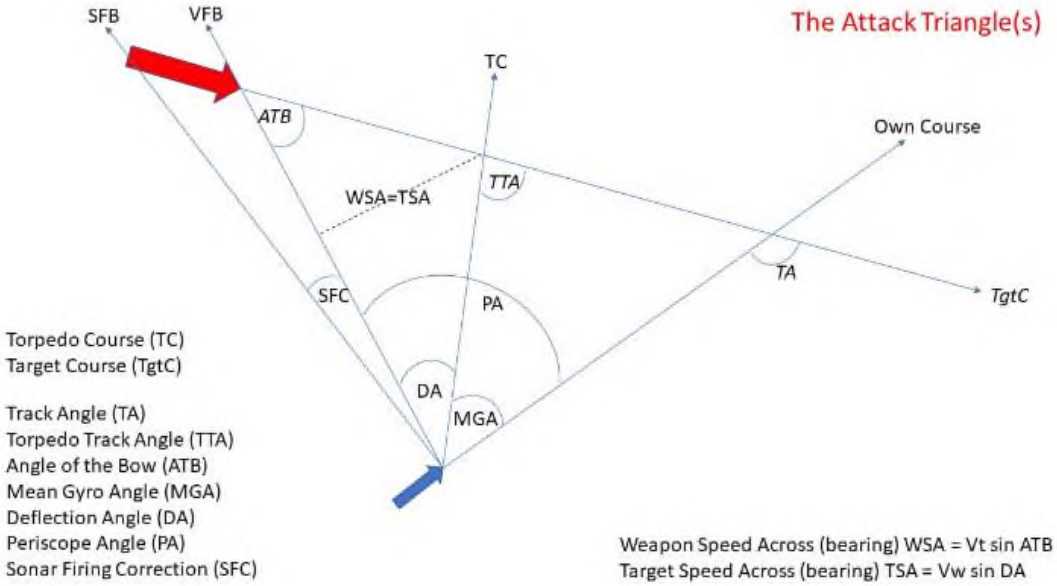

Figure 3.4 The Attacking Triangle
Image: Pieter Cox

To learn the art, submarines were organised in Sections[86] often with an old Pygmy class gunboat to act as both tender and target when a CO would endeavour to get his boat into a position 45° to 70° on the target's bow at under a thousand yards with the target going at its one speed and invariably steering a steady course. Speed was therefore known, leaving the course to be determined but often not even an estimation of the target's course was made. When COs were relieved, they passed on 'The Magic Number' DA, which only needed a slight adjustment for a finer angle-on-the-bow (ATB). In such a rudimentary way a submarine officer learned his trade, although perhaps only when he was in command. Hallifax, for example, was never allowed to conduct an attack when he was First Lieutenant because his CO needed to take

[85] H K Oram, *Ready For Sea*, (Bungay: Futura, 1974), 199.
[86] Nicholas A Lambert, 'British Naval Policy 1913-1914: Financial Limitation and Strategic Revolution', *The Journal of Modern History* 67/3, 1995 608. Keyes Mss 4/13 Memorandum dated 3 June 1911 identifies the Sectional organisation as: Dover Section I, Portsmouth Section II, Harwich Section III, Dover Section IV, Dundee Section VII. The organisation then adopted a 'Flotilla' nomenclature followed after the Second World War by Divisions. Then in 1952 when the NATO nomenclature was adopted, it became Squadrons and now it is back to Flotilla.

advantage of the few opportunities to practice.[87] Without proper training, it was difficult for COs to understand the problem thus limiting their ability to pass on the theory.

Typical of this didactic crudity is the experience of Cromie in 1910 when in command of the Pygmy class gunboat *Onyx* and the A-class boats in Devonport. Cromie would take the "*old mother hen tender and its brood of pondering submarines*" into Whitsand Bay where he would train the COs in attacking the *Onyx*.[88] Whether self-taught or not, Cromie's own skills proved effective when he torpedoed the German cruiser *Undine* in the Baltic in 1916, and on one day sank five merchant ships.[89] Others had to, "*rely on the innate senses that they happened to be born with if chance sent them an enemy their way*."[90] Some COs, however, were intent on self-development (or destruction). In exercises with the depot ship *Hazard* in 1903, Mansergh in the *A1*, a year before her loss, attempted to out-think Bacon/Lees in the *Hazard* and get in a surprise attack during a set-piece demonstration for the Lords of the Admiralty; it failed and Mansergh breached Bacon's safety edict.[91]

Self-taught, COs learned their trade while building a symbiotic relationship with their periscopes aided by a simple table to give them the DA to conduct an attack solely by eye. Thus, the moniker 'periscope eye' was created — Brodie, claimed his sole justification for command was his "*good eye*".[92] Indeed, having a good 'periscope eye' became the *sine qua non* for a submarine CO and the trope for future generations.

One submarine CO who wrestled with the attacking problem was Commander George Lewis who, in 1906 in the *B2*, had conducted the first underway dive — experimental and dangerously risky at the time but which of course became standard practice.[93] It demonstrated the mettle of the youngest Commander in the Navy who was short, tubby, fair-haired and absurdly young-looking. He had an impatient and exacting manner that made him intensely unpopular, whereas Horton could get away with similar characteristics largely because of his sporting ability, (he was a first-class Soccer player). Nonetheless, when Brodie relieved Lewis he found his command to be in impeccable order.[94] More importantly, however, Lewis was bright and he realised that from the inception of the Submarine Service in 1901 the standard method of teaching potential COs the art of attacking, and then maintaining those skill levels

[87] RNSM A 1983/22 Reminiscences of Captain Oswald Hallifax.
[88] Kerr, *Day's Work*, 1939.
[89] Bainton, *Honoured By*, 80-94, 99-100.
[90] Oram, *Ready For Sea*, 199,
[91] Bacon, *1900 Onward*, 66.
[92] C G (SeaGee) Brodie, 'Some Early Submariners II', *Naval Review* 1963-51-1.
[93] Ibid.
[94] Ibid.

by attacking surface ships at sea, was costly in terms of ships, submarines, manpower and fuel. Lewis also realised that a wartime expansion of the Submarine Service would increase the demand for these services. The solution, Lewis realised, was a shore-based attack simulator in today's terminology, an idea he had while in command of the Flotilla of three B-class submarines based in Gibraltar in 1913 where he built a prototype but dismantled it when he left.

Keyes later reflected on this pre-war attack training situation. Unsurprisingly, he was critical of the peacetime exercise rules and lamented that operational cycles had failed to fully test and reveal the real wear and tear of machinery [and crews] that the wartime patrols incurred.[95] But he believed that the peacetime training in 1912-1913 had been close to war conditions and submarines had been well prepared. After all, between January 1910 and January 1913 the 13 A-class boats, the kindergarten for COs, had made 1,350 exercise attacks.[96] Compton-Hall thought Keyes was probably too complacent. As an ex-CO and submarine authority he avers that submarine attack training:

> *"could and should have been significantly improved". Until the Is-Was appeared in 1917, COs fired by eye alone against usually the same target, but that could have been improved upon by the most basic target analysis and a little mathematical application."*[97]

It is hard to argue with Compton-Hall about Keyes but he talked with the benefit of hindsight and the infant amateur Service had, in just 11 years, progressed from static dives to prolonged patrols off a hostile coastline. That the COs were so capable was a credit to their endeavours and, despite the limitations of their training, British submarine COs' skills were to more than match the Germans with initiative and daring in the Baltic and with their penetration of the Dardanelles where they used "*ingenuity, improvisation and self-help to seek and exploit opportunities*."[98]

[95] TNA ADM 137/225 Keyes to Chief of War Staff, 1 November 1914. James Goldrick makes a similar point in his two papers: 'The Impact of War: Matching Expectation with Reality in the Royal Navy in the First Months of the Great War at Sea', *War in History 14/1* 2007 and 'Coal and the Advent of the First World War at Sea', *War in History 21/3* 2014.
[96] Chatterton, *Amazing Adventure*, 54.
[97] Compton-Hall, *Submarines*, 16.
[98] Ibid.

The First World War

Attack training becomes reality

Attack training became more realistic after 1914, although some COs failed to capitalise on the opportunities. An example of early amateurism was Archibald Cochrane of the *E7* who would allow his First Lieutenant (No 1) to conduct the attack but deny him the chance to do it properly. The interchange between the two officers is worth quoting for its comedy:

> *Captain: "Down periscope. What the Hell are you putting it up for?"*
> *No 1: "To see the target and find out what course to steer…"*
> *Captain: "Steer so and so." (the usual course)*
> *A pause followed. A little later:*
> *No 1: "May I use the periscope and have a look at her?"*
> *Captain: "Don't be a bloody fool. Wait two minutes and then surface".* [99]

Conversely, William Carr, a reserve officer, relates torpedo practice as being "*an interesting game but not without its dangers. The attacks are carried out under conditions as nearly approaching those of actual warfare as possible*." He recalls ducking under an escort before making a snap attack against the target calling it "*a most realistic game*". He qualifies the dangers by relating how one submarine was rammed and sunk, and in a second event two submarines collided.[100]

As Hallifax found out, the opportunities to practice attacking were still too infrequent even during the war. Between November 1915 and October 1916, when in command of the *B5*, based at Fort Blockhouse as a training submarine, he was prohibited from making practice attacks. When he did try an attack against the Ryde Ferry he was told abruptly to confine himself to his training class duties. The irony was that every day two or three submarines were positioned off Portsmouth to attack the German High Seas Fleet if it attempted to bombard Portsmouth, something expected daily by the local Commander-in-Chief.[101]

By 1914, a new wartime reconnaissance role had emerged to operate 'overseas' now the capability had been demonstrated but this was one for which the COs had to self-educate while

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[99] Compton-Hall, *Submarines*, 19-21. Evans, A S , *Beneath The Waves*, (London: William Kimber, 1986), 65-7. Cochrane's eccentricity continued. The *E7* was sunk in the Dardanelles and Cochrane taken prisoner but he escaped with eight others, after a trek of 32 days and 400 miles, they made it to Cyprus. Cochrane was awarded the DSO and retired from the Navy in 1922 when he became an MP and then Governor of Burma. In the Second World War he commanded an auxiliary cruiser on convoy duties.
[100] William Guy Carr, *Hell's Angels of the Deep*, (USA: Dauphin, reprint 2016), 215-7.
[101] RNSM A 1983/22.

at war. Acting much like the 18th/19th-century frigate watching enemy harbours, it was a constant demanding patrol on the edge of minefields operating under a policy initially identified as attack first-report later; the latter depending on wireless. Operationally, Keyes sensibly allowed his COs latitude to use their initiative to develop their own tactics and seize any opportunities that came their way. Consequently, "*the commanding officers who were determined, in Nelsonian fashion, to 'engage the enemy more closely' succeeded; those who stood off or were unimaginative failed*."[102] This was just as Bacon had predicted and many COs would prove both Bacon's perception and Keyes' belief well-founded.[103] A couple of extreme examples are Charles Benning in the *E5* who surfaced to attract a German destroyer. The destroyer charged at full speed whereupon *E5* dived and fired. Unfortunately, this coruscating act of derring-do, the first submarine torpedo attack of the war, was unsuccessful, for the destroyer avoided the torpedo.[104] Another was Cromwell Varley in the *H5*, who purposely ignored orders, entered the Ems River and sank a U-boat in July 1916.[105]

Wartime periscope, hydrophone, wireless and the Is-Was developments

Grubb periscopes were fitted to all classes of submarine until 1915. The Admiralty then trialled Italian and French periscopes with Messrs Kelvin, Bottomley and Baird acquiring the rights to manufacture them.[106] Grubb responded with improved brass periscopes and then non-magnetic steel tubes. A 24-hour desiccation problem was solved by Lieutenant Commander Frank Newhouse who created a vacuum inside the periscope that took only 10 minutes.[107]

Barr and Stroud was the natural choice to design a rangefinder for submarine periscopes as the company was making most of the Navy's rangefinders. Some prescient work in 1903 established that a vertical rangefinder in the upper part of the periscope tube was the best arrangement but there was no follow-up until resurrected by Hall in December 1915. A mock-up was made in July 1916 and shortly afterwards the company received orders for 13 FY1

[102] Compton-Hall, *Submarines*, 18.
[103] Lieutenants Edward Boyle and Lieutenant Commanders Norman Holbrook and Martin Nasmith were to win the VC for their exploits in the Dardanelles while Lieutenant Commanders Noel Laurence, Max Horton and Francis Cromie were awarded the DSO and the Russian St George Cross (VC equivalent) for their exploits in the Baltic.
[104] Bower, *Dead Reckoning*, 108; Harris, *Harwich Submarines*, 51.
[105] Bower, *Submarines*, 99.
[106] RNSM BR 3043, Submarines, 22-3.
[107] TNA T173/725 Claim of Lieutenant Commander FL Newhouse in respect of desiccators for submarine periscopes*;* John Graham (alias Klaxon) Bower, *The Story of our Submarines*, (Edinburgh: William Blackwood 1919), 69. Desiccation is critical even today to stop periscopes 'fogging'.,

periscopes[108] although the first periscope was fitted in the minelayer submarine *M3* in 1919.[109] The stadimeter rangefinder became the British standard and American Kollmorgen periscopes used the same principle[110]but the German Zeiss periscopes relied on a graticule.[111]

Figure 3.5: An FY1 Periscope

The Barr & Stroud periscope was developed in 1916 and incorporated a vertically mounted rangefinder.

Image: Thales

Figure 3.6: Range Finding

The stadimeter principle (above) was favoured by the British in the Barr & Stroud periscopes. An image of the target is superimposed on the real image using a known height. The Germans favoured the reticule (below) where a known height (or length) is assessed against the marks in the periscope.

An innovative bifocal, sky searching periscope known as CH2[112] was developed in 1917. It had three innovations: an internal focusing lens so the user could keep his eye on the eyepiece to change focus; rotating grips on the handles to change magnification; and a new range estimator capable of ranging in both the horizontal and vertical planes so the target's ATB could be determined from the virtual length and thereby course:[113] The first two became standards, the latter capability disappeared but visual clarity improved. Barr and Stroud were to establish themselves as the preeminent, later monopoly, supplier of submarine periscopes.

Commander (later Captain) CP Ryan, recalled to service, was an unusual choice to lead the development of the hydrophone for he was neither a scientist nor knew much about sound

[108] Periscopes follow Barr and Stroud's nomenclature. FY name is from its predecessor army rangefinders (the periscope rangefinder was an army rangefinder turned through 90°). Naval products adopted the first letter 'C'. The attack periscope 'CH' came in sequence, search periscopes came later, hence 'CK'. (See Appendices for the full list of Barr and Stroud periscopes).

[109] Moss and Russell, Michael and Iain, *Range and Vision: The First Hundred Years of Barr and Stroud*, (Edinburgh: Mainstream, 1988), 83.

[110] http://www.fleetsubmarine.com/periscope.html accessed January 2018.

[111] Torpedo Vorhaltrechner Project at http://www.tvre.org/en/aiming-with-the-periscope (a WW2 version).

[112] CH1 was an FY1 periscope without the rangefinder.

[113] Moss and Russell, *Range and Vision*, 113.

theory or instrument design. Yet, with an enthusiastic if eclectic, musically inclined staff[114] he managed to get a variation of the Fessenden system to sea for trials in the *B3*.[115] Ryan's work resulted in two new designs: an improved Fessenden which became Type 102 which went into the E-and L-classes, and a transmitting-only version that was designed to talk to submarines under tow.

Early outfits had two 5-inch plate hydrophones tuned to 900 Hz fitted in the submarine's pressure hull, either side forward.[116] A third plate was later added facing aft.[117] There were three principles behind the installation of this apparatus: safety, attack or tactical and navigation. For safety, it was considered possible to detect another dived submarine and so avoid a collision. The attack mode was severely limited, and the submarine had to be swung across the bearing of the target to find the null point between the two forward hydrophones. Unsurprisingly, this was not successful[118] so the deficiency was rectified by the later installation of the Revolving Directional Hydrophones (RDH). The navigational use was for the detection of the submarine bells and the tactical was SST with ranges out to 20 miles claimed but reception could be seriously affected by ambient or own-ship's noise. Their use laid down some of the principles for passive search housekeeping that would last well into the future. For example: slow speed to reduce flow noise; casing rattles had to be eliminated; machinery to be stopped (apparently the hydraulic system particularly interfered); and the operator was to be informed of course and speed changes and pump starts/stops etc. [119]

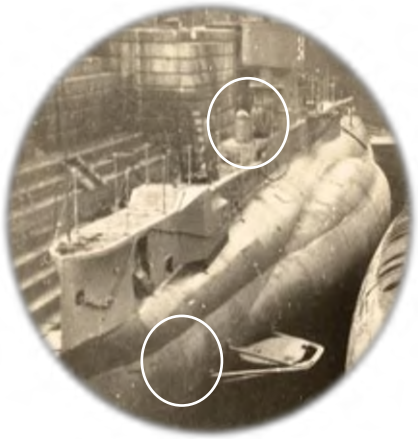


Figure 3.7: The revolving Directional Hydrophone
The RDH hydrophone can be seen ringed in front of the fin. The transmitting and receiving hydrophones are forward between the torpedo tubes and hydroplanes
photo: RNSM

[114] TNA ADM 218/1 A B Wood Personal Recollections of the growth of a Civilian Scientific Service in the Navy.
[115] Ibid, 49.
[116] TNA ADM 186/440 CB 1664 Handbook of Hydrophones in Submarines.
[117] TNA ADM 186/450, Hydrophones.
[118] Compton-Hall, Richard, *Submarines and The War At Sea 1914-18*, (London: Macmillan, 1991), 61.
[119] Ibid, 60.

RDH began to be fitted towards the end of the war with a set of revolving (trainable) hydrophones outside the hull initially in the stem of the boat,[120] but then on the forward casing.[121] RDH had two back-to-back plate receivers connected by a rod. Pointing a hydrophone directly at the sound source caused maximum movement whereas equal reception resulted in no rod movement and provided a bearing with an accuracy of ± 10°[122]. Even though the plate hydrophones were more sensitive and could detect sounds to three times the range of the RDH hydrophones, RDH detected surface ships up to nine miles, further than a typical North Sea visibility.[123]

Another Ryan product was a "*sophisticated arrangement of five powerful and sensitive hydrophones by which they* [a submarine] *could approach an enemy and obtain her position without using the periscope*."[124] The array was fitted in the anti-submarine R-class but as these boats were not used in their intended role the array's potential was not realised and array work stopped until asdic Type 186 in the 1950s.[125]

To overcome own-ship's noise the embryonic towed array began to be investigated in early 1916. In July 1917, G.H. Nash of the Western Electric Company developed the 'Fish' with which he claimed to have solved both the flow noise and bearing problems. It had a bi-directional hydrophone for bearing and a uni-directional hydrophone, which rotated, to resolve ambiguity. The 'Fish', first tested in the swimming pool at Portland,[126] won the day against opposition with an initial order for 136 sets and Nash was awarded £3000 for his work.[127]

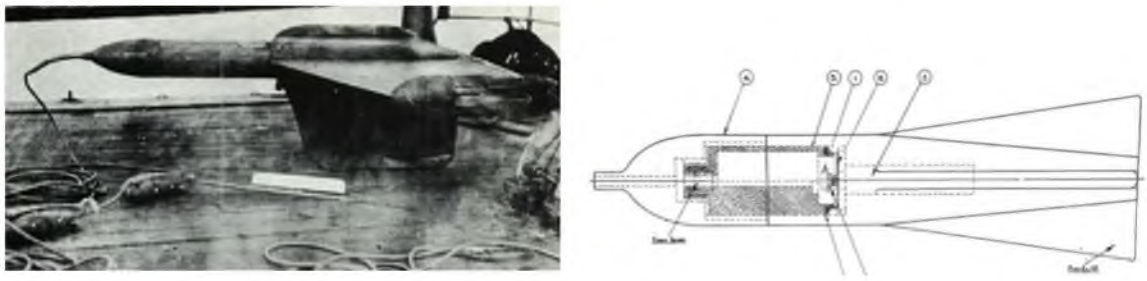


Figure 3.8: The Lancashire Fish and the Rubber Eel

The Lancashire Fish is clearly much larger than the 18-inch-long Eel and was a more sophisticated towed hydrophone. But it was too late to become operational during the war.

Photos TNA ADM 218/1 and TNA ADM 186/440

[120] TNA ADM 186/440 CB 1664 DTM Department Handbook of Hydrophones in Submarines 1924
[121] TNA ADM 186/450, Hydrophones.
[122] Ibid.
[123] H. De L. Standley, 'A Good Day's Work', in Thomas Woodrooffe (Ed), *Best Stories of the Navy*, (London: Faber & Faber, undated), 482-512. In this fictitious story Lt Cdr Thorogood, CO of the submarine *Q1,* appears to listen frequently and intently to what must be an RDF.
[124] BR 3043, Submarines, 29.
[125] http://rnsubs.co.uk/articles/development/sonar.html
[126] Carter, Geoffrey, *The Royal Navy at Portland since 1845*, (Liskeard: Maritime,1987), 48.
[127] Hackmann, *Seek and Strike*, 61.

Submarines, however, received Ryan's omni-directional 'Rubber Eel'. Eighteen inches long by 3 inches diameter it had a microphone to detect vibrations as sound waves compressed a rubber body and a 150 feet cable mounted on the bridge rail to tow the body astern or hang over the side while the submarine was stopped. Although there is no absolute proof, the Eel was possibly towed dived.[128] Research on towed hydrophones continued resulting in an improved Eel, called the 'Porpoise', and eventually the 'Lancashire fish'. Sadly, none went into production before the war ended when further development was overtaken by the favoured technology of asdic[129] and it would be another fifty years before research into the technology returned.

Submarine wireless fitting was opportunistic to begin with, and communications were limited to about 30 miles well into the First World War with a Type 10, 1kw wireless,[130] "*under fair conditions of sea*" (spray was a problem). [131] This necessitated a 'leader' ship with a more powerful wireless[132], undoubtedly an anathema to a CO especially when the leader hoisted a black ball ordering submarines to surface to communicate with her.[133] The capability, and the policy change to report first-attack later,[134] came with the introduction of the Type 14/15 Poulsen Arc 5kw transmitter giving a range of 50-60 miles.[135] The set relied on vaporising methylated spirits, bait to the 'rum-rat' sailor and overpowering to the operator.

Perhaps the most utilitarian innovation and the simplest, yet one of the most effective was the Is-Was, which had its genesis in Lieutenant John Saumerez Dumaresq's 1904 manual-mechanical instrument to determine the target's relative motion vectors for naval gunfire. Nasmith, a prolific inventor,[136] was clearly familiar with the Dumaresq for, while there is no suggestion that he plagiarised it, when he invented the Nasmith Director — an instrument to determine the optimum course to steer for an attack — its azimuth ring, bearing pointer and enemy bar had reflections of the Dumaresq. The Is-Was derived from the Nasmith Director's

[128] TNA ADM 1/13476 Submarine Quarterly Letter Number Eleven dated 11 April 1925.
[129] Hackmann, *Seek and Strike*, 62.
[130] Captain Barrie Kent, *Signal! A History of Signalling in the Royal Navy*, (Clanfield: Hyden House, 1993), 35; Lambert, *Submarine Service*, 324; Vernon W, Howland, Naval Radio, *Warship International Vol.37, 2(2000)*, 119-136; Harris, *Harwich Submarines*, 318. Some E-class were fitted with the Type 14/15 but it is not clear if the E11 been fitted, or if it was anomalous radio conditions when Nasmith achieved 60 miles in 1915.
[131] http://www.rnmuseumradarandcommunications2006.org.uk: HMS Collingwood Heritage Collection (CHC) *Submarine Installation.* Submarines had a special transmitter to 'dry' the aerial.
[132] Redford, *The Submarine*, 78-84.
[133] Kent, *Signal*!, 36.
[134] Bower, *Submarines*, 252. They also carried pigeons.
[135] Kent, *Signal!*, 254; Freidman, Norman, *Fighting The Great War At Sea*, (Barnsley: Seaforth,2014), 491-2.
[136] Other inventions include: 1904, a combined elevating and training gear for guns not worked by hydraulics; 1905, a submarine revolution indicator; 1920, the Nasmith-Lockhart Slide Rule; 1922, Varley-Nasmith periscope; 1925, submarine sounding apparatus fitted to 133 submarines; later, the Rescue Ship, 29 of which saved 4000 lives.

in 1917, and it was the Is-Was, rather than the Director, that became the first standard command aid to provide the DA being first used successfully by Lieutenant Claude Barry in the *D4* in 1918 when he sank the *UB72*.[137] The name 'Is-Was' is explained thus:

> *"because the submarine and target both moved, computing the DA for where the target 'Is' right now only identified where the target 'Was' a moment ago. Because the target moved, it 'Is' somewhere else in the next moment of time, and because of this the DA had changed".*[138]

In other words, the Is-Was' limitation was its inability to maintain a continuous solution, but it was a quantum leap forward and many COs found it of great benefit.[139] Hallifax, for example, when he joined Nasmith's Flotilla in the D7 found the principles of attacking receiving serious discussion and although embarrassed to participate with his lack of knowledge, Nasmith introduced him to the Is-Was', and this boosted his confidence immeasurably so that he was able to make five attacks against German U-boats.[140]

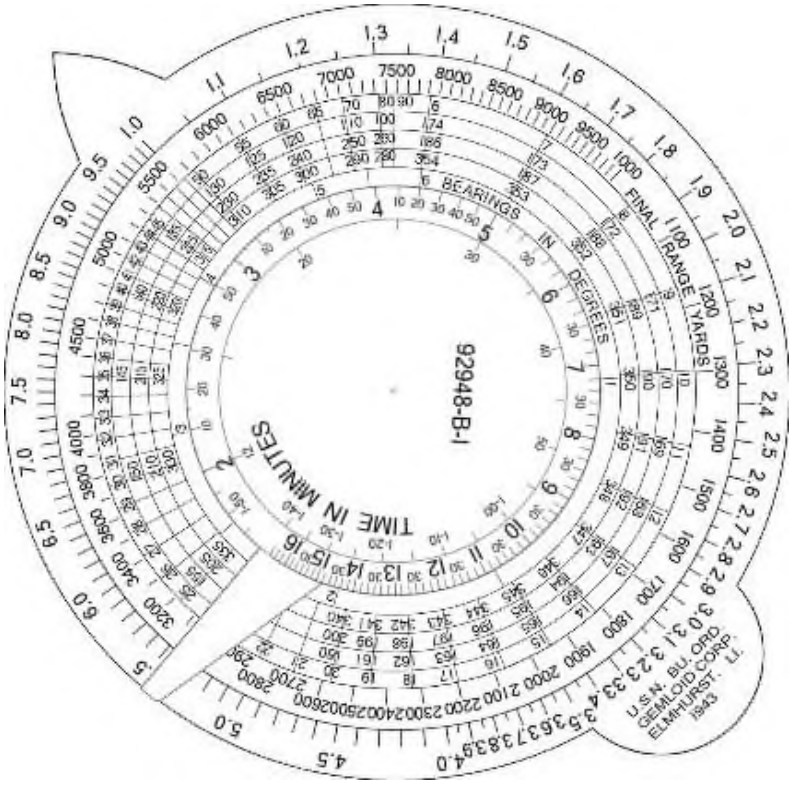


Figure 3.9: The 'IS-WAS'

No known good example of the 'Is-Was' remains in the UK. The command aid was also adopted and improved upon by the Americans who created a more practical version that could hang around the neck on a lanyard. The British version was to become mounted on a Sperry repeater.

Image: https://maritime.org/doc/attackfinder/

[137] https://uboat.net/wwi/boats/?boat=UB+72.
[138] Terry D Lindell, 'The Development of Torpedo Fire control Computers in the Royal Navy' in *100 Years Of The Trade*, Martin Edmonds (Ed), (Lancaster: CDISS, 2001).
[139] RNSM A 1983/22.
[140] Ibid.

An innovation re-visited

In 1915, when "*at Sheerness in the flotilla*",[141] George Lewis realised the criticality of COs attack practice and he refined his Gibraltar ideas, produced drawings and made a more sophisticated prototype. The benefits were immediately apparent and very quickly the dockyards provided an attack teacher to every submarine flotilla and depot ship. They cost £500, in total £8000 for the 16 made and were to prove an invaluable investment.[142]

After the war, in 1920, Lewis claimed £2000 (worth £47,400 today) plus £20 expenses, perhaps for the prototype from The Royal Commission on Awards to Inventors. Although unpursued, he was also looking for £1000 because the Admiralty had shown his attack teacher to foreign governments, notably the Americans, French and Italians. Lewis was awarded his claim. By using the example of a battlecruiser zigzagging at high speed and being able to come dangerously close to the submarine, scenarios prohibited by availability, cost and safety, Lewis' barrister explained to the laymen-Commission just how valuable this was in terms of being able to replicate an attack repeatedly, something impossible at sea.[143] Little, who as Chief of Staff (CoS) to Commodore (S) had been responsible for the decision to provide the Attack Teachers to the Flotillas and depot ships, also gave evidence. He described one of its best features being:

> *"… that it encourages Smoking Room discussion of attacking and elucidation of various situations, making the novice familiar with these and avoiding the dilemma into which the young commanding officer often gets at an awkward juncture, with the consequent deep safety dive and loss of attack". [144]*

The Royal Commission agreed saying the attack teacher had an "*exceedingly ingenious character* […] *they reproduce with the most extraordinary fidelity the actual conditions which would be operative in warfare*."

Without a formal training organisation, the Smoking Room was, indeed, an excellent and probably the only forum for reflecting on and disseminating the real lessons of war. The knowledge and utility of Lewis' achievement spread quickly so that even Cromie, now a Commander in command of the Russian-based flotilla, was aware. He asked Hall for an attack

[141] TNA T-173/698, Royal Commission on Awards to Inventors, 14; TNA ADM 196/125/229 Lewis' Service Record; RNSM Barrie Downer's mini-biographies. It is not entirely clear where Lewis was serving at the time for both the Pink List June 1915 and Ackermann, *Encyclopaedia*, 484, put the *Alecto* in Yarmouth with the Eighth Submarine Flotilla.
[142] TNA T-173/698, Royal Commission, 13.
[143] Ibid, 2-5, 15.
[144] Compton-Hall, *Submarines*, 74.

teacher to be sent out suggesting that it would also be useful for the Russians especially in winter, that is if he were allowed to show it to them. His request went unfulfilled.[145]

In time, Lewis' rudimentary machine would incrementally morph into today's computerised and sophisticated Submarine Command Team Trainers (SCTT). Therefore, Lewis' barrister understated the attack teacher's relevance and importance to the training and development of submarine COs; attack teachers were to become synonymous with Perisher. For the moment, however, Lewis' revised invention was timely for Hall.

Commodore Hall's problem and solution

Commodore Sydney Hall was appointed ICS for the second time in February 1915 and by August 1917 he had a problem. In 1914 the Submarine Service was small enough for the personal touch in appointing COs, especially with somebody like Hall who "*had that great gift of being able to remember every officer who served under him by name*"[146] If not the ICS, a Flotilla commander would often appoint an officer to command, an example being Cromie, when he appointed Leslie Ashmore to command the *C35* in the Baltic in October 1917 from being First Lieutenant of the *E1* without apparently asking Hall's advice or permission.[147] With the unprecedented expansion in the Service evident, (see Table 3.1), selection of commanding officers was becoming more difficult and to maximise the use of the new classes of submarines and their innovations, potential COs would need to be taught carefully and thoroughly.

Table 3.1: Numbers of Submarine Officers 1903-1918

Year	COs	Executive Officers	Under Training	General Service	No. of Submarines
1903		8 to 22 officers 'for submarine boats'			6
1904	20	25	8	14	9
1908	38	39	3	25	45
1914		**168 total** (1,250 Ratings)			86 (62*)
1918		**612 total** (5,446 Ratings)		20-30	187 (133*)
Lost or PoW	32	126 total (1,048 Ratings)			36 (56*)

RNSM Royal Navy Submarines and RNSM A 1990/46; A1990/47 Reports of the Inspector Captain of Submarines 1904 and 1908 respectively and *TNA ADM 137/2077 Commodore (S) War Records, Volume XI, miscellaneous papers 113 & 144.

Hall had the formal reporting process based on Form S206 on which to make his selection of COs, but the Submarine Service had a familial feel to it and Hall wished to retain an element of that. Consequently, in January 1917, he introduced a secret ledger for private reporting on

[145] RNSMM A 1990/073 Letters on Russian Affairs from Captain F N A Cromie CB DSO RN dated 8/21 August 1916.
[146] Carr, *Hell's Angels*, 247.
[147] Downer, *Perisher List*: Ashmore commanded another four submarines, became a Vice Admiral and sired two future admirals.

submarine officers in addition to the regular S206 reports. The reasons he gave for setting up the ledger are in a handwritten note on the first page. They read:

> *"Notes on Officers*
>
> *The size and rapid growth of the submarine service now make it impossible for the administrative staff to have personal knowledge of all officers.*
>
> *2. It is vital in selecting officers for a certain service on [a]class of vessel, that full information should be available, in order that appointments may be made of officers who are thoroughly suited to the particular service required.*
>
> *3. This book will be circulated at least twice in each year, but officers in command of flotillas should keep their own records so that all occurrences affecting officer's qualifications may be made as they occur — these should be copied into this book when it arrives and then destroyed so as to ensure this book been passed quickly from flotilla to flotilla.*
>
> *4. This book is not to be shown to anyone and the entries will therefore be in the handwriting of and initialled by the CO of the flotilla who are requested to give me all possible information to help me to come to a right decision as to ar:2.*
>
> *5. Reports sent to me on form S206 will be entered in this book in my office.*
>
> *S. S. Hall"* [148]*[sic]*

The ledger is rich in quotable comments ranging from the eulogistic "*Commander Leir never wanted other support than his own character and ability gave him*"; the disparaging "*Reverted to General Service as useless*"; or the more personal: "*Took to the bottle again after promotion and did s/m service great harm - should never be re-entered*".[149] The latter had been in command throughout the war and was in command of a K-class submarine at the Battle of May Island the night 31 January/1 February 1918; Post Traumatic Stress Disorder (PTSD) was unrecognised. Those going to succeed stand out: "*A very zealous and capable officer of sterling character and high professional attainments.*"[150] Comments on command potential are few.

The expansion of the Service with the increased numbers of both regular and reserve officers[151] meant a diminution of skills and a challenge to a cultural imperative, something that Little lamented. He believed that the war had encroached on the conditions of 'The Trade':

> *"I am a great believer in the concrete knowledge of all the details of a submarine in any of her proper officers […] Quick entry and training, necessitated by rapid construction during the war, has to some extent encroached on this old tradition…"*[152]

[148] RNSM A 1985/42.
[149] RNSM A 2007/557 Submarine Officers Reports Vol 1 1917 and Vol 2 1918.
[150] Ibid, Vol 1.
[151] Reserve Officers were known as 'Rockies'.
[152] Compton-Hall, *Submarines*, 73.

A notable requisite that Little identified as being affected was the, *"... complete knowledge of attacking and of the practical manoeuvring of the vessel ..."*.[153] Accompanying the increased officer numbers, and proportional to it, was the loss of opportunity for officers to be trained in attacking: too many officers for too few opportunities.

Captain Arthur K Waistell also recognised the attack training issue and wrote a memorandum in August 1917 on the training of submarine officers. Waistell was a 'T' and a destroyer specialist rather than a submariner, but he had commanded the depot ship HMS *Maidstone* and the Eighth Submarine Flotilla since September 1913.[154] He comments on the poor attacking performance of submarines and provides evidence based on the inspection of 720 torpedoes to show that the issue was something other than matériel. The conclusion he drew is that it must be the ability of the COs because they were being appointed to command without any proper foundation or training in attacking, their life having been spent in "*management and upkeep*" of a submarine, referring to their time as a First Lieutenant. He suggested a resolution to bring in experienced, and more senior, destroyer officers, give them a month's training in both submarines and periscope work and put them in command of a submarine. He argued that the First Lieutenant would then manage the submarine and the destroyer officer, in command, would be "*a specialist in the use of the periscope*."[155] In saying this he forgot the specialist knowledge a submarine officer needs to make his boat operate efficiently and that First Lieutenants would already be proficient in the use of the periscope and possess a better understanding of the art of the submarine attack, albeit they lacked practice.

Hall's reply is unknown, but he had three pressing issues to deal with when training and appointing COs: the growth of the officer corps, diminution of skills, and the apparent failure of COs. We can surmise that he would have seen the non-sensibility and difficulty in Waistell's argument, but his command had grown beyond familial controls, and there was clear evidence of a gap in attack training so Waistell's memorandum must have stimulated Hall's thinking as to how to close the gap with the obvious solution of a formal training course. And the key to resolving matters was Lewis' attack teacher.

Hall's first mention of a solution to these issues is in his Report of Proceedings for the period 1 January to 30 June 1918 in which he reports on the Periscope School — a name that appears to have been adopted rather than formally given. (The contracted, colloquial 'Perisher' developed during the interwar period). Hall reports:

[153] Compton-Hall, *Submarines*, 73.
[154] TNA ADM 196/89/97 Waistell's Service Record
[155] RNSM A 1917/8 Memorandum on the training of submarine officers.

> *"the new school for commanding officers approved by Their Lordships (which has come to be known as the "Periscope School" as it concentrates entirely on submerged attack by means of the periscope) is now in full swing. It is bound to produce most valuable results …"*[156]

The training in 'full swing' interestingly included some American officers. (The next would be in 2002). Hall goes on to anticipate further improvements when the School moves from Portsmouth to Campbelltown[157] which it did in late 1918. The results are difficult to identify because by the time officers began to be qualified by the Periscope School and gain wartime command experience the war was nearly over.[158] It is also interesting that he uses the phrase "*concentrates entirely on submerged attack by means of the periscope"* for this implies a single-subject curriculum rather than a range of skills. For example, no surfaced attacking and no gunnery despite its effective use in the war, nor were reconnaissance or anti-submarine patrols covered, all activities undertaken by operational submarines.[159]

Hall had written to the Admiralty on 14 August 1917 which replied, presumably approvingly, promptly on 21 August 1917.[160] Both letters are recorded but have disappeared together with Hall's reasons for the course. All that is known is that Hall's letter referred to "*the establishment of a Periscope School at the submarine depot at Portsmouth*" and that two submarines were to be detailed to be employed in this work. [161]

The first commanding officer of the Periscope School was Lieutenant Commander Henry Gill. This appointment was later to be known formally as Commanding Officer, Submarine Commanding Officers' Course or COCOQC, or more informally as 'Teacher'. Gill had an extensive career: command of the *A12, B9, W1, G6, D7, B6,* 'Commander of Submarines' in the Royal Hellenic Navy, service in the Q-ship HMS *Salvia*, command of the depot ship HMS *Platypus* before commanding the Fifth Submarine [training] Flotilla in April 1917 and then, in September 1917, HMS *Dolphin* "*for submarine F2 in command and as Staff Officer and for Instructional Duties*" at the exact time that the Periscope School was formed. Gill was thus an experienced CO appointed to a job that required his instructional capability. He was certainly highly thought of being "*a very promising and zealous officer*" and early on in his career recommended for promotion, but ironically his 'periscope eye' finally let him down for he was

[156] TNA ADM 137/2077 Commodore (S) war records, Volume 11.
[157] Ibid
[158] Ibid
[159] TNA ADM 137/2077 Commodore (S) war records, Volume 11-
[160] TNA ADM 12/1582A 11a (contd) Admiralty: Digests and Indexes
[161] Ibid

transferred to the retired list in late 1919 with defective vision.[162] The citation for his OBE in March 1919 read:

> *"This Officer was selected for command of the periscope school on its foundation as a school for commanding officers of submarines in the problem of submarine attack. The value of his services in this connection have been very great indeed, all our commanding officers pass through his hands and he is very strongly recommended for his conspicuous zeal and ability and untiring energy in training young officers in submarine warfare."*[163]

Eyesight was a critical factor for submarine COs as Lieutenant CL Kerr found out earlier in 1913 when, despite the strong support of Keyes and an ability to see clearly through a periscope, he was invalided out of the Navy by the First Lord of the Admiralty, Churchill. Many perfectly good submarine officers would suffer similarly on Perisher because they simply had difficulty looking through a periscope well enough although, interestingly, much later in 1951, Todd managed to escape the vigilance of the medical branch with his lack of binocular vision by confining himself to one-periscope-eye.[164]

The early Periscope Courses

The start of the first course is not formally identified, indeed it is difficult to identify any 'course' in the sense that we know it today but rather it appears that, in the first year or so of the Periscope School, officers seemed to come and go. The register of students indicates the School starting when Lieutenants George Mackness DSC and Charles V Powel joined on 15 September 1917. Their two names are actually preceded by that of Lieutenant Douglas R Attwood RNR but he joined later, on 29 September, it appears to take the command of the *F2* from Gill rather than for training. Whether he took the course is unclear, but he later commanded the *G7*. The first officer to leave the School was the ex-Mate, 23-year-old, Lieutenant John Mundell on 6 October 1917 (joined 29 September) and he may well be eligible to be called the first Perisher graduate albeit that he attended for just a week. Of the other six officers who completed the course in 1917, it is interesting that two of them were also ex-Mates, having been promoted from the lower deck under the scheme initiated under Churchill.[165] Being ex-Mates, now Lieutenants, these officers were often older than the norm, Reginald Critchlow and Robert Roe were both 32, however their colleague Mundell was, like Powel, only 23, both ex-Mates and young for a CO. That these officers went on to command

[162] TNA ADM 196/143/26 Gill's Service Record; RNSM Barrie Downer Mini-Biographies.
[163] RNSM A 171/87 GILL. Henry D. Lt.CDR. RN 1.10.15. PERISCOPE SCHOOL. HMS THAMES.
[164] Todd, *A Long Time*, 193.
[165] RNSM A 1945/22 29th of September 1917 to 5th January 1942; Roskill, *Naval Policy 1930-1939*, 31.

submarines says much about the meritocratic culture of the Submarine Service and its more embracing social attitude. Officers were respected for what they could do rather than for their social status. That said, however, when the Mate scheme ended, it was not until 1981 that the next 'Special Duties' officer, Frank (Sandy) Powell was to pass Perisher.[166]

Powel *et al* were followed in 1918 by another four ex-Mates, perhaps reflecting the growth of the Submarine Service: Lieutenants George Callaway, William Ibbet, Edward Cuff and Charles Cox, all of whom, except for Callaway who was classified 'unsat', went on to command. Two engineer officers, Lieutenants Reginald Herbert and John Heath, also qualified, The latter may have been a better attacker than engineer for his CO, Commander Ernest Leir reports that he " *did not master the science of the Vickers Diesel engine running before leaving to command a U-boat* […]". Herbert also went on to command a U-boat at the end of the war; they were used for trials and showing to the public in ports around the country.[167] Another, perhaps more contentious officer, was Lieutenant ALP Mark-Wardlaw who had joined the Navy under the Selborne Scheme.[168] Under that scheme, as a parallel to Gunnery, Navigation or Torpedoes courses, he had chosen Engineering and in doing so reserved his right to executive command. Consequently, he went on Perisher in March 1918 and then to command the submarine *F3* followed by the *E40* although she was only just ready for sea when he was sent to Greenwich for an engineering course. He reached the rank of Rear Admiral as an engineer arguing until his death in 1975 that the Navy honour its promise that he retained the right to executive command despite his many engineering appointments.[169]

Meanwhile, the *Thames*, which had been fitted with an attack teacher in 1915, briefly returned to Portsmouth in October 1918 before Gill took her, the Submarine School and the three F-class, V3 and V4 to Campbeltown. In December 1918 Gill was in the *Thames* "*in command and in command of submarine flotilla and in charge of the Periscope School*".[170] A considerable responsibility for a Lieutenant Commander!

[166] Like the Mate scheme, 'Special Duties' is promotion from a rating but not part of either the Supplementary or General Lists.
[167] RNSM A 19453/22 COQC . Six other officers commanded surrendered German U-boats including the Canadians, Ronald Watson and John Edwards.
[168] Sometimes known as the Selborne-Fisher Scheme, it was introduced by Admiral Fisher as Second Sea Lord to merge the engineering and military officers with a common early training.
[169] RNSM A1997/196 Mark-Wardlaw correspondence.
[170] RNSM Downer's Mini-biographies.

Initially, Gill's students were ungraded, though later they were given the gradings good/sat/unsat/fail. Lieutenant Horace Sills, the first failure in September 1918 shows that failure did not prohibit command. He was given the chance to re-take the course and in the interim was given command of first the *C1*, and then the German *U126*, but he never returned to complete the course and went on the retired list in June 1920.[171] Another two officers that year were classified as 'unsat' but Lieutenant Gerald Ruxton RNR went to the *U98* and Lieutenant Henry Crane had seven commands and ended up as Commander (S) Sixth Submarine Flotilla.[172] Some officers did not join the course even having been appointed[173] and nor did an officer necessarily have to complete and pass the course to get a command. In 1918 Edward Barraclough managed to only complete half the course before he was sent in command of the Harwich-based C21.[174] There were another 10 during the war who, like Barraclough, did not complete the course and were given commands and some, who had commanded before, took a shortened course which later became known as the 'Requalifying Course'. Between September 1917 and the end of the war in November 1918, 75 officers completed the course with only five being assessed as 'good' and 23 as satisfactory. There is no comment about the others. The list includes five reserve officers and two Canadian Lieutenants: John Grant Edwards (known as 'Jack Boy') and Ronald C Watson. William Maitland had preceded them, and the Periscope School, as the first Canadian to command a British submarine, the *D1*. [175]

Figure 3.10: HMS *Thames*
Home of the Periscope School the name Thames is synonymous with the Submarine Service.
Image: RNSM

[171] RNSM A 1985/42.
[172] Downer, Commanding Officers.
[173] RNSM A 19453/22 COQC Lieutenants Anthony Cunard and George Tweedy.
[174] RNSM A 1994/73 I Was Sailing, memoirs of Edward Barraclough; Downer, *Commanding Officers*: Barraclough was formerly Wedemeyer von Elsdagen but changed to the very English 'Barraclough'
[175] Edwards commanded a U-boat in November 1918, (not mentioned by either Ferguson or Downer). There is also confusion over 'R' for Requalifying Course or R-class submarines. Their appointments 'in command' is the only suggestion that they completed the course

With the closure of the Navigation School during hostilities,[176] it appears that the Periscope School also ran a navigation course, for some officers named on the Periscope School record did this course rather than the Periscope Course, which may account for them returning to GS.

Sometimes an officer had to leave the course without even starting training. Lieutenant Alexander Miller joined the *Thames* for the Periscope Course arriving around midnight on the 26/27 October 1918 (possibly just before the move north). After a long drive he felt the need for a drink so he turned-out the steward to open the bar. The steward made a complaint, and Hall complied with the recommendation of the *Thames'* commanding officer that Miller "*be appointed away from* HMS *Thames as soon as practicable*". Unfortunately for Miller, the CO of the *Thames* was Gill who was also, of course, 'Teacher'. Miller went back to the *Vulcan* never to return.[177]

The German comparison

The other major First World War submarine operator was the Imperial German Navy which worked-up its submarines at Kiel and had the equivalent of the Periscope School at Eckernförde, 30 km north of Kiel, well ahead of the British. By 1915, at least three and possibly five submarines were based there for training purposes although there is no indication that the Germans had an attack teacher.[178] The Commander's Course was a month's attack training under the watchful eye of the Chief of the School. [179] He worked in much the same way as the British Teacher and German COs would be failed if their attacking was not considered good enough.[180] Like the British, they were taught to fire at close range, 200 m (220 yards) - 300 m (330 yards) in the German case, which reduced errors allowing a single torpedo shot.[181] They also watched their torpedoes hit to decide whether a second torpedo was necessary before lowering the 'asparagus', their nickname for the periscope.

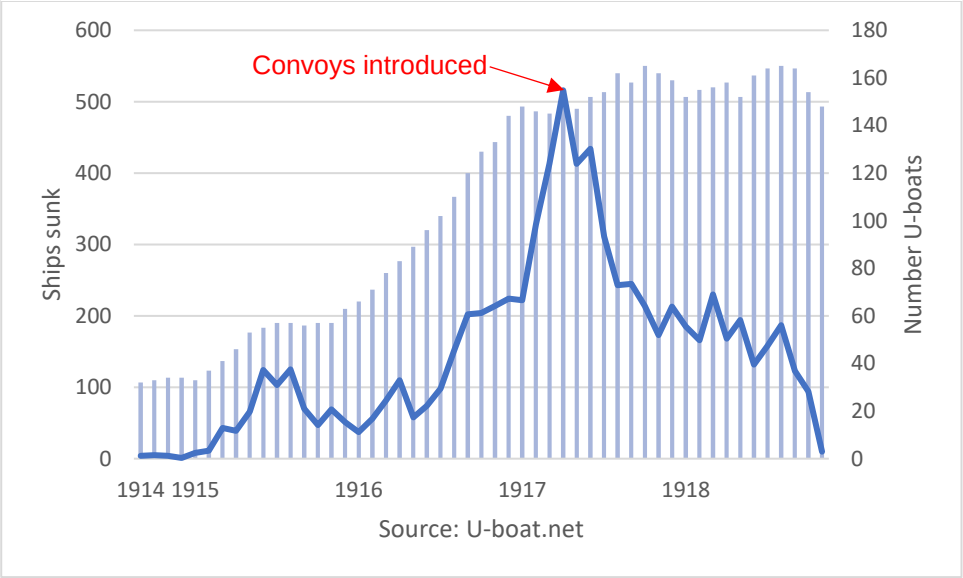
In comparing the effectiveness of the German and British COs we must consider the German fleet's lack of adventure and the British distant blockade sweeping the German mercantile

[176] B. B., Scofield, *Navigation and Direction: The Story of HMS Dryad*, (London: Mason 1977), 39.
[177] RNSM A 1985/42.
[178] Compton-Hall, *Submarines*, 16; Gibson & Prendergast, *The German Submarine War*, 55; Werner Fűrbringer, *FIPS*, (Barnsley: Pen & Sword, 1999), 11. Naming the German school to reflect the British 'Periscope School' may have been a convenience, for Fűrbringer calls the German version just the 'U boat School'; Ernst Hashagen, *The Log of a U-Boat Commander*, (London: Putnam, 1931),86. Hashagen also calls it "the Submarine School" but it is at Eckernförde,.
[179] Fűrbringer, *FIPS*, 11
[180] Hashagen, *U-Boat Commander*, 87.
[181] Chalmers, *Max Horton*, 17-18; Compton-Hall, *Submarines*, 69. Horton hit the German cruiser *Prince Adalbert* in 1915 in the Baltic from 300 yards. This was unusual, for British torpedoes generally needed 700 m (800 yds) to recover depth due to the high discharge pressure of the British torpedo tubes upsetting the torpedo's depth-keeping pendulum forcing the weapon deep on discharge.

marine from the world's seas that denied the British submariners targets in the North Sea and Atlantic. This made the British look to the Baltic and Sea of Marmara for their major submarine successes, all before the advent of the Periscope School. The German U-boat COs, however, had periods of unrestricted submarine warfare to their benefit with ample independent ships to attack while the British procrastinated over introducing convoys leading to the dangerously high number of allied ships sunk in 1916/17 shown in Figure 3.11 - a credit to German training. But the introduction of the convoy system in July 1917 drastically curtailed that success despite the large increase in the numbers of U-boats as Figure 3.11 again shows.

This is not to say that individual CO's skills were adversely affected for other factors played their part but it must show that their training was not as good as earlier results may have suggested.

Figure 3.11: Ships sunk vs U-boats 1914-1918



The Periscope School becomes permanent

The assessment of the Periscope School's early effectiveness starts with the data in Table 3.2. Superficially it would be reasonable to think that this comparison of torpedo firing numbers could yield an actuarial appreciation, albeit roughly hewn, for the effectiveness of Perisher in the last year of the war and the first full year of the Periscope School. Indeed, it can be easily concluded that the 24% was a demonstrable improvement in the number of torpedo hits in 1918 over the previous two years' 10% and 13% respectively and that this improvement was a result of the training COs received at the Periscope School from late 1917. But caution must be applied, the 24% of torpedoes hitting the target in 1918 has to be compared with the greater 34% in 1915 achieved before the advent of the Periscope School, and the average throughout

the war of 23%. There were fewer targets in 1918 which may suggest a greater accomplishment for that year although that credit may be ameliorated by weapon improvements and the greater use of salvo fire towards the end of the war.

Table 3.2: First World War Torpedo Firing in Action Results

	1914	1915	1916	1917	1918	1914-1918
Torpedoes Fired	32	145	68	119	54	418
Torpedoes Hits	3	50	7	15	13	98
Torpedo Failures	9	46	25	17	16	113
% Hits of Torpedoes Fired	9%	34%	10%	13%	24%	23%

RNSM A 1989/119 WW1 Firing Record

At the same time, any reflection on the effect of the introduction of the Periscope School is otiose because of the 57 officers who qualified in 1917/18 and are identified as being appointed in command or to depot ships for command only 14 went to front line operational submarines (D, E or H-class) and none of the submarines to which they were appointed saw any action before the end of the war. So, although it is reasonable to assume that the Periscope School improved the capability of COs in attacking prowess simply because it gave them the training and practice that Waistell had identified they lacked, a numerical quantification of an improvement cannot be attempted. Rather, it must remain speculation as to how much better the British COs' performance may have been had they had the advantage of a Perisher course earlier, something the Germans had benefitted from.

What may be more germane are the comments from the 'Lessons Learned' Round-Robin following the war. They contain an implicit criticism of the course that taught firing at close range (less than 1000 yards) when COs fired operationally from outside 1000 yards. But the benefits of the attack teacher and Perisher were both praised and the comment, "*all officers should pass the Periscope Course before command*" was made.[182] It is just one viewpoint but in the absence of any negative comments it can be taken as the first commendation as to the success of the course. That the Periscope School continued to operate, and Gill's post-war award add to that commendation.[183] COs were also asked to comment on what qualities they considered most important for a CO and despite the different expressions some traits emerged. After praising the benefit of the attack teacher and Perisher,[184] and the necessity to maintain attacking prowess against a variety of targets in adverse weather conditions, the qualities in

[182] RNSM A 2007/550 Lessons Learned in WW1
[183] TNA ADM 171/87. He was gazetted for the OBE(M) 1 April 1919.
[184] RNSM A 2007/558 War Experience.

order are: calm disposition (a cool head), submarine knowledge, situation awareness, quick decision-making, and leadership. Apparently, officers who excel at games of skill make good submarine captains![185]

One CO makes an interesting argument for the close-range attack. COs in the war found it often impossible to fire at the short ranges they had practised during the Periscope Course and were having to fire from over 1000 yards, and possibly up to 5000 yards with a high-speed torpedo. The longer ranges, he pointed out, had led to the development of the ability to fire a salvo of torpedoes from four or six bow torpedo tubes His comments on the close-range attack are most interesting. He argued it, "*was a splendid system for inculcating nerve and correct handling of the S/M, but developed a false impression of hitting possibilities with the torpedo*". The close-range attack has been maintained by Perisher to the present day to teach safety.[186]

The characteristics of the submarine commanding officer

In his biography of the controversial Godfrey Herbert,[187] E. Keble Chatterton, describes the early submarine CO. Published in 1935, he would certainly have been aware of the Periscope Course and it is therefore possible to read into his words a reference to the now COQC:

> *"training in submarines […] has an importance comparable only with yesterday's training in sail-driven ships. It is a school for character, for quickening the mind, developing courage and resourcefulness, giving scope for adventure and inculcating self-reliance. […] it is the daily living, and working together, with one's fellow men at close quarters that helps to make a submarine captain a true leader, but in the best sense of that word."*[188]

Commodore Sydney Hall, who shepherded the Submarine Service through most of the war, reflected more directly on his COs:

> *"In surface vessels there are several factors which may bring success – in spite of the commanding officer. A ship may be a good shooting ship, an excellent chief of staff, mistakes on the part of the enemy, assistance from other vessels are some of these factors. In submarines none of these counts. One man only, the commanding officer, can see, and he only with one eye. No one can help him."* He continues*: "The one great difficulty in submarine warfare is to find a sufficiency of officers […] who will rise superior to the incidental intricacies of these complicated vessels, who will make their opportunities and then take advantage of them when found under conditions of hardship and acute discomfort."*[189]

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[185] RNSM A 2007/558*;* Thomas Lowel, *Raiders of the Deep,* (New York: The Sun Dial Press, 1940), 13.
[186] RNSM A 2007/558 War Experience. Otto Weddigen in the *U9* had practised salvo fire in North Sea Manoeuvres in 1913: two forward tubes followed by two from aft.
[187] As the First Lieutenant of the *A4* he escaped with the CO, Martin Nasmith when she sank in Stokes Bay and later the *K13* when she sank in the Gareloch. He was accused of having shot survivors from *U-27* when in command of the Q-ship *Baralong*.
[188] Chatterton, *Amazing Adventure*, 253-4.
[189] Carr, *By Guess*, ix-x.

During the war, Bacon's anticipated strain manifested. Keyes recognised the strain on COs and their crews from both the weather and the adjacency of their patrol areas to the enemy: "*the brief reports of the Commanding Officers do not adequately express the strain and hardship to which they and their crews were subjected*".[190] Hall was struck by the physical appearance of fit young men displaying the strain after a week on patrol[191] and he talked about the arduousness of long periods dived and how the submariners need "*2 o'clock in the morning courage for the whole of the time they are at sea*." Two American officers who, embarked for a week's patrol, were "*fit for nothing*".[192] The submarine CO, John Bower, warned how continued stress can adversely affect morale and an ever-present fear of death and over-tired nerves can lead to mistakes.[193]

The loneliness of command could add to stress. Paradoxically, in a submarine, despite living cheek-by-jowl, it could be an even lonelier existence: "*Unlike the captain of the surface vessel, he has nobody whatever to assist him, but must rely entirely on his own judgement to manoeuvre the boat and to fire his torpedoes at the right moment*."[194] Keyes accentuated the point, "*the success of the enterprise and the safety of the vessel depend on his* [the captain's] *skill and nerve and the prompt, precise execution of his orders by the officers and men under his command*".[195] A 1928 Submarine Manual put the position of the CO more formally, "*the commanding officer was practically unaided with no one to assist or confirm his judgement of the situation which he sees, not from the commanding position with the full use of both eyes,*

Figure 3.12: Holbrook, Cromie, Horton, Laurence and Nasmith

"a flotilla of submarines commanded by dashing young officers, of whom we have plenty"…

[190] TNA ADM 137/1926 Keyes to Sturdee, 20 September 1914.
[191] TNA ADM 137/2077 Memorandum by Commodore (S) on the Performance of the Submarine Service 1914-16 dated 30 of August 1916.
[192] TNA ADM 137/2077 Report by Commodore *(S)* October 1917.
[193] John Graham (alias Klaxon) Bower, *Dead Reckoning*, (London: Rich & Cowan, 1933), 101-2.
[194] Rear Admiral D Arnold-Forster, *The Ways of the Navy*, (London: Ward Lock, 1931), 208.
[195] TNA ADM 137/1949 Decorations for submarine personnel: Telegram from Admiralty to Commodore (S), dated 16 September 1914.

but through a periscope at the brief and irregular intervals."[196] Even the naval tailors, Gieves, added their opinion, " … *It is upon the shoulders of the captain that it [the responsibility] falls. He it is who, at the periscope, is the sole connecting link between the crew and the surface world — they must obey blindly and trust implicitly* ".[197]

The encomiums immediately above conclude and summate what this chapter has shown about the self-taught development of the submarine COs. Despite no formal training in their professional specialisation, the limitations of the pre-First World War Manoeuvres, the cultural antipathy towards submarines and the lack of understanding of their potential, they assimilated the new technologies, developed their attacking skills and created a place in the order of battle for the fledgling Service and its submarines. Within well under two decades of the Submarine Service's conception, Bacon's imposed corporate culture had evolved into a culture around the characteristics and profile of these exceptional men. The legend of the 'One-Man-Band' was born (if not yet named) and the skill of the 'periscope eye', the symbiotic relationship with the periscope, became the *sine qua non* of the submarine CO.

Although the submariners showed their capabilities in the Baltic and at the Dardanelles/Sea of Marmara, concerns remained about the submarine COs' performance. At the same time, the now established Submarine Service had outgrown its familial values with the increase in size bringing a diminution of skills unrelieved by a lack of attacking practice. These issues coalesced to give the ICS, Sydney Hall a problem. Fortunately, he had the innovation of the attack teacher to provide a practical solution to the powerful training imperative, and together they led to the creation of the Periscope School. Here, submarine COs could be properly schooled and assessed in their trade by the Instructional Officer who would take the title 'Teacher'. Despite being behind the Germans in this training aspect, the School trained 57 new COs by the war's end.

The submarine CO produced was a high-quality officer, technically trained and safety-conscious with the confidence to take on responsibilities more than those of his GS peers. Furthermore, one who could operate independently under stress for long periods knowing the stakes were existential. No other military commander could lay claim to such immediate responsibility for someone so junior. This set the submarine CO apart from his contemporaries.

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[196] TNA ADM 186/462 Submarine Manual 1928.
[197] J A Blackburn and Kenneth Watkins, *The British Submarine in Being*, (London: Gieves, 1920), 88-9.

4. The Interwar Period 1919-1939

The early interwar period was as difficult for the Submarine Service as the rest of the Navy as it responded to government policy. In the submarines' case, once the 'fleet' submarine idea was finally found impractical,[1] their idiosyncratic capabilities were discarded in favour of being considered complementary to surface ships[2] and submariners had to accept that submarines were limited in attacking other submarines.[3] There was an existential threat from the reduced submarine building programme and an operational threat from the principles of the treaty on the Use of Submarines and Noxious Gases in Warfare, part of the 1922 Washington Conference which, although unratified, found their way into British government policy, the Navy and Perisher with a focus on submarines attacking warships and not merchant ships. The 'Treaty Era' has been covered in detail by historians but, as commented upon in the Literature Review, their focus has been the Fleet and aviation issues, not the submarine. The threats to the submarine's future apart, there are indications from archival material that morale in submarines was largely good. Perisher continued and consolidated, evolving from a course just teaching periscope attacking to a command qualification course, signaled by the name change to COQC. In doing so, by 1939, it had qualified a further 237 submarine COs which included seven Reserve Officers plus another four who had transferred to permanent commissions. The extensive personal innovation of the COs covering various aspects of submarining was another indicator of good morale. Having survived the difficult years and reached a nadir, the second part of the chapter covers the Submarine Service's preparations for the coming war. Although often hindered by risk-adversity in these preparations, submarines received a steady stream of technical innovations that added to their capability to detect, classify and resolve the attack problem, innovations with which Perisher was often closely involved. Consequently, the boats that went to war had developed from the rudimentary to a holistic weapon system.

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[1] Geoffrey Till, 'Retrenchment Rethinking Revival 1919-1939' in JR Hill (Ed), *The Oxford Illustrated History of the Royal Navy*, (London: BCA, 1995), 343.
[2] BRd 2, 0206. Even today, with the Submarine Services responsible for the national deterrent, submarines are not mentioned as a specific responsibility of the Fleet Commander whereas the FAA is.
[3] Hore, *The Habit*, 336.

Toward a Nadir: 1919-1936

External Influences

The end of the war disrupted the Periscope School's organisation and normally complete records. Examples are glaring gaps, the seven officers who appear to have been appointed but have their names then deleted, and eight days after the armistice eight officers leaving, four for unrecorded appointments and four in command of surrendered German U-boats.[4] Organisation went awry but an anecdote illustrates that the disorganisation possibly went deeper. This was the experience of Lieutenant Tom Parkinson who completed the Periscope Course in 1918, and then impressed Rear Admiral (Submarines) (RA(S)), with his ability to teach the OTC, a practical, rather than academic, submarine systems course ensuring that the ethos and culture of submarine knowledge endured. Despite passing Perisher, Parkinson had a problem for he could never find the courage to make a submerged attack on a ship underway because his nerves failed him thus resigning him to the reserve fleet. Parkinson's lack of self-confidence should have been exposed on course but as John Lang commented almost 100 years later, some officers attend Perisher lacking belief in their capability for submarine command.[5] The question is how Parkinson could have passed the Periscope Course, was it 'end-of-war' syndrome? And if he passed, one wonders how poor was Sills, the first failure.

The Periscope School was at Campbelltown in late 1918, where its five training submarines[6] were replaced by the *E23* and the brand new *H33* and *R12*[7] so that, by 1920, Perisher had three good, operational submarines to use. Meanwhile, the submarine officer corps was about to suffer scything cuts. In 1918 there were 517 officers[8] almost exclusively Commanders and below, with 187 submarines in commission and reserve: by 1923 there were 82 submarines.[9] There was thus a surplus of officers, reflected across the Navy, and in 1920 the Admiralty offered 'retirement' to all Captains and below hoping to make 650 officers of Lieutenant Commander's rank and below redundant. These latter redundancies would greatly affect the submarine CO cadre although there was a reluctance to leave the Navy and only 407 offered to do so. In 1921 the government appointed a 'Committee on National Expenditure' that became better known as the 'Geddes Committee' after its chairman Sir Eric Geddes.[10] It

[4] RNSM A 1945/22.
[5] John Lang interview January 2019.
[6] Three F-class, the *V3* and *V4*
[7] TNA ADM Pink List November 1919, /
[8] RNSM A 1945/4; RNSM A 1985/42. Haggard says 'about' 650.
[9] Ackermann, *Encyclopaedia;* Grove, 'British Submarines' quotes 142 boats but he may not have included those in reserve
[10] Roskill, *Naval Policy Vol 1*, 230-3.

recommended reducing the Navy Estimates from £81 to £60 million with a corresponding reduction in the officer corps. Consequently, under what became known eponymously as the 'Geddes Axe', 200 Lieutenants voluntarily 'retired' and another 350 were 'selected' for retirement. The reductions continued in 1926 and again in 1929 when there were further cuts to Lieutenant Commanders. The Submarine Service lost half its officer corps including experienced submarine COs, and many potentially good COs.[11] (Table 4.1).

Table 4.1: Submarine Service Officer Numbers

	July 1918	January 1928	August 1939	July 1943
Captains	6	5	8	14
Commanders	27	15	18	21
Lieutenant Commanders	45	46	53	29
Lieutenants	250	100	164	211
Sub Lieutenants and Mates	51	37	31	67
Gunners (T) and Boatswains	9	3	0	0
RNR all ranks	129	17	0	57
RNVR all ranks (includes RCNVR, RANVR, RNZVR, SANF)	0	0	0	146
Grand Totals	517	223	274	545

Source: RNSM A 1945/4 Growler's Book

Fortunately, there were exceptions albeit in a circuitous way. Cadet Michael Gordon Rimington whose father had taken the offered £300 for his son to leave the Navy but, as *loco in parentis*, Rimington's sister argued the case that Dartmouth was the equivalent of a public school and that her brother was therefore eligible for the Public School Special Entry. The Admiralty had to agree and Rimington re-joined the Navy, completed Perisher in 1934 and won the DSO with Bar and MiD as one of the older COs in the Second World War at age 41.[12]

A corollary of the redundancies was that the average age of Perisher students increased to 29-30 (29.5 in 1939),[13] Ben Bryant says that at 28 he was young to be doing Perisher by peacetime standards in 1934. Despite being 39 and still in command in 1945 he considered that the best years of a CO's life were "*25 to 30 — old enough to have experience, self-confidence and judgement; young enough not to think too much*" — echoes of Bacon.[14] He shared Horton's later view that those over 35 became overcautious putting many of those who had had their first command 10-11 years earlier in that category when the Second World War started.[15] These

[11] Collectively: G. H-J, 'A Submariner Remembers', *Naval Review* 1942-30-2; TNA ADM 182 AFO 1056/20 Surplus officers- special terms of retirement; TNA ADM 167/89 Board of Admiralty Memoranda 1933; Farquharson-Roberts, '*To The Nadir',* 152.
[12] http://www.unithistories.com/officers/RN_officersR1.html and email John Rimington January 2019
[13] RNSM Officers' Record Cards.
[14] Bryant, *Submarine Command*, 36.
[15] RNSM A 1945/4 .

events should have been demoralising for young officers aspiring to submarine command and a lowering of their morale could only have been exacerbated by other issues like pay cuts. A Lieutenant's pay, that had been increased in 1922,[16] was then cut by 23% between 1924 and 1937[17] and Marriage Allowance was only introduced in 1938.[18] The ramifications were felt in the Submarine Service. After 1918, reductions in the number of officers volunteering for submarines[19] meant that many had to be conscripted, but RA(S) Vernon Haggard, thought that they "*developed resourcefulness, initiative and self-reliance far more quickly than an officer would ever experience in GS especially in a big ship*"[20] and they had the additional submarine pay. Haggard, however, misjudged matters for when addressing a new OTC he gave a pompous albeit well-meaning speech when said that they should devote all their energies to their work rather than marry. Unfortunately, three of the class were already married; times had moved on.[21] Despite Haggard's rose-coloured spectacles, as late as 1935 the Submarine School Instructional Officer, commenting on the officers joining submarines, attributed their poor standard to "*a variety of psychological reasons, one of which is the depressing period of reduction that the Navy has been through during the last eight or ten years*" [22] These officers would become the COs of the Second World War.

Another morale-affecting, career-limiting factor for COs was that they had to labour under the restrictions of successive government defence policies and international naval treaties. The first was the introduction of the 'Ten Year Rule' by the Committee of Imperial Defence that assumed "*the British Empire will not be engaged in any Great War during the next 10 years*".[23] In effect, this was until November 1933 ensuring defence budget reductions were reflected in the submarine building programme and so just 37 new submarines were built in the 14 years 1919-1933 causing the Submarine Service to hit its interwar nadir of 54 boats in 1936. Even this was a remarkable achievement[24] for in 1923 the Admiralty Board rescinded building plans for a depot ship and seven overseas boats annually in 1925-26 and later years; and a 10-year plan for four depot ships, 60 overseas, 12 cruiser and eight fleet submarines.[25] Fewer hulls

[16] RNSM A 1921/7 Draft AFO Officers into submarines.
[17] Farquharson-Roberts, *To the nadir*, 158.
[18] George Menzies, unpublished diaries
[19] RNSM A 1921/7; TNA ADM 182 AFO 657.
[20] RNSM A 1985/42.
[21] Ibid.
[22] RNSM A 1935/25 Letter: Captain (S) Fifth Submarine Flotilla to the RA(S) dated 1 November 1935.
[23] Stephen Roskill, 'The Ten Year Rule - The Historical Facts', *RUSI Journal* 11/:665, 69-71.
[24] Simpson, *Periscope View*, 45.
[25] Roskill, *Naval Policy Vol 1*, 412-7.

meant fewer COs and fewer Perishers (47 passed in 1918: 22 in 1925) with poorer command prospects.

The unratified Washington Conference which "*failed to impose any measure of limitation on submarines themselves*"[26] was followed by the London Naval Conference in 1930 that focused on cruisers, limited the size of submarines rather than abolish them, and restricted submarines to the impractical 'cruiser rules' that had been part of the Washington Conference. The submarine thus had to comply with the same 'visit and search' legislation as surface ships, restrictions more applicable to an 18th-century privateer than embracing the empirical lessons of the First World War U-boat campaign. The London Naval Conference follow-on, the Second London Naval Treaty signed in 1936 between the Americans, British and French was paralleled by the Anglo-German Naval Treaty (1935) that allowed the Germans 35% of British tonnage and, later, parity in submarines.[27] The latter was attended by Little, formerly RA(S), representing the Admiralty which acquiesced to the agreement through its belief that it had the submarine controlled and the false confidence in the abilities of asdic,[28] anti-submarine warfare and the expected confinement of the U-boats to the Baltic and North Sea.[29] If Little saw any future issues for British submarines with the restrictions, or their utility given First World War experience, he held his counsel. The conference concluded that "*Germany has agreed never again to resort to what was known during the War as unrestricted submarine warfare*"[30] adding to the perceived veracity of government policy and Perisher teaching, despite Germany (and the Americans) secretly reviewing offensive strategies.[31]. The prescient few who realised the paradox in the situation were considered visionary rather than realistic.[32]

Perisher consolidates its position and worth

Nonetheless, despite these demoralising effects, Perisher continued to provide an average of almost 12 new COs each year between 1919 and 1939 teaching them to attack warships rather than merchant ships in reflection of British policy. The *Thames* was paid off in 1920 and the Periscope School transferred to HMS *Vulcan* and the submarines of the Sixth Submarine

[26] Roskill, *Naval Policy Vol 1*, 328.
[27] Joseph Maiolo, *The Royal Navy and Nazi Germany, 1933–39 A Study in Appeasement and the Origins of the Second World War*, (London: Macmillan Press, 1988), 57-9; Richard A. Best, 'The Anglo-German Naval Agreement of 1935: an aspect of appeasement', *Naval War College Review*, March-April 1981, 34/2, 68-85.
[28] George Franklin, *Britain's Anti-Submarine Capability 1919-1939*, (London: Routledge, 2003).
[29] Maiolo, *The Royal Navy*; Best, 'The Anglo-German', 68-85.
[30] Hansard HC (25 June 1935) Volume 303 at https://hansard.parliament.uk/Commons/1935-06-25/debates/a6387ec6-14a8-4acf-ae08-248903597831/Submarines(Anglo-GermanNavalAgreement).
[31] Herwig, 'Innovation Ignored', 227-64.
[32] Murray and Millett, *Military Innovation*, 263.

Flotilla at Portland.[33] Under Commander Charles S Benning of the *E5*-taunting-the-German-destroyer fame,[34] the Periscope School returned to orderliness with complete attendance records. Lieutenant Harry Oram joined this regime saying it was "*learning in luxury and great fun it was too*".[35] Notably, he makes no mention of the Teacher or Instructional Officer, rather there was no organised course of instruction but just making attacks from time to time under the watchful eye of the submarine's own captain so although nominally a 'course' it was a continuation of the rather haphazard way submarine COs had to learn 'The Trade'.

The tender, until 1931, was HMS *Fermoy*, a Hunt class minesweeper which, managing 16 knots with a submarine command qualified Lieutenant Commander in command, made a reasonable basic Perisher target. A big improvement in 1924 was a new attack teacher at Portland with the ability to simulate a screen of destroyers protecting a target ship,[36] installed at the same time as a Tactical School was created in Portsmouth Dockyard. Destroyer command exams had been introduced in 1921,[37] and from 1930 a prospective destroyer CO had to attend tactical training at the School;[38] although he was not assessed in the same pass/fail way as the submarine CO. With hindsight it is possible to see that not co-locating the Periscope School and its attack teacher with the Tactical School was a lost opportunity although when the Staff Course in 1934 was dedicating three days to Jutland and one hour to submarines it is probable that such a possibility never crossed anyone's mind.[39]

The *Vulcan* was relieved by the *Maidstone* in 1925 and both the School and the depot ship now had either a Commander or Captain in command with a Lieutenant Commander acting formally as the Instructional Officer or 'Teacher' as he was becoming known. In 1918 there were two Teachers Henry Gill and Richard Everard and again, between 1922-1926 Teachers overlapped in the sequence: James Boyd 1922-1924, George Tweedy 1923-1925, Claude Barry1924-1926, Henry Lake 1925-1926 and finally George Colpoys 1926-1927.[40]

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[33] TNA ADM 187 Pink List November 1919. The *Thames* became the South African Training Ship *General Botha*.

[34] Benning sailed close to the wind on occasions. When commanding the *K4* he was court marshalled twice: once for running aground but was acquitted on the grounds that the rats had eaten the relevant part of the chart and then censored for the loss of the *K1* after collision.

[35] Harry Percy Kendell Oram, Wendy Harris(Ed), *The Rogue's Yarn*, (Barnsley: Leo Cooper, 1993).

[36] RNSM A 1945/4.

[37] TNA ADM 182 AFO 2198/30 Training of Officers for Service in Destroyers.

[38] David MacGregor, 'The Use, Misuse, and Non-Use of History: The Royal Navy and the Operational Lessons of the First World War', *Journal of Military History* 56 (4), 1992; TNA ADM 182 AFO 2598/30. The course was extended to more senior officers in 1931.

[39] MacGregor, 'The Use'.

[40] Downer, Perisher List. Claude Barry was one of only three Teachers to have been Teacher twice 1924-5 & 1925-6, William Fell, 1930-32 & 1935-37and John Lang 1974 & 1978-80.

In October 1926 the Periscope School moved back to Portsmouth without the Portland attack teacher. At Fort Blockhouse the Fifth Submarine Half Flotilla and the School were now under the supervision of the Commander, Training Half Flotilla based on HMS *Alecto*. He, in turn, was responsible to the Captain (S), Fifth Submarine Flotilla and when the Half Flotilla was disbanded in November 1932 the School, or the COQC as it was called from the mid-1920s, came under the direct command of the Captain (S) Fifth Submarine Flotilla with the Teacher, a Lieutenant Commander in the promotion zone, as the COCOQC reporting directly to him.[41] Between 1926 and 1939 the Fifth Submarine Flotilla had an eclectic mix of submarines but the boats principally used for training were the popular and successful *H21* class of which 12 served over the period.[42] They also often became a Perisher's first command.

Perisher failures were few and far between the wars. After Sills in 1918, the next was Frederick Mott in 1925 and then, in 1930, the first Australian failure was James Barwood. He made history by being the first re-take when he returned to a CORQC which started in 1920 and passed.[43] Three years later, in 1933, Lieutenant Hugh Richardson failed with an attack teacher hit-rate of 50% and returned to GS. The criteria for failing is therefore unclear and it certainly cannot have been just 'hit-rate'. For example, an officer on Richardson's course had a 37% hit-rate and passed and later another with 50% passed although he went to GS voluntarily. This was Lieutenant Philip Saumerez, great-great-grandson of the Nelsonic era's Admiral Sir James Saumerez. The hit-rates included both attack teacher and sea-attacks so the inference is that passing was a subjective assessment made by Teacher; alas the record of what was said to the two who left despite passing is lost. Another two officers failed before the war, both in 1935 with poor attack teacher scores of 40% and 45% respectively and after only three or four sea-attacks.[44]

By the 1930s officers joined in groups and a course routine emerges although irregular because the Periscope School introduced other courses, notably the CORQC considered necessary for officers returning from their career-enforced time in GS. By 1925 the CORQC was well established with up to eight students on a course and in the years 1930-31 there were an equal number of CORQC and Perisher Courses. There were also other short courses for the designated COs of the submarine tenders and Anti-Submarine School Officers. On a 1920

[41] RNSM A 1945/4.
[42] http://www.naval-history.net/xGW-RNOrganisation1919-39.htm#9.
[43] RNSM A 1945/22.
[44] Ibid.

course of five anti-submarine officers one was awarded a 'very good', three a 'good' and one a 'fair', comparing favourably with the submarine officers.[45]

The submarine COs as innovators

Demoralising as the interwar years must have been for COs of the time, they appear to have been a remarkably resilient group capable of producing an imaginative plethora of 'tools for The Trade': "*The grand exodus did not, however, take away all the individual talent by a long chalk. The submarine officer is a very versatile creature and peace-time conditions gave more scope for the experimentalist*."[46] Perhaps this was not so surprising, naval officers at the end of First War War were "*intelligent, self-reliant highly disciplined … capable of extreme initiative*"[47] which the actions in the Baltic and Dardanelles as those of officers like Varley and Benning illustrated. Slide rules were to dominate these inventions with six known ideas to aid the attack problem and the circular slide rule, the Is-Was, foremost until replaced by the Submarine Torpedo Director (STD) or 'Fruit Machine' as it became known.

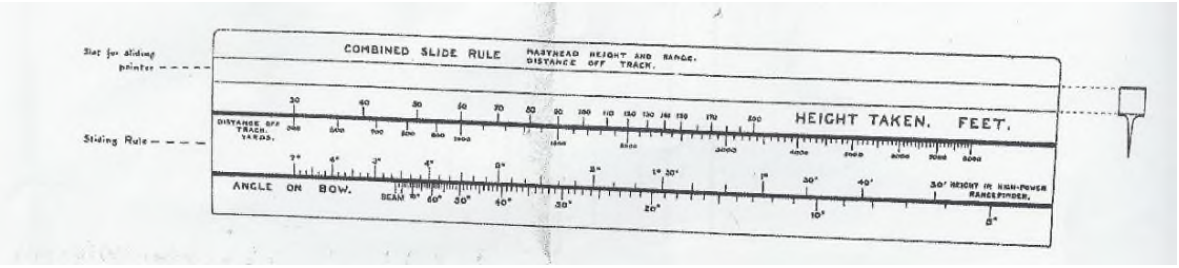


Figure 4.1: Combined Slide Rule

An example of a slide rule innovation is that from Lieutenant Commander E B Clark, a Perisher student in 1924, who proposed combining two slide rules to one which gave range by height and distance off-track by angle on the bow (Sine formula). The rule was used extensively.

RNSM A 1977/174/B4

The innovations sometimes received a cold response from officers of an earlier generation who, faced with a new lexicon of naval technology, lacked understanding. One such officer was Captain Cecil Ponsonby Talbot, (later RA(S)), who wrote:

> *"It is probably very useful to Officers who are adepts* [sic] *and have confidence in slide rules, but there is a large number of submarine officers (including myself) who are very suspicious of them, and consider they are likely to lead one astray in moments of stress".*

There were other inventions, some prescient, others impracticable. An automatic time bearing plot and an automatic plotting instrument[48] were both way ahead of their time but Guy D'Oyly-

[45] RNSM A 1945/22.
[46] G. H-J, 'A Submariner Remembers', *Naval Review* 1942-30-2.
[47] Farquharsen-Roberts, *Royal Naval*,41.
[48] RNSM A 1977/ 23/26/174/C8 Museum for Submarine Attack Instruments.

Hughes' seven feet wide, horizontal, Range Finding 'Fixed Base Periscope'[49] and a periscope with an additional eyepiece through which to view a model ship and compare the model's known ATB with that of the target were both rejected despite a trial in a CH12 periscope in the *X1*[50]. Various 90° angle directors were invented one of which came from a Perisher course as were a couple of night-sights but neither was acted upon although a night-sight of sorts was later developed.[51] This lack of night-sight development, and lack of night exercising, were to disadvantage the British submarines compared to the excellent German sights in U-boats.

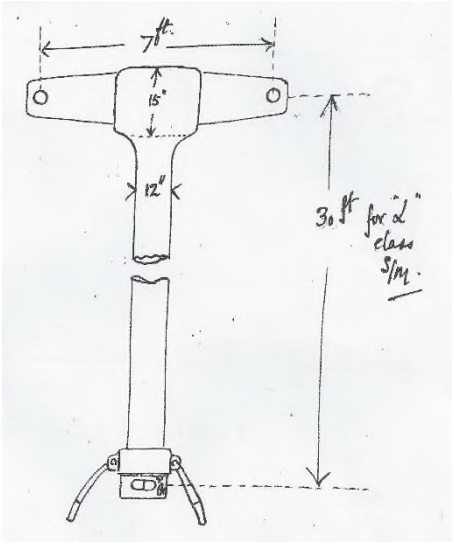


Figure 4.2: D'Oyly-Hughes' sketch of his Range Finding 'Fixed Base Periscope'
RNSM A 1977/174/B3

Use of the surface ship gunnery Dumaresq Fire Control Director had been limited in submarines[52] but Haggard, RA(S) in 1925, instigated trials to see how to use a Dumaresq to find target speed. There were limitations, and so use was left up to the discretion of independent COs. Rather dismissively, the Captain (S), HMS *Dolphin* considered that "*The most successful estimates of speed both in peace and war are generally those based on consideration of the circumstances, viz., the target ship, speed she can go, and the degree of hurry she is in etc.*"[53] Clearly a man who believed in the 'periscope eye'! Techniques did, however, materialise and one that would have longevity was the 'Millward method' which based itself on three bearings and a range from which is extrapolated the best fit of course and speed.[54] Future submariners would recognise it as the Local Operations Plot (LOP).

[49] RNSM A 1977/ 23/22 /174/B3.
[50] TNA ADM 286/528 Submarine handbook.
[51] RNSM A 1977/ 23/22/174/C8.
[52] Ibid/E1; Roger Branfill-Cook, *X.1: The Royal Navy's Mystery Submarine*, (Barnsley: Seaforth, 2012), 44. A Dumaresq was certainly used in the submarine *X1*.
[53] RNSM A 1977/ 23/22/174/E1.
[54] It is unclear who Millward was. He may have been an American.

An enforced return to General Service

During the interwar years, especially the 1920s and early 1930s, the competition for promotion was fierce. As Wingfield says:

> *"All the commanding officers were in the zone for promotion to commander and only one in three in the whole Royal Navy made the step.*[55] *I think it was unfair that the commanding officers of submarines, which were major war vessels, with several years' experience of command, had only the same chance of promotion as a Lieutenant Commander in a battleship whose finest hour was when he was allowed to operate the main derrick in the commander's absence".*[56]

The submarine CO, should he wish to be promoted, would have to spend time in GS, (in reality, he had no choice in the matter). GS was keen to ensure that the submariners did not depart too far from the culture of the mainstream Navy and a period in a battleship would resolve that. It seems that the report from a Captain in command of such a ship was more respected than the officer's own Captain SM report. The difficult bit was the activities and responsibilities open to such an officer in a capital ship:

> Officer of the Watch at sea
> Officer of Division
> In charge of a mess deck
> To run at least one game and to support all
> A part of watch, a boat or a Derek at General Drill
> Main Derrick
> Snotties' [Midshipmen] Nurse'
> Sailing races
> Divisions and Quarters – always attend if on board
> As Duty Lieutenant Commander run the Executive Department on behalf of the Commander.[57]

To the Lieutenant Commander fresh from a 'one-man-band' command of one or two submarines, when all responsibility was his, and his alone, this period as a derrick driver or classroom assistant must have been frustrating, the more so as these ships were manned with wartime complements, and had many over-zone Lieutenant Commanders,[58] reducing further the opportunities for responsibilities but increasing those for depression. Worse, the submariner had to avoid a 'black mark' that could easily blight his prospects of promotion in an era when promotion was at a premium: 48 out of 157 (30%) of Perishers in 1919-1931 being promoted compared to the post-1945 period 1946-59, (53%) and then later, 1980-90, (73%).[59] To the

[55] Whinney, *U-Boat Peril*, 25.
[56] Wingfield, *Wingfield at War*, 48.
[57] O'Conor, *Running a*, 41.
[58] Farquharson-Roberts, *Royal Naval*, 140-1.
[59] Ibid, 138-141 for an explanation and 111-13 for a graphic representation of the effect of low promotion numbers; Downer's Perisher Lists.

benefit of GS, the submarine officers undoubtedly took with them their experiences of rapid decision-making under pressure and that would have helped the interwar emphasis on developing initiative, independent action and aggressiveness.[60] Fortunately for the submarine COs, the practice went into abeyance during the Second World War and was not revived.

Towards War: 1936-1939

Major developments in technological innovations

The later interwar period saw innovation reaching into all aspects of submarining. Improved wireless[61] meant submarines could now communicate over 5-600 miles with the Type 38 valve-based transmitter and the opening of the Rugby VLF transmitter,[62] enabled submarines to read signals on a broadcast-routine basis anywhere at sea and even when dived. Work on hydrophones led to asdic, an innovation shrouded in the utmost secrecy even to the extent that quartz, used in the transducers, was referred to as 'asdevite'. Concealment continued until 1929 when the Naval Staff decided that the term 'asdics' could be used openly but installations and reference to them remained secret.[63] This led to some farcical policy implementations as when Colin Mayers was given a double envelope marked secret. Furtively reading its contents it told him that "*Submarines L53 and L54* [both asdic fitted submarines] *had left Gibraltar and would arrive at Devonport on March 10*". He then read the same words in the Times.[64] 'Asdic' finally reached the public's attention in December 1939 when Winston Churchill used it in the House of Commons.[65]

In 1922 the first submarine asdic, Type 113, was fitted in the *H32* for trials. This was a destroyer's Type 112 turned upside down so that the transducer was above the casing under, first, a canvas, then copper, then mild staybrite steel dome.[66] Copper was unpopular because, true to the traditions of the service, it had to be polished![67] The hydrophones were found to be

[60] Williamson, *The Royal*, 336.
[61] Hezlet, *Electronics*, 159.
[62] Malcolm Hancock, 'A Short History of Rugby Radio Station', *May* 2014 Issue 5 at https://www.ourwarwickshire.org.uk.
[63] Hackmann, *Seek & Strike*, 126.
[64] Colin Mayers, *Submarines Admirals and Navies*, (Los Angeles CA: Haynes, 1940), 60-1.
[65] TNA ADM 186/475 Handbook for Asdic set type 113A in HM Submarine "H32"; Hackmann, *Seek & Strike*, xxv. Mr RW Chapman, of the Clarendon Press, wrote to the Secretary of the Admiralty asking for clarification on behalf of Oxford Dictionaries. The reply came from Commander F J Walker (later Captain 'Johnny' Walker of Battle of the Atlantic fame) at the Antisubmarine School, HMS *Osprey* saying that the word derived from "*the first letters of the words Allied Submarine Detection Investigation Committee, a body which was formed during the war of 1914-1918, and which organised much research and experiment for the detection of submarines*". Hackmann avers that this committee did not exist, and the name was derived from Anti-Submarine Division-ics
[66] Hackmann, *Seek & Strike*, 166.
[67] Ibid, 173; TNA ADM 186/475 Handbook.

excellent so by the mid-1920s passive mode use predominated[68] but in 1929, the *H32* penetrated the columns in a convoy and made attacks using passive hydrophone effect and active asdic "*without any great difficulty*" with active detection ranges of 1200-1400 yards.[69] Type 113 stayed in service until 1937[70]

In 1923 work started on the 10Khz Type 116 for the O-class. Except for the *Oberon's* set, which had a surface capability, the set could only be operated with the submarine dived but not bottomed.[71] Success escaped the Type 116 for a good reason: it had a long vertical tube that extended through the pressure hull at both the top and bottom of the submarine which leaked into the asdic office. True to the eccentricities of many submariners, one First Lieutenant carried an umbrella![72] Type 116 became the Type 118 in 1929 and the standard interwar asdic set also remained operational until 1937. It was superseded by Type 120 in the *Thames*, early S-class and the minelaying Grampus class[73] where it was more efficiently closer to the bow and in the keel thus obviating the bottoming concerns[74] and the new asdic was fitted. The versatility of this asdic was demonstrated in the days before radar when the *Rainbow* led the destroyer *Bruce* " *through a long, narrow, tortuous channel, with no buoys or lights to assist navigation*" by using her Type 120A asdic in the active mode ranging on the numerous rocks and hazards.[75] 10Khz was now becoming the frequency of choice as it was giving submarines detection ranges on surface ships often comparable to, or better than, average visibility ranges in the North Sea.

As asdic developed, and submarine COs became familiar with its capabilities, its use evolved: active mode for manoeuvring submarines in formations and the use of SST for station keeping or communications; passive mode as a periscope complement and avoiding A/S vessels.[76] Meanwhile, Perisher still focused strictly on visual attacking for there was an element of indecision about the use of asdic that came from the top: "*the extent of the potential uses of the asdic are not sufficiently realised or appreciate*d" and a co-ordinated investigation of the potentialities was called for "*To facilitate co-operation between Submarines whether on the surface or submerged based upon active transmissions for SST."*[77] This was a mindset in the

[68] Hackmann, *Seek & Strike*, 128.
[69] RNSM A 1929/4 Letter from The Captain A/S HMS Osprey to the RA(S) dated 13 December 1929.
[70] Hackmann, *Seek & Strike*, 203-4; Ackermann, *Encyclopaedia*, 168.
[71] TNA ADM 186/457 CB 3002 (26) Progress in Torpedo, Mining, Anti-Submarine and in allied subjects 1926.
[72] Hackmann, *Seek & Strike*, 207.
[73] Ibid, 428; http://rnsubs.co.uk/, Barrow Submariners Association, Barrie Downer's notes.
[74] TNA ADM Minutes of the 35th A/S Design Committee Meeting held at the Admiralty on 21 January 1931.
[75] Mackenzie, *The Sword*, 58.
[76] TNA ADM 186/462 Submarine Manual 1928.
[77] RNSM A 1981/31 Proposed Future Policy.

mode of Fleet Manoeuvres exemplified in a 1936 detailed choreography of a Flotilla formation of eight submarines —a sort of nautical gavotte.[78]

The outstanding 10 Khz Type 129 followed, first trialled in the *Seawolf* in 1937 before being adopted as the standard submarine set in 1938,[79] just in time for the new construction submarines and the war. It was fitted in a streamlined dome at the forward end of the keel with the motor inside the pressure hull with access for maintenance, the latter achieved by Anthony (Crap/Gamp) Miers in the *Torbay* at night in enemy waters in the Mediterranean in April 1941, — an action indicative of his determination.[80] Type 129 was gyro stabilised and proved to be very capable as an intercept set (10 miles on an asdic ship transmitting), in the active mode (merchant ship detection at 3,400 yards; submarine at 2,900 yards), and best of all in the passive mode (13,000-18,000 yards on an escorted target and 4,000 yards on a submarine).[81] This enabled the determination of a contact's speed by propeller revolution count: a simple computation between the known number of blades, propeller size and number of revolutions needed to achieve a certain speed with, generally, a relationship between size of ship and propeller. For example, a merchant ship would typically have a single, slow-turning, four-bladed propeller whereas a destroyer would have two smaller, fast-turning propellers. But it also meant that, to better hear a target, submarines needed to reduce their self-noise.[82]

Figure 4.3: Asdic Type 113C in a Group III L-class and Asdic type 129 in HMS *Sentinel*

The Type 113C was fitted at the back of the fin to allow all around coverage.
Type 129 with Type 138 were the standard asdics in British submarines throughout Second World War
Photos: Courtesy Sally Farringdon ;Compton Hall, Richard, *The Underwater War 1939-1945*, Poole, Blandford, 1982.

[78] TNA ADM 186/499 Instructions for Submarine Operations, Section 1, The Tactical Handling of Submarine Flotillas dated 1936.
[79] TNA ADM 186/551 Progress in Torpedo, Mining, Minesweeping, Anti-Submarine measures, and chemical warfare defence, 1938.
[80] Paul Chapman, *Submarine Torbay*, (London: Robert Hale, 1989), 45-6. Miers (later Rear Admiral) was 'Crap' to the wardroom, 'Gamp' to the lower deck.
[81] TNA ADM 186/535 OSPREY Report 26 Appendix III.
[82] Ibid.

The technology closest to the immediate interests of Perisher students were periscopes and during the interwar years today's more familiar form began to take shape so that, by the late 1920s, there were four Grubb models and 150 Barr and Stroud periscopes of 10 models.[83] A Naval central depot for periscope repair was set up at Fort Blockhouse and the Admiralty, ever economically minded, had the periscopes shipped to Gosport by sea, rail being considered too expensive.[84] Following complaints of eyestrain by submarine watch-keepers using a monocular periscope, the binocular periscope was developed in 1924. This CK1 periscope went into service in 1925[85] but the technique of producing the binocular vision in an instrument that was just 60% greater at the top than the monocular version was kept a secret until the 1950s. Periscope photography started development in the mid-1920s at the Admiralty Research Laboratory (ARL) to meet the requirement to take a photograph following an attack. By 1933, after Barr and Stroud had taken over the work the requirement was for a reconnaissance role.[86]

An innovation of 1925 winning approval, trialled at sea and with the Perisher course, was a circular 25 ½ inch plotting board.[87] The trials received a special commendation from Teacher, Gerald Coploys, who commented that "*all officers should be required to be proficient in its use before passing out of the Training Class and Submarine Commanding Officers Course*".[88] RA(S), concurred and a standardised plotting board for all 'L' and later classes of submarine was provided,[89] modified so that it fitted in a drawer underneath the submarine's chart table.[90] The plotting board enabled Captain (S), First Submarine Flotilla, in June 1927, to identify the instruments that effectively made up the first command system. They were:

a) *Iswas* [sic]
b) *Slide Rule* [Combined Slide Rule]
c) [Cumming] *Plotting Board*
d) [Periscope] *Rangefinder*
e) *Patent Log*[91]

Meanwhile, the surface fleet had been developing the Brewerton automatic plotter consisting of a glass top with a pantograph arm for plotting above an electrically driven position keeper

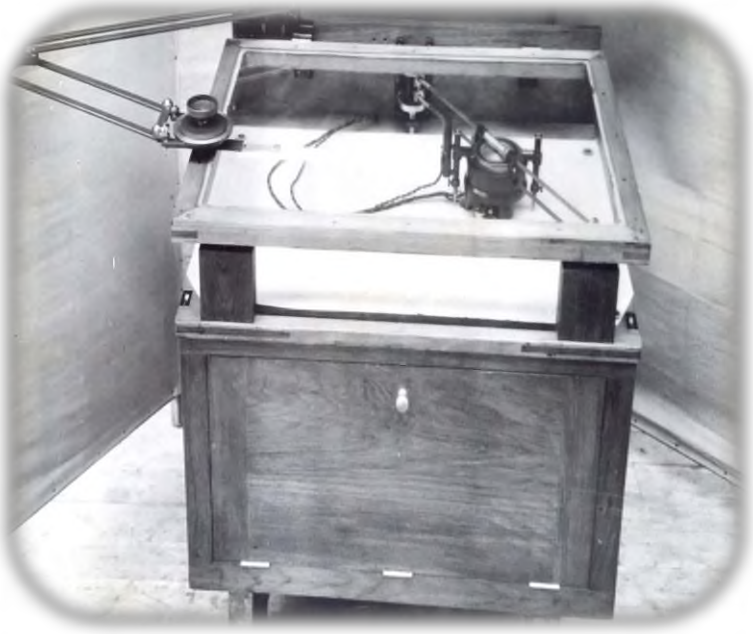
[83] TNA ADM 186/528 Submarine Handbook; Moss and Russell, *Range and Vision*, 121.
[84] AFL 186/1933 Submarine Periscopes Reports available at http://www.navy.gov.au/sites/default/files/documents/1936%20Bitonal.pdf.
[85] TNA ADM 199/1924 Technical Staff Monographs of HM Submarines Chapter IV, 113.
[86] TNA ADM 212/90 Photography through a submarine Periscope.
[87] RNSM A 1977/ 52/174/A2 Plotting Instrument (Lt. Cdr.A. S. Cumming, RN).
[88] RNSM A 1977/174/A4 Instructional Officer, Submarine Commanding Officer's Course, memorandum dated 2 February 1927.
[89] Ibid, Fleet Order 3005: Speed Finding Instrument in H. M. Submarines.
[90] RNSM A 1977/52/174/A5 Submarine Plotting Board Mark II.
[91] RNSM A 1977/ 23/22/174/A4 Museum for Submarine Attack Instruments: S/M Plotting Pros & [Remarks].

fed by the gyro and log but the 1928 trials had excluded submarines.[92]

At 60" x 48" standing 30" high it was simply too big for submarines and it was not until 1930 when a suitably reduced size table, installed in the *L56*, was found to be excellent for a strategic plot but otherwise no better than the plotting board. Recommended modifications were therefore made for a further trial in late 1930 in the Dolphin attack teacher (DAT) where once again Teacher and the Perisher students became the guinea pigs. Teacher recognised some benefits of the Brewerton Plotter, notably that "*it will give own ships position at any moment as accurately as the most efficient plotting board could obtain it. It relieves the plotting officer of any worry as to own ships position on the plot which is the main difficulty with the present plotting board*".[93] Nonetheless, it was concluded that the Brewerton Plotter had disadvantages rather than advantages over the plotting board. Some officers had a more conservative outlook on developments as one unknown staff officer commented:

> *"There are some CO's who are "Plot-minded" & who are prepared to sink their faith in such contrivances but I think (& hope) they [are] in the minority. The best & most successful S/M CO's are those who can carry a picture of the tactical situation in their heads & who can & do get hits without mechanical aids".*[94]

Figure 4.4: A Brewerton Plotting Table
The size was an encumbrance to submarine fitting.
Image: RNSM



[92] RNSM A 1977/52/28 Brewerton Plotter in Submarines-1928.
[93] Ibid
[94] RNSM A 1977/52/28.

A further trial in the *Regulus* in 1933 found the table to work "*very satisfactorily*" and "*has been found to be of great value*".[95] This was too late, for events had overtaken matters. In 1924 the ARL was developing a plotting table called the "*Crawler*", (the name was dropped in favour of the more prosaic ARL Table), a combined electrical and mechanical apparatus that resolved the course and speed transmitted to a pencil on a plotting table with a variable scale. Speed came from either a Forbes Log or a hand-set clock.[96] Its first trial in 1928 was witnessed by a submarine CO, Lieutenant Commander Galpin who recommended a table that could be adjusted to a chart's scale and provide a dead reckoning position "*would prove extremely valuable for submarines*".[97] A later review by the CO of the *L52* concluded that because of the clock, size, cost and delicacy of the ARL Table, it made the replacement of the Mooring [Plotting] Board unjustified. The report is probably why the ARL Table was not pursued by RA(S) until, in November 1933, the ARL Table was adopted as the fleet's standard table[98] and submarines were given a compact version developed in 1938.[99] McGeoch confirms the presence of such a table in the new *P228* (later HMS *Splendid*) in 1942 commenting that "*the later submarines were all being equipped with this* [plotting table]"[100] but there is some uncertainty.[101] Importantly though, the plotting board and then the ARL table meant that the target's range, course and speed could be overlaid on a fan of target bearings to achieve a 'best fit' solution viz: the Millward method. Useful as it may have proved for the attack problem the plotting table was not a panacea for navigation and submariners still had to rely heavily on dead reckoning and the estimated position. There was, perhaps, more art than science employed.[102]

The fourth important development, the STD, went to the very heart of Perisher training when it started to be fitted in submarines in 1938.[103] The STD was the initiative of Commander Geoffrey Wadham on the staff of RA(S) who, although not a submariner,[104] identified the problem submariners had in determining DA to Hugh Clausen, Chief Engineer, Admiralty

[95] Ibid.
[96] RNSM A 1977/52/32 Submarine Plotting Tables-1924/31.
[97] RNSM A 1929/3 Automatic A/S Plotting Table.
[98] RNSM A 1977/52/28
[99] TNA ADM 186/546 HMS OSPREY Portland, (experimental section) Half-yearly report 27, 1938.
[100] McGeoch, *An Affair*, 57.
[101] TNA ADM 199/1924 Technical Staff Monographs of HM Submarines Chapter IV says that the automatic plots went into the Thames class and one of the minelayers because the tables were too large for most classes, and it was only in 1945 that they began to be widely fitted.
[102] Compton-Hall, *The Underwater War*, 38-41.
[103] Ibid.
[104] TNA ADM 196/54/101 Wadham's Service Record.

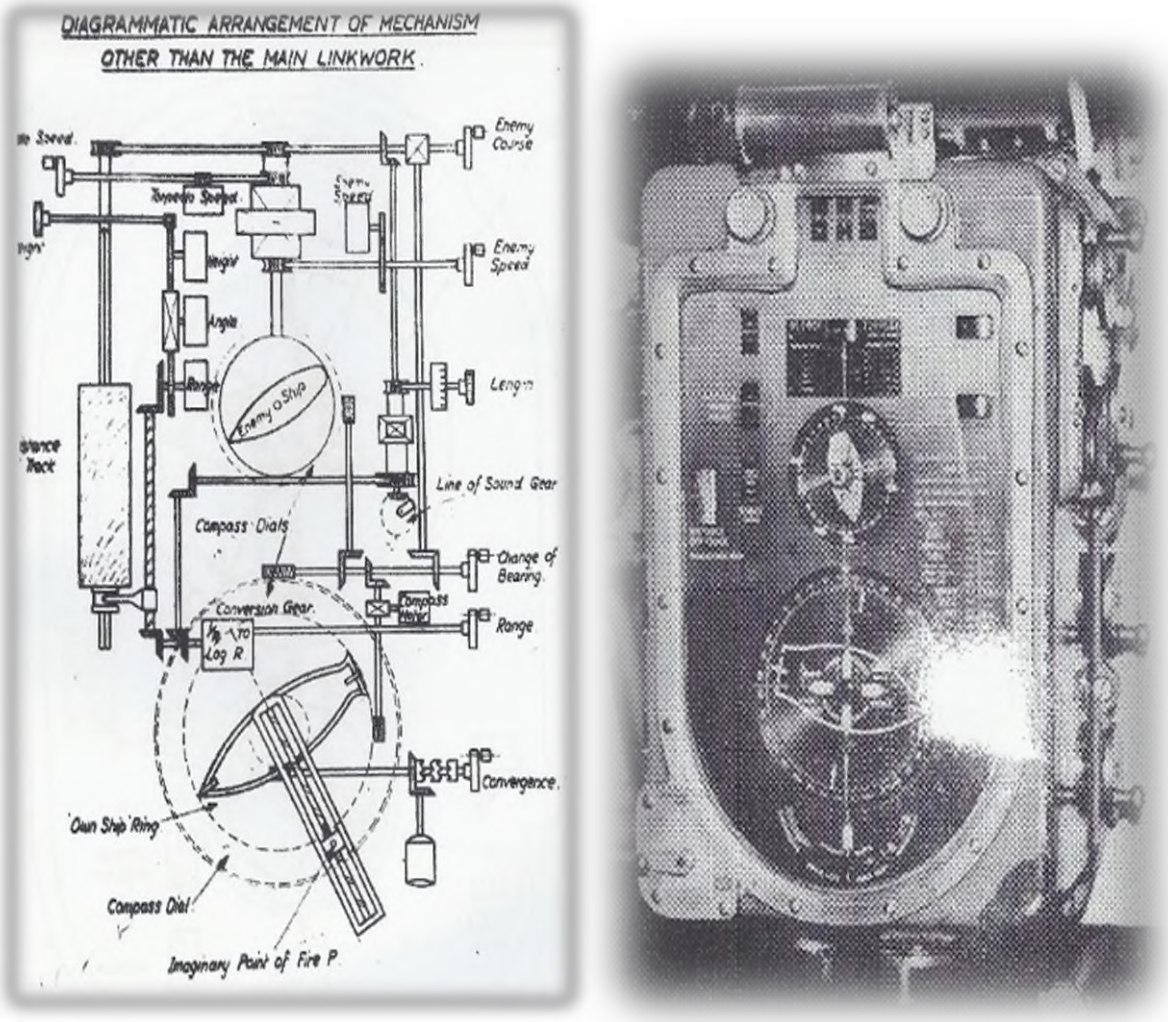
Ordnance Design Bureau.[105] The solution, he suggested, was an instrument along the lines of an existing torpedo sight and it was from this approach by Wadham to Clausen that the STD, given the nickname 'the Fruit Machine' because of its similarity to vending machines of the day, was born. [106]

Figure 4.5: The Submarine Torpedo Director 'Fruit Machine'.

Left: diagrammatic arrangement of the mechanism Right: STD in-situ in a control room

TNA ADM 1/24278 Submarine Torpedo Director Case No. 583.

Image courtesy of the Friends of the Submarine Museum.



The STD was "[D]*esigned to replace the present "Is Was" instrument and the various slide rules used for subsidiary calculations".*[107] It *"is designed to cover, as far as is possible, all the requirements for firing torpedoes from submarines, either straight shots, or shots angled 90° right or left with proper allowance for convergence".*[108] In 1934 a model was sent to Fort Blockhouse for trials by the Perisher in the attack teacher, and although it failed to provide

[105] TNA ADM 1/24278 Submarine Torpedo Director Case No. 583.
[106] Ibid.
[107] Edward Young, *One of Our Submarines*, (London: Rupert Hart-Davis, 1952), 34.
[108] TNA ADM 1/24278.

continuous, target parameters and torpedo gyro angle, it went into production in 1936 and was fitted just in time for the war[109] where it was generally operated by the Third Hand, (the next officer in seniority below the First Lieutenant — the name is submarine lore). Three hundred STDs were made for the RN[110] to serve throughout the war with great success[111] and from hereon the 'Fruit Machine' would play an integral part in submarine life as Perishers, COs and attack teams were drilled *ad nauseum* in its, and its successors' use, for many generations.

Training limitations

The best account of Perisher during the interwar period is from George (Shrimp) Simpson in 1927.[112] Simpson was then a Lieutenant and Perisher was a three-month course run from Fort Blockhouse with a curriculum that was solely practical attacking. This started in the DAT with a slow single ship on a steady course.[113] The aim was, he says, "*to develop a sense of location and a clear mental picture of one's own position relative to a target*".[114] This is the same mental picture that Admiral Sandy Woodward described as the requirement 40 years later when he was Teacher in 1967. Woodward's analogy is:

> *"to hold a mental picture of the surface scene … imagine sticking your head out of a manhole in Piccadilly Circus, taking one quick swivelling look round, ducking back down into the sewer and then trying to remember all that you have seen."*[115]

That fundamental principle of Perisher remains unchanged today. Simpson held that the mental picture had to be developed so that a CO was confident when "*confronted with an aircraft carrier escorted by eight destroyers zigzagging at 25 knots in a visibility of only 2 miles*."[116] Unfortunately, the attack teacher he used was far more limited. After a month of such attacks, the Perisher students went to sea in a submarine for one day each week. This gave them initial practice against a "*slow sloop*" (probably the *Fermoy;* she could do 16 knots) in different sea conditions and with the added distractions of local shipping. Such mid-interwar years' Perisher courses consisted of usually five officers who were given eight sea-training days out of a total of about 60 days and achieved about 58 attack teacher attacks and 24 sea-attacks,[117] an

[109] Ibid.
[110] Ibid. Another 80 were transferred to the Soviet Navy
[111] Lindell, *100 Years*. Just like the Americans, with the Is-Was and the TDC.
[112] Commander George Simpson (later Rear Admiral) was legendary for his command of the Tenth Submarine Flotilla that saw some of the fiercest fighting in the Mediterranean and took the largest casualties.
[113] RNSM A 1945/22 .
[114] Simpson, *Periscope View*, 45.
[115] Admiral Sandy Woodward, *One Hundred Days*, (London: Harper Collins, 1992), 56.
[116] Simpson, *Periscope View*, 46.
[117] RNSM A 1945/4.

improvement on the earlier immediate post-war courses which would typically do 30 to 40 attacks in the attack teacher and somewhere between 6-17 attacks in the submarine at sea.[118] In December 1934 Simpson returned to submarines from two years in the battleship *Nelson* and excelled in his CORQC with 100% hits.[119]

Bryant's experience on his 1934 Perisher confirms that little had changed since Simpson, it was still exclusively periscope attacks although he offers some interesting insights. First, the Perishers ran the attack teacher themselves suggesting there were no staff. Secondly, he states that "*the* [P]*erishers were neither subdued nor bowed down by anxiety*" which suggests that pressure and/or stress were either well-controlled or absent. He also suggests that the most anxious was the CO of the boat the Perishers were riding indicating that both command and conduct of the submarine remained with the CO rather than Teacher.[120]

Perisher was based on a depot ship about which G.H-J wrote a humorous and well-scripted article: the early depot ships were "*furnished from the scrapheaps; they abounded with rats and generally speaking were incapable of movement, being moored fore and aft and aground amidships on beef bones and empty gin bottles*",[121] while ratings complained vociferously about overcrowding and poor food onboard.[122] The depot ships took part in naval exercises representing a "*mighty convoy of merchant ships or an aircraft carrier*", and thus, because of their slow speed confining a formation of warships to a more stately progress.[123] Submarines, therefore, had the opportunity to practice attacking 'slow' (by naval terms) targets but not, it appears, Perisher. This contradicts Roskill's critical comment, oft-repeated, that "*not one exercise in the protection of a slow mercantile convoy against submarine or air attack took place between 1919 and 1939*",[124] an issue that George Franklin challenges with vigour relating a convoy defence exercise as early as 1928 in which a submarine penetrated the screen and shadowed the convoy on the surface from astern overnight, prescient of U-boat tactics.[125] In all, nine Convoy Defence Exercises are identified during the interwar years.

[118] RNSM A 1945/22 .
[119] Ibid.
[120] Bryant, *Submarine Command*, 33-4. Command/Conduct/Charge are modern concepts discussed later.
[121] G. H-J, 'A Submariner Remembers III', *Naval Review* 1942-30-4.
[122] Hannen Swaffer, *What Would Nelson Do?,* (London: Victor Gollancz, 1946), pp.34-5; Farquharsen-Roberts, *Royal Naval*, 124-9.
[123] G. H-J, 'A Submariner Remembers', G H-J was possibly Frank Gilbert Hackford-Jones: Perisher 1926.
[124] Roskill, *Naval Policy Vol 1*, 536; MacGregor, 'The Use'. Roskill's assertion is taken at face value by many other historians.
[125] Franklin, *Britain's Anti-Submarine*, 143; Marder, *Dardanelles to Oran*, 39-44. Marder gives a spirited and detailed repudiation of Roskill.

Table 4.2: Convoy Defence Exercises					
Year	Exercise	Attacking S/M Force	Defending A/S Force	Convoy Speed	Notes
1927	NP	4 Submarines	12 Destroyers	7	
1928	LA	4 Submarines	4 Destroyers	8	
1929	OD	1 Submarine	17 Destroyers	8	
1929	MA	9 Submarines	D6 & 1 A/S	11	
1930	AS	10 Submarines	D5 & D6	15	
1933	AF	u/k	4 Destroyers	9	
1933	RT	u/k	D1 & D4	u/k	Submarines targeted escorts, not convoy
1934	SK	3 Submarines	3 Flotillas	9	Heavily defended, but slow, troop convoy
1938	ZP	u/k	14 Destroyers	10	[Wolf] Pack attack failed
George Franklin, Britain's Ant-Submarine Capability 1919-1939, (London: Routledge, 2015, p.114					

The central issue was the speed of the (merchant) convoy. Early in the war a 'fast' convoy went at nine knots and by the summer of 1941 this had been raised to 10 knots, but that was still 'slow' by naval standards. 'Slow' convoys had started at seven knots increasing to 7.5 knots.[126] That these low speeds were only achievable by merchant shipping was, Richard Woodman says, a shock to the Royal Navy. But as they reflected the world's bulk-carrying tramp shipping they would have applied to much of the world's shipping. Approximately half of these exercise convoys were therefore 'slow', so arguably, both commentators were right, but within their own reasoning. What is important is that COs practised against naval convoys, 'fast' in merchant ship terms. Depot ships represented convoys but even such a target would have been 'fast' as they could manage more than 10 knots, even the long-serving Perisher depot ship, the *Cyclops*, could do 13 knots on her triple expansion reciprocating expansion. Anyway, British submarine targets were warships rather than merchant shipping and most attack teacher models were foreign warships with only a few merchant ships.[127] Not that that mattered too much for, no matter how big a convoy, a submarine would only see a few ships at a time.

Mars describes the attack training issue another way. The first problem was that operational efficiency lay with Commanders-in-Chief rather than the RA(S) and operational command of the North Sea flotillas was only transferred to RA(S) shortly before war started.[128] Submarines had therefore been more often used to train the surface fleet than themselves. Bill King recalls the "*clever and charming*" Bickford, trying to convince those who regarded submarines as clockwork mice for surface ships, by saying "*One day you will really need Submarines, if you*

[126] Richard Woodman, *The Real Cruel Sea*, (London: John Murray, 2004), 144.
[127] RNSM A 1945/22 .
[128] Geirr H Haarr, *No Room For Mistakes*, (Barnsley: Pen & Sword, 2015), 83-4.

neglect their proper training you won't have them for long."[129] Consequently, submarines had been "*used relentlessly and ruthlessly for training of destroyers and other A/S vessels*". Rather than train themselves for war "*in the balmier days of the late twenties and early thirties, many submarine captains were not so exacting*". [130] As a consequence COs entered the war in a state of what Mars calls "*early-stage amorphism*" [131]: the rigours of the 1914-18 war had failed to be reproduced in the peace of the 1920s-1930s, but the submariners understood the true effectiveness (ineffectiveness) of asdic and how to evade detection.[132] At the same time the acme of success for a CO was to penetrate a destroyer screen and get a single hit from a practice torpedo at close range on a major unit, hopefully a battleship, a practice to the detriment of salvo firing.[133] On that point Hezlet differs; he says that the full salvo was well-practised because COs were being trained to attack warships and it was the reduced salvo, to be used against merchant ships, that was omitted.[134] It is probable, therefore, that Mars was referring to the reduced salvo and as firing a salvo of practice torpedoes would have been prohibitively expensive, one torpedo can be used to represent a salvo, a practice employed by later Perisher courses. What we can conclude is that, if getting a practice torpedo to hit a warship was the way to prove yourself as a CO, and get promoted, it would also have been the focus of Perisher. Both Hezlet and Mars point out the importance of the gun action and how much this was practised in the early 1920s and 30s and it would make sense that Perisher also practised gun actions although there is no record of it happening. [135]

The Fourth Submarine Flotilla had the reputation of overcoming the exigencies and limitations of the home Flotillas in achieving operational efficiency.[136] Simpson considered it the "*premier flotilla*" in the 1920s.[137] Based on Hong Kong, in the late 1930s it was under the command of Captain Claude Barry, later the wartime RA(S) from November 1941, and under the tutelage of Commander George Menzies, both Commander (S) and CO of the *Regulus*.[138] Known as the 'Colonel' he had the reputation as a martinet.[139] The 14 strong submarine

[129] King, *The Stick*, 29. Commander Edward Bickford DSO, lost in the *Salmon* in July 1940, damaged the cruisers *Nurnberg* and *Leipzig* and sank the *U36*. Firing a salvo on both occasions from 5000 yards he was extraordinarily lucky.
[130] Mars, *British Submarines*, 33.
[131] Ibid
[132] Arthur Marder, 'The Influence of History on Sea Power: The Royal Navy and the Lessons of 1914-1918', *Pacific Historical Review* Nov. 1972, 41/4, 413-443.
[133] Mars, *British Submarines*, 33-46.
[134] Hezlet, *Submarine Operations*, 4-5.
[135] Ibid; Mars, *British Submarines*, 45.
[136] Whinney, *The U-Boat Peril*, 36.
[137] Simpson, *Periscope View*, 37.
[138] It was the practice at the time that the senior CO of a Flotilla would also be Commander (S).
[139] Todd, *A Long Time*, 87.

flotilla[140] had a war role to act as a deterrent against the Japanese fleet until a British fleet could be sent out to defend the Empire's interests: the 'Period Before Relief'.[141] In 1938 the FSL commented that he did not think the Japanese would relish running the gauntlet of the Fourth Submarine Flotilla in any putative attack on Singapore.[142]

Having been Menzies' navigator Mars was in something of awe of him and he opens the dedication of his *British Submarines at War 1939-45* with "*admiration and deep affection for the late Captain George Menzies, DSO, Royal Navy, who prepared us all for battle…*"[143] Supposedly quoting from Menzies' diaries, but more reflecting his memories of his time in the *Regulus*, Mars eulogises Menzies' equal speed manoeuvres based on a Divisional organisation with the intent to establish several submarines in a patrol line.[144] These manoeuvres, together with the high amount of local and day-running would have been excellent training for the Flotilla submarines in the basics of submarining, seamanship and ship-handling etc. In January 1938, the *Regulus* conducted a 28-day patrol returning with no defects for which Menzies was rightly acclaimed. But much of the patrol was spent on the surface during daylight including casing-banyans and at one time they needlessly landed a crew member for gonorrhoea, treatable onboard.[145] The value of the 28 days as a training war patrol is therefore questionable even considering the standards of the time. Indeed, Mackenzie, commenting on the 'O', 'P' and 'R-class' submarines, all of which had been on the China station and in 1940 many of which were operating in the Mediterranean, had "*a lack of realistic operational training for war*."[146] But some real operational energy did come from the Flotilla, Menzies made great efforts to develop air-sea (submarine) co-operation (he went flying himself many times) and the *Regulus'* patrol stimulated the Flotilla into conducting longer, more realistic patrols, of 14 days duration.[147] What probably made the Flotilla's reputation was its ability to conduct so many pro-submarine drills and exercises aided in part, no doubt, by the Commander-in-Chief 1936-8 being the submariner Vice Admiral Charles Little while the home Flotillas were tethered to the requirements of surface forces. All this, and the note for 1938 against Exercise

[140] https://www.naval-history.net/xGW-RNOrganisation1919-39.htm#9
[141] Roskill, *Naval Policy Vol 2* 437; For an excellent appreciation of the situation see James Goldrick, 'Buying Time: British Submarine Capability in the Far East, 1919-1940', *Global War Studies* 11 (3) 2014.
[142] Andrew Boyd, *Worthy of better Memory: The Royal Navy and the defence of the Eastern Empire 1935-1942*, PhD thesis, University of Buckingham, February 2015.
[143] Mars, *British Submarines*, Dedication; Matthew Todd interview 2018.
[144] Ibid; Menzies, *Personal diaries.* Menzies only mentions these manoeuvres three brief times.
[145] TNA ADM 116/4586 Submarine General Memoranda: two pills four times a day after meals; noncontagious after 24 hours treatment.
[146] Mackenzie, *Sword of,* 87.
[147] Menzies, *Personal diaries;* David A Thomas, *Submarine Victory*, (London: Wiliam Kimber, 1961), 203. The *Tantilus* (Lt Cdr H S Mackenzie) did a 56-day patrol in 1945 in Far Eastern waters.

ZP, 'Pack attack failed'(Table 4.2), contrasts sharply with the practice of the Germans during this period in their Baltic exercise areas, (see later).[148]

Exercise ZP shows that the First Submarine Flotilla under Captain Philip Ruck-Keene had "*practised "Wolf Pack" tactics*" similar to those of Dönitz.[149] The Royal Navy should not therefore have been taken by surprise by the German 'Wolfpack' tactics, but the threat went unrecognised and the tactics were neither adopted nor investigated further. Roskill explains the naïveté on the Royal Navy's obsession with asdic and the battle with a submerged submarine.[150] He also blames the cultural isolation of the Submarine Service as a 'private Navy',[151] with all that implies about lack of communication with the wider Service.

While one senior officer could say:

> *"Calculated risks in peacetime training had to be taken. …. Night fighting, at close range between completely dark and heavy ships, called for steady nerves, as did the job of light forces, of cruisers and destroyers, to locate shadow report and attack,"*[152]

Those risks were not for the Submarine Service. Bryant laments that between 1927 and 1938 he had never dived a submarine at night, nor taken part in fleet exercises at night, let alone a surface night attack without burning navigation lights, obvious to any thinking submariner as an important tactic — but risk-aversion prevailed.[153] McGeoch recognised the importance of night actions and had written a paper for publication by the Royal United Services Institution but it had been stopped by the Admiralty. Consequently, these fears were then hard-wired into exercise instructions of the time. CB 4000 dated 1938 specifies:

> *"In peace, submarines are not allowed to dive during dark hours except in purely submarine and anti-submarine exercises in accordance with the instructions in Chapter 7.*
>
> *They are, however, allowed to operate on the surface during dark hours but should, as far as possible, be kept clear of areas where surface forces are likely to make contact."*[154]

Franklin makes the case that although operating dived at night was considered dangerous, many night exercises must have been made with the submarine on the surface, and if the CO was on

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[148] David Westwood, *The Preparation and Training of U-boat Crews 1925-1945*, at http://www.U-Boat.net.
[149] Bryant, *Submarine Command*, 40.
[150] Stephen Roskill, *The War at Sea 1939-45 Vol 1*, (London: Collins, 1960), 354.
[151] Roskill, *Naval Policy Vol 1* 536-7; Whinney, *U-Boat Peril*, 42. The 'Private Navy' was reflected in the opinion of Captain Bob Whinney although he also recognised that the isolation allowed the Submarine Service to be "*realistically professional in a manner like no other part of the Navy*".
[152] James Goldrick, *Learning How to Do Over the Horizon Warfare at Sea.*, Lecture, United States Naval War College, 6 October 2016.
[153] TNA ADM 116/3564 China Station: Quarterly Reports of 4th Submarine Flotilla. The report for June 1925 reports "*Two night attacks*". From practices at the time, they would have been surfaced with lights on.
[154] TNA ADM 239/254 CB 4000, Standard instructions for sea/air exercises, 132

the bridge, the rules allowed no navigation lights. It is likely therefore that some COs may have had some experience of operating at night but Perisher would undoubtedly have been taught compliance with the restrictive rules thereby missing out on skills that would be called for frequently in the coming war. The safety concerns, however, were substantiated by an event in 1925. It was becoming recognised that attacks on tenders were rather stereotyped so larger scale exercises that included night cruising were introduced and it was during one of these exercises that the submarine M1 was hit by a Swedish merchant ship and lost.[155] This accident cannot have helped the development of more realistic night-time interactions for it took until the spring of 1939 for Ruck-Keene to get permission for submarines to operate at night without navigation lights.[156] The lack of night-time exercising contributed to British submarines only having a primitive night-site for torpedo control on the surface[157] whereas the U-boats had a Zeiss binoculars-based sight. There are no records of Perisher conducting night-time attacks until the war. Nevertheless, Bryant considered the training sound[158] as did Mervyn Wingfield who thought that it worked well when put to the test. A typical exercise experienced by Wingfield was in the Sea of the Hebrides where eight H-class submarines would fire practice torpedoes at targets transiting their patrol area, but only by day.[159]

While some considered the training good, William (Bill) King who took his Perisher in 1938 at the early age of 27 was questioning. King used metaphors to describe the submarine attack: many can sing but a virtuoso is needed to hit the perfect note; and the necessity to point British submarines "*like a bow and arrow*" because they lacked the gyro-angled torpedoes of the Germans and Americans. He describes himself as "*wallowing around like a stuck whale in the path of the oncoming target ship*."[160] This dissatisfaction could, of course, have been a personal failing (he seems to blame himself), a failing of his Teacher, John Wisden, or the curriculum of the course itself. Gladly, his concerns were misplaced for he survived the war to become one of the best-known successful British COs.

Mars opines the interwar years as penny-pinching, treaty-driven, denied-of-reality:

> *"At the tail-end of this nightmare procession of mistakes, incompetence, sloth, cupidity and self-deception straggled, forlorn and unwanted but fortunately not unhappy, the British submarine in Home Waters. Almost an embarrassment to exalted sisters of the surface this pathetic Cinderella was about to have her ball; but without a fairy godmother (unless Max Horton could later have been so described!),*

[155] RNSM A 1985/42.
[156] Bryant, *Submarine Command*, 39.
[157] King, *The Stick*, 67; Bryant, *Submarine Command*, 74. Bryant had a homemade sight.
[158] Bryant, *Submarine Command*, 41.
[159] Wingfield, *Wingfield at War*, 57-8.
[160] King, *The Stick*, 24-25.

certainly with no charming escort: she crept softly and in rags to her dance of death; more brazenly and better clad through the fire dance, to emerge triumphant ... six years and more than 3100 lives later";[161]

Nonetheless, materially, the later interwar years had been beneficial to the submarine fleet. It had 63 submarines, of which about 40 could be considered operational, with better periscopes and asdics, and plotting tables and the STD to be introduced to form the genesis of future command systems. The CO was now beginning to receive more information needing synthesis.

Perisher students would have been familiar with these developments as their careers progressed and, as all generations do with technology, assimilated them into their knowledge banks. As they would have done with the major task of learning how to handle submarines that would be required to act as a torpedo boat, gunboat, minelayer, troop and store carrier, tanker, and navigational beacon, and used for air-sea rescue, reconnaissance, surveying, convoy escorting, anti-submarine, and special forces operations.[162] The question was, where would these skills be taught and where was the COQC to be based during wartime? Thought was given to these issues in an inter-staff letter in June 1938 about training issues. The COQC was an easier problem than the Submarine School and the envisaged solution was Devonport with an attack teacher-fitted depot ship or to build a new attack teacher onshore "*It has been there before with an attack teacher in the Port Library*".[163] But Devonport was not to be the answer.

Table 4.3: Submarine and Perisher Statistics 1918-1939

	SMs	SMs Built	SMs Lost	COs Lost	Perishers
1918	187	33	1		13
1919	184	5	2	1	10
1920	174				11
1921	150		2	1	10
1922	107		1	1	12
1923	82		1		15
1924	72	1	1	1	4
1925	65	1	1	1	10
1926	67		1		11
1927	61	3			10
1928	59				4
1929	60	4	1	1	7
1930	63	8			10
1931	62	3	1		9
1932	61	3	1	1	7
1933	58	4			12
1934	60				8
1935	59	3			13
1936	54				15
1937	55	3			14
1938	60	6			10
1939	63	7	1	1	11
Totals		54	14	8	226
Average					10.2

Sources: Ackerraann, Paul *Encyclopaedia of British Submarines 1901-1955* Penzance, Periscope Publishing; 14S9 and Evans, AS, *Beneath The Waves*, London, Wiltiam Kimber, l986

[161] Mars, *HMS Thule*, 25.
[162] Bryant, *Submarine Command*, 49.
[163] RNSM A 1988/15 Letter from Commander GWG Simpson to Captain Keble White dated 6 June 1938 and staff comments. This is the only reference found as to either the COQC or an attack teacher in Devonport.

We can conclude that the Submarine Service survived its nadir. It survived despite early post-war difficulties, and from being considered "*more from a moral and legal aspect than from a tactical and operational one*"[164] as it diminished in both numbers of submarines and men. Throughout both the troubled and ascendant interwar years, however, Perisher met the changing needs of the Submarine Service, its continuation and name change to COQC are proof of that. A consolidated position enabled it to provide a steady stream of innovative submarine COs suggesting a strong and healthy culture within the Submarine Service while other parts of the Navy were depressed and despite the Submarine Service losing 14 boats and eight COs in peacetime.

Limited to attacking warships, and obstructed by risk-adversity, the submariners missed their opportunity to alert the Navy to the possibilities of night-time convoy attack. Materially, however, the submarines were much improved in the form of periscopes, asdics and an embryonic command system many of which the Perisher had played an active part in developing. There were two schools of thought about how well-prepared submarines were for war. The COs had been well-trained through Perisher but some bemoaned the operational training while others considered it 'sound'. The war would show who was right

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[164] Haarr, *No Room*, 85.

5. The Second World War

In 1939, the Submarine Service establishment, of GS, reserves and submariners, was 5,458 officers and ratings, 4% of the Navy, of which 2,215 were submariners, just 1.7% of the Navy. Of these, five Commanders, 29 Lieutenant Commanders and 15 Lieutenants commanded the in-commission, operational submarines out of the 57 in total.[1] By the end of the war, the number of submarines had more than doubled to 123 with 58 building[2] and an establishment that had grown proportionally. Perisher embarked on an energetic evolutionary journey over the next six years of the Second World War to respond to the changing exigencies and imperatives: losses of 65 COs, an increased building programme, reduced experience of students, and growing demand for COs.[3] To cope, Perisher acquired considerable assets to qualify an unprecedented 233 COs.[4] This was Perisher's shortest and most evolutionary period and therefore requires coverage in the first part of this chapter.

The RN also operated submarines of six other nations[5] and, while it was not a prerequisite that their COs were qualified under the British system, some saw the benefit and took the Perisher course. The other Second World War principal submarine protagonists, America, the Soviet Union and Germany trained large numbers of submarine COs. Thus, a comparative review of their qualification programmes to illuminate differences, and the relative performance of British submarines, (by inference, Perisher), forms the second part, albeit limited by necessity due to the lack of similar studies of these navies, and the confines of this thesis.

[1] Hezlet, *Submarine Operations*, 1-3. Reserves and General Service totalled 3,243. Ackermann, *Encyclopaedia*, 104 quotes 57 boats but Hezlet says 59 boats,
[2] Ibid, 104. 181 were added including nine ex-USN boats and four captured U-boats, 31 went to allies, one was sunk as a target, seven were scrapped and 74 lost with two damaged beyond repair.
[3] Ibid,371.
[4] RNSM A 1945/22 ; Barrie Downer, Submarine Commanding Officers 1901-2018.
[5] Dutch, French, Greek, Polish and Yugoslavian with, later, the Italians.

Perisher's Most Intense Period

Perisher's initial reaction to war

The last peacetime Perisher finished in July 1939 with all six students passing.[6] One of them, Hugh Haggard, the son of the earlier RA(S), went on to sink over 20,000 tons of enemy shipping in the *Truant,* won the DSO, DSC and MiD*[7] and became an Admiral. Three others survived the war in command but two died.[8] This Perisher was to be the last of the lengthy three to four-month courses. Thereafter, exigencies of war would reduce Perisher to between six-nine weeks.[9]

An early war incident that Mars probably had in mind when he remarked, "*British submarines operating in the North Sea, were initially constrained by moral, political and inbuilt training omission restrictions*,"[10] had implications for both the government and Perisher. In December 1939 Edward Bickford in the *Salmon* sighted the large German trans-Atlantic liner *Bremen* crossing his stern off Norway. Bickford was constrained by the Prize Rules and as he undoubtedly would have been taught on Perisher, surfaced and signaled for the *Bremen* to stop, which, of course, she did not. The *Salmon* then had to dive when threatened by a German aircraft and the *Bremen* continued her voyage. [11] The incident influenced the government to change its attitude, which they did on 9 April 1940 by signal at 1324, just as Lieutenant Commander Jack Slaughter in the *Sunfish* was carrying out a dummy attack off Lysekil in Sweden on the German merchantman SS *Amasis*. The signal was deciphered during the attack and the 7,129 *Amasis* carrying 7,300 tons of coal was the first German merchant ship to be sunk under a British unrestricted submarine warfare policy [12] Perisher though, remained warship focused.

The first wartime effect on Perisher was that it was put in abeyance owing to the reactivation of the reserve submarines and their need for full complements resulting in First Lieutenants due to go on Perisher being diverted to complement billets. At the same time, many officers began to be recalled from GS and retirement and they needed a CORQC the first of which was

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[6] RNSM A 1945/22 .
[7] Hezlet, *Submarine Operations*, 367.
[8] Evans, *Beneath the Waves*, 218-221; Cecil Crouch, DSO** DSC in the *Thunderbolt* and Francis Brooks in an air crash in 1943
[9] RNSM A 1945/4 .
[10] Alastair Mars, *British Submarines at War 1939-45*, (London: William Kimber, 1971), 28.
[11] Hezlet, *Submarine Operations*, 16.
[12] Ibid, 27. Haarr, *No Room*, 165, 177. 19 merchant ships had already been sunk in Skagerrak/Kattegat waters. Slaughter was 35 and this was to be his last submarine command as he was a casualty of the Horton superannuation policy. He was a well-known Captain (SM) in the post war years.

in August 1939 for three officers: Lieutenant Commanders John Forbes and Ronald Burch who had completed Perisher in 1935 and 1937 respectively, and John (Ginger) Harvey. Harvey was something of an anomaly because he had left the Navy in 1934 as a Lieutenant without being selected for Perisher.[13] He was not, therefore, command qualified and a CORQC was inappropriate. As there were neither submarines nor targets available for sea-attacks the course was confined to the attack teacher where Harvey conducted 55 attacks, 35 of which were hits (65%); comparatively a good score. Then, based on the CORQC rather than a full Perisher, Harvey was appointed in command of the *H50* at Portland from where he received an average report but with the comment "*not rec. for cmd of a S/M in the North Sea area*"[sic].[14] This is indicative that a 'non-operational' pass was now possible but as the war had not yet started in the Mediterranean he was appointed to command the *Osiris* based in Alexandria. Three months later in September 1940, Italy joined the war and Harvey was off Otranto when he sighted three merchant ships in convoy. Firing, and missing the merchant ships, the Italian destroyer *Palestro* appeared from behind the merchant ships, was hit, then sank.[15] On return to Alexandria, the *Osiris* was met by a boat with a message from Captain Sydney Raw, Captain First Submarine Flotilla. It read:

> *"My dear Harvey. Welcome back to the flotilla and my, our, very heartiest congratulations on your successes. Herewith your new recognition signal <u>without which</u> at the masthead "Gangster Harvey" will <u>NOT</u> be allowed alongside!"*

Enclosed with the note was a Jolly Roger flag, the first to be flown in the Second World War. It was the now commonly known black and white flag, but the first submarine Jolly Roger flown by Max Horton in late 1914 to celebrate the sinking of the cruiser S*MS Hela*, had been yellow with black, his second, a few weeks later, to celebrate the sinking of the destroyer *SMS S117*, was white and black.[16]

Normally such a sinking would bring an award, but Harvey received nothing, even after later doing sterling work as CO of a Perisher training submarine for the remainder of the war. The supposition is that Horton learned of Harvey's attacking limitations from his interview with Harvey's First Lieutenant, Hugh Mackenzie, on the latter's return for Perisher. Harvey is the only officer appointed in command without completing a Perisher since the end of the First World War.

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[13] He was promoted Lieutenant Commander on the Reserve List.
[14] Harvey's personal records held by his daughter Sally Farringdon.
[15] Hezlet, *Submarine Operations*, 357; TNA ADM 219/572 – 219/580 Harvey is not alone in hitting a ship that he did not aim at. The post-war Hollerith analysis identified 30 such instances in which 26 of the ships were sunk, most were escorts.
[16] Harris, *Harwich Submarines*, 132, 174.

Figure 5.1: HMS *Osiris* flying the Jolly Roger with (inset) Lt Cdr 'Ginger' Harvey.
The first Jolly Roger to be flown in the Second World War was sent out in a boat on the *Osiris's* return to Alexandria following the sinking of the Italian destroyer *Palestro*.
Image: By kind permission of Sally Farringdon

Perisher's suspension, the increased submarine building programme and Horton's supersession of over-age COs (see later) created a shortage of new COs. Recognised in late 1939 it was planned to significantly increase the throughput of Perisher students by running four courses of six students per course with the intention to give them about 50 attacks in the attack teacher and 10 sea-attacks. The 24 new COs this would provide was insufficient and consequently, in 1940 the number was considerably increased to 46 with just two 'not completing the course'.[17]

The attack teacher takes precedence

During this early period, the DAT was upgraded and installed in a purpose-built building with a longer target track trolley with the rails sticking out of a window so that greater distances could be simulated. Its 'screen' capability and several other parts were taken from the Portland trainer, and the old Dolphin trainer moved up to Blyth,[18] where it was soon to be replaced. At the same time an attack teacher like the DAT was ordered for Dundee for the multi-national Ninth Submarine Flotilla[19] and the new depot ships, HMS *Medway*, *Forth*, *Maidstone* and *Adamant*, were all given up-to-date trainers[20] whereas the older depot ships still had the Lewis-type attack teachers.[21]

The attack teacher crews were all staffed by submariners until 1941 when WRNS took over except for the Rothesay Attack Teacher (RAT). They proved very capable although Coote considered that they could be mischievous "*with the power to make any candidate they fancied look better than he was, literally by pulling strings and vice versa!"*[22] DAT became a trainer

[17] RNSM A 1945/22 ; RNSM A 1945/4 , says that all 46 passed.
[18] Ibid.
[19] Mark C Jones, 'Experiment at Dundee: The Royal Navy's Ninth Submarine Flotilla and Multinational Naval Co-operation during World War II', *Journal of Military History* 72 No.4 (2008), 1179-1212.
[20] Jones, 'Experiment at'.
[21] RNSM A 1945/4.
[22] Coote, *Submariner*, 154.

for WRNS who were going to the attack teachers at Dundee and Blyth.[23] With WRNS working so closely with submarine officers it was inevitable that there would be some interaction and 'Dickie' Tibbatts was one such officer. He met his future wife in the DAT and when he did his Perisher his wife analysed his attacks for him, and he passed.[24]

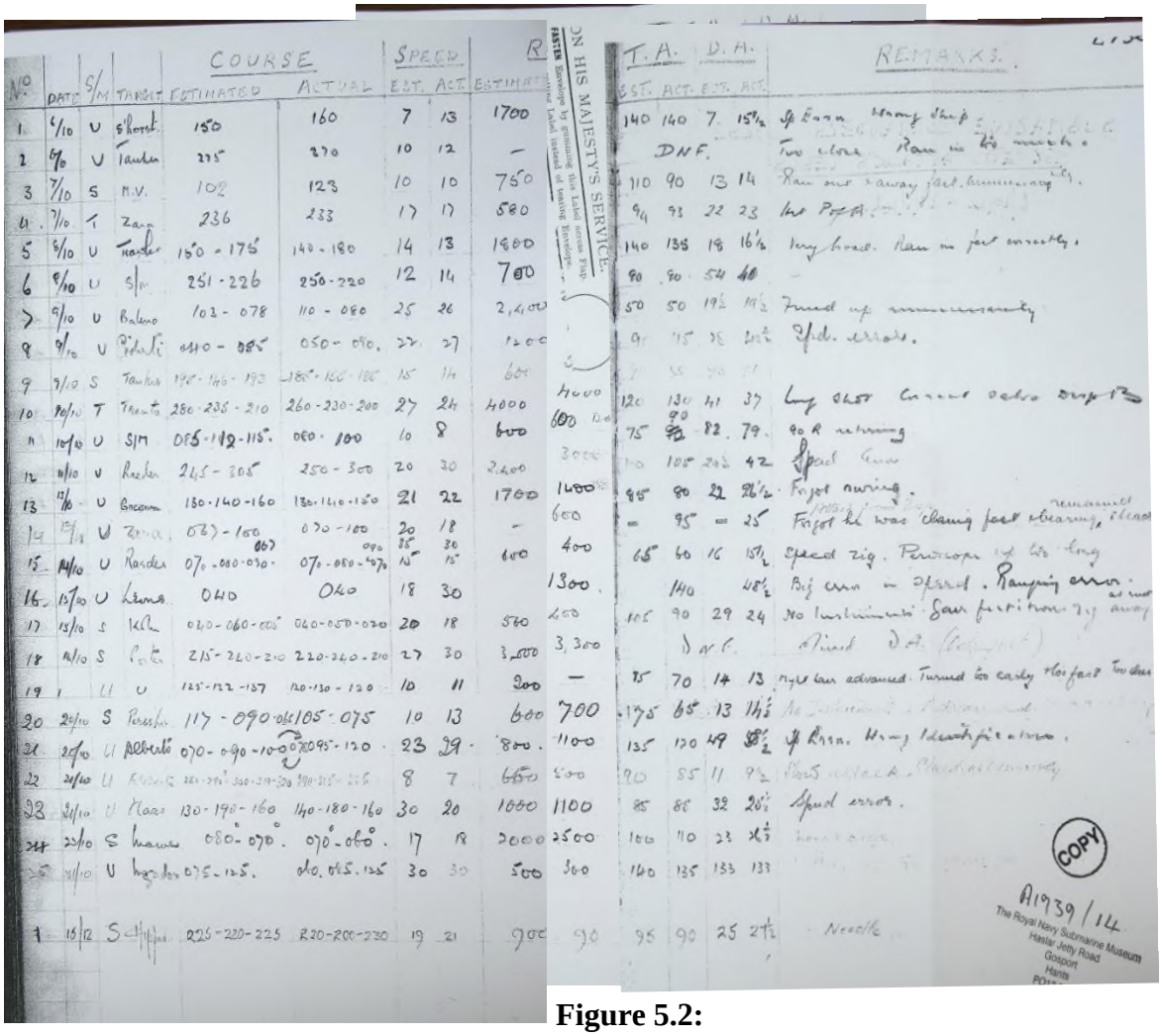

Figure 5.2:
1941 Attack Teacher Record
This is the attack teacher log for Lieutenant Dennis Beckley DSO DSC MiD.
He conducted 26 attacks and 'Did Not Fire' on two occasions.
RNSM A1939/14 Beckley, Commander D J , *A submariner's War*

With increasing numbers of Perisher students, seniority fell, by 1941 to 3 to 3.5 years and by 1942 1.5 to 3 years.[25] With reduced seniority came reduced experience indicating that Perisher selection was on merit and it had some shining examples like that of Richard (Mike) Willoughby shows. Willoughby was appointed to the COQC in January 1943 at the age of 31 with only 17 months experience in submarines, a non-volunteer Reserve officer, he passed and

[23] Coote, *Submariner*, 154.
[24] Email Matthew Todd December 2018.
[25] RNSM A 1945/4 .

went on to command three boats. He had led an extraordinary life but found his forte in submarines.[26] As seniority fell so did age, from 29.5 in 1939 to 24.6 in 1944, which may be only a few years difference, but it represents the typical peacetime span of submarine experience before Perisher. While the Reserve Officers tended to be older, some officers were much younger. An example is John Anthony (Tony) Troup[27] who took his Perisher in March 1943 and was appointed in command of the *H32* on 7 June 1943 at the age of 21 years 10 months and 21 days – the youngest submarine CO. Troup was exceptional, of the 28 most successful Second World War COs recorded by Hezlet, the average age at Perisher was 28, the youngest being 25 and the oldest 31. Very few COs were over Horton's superannuation age of 35 at war's end.[28]

Although selected on merit, the decrease in seniority, age and experience was recognised as detrimental and in January 1943 the course was extended to eight weeks: three weeks at the DAT, four sea attack weeks and an additional week in Scapa Flow conducting attacks on high-speed screened targets.

While the Perisher used the DAT, a new attack teacher had been built in Blyth and one was to be built at Rothesay. The Blyth attack teacher was an advancement on the Lewis-based models with a cyclorama system designed by a theatre company.[29] Rather than models, an epidiascope projector projected an image of the target on a painted sea surface to look at through the periscope. A gallery of lights provided lighting effects to cover scenic conditions: Fine Day, Dark Night, Sunrise, Sunset, Dusk, Dawn, Moonlight and Misty Day.[30] Sam Fry describes the later but similar RAT:

> *"Two targets could be projected on the circular walls by illuminating metal ship models with very powerful lights. This meant that a rather ghostly image appeared for the periscope to observe and take ranges and bearings from […] The mini submarine control room revolves inside the cyclorama provided by the wall structure containing it and access to the control room could only be obtained when it had been returned to the start position opposite to the entrance."*[31]

[26] RNSM A 1945/22 ; RNSM Officers' Card Index. Young, *Submarines*, 114 & 85. Willoughby joined submarines on 10 August 1941 and was appointed to COQC on 17 January 1943 having variously been: a Merchant Navy apprentice, quartermaster, yacht skipper, shipyard hand, salesman, clerk, chauffeur, and commanded a yacht at Dunkirk.
[27] Later Vice Admiral.
[28] Hezlet, *Submarine Operations*, 365-6
[29] Fry, *Rewarding Years*, 65. Fry describes the later Rothesay cyclorama-based attack teacher as based on the Blyth attack teacher. He was First Lieutenant of the RAT 1956 -7.
[30] RNSM A 1976/4 Handbook of Torpedo Attack Teacher (CYCLORAMA). An epidiascope projector is an optical projector capable of giving images of both opaque and transparent objects.
[31] Fry, *Rewarding Years*, 65-66.

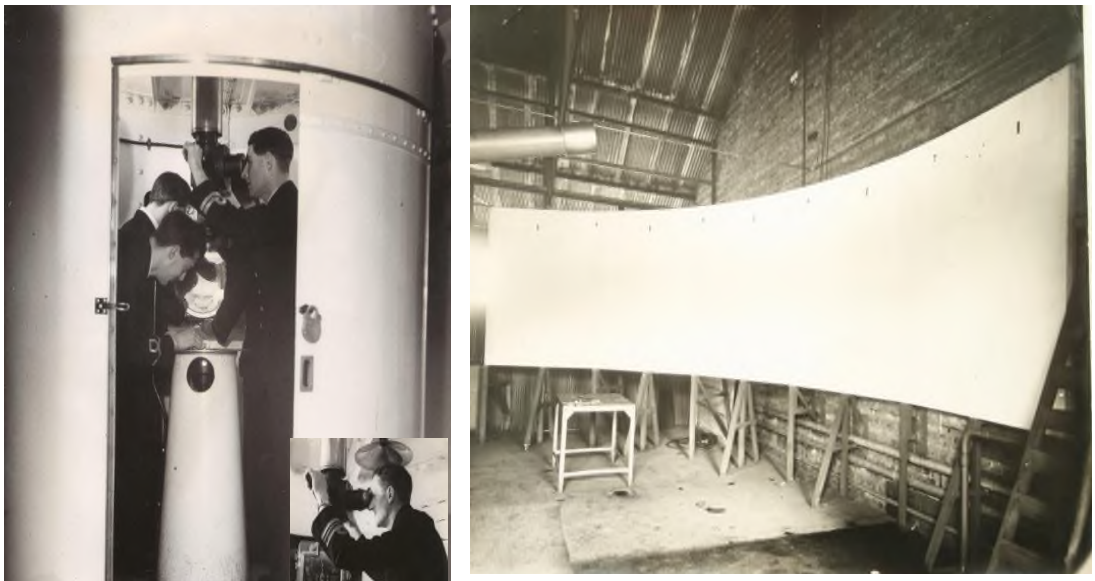

Figure 5.3:
Views of the Blyth Attack Teacher
The round control room with, Lt Cdr MacVicker at the periscope inset and part of the cyclorama screen (under construction?).
This was later replicated at Rothesay
Images: RNSM

The Blyth attack teacher was operational towards the end of 1942 and it had an important, and interesting, adjunct, an Askania training device, today called a Ship Control Trainer, that simulated the submarine's trim and control. Todd trained on it in 1943 and described it as:

> *"a cramped control room mounted on a pivot, allowing a small party to try out the planes, attempt to catch a trim or change depth. Being before the age of computers, the device had a limited brain, but the OOW had a Ballast Pump switch box allowing him to pump or flood anywhere in the submarine, (actually re-balancing the machine and giving more or less work for the planes, depending on his skill), and he could also change speed. The planesmen worked their planes as they would at sea, and increased speed enhanced their effect, as it should. The instructor could introduce problems, sudden changes in angle, changes in trim or he could order depth changes, and the results were fairly realistic".* [32]

Figure 5.4:
The Askania Trainer of German origin
Note the officer at the left operating the telegraphs backwards.
Images: RNSM

[32] Todd., *A Long Time*, 11.

Askania was/is a German company and even though the training device was acquired through Askania's American subsidiary, it meant that a German-developed simulator was training British submariners to sink German ships. The Askania training device had come to the attention of the Admiralty before the war when Commander JAC Hill, who was on the RA(S) staff at the time, visited Kiel in 1936. When there, the Germans asked him if they could purchase an attack teacher. In exchange, they were offering a "*depth keeping trainer*": the Askania training device. The German request was refused and a row between the London-based German Naval Attaché and the Admiralty ensued although nothing came of it. [33]

The extension of Perisher meant a reduction to five officers and two courses overlapping. To compensate for the shortness of the course newly qualified COs went to a depot ship as spare crew and a Submarine Temporary Memorandum dated 30 May 1940 ordered that they be given every opportunity to practice attacking.[34] By June 1940, a further 19 officers had qualified when Teacher Pat Steel had a course of just three: Lieutenants Lennox Napier, David Abdy and Mervyn Wingfield. Steel had been CO of the *Triton* when she torpedoed the *Oxley* in September 1939 for which he was exonerated but at the age of 36 was made Teacher and did not command again.[35] By this time German aircraft were operating from French airfields close to the submarine exercise areas to the south of the Isle of Wight causing concern which was confirmed when a destroyer was sunk by a magnetic mine probably dropped by an aircraft.[36] Consequently, following their DAT time, Wingfield's Perisher was moved to Fowey for sea-training on 22 June 1940, the day France fell.[37] They were given the *Oberon* and the *Otway*, two elderly submarines recently taken out of reserve, and not the optimum submarines for Perishers for, having been designed for the Far East, they were twice the size of the S and U-classes in which prospective COs could expect to serve. Their choice also serves as a comment on the lack of importance of asdic during Perisher for these boats had the obsolescent Type 116.[38] The target and depot ship was HMS *Warrior II*, formerly Frederick W Vanderbilt's steam schooner yacht built in 1904 and capable of 15 knots. On 11 July 1940 the *Warrior II* was bombed and sunk off Portland, an event that Growler may have confused with the destroyer

[33] Simpson, *Periscope View*, 66; Professor AM Low, *The Submarine at War*, (New York: Sheridan House, 1942), 113; Joseph A Maiolo 'Deception and intelligence failure: Anglo-German preparations for U-boat warfare in the 1930s', *Journal of Strategic Studies*, 22/4, 55-76.
[34] RNSM A 1945/4
[35] Haarr, *No Room*, 95-7; https://www.unithistories.com/officers/RN_officersS3.html.
[36] Ibid. Lewis, *Spithead*, 94. The destroyer cannot be identified but two armed trawlers were sunk in Spithead by aerial mines.
[37] Wingfield, *Wingfield At War*, 67
[38] Hezlet, *Submarine Operations*, 13.

referred to earlier. Notwithstanding, Perisher moved to Rothesay to join the old H-class submarines based on the *Cyclops* .[39]

Ian McGeoch, with six years seniority as a Lieutenant, took his Perisher in late 1940 with Steel as Teacher. After three weeks in the DAT, his course of six went north to join the *Cyclops* at Rothesay. The routine then followed a pattern known to generations of COs afterwards. They would board the submarine in the early hours, in his case the *Oberon*, and as duty captain, under the watchful eye of the boat's captain, take the submarine north-about through the Kyles of Bute to what were considered the quieter areas of Inchmarnock Water where they would take turns to attack the *Warrior II's* replacement HMS *Cutty Sark*, a steam yacht built on a destroyer design for the Duke of Westminster in 1920 and capable of 25 knots – a worthy target. The whole course was six weeks long and there was some angst as he describes being called into the *Oberon* CO's tiny cabin to learn his fate: pass or fail. He passed

Application for the attack teacher *and* an Askania at Rothesay was made to the Admiralty in July 1942,[40] on the basis it would assist when the weather inhibited attacks at sea.[41] It was built in Portsmouth Dockyard with a conning tower and hatches to simulate surface attacks[42] (these survived into the 1970s)[43] and installed during the summer of 1943 in the grounds of Ettrickdale house belonging to the Marquis of Bute, in Port Bannatyne. The house became the attack teacher staff's quarters, but the head gamekeeper and his wife continued to live in the gate-cottage and the amiable couple often put-up officers' wives receiving, in return, off-rationed food from the sailors.[44] The RAT had a crest with a seal balancing a torpedo on its nose opposite a rat in mortar board and gown.

Rather than the full length of the course be moved to Rothesay, when the attack teacher was built, it was considered a better option to give officers returning from stressful appointments the benefit of changes of atmosphere and the opportunity to visit families and friends, who were more likely to be in the south of the country, before they returned to further stressful appointments. This decision proved prescient because later Perisher courses were run in tandem and one was able to use the DAT while the other course was using the new RAT and doing sea-attacks in the north. [45]

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[39] Thomas, *Submarine Victory*, 70.
[40] Ibid.
[41] Ibid; Hezlet, *Submarine Operations*, 36 and 308; Lt Cdr B Warlow, *Shore Establishments of the Royal Navy*, (Liskeard: Maritime, 1992), 17. The shore base at Dundee, HMS *Ambrose*, was created in the first part of 1940 for allied submarines but by 1944 only the French submarine *Rubis* was operating from there,
[42] Fry, *Rewarding Years*, 66.
[43] Email Michael Samborne August 2017.
[44] Correspondence with David Rostron who lived with his grandparents in the cottage.
[45] RNSM A 1945/4 .

Howard (Boggy) Bone, the first Commander Teacher, submitted proposals in January 1943 to upgrade the DAT to handle two targets, a target that could zig-zag independently of its screen, a screen that was able to weave, and a screen that would run automatically parallel to the target, all reflecting operational experience. Attack teachers were also ordered for Beirut, Malta, Colombo and the depot ships HMS *Montclare* and HMS *Wolfe*.[46]

Edward Woodward undertook the DAT upgrade assisted by John Roxburgh.[47] Woodward had been very successfully commanding the *Unbeaten* under George Simpson in the Tenth Submarine Flotilla based in Malta until she was bombed while alongside in Malta resulting in Woodward having to bring the boat home. He was thought highly of by Simpson for apart from his physical prowess as a swimmer, Simpson says that "*he had a particularly good eye for periscope attack while, at the same time, his theory and mathematical ability put him in the top-flight of those who relied chiefly on instruments when time allowed such lethargic assessment".*[48] These latter qualities made him an ideal choice for the job of designing and supervising the new DAT. There was another side to Woodward, he was outspoken[49] and he played "*the game of war in reverse*." This meant he drank excessively in Malta between patrols so that by the time he returned to his boat he would be completely washed-out, "*looking pale and in need of complete rest*" and "*would escape from the dangers of a social 'sea lion' amongst the mermaids of Malta's coastline into the refuge of wartime submarine patrol*." His rest period came when he turned the boat over to his First Lieutenant to take her out to the patrol area. Once there, Woodward would be fresh as a daisy![50] How much his lifestyle continued as Teacher is not known. The first Perisher to use the new attack teacher was in August 1944 and it was to remain essentially the same until replaced in 1970 by the A/S 1080D, which accompanied the introduction of the P and O-class submarines.[51]

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[46] RNSM A 1945/4 .

[47] Commander EA (Teddy)Woodward, *The Story of Submarines "A Damned Un-English Weapon*, privately produced recording. Roxburgh was later Vice-Admiral.

[48] Simpson, *Periscope View*, 167. While in command of *Unbeaten*, Woodward sank 57,839 tons of shipping and the *U-374* with only one miss recorded. Jürgen Rohwer, *Submarine attacks of WW 2 European Theatre of Operations 1939-1945*, (London: Greenhill, 1997) passim.

[49] Mrs Joan Wilson, 'They Also Served – LCDR Donald R Wilson, DSC, RANVR', (Australian) *Naval Historical Review 2018,* 5. Australian War Memorial Collection at https://www.awm.gov.au/collection/C1193550 acquired September 2019 relates how outspoken he was about the RAF who had sunk his late boat HMS *Unbeaten*.

[50] Simpson, *Periscope View*, 167.

[51] All attack teachers carried the preface A/S. This may well have been a throwback to the contention between the nomenclatures asdic and sonar. See TNA ADM 1/9880 *definition of terms and expressions: Asdic origin and definition* and TNA ADM 1/16497 Proposal to substitute the term sonar for Asdic: discussion but no change.

Evolutionary technology: radar revolution

Technological innovations continued apace during the war. First periscopes, where a technique to increase the light transmission by about 60% by coating the surfaces in the periscope column and thus greatly improve both day and night-time visibility was introduced in 1940.[52] Another development was an air blast technique to clear the periscope window of sea spray and, while on the subject of window cleaning, the ARL in 1944, perhaps belatedly, gave some advice on how best to clean periscopes: the glass was to be wiped using a clean linen cloth and a fluid such as pure alcohol, ether or methylated spirits.[53] Previously, jewellers' rouge had been used but wardroom gin was found to be a suitable substitute for the more unusual substances.

Binocular, bifocal and sky-search technologies were all developed to become standard during the Second World War[54] and in 1942 special Kodak periscope cameras were introduced giving submarines an excellent reconnaissance and intelligence-gathering capability although there is no mention of this being exercised on Perisher.

The now standard Type 129 asdic was complemented in 1940 by a Mine Detection Unit (MDU)[55] and a Low Frequency/Medium Frequency, radio Direction Finder, known as Huff-Duff, made an appearance on the after casing of all classes of submarine with, from 1943 a manually-trained, listening-only, hydrophone called Type 138 added to cover Type 129's blind arc astern.[56] In the T-class the Type 138 set was in the engine room where its intrusion caused considerable problems.[57]

Figure 5.5: HMS *Tabard's* Asdic Type 138 and Huff-Duff
The asdic Type 138 can be seen on the after casing above the engine room between the external torpedo tubes and just forward of the Huff-Duff aerial.
Image: Google

The Type 129 was a most versatile asdic comparable with the sophisticated German hydrophone arrays.[58] Its qualities are ably exemplified by the experiences of wartime COs.

[52] Moss and Russell, *Range and Vision*, 148.
[53] TNA ADM 204/648 Cleaning of optical glass surfaces.
[54] Moss and Russell, *Range and Vision*, 121.
[55] Hackmann, *Seek and Strike*, 219.
[56] Ibid, 217-8.
[57] Paul J Kemp, *The T Class Submarine: The Classic British Design*, (Annapolis MD: Naval Institute Press, 1990), 53-4.
[58] Ibid, 218.

Mackenzie, in the *Thrasher* in 1941, used the MDU to keep the boat away from minefields on either side of the Benghazi approach channel[59] and he used it successfully for SST communications with the *Upholder* at a range of eight miles in the Gulf of Taranto[60] (alas, after later hearing an intensive depth charging in the Gulf of Sirte, communications failed as the *Upholder* had been sunk).[61] Ben Bryant used the MDU to effect in the *Safari* by creeping up the coast of Yugoslavia in October 1943 and tracking the minefield to seaward of him.[62] Mervyn Wingfield, in the *Taurus*, used Type 129 to give him a passive firing bearing for a salvo of six torpedoes — one of which hit and sank the Japanese U-boat *I34*.[63] Perspicaciously, James Launders, CO of the *Venturer* used his Type 129 for an hour, again in the hydrophone effect mode, while he stalked the snorting *U-864* off Norway on 9 February 1945 before making history by being the first British submarine to sink another submarine while both were dived.[64]

The 129/138 combination continued at sea until the early 1950s in submarines of seven nations and Perisher students would have been familiar with it.[65] But Type 129 was seriously affected by own-ship's noise, especially the propellers. Unsuccessful trials to reduce their noise involved using a Gill "*hydraulic propulsion mechanism*"[66] or shrouded, helicoidal propellers developed during the First World War,[67] but the idea was only next visited for the *Churchill* in 1967.[68] A better solution came later with the T-class and resiliently mounted machinery copied from the *U-570*.[69]

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[59] Mackenzie, *The Sword*, 111.
[60] Ibid, 106.
[61] Ibid, 115; Jim Allaway, *Hero of the Upholder*, (Shrewsbury: AirLife, 1991), 164.
[62] Arthur P Dickison, *Crash Dive*, (Stroud, Sutton, 1999), 30.
[63] Hezlet, *Submarine Operations*, 366; Wingfield, *Wingfield At War*, 109; Ian Trenowden, *The Hunting Submarine*, (Kimber: London, 1974), 29. Although it was not until early in the Second World War that Churchill decreed that all British and allied submarines were to be referred to as 'submarines' and all German, Italian and Japanese submarines were to be called 'U-boats'.
[64] Hezlet, *Submarine Operations*, 313; Dan Conley & Richard Woodman, *Cold War Command*, (Barnsley: Seaforth, 2014), 17. The *U-864* was fitted with a '*schnorchel'* (American: snorkel; British: snort) after the Germans found the system in the Dutch *O26* (renamed *UD4)*. Launders detected *U-864's* misfiring engine on *Venturer's* asdic while the U-boat was snorting, confirmed it was a submarine contact when he saw her periscope, and then tracked her by sonar for an hour before firing a four-torpedo salvo at 2000 yards with the torpedoes set at depths between 30 and 36 feet. William P Gruner, *US Pacific Submarines in World War II* at https://maritime.org/doc/subsinpacific.htm. Although the Americans made 31 "sound" (asdic) attacks none were successful. Rear Admiral Ivan Kolyshkin, *Submarines in Arctic Waters*, (Amsterdam: Fredonia, 2005), 227-8. The accolade of the very first passive successful asdic attack must probably go to Captain 2nd Class Grigoriy Ivanovich Shchedrin in the Soviet submarine *S56*. He sank a transport with one torpedo in the Barents Sea in March 1944 from a depth of 20 metres.
[65] Ackerman, *Encyclopaedia*, 48; Hackmann, *Seek and Strike*, 217-9. The nations were France, Holland, Russia, Turkey, Greece, Norway and Poland.
[66] *The Engineer* 2 April 1920, 346.
[67] https://www.gracesguide.co.uk/Gill_Propeller_C acquired May 2018.
[68] TNA ADM 186/535 OSPREY Report.
[69] Chapman, *Torbay*, 31; TNA ADM 239/358 Report on ex-German U-570 (HMS Graph).

If the development of asdic, periscopes and even the plotting table were evolutionary, radar was revolutionary. As Captain Donald McIntyre wrote:

> *"The long road followed by naval history is studded with innumerable milestones each of which marks some noteworthy advance in the technique of sea warfare. .... Amongst these must surely be the introduction of shipborne radar at the beginning of World War II."*[70]

Submarines, however, were one case when culture overcame technology determinism and initially rejected the new technology.[71] Radar in submarines had a serendipitous provenance, tortuous early development and chilly welcome; its early employment was "*based on ignorance, and even suspicion*";[72] the contrast with the surface navy could not have been greater. There, radar was widely used for safety, gunnery, navigation, all escort duties and "*Best of all, it could find surfaced U-boats*".[73] British submariners, however, feared that transmitting on radar allowed the enemy counter-detection. When Mars said "*the best policy for a submarine is never to let out any sound, ray or thing unless it's going to hurt the enemy*"[74] he was probably reflecting the sentiments of all COs: stealth was all-important. But while radar's principal advantages were recognised,[75] the technology was unappreciated and failed to initially capture the confidence of British COs[76] one of whom said to a scientist "*The mark one eyeball is more effective than your radio stuff and it takes up less room*".[77] There may have been good reason for this attitude because there were no apparent tactical exercises or trials to determine how radar could be best used in submarines although there was an intent for Perisher to use it.[78] Short courses were available from late 1943[79] but any comprehensive explanation of radar for Executive Officers waited until 1946 — and then it was secret. [80] Rather, the Captains (S) were invited to ensure that COs made themselves familiar with the handbooks for maintenance rather than tactical guidance.[81] Fortunately, the derogatory statements were to

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[7o] Donald MacIntyre, 'Shipborne Radar', *Proceedings of the United States Naval Institute*, 93/9.
[71] Alistair Mars, *HMS Thule Intercepts*, (London: Elek Books, 1956) 67-8; Hezlet, *Submarines Operations*, 354: RNSM A 1997/140/003, Memo on Radar Development.
[72] HMS Collingwood Heritage Collection (CHC) Naval Radar Equipment Chapter 2, at www.rnmuseumradarandcommunications2006.org.uk).
[73] Monsarrat, *Monsarrat at*, 294.
[74] Mars, *HMS Thule*, 67-8.
[75] TNA ADM 1/13476, The Employment of Radar in Submarines.
[76] Hezlet, *Submarine Operations*, 354. Only 56/7640 contacts with the enemy made by Submarines on patrol between 1941 and 1945 were made first by radar.
[77] RNSM A 1997/140/003, Memo on Radar Development. Space for radar was at a premium in all boats.
[78] TNA ADM 1/13478 Admiral (Submarines) letter dated 8 September 1943. An American radar Type SJ was to be fitted in a COQC training submarine.
[79] TNA ADM 116/4586 Submarine General Memorandum 244 dated 29 December 1943.
[8o] CHC, Naval Shipborne Radar, Notes for Executive Officers, March 1946.
[8ı] TNA ADM 1/13476, Radar in Submarines.

change as the war progressed, radar sets proliferated and COs assimilated the technology through experience.

Lieutenant Commander Philip Francis in the *Proteus* had the first submarine Type 250 radar on a telescopic mast in the summer of 1941.[82] In November 1941 she successfully shadowed a convoy for six hours using radar at night until she could see her target in the moonlight and sank the German steamer *Ithaka* [83] — the first time radar had been used by British submarine to prosecute an attack[84] albeit she was assisted by two supernumerary students from Dundee University who knew how to use the set.[85]

Despite the *Proteus'* prowess, the RA(S) initially seemed to share the same misgivings as his COs until early 1943 when reports of the American submariners' success with their radars and the advent of the Type 291W gave the impetus to the wider fitting of radars in submarines.[86] By July 1943, he was encouraging radar to be used "*when any material advantage is likely to accrue*".[87] By late 1943 Perisher was conducting radar assisted attacks giving rise to an anecdote that perhaps illustrates the lack of understanding. Lieutenant E Keith Forbes RCNVR was the duty captain in the *Proteus* on the night 17/18 February 1944 under Teacher Edward Woodward conducting a radar assisted attack against the armed yacht *Breda*.[88] Forbes claims that he could see that a collision was inevitable, but he was ordered to continue by Teacher with the result that the *Proteus* hit the *Breda*. Ferguson then relates Forbes saying that the *Breda* sank, the *Proteus* decommissioned and her CO's failure to intervene resulted in dismissal from his ship. Unfortunately, many of the facts are inexact as related and Forbes could have been trying to hide his Perisher failure.[89]

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[82] Norman Friedman, *Naval Radar*, (London: Conway, 1981), 196.
[83] Hezlet, *Submarine Operations*; Howse, *Radar at Sea*, Appendix D, Both relate the story. Jŏrgen, *Allied Submarine*, 147 confirms.
[84] Hezlet, *Submarine Operations*, 105 also confirms the incident.
[85] Captain George Hunt, in Hood, (Ed), *Submarine*, 297.
[86] RNSM A 1997/140 and TNA ADM 1/13476 Admiral (Submarines), The Employment of Radar in Submarines. Various experiences are quoted the most notable being the experience of USS *Shad* which had fired both a bow salvo of six torpedoes and a stern salvo of three torpedoes entirely by radar at a blockade runner escorted by four escorts in the Bay of Biscay. Admiral Eugene B Fluckey, *Thunder Below*, (Urbana IL University of Illinois, 1992), passim. Fluckey, possibly the most successful American submariner in the Second World War relates of using radar frequently.
[87] TNA ADM 1/13476*;* http://www.uboataces.com/radar-warning.shtml. German radar detection was catch-up.
[88] Formerly the Steam Yacht *Sapphire* built by John Brown's for the Duke of Bedford.
[89] Julie H Ferguson, *Through A Canadian Periscope*, (Toronto; Dundurn, 2014), 212; https://www.scottishshipwrecks.com/hms-breda/; https://uboat.net/allies/warships/ship/3403.html acquired December 2018; Hood, *Submarine*, 149-153. The Breda did eventually sink in Campbeltown Loch on the 18 Feb. The *Proteus* was only decommissioned in June 1944 after many more exercises. Lt Vershoyle continued in command until April 1944 when he was classified as 'non-operational' and returned to GS and command of a destroyer.

The roll-out for the much-improved hybrid, air-warning and surface (P and X-bands) successor, was delayed by RAF priorities. To quote the paper's author, "*to say that submariners were annoyed about this would be the understatement of all time*".[90] As a stopgap, the Admiralty requested to buy American Type SJ radars which had no air-warning so a 'lash-up' Type 291 was fitted (in the wardroom pantry!). This was unsuccessful.[91] The proposal of fitting a Type SJ radar in a T-class for the COQC coincided with RA(S) finally understanding the potential of the technology: "*He* [RA(S)] *is now convinced of the paramount importance of the offensive potentialities of Radar and wishes to cooperate to the fullest possible extent with Director of Signal Department, to further this end*."[92] Despite the unreliability of the Type 291W in the sweltry conditions of the Far East,[93] (Young's broke down at a critical moment during a gunnery action; Mars had his set removed because of its unreliability; in the *Templar*, Beckley's set failed in heavy rain; and in the *Telemachus* King's radar had various failures[94]), British COs also came to understand and accept the potential of radar. Young called it a "*wonderful new invention*!"[95] and Hezlet used it extensively and very successfully in the *Trenchant*.[96]

Figure 5.6:
SJ Radar on HMS *Tiptoe*
Image : Revolvy.com

[90] RNSM A 1997/140/003 Memo on Radar Development.
[91] TNA ADM 220/83 Status of Radio and Radar Research and Development Production of Type 267; Hezlet, *Electronics*, 233, SJ radar had been at sea since 1942.
[92] RNSM A 1997/140/003 Memo on Radar Development.
[93] Admiralty Bulletin, Radar in Submarines, June 1944.
[94] Edward Young, *One of Our Submarines*,(London: Rupert Hart-Davis,, 1952), 285; Mars, *HMS Thule*, 67-68. In Mars' opinion "Unless the thing is 100 per cent, it's only a nuisance"; Hezlet, *Submarine Operations*, 251, 324.
[95] Young, *One of*, 285.
[96] Vice Admiral Sir Arthur Hezlet, *HMS Trenchant at War*, (Leo Cooper: Barnsley,2001), passim.

Lastly, a weapon that was to achieve longevity was the Mark 8 torpedo which was introduced into service in 1927, staying operational until 1986.[97] Issues with its upgrade that continued into 1943 did not prevent 3,732 weapons from being fired by 1944, although, at the start of the war submarines had to use early variants and even earlier torpedoes including the Mark IV.[98] Unlike American and German torpedoes, the Mark 8 had no gyro-angling, although it could fire 90° left or right but that was inaccurate, seldom used and only advised as a last resort. These limitations meant a submarine had to be pointed at its target, an expertise that Perisher was to inculcate into students. Work on an electric torpedo started in 1940 but was stopped in 1941 when the *U-570* and its load of German G7e weapons were captured. An attempt to re-engineer the G7e for use in the Mediterranean, the wakeless Mark XI, arrived too late for that theatre of war and was not used in the Far East although it was to provide the basis for future British electric torpedo development.[99]

Selection, qualification and superannuation

The COQC started 1942 in much the same way as 1941 with courses of usually five officers with each getting about 25 attack teacher and 20 sea-attacks that included two screened attacks.[100] But Perisher now began to evolve reflecting the accumulated wartime experience. Officers were appointed to Perisher on a points roster system under Submarine General Memorandum (SGM) 210 reports. These reports on individual officers were submitted monthly with three points for each month's service in submarines and two points for each month's seniority as a Lieutenant. It was confined to RN officers until March 1943 after which it included all First Lieutenants, whether RN, RNR or RNVR, who had a minimum of three consecutive months with the same CO. Reserve Officers, who were generally in their early 30s, received an additional point for every year of age over 23.[101] In July 1943 the top 20 officers comprised ten RN, eight RNR and two RNVR.[102] The officer's CO would make one of three recommendations: Early command – which carried a bonus point; Command in due course; or Not recommended. In early 1944 the process was seen to cause problems because COs were interpreting the definitions in different ways and the selection of the accelerated officers was inconsistent. It was deemed to be creating Perisher failures although failure had, in reality, been

[97] Branfill-Cook, *Torpedo,* 55.
[98] Guy Sitwell, *Submarine Weapons and their Weapons Officers,* unpublished.
[99] Branfill-Cook, *Torpedo,* 58.
[100] RNSM A 1945/4 .
[101] TNA ADM 116/4586 Submarine General Memorandum; RNSM A 1945/4 .
[102] RNSM A 1945/4 .

minimal: 1940:1; 1941:2; 1942:4; 1943:5; 1944:5; 1945:1.[103] This may well be explained by Napier's self-depreciation that "*they were not so particular* [about who passed Perisher] *in those days*", self-deprecating because Napier was a polymath intellectual, who taught himself Latin while on patrol and as a German linguist, higher mathematics from German textbooks for fun. He became Teacher and went on to analyse every Second World War submarine attack.[104] Meanwhile, the criteria for selection were altered, first in August 1944, to a First Lieutenant who had been in post for at least six months with 90 of those days at sea in an operational area. The definition of an operational area included a work-up patrol and, for the Far East boats, from their arrival in Ceylon. The categories were now: Recommended for accelerated command; Recommended for command; Not yet recommended; Not recommended. The criteria were then again altered in September 1944 limiting the recommendations to officers who had completed a minimum of six operational patrols as First Lieutenants. The effect of this latter change was to greatly reduce the number of officers recommended but the additional points for accelerated command now ensured that officers went on Perisher by meritocracy. With the extended patrols being conducted by the Far East boats the criteria were again changed to reflect operational experience rather than just the number of patrols.

Most submarine COs were in their 30s, some Lieutenants were under 30 and some officers were over 40.[105] Horton arrived as VA(S) on 4 January 1940 and one of his first acts, on the 24th, was to issue his "*Supersession of over age Submarine Commanding Officers*" memorandum sent privately to the Captains (S). Based on his own experiences in the First World War, and echoing Bacon, Horton considered that the "*very high degree of physical and mental endurance and demands on commanding officers of those qualities of constant alertness and resilience*" were best handled by younger men.[106] Consequently, COs over the age of 35 were to be relieved. The excessive physical and mental demands did not just apply to older officers, however, McGeoch admitted to being tired when he was in command at 29[107] and as the brave examples of George Davies in the *Tribune* and Christopher Hutchinson in the *Truant* who both asked to be relieved in 1940 demonstrated. Davies was three weeks shy of his 35th

[103] RNSM A 1945/22 .
[104] Christopher Napier, *HMS Rorqual*, privately published.
[105] Hezlet, *Submarine Operations*, 2-3.
[106] Chalmers, *Max Horton,* 101. Horton's views on ageism were not confined to the submarine commanding officers. In a letter to the first Lord of the Admiralty in October 1940, in commenting rather presumptively that in his opinion the Commander in Chief Home Fleet should be based ashore, he adds "*the admirals of individual squadrons should be considerably younger. Generally the age of responsible officers at sea should be reduced"*.
[107] McGeoch, *An Affair,* 101.

birthday; Hutchinson had sunk the German cruiser *Karlsruhe* off Norway a few weeks earlier and survived a 19-hour depth charge attack before deciding he could "*take it no longer*".[108] He noted:

> *"I had time to take stock of myself. I had not been able to sleep without drugs for many weeks in harbour, and at sea I dare not take pills that could make me drowsy. After much hard thinking I decided that perhaps I, as well as my ship, needed repair and that it was unfair on my magnificent crew to try and lead them when my nerve had partly gone"*[109]

He went to hospital and three months leave, while his boat did well under Hugh Haggard.[110] Neither of their careers was adversely affected: Davies was promoted and awarded an OBE for work in midget submarines and Hutchinson served until 1962 becoming a Vice Admiral.[111] The age requirement was later breached many times with older COs performing extremely well: John (Tubby) Linton who sank 42,400 tons of shipping[112] was 38 in command of the *Turbulent* when posthumously awarded the VC; Miers was 36 when he won his VC in the *Torbay;* and Rimington, the public school re-joiner, was a 36-year-old Commander in command of the *Parthian* in 1940 when he sank the Italian U-boat *Diamante*. (Rimington was later brought home early from the Far East in 1945 at age 41 because, his wife claimed, "*it was felt he was getting too old to be in submarines*.")[113] But, the effects were felt in the Flotillas very quickly when Menzies had three officers relieved: Robert Stirling-Hamilton, Ronald Jonas, and Robert Peers, who were all 36 years old.[114] Menzies comments that he thinks "*that a number of the older ones were feeling it*."[115] But it could be an emotional time for those being relieved for as Stirling-Hamilton wrote:

> *"On arrival I found that I had been relieved and so left in a few days with many regrets at saying goodbye not only to a very efficient and cheerful ship's company but, even more so, to fifty two friends. Nearly all of them had been with me for some time, including many days at close quarters at sea, and I had served with some half a dozen of them in a previous commission in China so that there was little that we did not know about each other. The Navy can produce nothing finer than a good*

[108] Menzies, Personal Diaries.
[109] RNSM A 1991/301 Biography of Christopher Hutchinson. There may be more to this story than meets the eye. A story attributed to *Truant's* (unnamed) signalman in the same RNSM A 1991/301 box, relates how Hutchinson walked through the boat with a pistol threatening to shoot anyone who panicked while they were being depth charged.
[110] Ibid.
[111] http://www.unithistories.com.
[112] Hezlet, *Submarine Operations*, 367.
[113] Email John Rimington May 2019.
[114] RNSM CRTY 2019/6 *Submarine Service Movement Record Index Cards*. Captain George Menzies was the Captain (S) Second Submarine Flotilla.
[115] Menzies, Personal Diaries.

submarine's crew, and Thistle was indeed one which I am deeply proud to have commanded."[116]

His boat, HMS *Thistle*, was lost 48 days later.

Whether Horton was justified is questionable. Of the 40 top COs,[117] three were 35 years or over at the start of the war (older at the end!). The Hollerith investigations after the war also looked at the effect of age but its findings were inconclusive:

> *"the age of submarine commanding officers decreased rather than increased during the war. No clear trends [as to the effect of age] could be found in the tables. Commanding officers in their mid-20s did well, and in the later years of the war, those over 28 did better. The success of commanding officers on their first few patrols was found to be 'impressive' but those with plenty of experience were better still. In general, age and experience did not seem to be important factors in success. Some submarine commanding officers, whatever their age or experience, were simply shown to be better than others."*[118]

The key to any Perisher course, its development and the quality of CO it produced, was the Teacher. By the time Steel was relieved in January 1942 by Bone, he had qualified 75 officers with just three failures. Bone had won accolades for his operations in the *Tigris* in the Bay of Biscay and off Northern Russia.[119] He introduced further improvements into the course based on operational experience notably the 'point of aim' and salvo fire and a high-speed 'weaving' target', high-speed screened attacks and more night attacks and the course benefitted from additional warships lent by Horton when he became Commander-in-Chief, Western Approaches later in the year. Bone's emphasis on salvo fire was helped by the CO of the HMHLS *Katsonis*, Lieutenant Commander Ypoploiarkhos E Tsoulkalas, RHLN, and his innovation, the Torpedo Spreading Rule more commonly known by its eponymous 'Greek Slide Rule' name.[120] The rule produced the firing interval and spread of various torpedo salvo combinations and its use continued well after the end of the war. But perhaps the best improvement was that Perisher sea weeks began to be conducted in submarines typical of those that graduates would go on to command as S-class and T-class boats were lent to the course

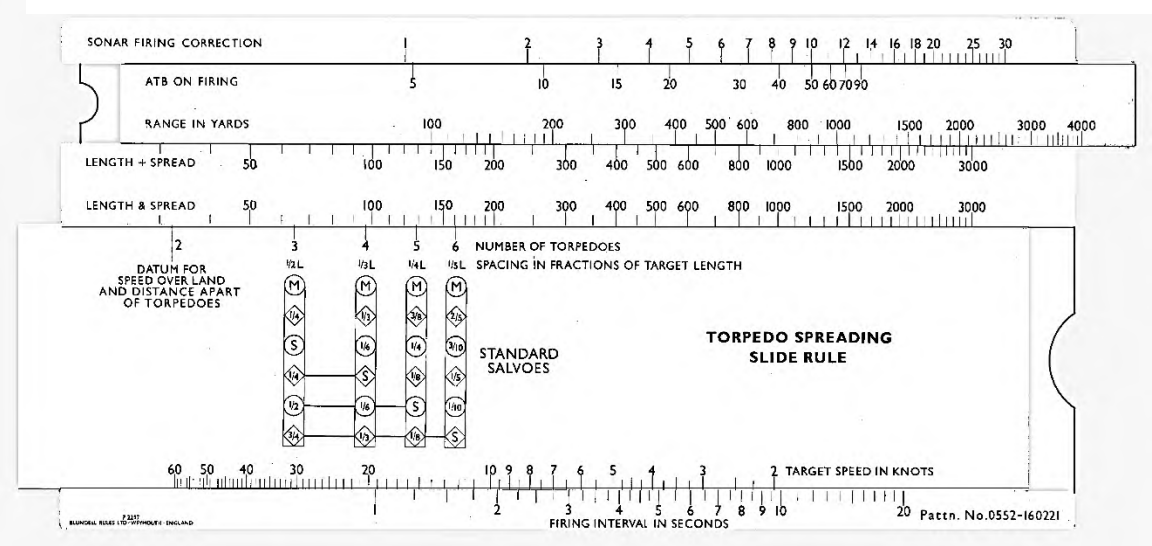
[116] RNSM A 1995/75 HMS Thistle a History by R W Stirling-Hamilton.
[117] Hezlet. *Submarine Operations*, 365-367. The criteria are: 'Giant killers', those COs that sank or damaged heavy enemy warships, sank U-boats and had the highest tonnage score.
[118] Ibid, 358.
[119] Ibid, 368 and https://uboat.net.
[120] There is some contention over Tsoulkalas' position onboard the Greek submarine *Katsonis* as either CO or First Lieutenant. Hezlet, *Submarine Operations*, 208 identifies him as the CO of RHlNS *Katsonis* but other sources, notably https://uboat.net/ and the memorial site http://skiathian.blogspot.com have the CO at the time of her loss on 14 September 1943 as variously Commander Athanasios Spanidis and Lieutenant Laskos (certainly the CO when she made her escape from Greece). What is undisputed is that Tsoukalas managed to escape the *Katsonis'* sinking by swimming ashore and he created an excellent slide rule.

from the Third Submarine Flotilla.[121] Towards the end of the year, the *Sealion* was transferred to the Seventh Submarine Flotilla for the COQC's exclusive use.[122]

Figure 5.7: The Torpedo Spreading or Greek Slide Rule

It gave the firing interval time for a 'hosepipe' salvo of a varying number of torpedoes on various track angles.

Image courtesy of Pieter Cox



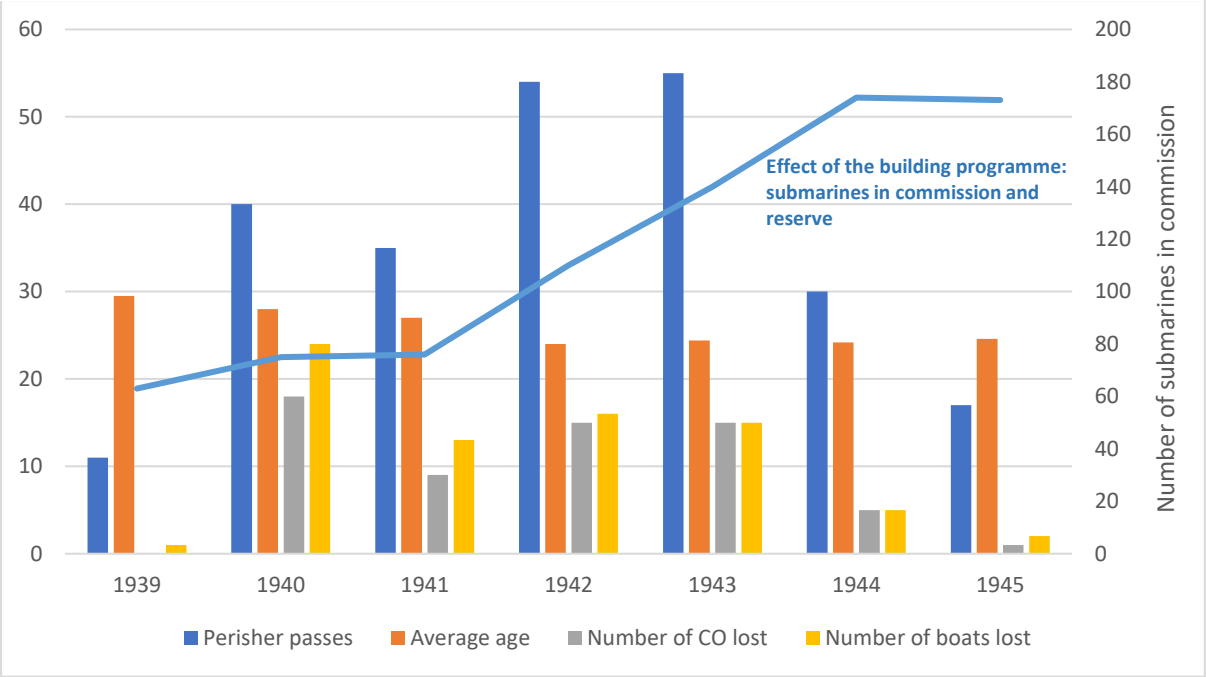
Perisher further evolves

By the start of Bone's tenure in January 1942 the Submarine Service had lost 35 submarines and 27 COs and the building programme had accelerated to over 30 submarines a year (1942:31; 1943:38; 1944:39) so there was now the problem that insufficient numbers of officers were being qualified for command to compensate for the losses and to fulfil the expansion of the submarine fleet.[123] Perisher responded by increasing to six students and overlapping courses by one week to increase throughput. This meant that Teacher, who would be at Rothesay conducting sea weeks, was unavailable for the first week in the attack teacher for a new course so the gap was filled by a spare crew CO from *Dolphin*. This was unsatisfactory, and the process must have been very tiring for Bone. But the effects of this reorganisation that enabled a large increase in Perisher qualifications in response to the building programme can be seen

[121] Hezlet, *Submarine Operations*, Appendices, The Third Submarine Flotilla had three S-Class and two T-class.
[122] RNSM A 1945/4 .
[123] Hezlet, *Submarine Operations*, 371; Evans, *Beneath The Waves*, App 1. Of the 18 officers to die in 1940, all but two had qualified in the late 1930s and DV Sprague, who qualified in 1932, was killed while in command of the *Thames* boarding a French submarine. Seven of the nine who died in 1941 had qualified in 1940, one suspects a shock to both the 1940 classes and Teacher Pat Steel.

represented dramatically in Figure 5.8. The overlap of courses required a second Teacher and Woodward was appointed following the DAT upgrade.[124]

Figure 5.8: COQC Response to losses and Submarines in Commission



Bone received a student who was 'going around the buoy'[125] but not because of failure. This was McGeoch who had completed his Perisher in late 1940 at the age of 26 and then went in command of the *H43* for a few months before becoming the spare crew CO in Malta. McGeoch lacked confidence for, as he had told RA(S), he had completed just one attack since Perisher and his time in Malta, despite one patrol in the *Ursula*, was plagued by a stomach ulcer and pneumonia. Without a complement billet he persuaded Simpson that he should have another Perisher and he came home in the *Ursula* to be spare crew CO for the Third Submarine Flotilla based on the depot ship *Forth*. This was fortunate because it allowed him to use the onboard attack teacher training submarine 'attack teams' and First Lieutenants aspiring for Perisher. He must thus have found himself well prepared when he joined Perisher under Bone following which, full of confidence, he went to join the *P228* (HMS *Splendid)*.[126] His experience, however, was indicative of how skills could fade and a good argument for the CORQC which

[124] RNSM A 1945/4; and RNSM, Downer, Mini-biographies, he stayed as Teacher until October 1945 after which he went to the *Cyclops.*
[125] Taking the course again.
[126] McGeoch, *An Affair*, 54.

could result in an officer being downgraded from 'operational' to 'non-operational' as happened to Lieutenant Trevor Walling in 1944.[127]

Lieutenant Connell Thode's course in April 1943 was a typical four weeks in the attack teacher then four weeks day-running in the *Sealion* based on the *Cyclops* followed by advanced attacking at Scapa Flow in the *Sceptre*, commanded by the Australian, Lieutenant Ian McIntosh RN,[128] where Thode attacked the battleship HMS *Rodney* escorted by 12 destroyers. But it was untypical in that Thode was RNZNVR and the only New Zealander to command a submarine. Thode's asthma invalided him out of submarines for six months. On return in early 1944 he took a typical CORQC, this one being for several COs who had been away from the operational areas 'ping-running' (anti-submarine training) in Canada.[129] Thode was followed in 1944 by the first RANVR officer to command a submarine, Lieutenant Geoffrey Gillie in the *H33,* and later Lieutenants William Littlejohn and Don Wilson RANVR.[130]

The Scapa Flow weeks started in March 1943, were extended to two weeks owing to frequent bad weather and proved demanding and popular. Teacher had to be replaced for the second week by the Commander (S) Ninth Submarine Flotilla at Dundee. One day was spent in submarine versus submarine attacks otherwise the Scapa Flow target was a cruiser or larger, screened by four or more destroyers and a range of attacks were carried out:

> *Type 1. Target and screen on a steady course at 20 knots or more.*
>
> *Type 2. Target and screen zigzags, speed 20 knots or more.*
>
> *Type 3. Target steady course, at 20 knots, with screen Zigzagging, independently at high speed.*
>
> *Type 4. Target Zigzagging at 20 knots with screen weaving independently of target at high speed.*
>
> *Type 5. Large Fleet Auxiliary screened by two destroyers at medium speed.*
>
> *Type 6. High-speed unescorted cruiser or above.*[131]

These advanced attacks and the extended establishment of the Perisher organisation —a second Teacher, the *Breda,* and now HMS *Blade*, (the ex HMNLS *Z5*[132]), two destroyers each from Campbeltown and Western Approaches, a sloop from the A/S experimental establishment and the tender from the Third Submarine Flotilla — meant that Perisher was now able to train COs

[127] RNSM A 1945/22
[128] McIntosh was born in Geelong and joined the RN in 1938. Later Vice Admiral.
[129] RNSM A 1995/443 Thode's memoirs.
[130] National Archives of Australia A6769 Item Numbers 52167, 52291 and 53316.
[131] RNSM A 1945/4 .
[132] http://www.netherlandsnavy.nl. The First World War Dutch destroyer *Z5* escaped the occupation of Holland, transferred to the RN in March 1942 and renamed HMS *Blade*.

in almost every gambit of submarine operations: high-speed screened attacks, submarine versus submarine, coast-crawling, gunnery[133], radar, A/S hunts, boarding, night attacks and evasions.[134] The only operations that seemed to be missing were minelaying and special operations of which many were conducted in both the Mediterranean and the Far East. To compress so full a curriculum into so few weeks deserves commendation.

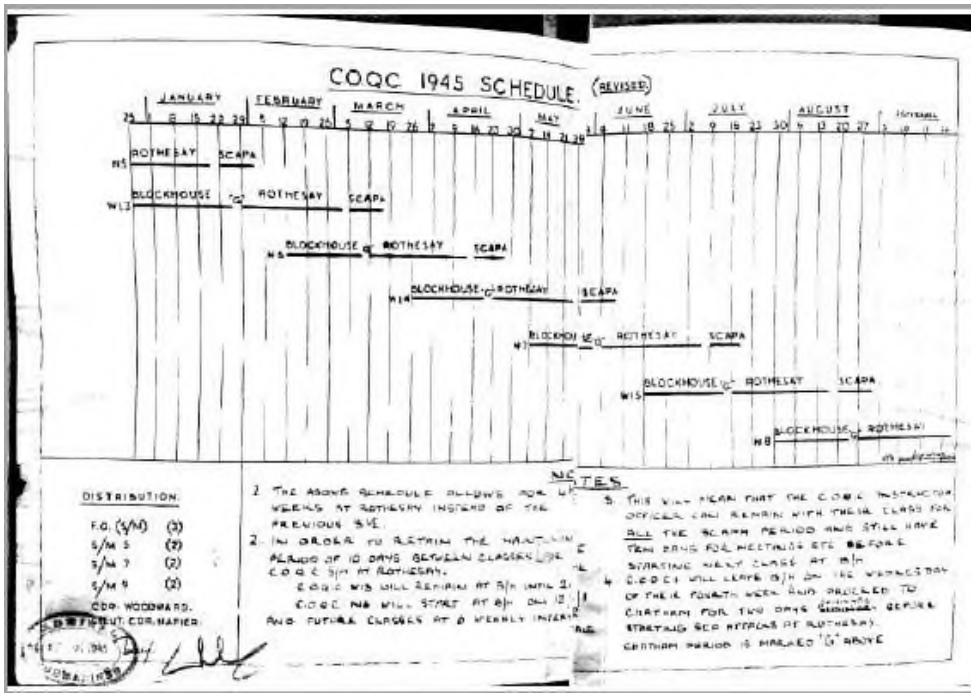


Figure 5.9: COQC 1945 Schedule

The revised schedule of consecutive courses overlapping was started in January 1943
N: Lieutenant Commander Napier; W: Lieutenant Commander Woodward
Notes below the schedule at RNSM A 1945/4 say:
1.The above schedule allows for 4 1/2 weeks at Rothesay instead of the previous 3 1/2.
2. To retain the maintenance period of 10 days between classes for COQC S/M at Rothesay,
COQC W 13 will remain at B/H [Fort Blockhouse] until (?)
COQC N 6 will start at B/H on 12/2/45 and future classes at six weekly intervals
3. This will mean that the COQC instructor officer can remain with their class for all the Scapa. and still have 10 days for meetings etc before starting next class at B/H
4. COQCs will leave B/H on the Wednesday of their fourth week and proceed to Chatham for two days gunnery before starting to see attacks at the Rothesay. Chatham period is marked 'G' above
RNSM A 1945/early and effective as they can 4

The withdrawal of the *Trusty* and *Truant* at the end of 1942 from the Far East left no boats on that station but the situation soon changed following the surrender of Italy and the re-establishment of a Far East Flotilla. Previously there had been problems with getting crew members to and from the UK, especially those going home for Perisher. Therefore, apparently in anticipation of the return to the theatre that would lead to 31 boats operating there by VJ day, 15 August 1945, in February 1943 it was proposed to establish a Periscope School in

[133] The COQC 1945 Schedule indicates that gunnery was conducted in Chatham whereas, Hezlet, *Trenchant*, 33, says there was a 'dome' gunnery trainer at Greenock for the guns' crews.
[134] RNSM A 1945/4 .

Australia at Watson Bay, Port Jackson, at the entrance to Sydney harbour. The purpose of the School would be to run a local COQC that would train COs in the techniques specific to the station especially, notably presumably, special operations which were conducted extensively and excluded from the British Perisher. It was to be quite an extensive adventure with a Commander in command, a submarine CO to assist, and the shore complex, which would replicate the attack teacher facility at Fort Blockhouse, would be staffed by WRNSs. The proposal suggested three U-class submarines be attached as they were unsuitable for Far Eastern operational work and could act as first commands for newly qualified COs. Should those submarines be unavailable older submarines could be employed if they had modern periscopes, 'fruit machines', asdic and all the attack equipment supplied to modern submarines. The School would also train attack teams and officers and ratings joining submarines.[135] While the Submarine School did not materialise a few officers were recruited to submarines locally in the Far East. One, Sub Lieutenant David Blamey RNVR, received his escape training on the beach in Trincomalee and after a five-week course was at sea as a junior officer in an operational submarine not having seen Fort Blockhouse.[136]

The first Reserve officer to qualify in the Second World War was Lieutenant Norman (Jack) Coe RNR in November 1941. He was followed by another 20 Reserve Officers and six Reserve Officers who had transferred to permanent commissions. Many of the VR officers admitted on Perisher from early 1943 had started as non-volunteers, but they flourished and 10 qualified for submarine command. The January 1943 COQC, now staying in the Glenburn Hotel but eating onboard the *Cyclops*, had two VR officers: Frederick Edward (Teddy) Young (he designed the logo for Penguin Books before the war) and Frederick (Freddie) Sherwood RCNVR. Sherwood had pre-empted the admission of VR officers by attending the last 1942 Perisher, but he had failed. He then redid the sea weeks on the same Perisher as Young in January 1943. On completion, Sherwood forewent his leave in Canada and went to command the *P556* on 15 March 1943 just eight days before Young joined the *P555* on 23 March 1943.[137] Thus Sherwood could claim to be the first VR officer to command a submarine and Young the first RNVR.[138]

[135] RNSM A 1943/41 Preparation for future submarine warfare in the Far East, Captain (S) No. 02168/408/801 dated 14 February 1943.
[136] RNSM A 1996/075, David Blamey, Happy Memories of the Royal Navy.
[137] *P555* and *P556* were American S-class submarines built in the 1920s and transferred to the RN in 1942. Their only use was training and both were returned to the USN before the end of the war.
[138] RNSM A 1945/22

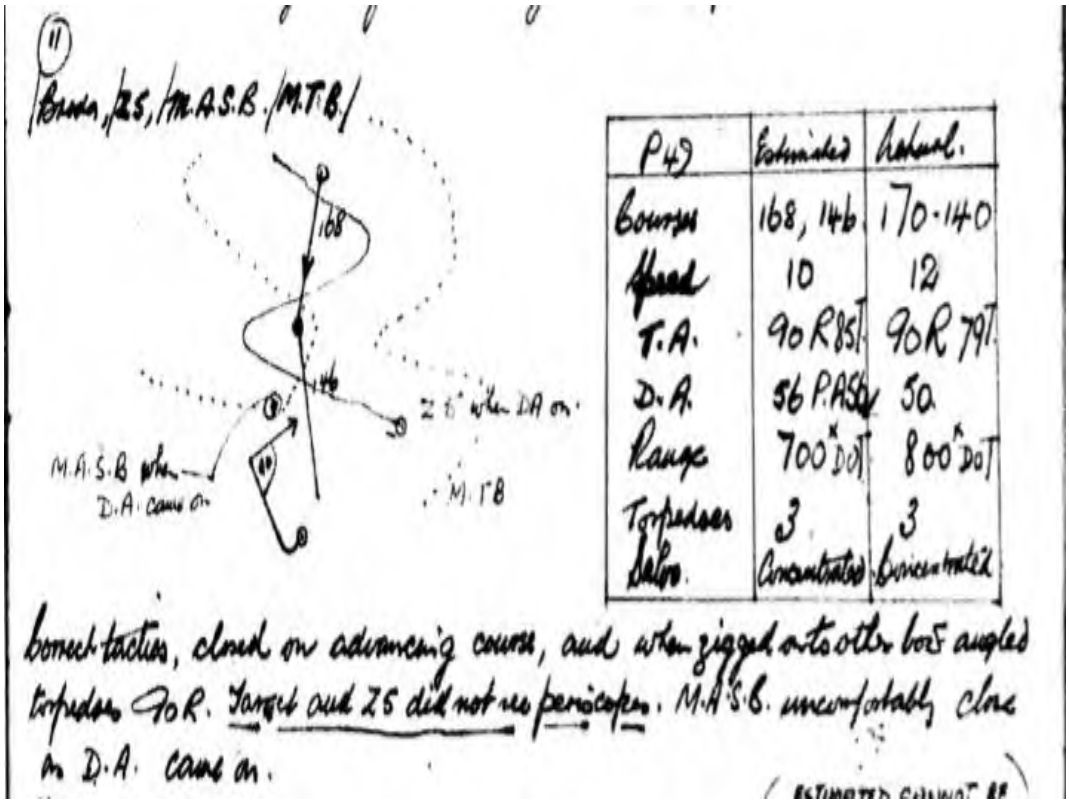


Figure 5.10: A Typical Attack Record From 1943

The record shows the target approaching from the north weaving about a mean line of advance of 168°-146° with a MASB (Motor Anti-Submarine Boat) as the left-wing escort and the Dutch destroyer *Z5* as the right wing escort although it is annotated as an MTB (Motor Torpedo Boat). The attacking submarine makes an advancing attack from the south and fires on a 90° track angle at a range of 700-800 yards. The attacking officer is clearly worried about the closeness of the left-wing escort as he is firing.

RNSM A 1945/22 COQC Records

By the end of 1943, with 59 COs and[139] 67 submarines[140] lost the building rate was retained at 39 in 1943 and 1944 but only 18 in 1945. In the same period, 141 officers passed Perisher[141] and the course began to host both allied officers and a requalifying course. The December 1943 course was cancelled, and the September 1944 course consisted entirely of requalifying officers under Lennox Napier who replaced Bone in March 1944. The pressure on Perisher was easing and the course was able to diversify in whom it trained.

Figure 5.11:
The Four Second World War Teachers:
Steel; Bone; Woodward; Napier

Images http://www.unithistories.com

[139] Hezlet, *Submarine Operations*, 371.
[140] Evans, *Beneath the Waves*, Appendix 1.
[141] RNSM A 1945/22 suggest 139.

Stress is a problem

Commanders were awake to the dangers of stress in COs and drink was an obvious sign but there were other symptoms. It was, for example, accepted that during the war the extrovert COs became more extroverted and the introvert more introverted. Of the former must be the example of Miers whose outbursts were legendary. As an example, Nash related hearing Miers extol the virtues of his officers only to find the navigator under arrest and the First Lieutenant with a black eye – a known summary punishment of Miers.[142] At the other end of the spectrum were Wanklyn, "*very quiet and modes*t",[143] and King who had the reputation of hardly speaking at all at sea on patrol, so intent was he on the job in hand.[144]

Stigmata of the fingernails was another symptom when the period of an operational patrol would very often appear as a ridge on the CO, officers' and many ratings fingernails. The creation of the stigmata ridges was diagnosed as being psychological.[145] Or stress could manifest itself as a physical complaint such as that experienced in the First World War in the case of D'Oyly-Hughes who suffered from a "*fever, headaches, and unlawful gratitude. Simply couldn't move a limb for love nor money*"[146] or Claude Dobson who commanded submarines throughout the war then won the VC in the Baltic in Motor Torpedo Boats in 1919 after recovering from neurasthenia.[147] Churchill was aware of the stress on the COs as the story of Bickford illustrates. After sinking the *U36* and damaging the German cruisers *Nurnberg* and *Leipzig* in the *Salmon*, Bickford was awarded the DSO, promoted to Commander and invited to lunch with Churchill. After lunch, as the other guests departed, including the FSL, Bickford spent two hours with Churchill being cross-questioned by him. In answer to Churchill's question as to how to relieve the pressure, Bickford suggested having two submarine crews. Bickford's suggestion lay dormant until Churchill, who as Prime Minister, challenged Horton, as VA(S) on the matter. Horton argued the improbability of finding another 60 submarine crews inevitably introducing unacceptable levels of efficiency.[148] The idea was to resurrect itself with Simpson in the Tenth Submarine Flotilla in Malta although he was trying to squeeze the

[142] Brian Izzard, *GAMP VC*, (Yeovil: Haines, 2009), 84.
[143] Ibid, 203.
[144] Telecon with Chris Belton April 2019.
[145] John Winton, *The Submariners: Life in British Submarines 1901-1999*, (London: Constable, 1999), 107.
[146] Laura Rowe, 'Constructing heroism: submarines, submariners and the Dardanelles Campaign, 1915', *Journal for Maritime Research*, 21 January 2019. Rowe is quoting D'Oyly Hughes to his parents, 12 Jun. 1915; Winton, *The Submariners*, 48.
[147] Steve Dunn, *Battle in the Baltic*, (Barnsley: Seaforth, 2020), 147. Among his commands was *C27* in which he sank the *U23* after being towed by the 'Q-ship' *Baralong*. Neurasthenia symptoms included lassitude, fatigue, headache and irritability.
[148] Simpson, *Periscope View*, 83-4.

maximum out of his diminishing assets rather than relieve stress. He came up with the idea of a submarine arriving after sunset and going to sea the next day with a mixed crew of spare crew and a damaged submarines' crew. The suggestion was met with loyal compliance but covering caveats, for example, Wanklyn who insisted on returning only to the *Upholder*. Tomkinson however totally rejected the idea. [149]

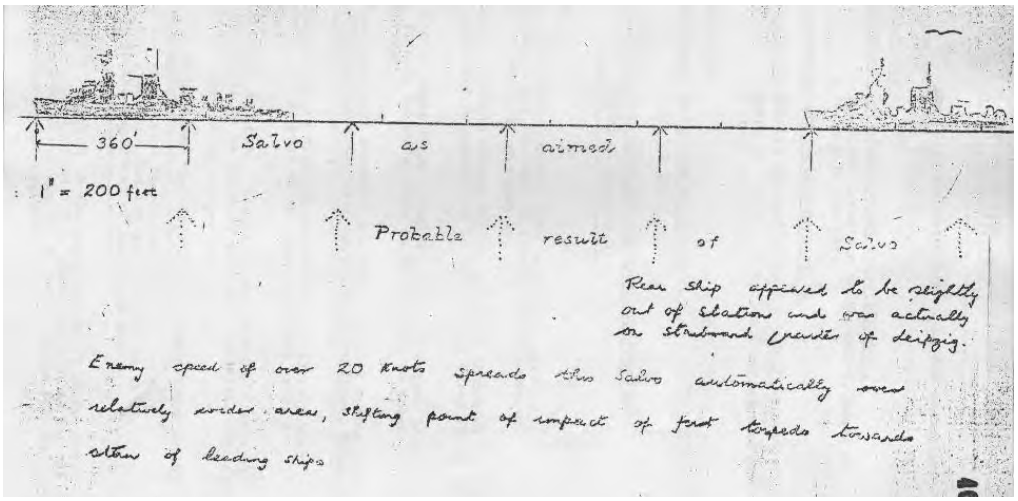


Figure 5.12: Bickford's Patrol Report: Attack on the German Cruisers Nurnberg and Leipzig

Having fired at the *U-36* from 5,000 yards and hit her, he now fired at the cruisers again from 5,000 yards. He was either exceptionally skilled or lucky or a bit of both.
Image: Courtesy of Commodore Peter Wickham- Martin
nephew of the *Salmon's* First Lieutenant Michael Wickham-Martin.

The top line of arrows indicates the aim of the salvo. The second row of arrows indicate how the salvo was actually fired. Had the torpedoes run as intended maybe both cruisers would have been hit in the bow.

The writing underneath says:
Rear ship appeared to be slightly out of station and was actually on the starboard quarter of Leipzig.
Enemy speed of over 20 knots spreads the salvo automatically over relatively wider area, shifting impact of first torpedo towards stern of leading ships (sic).

Horton was equally sensitive to the stresses on his COs especially in the Mediterranean where the losses were high. By August 1942, 27 boats had been lost there, when he wrote to Simpson expressing his concern about one of Simpson's COs: "*I expect _is probably in need of a rest and will try to make arrangements to relieve him shortly*."[150] Horton tried to relieve the strain and tension of the Malta-based submarines by limiting time there to one year.[151] The wisdom of this was seen in an analysis into the losses of submarines in the Mediterranean which identified that inexperience with the area caused many submarines to be lost during their first two or three patrols. But losses of submarines that carried on operating past the one-year mark during 1941, 1942 and 1943 rose very sharply. The conclusion was stress-induced tiredness.[152]

[149] Simpson, *Periscope View*, 210-3.
[150] Chalmers, *Max Horton*, 117.
[151] Simpson, *Periscope View*, 186.
[152] Alistair Mars, *Court Martial*, (London: Frederick Muller, 1954),.48.

And Simpson, of course, being at the heart of matters was very aware of the stress on his COs. He realised, for example, that Linton needed rest even though Linton rejected the idea himself[153] and so Linton's Victoria Cross was awarded posthumously after the *Turbulent,* now based at Algiers, failed to return in March 1943.

Stress, of course, was not just a Mediterranean problem or an RN one. An American officer with eight years in submarines who was considered an efficient submarine captain suddenly went "*stark raving mad*" sitting at the dinner table in the depot ship's wardroom when he began to crow like a cockerel. His mind had given way completely[154] — unsurprisingly American psychiatrists claimed a maximum of four operational patrols for their COs.[155] Stress and fear are stablemates, fear can induce stress and stress, managed, can overcome fear. (When stress is unmanageable, fear may dominate). Eugene Fluckey talked openly about fear. He said:

> *"Fear is a natural characteristic of all living creatures, necessary for self-preservation. To win, however, fear must be controlled, enabling expertise to determine when to fight and when to run away — to be able to fight another day. As experience teaches, the subconscious almost automatically weighs the odds."*[156]

Without experiencing stress, without being stretched to their limitations, COs would possibly have been unable to make those subconscious decisions. Salutary words for Perisher.

Stress became too much for some COs as we have seen with Menzies' COs recognising their symptoms and taking the brave decisions to have themselves relieved. Another was Peter Ward, CO of the submarine *Usk,* when he had to nurse his boat from Scotland to Alexandria in 1940 after British communists had sabotaged her. Such was the strain, it broke his health and he had to be relieved.[157] He was lucky, as was the Soviet CO who also had to be relieved due to stress becoming too much for him. Rather surprisingly we may think, he was treated with sympathy.[158] So too was *Korvettenkapitän* Heinrich Bleichrodt in *U-109* who twice radioed for permission to return from patrol in December 1942 having had a breakdown whereas the Commander of *U-505*, *Kapitänleutnant* Peter Zschech, committed suicide during heavy depth charging in 1943 and the IWO, *Oberleutnant* Paul Meyer, brought the boat home.[159] This was the only such case of any submarine CO's suicide at sea in the war.

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[153] Simpson, *Periscope View*, 267.
[154] Carr, *Hell's Angels*, 220.
[155] Fluckey, *Thunder Below*, 251.
[156] Ibid, 219.
[157] John Wingate, *The Fighting Tenth*, (Penzance: Periscope, 1991), 31.
[158] Kolyshkin, *Arctic Waters*, 58.
[159] https://uboat.net/boats/u505.htm acquired June 2019.

Waistell re-visited

Both the Americans and the Germans used non--career submarine officers so it is worthy of note that the Submarine Service re-visited Waistell's First World War idea of appointing destroyer officers to submarine command following a short training. Waistell's ideas had been given some support in a 1944 Naval Review article which bemoaned the fact that officers were failing Perisher because they lacked the experience and developed personality of an older officer. (Only 17 had failed in the period 1940-1944). He argued that the necessary character and power of command required by a CO cannot be developed in the few months [often just weeks during the war] of Perisher and that the disadvantages of introducing officers from outside the Submarine Service would be compensated by the maturity of the older officer.[160] Waistell's ideas were not put into practice in the First World War, but in 1943 four Lieutenants from GS, Jack Bitmead, Frank Graves, Loftus Peyton-Jones and Tony Blomfield, were sent for submarine training with the intention of fast-tracking them as submarine COs. The first three had come from destroyers and Blomfield from MTBs. They joined the OTC in January 1943 and were treated with both curiosity and concern. Following the OTC they spent a week in the attack teacher with the Perisher before being sent to the Mediterranean for operational experience. Sadly, none of them was to achieve submarine command. Bitmead had been in the Merchant Navy so as an RNR officer he was a little older than the 24 years of the others, he had won the DSO in May 1942 in the destroyer *Forester* where he took command following the death of the CO and conducted two brilliant operations. In May 1943 Bitmead did four patrols in the *Unruffled* with the experienced John Stevens DSO DSC in the Mediterranean but found being depth-charged to be "*interestingly unpleasant*" and reverted to GS. Graves also did four patrols but had much the same opinion while Blomfield returned to MTBs.[161]

Loftus Peyton-Jones had the most adventurous time when he was sent to the Eighth Flotilla based on the *Maidstone* in Algiers and joined the *Sahib* commanded by Lieutenant John Bromage.[162] Although Peyton-Jones says he felt "*rather like a goldfish in a bowl in the company of some of the most experienced submarine commanders of the war with many feats of enterprise and daring to their credit*"[163] he had every reason to feel otherwise having already been awarded the DSC and then the DSO for his action during the Battle of the Barents Sea in the destroyer *Achates*. Peyton-Jones had a baptism of fire in the *Sahib* although a rather short

[160] 'Mortimer', 'The Submarine Commanding Officer,' *Naval Review* 1944-32-1.
[161] Loftus Peyton-Jones, *Wartime Wanderings*, (privately published,1993), 270.
[162] Wingate, *Fighting Tenth*, 298.
[163] RNSM A 1995/196 SURPRISE, SURPRISE by LE Peyton-Jones.

one. The *Sahib* had sunk a tug by gunfire and the heavily escorted Italian merchant ship, *Galiola*, by torpedo, for which Bromage, received the DSO. When the *Sahib* was counter-attacked by 51 depth charges she was forced to surface and scuttled, and with just one fatality the crew were rescued and imprisoned. Peyton-Jones escaped from an Italian prisoner of war camp before being deported to Germany. After many months walking across Italy and finally escaping in a duck shooting punt, he returned to the UK where he was invited to re-join submarines being told he would have to do a full First Lieutenant's job before getting a command. GS offered him the immediate command of a destroyer so unsurprisingly he took the job ending the experiment with all four officers commanding destroyers.[164] Where the British failed the Germans succeeded as the story of Peter Cremer, an ex-destroyer officer who commanded four U-boats, conducted nine operational patrols and sank 27,000 tons of shipping shows.[165]

The Other Protagonists and Effectiveness

American, Russian and German equivalents of Perisher

The American submariners had a difficult early war for three principal reasons: the inadequacy of the torpedoes; the poor quality of the COs in the early years; and a risk-adverse culture. The first, not resolved until late 1943, was a result of the selection process for submarine command being based on seniority rather than the meritocracy of the British and Germans. Consequently, in 1941, Lieutenant Commanders of 38 years or older who had not taken the Prospective Commanding Officers (PCO) course introduced in the spring of 1941, were in command.[166] The PCO course lasted one month, following which officers made a 'PCO cruise' as a sea rider under another CO to gain combat experience before joining the PCO 'pool' to await command. There were 63 PCO courses during the Second World War and 434 officers qualified, far more than the British 233 wartime qualifiers.[167] The PCO course was more like the early Periscope Course rather than the wartime COQC and even though a 'pass' was mandated for submarine command, as late as 1944 Herbert Mandel was 'qualified for command' by his CO in the USS *Croaker* rather than the PCO course.[168] The risk-adversity culture was both created and ratified by their commanders.[169] When Captain John Wilkes, Submarine Squadron Five, told his COs

[164] Peyton-Jones, *Wartime Wanderings*, 260.
[165] Peter Cremer, *U-Boat Commander*, (London: Bodley 1984).
[166] Blair, *Silent Victory*, 107n; Fluckey, *Thunder Below*, 153, Fluckey believed the average age was 42
[167] Lieutenants Pete Eisenhauer and Brett Noyes USN, 'N H, KNOUT', *Journal of Naval Science, Vol.13, No. 1 (February 1987*); RNSM A 1945/22 .
[168] Captain Herbert I. Mandel, *Submarine Captain and Command at Sea*, (Naples FL: Collage, 2005), 111.
[169] Blair, *Silent Victory*, 108n.

"*Listen, dammit, don't try to go out there and win the Congressional Medal of Honour in one day . The submarines are all we have left. Your crews are more valuable than anything else. Bring them back*" [170] his words reflected more a 'fleet-in-being' than aggressive submarine operations. This culture had been developed by peacetime exercises that focused on sinking warships and led to an unrealistic belief in the vulnerability of the submarine from aircraft, active sonar and depth charges. Thus, a deep attack was considered better than a hazardous periscope attack. Consequently, more aggressive COs, who were more likely to get 'caught' at periscope depth during an exercise, were reprimanded for their actions whereas the men whom Andrew Gordon calls 'Regulators', those who kept a clean record, rose through the ranks.[171] This led to many of the older, seniority-appointed COs, having to be relieved for "*poor health, battle fatigue, or non- productivity*", (one CO 'went to pieces' during his first depth charging and the XO had to take command),[172] and in 1942, 40 of 135 (27%) COs, were relieved of their command — an emotionally draining exercise for both men and Service — with a further 25 and 35 sacked in 1943 and 1944 respectively.[173] Two submariners vouch for the lack of aggression. Fluckey observed that "*10% produced good results but 90% were too cautious, a result of restricted training in peacetime which notably prohibited attacks on merchant ships, accompanied by faulty torpedoes*."[174] Miers witnessed the problem first-hand when he was the RN's Submarine Liaison Officer with the USN and rode the USS *Cabrilla* whose CO was 37 and failed to press home attacks on several occasions on an operational patrol; Miers was scathing in his criticism.[175] The problem was tackled by the dismissals and the lowering of the maximum age to 35[176] allowing younger officers to be promoted to command so that in 1942 many younger officers in their late 20s became COs.[177] Reserve Officers were also allowed to command (seven commanded operational patrols),[178] and surface ship officers transferred to submarines, (Fluckey in the *Barb* in 1944 received a new executive officer "*fresh from being a skipper and divisional Commander of torpedo boats*"). [179] Despite the problems, credit has to be given to the American Submarine Service for its outstanding success against the Japanese

[170] Ibid, 131.
[171] Gordon, *The Rules*,177-9. A 'regulator' or authoritarian, was an officer who complied, kept his nose clean (some say brown), his ship out of harm's way and his profile out of contention; the obverse was the 'rat-catcher or autocrat.
[172] Reeve and Unwin, *The Face*, 194
[173] Blair, *Silent Victory*, 553 and 818.
[174] Fluckey, *Thunder Below*, 153.
[175] Izzard, *GAMP VC*, Chapter 17.
[176] Fluckey, *Thunder Below*, 53. He gets both British and German age limits wrong.
[177] Blair, *Silent Victory*, 361-62.
[178] Ibid, 818.
[179] Flukey, *Thunder Below*, 71.

sinking one battleship, 8½ aircraft carriers, 14 ½ cruisers, 45½ destroyers, 25 submarines[180] and 1,113 Japanese merchant ships totalling nearly five million tons sunk[181] That is, "*A force that represented less than 2% of the US Navy* [and that] *accounted for 55% of Japan's Maritime losses.*"[182] As the majority of those sinkings were by PCO qualified COs, the PCO course must take some, perhaps much, of the credit.

We can only glimpse what the Soviet Navy, which joined the war in mid-1941, did to qualify its submarine COs. But we know that an officer would do four or five years in various submarine billets before command. The Soviets also gave Merchant Marine officers two years accelerated training following which they were made First Lieutenants of submarines and then, depending on their suitability, they went to command.[183] The Soviets emphasised training their submarine officers well:

> *"Skill… has to be nurtured. Even good seeds require fertile soil. That soil is a person's physical and moral health, the steadiness of his nervous system. By going through the crucible of military training, talent is smelted into an alloy of intelligence, character and temperament made strong by its harmonious integrity. A submarine captain must have not only self-control, he must be not only courageous, daring and soberly calculating but also possess all these qualities in the required proportions…. In battle the creative element is an independent dispensable part of a captain's armaments."*[184]

Ivan Kolyshkin gives the example of Lieutenant-Captain Israel Fisanovich one of the Soviet Navy's most accomplished COs.[185] Fisanovich was appointed as First Lieutenant of the submarine *M172* where he then took over from the CO.[186] As a new CO at the age of 27 he and the submarine went through what was typically a 14-16-week work-up. Having accomplished this, the submarine then went to sea on an operational patrol with a senior officer, Divisional Commander or similar, embarked to approve the CO's capability. Thereafter he was qualified in command but from the way the senior officers interfered, the COs must have found the practice inhibiting.[187]

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[180] Arthur Hezlet, *The Submarine and Sea Power*, (London: Peter Davies, 1967), 207. The halves are because the submarine shared the success with aircraft.
[181] http://www.ibiblio.org/hyperwar/Japan/IJN/JANAC-Losses/JANAC-Losses-2.html
[182] Blair, *Silent Victory*, 879.
[183] Kolyshkin, *Arctic Waters*,39.
[184] Ibid, 27-28.
[185] Fisanovich was a hero of the Soviet Union who had passed out top of his military Academy. In 1944 he went to Britain to take command of the former HMS *Sunfish*, renamed *V-1 (B-1),* lent to the Soviet Navy. While on passage to the USSR, and in a submarine moving safe haven, *V-1* was attacked in error by a Coastal Command Liberator aircraft that was 80 miles out of position. The boat was lost with all hands. The incident was hushed up to save diplomatic embarrassment ahead of the Yalta Conference.
[186] *M173* was a *Malyutka* class Russian: (Малютка; *baby* or *little one*), and referred to as 'Midgets', built in the Soviet Union they could easily be transported by rail.
[187] Golovko, *With the Red Fleet*, passim.

Germany had started training future submarine officers secretively in the mid-1930s when a submarine school was established in the Naval academy grounds at Műrwik near Flensburg with the first regular commanding officers' course in January 1933.[188] When *Fregattenkapitän* Karl Dönitz was appointed in command of the *Weddigen* Submarine Flotilla in 1935, the first U-boat Flotilla since the U-boat commanders which included some of the most successful Second World War U-boat commanders, Prien, Schepke, Schultze and Frauenheim. Using torpedo boat tactics with the submarine on the surface at night, a U-boat would have to complete 66 dummy attacks and a similar number of dived dummy attacks before it even fired a torpedo — this at a time when the Royal Navy submarines had navigation lights switched on. Dönitz brought the firing range down from over 3000 yards (in deference to asdic) to 600 yards (he doubted the efficacy of asdic) with a minimum range of 300m. [189] These ranges are for when a U-boat could get close to, or inside a convoy and they compare with the lessons learned by the British during the First World War that the pre-war ranges of 400-600 yards were generally unachievable (the British were usually firing at warships rather than convoys) and ranges over 1000 yards were adopted[190] and then taught by Perisher.

With his Flotilla proficient in attacking, Dönitz began to develop the 'group tactics' that had been conceived by *Kapitän sur Zee* Hermann Bauer, Commander of the Imperial Navy's U-boat Service in 1917. Bauer had written in the early 1930s about the advent of the Wolfpack in his book *Das Underseeboot* which, translated by Hyman G Rickover the future 'father' of the American nuclear submarine programme, became a USN standard text.[191] Bauer argued that German First World War submarine policy equated to American privateers in 1812[192] but his thoughts bypassed the Royal Navy as did Dönitz 's *Die U-Bootwaffe* published in January 1939 which emphasised the advantages of a U-boat on the surface at night. Dönitz's development of command, control and tactical methods to bring a group of U-boats on to the same convoy target became known as the 'Wolfpacks' culminating in a successful Baltic exercise in 1937, then the North Sea and in 1939, the Atlantic. But there were critics. In 1938, one officer, Otto

[188] Blair Clay, *Hitler's U-boat War: The Hunters 1939-1942,* (London: Orion, 1997), 32.
[189] Karl Dönitz, *The Memoirs of Karl Dönitz,* (London: Frontline,1990), 13-5.
[190] RNSM A 2007/550 Lessons Learned in WW1.
[191] Surprisingly, it has proved impossible to locate an English translation.
[192] GP Thomson, 'The submarine in future warfare: A German view', *Journal of the Royal United Service Institution,* 76 (1931), 511.

Köhler, had presciently warned of the dangers of radar being able to detect the surfaced U-boats.[193] He was ignored, principally because Dönitz was slow to appreciate technology.[194]

Although there were many routes to command a German U-boat the normal route was similar to the British with an officer progressing through the junior officer positions to become a First Watch Officer (IWO or First Lieutenant) for between three to 18 months. When selected for command the officer would take a Commander's Course following which he went to sea in an operational submarine for normally one patrol as a 'Commander Trainee' in much the same way as an American PCO graduate. Commanders' courses were initially conducted by their home Flotilla under *Höheres Kommando der Unterseebootsausbildung* (HKU) in Kiel but advanced training moved in 1943 to be a responsibility of the *Führer der U-Ausbildungsflottillen*, (F.d.U. AusB: Head of the Training Flotillas), *Kapitän zur See* Viktor Schütze, a successful U-Boat commander who had sunk 35 ships. Under this organisation, prospective COs would complete a four-eight week intensive course with the 24 Flotille or '*Schiessflotille'* (shooting flotilla) during which about 25 students on each course would fire 35-50 torpedoes from the Flotilla's 15 Type VII boats.[195] Surface night attacks had the CO on the plotting board in the Control Room with the firing supposedly effected by the IWO on the bridge where he had high-power Zeiss binoculars mounted on a gyroscopic compass repeater but in reality, COs always seemed to be on the bridge with the IWO on the binoculars to which the many autobiographies and films testify.[196] When this training became impracticable due to losses, COs were trained at the submarine school on attack teachers followed by torpedo firings in a special submarine flotilla in Danzig and Memel. When appointed to a boat, the CO would take her to battle training in the Baltic[197] where it would typically carry out 26 submerged daylight attacks and over 60-night surface attacks. Starting with dummy attacks, the daytime attacks then used training torpedoes[198] but only water shots were fired at night, presumably so as not to lose torpedoes. This compares most favourably with British submarines both during their work-ups and for the Perisher.

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[193] Timothy P Mulligan, *The* [U-Boat] *Submarine Commander's Handbook*, 140. Despite Köhler being a good CO Dönitz makes no mention of him in his memoirs.
[194] Dieter Hartwig, *Großadmiral Karl Dönitz: Legende und Wirklichkeit* (Paderborn: Ferdinand Schönling, 2010), 100-4.
[195] Werner Hirschmann, (with Donald E Graves) *Another Place Another Time*, (Friesens MN: Robin Brass Studio, 2004).
[196] Blair, *Hitler's U-boat War*, 42; Herbert A. Werner, *Iron Coffins,* (London: Cassell, 1969); and the film, Das Boot, modelled on the *U-96* and for which the CO of *U-96*, *Kapitänleutnant* Heinrich Lehmann-Willenbrock, was the consultant.
[197] David Westwood, *The Preparation and Training of U-boat Crews 1925-1945*, http://www.U-Boat.net.
[198] Clay Blair, *Hitler's U-boat War: The Hunters 1939-1942*, (London: Orion, 1997), 42.

Performance comparisons

Compton-Hall had a rather partisan view when commenting on the efforts of other navies. For example, he compares what he calls the exhaustive (and exhausting) periscope schooling of Perisher with the Americans who, he says, "*were not as well grounded in tactics and periscope usage*",[199] and the Germans fired at point-blank range which meant they did not have to worry too much about errors in target estimations or salvo spreading and could fire just one or two torpedoes; the Russians he believed did not understand the principles of a salvo and just fired everything as quickly as possible on slightly diverging courses.

He was probably right about the Americans early in the war when they had severe problems with their COs; the 15 Pearl Harbour-based submarines sank just 15 Japanese ships in the same period that German U-boats under Operation Drumbeat sank 204 ships off the east coast of the United States in 1942.[200] But the Americans had introduced the PCO course before they entered the war and when it is considered that the USN Submarine Service accounted for 4,779,902 tons of Japanese merchant shipping and 54,192 tons of naval ships, together 54.6% of Japan's total maritime losses,[201] (the nearest success came from the much-lauded carriers sinking 1,452,900 or just 16.3%),[202] and the greater part of those sinkings was accomplished by officers who were PCO course qualified, his comments may be questionable.

U-boat COs certainly had thorough training but their greatest successes were mostly when they were on the surface at night in the years 1939-1942. Mars avers that the first year for the U-boats was relatively easy because Britain had so few escorts that the U-boats' main enemy was the weather. Consequently, convoys of 50 old ships "*puffing along at 8 knots and with only a couple of ancient destroyers and a few trawlers for protection were easy targets*."[203] This contention is quantified by a study of Otto Kretschmer's record as the most successful U-boat commander. His success was in the 19 months September 1939 to March 1941, before the escort build-up, before radar and before the Wolfpacks. He operated individually and was able to penetrate a convoy screen to fire from close range. 'One torpedo, one ship' was his maxim.[204] Mars is even more scathing about Kretschmer and his peers: "*Germany's 1,175 U-boats sank just over 2,500 ships for a loss of 781 U-boats. That works out slightly more than two ships for*

[199] Richard Compton-Hall, *The Underwater War 1939-1945*, (Poole: Blandford Press, 1982), 56.
[200] Blair, *Silent Victory*, 893.
[201] Ibid, 900. Blair is quoting JANAC figures which, as he points out, are a good approximation.
[202] William P Gruner, *US Pacific Submarines in World War II* at https://maritime.org/doc/subsinpacific.htm acquired January 2020.
[203] Mars, *British Submarines*, 28.
[204] Michele Magnozzi, 'One Torpedo, One Ship: An appraisal of Otto Kretschmer's U-boat tactics, 1939-1941', *Mariner's Mirror* Volume 107:2, (May 2021),202-215. The great majority of his attacks were made at 300-800m.

each U-boat and three ships for each U-boat lost." He comments that as a strategic and tactical achievement under relatively easy conditions, he does not think much of it.[205] Horton, however, a man with perhaps a wider perspective, respected the German submarine COs: "*The best German commanding officers were no slouches (and I would still like to know how Prien got into Scapa)*"[206] That their successes tailed off in the latter years of the war, even as the U-boat numbers increased, was due to several factors. Certainly, the technological and tactical anti-submarine innovations of the Allies were major factors, but experience became a premium and the imperatives of the front line denied any extended training of the inexperienced German COs. Although the training given U-boat COs seems thorough, Cremer was critical considering the training too short "*They had to take the place of the fallen as quickly as possible and were not prepared thoroughly enough 'shot through too quickly', as we old hands called it. The short time they spent in the ARU-Front or training group gave them no real idea of the actual conditions*."[207] Palmer questions whether or not the centralised control was the weak point in the U-boat campaign and speculates as to what would have happened if the U-boats had kept radio silence but he draws no conclusions.[208]

Compton-Hall is highly critical of the Soviet COs with plenty of seemingly inside knowledge and detail, yet he only quotes Kolyshkin[209] and Golovka[210] and in doing so contradicts both so it is difficult to know the facts although one sides with Compton-Hall because Soviet authors tended to gilt their deliveries for Soviet audiences.[211]

Another naval historian, the Australian Mackenzie Gregory has approached the comparison of submarine arms from a different perspective. He argues that, because of the diversity of boats, [the large ocean-going American boats, the standardised German U-boats and the utilitarian British submarines], different operating areas [calmer Western Pacific, the wild North Atlantic and the treacherous Mediterranean] and anti-submarine forces [ineffective Japanese, professionalism of RN-led Allies and capable Italians] the only reasonable comparison can be made on a ratio of tonnage sunk for submarines lost. His results are in Table 5.1 and on this basis the American Submarine Service far exceeds any of the others although that ignores the fact that allied submarines in the Mediterranean suffered at the hands of some

[205] Mars, *British Submarines*, 28.
[206] Chalmers, *Max Horton*, 147 A speech to submarine officers following the war. The answer is by brilliant staff work by Dönitz' team, good seamanship, navigation and outstanding submarining.
[207] Cremer, *U-Boat Commander*, 160.
[208] Palmer, *Command*, 279.
[209] Kolyshkin, *Arctic Waters*, passim.
[210] Arseni Golovko, *With the Red Fleet*, (London: Putnam, 1965). Admiral Golovka was CinC Soviet Northern Fleet at age 35.
[211] Llewellyn-Jones, *Anti-Submarine Warfare*, 96-7, adds some credibility to Compton-Hall's viewpoint.

very professional anti-submarine forces a point not lost on the American official history which acclaims "the world's greatest submarine force" but then modestly offers:

> *" It would do very well however for all submariners to humbly ponder the fact that Japanese anti-submarine defenses were not of the best. If our submarines had been confronted with Allied anti-submarine measures, the casualty list of the submarine force would have been much larger and the accomplishment of Allied submarines much less impressive."*[212]

Nonetheless, the Americans did very well, but then so too did the British but it is the questionable German performance that captures the general attention which is perhaps incongruous with the general perception.

Table 5.1: Comparison of Submarine Services by Ships and Tonnage Sunk per Submarine Lost

Submarine Service (In rank order)	Total submarines lost	Total tonnage sunk	Total number of ships sunk	Number of ships sunk per submarine lost	Tonnage sunk per submarine lost
USA	52	5,200,000\	1314	23	101,923
Britain	75	1,520,000	697	9.3	20,266
Germany*	781	14,500,000	2,828	3.6	18,565
Italy	82	1,000,000	n/a	n/a	12,195
Japan	127	907,000	184	1.4	6,923
Russia	109	402,437	160	1.5	3,692

- These figures vary a little with different sources For example, n his memoirs Doenitz quotes,759 ships sunk totalling 14,119,413 tons. But the differences do not detract from the point being made.

Source: Mackenzie J Gregory., The Role of the Submarine in World War 2 at http://www.ahoy.tk-jk.net/macslog/TheRoleoftheSubmarineinWo.html

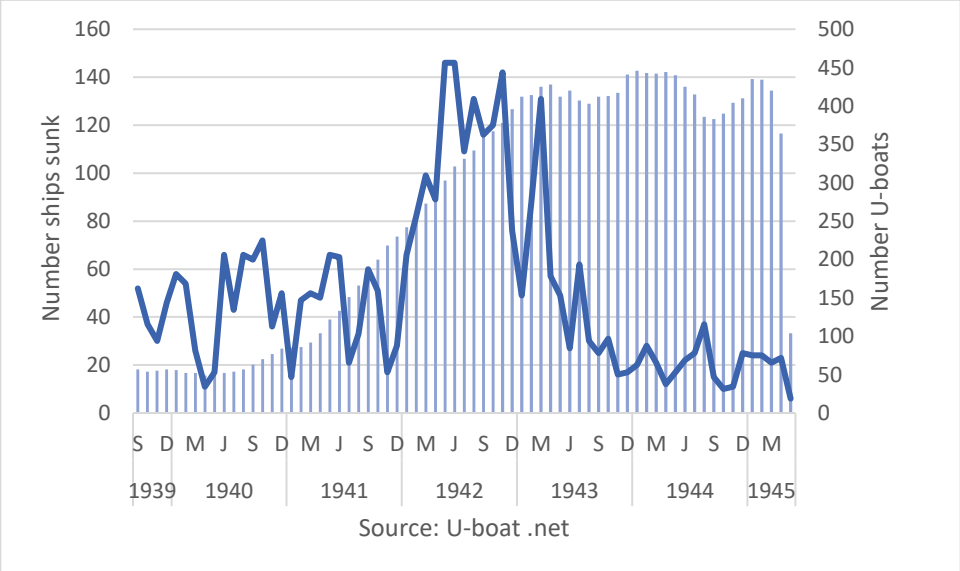
Another way to draw comparisons about CO training is to look at each Submarine Service's 'Ace' COs which were never plentiful in any Navy. American submarines, which accounted for just 2% of American naval forces, made 1,588 patrols and fired 14,748 torpedoes. The top 10 US COs, 2% of the 465 American submarine COs, sank 665,998 tons or 12.8% of the American total. They used an average of 3.5 torpedoes in salvoes and their success was later in the war when the American torpedo problem had been resolved and a better quality of CO was at sea.[213] The British fired 5,121 torpedoes of which 3,220 (62.8%) were fired in 1363 (78.7%) salvo attacks out of the 1,732 torpedo attacks of which 688 (39.7%) were successful.[214] This success rate should be compared with that of 23% in the First World War but even more impressive were the boats of the Tenth Submarine Flotilla based on Malta in 1942 which had 71 successful attacks out of 154, (46.1%), double the 23% achieved in the First World War.

[212] Dan Van De Vat, *The Pacific Campaign*, (New York: Simon & Schuster, 1992), 339.
[213] J Gregory Mackenzie, at http://www.ahoy.tk-jk.net/macslog/TopTenUSNavySubmarineCapt.html.
[214] Hezlet, *Submarine Operations*, 355. Hezlet's number of 688 differs slightly from Mackenzie's 697.

Good training would have been at the core of this performance and that, of course, was Perisher. The top ten or 3.4% of the total 290 British COs, sank merchant shipping totalling 96 ships of 409,465 tons or 27% of the total score the greater part in the calmer, clearer, submarine-revealing waters of the Mediterranean where mines claimed 38 (82.6%) of the 46 boats lost there.[215] On the German side, 2.2% of the total 1,401 U-boat commanders sank 31% of the shipping while the top ten German U-boat COs, representing a minute 0.7%, collectively accounted for 345 ships totalling 1,980,589 tons 13.6% of the total 14.5 million tons sunk but these successes also must be put into context. They were all in the early war years with only two of the ten COs operating at sea as late as 1943 and, except for two forays into the Indian and South Atlantic Oceans, their successes were almost all in the wide-open spaces of the North Atlantic and in the early years of success away from mines and aircraft. As these numbers represent 12% of the 2,779 ships sunk by U-boats, they add credence to Mars' comments mentioned earlier about easy targets.

By late 1943, attacking became much more difficult for the Germans and their training was tested as the U-boats started to experience something akin to the opposition that the British boats experienced in the Mediterranean. By this time the U-boat numbers were climbing to reach their 1,175 total with much improved torpedoes and an excellent fire control system. As the pressure came on the U-boat force and despite that they had "*fought courageously, stubbornly and imperturbably*",[216] their results faltered and in the absence of any matériel

Figure 5.13: Ships sunk vs U-boats 1939-1945



[215] Hezlet, *Submarine Operations*, 354-72.
[216] Frank L MacLean *The Fifth Field* at https://www.thefifthfield.com/biographical-sketches/karl-donitz/. Dönitz 's valedictory message to the U-boats on 4th May 1945.

deficiencies this must reflect, in part at least, on their training. Figure 5.13 shows this almost mirroring Figure 3.11 as to what happened in the First World War.

Gregory's tonnage figures quantifying Mars' jaundiced view of the German capability implicitly suggest a large difference in the size of ships sunk between the Americans' 4000 tons and the British 2000 tons. Total tonnage is a better yardstick because it is an indication of the damage done to the enemy, but it is not an indication of skill, for it is easier to hit a large ship with a torpedo than a small ship.[217] Ship-handling is also made easier with gyro-angled torpedoes rather than the straight running torpedoes of the British. To get your boat into the correct firing position to fire a spread or hosepipe salvo of zero gyro-angled weapons demands the special type of 'submarine-seamanship' that the British were taught on Perisher.

It can be concluded that although this analysis does not provide any direct appreciation as to the effectiveness of Perisher it does suggest that the Americans did perform very well for which the PCO course can take much credit and, contrary to reputation, the Germans, despite the excellence of their training, were not as good as generally perceived. But it also strongly suggests that the British COs operating in more hostile waters against a capable opposition were more skilful. The best British COs had a much better proportional record than any others and certainly by the average ship size comparison.

That skill, we can reasonably conclude, as Compton-Hall does when he relates the skilful sinking of the Italian cruiser *Arnando Diaz* by the *Upright* in February 1941,[218] was as a result of the Perisher training that, as noted in Chapter Four, both Bryant and Wingfield applauded and none complained about even though some, like King, may have become lost in the box now and again. But was performance on Perisher an indication of how good a CO a student would become? Taking Wanklyn's record as an example, his miserable 47% score was prescient of his early months in command of the *Upholder* in the Mediterranean before he went on to sink a destroyer, two U-boats and 89,059 tons of shipping.[219] It is another Perisher maxim that Perisher is the easy bit, the real test comes when you are in command. The true influence of Perisher during the Second World War period we may never know for so many found a watery grave without us knowing why. Could they have done better? Could they have been trained better? One just wonders how the Mediterranean Aces, Wanklyn, Linton, Tomlinson and Miers, would have performed in the better American boats in the easier battlespace of the Pacific in those same early years with the benefit of their Perisher training.

[217] Hezlet, *Submarine Operations*, 365.
[218] Compton-Hall, *Underwater War*, p.81.
[219] Simpson, *Periscope View*, 126; Wingate, *Fighting Tenth*, p.40.

Meanwhile we can conclude that Perisher had its shortcomings as war approached, and as seen in the previous chapter, the limitation to operational training caused by risk-adversity is a valid criticism. When war came in 1939, however, Perisher responded with alacrity to evolve into something far more dynamic. It reduced its length, thereby condensing the curriculum but at the same time extending its content, increased the number of courses, changing its location for safety reasons, and introducing more difficult opposition in the challenging waters of Scapa Flow. The demand for larger numbers of COs inevitably led to officers with reduced experience being recommended but a meritocratic points system allowed those with the capability to succeed early. The course evolved from teaching just eyes-only attacking to the near-full gambit of submarine operations and skills from coast-crawling to night attacks, radar attacks to submarine vs submarine, and gun attacks to attacks against high-value targets screened by fast zigzagging escorts.[220] While the number of ships operating with Perisher increased, there was no real imposition on the wider Navy. This self-sufficiency delivered 233 qualified COs to the Submarine Service few of whom were 'Aces' and it is surprising how some passed: Hezlet omitted an ARL for five consecutive attacks in the attack teacher but he passed (he must have performed much better during the sea-attacks) and went on to be a most successful CO winning the DSO and DSC and appearing in two of his own 'Giant Killers' lists for the sinking of the *U859* in September 1944 and the Japanese cruiser *Ashigara* in a brilliant action in June 1945 in the *Trenchant*[221] — showing that Perisher attack teacher records were no guarantor of a COs operational performance. Some should not have passed Perisher at all but did: Christopher Rankin's leadership and submarining skills were so poor they led to a mutiny onboard the *Simoom* when the entire crew signed a Round-Robin refusing to go to sea with him. Fortunately, he was very much the exception.

Table 5.2: Submarine Build and Losses and CO Losses and Perishers 1940-1945

	SMs	SMs Built	SMs Lost	COs Lost	Perishers	Average Age
1940	75	15	24	18	40	28.2
1941	76	20	11	9	35	26.9
1942	108	31	17	17	54	25.7
1943	126	38	16	14	56	24.8
1944	149	39	4	4	30	24.6
1945	149	18	1	1	18	24.8
Totals		168	74	64	233	26.3

Sources: Ackermann, Paul, *Encyclopaedia of British Submarines* 1901-1955 Penzance, Periscope Publishing, 1989, Evans, AS, *Beneath The Waves*, London, William Kimber, 1986 and RNSM Officers' Record Cards

[220] RNSM A 1945/22 .
[221] Hezlet , *Submarine Operations*, 365-6.

The war was to end, however, on a more happy, familial note. In 1945 John Martin, was in command of the *Solent* and his brother, Kenneth Martin, was in command of the *Sleuth*. Both submarines were operating in the Far East as part of the Twelfth Flotilla based on the *Wolfe* in Trincomalee and they were the last two boats to come off patrol at the end of the war against Japan.[222]

[222] Thomas, *Submarine Victory*, 208. Both brothers went on to command the same submarine HMS *Alliance* after the war.

6. Obsolescence to Nuclear

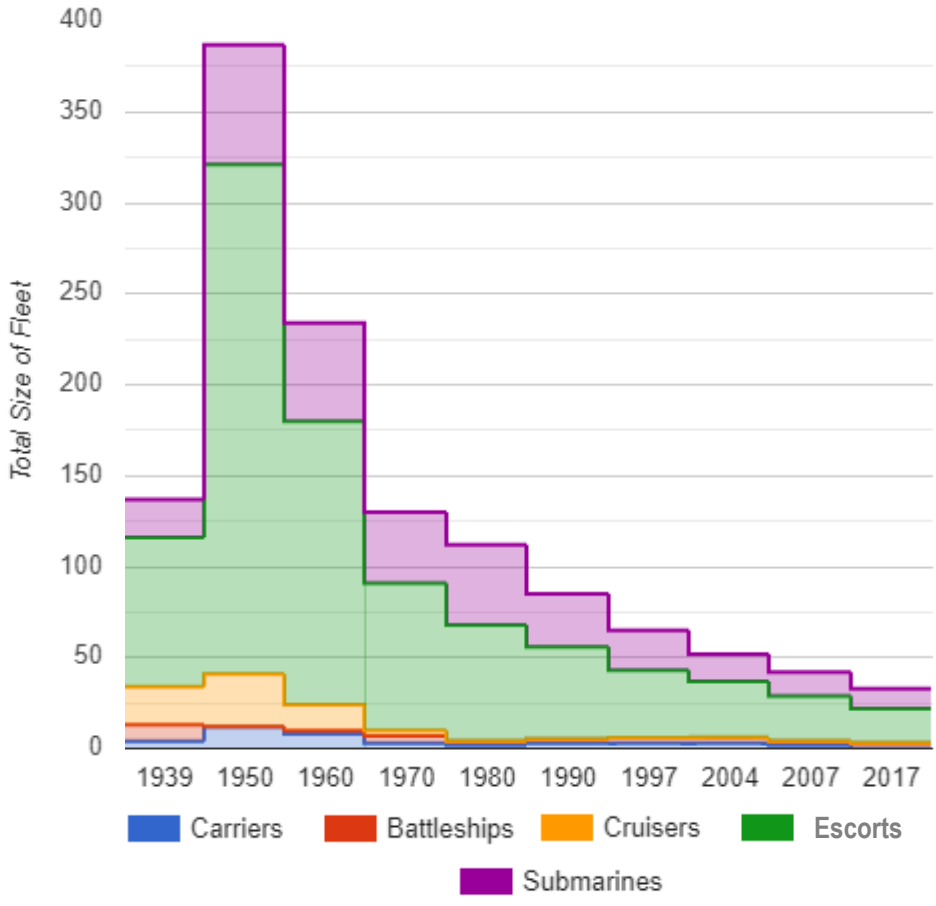
Chapter 6 covers a period of change in the Navy, the Submarine Service and Perisher's evolution. Thirty-nine COs qualified in the period 1946-1949 and 127 COs in the 1950s. Despite there being some inspirational submarine COs, some who passed Perisher during these periods were questionable. 'Churn', or personnel turnover, is generally considered a measure of an organisation's social health. On that basis, in the late 1940s, the Navy was badly off with only 22% seamen re-enlisting compared to 68% before the war and technical branches, who were suffering from men leaving in response to the demand for technical skills in a rebuilding economy, was down to 4%, a critical number in any organisation.[1] Contributing to this demoralisation was the large numbers of ships in reserve, the paring of ships on foreign stations, and the forthcoming reduction in aircraft carriers. In 1950 there were 12 carriers and naval aviation dominated naval policy and force structures. The FAA was fortunate in having the Fifth Sea Lord and at least two departments working in its interests.[2] Submarine interests, on the other hand, were divided over several departments, a division that was later to have serious consequences. As the number of carriers declined so too there was a continuous reduction in the Fleet's size both in ships and the establishment of 144,000,[3] demonstrable to 1965 and evident in Figure 6.1. Within these reductions, the relevance (and budget commitment) of the submarine force increased proportionately.

The transition from war to peace in 1945 was less disruptive for Perisher than in 1918, and the immediate post-war course differed little, if at all, from earlier Perishers with the course continuing to be periscope-surface-attack orientated. This did not help the transition to the underwater battlespace in 1947 which was inhibited by obsolescent submarines, sensors, tactics and training.[4] Fortunately, by the mid to late 1950s, innovation was on its way with

[1] Grove, *The Royal Navy*, 215; Grove, *Vanguard to*, Appendix Five.
[2] Grove, *The Royal Navy*, 213-42, 5; Grove, *Vanguard to*, passim.
[3] Ibid, 27; for a tabular list of immediate post-war fleet reductions.
[4] Malcolm Llewellyn-Jones, *The Royal Navy and Anti-Submarine Warfare 1917-49*, (London: Routledge, 2006), 168; TNA ADM 259/111Trials of asdic Types 171X and 718X in HMS/M Thermopylae.

new submarines and sensors so that, by 1969, most wartime submarines had gone, replaced by the excellent P and O-class SSKs, the first three SSNs and the four Resolution class SSBNs. There was also the recognition that the best anti-submarine asset, and certainly the only asset that could operate close to Soviet bases, was the submarine.[5] Although Perisher had yet to evolve sufficiently to embrace both the underwater battlespace and the nuclear context fully, it transformed itself from an 'art' into a 'science' thanks to the thinking and initiative of the inspirational Sandy Woodward as Teacher and developing more of a 'command' focus. In the 1960s, 108 COs qualified but the total number of 235 for the period 1950-69 represented just 38% of officers taking the OTC, a wastage exacerbated by almost all officers who failed Perisher leaving the Submarine Service. The Chapter covers the immediate post-war developments and then the genesis of the submarine fleet that would bear the brunt of the major part of the Cold War. It begins to draw more on oral history than archival material.

Figure 6.1: The British Navy-Fleet size 1939-2017 (excluding minor vessels)



Adapted from https://www.historic-uk.com/Blog/British-Navy-Size-Over-Time/

[5] TNA ADM 205/53 A balanced post war fleet; Hennessy & Jinks, *The Silent*, 72-3.

1945-Mid 1950s

Post-war developments

George Creasy became RA(S) in late 1944. Although not a submariner Creasy understood well the technology that the 156 surrendered and 221 scuttled U-boats had to offer.[6] This included the *shnorchel* (Anglicised noun: snorkel; verb: to snort), 'GNAT' homing torpedoes, radar interception receivers, asdic decoys, short-range radios and of particular interest the rubber anti-asdic coating, codenamed '*Alberich'*.[7] He ordered the *Vulpine* to be fitted with a dummy snort against the received wisdom which considered it a "*dangerous device for a submarine and nothing to worry about*".[8] It soon became apparent that even the new A and T-class submarines were obsolescent and at one stage it was considered scrapping them in favour of manning an equal number of Type XXI German U-boats. The decision, however, was made to continue with the 16 deeper diving A-class with their longer periscopes (deeper periscope depth) and to replace the old T-class with new builds all to be fitted with Type 267 periscopic radar and what was now seen as an essential snort.

RA(S), now Flag Officer Submarines (FOSM), moved back to Fort Blockhouse from Northways in September 1945 and Flotillas were reorganised with the Third Flotilla in Scotland working-up submarines and taking on responsibility for the COQC, the Fifth Flotilla in Gosport training submarine crews and the Seventh Flotilla at Portland providing anti-submarine services.[9]

The wartime submarine fleet and building programme were unsustainable and both were soon reduced with a requisite reduction in the demand for COs. The pre-requisites for Perisher were therefore again changed to three consecutive months service with the same CO and no Reserve Officers. In response to allied navy requests, the October 1945 Perisher was five allied officers only,[10] with the selected RN officers delayed by a course. COQC courses were now run every three to four months and increased in length to 11 weeks.

What part Teacher played during the immediate post-war period is unclear for, following the DAT, students went to Rothesay and were dispersed around operational boats for their

[6] https://uboat.net/articles/84.html. 116 of the surrendered boats were also scuttled under Operation Deadlight.
[7] Compton-Hall, *The Underwater*, 50-51, 154. GNAT=German Naval Acoustic Torpedo.
[8] Hezlet, *Submarine Operations*, 308. It was considered especially dangerous during depth charge attacks. Email Driekus Heij November 2018. The Dutch claim the 'Snort' was invented by Lt J.J.Wichers RNLN in 1933 and fitted in the Dutch submarines O19, O20 and O21 but in 1917 Johnston Robb, an Assistant Manager at Scotts Shipbuilding and Engineering had filed Patent 106330 ' Arrangement for running main engines submerged' with an induction mast. It was not acted upon.
[9] Hezlet, *Submarine Operations*, 349-352.
[10] RNSM A 1945/4 .

sea-attacks under the guidance of operationally experienced COs.[11] If this happened, (and there is only an implication), it was for a short time, for by 1946 Paul (Johnny) Murray-Jones was on Perisher at sea with the first post-war Teacher, Hugh Mackenzie. Then, in 1948, poor planning resulted in all submarines being an officer short causing an additional workload and low morale. FOSM called it a 'Period of Added Contentment', the contentment being that they could keep enough submarines at sea to service the Fleet — a throwback to pre-war days of providing anti-submarine targets rather than operational submarines.[12]

During this immediate post-war period there were two groups of COs, the majority who settled down to the peacetime Navy, 'the Roxburgh Group', and a smaller group who drank too much.[13] Peter Herbert observed: "*There were some who were absolutely shot … You didn't blame them, they'd had a hell of a war.*"[14] King made the point "*I was a wreck, physically, morally, socially, financially and in every other way*".[15] Notwithstanding, many of both types were excellent COs, often with strong personalities. The culture was that submarines were dry at sea but entertained at lunchtime and/or in the evening in harbour. COs would leave matters to their officers visiting the boat briefly during the day, although a CO with a distinguished Mediterranean career took this to the extreme with a courtesy visit to fill his hip flask and then disappeared for the day. Submarine folklore had a third group, a coterie of COs to be avoided at all costs. Three, whose surname began in a 'W', and a fourth with a palimpsest 'W' added became known as the four 'Ws'.[16] They were charged with egregious legend, but some eyewitness accounts suggest calumny. One was simply too intelligent that his IQ left him bereft of leadership. Sadly, he later committed suicide.[17] The actions of all, however, were inexcusable: self-centred, autocratic and incompetence to the point of being dangerous, are just some of the accusations. One of this group nearly lost his submarine by being sucked into the primeval ooze of the Saint Lawrence River while another attempted to dive 'on the watch' off Bermuda with the upper lid open.[18] The boat was only saved by the Engineer countermanding the CO. This same CO had six or seven First Lieutenants in eight months as they were either sacked or resigned.[19] Other incidents were hitting rocks while deep

[11] RNSM A 1945/4.
[12] Todd, *A Long Time,* 169.
[13] Anthony Whetstone interview May 2017.
[14] Hennessey, *The Silent*, 60.
[15] John Parker, *The Silent Service*, (London: Headline, 2002), 267; Hervey was FOSM in 1981.
[16] Not to be confused with the three cricketing 'Ws' of the same period: Weekes, Worrell and Walcott.
[17] Husk and Belton interviews.
[18] Richard Turner, *Fisher, Sailor, Poacher, Spy*, https://www.rnsubmusfriends.org.uk/. In 1955 the *Seraph* had a similar experience in Inchmarnock Water conducting escape trials.
[19] Email Dick Husk September 2019.

or merchant ships at periscope depth. Typically, they did no planning and were poor at both communicating and people skills.[20]

Murray-Jones believed Mackenzie was in Whetstone's first group, for he holds the greatest respect for Mackenzie calling him a "*gentle man*". The course was now at a more leisurely pace than in wartime but was able to incorporate the accumulated war knowledge including, notably, asdic.[21] To achieve this Mackenzie had two tools: the dedicated services of the submarine *Spiteful* and, despite his reputation as a gentle man, a length of heavy rope with a Turks head on the end which Mackenzie would strike (gently?) across the back of the duty captain if he considered the periscope was raised for too long a period. Disparagingly nicknamed 'the lash', his playful pugnacity was taken in the good humour of submariners toward such things.[22]

The focus of the course was still on periscope attacking, for which there was little prescription, if any, about how often you should look at a target or an escort or indeed do an ARL. Judgement was very much with the student, his appreciation of the surface picture, and his ability to get into an attacking position with minimal mental arithmetic demands. Students would endeavour to avoid having to leave periscope depth, unless it was necessary for escort-screen penetration, for asdics were still poor and asdic-only attacks (known as 'blind' attacks) were in their infancy if practised at all. Similarly, for the ARL, giving Murray-Jones something of a shock when an escort, rejoining its formation, ran over the Perisher submarine periscope standards. When rejoining a formation, the rule was that the ship rejoining should stay clear of the exercise submarine so a Board of Inquiry decided that the fault lay with the CO of the escort rather than the lack of an ARL by Murray-Jones.[23] The decision would be different today!

Perisher extemporised its way through the drama of the power crisis, 'Operation Blackcurrant', in the winter of 1946/47 when all available submarines and depot ships were detailed-off as generating stations around the country during a coal strike forcing the Perishers to live and eat ashore for the first time but managing to retain the *Spiteful* and its targets which, being surface ships, were unaffected.[24]

[20] Names withheld out of courtesy.
[21] Mackenzie, *Sword of*, 161.
[22] 'Johnny' Murray-Jones interview September 2019.
[23] Ibid.
[24] Mackenzie, *Sword of*, 162.

Although Mackenzie found being Teacher sometimes exhausting, the immediate post-war Perishers seem to be particularly unstressed by the pressure[25] even with high-speed destroyers and then the tight-circling Type 14 frigate that could add even further challenges. The Submarine Service was entering an exciting and challenging time with the prospect of nuclear submarines allowing Mackenzie, in his Teacher's submarine policy role, to use his intellect by writing a prescient paper on the use and value of the nuclear submarine. His enthusiasm may have helped in the choice for him to become Chief of the Polaris Executive in 1962.[26]

With the focus purely on visual or radar attacking and the emphasis on '*sinking'* the target,[27] many other aspects of submarine warfare practised on the wartime Perisher appear to have been dropped. Murray-Jones, who had been involved in special operations on the North African coast saw no necessity for such evolutions to be included considering them "*commonsense*".[28] But Todd, who took his Perisher in 1951 under Sam Porter, disagreed. He had conducted several special operations with Mars in the Far East and is critical that Perishers did not have the skills. When CO of his own submarine and asked to do special operations, he found that the wheel was being reinvented by both the Submarine Service and the special forces.[29] He was also critical of the way attacks were conducted considering them 'Edwardian'. He found it difficult to believe that after two world wars submarines were still pointing their boats to achieve the DA before firing hosepipe salvoes[30] and he wondered how many submarines had been put in danger by the practice. Rather than developing angled salvo fire, the 'periscope eye' retained its prominence and those who missed their DA were ridiculed. Todd did not blame his Teacher, whom he considered having nerves of steel, but the conservatism of the FOSM Staff, some of whom still fought the introduction of radar. At least Todd's Perisher submarine had a Fruit Machine, a machine so basic that one of his course, Barnaby (Peter) Samborne,[31] could out-think it. Consequently, Samborne was used extensively by the other students![32]

[25] Email Michael Hickie September 2019.
[26] Mackenzie, *Sword of*, 163-4.
[27] Ibid.
[28] Murray-Jones interview.
[29] Todd, *A long Time*, 194.
[30] Firing torpedoes by time interval along the same course using target speed to achieve the spread.
[31] Email Mike Samborne September 2019. Not even his son, Mike, knows why he was called Peter. Samborne went to the US and qualified under their nuclear programme reportedly coming top of class and co-Commander of USS Skipjack. He then went on to become the first CO of HMS Dreadnought the UK's first nuclear submarine.
[32] Todd, *A long Time*, 194.

The 1951 Perisher started in the normal way in the DAT, a primitive machine for even that time run by a retired Electrician called Mr. Miers, who had the reputation of being able to tell who was going to fail from the start. Later, at the RAT, a failure from the previous course, David Lupton, joined them.[33] In the DAT/RAT and at sea command presence and grasp of the surface picture were the principal attributes supported by some basic mental arithmetic with conduct of the attack a matter for the student's judgement. A few excelled, for example, it was written about John Fieldhouse[34] that "*he was not the most brilliant attacker or ship handler; but he had a fine sense of tactical awareness*".[35]

The battlespace goes underwater stimulating innovation

At the instigation of the then Commander Hezlet, in 1947 the Admiralty confirmed that henceforth "*In war the primary function of our submarines will be the interdiction and destruction of enemy submarines in enemy-controlled waters*".[36] This policy declaration was the key for the Submarine Service to move to the forefront of British naval planning[37] where Goldrick's colourful Cinderella analogy applied to the anti-submarine branch is equally applicable to the young, beautiful Submarine Service finding its Prince Charming in the underwater battlespace.[38] There was a problem, however, the tools for such a battle were inadequate, sometimes absent, and when, as late as 1955, Perisher was conducting submarine versus submarine attacks, the target submarine had to hoist a mast with a flag because asdic detection of a dived submarine was so poor.[39] At least the target boat was dived, previous Perishers had had to attack surfaced submarines. FOSM, the procurement staff and industry therefore had three primary focuses: asdics, streamlining of submarines for greater underwater speed and quietness and weapons.[40]

Consequently, the research organisations reorganised. The Admiralty Underwater Weapons Establishment (AUWE) was formed and undertook to replace Types 129 and 138 with Types 168 and 169, but they were slight improvements. Something much better was

[33] If true, he would have been the third-only re-scrub, the first being Sherwood but it is not possible to confirm its veracity.
[34] Later Admiral of the Fleet, Chief of the Defence Staff.
[35] COQC Reports, COQC 29 dated 8 December 1955.
[36] Llewellyn-Jones, *The Royal*, 168; TNA ADM 259/111Trials of asdic Types 171X and 718X in HMS/M Thermopylae.
[37] Commander Geoff Tall, 'The History of the Royal Navy Submarine Service', *RUSI Journal*, 146/3.
[38] James Goldrick, 'All should be 'A' Teams' in, Marcus Faulkner & Christopher Bell (Eds), *Decision in the Atlantic*, (Lexington KY: Andarta Books, 2019).
[39] Whetstone interview.
[40] Norman Friedman, *British Submarines in the Cold War Era*, (Barnsley: Seaforth, 2020) has development details.

needed but before four new sets for the new Porpoise-class submarines were developed contention was to intervene as asdic changed its name to sonar after some acrimonious exchanges.[41] At the same time the Americans initiated the BQR programme based on German sonar arrays. They also embarked on a programme named JEZEBEL to detect discrete frequencies (tonals) from a target using narrowband techniques with frequency analysers. This programme was to morph into an airborne sonobuoy system and the seabed Sound Surveillance System, SOSUS, both of which were to prove effective during the Cold War. Although aware of the American work and, despite having investigated the German *Gruppenhorchgeräte* (GHG) found in the *U-570/HMS Graph*,[42] it was only in the mid-1950s that the similar British CORSAIR and parallel sonar Type 191 programmes were started[43] but after lengthy trials both programmes were stopped because it was thought it would be ineffective against future noise-reduced submarines. This thinking was wrongly based on the assumption that the Soviets would make parallel progress in noise reduction.[44]

In parallel, a signal processing technique known as 'KNOUT' was trialled with multi-hydrophone arrays fitted to the casing of the *Tireless* and *Thule using* 'liberated' GHG arrays.[45] During 1956's 'summer war' the *Thule* detected over 130 different ships of which 36 were exercise targets and she was credited with eight successful attacks following detection by the arrays. A similar submarine, without KNOUT, made no detections in three weeks.[46]

KNOUT led to the Type 186 or 'Searcher' sonar with 12 double hydrophones on either side of the submarine.[47] In March 1957 the *Auriga* was fitted with Type 186 for trials in the North Atlantic to be conducted by two eminent COs, Todd and Whetstone. Their conclusions set the basis for Type 186 operation for decades to come with the submarine having to either circle or carry out a sinusoidal course in the ultra-quiet state. [48] 'Searcher' took advantage of noise reduction improvements based on the resilient rubber mountings found in the *U-570*/HMS *Graph*[49] which resulted in a Porpoise-class radiated noise when snorting of just 3%

[41] TNA ADM 1/16497 The Commodore HMS *Western Isles.*
[42] Hackmann, *Seek and Strike*, 352. A hydrophone array. The British had focused on asdic active transmission to detect submarines, whereas the Germans continued development of passive-listening hydrophones arrays started in 1914. By the end of the war the Germans had developed what was effectively a bow array system called *Balkon*.
[43] Type 191 was, like SOSUS, to investigate the capability of seabed arrays to detect submarines.
[44] *Project CORSAIR*, http://arl.g3w1.com/Corsair/index.htm acquired June 2018.
[45] Eisenhauer and Noyes, 'N H KNOUT'. The numbers are wrong. Asdic Type 186 had 12 sets of two hydrophones each side of the submarine: a total of 48 hydrophones not 96.
[46] 'KNOUT', History of the Admiralty Research Laboratory (ARL) Teddington: 1921 to 1977, http://www.arl-teddington.org.uk/arl_knout_dice_soap.htm acquired June 2018
[47] TNA ADM 259/255 Thoughts on the Tactical Uses of Type 186 Submarine Search Hydrophone Set.
[48] TNA ADM 259/255 Type 186.
[49] Robert Bud & Philip Gummett, *Cold War, Hot Science*, (London: Science Museum, 2003), 166 .

the previous norm.[50] The *U-570's* mountings had been developed by the acoustic scientist Erwin Meyer whose work on *Alberich* would eventually lead to the anechoic coatings of today's submarines.[51] Other research into machinery noise and propeller cavitation started in 1941 also contributed significantly to the noise reduction and led to the pump jet propulsion system that went into the design of the SSN *Churchill* in 1967.[52]

In 1953, trials of a new combination sonar, a derivative of the surface ship 'four square' Type 170, produced the Type 187 to become known by generations of submariners as 'Attacker' and its large dome was to become an iconic feature of British submarines. The intent was that it would provide bearing accuracy with the other development, Type 719x nominated 'Scanner' providing torpedo detection from the keel and the back of the fin.[53]

The fourth sonar in the quartet was Type 197, or 'Watcher'. Development started in the late 1950s with an active intercept sonar known as Type 196. Work was stopped in 1959 as part of a general NATO Policy Independence Programme and the research was given to the French. After a contentious period of development[54] the French produced the Type 197, a

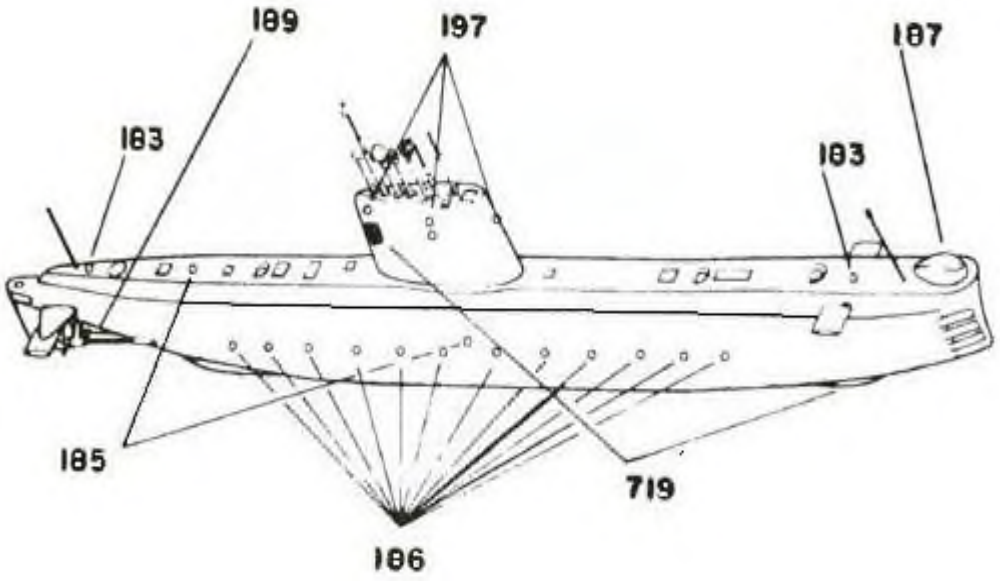


Figure 6.2: Oberon class sonar fit
The other sonars shown are: 183 Emergency underwater telephone; 185 Underwater telephone and 189 cavitation detector
Graphic:-Canadian Armed Forces at http://jproc.ca/rrp/rrp2/oberon_sonar.html

[50] Barrow Submariners at http://arl.g3w1. Philip com/.
[51] The interesting story of how Meyer rescued his research and family from under the noses of the Russians is at http://www.guicking.de/dieter/Erwin-Meyer-Eng.pdf. The first anechoically coated submarine was *U480*, sunk by a mine and not found until 1988, she had remained undetected by asdic/sonar in the Channel.
[52] Bud and Gummett, *Cold War*, 162-4.
[53] Type 187 also had a low power active mine-detection capability.
[54] TNA T- 225/2974 Requirement of SONAR/ASDIC and associated detection equipment for the Royal Navy, letter dated 8 August 1962; Sam Mason, *ASDIC and SONAR, A personal story from the Cold War*, unpublished notes.

most capable set providing bearing, frequency (for classification), range by ping stealing, range by transmission interval, danger level and mode of operation[55] but it was woefully inaccurate for bearing.[56] These four sonars would form the principal sonars of all P and O-class submarines — the boats that Perishers would use for COQC for almost three decades. Perishers would become as familiar with them as the periscope.

By the end of the war radar had reached its operational zenith in an offensive role and by 1946 Type 267W radar incorporating a single mast, automatic control and X-band, was widely fitted and stayed at sea until 'LUCY', produced by the Decca Radar Company in 1952/3,[57] became the Type 1002 I-band slow-scan radar, (slow scan being to maximise the echo return from transmitting just above the water) was fitted in the Porpoise-class.[58] The CK17 periscope with JT1 pulse burst capability[59] and a radio main mast assembly capable of transmitting 500 watts with a high-frequency and very high-frequency aerial, known as the ALN and AP 67004 or Conical Log Spiral (CLS) respectively, were developed. The mast initially went into the T-class conversions, then the Porpoise-class new-build[60] and thereafter all submarines had an ALN or its successor fitted.

With the transformation of submarines from being submersibles to being submarines with a snorkel, able to operate fully in their environment, the tactical importance of radar (and the Perisher radar attack) lost out to sonar but the protection of radar from air attack remained essential. This imperative heralded the introduction of a broadband radar intercept, 360º direction-finding set, first the UA2 on an AYF aerial followed quickly by the UA4/AYG which benefitted from transistors and the ability to display S, C and X-bands simultaneously.[61] Generally, however, and unlike in surface ships, these sets and their successors were used as for warning of a potential detection rather than tactical analysis, hence their name 'Warner'. Little to no education other than the most basic was given on Perisher and if a CO wished to use them for other uses, like intelligence gathering, he had to work it out for himself.

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55 Mason, ASDIC and SONAR.
56 TNA DEFE 67/26 Operation Evaluation Report Sonar Type 197.
57 TNA ADM 220/1081 ASRE Technical Note NX-57-2 and *The Decca Legacy*, at http://woottonbridgeiow.org.uk/decca-legacy was 20/chapter10.php.
58 Friedman, *Naval Radar*, 197; TNA ADM 220/10 ASRE Technical Note NX-57-3; TNA ADM 234/783 Display Outfit JP 2 and Console Lower Assembly for Radar Type 1000/1 *Series*; Email John Wise 2018.
59 Emails Alan Rae, Historian at Thales Optronics; www.fleetsubmarine.com/radar.html acquired December 2017. The Americans had a periscope mounted radar (ST) late in WW2 but it was very basic; https://www.rnsubmusfriends.org.uk where a number of submissions and a photograph attest to the JT1 nomenclature and its association with Type 1000 radar. Friedman, *Naval Radar*, 197 says it was called a radar Type 973.
60 Moss and Russell, *Range and Vision*, 156; CHC at http://www.rnmuseumradarandcommunications2006.org.uk/
61 John C. Wise, private papers.

Figure 6.3: (left) UA2 and (right) UA4
Both sets could detect S, C and X bands but the later UA4 could display them simultaneously.
Image: J C Wise & Associates

Remaining dived, submarines no longer had the opportunity for astronomical observations, so the Artificial Horizon Periscope Sextant (AHPS) capability was developed and fitted in the P- and O-classes' CH74 which, teamed with the CK25 search periscope and its photographic capability, became the periscopes most familiar to Perisher students. The large CK25 needed to be turned continuously so the Navy's Barr and Stroud liaison officer, Commander Lane, produced the eponymous electrically powered 'Lane Roundabout' with a seat and control of the turning motion of the periscope by foot pedals thus resolving torque issues and watchkeeper tiredness.[62] From 1959, Teacher often had use of the special CH76 periscope, longer than the CH74 so he could see over the student's periscope but only two were made and they caused many problems. The Resolution class CH 78 had a radar and image intensifier (II)[63] and the CH80 experimental laser-ranging, but the submariners' visceral antipathy towards transmissions of any sort from a submarine rejected the project.[64]

Figure 6.4: Oberon class submarine periscopes
In the background is the CK25 search periscope with the seat of the 'Lane Roundabout' visible; In the foreground is the CH74 attack periscope
Images: http://www.hazegray.org/

Figure 6.5: The masts of an Oberon class submarine
Left to right:CH74 attack periscope; CK25 search periscope; radar 1006, ESM AYG; snort induction, ALN HF radio mast with UHF/VHF radio stub; snort exhaust
The effect of feather is clear although the submarine is probably purposely creating 'feather' for the photograph.
Image: reddit

[62] Moss and Russell, *Range and Vision*, 165.
[63] An image intensifier operates at the same wavelength as the human eye as well as near infrared and exploits ambient light from the stars and the moon to enhance vision.
[64] Other navies, however, persist with laser range findings. For example, the Kollmorgen and Zeiss periscopes.

The development of the STD, the STD Mark IIx, led to the Torpedo Control System Submarines 2 (TCSS2): "*It had a position keeper meant to keep it up to date and required two operators*!"[65] The implied disparagement is echoed by "*An adjunct had been fitted to make it* [STD] *the TCSS2*for angled torpedoes rather than straight running. The drill was horrendous and would have been so prone to error as to limit its use in war*".[66] The 1955, COQC 28 with Donald Hay as Teacher used the TCSS2 to fire several salvoes.[67] Meanwhile, a new design suffered a setback in 1952 when a prototype was sent to the RAT. It lasted there just 24 hours, long enough for Coote, now Officer Commanding RAT, (OCRAT) to realise that the new Torpedo Control Calculator's (TCC) designers had not grasped the bearing rate issue. It was returned to Bath and it took some years for the TCC Mark 16, a central part of TCSS3, to appear.[68] The next trials were again a failure so Samborne, now OCRAT, resolved the problem by taking the TCC apart and with the help of the First Lieutenant, Martin Wemyss, used his own tools to get it working to within the required ±1°[69] whereupon manufacture was placed with Barr and Stroud.[70]

The TCSS4 was intended for the cancelled, 1953 Boreas class, and was to include two important features: a Bearings Only Analyser (BOA), intended to use "*the "Three bearing" method of deducing a relative course*" — the Millward method, and a Target Position Keeper (TPK). The first would provide a solution to the second.[71] A complication was the adaption of both TCSS3 and TCSS4 to accommodate the high test peroxide (HTP) powered, pre-patterned 'Fancy' torpedo (an attempt to replicate the German '*Inogolin'*, HTP torpedo, by modifying a Mark 8 torpedo[72]) until the loss of the *Sidon* in 1955[73] when both Fancy and HTP submarines were cancelled resulting in the Porpoise-class having the TCSS6.[74] The downside was that the BOA was delayed until 1971 and DCD. (See Chapter Seven).

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[65] Christopher (Kipper) Walker, at the Friends of the Royal Navy Submarine Museum, Members' Forum at https://www.rnsubmusfriends.org.uk/dits_bits/fruit-machine-but-which-one/ dated 19 March 2006.
[66] Fry, *Rewarding Years*, 64.
[67] RNSM A 1945/22 .
[68] Coote, *Submariner*, 176.
[69] Moss & Russell, *Range and Vision*, 165.
[70] TNA ADM 263/172 Torpedo and Anti-submarine Fire Control Group Progress Review for May 1955 to May 1956; Martin Wemyss interview November 2019.
[71] TNA ADM 263/118 *A preliminary note on TCSS Mark 4 OD 0 (Stage A);* TNA ADM 263/191 Admiralty Gunnery Establishment, Progress Report up to 31 December 1955; Hennessy & Jinks, *The Silent Deep*, 130-2 has a good explanation of the Boreas class.
[72] Branfill-Cook, *Torpedo*, 70.
[73] Evans, *Beneath The*, 405-409. The *Sidon* was lost when an HTP torpedo exploded as the submarine was alongside the depot ship HMS *Maidstone* on 16 June 1955.The fitting of TCCS6 is confirmed by Tony Wardell, Electrical Officer of HMS *Cachalot* on commissioning.
[74] See Hennessy & Jinks' *The Silent Deep*, 152-166 for an explanation of both the torpedo and submarine HTP programme.

Mid 1950s-Late 1960s

Perisher benefits from character and intellect

The mid-1950s pressure on Perisher came from a combination of the 25% failure rate[75] and a growing Submarine Service causing some inappropriate early selections for Perisher.[76] The course had progressed little with 'periscope eye' at a premium, first at the "*string and sticking plaster*",[77] DAT, and then at the RAT, now a Blyth-like cyclorama system where the focus was on anti-submarine attacks for which the 'Bidder' or Mark 20 electric, passive homing torpedo had been developed.[78] Bidder was based on German electric torpedoes as the main anti-submarine weapon to fire from the stern torpedo tubes although there is no record of any weapons being fired at sea by Perisher. The old Mark 8 retained its primacy, even against a snorting submarine when the running depth was set at the deeper 35 feet.[79]

Perisher benefitted from some of the most intellectual, selectively appointed officers on the RAT staff who had the time and capability to give thought to the underwater battle and BOA problems. Early after the war was Dicky Tibbatts, about whom John Coote, no slouch himself, talks in an admiring manner: "*the brightest and most refreshing thinker at his level in the Submarine Service*".[80] While at Rothesay, Tibbatts wrote a percipient paper entitled 'A Quick All Round Look' identifying the shortcomings in effective torpedo control systems. It appears that the CoS took offence, and the paper was killed leaving the Submarine Service lagging behind its peers for many decades.[81] Tibbatts also passed on to the Perishers a choreography of pointing the target and then altering 90° to determine a unique solution for course and speed with a scaled ruler.[82]

Coote followed Tibbatts in 1950 and developed the Time Bearing Plot (TBP): a vertical Perspex sheet graduated in squares so that an appropriate scale can be used. An operator would sit behind and, writing backwards, mark up the bearings of the target using a chinagraph pencil from which a bearing rate could be read using a special protractor and range calculated using a slide rule working on the 1936 formula (see later). Coote was a pragmatist and adopted the principle "*only to teach methods which could be readily grasped by a totally exhausted C.O.*"

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[75] RNSM COQC Records and D/NAVSEC 19/1/52B dated June 1983 Submarine Seaman Officers – Numbers Update
[76] Fort Blockhouse Forum November 2019.
[77] Whetstone interview.
[78] RNSM Whitehead Collection; Branfill-Cook, *Torpedo*, p.240, gives the introductory date as 1960.
[79] Email Tim Duchnese October 2019.
[80] Coote, *Submariner*, 174.
[81] Ibid.
[82] Ibid, 175.

In this, he was influenced by the wartime-experienced John Stevens who had sunk over 33,665 tons of shipping in the submarines *P46* and the *Unruffled*. Stevens was on a requalification course and after listening to the "*esoteric mathematical formulae*" he suggested that if the target was worth firing at it was worth "*giving her the lot*", in other words a full salvo and for that the DA was always 10°. Coote took this to heart and had a brass plate fixed above the attack periscope which said "*Remember, the DA is always 10*°".[83] He also had a quotation pinned to the wall: 'No game is ever worth a rap for a rational man to play into which no accident or mishap can possibly find a way'.*[84]* How inspirational it was to prove is unknown.

Each student would do 50+ attacks in the attack teacher before 40+ attacks over six weeks at sea.[85] This was followed by a three-day exercise carrying out multiple attacks on escorted ship targets and conducting minelays and surveys while being harassed by anti-submarine forces.[86] There was a little experimentation using the first of the T-class streamline submarines in 1955 and trying new sea areas off the Isle of Man in 1958[87] but despite many submarines still having a gun, gun actions went unpractised.[88] Course 37 in 1958 was the first course to be split into two using both the DAT and RAT at the same time. The period was notable for some of the Perishers' names: Fieldhouse "*a very good officer in every way*"; Mike Henry and his "*quick brain*"; Whetstone's "*first rate qualities… a splendid officer in every way*"; and in 1953 Lance Bell-Davies was identified as a future OCRAT.[89] The course would end by attacking the depot ship with four escorts and it was assumed that if you could do this you could do all the other unpractised aspects of submarine operations.

Teacher in the mid-1950s was the notable character Donald Hay, a very correct officer who fitted the public image of a naval officer well with a ginger beard and thick-set physique although he had a rather superior air. Nonetheless, he may well have been good at his job for failures take a dip during his tenure, and if any officer did fail, he was merely landed at the next opportunity, the practice of offloading into a launch not yet having made an appearance.

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[83] Coote, *Submariner*, 175.

[84] Whetstone interview. The quotation's provenance is the poem 'Ye Wearie Wayfarer' by the Australian poet Adam Linsay Gordon and it related to the (famous in Australia) cricketer Tommy Wills.

[85] COQC Reports, Letter to The Captain (S/M), Third Submarine Squadron, Commanding Officers' Qualifying Course Number 28, dated 29th July 1955.

[86] Turner, 'Fisher, Sailor'. It is unclear what is meant by 'surveys'.

[87] COQC Reports, COQC 36 dated 3 April 1958.

[88] Email Tim Duchnese October 2019.

[89] COQC Reports, COQCs 22, 28 and 29 dated 27 July 1953, 28 July 1955 and 8December 1955 respectively. He was Teacher, not OCRAT, and later, a Vice Admiral. His father was Vice Admiral Richard Bell Davies VC CB DSO AFC, doyen of the FAA

When at sea Hay would change into a pair of white tennis shoes, an affectation that one Perisher identified as good fun to bait Hay about and so bought himself a similar pair. Noticing this Hay said, "*Gilbert, I'm looking at your shoes*". Gilbert replied, "*yes sir, tennis shoes like yours*". Not to be gainsaid Hay came back with "*no Gilbert, mine are clean*."[90] (Brian Gilbert passed). Hay also accused a Perisher of eating with his knife and fork improperly mooting that this was grounds for failure. Whether said in jest or arrogance is unclear but when the student did fail it was because, by his own admission, he could not handle three ships.[91]

The last Teacher in the 1950s was Lance Bell-Davies, "*noisy, decisive and informative*"[92] and committed to verbal rather than documented teaching, he believed a CO needed flair and the quiet, cerebral type distracted him. One such student elicited the expression "*For God's sake boy, grab the bull by the prick and pole in there!*"[93] He was also a great believer in the late-night drinking expeditions considering that the effects would simulate the semi-exhaustion of a war patrol. A typical Bell-Davies Perisher attack started with two radar 'looks' while the target was at about 14,000 yards and used the STD then TCSS2/TCSS3 but 'eyes-only' if it then became too easy. Blind attacks were also practised and in the fourth week there was a target and screen of four or five destroyers doing over 25 knots. In the middle of the five attacking weeks was a week at the Joint Anti-Submarine School (JASS) at HMS *Sea Eagle,* Londonderry for submarine-aircraft tactics (SUBAIR) and at the end, inshore work.[94]

Other notable RAT officers continued the search for the Holy Grail of BOA. Among them were Peter Herbert's 'Ettrick-method', a mathematical method of solving BOA named after the beautiful Ettrick Bay:[95] Whetstone and Henry, devised the WetHen plot while 'sea-riding' the USS *Tullibee* during a submarine v submarine exercise (SSX) in 1963. "*It was a BOA solution to get a homing torpedo within range of the target and used by the USN rather than the Royal Navy in SSXs, but never really successfully*".[96] Wemyss, considered his time at the RAT in the early 1950s a great advantage as did Fry who considered the job of First Lieutenant as a plum job in 1956-1957 where he mastered the bearing rate issue.[97]

[90] Whetstone interview.
[91] John Tipping interview April 2019.
[92] Email Tim Duchesne October 2019.
[93] Ibid.
[94] Ibid.
[95] Email Sam Poole November 2017. Poole, along with Guy Warner, was one of the first two submarine-qualified Instructor Officers who contributed so much to the training of submarine officers and resolution of the bearings only problems.
[96] Email Tony Whetstone October 2017.
[97] Fry, *Rewarding Years,* 64-5

The last depot ship, the *Adamant*, left Rothesay in 1957 denying Teacher the opportunity to leave a failed Perisher inboard. Instead, he was taken back to Faslane then, sometime in the 1960s, the practice of landing him by boat began. A failed Perisher was given a bottle of whisky and ushered off the submarine on to the launch *James Bond*. Although this may have seemed harsh and dramatic, in some opinions it was considered humane,[98] and it was most certainly appreciated, for it saved embarrassment. When SSNs began to be used for Perisher, however, it was sometimes not practical and the failed student would have to stay onboard.[99]

Figure 6.6: RMAS James Bond
The fast launch that had the dubious responsibility of taking failed Perishers off the submarine and back to Faslane.
Image: Serco Maritime Services

The Principal Control Officer and nuclear submarines

In the early 1960s, the Royal Navy had over 30 submarines and there were three Perisher courses of about 15 weeks a year with the same 1950s format of five sea-attacking weeks, now called COQCEX, and the JASS SUBTAC training. The only notable change was the introduction of periscope reconnaissance (periphot) in 1961.[100] This probably stemmed from the then work-up organisation under the Captain, Third Submarine Squadron (SM3), to whom COCOQC reported. Submarines worked themselves up with nominal support from SM3 staff and Perisher followed much of the operational work-up package.

The Teacher who took the course into the new decade was Brian Hutchings, a large man who tended to generate "*quite a head of steam and noise*" who was "*not always the easiest man to work for*", he would rant and rave at minor mistakes but mentor the more serious.[101] Others, however, like Dick Heaslip thought him "*a great Teacher*".[102] Hutchings was relieved by the highly-respected Martin Wemyss who recognised that the Perisher he was teaching differed little from that of his father's in 1925. Wemyss had a higher-than-average failure rate and that stimulated the course's post-war reputation toward notoriety enabling the name

[98] Grenier interview.
[99] David Charlton, private papers.
[100] Email Dick Husk April 2019.
[101] Woodward, *100 days*, 55.
[102] Vice Admiral Sir Tim McClement's private papers

'Perisher' to take on a darker connotation.[103] Teachers were now all newly promoted Commanders who served in the job for two years, although the chain was broken when Lieutenant Commander John Davenport relieved Wemyss. Davenport's tenure was peremptorily curtailed when his wife was taken ill and another Lieutenant Commander, Peter Cobb, who was OCRAT at the time and "*a most capable Teacher*"[104] took over the last of Davenport's courses. Then came the last of 'the art of attacking' Teachers, Sam Fry.

While Perisher was a pass/fail course occasionally officers participated in two courses, owing to sickness. In 1962 Francis Ponsonby fell down a stairway in Portland badly hurting his back and forcing him to re-join Perisher two courses later. Peter Bryan collapsed with a neurological virus in 1970 but returned 18 months later and had the distinction of having two Teachers: Dick Husk who passed him on the periscope weeks and Frank Grenier who passed him after Cockfight.[105]

The Principal Control Officer (PCO) course, later named Attack Coordinator (AC) course, was introduced in the early 1960s to train First Lieutenants in coordinating the Command Team.[106] PCO gave officers a better preparation for Perisher and heralded the cultural shift from the 'one-man-band' to what was to become the Command Team in response to the introduction of nuclear submarines with the increased complexity, improved sensors, command suites and highly skilled, well-trained officers and senior ratings. A Staff Requirements paper for a RAT replacement provides an excellent exposé of attack teacher benefits articulating well how the culture was progressing from the 'one-man-band' to a Captain-led, team effort. It says, "*The Commanding Officer today relies, in a way that was virtually absent before, upon other members of the crew who handle the information and who form, with him, a team*".[107] The term 'Command Team' must, however, be used with the understanding of its context. The 'Team' is there to support the 'Command' and, while surface ship command is necessarily devolved, in a submarine the primary function of command to make decisions, albeit now with advice, remained unchanged. Jock McLees experienced the transition in his first boat in the late 1960s illustrating the difference of his first, very 'old

[103] Dick Husk interview October 2018. Wemyss's failure rate was reputed to be 60% but in reality was 43% - still high.
[104] Christopher Walker interview September 2019.
[105] Husk interview.
[106] TNA ADM 1/2885 Faslane Attack Teacher, FOSM's letter to the Admiralty dated 5 June 1963; COQC Reports, *COQC No. 47 dated 30 November 1961*. Not to be confused with the American Prospective Commanding Officer course.
[107] TNAADM 204/2453 Requirements for a new Rothesay Submarine Attack Teacher.

school' Captain with his relief, newly from Perisher with more modern ideas about using a team. The anecdote will be recognisable to most submariners of the time:

> *"Alec Hosie carrying out the first attack with Part III Jock as TCCO, puts the periscope down after a TSU.[Target Set-Up] I'm staring fixedly at the dials and knobs when I suddenly find myself flat-faced against said dials and knobs as Alec boots me physically very hard in the backside with his right steaming bat! [shoe] I hear him growl, "You say 'That puts you ...!', C***!" .*[108]

The drill was indelibly engraved on McLees' mind but today there would more likely be a court martial and counselling. Fortunately, such behaviour was limited and there was a precedence for his second captain's more thoughtful leadership philosophy: in 1942 *Korvettenkapitän* Reinhard Hardegan[109] had written:

> *"… it was a case of first among equals. You are not the Lord of the submarine, that's wrong. As commander, I was just the commander and the success of the boat represented the success of the whole crew, not of any one person… It was teamwork and as a team we enjoyed success…"*[110]

Along with the PCO, the requirement for non-navigational specialist officers to have passed the Navigation Ship Command Examinations was introduced. Previously there was no requirement for any pre-Perisher preparation work, and at least one Teacher preferred a "*virgin mind to rape*".[111] Elementary wartime arithmetical rules were used, for example, using true heights for ranging, the go-deep range was 1000 yards on all bearings although it was permissible to stay at periscope depth if a ship on the beam encroached. For a ship judged to be 'safe' the 'look' intervals were a matter of judgement and a student would be criticised for looking too often, although Teacher would be unable to qualify the criticism. Similarly, the ARL interval depended on a student's situational awareness and the log keeper was used for the time interval. Teacher aimed to inculcate into the student an intuitive understanding as to how often to look at a target or escort to remain safe without over-exposure of the periscope. Fry would sometimes restrict his students in the number of both target and ARLs they could make.[112] This was recognised as the 'art' of attacking.

The arrival of the first nuclear SSN, the *Dreadnought*, in 1963 caused ripples. Should the commanding officer of an SSK become incapacitated while at sea the First Lieutenant, lacking

[108] Email Jock McLees September 2018.
[109] https://uboat.net/men/hardegen.htm Hardegen's was a pilot before joining U-boats in 1939 and ended the war in command of a naval infantry battalion. He lived to 105.
[110] Hood, *Submarine*, 47.
[111] Tim Duchesne private papers. He was quoting Bell-Davies, his Teacher.
[112] Belton interview.

a command qualification, would normally bring the submarine home.[113] For an SSN, however, returning to port would be a severe limitation on the use of the boat's extensive capability. A decision was therefore made for both the CO and the First Lieutenant, now referred to as the Executive Officer or XO, to be command qualified.[114] The decision was frequently vindicated as when Rob Forsyth spent two patrols in the *Repulse* effectively in command while the CO suffered extreme back pain and when Grenier, then FOSM, insisted that the XO of the *Churchill* continue in command when the CO had to leave the boat.[115] For the *Dreadnought* matters went further with a 'first' and 'reserve' team: the two COs were Samborne and Fieldhouse and the XOs Squires and Herbert, all-nuclear trained in the US with three later becoming FOSM. Having two command qualified officers did not put any immediate pressure on the Perisher programme whereas the decision to buy Polaris and build four SSBNs did, for apart from throwing the SSN build programme into disarray, these boats were to have two crews needing an additional 16 command qualified officers: eight COs, and eight XOs. This meant transferring some 'Dry List' officers back to the 'Wet List' and recalling others from either shore or GS jobs.[116] This proved popular, for Appointers were able to give exceptionally long advance notice, four years in the case of Basil Watson before he took command of *Revenge* Starboard.[117] If Whetstone is typical, these officers were undaunted by the prospect of commanding a nuclear submarine despite never having served in one. He says "*most submarine officers that succeed develop a self-confidence that they can hack it. The Perisher gives you that confidence*"[118] although one officer appointed in command of an unfamiliar SSN was heard to comment in the bar that the only cry he recognised was 'captain on the bridge'.[119] This anecdote is indicative of a malaise identified by Richard Sharpe when working in Defence Intelligence and privy to USN patrol reports. He saw that the early RN SSN COs lacked an appreciation of the SSN's full capability, using them instead as advanced SSKs. This way of commanding had, of course, been taught to them on Perisher. What was missing was a proper introduction to nuclear command but there was no experience, they were all pioneers much as in the early days of submarines, and it fell to a few of the most thoughtful to evolve best practices. Once a CO was identified, he was given nuclear training at

[113] Email Piers Neve March 2020. An exception was when Neve was First Lieutenant of the Type 2400 *Unseen* in 1993 he took conduct for a seriously ill CO for five days during an international exercise.
[114] When and by whom is unclear.
[115] Grenier interview.
[116] The Wet and Dry Lists identified officers who would or would not, respectively, be considered for further sea command appointments in either ships or submarines.
[117] Basil Watson interview January 2020.
[118] Whetstone interview.
[119] A call for the CO to go to the bridge in an emergency.

Greenwich[120] and a CORQC. The first of these latter courses with the two COs and XOs of the *Resolution* then building, Commanders Mike Henry and Ken Frewer and Lieutenant Commanders Dick Husk and Francis Ponsonby respectively, was conducted by OCRAT, Commander Robin King, and was one week in the attack teacher and one week at sea sharing the COQC frigates.[121] The course later took various forms as CO or XO Designate Courses, (CODC or XODC) going to sea with Perisher where they would participate or just observe. Dan Conley witnessed perhaps one of the more exacting such courses in the *Sealion* in 1969 under Woodward when "*there were many Teacher-initiated 'Flood Qs'*[122] *and clearly a lot of pressure upon the students, but no one failed*."[123] There is, indeed, no record of any officer failing a CORQC.

In the 1960s and 1970s the Submarine Service recruited officers from the General List (GL) post Bridge Watchkeeping and Ocean Navigation Certificates and Fourth Year Courses (about 30% of the GL intake), the Supplementary List (about 40% of the total intake), some Special Duties officer specialists and now, with nuclear submarines, some GS Torpedo Anti-Submarine (TAS) and Navigation (N) specialist officers. The intent was that the latter two would stay for up to two and a half years with a first 12 months in an SSK before going to a nuclear boat and although the policy was for them not to command it was not categorically excluded. To accommodate this variety a drafting preference card system to help manage careers was introduced and the Long Courses were extended to Supplementary List officers but the MoD stopped the practice until the officers transferred GL. One of the GS TAS officers was Roy Newman, although newly qualified he was lent initially for a shore job teaching oceanography to submariners including Perisher. Having become conversant with submarines and submariners, Newman gladly accepted an invitation to join submarines and within six months went, without the benefit of an OTC, from Fifth Hand to First Lieutenant in the *Otus* after which, following courses, he spent about a year in the *Warspite*. But Newman was only on loan to the Submarine Service and had to return to GS, but his capability had been spotted and he had been recommended for Perisher so when asked to return to submarines with the prospect of a Perisher he readily took the opportunity. After four months in the *Ocelot* as First

[120] Whetstone interview. The course was an appeasement exercise to Rickover for the technology transfer
[121] Husk interview.
[122] 'Q' tank was a 'Q'uick flooding tank introduced after First World War experience in 'crash dives'. The tank provided a fast extra 4 tons of ballast to give the submarine negative buoyancy and a bow-down angle that accelerated diving or going deep from periscope depth. It was used for ducking under escorts but to use it too early or to leave it too late, resulted in embarrassment for the student and the opprobrium of Teacher.
[123] Dan Conley, *Perisher Tales*, https://www.rnsubmusfriends.org.uk/.

Lieutenant to refresh his skills, he passed Perisher to find himself with less than two years submarine service in command of the *Onyx* as the only GS transferee to pass Perisher.[124]

Complementing the new nuclear submarines meant a drawdown on officers from the SSKs, compensated for by the RCN and RAN taking the opportunity to train their officers in RN O-class submarines as they acquired their own boats.[125]

Selection process issues

After 1945, the pressure for CO numbers eased and, with falling numbers of hulls, selection appears to have been easily managed with an understood progression from Fifth Hand to First Lieutenant giving an officer all the experience he required. Form SGM 1503 was used for Perisher recommendations although exactly from when is unknown.[126] What did emerge was that Perisher selection was, and continues to some extent to still be, subject to influential factors: capability versus inexperience; the pusillanimity of a CO to give a 'No' recommendation; the 'we'll let Perisher sort him out attitude' for the 50:50 candidate; pressure to maintain the command plot; and taking informed risks with some candidates.[127] In the 1950s-1960s it may have been because they lacked frontline operational submarine experience coming from submarine squadrons based in Singapore, Australia or Canada.[128] Undoubtedly these factors enabled some inappropriate selections like the four Ws, a result of the course being focused too closely on the mechanics of attacking to the detriment of the softer command qualities. In 1964 Davenport expressed criticism of the selection process and suggested that at least once in a First Lieutenant's career he should be observed acting in command of a submarine other than his own by his Captain SM before any recommendation for Perisher is ratified by the Captain SM. His suggestion went nowhere.[129] But a CO's inappropriate recommendation could be exacerbated by the Perisher Selection Board of Captain SMs who, it can be charged, was sometimes guilty of not knowing its officers sufficiently or ratifying what they knew was a wrong decision in the misguided interests of the man concerned — the 50:50 candidate who deserved a chance! On the other hand, there

[124] Roy Newman interview January 2020. Later Vice Admiral.
[125] Dennis Mills, 'Providing the People (2)' in Captain J E Moore, (Ed), *The Impact of Polaris,* (Huddersfield: Richard Netherwood, 1999).
[126] SGM 1503 has disappeared from the archives although the Form has not. See Appendices.
[127] These factors emerge in one form or another from every interview but were summarised neatly by the Wellington Forum.
[128] COQC 47 Report 30 November 1961
[129] COQC 55 Report 5 August 1964.

were occasions when a Captain SM would override a CO's 'No' or 'Now' based on the CO's limited experience or possibly because of the CO's character.[130]

The internationalisation of Perisher

Following the allied officers' course in 1945, Perisher would often have an allied officer student or, after 1949, now a NATO officer. Submarine COs of 17 nations were Perisher trained but historians have failed to recognise the extent to which Perisher was instrumental in shaping the submarine services of other navies.[131] In 1963 Wemyss's last of six courses consisted of two German, two Danes, a Dutchman and an Israeli. The Israeli passed unconditionally, the Dutchman failed and the others, because they had paid for and attended the course, were passed but only subject to ongoing supervision — a qualification unavailable to British students. With the increasing requests by NATO navies for places on the COQC it was decided in the mid-1960s to run a separate NATO Perisher. Teacher was an 'in-zone' Lieutenant Commander probably on the staff of the RAT (later the SCTT) and he would do the job for the duration of the course. Following their purchase of O-class submarines, a Chilean or Brazilian student would occasionally join a course and Australians, Canadians and the Dutch would regularly join either the NATO or RN course.[132] One NATO officer would join an RN course and an RN officer the NATO course. As a quid pro quo for the NATO students, Perisher was given NATO frigate time, normally in the summer when a NATO and Perisher submarine would operate in adjacent exercise areas with the escorts/targets running between the two areas. When the RAN acquired O-class submarines an exchange appointment for a CO was established between the RN and RAN. The Australians invariably proved to be popular commanding officers as the story of Ian MacDougall who commanded the *Otter* illustrates.[133] As his farewell present the ship's company gave him a framed piece of

Table 6.1: Perishers of Other Nationalities

Nationality	Perisher Nos
Australia	46
Brazil	2
Canada	46
Chile	2
Denmark	30
France	11
Germany	8
Greece	5
Israel	9
Netherlands	91
Norway	57
Poland	8
Portugal	5
South Africa	1
Sweden	2
Turkey	2
Yugoslavia	2

RNSM A 1945/22 COQC Records

[130] Wellington Forum.
[131] Mark Desmond Francis Gjessing, *Anglo-Australian Naval Relations and Co-operation 1945-1975*, PhD thesis, University of Leeds November, 2011, 189, 345. Gjessing gives the training of submariners a perfunctory mention and the qualification of RAN COs through the RN Perisher is not mentioned at all.
[132] Husk interview.
[133] Later Vice Admiral RAN.

the Captain SM's office carpet as a memento of the many times he had stood on the carpet in their defence for some misdemeanour.[134]

Following Davenport, Fry was Teacher 1965-1967. He rather unusually downplays the course by saying that it is "*just another course*" although he recognised it as a demanding one.[135] His courses followed the regular pattern but the SSX of one course was interrupted by a Whisky-class Soviet submarine intruding with the two Perisher submarines taking up the trail which must have provided good training. The emphasis was still on periscope attacking, safety and for Fry, the use of the stopwatch for the most dangerous ship. He placed great emphasis on situational awareness and the accuracy of time for safety which he could measure intrinsically to the second. He had a concern about the lack of submarine operating knowledge of his students so he introduced an exercise called 'Roundabout' to teach "*inshore work, periscope reconnaissance, intelligence gathering and minelaying*".[136] Then, for the last 48 hours of the course, during a period subsequently called Cockfight, these skills were exercised although this story conflicts with Tim Duchesne's Perisher under Bell-Davies in 1959.[137] Thus the disciplines of planning and preparation of operations began to be delivered. Whether Sam Fry believed in the occult or not, each morning he would read each student's horoscope and determine how that student would perform that day. The students' view was that he spent most of the day endeavouring to ensure that that was how the student *did* perform![138]

The impact of technological innovation

Technological innovations continued to influence with the first 'Skynet' communications satellite in operation in 1969 although it would be some time before submarines had that capability.[139] In electronic warfare, UA4 was replaced by UA11/12 on an AYZ mast in SSBNs and SSNs from the mid-1960s.[140] Also in nuclear boats, Periscopes were now mounted athwartships rather than longships with torque assist to replace the 'Lane Roundabout' and one low-technology innovation in the *Swiftsure* Control Room, introduced by the third CO, John Speller, was to have an effect beyond its simplicity. It was a captain's chair, and its arrival was to give the transition from the one-man-band to the command team culture an

[134] Telecon Rob Stevens March 2020.
[135] Fry, *Rewarding Years*, 97.
[136] Ibid, 97-102.
[137] Duchesne, private papers; he relates these skills being exercised earlier.
[138] Norman Dingemans, Fort Blockhouse Forum November 2019.
[139] Hezlet, *Electronics*, 281.
[140] Wise, private papers.

unconscious boost.[141] From his chair, the CO could now manage his sensors, information and command team; another example of a non-linear innovation.

The nuclear reactor was, of course, a huge development but the hull-mounted sonars were also a leap in technology, predominantly, the bow array Sonar 2001 whose very name reflected its advancement for instead of being named sequentially Sonar 201 an extra '0' was added to reflect its advancement. Primarily an active sonar but later used more effectively in its passive role, 2001 was a ground-breaking, massively advanced sonar for its day, much admired by the Americans for the standard of its engineering, stolen by the Soviets[142] and coveted by the French who, refusing to buy a foreign sonar, asked for the production drawings. They were refused.[143] Importantly, Sonar 2001 was never formally accepted into service thus allowing continuous development[144] and consequently submarines often going to sea with a modification. The story of how Sonar 2001 came to be fitted in the boats may be apocryphal for it is about Admiral Louis Mountbatten, FSL, deciding between two warring development teams based on a submarine model and a lump of plasticine to represent the sonar.[145] The chosen poor position above the centre line was corrected later in the *Swiftsure* class's 2001 BC variant to look downward with the position of the torpedo tubes reconfigured.

In 1961 submarines received a new torpedo, the wire-guided 'Grog' Mark 23 a development of the unguided, anti-submarine Mark 20 whose development had, in turn, been based on the German 'Spinne' T10 torpedoes. The Mark 23 torpedo was guided through a Torpedo Guidance Control Unit 1 (TGCU1) an ungainly piece of equipment for a submarine. It had a poor display and poor ergonomics although Fieldhouse in the *Dreadnought* had trained his chef to operate it – he was trying to make a point.[146] TCSS6 accompanied the Mark 23 and TCSS9, whose introduction began in 1967, accompanied the next generation torpedo the 'Tiger Fish', Mark 24. In the end, the TCSS family spanned almost 40 years. Even though some die-hard COs spurned its benefits[147] it is unsurprising that, by the late-1960s, TCSS6/9 had become a well-proven, efficient fire control system and its use was a well-understood,

[141] Dingemans, Fort Blockhouse. The Captain's chair was a Second World War innovation as COs found themselves having to spend so long on the bridge. Speller also introduced a 'Big Brother' with the sound room, Comint, Elint and special fit office all on the same broadcast so everybody knew what was happening.
[142] R. C. S. Trahair& Robert L. Miller, *Encyclopedia of Cold War Espionage, Spies, and Secret Operations*, (Littlehampton: Enigma, 2009), passim: The notorious Portland Spy Ring.
[143] Mason, ASDIC and SONAR.
[144] Dr Donald Nairn, interview July 2018.
[145] John Bench interview February 2018.
[146] Tony Wardale interview April 2018.
[147] Wardale recalled his CO in the *Cachalot* in 1960, Geoffrey Tottenham, ordering the TCC switched off and conducting the attack by eye. It may have been brilliance or bravado.

well-drilled, attack team effort especially for the execution of a surface attack where the periscope was often the primary sensor. While the TCSS' TCC was central in this process it was complemented by an eclectic collection of mostly monographic plots: chinagraph-TBP, pencil-multi-dividers-ARL Table-LOP, stopwatches and slide rules.

The Bearings-Only Problem

The tactical scene was now BOA-focused accompanied by the shift from periscope primacy to sonar dominance and a plethora of contacts invisible through a periscope. It became necessary to understand this complex picture on the watch rather than closing-up the attack team which could, realistically, only manage one contact confidently. The resolution was the Contact Evaluation Plot (CEP) developed as an evolution from the earlier, rudimentary sonar Type 186 plot.[148] The CEP comprised a role of graph paper displaying about 2 ft² for plotting all contacts, both visual and sonar, own-ship's movements and other important information. The CEP became essential for a dived submarine and generations of submarine officers found it difficult to dispense with even when computerisation arrived.

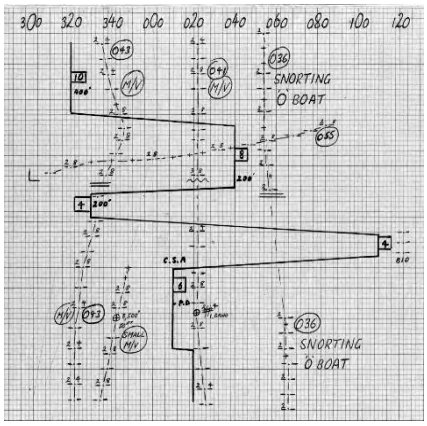

Figure 6.7: CEP Plotter and typical CEP plot
Own ship's course is the heavy straight lines. Further information would be added at the side.
The CEP was an art.
Images courtesy of the *Courageous* Project

The Americans too, had been wrestling with the BOA problem, and, unsurprisingly, some of their solutions were adopted by the RN. The Lynch Plot and the Speiss Range were two but the one to gain favour was the 1936 Range, developed by Lieutenant John Ekelund USN in the late 1950s where it was known as the 1934 Range.[149] The 1936 Range was used extensively on the TBP and the CEP and its principles underpin some of the mathematics behind the later

[148] Fry, *Rewarding Years*, 94; Guy Warner interview February 2018.
[149] JOC Michael Foutch, 'The Ekelund Range: a story of innovation, determination and communication', *Undersea Warfare Magazine.* at http://www.public.navy.mil/subfor/underseawarfaremagazine/Issues/Archives/issue_15/ekelund.html acquired February 2018. The reason for 1936 or 1934 depends on what value is used for the nautical mile/Pi. See Guy Warner, 'Do you remember the 1936 Range?', *All Round Look Year Book 2013/2014*, Friends of the Royal Navy Submarine Museum.

computer-based command systems. Ignoring the proof of the formula, the 1936 Range is expressed thus:

Range = 1936 (Own Speed Across 1~-Own Speed Across 2)/

(Change in Bearing Rate 1~- Change in Bearing Rate 2) or

RANGE = 1936/1 x Change in Own Speed Across/Change in Bearing Rate or

RANGE (in Kyds) = 2 x Change in Own Speed Across/Change in Bearing Rate[150]

Rules of thumb developed as the 1936 Range became familiar, all of which would be used by Perisher students. This then, was the stage for almost 30 years of Perisher attacks: familiar periscopes, new sonars, the TCSS family, monographic-based plots and the Mark 8 torpedo. How they executed those attacks was, however, about to change radically.

The Woodward revolution

Fry and Woodward were the two doyen Teachers of the 1960s although their characters were quite different. Fry, the intuitive submariner, would shout at students and employ bells and silly tasks, today his actions could amount to bullying but not then, and they did the trick in raising the student's aggression.[151]

Figure 6.8:
Sam Fry and Sandy Woodward
The two doyen Teachers of the 1960s,

Woodward was the cerebral submariner who shared many characteristics with Max Horton. Jeremy Larken, colleague, admirer and friend of Woodward, paints an illuminating picture:

> *"awesomely professional … blessed with a penetrating wit, perceptive of the bizarre and pitiless of poseurs … [he] could scarcely organise a sentence without some irony or 'double entendre', be it illuminating, mischievous or just funny … brusque and caustic he could be, but always an excellent teacher, and beneath the*

[150] Guy Warner, 'The Tactical Challenges of Submarine Operations. An Historic Perspective. Part 1 - Before Computer Assistance', *The Naval Review* 2016-104-1.
[151] Belton interview.

> *banter kindly and caring. With that power of intellect, his difficulty was in empathising with a ship's company."* [152]

Of all the Teachers Woodward was probably the most radical, for his rationalism was to eclipse Fry's empiricism. He was also the most eloquent leaving copious notes explaining what he was doing and why. In these notes, he recognised his shortfalls and laid bare his concerns and errors revealing that even a thoughtful and intelligent Teacher like him could still make mistakes.

Woodward relieved Fry in 1967 and for his first course he used the same format as Fry with four weeks in the DAT and one week at the RAT followed by sea weeks culminating in attacks against four fast ships and an RFA as the target. Woodward once remarked that "*If you don't have self-doubts, you're a fool*"[153] so it is unsurprising to find this philosophy in his notes as he admits to finding this course as a refresher for himself and regretting his lack of better preparation and handover, something that he impresses on future Teachers to ensure they do.[154] Despite this, all students passed although in Woodward's opinion they had been taught only basic standard doctrine.

On his second Perisher, COQC 65, Woodward began to develop what he called logical techniques for every occasion that he felt would accelerate learning and would form the basis for a 'new Perisher'. The first of these was 'look planning' and definitive guidelines for the use of stopwatches using mathematical principles and mental arithmetic in which Woodward codified the actions of the best attackers. These developments had been under discussion although it is unclear with whom, but Woodward takes pains to place them in perspective. He says:

> *"It became apparent to me that there is a marked conflict between the "physical safety" requirements of a peacetime S/M operating as taught during COQC and the reality of fighting quiet escorts, deep draft targets, varying environments etc."*[155]

The exemplar for the latter must be Chris Wreford-Brown's attack in the *Conqueror* on ARA *Belgrano*:

> *"[I] started my attack on a 13 knot zig zagging target from about 12,000 yards astern (not a typical Perisher target). Therefore, much of the attack was undertaken deep at maximum speed in the 3/4 power state. I returned to PD [periscope depth] 90 minutes later, did one visual set-up at 3,000yds astern of the*

[152] Jeremy Larken, *Sandy Woodward*, a personal eulogy.
[153] Eric Thompson, *On Her Majesty's Nuclear Service*, (Casemate: Oxford, 2018), 189.
[154] RNSM A 2014/016 Woodward notes.
[155] Ibid.

target went deep at 20 kts again. Returned to PD 37 minutes later for a visual set-up on the port beam of the target and fired the salvo 4 minutes later."[156]

Woodward's words and Wreford-Brown's experience serve to define the requirement for a Periscope Course separate from a 'reality' course. The COQCEX weeks were therefore an exercise in safety management. As Larken put it:

"He [Woodward] rationalised these skills with some mental mathematical props which as a student I found extremely useful before the process became embedded in my brain with experience — from 'conscious competence' to some controlled and always self-critical 'unconscious competence', governed by a newly developed 'sixth sense' which the Perisher process helps one develop."[157]

That 'sixth sense' was the key to safety.

Woodward continued the development of his new techniques introducing *inter alia,* T1/T2 for ducking under an escort,[158] doppler shift using tuning forks for detection of course alteration, integration of the plots and especially BOA techniques. He also introduced SSN-specific tactics. Woodward had very few failures although the courses had, in his opinion, varied considerably in their capabilities. By COQC 68 Woodward had refined his 'new Perisher': three weeks in the DAT with one week in the RAT for SSX attacks were followed by four continuous weeks in the Clyde areas for periscope attacking. There then followed a three-week tactical phase in the DAT and at the JASS followed by a two-day patrol (Cockfight) in the Clyde and Londonderry areas. A side-effect of this reorganisation was that he managed to reduce the frigate requirement by about 20%, a boon to the Fleet planners.

Although Woodward conceded that the general standard "*was much as ever*", he vindicated his developments on the basis that some students would not have passed without his new methods, methods that also relieved the pressure on Teacher, "*from a serious state of nervous exhaustion… to a sense of just another day's work done*".[159] It is difficult to over-emphasise the extent and effect of Woodward's work. He did not immolate the 'art' of attacking but his revolution replaced the 'periscope eye' with the binary influence and exactitude of time on a stopwatch. No longer could a range be left to the reading of a slide rule, no longer could the threat of an escort be left to judgement, no longer could an ARL be inspirational. Now, observation at exact, time-limited and regulated intervals prevailed. A visual attack is the equivalent of a twentieth-century joust:

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[156] Email Chris Wreford-Brown June 2020. The salvo was three Mark 8 torpedoes of which two hit.
[157] Jeremy Larken commenting on Ali Kefford's, 'Ultimate test of leadership under stress', *The Times* 15 April 2017.
[158] T1 = time on top from going deep and flooding Q. It should be 1.00 minute. T2 = time to come up safely; measured from the escort being 'on top' to opening out to its new go-deep range directly astern.
[159] RNSM A 2014/016 Woodward's notes.

The attack starts with the CO (student) taking a first look at the surface situation starting his ARL routine (depending on visibility, nominally every three minutes lasting about 20 seconds but can split it into halves). For this he (usually) uses a wrist stopwatch but around his neck on a lanyard is a second stopwatch to be used for the most dangerous escort, the 'Charger', the escort that will purposely steer directly at the submarine to force it deep. Two more stopwatches hang from the waist, on the left side the stopwatch for the 'right-hand escort' and on the right side the stopwatch for the 'left-hand escort'. The nominations of these two stopwatches demonstrate an added complexity to the situation. The student will, of course, be unconsciously aware of port and starboard and how they relate to left and right, but in the attack situation the escort on the right wing of the formation will be on the submarine's relative port or left side and vice versa for the escort on the left wing. When using relative bearings these are further complicated by the right-wing escort being on a 'red' (port side) bearing and the left-wing escort being on a 'green' (starboard side) bearing. The student must therefore first mentally orientate himself for when he wants to look at the right-wing escort to look to his left and vice versa even when the submarine is altering course when the relative bearings are changing.

He assigns his resources, plots and sonars, accordingly, and the mental arithmetic starts with initial estimates of range, course (angle on the bow) and speed of the target and escorts: from which trigonometry he estimates the length of the attack and distances off-track from the target and the all-important look intervals of the escorts. If too far off-track he will close the target on a converging course using speed and a deeper depth so as not to reveal periscope wash but ensure he is back at periscope depth (PD) within his look interval and ARL time.

He may have to repeat the process before getting 'in the grain' and achieving an optimum firing position of 1200-1500 yards off, and at right angle to, the target's projected track for a Mark 8 torpedo. This will mean 'penetrating the screen' —getting between the escorts and the target. The three escorts are threats — left-wing, right-wing and the most dangerous, the 'Charger' — he looks at them in turn, mentally working out the interval it will take any one of them to reach a threatening position. This, for a typical escort, will be about 1200 yards (an assumption of 1mins run towards the submarine at a combination of escort's maximum speed and submarine speed of 7kts). At 1200 yards the CO must take the submarine down to 90 feet to let the escort pass overhead, and then return to PD safely. The routine would be as follows:

Check everything in the submarine is ready and continue consciously monitoring: attack team alertness; good trim; right speed to limit periscope wash; all ships systems available (for example hydraulic pressure for the periscopes); sonar in contact and holding, reporting on loudspeaker.

For each 'set-up", as the periscope is raised, the CO follows it on his haunches raising himself, rather akin to doing slow squats in the gym. The periscope must only be up for 5 to 10 seconds otherwise the escort may either sight or detect it on radar.

"Bearing that! Range that! ' He calls out, pressing a button for the bearing to be transmitted to the TCC. As the periscope is lowered the CO twists the periscope (no torque assist) to leave it on the bearing he next wants to look at. He uses the stadimeter rangefinder minutes of arc, which has been called out, to do a mental sum:

height of the fixture on the ship/ minutes of arc = range

subtract 1200 yards

convert the remaining distance into time i.e., how long it will take the escort at full speed to cover that distance, typically three, four or five seconds per 100 yards. This time is his 'look interval' or time within which he must range on that ship again.

e.g., Mentally: height of ranging point on escort 40 feet – stadimeter minutes 15 – 40/15=2.6 = 2600 yards – 2600-1200=1400 – 1400x4secs=1min 10 secs – the CO must look at that ship within that time regardless of the look interval times of the other ships and the ARL

Repeats for other escorts and target remembering all the time intervals and doing an ARL.

As the ships get closer and the time intervals shorten the routine becomes frenetic with periscope raising and lowering in quick succession and the mental arithmetic whirls with escorts passing either side of the submarine and the danger of the Charger getting closer to the 'go-deep' range. Adding to the complexity is the control room noise: sonar reports, 'pinging' of the escort sonars on the underwater telephone, cries from various attack team members as solutions are worked out on the plots, all of which he must monitor and react to while remembering all the look intervals and the time expired. All under the constant vigil of Teacher on the after periscope.

The CO is under the greatest pressure, both physical and mental. Physically, he is repeatedly squatting and standing and swinging the periscope around. If not physically fit this can become a strain with mental ramifications. Once mastered, however, it can be enjoyable, but for the student CO who is having difficulty, it is at this stage that he is likely to exhibit pressure becoming stress. This usually manifests in sweating and an agitated demeanour with shouting and perhaps berating a crew member for a minor misdemeanour. This is not appreciated by the submarine ship's company. Mentally, he will lose consciousness of what is happening both within the submarine and on the surface and at worst his brain will start to freeze. His ability to look through the periscope becomes impaired, and his mental arithmetic fails— all warnings to Teacher that the CO has difficulty managing the stress.

Finally, and not before, and certainly not after, the Charger gets to the 'go-deep range' of 1200 yards and the CO orders the submarine deep with the cry "Full ahead together, flood Q, keep 90 feet, midships, down all masts". If he does this before the Charger gets to 1200 yards it will be noted by Teacher and if he allows the Charger to get closer than 1200 yards Teacher will take charge and take the submarine deep himself as a safety measure. Both eventualities receive a black mark.

As he 'goes deep' he will endeavour to do an ARL and possibly a target set-up. These will give him the maximum time to get back up to PD. As the Charger passes overhead everybody in the submarine will hear its propellers. The CO now has another mental arithmetical calculation, to work out the interval from when he went deep to when the Charger was on top, to when it is safe to come back to PD called T1/T2. When safe, he will order PD. Arriving there, he checks the Charger is 'safe', an ARL and then a target 'set-up. The screen has been 'penetrated' and the shooting analogy is evident because the CO has to work out the DA, the bearing of the target on which to fire to allow torpedo and target to meet. Invariably an alteration of course is needed incurring another mental computation for the time of the turn against how far the target will travel in that same period. At the same time he prepares the submarine's fire control system and torpedo tubes for firing.

Once in the right position, the CO is given a bearing on which to put his periscope called the Periscope Angle, (the DA plus an allowance for the delay during firing and distance from tube to periscope), and when aligned with the appropriate position on the target (normally midships on the commercial ship or the bridge on a warship) lines up he orders 'Shoot'. When the cry "Set" is heard indicating the solution is set on the fire control system, (hopefully immediately after 'shoot'), the AC, (during Perisher a fellow student but normally the First Lieutenant) orders "Fire" and the torpedo fire button is pressed. The other torpedoes will be fired by the AC by timing on a stopwatch. This is the end of the attack but in reality, of course, the submarine would now have to take counter-attack evasion.

The danger of the Charger and the 'duck and up' to both ship and submarine should not be underestimated. It certainly was not by the submarine's ships company and the panel watchkeeper[160] who would be alert on hearing the cry "*stand by Q*". Occasionally matters

[160] A Control Room watchkeeper responsible for flooding and blowing tanks.

would get too close for comfort as in the case of one panel watchkeeper with both hands on the flooding valve for Q tank going whiter in anticipation of being put deep by the Charger when Teacher quietly offered to the student "*Have you thought of flooding Q?*". At this prompt the student realises the situation but only gets as far as "*Full …*" before the panel watchkeeper hauled on the Q flood valves while looking directly at the student replies "*Fuck You*". The student's failure was unsurprising.[161]

Figure 6.9: Periscope cartoon
The event depicted is a true event. It happened in an Australian submarine when the cartoonist, Sandy Freeleaugus, was planesman. He was subsequently hit around the head with a rubber covered microphone!
Image: courtesy of Sandy Freeleagus

The benefit of this drama was not necessarily to create a perfect attack for "*It took quite some time when in command to realise that the Woodward method was not the sacrosanct rule; once you gained experience there are so many other clues that you can use*".[162] Rather, it inculcated Larken's unconscious competence, the instinctive feel for the threat of an approaching ship. While a huge use of assets it enabled a student to demonstrate his ability to manage pressure, essential for submarine command. Much was recognised as a mechanical exercise but later, during Cockfight, the student would be expected to demonstrate an ability to stretch the unconscious competence. Woodward's work had changed submarine attacking, "*from an art into a science*" that is continued to today. That and some 40 changes, additions and notes to doctrine documentation are his legacy.

Woodward inherited an era when 'periscope eye' and 'the-one-man-band' attitude prevailed with the predominance of diesel submarines in the fleet. But he saw past these constrictions towards the 'Command Team' concept where the CO became the "*manager*" of the organisation dealing with processed rather than raw information.[163] The logical conclusion

[161] Email Derek Smith March 2020. The panel watchkeeper was Ted Toyer.
[162] Lang interview.
[163] Whinney, *U-Boat Peril*, 126. In this he had been preceded by GS as far back as the later war years when a destroyer CO was having to contend with inputs from asdic, radar, visual and other ships.

to this philosophy was that "*the S/M CO must, at some time in the future, be weaned from his periscope so that he can at last operate properly as "manager" of his AIO*" [*sic*][164] He recognised that this revolutionary concept would need the Periscope Course to be repositioned to the PCO stage thus fracturing the continuity of the Perisher nexus with command but the benefits of a Periscope Course at age 27/28 would be a better assessment of suitability for command than at the later average age of 31. The man who failed the Periscope Course would then have time for a Long Course and a future career alongside his pre-submarines peers in GS thereby reducing the needless loss of good officers, something he felt strongly about. He saw Cockfight as being similar to the CORQC and the tactical phases of most Long Courses. Based on these premises he saw a submarine officer's career as something like the following:

> *Age 22-27 4/3 Hand + First Lieutenant. Long TAS, N or whatever may replace. [today the Intermediate/Advanced Submarine Warfare Course]*
> *Age 27-28 Periscope Course*
> *Age 29-30 PCO Patrol [1st Lt. SSK] (and Fleet?) (Exceptionals to 1st command [presumably SSK] or XO Nuclear) [sic]*
> *Age 30-36 Tactical Course/Refresher. First command then as now. [at that time: SSK then XO Nuclear, promotion and Nuclear command]* [165]

The logic of this approach, which put ability on the tactical course as the criterion for command once proven 'safe', is seductive, especially as its prescience has been proven. It allowed for the high-flyer to achieve command early, by-passing time as an SSK First Lieutenant to take the tactical course and then on to command. Although unspoken, we can presume (because it was the practice) that both the Periscope Course and the Tactical Course would be pass/fail. Praxis, he believed, would take six years.

Accompanying mathematical attacking Woodward tried to introduce other changes like a Submarine Command Ship Command Examination arguing that if this was not required neither should the navigational exams. He was told that the latter had been introduced to reduce the number of collisions and groundings. His riposte, that the ability to work out the height of tide in some obscure location had nothing to do with that ambition, resulted in the compromise that the oral navigational exam should include more submarine related aspects and a requirement for him to draft an SGM for pre-Perisher reading.[166] Woodward also believed he should be able to quantify why a student had passed or failed so he devised a graphical record of the students' attacks, a practice followed in principle by most following Teachers. Many years later a very senior ex-Teacher was watching in horror the TV

[164] RNSM A 2014/016, Woodward's notes.
[165] RNSM A 2014/016, Woodward's notes.; COQC Reports Course Reports No 66 dated March 1968, 67 dated 24 July 1968 and 68 dated 20 December 1968.
[166] RNSM A 2014/016 Woodward's notes.

programme '*How to Command a Nuclear Submarine'*.[167] What surprised him was Teacher, (Jim Perks), making notes when, in his opinion, observation of the student would have been sufficient for a judgement. Thus, Perisher moved from both an art to a science and from a subjective opinion to quantified judgement.

Short winter days in the Clyde areas were unconducive to periscope safety training so Woodward took the Spring Perisher to the Gibraltar areas which benefited from open water for torpedo firing and a popular run-ashore.[168] Husk continued the practice and found, in the absence of Clyde fishing vessels, that an inshore minesweeper, well-handled, could do the same job of pressurising students. By 2016, when the *Ambush* had a collision with a merchant ship off Gibraltar, the corporate knowledge of Gibraltar-based Perisher training had atrophied and the risks, so readily embraced previously, now needed re-consideration.[169]

By the end of Woodward's time, the periscope weeks were four continuous weeks and Fry's Roundabout, with a periscope reconnaissance (periphot) introduced,[170] had become

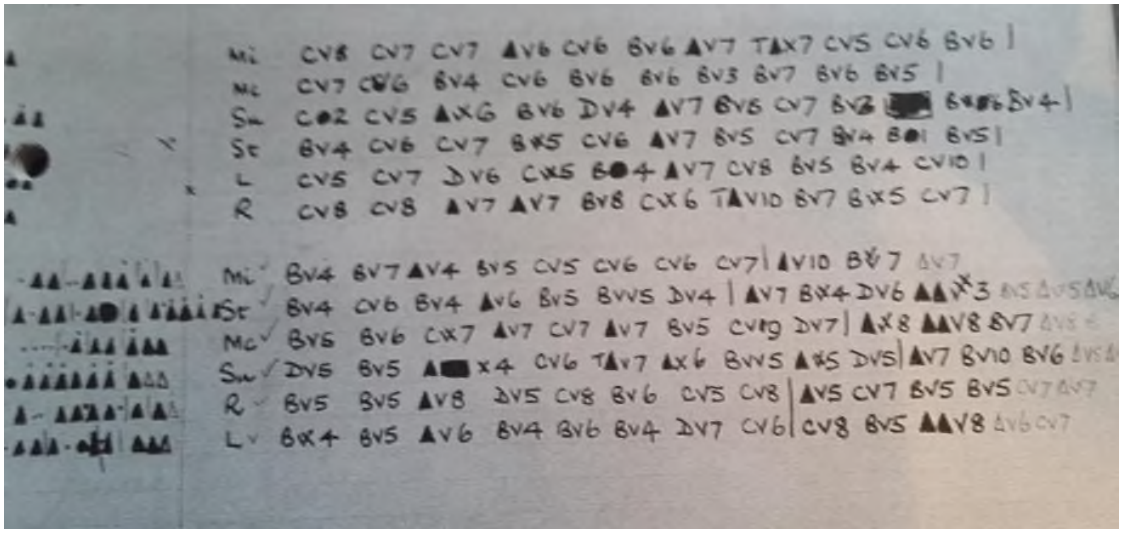


Figure 6.10: Woodward's Attack Record Example

For many good reasons Woodward was very keen on keeping careful records of a students attacks and he devised a detailed methodology. He also graded his officers: Exceptional, Above Average, Below Average, Failure

Letter Code:
A Duck for escort, up again for target
B Duck for escort, unable to come up again
D Duck for escort, able to come up but didn't
C Periscope depth throughout
T TFX torpedoes fired
S Anti SAU

Numerical Assessment
Tactics: 1 to 3
Timing/Estimations: 1 to 3
Relative Picture: 1 to 3

Safety Symbol:
V Safe in every respect
Arguably safe-late Q, holes in looks
X Kept deep by Teacher
Unsafe-no idea of danger

Penalty Marks
-1
X -1
-3
D -1
Perfect attack +1

RN SM A 2014/016 COCOQC Guidance Philosophy Advice Thoughts Woodward's notes

[167] A History Channel production.
[168] Husk interview.
[169] John Weale interview January 2020.
[170] Husk interview.

Letter Code:
A Duck for escort, up again for target
B Duck for escort, unable to come up again
D Duck for escort, able to come up but didn't
C Periscope depth throughout
T TFX torpedoes fired
S Anti SAU

Safety Symbol:
V Safe in every respect
Arguably safe-late Q, holes in looks
X Kept deep by Teacher
Unsafe-no idea of danger

'Prowlex', a two-week period to allowing Teacher to see far more of a student's command presence and real character rather than just periscope attacking prowess. Prowlex put him under risk pressures in a decision-rich environment often helped by combining with the NATO Joint Maritime Course (JMC).[171]

Summarising, the Submarine Service entered the post-Second World War with an obsolescent fleet of submarines, inadequate to meet the requirements of the new underwater battlespace. So too, Perisher continued a limited curriculum and can be criticised for passing some officers of a questionable standard and lauded for the introduction of the NATO Perisher. Fortunately, reorganisation began to provide the necessary innovations, first in the adaptation of the older boats and then the arrival of the P- and O-classes with their new sonar suite that would usurp the primacy of the periscope, accentuate the importance of the BOA, and provide the Perisher with a standard boat for the next three decades.

Then came a revolution in propulsion with the introduction of nuclear power in the *Dreadnought*, the first SSN, and the four Resolution class SSBNs' as technological innovation continued apace with the advanced sonars, new weapons and fire control systems. The introduction of nuclear boats also needed submarine officers qualifying as specialists, (some from GS), and two command qualified officers in each nuclear boat. They had no previous nuclear experience and had to assimilate multiple technological innovations following a reintroduced Perisher refresher course. The stimulus, accompanied by the introduction of the PCO course, was to morph from the one-man-band to the command team concept and while Perisher and the requalification course adopted the latter, both remained SSK-focused.

Another type of revolution, rather than evolution, came from Woodward when he captured Perisher's best attacking practices and gave them a logical, quantifiable, arithmetical basis. Turning the art-form attack into a science he managed to put greater mental pressure on the student and although the Mark 8 periscope attack still dominated, at the same time he used the periscope-attacking COCQEX weeks to inculcate the safety 'sixth sense' rather than have 'periscope eye' be the primary criterium for passing Perisher. Instead, greater emphasis began to be placed on the more tactical Prowlex enabling the evolution of a more comprehensive command assessment, although it would be some time before Perisher practised nuclear command.

[171] RNSM A 2014/016 Frere's notes.

7. A New Emphasis: 1970s and 1980s

The 1970s and 1980s constitute what is sometimes known as 'Phase III of the Third [Cold] War'.[1] Reminiscent of the German U-boats' success in 1940-41 it was a "Happy Time" when Western submarines had the acoustic advantage of the Soviets. It was also a time when the Submarine Service was transforming visibly epitomised by the submarine specialisation qualification badge, or 'Dolphins', a cultural artefact designed by Frank Grenier who was paid £25 from the Herbert Lott Fund. and before too much is read into the symbology, the reasons are prosaic: "*The Submarine Branch merely felt it was time to have a unified Officer/Ratings badge/symbol, other than the HM Submarines cap tally*."[2] The reasons were threefold: rejection of a rarely used earlier badge, introduced for ratings in the late 1950s nicknamed, 'sausage on a stick', the important cultural implication that all the quiddities of submarine subculture would be transferred and continued into the new nuclear age under the established ethos as being "*one for all*", and many other navies had already recognised their submariners.[3] It was rumoured that the Admiralty Board only acceded to its introduction on the understanding that it could be taken away as a punishment but there is no confirmation of what may be a calumny,[4] and since then an SSBN patrol, a black Dolphin badge for trainee submariners and a GS badge have been introduced. (Subsequently, in 2021, another cultural artefact has been approved with submarine officers entitled to wear the old black caps).

At sea in the early 1970s, the Submarine Service had 42 SSKs including some of the old T- and A-class boats and now all the newer P- and O-class boats, four SSNs and four SSBNs. But the Navy's reduction was continuing and by 1979 the total establishment was down to 79,000[5] and another time of low morale when some ships had to be laid off for lack of crews[6] until the

[1] Owen R. Cote, Jr, "The Third Battle" (2003). *The Newport Papers*. 16. at https://digital-commons.usnwc.edu/newport-papers/38. The phases are: Ø1 1945-1950, Ø2 1950-1960, Ø3 1960-1980
[2] Email Grenier May 2021; Redford, *The Submarine*, 179-82 suggests the badge was introduced for many reasons including 'elitism'. Grenier rejects this as a modern judgement.
[3] Email Grenier May 2021.
[4] Martin Wemyss unpublished private papers.
[5] Grove, *The Royal Navy*, 213-15; Grove, *Vanguard to*, Appendix Five.
[6] Grove, *The Royal Navy*, 242.

Services received a fillip from a Thatcher government pay rise.[7] Even so, by the end of the 1980s, there were the 16 P- and O-class SSKs, 17 SSNs and the four SSBNs, the Upholder SSKs were building, the Vanguard SSBNs were ordered and the total submarine establishment was about 2000 officers and 6000 ratings.[8] Perisher provided 197 COs to meet the high demand for submarine command qualified officers for, despite the reduced number of submarines, all nuclear boats needed two command qualified officers as CO and XO, and the sophistication of the fleet increased the number of command qualified staff appointments. Perisher was again running two courses in parallel as it had during the Second World War and with initially the same focus on the Mark 8 torpedo. But, following the Woodward revolution, Teachers could now put students through a quite different assessment than just periscope attacking as the course evolved with COQCEX reducing in length to become a stress-test, safety-orientated teaching period rather than the attacking prowess assessment of former Perishers, and Prowlex became the increased-in-length tactical part renamed as Cockfight to put Perisher students into decision-rich situations that enabled them to reach their limitations. From 1985 both Teachers were nuclear command experienced and the nuclear programme and Tigerfish torpedo began to dominate for the RN students with SSNs beginning to be used when available.

With the benefit of the oral history from the many participants still available of these 20 years, this chapter first outlines the principal developments during what was the height of the Cold War. It then departs midway through the historical narrative to explore the nuances and Shibboleths of Perisher to provide a better understanding of what a student was experiencing and how he was assessed before addressing the start of Perisher's evolution towards modernity.

The New Emphasis Starts: The 1970s

Weapon developments and technological innovation

The main weapon of the early 1970s was the Mark 23 but it was unsuccessful as can be gleaned from Eric Thompson's memories on firing a Mark 23 from the *Osiris* during Perisher in 1971:

> *"The beast had one simple listening device on its nose, was hard of hearing, had zero intelligence and would happily attack a snapping shrimp if it heard that first.… Guiding a torpedo against a submarine at an unknown depth was like trying to pin the tail on the donkey blindfolded. Its ineffectiveness came as a shock."*[9]

Development had started in 1959 on a new torpedo under the codename 'Ongar', (apocryphally because Ongar, at the end of a London underground line, was a metaphor for the ultimate

[7] HMSO, Review Body on Armed Forces Pay Eighth Report 1979.
[8] Grenier interview.
[9] Thompson, *Nuclear Service*, 77.

torpedo).[10] The weapon became Tiger Fish, then the less personal Mark 24, and finally the Mark 24 Mod 0, with the compound name, Tigerfish, introduced into service in 1974, five years late.[11] It was accompanied by the TGCU2, the Navy's first foray into a digitised computer with its early ergonomic limitations, something that some COs found difficult to assimilate.[12] The failed trials in the *Warspite* in 1970 to see if a TGCU2 could fire the Mark 23 had sounded the death knell for what had proved such a poor weapon to have had at sea during the tensions of the Cold War[13] and by 1977, it had disappeared from the Perisher curriculum.

Tigerfish had problems and after rogue Tigerfish torpedoes had chased the Arran ferry its trials were expelled from the Clyde areas. The banning gave birth to a new range at Raasay called BUTEC (British Underwater Test and Evaluation Centre), a rather rough and ready affair to begin with and a shadow of its American counterpart, AUTEC (Atlantic Underwater Test and Evaluation Center), but a useful facility for the Post Design Services Team. The Mod 0 was an anti-submarine weapon so a development called Mod 1, capable of use against both submarines and surface ships was approved in 1968 with an in-service date of 1977 which became 1980.[14] Unfortunately, Tigerfish gained rightful notoriety with its reliability of only about 30%[15] so a rectification programme was started[16] though 146 weapons were loaded into submarines over one weekend in December 1980 in response to the Polish crisis.[17] Perisher began to consider Tigerfish in 1976, albeit only in the form of a project paper, one of five that the students produced.[18] Then in both 1977 and 1978, Perisher fired Tigerfish weapons that all worked perfectly but unfortunately in 1979 two out of the four failed again. In 1980 and 1981 there were no Tigerfish weapons for Perisher to fire at all. This can be compared to the typical 50 Mark 8 torpedoes successfully fired on other courses throughout the 1960s, 1970s into the 1980s using the TCSS family.

Alongside Tigerfish, a sea skimming version of the American UGM-84 Sub-Harpoon had been chosen over the British Sub-Martell for the RN's Under-Sea Guided Weapon in 1975. Trials in the *Courageous* in 1979-80 proved outstandingly successful with the consequence

[10] Hennessy and Jinks, *The Silent Deep*, 305.
[11] Branfill-Cook, *Torpedo*, 240.
[12] Ibid and Tim Hare interview March 2020.
[13] Bench interview.
[14] Ibid.
[15] Conley & Woodman, *Cold War*, 141-2.
[16] Robin Selby, *Sting Ray and Spearfish*, (Amazon: Kindle Version, 2016).
[17] Bench interview. This was an unofficial 'store for war' in preparation for the Soviet reaction to the Polish Solidarity Movement's challenge.
[18] COQC 1/76 Report. The other papers were: CO Turnover Notes; SSK CO (Designate) Course; Future Generation Submarine; and Proposed amendment to CSOs Section 3 'Safety Rules in Attacking'.

that three SSNs were fitted with the weapon for the Falklands and the Americans paid for the British development to incorporate the new profile in their own later production runs.[19] It would be a while, however, before Sub-Harpoon entered the Perisher curriculum.

As the 1980s were ending the weapon outfit was a mix of Mark 8 and Tigerfish Mod 1 weapons and it was time to get rid of old Mark 5 mines. As these were being dumped at sea five exploded on reaching their crush depth. This was a concern, for the warheads were the same as those in the Mark 8 torpedo designed for a Second World War submarine's diving depth. Now, of course, submarines went much deeper and there was a possibility of a Mark 8 being exposed to greater pressures. The consequence was the revered Mark 8 being condemned, even though Perisher would continue to teach Mark 8 attacks and submarines continued to carry the weapon until 1992. Until the weapon could be decommissioned the interim solution was for a condom to be placed over the torpedo tube inboard vent to indicate rising pressure from a leaking tube, possible flooding, and danger if the torpedo was taken deeper than its crush depth. In that state the *Conqueror* went to the Falklands.[20]

The first important event to the development of the TCSS 9 command system replacement was the serendipitous recruitment of Instructor Lieutenant Guy Warner, an Oxford mathematician, into the Submarine Service in 1966. Warner's appointment coincided with the development of DCA[21] (then called TDHS: Tactical Data Handling System) for the *Swiftsure*, but by the time he joined the project in 1972 it was too late for him to influence the design although he realised the software would have limitations which he knew could be resolved using Kalman algorithms which he wrote, and proved, but were not yet installed.[22] Meanwhile, the *Warspite* had collided with a Soviet submarine[23] and it was realised that the SNCP[24] programme was in urgent need of a BOA computer for close-range use. The Naval Projects Officer at AUWE, John Bench, designed and completed within six weeks, an interim DCD to solve the BOA problem for installation in the *Courageous*.[25] The two DCDs produced, which emulated the TBP but allowed an operator to generate a solution for range, course and speed

[19] Bench interview.
[20] Ibid.
[21] The nomenclature of 'DCA' and subsequent systems indicated: 'D' for digital; 'C' for submarines; and the third letter indicated the sequence of the system. 'A' was thus the first digital system for submarines.
[22] Warner interview
[23] RNSM Alliance Project interview with Tim Honnor. Hervey had come from command of the destroyer HMS *Cavalier* with no SSN experience or training and an inexperienced wardroom.
[24] SNCP: Special Naval Control Programme. Sometimes NASP: Naval Activities Support Programme. Sometimes 'special-fit' or 'sneaky-boats'. They had the JCO 26 special equipment fit.
[25] Michael Pitkeathly, WO(TSSM) & Captain David Wixon, Royal Navy(Eds), *Submarine Courageous Cold War Warrior*, (The HMS *Courageous* Society), 41.

to match the bearing rate, were technically a success.[26] But the typically dark humour of the operators in the *Courageous* with their "*much unloved DCD and its computer*",[27] viewed DCD more circumspectly when, for unknown reasons, it used to spew out paper tape "*usually at the least convenient time, much to the irritation and frustration of the CO, the embarrassment of the maintainers and the covert amusement of the rest of the Control Room Team*."[28] One can imagine the effect of this in a tense tactical situation. Successful as it was, however, DCD did nothing to relieve the manpower-dependency of the command system.

In 1974, DCA was given the Kalman algorithms developed by Warner[29] leaving the same ergonomics but now with the capability to deal with 25 contacts consecutively but DCA still had to be complemented by TCSS9, which was by now obsolescent. Its replacement was DCB, the first of which went into the *Sceptre* in 1978. DCB had the same DCA command system but with two sets of Control Room consoles and the Submarine Weapons Interconnector Sub System to replace TCSS9. It was fitted in all new-build submarines and back-fitted into the Swiftsure and Valiant class starting with the *Courageous* in 1978 where it had to be shoe-

Figure 7.1: DCB
Below: Either side of the PCO's console, are the Target Motion Analysis consoles. The two fire control consoles with their double screens are furthest away.
Images courtesy of Michael Pitkeathly and the Courageous Project.

[26] Bench interview. The *Warspite's* DCD was irreparably damaged in her fire in Liverpool.
[27] Pitkeathly, *Submarine Courageous*, 148.
[28] Ibid, 41.
[29] Bench interview.

horned-in, commandeering a wardroom shower and intruding into the space needed for the search periscope operator.[30]

Regardless of how successful DCA and DCB were to eventually prove, like all cutting-edge developments they suffered from teething troubles. Consequently, some COs kept a manual CEP as a fall-back. Even as late as 1983, when DCB with an automatic CEP called Diablo, had long replaced DCA, Martin Macpherson, CO of the *Trafalgar* on commissioning, had a clandestine manual CEP installed. Onboard for a celebratory glass of champagne, the then FOSM, Sandy Woodward spied the CEP and berated Macpherson who stood his ground and the two had to be parted by the FSL, John Fieldhouse; Macpherson got to keep his CEP[31] and so did future COs for even with the next generation of command system a fall-back CEP was retained in the form of a laminated board that gave about two hours tracking time.[32]

The *Sceptre* left Barrow in 1978 but it took time for trust to develop in the DCB. The *Sceptre's* CO, Rob Forsyth, was content with the fire control side of DCB but found the solutions being generated by the command side untrustworthy and there was no DCB attack teacher available to resolve the problem.[33] Forsyth's innovative solution was to use the *Nemesis* SCTT WRNSs staff and their adept use of DCA to compare their solution with the DCB generated solution. To do this he took the WRNS to sea. Forsyth was of the TCSS generation and, while he developed a good working relationship with DCB, getting to grips with

Figure 7.2: Diablo
The automatic CEP was introduced with DCB but COs retained the old manual CEP .
Images courtesy of Michael Pitkeathly and the Courageous Project.

[30] Pitkeathly, *Submarine Courageous*, 148.
[31] Email Martin Macpherson February 2018.
[32] Philip Titterton interview February 2019.
[33] Email Barrie Downer April 2018. A/S 1083 *Damocles*, the first DCB fitted attack teacher, was not commissioned until 1980. Nor was there a DCB for the maintainers to train on, merely a mock-up.

computer-based command systems was a struggle for many.[34] One reason was that the personal computer had yet to become common, a second was the training offered to officers. While the OTC received command systems instruction, command qualified officers' introduction to the technology was *ad hoc* and Perisher students receive no training at all.[35] The Americans, on the other hand, ensured their officers were given thorough training in their command systems.[36]

DCB was coincidental with the introduction of Sub-Harpoon and modified to fire the weapon but Soviet Battle Group tactics demanded a salvo fire of four Sub-Harpoons that called for a redesigned discharge sub-system integrated with the Command and Fire Control Systems.[37]

Other command systems were DCC, a spin-off of DCB for the Upholder class to be built in the late 1980s/early 1990s, and DCH which replicated DCB capability and was destined for ten O-class submarines starting with HMS *Onyx* in late 1987.[38]

After Warner, the second vital event was the appointment of Sandy Woodward to command the *Warspite*. When he had been Teacher, and was taking over from Sam Fry, Woodward realised that Fry knew the target was turning for the next training run because of the doppler shift in the active sonar on the escorts. Woodward had developed this as an attack technique for Perisher using tuning forks, he now used the principles in a way that would revolutionise the underwater battle. He was, he said:

> *"able to apply some fairly ordinary mathematics, which, with some simple electronic equipment to do most of the work, produced all sorts of amazing information previously unavailable to us."*[39]

His reference to the 'amazing information' would contribute to the introduction of the use of towed arrays and the narrowband trail.

The first British submarines to receive a towed array, Sonar 2023, were the Resolution class SSBNs in the mid-1970s followed by Sonar 2024, fitted to some Swiftsure class boats coupled to the Sonar 2007 analyser. Sonar 2007 was a development of Sonar 186 with a narrow band analyser, Sonar 2017, and steerable beams which enabled the submarine to steer a straight

[34] Ballantyne, Iain, *Hunter Killers*, (London: Orion, 2013), 298-9.
[35] Conversation with Commander Peter Green March 2018.
[36] Dan Conley interview March 2018. Dan received thorough American command systems training while at COMSUBDEVRON 12.
[37] Ibid.
[38] Barrie Downer, *DCH Progress Meeting, 9 June 1987*, Private notes .
[39] Woodward, *One Hundred Days*, 62.

course rather than the circling or sinusoidal course demanded by Sonar 186, although bearings were still manually transmitted.[40]

In the *Warspite*, Woodward naturally wanted to avoid another collision and the key, he surmised, would be the doppler shift. Not, this time, from a high-frequency active sonar, but from a low-frequency target radiated noise, often used for classification. The Submarine Tactical Development Group (STDG), (later the Submarine Tactical and Weapons Group) (STWG), started by Robin King to emulate the American's COMSUBDEVRON 12, had been analysing the *Warspite* incident and had concluded that a range-steady state in the trail would reveal the base frequency above and below which would indicate range-closing and range-opening independent of bearing movement. The first Submarine Trailing Manual was written by STWG[41] and a new generation of (circular) slide rules was created.[42] Warner then devised a mathematical formula to work on an HP35 hand-held calculator and a Range Evaluation Plot that plotted frequency rather than bearing. But getting to the base frequency was difficult.

> *"Initially when narrowband tonals became the trailing norm the RN fell into the trap of deriving a so-called target base frequency e.g. 300HZ. Having calculated or estimated target range, adjustments were made to this range based upon the observed Doppler shift up or down plotted on a time frequency plot. What was not appreciated was that tonals being emitted from a Soviet submarine were often unstable and what could look like opening Doppler was in fact a closing situation".*[43] ***It was realised that the observed frequency rate and bearing rate could calculate target range. This was called a 1959 range and its own circular slide rule was developed.***[44]

Richard Sharpe had his opportunity to put these ideas into practice in the *Courageous* in 1974 and he used a colourful but apt analogy to explain the BOA problem:

> ***"The most important and obscure of the submariner's black arts is the need to establish viable estimates of target course, speed and range, when provided only with passive sonar bearings. It is difficult enough when the noise source is constant, as in a cavitating surface ship propeller, but achieves a whole new plane of obfuscation when the contact is irregular. A simple analogy is that it is like being in a field with a herd of cows in pitch darkness. You can hear munching, the swish of tales, footfalls and the occasional seismic contribution to global warming, but only a fool would claim that he knows the exact PIM (position and intended movement) of any individual animal. Part genius or pure 'con job'."*** [45]

[40] Hennessy & Jinks, *The Silent Deep*, 375.
[41] Conley interview. The Approach and Attack Manual was written in 1987 by Conley at STWG.
[42] Email Warner April 2018.
[43] Email Conley April 2018.
[44] Ibid.
[45] Pitkeathly & Wixon, *Submarine Courageous*, 128.

This was all very new for the Perisher students and while one or two may have come from SNCP submarines where the skills were now practised, most Perisher students during the 1970s may have been aware of the techniques but were generally uneducated in, nor practised in, these new skills.

Another sonar development was the next generation of bow array sonars, Sonar 2020, in the early-mid-1970s that went to sea in the Trafalgar class in 1983. It was an evolutionary development from the Sonar 2001 with a chinstrap bow conformal array, improved vertical coverage and accuracy and improved processing and track management displayed on new twin 24-inch cursive displays that replaced the old Sonar 2001 chemical recorder paper rolls.[46]

Administrative innovation and Perisher evolution

In 1973, as the Swiftsure class started commissioning, responsibility for the COQC moved from SM3 to a new organisation initially called the Submarine Work-Up Authority, then briefly the Submarine Sea Training Organisation which, when abbreviated to SSTO, caused confusion with the stores organisation[47] and so the title was again changed to the Captain Submarine Sea Training (CSST). Fry was appointed as the first CSST for a limited period of nine months until Woodward took over.[48] The events leading to this change were sometimes dramatic and contentious. They started with some incidents in the late 1960s and early 1970s including the *Dreadnought* hitting an uncharted pinnacle at speed during an exercise off the west coast of Ireland. Then in June 1971, the *Artemis* sank alongside at *Dolphin* and in February 1972 there was the 'great submarine chase' when an SSN trailed a British SSBN thinking it a Soviet.[49] The events compounded to cause Commander-in-Chief Fleet, Admiral Sir Edward Ashmore, to bypass FOSM by sending a former Commander Sea Training, Captain (Dad) MacDonald, to

Figure 7.3: HMS *Artemis* sunk alongside HMS *Ocelot*.
The top of the Artemis' fin can just be seen alongside the Ocelot. The sinking epitomised a malaise in submarine practice that led to the introduction of Submarine Sea Training.
Image: IWM

[46] Kevin Butcher, *Sonar So Far*, unpublished notes.
[47] SSTO: Senior Stores and Transport Officer.
[48] Fry, *Rewarding Years*, 133.
[49] Woods interview.

review the submarine sea training organisation at SM3.[50] The report concluded that SM3 was overloaded and a third Captain SM was required at Faslane to complement SM3 and SM10. The report stimulated FOSM, Rear Admiral John Roxburgh[51] to initiate an enquiry under Commanders Mike Ortmans and David Borthwick. The results of this study and the creation of CSST were endorsed by the wider Submarine Manpower and Policy Study, known as the Cook Report,[52] which followed shortly after and while heralding a reorganisation of FOSM's roles, responsibilities and future move to Northwood, it recommended CSST taking responsibility for the Faslane Manoeuvring Room Trainer, the SCTTs, the later Nuclear Submarine Control Trainer and COQC. [53] Weymss, who was personally involved in the studies, records that blood was spilt and some egos bruised.[54] CSST, however, was to prove too big an organisation and so the COQC reverted to SM3 but in reality only for administrative purposes for Teacher really worked for the CoS and through him FOSM.[55] Thus, the Perisher demarcation lines were blurred but it worked because the main players shared a common interest in Perisher's success. *En passant*, Wemyss, when Captain SM3, told the students of their pass or failure rather than Teacher.

With the introduction of CSST and the development of Faslane to accommodate the growing nuclear fleet came the demise of Rothesay and the installation of a new generation of SCTTs, A/S 1080, *Pugnacious*, and A/S 1081, *Nemesis,* (A/S 1080D was to be the DAT update). Submarine command teams were now able to work in cohesion in the embodiment of Woodward's vision.[56] The SCTTs were cutting-edge computer-based technology appearing on the BBC's Tomorrow's World technology programme and they could operate independently or in a common exercise and thus SSN could fight SSK or vice versa[57] although long hours searching for each other was considered ungainful use and consequently, it was used infrequently.[58]

A command qualified Commander SCTT and Lieutenant Commander were supported by Weapons, Instructor Officers and WRNS who won accolades not least from Woodward as

[5º] Wemyss, private papers.
[51] Later Vice-Admiral .
[52] TNA DEFE 69/277 Submarine Manpower and Policy Study (Cook Report).
[53] RNSM A 2000/061 Submarine Sea Training.
[54] Wemyss interview.
[55] Fry, *Rewarding Years*, 135.
[56] Email Guy Sitwell December 2017.
[57] Graham Crofts, ex-Ferranti, Marconi and BAE and John Francis, ex-Faslane Ferranti Site Manager., unpublished notes.
[58] Email John Francis January 2018.

many became experts in the tactical situation and attack process.[59] The staff conducted training in idiosyncratic ways but left Teacher to conduct his course. The Lewis-famed Smoking Room was no longer available nor was the informal Rothesay atmosphere, except when initial teething problems caused the staff and students to take the *James Bond,* down to Rothesay where they would open up the old attack teacher.[60] Each Teacher had his own style of delivering lectures, often after a working day with a beer. Paul Hoddinott recalls one with a tongue-in-cheek delivery but practical themes: maintain your sleep, you never know when you will get the next opportunity; do a bottoming exercise before a docking, you can then explain any scrapes; and be aware that as a submarine CO, women will find you attractive, but you will not always be a submarine CO.[61]

A side benefit of the new SCTTs was that the Navy was introduced to Training Needs Analysis (TNA) and commercial world practices from companies like Marks & Spencer.[62] Training desiderata and key training clues were built into the simulation to provide flexibility, for example, the ability to stimulate a reaction to a surprise contact.[63] This was good for Perisher, for its training needs began to get formal recognition even though TNA had yet to reach the course itself.

Following Woodward's changes, there was a growing acceptance in the 1970s of his ideas that the COQCEX periscope weeks were safety training, and as COQCEX started to decrease and as Cockfight, increased in length, this latter tactical part of Perisher became the more important. This can be seen in the Teachers' comments: "*The most important part of the course.* [Prowlex] *The pressure is still there, but this is where the flower should blossom, and confidence really comes to most*" and "*the most important part of the course … weaning away from the periscope course …considerations such as ECM policy, no cavitating, sonar policy, snorting policy, overall patrol policy etc etc become the major considerations.*"(sic)[64] This allowed Teachers to look at students' reactions to different pressures and their management of stress, and to introduce them to risk-taking. The assessment, while it continued to be pass/fail, took on a different hue, it was not made just on their periscope attacking capability but much more on their 'command' abilities.

[59] Email McLees January & September 2018.
[60] Email Sam Poole October 2017.
[61] Paul Hoddinott interview June 2020.
[62] Work led through a Ferranti team based in Chichester which dealt with commercial companies.
[63] Butcher, *An integrated systems approach*, unpublished notes.
[64] RNSM A 2014/016, Authors unknown, 130 and 139.

In 1972 FOSM (and so Teacher) came under pressure to reduce the number of surface ship assets required for Perisher. Teacher at the time, Terry Woods' solution was to emulate the wartime Perisher and run double courses, with two Teachers, twice a year thus allowing the surface ships to transit two adjacent exercise areas with a Perisher submarine in each area. The Teachers became known as Teacher A (or North) who was COCOQC, and Teacher B (or South) would later relieve Teacher A.[65] There were also NATO and requalifying courses. The NATO Teacher was usually a likely-to-be-promoted Lieutenant Commander. Nigel Franklin ran the 1970 course followed in 1971 by Tim Swales who was both a talented submariner and an accomplished pianist, much to the benefit of the Perisher's runs ashore. Teachers frequently thought of the future. For example, in 1977 Toby Frere was planning for a move of the Maritime Tactical Course (MTC) to the end of the course and the inclusion of an SSN for a week for the first time. It seems that this latter intention became the stimulus for a Perisher review. Frere was asked to look at two questions: 1. Does the present COQC fit an officer for command? 2. How will the COQC change in the future? He concluded in favour of the periscope weeks viability to check for safety capability although he conceded the dichotomy of 'whites-of-the-eyes' weeks for safety assessment and the teaching of 'real' tactics. The idea of moving the Periscope Course to the AC (previously PCO) course — a resurrection of Woodward's idea — was reviewed and he sensibly argues against sending someone in command without tactical training and assessment but in the absence of Frere's final report, it is impossible to confirm his familiarity with Woodward's intent to provide tactical training before command, so his rejection of the move is puzzling.[66]

Rob Forsyth recognised that Perisher was suffering from 'hysteresis'[67] with the course lagging behind the impact of the nuclear programme. He suggested a three-week Cockfight: two weeks SSK-based and a third week, for the RN officers only, to "*Carry out SSN Operations as watch leaders*".[68] But any ascendency of his ideas was deflated by the strong opprobrium of his successors, Geoff Biggs and Barry Carr, whose lobbying to leave Perisher largely unchanged, commenting that "*the COQC must be evolutionary and not revolutionary*", prevailed.[69] Carr's views had substance for, following Cockfight, the 78/1 course spent a five-day 'trailex' in the *Churchill* and *Superb* generating two viewpoints. First, the students who had

[65] Terry Woods interview January 2019.
[66] RNSM A 2014/016 Forsyth's notes.
[67] When the value of a physical property lags behind changes in the effect causing it,
[68] COQC 2/76 Report dated 21 October 1976.
[69] RNSM A 2014/016, Carr's notes.

just completed Cockfight as CO felt acting as a Watch Leader was a backward step. Moreover, on one of the boats:

> *"the CO was in his first nuclear submarine. Some of the Perishers had had considerable nuclear experience and started to operate the submarine in a proper nuclear role. This exceeded the CO's spectrum of experience and expectation and his submarine was effectively withdrawn from … the students."*[70]

Carr offered five reasons for discontinuation including: "*It is very difficult in the large SSN organisation to establish a Lieutenant as the Duty Captain - he was often missed out in the chain of Command reporting*."[71] Nonetheless, by 1979, John Lang was also seeking to reduce COQCEX from four to three weeks as the emphasis shifted from COQCEX to Cockfight but it would be a decade before anything nuclear associated happened.

Grenier lays the blame for this situation at the laziness of corporate thought where nuclear command was considered just part of the progression process that had been so steadfast throughout the Submarine Service's history.[72] This is a harsh criticism, especially against himself, for the Submarine Service was expanding fast and was operationally heavily loaded. But it is based on the reflection that those responsible for overseeing Perisher, the Captain SM3, CoS and FOSM, did not engage with the Teachers. Indeed, no Teacher recalls having any such conversation or direction as to how to conduct himself in the role and nor was the job of Teacher documented. The weakness was the challenge of *quis custodiet ipsos custodes*?[73] Meanwhile, the nuclear programme continued to have subtle effects on Perisher. As has been seen, Richard Sharpe knew how far behind the Americans the RN was and set out to change matters first when in command of the *Courageous* in 1974 and then as the Warfare Officer on the staff of FOSM, where he wrote the seminal document for submariners, 'The Concept of Operations' with its maxim "*Not only prepared for war but operationally committed to today's confrontation*".[74]

SGM 1503, with modifications, lasted into the 1990s, but the testament of almost every Teacher relates instances when students should not have been on the course. These indicate that selection problems continued and there is also clear evidence that the Perisher selection process was used at times as a cleaning-out exercise of senior First Lieutenants by COs, (supported by equally poor judgements by the Captains SM) unwilling or unable to give the 'No' recommendation. Woods experienced this with COQC 2/74 when he was given six "rather dull

[70] First Devonport Forum.
[71] RNSM A 2014/016, Carr's notes.
[72] Grenier interview.
[73] Second Devonport Forum.
[74] Email Guy Warner April 2018

students"' and the admission by CoS that he was "clearing the list".[75] Ironically there is evidence to suggest that a 'No' candidate for Perisher could well have been relieved at not being recommended for, as Lang observed, some people go on Perisher knowing in their hearts that the job of CO is not for them but hoping they will get through Perisher to continue their career. In 1976 Geoffrey Biggs questioned why the whole course of COQC 2/76 was both recommended and then selected when it was known that they were a weak selection, he termed them 'grey'.[76] Clearly, the selection process had failed and only three out of the eight RN students passed COQCEX. The consequences were considerable consternation both upwards and downwards and FOSM, while rightly pointing out that the experience justified a Perisher, had to write a 'don't panic' letter to reassure young officers about their future.

The first student to be selected for Perisher with no previous SSK experience was on Course 2/79.[77] Fortunately, he was highly intelligent and able to overcome his SSK inexperience to pass but was unable to fulfil his promise and never commanded. That was partly because 2/79 was also the first course where there were insufficient SSK commands for the students and he was one of two officers who went to an SSN as the XO. This had the implication of a second-class pass and it was unpopular although the officers who experienced the early practice, like David Cust, agreed that in the end, it was beneficial. At first, however, Cust felt as if he was being given a further hurdle to jump but as XO of the *Dreadnought* he was fortunate in his captain, Johnny Clarke, and he felt the experience made him a better SSK CO. Tim McClement went to the *Conqueror* and war as XO, thoroughly enjoyed himself and also found the experience beneficial; it certainly did nothing to limit their careers, McClement became a Vice Admiral and knighted, and Cust a Commodore. The consequence of the practice becoming normal was SSK COs becoming older with the extreme example of David Southcott. By the time he had completed Perisher, spent three years as an SSBN XO and six months ashore, he was 37 and initially FOSM considered him too old for an SSK command but acquiesced and Southcott commanded the *Opportune*.

With the consolidation of the new practices, an evolving curriculum and a shifting emphasis, COCQEX decreased in length and Cockfight lengthened. By the end of the decade, visual attacks were three weeks in the attack teacher followed by four weeks at sea but tactical training had increased to four weeks in the attack teacher and a comprehensive two-plus weeks on Cockfight. This can be seen in Table 7.1 with the detail of Cockfight in Table 7.2.

[75] Woods interview.
[76] RNSM A 2014/016, Biggs' notes.
[77] Nomenclature formats changed periodically.

Notable is the addition of the MTC at HMS *Dryad.* In the late 1960s students attended the JASS between the periscope weeks and Prowlex until the benefit became questionable and then JASS closed in 1970. Both HMS *Vernon* and the Joint Maritime Operation Tactical School at Turnberry were tried for tactical training but neither were found satisfactory, so Perisher decided on the MTC although the course was criticised for its length and time profligacy.

Table 7.1: Comparison of COQC

1970 one course curriculum		1978 two parallel courses curriculum	
Weeks		**Weeks**	
2	Technical Courses	2	General Acquaint Courses and Visits
2	Leave	3	Attack Teacher Training, Dolphin and Faslane
2	Dolphin Attack Teacher	4	COQCEX
1	Rothesay Attack Teacher	4½	Tactical Training, Dolphin and Faslane
1	Dolphin Attack Teacher	2 ½	COCKFIGHT
4	COQCEX	2	Leave
1	LRMP Course RAF St Mawgan	4	MTC, HMS *Dryad*
1	ASW Course, HMS *Vernon*	n/a	CODC
2	Tactical Course Dolphin		
2	PROWLEX		
Total 18		Total 20+	

COQC 70/3 & COQC 78/2 Reports

Table 7.2: COCKFIGHT 1978 (21 Oct – 6 Sep)

21 October	**Ocean Operations**
	Covert transits Dived R/V Co-ord Transit 3 days SSX Two days Attacks on the Surface Forces UW L on two Leander Class FF (with LRMP opposition throughout the Ocean Phase)
30 October – 6 November	**Surveillance Patrol and Inshore Operations**
	Photo-recces Minelays SBS Operations (without Royal Marines) Bottoming Minefield Penetration Agent recovery Use of R0E Intelligence gathering

Faslane COQC Records, COQC 2/78

Perisher Shibboleths

The management of pressure and stress

Submariners frequently refer to the 'stress of Perisher' and Teachers talk about pressure causing the terms stress and pressure to become interchangeable, so it is necessary to understand the difference between the two. In an inanimate object stress is internal and pressure external, and it is similar in a Perisher student. There is 'Chronic Stress' or 'Occupational Stress' related to conditions in the workplace.[78] As can be imagined, a submarine inherently induces chronic stress. Additionally, the student brings stress on course usually associated with family, finances, the car, the mortgage, whatever is significant, and each student is different but a common factor is fear of failure.

'Pressure' is "[a] *situation in which you perceive that something at stake is dependent on the outcome of your performance*".[79] In the extreme, when it is threatening, life-endangering or traumatic, pressure can become 'acute stress'. This is not as bad as it sounds for it can stimulate performance and it is something a student will experience repeatedly on Perisher. But, when that pressure, now stress, becomes too much, when "*the perceived demands (stressors) exceed perceived resources to cope with* [the] *demands*"[80] it becomes 'catastrophic failure'.[81]

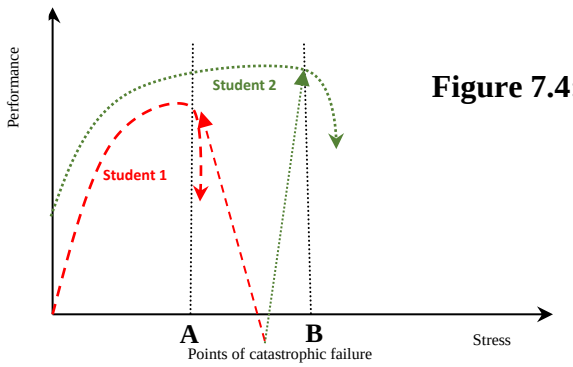


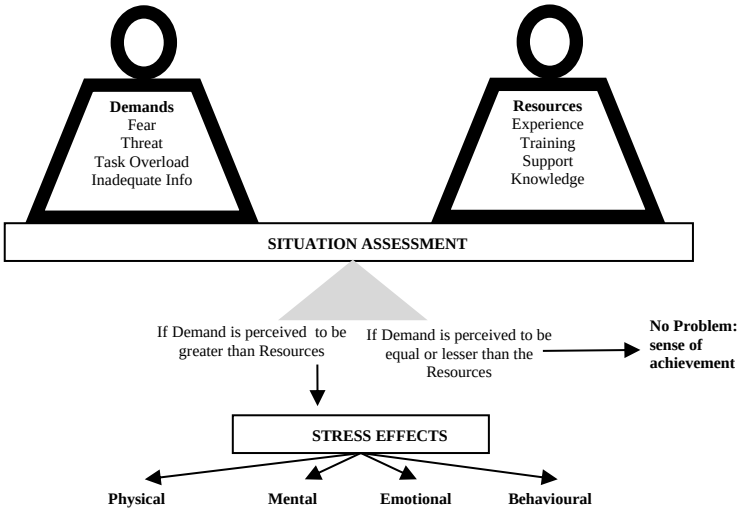
Figure 7.4: Stress

Each student starts the course with a level of stress. As Stress increases from Level A to Level B, Student 1 will have reached his Catastrophic Failure Point whereas Student 2 will be near his optimal performance.
Source: David Charlton

[78] Rhona Flin, *Sitting in the Hot Seat*, (Chichester: John Wiley and Sons, 1996), 98.
[79] Hendrie Weisinger and J.P. Pawliw-Fry, *How to Perform Under Pressure*, (London: Hodder and Stoughton, 2016), 37.
[80] Flin, *Sitting in*, 100.
[81] Ian Beadle interview July 2020; Charlton interview. For a more neurological exploration of stress see Colin A. Wastell in John Reeve and David Stevens (Eds), *The face of Naval Battle*, (Crows Nest NSW Australia:Allen & Unwin, 2003).

No two students' points of catastrophic failure will be the same. The key is the student's judgement of "*the degree of demand in the environment (danger, time pressure, responsibility) and whether his or her personal resources, (knowledge, skills, support from others) can match these*".[82] Many factors come into play shown as a balance mechanism in Figure 7.5.

Figure 7.5: Rhona Flin Stress Process Model



From: Rhona Flin, *Sitting in the Hot Seat*, (Chichester: John Wiley and Sons, 1996).

As discussed earlier, it is easy to see from the exploits of COs in the Second World War the stressors that life-threatening situations aroused. Every event was stressful, and those stressors manifested themselves in various ways. It is not surprising therefore that Perisher should ensure that aspiring COs can cope with pressure and stress.

That the mental arithmetic put the student under pressure and allowed the Teacher to see a student's stress levels is indisputable; the more ships the greater the pressure as was Woodward's intent. Some Teachers were dogmatic about how these mental sums should be performed; others recognised that people's brains work in different ways. That was the experience of Tim McClement and David Charlton who had had difficulty with the rote method of mental arithmetic during their own Perishers and so when Teacher they made sure that students were aware of alternative methods of calculation.[83] Some, such as Martin Macpherson and Doug Littlejohns, had no problem, indeed their Teacher, Rob Forsyth, worried about keeping ahead of them for they saw Perisher as a challenge and an opportunity to 'take on Teacher'. James Burnell-Nugent, a Cambridge mathematician used cosines rather than sines for his mental arithmetic and at the other end of the spectrum, Colin Stockman, a classics

[82] Flin, *Sitting in*, 100.
[83] Vice Admiral Sir Tim McClement and David Charlton interviews March 2019.

scholar and feeling equally confident, conducted an attack in Latin, first taking the precaution to brief the ship's company so that they knew that '*citado gradu, inundate Q*' meant 'full ahead together, flood Q' … but his Teacher, Johnny Clarke, did not.[84]

For most students, Teachers observed that pressure became a stimulant as a student's proficiency improved.[85] Seeing this, Teachers would add artificial pressure such as Mackenzie's 'lash' and Fry's bells and silly tricks which seemed to both stimulate and lighten the tension.[86] Late-night drinking developed a reputation during the 1950s and 1960s and was principally used by Teachers to add to the pressure on students by having to go to sea the next day short of sleep and maybe with a numbed brain, symptoms, if not the cause, of a wartime scenario. But it may be a calumny to press the reputation too hard, this was, after all, a career make or break course and while the occasional celebration happened — Fry, for example, had a party on Thursday nights[87] — only one Teacher mentions the practice as being with purposeful intent and he recalls the perceptive student seeing through the masquerade and going to bed and by the later 1970s the golf course was probably more popular.[88] But tiredness is a constant issue for COs and a student had to experience making decisions when tired and to learn the necessity of sleep. As Hoddinott was advised, "*sleep is a weapon*".[89]

Cockfight pressures were different to COQCEX, operationally more realistic and often associated with risk. Hazardous navigation was an important pressure as were the weather (visibility especially), warships, aircraft, merchant ships and fishing vessels and again sleep, and Teacher did not control all these pressures. The aim was for a student to emulate Fieldhouse by having "*the gift of being able to absorb pressure while seeming to remain relaxed*"[90] — a hard act to follow

The purpose of putting the student under pressure was not for him to reach his catastrophic failure point but to apply pressure empathetically for the student to experience how he could cope with stressful situations. The majority did, hence the 75% pass rate, but students who developed acute stress-triggered their body's stress response system and over-produced adrenaline which "*decreases the ability of the brain to carry out even relatively simple mental tasks, in particular arithmetic ones*",[91] i.e. the notional seven processing channels are

[84] Interviews: McClement, Charlton, Forsyth; Second Devonport Forum.
[85] RNSM A2014/016 passim.
[86] Grenier and Belton interviews.
[87] Fry, *Rewarding Years*, 98. Later, the Perishers would host the officers from the Perisher boats to dinner.
[88] Forsyth and Derek Anthony interviews November 2018.
[89] Hoddinott interview.
[90] Basil Watson, *Commander-in-Chief*, (RNSM: Gosport 2005), 43.
[91] David Charlton, Stress Presentation to Aberdeen OIM Conference 1992, private papers.

overwhelmed.[92] Various reactions have been observed in students: illness, 'worried sick'; aggression, commonly misdirected; mental freezing and lack of acuity; inability to prioritise, butterfly actions or focusing on the facile or trivial; ostrich actions by not accepting reality; seeking safety by 'praying to the periscope'; reversion to specialism: navigators go to the chart table and miss a near collision, sonar officers control the tactical plot but nearly run aground; reversion to type, if an officer has been masquerading, his real character will be exposed.[93] These are all signs for a Teacher to fail the student who has demonstrated an inability to cope with the expected pressure and stress of command. Perisher has unveiled a weakness.

The risk versus safety conundrum

The story of Mars' fortitude in Chapter Five had a successful denouement, he torpedoed the Italian cruisers *Bolzano* and *Attendola* both of which were put out of commission.[94] The moral is that Mars was (capably) taking a risk and if COs had to face such risks Perisher had to prove them capable of doing so. This became the increased focus of Cockfight as it lengthened and students were expected to plan and execute potentially risky serials, typically minelays, photo-reconnaissance and special forces all in navigationally challenging waters. Teachers generally frowned upon a risk-adverse plan (only one Teacher said he would not fail a risk-adverse student)[95] and would introduce risk challenges followed by encouraging the student to do the unsafe thing but to do so consciously to build confidence and as a test of the student's decision-making, tactical/spatial awareness and mental and physical stamina limitations. Charlton makes the analogy of exceeding the speed limit: you know the limit and the penalty, so you drive more carefully. Played into an operational scenario the balance may be between a successful mission and counter-detection, collision, grounding or worse.[96]

Teachers placed great store in these risk serials as their words reveal: "*the most important thing you give a Perisher is the knowledge of where his limits are*",[97] "*of all the disciplines taught and tested by the Teacher the single most important is to ensure all future COs are conscious of their own limitations*". [98] If the student accomplished the mission, he demonstrated his capability to Teacher and gained a valuable lesson for the future. At sea, every CO faces

[92] George Miller, The Magical Number Seven, *Psychological Review* 63(2), 81-97.
[93] Charlton, Stress Presentation.
[94] Hezlet, *Submarine Operations*, 162 & Mars, *Unbroken*, 126.
[95] Perfect interview.
[96] Charlton interview.
[97] Grenier interview.
[98] Admiral Sir Mark Stanhope, *The Modern Perisher*, article written for an RNSM book as yet unpublished.

continuous risks and as seen, Thompson humorously identified risks, but risks demand analysis, skill and judgement, for:

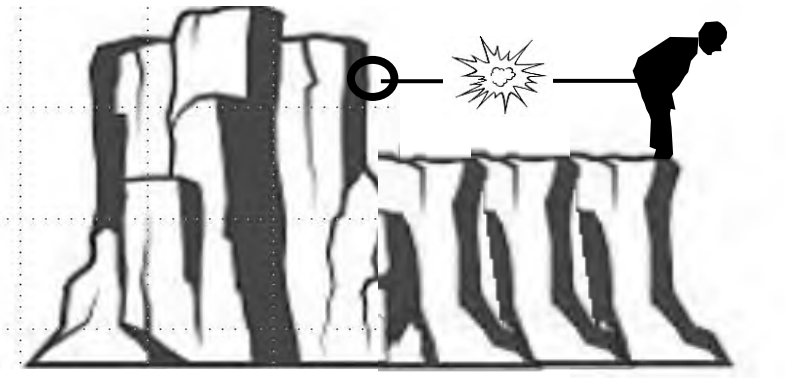
> *"being a submarine captain is knowing when to take risks and how to take risks"*[99]*; more specifically "SSN command is a risk-benefit-analysis job. You are sometimes asked to do dangerous things and the biggest job of the CO is to look at the risk against the benefit that might be accrued, working out the safety lines within your limitations".*[100]

Here are the two most important leitmotifs of Perisher, 'safety' and 'limitations', and there is a close relationship between risk, safety, pressure and limitations: "*to be safe you need to know your limitations*",[101] "*with risk comes pressure*",[102] "[A CO's] *own limitations are the limiter for risk*".[103] If a CO is to be both safe and successful he must stay within his limitations: "*Of all the disciplines taught and tested by the Teacher the single most important is to ensure all future CO's are conscious of their own limitations*."[104] But the experience of risk can be elusive:

> *"you can formalise, mandate, regulate, scrutinise, and criticise risk-taking, but unless you have taken proper risk with proper consequence (and probably experienced the consequence), you can't know risk. Risk is never simplistic. From the outset, you need to accept you cannot remove it entirely."*[105]

Munns saw this job of Teacher in an analogy with his students on a mountain ledge tied to the mountain by elastic. To be effective, they should feel the elastic pulling as they peered over the edge of the ledge. Some found the pull overcoming and never reached the edge. For others, it was so weak that they ignored it and fell over the edge. Perisher aimed to teach students the value of the correct balance between the pull of the elastic (back to safe but ineffective operation) and the temptation to overstretch and perhaps head into danger.[106]

Figure 7.6: Munn's analogy



Mars' experience was an example of Munns' elastic.

99 McLees interview.
100 Moores interview.
101 Grenier interview.
102 Ryan Ramsey interview April 2020.
103 Stanhope interview.
104 Stanhope, 'Modern Perisher'.
105 Ryan Ramsey, *SSN14*, (Bloomington IN: Xlibris, 2016), 163.
106 Munns interview.

Mars stretched the elastic to its limits but not beyond the limit of proportionality; it did not snap. The value of the analogy is also described by the German U-boat commander Reinhard 'Teddy' Suhren when he commanded U-boats in Norway in 1944 and one of his Commanders had confessed to being scared before an attack. Persuading the man that this was normal, Suhren convinced him to return to sea with the proviso that should he be unable to overcome his fear, a codeword message would ensure his recall. The man had a brilliant patrol returning to harbour bursting with pride only to have his bubble burst by Suhren bringing him ashore. Suhren reasoned that the Commander had reached the extent of his elastic and the next patrol would undoubtedly break it.[107]

Teacher's pass/fail contention

It was the job of Teacher to assess a student's capability to be a submarine commanding officer. The criteria for assessment, however, had changed. Since 1945, and especially since the Woodward revolution, assessments had evolved towards command capability with the benefit of a lengthening Cockfight, during which a student must deal with tactical, technical and sometimes even personnel situations for a much longer period within the command team philosophy rather than the periscope-orientated one-man-band. This more command-capability-taxing environment enabled Teacher to assess a student's fuller portfolio of attributes. In the view of at least one Teacher, it took too many years after the war for the course to change while both the assessment and mystique of Perisher, based around a mathematically based technical attribute, was guarded by its alumni to mask other evolving technical attributes of increasing importance. The five-ship attack outlived its necessity while command capability remained a poor cousin and management ability was not even considered.[108]

As Cockfight became weeks rather than days, and the importance of COQCEX morphed from attacking to safety, command capability, discussed in Chapter Two, began to take precedence over periscope attacking. That played to a Teacher running a four- or five-month course who had time to see a more complete version of the student whereas the wartime Teacher was time-limited.

As seen, it is difficult to produce a common definition of command although both Teachers and COs were, unsurprisingly, aware of all the command attributes if not as academic definitions but certainly in the empirical sense. But with no documentation, and only vague

[107] Teddy Suhren, *Teddy Suhren Ace of Aces*, (Chatham: Barnsley, 2017), 216-217.
[108] Munns interview March 2019.

directions as to why students should pass or fail for reasons other than periscope safety,[109] they would make their assessments reflecting their own experience and nuanced appreciation of what was required of a CO thus perpetuating a special part of the submariners' culture. What Teachers wanted to see was how a man's command presence, his character, personality traits, technical knowledge and tactical capability could come together to show that he would be a safe CO, that he could operate under pressure and carry stress, and that he knew his risk limitations. Until the 1990s and the appointment of the McClement-Anthony-Stanhope triumvirate with their nuclear command focus, students were considered for SSK command only. Reflection suggests that this was a failing as the nuclear fleet grew.[110]

Except for the very confident almost all students would join the course with an element of doubt, mindful of the finality of failure, it was part of the self-inflicted stress. Most students equally had a 'Damascus' moment when they realised they could assume the cloak of command. It may have been a complex or simple thing: realisation that the seemingly impossible was doable,[111] a serial executed with panache or just a kindly word from Teacher. That point was marked by the way his orders ceased to be mere parrot-cries and were given because of a personal appreciation of all the factors of the situation.[112] This can only be achieved at sea, on Perisher. It was all too evident to Teachers if a man could not reach that moment for he would see him writing his destiny as he started to get things increasingly wrong and both student and Teacher knew it. The student's demeanour would reveal his mental state as he entered the downward spiral of loss of confidence and Teacher saw in his eyes "*the spent quantity*".[113] While there are no absolute standards the consensus is that such a state is driven by the man who fails to establish his limitations and unknowingly crosses them.

The decision as to failure was the sole province of Teacher and had to be subjective based as it was, at least in part, on the undefined criteria of command presence. Without exception, Teachers were aware of the enormity of this responsibility, how it would affect the individual and the effect it may have had on his career. It was, therefore, never taken lightly and Teachers talk about taking pains to ensure as much objectivity in their assessments as possible. The decision was, nonetheless, pass or fail.

[109] McLees interview.
[110] Forsyth, Grenier, Lang and Perfect interviews.
[111] Weale recalls getting past a totally darkened, stationary and quiet Type 23 frigate on a pitch black night in the Minches.
[112] Wemyss interview.
[113] Clarke interview.

Fortunately, Teachers had three benchmarks against which to measure their decisions. The first was the CO of the Perisher submarine who would have seen the Perisher students at close hand and was well-positioned to judge their performance against the generally known expectations of the Submarine Service. The second was the senior officers who generally took the opportunity to ride the Perisher boat in the late stages of the course. As experienced COs they could spot both strengths and weaknesses in a candidate. Ryan Ramsey took these senior observers a step further experimenting with two senior police officers. Although unfamiliar with the idiosyncrasies of the Control Room they were most familiar with the attributes of command and recognised issues with one student advising greater pressure. It proved Ramsey's misgivings and the man failed.[114] The third benchmark is the submarine's ships company whose confidence in their commanding officers is formed from the great store and pride they place in their COs having been thoroughly tested. Teachers would take pains to brief the ship's company before they started running for Perisher and they, in their turn, would invariably work hard for the students but they also kept a weather eye out for the student who lacked technical capability or the intangible command and leadership qualities. "*It was quite easy to tell when the ship's company did not like the student by the way they reacted to him*".[115] A ship's company could not fail a student, but they could make sure their opinion was seen by Teacher. History suggests that they were invariably right. For the man who made his own decision to withdraw, Teacher could usually do nothing implying that personal determination, perseverance and desire were requisites for success.

In comparison to other naval professional courses where a student could be graded against examination marks, there has been no formal marking scheme or grading in Perisher. Teachers, therefore, used subtleties in their assessments, for example how the comments on a student are phrased and the order of students on which the comments were made, the first indicating the best. Unfortunately, the Teachers' end of course student reports have not survived for the full life of Perisher but glimpses can be seen as in the early days when a student was classified as good/sat/unsat. Post-1945 there is no standard category of wording but in 1953 adjectives were used: useful/satisfactory/above average ability/reliable and satisfactory. In 1958 Teacher tried to be a little more explicit with expressions like "*may well prove outstanding*" (the officer in question did not prove worthy of the comment) but they then reverted to the laconic brevity of predicting an 'above average', 'good' or 'average' commanding officer. Woodward himself is

[114] Ramsey interview.
[115] Lang interview.

one of the more obscure reporting officers, examples being: "*good command potential*" (the student's name suggests this is the highest category) or "*should make an excellent/above average/first-class/satisfactory commanding officer"*. The last reports available to review stem from the 1970s when there appears to be more consistency. In 1978 Barry Carr graded his students using phrases: he will command a 'very happy and successful' or 'happy and successful' or 'very happy and operationally efficient' or 'happy and operationally efficient' submarine. Thereafter, reports on students are rendered as annexes lost to the archive although in the 1980s some Teachers commented on how well or otherwise students had performed on different serials, but they do not indicate overall performance. Interestingly, no Teacher predicts stardom nor, indeed, a future Teacher although there is one recommendation for a future RAT CO/XO, a clear indication of a competent attacker.[116]

Were the assessments accurate? With only one exception,[117] no commanding officer questioned his Perisher or the veracity of his Teacher's decision to pass him. Nor, importantly, did those who failed. Teachers, unfortunately, were sometimes pressed into passing foreign students against their better judgement and were usually proved right but never an RN student although sometimes they worried over one or two. There was a consensus that one measure of the effectiveness of Perisher is proved by there being so few serious submarine accidents but as Iain Breckenridge, who presently has responsibility for Perisher, points out, "*we do not get to assess how effective a particular SMCC was until 4-6 years later when the successful students move to Command*." Breckenridge certainly has confidence in the modern Perisher: "*Given how well these CO's are performing during longer SSBN patrols and specific intel missions (both real leadership and mission command tests) points to the courses of circa 2014-16 delivering good products*." Meanwhile, the only decision Teacher can make remains pass or fail.[118]

[116] COQC Reports.
[117] He asked for his comments to be anonymous.
[118] Email Captain Iain Breckenridge, FOST Captain (Submarines), November 2020.

Evolution Towards Nuclear: 1980s

Various developments.

In 1980, Perisher had an accommodation problem. After the Glenburn and Victoria hotels, the latter with the wood carving over the bar, 'He who hoots with the owl by night shall not soar with the eagle at dawn',[119] Perisher used the Craignethan Hotel but in late 1979 the hotel burned down. Martin Macpherson had recently joined as Teacher B, and before he and John Lang, Teacher A, could further shift the emphasis toward the Cockfight serials they had to find a resolution to the potential hotel crisis for COQC 1/80. Various places were considered but at Brodick, the Douglas Hotel was in receivership and although rather shabby there was much going for it from a Perisher standpoint, especially that Brodick was on the doorstep of the exercise areas. A deal was struck with the unintentional benefit that the Receiver offered to sell the wine cellar and a student of COQC 1/80, Huntley Gordon, was something of a sommelier. He spotted some extremely high-quality port allowing Perisher to collectively buy 10 or more cases at £3 a bottle rather than £20+. The change of venue was also to prove a success.[120]

Cockfight was again timed to coincide with the JMC which sometimes brought with it an unexpected Soviet submarine or spy ship intruder. Surface ship assets were negotiated with Fleet Headquarters, a popular solution being STANAVFORLANT[121] which, with its international mix of ships of different heights and speeds gave the students an added challenge. COQCEX was reduced to 15 days by 1984 with a name change to 'Safety and Attack Training' and the Mark 8 was finally replaced by ASuW Tigerfish attacks.

The name change made no difference to Perisher submarine ships' companies, for while the students, Teacher and Submarine Service at large may have enjoyed the mystique of Perisher, for the crew of a Perisher submarine life was long days and hard work. Colin Clarke described them:

> *"The submarine would moor in the evening and immediately start loading torpedoes for the following day's firings finishing just in time for a quick run-ashore before a 0500 start cleaning the boat, breakfast and being ready to dive by 0700 with the Perishers embarked. The submarine would then be in two watches with Action Stations in between; survival depended on short periods of sleep. (It is hard to imagine any other walk of life including the surface navy where such rigours would/could be tolerated)."*

[119] Ring, *We Come*, 173.
[120] Emails John Lang and Martin MacPherson October 2019.
[121] Standing Naval Force Atlantic, a NATO joint force.

As a back plotter on the TBP Clarke had a ringside seat and could watch the idiosyncrasies of students putting him in a good place for the 'betting book' or sweepstake as to which students would fail. It cannot have added to a weak student's confidence to "*hear the chanting of 'James Bond is just around the corner' by members of the ship's company as the students passed by*."[122] Black humour and perhaps unfair additional pressure indeed, but then, there was no room for escape in an SSK. Any sympathy there was for a disembarked student was quickly dispelled by diving, continuing the attacks, watch keeping, scrubbing-out, loading torpedoes and a few beers ashore before another early morning start.

Submarine availability was sometimes a problem solved by using foreign boats. For COQC 1/80 the Dutch provided with HNLMS *Zwaardvis*. Lang was pleased with both boat and crew[123] although she was less well received in 1985 by Rob Stevens who considered the weapon system differences difficult. The Canadian HMCS *Onondaga* was used in 1986 taking advantage of the same language and class of submarines although McLees, like Stevens, found the different weapon system an encumbrance. By COQC 2/82 a 'surveillance serial' introduced by Frere in 1975 was called 'Binting' (basic intelligence gathering) and used both scheduled and targets of opportunity, for example a submarine transiting back to Faslane through the exercise areas.

Lang introduced "*the most comprehensive CO designate courses*" following the MTC at Dryad that included a Ship Command Warfare Exam refresher, a Senior Officers Divisional Course and lastly, ship-handling.[124] The latter should be compared to earlier times when First Lieutenants, and Third Hands, were given Harbour 'Driving Tickets' qualifying them, for example, to take a submarine from the *Dolphin* berths to Portsmouth Dockyard. The Ticket appeared on the SGM 1503. To compensate for the lack of experience, four days ship-handling in an SSK was added to the CODC. In 1983 Dai Evans introduced narrowband sonar training into the SCTT tactical training and then in the *Oracle* at sea with a towed array for Cockfight. Surprisingly with hindsight, he was criticised for teaching new tactics, which was considered the job of STWG rather than Perisher. His rebuff was to have the students think more deeply about tactics and produce a draft Submarine Operating and Tactical Instruction.[125]

The Evans Perisher also became the focus of a study by Surgeon Commander Morgan O'Connell, a specialist psychiatrist in stress and PTSD. When Dick Heaslip, who had not been Teacher, relieved Sandy Woodward as FOSM in 1984, he was concerned that students were

[122] Emails Colin Clarke April 2020.
[123] Email John Lang March 2020.
[124] COQC Report 1/80 dated 2 June 1980.
[125] COQC 1/83 Report dated 8 August 1983.

being put under excessive stress (accounting for the high failure rate) and he asked O'Connell to investigate. But the course came out with a clean bill of health, in fact, admiration from O'Connell who only advised that students be given as much notice as possible to prepare themselves and thereby carry as little stress as possible into the course.[126] O'Connell was not the first psychiatrist to study Perisher, that had been in 1917 when Professor C Spearman, an eminent psychiatrist, studied attack teacher training although his report is jejune by today's standards.[127]

Teachers reflect on the nexus between how well students gel to give mutual support and their innate capability and success. An exception had been Terry Woods' 73/1 course which never managed a balanced team spirit yet the brilliance of Mike Boyce and an equally proficient Israeli raised the attacking excellence of all to a level higher than normal.[128] There are no reports of conflict within a course but there are suggestions of tensions between Teachers, a natural human reaction perhaps. An obvious example was when Dai Evans was COCOQC with Rob Stevens as Teacher B. Being senior Evans was first back to harbour, much to his self-satisfaction until Rob Stevens, fiercely competitive, took the deep transit 'tunnel' through the exercise areas to beat Evans' boat home much to the delight of the ship's company and students but less so to Evans.[129]

Administratively, COCOQC and the course moved from the Captain SM3 to CSST in 1983/84 although Toby Frere advised direct lines be maintained by Teacher to both FOSM and Fleet Headquarters.[130] The structure, continued today under the FOST organisation, had the advantage of providing a close relationship between work-up and Perisher. At that time it was expected that nine rather than 12 Upholders would be built and Dai Evans reflected on how more technically demanding Perisher would become as he looked forward to the implications of the new submarines on Perisher students. He wrote:

> *"The 'Concept of Submarine Operations' [rewritten by Richard Sharpe] gave conventional submarine operations fresh impetus and the advent of narrowband equipment and the towed array have recently given a further welcomed boost. Aspects of conventional submarine warfare are becoming more complicated as equipment fits become more versatile. The demands made of Commanding Officers are becoming far more diverse than they were some 10 or 15 years ago."*[131] *[The*

[126] Telecon and Email Morgan O'Connell April 2020.
[127] TNA ADM 137/2077 Commodore (S) war records, Volume XI, miscellaneous papers.
[128] COQC 1/73 Report dated13 April 1973.
[129] Telecon with Rob Stevens March 2020.
[130] RNSM A 2014/016 Frere's notes.
[131] COQC 1/83 Report dated 8 August 1983.

Upholders, then known as the Type 2400] "will not have the endurance and the mobility of a nuclear submarine [but] the equipment fit will be broadly similar."

Evans was concerned that Perisher needed to adapt to the sophisticated new submarines, and he reviewed the content and length of Cockfight to effect the step change.[132] His efforts were to no avail, only four of the class were built, their operational life was short (barely two years for the *Unicorn*) and none were used for Perisher. That an important progressive step in the development of COs where an officer could cut his 'command-teeth' in a diesel boat before taking on the heavy responsibility of a nuclear submarine was lost, is unquestionable, somehow Perisher would have to compensate. That aside, Evans' efforts reflect the deep thinking that some Teachers put into their job and there was to be more cerebral attention in the future years.

Principal innovations in command systems, sonars, weapons and SCTTs.

In 1983, DCB was modified for Sub-Harpoon, while its replacement started Feasibility Studies. This was to be the ground-breaking 'Submarine Command System' (SMCS,) vocalised as 'smacks' and, instead of being given a new three-letter acronym, DC'X', the name stayed with the programme. The commercial development was led by Warner who had now left the Navy.

Design work on the next generation of bow array sonars, Sonar 2020 an evolutionary development of the passive capability of Sonar 2001, had started in the early-mid-1970s and went to sea in the *Trafalgar* in 1983 but the CO, Martin Macpherson, was responsible for finding out how to use the sonar following the manufacturer's basic training.[133] Weapons too, had developed. Tigerfish Mod 1 began to enter service in 1980 just as the Naval Staff Target for its successor, NST 7572, (later known as Spearfish), was starting Feasibility Studies. Despite pleas, the lack of Tigerfish weapons available to the Perisher added to persistent weapon failures had exacerbated the submarine community's lack of confidence in the weapon.[134] But a 1983 AUTEC trial demonstrating how two SSNs using DCB to fire two Tigerfish torpedoes at each other was outstandingly successful.[135] Adding to this success the Tigerfish Mod 2 torpedo, product of a 1987 Mod 1 get-well programme, proved itself world-class when the *Turbulent* and the *Superb* conducted under-the-ice trials in 1988. At last the Submarine Service had a weapon worthy of its capability but ironically it became operational just as the Cold War was ending.

[132] Ibid.
[133] Butcher, *Sonar So Far*; Nairn interview; Perfect interview.
[134] RNSM A 2014/016 passim .
[135] Thompson, *Nuclear Service*, p.180.

A new DCB trainer, A/S 1083 *Damocles,* was commissioned in 1980[136] to provide training for both Control Room and Sound Room teams either integrated as a full attack team or separated for different scenarios. *Damocles* was *very* different, it was fitted into five road-worthy trailers parked, initially, on the edge of the helipad at Faslane.[137] The unsubstantiated reason for a trailer trainer was for rapid mobility and survivability in the event of war. In 1985 they were transported by road from Faslane to Devonport where they were plugged in and triumphantly worked immediately.[138]

Damocles was followed in 1985 by A/S 1102, *Tactician,* installed in the old *Nemesis* facilities. This was a prestigious, ground-breaking SCTT well ahead of its years and full of innovations: CGI-generated real-time periscope view with a capability to generate target, seascape, coastal and polar effects,[139] ability to play real recorded sounds from sea, high fidelity acoustic aural effects, through-hull sound effects,[140] and Commercial-Off-The-Shelf emulation of the onboard operational displays and controls. A/S 1104, *Veracity*, the Vanguard SCTT followed in 1989 and like A/S 1102, *Veracity* provided training for both the Control Room and Sound Room teams with yet a further transition in design and capability.[141] As the nuclear submarine fleet increased, the demands on the SCTTs grew. The solution was to start evening training, sometimes an unpopular expedient. Life, however, had its lighter moments. One Ferranti engineer found time to programme a sonar suite to play 'Jingle Bells' at the end of a training session during the festive season.[142] And SCTT staff could use the in-built stimulation capability to their advantage by interjecting an event to bring an over-performing Perisher down to earth or, on the other hand, boost the confidence of a struggler.[143] The SCTT was also used clandestinely by Warner before he left the Navy and Littlejohns to develop both command systems and weapon improvements.[144] On occasion, this caused friction with the Ferranti

[136] Butcher, *Sonar So Far*.
[137] Hackmann, *Seek and Strike*, 278. Mobile asdic trainers, called MA/STUs, had been built in the Second World War by Portland Dockyard. They were housed in commercial buses. By the end of the war there were 17 single-deckers and 12 double-deckers that travelled the country delivering asdic operator training.
[138] Email Graham Crofts January 2018.
[139] KJ Butcher, *Common scenario generation tool,* (Alenia Marconi, 1999).
[140] These came about in an interesting way. The sonar operators complained they could not hear the active transmissions because they were wearing headsets which blanked transmissions when the sonar transmitted but they were referring to the transmission being heard through the hull of the submarine which had to be modelled.
[141] Croft notes.
[142] Email John Francis December 2017.
[143] Email Sam Poole December 2017.
[144] Email Doug Littlejohns January 2018.

contractors but it is to their credit that once the value of the work was recognised the upgrades would be made and given a thorough testing by the SCTT staff.[145]

Other innovations were Racal's 'MORTHOE' UAC ESM system, and for the boats that went to the Falklands, MEL's 'SANDMAN' ESM system that did sterling work,[146] followed by the UAH/UAL for the Oberons and then the UAP series toward the end of the 1980s rolling into the 1990s.[147] Another was to replace the obsolescent ARL Table which, by the 1970s, was being phased out of service in GS as Action Information Organisation automatic plotting systems took over. At the same time, the importance of accurate navigation became increasingly important for the correlation of ships tracks during exercises and for use as a General Operations Plot. Development of a replacement table started in 1976, produced the Ship's Navigational and Plotting Table (SNAPS) with a central computer that took and processed inputs from all sources of navigation data including the Ships Inertial Navigation System. These inputs could be 'weighted' by the navigator to produce the best available navigational position.[148] The SNAPS table was introduced in the late 1980s taking over the ARL tables' LOP role.[149] SNAPS was, in effect, the automatic plotting table that had been called for many decades earlier.

Issues with the Selection Process

Selection issues continued in the 1980s. In 1981, Macpherson observed that he had two officers who clearly should not have been on the course one of whom, despite good reports, did not even have a 'Now' recommend (but he passed) and the other student had very poor reports and unsurprisingly failed. Macpherson was unimpressed by the haphazard way things were done when he attended two of the Perisher Selection Boards.[150] Later, when he was CoS to FOSM and chairing the Perisher Selection Board he was equally unimpressed by the lack of knowledge of recommended officers by some of the Captain SMs. This was perhaps understandable when the Submarine Service was large but as it reduced greater familiarity could be expected. Leadership capability was sometimes a problem as Husk found out when he had to fail two of his 30 students for their poor leadership and command attributes even

[145] Email Peter Christmas January 2018
[146] Wise, *The Navy*, 103.
[147] Wise, private papers.
[148] A E Fanning, *Steady As She Goes, A History of the Compass Department of the Admiralty*, (UK, HMSO, 1986), 377-9.
[149] ECPINS© D-MOP Digital Maritime Operations Plot, OSI Maritime Systems brochure,.
[150] RNSM A2014/016 Macpherson's notes.

though one was "*almost as intelligent as Woodward*".[151] The majority of the inappropriate recommendations, however, was for students with a lack of technical skills. In the 1970s-1980s students who lacked periscope time, (mostly gained in SSKs), were disadvantaged, then those from SSKs who lacked SSN time found themselves behind the tactical curve when it came to Cockfight and if from an SSBN, they could be severely disadvantaged.[152] Sufficient seatime was always an issue although it was included in the SGM 1503 and was of particular concern in the late 1980s/1990s when officers were being recommended for Perisher with as little as three years sea experience against the received wisdom of a minimum of five years. Circumstances had created this situation: officers joining post-university missed out on both the seatime and wider naval experience of the previous generations added to which submarines were spending long periods alongside with defects. But sometimes taking a risk on an exceptional officer paid off. An example is Colin Stockman, a late entry to the Submarine Service at age 26, who was given a structured career before Perisher by being sent initially to an SSN then an SSK as Third Hand followed by Watch Leader in another SSN and so to Perisher aged 30. James Burnell-Nugent was another who spent just a year in an SSK working his way to Third Hand and then serendipitously finding himself as the navigator and Watch Leader of the *Swiftsure* for two years thence to Perisher. Tim McClement had only one year and ten months seatime in submarines before he went on Perisher despite his Teacher, Macpherson, initially rejecting him as too inexperienced. These officers were, however, exceptional for they became a Captain, Admiral and Vice-Admiral respectively so it can be argued that it was not such a risk after all and the selection process properly recognised meritocracy.

In the mid-1980s there was a crisis in getting sufficient officers to Perisher to meet the needs of the growing submarine fleet. The genesis for this problem lay in the early 1970s. At that time, the MoD Submarine Seaman Officers Working Group had produced the Submarine Seaman Officer Career Structure, a study identifying how to maintain the submarine command qualified plot from initial training through Perisher into nuclear command and beyond. The key was an annual pass of 13 Perisher students and this, in turn, needed 43 equivalent GL[153] officers to start submarine training. Statistically, GL officers had a lower drop-out rate than Supplementary List (SL)[154] officers and consequently were deemed more 'cost effective'

[151] Husk interview.
[152] Anthony interview.
[153] Typically joined at age 18+ with A levels.
[154] Typically joined at age 17+ with five O levels.

although empirical evidence subsequently showed this wrong as many eminent SL Cold War submariners reached Captain and above. In the mid-1970s, however, many Lieutenants left due to poor pay and conditions of service and so, together with the non-recommends and the typical 25% Perisher failure rate (over 1975-1985 the failure rate was 23.6%), the numbers who started the OTC had halved by the time they reached Perisher selection. With reduced numbers, the Appointer's flexibility was reduced and by the 1980s the Career Structure Plan became unsupportable with little slack for broadening-experiences such as staff courses, placing submarine officers at a disadvantage for the higher ranks later in their careers. Other issues were officers joining their submarines in build or refit later than ideal, little appointment choice, unavoidable personality clashes and a sometimes lack of the appropriate mix of sea jobs and experience, an imperative for Perisher. All too often the system failed the officers, a simple example being SMCC 3/86 were McLees comments on the failure of two students "*both had undergone appointments which left them less than ideally prepared for SMCC*".[155]

Perisher fed the submarine command qualified plot of Lieutenant/Lieutenant Commanders billets (SMCQOs). During the 1960s-1980s, the SSK COs in this plot were generally in their early 30s (Johnny Harris got his first command at age 27 whereas David Perfect was 36).[156] The consensus was that, because of their employment, the optimum age for command of an SSN was 35 and an SSBN a little older although inevitably this occasionally worked out in reverse, Lang for example was 36 in command of an SSBN before becoming Teacher for the second time at 38. In 1983, the requirement for 36 submarine crews, (it remained broadly static until 1994), important shore jobs, training courses and margins for sickness and turnovers was 76 SMCQOs, but there were only 64 qualified officers, a shortfall of 15.7%. Rob Stevens identified the problem as the lack of numbers going on Perisher rather than the failure rate.[157] The resolution identified by Johnny Milnes, the Appointer at the time, was that the OTC classes needed to be increased to around 40 officers (which accorded with a referenced 1973 study) to achieve 18 officers starting Perisher 6-8 years later. With an annual output from Dartmouth of around only 80-100, the Submarine Service was never going to receive the 40-50% of BRNC's output needed to achieve the plot's ideal-world sustainability.[158] The problem did not go away

[155] SMCC 3/86 Report dated 12 December 1986.
[156] Perfect interview.
[157] Rob Stevens, *COQC – Assessment Criteria*, Letter to Captain MGT Harris, SM3, dated 20 January 1984.
[158] Johnny Milnes interview January 2019.

Perisher evolves towards the nuclear programme

As the command plot and stress issues continued, Heaslip suspected that any development of Perisher had been guarded against by a combination of factors: the self-satisfaction and complacency of previous Teachers, the pride of Perisher graduates being wounded by any change they considered detrimental to its reputation, and the danger of testing the Perisher mystique. Other pressures were fewer immediate command jobs and increased unpopular SSN XO appointments breaking the Perisher-command nexus. Conversely, some felt that the Perisher format no longer reflected the battlespace and that the format was well past its 'sell-by' date especially the Foreign and Commonwealth students who considered the Mark 8 tactics an anachronism compared to their national weapons. Heaslip charged the CSST, Mike Boyce, with aligning Perisher more closely to the requirements of the nuclear fleet. The required changes had a willing executor in Teacher, Jock McLees, for he thought they were 10 years overdue, and he had written a prescient but unsuccessful paper when he was ST1 under SM3 in 1981 reflecting on the fragmentation of the training organisation and advocating that the COQC join the sea training organisation. This had now been implemented but the experience had made McLees sensitive to the danger of radical change and the damage that could threaten the beliefs of Perisher devotees. He had a special concern for the submarine crews who took pride that their commanding officer had been through Perisher, proved himself worthy of command and would keep them safe. There was also an inherent risk in being the first Teacher to question the stopwatch formulaic approach for, should an accident result, he would carry the full force of blame. The principle had to be, therefore, evolution not revolution.[159]

Fortunately, it was decided to cancel the second 1985 Perisher (which probably helped the shortage of candidates at that time) while a review was undertaken. The review concluded that both Teachers should have nuclear command experience and RN student periscope weeks would only have to deal with up to three attacking ships while the Foreign and Commonwealth students continued in the SSK with four ships. Adaption of COQCEX mental aids and periscope drills would have to wait until an SSN was used for COQCEX but the name, Commanding Officers Qualifying Course was changed to the Submarine Command Course or SMCC to better reflect the status of the course with Cockfight now 26 days at sea versus COQCEX's 15 days and most successful students going to XO jobs. [160]

[159] Jock McLees interview.
[160] Ibid.

By SMCC 1/86, Perisher was an amalgam of Tigerfish Mod 1 drills and procedures with Mark 8 torpedo salvoes used against an escort approaching too closely. McLees concludes "*The shift in emphasis from the Mark 8 to Tigerfish Mod 1 during COQCEX is considered to have been successfully achieved*". SMCC 1/86 fired the last ever 12 Mark 8 practice torpedoes and the first Tigerfish Mod 2 torpedoes at BUTEC. To enable the Tigerfish drills some of the rigid COQCEX run plans were replaced by more open 'freestyle' runs that allowed the surface forces to charge mast detections and to conduct Torpedo Counter Measures.[161] This worked well and tested the students. SMCC 2/86, was split into designate courses: XODC(N) for students who were going as XOs of nuclear submarines and CODC(D) for those going in command of SSKs. For the first time an SSN, the *Warspite*, was used by Perisher during Cockfight for the XODC(N) together with a course of Pre-Joining Training officers (PJT(N)). Rather like the old CORQC, PJT(N) was a course of SSK command experienced officers now going to command nuclear submarines. In a sensible sharing of responsibilities, the CO of the *Warspite*, Derek Anthony, looked after the PJT(N), which gave him valuable experience before becoming Teacher himself.[162]

Unusually there was a third Perisher in 1986 and another first, the use of the T-class submarine *Tireless*. The *Tireless* must have been a step-change for some of the students with the advancements in both technology and tactics. For example, apart from the new Sonar 2020, which had gone to sea with the Trafalgar just three years earlier, [163] and DCB command system she had the most sophisticated hull-penetrating periscopes. The attack periscope, a CH84, was quasi-binocular with thermal imaging, electronic control, a stub of a VHF/UHF communications aerial called AVS and a TV camera. The TV was a quantum change in submarine command practice for the surface picture was no longer the sole province of the captain but could be shared with the command team. (Some special fit submarines had previously had this capability). And the search periscope was a highly sophisticated CK34 binocular periscope with the latest electronics.[164] There was some relief for the students however as all the controls and read-outs had been contained in two simplified panels on either side of the ocular box[165] and vibration was controlled by a wider diameter tube made of a higher grade of stainless steel with special anti-vibration optics.[166]

[161] SMCC 1/86 Report undated.
[162] SMCC 2/86 Report undated .
[163] Butcher, *SonarSo Far*.
[164] Thales brochure: *100 years.*
[165] GUA UGD 295/27/2/17 Periscopes for the 80's, a Barr and Stroud marketing brochure.
[166] Maritime Defence, *Periscopes and optronic masts*, 20/2, 36. The American Kollmorgen periscopes use a hydrodynamic fairing whereas the German Zeiss periscopes use gyro stabilisation.

McLees was relieved by Tim McClement as Neil Robertson assumed the Teacher A, COCOQC role with responsibility for Perisher policy. Robertson was a stalwart CO, reliable, experienced, charming but conservative. McClement, on the other hand, had had a meteoric career going to Perisher after just 22 months seatime but he had been mentored in two key appointments by Boyce the latest as ST13 on Boyce's CSST staff. This experience made him keen to see Perisher more aligned to the war-fighting of the day with the Tigerfish as the torpedo of choice, the towed array at the centre of tactics and the SSN in Direct Support operations. Change had to be introduced by stealth and in this he was fortunate by being responsible for the Perisher schedule so he managed to substitute mine lays, for which there were no mines, with more towed array exercises and simulated Sub-Harpoon firings.

After a year Derek Anthony relieved Robertson as Teacher A.[167] Anthony was on the same wavelength as McClement and together they laid the groundwork for the future Perisher although they were careful to take the evolutionary route rather than revolution. While retaining McClement's initiatives, they reduced the COQCEX time to two and a half weeks with a three-week Cockfight including a week's close inshore work and even though there was at that stage no threat of the final demise of the SSK, they began to plan for a total nuclear Perisher recognising that some officers would miss out of an SSK command.[168] When Mark Stanhope relieved McClement, thereby joining this triumvirate of outstanding submariners all of whom would go on to flag rank, he and Anthony re-thought the mental aids. For example, the one-minute 'Q routine' to go deep became one-minute 10 seconds— another mental nuance for the Perishers. [169]

In 1988 a third Teacher, David Southcott, joined as Teacher C until 1990 with responsibility for the CODC(D) and the foreign students who paid for the course. (In 1975 the price was £43,000 a week with a proposal to raise it to £270,000 but that was considered excessive).[170] It was Stanhope who reaped the benefit of the planning and was the first Teacher to use an SSN, the *Conqueror*, for COQCEX. The Mark 8 had been withdrawn from service in 1986 so Stanhope emulated a Mark 8 attack by calling a Mark 24 wire break before discharge. David Charlton later called this the 'Kittenfish drill'.[171]

[167] Anthony interview.
[168] McClement interview.
[169] Stanhope interview.
[170] RNSM A 2014/016 Frere's notes; Ferguson, *Canadian Periscope*, p.319 quotes C$365,000(£180,000) a student in 1990.
[171] Charlton, private papers.

Perisher's divergence raises issues

In 1987 the RCN was concerned after the third Canadian officer in a row failed. The RCN had a long-established relationship with Perisher going back almost to its conception but more importantly from the 1960s when the RCN started its own Submarine Service proper with first, the acquisition of an American ex-Guppy, the *Grilse*, followed by three O-class submarines. The pipeline of commanding officers had worked well and 44 officers qualified for command until these failures.[172] Previously, the RCN failure rate had, over the period 1978-1985 been 28.6%, very similar to the RN's 27.6%, the RAN's 29.4% and the RN

LN's 22.2%. But the three failures pushed the Canadian failure rate up to 39% and their CO pipeline was severely affected. Unsurprisingly this caused consternation and a root and branch study of the Canadian Submarine Service under Captain (N) David Pollard CF, Commander of the Canadian Maritime Tactical School (but not a submariner) was conducted. Pollard identified the cause as being something between a temporary aberration and a failure of training, experience and preparation.[173] Remedial action was taken: the selection process was improved and a Submarine Officer Continuation Course (SOCT) was established, the Canadians having started their Submarine Sea Training organisation some years earlier. The SOCT courses were structured to run for about 2-3 weeks with roughly half the time in a classroom and/or attack teacher and the other half at sea under the tutelage of a current CO, conducting operations similar to Perisher off Canada and sometimes as far away as Norway. It was envisaged that an officer would experience a number of these courses before selection for Perisher and the course would indicate much better an officer's suitability for Perisher. The effect was almost instantaneous with the failure rate falling to just 12% in 1988-1993. Mark Stanhope commented, "*in consequence* [of SOCT] *the Canadian students have turned in the best performance from the Foreign and Commonwealth in the last three courses*".[174] At the same time as the Pollard Report it became evident to the RCN, RAN and RNLN that the RN Perisher requirements were diverging. The RAN, who had 46 officers qualified under the RN Perisher[175] since 1926, considered but rejected the idea of their own Perisher on cost grounds. The Dutch Commander SM, Driekus Heij, opened conversations with the RAN, RCN, RNoN and Royal Danish Navy about the idea of an alternative Perisher and sent one of his officers on

[172] Two in First World War, two in Second World War, and 40 since 1953 and the acquisition of HMCS *Grilse*. Lt J.O'N. Fitzgerald RCN, as an Electrical officer, was an anomaly and did not command. Lieutenants G Gigg and S.G. Tomlinson between them commanded five RN submarines.

[173] Canada, Department of National Defence, Report on the Personnel Structure of the Submarine Service of Canada, 22 April 1988. (Pollard Report).

[174] SMCC 2/90 Report dated 25 July 1990.

[175] 46 RAN officers plus 26 RN transferees and one ex-South African Navy CO.

the NORSMCC which had been running since 1967 in a similar format to the RN course. Heij concluded that although it was good, its operational focus was the fjords and the blue water element that the other navies operated in was missing.[176] This thinking was soon to be taken a stage further.

A lament and review

With the use of an SSN for COQCEX, there was now no need for Perisher students to live ashore in hotels. The local's lament was expressed in a poem by one of their number, Charles Forest.

Oh, Perishers, it's time tae gang,
And tak'yer craft, sae black and lang,
Tae venture intae other seas,
And others wi' your antics please,
And armed wi' a' these maps and charts,
Your stopwatch and your deadly darts,
Protect us a'

We've seen ye in the mornin' light
Come doon the stair and hae a bite,
A wee bit toast, a cup tae cheer,
Then off tae tangle wi'the best,
Tae face the teacher's searching test,
And winds that blaw

Fareweel! We'll miss your wee bit chat,
The golf game … Aye, I mind o'that,
Your wives, your children, Happy times,
With some frae here and other climes,
We'll miss ye a', and when you're gone,
We'll mind o'you, and boats that shone,
Sae bright an' braw, and gie'a hand o'thine.

An era had ended but the 1970s and 1980s had been exciting times for the Submarine Service and Perisher 'fighting' the Cold War which provided new operational experiences and command challenges all of which were fed into the Perisher loop to be passed to the next generation. At the same time, more complex and capable submarines with sensor, weapon and command system innovations were being commissioned. They were supported by evermore capable SCTTs. Unexpressed, morale was high as the culture, epitomised and continued by the new submarine badge, evolved from the one-man-band to the command team. In parallel Perisher, which had recently experienced the Woodward revolution, evolved with the command team culture by changing its profile from periscope attacking predominance to the focus on tactical training and Cockfight enabling Teachers to assess more of a student's command capability by putting him under pressure in risk and decision-rich environments in response to the demands of the Cold War. Finally, Perisher made the evolution to meet the now unavoidable imperative of the nuclear programme.

Some of the finest Cold War submariners had shepherded Perisher through the two decades to meet the increased demand for command qualified officers by qualifying 197 commanding officers. Eight of the 19 Teachers, (excluding NATO Teachers), would reach flag rank. All Teachers had played their part in the evolution of Perisher to different extents, not that it was without difficulties as Teachers who had tried to be innovative were met with cultural

[176] Driekus Heij interview February 2019.

opposition. Then, in 1989 the Submarine Service was hit with a technological issue of the most serious kind when a crack was found between dissimilar metals in one of the steam generators of the *Warspite*. The problem adopted the eponymous moniker 'Trouser Legs' because that is what the two pipes involved looked like.[177] With the potential for a primary coolant leak, all submarines had to be checked and this led to a 'log jam at the jetty', few submarines at sea and serious ramifications for the submarine flotilla and Perisher. Decisions were made to expedite the decommissioning of the older SSNs, leaving just the *Valiant*. Two SSBNs were kept running although they ended up doing extended patrols. With few submarines at sea, officers were finding it hard to get sea experience and their Perisher recommendations. No sooner had a Watch Leader been recommended than he was relieved to give somebody else an opportunity. Although there was no immediate effect, knock-on effects were inevitable and the inexperience of students in inshore waters and around fishing vessels was to become noticeable later.[178]

[177] Thompson, *Nuclear Service*, 220.
[178] SMCC 2/92 Report dated 3 August 1992.

8. Nuclearisation and the Modern Perisher: 1990 – 2017

The period 1990-2017 saw the final evolutionary phase of Perisher to reflect modernity as the course responded to the equally powerful, if different from previous, imperatives of technological innovation and societal influence. The SSKs all decommissioned, and the submarine force reduced from 33 hulls to four SSBNs, three new Astute class and four Trafalgar class SSNs, available for a periscope-orientated Perisher. The 1990s saw 85 new COs qualified with, in the early years, a failure rate of 30% and increased pressures on the SM(CQ) plot.[1] Perisher became one, fully-nuclear course at a time, with the consequential breaking of the command nexus as graduates now all went to nuclear submarine XO billets rather than SSK command. Perisher also experienced its worst event with the 1990 sinking of the fishing boat *Antares* followed, in 2000, by the *Triumph* grounding in deep water during Perisher[2] and, while not conducting Perisher, the brand new *Astute* also grounded, to great embarrassment in 2010, drawing questions about Perisher's standards.

With the decommissioned boats went Sub-Harpoon in 2003 and Tigerfish in 2004 to be replaced by the Tomahawk Land Attack Missile, with SMCS or a suitably modified DCB command system, and the Spearfish torpedo. The Perisher curriculum was now firmly focused on the tactical Cockfight, with additional modules to develop a well-constructed, fit-for-purpose course and a more informed, well-rounded 21st century CO, albeit one under threat from new pressures of information overload imposed by technological innovation. Another 82 officers qualified in the 2000s with a brief rise in the failure rate to an extraordinary 50%, although far more officers who failed now stayed within the Submarine Service. These events are in two parts of this chapter, the first deals with events of the 1990s while the second covers the longer period 2000-2017 and the creation of the modern Perisher.

[1] Absence of records prohibits full failure details.
[2] SMCC 100 Report dated 4 August 2000

End of the Cold War: 1990s

Perisher in the 1990s

The 1990 'Options for Change' Strategic Defence Review (SDR) expedited the decommissioning of five SSNs[3] with two more to go under the 1998 SDR.[4] In the interim worse was to happen. The Defence Costs Study 1994 brought scything cuts, so severe and immediate that the Upholder SSKs were at risk. As FOSM, Toby Frere's defence of the SSKs was ardent, based on the boats' complementary role to the SSN, capability in the littoral role and training of ASW forces. So too, the less tangible benefits: the vital personnel 'pyramids' for both officers and ratings including Perisher and command experience, and interoperability and influence with non-nuclear allies. Alternatives considered included the possibility of running the Upholders with RN crews for a Gulf state and an Upholder was sent out to the Gulf as a pre-cursor.

Although Frere played his 'adviser to the Navy Board' card as best he could he was disadvantaged by there being no 'Submarine Division' in the MoD as in the Pentagon, and many on the Naval Staff looked on the demise of the SSKs as justification for the Submarine Service's disproportionate slice of the Naval Budget.[5] In the end, it was Hobson's choice. When asked privately by the FSL, Admiral Sir Benjamin Bathurst, an aviator, whether SSN numbers should be reduced to save the SSKs Frere knew that his arguments lacked authority and could not prevail, so he decided in favour of the SSNs. Consequently, the Upholders decommissioned in 1994 leaving the Submarine Service with a big gap in both its training and operational capability, for the Upholders were both excellent first commands and superb submarines more akin to a Trafalgar class than an Oberon.[6] A little-known aspect of these intrigues is that the 'horse-trading' was conducted outside the normal Staff procedures[7] and an unsubstantiated rumour has it that the Gulf 'deal' was conducted in the Garrick Club with a well-known political interlocutor.[8]

The direct effect on Perisher was that, by 1992, most Perisher graduates were being appointed as XO of a nuclear submarine and only a few could aspire to command of an SSK later. This situation brought into sharp focus the viability of non-nuclear navies sending their officers to the RN Perisher on which point two important initiatives were started. The RNLN

[3] Select Committee on Defence Eighth Report at https://publications.parliament.uk/pa/cm199798/cmselect/cmdfence/138/13805.htm, acquired March 2020.
[4] Claire Taylor, *A Brief Guide to Previous British Defence Reviews*, House of Commons Library SN/IA/5714 dated 19 October 2010.
[5] Toby Frere, *SSKs*, private paper, interview and emails November 2018.
[6] Ibid; Email Jonti Powis March 2020.
[7] Email David Cust March 2020. Cust was Staff Officer Plans and Programmes to Frere.
[8] Sensitivities preclude revealing the source.

had been the longest supporter of the RN Perisher participating since 1939 and building a reputation of excellence. But the Dutch Submarine Service itself had come close to being a victim of swingeing cuts following the end of the Cold War as the Dutch government sought to take advantage of the so-called 'peace dividend'. The Dutch Submarine Service and its cadre of professional submariners were only saved by its then Captain SM, Driekus Heij. In 1992 Heij had marketed well the capabilities of his Walrus class boats and their crews to the Americans and Canadians. Then, with war breaking out in Yugoslavia, Heij presciently positioned one of his boats at Naples ensuring that the NATO commanders were aware so that, when they needed support, which they did, and called upon the Dutch government to provide it, Heij was able to provide his submarine on task within a day and the kudos to the Dutch government saved the submarine flotilla. But Heij still had the problem of training his COs and he conferred with Frere. The conclusion was that Heij's successor, Hans van de Ham, negotiated Memoranda of Understanding with the RAN, RCN, RNoN and the RN, and the first Dutch Perisher started in September 1995 running concurrently with the SMCC with the Dutch supplementing the surface assets. These MoU continue, and since 2009 there has been a tri-nation SMCC MoU between the RN, the RNLN and the RNoN.

In parallel, the Canadians conducted a study into Canadian submarine command and concluded that the RCN needed to run its own Perisher (CSMCC),[9] the first of which was in 1994 and then irregularly until 2000. With the decommissioning of the Canadian Oberons in 1999, the RCN reverted to the NLSMCC and occasionally the NORSMCC with a failure rate of 30% mostly because the SOCT courses had reduced. A 2011 study confirmed the demise of the CSMCC but confirmed the pass/fail criterion.[10]

The RAN joined the NLSMCC in 1995 with a failure rate similar to the RN Perisher but a recruitment crisis in the late 1990s and early 2000s, and other Collins class programme issues, affected the preparedness of students in the later 2000s causing the failure rate to increase to 60% forcing qualified officers into a third or fourth command. Nonetheless, the RAN refused to compromise the quality standards albeit one officer returned to Perisher after taking himself off the course. He then took himself off course again.

The RAN views the NLSMCC as an exploration of a student's character, personality and command competency adding the USN PCO course following Perisher for weapon training.

[9] Canada, Department of National Defence, 4500-1(DNR)Final Report of the Canadian Submarine Command Study Team (SMCST) May 1992.
[10] 3371-1080-1(SCST) Milestone All-Round Look Report of the 2011 Canadian Submarine Capability Study Halifax N.S., 9 December 2011.

Since 2006 the Australian COs have been Commanders, a recognition of the submariner's equality with their peers in command of frigates, a move that pushed the average CO's age up and although one CO was in his early 30s two were in their 50s. Reviews of the RAN submarine warfare continuum and command qualification have concluded in favour of an Australian Perisher and an organic XO course.[11]

The American PCO course had grown from its original four weeks in 1941, and by the 1990s was a nine-month, reactor-focused course run four times a year and since 1984 alternating between the Pacific and Atlantic submarine forces with a requirement that the students are selected for promotion to Commander. The most demanding three months was an intense study of the reactor plant with comprehensive examinations. Nine weeks of tactical training followed (the part attended by the Australians) with three weeks at sea in three distinct phases: mini-wars against surface and air forces during which a student fired ADCAP torpedoes and the surface forces retaliated with their weapons; specialist SSBN versus SSN operations for SSBN designated officers; and SSN versus SSN during which students again fired ADCAP torpedoes in free-play. The course also included other submarine operations such as photo-reconnaissance, MPA co-operation, large strike engagements, surveillance, minelaying and special forces operations.[12] Although the lengthy nuclear training was very different, the latter part was not too different to Perisher but with a shorter tactical phase.

As for the Soviets, then Russians, following the Second World War training returned to the Baltic and between 1969-2005, about 6000[13] submarine commanding officers qualified, including in the 20 years 1971-1991, 946 SSBN COs who were considered the elite and automatically awarded 'Hero of the Soviet Union'. SSBN, SSN and SSK CO's were trained separately on a 10-month course. (See Table 8.1). There were no exams and it is unclear if the 'practical' parts were at sea or in a simulator, the first of which, '*Ataka'* (Attacker), was introduced in 1962 capable of modelling two submarines and three surface ships, MPA and helicopters. This was upgraded in 1974 with the acquisition of a British Solartron bridge simulator modified for military use and kept operational until 2003. Computer-based training was introduced in 1998 with a tactical-specialist simulator complex called '*Komandor'*.

[11] Australian Forum. Subsequently, the 2021 AUKAUS agreement may change future command qualification.
[12] Lotring and Fowler, Captain Arnold USN and Captain Jeff USN, PCO training: *Making the Best Better*, acquired at https://www.public.navy.mil/subfor/underseawarfaremagazine/Issues/Archives/issue_05/pco_training.html January 2019.
[13] Rimashevsky, *High Special Officers' Classes of The Navy of The Russian Federation*, (St. Petersburg: Vysshie Specialnye Oficerskie Klassy Voenno-Morskogo Flota, 2005). This figure, which seems astonishingly high, cannot be quantified.

An officer was appointed on recommendation from XO (one of two XOs in an SSBN), and on successful completion received a certificate rather than a badge. Politology was the province of the 'Commissars' or political officers until perestroika.[14] They were qualified submariners who, while not entitled to command, stood watches both during and after the war until 1981 when the Whisky class *S363* ran aground near Karlskrona, Sweden, from whence the practice was discontinued probably because the Captain 3rd Rank [Commander] Commissar V Besedin was Officer of the Watch at the time. Also onboard was Captain 1st Rank [Commodore] I Avrukevich, which must have caused some embarrassment. Commissars continued until 1991/2 after which they took on a personnel role under the command of the submarine's CO.[15]

МИНИСТЕРСТВО ОБОРОНЫ РОССИЙСКОЙ ФЕДЕРАЦИИ

СВИДЕТЕЛЬСТВО

С ОТЛИЧИЕМ

Выдано капитану 3 ранга
(воинское звание)
Косинцеву Дмитрию Геннадьевичу
(фамилия, имя и отчество)

в том, что он в 1996 г. окончил десятимесячные 6 ВЫСШИЕ СПЕЦИАЛЬНЫЕ ОФИЦЕРСКИЕ ОРДЕНА ЛЕНИНА КЛАССЫ ВМФ
по специальности
командир подводной лодки

Основание: Приказ Главнокомандующего ВМФ
от «26» июля 1996 г. № 0290
Выписка из экзаменационной ведомости прилагается к личному делу.

Председатель
экзаменационной комиссии
контр-адмирал (воинское звание) В. Фиошкин

Начальник 6 ВСОК ВМФ
вице-адмирал (воинское звание, подпись) В. Устименко

Тип. 6 ВСОК ВМФ. Зак. 167. 27.05.93.

Регистрационный № 84

Figure 8.1: Russian CO's Certificate

Defence Ministry of Russian Federation
CERTIFICATE with honors
Given to captain 3 rank Kosintsev Dmitry Gennadievich,
In 1996 he graduated the 10-months 6th High Special Naval Officers Classes
Speciality – Submarine Commanding Officer

Order of the Chief Navy of 26 June 1996 #0290
Exams results are attached to the personal file
Chairman of the examination commission Rear-Admiral Fioshkin
Chief of the 6th Naval Classes
Vice-admiral Ustimenko
Reg # 84
Image: Dimitry Kosintsev;

Table 8.1: Russian SSBN COs Course Curriculum

Discipline	Share of overall course time: theory/practice
SSBN tactics	18% 36/64
Military use of submarine weapons	29% 42/58
Military preparation and direction of a submarine	15.7% 55/45
Radioelectronic guaranteeing (security) of submarines and military use of signals (jamming/EW)	11.7% 49/51
Navigation and law of the sea	10.2% 41/59
Problems of sociology, politology, military psychology, pedagogy and law	9.6% 43/57
Physical training	5.5% 89/19]

Source: Rimashevsky, *High Special Officers' Classes of The Navy of The Russian Federation*, (St. Petersburg: Vysshie Specialnye Oficerskie Klassy Voenno-Morskogo Flota, 2005).

[14] Email Dimitry Kosintsev July 2020 Commissars training was five years.
[15] Email Dimitry Kosintsev November 2018.

The Soviets trained submarine commanding officers of their satellite nations starting in 1946 with Yugoslavia then Bulgaria, Romania, Poland, China, North Korea, GDR and Albania; today it is the Algerians and Vietnamese.[16]

The 1990s had started in a bad way with Perisher experiencing its worst ever event in November 1990 with the sinking of the fishing vessel *Antares* and the loss of four lives by the *Trenchant* with SMCC 3/90 under David Perfect as Teacher embarked. Ironically, SMCC 2/90 had introduced a lecture on fishing activities, also held for SMCC 3/90. The incident triggered a Naval Board of Inquiry, Scottish Procurator Fiscal inquiries, and an investigation by the Marine Accident Investigation Branch (MAIB) so apportioning blame, if any, has no part here.[17] It is notable, but not mentioned in the MAIB report, that SMCC had something of a chaotic course having to change submarines four times: two SSNs and two SSKs and had been out to AUTEC to conduct torpedo firings. As the course report relates, the course only settled down for the final inshore phase and then the Perishers only joined the *Trenchant* 48 hours before the incident.[18] It must have been disorientating for the students so, while no excuse, it is unsurprising that the watch keeping and handover came under scrutiny fitting well with the findings of Doull's study into Submarine Command Teams that concluded:

> *"the root causes of … 41% of near-misses [incidents] are considered to be attributable to 'non-technical' human failures … namely flawed decision-making, poor communications, incorrect use of documentation, checking errors, inadequate watch keeping, inappropriate task allocation, Safety Culture and fatigue."*[19]

Operational submarines have a litany of incidents reaching back over the history of the Submarine Service with 49 between 1945-1988 that can be attributed to the CO[20] and 20 since 1988. (See Table 8.1). Of the incidents between 1945-1988, 10 were with fishing vessels, nine by SSKs, one by an SSN but with no loss of life.[21] These were the publicised incidents, there were undoubtedly others known only to the Submarine Service as the author can attest to, having been caught in the trawl of a fishing vessel in 1974 and Derek Anthony, who sat on the Board of Inquiry into the *Antares*, kept two fishing floats in his office as a reminder of a

[16] Email Dmitry Kosintsev January 2019; Rimashevsky, *High Special Officers' Classes of The Navy of The Russian Federation*, (St. Petersburg: Vysshie Specialnye Oficerskie Klassy Voenno-Morskogo Flota, 2005), passim.
[17] https://api.parliament.uk/historic-hansard/commons/1991/mar/19/antares; MAIB Investigation Report dated 15 April 2015 at https://assets.publishing.service.gov.uk/media/54c1127c40f0b6158d00001b/MAIBReport_AntaresHMSTrenchant-1992.pdf; https://hansard.parliament.uk/Commons/1991-10-22/debates/e063537b-29fb-48cd-8142-922d76c342e4/MvAntares.
[18] SMCC 3/90 Report dated 5 December 1990.
[19] Doull, *The Impact*.
[20] William M Arkin and Joshua Handler, *Neptune Papers No.3: Naval Accidents 1945-1988*, (Washington DC: Greenpeace & Institute for Policy Studies, June 1989).
[21] Ibid. Probably due to the less power of a diesel submarine.

Mediterranean incident. Submarine-fishing vessel interactions have been inevitable for between 1950-1990 the UK had a fishing fleet averaging 1324 vessels >10 m and ⅓ to ½ were in Scottish waters.[22] There is much of a 'there but for the grace of God' about such incidents.[23]

Following the *Antares*, the "*Fishing Vessel Avoidance - Flotilla Guidance*" extended safety distances from fishing vessels and the Perisher had dinner in Tarbert with fishermen followed by a day at sea on a trawler. The reactive measures did not, however, eliminate all incidents and the *Valiant* had a near miss during SMCC 2/93[24] and another fishing vessel, the *Karen*, was nearly sunk in the Irish Sea in April 2015.[25] This was despite the approach limitation of the submarine to a fishing vessel (3000 yards in 1992) which could force the inshore Cockfight serials from "*a tactical scenario to that of fishing vessel avoidance*" — often on a weekend when fishing was banned.[26]

Table 8.2: List of Submarine Incidents since 1988 known to the Marine Accident Investigation Branch

Date	Event
July 1988	HMS *Conqueror* collided with the yacht *Dalriada.*
Nov 1989	HMS *Sceptre* snagged the fishing vessel *Scotia*.
Oct 1989	HMS *Spartan* grounded off the west coast of Scotland.
Nov 1990	HMS *Trenchant* snagged the fishing vessel *Antares.*
March 1991	HMS *Valiant* grounded in the North Norwegian Sea.
July 1996	HMS *Trafalgar* grounded off the Isle of Skye.
July 1996	HMS *Repulse* grounded in the North Channel.
n/k	HMS *Turbulent* grounding in the North Channel.
July 1997	HMS *Trenchant* grounded off the coast of Australia.
Nov 2000	HMS *Victorious* grounded, when surfaced, on Skelmorlie Bank.
Nov 2000	HMS *Triumph* grounded.
Nov 2002	HMS *Trafalgar* grounded on Fladda-chuain.
May 2003	HMS *Tireless* struck an iceberg.
May 2008	HMS *Superb* grounded in the Red Sea.
Feb 2009	HMS *Vanguard* collided with FS *Le Triomphant*.
April 2009	HMS *Torbay* grounded in the Eastern Mediterranean.
Oct 2010	HMS *Astute* grounded off the Isle of Skye.
April 2015	n/k snagged the fishing vessel *Karen* in the Irish Sea.
July 2016	HMS *Ambush* collided with the merchant vessel Andreas.
Nov 2018	n/k near miss with *Stena Superfast VI*I in the North Channel.

Source: Maritime Accident Investigation Board

A beneficial outcome of the *Antares* affair was clarification of the relationship between Teacher and the CO of the Perisher submarine. This issue dated back to the earliest Perishers although in practice had not been contentious. Woodward, presciently anticipating an inevitable problem, raised the subject personally with FOSM, but alas to no avail:

"I took it up verbally with FOSM who really didn't want to know about it, much less to do anything towards clarifying it. No reasons given. I suspect that the reasons for not doing anything were twofold (i) A case has

[22] TNA, UK C Fisheries Statistics Archive. This number is a best guesstimate based on changing parameters of reporting statistics.
[23] Emails Derek Anthony November 2018.
[24] COQ Reports, SMCC 2/93 Report dated 22 November 1993.
[25] MAIB Investigation Report 20/2016.
[26] COQ Reports, SMCC 3/91 Report dated 15 January 1992.

not yet occurred (ii) If it did, the management hope to clear both CO and COCOQC in the legal muddle."

Now, however, the issue was unavoidable and led to the legalisation of the definitions of Command, Conduct and Charge in 2005.[27]

Before the main change to a full nuclear Perisher in 1994, the course was reduced to one Teacher and the students were all streamed nuclear. The course was run three times a year with the spring course complemented by the NLSMCC, and RN-RNLN interaction encouraged. Careful to maintain the SMCC as a command course, but in response to some of the students lacking skills normally acquired as a First Lieutenant, Teachers David Charlton, David White and Paul Lambert, introduced XO-biased modules: a staff paper, a management exercise, spreadsheets, weapon training and computer-based training.[28] Chris Munns also introduced Rule of the Road tests, a physical 'Fitness Test' led by himself, and changed the format of the periscope time reducing it to just one week at sea with a single ship target and shifting the emphasis very much to the operational side of Cockfight. It was left to the three Teachers who followed Munns, Simon Williams, Bob Mansergh and John Edgell to consolidate the nuclear-only course. Their students now had a GS equivalent qualification in the PWO (SM), having completed both their initial and advanced warfare courses. The Teachers continued with both Tigerfish and its replacement Spearfish tactics with Mansergh expressing concern as to the competence of Tigerfish-fitted submarines to use the more tactically demanding Spearfish (but that is surely not surprising?). They also introduced Tomahawk tactics. This weapon, which made its debut during the 1991 Gulf War, was acquired and test-fired by the RN in 1998 and 1999, the *Splendid* was the first submarine to fire a Tomahawk missile in combat during the Kosovo War.

As related, Perisher had previously been subjected to reviews by psychiatrists so between 1992 and 2000 it was the turn of a psychologist's research programme to see if success on Perisher could be predicted from the AIB tests.[29] Confidentially graded on personality, stress and success, the research concluded that ambition was the only continuity factor.[30] This finding correlated with that of David Charlton who, both when Teacher in 1991 and later in the oil and gas industry, endeavoured to find suitable objective psychometric tests to suggest predicted

[27] BRd 2, 0802.
[28] Charlton interview and Paul Lambert interview January 2020.
[29] Email Sarah Wattie, Psychologist, Institute Naval Medicine April 2020. There is a correlation between fitness at the AIB and performance in Initial Officer Training at Dartmouth.
[30] Ian Beadle, *The use of psychometric and other assessment centre measures in predicting performance on a naval command course*, EdD Thesis, University of Sussex 2011.

performance in Perisher-type situations but failed to do so relenting: "*I now acknowledge it as a lost cause...! Long live Teacher's gut feeling!"*[31]

The Modern Perisher: 2000-2017

Developments in both technology and organisation

The new millennium saw extensive innovations for the CO to assimilate, notably in terms of sonar developments. The first, in 2003, was Sonar 2074 the update for the Swiftsure and Trafalgar classes, a long-range, active/passive, multi-function suite with bow, flank and towed arrays.[32] The later Trafalgar and early Astute classes received Sonar 2076, developed in response to the Walker spy ring leaks in the 1980s to maintain a UK acoustic advantage. Sonar 2076 was a fully integrated suite similar to Sonar 2074[33] but with Sonar 2082, the 'Donald' intercept set that had been developed for Sonar 2051/Triton in the updated O-boats.[34] The complexity and amount of data provided by these sophisticated suites added considerably to the information load of the commanding officer — a long way from the Revolving Asdic.

In the Control Room, RN WECDIS (Warship Electronic Chart Display and Information System) replaced SNAPS from 2008 in the Trafalgar and Vanguard classes while the Astute

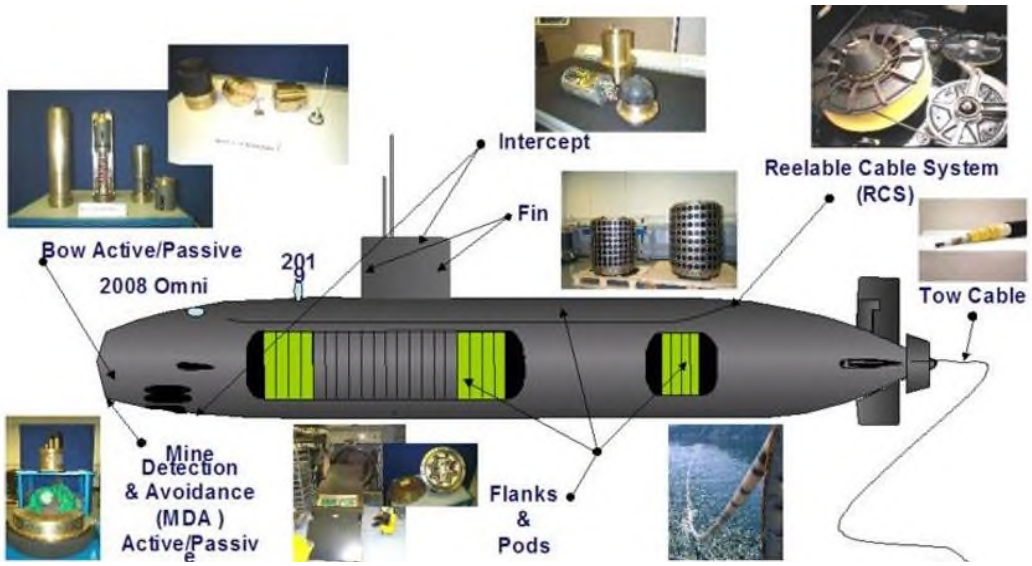


Figure 8.2: The Integrated Sonar 2076 Suite of the Astute Class

Comparison with the P and O-class sonars at Figure 4.4 shows the increase in information available to the CO of an Astute class submarine than an SSK.

Graphics: BMT Defence Systems

[31] Email David Charlton July 2018.
[32] Butcher, *Sonar So Far.*
[33] Downer, Sonar notes.
[34] Ibid; Butcher, *Sonar So Far;* https://www.naval-technology.com/projects/vanguard-submarine/ acquired July 2018; Dr Donald Nairn interview July 2018.

class have a WECDIS software system integrated into their command system.[35] So good is the system that the imperatives of navigational risk for the students are taken away and must be artificially re-introduced by Teacher.[36]

The Astute class brought another Perisher-centric new technology, the non-hull-penetrating optronics CM10 mast, trialled in the *Trenchant* in 1998 and now with two in each Astute class submarine. While the few remaining periscope-fitted submarines are used for Perisher, periscope safety techniques will continue to be taught. But after 100 years the procedures have now all to be re-thought, tested and re-implemented. The implications are evident in the *Ambush* incident of 2016 for "*the transition from an SSN with a periscope to an A-class* [Astute] *with an optronic mast and the hoovering up of information is a bigger transition than from a diesel submarine to a periscope-fitted SSN*".[37] Ashore, the latest SCTT, A/S 1119, *FAST*, for the Astute class was commissioned in 2005 under a Public Finance Initiative project continuing the attack teacher's vital link in the transition of a submarine officer into a submarine commanding officer; COQC/SMCC and the attack teacher have been almost synonymous.

Alongside the technological innovations, and under the auspices of the 2002 'Fleet First' policy, sweeping changes were made to the Navy.[38] For the Submarine Service, CSST became part of the FOST organisation and Captain Jon Westbrook, then CSST, changed his title to Flag Officer Sea Training Director North, or FOST D (N), although the Sea Training titles were retained including the COSMCC as ST8. The merger of sea training organisations may have been a necessary and logical change, but it highlighted the difference in philosophy between submarine work-up staff who witnessed the quotidian capability of a CO and his boat by staying on board for lengthy periods, and the surface ship sea-riders who were confined to ephemeral serial observations by embarking and disembarking daily. Westbrook encouraged both his sea-riding staff and his Teachers to consider the principles of submarine command in the context of fighting their submarines in the modern battlespace.[39] It is interesting to read, therefore, that the first Perisher of 2002 conducted its final inshore time undertaking the usual navigationally-testing operations in support of a notional Amphibious Ready Group approaching the coast.[40] The year also saw an American return to Perisher for the first time

[35] Telecon Commander David Pollitt March 2018. Pollitt is Capability Development Manager, OSI Maritime Systems and emeritus Royal Navy Fleet Navigator.
[36] Gareth Jenkins interview January 2019.
[37] John Weale interview January 2020.
[38] Telecon Philip Greenish April 2020 Fleet First' made 35% reductions in the Navy's organisation.
[39] Email Jon Westbrook March 2020.
[40] http://www.godfreydykes.info/.

since 1918 with the appointment of Lieutenant Commander Steve Mack USN and then, in 2014, the first French officer since the war, *Lieutenant de Vaisseau* C C Legrand.

There were other ramifications of 'Fleet First', some immediate and others that took time to manifest. FOSM's title was changed to Rear Admiral Submarines (RASM) but the titular head of the Submarine Service now had no responsibility for its usual administrative affairs including selection for Perisher, the Perisher course and the SMCQO plot. A 1999 study by Commander SJ Shield had identified that the SMCC structure had been designed to support a large SSK Flotilla and that the downsizing had created fragility in the Submarine Warfare Branch.[41] This manifested itself in 2009 with concerns about the potential effect on operational capability caused by resignations, called voluntary outflows (VO), amongst junior officers and the 'significant shortfall' in the SM(CQ) plot. The necessity for a further 2009 study called the Submarine Warfare Officer Cadre Manning Review by Captain SB Hardern (not a submariner) suggests that any implemented recommendations by Shield had been unsuccessful. Hardern identified *inter alia* that the SMCC was the "*centre of gravity*" of the Submarine Service and it needed to qualify six COs every year. The report also highlighted a shortage of Submarine Warfare Officers although this was expected to improve by 2017 but in the short term there were the problems of the 'grey beard' XOs with an average age of 38, (one XO of an SSBN was 52), second XO appointments becoming increasingly common (in 2009 there were four) and second commands being the norm.[42]

The causes lay deep in the junior officer structure with VO causing a 20% shortfall of availability of officers at the Basic and Intermediate Warfare course levels and the depletion at the Advanced Warfare Course level by SMCC failures without the SM(CQ) being enhanced. The situation was critical: a 16% under-manning (226 officers to fill 269 billets) with a shortfall of 46% Lieutenant Commanders SM(CQ) (45 officers to fill 83 billets with 47 of those billets being essential operational or seagoing) and a 2009 Perisher cancelled due to a lack of suitable candidates. Normally, there were two courses a year with between four and six students who were selected in much the same way as before by a Board, now chaired by the Naval Personnel Team, Team Leader, (NPT(X) TL), who may or not be a submariner with FOST D(N), and the Captains SM from the Devonport and Faslane Flotillas. The Appointer, now called Submarine Officers Career Manager (SMOCM), attended to review the six-monthly selection reports.[43]

[41], Jenkins, 'Review of'.
[42] DNPS, *Submarine Warfare Officer Cadre Manning Review*, 31 March 2009.
[43] Ibid.

The selection processes' SGM 1503 'Recommendation for Submarine Command' was revised in June 1991 to embrace the new terminology of Watch Leader and further revised and considerably extended in April 1995 as SGM 1202 to show the officer's detailed sea experience now used as a criterion for Perisher selection. Jon Westbrook had introduced the Watch Leaders Brief in 1996 and much of this was picked up in the Warfare Officer's Log introduced in the late 1990s to give officers structure to their preparation for Perisher although it was not referred to in the selection process. SGM 1202 was, in turn, withdrawn in favour of the revised S206, now MoD Form 2020 in 2000[44] before the Command Competency Form (CCF) was introduced in 2012. A criticism of the SGM 1503/1202 was that it highlighted weaknesses[45] with a consequential harsher Submarine Service reporting system than other parts of the Navy. This harshness was carried over into the S206/2020 reporting, which, between the demise of SGM 1202 and the introduction of the CCF were used for Perisher selection. The practices then worked their way into the promotion boards where, with no quotas, submariners were disadvantaged when assessed alongside the more generously marked other specialisations. The CCF, which is separate from the Officers Joint Appraisal Report (OJAR) that replaced the S206 in 2007, does a similar but better job, than the SGM 1202: "[The CCF] *process is thorough, fair and allows the Board members[46] to objectively determine those who warrant selection based on the reports of the potential candidates' COs.*"[47] Indeed, it has the hallmarks of a well-constructed format.

Hardern reviewed the question of the XO being command qualified and while the status quo was identified as being both preferable and possible if measures were taken to improve the situation, it was recommended that there should be an open possibility for an XO not to be command qualified. Rather than take the SMCC he could take a XODC, perhaps even joining the GS XODC in part. Any prospect of him also doing just the periscope safety part of Perisher as advocated by Woodward and resurrected during Frere's tenure appears not to have been considered — if, indeed, it was known about for by now the historical files had been archived. Second commands, probably in an SSBN and a Captain's command for a first of class were also recommended as ameliorative measures. (The report seems unaware of precedence). [48]

A major conclusion was a delay in selection for SMCC by 12-15 months so that officers completing a first XO appointment were in-zone for promotion to Commander. This had

[44] Email John Edgell January 2020.
[45] Parr interview.
[46] The SMCC Selection Board of four Captains.
[47] Jenkins, 'Review of'.
[48] DNPS, *Submarine Warfare*.

merits. It would give an officer a chance of a better social/family life with stability and perhaps 12 months ashore before selection. From a professional viewpoint, it would increase experience and preparation time before SMCC, both important factors in the failure rates. It would also reduce the necessity of taking a risk on marginal officers at the selection process and most importantly, it would help re-establish the Perisher-command nexus. The average age of a first job XO was 34.3 but the age for SASB1 (Sea Appointments Selection Board for GS XO) was 38.06 and the average age for promotion had risen to 41.8 years. The consequence was that there were around six years between SMCC and command, sometimes even up to 8 years. This was detrimental to the maintenance of skills. The delay would increase the XO age to about 35.5, closer to the GS XO's SASB and reduce the time before command.

The Hardern Report had cleared the way for women in submarines and in 2014 the first female officers qualified as submariners.[49] The RN was some years behind some other navies in taking this step, The RAN allowed women to serve in submarines in 1999, a little ahead of the RCN in 2001 and the USN in 2010,[50] but all were well behind the RDN and RNoN who started in 1985 with the latter having their first female submarine CO, Solveig Krey, in 1995 followed by the Swedes in 2010. The first RAN female to take Perisher was in 2019 but she unfortunately failed the NLSMCC. A female RN officer has yet to take the SMCC.

Another aspect of societal change that was having an effect was the growing prevalence of risk-adversity in almost all walks of life. On hearing, *inter alia*, of such things as tugs being required when transiting Rhu narrows or check off lists for boat transfers, both of which used to be bread and butter seamanship evolutions, earlier Teachers expressed concern that the Submarine Service may become risk-averse with a consequential impact upon war-fighting capability.[51] Four ex-FOSMs (three of whom had been Teacher) expressed the same concerns about an over-focus on risk management introducing risk-adversity,[52] as one says, "*commanding officers must not be risk-averse and the command chain must accept that 'shit happens'. It is wrong to expect a man to be risk-averse during peacetime and then expect him to change for a war*"[53] as was the infamous case of American submarine COs in 1941. RN submariners still generally consider American COs to be procedurally driven to the point of risk-adversity "*too much regulation removes responsibility*"[54] but at least one American CO

[49] Hardern, Section 4, Part 4, Paragraph 36.
[50] Lieutenant Commander Debbie Pestell MD RCN, *Experiences with Mixed Gender Submarine Crews* at ttps://pdfs.semanticscholar.org/ acquired April 2020.
[51] Phillip Titterton interview February 2019.
[52] Stevens, McClement, Parr and Lambert interviews.
[53] McClement interview.
[54] Parr interview.

sees matters another way when Ron LaSlavia wrote of his time taking over the USS *Montpelier*: "*Even in peacetime, submarine command requires a constant assessment of risk versus gain. While the price of an error can be extremely high,* [shit happens] *an overly conservative approach means that the crew doesn't accomplish all it can with the ship*".[55] There are several reasons for the creeping risk-adversity, the first is because society is becoming risk-averse, another that the reduced size of the submarine fleet necessarily reduces the variety of CO's experiences they can pass on.[56] A major cause stems from the 2009 review by Charles Hadden-Cave QC into the issues following the loss of an RAF Nimrod aircraft in Afghanistan in 2006. This review gave the green light to the introduction of engineering management principles into the world of war-fighting, sea-sense and seamanship: "*the engineering world* [s] … *cottage industry of risk management imposes risk into activities which have been performed for generations quite safely*".[57] The concern is that instead of handrails the procedural drive will produce bureaucratic handcuffs which in themselves will be unsafe.[58]

The more recent Teachers, however, push back against this perception arguing that processes and procedures must compensate for experience and, as commented upon, the present FOST Captain (Submarines) has confidence in COs meeting the "*real tests of leadership and mission command*" with the longer and more intense patrols undertaken.[59] With the reduced number of submarines limiting sea experience who can argue against the necessity to exercise caution and the necessity for a Perisher submarine having to complete Directed Continuation Training (a sort of mini-workup) before embarking the Perisher, and when Risk Management Reviews have to be undertaken before Perisher can be conducted in, now unfamiliar, places like Gibraltar, all of which were previously unheard of and considered unnecessary.[60] At the same time, a tocsin from an ex-FOSM who is in the unique position to compare Perisher with its civilian peer Police and Fire Service command courses should be heard. Parr is concerned about the malaise of people restricted by regulation and encourages the military:

> *"to ensure that people are not afraid to step away from procedures at the appropriate time, to think outside the box and make a decision based on events rather than process. In Navy parlance to 'look out of the window'."*[61]

[55] Ron LaSlavia, *Taking Command: The Crew Is Only as Good as the Captain*, https://www.entrepreneur.com/article/284707 acquired June 2020.
[56] McLees interview.
[57] Parr interview.
[58] Titterton interview.
[59] Email Iain Breckenridge April 2020.
[60] Irvine Lindsay interview November 2018 and Jenkins interview.
[61] Parr interview.

Course analysis and curriculum experimentation

Andy Bower relieved Jim Perks as Teacher towards the end of 2010 as the Hardern Report became common currency. When Bower's first course in 2011 was cancelled, he was tasked with reviewing Perisher; he had Hardern in mind. Starting with five principles, Bower cultivated concerns as the work evolved. First, the SMCC-command nexus which, in the days of the SSK fleet had been quite simple, command had more or less immediately followed Perisher, but now it was after an XO's job and maybe one, two or more jobs before being promoted and selected for command. SMCC was losing its lustre and mystique. Secondly, he was concerned as to the compatibility of a pass/fail philosophy with modern training practices, and he felt his concerns were justified when he could find no course that was not a scion of the RN Perisher that adopted the same principles. Then the implementation of the pass/fail decision also concerned him as he felt it was inequitable that such a decision should be reliant on a single opinion. Next, he had become aware that some officers were passing Perisher on the basis that they would either make a good XO or that they would improve in time to be worthy of command. This he felt betrayed the principle of SMCC being a command course and if so, the Service should be open and honest about the outcome. And finally, documentation. Bower recognised that there was no common understanding or narrative, a fault that lay at the feet of a lack of process.[62] It can be appreciated that these concerns of Bower went to the very heart of the Perisher ethos.

Bower's conclusions and recommendations reflect his ability to consider the subject rationally and objectively. The report was presented to the Submarine Advisory Board, (SAB: a think-tank with no executive authority), from which some of the recommendations were soon adopted. For example, it became immediate practice for FOST D (N) to ride the Perisher submarine and confirm the Teacher in his decisions. The possibility of a re-take during the shore training phases was another recommendation that found favour with the SAB albeit heavily caveated as to at what stage a student could be offered a second chance. But, while finding favour, it was unadopted until around 2013 when it was becoming clear that, despite the actions following the Hardern Report, Perisher and SM(CQ) plots were becoming untenable.[63] Perisher failures had further denuded the SM(CQ) pipeline so that some officers were now on their third commands. The SAB considered ameliorative measures such as a special submarine CO category (akin to specialist aircrew)[64] and second-class Perisher passes

[62] Andy Bower interview May 2020.
[63] Parr interview.
[64] Forsaking promotion, officers are allowed to continue flying.

but both were rejected,[65] the latter because of any possible public reaction to a reduction in nuclear-related standards. The recommendation was in place in time for Chris Morgan to be the first student since 1945 to be granted the opportunity of a second chance and he joined SMCC 1/13 having failed a previous course's eyes-only. Sadly, he failed again. Of all Bower's findings, documentation was possibly the easiest to deal with and Bower codified and defined the SMCC but it met neither the ISO 9001 standards that the Dutch had employed nor the MoD's Defence System Approach to Training standard. That was for later.

The resolution to the Perisher-command nexus and XO/CO course question were the two most difficult and contentious products of the report and Bower's solution resurrected Woodward's ideas of 1968 and Frere's review of them in 1975. Like Woodward, Bower concluded that Perisher could be split into two: SMCC1, a prerequisite for an XO appointment with the safety Periscope Course and all the ancillary courses (the nomenclature SMCC would shield any of the standards-reduction criticism); once XO-experienced, recommended for promotion and SASB1 approved, a student would attend SMCC2, a tactical course. What discussions the SAB had and its conclusions are unknown for both this recommendation and the report itself lost visibility during a period of frequent changes at the top of FOST (N) that followed.[66] Its disappearance ensured that John Weale, who followed Matt Parr as RASM, had to argue vociferously against a policy that considered staff courses and shore jobs a necessary prerequisite to command in favour of immediate post-XO promotion, SASB and back to sea as soon as possible in command in an endeavour to both maintain relevant skills and fill the SM(CQ) plot.[67]

A result of the churn at the FOST D (N) level was that Bower's report and documentation failed to reach the next Teacher, Ryan Ramsey, in November 2012. Like Bower, Ramsey is a lateral thinker, and it is quite possible that had he been made aware of Bower's findings he may have tried to develop them further, embellished, of course, by his own ideas. But instead, Ramsey bought his innovations to Perisher strongly coloured by his experiences with the Dutch, Americans and time on FOST staff. In doing so he was not without his critics.[68]

Ramsey believed that the CO's status as guardian of the national deterrent was poorly recognised. He also knew that COs would have to deal with unprecedented influences at international, national, NATO and command levels and that they therefore needed greater

[65] Parr interview.
[66] Bower interview.
[67] Weale interview.
[68] Ramsey interview.

strategic and political awareness and a more deserving profile. Woodward apart, previous Perisher developments had largely been small changes, Ramsey, on the other hand, introduced his innovations by the theatrical flourish of having the course assemble in Nelson's cabin in the *Victory* thereby immediately inculcating both a sense of importance and history. Visits to the Cabinet Office and the House of Lords appear to have had mutual benefit with the students meeting jurists and legislators and they, in turn, meeting the men at the sharp end. Ramsey believed that Perisher should reflect modern operations and warfighting and the key to this was Cockfight which he renamed 'Mini Wars' replicating the American PCO course, which offered what he considered a more relevant scenario replacing events like the periphot with offshore intelligence gathering. This, and similar changes, were the gravamen of his critics for in their opinion events like a periphot were not an operational imperative but a means of testing a student under pressure in a decision-rich environment. In their opinion, Ramsey was in danger of changing Perisher's purpose of putting a student under pressure to learn his limitations and have his stress-capability assessed in favour of a tactical training exercise.

Ramsey's other developments were to introduce best practices from other similar command courses, notably the police with whom he set up a 'leading out of context' experience — students swapping jobs with police officers. He introduced lectures from previous COs to reveal 'warts and all' experiences, a two-way beneficial experience, and finally, a development came from his own Perisher when the one student to fail did not know why he had failed. Ramsey believed quantification for both failure and pass was essential. In this he aligned with both Woodward and Bower, especially Bower's concerns about documentation, for Ramsey developed nine 'Command Competency Descriptors' with three grades, 'exceeding competency', 'competent' and 'development needed' against which to assess a student. He also wrote 'A Guide to Submarine Command'. The latter is still in use; the Descriptors and many of his changes are not, his immediate successors considering reversion to the more conservative format being in the interests of the students.[69]

Shortage of assets for the eyes-only, safety phase for SMCC 1/13, stimulated an agreement with the RNoN and the RNLN to use their submarines and surface assets in return for attack teacher training. This caused an issue because, while the RNLN operated in similar deep water, the RNoN submarines focused on fiord-fighting, so new rules had to be worked out and practised in the attack teacher. Ramsey and the students then flew to Norway and spent another week in the Norwegian simulator before being judiciously split for the seatime in the

[69] Ramsey interview. His successor was one of only two people to decline interview.

Norwegian and Dutch submarines. Because of space limitations, Ramsey rode the Dutch boat but kept in daily touch with the Norwegian teacher. He took feedback from both Teachers about what they thought of the UK students, not just from an eyes-only perspective, but also about how they performed during the overnight CASEXes etc. but the other Teachers could not fail an RN student.

Another innovation came from the Royal Marines Special Boats Section who used coaching, so Ramsey hired an external coach for the students,[70] (the idea was continued by Gareth Jenkins). Ramsey was also considerate of the student that was due to fail by ensuring that the student realised his failure and then spared him any embarrassment of exhibiting his difficulties in front of the customary sea-riding senior officers by ensuring the student was landed before they embarked.

Perisher in 2017

The Perisher of 2017 and today is an impressive, professionally structured course enabling it to deliver training representative of the modern battlespace having embraced cultural shifts and reflective of societal influences. Its principles differ little from the Periscope School of 1917 although differences in content and delivery are infinite and very shortly the course will differentiate itself from all previous courses by being fully documented to produce an objectively defined, repeatable course. The subjective final adjudication of pass/fail by Teacher has been retained.

The two courses a year are now 24 weeks long and organised in four phases, the order of which may change but of which only Phase 4 is at sea. Phase 1 embraces the old COQCEX although this is now conducted in the SCTTs at either Faslane or Devonport. The four weeks of 'Visual Safety' culminate in a student being assessed conducting two 5-ship attacks. The value of this training will undoubtedly increase with the improved fidelity of the attack teachers presently under development at Southampton University. Phase 2, the shortest phase of four weeks, is a mix of a wider tactical game, nuclear propulsion, logistics and the long-established visits to defence contractors. Phase 3 is again in the SCTT for tactical training on completion of which the students go to sea in an SSN to consolidate the SCTT training and to be finally assessed in Phase 4.

Principles apart, there are big differences between today's Perisher and yesteryear. The first, as discussed, is the demise of COQCEX but there is also concern about a Teacher's ability to

[70] Ramsey interview and emails.

put students under pressure being made more difficult in Phase 4 with the paucity of assets available and the excellence of technology, the WECDIS navigational system is an example.[71] On the other hand, students today have other stressors notably information overload. With technology comes information to the point it can overpower the Magical Number Seven,[72] the perceived limits on the human's capacity for processing, making situation awareness and decision-making increasingly complex and a serious mental stressor.[73]

Then there is the selection process which came under the greatest pressure in the early 2000s when retention problems caused a shortage of suitable candidates and some difficult decisions to select people who would not normally have passed the selection process had to be made. The Selection Board reviewed the six candidates for the next course and then identified the potential candidates for the following course and what was colloquially known as the 'black spot' candidates who in normal times would not make the selection and be let go, but because of the imperatives of the pipeline found themselves on the provisional list. Unsurprisingly failure rates began to rise to the reported 35%.

Despite these later issues and the subjectivity of the process with SGM 1503, it was generally thought to be "*as good as it could have been*"[74] and "*the system was providing the right number of the right sort of commanding officers*".[75] There is no record of anybody suggesting any alternative, certainly not for a more objective selection process such as the Norwegians who put their candidates through an examination and interview process before being selected. Recently, the process has become more analytical with the Command Competency Framework measuring seatime in days so that students now have about 1500 days equating to six years at sea before selection. The numbers remain an issue, the quality less so.[76]

A student's selection for Perisher is now conducted similarly to the past with selection decisions being made against reports by a Board, the reports are much improved and the student is expected to be well prepared, including having the ability to conduct a two-ship attack in the SCTT. They are helped in this by keeping a Warfare Officer's Log (not reviewed by the Board) and the logically progressive career warfare courses to qualify PWO(SM). Since the 1980s the principal assessment time, and most often failure point, had shifted from COQCEX to the

[71] Devonport forums.
[72] George Miller, The Magical Number Seven, *Psychological Review* 63(2) 81-97. It was considered that the brain could only retain seven things at one go. This is now contested to be four: Professor Parker, University of New South Wales. 'Four is the 'magic' number,' *ScienceDaily*, 28 November 2012.
[73] Jenkins interview.
[74] Stanhope interview.
[75] Clarke interview.
[76] Perks interview.

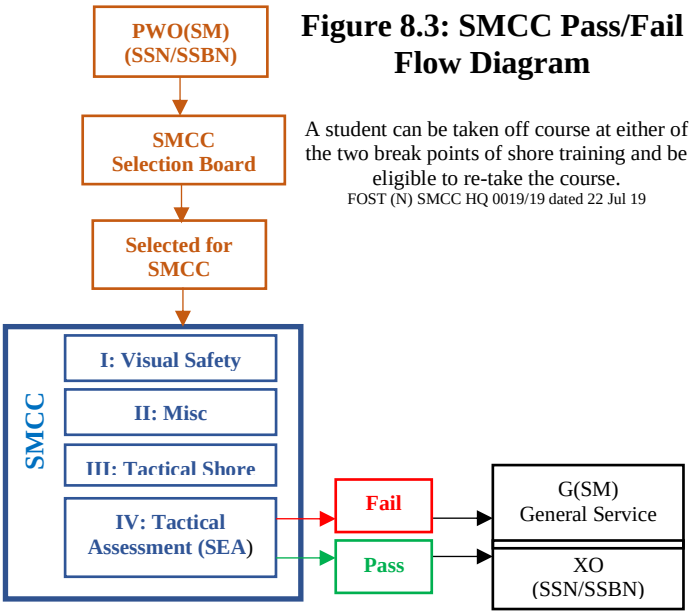


Figure 8.3: SMCC Pass/Fail Flow Diagram

A student can be taken off course at either of the two break points of shore training and be eligible to re-take the course.
FOST (N) SMCC HQ 0019/19 dated 22 Jul 19

Cockfight, and now Phase 4. Students were, of course, being assessed earlier and whereas a student could previously be failed during COQCEX he can now be failed during either Phase 1 or 3. But if appropriate, rather than failing, a student can now be sent back to sea for further experience before reselection for a future course. (In 2019 this was extended to Phase 4 in exceptional circumstances). These measures would help the SM(CQ) pipeline issues identified in the Hardern Report although there was little sign of this having happened with a 35% gap in the plot in 2019, (vice the 45% in 2008).[77] The changes have been introduced as both a palliative to the Hardern Report issues and as a reflection of other organisations like the special forces, Royal Marines and Police. Gareth Jenkins, Teacher in 2017, welcomed the options for he considered that passing or failing had become unhealthy for the students, detracting from their focus on the course. While the exceptional circumstance of a re-scrub from Phase 4 has been allowed neither Jenkins, Perks nor Weale believes that it will be invoked for, much as earlier Teachers had identified, once a student has reached an advanced stage in the Perisher and fails, he has learned his limitations the hard way and repetition would be inflicting pain on himself.

Relevant to submarine command and cognate to the selection process is the question of age. Bacon considered submarining a young man's game and it still is, it just depends on the definition of 'young'. Over the last 30 years, however, following the demise of the SSK fleet, ages have increased again and can be summed up thus: Perisher in late 1980s, 30+/-3, today 35+/-5; SSK late 1980s 35+/-3, today n/a; SSN today 45+/-5; SSBN 47+/-5; FF/DD 45+/-5.[78] The mean age for Perisher students has, for some years now, been 35.5 with ages ranging between 31 and 40. But it is an indubitable anatomical axiom that age changes people. Physically we become less durable, mentally we err away from Bacon's 'rashful' young men'.

[77] FOST (N) SMCC HQ 0019/19, *Review of the Submarine Command Course*, dated 22 July 2019, clause 2.22.
[78] Emails Tim McClement March 2019.

On the obverse, we gain experience, confidence, personal courage and our leadership styles hopefully improve.[79] At 40 and in command of the *Sceptre*, Forsyth felt he was beginning to lose the CO's sixth sense alertness; Lang, Teacher at 39, "*never felt the test of time*" but Irvine Lindsay was Teacher at 50 and had "*never been so tired, physically and mentally*".[80] Clarke is doubtful that over 40 you will have the necessary mental agility but may find life easier in an SSBN, he was CO of the *Dreadnought* at 34 and had no problems but at age 41 as CSST, he found riding submarines very wearying. Jenkins was teacher at 44 and believes officers in their first command at 45 feel no disadvantage of age. The answer depends, therefore, "*on the individual and age is an inappropriate criterion for command which is very much an individual thing depending on aptitude, experience and ability to command*".[81] Perisher has merely responded to the raw material available.

Reflecting societal imperatives, the Perisher student is now exposed to broadening subjects like Ethics and Law of Armed Conflict, Human Factors, Risk Management, Critical Thinking and Coaching and Mentoring.[82] Students are required to write research papers assessed by academics. They will have attended career leadership courses and a strong emphasis on leadership is maintained in subtle ways with exposure to alternative thoughts on leadership. For example, from the Defence Academy, Royal Marines and British Airways, and have 'fireside chats' and visits and discussions on a 'warts and all' basis with previous, sometimes retired, COs. The students also write a leadership paper, again assessed by an external examiner. These exercises, together with other administrative tasks, are reviewed and commented upon for the student's suitability for further staff work and courses.

Two changes introduced following the *Ambush's* collision are of special interest. First, submarines identified for Perisher work now conduct a special mini-workup called Directed Continuation Training before embarking the Perisher. Second is a departure from previous practice but one that may have satisfied Woodward when he raised it as an issue with FOSM in the 1960s. After the *Antares* incident, the concept of Command, Conduct and Charge was formalised and Teacher was able to take Conduct and the student Charge. The *Ambush* incident, however, showed that the additional load on Teacher was unsafe so now Conduct remains with the CO and Teacher takes no responsibility for the submarine releasing him to focus on his students who only take 'charge' if doing 'eyes-only'. While the transition to Perisher in Astute

[79] Jake Moores interview February 2019.
[80] Forsyth, Lang, Clarke and Jenkins interviews.
[81] Wellington Forum.
[82] Email Breckenridge.

class submarines may well prove transformative, safety, which has taken a much wider context, rigidity and prominence, remains the priority, and the first of three areas of competence against which a student is assessed, the others being 'Tactical' and 'Leadership', with the term 'Command Ability' now absent.[83] It is unsurprising, therefore, that "*SMCC is conducted in accordance with the extant Platform Safety Case and platform-specific operating documentation* […] *SMCC is <u>not</u> authorised to operate outwith extant platform safety documentation*."[84] Teacher and the students are therefore not enabled to breach the submarine's operating envelope, for example, to simulate torpedo evasion. One ex-Perisher student described this as operating "*professionally at last*"[85] an expression that raises an eyebrow among the erstwhile Teacher cohort. While today's Teachers are content to abide by the limitations it is only to be hoped that Perisher does not revert to risk-adversity but proves as effective as its forebears especially as a new Cold War escalates, for as the U-boat ace Rear Admiral Erich Topp said: "*The odds in favour of success are in no way enhanced through the use of extreme caution*".[86].

In many ways this period was possibly the most evolutionary of all. The end of the Cold War, just as a good torpedo became operational, heralded defence cuts that meant, despite a spirited defence, the demise of the SSK. The repercussions for Perisher were extensive and the course adjusted by becoming fully nuclear, adapting and evolving to train, assess and reflect the sea experience of the SSN CO rather than the SSK CO, and reducing to one course. But the Perisher-command nexus was broken with all officers going as XO of an SSN or SSBN and consequently the course changed its name to SMCC and the Canadians and Dutch established their own Perishers with the Australians joining the Dutch. Meanwhile, the Americans returned to Perisher, the SM(CQ) plot came under pressure, and the selection process went through iterations

Perisher experienced its bitterest moment with the sinking of the *Antares*, and although there had historically been incidents between submarines and fishing vessels, the event was possibly overdue with the size and power of the submarines operating in fishing vessel populated waters. Further diminishment of the submarine fleet was accompanied by the assimilation of technology in terms of new boats, sensors and weapons, way beyond anything previously experienced. Along the way, Teachers showed their continued imagination, initiative and

[83] FOST(N) SMCC HQ 0019/19.
[84] Jenkins, 'Review of'.
[85] Tim Green interview July 2029
[86] https://www.richiekohler.com/;Topp.

cerebral capability with the Bower study and Ramsey reforms— perhaps both opportunities missed. The Harden Report opened the way for women in submarines and the established pass/fail was reviewed to allow a re-scrub under certain circumstances.

The course may have evolved, but people do not change, and confidence can be gained from the qualities of officers going through SMCC today being equal to, if not higher than, their forebears Today's well-informed, well-schooled CO adds a new attribute of command, managing a plethora of information from disparate sources and advanced sensors adding to the fundamentals of submarining that remain unchanged since Bacon.

9. Perisher Concluded

Received wisdom is that Perisher was an answer to the losses of submarine COs in the First World War whereas this thesis uniquely identifies the conception of the Periscope School as a serendipitous confluence of factors. Although the periscope attack training it gave COs was too late to have any real effect on the outcome of the war its value was appreciated, and the Periscope Course acclaimed. The comment "*all officers should pass the Periscope Course before command*"[1] bore sufficient testament to ensure the course's continuation, and its re-naming to COQC with all that that implied. Adopting the moniker 'Perisher', between the wars the course set out on a road of evolution from basic use of the periscope to the exacting test and assessment of command qualities in decision-rich, pressurised, risk-complex, and information-laden scenarios of 2017.

The thesis accomplishes the aims identified in Chapter One. The unique analysis has demonstrated how Perisher's evolutionary process was a series of periods, each responding to the needs of the Submarine Service represented by the exigencies and imperatives of the time. It shows how a 'Perisher process' developed whereby sea experience, the essence of naval and especially submarine command, was embraced and perpetuated by each generation of Perisher. The foundations for that road had been laid earlier with Bacon establishing the ethos and precepts of the Submarine Service that would prevail to today within a culture that coalesces pride, professionalism, self-discipline and mutual respect, now overtly expressed in the submarine badge.

The submarine was one of the great innovations of the nineteenth century and its young adherents grappled with the third dimension and the internal combustion engine to the sometimes bemusement and cultural opposition of the wider (older) Navy until the submariners proved the capability of the overseas boat, when doctrine began to be properly formed — analogous to the IT innovators of today speeding technology forward to the incomprehension of older generations. Just as digitisation is now the exemplar of technical innovation, so the submarine was then — and continues to be so as it joins and is driven by the digitisation revolution— which has meant two things: a synergy between CO and technology (first the

[1] RNSM A 2007/558 War Experience.

periscope, then growing technology of the sonar systems, and latterly the command systems); and a responsibility on the CO for assimilation of each new technology before it can be embraced by tactical doctrine. Sometimes the praxis was immediate, for others (and radar is the prime example given) it was more circumspect.

The interwar years' evolution was undramatic if fit for purpose through a period of uncertainty and discord until, as the thesis demonstrates, inadequacies became apparent as the Second World War approached. Risk-adversity was the cause of a lack of night-time operations, but a failure of technology, thoughtfulness and finance confined Perishers to conducting "*bow and arrow*"[2] 'periscope eye' attacks because they lacked the gyro-angled torpedoes of the Germans and Americans, even if the strengthened mental muscles and improved ship-handling as COs manoeuvred into the optimum firing position would prove beneficial. When war came, however, Perisher responded with alacrity and celerity to evolve a course that met the wartime demands in terms of numbers, quality and extent of training by shortening the course time, (thereby intensifying it), running consecutive courses and adding Scapa Flow high-speed, multi-ship attacks. These latter reflected "*The doctrine for RN submariners … almost exclusively aimed at attack of warships, preferably capital ships*."[3] even though, contrary to Roskill, there had been attempts at attacking convoys, (i.e. merchant ships). Wanklyn was complaining about this doctrine when he said that Perisher students were "*always being trained in attacks on high-speed targets, like destroyers and the occasional cruiser*", not good training for the Mediterranean battle in which he was embroiled where "[It took] *time to get used to tackling these relatively slow supply ships*."[4]. Could it have been remedied? Yes, if the lessons of the First World War had been appreciated but the submarine was still an innovation largely side-lined.[5] Despite the shortcomings, if Bryant and Wingfield are indicative, the training leading into the Second World War was sound and worked well when tested. After all, the Submarine Service was "*realistically professional in a manner like no other part of the Navy*",[6] possibly an arrogant claim if it had not been made by a GS officer. Nonetheless, a claim validated when comparisons are made to show how the British contentiously outperformed their American and German peers for which much of the credit must be given to their training by Perisher both before and during the war.

[2] King, *The Stick*, 24-5.
[3] Franklin, *Britain's Anti-Submarine*, 143.
[4] McGeoch, *An Affair*, 52.
[5] Murray, *Military Innovation*, 227-264.
[6] Whinney, *U-Boat Peril*, 42.

As late as 1956, Martin Wemyss found himself on a Perisher that differed little in most respects from his father's in 1925 implying that it had stagnated as a periscope course rather than evolve in the intervening years although there were now many more failures which indicate a more severe test. While Perisher may have initially had difficulty reflecting the new underwater battlespace, it produced a litany of outstanding Cold War submariners whose professionalism, awards and promotions reflected the success of their operations using Perisher-learned skills.

It was the Woodward revolution in 1968 and the realisation that, while the Mark 8 periscope attacks were continued, their raison d'être had changed from the primary attack to a means of inculcating the safety sixth sense. Hereon in, there is no doubting that through the application of pressure and risk, both COQCEX and Cockfight, laid bare the students' decision-making ability under stress, his character, personality and most importantly, his limitations as never before and it was this, and the 25% who succumbed to catastrophic stress, that gave rise to both the respect and post-1945 mystique in which the course is deservedly held.

It was the egregious lack of an efficacious weapon during the Cold War that confined the course to be a test of a student's command rather than tactical competency, much as the RAN consider the NLSMCC an exploration of a student's character, personality and command competency with the USN PCO course adding the tactical aspect. Consequently, the Mark 8 torpedoes, which had first come into service in 1927, were in relative abundance for Perisher, but as new torpedoes and technologies were being introduced — Mark 20; Mark 23; Tigerfish Mod 0, 1 and 2; towed arrays *et al* — Perisher found itself at the back of the queue. In contrast, as Perisher was starved, the Americans' PCO course was fed multiple ADCAP weapon firings. When Dai Evans tried to break out of the confinement by introducing towed array technology and tactics, he received criticism from votaries of a conservative Perisher who failed to recognise that earlier, wartime Perishers had been at the forefront of tactical thought and whose students went straight to war. It was difficult to argue that the Cold War student who lacked trailing and towed array experience, and whose familiarity with the latest weapons was perfunctory, could fulfil Evans' commitment to camera "*at the end of the course the student should be able to take his submarine to war*".[7] This was Macpherson's "*we Teachers were behind the curve*", not the proof of command qualities, they were well tested and assessed, but the knowledge and ability to employ the total weapon platform. And that was just an SSK. From the early 1960s there was another factor, the nuclear submarine.

[7] BBC Documentary 'Million Pound Captains'.

As a speaker at the Perisher Centenary dinner said, "*Perisher has evolved*",[8] something that this thesis has made clear, especially the Woodward and nuclear 'revolutions'. Those evolutions have been at the instigation of the Teachers and it is not to be disparaging to say that there is a nexus between the development of Perisher and the experience, perspicacity, and certainly the thought that some Teachers gave Perisher even if some innovations were rejected. Proposed developments were terminated as embryonic by the culture of the time being inappropriate to give them birth or because Teacher, who initiated and articulated the conception of change had his attention absorbed by the quotidian. Teachers were under the remit of implementation and the midwifery of change lay higher up the command chain where policy lay with CSST, CoS and FOSM/RASM. A failure there was to recognise the differences between SSK and nuclear command: "*the route to nuclear command was considered to be just part of the progression process that had been so steadfast throughout the Submarine Service's history … there was no conscious thinking*."[9] With such an absence of dialectic challenge and too little dialogue between Teachers and policymakers, there could not be any conscious thinking. If Woodward could not navigate the command complex there was little chance for his successors, no matter how veracious their proposition. The frustrations of Evans, McLees and Forsyth *et al* were evidence of this phenomenon but the caucus of conservatism was against them. Some had a little more success although they also had imperative causation, the response to the all-nuclear Perisher is a good example as are, rightly or wrongly, the innovations of Ramsey even if they were reversed by his successor. Missing out in the evolving changes is Bower and his split Perisher of the SMCC1-Safety Training as a qualification for XO and SMCC2-Tactical Course as the prerequisite for command. Although Bower's ideas may have appeared radical at the time, he was unknowingly resurrecting Woodward's thoughts from 44 years earlier. A renewal of those ideas, for which Woodward had put the praxis at six years, was reviewed but sadly not accepted by Frere when he was Teacher in 1974. Its oversight then and during Bower's time may be a loss, for its implementation could have been a pathway out of the pressures of the SM(CQ) maze experienced then and subsequently.

Perisher played perfunctorily with SSN tactics before the imperative of the demise of the SSK eventually made it change and when it did, the Submarine Service was fortunate to have the outstanding triumvirate of McClement-Anthony-Stanhope to take Perisher through the transition. Following Teachers have evolved the course as the tangibles of weapon portfolio,

[8] McClement, 'Perisher dits'.
[9] Grenier interview.

platform capability and battlespace have changed, and the intangibles of submarine command have had the extraneous demands of cultural and societal change loaded on today's COs. In response, Teachers over the 2000s deftly introduced changes and improvements that reflected the complex warfare platforms of the modern submarine and both societal influences and contemporary educational developments to produce a well-rounded commanding officer. This has not lowered the command bar, students are still rigorously searched-out to prove themselves worthy of submarine command, and because of the PWO(SM) programme and the elongated tactical phase, they are more tactically knowledgeable.

Of course, there are concerns about Perisher especially as incidents at sea continue and they can prompt the questioning of Perisher. But these incidents also must be put in perspective. Operating submarines is a dangerous business, the environment of the third dimension is dangerous, and submarines themselves are inherently dangerous and while conducting Perisher those dangers are further enhanced so it is not surprising that occasionally things go wrong. But while 12 other countries have lost submarines since the Second World War, the RN Submarine Service has not had a total loss of submarine and crew since the *Affray* in 1951 and nor have the principal countries trained by Perisher, so something must be going well, and it might well be Perisher.[10] An expert review, on the other hand, suggests most incidents are a failure of seamanship (and seamanship training/experience), and/or the diminution of the Navigator's qualification away from the specialist, rather than Perisher.[11]

Is the selection process, which has possibly been one of the best reflectors of change over the years, fit for purpose? Certainly, today's CCF provides a comprehensive profile but the human element in selection, perhaps responding to other pressures, still prevails. The more contentious pass/fail and XO or CO course questions also prevails. Pass/fail has served Perisher well and there is a strong lobby, and other-Navy's examples led notably by the rigours of the Dutch ISO 9001, that support its retention. The possibility of a re-take is even more contentious, but it reflects modernity as does documentation of Perisher. It would be pedantic pertinacity to deny either with the evidence that supports their benefits. The XO-CO question is, perhaps, bigger. The demise of the SSK command and successful Perisher students going exclusively to XO jobs inevitably attracted questions as to Perisher's command credentials,

[10] The *Truculent* had sunk in 1950 and the *Sidon* had a torpedo explosion in 1955 killing 12 men and sinking the submarine alongside. The *Artemis* sank alongside in 1971 without loss of life. Other countries are: Argentina, France, India, Indonesia, Korea, North Korea, Pakistan, Peru, Russia, Turkey, USA including a Swiss midget submarine. Mary F. Romig, 'Fatal Submarine Accidents; A Bibliography 1900-1965', *The RAND Corporation*, 1966; Evans, A S , *Beneath The Waves*, (London: William Kimber, 1986).
[11] Commodore David Cust and Captain John Edgell were asked to review the incidents.

especially as there was creditable evidence to suggest that it is not (always) perceived as such. While the challenge has tenacity, policymakers vehemently deny any accusatory suggestions and it is hard to gainsay the opinion that seems to reject investigation of the worthiness of the Bower and Woodward's ideas.

There is a propensity for generations to raise the bar and Perisher has been no exception, stimulated as it has been by the advance of technology, so that the post-war CO proved throughout the Cold War to be in every way as good as the wartime CO. Today, the submarine CO has a boat, weapons, sensors and information unimaginable to his predecessors. So too, the demands on him far exceed anything that could be conceived of, not in the physical sense, for onboard living is very different between the first A-class and today's Astute class, but in the cognitive sense. His boat and its capabilities may be the envy of his predecessors, but he operates within an ethos and a culture that they would readily recognise. The material has developed and evolved through innovation; the abstract has persevered.

That Perisher has evolved is indisputable. That it has always evolved in harmony with the Submarine Service's needs is more questionable depending on the questions and how they are asked. That Perisher evolved in the interwar period is certain from its consolidation and the training inadequacies leading into the Second World War were not, necessarily, the fault of Perisher. The Second World War was probably Perisher's finest period but then, the imperatives were at their most demanding. That period can probably be matched, if not by numbers but by the quality of the Cold War COs, with a double Perisher throughout the 1970-1980s providing 197 well-tested COs for an expanding, diverse submarine fleet even if weapon and tactical training may have disappointed. Since then, Perisher has had to respond and evolve yet again to meet the needs of a diminishing number of submarines but increased demand for SM(CQ)s and, at the same time, assimilate outstanding technical developments and strong societal changes. Context is required: in 1914 the Submarine Service had 62 boats in commission and 168 officers, almost exclusively Executive Officers with the few Marine Engineers shore-based. The submarines were basic in all respects although leading-edge for their period. By 2017 there were 11 submarines whose evolutionary development has produced boats of immense complexity and capability in all aspects. The officer cadre of 840 included Warfare (Executive), Nuclear Marine Engineers, Weapons Engineers, Logisticians (Pussers and Instructors), and Medical Officers.[12] As the evolution of technology, capability, weaponry,

[12] Rear Admiral Roger Lane-Nott, *'The state of the Royal Navy' submarine flotilla and UK ASW capability*, https://www.savetheroyalnavy.org/the-state-of-the-royal-navy-submarine-flotilla-and-uk-asw-capability/

tactical doctrine and even officer specialisation has progressed it has reflected the changing challenges of the submarine command imperative. The Literature Review emphasised the absence of relevant historiological sources on these matters. In providing quantifiable evidence that the Periscope School/COQC/SMCC or Perisher, through the qualification of 1,165 British submarine commanding officers, has evolved to meet its imperatives., this thesis, as the first academic study of any type of command course, complements a lacuna too long neglected by historians.

It remains to be seen whether the COs of tomorrow will say (to paraphrase Lord Howe) 'thank you for doing your duty in providing me with your risk assessment, your staff papers, your leadership courses and your inclusivity and diversity training. And now face me towards the enemy'. We now know, because this thesis shows it, that Perisher responded, adapted and evolved, mostly at the appropriate time and in the right way to produce submarine COs who 'faced the enemy'. If Perisher continues its 100 years of evolution, and in whatever form it should take, it will ensure that submarine COs continue to do so. But let's leave it to an old adversary to comment. Apocryphally, a post-Cold War Russian Admiral said that the best submarine would have American technology, Russian weapons, and a British commanding officer.

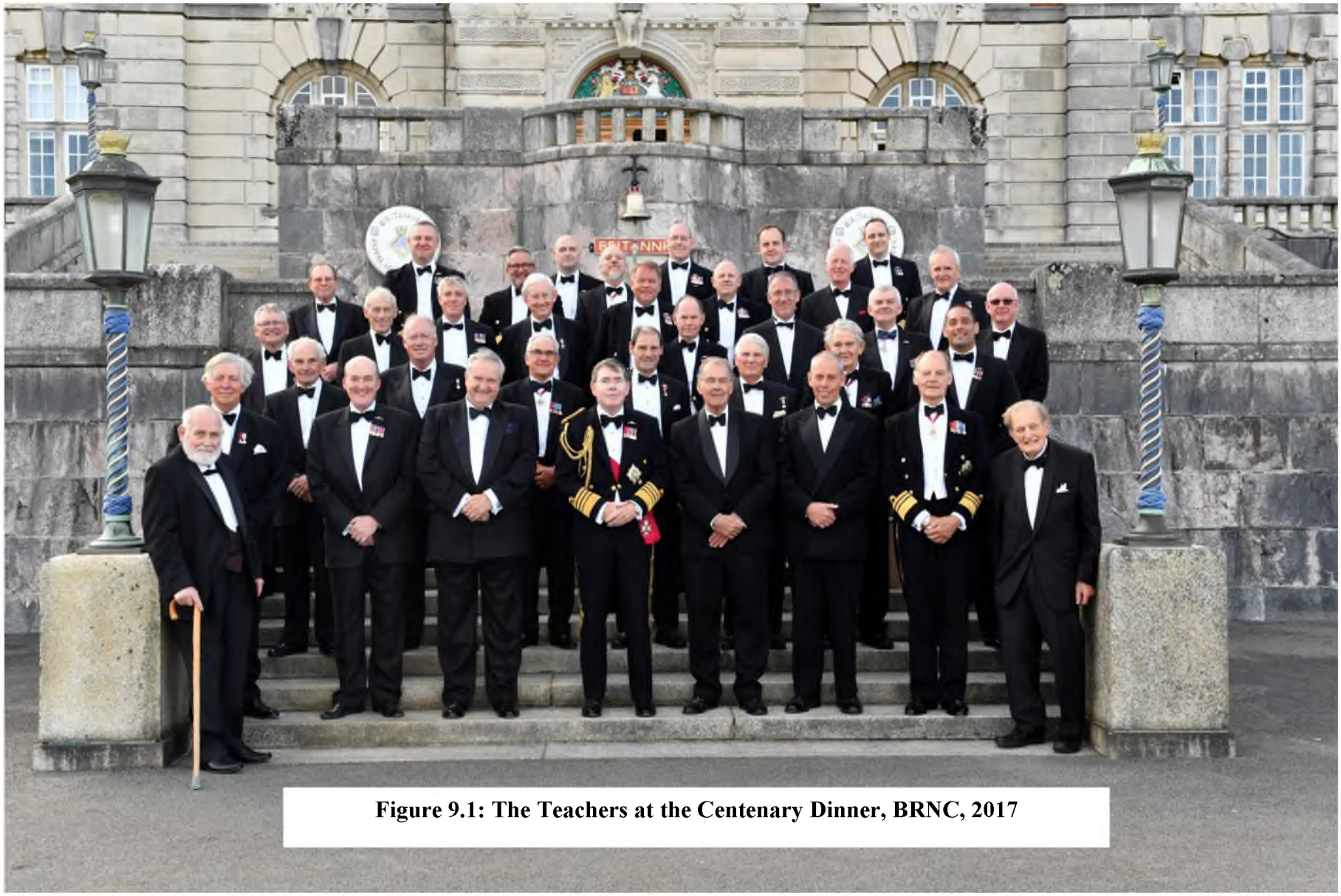


Figure 9.1: The Teachers at the Centenary Dinner, BRNC, 2017

1 John Livesey 2 Jim Perks 3 Irvine Lindsey 4 Paul Lambert 5 Paul Burke 6 Andy Bower¶

7 Justin Codd 8 Brian Needham 9 David Perfect 10 John Edgell 11 John Lang¶

12 Michael Walliker 13 Philip Titterton 14 David Charlton 15 Paul Robinson¶

16 Terry Woods 17 Johnny Clarke 18 Neil Robertson 19 Rob Stevens 20 Martin MacPherson¶

21 Simon Williams 22 **Ed Veen RNLN** 23 Paul Abrahams 24 Ryan Ramsey¶

25 Jock McLees 26 John Davenport 27 Toby Frere 28 Bob Mansergh 29 David Soutcott¶

30 Mark Stanhope 31Norman Hodgson 32 Rob Forsyth 33 Chris Munns 34 Fran Grenier¶

35 Tim McClement 36 Peter Cobb¶

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Royal Navy; Tom King; Rear Admiral Niall Kilgour CB ; Captain Third Rank Dmitry Kosintsev Russian Navy; Vice Admiral Sir Paul Lambert, KCB, KStJ; Commodore Gavin Lane Royal Navy; Rear Admiral John Lang DL. Hon D Tech. FNI. FRIN. MIS; Rear Admiral Jeremy Larken, DSO FInst; Commander Bob Laverty MA Royal Navy[i]; Captain Gordon Leveratt Royal Navy; Captain Irvine Lindsay OBE MA Royal Navy; Professor Stephen Linstead; Captain Doug Littlejohns CBE, MBA, BSc, FIMA, CMath Royal Navy; George Malcolmson; Commodore Martin Macpherson OBE Royal Navy; Captain Michael Manfield Royal Australian Navy; Commodore MGB Manning AFC JP FCMI Royal Navy; Captain Bob Mansergh OBE Royal Navy; Sam Mason; Commander Dunx McClement BEng(Hons) MSc MA PGDip NRT CEng CMgr FIMechE MCMI MCGI Royal Navy; Vice Admiral Sir Timothy McClement, KCB, OBE; Captain Jock McLees Royal Navy; Commodore Ken McMillan Royal Canadian Navy; Commodore John Milnes Royal Navy; Commodore Jake Moores OBE DL BSc Royal Navy; Captain Chris Morrison Royal Navy; Commodore Chris Munns MBA Royal Navy; Commander Paul Murray-Jones Royal Navy; Lieutenant Commander Christopher Napier OBE; Dr. Donald Nairn ; Captain Keith Nesbit, Royal Canadian Navy; Commander Charlie Neve Royal Navy; Vice Admiral Sir Roy Newman KCB JP DL; Captain Tim Norman-Walker Royal Navy; David Northam; Surgeon Captain Morgan O'Connell F.R.C.Psych Royal Navy; Rear Admiral 'Paddy' O'Riordan CBE DL; Rear Admiral Matthew Parr CB;Commander David Perfect Royal Navy; Commodore J Le S Perks OBE Royal Navy; Admiral Sir James Perowne KBE; WO(TSSM) Michael W Pitkeathly MBE Royal Navy; Captain J.A.Y. Plante SSM QDJM CD Royal Canadian Navy; Commander Jonty Powis BSc AFNI USNI FRAS Royal Navy; Commander Hugh A E. Powlett, Royal Navy ; Jim Prescott; Captain Gavin Pritchard OBE Royal Navy; Alan Rae; Commander Ryan Ramsey MA MSc Royal Navy; Commander Neil Robertson Royal Navy; David Rostron; Commander M D P Samborne Royal Navy; Captain Richard Sharpe OBE Royal Navy; Captain Colin Stockman BA, MBA, FCMI Royal Navy; Commander Daniel Simmonds Royal Navy; Commander Ben Smith Royal Navy; Admiral Sir Trevor Soar KCB OBE DL; Commander David Southcott Royal Navy; Captain John Speller OBE Royal Navy; Captain Philip Stanford Royal Australian Navy; Admiral Sir Mark Stanhope, GCB, OBE, ADC, DL; Commander Ole Steinsland Royal Norwegian Navy; Rear Admiral Rob Stevens, CB; Commander Tim Swales Royal Navy; Captain Dan Sutherland Royal Australian Navy; Commodore Eric Thompson MBE MSc DipEE CEng RN DL Royal Navy; Lieutenant Commander John Tipping Royal Navy; Commodore Phillip Titterton CBE Royal Navy; Lieutenant Commander Matthew Todd Royal Navy; Captain Roger Trussell Royal Navy; Captain Stephen Upright Royal Navy; Commander David Vaughan OBE BA FRIN MNI Royal Navy; Lieutenant Commander Christopher Walker MBE. AMINucE AMBIM Royal Navy; Captain Patrick (Pat) Walker CBE Royal Navy; Commodore Michael Walliker CBE Royal Navy; Captain Tony Wardale MA, FIET Royal Navy; Commander Guy Warner MA MSc CEng MBCS CITP Royal Navy; Captain Basil Watson Royal Navy; Miss Sarah Wattie MA MSc CPsychol; Rear Admiral John Stuart Weale CB, OBE; Rear Admiral Martin Wemyss CB; Rear Admiral Jon Westbrook CBE; Rear Admiral Anthony Whetstone CB; Commander Ian Whitehouse BSc, MBA, MIHSM Royal Navy; Vice Admiral Peter J Wilkinson CB, CVO, BA (Hons); Geoffrey Williams; Lieutenant Colonel David Wood MBE MC British Army; John C. Wise MBE; Commander Terry Woods OBE Royal Navy; Captain Richard Wraith CBE Royal Navy; Captain Chris Wreford-Brown DSO MBA Royal Navy; John Wickenden; Mrs. Joan M Wilson OAM; Geoff Williams; Captain Richard Yeomans BSc Royal Navy.

APPENDICES

APPENDIX ONE: INTERVIEWS

All interviews have been conducted in accordance with the King's College London ethical compliance requirements and the practices and ethical principles of the Oral History Society to maintain the fidelity of the information. Agreement to be interviewed was first sought often by necessity through an intermediary who had access to contact details and a suitable venue, usually the interviewee's home, was arranged. Explanation of the process was given to interviewees at the start of each interview most especially aspects of confidentiality, and permission to record had to be given by the interviewee following an explanation as to what would happen to the recording (held on a private database until deletion on completion). Recordings were transcribed manually and their content used to construct the history of the course and for analysis for Chapter Four. Transcript will be similarly destroyed on completion. Interviews were often followed up by emailed supplementary questions or ancillary information from the interviewee.

There were five different types of interview: Teachers, COs, Forums, Failures and technical. Despite the differences all interviews had the same rhythm based on the principles advocated by the Institute of Coaching. That rhythm starts with the open questions of Kipling's Honest Working Men: What? Why? When? How? and Where? Answers were 'mined' with increasingly closed questions. It reflects the interest every interviewee took in the study that conversation never faltered. Quite the reverse, occasionally discussions had to be discreetly returned to the theme or terminated to avoid diversion into other matters or reminiscences.

The interviews with ex-Teachers explored both their personal and Teacher Perisher experiences whereas the CO interviews and Forums focused on the interviewee's personal experience. In the way of human nature some confidences were disclosed but have not be repeated in the study although it can be commented that they did reveal that submarine COs are not homogeneous and that the system does sometimes fail in its selection of Teacher. Interviews with failed Perishers were productive rather than sensitive and it is to the great credit of the interviewees that to a man they were totally open and realistic regarding their Perisher experiences. The technical interviews used more closed questioning.

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KING'S College LONDON

15/06/2018

David Parry

Dear David

Perisher

Thank you for submitting your Research Ethics Minimal Risk Registration Form. This letter acknowledges confirmation of your registration: your registration confirmation reference number is MRS-17/18-7468. You may begin collecting data immediately.

Be sure to keep a record your registration number and include it in any materials associated with this research. Registration is valid for **one year** from today's date. Please note it is the responsibility of the researcher to ensure that any other permissions or approvals (i.e. R&D, gatekeepers, etc.) relevant to their research are in place, prior to conducting the research.

Record Keeping:

In addition, you are expected to keep records of your process of informed consent and the dates and relevant details of research covered by this application. For example, depending on the type of research that you are doing, you might keep:

- A record of the relevant details for public talks that you attend, the websites that visit, the interviews that you conduct
- The 'script' that you use to inform possible participants about what your research involves. This may include written information sheets, or the generic information you include in the emails you write to possible participants, or what you say to people when you approach them on the street for a survey, or the introductory material stated at the top of your on-line survey
- Where appropriate, records of consent, e.g. copies of signed consent forms or emails where participants agree to be interviewed.

Audit:

You may be selected for an audit, to see how researchers are implementing this process. If audited, you will be expected to explain how your research abides by the general principles of ethical research. In particular, you will be expected to provide a general summary of your review of the possible risks involved in your research, as well as to provide basic research records (as above in Record Keeping) and to describe the process by which participants agreed to participate in your research.

Remember that if you have any questions about the ethical conduct of your research at any point, you should contact your supervisor (where applicable) or the Research Ethics office.

Feedback:

If you wish to provide any feedback on the process you may do so by emailing rec@kcl.ac.uk.

We wish you every success with this work.

With best wishes

Research Ethics Office

Dear Perisher

You will receive this via the kind hand of Malcolm Avery. If for any reason we are already in touch please ignore this message.

With the Perisher now being over 100 years old it is time for its history to be written and as a minor maritime historian I have taken on the onerous task. This has the support of RASM, is in conjunction with King's College London and is sponsored by BAE.

The history from 1917 to 1945 has largely been a matter of archival, primary and secondary source material research. For the post WW2 history, however, I have to rely on oral history. To that end I have interviewed many of the past Teachers and their input has been simply excellent. I now need to capture the memories, experiences and opinions of Perishers. To enable me to do that I hope to interview a few Perishers, maybe ask others to complete questionnaires but most importantly I am hoping to hold forums of 4-6 Perishers in Gosport (either the RNSM or Fort Blockhouse) in Devonport on board the *Courageous*, in London on board the *Wellington* and in Faslane.

If you feel able and inclined to help this venture I would be most grateful if you could complete the attached simple form and send it back to me. I will then contact you directly by email.

The form is a Word document so you will have to download it, click 'enable editing' at the top, fill the form in digitally, save it and attach it in an email back to me at **COQCstudy@gmail.com.** If you have any problems with that please fill it in by hand and mail it back to me at the address below

I very much look forward to meeting many of you at the forums but I can only manage limited numbers so please do not be offended if you are not on a list. Rather, it will give you the opportunity later to criticise what others have said!

VMT

David Parry
26 Kiln Lane
Farnham
GU10 3lLU

PS the histories of attack teachers, periscopes, sonar, command systems and radar are available on the Friends of the Submarine Museum website.

Personal	
Name	
Rank	
Address	
Phone	
Email	

Participation		
Are you willing to be interviewed?	☐ Yes	☐ No
Are you willing to answer a questionnaire?	☐ Yes	☐ No
Are you willing to participate in a forum? (4-6 Perishers together sometime over next 3-6 months)	☐ Yes	☐ No
If 'Yes' which venue?		
☐ Devonport 29 October	☐ London 11 November	
☐ Devonport 30 October	☐ London 20 November	
☐ Gosport tba	☐ Faslane tba	

Additional Information
If you have any comment or especially any special experience that can add to the history of the Perisher please give brief details.

Dear XX

I am truly delighted that you have offered to contribute to this research. And I very much look forward to meeting with you on XX.

By way of introduction and preparation I thought I would offer these notes. First is a brief explanation as to why I have embarked on the study. This is followed by a few notes on the conduct of the interview and the subjects that we may cover. The list of the latter is neither obligatory nor exhaustive; I very much welcome any particular aspects you think can add value to the study and history of the Perisher whether that means amending the agenda or focusing on some deeper aspect of any of the subjects.

What I would ask is that if at all possible you give some pre-meeting consideration to the subject matters in a self-challenging way.

Oral history often tends to become distorted because we naturally adjust the memories of events through the lens of subsequent experience. We can also frequently forget or get detail wrong even though deep in our conscience the right version is probably available. One way of overcoming these issues is to try and take ourselves back to the conditions at the time of the event by recalling the smells, sounds and tactile feel of things associated with the event. To give a simple but relevant example, Sandy Woodward talks openly and eloquently about his lack of preparedness for his first Perisher course as Teacher and the effect this had on his students. Although he does not say it, an element of nervousness can be detected. With the confidence gained from the following Perisher courses, and the passing of time, if those sentiments had not been recorded at the time could easily have been overridden by memory or lost in later experiences. So, when reflecting on the various aspects, may I ask you to challenge yourself? When you say that is how you feel about an issue now, can you please ask yourself how you felt about it then?

Of course, the same subsequent experience that may distort our memory can serve to provide a more objective appraisal of the event. And this is exactly what Woodward does at the end of his tenure in his turnover notes. He recognises his unpreparedness and then offers those who follow the resolution in light of his two years as Teacher.

Lastly, as the anecdote is the historian’s illustrator, I will welcome as many illustrative anecdotes, or just plain ‘dits’, you care to share with me.

APPENDIX TWO: PERISHER LIST

The following RN students passed perisher 1917-2017

Lt D R ATTWOOD	1917
Lt L H BAYLEY	1917
Lt R T CRITCHLOW	1917
Lt P L EDDIS	1917
Lt G J MACKNESS	1917
Lt J M MUNDELL	1917
Lt C V POWEL	1917
Lt R C T ROE	1917
Lt E B TOD	1917
Lt E M C BARRACLOUGH	1918
Lt D C BELL	1918
Lt T C M BELLAIRS	1918
Lt J A P BLACKBURN	1918
Lt S A BROOKES	1918
Lt W BROOKES	1918
Lt A M CARRIE	1918
Lt W S CARSON	1918
Lt A J CLEMENCE	1918
Lt G E COLPOYS	1918
Lt A E CONN	1918
Lt C E A COX	1918
Lt F L de SPON	1918
Lt W A C DICKSON	1918
Lt L V DONNE	1918
Lt D J GAVIN	1918
Lt W HAYNES	1918
Lt W HIBBERT	1918
Lt A E HODGSON	1918
Lt R C HOLLAND-PRYOR	1918
Lt W IBBETT	1918
Lt H N LAKE	1918
Lt A S LINDSELL	1918
Lt A D L MacPHERSON	1918
Lt A L P MARK-WARDLAW	1918
Lt C MAYERS	1918
Lt A Mc G McCULLOCH	1918
Lt A A L MITTEN	1918
Lt R F MORICE	1918
Lt M J NICHOLSON	1918
Lt T J PARKINSON	1918
Lt A L PEARS	1918
Lt O W PHILLIPS	1918
Lt J W PINHEY	1918
Lt E R REED	1918
Lt H L RENDEL	1918
Lt C A ROBINSON	1918
Lt G H RUXTON	1918
Lt G A C SHARP	1918
Lt A B SMITH	1918
Lt A H J STOKES	1918
Lt J A L STOKES	1918
Lt C R THOMPSON	1918
Lt R A TREVOR	1918
Lt T F A VOYSEY	1918
Lt A WARDELL-YERBURGH	1918
Lt G M K WHITE	1918
Lt K M WILKINSON	1918
Lt A S CUMMING	1919
Lt G C L DALLEY	1919

Lt C H L EVANS	1919
Lt D W GRANET	1919
Lt G A G HAGGARD	1919
Lt C A KERSHAW	1919
Lt E M LOLY	1919
Lt H K B MITCHELL	1919
Lt N R PEPLOE	1919
Lt G T A SCOTT	1919
Lt J G SUTTON	1919
Lt T B THOMAS-PETER	1919
Lt G A G WILLIAMS	1919
Lt O M ANDREW	1920
Lt L H ASHMORE	1920
Lt A L BESANT	1920
Lt J S BETHELL	1920
Lt P F COOPER	1920
Lt V C DORMAN-SMITH	1920
Lt W L DOWDESWELL	1920
Lt G G N GRAHAM	1920
Lt H P K ORAM	1920
Lt F D PITT-PALMER	1920
Lt P S J PONSONBY	1920
Lt C C ALEXANDER	1921
Lt B L CLARK	1921
Lt J CRESSWELL	1921
Lt E R DODD	1921
Lt C C FLEMMING	1921
Lt W H D FRIEDBERGER	1921
Lt J H MacNAIR	1921
Lt F D MORRIS	1921
Lt J MURRAY	1921
Lt W O SCRYMGEOUR-WEDDURBURN	1921
Lt G J D TWEEDY	1921
Lt T D K WILLIAMS	1921
Lt G L ANSELL	1922
Lt M BLOOD	1922
Lt V R L BOWLBY	1922
Lt R R DEVLIN	1922
Lt E V HUME-SPRY	1922
Lt A S HUTCHINSON	1922
Lt J de M LEATHES	1922
Lt R A NICHOLSON	1922
Lt C O O'CALLAGHAN	1922
Lt T B OKELL	1922
Lt H E SPRAGUE	1922
Lt C B ALLEN	1923
Lt W L BERRIDGE	1923
Lt R C DONOVAN	1923
Lt B R HOOPER	1923
Lt J L F HUNT	1923
Lt W St A MALLESON	1923
Lt S E NORFOLK	1923
Lt S M RAW	1923
Lt W D STEPHENS	1923
Lt T M TAYLOR	1923
Lt G A VOELCKER	1923
Lt T YEOMAN	1923
Lt R S BARRY	1924
Lt T B BRUNTON	1924
Lt A G BUCHANAN	1924
Lt G P CLARIDGE	1924

Lt J G W DENEYS	1924
Lt T H DICKSON	1924
Lt F G EMLEY	1924
Lt B W GALPIN	1924
Lt W E HIGHAM	1924
Lt C Y C KEAYS	1924
Lt F L MERRIMAN	1924
Lt J B MITFORD	1924
Lt G H F OWLES	1924
Lt P RUCK-KEENE	1924
Lt G G SLADE	1924
Lt W E WARNER	1924
Lt G W E CASTENS	1925
Lt R L M EDWARDS	1925
Lt F J C HALAHAN	1925
Lt W D R HARGREAVES	1925
Lt K J T SOUTHGATE	1925
Lt D E G WEMYSS	1925
Lt J P APPS	1926
Lt C S BROCK	1926
Lt T E K DONALDSON	1926
Lt J L FLETCHER	1926
Lt F G HACKFORTH-JONES	1926
Lt G HEALY	1926
Lt L PHILLIPS	1926
Lt C PLUMER	1926
Lt F H E SKYRME	1926
Lt H de L STANDLEY	1926
Lt G G THYNE	1926
Lt E P A BROOKES	1927
Lt Cdr E B CLARKE	1927
Lt M T COLLIER	1927
Lt W R FELL	1927
Lt T J JENKS	1927
Lt H V KING	1927
Lt J H LEWES	1927
Lt E R C McVICKER	1927
Lt A S H MORRIS	1927
Lt L M SHADWELL	1927
Lt R M H SOWDON	1927
Lt J H THOMAS	1927
Lt H L S BAKER	1928
Lt J R S BROWN	1928
Lt A M CHOVIL	1928
Lt H C CUMBERBATCH	1928
Lt Cdr E S FELTON	1928
Lt R C S GARWOOD	1928
Lt R E S HUGONIN	1928
Lt H M C IONIDES	1928
Lt L L B MYERS	1928
Lt G W C SIMPSON	1928
Lt J P WISDEN	1928
Lt R E BUTLER	1929
Lt C J FIRTH	1929
Lt E R GIBSON	1929
Lt R G B HAYTER	1929
Lt D TOD	1929
Lt E ARMSTRONG	1930
Lt G H BOLUS	1930
Lt H R CONWAY	1930
Lt H G COOKE	1930

Lt R W KEYMER	1930
Lt A F StG ORPEN	1930
Lt J G ROPER	1930
Lt R SHERIDAN-PATTERSON	1930
Lt R N GARNET	1931
Lt P H HEATHFIELD	1931
Lt F W LIPSCOMB	1931
Lt J W McCOY	1931
Lt R W MOIR	1931
Lt J H MONTGOMERY	1931
Lt B I O'DONNELL	1931
Lt R W PEERS	1931
Lt J W STUDHOLME	1931
Lt G TANNER	1931
Lt R S WARNE	1931
Lt S W BENNETTS	1932
Lt H G BOWERMAN	1932
Lt G B H FAWKES	1932
Lt W S HALL	1932
Lt D C INGRAM	1932
Lt R Mc C P JONAS	1932
Lt R G MILLS	1932
Lt P Q ROBERTS	1932
Lt D F SPRAGUE	1932
Lt R W STIRLING-HAMILTON	1932
Lt W K R CROSS	1933
Lt R G GAMBER	1933
Lt R T GORDON-DUFF	1933
Lt J G GOULD	1933
Lt E R J ODDIE	1933
Lt G C PHILLIPS	1933
Lt M L POWER	1933
Lt G M SLADEN	1933
Lt H C BROWNE	1934
Lt B BRYANT	1934
Lt F W COLLINS	1934
Lt G P S DAVIES	1934
Lt R H DEWHURST	1934
Lt R L S GAISFORD	1934
Lt T C LLOYD	1934
Lt R P LONSDALE	1934
Lt G H NOWELL	1934
Lt S H PINCHIN	1934
Lt M G RIMINGTON	1934
Lt C A ROWE	1934
Lt H P de C STEEL	1934
Lt P J H BARTLETT	1935
Lt Cdr C J BLAKE	1935
Lt N E CUTLER	1935
Lt J H FORBES	1935
Lt J W LINTON	1935
Lt J D LUCE	1935
Lt H A L MARSHAM	1935
Lt F C F NICOLAY	1935
Lt J E SLAUGHTER	1935
Lt B W TAYLOR	1935
Lt H G WALTERS	1935
Lt W J W WOODS	1935
Lt W A CAVAYE	1936
Lt W D DUNKERLEY	1936
Lt H G DYMOTT	1936

Lt D A FRASER	1936
Lt C H HUTCHINSON	1936
Lt A S JACKSON	1936
Lt R F LEONARD	1936
Lt J G P D LONG	1936
Lt A C C MIERS	1936
Lt L P MOORE	1936
Lt E F PIZEY	1936
Lt V J H VAN DER BYL	1936
Lt J A S WISE	1936
Lt K M WOODS	1936
Lt H F BONE	1937
Lt R J BURCH	1937
Lt M K CAVANAGH-MAINWARING	1937
Lt R D CAYLEY	1937
Lt D St CLAIR-FORD	1937
Lt F B CURRIE	1937
Lt P S FRANCIS	1937
Lt W S HASELFOOT	1937
Lt J G HOPKINS	1937
Lt J E MOORE	1937
Lt R M L PEACOCK	1937
Lt G H REYNOLDS	1937
Lt L St G RICH	1937
Lt G S SALT	1937
Lt B T SIMONS	1937
Lt S R WHITE	1937
Lt E O BICKFORD	1938
Lt P N BUCKLEY	1938
Lt H J CALDWELL	1938
Lt A N G CAMPBELL	1938
Lt W S DONALD	1938
Lt J H EADEN	1938
Lt R M EPAIN	1938
Lt T T EUMAN	1938
Lt G H GREENWAY	1938
Lt G D A GREGORY	1938
Lt W D A KING	1938
Lt D E MANSFIELD	1938
Lt R G NORFOLK	1938
Lt W O SHELFORD	1938
Lt E F BALSTON	1939
Lt F J BROOKES	1939
Lt J F B BROWN	1939
Lt P J COWELL	1939
Lt C B CROUCH	1939
Lt H A V HAGGARD	1939
Lt G H S HAWARD	1939
Lt R F JENKS	1939
Lt D S MASSY-DAWSON	1939
Lt T A TURNER	1939
Lt P R WARD	1939
Lt D A B ABDY	1940
Lt R L ALEXANDER	1940
Lt L W A BENNINGTON	1940
Lt R S BROOKES	1940
Lt R E CAMPBELL	1940
Lt A R CHEYNE	1940
Lt A F COLLETT	1940
Lt R E COLTART	1940
Lt G R COLVIN	1940

Lt E F P COOPER	1940
Lt G P DARLING	1940
Lt H N EDMONDS	1940
Lt R M FAVELL	1940
Lt P L FIELD	1940
Lt R M GALLOWAY	1940
Lt P R H HARRISON	1940
Lt B G HESLOP	1940
Lt A R HEZLETT	1940
Lt J S HUDDART	1940
Lt J B DeB KERSHAW	1940
Lt M A LANGLEY	1940
Lt J L LIVESEY	1940
Lt A J Mackenzie	1940
Lt S L C MAYDON	1940
Lt I L M McGEOCH	1940
Lt L W NAPIER	1940
Lt H R B NEWTON	1940
Lt C P NORMAN	1940
Lt E D NORMAN	1940
Lt G V PROWSE	1940
Lt R P RAIKES	1940
Lt E P TOMKINSON	1940
Lt C G WALKER	1940
Lt M D WANKLYN	1940
Lt G C St B WATKINS	1940
Lt R D WHITEWAY-WILKINSON	1940
Lt M WILMOTT	1940
Lt M R G WINGFIELD	1940
Lt E A WOODWARD	1940
Lt J S WRAITH	1940
Lt M F R AINSLIE	1941
Lt D J BECKLEY	1941
Lt J H BROMAGE	1941
Lt T N CATLOW	1941
Lt F D G CHALLIS	1941
Lt R J CLUTTERBUCK	1941
Lt N J COE	1941
Lt J W D COOMBE	1941
Lt W W DENNIS	1941
Lt M E FABER	1941
Lt R GATEHOUSE	1941
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Lt A C HALLIDAY	1941
Lt R J HEMINGWAY	1941
Lt N L A JEWELL	1941
Lt W N R KNOX	1941
Lt R B LAKIN	1941
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Lt H S Mackenzie	1941
Lt N MARRIOT	1941
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Lt A C G MARS	1941
Lt D S R MARTIN	1941
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Lt J C OGLE	1941
Lt W A PHILLIMORE	1941
Lt A J W PITT	1941
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Lt A H B ANDERSON	1942
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Lt R E BODDINGTON	1942
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Lt D S Mc N VERSCHOYLE-CAMPBELL	1942
Lt T R WALLING	1942
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Lt M P SETH-SMITH	1952
Lt J H WILES	1952
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Lt H J BICKFORD-SMITH	1953
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Lt J R MEREWETHER	1954
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Lt A J WHETSTONE	1955
Lt J L S BEAUCHAMP	1956
Lt P R COMPTON-HALL	1956
Lt R CUDWORTH	1956
Lt J N F DAVENPORT	1956
Lt G H F FRERE-COOK	1956
Lt N J GILBERT	1956
Lt J M HAIGH-LUMBY	1956
Lt P N HAMILTON-JONES	1956
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Lt T S MORRISON	1957
Lt C J RINGROSE-VOASE	1957
Lt R J F TURNER	1957
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Lt B K WHITE-CROSS	1958
Lt M R WILSON	1958
Lt T J ANDREWS	1959
Lt R N BUCKLEY	1959
Lt K R B CADOGAN-RAWLINSON	1959
Lt S S R CONWAY	1959
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Lt G R H LLOYD-WILLIAMS	1960
Lt R A MORRIS	1960
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Lt J L ROUND-TURNER	1964
Lt N B SHACKLOCK	1964
Lt N G WARNEFORD	1964
Lt Cdr C P R BELTON	1965
Lt D C ELIOT	1965
Lt Cdr T EVERARD	1965
Lt Cdr P F GRENIER	1965
Lt T J W HALE	1965
Lt G JAQUES	1965
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Lt Cdr F D LOWE	1965
Lt Cdr B A NEEDHAM	1965
Lt P L ROACH	1965
Lt M D SIZELAND	1965
Lt Cdr J M SLAUGHTER	1965
Lt Cdr R M VENABLES	1965
Lt C G O WALKER	1965
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Lt R A ANDERSON	1966
Lt Cdr H G ASHTON	1966
Lt Cdr C A F BUCHANAN	1966
Lt N F DINGEMANS	1966
Lt Cdr K HOLLIDAY	1966
Lt J P H McCALL	1966
Lt Cdr B I NOBES	1966
Lt D M O'BRIEN	1966
Lt Cdr I D C ROSS	1966
Lt R G SHARPE	1966
Lt Cdr R C WHITESIDE	1966
Lt Cdr C L WOOD	1966
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Lt Cdr J N FRANKLIN	1967
Lt P J IRWIN	1967
Lt P D JOHNSTONE-HALL	1967
Lt P W LINDLEY	1967
Lt A M D MILNE-HOME	1967
Lt Cdr D W MITCHELL	1967
Lt J P B O'RIORDAN	1967
Lt K S PITT	1967
Lt D P B RYAN	1967
Lt V J SHAW	1967
Lt Cdr J P SPELLER	1967
Lt C J WARD	1967
Lt Cdr M E WHITE	1967
Lt T J AUSTIN	1968
Lt D H BARRACLOUGH	1968
Lt G W R BIGGS	1968
Lt R F CHANNON	1968
Lt J J S DANIEL	1968
Lt R H FARNFIELD	1968
Lt R T FRERE	1968
Lt Cdr R G P MENZIES	1968
Lt C J MEYER	1968
Lt Cdr C A B NIXON-ECKERSALL	1968
Lt Cdr H PELTOR	1968
Lt D I RAMSAY	1968
Lt R O SHELLARD	1968
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Lt R C MEYRICK	1969
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Lt Cdr R T NEWMAN	1969
Lt J F T G SALT	1969
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Lt W M LOGAN	1971
Lt I V McVITTIE	1971
Lt A D E PENDER-CUDLIP	1971
Lt T J K SLOANE	1971
Lt A W M STEPHENS	1971
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Lt N ESTYN-JONES	1972
Lt A P HODDINOTT	1972
Lt J S LANG	1972
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Lt A St J STEINER	1972
Lt A W WAINWRIGHT	1972
Lt F A BARBER	1973
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Lt D L P EVANS	1974
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Lt R C LANE-NOTT	1974
Lt W G F ORGAN	1974
Lt C W RODDIS	1974
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Lt N J K CREWS	1975
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Lt R J BRADSHAW	1977
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Lt A M POULTER	1977
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Lt D M TALL	1977
Lt P R ANDERSON	1978
Lt J M BURNELL-NUGENT	1978
Lt J A COLLINS	1978
Lt J R C FOSTER	1978
Lt Cdr P P JEANNERET	1978
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Lt I S H RICHARDS	1978
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Lt S B P ANDERSON	1979
Lt D J ANTHONY	1979
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Lt J A C MIERS	1979
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Lt Cdr A P JOHNSON	1980
Lt N S R KILGOUR	1980
Lt G A R McCREADY	1980
Lt D M PERFECT	1980
Lt N J P WRAITH	1980

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Lt M STANHOPE	1981
Lt C D STOCKMAN	1981
Lt Cdr G WEBSTER	1981
Lt J A BOYD	1982
Lt R DEAN	1982
Lt Cdr N H L HARRIS	1982
Lt S C MARTIN	1982
Lt R P MOORE	1982
Lt P NORRINGTON-DAVIES	1982
Lt R A W PECK	1982
Lt J F TUCKETT	1982
Lt D S H WHITE	1982
Lt I R WHITEHOUSE	1982
Lt S P BEBBINGTON	1983
Lt D R CHARLTON	1983
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Lt M B AVERY	1984
Lt Cdr R L BEVERIDGE	1984
Lt R P BOISSIER	1984
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Lt Cdr R L'OSTE-BROWN	1984
Lt P H ROBINSON	1984
Lt N TIDBURY	1984
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Lt Cdr S M TURNER	1985
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Lt G HOLMES	1987
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Lt N D A POLLITT	1987
Lt Cdr C H REYNOLDS	1987
Lt T A SOAR	1987
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Lt R R WEBERSTADT	1988
Lt Cdr S T WILLIAMS	1988
Lt Cdr M ANDERSON	1989
Lt Cdr I D ARTHUR	1989
Lt I F CORDER	1989
Lt M E FINNEY	1989
Lt J H J GOWER	1989
Lt Cdr N R HARRAP	1989
Lt D HARTLEY	1989
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Lt M H WILLIAMS	1989
Lt Cdr P W M CARROLL	1990
Lt Cdr M L DAVIS-MARKS	1990
Lt Cdr M L DAVIS-MARKS	1990
Lt S B DONALDSON	1990
Lt N J HUGHES	1990
Lt P W McDONNELL	1990
Lt I S PICKLES	1990
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Lt Cdr S R BAUM	1991
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Lt N J CHAPMAN	1991
Lt Cdr M A R CHICHESTER	1991
Lt Cdr C D LIGHTFOOT	1991
Lt D J LOVELL	1991
Lt Cdr D M J MARSTON-GRIMLEY	1991
Lt G A NEWTON	1991
Lt Cdr N J POMFRETT	1991
Lt Cdr W WORSLEY	1991
Lt Cdr P ABRAHAM	1992
Lt Cdr R D J BARKER	1992
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Lt K GOMM	1992
Lt Cdr I D HUGO	1992
Lt Cdr N D JERVIS	1992
Lt Cdr R KELLY	1992
Lt Cdr C S A LITTLE	1992
Lt Cdr J MILLWARD	1992
Lt Cdr R K TARRANT	1992
Lt Cdr S R AIKEN	1993
Lt Cdr J C BERNAU	1993
Lt K N M EVANS	1993
Lt Cdr M J HAWTHORNE	1993
Lt Cdr A M McKENDRICK	1993
Lt M J PARR	1993
Lt Cdr C I REID	1993
Lt Cdr I T ROBERTS	1993

Lt Cdr S J SHIELD	1993
Lt Cdr G L WILSON	1993
Lt Cdr R M ALLEN	1994
Lt N R FIRTH	1994
Lt C R FULTON	1994
Lt Cdr T J GREEN	1994
Lt S J HUSSEY	1994
Lt Cdr N MEREDITH	1994
Lt Cdr P C NEVE	1994
Lt Cdr P J TITTERTON	1994
Lt J S WEALE	1994
Lt A COLES	1995
Lt M A COOPER	1995
Lt R FANCY	1995
Lt Cdr J B GETHING	1995
Lt M D Mackenzie	1995
Lt Cdr D J POLLOCK	1995
Lt A J TAYLOR	1995
Lt J S BARK	1996
Lt P T BARKER	1996
Lt I G BRECKENRIDGE	1996
Lt Cdr A S CORBETT	1996
Lt M LISTER	1996
Lt Cdr I A McGHIE	1996
Lt Cdr M J D WALLIKER	1996
Lt J A P WHITE	1996
Lt P D BURKE	1997
Lt Cdr S R DRYSDALE	1997
Lt Cdr P J GREEN	1997
Lt N J HIBBERD	1997
Lt Cdr N W HINE	1997
Lt Cdr I G LINDSAY	1997
Lt P A REIDY	1997
Lt Cdr C S SHEPHERD	1997
Lt Cdr N D E CARSON	1998
Lt Cdr R P DUNN	1998
Lt C D GOODSELL	1998
Lt M R HONNORATY	1998
Lt R J LINDSEY	1998
Lt Cdr D C RICH	1998
Lt S A WALLER	1998
Lt Cdr R J ANSTEY	1999
Lt H D BEARD	1999
Lt Cdr N S BOWER	1999
Lt Cdr P V HALTON	1999
Lt Cdr M D MANFIELD	1999
Lt J Le S PERKS	1999
Lt Cdr M R TITCOMB	1999
Lt Cdr R ALLEN	2000
Lt Cdr P BLYTHE	2000
Lt Cdr C GROVES	2000
Lt Cdr S R A MURPHY	2000
Lt P G A NOBLETT	2000
Lt P B M O'BYRNE	2000
Lt Cdr R T RAMSEY	2000
Lt Cdr S J RYAN	2001
Lt R I SMALLWOOD	2001
Lt Cdr R WATTS	2001
Lt Cdr E G AHLGREN	2002
Lt Cdr G BUCKINGHAM	2002
Lt Cdr M J DENNIS	2002

Lt Cdr P E DUNN	2002
Lt Cdr S P WALKER	2002
Lt Cdr S P ASQUITH	2003
Lt Cdr D A BESSELL	2003
Lt Cdr A BOWER	2003
Lt Cdr S G CAPES	2003
Lt Cdr I C SURGEY	2003
Lt Cdr R C TANNER	2003
Lt R H GRIFFITHS	2004
Lt P D JONES	2004
Lt N J LAMONT	2004
Lt Cdr J McGUIRE	2004
Lt Cdr N J WHEELER	2004
Lt Cdr A J AITKEN	2005
Lt Cdr S J BLACKBURN	2005
Lt D CLARKE	2005
Lt Cdr J C CLAY	2005
Lt Cdr M G THOMPSON	2005
Lt Cdr J R WYPER	2005
Lt Cdr J CODD	2006
Lt Cdr S JOHNSON	2006
Lt Cdr J E LIVESEY	2006
Lt Cdr R J SMALL	2006
Lt R DAINTY	2007
Lt Cdr D A DAVENEY	2007
Lt Cdr J GRAY	2007
Lt J HUTCHINGS	2007
Lt Cdr A JOHNS	2007
Lt Cdr S ARMSTRONG	2008
Lt C BALLANTYNE	2008
Lt Cdr D KNIGHT	2008
Lt Cdr D MASON	2008
Lt Cdr D G JENKINS	2009
Lt Cdr A J MARSHALL	2009
Lt Cdr J D MITCHELL	2009
Lt Cdr R J FILLMORE	2010
Lt Cdr D A FILTNESS	2010
Lt Cdr D MARTYN	2010
Lt Cdr DWM CROSBY	2011
Lt D J FOX	2011
Lt Cdr P S KAY	2011
Lt Cdr N A BOTTING	2012
Lt Cdr C D GILL	2012
Lt Cdr S T L OWEN	2012
Lt Cdr L P BULL	2013
Lt Cdr D J BURRELL	2013
Lt Cdr I B FERGUSSON	2013
Lt Cdr B S HASKINS	2013
Lt J M LEWIS	2013
Lt Cdr D D H SIMMONDS	2013
Lt Cdr B SMITH	2013
Lt Cdr M W ADAM	2014
Lt Cdr M J HOPTON	2014
Lt P A JAMIESON	2014
Lt Cdr S E McALLISTER	2014
Lt A M PARISER	2014
Lt Cdr S A BRIAN	2015
Lt Cdr J DUFFY	2015
Lt Cdr M WALKER	2015
Lt Cdr J CURSITER	2016
Lt Cdr C DICK	2016

Lt Cdr M SEAL	2016
Lt Cdr J BETCHLEY	2017
Lt Cdr J COLLIE	2017
Lt Cdr J HOWARD	2017
Lt Cdr I CRITCHLEY	2017
Lt Cdr O MORROW	2017
Lt Cdr J REID	2017
Lt Cdr N STONE	2017

Year	Number of Perishers
1917	9
1918	48
1919	13
1920	11
1921	12
1922	11
1923	12
1924	16
1925	6
1926	11
1927	12
1928	11
1929	5
1930	8
1931	11
1932	10
1933	8
1934	13
1935	12
1936	14
1937	16
1938	14
1939	11
1940	40
1941	35
1942	54
1943	56
1944	30
1945	18
1946	10
1947	9
1948	9
1949	11
1950	10
1951	12
1952	14
1953	11
1954	14
1955	12
1956	13
1957	11
1958	17
1959	13
1960	10
1961	7
1962	7

1963	8
1964	10
1965	15
1966	12
1967	14
1968	16
1969	9
1970	11
1971	13
1972	7
1973	4
1974	13
1975	11
1976	8
1977	13
1978	12
1979	11
1980	9
1981	10
1982	10
1983	5
1984	8
1985	6
1986	6
1987	17
1988	10
1989	13
1990	9
1991	10
1992	10
1993	10
1994	9
1995	7
1996	8
1997	8
1998	7
1999	7
2000	7
2001	3
2002	5
2003	6
2004	5
2005	6
2006	4
2007	5
2008	4
2009	3
2010	3
2011	3
2012	3
2013	7
2014	5
2015	3
2016	3
2017	7
Total	1165

APPENDIX THREE: TEACHER LIST

Surname	Forenames	From	To
Gill	Henry Dale	1917	1919
Everard	Richard Henry Bagot	1918	1918
Macintyre	Ian Agnew Patterson	1919	1921
Bennett	Alan Courtenay Moncreiffe	1921	1924
Boyd	James Lawrence	1922	1924
Tweedy	George John Drumelzier	1923	1925
Barry	Claude Barrington	1924	1925
Lake	Harry Neville	1925	1926
Barry	Claude Barrington	1925	1926
Colpoys	Gerald Edward	1926	1927
Flemming	Charles Cecil	1927	1928
Galpin	Bernard William	1928	1930
Allen	Conway Benning	1929	1930
Fell	William Richard	1930	1932
Menzies	George Cunningham Paton	1932	1933
Plumer	Claude	1933	1934
Hayter	Reginald George Bazaine	1934	1935
Fell	William Richard	1935	1937
Wisden	John Patrick	1937	1939
Gaisford	Richard Lindsey Stephen	1939	1939
Steele	Hugh Patrick de Crecy	1942	1944
Bone	Howard Francis	1942	1944
Woodward	Edward Arthur	1943	1945
Napier	Lennox William Napier	1944	1945
Mackenzie	Hugh Stirling	1946	1947
Hunt	George Edward	1948	1949
Porter	Stewart Armstrong	1950	1952
McIntosh	Ian Stewart McIntosh	1952	1954
Hay	Donald	1954	1955
Cairns	Rudland Dallas	1956	1958
Bell-Davies	Lancelot Richard	1958	1960
Hutchings	Brian Charles Gilbert	1960	1961
Wemyss	Martin La Touche	1961	1963
Davenport	John Norman Fieldwick	1964	1965
Fry	Ronald George	1965	1967
Woodward	John Forster	1967	1969
Husk	Richard James	1969	1970
Grenier	Peter Francis	1970	1972
Swales	Gerald Timothy	1971	1972
Woods	Terrence Ernest	1972	1974
Frere	Richard Tobias	1974	1975
Lang	John Stewart	1974	1974
Forsyth	Robert Stanley	1975	1976
Biggs	Geoffrey William Roger	1976	1977
Carr	Barry John	1977	1978
Hodgson	Norman Richard	1978	1979
Lang	John Stewart	1978	1980
MacPherson	Martin Douglas	1980	1981
Clarke	John Patrick	1981	1982
Gilbert	Michael Phillip	1981	1982
Evans	David Lindon Powell	1983	1984
Stevens	Robert Patrick	1984	1985
Mclees	John	1985	1987
Robertson	Neil David Vionnee	1986	1987
McClement	Timothy Pentreath	1987	1988
Anthony	Derek James	1988	1989
Southcott	David Roger	1988	1990
Stanhope	Mark	1989	1990

Perfect	David Maxwell	1990	1991
Charlton	David R	1991	1992
White	David Simon Hayden	1992	1993
Lambert	Paul	1993	1994
Munns	Christopher Ronald	1993	1994
Williams	Simon Thomas	1995	1995
Mansergh	Robert James	1996	1997
Edgell	John Nicholas	1998	1999
Abraham	Paul	2000	2001
McGhie	Ian Andrew	2002	2002
Walliker	Michael John Delane	2003	2004
Burke	Paul Dominic	2005	2005
Titterton	Phillip James	2006	2007
Perks	James Le Seelleur	2008	2011
Bower	Andrew John	2010	2012
Ramsey	Ryan Trevor	2012	2013
Livesey	John	2013	2014
Irvine	Lindsay	2014	2014
Codd	Justin	2015	2016
Jenkins	Gareth	2016	2018
Haskins	Benjamin	2019	2020

Source: Barrie Downer, Barrow Submariners

APPENDIX FOUR: BARR AND STROUD PRODUCED PERISCOPES FOR ROYAL NAVY SUBMARINES

ATTACK PERISCOPES

TYPE	YEAR OF ORDER	DESCRIPTION
FY 1	1916	First range finder
CH 1	1917	Unifocal
CH 2	1917	Bifocal (skysearching)
CH 3	1917	Unifocal
CH 4	1917	Bifocal (skysearching)
CH 5	1918	Bifocal (skysearching) (Redesign of CH 2)
		Unifocal with range/inclination estimator
CH 7		CH 4 converted to carry bifocal attacking gear, range estimator
CH 8		Look out bifocal skysearching with roll top prison, top diameter 7.8 inches
CH 9		Unifocal, top diameter 5 inches
CH 21	1926	Bifocal
CH 22	1926	Redesign of CH 13 (French Navy bifocal periscope) 300 mm Well
CH 27	1926	Torpedo Director bifocal skysearching with range estimator
CH 28	1926	Line in space gear and torpedo director
CH 29	1926	Bifocal skysearching periscope (10° depression, 100° elevation)
CH 30	1927	Redesign of CH 23 (French Navy bifocal periscope)
CH 31	1927	Redesign of CH 24 (French Navy periscope)
CH 34	1929	Commander type
CH 35	1929	Zenith type
CH 36	1930	Attack
CH 37	1930	Navigational with range and inclination estimator and line in space gear
CH 40	1931	Bifocal, Swordfish Class
CH 42	1932	Bifocal attack (spherical top)
CH 50	1935	Unifocal
CH51	1935	Attack
CH55	1936	Bifocal attack
CH 57	1940	Unifocal (redesign CH51)
CH 58	1940	Bifocal (redesign CH55)
CH 61	1941	Bifocal skysearching night periscope (redesign of CH 50)
CH 62	1941	“Varley” Class bifocal sky searching
CH 65	1942	‘X’ craft, bifocal attack
CH 66	1943	‘A’ class
CH67	1948	‘T’ class conversion bifocal attack with sextant
CH 68	1951	Midget submarine bifocal attack
CH 70	1953	Bifocal
CH 71	1956	Bifocal new design
CH 72	1956	Bifocal new design
CH73	1956	‘A’ class bifocal attack
CH 74	1958	Oberon class bifocal attack
CH75	1959	Dreadnought and Valiant class bifocal attack
CH 76	1959	COQC bifocal attack
CH 78	1964	Resolution class attack with radar and II
CH 79		Swiftsure class
CH 80		Prototype laser range finder with stabilised top prism
CH 82		Prototype thermal imaging
CH 83	1973	Swiftsure class (modified CH79) quasi/binocular attack, TI and AVT, TV camera
CH 80		Trafalgar class because I/binocular attack, TI, electronics AVT and TV camera
CH 85	1980	Upholder class bi-ocular attack
CH 91		Vanguard class

Barr and Stroud have also supplied periscopes to Australia Brazil Canada Chile Denmark Estonia France Greece Italy Japan Latvia Netherlands Pakistan Poland Portugal South Korea Spain Sweden USA Yugoslavia

Tables produced by kind permission of Barr and Stroud

SEARCH PERISCOPES

CK 1	1924	Binocular
CK 2	1927	Skysearching binocular
CK 3	1928	Parthian class
CK 4	1929	Bifocal binocular RN Tank periscope
CK 5	1930	Thames class bifocal binocular
CK 6	1930	Swordfish class bifocal binocular
CK 7	1935	Bifocal binocular
CK 8	1935	Bifocal binocular
CK 9	1936	Bifocal binocular
CK 10	1942	Bifocal binocular (training gear omitted)
CK 11	1942	Bifocal binocular (training gear omitted)
CK 12	1943	Bifocal binocular (rising top prism)
CK 13	1943	Bifocal binocular night (rising top prism)
CK 14	1943	'A' class bifocal binocular night
CK 15	1947	Combined night/radar
CK 16	1949	Bifocal binocular night
CK 17	1952	'T' class conversion bifocal binocular night (with waveguide)
CK 18	1952	'A' class bifocal binocular night (to replace CK14)
CK 20	1953	Combined night/radar (similar to CK17)
CK 22	1956	Bifocal binocular night (prototype new design)
CK 23	1956	Prototype new design
CK 24A	1956	Bifocal binocular night
CK 20A	1956	Porpoise/Oberon bifocal binocular
CK 24	1958	Oberon class bifocal binocular night
CK 25	1958	Dreadnought/Valiant classes photographic
CK 26		Swiftsure class bifocal binocular
CK 28	1964	Resolution class photographic/sextant
CK29		Swiftsure class bi-ocular photographic
CK 33		Swiftsure class modified CK29 for Morthoe
CK 34	1973	Trafalgar bi-ocular, AHPS IV, Morthoe, AVS, 10 inch main tube
CK 35	1980	Upholder class (modified CK34)
CK 51		Vanguard class self protection mast
CM 010	2000	Astute class Optronic mast

APPENDIX FIVE: GREEK SLIDE RULE

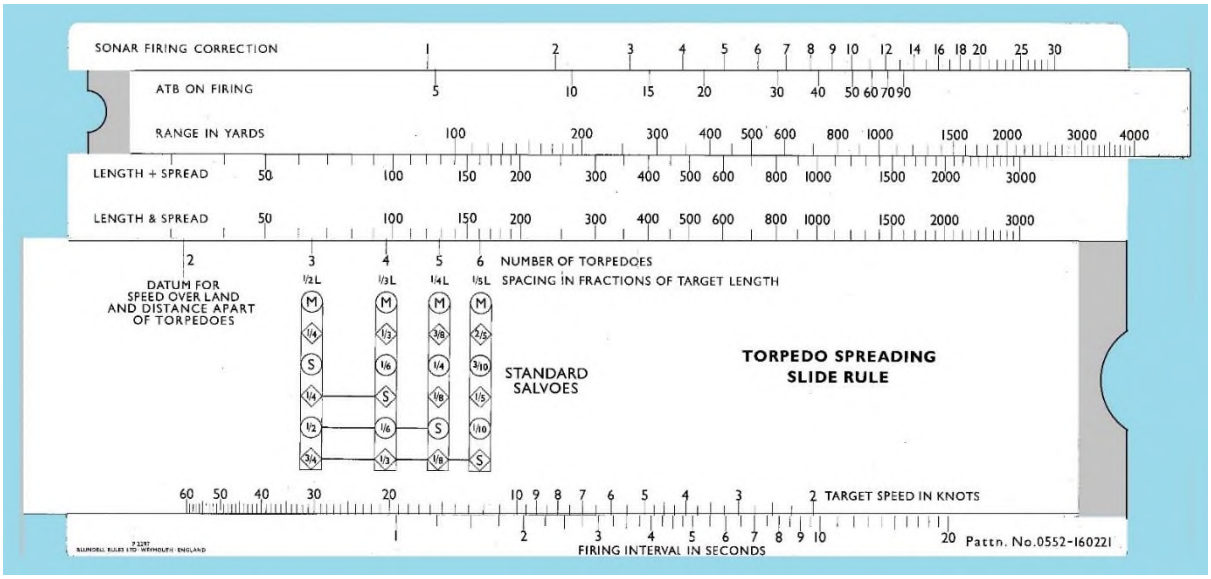
Courtesy of Pieter Cox

Manufacturer: P 2297; Blundell Rulers Ltd, Weymouth, England. Patt No 0552-160221

Purpose: to determine points of aim, firing interval and sonar firing correction for a "Major Breakdown" [ie zero GA] attack. Point of entry for use is determination of number of weapons and the quality of the firing solution, determined by Submarine Attack Tables (Table 48).

Considerations:

Mk 8 torpedo countermining range is 95 yds. If calculated firing interval is <2 Secs, use greater spacing (in terms of target-length) to increase**.** Torpedo speed = 43 or 44 kts.



Large moving slide

Diagram to show points of aim for number of weapons and target-length spacing.

Upper scale: Set target-length spacing against target-length. Read total salvo spread (a) against "Number of torpedos" on "Length & Spread" scale. Note: Increase spacing if "Datum for speed over land and distance apart of torpedoes" is <95ft.

Lower scale: With upper scale set, read firing interval against target speed.

Smaller moving slide

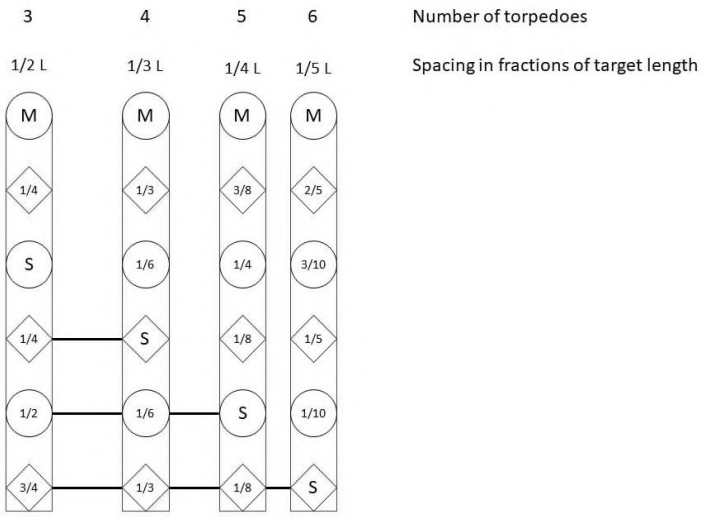
Set "Range in yards" against total salvo spread (a) on "Length + Spread" scale.

[*NB: I suspect error in course notes, which say to add spread to length: the "&" and "+" signs on the scales are simply to differentiate between the scales and not an instruction to add]*

Read "Sonar Firing Correction" against "ATB on firing".

Points of aim diagram for standard salvoes

The "Standard Salvoes" diagram shows the points of aim for a given number of weapons set at a given target-length spacing:



The symbols (circle or diamond) contain M (middle), S (Stem or Stern) and fractions (of target-length).

Steps:

Decide number of torpedoes and choose underlying column.

Move down to “S” symbol and use only symbols corresponding to “S”. Eg, if S is in a diamond, only choose diamond symbols in that column for the remaining steps.

If using standard spacing (ie equally spaced from stem to stern) chosen, remain in chosen column.

Fire the first weapon at the stem; move up the column and fire the second weapon at the next corresponding symbol and so on, moving up the column towards the M symbol and then returning back down.

Example 1:
Six weapons, 1/5L spacing. First weapon at stem, second at 1/5L, third at 2/5L, [pass through middle] fourth at 2/5L (from stern), fifth at 1/10L (from stern) and sixth at stern.

Example 2:
Five weapons, 1/4L spacing. First weapon at stem, second at 1/4L, third at middle, fourth at 1/4L (from stern) and fifth at stern.

If using wider spacing, after choosing number of weapons and moving down to “S” symbol,

Move across to column corresponding to chosen spacing.

Fire the first weapon at the corresponding target-length ahead of the stem and continue as before.
Example 3:
Four weapons, 1/2L spacing. Choose four-weapon column. Drop down to “S” and then move across to 1/2L column. First weapon 1/4L ahead, second 1/4L in, third 1/4L (from stern), fourth 1/4L abaft stern.

Visual fire
Three options:
Fire on all observed points of aim;
Fire on first two points of aim and use actual interval for remainder of salvo;
Fire on first point of aim and use calculated interval.

Blind fire
Apply Sonar Firing Correction to compensate for distance from target screw to first point of aim

APPENDIX SIX: THE ATTACK; ATTACKING AND MENTAL NOTES

1. The first set of Mental Notes are from Paul Branscombe's 1975 Perisher, Teacher Toby Frere. They are an example of the post-Woodward era.
2. The second set of 'Attacking Notes' are from an Attack Coordinator course in 1984 provided by Pieter Cox.

MENTAL RULES NOTES

These notes appear to be pre-Woodward although their publication date is uncertain

Introduction

These are short notes on the "observed" common errors during COQC attacks and the Perisher generally. No doubt many of these errors occur at sea. The object of these notes is to provide a ready reminder to help to achieve some of the "perfection" aimed at during the COQC's training. "Polish" is essential-it is second nature, the Command is free to give maximum attention to the all important task of "fighting the ship".

Periscope Drill

1. Firstly decide what you want to use it for (and stick to it).
2. Then do "Captains Rounds" before the periscope goes up.

i.e.. Look at
- a Depth and Trim
- b Your speed-on occasions it is necessary to go SLOW ONE.
- c The position of the wheel and your COURSE.
- d The bearing of the ship concerned-SONAR and TBP.
- E What is expected: from your STOP WATCH
  on the TCC
  from the LOP

3. Plan your looks e.g.

	Stop Watch Time	Purpose
	00	ARL
	01	TSU
	02	Escort
ARL = All Round Look	03	TSU
TSU = Target Set Up	04	Escort
FSU = Firing Set Up	05	ARL
	06	FSU on Escort
	07	Check Bearing
		Fire at Escort
	And so on	TSU

4. The periscope exposure must be kept to a minimum
   All round looks should be taken in LOW POWER
   The duration must not be over 25 seconds
   you may have to split the ARL into 2 or 3 looks, taking into account:
   (a) VISIBILITY
   (b) TACTICAL SITUATION
   (c) SEA STATE
   (d) THE OPPOSITION-Helicopters, radar et cetera.
   This will help you to reduce the period during which the periscope can be detected.
   However, use the periscope depth appropriate to visibility and sea conditions. Periscope looks should be in the region of 12 seconds for RANGE and BEARING; 6 seconds for RANGE OR BEARING

1. Tell people what you see-in this way you can tie up the sonar with the visual information.
2. Slow your orders down-this saves endless repetitions.
3. Talk to the person you want to hear, but remember not to talk to the periscope.
4. Brief your teen personally if possible-even during the attack.

The Target

1. Aim for a reasonable number of target-set-ups-compatible with the ability of your team and the tactical situation.
2. Do not get mesmerised by one ship so that you forget the others.
3. Similarly do not neglect the target as you penetrate the screen.
4. Warner look for one thing only-do not combine and ALL ROUND LOOK with a target set-up.
5. Remember virtual target length-it helps to assess the angle on the bow.
6. Tell the team if you see the target altering course.
7. Watch the goalposts on a tanker when broad-it is the best guide to ATB.
8. Remember the mental aid ATB + Relative Bearing = TRACK ANGLE (ship's).
9. Use the Time Bearing Plot to confirm estimations, e.g. angle on the bow-does the bearing rate reflect your solution and so on.
10. Watch the TBP true bearing to see if you are in the grain.
11. Pay attention to your LOP-he is trying to help you. Use it for speed estimations, especially later on.

Ranging

1. Range in HIGH POWER-always against escorts.
2. Choose a suitable height of fixed structure.
3. Learn what an escort looks like at 1000 yards. (You will then automatically go deep without the need to waste time ranging).
4. Do not fiddle with the knotsob-bring the image smartly down, then say "range is that", otherwise you tend to merge the images.
5. Remember that at long range you are only actually seeing a percentage of the ranging height if it is measured to the waterline.
6. In rough weather you may have to estimate were the waterline of the ship is to range accurately.
7. In poor visibility-e.g. rain, you might be better off using LOW POWER to range, but always make sure that everybody knotsows you have taken LOW POWER rangers when you do.
8. Do not range on Escort for safety when they are close and broad-they do not move sideways-watch for a change in ATB.

Going Deep

1. Watch the trim and at sea state-you may have to go down earlier than 1 minute's run at his maximum speed.
2. Get the ranges of the nearest ships.
3. Get a target set-up going down (and put it on the TCC if through the screen). Get an all-round look in as you go down or just before.
4. Get the orders correct:
    i. Full ahead together
    ii. Flood Q
    iii. 90 feet (for ducking under an escort)

    Or 180 feet (four going to safe depth)

    iv. midships
    v. Check all masts write down.
5. Remember to slow down when you get to depth.
6. Controlled the sonar properly so that you can come up again.

7. Do not vent Q until you decide to come up. Venting may interfere with Sonar.
8. Always remember the depth of water you are operating in.

Coming Up From Deep

1. Listen on the Under Water Telephone/Pressure Hull for a chap going overhead.
2. Watch out though, for the one who turns back, especially across your stern.
3. You may need a hand train sweep on 719 for extra safety and in any case listen on the Under Water Telephone for someone close.
4. "Vent Q" always and then "Stand by Q".
5. Get speed on, have the wheel amidships.
6. Order the correct depth.
7. Slow down once you have got sufficient way to take you up safely.
8. Put the periscope up looking at the most dangerous ship first.

Firing Drill

1. Be prepared to fire:
   in solution
   bow caps open
   up-to-date bearings on TCC
   TCC settings correct
   appropriate spacing applied.
2. Order your settings!
3. Get the firing set up on early
4. Fire at escorts in contact at the right range.
5. Remember:
   Hitting Run (particularly for fine and broad tracks).
   Track angle-keep it always in mind.
   Gyro angle is-you must try to keep them small.
   Are you "in solution" or going "out of solution".
6. The Firing Drill must be Chris-check the TCC before you fire. However do not worship at the shrine of the TCC. The TBP bearing rate should be reasonably close to that being generated on the TCC.
7. You must get the fine ATB's right-the DA error can be large.
8. Do not try and improve the Track Angle at the last minute for a DA shot. It may cause you to miss your DA.
9. Remember to go deep for the target after firing if you have two for safety reasons.

The Stop Watch

1. Always look at your Stop Watch-do not guess-time is exact.
2. And now for ranging errors so that you have time in hand, but do not look unnecessarily-he cannot fly.
3. Do not look unnecessarily at escorts going away-but do not forget them.

Sonar

1. Control it correctly using the proper drills.
2. You can never tell this Sound Room too much and they can never tell you too much.
3. Keep the Sound Room up-to-date with what is happening-e.g. opening bow caps, firing by sonar shortly etc.
4. do not influence sonar teen decisions by asking stupid or pointed questions.
5. Do not go full ahead with the bow caps open!

6. Remember the stern.
7. Remember all round sweep.
8. Remember 719 in slow training will increase its detection capability and is useful for bearings of short range sonar transmissions.
9. Watch bearing rate and intensity.
10. Observe the 187 bearing repeater (you can easily see how it is being employed, and it is holding a target it shows you the relative bearing immediately).

Blind Techniques and see CSO's

1. Come shallow for radar looks.
2. One radar look may clarify.
3. Use the 197 intelligently. Use 197 bearings of transmissions to try to get screen disposition.
4. Remember 719 can be used to get accurate bearings of short range sonar transmissions when blind.
5. Get the sonar organised early-especially on the target.
6. Be prepared to defend yourself against escorts. Use 7192 track escorts.
7. Remember your range from a ship is less than his transmission interval if he is in contact.
8. Watch your gyro angles.
9. Fire in the "Flat" if possible-it reduces your errors.
10. Fire early in the Track Angle is increasing.
11. Reduce your own alterations of course and speed to essentials, it will help you get better solutions.
12. Consider displaying bearing rate on the Time Bearing Plot every so often on the curve to help the team.
13. Recognise a going away curve on the TBP.

THE DISTANCE OFF TRACK RULE

$$\text{The Distance off Track} = \frac{\text{Range x ATB}}{60}$$

Sometimes knotsown as the CLOCK FACE rule, since the ATB is divided by 60 (or the number of minutes on the clock face) and then the range is multiplied by the resulting fraction e.g. ATB of 5° represents 1/12 of the clock face, so multiply the range by 1/12. Similarly the ATB of 15° represents ¼ of the clock face.

Example Range 12,000 yards ATB 5°

$$\text{D OT} = \frac{12{,}000 \text{ X } 5}{60} = \frac{12{,}000}{12} = 1000 \text{ yards}$$

This rule is reasonably accurate up to 50° on the enemy's bow.

You may prefer to use the sin ATB instead of the ATB divided by 60.
This is always accurate (See Rule 6).

SPEED AND DISTANCE RULE

In three minutes a ship goes an equal number of hundreds of yards as it speed in knotsots. In one minute a ship goes an equal number of hundreds of feet as it speed in knotsots.

Example

In 3 minutes at 5 knotsots a ship does 500 yards.
In 3 minutes at 35 knots a ship does 3500 yards
In one minute at 10 knots a ship does 1000 feet.
In 1 minute at ½ knotsot a ship does 50 feet.
In 1 the second at 1 knotsot a ship does 100/60 feet = 1 2/3 feet

Time in minutes it takes to do a given distance at a given speed =

$$\frac{\text{(Distance in yards)}}{\text{(Speed in knotsots x 100)}} \times 3$$

How long will it take a ship to go 6000 yards at 15 knotsots?
Time in minutes = $\frac{(6000)}{(15x\ 100)} \times 3 = \frac{60}{15} \times 3 = 12$ minutes

How long will it take a ship to go 500 yards at 20 knotsots?
Time in minutes = $\frac{(500)}{(20 \times 100)} \times 3 = \frac{5}{20} \times 3 = ¾$ minutes.

DURATION OF ATTACK (LESS THAN 60° ON TARGET'S BOW)

If less than 60° on the bow of the target, the attack will last:

Example: Range of enemy 6000 yards. Speed of enemy 10 knotsots.
D OT 2000 yards

Attack will last 6000 - ½ x 2000 yards at 10 knotsots.
= 5000 yards at 10 knotsots
= 15 minutes (by three minute rule).

Note: When advancing on the target the actual time will be slightly less, retiring slightly more.

DURATION OF ATTACK (Between 60 and 120° on target's bow)

If between 60° and 120° on the bow of the target, the attack will last:

$$\frac{\text{Number of degrees of bearing to go before PA comes on}}{\text{Rate of change of bearing in degrees per minute}}$$

Example:

Target doing 12 knotsots at a range of 8000 yards
ATB 60°, relative bearing Red 50, PA 16° Red.

There are 50 - 16 = 34° to go before PA comes on.

Rate of change of bearing = $\frac{12 \times 2}{6}$ = 3° per minute

Therefore time attack will last = $\frac{34}{3}$ = 11 ½ minutes

THE RANGE RULE

When the range in minutes = the masthead height in feet, then the range = 1150 yards.

Similarly, when the range in minutes = half the masthead height in feet then the range = 2 x 1150 = 2300 yards.

Example: Masthead height 60 feet. Range in minutes 60 minutes. Range = 1150 yards.

Masthead height 60 feet. Range in minutes 12 minutes. Range = 5 x 1150 = 5750 yards.

Masthead height 60 feet. Range in minutes 120 minutes. Range = $\frac{1150}{2}$ = 575 yards.

THE SINE RULE

A table of values for the sin ATB is useful in connection with the next three rules:

sin 15° = ¼
sin 30° = ½
sin 45° = 0.7
sin 60° = 0.9
sin 90° = 1.0

at the end of these aids is a more comprehensive table of sines for those who are interested.

RATE OF CHANGE OF BEARING RULES

Rate of change of bearing = 1° per knotsots of enemy's speed per minute at 1 mile when on beam of target, or:

Rate of change of bearing in degrees per minute

$$\frac{\text{Twice enemy speed in knotsots}}{\text{Range in thousands of yards}} \times \sin \text{ATB}$$

Example: Rate of change of bearing of target doing 15 knotsots, if you are on his beam at a range of 9000 yards

$$= \frac{15 \times 2}{9} \text{ degrees per minute}$$

= 3 ½° per minute.

Rate of change of bearing of target doing 18 knots, if you are 30° on his bow at a range of 3000 yards.

$$= \frac{18 \times 2}{3} \times \tfrac{1}{2} = 6° \text{ per minute.}$$

VIRTUAL TARGET LENGTH RULE

Virtual target length = Target length x sin ATB.

Example: Target length 400 feet. ATB 30°
Virtual target length = 400 x ½
= 200 feet.

RANGE BY ANGLE ATTENDED RULE

One degree at 1000 yards sub tends 50 feet.

$$\text{Range in yards equals sign } \frac{\text{Virtual target length x 20}}{\text{Angle's attended in degrees}}$$

Example: Virtual Target length 500 feet, sub tending 5°

$$\text{Range} = \frac{500 \times 20}{5} = 2000 \text{ yards}$$

TRACK ANGLE RULE

(a) Track angle = Relative Bearing + or - ATB

Example: Target Bearing Red 60, Submarine is 50 on the starboard bow of target.
TA = 60 + 50 = 100 Track.

(b) If Submarine is on 110 track and relative bearing is read 80, then submarine is 110 - 80 = 30 on the starboard bow of the target.
If next bearing is Red 60 and enemy has not altered course, then submarine is now 110 - 60 = 50 on starboard bow target.

TARGET COURSE RULE

Target course = Reciprocal of true bearing + or - ATB.

Example: True Bearing 020°, 30° on targets port bow
Target Course = 200° + 30° = 230°

or

True Bearing 260°, 40° on target starboard bow.
Target Course = 080° - 40° = 040°

COURSE TO STEER FOR A REQUIRED TRACK

Course to steer for a required track = reciprocal of Target Course plus or minus track required.

Example: Target course 140° S/M is on the starboard bow.
Course to steer for 100° track = 320° + 100° = 060°

or

Target Course 330° S/M is on Port bow.
Course to steer for 120° track = 150° - 120° = 030°

SPEED OF TARGET BY DISTANCE OF SECOND BOW WAVE FROM STEM

Formula: $S = 4/3 \times \sqrt{D}$ or $D = (3/4S)^2$

Where S = Target speed in knotsots
D = Distance in feet of second bow wave from stem of target.

Example: 432 feet target, second bow wave 1/3 length from stem.
I.e. Second bow wave to stem = 144 feet

Speed equal $/3\sqrt{144} = 4/3 \times 12 = 16$ knotsots.

MORE COMPLETE TABLE OF SINES

Sin 15 = ¼	Sin 90 ½ equals 1/3
Sin 30 = ½	Sin 41 ¾ =
Sin 48 ½ = ¾	Sin 90 = 1

Sin 5 = 0.087	Sin 45 = 0.707
Sin 10 = 0.174	Sin 50 = 0.766
Sin 15 = 0.259	Sin 55 = 0.819
Sin 20 = 0.342	Sin 60 = 0.866
Sin 25 = 0.423	Sin 65 = 0.906
Sin 30 = 0.5	Sin 70 = 0.94
Sin 35 = 0.574	Sin 80 = 0.985
Sin 40 = 0.643	Sin 90 = 1.0

PERISCOPE HINTS

Periscope Drill

(A) Lowering the Periscope:

1 Set it on the bearing you next will require, if you knotsow it.
2 Take any appropriate manoeuvring action.
3 Start your stopwatch or at least note the exact time.
4 Check that (a) you have absorbed the recent information
5 (b your team have also, and more important, ensure that they received it correctly.
6 Decide what must be looked at next, if different from your thoughts at 1 above. Then decide when you must next look.
7 LEAVE the periscope until JUST before you require this next look. It will tell you nothing while it is down makes a poor altar.
8 Go round your plots and/or books, check your submarine is under control, team under control, mind under control.
9 Slow down for the next look. Period

(B) On returning to the periscope:

1. Knotsow what you are going to look at, what relative bearing it should be on, and what you want from this look, i.e. Bearing and range, range only, ATB check, recognition, all round look.
2. Check submarine depth and speed.
3. Check your stopwatch and order up periscope on proper time - not 10 seconds before eight seconds after, but on the time you previously calculated.
4. As it goes up set it accurately on the in LP and look with LH on handle, RH on handle but ready as soon as you are in HP to move to the range estimator.
5. Stop the periscope when you can see what you want - always show too little rather than too much, so keep one part of your brain switch to a height of my above water during the look. Make like John Mills, you may even do it right as well.

All Round Looks

we all see varying amounts in our all round looks; decide your frequency of looks in relation to what they are. For example:

1. Anti-aircraft - you would probably not see an aircraft beyond 7 miles in LP and you want to see him before he comes within 2 Miles - hence you have 5 miles of aircraft travel to spot him in - given the aircraft a speed of 200 knotsots - then the answer is an all round look in LP every 1 ½ minutes or an all round look now should leave you unworried about aircraft interference for the next 1 ½ minutes.

2. Anti--ship - in good visibility, you all round look should pick up ships at at least 8000 yards. Check that it does so - adjusting your sweep speed accordingly. When confident that this is so, a new calculation can be readily made for the frequency of look namely allow a max closing speed of 40 knotsots, then a new target could arrive on top in 6 minutes from outside LP visibility range - hence all round look every 5 minutes, or to be safer, 4 ½. In bad visibility, the frequency of an all-round look has to be related directly to the minimum local visibility, i.e. visibility 2000 yards, all-round look every 45 seconds.
3. Anti-helicopter - in any visibility this is very difficult to cover by a rule. The general advice is to keep alert for any indications of helo operation, i.e. sonar transmissions, helo traffic on the UHF nets, proximity to shore basis, intelligence et cetera. If in a possible helo operating area, always remain alert to the danger - watch for spray around the periscope in case there is one right on top or very close; when looking up or down wind, remember they will present and on, and therefore more difficult to see. Aspects - don't forget, new helos may have X band radar fitted.

Finally, make your all round looks as quick as possible, splitting them if necessary. Learn to knotsow what you can see on them because when you're confident of this, and all-round look in which nothing is cited is still of value is negative information and such information buys you time to concentrate on other sensors.

HINTS FOR LOOK PLANNING WHILE PENETRATING THE SCREEN AT PERISCOPE DEPTH

1. Construction of the Go-Deep Circle

the go-deep range is calculated using a range rate made up of the escort's maximum speed plus a component of a submarine speed of 7 knots along the relative bearing (speed x cos relative bearing). This latter speed is the mean speed achieved by a 'P' or 'O' class submarine when going deep at Full Group Down. One minute's run at this range rate is the Go-Deep Range. In establishing this safety rule it is assumed that as you put the periscope down the escort could accelerate to its maximum speed in order straight towards - all instantly. The angle on the target's bow has no bearing in calculating the Go-Deep Range.

A. For Example: A 23 knotsots maximum escort right ahead.
Go-Deep Range Rate = 23 knotsots ÷ 7 knotsots = 30 knotsots.
Go-Deep Range = 1000 yards.

Same escort on beam
Go-Deep Range Rate = 23 knots + 0 knots = 23 knots.
Go-Deep Range = 766 yards.

Same escort right astern
Go-Deep Range Rate = 23 knots - 7 knots = 16 knots
Go-Deep Range = 530 yards.

B. If all the Go-Deep Rangers are joined the shape formed is knotsown as the Go-Deep Circle.

2. The Look Interval

A. This is the time taken to cover the difference between the actual range at the last look and the Go-Deep range on the relative bearing. This time is calculated using a range rate calculated in a similar way as above, but using the submarines actual speed.
B. (i) Assume our 23 knots (maximum) escort is going to pass 1000 yards down the starboard side on a reciprocal course. Our actual speed is for knotsots. This ship is the left-wing escort on our diagram. At a relative bearing of green 27 the first range of the escort is 2500 yards.

$$\text{Go-Deep Range Rate is } 23 \text{ knots} + \frac{(90 - 27)}{60} \times 7 \text{ kn} = 30 \text{knots}$$

Go-Deep Range is therefore 1000 yards
Difference between actual and Go-Deep Ranges = 1500 yards
$$\text{Range rate used to calculate look interval} = 23 \text{ kn} + \frac{(90 - 27)}{60} \times 4 \text{ kn} = 27 \text{ kn}$$

The look interval is therefore the time taken to cover 1500 yards at 27 kn. Here the following mental aid will come in useful.

Range Rate	Time to cover 100 yards
45 kn	4 seconds
36 kn	5 seconds
30 kn	6 seconds
26 kn	7 seconds
22 ½ kn	8 seconds
20 kn	9 seconds

Therefore look interval will be seen to be 100 seconds or one minute 40 seconds. This means that one minute 40 seconds after taking the range of 2500 yards the escort could be at the go-deep range of 1000 yards. The next look at this escort must be inside this time interval.

B. (ii) For the purposes of this example let us assume that the escort was not doing his maximum speed of 23 kn, but only 15 kn. He has only advanced to a range of 1700 yards and is now at a relative bearing of Green 35.

The Go-Deep range rate is still, for all practical purposes, 30 kn.
The Go-Deep range is still 1000 yards.
Differences between Go-Deep range and actual range is 700 yards.
Range rate used to calculate look interval still = 27 kn.
Look interval now is 45 seconds.

The following look plan will develop in our example.

	Range	Bearing	Go-Deep range	Look interval
Look 1	2500	Green 23	1000	1500 at 27 = 1 minute 40 seconds
Look 2	1700	Green 35	1000	700 at 27 = 45 seconds
Look 3	1350	Green 46	950	400 at 26 = 28 seconds
Look 4	1200	Green 57	920	280 at 25 ½ = 19 seconds
Look 5	1080	Green 66	880	200 at 24 ½ = 15 seconds

Look 6	1040	Green 75	840	200 at 24 = 15 seconds
Look 7	1000	Green 84	800	200 at 23 ½ = 15 seconds
Look 8	1000	Green 93	770	230 at 23 = 17 seconds
Look 9	1030	Green 103	730	300 at 22 ½ = 24 seconds
Look 10	1100	Green 115	650	450 at 21 = 32 seconds
Look 11	1300	Green 130	600	700 at 20 = 1 minute 3 seconds
Look 12	1800	Green 151	560	1240 at 20 = 1 minute 55 seconds

B (iii) These look intervals represent the time between actually taking Rangers. Since the stopwatch is not started until the periscope has gone down and it is a few seconds from "Periscope" to taking a range, the look interval must be reduced still further. A standard reduction of six seconds is used. Therefore the look interval calculated after Look 6 should be 9 seconds. It may be helpful to start the watch as the periscope goes up. This has the advantage of giving you time in hand plus less to think about when the periscope goes down.

C. Note:
(i) up to Look 5, range is the only important factor from a safety point of view. From Look 6 onwards (i.e. a broad angle on the target's bow of 70 starboard) the look can be restricted to checking that the angle on the target's bow is increasing. No range need to be taken because the ships do not move sideways. When taking ATB checks only the interval established after the last occasion taking a range must be used (in our example 15 - 6 = 9 seconds). This interval must be maintained until a further range is taken. This would be a Look 9 in the example. Then a longer look interval can be used, i.e. 24 minus 6 = 18 seconds.

(ii) When the ATB is greater than 150, a minute may be added to the calculated look interval as it will take the escort this time to turn round and be back at the same range coming straight towards.

D. The above example is very simple and does not take into account consideration of the presence of other ships or a target astern of the escort. All round looks and Target Set Ups must be planned into the scheme. The example takes about 6 ½ minutes and this is a long time to go without an ARL or TSU; these might well be injected after Looks 1 or 2 when the interval is large enough to allow this. An ARL might be injected as to half ARLs after Looks 5, 6, 7 or 8 when you are only looking at the ATBs and these can easily be checked during an ARL.

3.Timing Two Escorts

a. When two escorts present threat to submarine safety they are best both times on a split second hand stopwatch. The way to do this is to start the watch on the less dangerous escort; (the time shown by the minute hand and the black second-hand will then be the time since the last look at this escort). The red hand is stopped on a look at the most dangerous escort in the time since that look is the difference between the red and black hands.

b. Since the time interval on the nearer escort is shorter, the red hand should be re-set and stopped again on each look at this escort. Meanwhile the black and continues to run on the further escort. When the look interval on the further escort has nearly expired, another range must be taken of him and the watch re-started. This then entails taking a range of the nearest escort to update the red hand.

4. Planning the Looks

a. Returning to our earlier example we will now assume that there is a second escort, the right-wing escort 4000 yards on the starboard beam of the first one, steering the same course and speed and having the same maximum speed. There is also a target astern of the two escorts. The following is suggested as a look plan:

		Range & Bearing	Maximum Interval	Time Since Look 1	Time on Stopwatch
Look 1	LW	2500 Green 23	1minute 40 seconds	00.00	00.00
Look 2*	ARL			01.00	01.00
Look 3**	RW	3500 Red 45	3 minutes	01.20	00.00
Look 4	LW	1700 Green 35	45 seconds	01.40	00.20
Look 5	LW	1350 Green 46	28 seconds	02.25	01.05
Look 6	TSU		Saying 3 minutes	02.35	01.15
Look 7	LW	1200 Green 57	19 seconds	02.53	01.33
Look 8	LW	1080 Green 66	15 seconds	03.12	01.52
Look 9	LW & ARL	Green 75 (ATB check)	15 seconds	03.27	02.07
Look 10	LW is	Green 84 (ATB check)	15 seconds	03.42	02.22
Look 11	LW	Green 93 (ATB check)	15 seconds	03.57	02.37
Look 12	LW	1030 Green 103	24 seconds	04.12	02.52
Look 13***	Rw	3000 Red 95	2 minutes 30 seconds	04.20	00.00
Look 14	LW	1100 Green 115	32 seconds	04.36	00.16
Look 15	ARL			04.50	00.30
Look 16	LW	1300 Green 130	63 seconds	05.08	00.48
Look 17	TSU			05.35	01.15

Look 18	LW	1800 151	green	1minute 45 seconds	06.10	01.50

*RW seen for the first time at about 4000 yards and requirement to start the watch on him realised, (he is second nearest escort).

**Watch restarted on RW, 10 seconds before look required at LW.

***Watch restarted on RW. Interval on LW not exactly measured while re-starting but LW look taken as soon as possible after restart.

NB: target is timed on CO's stop wristwatch and hence separately from escorts.

b. The diagram indicates the approximate escort positions (Figure 1).

c. It is clear that there would be no opportunity to look at the further escort or target or take an ARL when the LW escort was passing close, so these had to be fitted in when there was still time to do so. By doing this we were free to concentrate on the left-wing escort when he was close, knowing that we were safe from the other two ships.

d. It should be noted that throughout the Example, various approximations have been made. This is deliberate, since the Submarine Commanding Officer should not waste time trying to refine his mental aids down to the last 5 seconds or 50 yards.

In conclusion, the foregoing calculations and plans are all required to be done in the head while the ships approach and pass. These hints are intended to help S/M CO's and in particular the COQC students to organise their thinking in advance of the occasion. It is realised that the occasions only arise rarely and operational conditions (though frequently during COQC) - hence the greater need for an established technique which is intended to cover both the safety and operational requirements. It is not intended as an exact Science, particularly since the only exact input is stopwatch time and even that can be wrong. This is a guide to work to, safety times and limits must be changed to suit the environment and expertise of the CO concerned.

5. PLOTS

(a) Time Bearing Plot
(i) Scale - Suggest the standard scale for all attacks be one minute equals 1 inch. This means accuracy of plotting is improved, data rate is higher but curves vary due to new scale and range rate.
Bearing rate can be measured using Bearing Rate Protractor or using the Wood rack (see Annex for template).
(ii) Curve recognition - learn the new curves for closing, range steady, opening, simulating and circling targets.
(iii) Curve Factors:

Own Range Rate
Steady bearing TSA = OSA
Steady curve approximately, 90° relative bow (Range steady)
Circling target - Bearing rate match impossible
- No opening closing curves
- No 1936 range

(iv) Information to be passed from the TBP:

1 or 2 minute bearings to the LOP
1936 Ranges
Bearing rate for comparison
Bearing rate for Lynch plot
Change in bearing movement (? Zig's)
Speiss bearings for LOP

(b) Lynch Plot

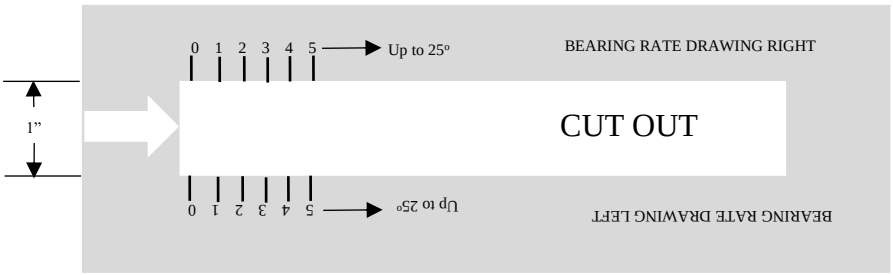
Max bearing rate at normal to relative course plotted
Assess speed v Max bearing rate = Range at CPA
Range and CPA v Relative Course = Range on Bearing

(c) LOP

Do everything possible to eliminate plotting errors - rates of acceleration, deceleration, turning circles, et cetera. Use ARL Table if errors are known.

Consider each banner bearings separately because of above. Suggest each fan in a different colour.

THE WOODTRACK (Not to scale)



Note scales are the same as on TBP
How to use:
Set bearing for which bearing rate is required opposite arrow
Move ruler sideways until bottom is at zero
Read off bearing rate on top scale(This is in fact, the bearing difference over

CONSIDERATIONS WHEN COMING UP FROM DEEP

1. Environment

Bathythermograph trace and range prediction.
Scanner ranges for the day based on experience.
Surface state - swell, sea, noise.
Day/night/visibility.

2. Shipping

CEP History. Bearing rate 10°/minute plus. = Close.
Lanes - come up parallel
- they were blanking arcs of large merchant vessels, it may be necessary to cross tracks by over 500 yards, to clear arcs.
Classification - merchant ships tend to stick to define tracks, fishing vessels are unpredictable.
Inshore - turn and plot contacts to obtain TSA and Range.
Over the top may mean safe unless he turns back.

3. Sonar

Clear stern arcs.
Reduce own noise.
HE will appear on 197 at short range - ? Settings.
HE will appear on 185 at short range - ? Side.
Scanner contact may fade/get louder as bow this period.
Know Scanner gain and stern arc settings and channel.
In good conditions, beware of getting bogged down by long-range Attacker contacts.
Active sonar may help, particularly with high/low Doppler, but beware of 'No Echoes', and bottom echoes.
Continue reports were coming up; especially new HE.

4. Escort

Remember 'Fainter' may mean altering course: always confirm by consistent bearing movement that he has not turned back.
'Faded' on Scanner - Attacker cheque for reduction in revolutions.

5. Miscellaneous

Time since last ARL and the assured range covered.
Stop at 120 feet to check if coming from deep.

6. Organisation

Has 'Q' been vented?
Is radar ready?
Are you at Diving Stations?
Do you need to shut off bulkheads?
Do you need both periscopes manned?

Choice of course - shipping lanes, safety course, sea conditions, navigation.
What is the relative bearing of the most dangerous ship?
Will you remain at F 80 or reduced to SAT before raising masts to reduce ‘feather’?
Any new HE and if at all worried whilst coming up to PD - Reverse planes. FAT. Flood ‘Q’. (You may be lucky?) And see if planes have not had time to act, but this should be regarded as profit.

COMING UP FROM DEEP

1. INTRODUCTION

The decision to return to periscope depth after being forced deep by an escort in the close quarters situation can only be made on sound evidence. The submarine must remain deep unless there is complete proof that it is safe to come up. The Commanding Officer must be at least 95% confident of his decision to return to periscope depth. He must not develop the habit of coming up when he is only 75% sure.

2. This philosophy is essential to combat the natural urge of the commanding officer to return to periscope depth when he “wishes it to be safe”.

3. The minimum safety requirement is that no ship should be within the go deep circle when looked at immediately after returning to periscope depth.

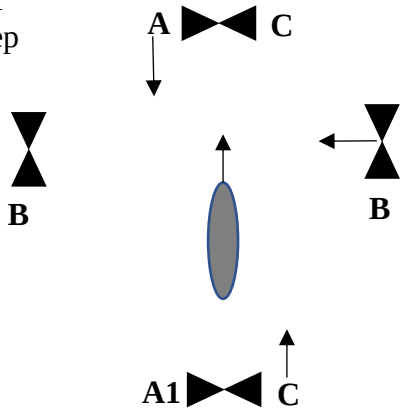
4. AIM

The aim of the paper is to discuss the technique of obtaining and applying that evidence which will enable the submarine to return to periscope depth safely.

5. SINGLE SHIP

in the simplest case the submarine goes deep for an escort at a distance, one minutes run at maximum closing speed from on top. The ship run straight in over the top and runs out without altering course. Providing Scanner tracks the escort in and out the submarine can safely return to periscope depth after a predetermined time period this time will depend on the escort approach relative bearing. Time is measured from ordering “Flood Q”.

Figure 1
The Go-Deep



Consider frigate A: if he takes T to reach on top then he will take 2/3T to reach A1, from on top

Consider frigate B: if he takes T to reach on top he will take T to reach B1, from on top

Consider frigate C: if he takes T to reach on top then he will take 1 ½ T to reach C 1, from on top.

The minimum time deep is one minute 40 seconds for frigate A.

6. This technique is carried out as follows: The submarine goes deep and the stopwatches started when "Flood Q" is ordered. When CPA is reach the red hand is stopped, the time noted and the required run out time calculated. Throughout, constant scanner bearings are passed over the intercom.

7. If the escort comes close aboard, the submarine may rock slightly or the escort propeller noise be heard through the whole period these are the most clear indications of CPA providing the main set is switched to 18 dB. HE shows clearly when the escort is at close range.

8. In addition to timing the escort, constant scanner reports must be checked to ensure that the escort is steering away from the submarine after passing over the top. If the escort has reached the go deep circle by timing and is still steering away then he must be at a minimum of two minutes run to on top: allowing one minute to turn round the fastest turning frigate. If these criteria are met then it is safe to return to periscope depth at that instant.

9. About 5% of all coming up from deep problems respond to this technique. It works best for ships near their maximum speed passing almost over the top of the submarine maintaining a steady course for about three minutes. That this does not often occur with escorts. The assumptions used in this method are only valid for about 3 or 4 minutes.

10. USE OF THE LOP

The LOP is the main aid in clarifying the movements of the escort. Scanner bearings of the escort plotted every 30 seconds. As the bearings steady up the coming towards solution is assumed and plotted in. The LOP can then inform the command that the escort should be on top. If he is not and the bearings are still fairly steady than the going away solution is valid. It is then necessary for the LOP to estimate the range and course of the escort. If he is outside the go deep circle steering away from the submarine then it is safe to return to periscope depth.

11. MULTI-SHIP PROBLEM

Consider to escort and the target. The nearest escort puts the submarine deep. Both escorts are cleared to safety by a combination of timing and plotting on the LOP. The decision to return to periscope depth then rests with the likely range of the target.

12. Before the submarine is put deep a good target range must be taken and the time to go deep calculated. This time is on the wristwatch. As the submarine goes deep range on the limiting ship - the second nearest escort - is taken, and the stopwatch started on Q in the normal way. Scanner is then ordered to report both escorts and the limiting ship

is plotted on the TBP. The Commanding Officer "clears" each ship for safety starting with the escort which put him deep. The second nearest escort is then cleared either by:

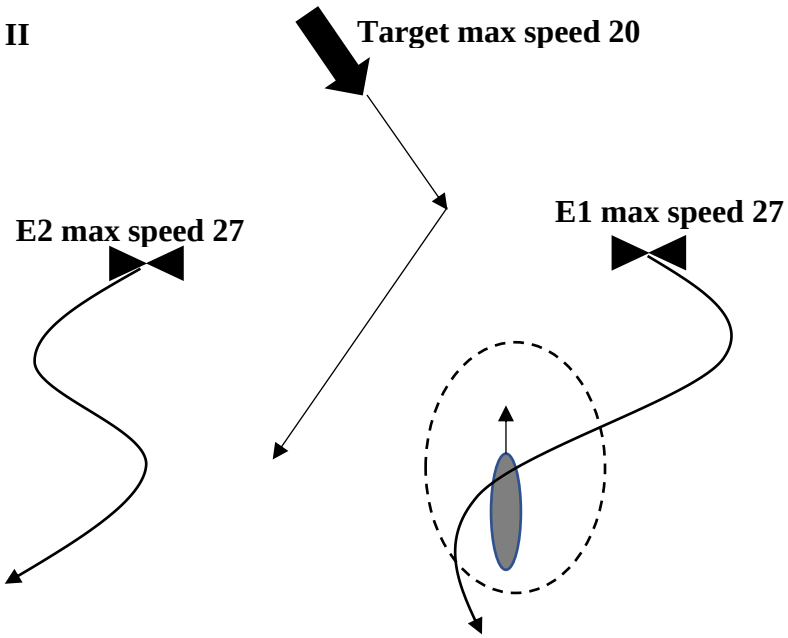
Time elapse on stopwatch

Plotting and timing. Namely, more than 50° ATB, more than 60° on relative bow, range greater than 2500 yards, two minutes on TBP before going deep.

If the second escort is cleared then the Commanding Officer must ensure that the time elapse on the target has not expired. If both escorts and the target are cleared, the former by plotting; the latter by time elapse; then it is safe to return to periscope depth.

13. Figure II gives an example of the course of events described above. Submarine goes deep for E1. E2's range = 6300 yards. E2 will have to be cleared on plotting sonar information. Target's time to on top = 7 minutes (5 minutes deep). The command has five minutes from taking the target range to plot E1 and E2 and ensure that they are

Figure II



continuing South. The order to return to periscope depth must be given 5 minutes after taking the target range - not from "Flood Q".

14. Bearing in mind frigate a in figure 1, the minimum range for any ship to be in order that it may be cleared on time elapse is three minutes 40 seconds to on top. Therefore, if the target range produces a time elapse of less than three minutes 40 seconds to on top when the submarine goes deep, the remainder of the attack should be done blind.

15. ALL ROUND LOOK

The efficiency of the method enabling the submarine to return to periscope depth lies in the Commanding Officer concentrating on the potentially most dangerous ship's this can only be achieved by carrying out a good all-round look in good visibility just prior to going deep. Invisibility is under 5200 yards (3 minutes 40 seconds at 42 knots) than a conventional sonar suite must be carried out to ensure no other ships are a potential danger, once the escort has gone past. During this time the submarine must be a safe depth since the time elapse on any ships just outside 5200 yards will have expired.

16. LIMITING SHIP'S SPEED

In deciding which is the limiting ship the different maximum speeds of the ships must be allowed for. A 36 kn ship at 5600 yards will take the same time as a 30 kn ship at 4800 yards to reach on top. The close ship is not always the limiting ship.

17. USE OF SCANNER

Constant reports of the escort giving variation in intensity and gain settings are required. The report “fainter” is insufficient evidence that the escort so going away. Quite often a “fainter” report will indicate an escort turning towards.

18. USE OF ATTACKER

It is usual for escorts to patrol their station at 16 kn non-cavitating. Attacker must investigate in sonic for the second escort is scanner does not hold him.

19. USE OF UNDERWATER TELEPHONE

Assessing the Doppler on medium-range sonar fitted escorts is a valuable aid in deciding to return to periscope depth. This is best heard on the underwater telephone. The Commanding Officer must be familiar with the sonar he is listening to.

20. CONCLUSION

The Commanding Officer must decide to remain deep unless he has enough evidence to prove that all ships are outside the go deep circle when he returns to periscope depth. This evidence is best connected by a combination of time elapse and plotting. If he is in any doubt he must remain deep.

Why Mental Aids

1. The good CO/AC is the one who can monitor all that is going on around him to:-
   a. Bowl out mistakes.
   b. Prevent the exchange of incorrect information.
   c. Take over when equipment fails.

2. They assist the tactics of achieving a firing position.

DISTANCE OFF TRACK

DOT = R SIN ATB

Note: The 'clock face' rule is accurate to 50°.
It is better to know your sines.

SINES

5°	1/12	45°	7/10
10°	1/6	50°	3/4
15°	1/4	55°	5/6
20°	1/3	60°	6/7
25°	3/7	65°	0.9
30°	1/2	70°	0.94
35°	4/7	80°	0.98
40°	2/3	90°	1

VIRTUAL TARGET LENGTH

VTL = TTL Sin ATB
VTL (for torpedo analysis) = TTL Sin TTA

RANGE BY HORIZONTAL SUBTENDED ANGLE

a. 1° subtends 50 ft at 1000 yards.

b. $$\text{Range} = \frac{\text{VIRTUAL TARGET LENGTH}}{\text{ANGLE SUBTENDED}} \times 20 \text{ yards.}$$

RATE OF CHANGE OF BEARING

If OSA is zero, then

a. When ATB is 90° and range is 2000 yards, the bearing rate = 1° per min for each knot of target speed.

$$\frac{\theta}{B} = \frac{2 \times Vt \times \text{Sin ATB}}{\text{Range in kiloyards}}$$

$$\frac{\theta}{B} = \frac{2 \times TSA}{R}$$

e. Speed

Old RFA	12 kts
New RFA	15 - 18 kts
Escort	16 - 18 kts (when operating solo)
Old MM	10 - 12 kts
New MM	14 - 17 kts
Container ships	20+ kts
New Tanker	16 - 21 kts
ASW group	18 kts

ROUGH DA

0 - 60	Vt Sin TTA
60 - 75	Vt
75 - 95	1½ Vt
95 - 110	1⅔ Vt = Max DA

But peak value for DA occurs at increasing values of TTA, particularly for high speed targets. At the maximum DA, for speeds in excess of 27 kts, DA = 1½ Vt.

SPEED BY SECOND BOW WAVE (and it is simulated in SCTT)

S = 4/3 D

S = Speed D = Dist bow to second bow wave

DURATION OF ATTACK

a. ATB 0 - 60

Duration = Range - ½ DOT @ Vt

b. ATB 60 - 120

$$\text{Duration} = \frac{\text{No of degrees before PA comes on}}{8}$$

VIRTUAL HEIGHT

Virtual height = 1.15 x True Height

RANGING

$$\text{Range} = \frac{\text{Height}}{\text{Minutes}} \times 1150 \text{ yards}$$

$$\text{Range} = \frac{\text{Virtual Height}}{\text{Minutes}} \times 1000 \text{ yards}$$

HEIGHT, LENGTH, TONNAGE

a. Height

8 feet per deck (Old/medium ships)
10 feet per deck (New/large ships)

b. Length

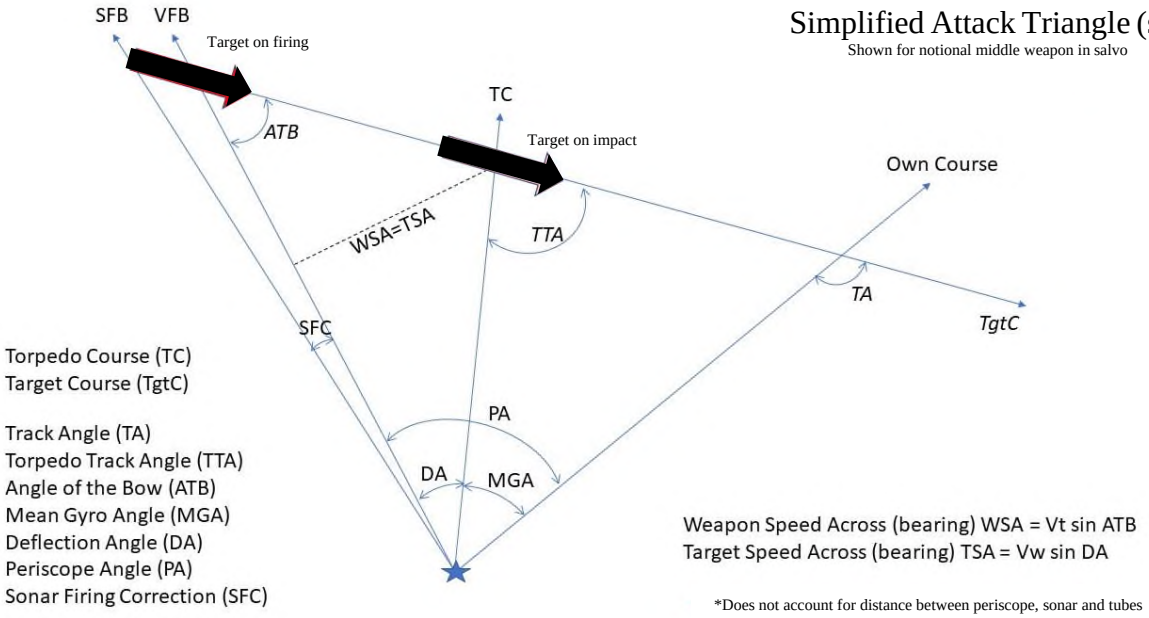
Estimate number of lifeboat lengths and multiply by:-
(i) 30 - 35 feet (small ships)
(ii) 40 feet (large ships)

c. Tonnage

(i) Count number of cargo hatches
(ii) multiply by 400 tons for coaster
4000 tons for cargo ship
900 tons for 4 hatch cargo liner
1200 tons for 5 hatch cargo liner
1500 tons for 6 hatch cargo liner

d. Draught

Watch our for merchant ballast condition.



Obtaining the Attacking Position (AP)

Pointing target, able to fire in one minute.

1. To manoeuvre submarine into AP asap, maintaining the fire control solution.
2. To improve AP such that target alterations in course and speed have least effect on AP.
3. If AP lost, to regain asap.

Detection, Classification, Approach, Attack, Evasion.

Get a feel for DOT (range Sin ATB).

Approach – when submarine moves from initial position to within weapon range. Close or open DOT as soon as possible.

Ideal position

DOT: 1200-1800yds
TTA: 90+Vt (or 80+Vt for first weapon in salvo)
MGA: Zero.

Large DOT (>3000yds)

- Close DOT – use 90° or 120° track.
  - Vt > 23kts, use 90° track
  - Vt < 23kts, use 120° track
- Go as fast as possible, ie go deep to run in; depth depends on CIS, weather conditions etc.
- While deep, monitor and steady bearing, or even push bearing other way (full ahead together, group down, 120ft)

Medium DOT (1800-3000yds)

- Close slowly on best track angle, or 60° track to shorten the attack.

$$\text{Duration of attack} = \frac{\frac{1}{2}DOT}{Vt}$$

- Watch target bearing. If getting too close, parallel target course and turn in at right time.

Ideal DOT (1200-1800yds)

- Maintain DOT by paralleling target course (or maybe edge out a bit)
- Do not close track
- Turn in before firing – remember tactical diameter.
- NB: Turning rate of "O" boat: 6 x own speed (degrees / minute).

DOT too small (<1200yds)

- Open on 60° (slow target), 90° (medium target) or 120° (fast target). Open early, decide when to turn in.

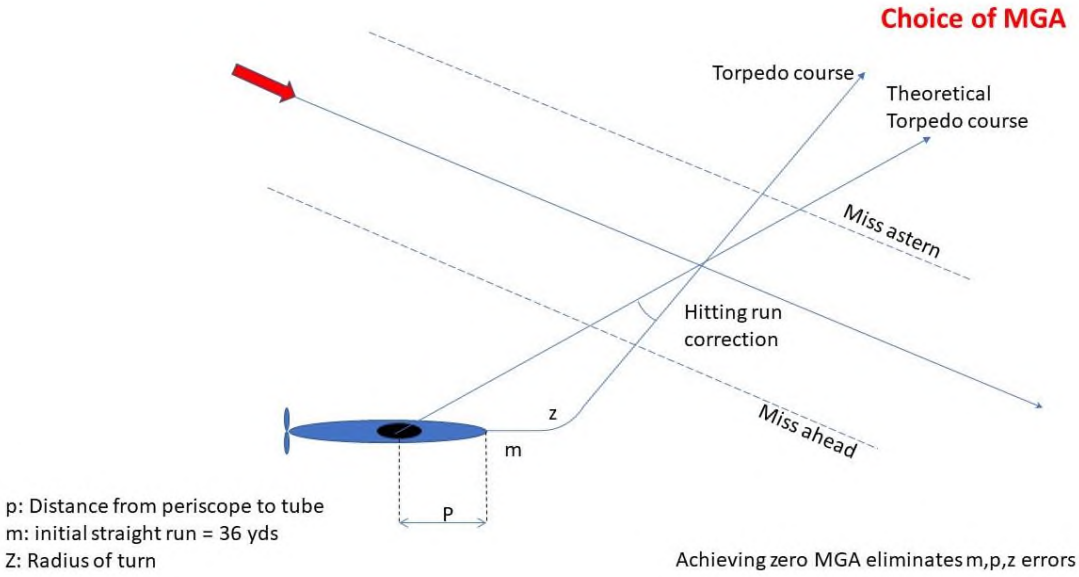
Turns

- Advancing – turn towards target.
    - Shortens attack;
    - In weapon arcs;
    - Easier to orientate;
    - Sonar arcs open;
    - Reduced time in target sonar arcs;
    - Needs fewer periscope looks;
    - BUT
    - Less time for team to settle down;
    - Greater chance of having to fire on a poor DA;
    - May need to go deep and speed up to increase turning rate.
- Retiring – turn away from target
    - Takes longer;
    - Better chance for team to settle;
    - Better chance for good firing angle.

Hitting Run (HR): Distance torpedo runs along Torpedo Course.

- Short HR:
    - minimises errors;
    - Less chances of target evasion;
    - More accurate solution.
    - Minimum HR depends on weapon recovery range (time for weapon to get on depth when fired from deep: 500yds).

Choice of MGA



Correct choice of MGA reduces effect of errors on DA/TTA graph.

Golden Rules of Attacking

1. Attack what you see, not what you think you see;
2. Don't broaden the ATB in the closing stage of the attack, unless sure.
3. Get off-track early if circumstances permit.
4. Don't miss the DA.
5. Try to steady on firing course one minute before intending to fire.
6. Avoid confusion by (a) cutting down on noise in CR; (b) correct mistakes positively; (c) do not turn the wrong way.
7. If caught between the legs of a zig-zag, fine up and fire early OR get out fast.
8. Watch which way the bearing is moving.
9. Ensure you know what you are attacking.

Mental Aids

1. DOT = Rg Sin ATB.

"Clock-face rule" OK up to 50

Sin 5° = $\frac{1}{12}$
Sin 10° = $\frac{1}{6}$
Sin 15° = $\frac{1}{4}$
Sin 20° = $\frac{1}{3}$
Sin 25° = $\frac{3}{7}$
Sin 30° = $\frac{1}{2}$
Sin 35° = $\frac{4}{7}$
Sin 40° = $\frac{2}{3}$
Sin 45° = $\frac{7}{10}$
Sin 50° = $\frac{3}{4}$
Sin 55° = $\frac{5}{6}$
Sin 60° = $\frac{6}{7}$
Sin 65° = $\frac{9}{10}$
Sin 70° = 0.94
Sin 75° = 0.98
Sin 80° = 1

Range by horizontal subtended angle: 1° = 50ft at 1000yds.

2. Virtual target-length = Target-length x Sin ATB.
3. Range = $\frac{2RSA}{Bdot}$ NB Bdot=Bearing Rate.
4. Speed/distance:
   Distance in 3 minutes = Vt in hundreds of yards;
   Distance on one minute = Vt in hundreds of feet.
5. Time to travel = $\frac{Distance\ x\ 3}{Speed\ x\ 100}$
6. Track Angle (TA) = Relative Bearing ± ATB.
7. Target Course = Reciprocal of Bearing ± ATB.
8. DA rules
   TTA = 0° - 60°: DA = Vt Sin TTA
   TTA = 60° - 75°: DA = Vt
   TTA = 75° - 95°: DA = 1¼ Vt
   TTA = 95° - 110°: DA = 1⅓ Vt
9. Speed by second bow wave

Speed = $\frac{4}{3}\ x\ \sqrt{d}$, where d=distance to second bow wave.

10. Duration of the attack = $\frac{Rg-\left(\frac{1}{2}\right)DOT}{Vt}$

Virtual height = True Height x 1.15. ie True Height, plus $^{1}/_{10}$, plus half of $^{1}/_{10}$

Mk 8 Torpedo

Range:	5000yds
Speed:	43 or 44 kts (Hitting Run > or < 1500yds)
Depth:	0-44ft in 2ft steps, minimum 10ft. Reset if over 44ft set.
Maximum GA:	180° (weapon); 150° (Equipment with angular spacing).
Initial straight run:	36yds
Turning radius:	147ft
Recovery from deep:	500ft
Recovery from shallow:	300ft
Maximum firing depth:	200ft
Safety range:	300ft
Countermining range:	90ft
Dead run:	80ft
Minimum firing interval:	5 seconds, to avoid countermining.
Minimum depth of water:	60ft below keel.
Running accuracy:	± ½° from GA set
Minimum impact angle:	15°
Crush depth:	270ft

Restrictions

Water ingress into pistol / warhead.

- Do not flood tube for more than 1 hr;
- Do not equalize until just before firing;
- Do not equalize for >30 minutes at PD, >15 minutes deeper.

Over-pressurization of warhead can lead to explosion.

In peacetime – do not load warshots.

In wartime – do not flood tubes until necessary.

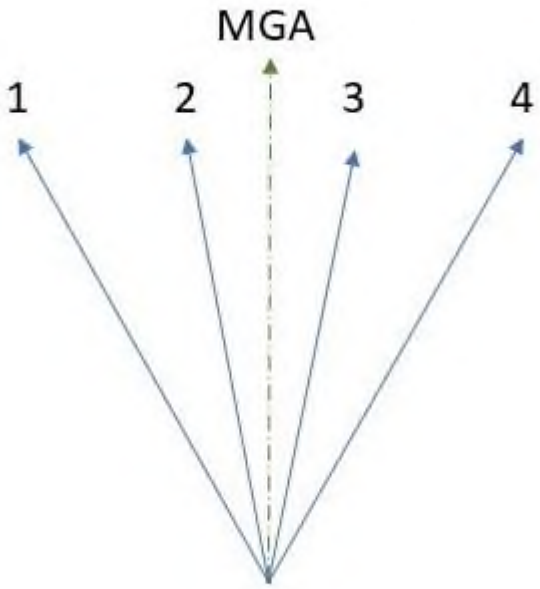
Salvo Fire

- Reasons for salvo. Covers:

- DA error (ie solution errors);
- Fire control error;
- Weapon error (GA ±½°, speed ±1½kts).

- Solutions:
  - Good: ±2½°;
  - Average: ±5°;
  - Poor: ±8½°.

  Solution is CO's choice – based on range, conditions etc. generally, visual attacks use good or average; sonar use average or poor.
- Angular spacing: Spreads torpedoes around the MGA:



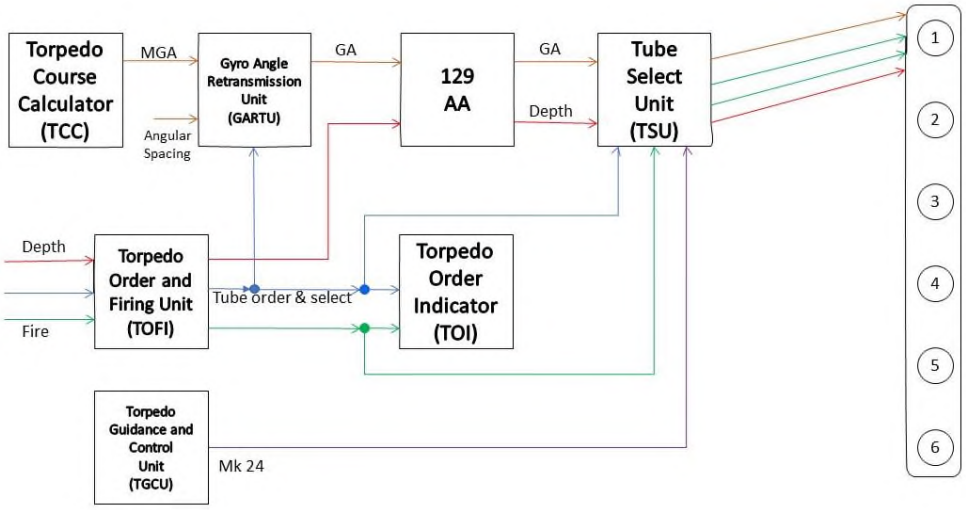
  - Advantage: uses minimum firing interval
  - Disadvantage: Error increases with range.
- Tables:
  - Tables give Angular Spacing, given type of solution and target-length, then entered for TTA and DOT, number of torpedoes in salvo and number hits required to give final spacing.
- Fire torpedoes from aft to forward to avoid weapon bunching.

Weapon system: Weapon Readiness States

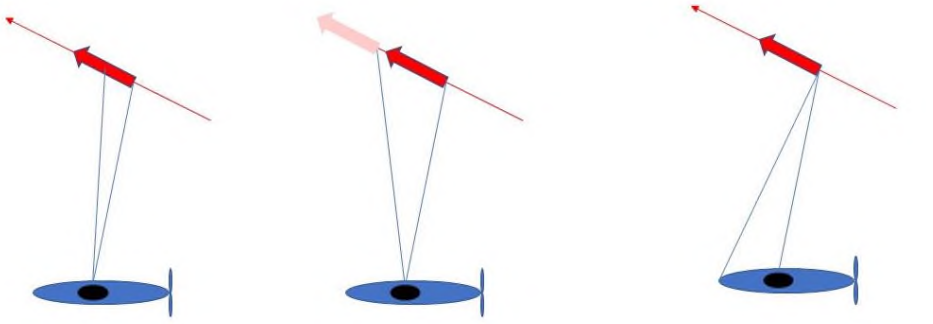
Ref:
SMP 16 (TWI)
TWOPS

1. "Action": ready to fire in one minute. Maintainable for 2 hours;
2. "Defence": ready to fire in one minute. Relaxations on weapons and manning;
3. "Patrol": Able to achieve State 1 within five minutes.
4. "Patrol relaxed": Able to achieve State 2 within two hours.
5. "Unready": AMP, DED, Refit etc.

TCSS Block Diagram:



Corrections



Line of sound | Speed of sound | Hydrophone correction

Minor Breakdown Fire

Aim

To fire a salvo of Mk 8 torpedoes, with no TCC but able to set GA on GARTU by hand.

Needed if

- Angle solver defective;
- Transmission failure between TCC and GARTU;
- Complete TCC failure.

Function of TCC

- Tracks a target throughout the salvo;
- Solves TSA and WSA to determine DA, which gives GA;
- Applies SFC;
- Produces Hitting Run Correction.

Ideal Firing position:

- TTA = 80° + Vt;
- GA = 0;

- DOT = 1.2kyds – 1.8kyds (towards greater range for SGA fire).

Rule of Thumb

- Lead-ahead should be at least either (a) 2 x target speed, or (b) 3 x BDot, ahead of target;
- BUT still want to fire on zero GA.

Drill:

CO: "Standby SGA fire. Ship's head on discharge will be … , SGA … degrees."
TCO: "TC … , TTA … , HR …"
TBPO: Marks Ship's Head and Torpedo Course.
GARTUO: Calculates SGA correction from SGA and HR. Sets SGA and correction on GARTU.
FCO: From SATs, reports "DA … , SFC … , Spacing … ."
AC: Calculates increment used to update GA as the salvo changes. Since increment depends on bearing rate and firing interval is 6 seconds, increment = $\frac{1}{10}$ Bearing rate.
TBPO: Applies DA to TC to give VFB;
Applies SFC to VFB to give SFB;
"Predicted Time of Discharge … ; Bearing rate at discharge … ."
GARTUO: Notes increment and sets it on for subsequent weapons.
FCO: Selects tube … ; Angular spacing calculated as usual from SATs.
AC: Converts VFB to Periscope Angle (PA);
[SGA correction is the Hitting Run Correction].

Fine aspect target (eg late target zig)

- CO reviews TBP and eyeballs a suitable VFB, using a default DA of 6°
- Having ascertained a reasonable VFB and applied the DA, CO can calculate SGA and then goes into above drill.
- FCO sets an angular spacing of ½°.

If the DA is missed, it is possible to shift up to 10° left or right. But – need to be on flat of the curve.

Major Breakdown Fire

Aim

To fire a salvo of Mk 8 torpedoes with zero GA and whatever depth is set on the weapon at the time, firing by time interval. Necessary in the event of failure of transmission of depth or GA to the weapon by:

- GARTU;
- 129AA amplifier;
- TSU;
- TOI.

Linear spread is achieved by firing interval. Different points of aim achieve weapon spread within the linear spread.

Procedure

- Enter SATs (Major Breakdown) for Target-Length, TTA, number of torpedoes and DOT.
- Use Greek Slide Rule to determine points of aim and firing interval – SATs p48 give instructions.

- If firing interval is less than 5 seconds, either accept risk of countermining or increase spacing (eg from ¼ to ⅓-length etc).
- Own speed correction:
    - 0-4kts, add 0 seconds to firing interval;
    - 5-10kts, add 1 second to firing interval;
    - 10-15kts, add 2 seconds to firing interval.
- Methods of fire:
    - All by observed points of aim;
    - Observed Firing Interval – ie first two by points of aim, rest by FI as determined by first two weapons;
    - First fired visually, remainder by corredted firing interval.
    - Sonar – all by sonar.

Note: Sonar Firing Correction is always large, since we have to correct from screw to middle of target (as usual) and then from MoT to first point of aim. If all else fails, use default of 4°.

Drill

CO: "Standby Major Breakdown Fire. Ship's Head will be … ."

TCO: "TC … ; TTA … ."

FCO: "DA … ."

AC: "PA … ; Spacing …; Points of Aim … ; Firing Interval …; SFC … ."

TBPO: Marks SH, DA, SFC. "Predicted time of discharge … ."

APPENDIX SEVEN: SELECTION FORMS

The three forms show how the selection process improved over time.:

- SGM 1503 Modified in 1991
- SGM 1503 Modified in 1995
- Today's Command Competency Framework. The Form is in Microsoft Excel and clicking on the 'skills' boxes opens up further spreadsheets.

Form SGM 1503, 1991 Version

Annex A to
SGM 1503
(Revised 6/91)

STAFF IN CONFIDENCE
(When completed)

RECOMMENDATION FOR SUBMARINE COMMAND

Date of Report — Last S206 Dated

1. Personal Details

D of B	Rank	Seniority	Forename(s)	Surname

Age	List	Commission	Spec/Sub Spec	Ship/Estab	Date Comp OTC
		FCC	X SM	HMS	

Period of Report	Date Joined	Duties
		Watchleader, Tactical Systems Officer, Crypto Custodian.

2. Qualifications

SMWC (Date passed or NO)	10/90
SCE Subjects passed	Nil
Driving Licence (SGM 1503.13c) (Y/N)	

3. Experience

	SSK	SSN	SSBN	Shore
Sea	3.5	1.3	Nil	
Watch Leader	1.9	1.3	Nil	0.6
Drives	Nil	Nil	Nil	

4. Future Command Potential

	HIGH	AVE	LOW
SSN/SSBN XO	✓		
SSK CO	✓		
SSN/SSBN CO	✓		

	Marks
a. Shiphandling Dived	7
b. Technical Competence	7
c. Tactical Competence	7
d. Weapon System Knowledge	6
e. Command Presence	7
f. Organising Ability	6
g. Drive and Ambition	7

5. General Report and Appointing Considerations

has now completed a 5 month running period as a watchleader which has included a long work up and an operational patrol and has matured into a very competent and assured watchleader. He has a firm and commanding presence, handles stress well and possesses good reserves of stamina. An honest watchleader with an abundance of command potential will, with more experience, justify a firm recommendation for SMCC.

Signature Name Rank

6. Recommendations by Captain (SM) for SMCC /

Signature Name Rank

STAFF IN CONFIDENCE
(When completed)

Form SGM 1503, 1995 Revised Version

RESTRICTED STAFF (WHEN COMPLETED)

SGM FORM 1202
Revised 4/95

RECOMMENDATION FOR SUBMARINE COMMAND

Date of Report: | **Last 206 Dated:**

1. Personal Details

Date of Birth	Rank	Seniority	Forenames	Surname

Age	List	Commission	Spec/Sub-Spec	Ship/Establishment	Date Comp OTC
	GL	FCC	X SM	HMS	

Period of Report	Date Joined	Duties
From:		Sonar Officer, OOW, DO, OOD

2. Qualifications

Date Passed SMAWC	Jul 95		
Ship Command Examinations Completed		YES/NO	
NAV 1	YES	NAV 3	YES
NAV 2	NO	NAV 4	YES

3. Experience

	SSN	SSBN	Shore
Sea Service as OOW	0.4	0.3	0
Total Sea Service	1.4	2.6	0
Shiphandling Evolutions	0	0	

4. a. General Report and Appointing Consideration

is a mature character who joined from Advanced Warfare Course, spent christmas on patrol in and settled quickly into the role of watchleader. His management and leadership skills were fully tested as Rededication Officer and he uses his fine organisational ability to smoothly and efficiently run his watch. A thoroughly reliable Officer of the Watch surfaced he displays sound judgement and makes logical decisions. In the attack teacher he has shown that he works well under pressure and is confident in his own ability as a dived Officer of the Watch. lacks experience as Officer of the Watch Dived but is developing well and displays the qualities required for submarine command. He will be recommended for SMCC once he has gained the necessary sea experience.

Signature: Name:

b. Command Potential	High	Average	Low
SSN/SSBN XO	✓		
SSN/SSBN CO	✓		

c. Attributes	Marks
i. Shiphandling Dived	6
ii. Technical Competence	6
iii. Tactical Competence	6
iv. Weapon System Knowledge	6
v. Command Presence	7
vi. Organising Ability	7
vii. Drive and Ambition	7
Total	45

5. Comments by Captain (SM)

Signature: Name: Rank:

Recommended for SMCC:	
Now	-
Not Yet	1/99
No	-
Captain(SM)'s Recommendations	
Yes	
Course No	
No	

RESTRICTED STAFF (WHEN COMPLETED)

6. ADDITIONAL SHIP COMMAND EXAMINATIONS PASSED
NAV 5 Metoc Administration aand Personnel NBCD

7. SEA EXPERIENCE (OTHER THAN SUBMARINES) POST OTC		
SHIP	APPOINTMENT	SEA TIME (YEARS/MONTHS)

8. RECENT EXERCISE EXPERIENCE/NOTEWORTHY APPOINTMENTS			
EXERCISE/APPOINTMENT	ROLE	MONTH/YEAR	DURATION

Command Competency Framework

REPORT FOR COMMAND QUALIFICATION BOARD									
NAME		INITIALS		RANK		SVCE No.		Seniority	
PREVIOUS SEA EXPERIENCE HISTORY POST FNO / IWC									
Date Comp: FNO						PWO/PWO(SM)/PWO(AV)			
From	To	Assignment		Employment		CO / 2RO		Months at Sea	
						TOTAL QSS		TOTALS	
TOTAL COMMAND TACTICAL TRAINING / EXPERIENCE DEVELOPMENT									
OP Patrols / Deployments conducted post FNO / IWC:		Platform				SSBN			
FOST Training at Sea post BWQ/BSQ:									
Hours in Conduct						Berthing / Un-Berthing			
Submariners Only									
No. of at sea inshore Ops as DC, AC or NO						At Sea EO Attacks			
No. of SCTT inshore Ops as DC, AC or NO						SCTT EO Attacks			

REPORT FOR COMMAND QUALIFICATION BOARD									
NAME		INITIALS		RANK		SVCE No.		Seniority	
No. of SCTT inshore Ops as DC, AC or NO						SCTT EO Attacks			
THIS REPORTING PERIOD		**FROM**				**TO**			
Current Appointment						Date Joined			
Current CO / 2RO						Date CO / 2RO Joined			
Period CO and Candidate Together		FROM				TO			
Command Competency Framework:		Recommendations						Warfare Officers LOG / ORC - Completion Date	
Professional Skills									
Thinking Skills									
Leadership Skills								SCE1/SCE2 Completion Date	
People Skills									
Personal Skills									
TOTAL		**Command Potential**							

REPORT FOR COMMAND QUALIFICATION BOARD									
NAME		INITIALS		RANK		SVCE No.		Seniority	

Commanding Officer's Report and Recommendation By recommending this officer, COs are stating that, upon successful completion of the board, they are content for this officer to hold unsupervised conduct in their ship.

Recommended for	CQ1		CQ2		SMCC	
NAME		SIG		RANK		DATE	

Other Domestic / Personal Factors for Selection Consideration:

I have read and understood the contents of this report	SIG		DATE	

Senior Assessing Officer (CQ)
(For unsuccessful candidates include recommended consolidation period)

Result	CQ1		CQ2		
NAME		SIG		RANK		DATE	

APPENDIX EIGHT: CURRICULUM COMPARISONS

The length of the course was about three months for most of the inter-war years and then unsurprisingly had to adjust in response to the imperatives of WW2 before lengthening to a more or less standard 21 weeks. Over the period since WW2 it is very clear how the focus has moved from the visual periscope attacking, that became an essential part of safety training finally being totally completed in attack teachers, to the tactical training with a substantially increased attack teacher training before a four week Cockfight.

Visits appear to be a creation of the late 1950s. The earliest mention of them being in 1962 although this omission may be due to the brevity of COQC Reports of those earlier years being typically 1½ pages compared to the seven pages of later reports. However, Martin Wemyss recalls his Perisher visits in 1956 to Barr and Stroud, Exide Batteries, the Royal Navy Torpedo Factory at Greenock where they were experimenting with oxygen peroxide for the 'Fancy' torpedo that blew up the *Sidon* in 1955, ARE Haslar, (where they held bottles of bits of people blown up in the *Sidon*)., HMS *Royal Arthur* and the ARL Teddington. The first reported visits programme in 1962 was confined to the research establishments AUWE, ASWE, ARL and HMS *Mercury*, the Communications School although there is suspicion, as it is mentioned by Woodward in his copious notes, that a rather boring visit was made to the periscope manufacturers Barr and Stroud but this visit seems to have been discontinued and then picked up again later 1978. By the 1980s visits are substantial, for example COQC 1/85 made visits to Marconi Underwater Systems, Vickers Engineering at Barrow and Barr and Stroud together with two visits to FOSM at Northwood, one administrative the other operational, RAF Kinloss for a Nimrod flight, 819 Naval Air squadron (Sea King Helicopters), HMS Dolphin for a Supply Acquaint Course, Admiralty Research Establishments Haslar, Portsdown, Southwell and Teddington, Royal Marines (SBS) Poole, Hydrographer of the Navy at Taunton, HMS *Royal Arthur*, the Petty Officer Training School, Captain Submarine Acceptance at Bath, Defence Intelligence Staff and HMS Excellent in Portsmouth for a Divisional Course. But if the 1980s visits were extensive by 2018 they are broadening with a Coaching and Mentoring Course, attendance at the Naval Leadership Conference visits to four Defence Manufacturers and other Defence and governmental offices like GCHQ and the Cabinet Office. But perhaps equally important are the large number of guests who visit the course many of whom give lectures or presentations.

Comparison of COQC courses

1918		1920s—1930s		1940—1941		1943 — 1945	
No. of weeks	**Curriculum**	**No. of weeks**	**Curriculum**	**No. of weeks**	**Curriculum**	**No. of weeks**	**Curriculum**
4	Atendance at the Periscope School is irregular to begin with but then settles down to about one month	12	In 1920 the Periscope School moves from Campbeltown to Portland and from 1923 courses establish themselves for about three months duration. In 1924 a new attack teacher that can manage a target and destroyer screen is built in Portland dockyard but in 1926 the School moves back to Fort Blockhouse. COQC courses continue until April-July 1939.	4— 6	Following a small Requalifying course in September 1939 the first wartime course of four weeksstarts in January 1940. It is then lengthened to six weeks, all visual attacking	3 — 3.5 3 — 4.5 1 — 1.5 **Total:** 7 — 9.5	Dolphin Attack Teacher Rothesay Attack teacher Scapa Flow Fast Attacks

1960-1967		1968		1978		1985	
No. of weeks	**Curriculum**	**No. of weeks**	**Curriculum**	**No. of weeks**	**Curriculum**	**No. of weeks**	**Curriculum**
3	Technical Courses	3	Technical Courses	2	General Acquaint Courses and Visits	1	Dolphin Acquaint Courses
2	Leave	2	Leave	3	Dolphin Attack Teacher and Faslane S CTT	1	Visits
4	Dolphin Attack Teacher	1	Dolphin Attack Teacher	4	COQCEX Periscope Weeks	3	Faslane SCTT/Dolphin Attack Teacher
2	COQCEX Periscope Weeks	1	Rothesay Attack Teacher SSX	4.5	Dolphin Attack Teacher and Faslane S CTT Tactical Training	3	COQCEX Periscope Weeks (15 days at sea)
1	SSX	2	Dolphin Attack Teacher	2.5	Cockfight	1	Dolphin Attack Teacher Inshore Operations
1	Londonderry Joint Anti-Submarine School	4	COQCEX Periscope Weeks	2	Leave	3	Faslane SCTT Tactical Training
4	COQCEX Periscope Weeks	1	Dolphin Attack Teacher Tactical Games	4	Maritime Tactical Course, HMS *Dryad*	1	Visits
2 days	Cockfight Inshore Operations	1.5	Londonderry Joint Anti-Submarine School	n/a	Commanding Officer Designate Courses	4	Cockfight (26 days at sea)
		0.5	Dolphin Attack Teacher Tactical Games [2]			2	Visits
		2	Patrol in Clyde and Londonderry Areas (Prowlex) [3]			2	Senior Offficers Divisional Course and Visists
Total: 17.3		**Total**: 18		**Total**: 22		**Total**: 21	

Notes:

1991		2000		2018	
1		1	Introductory Week	1	Coaching and Mentoring Course
3	Dolphin Attack Teacher Safety Training	2.5	Faslane SCTT Safety Training	1	Operational Visits
1	Industrial Visits	1	Operational visits	1	Faslane; start Safety Training; Fitness Test; Rule of the Road Test
3.5	Faslane SCTT Tactical Training	2	Faslane SCTT Tactical Training	4	Faslane SCTT Visual Safeth Training
1	Operational Visits	1	Operational Visits	1	MWC/Portsmouth Visits
4	Cockfight (SSN[4]	3.5	Faslane SCTT Tactical Training	1	Capability Visists
1	Visits	4	Cockfight (SSN)	1	Raleigh Week
		4	Courses Leave and XO PJT	1	Human Factors/ Clyde Fisheries Association
				6	Faslane SCTT Tactical Training
				4	COQCFIGHT (Cockfight)
Total: 21		**Total**: 19		**Total**: 21	

1. This was the first Woodward designed Perisher for which he leaves copious notes
- Frigate-days were reduced from 62 to 50.
- Course extended from 3 months to 4 1/2 months
- Periscope sea attack weeks progressed from one to four ships.

2. Five games were 'played':
- 186 Game: contact evaluation and long approach
- North Cape: attacking high-speed targets, approach from long range, DOT of surface force
- URG: Soviet tactics
- West Norway: evasion of ASW search groups
- North West Norway: long approach towards snorting non-cavitating target

3 Prowlex (from next course in Portland Areas)
- Photographic Reconnaissance
- Co-ordinated attack and transit
- Minelay
- Bottoming
- SBS Operations
- Opposed transits
- Underwater photography
- Exercise WESTLAKE

4
2 days: Familiarisation
7 days:ASuW/Inshore Operations
4 days:SBS Operations/Array On
6 days:Covert transit/SUBTACEX
+ will be destroyed were
+9 days: Joint Maritime Course Exercise
5 days: Clyde Penetration/Inshore Operations

APPENDIX NINE: COMMAND MATRICES

The Command Matrices provided here show the commonality in command attributes between organisations like the Emergency Services, in this case the Fire Service and other disciplines like commercial flying with Perisher, based on the matrices produced by Ryan Ramsey.,

FIRE SERVICE COMMAND MATRIX

Cohen-Hatton, Sabrina, *The Heat of the Moment*, London, Penguin,2019

LEADERSHIP • Setting and maintaining standards of performance • Values and supporting others • Leadership style • Competence • Safety leadership	SITUATION AWARENESS • Information gathering • Understanding information • Anticipating incident developments
DECISION-MAKING • Intuitive decision-making • Analytical decision-making • Planning	TEAMWORK • Cooperation • Team formation • People-oriented
COMMUNICATIONS • Listening • Communication style • Briefing	PERSONAL RESILIANCE • Thinking time • Stress and fatigue management • Confidence

RYAN RAMSEY COMMAND MATRIX	
Professional Standards (PS) • Manages the submarine to achieve the highest levels of safety, efficiency, and operational capability. • Maintains a high standard of discipline, conduct and appearance. • Demonstrates responsibility for the duty of care and welfare of the crew. • Considers best interests of operational programme. • Communicates and interacts with squadron and operating authority to best interests of operational programme and submarine • Conducts reviews to analyse and improve performance • Demonstrates a motivation for continuous professional development	Situation Awareness (SA) • Continually maintains awareness of submarine's systems state, position and intended movement, sub-surface, and surface environment. • Continually maintains awareness of the other units and people involved in or affected by the operation. • Uses periods of low workload to conduct briefings and think ahead. • Makes good use of intuitive and deductive decision making. • Regularly reviews, shares, and updates mental models using the elements of situation awareness (Plane, Path, People) • Considers not just 'what' to do but 'how' to do it • Sets objectives and establishes bottom lines • Discusses 'what if' scenarios and contingency strategies • Recognises and responds effectively to indications of reduced SA
Leadership & Teamwork (LT) • Takes initiative, inspires and motivates • Empowers and values both officers and ship's company • Creates atmosphere for open communication • Considers suggestions of others • Does not interfere unnecessarily • Ensures crew involvement and task completion • Supports, coaches, delegates and directs as required • Advocates own position and intervenes when appropriate • Carries out instructions when directed • Demonstrates empathy, respect and tolerance for others • Encourages, gives and receives feedback constructively • Addresses and resolves conflict in a constructive manner	Workload Management (WM) • Is calm, methodical and not impulsive • Plans and prioritises tasks effectively • Anticipates and plans for potential high workload situations • Assesses and manages time to ensure task completion • Distributes tasks appropriately utilising all resources • Manages interruptions and distractions effectively • Recognises signs of stress, fatigue and overload and responds by making time time and reducing workload • Offers and accepts assistance and asks for help early
Communications (CO) • Conveys information clearly, accurately and in a timely manner • Briefings are open, interactive, concise and relevant • Uses body language that is consistent with verbal messages • Checks for understanding of important information • Listens actively and demonstrates understanding • Resolves uncertainty and ambiguity • Uses relevant and effective questions	Problem Solving & Decision Making (DM) • Uses an appropriate decision-making process • Allocates appropriate time for decision making process • Uses all resources to diagnose and understand the problem • Asks for options or suggests alternative options • Discusses the risks and consequences of alternative options • Communicates agreed option and assigns tasks • Reviews and validates original decision • Recognises change and adapts plans as required to ensure an

British Airways Pilot Competencies

BRITISH AIRWAYS

Professional Standards (PS)

- Manages the aircraft to achieve the highest levels of safety, efficiency and customer experience
- Maintains a high standard of discipline, conduct and appearance
- Demonstrates responsibility for the duty of care and welfare of the crew and customers
- Considers best commercial interests of British Airways when making decisions
- Communicates and interacts with customers as appropriate for best commercial advantage
- Maintains high operational standards
- Conducts reviews to analyse and improve performance
- Demonstrates a motivation for continuous professional development

Situation Awareness (SA)

- Continually maintains awareness of aircraft state, position, flight path and general environment
- Continually maintains awareness of the people involved in or affected by the operation
- Uses periods of low workload to conduct briefings and think ahead
- Identifies and manages threats and errors
- Regularly reviews, shares and updates mental models using the elements of situation awareness (Plane, Path, People)
- Considers not just 'what' to do but 'how' to do it
- Sets gates and establishes bottom lines
- Discusses 'what if' scenarios and contingency strategies
- Recognises and responds effectively to indications of reduced situation awareness

Knowledge & Application of Procedures (KP)

- Demonstrates practical knowledge of aircraft limitations and systems
- Demonstrates thorough knowledge of regulations, policies and procedures
- Correctly sources required operational information
- Correctly operates aircraft systems and equipment
- Follows SOPs unless safety dictates otherwise
- Applies relevant procedural knowledge
- Disciplined management of aircraft procedures and checklists

Leadership & Teamwork (LT)

- Takes initiative, inspires and motivates
- Empowers and values other team members
- Creates atmosphere for open communication
- Considers suggestions of others
- Does not interfere unnecessarily
- Ensures crew involvement and task completion
- Supports, coaches, delegates and directs as required
- Advocates own position and intervenes when appropriate
- Carries out instructions when directed
- Demonstrates empathy, respect and tolerance for others
- Encourages, gives and receives feedback constructively
- Addresses and resolves conflict in a constructive manner

Workload Management (WM)

- Is calm, methodical and not impulsive
- Plans and prioritises tasks effectively (including Fly, Navigate, Communicate)
- Anticipates and plans for potential high workload situations
- Assesses and manages time to ensure task completion
- Distributes tasks appropriately utilising all resources
- Manages interruptions and distractions effectively
- Recognises signs of stress, fatigue and overload and responds by making time and reducing workload
- Offers and accepts assistance and asks for help early

Manual Flight Control (MF)

- Controls the aircraft manually with accuracy and smoothness
- Operates the aircraft within the normal flight envelope
- Manages the flight path and energy to achieve optimum operational performance
- Uses appropriate modes and makes correct target selections
- Monitors flight guidance systems effectively
- Detects deviations from the required aircraft state or flight path and takes appropriate action

Communications (CO)

- Conveys information clearly, accurately and in a timely manner
- Briefings are open, interactive, concise and relevant
- Uses body language that is consistent with verbal messages
- Checks for understanding of important information
- Listens actively and demonstrates understanding
- Resolves uncertainty and ambiguity
- Uses relevant and effective questions
- Adheres to standard RT phraseology and procedures

Problem Solving & Decision Making (DM)

- Uses an appropriate decision making process
- Allocates appropriate time for decision making process
- Uses all resources to diagnose and understand the problem
- Asks for options or suggests alternative options
- Discusses the risks and consequences of alternative options
- Communicates agreed option and assigns tasks
- Reviews and validates original decision
- Recognises change and adapts plans as required to ensure an optimum outcome

Automatic Flight Control (AF)

- Controls the aircraft using automation with accuracy and smoothness
- Operates the aircraft within the normal flight envelope
- Manages the flight path and energy to achieve optimum operational performance
- Uses appropriate level of automation
- Briefs and uses appropriate modes and makes correct and MCDU selections
- Monitors flight guidance systems effectively including engagement and automatic FMA transitions
- Detects deviations from the required aircraft state or flight path and takes appropriate action