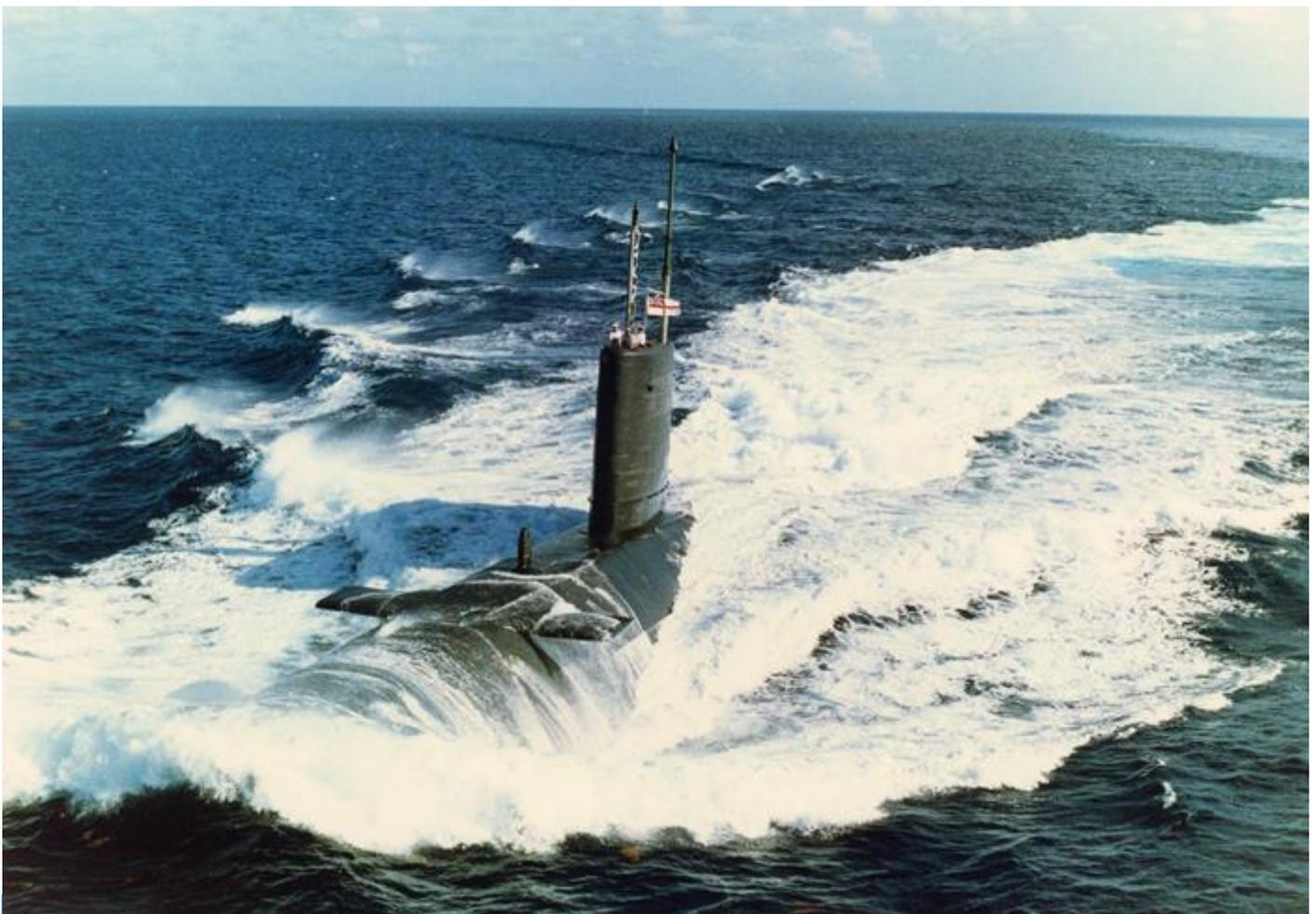


Society Members' Bulletin



Special Supplementary Edition HMS Courageous



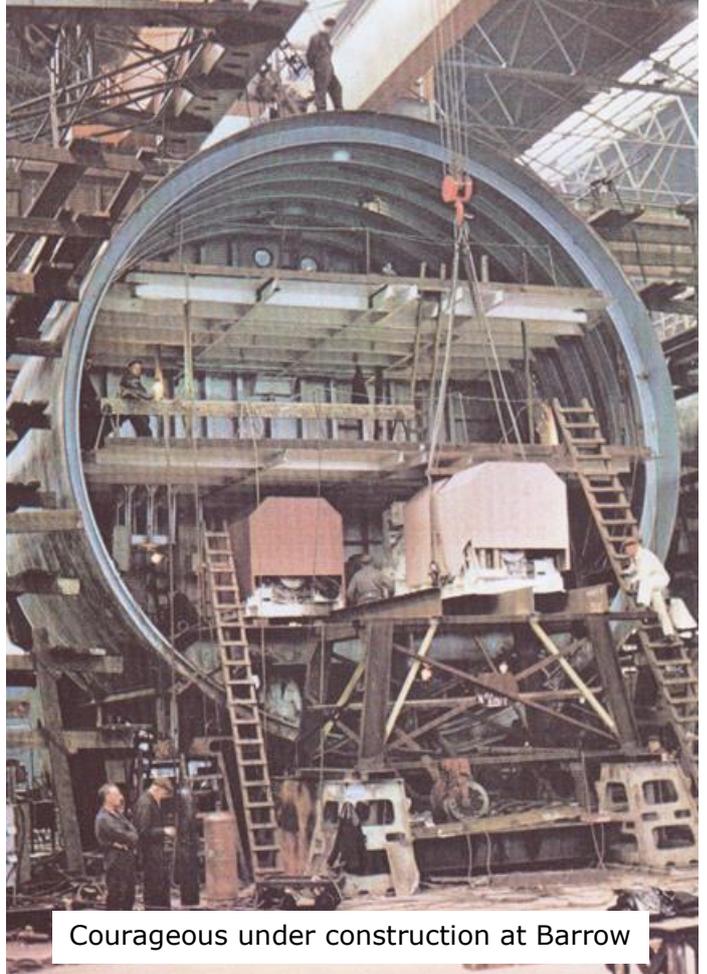
September 2013

**Royal Naval Engineers' Benevolent Society
Founded in 1872**

HMS COURAGEOUS

A Cold War Veteran

On a bright and blustery day in March 1970, HMS Courageous became the seventh British nuclear submarine to be launched by the Vickers Shipbuilding yard at Barrow-in-Furness, Cumbria. Some 6000 tickets had been issued for the event and spectators gathered to witness Courageous' sponsor Mrs Margaret Morris, wife of Mr John Morris, Labour MP for Aberavon and then Minister of Defence for Equipment, perform the honours of launching the



Courageous under construction at Barrow



Mar 1970: Mrs Margaret Morris christening the boat

submarine with a bottle of wine supplied by the MOD Wine Making Circle.

Costing around £26 million, she was the last of the first generation of nuclear submarines to be built for the Royal Navy. Courageous was the 285th submarine to be built by Vickers at Barrow for the Royal Navy. HMS Dreadnought (partly American) was the first nuclear boat, followed by Valiant, Warspite, the four R-Class Polaris submarines and then Churchill and Conqueror, built to a slightly different



Courageous slipping into the Walney Channel



Sailing into the Irish Sea from Barrow to conduct contractor's sea trials

design. Courageous was of a type known as Fleet Submarines. These were vastly superior to the older diesel electric powered boats with their limited endurance and frequent need to snort diesel and recharge batteries on the surface making them vulnerable to attack. In contrast, although expensive to run, the new nuclear submarines

were fast and could roam the world's oceans at will, only coming into harbour to store food, conduct essential maintenance and rest the crew. This enabled them to undertake a wide variety of tasks, making them very cost effective.

The Cold War, which lasted from the



The casing party during sea trials



Oct 1971: The Commissioning Ceremony at Barrow—in—Furness.

1950's to the early 1990's, was then at its height with the military forces of both the Soviet Bloc and NATO being held at a constant state of high readiness in case of full-scale nuclear war. The Fleet Submarines proved to be ideal platforms for covert surveillance of hostile units with many patrols being conducted throughout these years to track the movements of the Soviet

Navy.

Following her launch, Courageous entered into an extensive series of contractor's sea trials to prove her systems and ensure she was thoroughly seaworthy.

On 16 October 1971 the Commissioning Ceremony for Courageous was held in Barrow on a wet and miserable day, in



Oct 1971: The officers of Courageous' first commission.



Oct 1971: Mrs Pat Fry and Assistant Cook Bill Martin cutting the commissioning cake

front of an audience of invited guests and dignitaries, when the boat was formally accepted into service with the Royal Navy. To mark the occasion a Commissioning Cake was formally cut by Mrs Patricia Fry, wife of Courageous' CO Commander 'Sam' Fry, assisted by the youngest member of the crew Assistant Cook Bill "Pincher" Martin.

Two weeks later on Tuesday 2 November, to the strains of "Now is the Hour" played by the Vickers Works Band, Courageous departed Barrow on passage for the West of Scotland. She was joining the Third Submarine Squadron based at Faslane on the

Gareloch, one of the lochs leading into the River Clyde.

The Clyde Submarine Base was then home to the Third Submarine Squadron of Nuclear Fleet and Diesel Patrol Submarines, "the fighters", and the Tenth Submarine Squadron consisting of the four Polaris submarines, "the bombers". The Base also conducted the training of all submarines before they joined their Squadrons and this was known as 'work up'.

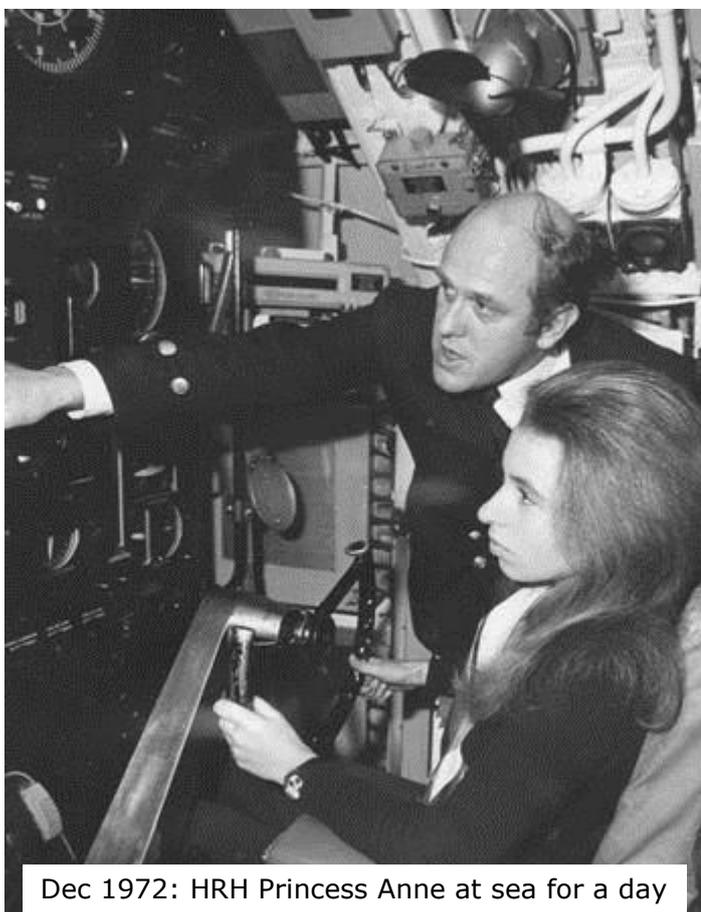
Courageous, as built, suffered from an inadequate fighting system. Her weapons consisted of the very old, but fairly reliable, Mk 8 (Mod 4) torpedo, a



Dec 1971: Leaving Gibraltar

left-over from the Second World War. These could only be used against surface targets and were normally fired as a salvo from short range to be sure of a hit. The anti-submarine weapon was the obsolete and very unreliable Mk 23 torpedo, which had a poor reputation amongst submariners. The Action

Information and Fire Control System, was also very rudimentary and could only really handle one target at a time. Courageous had six torpedo tubes sited forward below the main sonar array. The fore-ends now known as the Weapon Stowage Compartment, was a large compartment with a capacity of 25 re-load torpedoes.



Dec 1972: HRH Princess Anne at sea for a day

During the 'cold war' the Soviet Navy rapidly expanded and hardly a month went by without a new submarine coming into service. This posed a real threat to world security and it was vital for NATO to maintain a close watch on the Soviet fleet, especially their nuclear ballistic and attack submarines.

Royal Navy submarines were at the forefront of this surveillance effort, in tracking Soviet units to gather intelligence on sensors, weapons, tactics and general operating patterns. Surveillance tasks often involved operating in very close proximity to Soviet submarines, observing tactical exercises and even simulating attack profiles. Many operations were undertaken west of Ireland as Soviet units tracked to their patrol stations off



Apr 1974: Arriving in Devonport for a 16 week Docking and Essential Defect period.

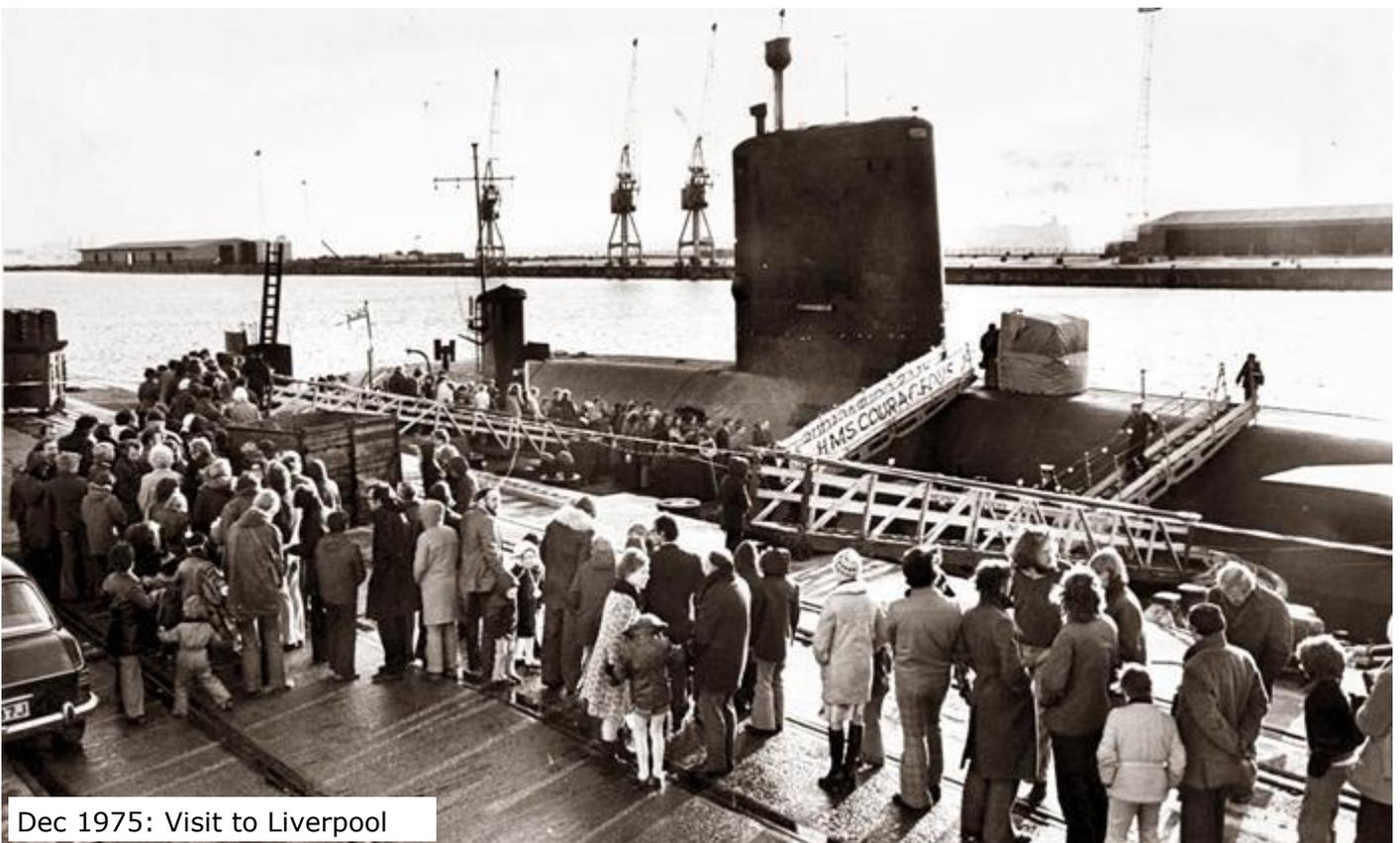
the USA's eastern seaboard and in the Mediterranean.

These operational patrols fully tested the mettle of personnel and all RN submarine crews, including that of Courageous. They had to keep themselves at a high state of efficiency and readiness. Time on patrol was supplemented by additional crew training, trials of new equipment and complex fleet Anti-Submarine Warfare

exercises - in either the Blue or Orange roles (Orange being the loyal opposition).

There were few opportunities for port visits and in her first three years Courageous only managed to visit Barry Island in Wales and Haakonsvern near Bergen.

One particularly tragic incident occurred in December 1972 when Able Seaman Raymond Hutchins was lost overboard



Dec 1975: Visit to Liverpool



Aug 1976: Entering Portsmouth for Navy Days



Sept 1976: Courageous flying its Decommissioning Pennant on departure from Faslane



1976 to 1978: 89 week nuclear refit in Chatham dockyard



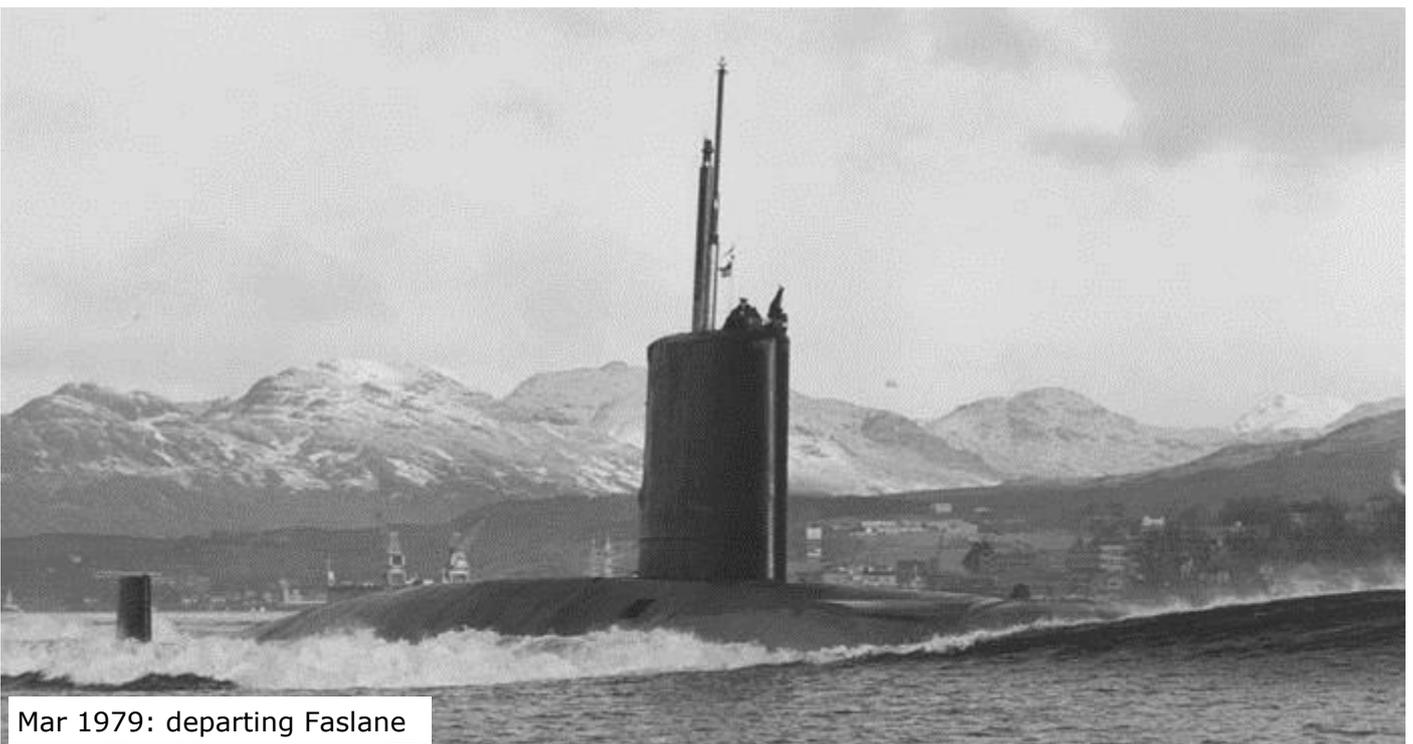
Jul 1978: Mrs Margaret Morris inspects guard of honour at the Rededication Ceremony

in extremely rough weather when acting as lookout from the top of the fin off Barra in the Outer Hebrides. Towards the end of the first commission the crew enjoyed visits to Corfu, Liverpool and Hull - to celebrate the 75th Anniversary of the Submarine Service. She was at Portsmouth for Navy Days 1976 where a great many people took the opportunity to visit and marvel at her.

In September 1976, Courageous was

taken in hand by Chatham Dockyard, for her first refit. This was completed on time and to budget, though this success was somewhat spoiled by an industrial dispute that delayed sailing for three weeks.

She re-entered service in August 1978 with a much improved Action Information and Fire Control System known as DCB, which was a great step forward. The obsolete Mk 23 Torpedo



Mar 1979: departing Faslane



June 1981: Sub-Harpoon trials in the USA

had been superseded by the Mk 24, which eventually germinated into the Tigerfish Torpedo; a weapon that had taken many years to develop and meant that British submariners at last had a weapon capable of sinking dived enemy submarines. However, Courageous still carried the old Mk 8 torpedoes for use against surface targets; the same type used to sink the General Belgrano during the Falklands conflict in 1982.

Following refit, and after completing many trials and an extensive work-up period, Courageous returned to operational service with the Third Submarine Squadron at Faslane. In 1979 she deployed to the Mediterranean to conduct training exercises with a Task Group that was continuing on through the Suez Canal to the Far East. Port visits were made to Haifa (possibly the only ever visit by a nuclear submarine to Israel), and Corfu again, before re-deployment across the Atlantic. There she went to Charleston in the USA for a well earned maintenance period and

some "R & R" (rest and recreation) for the crew. On such occasions a proportion of the crew would change over to take leave and ensure the greatest use of the personnel; a practice known as the fifth watch.

In 1980 Courageous was selected as the trials submarine for the Evaluation and Acceptance of the Royal Navy Sub-Harpoon, a US designed tactical missile system for use against surface ships. This entailed an extended docking period for conversion to the role, but before entering Chatham Dockyard, the boat enjoyed a welcome visit to Bremerhaven.

During the subsequent work up Courageous collided with rocks off Sanda Island, near the southern tip of the Mull of Kintyre, whilst conducting a navigation exercise. Part of the pressure hull was distorted, but such was the belief in the watertight integrity of the hull and the quality of steel used that the boat was allowed to continue operations. This damage was not repaired until the next refit some three years later!

In June 1981 Courageous deployed to San Diego in California for Sub-Harpoon trials, sailing via the Panama Canal and calling at Bermuda and Willemstad in the Dutch Antilles en route. For nine months she operated from the US Navy's Pacific Base, firing a total of 66 dummy missile blanks and 15 live firings against old redundant US warships. The acceptance trials were a complete success and the weapon system was subsequently brought into service by the Royal Navy.

Courageous departed San Diego on 15 February 1982 to start her journey home, passing through the Panama Canal and calling in at Charleston and Bermuda. She arrived back at Faslane



Aug 1982: Return from the Falklands



Aug 1982: Docked in Faslane on return from the Falklands

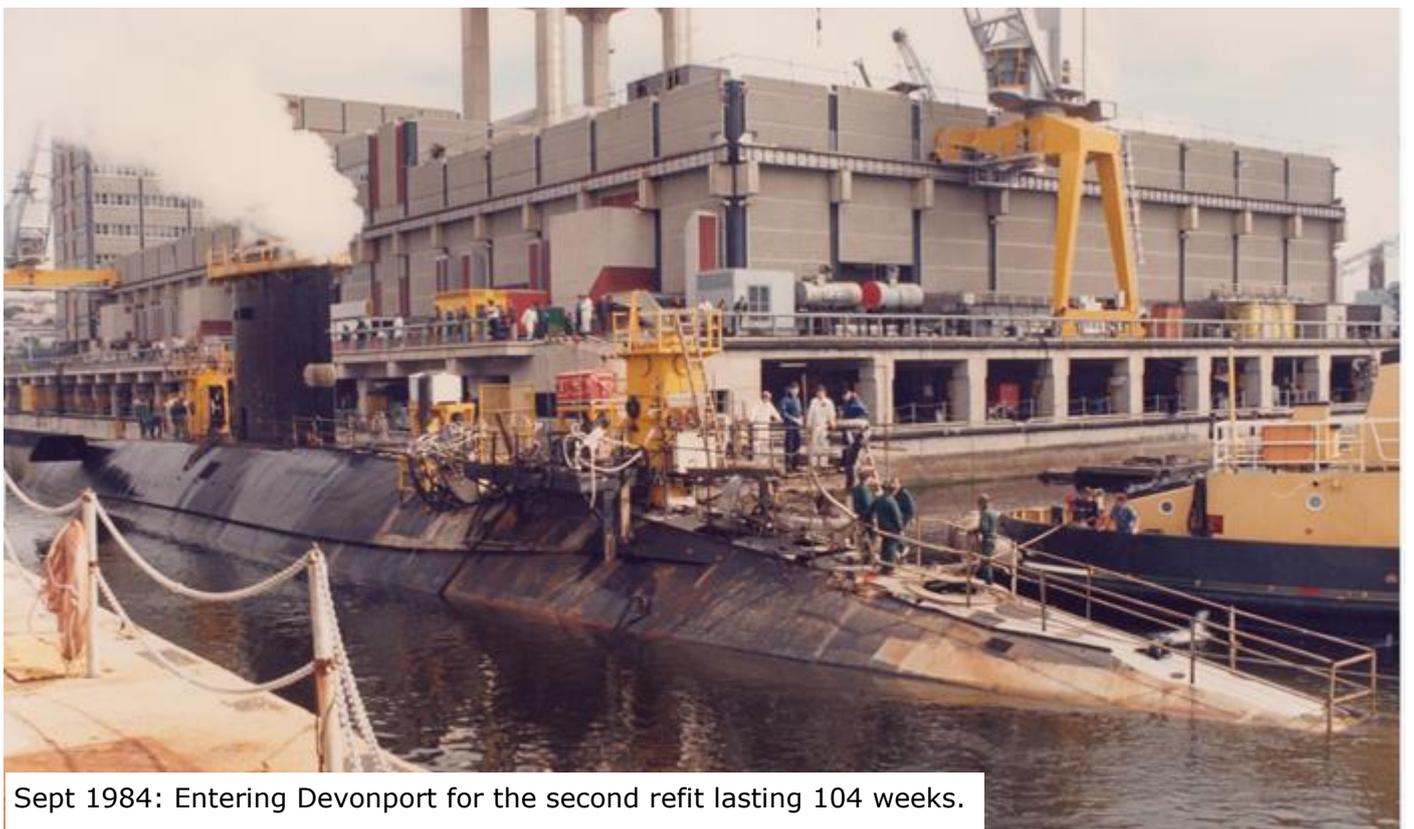


1983: In San Carlos Water, Falkland Islands.

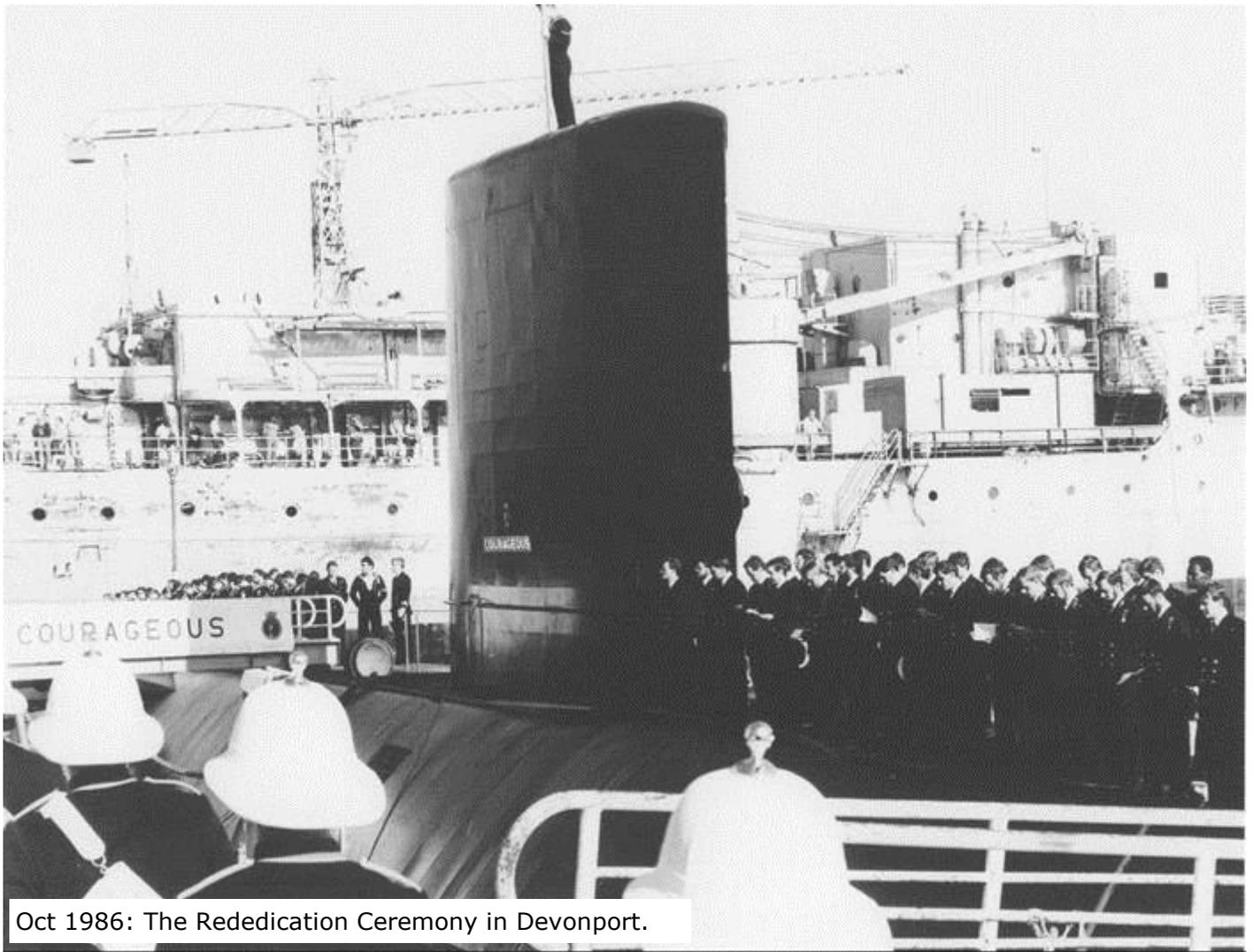
on the 2 April after an absence of 302 days and 26,000 miles sailing, just as the Argentine Forces were invading the Falkland Islands.

As can be imagined, after ten months away, there was much to be done before the boat was fit for deployment, but after sustained effort, long hours and a quick docking Courageous sailed for the South Atlantic on 12 May. She was

deployed towards the Argentine coast to provide early air attack warning for the Task Force. Whilst on station an Argentine hospital ship was sighted and allowed to pass unharmed. Although the conflict ended on 15 June with the surrender of the Argentine forces in Port Stanley, Courageous did not return immediately and was kept on patrol in the area for an extended period, finally



Sept 1984: Entering Devonport for the second refit lasting 104 weeks.

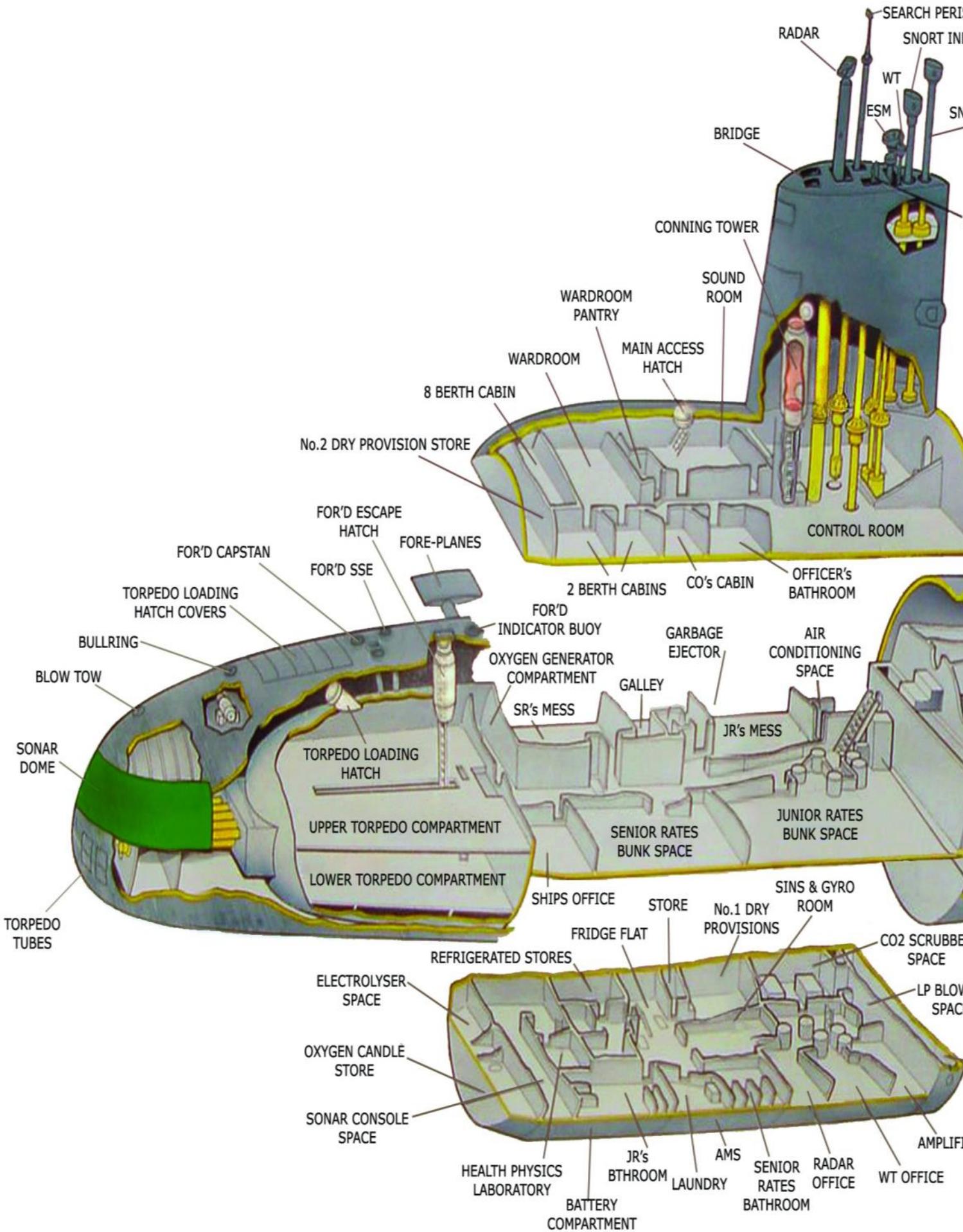


Oct 1986: The Rededication Ceremony in Devonport.



Apr 1992: Sailing into Plymouth for the final time flying its Decommissioning Pennant.

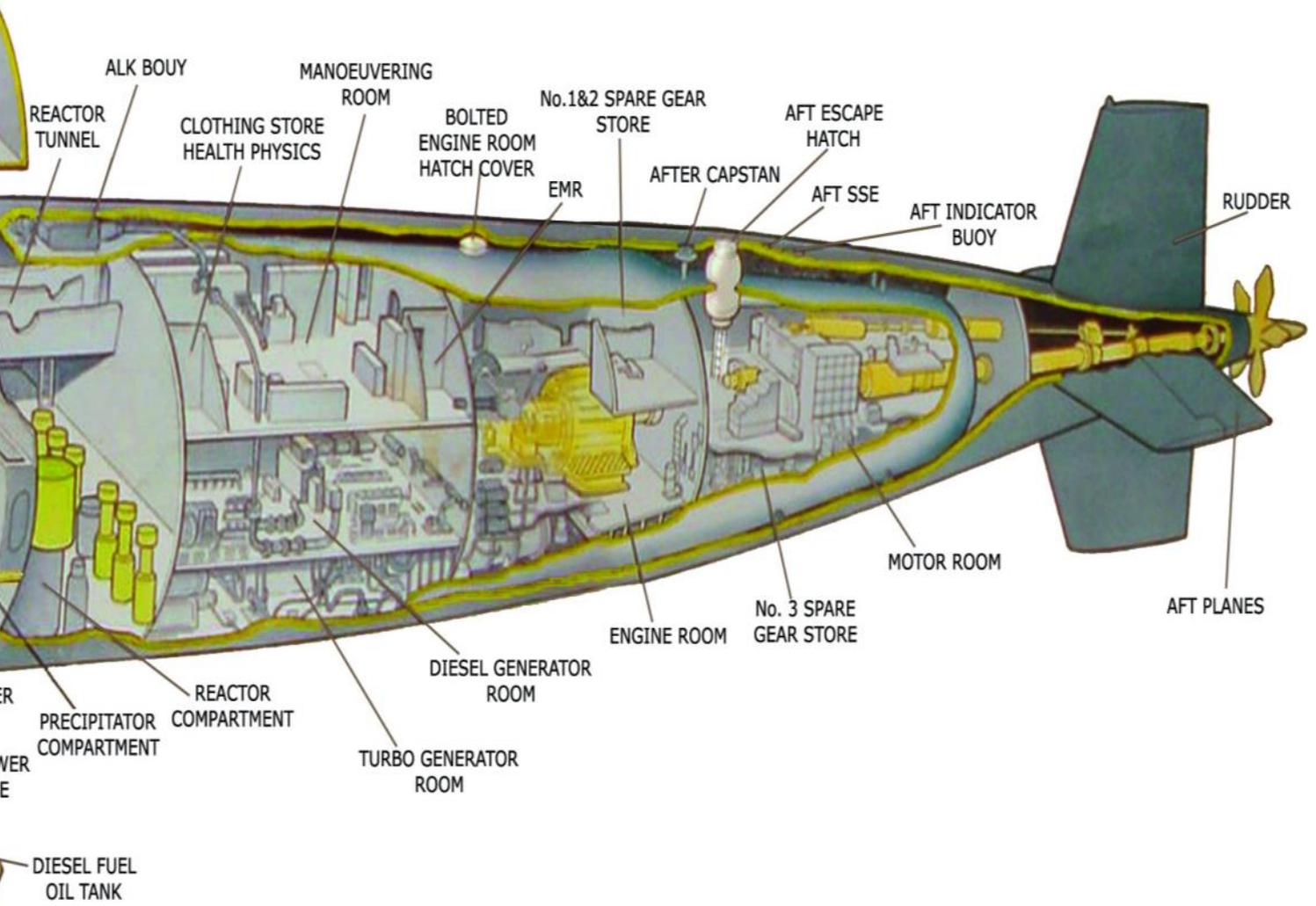
Schematic diagram of HMS Courageous.



SCOPE
DUCTION

PORT EXHAUST

ATTACK PERISCOPE

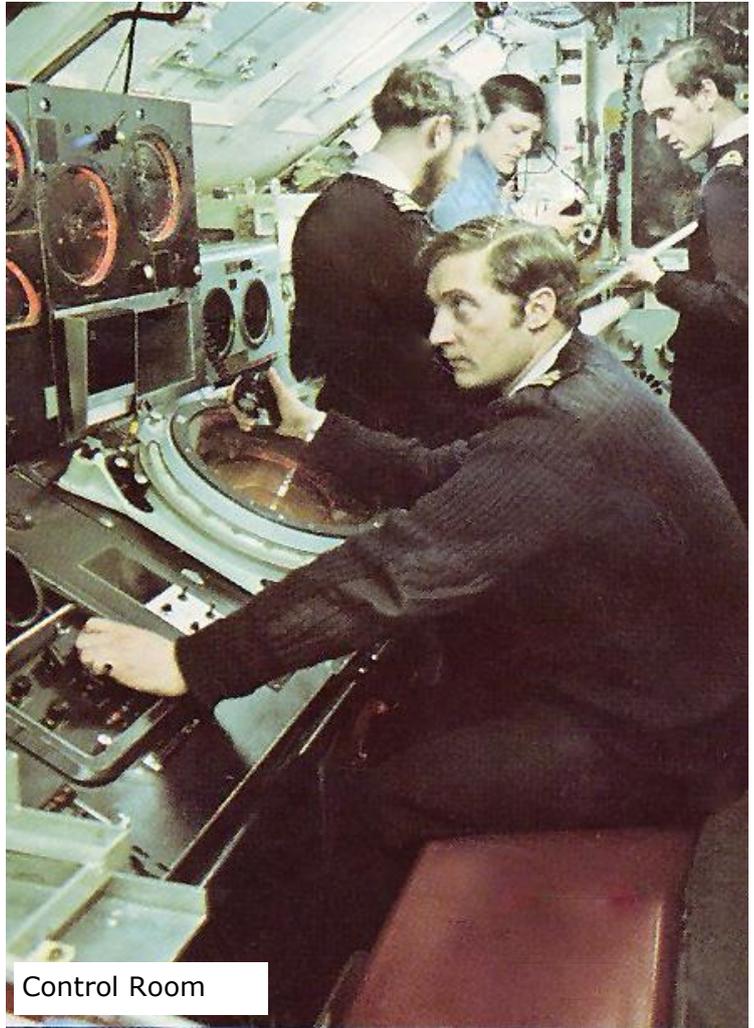


IER SPACE

arriving back home in August.

There were three more, long South Atlantic patrols before it was time for a second much needed refit, this time at Devonport, and preceded again by being open to the public for Navy Days 1984. During the £79 million refit considerable work was undertaken to upgrade and enhance the boat's systems, but although the work was completed on time, sailing was once again delayed, this time by three months due to an engineering fault.

Once clear of Devonport and after completing trials and work up in early 1987, Courageous re-joined the Third Submarine Squadron in Scotland to return to normal operational running. Three deployments were made to the East Coast of America, which included conducting trials of the new Spearfish torpedo, fleet exercises with RN and



Control Room



Steering Position

US Navy ships and showing the flag at Bermuda, Port Canaveral and Fort Lauderdale.

Although Courageous was planned for another refit and continuing service with the fleet, there had been problems with the older nuclear submarines' propulsion systems. This coupled with the fall of the Berlin Wall and thawing of relations with the Soviet Union led to a decision by MOD to lay up all the RN's remaining first generation nuclear submarines. So finally, in April 1992, Courageous was decommissioned in Devonport. The reactor plant was de-fuelled, equipment stripped out, and Courageous was laid-up alongside Warspite and Conqueror to await final disposal under the ISOLUS (Interim Storage of Laid-Up Submarines) project.



Attack Periscope



Control Room Systems Console



Sound Room

About Courageous

The hull is clean in form to maximise speed and quietness. The fin, or in old terminology the conning tower, housed a collection of masts and periscopes and was where the Officer of the Watch and a lookout were stationed when Courageous was on the surface. The submarine was controlled in depth by the fore and after planes and for course and direction by a large rudder. The main sonar array was wrapped around the bow position over the six torpedo tubes. Internally the submarine had three decks for most of her length and the pressure hull was 33 feet in diameter. There are many water tanks situated on the lower levels of the submarine and many of these were to enable the trim of the submarine to be maintained.

The Control Room is the nerve



Tactical Data Handling System



Junior Rates 56 man bunk space

centre of the submarine. On the starboard side is the Ship Control position and the One Man Control system with built in redundancy in case of damage or failure. Both positions were manned, the left hand side being manned by a Senior Rate controlling the after planes and the right hand side manned by a Junior Rate who controlled the fore planes and steering of the submarine.

The Systems Console was manned by a technical Senior Rate who controlled many of the ships systems such as the Trim system, three Hydraulic systems, Bilge system, High Pressure Air, blowing panel for the Main Ballast Tanks, raising and lowering of all the masts and Periscopes and a great deal more.

The Ship Control Officer of the Watch - either a junior officer or an experienced senior rate - would be stationed behind these positions in what was called the

“bandstand” to direct operations as required by the Command.

On the port side was the tactical or operational area, plus the navigation position. All contact data was passed to the Action Information System where it was analysed and displayed for the Command. The Fire Control suite was where the weapon system was brought to the required state and the position that fired and controlled the wire-guided torpedoes. The navigation area on the port side aft had a chart kept constantly up dated with a spot of light to show the current dead reckoned position. Navigation was undertaken using a mixture of Ships Inertial Navigation System, Satellite Navigation, astro-fixing, Decca, echo sounders and visual fixing.

Two periscopes were fitted. The Search Periscope was used for normal operations and had various electronic receivers fitted to provide extra information. However, its larger head made it easier to detect than the much thinner Attack Periscope, which was reserved for more stealthy tasks.

Weighing nearly two tons each, the periscopes were raised and lowered on long hydraulic rams and had torque assist motors to help the Periscope Watch-keeper rotate the heavy steel tubes to provide all round vision. The starboard side aft of the Control Room was the main passage way from forward to aft. This was also known as ‘Grumpy Corner’ and was where the outside staff were required to sit when on watch waiting to be detailed off for a myriad of jobs to be undertaken around the boat.

When dived, the Sound Room was always manned by sonar operators who would detect other ships and submarines normally through the use of



The Galley

passive sonar and analysis of their different, distinctive noise signatures. Track contacts would then be classified and passed to the Tactical Data Handling System in the Control Room. Transmissions on active sonar were usually kept to a minimum to avoid detection by an unseen enemy.

The Wardroom was where the officers worked, socialized, rested and had their meals. Although their food was exactly the same as the rest of the crew it was served by stewards. The food came up from the Galley on the deck below via a lift (dumb waiter) to the pantry situated just aft of the wardroom and served through the hatch.

The Captain was the only man on-board to have his own cabin, but had an open invite to use the Wardroom. There were between 13 to 20 officers carried depending on the role of the submarine at any time. There was an officers' eight-man bunk space just forward of the

Wardroom with two, 2-man cabins for the more senior officers. The other use of the Wardroom was as the damage Control Centre as it could be rapidly converted to this role to oversee emergency response and subsequent repairs to any system failures, fires, floods or action damage to relieve the pressure on the control room.

The Wardroom Heads and Bathroom were fairly compact with two toilets, one shower and one basin for use by 13 officers.

On two deck, the Senior Rates Mess was home to about 50 senior rates and they used this mess for meals and recreation, but not work. There was a bar, but there was an unwritten rule that only beer was drunk at sea, with many of the crew never drinking any alcohol after leaving harbour. For recreation, whilst at sea, normally 56 movies were carried for an eight week patrol. Each would be shown twice a day and rotated between



Senior Rates mess

the messes to provide a very welcome diversion to the tedium of daily routine. Other favourite pastimes were cribbage, 'uckers' (a naval derivative of Ludo), dominoes and numerous card games, not forgetting inter-mess quizzes and reading.

The Junior Rates Bunk Space had bunks for 51 men, the Senior Rates had bunks for 33 and the Wardroom bunks for only 13, giving a grand total of 97 fitted bunks on-board. With a crew of perhaps 120 or even more this was a continual problem and was solved by using the fore-ends as an overflow sleeping area. Some unlucky junior rates also had to 'hot bunk', which meant you relieved the person on watch who would then use the bunk that you had just vacated, hopefully using his own sleeping bag! Even today this system, is still in evidence with the more modern 'T-Boats'. The bunk spaces were fairly cosy and congested but most men had a small personnel locker and each bunk had a bunk light for reading and a punkah louver for delivering fresh air.

The Galley prepared three meals a day and watch routines were worked around

the meal times. There were four chefs, with the Petty Officer in charge keeping watch on the after planes as well as arranging the menu and maintaining the catering account. The night time chef baked the bread, cleaned and prepared some of the meals for the day shift who cooked the other two meals. Food was generally very good and much improved on that provided in the conventional diesel submarines. On patrol tinned, frozen and dehydrated foods were used after the limited fresh had run out and everything was stored to the menu - last in first out. Courageous was normally stored for 56 days plus 14 days emergency rations. However during the boat's three month Falkland Patrols much extra food had to be embarked. Even 2 Deck had a false deck of large tins down its complete length to take the extra rations.

Noise in the Galley had to be strictly controlled and the chefs had to gain permission from the Control Room to run their various machines. The deep fat fryer posed problems - fire risk and atmosphere pollution. If the atmosphere was out of tolerance then the chips,



Junior Rates mess

which were only allowed twice a week, would be cancelled for that meal. The working environment was often very hot and sweaty, but particularly difficult in rough weather especially if there was any fat or oil on the deck. It was always important to have the galley well secured especially in stormy seas or if doing high speed manoeuvres, not always compatible when cooking for 120 hungry men!

The Senior and Junior Rates Heads (lavatories) and Bathrooms were situated on 3 Deck and were used by the majority of the crew. A laundry was situated between these two bathrooms and was operated by the stood down watch outside technical staff. It had one industrial washing machine and one spin dryer and was operated so that the whole crew had a change of working clothing twice a week.

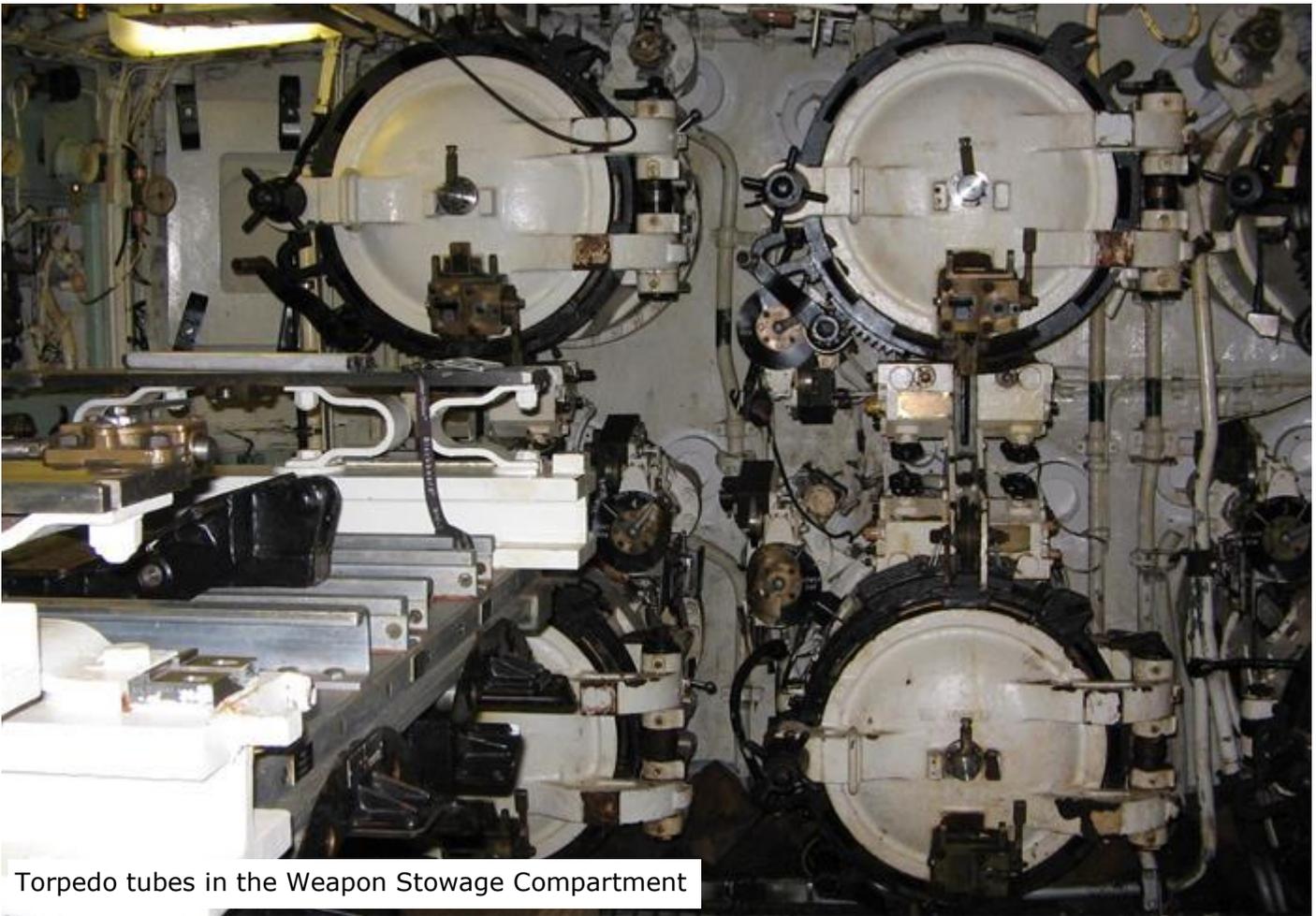
These submarines were much more generous with electricity and fresh water than any diesel submarine. Enough fresh water was made to support the propulsion system, domestic

use including the galley, heads and bathrooms and to keep the submarine clean.

Dirty water and sewage was collected into tanks and discharged overboard once a day. All rubbish, known as gash, produced on board had to be collected, sorted and crushed into large degradable tins that were discharged from the gash gun, which resembled something like an inverted torpedo tube.

Courageous could remain closed up at a very high state of readiness for protracted periods by using a "one in two" watch-keeping system that was implemented for all "forward" operators. Personnel spent six hours on, then six hours off watch i.e. a normal 84 hour working week. The propulsion watch keepers, "back aft", maintained the "one in three" system due to the cramped and hot conditions, but all enjoyed three square meals a day, served around the watch changes.

After a long patrol there were some



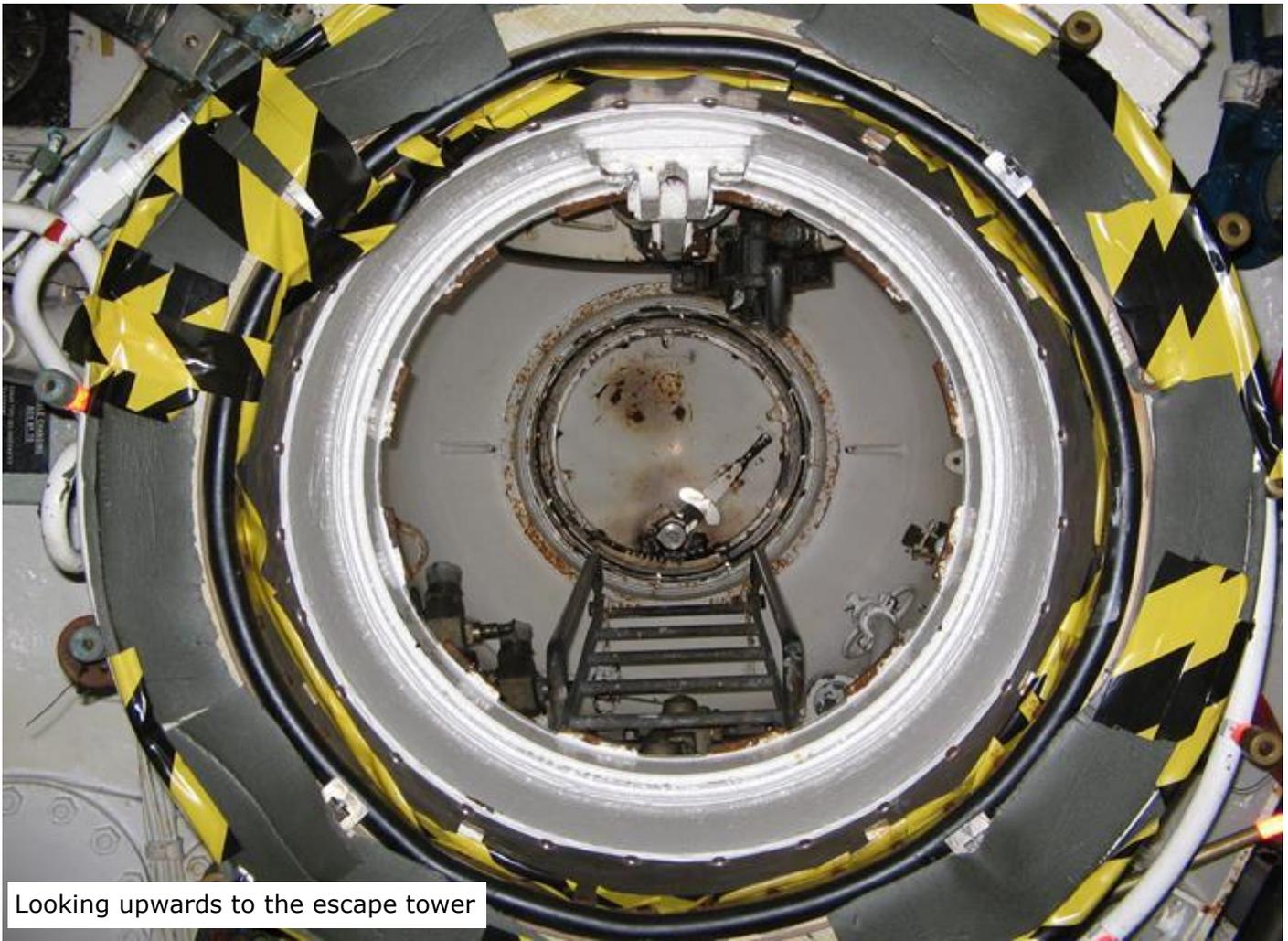
Torpedo tubes in the Weapon Stowage Compartment

effects that were very noticeable, such as most of the crew looking very pallid from a lack of sun, unfit, any understanding of the latest news was poor, all clothing had the ingrained smell of the submarine, visual depth perception was often poor for a short period after and there were other effects as well.

The Weapon Stowage Compartment, also known as the fore-ends, had six torpedo tubes on the lower level of the compartment. A torpedo was discharged from its tube by means of an air operated water ram, basically a slug of water ejected the weapon out of the tube and was a very noisy operation. The full weapon load was 31 weapons which including 25 on the racks on the upper and lower level stowages. A mixed weapon load of either wire-guided torpedoes, Tigerfish (later replaced by the Spearfish), or the Royal Navy Sub-

Harpoon could be embarked - a very useful weapon load that gave Courageous plenty of hitting power. The weapons were loaded by crane onto temporary loading rails passed down through the weapons embarkation hatch into the fore-ends, before being well secured into their individual trolleys. The upper level of the fore-ends was also used as an overflow bunk space and an additional 24 bunks could be used depending on the weapon load embarked.

There were two escape compartments on-board, one forward, in the fore-ends, and the other aft, in the motor room. Both were fitted with a two-man escape tower, which provided the means for either rescue or escape. These allowed two men at a time to escape from depths down to below 600 ft and this would have been a very traumatic experience indeed. Both compartments



Looking upwards to the escape tower

had a Built-in Breathing System with a dedicated air supply which provided air under pressure for breathing during flooding in 'compartment escape' as the atmosphere becomes contaminated with gases under pressure that are lethal. Both escape compartments were also equipped to release a distress indicator buoy and fitted with an underwater telephone, Submerged Signal Ejector and Oxygen Generators to produce Oxygen and Carbon Dioxide absorption units to clear that gas and a whole host of other vital escape equipment.

All submariners were required to undergo escape training in the 100 ft. tank at what used to be HMS Dolphin, but is now Fort Blockhouse, Gosport. Nowadays, the preferred method of escape from a sunken submarine is to wait to be rescued by mini-submersibles designed for the purpose.

The atmosphere on-board Courageous required purification and constant monitoring. Gases such as hydrogen from the battery, Carbon Dioxide from exhaled breathing, Carbon Monoxide from smoking had to be removed, not forgetting odours, hydrocarbons and dust particles.

Carbon Dioxide is removed from the atmosphere with the use of two machines known as scrubbers using the chemical agent amine. Hydrogen and Carbon Monoxide also goes through a machine that cleans these gases from the atmosphere. Dust particles were removed by two precipitators and they worked on the principle of charging the particles with a positive charge and then they were trapped on a plate with a negative charge. To support life, oxygen for breathing must be produced and this was done using an electrolyser, which

basically produced one part oxygen and two parts hydrogen from sea water, with the excess hydrogen being discharged overboard.

To prevent danger from fire or contamination of the boat's atmosphere many everyday items were strictly controlled such as aerosols, shoe polish, glue, paint and talcum powder.

The turbo generators on-board could produce large amounts of AC electrical power up to 2 megawatts, enough to supply a small town. The power was used for numerous purposes ranging from bunk lights, the galley to the main sonar and hydraulic plants.

Motor generators under normal conditions took a supply from the AC system and converted it to DC which was used primarily to charge a huge battery. In the event of loss of the AC generation capability these machines would power reverse and supply the AC system directly from the battery to maintain vital supplies for ships and reactor safety.

The reactor was contained in a steel pressure vessel containing the Uranium 235 fuel. Control rods were positioned so they could be raised and lowered to adjust the chain reaction until steady. The heat generated in the reactor core was removed by the primary coolant water, pumped by the six primary coolant pumps. This extremely hot pressurised water was fed through tubes into the two steam generators. The heat from this boils the lower pressure water, forming steam, which was then directed to the turbo-generators and the main turbines to provide propulsion for the submarine. The reactor and all the propulsion systems were controlled from the Manoeuvring Room - a very complex control centre operated by highly trained and competent operators.

From the outset of the nuclear programme, the highest standards of quality control and operating procedures were maintained to ensure that no-one was at risk through the use of nuclear power.

The turbo generators on-board could produce large amounts of electric power up to two megawatts each, enough to supply a small town. Direct Current was passed through motor generators to be converted to Alternating Current and used for hundreds of purposes ranging from bunk lights, the galley to the main sonar and hydraulic plants. The system was designed to ensure that electrical supplies, vital to the safety of the submarine and its reactor, were always available.

Courageous' main propulsion came from two, port and starboard, reversible steam turbines rated at 18,000 shaft horse power. These rotated the shaft through a gear box and clutch and then to the single propeller. The turbines were normally controlled from the Manoeuvring Room but could also be operated locally in the Main Machinery Space just aft of the Manoeuvring Room and occupying the full diameter of the pressure hull. To reduce noise transmissions the turbines were supported on a raft, which had to be locked down rigidly when the submarine was moving at high speed.

If the main turbines were not available they could be de-clutched at the gear box. This allowed the shaft to be turned solely by the Emergency Propulsion Motor which was supplied directly from the Main Battery.

This was situated in the Motor Room and could be controlled locally or, more normally, from the Manoeuvring Room. The main battery, situated forward in a

large sealed tank, provided power for the propulsion motor. However, the battery could only support it for a very limited period of time before diesel generators were needed. This required the boat to come to periscope depth to induce air, offering the opposition a much greater chance of counter detection.

There was also a device known as the "egg beater", rather similar to the bow or stern thrusters in modern ships. This could be lowered from within the hull to provide an additional means of propulsion, and was normally used for berthing the boat alongside by driving the stern in the required direction.

Diving and surfacing the submarine was a comparatively simple process. Large main ballast tanks are built around and external to the pressure hull, three forward and three aft. The tanks had openings at the top known as main vents, normally kept shut, and on the underside were large openings called free flood holes. On the surface, the submarine is positively buoyant with her main ballast tanks being full of air. On diving the main vents are opened allowing the air in the main ballast tanks to escape making the submarine heavier and allowing her to dive as she becomes negatively buoyant. Once fully submerged the main vents would be shut.

When dived and with a good trim on, the submarine is generally in a neutrally buoyant state. In order to surface, high pressure air is blown into the main ballast tanks, the main vents remain shut and the water is displaced through the free flood holes allowing the boat to become positively buoyant and surface. As high pressure air is a valuable commodity, low pressure air is subsequently used to gain full surface

buoyancy.

When descending into the depths the pressure of the sea compresses the hull so the submarine actually becomes heavier. This means water must be pumped out at greater depths to remain neutrally buoyant. The reverse applies on rising from depth when water must be flooded in to control the submarine buoyancy.

The hydroplanes were used to control the attitude and depth of the submarine when dived, in combination with speed. At high speed the fore planes were not used and control was only by the after hydroplanes. Only small amounts of movement would be used as otherwise the consequences could be very violent and dramatic.

High speed manoeuvres, known as "angles and dangles", were often practised to ensure that the ship control team remained competent to handle the unexpected. The fore-planes, used to control the depth and attitude of the submarine, were positioned in line with the top of the forward casing. Being non-retractable, and robust in construction, surface warships were loath to allow this class of submarine to berth alongside due to the damage that the planes could inflict.

Since decommissioning a number of factors came together to enable Courageous to become the first nuclear submarine to be opened for viewing by the public. The most important was the Government's desire to demystify the workings of nuclear submarines and demonstrate that British reactor plants are very safe. To this end it was decided to open up a redundant first generation nuclear submarine and after careful consideration Courageous was chosen as being in the best material state of the

three available at that time.

Ministerial approval was granted and despite a restricted budget great effort was put in place to refurbish her on a limited scale, enough to make her safe for public viewing.

It should be noted that Fleet Submarines continue to serve as outstandingly valuable and effective units of the Royal Navy able to project national or NATO power not only at sea, but far inland with today's generation of Tactical Land Attack Missiles.

We hope this booklet has gone some way to explain in simple terms a small bit about the nuclear submarine Courageous, her history, what life was

like on-board and how she operated.

If your interest in submarines has been sharpened the Royal Navy Submarine Museum at Gosport has an old diesel submarine "Alliance" on display, and at Chatham there is the more modern 'O-Boat' Ocelot. Both are well worth a visit.

To book your tour of Courageous or for any further information please call 01752 552326 during normal working hours, or email desnbcd-cob-book1@mod.uk.

Address: Naval Heritage, QHM Building M049, HMNB Devonport, Plymouth, PL2 2BG.



Courageous in 3 Dock, Devonport

The Volunteer Workers— Maintaining the Future.

Courageous was moved into 3 Dock in South Yard and made ready for Navy Days in August 2002. A group of Volunteer Guides was established to conduct tours and from this group germinated a smaller sub group (the Courageous Volunteer Workers) who decided that the boat needed much more renovation carried out to present Courageous in its former glory and a proper visitor attraction. When the boat originally opened only the Wardroom, Control Room, Bunk Space, Galley, S/R Mess and the upper level of the Fore-Ends were open to the public, leaving many interesting areas unseen.

The Volunteer Workers have by honest and foul means searched, located and then re-located; store robbed, begged, borrowed and acquired many items of equipment appertaining to that era from when she was in commission. Loading and fitting these items has stretched the imagination and ingenuity of this group but has significantly improved the overall image of this unique attraction.



Unfortunately, the Caisson for 3 Dock was running out of licence in 2005 and although given a year's extension the business case failed and preparation made to move Courageous to a wet berth. This involved making the boat watertight again to the extent of giving her a vacuum test which involved the dockyard making a needless mess and causing much internal damage. Courageous was moved to 3 Basin where she now resides. There was indeed a great deal of speculation as to whether Courageous would ever be open to the public again.

However, with the hard work of an S.D Engineer Officer who took over as Project Manager and the continued efforts of the Volunteer Workers the boat against some opposition was quietly reopened.

The efforts of the Volunteer Workers have never ceased and are still continuing to this

day. The Courageous has the majority of the forward compartments open to view by the general public and in effect often miss seeing some compartments due to lack of time for the tours.

The Courageous is the only nuclear hunter killer submarine open to the public this side of the Atlantic and is therefore a unique exhibit unrivalled by other maritime museums.

The information and pictures used in this special edition Bulletin have been provided by Nigel Thornber of the Courageous Volunteer Workers, facilitated by Tony Worsfold, and edited by Mark Stevens.

This Society Members' Bulletin is published and distributed by the Royal Naval Engineers' Benevolent Society. Opinions expressed in the Society Members' Bulletin do not necessarily represent the views of the Executive Council of the Royal Naval Engineers' Benevolent Society, E&OE. The RNEBS cannot guarantee the accuracy of any information provided by contributors and information sources and photographs will be accredited where possible or where known.