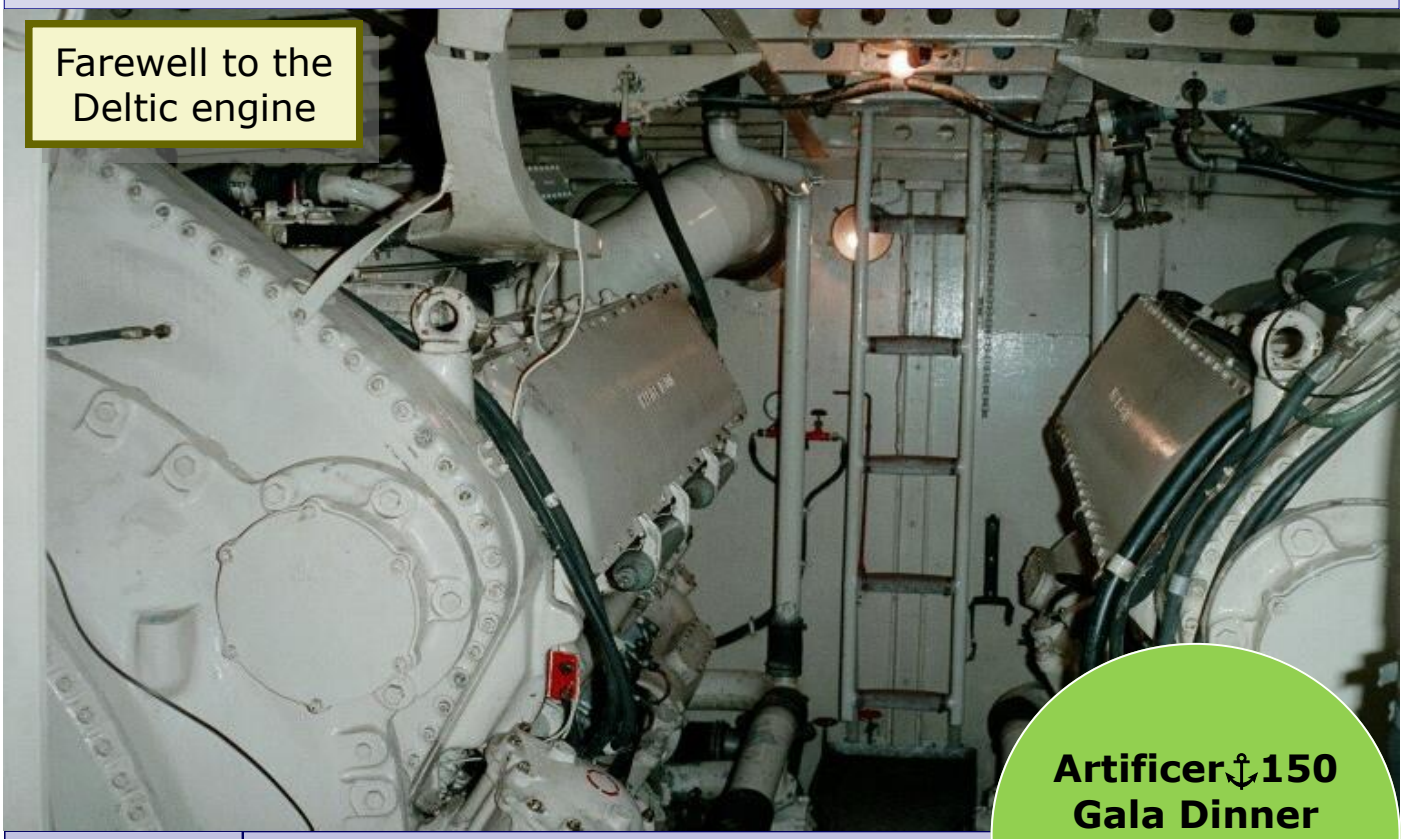
SOCIETY MEMBERS' BULLETIN

Issue 15 - April 2017



Artificer⚓150 Gala Dinner Now open for business

Inside this issue:

Royal Naval Engineers' Benevolent Society
Founded in 1872

ROYAL NAVAL ENGINEERS' BENEVOLENT SOCIETY

Society Members' Bulletin

Dear reader

As we approached the production of Issue 15, I thought it was about time we changed the look of the magazine and update it a bit. So I hope that the new design meets with your approval.

The new RNEBS website should be easier and certainly faster to use than our previous site, as we have changed our hosting provider and use a different software suite to create and edit the pages. So have a look at www.rnebs.co.uk and let us know what you think.

The Artificer 150 Gala Dinner preparations are well underway. See the back page for more details.

Thanks to Alex Goddard for mentioning that HMS Atherstone was placed in Very Low Readiness in October 2016 prior to her being re-engined. She will be the last of the Hunt Class to go through HRPP (Hunt Re-Propulsion Project) and with no other Deltic powered vessels remaining, marks the end of Royal Navy operations with the Deltic. The end of an era. It was purely coincidental that I had already written an article about Deltic engines ready to be published in this issue.

Regards

Mark Stevens

Editor RNEBS Publications

Distribution:

Only members and associate members of the RNEBS are entitled to a copy of the Society Members' Bulletin.

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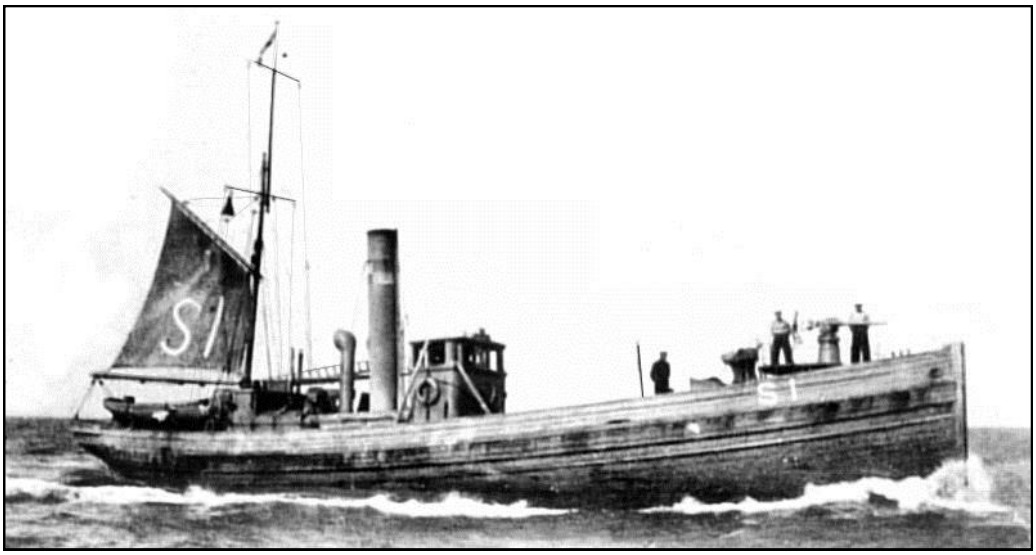
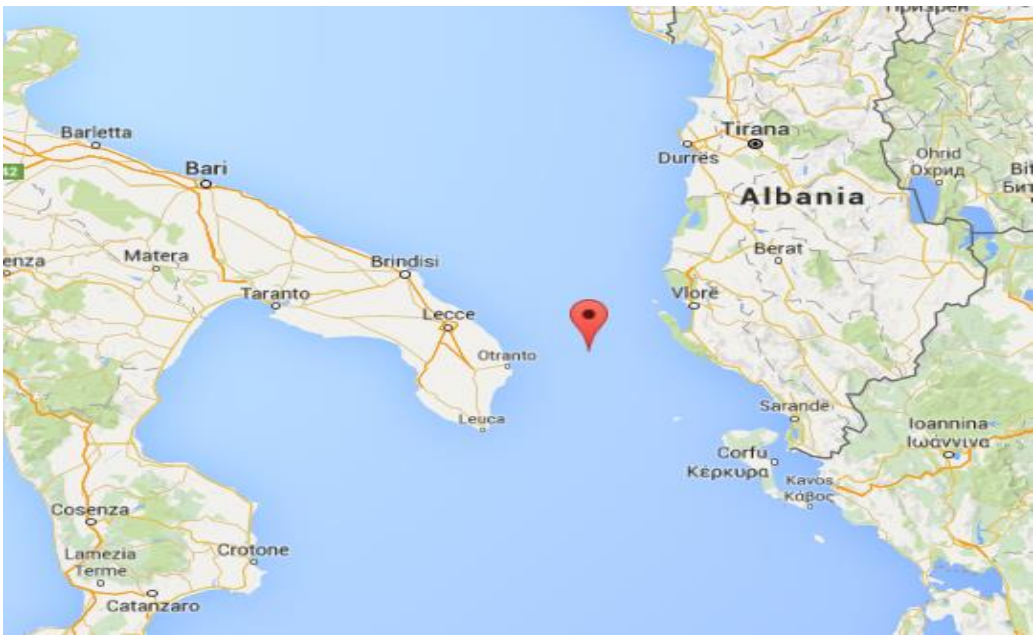
The Battle of Otranto Straights

the largest surface action in the Adriatic Sea during World War I

In May 1917, the largest surface action in the Adriatic Sea took place between the Austro-Hungarian and German navies and the allied forces of the United Kingdom, the Kingdom of Italy and France. The battle was the culmination of events that aimed to destroy the 45 mile wide allied naval blockade at the southern end of the Adriatic Sea between Brindisi and Corfu known as the Otranto Barrage. This had been formed to prevent the Austro-Hungarian navy from escaping into the Mediterranean and posing a threat to allied operations.

The blockade consisted mainly of some 40 British drifters (boats designed to deploy and retrieve drift nets), equipped with steel indicator nets, that were meant to discourage enemy submarines from entering allied waters. These were much used during WW1 and could be as long at 110 yards. These drifters were supported by a small number of destroyers and aircraft, but there was insufficient numbers to prevent enemy submarines from passing through to wreak havoc on shipping throughout the Mediterranean. Even though the blockading forces were increased to 35 destroyers, 52 drifters and 100 other vessels, the enemy submarines continued to escape.





General Secretary's Report

By Cliff Fiander

Artificer 150

Preparations for the dinner continue apace. Over 270 tickets have been sold so far which is an excellent start, bearing in mind they were only released for sale on 23 February.

Initial visits to the caterers and Guildhall have taken place prior to planning the menu, the seating plan and the fine detail of the celebration.

The Chief Naval Engineer Officer, Chief of Materiel (Fleet) and Chief of Fleet Support - Vice Admiral Simon R Lister CB OBE CEng, FIMarEST has kindly agreed to be the Guest of Honour. In a stellar career beginning in 1978 Admiral Simon served in Valiant, Odin, Torbay and Trenchant. He was Assistant Naval Attaché in Moscow in the early '90s during the collapse of the Soviet Union and had a return match as the Naval Attaché ten years later in 2001. In his present appointment as an engineering 3* on the Navy Board he is responsible for the delivery of the maritime equipment programme and the availability of ships and submarines.

As President for the Dinner we are most fortunate to have Captain Peter J Towell OBE MA MBA CEng, CMarEng, FIMarEST Royal Navy. Captain Peter joined in 1982 as an artificer apprentice and served in every artificer rate except Warrant Officer before being promoted to the SD List. Following promotion he served as DMEO in York, Senior Engineer in Ark Royal and amongst other staff appointments he oversaw the genesis and early delivery phase of Project Faraday, for which he was appointed an OBE. He is now the Commanding Officer of HMS Sultan and the Commandant DSMarE.

Action continues to appoint a Guest Speaker who, it is intended, will complement the theme of engineering excellence and build on the significance of the occasion

RNEBS Awards

The Society continues to support the training schools by sponsoring an evolving array of awards that provide tangible evidence of the Society's commitment to the promotion of Engineering Excellence and the advancement of all engineers.

The latest of these is the Engineering Technician Initial Career Course Academic Prize which is awarded at HMS Sultan to the trainee achieving the highest academic average on the Engineering Technicians Initial Career Course (ETICC). It is awarded at the passing out parade for each course completing throughout the year and takes the form of an engraved glass trophy. Whilst this trophy remains on permanent display in the atrium of Pillar Building, each winner receives a Maglite torch engraved with "Presented by the RNEBS" and an accompanying certificate.

A further prize, the ETICC Highest Academic Achievement Prize is awarded annually to the trainee achieving the highest academic average on all the Engineering Technicians Initial Career Courses completing in that academic year. The award is a silver cup engraved with the winner's name; it is presented at Divisions and also remains on permanent display in Pillar building beside an Honours Board displaying the names of each winner. As a personal memento the winner receives an engraved glass tankard together with an accompanying certificate.

Recognising the need to reward achievement by senior technicians the Society is sponsoring an award for the Chief Petty Officers Qualifying Course (CPOQC) at HMS Collingwood. This is a 12 week career course designed to prepare Petty Officers who are due to be promoted to CPO for their job onboard as a group head and focuses heavily on engineering management. There will be one course per term and the prize will be awarded to the top student from the Exam Phase which consists of a principles exam and a 4 day real time scenario based assessment. The prize will take the form of an engraved decanter and will be presented at Divisions.

The Society has a unique position and I was reminded of this by an advertisement in the 1962 Caledonia Magazine I read recently in an attempt to capture a flavour of my youth. Having publicised the fact that the Society was "Now open to all Artificers" it went on to point out that "The Society was formed by Artificers in 1872 and provides benefits unobtainable from other sources. It has aided and encouraged many to secure promotion and improve their position". I believe it is in the Society's interest to ensure it continues to do so.

Development of expertise and competence

Much has been written about the lack of trained capability of the technicians at sea, particularly with the inconveniently increased reliance on manufacturers' representatives. And before lapsing into a criticism of the technicians I should point out that these guys and girls have all the enthusiasm and aptitude as artificers had in the "old days". They just never had the time, the support or the incentive to develop into the backbone of every engineering department because the Navy, for understandable reasons of economy, significant advances in machinery reliability and simplified maintenance processes considered it was unnecessary. Programme Faraday is addressing these difficulties and under its influence the training schools are designing courses and training regimes to re-establish the competencies, ethos and incentives that were lost and doing so most commendably against a background, no doubt, of reducing training budgets.

What is more challenging to re-establish is the esprit-de-corps enjoyed by artificers that was forged in a long and testing apprenticeship and sharpened at sea under the critical gaze of those with experience and the rate and qualifications to prove it. Fortunately the engineering ethos so effortlessly instilled in artificers can still be used to the Navy's advantage. The name Artificer and all its connotations of experience and competence still survives and whilst it may be a somewhat simplistic approach it could be a rank awarded to anyone who has, say, achieved the rate of Petty Officer Technician. This would establish an immediate recognition of competence and experience; it would provide a source of incentive and would not disadvantage any other ratings, regardless of specialisation. It would apply equally to the regular ET stream, the direct entry and to the fast track candidates. It would also cost almost nothing.

On a very sad note I have to advise members that the Vice President, Mark Stevens' wife Heather Marie Stevens passed away, aged 57, at Rowans Hospice on Sunday 19th March 2017 after a long and bravely fought illness. Heather was a great support to Mark in his various endeavours for the Society and as a wife, mother and grandmother she will be greatly missed. Mark has borne his loss with great fortitude and throughout a very trying and emotional time he has continued to work almost single handedly to produce this Bulletin. The Society will be represented at Heather's funeral on Tuesday 11th April.

INS Kalvari

The first Scorpene Class submarine for the Indian Navy

The Indian Naval Submarine Kalvari (S50) is the first of six Scorpene diesel-electric attack submarines (SSKs) on order for the Indian Navy, built under a technology transfer from French company DCNS. The submarines was set afloat at Mazagon Docks Limited (MDL) in Mumbai October 2016 (see picture below) and spent 10 months carrying out sea trials day's before being commissioned in September 2016.

INS Kalvari is 67 m long, 6.2 m in diameter, weighs 1550 tonnes and is part of a $3.6 billion contract signed by the Indian defence ministry with French firm DCNS in October 2005 to deliver six vessels. The contract envisages construction of six SSKs under India's Project 75 submarine construction programme at MDL under license from DCNS.

While the first four are conventional submarines, the last two are to be equipped with the Air Independent Propulsion (AIP) system, which will enable the vessel to stay underwater for longer periods of time, up to 71 days. Powered by two diesel generator sets, range is predicted to be 6,500 nm at 8 kts submerged or 550 nm at 5 kts surfaced and can dive up to a depth of 300 m. The INS Kalvari will be armed with six 533 mm torpedo tubes that can deploy the SM-39 Exocet Block 2 anti-ship missile. It is planned to carry 18 Black Shark torpedoes or 30 mines. These vessels will feature a sonar suite that consists of a long-range, passive cylindrical array, intercept and active sonar, distributed and flank array, and high-resolution sonar for mine and obstacle avoidance.

Against its requirement of 24 to 30 submarines, India currently has only 14 submarines: nine Kilo class (EKMs), four German-designed HDWs (SSKs) and one Akula class nuclear-powered submarine (SSN) on lease from Russia since 2012.

It is expected that MDL will supply the other five SSKs at a rate of one every nine months. This vital gap in the Indian Navy's submarine strength will then be filled, if not fully, but substantially by 2020. About 30% of the equipment on board is made in India as well as the pressure hull.

Photo © The New India Express

Royal Navy Apprenticeships

Too good to be true?

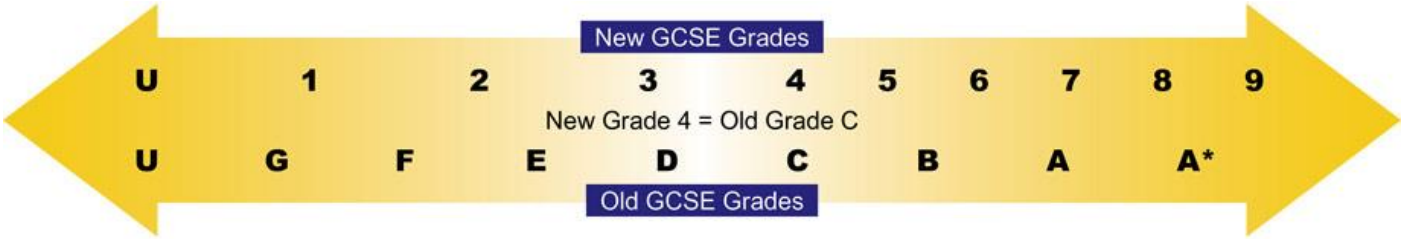
In a recent foray onto the Royal Navy website, I was quite surprised to see the plethora of apprenticeships being offered from "engineering" to "public service" and even "leisure, travel and tourism".

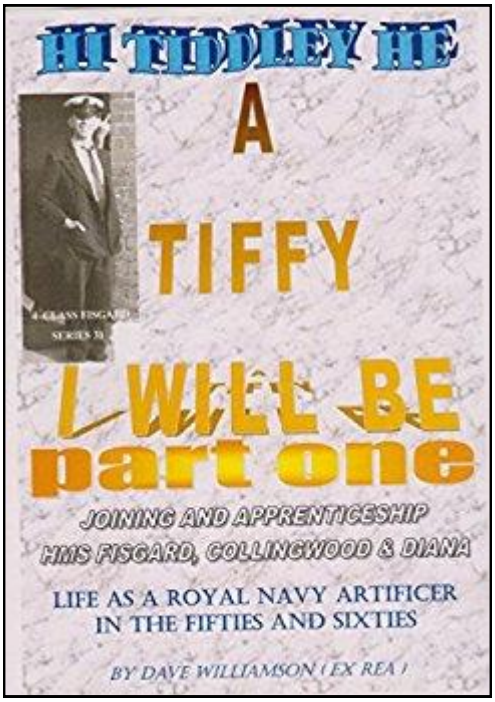
Well It seems that every job available in the RN now has an apprenticeship bolted to it and that all recruits will start on one. Is this just a ploy to encourage young people to join the navy in lieu of starting a training programme in a civilian environment? The majority of the roles offered will come with a basic salary of about £16k.

However, if you want to start on £31k from day one then there is the Undergraduate Apprenticeship Scheme (UGAS) where you would study for a BEng and join up as a Probationary Leading Hand. After 3½ years of training and education you would become a Petty Officer, then after a further 3 years active service you would then complete a one year in-service university course.

Another interesting fact is that GCSE grades are being reorganised this year and changing from the seven A-G grades to the new nine 1-9 grades, where grade 9 is the highest. The navy's base line requirements will also shift from three GCSE's at grade C or better to three GCSE's at grade 4 or better. The diagram at the bottom shown the comparison between the two schemes.

To help promote the idea of these Royal Navy apprenticeships, the RN has come up with the "idea" of presenting awards. The first awards ceremony was held on 17th March in Plymouth where Admiral George Zambellas, First Sea Lord and head of the Royal Navy, presented awards to 15 finalists. Many will be thinking that there is nothing new here as the Society has been presenting awards to engineering trainees for many years now. I suppose the question that needs to be asked is "are these apprenticeships as good as the original tiffy courses?" The answer is probably "wait and see".





Could be a good read…

A book by ex REA David "Bungy" Williamson

One man's memoir of time in the Royal Navy during the late fifties and the sixties as an artificer. Firstly as an apprentice from 1957 to his first ship, HMS Diana, as a UA killick tiff in a PO's mess thru a submarine depot ship, a frigate in the Far East onto two aircraft carriers as a Chief Tiff "neither sought nor wanted". Then CinC's technical staff before leaving in 1972 with three years Chief Tiff seniority, ten years before the Falkland's War. This is a tale of fun, mischief, avoidance, travel and peculiar adventure in a failed attempt to by-pass success. I am sure that one or two of our members will remember him.

There is also a Part 2 and a Part 3 but only available in Kindle format from Amazon

The Napier Deltic Engine

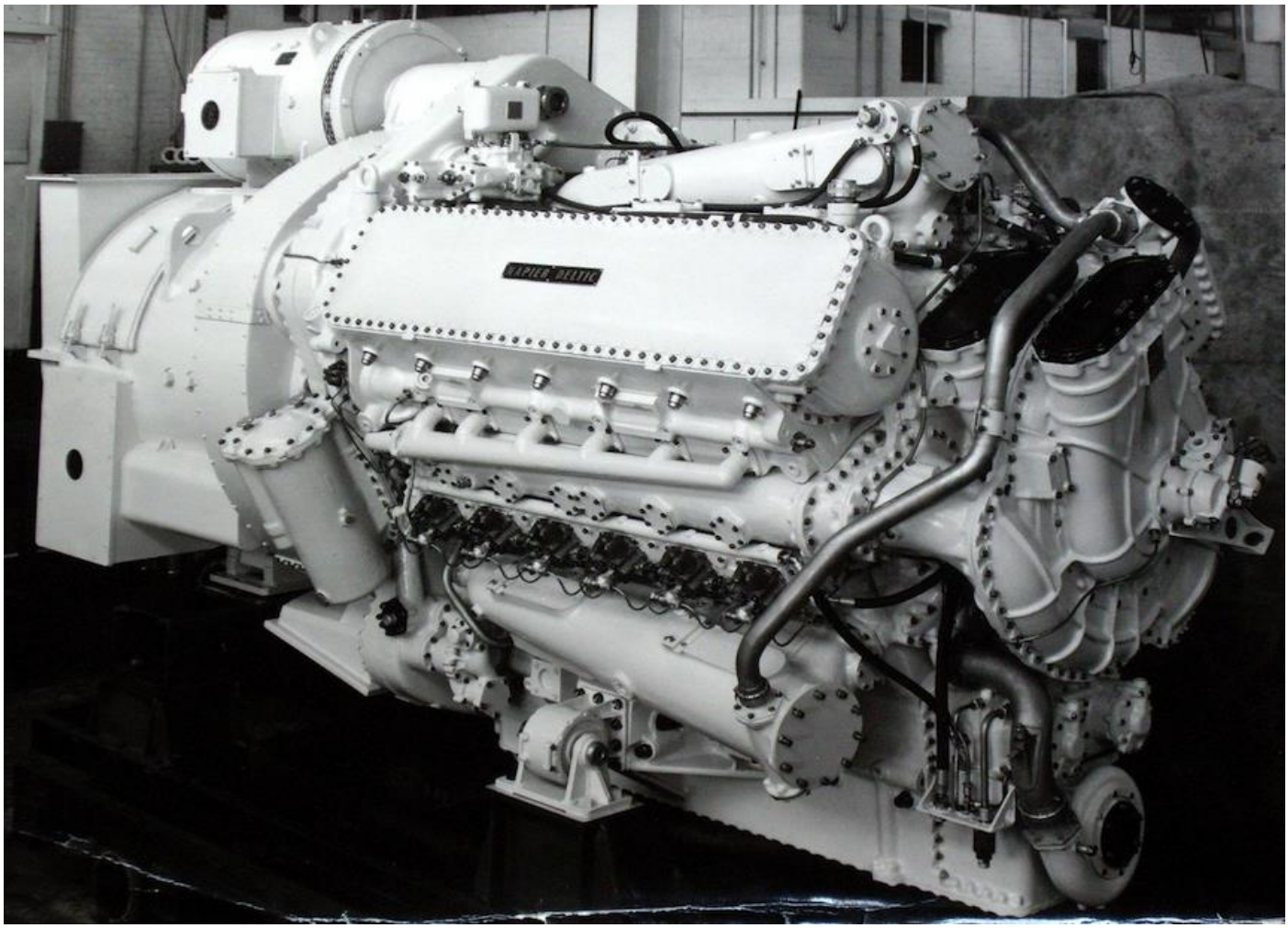
A high power diesel for patrol boats

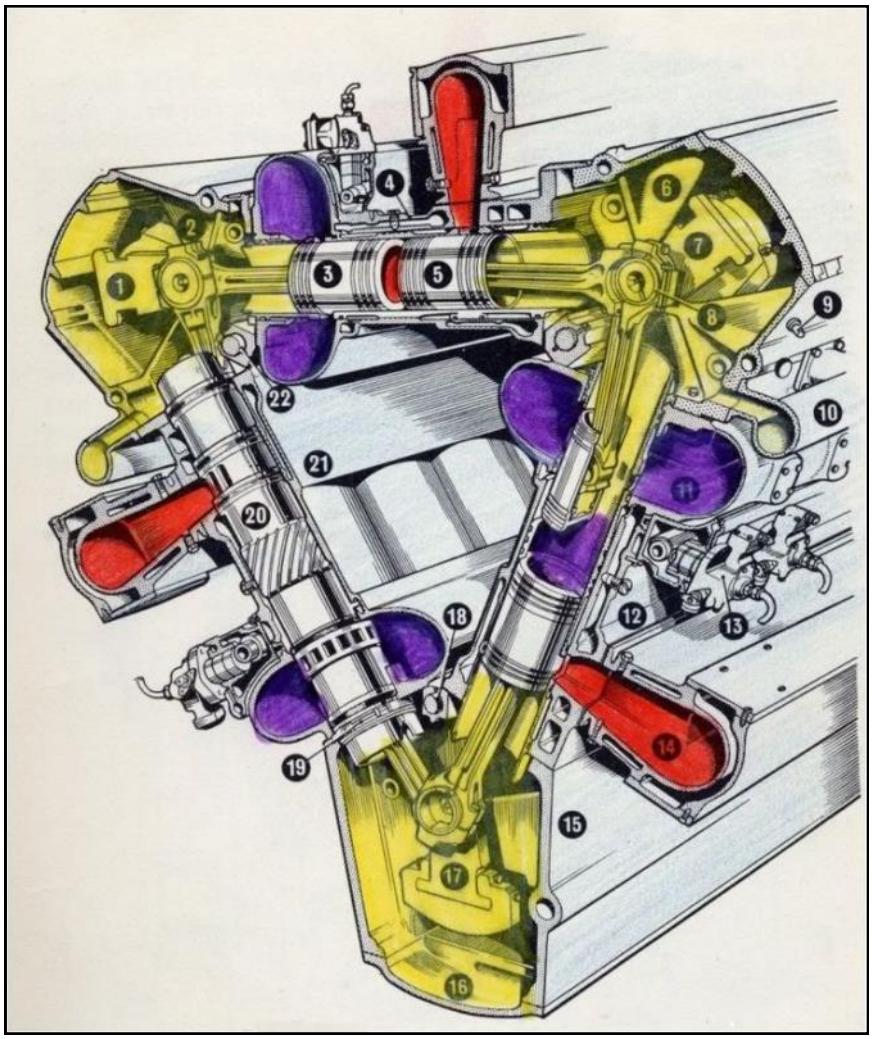
In 1943, an Admiralty committee was set up, under the chairmanship of Sir Roy Fedden, to investigate the development of a high-speed, light weight, diesel engine, to replace the contemporary petrol engines used in Fast Patrol Boats, such as the 27-litre Packard V12, weighing 746Kg and producing about 1400 hp. Wherever high-powered gasoline engines were installed there was always the serious and unavoidable risk of fire and explosion, so it was understood that a diesel unit would be safer as well as being more economical.

The committee recommended a 2-stroke sleeve valved compression-ignition engine similar to the Napier Sabre, a British H-24 piston aero engine. A contact was eventually placed with the English Electric Company, the parent firm of D. Napier & Son. English Electric however offered an alternative design, that of the Deltic engine. Work was conditional that Napier's would undertake the design, development and manufacture from basic proposals submitted by N. Penwarden, a draughtsman at the Admiralty Engineering Laboratory.

Development work on the Deltic engine was started in 1947 and the first unit was completed in March 1950. By January 1952, six engines were available for full development and endurance trials. Two of these units were fitted for operational endurance trials in a fast patrol-boat. The units proved to be an outstanding success and represented a major technical advance on any compression-ignition engine so far developed.

The components of the engine were small enough to permit the use of the most modern aircraft engine materials and manufacturing techniques at that time. This made possible the





Key:

1. "BC" crankshaft
2. "BC" crankrose
3. Inlet piston
4. Injection Nozzle Adaptor
5. Exhaust piston
6. "AB" crankcase
7. "AB" crankshaft
8. Main bearing cap
9. Crankcase tie-bolt
10. Drain oil manifold
11. Air inlet gallery (Purple)
12. "A" Camshaft casing
13. Fuel injection pump
14. Exhaust manifold (Red)
15. "CA" crank cover
16. Crank space (Yellow)
17. "CA" crankshaft
18. Blower flexible drive shaft
19. Liner ring nut
20. Cylinder liner
21. "C" cylinder block
22. Blower flexible drive-shafts

use of such items as fully-hardened crankshafts, thin-wall lead-bronze bearings, case hardened and ground gears, which at the designed ratings gave extremely long life.

Design Features: Deltic Engines are opposed piston, liquid cooled compression-ignition engines operating on the two stroke cycle and employing a mechanically driven turbo-blower. Charge-air coolers are integral with the turbo-blower unit. They offer substantial weight and space advantages when compared to other traditional engine designs. The triangular arrangement of the 18 cylinders results in a compact engine, consisting structurally of three cylinder blocks forming the sides and three crankcases, one at each apex of the triangle. This arrangement fully exploits the mechanical simplicity of the opposed piston design.

Short crankshafts are used and as each crankpin carries one inlet and one exhaust piston, the loading on all crankpins is exactly the same and the reciprocating forces are perfectly balanced within the engine. When supported on flexible mountings, Deltic engines are virtually vibration free. The power transmitted through each crankshaft is therefore identical, and torsional vibration is controlled by using quill-shafts in tune with viscous dampers secured to each crankshaft. These features combing with the characteristics of a fast running multi-cylinder two stroke, produce a smooth running engine with a maximum-to-mean torque of less than 1.03 to 1.

Low Maintenance Factor: Deltic engines used an extensive number of common parts and components such as auxiliary pumps and control units permitting the extensive use of repair by replacement. Major units of the engine, such as the blower, phasing gear case and

reverse-reduction gearbox are also interchangeable which enable reduced servicing times.

Engine Configuration: The basic shape of all Deltic engines is triangular comprising three cylinder blocks and three crankcases "tied" together by a system of high tensile steel bolts which pass through the cylinder blocks and crankcases. These bolts carry the combustion loads and unite the whole assembly into a strong and rigid structure.

Components: Each crankcase is a one-piece aluminium alloy casting substantially webbed and carrying a crankshaft in thin-walled lead plated and indium-infused lead-bronze main bearings. Each bearing cap is secured by four studs and additionally located by a tie-bolt which passes transversely through the cap and the crankcase walls on either side. The two upper crankcases are identical but the lower one is deepened in section to carry engine bearers to provide effective oil drainage for the dry sump lubrication system and to accommodate drives for the oil and water pumps.

The crankshafts have hollow nitrided crankpins and the bearing surfaces are finished by lapping. Each crankshaft is balanced and fitted with a viscous-type torsional vibration damper. The top crankshafts are identical and rotate in a clockwise direction. The bottom crankshaft has opposite-handed throws and rotates in an counter-clockwise direction to obtain the correct phase relationship.

The three cylinder blocks are identical light alloy castings of mono-block construction with integrally-cast coolant passages, exhaust ports and air inlet manifolds. The cylinder liners are of the open-ended 'wet' type and are machined from hollow steel forgings. They are chromium-plated in the bore, honey-chrome etched and finished by lapping. Each liner is located longitudinally by a ring nut which clamps a flange on one end of the liner against a shoulder in the bore of the cylinder block. The liners are located radially by the injection nozzle adapters which are screwed through the cylinder block into the wall of the liner.

Each piston consists of two separate parts;

1. An outer piston body of cast aluminium which has an unbroken skirt and carries the two top compression rings in an austenitic iron insert bonded to the aluminium by the 'Alfin" process.
2. An inner member which is machined from a 'Y' alloy forging; the latter carrying a fully-floating, hardened-steel gudgeon pin.

Trials boat P5212

In 1946, 34 German built E-boats were surrendered to the British, one of which was designated S-130 (P5230). This vessel was originally fitted with three Daimler-Benz MB501 V20 diesel engines each developing 2000 hp. The two outer engines were removed and replaced with the much shorter Deltic engines, each developing 3000hp, so upping the total output from 6000 hp to 8000 hp. The Deltic engine weighed about one fifth of an equivalent powered engine meaning that the trials boat weighed considerably less.

A short film made in 1953 is available on YouTube containing various shots of the converted former German gunboat (P5212) zooming about on the sea powered by the lightweight Deltic diesel engine. A large crew stands on board, presumably observing the performance of the engine as the craft moves along at speed.

https://www.youtube.com/watch?v=aaWwmslD2Oc

When assembled these parts form passages beneath the piston crown and behind the piston rings in which oil is shaken by the piston motion and assists cooling. Each crankpin carries a pair of connecting rods (one plain and one forked) on thin-wall, lead-bronze, lead-plated, indium-infused bearings. The exhaust pistons are attached to the forked rods which are reinforced by a nitrided steel bearing shell, the inner surface of which carries the thin-wall bearing for the crankpin. The inlet pistons are attached to the plain rods which carry a thin-wall bearing that moves on the outside of the steel bearing shell.

The injection pump camshafts are enclosed by light allow casings assembled to the outer face of the cylinder block. The camshafts are carried in phosphor-bronze bearings lined with white metal and are driven through short quill-shafts which incorporate simple vernier timing adjustments.

Power: is transmitted from each crankshaft through coupling quill shafts to phasing gears which combine the three outputs into a single shaft. The direction of rotation is determined by the arrangement of the idler gears. The phasing gear also drives an ancillary power take-off shaft and the engine auxiliaries, except for the fresh and sea-water pumps and oil pumps which are located on the bottom crankcase and driven through spur and bevel gears from the bottom crankshaft .

A single-stage centrifugal blower mounted on the free end of the engine, and driven through flexible shafts from the crankshaft gears, provides an air flow that completely scavenges the combustion chambers and provides a degree of supercharging. The blower and its driving gears form an independent unit that can be readily interchanged.

Fuel: This is supplied to two nozzles in each cylinder by separate fuel injection pumps. The pumps for each cylinder block are supplied with fuel from a common pressurized fuel line in a circulation system which precludes air locks. The design permits any one pump to be removed and replaced by another so that correct timing and matching are automatically obtained.

Lubrication: All bearings and gear trains in the engine are supplied with oil under pressure where the drain oil is returned to the tank by a scavenge pump. The dry sump system incorporated two full-flow filters, coupled in parallel, either of which may be isolated for replacement while the engine is running. The single pressure pump supplies all services including the metering pumps that control the flow to the blower bearings and to the sparge jets which spray the meshing points of the various gears. Oil is taken from the crankshafts through ducts in the connecting rods and gudgeon pin housings to cool the pistons and is then discharged through drain holes to the crankcase.

Cooling: This is effected by a fresh water circulating system and the heat transfer properties of the lubricating oil where the fresh water and oil are further cooled by air or sea water through heat exchangers. Thermostatic valves control the flow to the heat exchangers to maintain efficient running temperatures in the engine. A water-cooled exhaust manifold is fitted to each cylinder block and all three manifolds are coupled to a common expansion tank. The temperature of the gas flow from each cylinder is measured by individual thermocouples fitted in the manifolds.

Control and Gearbox: The fuel injection system (and the ahead-and-astern gearbox when fitted) is controlled automatically by movement of a single lever. This is except for starting and stopping when the engine is controlled by a second lever that overrides the automatic

system. The ahead-and-astern gearbox incorporates a hydraulically-operated friction clutch which enables the engine to idle in neutral or to drive ahead or astern through spur gears in constant mesh simultaneous selection of the required drive. The desired speed is made with a single control lever that moves over a quadrant from a central 'NEUTRAL' position to 'AHEAD" in one direction, or to 'ASTERN' in the other direction. The control system switches the clutch operating oil to the appropriate side of the hydraulic clutch in the gearbox and compresses the desired speed upon the hydraulic governor which relays it to the fuel controls after it has made allowance for engine load and running conditions.

Mounting: The light weight and balanced thrust of the Deltic enables flexible mountings to be employed for carrying the engine, thereby completely isolating the bearers or structure from pulsations and accommodating thermal expansion.

External Finish: The external surfaces of all castings are finished in enamel and all other parts that are liable to corrosion are cadmium or tin-plated.

The illustration below shows the technical details of the crankshaft phasing, port timing and firing order.

PHASING AND TIMING

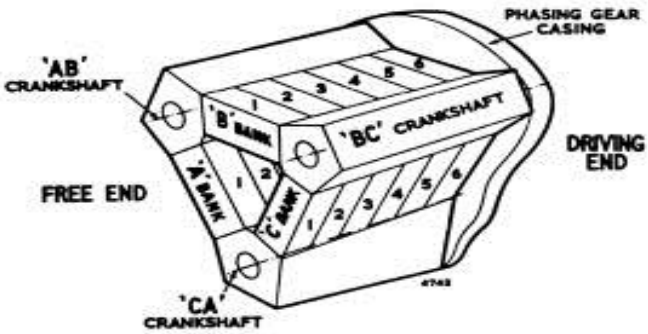
CRANKSHAFT PHASING (On No. 1 cylinders)

C.1 Exhaust piston	T.D.C
B.1 Exhaust piston	40° before T.D.C
A.1 Exhaust piston	80° before T.D.C
Exhaust piston lead	20°

PORT TIMING (relative to exhaust T.D.C.)

Inlet opens	145° after T.D.C
Inlet closes	105° before T.D.C
Exhaust opens	112° after T.D.C
Exhaust closes	112° before T.D.C

FIRING ORDER

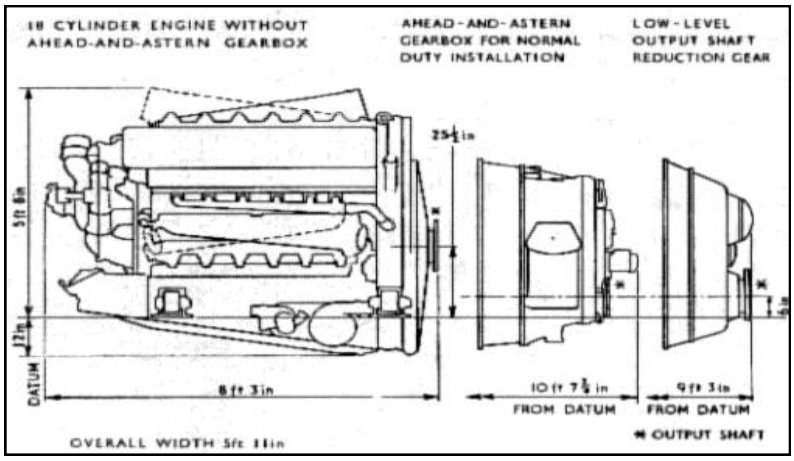


CYL. BANK	MEAN CRANK ANGLE (C.I. CYLINDER) - DEGREES															
	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350	
C	1		5			3		4		2			6			
B		1			5		3		4			2			6	
A		6		1			5		3		4			2		

INJECTION TIMING

Timing	Datum setting 19° before exhaust T.D.C
Injection pumps control shaft setting ("rack reading") - (at 0° governor output scale setting)	96°

AIR START DISTRIBUTOR TIMING



Smaller nine-cylinder Deltic 9 engines were used as marine engines, notably by minesweepers. The Ton class vessels were powered by a pair of Deltic 18s and used an additional Deltic 9 for power generation for their magnetic influence sweep. The Hunt class used three Deltic 9s, two for propulsion and again one for power generation, but this time with a hydraulic pump integrated as well to power bow-thrusters for slow-speed manoeuvring.

SPECIFICATIONS

Bore	5.125	inches
Stroke	7.25 X 2	inches
Swept Volume Total	5,384	cubic inches
Swept Volume Effective	5,300	cubic inches
Compression Ratio Nominal	19.26 to 1	
Shaft HP - Maximum	2500 @2000rpm	
Shaft HP - Continuous	1875 @1700rps	
Piston Speed @2000rpm	2416	ft/min.

WEIGHT SUMMARY

Net Dry Weight - Engine	8727	lbs
NDW - with reverse gear	10,500	lbs
Power/Weight -Engine	3.5	lbs/hp
P/W with reverse gear	4.2	lbs/hp

PHYSICAL DIMENSIONS

Width	6' 2.5"
Height	7' 1"
Overall Length with reverse	10' 11''

Engine Starting Procedures

Starting Preliminaries (before initial start each day)

1. Carry out the dailiy inspection.
2. Check that the sea-water cocks are open.
3. Check that the fuel and oil inlet cocks are open.
4. Prime lubrication oil system.
5. Operate the fuel priming pump until a fuel pressure of at least 10lb/in² registers on the gauge.
6. Insert the required number of capsules into the cold starting aid unit and prime the system by operating the priming cock.

Warning: The fluid used in the starting aid system is highly flammable.

Starting

1. Set the master control lever to the NEUTRAL position.
2. Move the shut down lever to RUN.
3. Depress the air start lever and hold until the engine fires.
4. If the retractable maximum stop has been used, return the stop to the normal position when the engine has started.

Stopping

1. Move the master control lever to the NEUTRAL position.
2. Move the shut-down lever to STOP.
3. If this is the final stop of the day, carry out an after running inspection.

The Deployment of Deltic Engines in Trains

Replacing steam with high power diesel

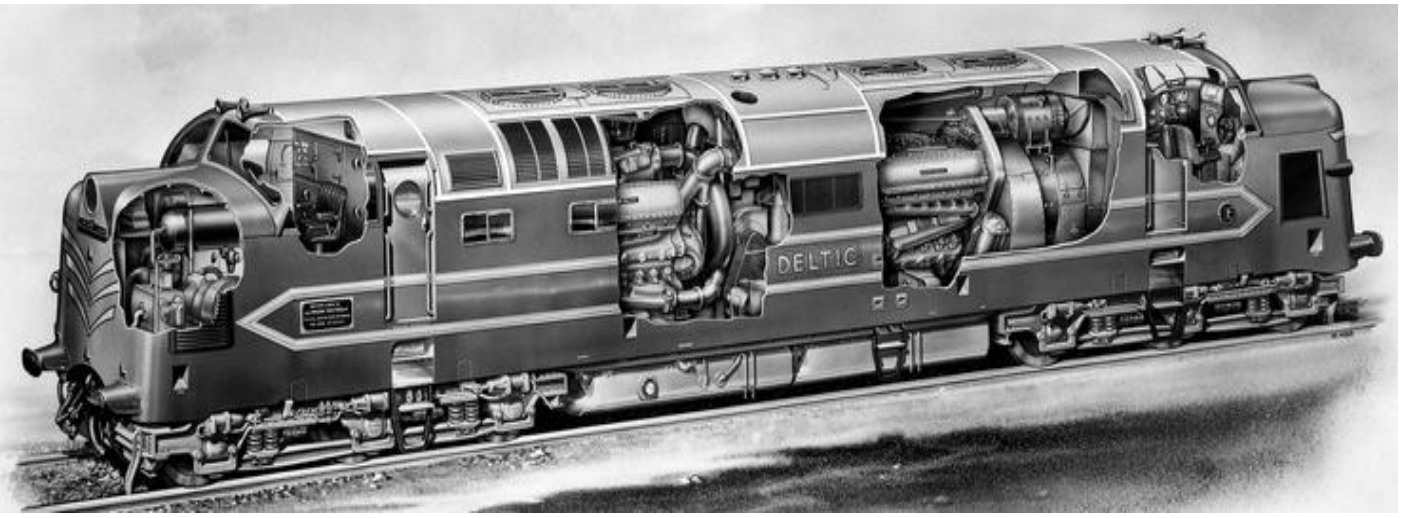
In the early 1960's, British Rail utilised the Deltic engine to increase the performance of locomotives with diesel engines on the East Coast Main Line. The maximum available power for recently introduced Class 40 diesel locomotive was 1450 drawbar horsepower and the maximum power recorded for a steam powered Pacific A4 was 2450 drawbar horsepower. The new 100 ton diesel-electric locomotives fitted with twin Deltic engines could develop 2750 drawbar horsepower and could travel at over 100 mph. They were considered to be one of the most successful low weight high speed locomotives ever.

Only 22 of the British Rail Class 55 locomotives were built between 1961 and 1962 by English Electric. They stayed in service up until the late 1970's when there were superseded by the Intercity 125 trains and were deployed to other roles.

The first two Class 55's, 55001 and 55020, were withdrawn and cut up in January 1980, 55003 was withdrawn in December 1980 followed by 55005 and 55006 in February 1981. 55012 was withdrawn in May 1981 followed by 55018 in October 1981. The final run down of the class started in November 1981 when 55004, 55011 and 55014 were withdrawn. By the end of December all remaining Class 55's were withdrawn with the exception of the four 'railtour' locomotives. These were 55002, 55009, 55015 and 55022 which survived until January 1982 for the farewell railtour.

A Deltic sounded very different to any other locomotive. At idle, the phasing gears inside the engine could be heard as could the scavenger blower and exhaust. The noise varied depending on where and how far away you were standing in relation to the locomotive. The engine note was like a low, rumble of thunder. An 18 cylinder Deltic rail engine idled at 700 rpm (faster than most other diesels at full bore) and could run up to 1500 rpm. As the engine rev's increased the Deltic engine also changed character. The rattling and vibration in the phasing gear changed frequency, and the engine note became a higher-pitched very smooth drone. For this reason the locomotives were nick-named 'Drones' or 'Lancaster Bombers'.

A Class 55 locomotive had a striking symmetry to its design. Having two engines, the exterior number 1 and 2 ends were hard to differentiate (1 end had an access plate to the exhausters while 2 end had a waste pipe from the urinal). Unlike many other classic English Electric designs the cab had two tear shaped front windows contributing to the impression




Deltic engine in situ

of power that the class exude. Apart from the external design of the Class 55, a Deltic exhaust was unique. When setting off the Deltic engines could expel two large plumes of exhaust as the two stroke engine design carried over a quantity of oil into the exhaust collector drum which, when hot, led to a pale blue exhaust trail in most cases. After standing idling for some time, a Deltic could produce a cloud of smoke that many steam locomotives would find hard to match.

The Class 55's were the first locomotives expressly designed to be maintained by component replacement. Up until that time a locomotive had an associated engine and generator and if it failed it went into the local repair shop to be fixed. The locomotive then returned to service several days or weeks later. The Deltic was designed to be diagrammed for a high availability, hence the 44 x engines built for the locomotives themselves together with 13 x spare engines. When a power unit developed a problem the locomotive would enter Doncaster Plant, the power unit exchanged and tested and then released, often in only one day. This method of repair-by-replacement enabled the Deltic locomotives to achieve higher mileages than other locomotive classes. For example locomotive 55010 became the first Deltic to achieve 2 million miles in less than 12 years.

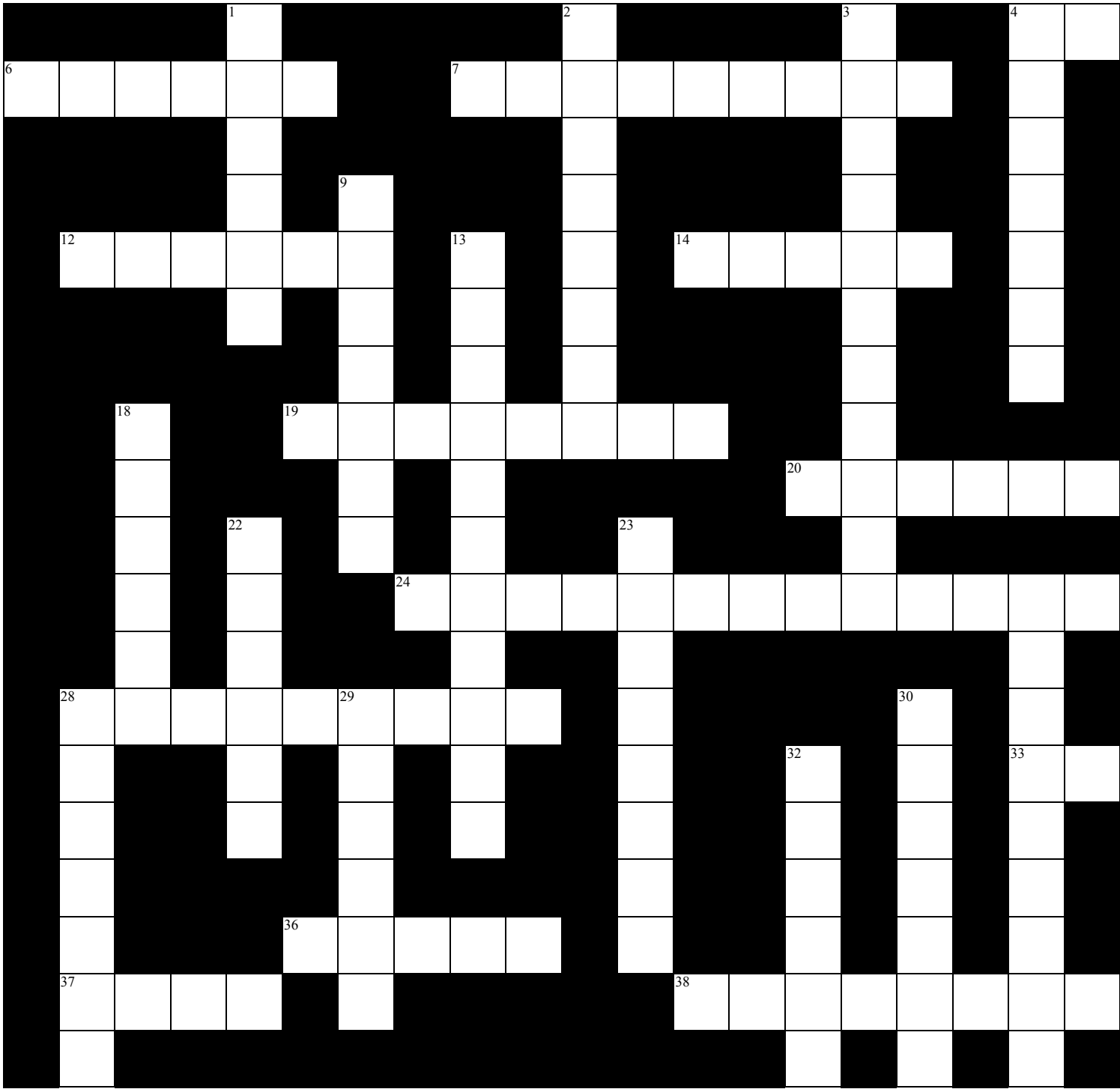
The Deltic engine was a complicated machine but was no more unreliable than other slow diesels but suffered higher stress levels due to the nature of its work and the fact that it operated at much tighter tolerances than more conventional units. By the mid 1970's the locomotives suffered because of the unavailability of spares and when nearing the end of their working lives, when repair costs were being further trimmed, it was not unusual to see locomotives travelling on one engine. All Class 55 Deltic engines were initially repaired and tested by Napier in Liverpool and then by British Rail in Doncaster.

Several Class 55's escaped the cutters torch. 55002 became part of the National Collection and was exhibited at the National Railway Museum in York. 55016 and 55022 were purchased from British Rail by the Deltic 9000 Fund, which later became Deltic 9000 Locomotives Ltd. The Number 2 end cab from 55008 and the Number 1 end of 55021 have been salvaged and restored by volunteer groups. 16 Class 55's were cut up by British Rail at Doncaster between 1980 and 1983 and the Deltic Preservation Society obtained a large number of spares including five power units which are now located at the society's depot at Barrow Hill. Various other parts such as bogies were retained by British Rail for re-use.

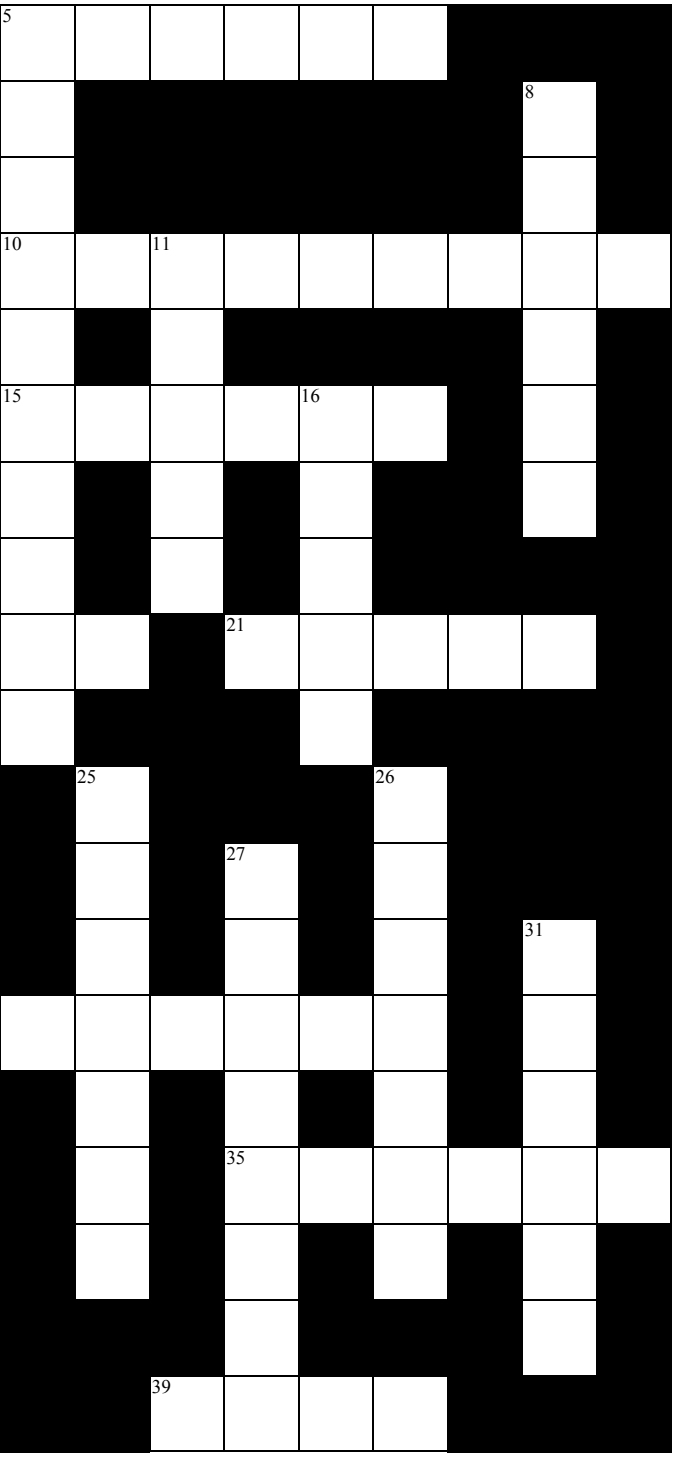
The Big Crossword #002

Here is another chance to win a brand spanking new Society Tie with the Society crest. The theme this time is all about aeroplanes, mostly British naval aircraft with a few American ones thrown in for good measure. Some answers will have the "sea" prefix and some of them won't. It's up to you to work it out. When you have completed the puzzle, there is the secondary challenge that involves the summation of the value of the first letter of the all the answers. Taking A=1, B=2, C=3 etc., the task is to add up the 40 numbers and find the total value.

When you have worked this out , email the number with your postal contact details to me at Contrabyte@gmail.com for the chance to win the prize for the first correct drawn out of the hat at a management committee meeting.



4	Across	Cerura vinula
6	Across	Old magician
7	Across	Pirate
10	Across	Big wind
12	Across	Douglas DC-3
14	Across	Highly ariel bird
15	Across	Bird like dinosaur
19	Across	Capital of Australia
20	Across	Antagonist
21	Across	Bird in the garden pond
24	Across	WW2 fleet carrier fighter
28	Across	Francis Chichester's ketch
33	Across	Small striped furry mammal
35	Across	Large white seabird
36	Across	Fiery ball of rock and ice
37	Across	Cat with tufted ears
38	Across	Twin booms and twin engines
39	Across	Buzzing little pest



1	Down	The winner
2	Down	Saracen sword
3	Down	Beautiful boxer
4	Down	Black cat
5	Down	Falkland winning plane
8	Down	Trapper or pursuer
9	Down	Boldly courageous and brave
11	Down	Carrier-based torpedo bomber
13	Down	In charge of the world
16	Down	Top river predator
18	Down	Posh regatta venue
22	Down	Old Anglo-Saxon kingdom
23	Down	De Havilland DH.110
25	Down	Dracula
26	Down	Mare Rex
27	Down	Produces caviar
28	Down	African antelope
29	Down	Shooting star
30	Down	Olympic spear
31	Down	Type of dragon
32	Down	Mr Spock is one

The solution to Crossword #001
can be found on page 30.

Successor class Submarines

Replacing the Vanguard class nuclear ballistic missile carriers

Since the retirement of the last Royal Air Force free falling nuclear bomb in 1998, the British nuclear deterrent has been entirely submarine based, carried onboard the Vanguard class submarines. The deterrence is based upon the premise that a potential enemy cannot eliminate our ability to strike back in a first strike if a missile submarine remains at sea.

Unlike the U.S. nuclear arsenal, which is built upon a threesome of land-based, air-launched, and submarine-carried nuclear missiles, Britain's entire nuclear deterrent is carried by its four Vanguard class nuclear missile submarines.

The nuclear powered Vanguard class submarine incorporates a selection of successful design features from other British submarines and is quite unlike its predecessor, itself an adaptation of the Valiant class.

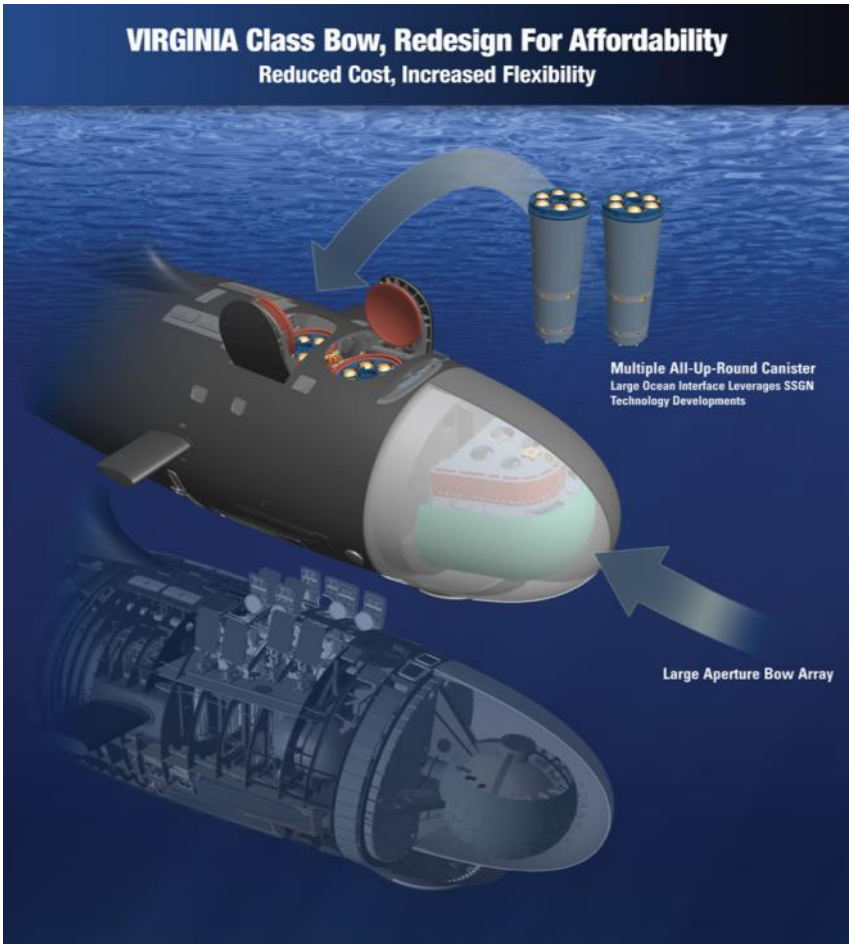
HMS Vanguard was designed with a twenty-five year hull life and thus was expected to require replacement by about 2019, but a less demanding operational profile and deployment cycle than originally anticipated has allowed her projected service life to be extended to 2024 if required.

With the Astute project currently planned to complete with the delivery of the seventh hunter-killer around 2019, the first Vanguard replacement is required in 2021.

Planned to enter service in 2028, the Successor class of SSBN will be built largely by three of Britain's biggest defense contractors: BAE Systems, Rolls-Royce and Babcock International. Construction of the first submarine began in October 2016 with the cutting of steel for the hull by Defence Chief Sir Michael Fallon, but that boat won't enter service until 2028.

Intended Missile Stowage System: Although the initial designs are somewhat undefined at present, one of the key features of the new boats will be a Common Missile Compartment (CMC). The CMC aims to define the missile tubes and accompanying systems that would be used to launch new ballistic missiles, successors to the current Trident II/ D5 missile fleet used by the USA and Britain.

For the US and UK, the CMC needs to be part of that adaptation. Key options under



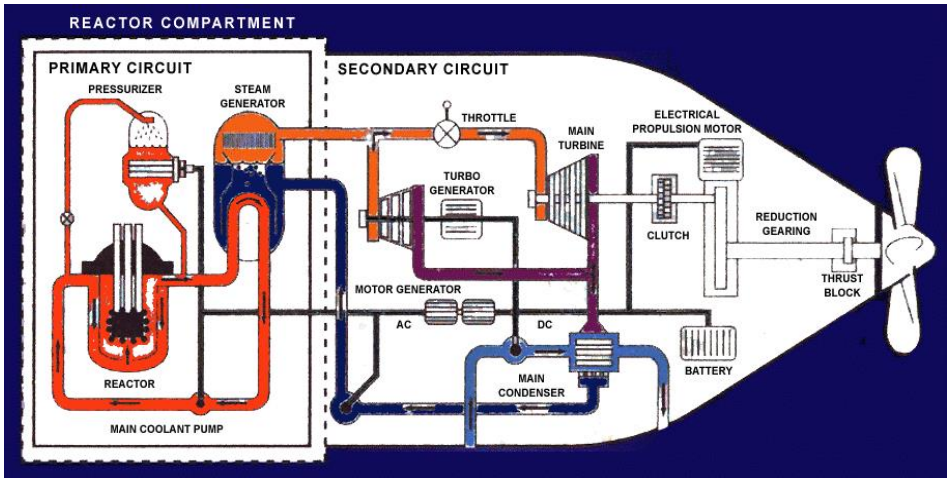
consideration include an increase in the diameter of each tube from 2.21m – 3.04m, and the potential for flexibility beyond nuclear missiles, this would provide incredible future-proofing while delivering a multirole capability.

The British government took the first steps in 2006 towards a joint US/UK missile compartment and the project was launched in 2008, initial gate approval for Britain's Successor project followed in 2011. Other contracts have followed, covering design and even the new kind of nuclear reactor the submarines are expected to use.

There is a precedent for this in the United States, the Virginia Class Block III fast attack submarine replaced their 12 vertical-launch cruise missile tubes with 2 Common Weapon Launcher (CWL) as seen in the picture on page 18. The size of the CWLs allows the launch of cruise missiles, UAVs, UUVs and other types of payloads such as Launch and Recovery Modules.

British and American collaboration will benefit the Successor class missile capability. The 2010 Strategic Defence and Security Review stated the submarine will have eight operational missiles, carrying no more than 40 operational warheads between them.

Intended Nuclear Power Plant: Another important feature of the collaboration between the UK and the US is the work carried out on the new and advanced PWR-3 pressurised water reactor nuclear. PWR-3 is the third generation of British pressurised water reactors that has been built on cutting edge nuclear propulsion research undertaken by the MoD and



Rolls-Royce in the last few decades and is rumoured to be at a very advanced stage of development.

The exact nature of the UK's industrial access to US reactor technology remains largely unknown in the public domain. However, The Royal Institution of Naval Architects has reported that it is likely the UK has been given a good look at the S9G reactor design that equips the US Navy's Virginia Class submarines.

The lead partner for the Successor programme, BAE, has been working on the concept design phase since 2007. Now completed, an outline submarine design has been selected.

Approving the Business Case: Following the Government's approval of the Initial Gate Business Case in May, 2011, the programme moved into the Assessment Phase. This is the first major stage of the new submarine's design and development where the vessel concept and requirements are fleshed out and finalised into a detailed hull form and systems. Current expectations are that it'll look like one of the two models that were displayed at the Defence Systems and Equipment International exhibition in 2007. Named 'Concept 35' and 'Advanced Hull Form', they represent a conservative and radical view of how a future submarine might look and work.

Proposed Designs: Concept 35 was developed with the same design philosophy to that of the Astute class, driving down costs throughout the boat's lifetime. One of the key decisions made for this concept included using off-the-shelf components, rather than investing in custom design.

Certain design aspects of the Concept 35 design are less conventional where significant automation techniques would be utilised to a far greater degree for submarine control and condition monitoring. For example, Concept 35 would incorporate passive safety features in the nuclear power plant (similar to those used in civil reactors) such as coolant valves that automatically open if they fail, rather than close, so that coolant can still reach the reactor core.


Advanced Hull Form


Concept 35

The far more ambitious proposal is the Advanced Hull Form submarine concept where the design is clearly very different from any other submarine. It proposes an oval cross -section rather than cylindrical where the hull splits into a Y at the stern with the propulsors mounted inside angular ducts that are integrated into the hull.

BAE have stated that the resulting unusual hull design offers a great deal of advantages in terms of noise signature, manoeuvring and offers large volumes for payloads and equipment outside the pressure hull.

Additionally, it has reportedly been designed for relatively low cost construction using largely flat or single curvature surfaces.

This approach also allows rapid repair and modification, giving the basis for a flexible and economical platform through life. Safety is enhanced by the hydrodynamic design, which offers improved manoeuvring and emergency recovery compared with current designs. It is further improved through the external payload and equipment locations, which minimise hull penetrations and improve watertight integrity.

Progress to Date: Successor is now in the detailed design stage and it is expected to begin delivery in 2028. It is expected to be the most technologically advanced submarine in the history of the Royal Navy. The name of the class is to be the Dreadnought class. The next three boats will also be given names with "historical resonance"

Groundwork has started on the renovation of the Central Shipyard Complex in Barrow-in-Furness that will be used for fitting out Dreadnought class submarines. The start of the work is the culmination of three years planning and preparation and marks a milestone as the first major development on the site in many years. The BAE Systems project team, currently comprising ten people, are committed to delivering a building which will secure submarine boat building capability in the yard for the next 25 years and beyond.

Improvement to Infrastructure: BAE Systems announced in 2014 a £459 million modernization of the entire shipyard in anticipation of government approval of the nuclear deterrent submarine replacements. Renovation of the central yard complex is expected to be completed by the end of 2017. The central yard complex will include a new manufacturing facility and paint shop. The then British Prime Minister David Cameron confirmed in November 2015 that Britain will order four new submarines. BAE Systems was given an additional Ministry of Defence contract for the final phase of design work.

Photo © BAE: An aerial view of the BAE Systems site in Barrow-in-Furness, Cumbria

The Ships of Henry VIII's Navy (1509 to 1547)

Henry the VII was credited with being the founder of the Royal Navy in the late 1490's. He was responsible for getting the first dry dock constructed at Portsmouth after identifying the advantages of this area as a permanent naval base. However, he only ordered a few new ships to be built (Sovereign, Regent, Sweepstake and Mary Fortune), preferring to hire Spanish ships instead as the costs were lower.

It was his son, Henry VIII who greatly expanded the navy, providing some 86 'ships' by either building from scratch, purchasing from abroad or capturing from the enemy. Henry's new ships were the first to incorporate watertight gun ports enabling the heavier guns to be carried lower down near the waterline.

In 1546, thirteen armed rowbarges of 20 tons each were built - Double Rose, Flower de Luce (captured by the French in 1562), Sun, Harp, Cloud in the Sun, Hawthorne, Three Ostrich Feathers, Falcon in the Fetterlock, Portcullis, Rose in the Sun, Maidenhead, Roseslip and Gillyflower. The first three of these were rebuilt in 1557-58 and classed as pinnaces, the next five named above were sold in 1548-49, for £154 each, and the last five were condemned in 1552.

There were a variety of vessels that came in all shapes and sizes and the following key will help to distinguish between them:

Bark: A sailing ship of three or more masts having foremasts rigged square and the after mast rigged fore and aft.

Carrack: A large three or four masted ship, originally developed as a merchantman in southern Europe. Characterized by deep draught, relatively broad beam and very high fore and aft castles.

Galleasse: A large oared warship, also propelled by sail, usually three masted, with a gun deck over the rowers' benches. A cross between a carrack and a galley, it tended to suffer from the disadvantages of both.

Galleon: Usually used to describe a medium or large sailing ship, built flush decked and without castles. Galleons were normally somewhat longer and narrower than carracks and had superior handling qualities.

Galley: A lightly-built fighting ship, chiefly propelled by oars. Galleys were fast and could move independently of the wind, but they could not carry heavy armament and were at risk in rough weather.

Hoy: A small sloop rigged, one or two masted coastal vessel or heavy barge of around 60 tons. Most hoys were merchant vessels and frequently taken as prizes during time of war.

Pinnace: A small vessel in common use usually having two masts and sizes anywhere from a few tons up to 50 tons.

Rowbarge: A small flat bottomed vessel of up to 20 tons propelled by oars or sweeps and carrying up to 12 guns.

Henry's naval vessels
in an approximate chronological order:

Katherine Pomegranate: Originally the "Sweepstake", this 'galleasse' was rebuilt in 1511 and renamed in honour of Katherine of Aragon.

Mary Rose: Built in Portsmouth in 1509 as a three masted 'carrack' and weighed 600 tons. It was rebuilt in 1536, uprated to 700 tons and armed with new bronze muzzle-loaded guns. The ship sank during the Battle of the Solent in July 1545 when water poured in through the lower gun ports that were only sixteen inches above the waterline.

Peter Pomegranate: Built in Portsmouth in 1509 as a three masted 'carrack', weighed 400 tons and was armed with 60 small calibre swivel guns. It saw action in the Battle of Saint-Mathiew in August 1512. It was enlarged in 1536 to 600 tons and its name was shortened to "Peter" and saw action again in September 1547 at the Battle of Pinkie Cleugh on the banks of the river Esk, near Mussleburgh, Scotland. The ships fate is not recorded but was last mentioned in records in 1558.

Jennet Prywin: Originally a 70 ton Danish ship, it was captured from the Scottish pirate, Andrew Barton, in 1511 by the Howard brothers Edward and Thomas.

Lion: A second ship captured from Andrew Barton, in 1511. Weighed 120 tons and carried 36 guns. Was sold in 1513.

Anne Gallant: Built in 1512 and weighed 140 tons. Wrecked in 1518.

Christ: Purchased in 1512, weighed 300 tons and was captured by the Turks in 1515.

Dragon: Purchased in 1512, weighed 100 tons. It took part in the Battle of Saint-Mathieu and was heard of in 1514.

Henry Galley: This 'galley' was built in 1512, weighed 80 tons and was lost at sea in 1513.

Maria de Larreto: This 800 ton 'carrack' was taken as a prize from the Genoese in 1512 and returned in 1514 having been laid up in Portsmouth.

Katherine Fortileza: This 550 ton 'carrack' was purchased in Genoa in 1512 and condemned in 1521 after being damaged in a storm.

Gabriel Royal: This 700 ton ship was purchased in Genoa in 1512. Last heard of in 1526.

John Baptist: Was purchased in 1512, weighed 400 tons, carried 23 guns and was wrecked in 1534.

Mary George: Was purchased in 1512, weighed 250 tons. Last heard of in 1526.

Mary James: Was purchased in 1512, weighed 240 tons. Last heard of in 1529.

Lizard: Was purchased in 1512, weighed 120 tons. Last heard of in 1522.

Great Nicholas: Was purchased in 1512, weighed 400 tons. Last heard of in 1522.

Great Bark: Built in 1512 as a three masted 'carrack', weighed 250 tons. Sold in 1531.

Barbara of Greenwich: Weighed 140 tons. Last heard of in 1514.

Rose Galley: A 'galley' of 80 tons. Last heard of in 1521.

Katherine Galley: A 'galley' of 80 tons. Was captured by the French in 1522.

Less Bark: A ship of 180 tons carrying 109 guns. Last heard of in 1552.

Black Bark: Weighed 70 tons and Last heard of in 1514.

Great Barbara: This 'carrack' was purchased in 1513 and weighed 400 tons. Last heard of in 1524.

Henry Hampton: This ship was purchased in 1513 and weighed 120 tons. Last heard of in 1521.

Mary Imperial: Weighed 100 tons. Last heard of in 1525.

Henry Grace à Dieu: Known as "The Great Harry" it was built at the Woolwich dockyard from 1512 to 1514 this 'carrack' was the first English two-decker and weighed 1500 tons. She was armed with 43 heavy guns and 141 light guns and was the first to feature gun ports. At sea the ship was top heavy and was useless as a fighting platform. She was rebuilt at Erith in 1536 and her weight reduced to just 1000 tons. The four masts gave the ship better sailing characteristics. The crew was also reduced from 800 to 700.

Great Elizabeth: This 900 ton 'carrack' was purchased in Lubeck in 1514 and carried 97 guns. It was wrecked off the coast of Cornwall whilst escorting Mary to France later that year.

Great Galley: This 500 ton 'galleasse' was built in Greenwich in 1515.

Mary Gloria: A ship purchased in 1517, weighing 300 tons. Last heard of in 1522.

Katherine Bark: A 100 ton ship built in 1519. Last heard of in 1525.

Bark of Morlaix: A 60 ton ship taken as a prize from the French in 1522. Last heard of in 1530.

Bark of Boulogne: An 80 ton ship taken as a prize from the French in 1522. Last heard of in 1525.

Magdeline: A 120 ton ship that appeared in 1522. Last heard of the 1525.

Mary Grace: A 90 ton 'hoy' captured in 1922. Last heard of in 1528.

Mary and John: A 'galleon' that appeared in 1522 and was last heard on in 1530.

John of Greenwich: A 50 ton ship captured in 1522 and last heard on in 1555.

Primrose: A 160 ton ship built in 1523 and last heard on in 1549.

Minion: A 100 ton ship built in 1523 and later rebuilt and enlarged in 1536 to 160 tons. It was involved in the Battle of the Solent in 1545 and then given to Thomas Seymour in 1549.

Mary Guildford: A 160 ton ship built in 1524. It was primarily used to transport wines from

Bordeaux to the royal wine cellars but did venture to the West Indies between 1524 and 1528 to investigate the commercial aspects in the New World.

Trinity Henry: An 80 ton ship appeared in 1519. Fate unknown.

Mary Willoughby: Appeared in the navy list of 1535, was taken by the Scots in 1536 and recaptured in 1547. She was rebuilt in 1551 increasing her the weight from 140 to 160 tons and carried 23 guns. It carried 146 crew including 14 gunners; sold in 1573.

Lion: A 'galleasse' built in 1536 weighing 160 tons and carrying 50 guns. Listed as a ship from 1549 and was last heard of in 1552 when docked for survey.

Matthew: A 600 ton ship carrying 161 guns. Purchased in 1539, it took part in the Battle of the Solent in 1545 and was last heard of in 1558.

Jennet: This 180 ton 'galleasse' carrying 41 guns was reported to be the first ship built in Portsmouth in 1539 carrying 41 guns. It took part in the Battle of the Solent in 1545 and was converted to a 200 ton 'galley' in 1558 and was last listed in 1578.

Dragon: A 140 ton, 45 gun 'galleasse' built in 1542. Took part in the Battle of the Solent in 1545, listed as a ship from 1549 and was last heard of in 1552 when docked for survey.

Galley Subtle: A 200 ton 'galley' built in 1543 and carried 31 guns. Condemned in 1560.

Pauncy: A 450 ton ship built in 1543, carrying 97 guns. Condemned in 1558.

New Bark: A 200 ton, 53 gun 'galleasse' built in 1543; converted to a 'galley' in 1558 and last heard of in 1565.

Artigo: A 140 ton French prize captured in 1543 and sold in 1547.

Jesus of Lubeck: Purchased from the merchants of Lubeck in 1544.

Marryan: This 500 ton, 63 gun ship was purchased in Hamburg in 1544 and later sold for £400 in 1552.

The Struse of Dawske: Purchased in 1544 and sold in 1551. She weighed 450 tons, had a crew of 250 and carried 39 iron guns.

Mary Hambro: Purchased in Hamburg in 1544, the ship weighed 400 tons, carried 70 guns, took part in the Battle for the Solent in 1545 and was sold for £20 in 1558.

Falcon: Built as a 'pinnace' in 1544, it weighed in at 83 tons and carried 22 iron and 4 brass guns. It took part in the Battle of the Solent in 1545 and was last heard of in 1578.

Swallow: This 200 ton 'galleasse' was built in 1544, carried 26 guns, fought in the Battle of the Solent, was converted to a 'galleon' in 1558, fought against the Armada in 1588 and was last heard of in 1603.

Unicorn: Originally a 36 gun, 240 ton 'galleasse' of French origin, she was captured from the Scots in 1544, listed as a ship from 1549 and was sold in 1552 for £10.

Salamander: Originally given to James V of Scotland by the French king Francis I in 1537, this 300 ton 'galleasse' was a captured at Leith in 1545. It carried 200 crew and 20 gunners. It was used against Scotland in Edward Clinton's invasion fleet of August 1547. It was reportedly condemned in 1559, but may have been destroyed as late as 1574.

Christopher of Bream: This 400 ton ship was purchased in Danzig in 1545, carried 53 guns, renamed as the "Christopher" in 1548 and was sold in 1556.

Mary Thomas: A small 10 ton ship captured in 1545 and last heard of in 1546.

Mary James: A 120 ton ship captured in 1545 and last heard of in 1546.

Mary Odierne: A 70 ton ship captured in 1545 and last heard of in 1545.

Trinity: An 80 ton ship captured in 1545 and last heard of in 1545.

Sacrett: A 160 ton ship captured in 1545 and condemned in 1559.

Mermaid: A 200 ton 'galley' captured in 1545 and listed until 1563.

Hind: An 80 ton 28-gun 'pinnace' built in 1545; listed as a ship from 1557 and sold for £8 in 1557.

Grand Mistress: This 450 ton 'galleasse' was built in 1545, carried 28 guns, fought in the Battle of the Solent, and was listed until 1552.

Anne Gallant: This 450 ton 'galleasse' was built in 1545, carried 50 guns, fought in the Battle of the Solent, and was listed until 1559.

Greyhound: This first vessel to carry the name was a 160 ton 45-gun 'galleasse', built at Deptford, and launched in 1545. She was listed as a ship from 1549, rebuilt as a 'galleon' in 1558 and wrecked off Rye in 1563.

Hope Bark: An 80 ton 'bark' carrying 5 guns, built in 1545 and last heard of in 1548.

George: An 80 ton 'galleasse' purchased in 1546, carried 28 guns and was listed until 1558.

Hart: A larger 'galleasse' built in 1546, weighing 300 tons and carrying 56 guns. She was listed as a ship from 1549, rebuilt again in 1558 and listed until 1568.

Antelope: Launched in 1546, this 'galleasse' was built as a flush decker, had a crew of 200 and weighed 300 tons. She was rebuilt in 1558 as a 'galleon' of 341 tons, gaining a forecastle and a half aft-deck. She was again rebuilt in 1581 increasing her weight to 400 tons. She participated in the campaign against the Spanish Armada in 1588. Rebuilt again in 1618 and now classified as a mid-sized ship of 450 tons, carrying 34 guns. During the English Civil War she was destroyed in 1649 after being raided by parliamentarians.

Tiger: This 'galleasse' was a flush decked ship with no superstructure and heavily armed. Built in 1546, weighing in at 160 tons and carrying 43 guns (6 x 9pdr, 14 x 6pdr and 2 x 2pdr), she was converted to a 'galleon' in 1570. She won the battle honour 'Armada 1588', was used as a floating battery from 1600 and eventually condemned in 1605.

Bull: A 'galleasse' built in 1546, at 160 tons and carrying 26 guns. Converted to a 'galleon' in 1570 and renamed Adventure in 1594.

The Murrian: Was brought into the navy in 1545 and sold out in 1551. She weighed 500 tons, had a crew of 300 and carried 63 brass and iron guns.

The next Bulletin will continue the story of Early English Warships — 1547 to 1603.

RNEBS Highest Academic Achievement Award

RNAESS POAET(M) (QC)

Petty Officer Air Engineering Technician Steven Smith

Steven Smith joined the Navy in 2004 and after completion of Phase 2 training at HMS Sultan undertook Phase 2B training at 771 NAS, RNAS Culdrose. He remained on 771 NAS until Dec 2006 when he joined his first front line Squadron - 849 'A' Flight. He remained on 849 'A' Flight (which shortly after joining decommissioned and became 854 Squadron) until May 2009. He deployed on trips to the Caribbean and America on APT(N), on board HMS Ocean, and on board RFA Argus, on Op Calash.

Steven was selected for promotion to LAET in July 2008, and post completion of LAET(M)QC and LRLC, was promoted in Apr 2010 to Leading Hand. On completing CCSAM and consolidation time at 849 NAS he joined 857 NAS and deployed on four operational tours of Op Herrick, Afghanistan, as an 'M' Trade Supervisor. In July 2014 he was selected for promotion to POAET(M), and after one final deployment, with 857 NAS (this time to Op Kipion), joined HMS Sultan to complete POAET(M)QC in Feb 2015. He was promoted to POAET(M) in January 2016 after successful completion of POAET(M)QC and SRLC, and after a short time on 771 NAS, joined 849 NAS Palembang Flight as the AEOW.

Steven will hopefully see out the only remaining Sea King Squadron and allow him to progress into the future of the Royal Navy ASaC capability, Crowsnest.

Below: Prize decanter presented to Steven Smith by RNEBS Vice President Mark Stevens

Photo: PO(phot) Nicola Harper

Solution to Crossword #001

Here are the answers to Crossword Puzzle #001. They were all ships names, past and present. The answer to the secondary task was 521.

I received no correct answers although some were very close, so unfortunately there will be no prize offered this time. Better luck with #002.

A	N	T	E	L	O	P	E		P	O	R	T	L	A	N	D			T		A			M		B				
C									E			I		N					R		N			A		A			D
H		S	O	B	E	R	T	O	N			R		D				W	E	S	T	M	I	N	S	T	E	R		
I			D			Y			E		T	E	R	R	O	R			N		R			C		T		E		
L			I			E			L			L		O					T		I			H		L		A		
L	E	A	N	D	E	R			O	G	R	E		M				C			M			E		E		D		
E		C				O			P			S	H	E	F	F	I	E	L	D		G		S		A		N		
S		A				S			E			S		D				N				R		T		X		O		
		S	U	C	C	E	S	S						A				T				E		E		E		U		
		T														T	R	U	M	P	E	T	E	R				G		
		A			C					W				B				R				N						H		
	P				E	S	K	I	M	O		C	H	U	R	C	H	I	L	L		A				S		T		
R	O	D	N	E	Y					T				L				O								A				
	R		I		L	O	C	U	S	T		B		W		V	A	N	G	U	A	R	D			B				
A	P	O	L	L	O					O		L		A		I					L					R				
	O		E		N			C	E	N	T	A	U	R		C					B		B	I	T	E	R		
	I								C			Z		K		T					I		R		Y		A		
A	S	T	E	R					H			E			B	O	X	E	R		O	C	E	A	N		C		
	E				A	M	A	Z	O	N		R				R					N		D		E		E		
														C	L	Y	D	E					A				R		

1	Across	A	1
2	Across	P	16
10	Across	S	19
13	Across	W	23
14	Across	T	20
15	Across	L	12
17	Across	O	15
19	Across	S	19
21	Across	S	19
22	Across	T	20
27	Across	E	5
28	Across	C	3
30	Across	R	18
32	Across	L	12
34	Across	V	22
36	Across	A	1
37	Across	C	3
39	Across	B	2
42	Across	A	1
43	Across	B	2
44	Across	O	15
45	Across	A	1
46	Across	C	3

1	Down	A	1
2	Down	P	16
3	Down	T	20
4	Down	A	1
5	Down	T	20
6	Down	A	1
7	Down	M	13
8	Down	B	2
9	Down	D	4
11	Down	O	15
12	Down	R	18
16	Down	A	1
18	Down	C	3
20	Down	G	7
23	Down	C	3
24	Down	W	23
25	Down	B	2
26	Down	P	16
29	Down	S	19
31	Down	N	14
33	Down	B	2
34	Down	V	22
35	Down	A	1
38	Down	E	5
39	Down	B	2
40	Down	T	20
41	Down	R	18

A Request for Information

The Queen Elizabeth Class Aircraft Carriers are the biggest and most powerful warships ever constructed for the Royal Navy. The first of class, HMS Queen Elizabeth is expected to enter Portsmouth for the first time during the summer of 2017 . The RN/RM would like to hear from anyone who served on board the previous HMS Queen Elizabeth which was commissioned in 1913 and decommissioned in 1948. Please forward your name and service number to NAVYPOL-QECFEPENGAGEMENTS@mod.uk copied to NAVYPOL-QECFEPPM@mod.uk if you served on board or know of someone that did.

The Robbins Memorial Essay Prize

"Have you a story to tell, a simple answer to an engineering problem or an amusing anecdote?" Yes, you have seen these words before in the NER. If the answer is yes and you would like the chance to win a cash prize and have a few thousand well penned words together with a couple of pictures, then send what you have to the Bulletin editor and you may get your name in print. MS-Word and JPG's please.

Austal launches support ship for Royal Navy of Oman

Australian Engineering Success

Australian shipbuilder, Austal has completed the first of two 72.5m High Speed Support Vessels (HSSV's) being built for the Royal Navy of Oman (RNO). The future RNOV *Al Mubshir* (pennant number A10) was successfully launched after 13 months of construction and fitout at the company's Henderson, Western Australia shipyard. Austal was awarded the US$124.9 million contract for the design, construction and integrated logistics support of the two HSSV's in March 2014 and construction commenced in August 2014.

Austal is a global defence prime contractor and a designer and manufacturer of defence and commercial ships. For more than 27 years Austal has been a leader in the design, construction and maintenance of revolutionary ships for Governments, Navies and Ferry operators around the world. More than 255 vessels have been delivered in that time. These include multi-mission combatants, such as the Littoral Combat Ship for the United States Navy and military high speed vessels for transport and humanitarian relief, also for the U.S. Navy.

Austal also designs, constructs, integrates and maintains an extensive range of patrol and auxiliary vessels for government agencies globally, including the Cape Class Patrol Boat Program for Australian Border Force. Defence vessels are designed and constructed in Mobile, Alabama and in Henderson, Western Australia. High performance aluminium vessels have long been at the heart of Austal's research and development.

Based on the proven Expeditionary Fast Transport platform, the HSSV offers a range of capabilities to support naval operations, including helicopter operations, rapid deployment of military personnel and cargo, search and rescue operations, humanitarian aid and disaster relief missions.

This first HSSV RNOV Al Mubshir (S11), was handed over to the Royal Navy of Oman in May 2016 and the second vessel, RNOV Al Naasir (S12), was delivered in September 2016. The two-ship programme is intended to bolster the RNO's sealift capabilities .

The ships, which features a catamaran design, have an overall length of 72.5m, overall beam of 18.2m, and a draught of 3.2m. Powered by four MTU16V 4000 M93L diesel engines, the ships have a top speed of 35 kts and a standard range of 2,150nm at 12.5 kts. The engines burn 1,135.7 litres of fuel an hour, and the propulsion systems includes four Rolls Royce 80S3 water jets. The vessels can accommodate a crew of 69 with space for 250 civilian personnel and have a military lift capacity of 350 tonnes.

The HSSV will be armed with one 20mm gun as a primary weapon and four 12.7mm general purpose machine guns. The ships are fitted with one electro optical surveillance system to provide identification and recognition of maritime threats.

Visit to the National Memorial Arboretum

The re-dedication of the Engineers Memorial

The event on Sunday 2nd October 2016 was conducted in brilliant sunshine that showed off the new wording on the front face of the memorial stone very well.

Opening address by RNEBS President, David Woollard

"Ladies and gentlemen, as the current president of the Royal Naval Engineers' Benevolent Society it is my privilege and pleasure to welcome you all to the National Memorial Arboretum for this 5th Anniversary rededication of the RNEBS Memorial.

How the Arboretum has changed in the five years since we met here before. The arboretum aspect, the trees themselves have noticeably matured over this time and now add more scale and structure to the whole site.

Significant new memorials of all shapes and sizes continue to be commissioned and installed by all manner of organisations, making there ever more to see, to appreciate and to pay our respects to. And of course the opening of the new visitor centre in a couple of weeks' time will be a fitting development. Other Artificer memorials, the Fisgard Association and the Old Caledonia Artificer Apprentices Association benches and plaques are close by.

Our own memorial has stood the test of time well apart from the somewhat shallow lettering here on the front face and the fact that many visitors had no understanding of who the engineers were who are commemorated here. We have therefore reworked the front face as you see and it now clearly states that this memorial is to Artificers. The rear face has been made plain again and we are considering the inclusion of the RNEBS crest in that position.

I would like to thank Chris Heaver for organising this visit and to extend particular welcome to our principal guest Captain JJ Price Royal Navy, an ex-ERA and RNEBS member.

We are also very pleased to welcome Pam Lloyd, widow of David Lloyd who died in January, along with their son and his partner and David's sister; welcome to you all.

Our rededication is made complete through the attendance of Reverend Canon Paul Bentley, an ex Shipwright, who will shortly conduct our service. Our thanks to you Paul and welcome to your guests. After the service you may explore at your leisure but please foregather back at the Marquee for lunch at 1300. After lunch you are free to explore until the closing time of 1630 when light refreshments will be available in the Marquee."

Photos supplied by Tony Worsfold

Address by Captain JJ Price RN (Rtd)

Mr President, fellow members and guests.

We are gathered for a service of Remembrance for Artificers who lost their lives in the service of their country and to re-dedicate this fine memorial stone, placed here five years ago, after, I'm sure, considerable discussion, effort and organisation by the Society, and dedicated to Artificers past, present and future.

I feel very privileged to have been invited to say a few words and perhaps I might present my credentials for being here. I joined Fisgard in January 1956, an important year in that we wore black caps for the last time and it was announced that our No 1 uniform from then on would have gold buttons. On being selected as an ERA, I, along with many others, was persuaded by CERA Morey - he had been my 2 class craft instructor - to join the Society.

I completed my apprenticeship and time as a 5th class before passing the Admiralty Interview Board to join Dartmouth for 2 terms as an Upper Yardman. So at the end of 1961 was commissioned as an Acting Sub Lieutenant (E) on to the General List. In 1994 I retired as a senior captain, a rank slot and pay grade now occupied by Commodores.

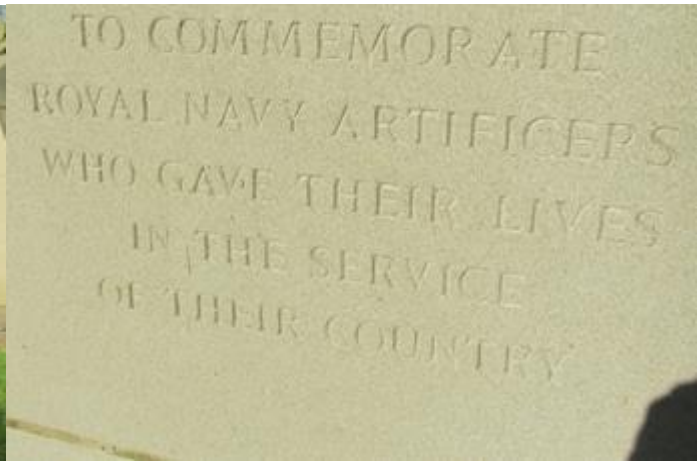
It is 100 years since the battle of Jutland, the meeting of two battle fleets the sheer size of which is now difficult to comprehend given the size of our present navy. Notably, among the many ships of varying sizes lost or considerably damaged that day, three battle cruisers blew up with total loss of life except for a handful of survivors from the one thousand two hundred officers and men in each ship. Those who have served in big ships such as carriers, for instance, would appreciate the huge loss of Artificers in just those three ships.

Some figures found by Mark Stevens, and there seem to be no certain figures, gave Artificer losses in WW1 as about 1100 and those in WW2 as about double that. Surprisingly, losses between the wars and since WW2 were also considerable. Some of you might have forebears or friends or comrades among the fallen and this re-dedication for you will be particularly special.

But it is not only the fallen that we might honour today but also all those generations of Artificers who have toiled through the years to keep ships running, in conditions of heat and noise in the case of ERAs, that has to be experienced to be properly appreciated.

As we look to the future, now is also a very significant time in that the name Artificer no longer exists in the Royal Navy and, to my mind, it is not only a change of name, which perhaps would not be too contentious, but a complete departure from the system of apprenticeship training put in place by Admiral Jacky Fisher in 1903 to ensure that the fleet had the best trained engineering specialists, second to none, to maintain and operate increasingly complex machinery. That was the system we grew up in, wearing our gold buttoned uniforms and knowing with certainty that we were a bit special and different.

May I now return you to our Padre, the Reverend Canon Paul Bentley, himself an ex Artificer, to continue to lead us in the Remembrance service.



Artificer 150

http://www.artificer150.co.uk/

The website is now open for business

There has been a very good response so far regarding the Gala Dinner to be held in May 2018, with over 450 people expressing an interest in attending and over 300 people buying tickets. This is a limited number event that will never be repeated, well not in our lifetimes. It is first come first serve, so get your tickets sooner rather than later. Keep checking the website for updates and do let us know if there are any errors or omissions.

Table seating will be allocated by nominated groups and there is a list of group coordinators on the website. So let your organiser know if you wish to be seated with your classmates. The remainder will be allocated by class entry where possible. If we do not have your class entry details then your table allocation will be random. The table seating plan and table allocations will be posted on the website once we have sold all of the tickets. If you then have any objections, then let us know via the website messaging system.

We hope you see as many of you next year for the big event.

Crossing the Bar

Those members who have passed on since Sept 2016.

Dennis John Robinson, 09633. Joined the Society July 1967, died 05 August 2016.

Roy Ian Galvin, 08576. Joined the Society January 1964, died 28 September 2016.
Widow: Mrs Deborah Galvin.

Brian Hale, 12550. Joined the Society Jan 1983, died 08 November 2016.

Roy Ian Galvin

Roy served in the Fleet Air Arm for 24 years. In 1963 at the age of 16 he joined HMS Fisgard as an Artificer Apprentice and became an Aircraft Artificer in 1967. Roy then served in Osprey, Daedalus and at Royal Arthur. In 1979 Roy became a Chief Aircraft Artificer.

In October 1979 Roy sailed on HMS Endurance on its journey to the Falkland Islands and Antarctica and was responsible for the maintenance of its helicopters. He wrote home regularly and in one of his letters excitedly reported: "David Attenborough, the famous man who made that series Life on Earth, is on board ship filming for a new series which may be called Planet Earth." Roy returned home in May 1981.

After the Endurance, Roy continued his career at Daedalus, Heron and then on HMS Illustrious. Before retiring in 1987 Roy gained an Honours degree in Maths and Computing with the Open University. Following his naval career Roy went on to work as a Project Manager at Scottish and Southern Electricity until he took early retirement in his mid-fifties. He had many interests in his retirement including walking his beloved Standard Poodles and as a car enthusiast enjoyed attending Goodwood.