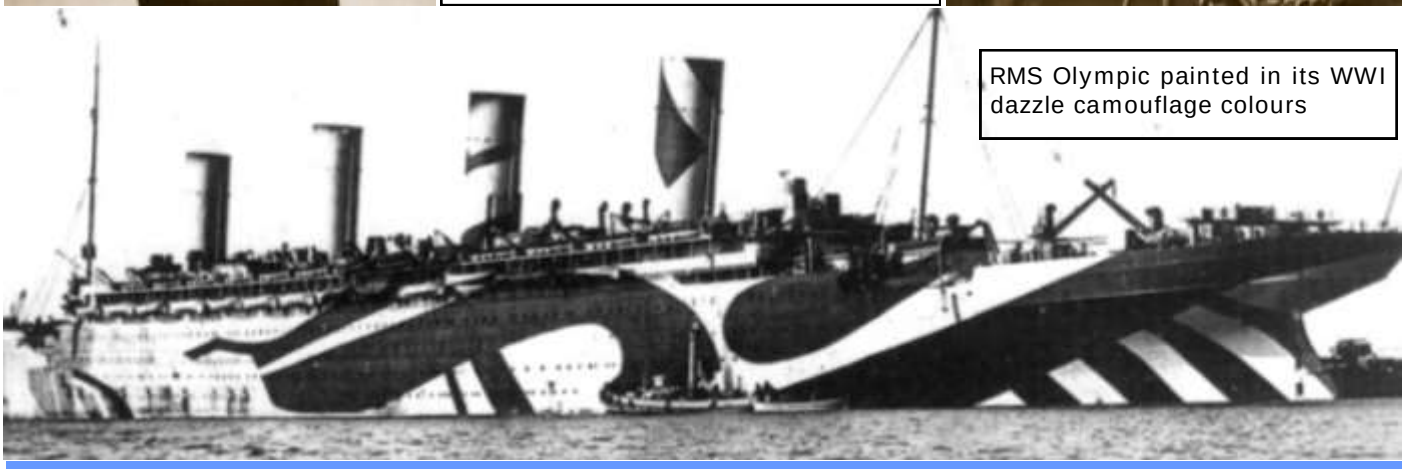
# Society Members' Bulletin

## 1914—2014: 100 year anniversary of the start of the Great War

The first battle of the First World War was that of Heligoland Bight on 28th August 1914. The Harwich Force was commanded by Commodore Reginald Tyrwhitt (right) and supported by Admiral David Beatty (left). Victory was declared by mid afternoon with the sinking of three German light cruisers and one destroyer. The battle took place only 23 days after Britain's declaration of war against Germany. More details can be found on page 3.



RMS Olympic painted in its WWI dazzle camouflage colours

April 2014
Issue 9

Royal Naval Engineers Benevolent Society

Founded in 1872

# Society Members' Bulletin

April 2014

Well chaps, here is Bulletin number 9. It seems to be proving popular from the feedback I am receiving, so please keep the dialogue going. The more information you can send me, the less research and work I have to do. And if you can provide a couple of pages and some photographs and diagrams, you could be in with a chance of winning the annual Robbins Memorial Prize (details on the back page) if it is deemed to be of engineering interest.

So it is the 100th anniversary of the start of the First World War or the Great War as it was known, and was supposed to be the war to end all wars. As the first naval engagements did not start until August, I have not included much of historical importance in this issue, and the fact that I have a backlog of articles and snippets that I wanted to get in.

The Navy's latest attempt to change engineering careers, Project Faraday, seems like a thinly veiled attempt to introduce some artificer like qualities, probably because the powers to be have realised that they cannot run engineering departments without skilled people who can analyse, diagnose and come up with a course of action to rectify any defects. Does this sound familiar?

And did you know it is the 350th anniversary of the founding of the Royal Marines, or as it was known back in 1664, the Duke of York and Albany's Maritime Regiment of Foot.

Regards

Mark Stevens

Editor, Society Members' Bulletin

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On August 28, 1914, the first major naval battle of the conflict breaks out between British and German ships in the North Sea, near the northern coast of Germany in a partially enclosed body of water known as Heligoland Bight that contained several bases of the German High Seas Fleet. However the German fleet had rarely ventured far from port, so it was planned by Commodore Roger Keyes that Commodore Reginald Tyrwhitt would lead a small fleet of British ships into the bight in order to lure German ships to chase them out to sea to where a larger British force, commanded by Vice Admiral Sir David Beatty, would be waiting to confront them.

At 7:00 am, Tyrwhitt's squadron began the operation by sinking two German torpedo boats. As the British attack had not caught the German fleet entirely by surprise, its defence was ready, and Tyrwhitt soon found his men outgunned by a German force, who used the thick fog hanging over the bight to partially conceal themselves and fire unexpectedly on the British ships. At 11:25 am, Tyrwhitt called for immediate assistance and Beatty's First Battle Cruiser Squadron rushed to his aid from over 30 miles away, reaching the bight at 12:40 pm. The powerful British squadron subsequently sank three German cruisers and damaged three more, causing a total of 1,200 German casualties. The Royal Navy, on the other hand, lost only 35 sailors, and none of their ships. Thus ended the first naval venture of the war.

# How to Dazzle the Enemy

Dazzle Camouflage was a camouflage paint scheme used on ships, extensively during World War I. This technique did not conceal the ship but made it difficult for the enemy to estimate its type, size, speed and heading. Its main purpose was to confuse rather than hide.

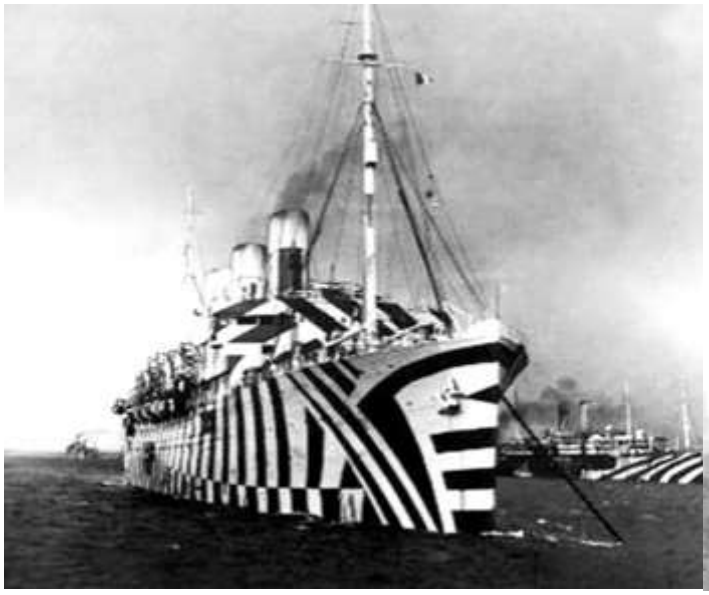
The father of dazzle camouflage, Norman Wilkinson, was a marine painter, illustrator and poster artist , serving in the Royal Navy Volunteer Reserve. His idea was not to make ships invisible, but to make it hard for *U*-boat skippers to precisely measure the speed, direction, and future position of any ships he was intending to blast with a torpedo. He convinced his superiors to allow him to test his idea. When the test went well, Wilkinson was told to proceed and hired Vorticist artist Edward Wadsworth to be a port officer in Liverpool, England, and oversee the painting of the dazzle ships.

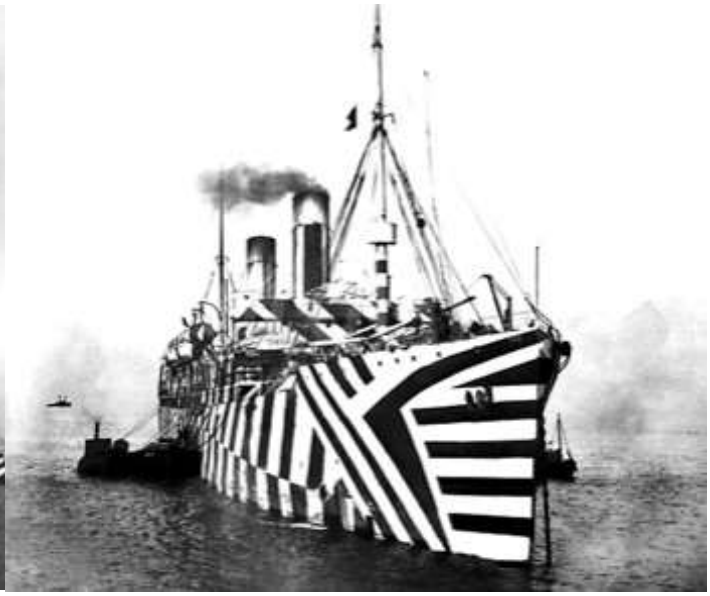
The dazzle paint served to deceive the eye and cause the U-Boat commander to misinterpret the speed, direction or size of a ship. By simulating a false bow towards the stern of the ship, painters could make a vessel appear to be moving in the other direction. Several Cunard liners, repurposed for troop-ship duty, used a distorted checkerboard pattern, which made the ship appear to be steaming away when viewed from directly to the side.

Women artists from London's Royal Academy of Arts dazzle-painted small scale models for optical studio testing before the design for each warship was finalized. It would be impossible to make this kind of stuff up, though perhaps it's not surprising that historically it's been standard practice for artists and designers to devise wartime camouflage. In the end the military effectiveness of dazzle painting was uncertain and was obviously ineffective against the technological aspects of a submarine attack, but did end up causing the U-Boat commanders to take a longer period of time in setting up their attack, giving the ship precious time to change course or attack and had the effect of being very good for ship's morale, and it of course it produced some surreal and beautiful ships.

In 1915, the Admiralty requisitioned the Olympic and converted it into a troop ship, removing all of its peacetime fittings and installing 12-pounders and 4.7 inch guns. In 1917, the Hired Military Transport (HMT) Olympic was fitted out with 6 inch guns and received its dazzle camouflage colours (see front cover).

Every camouflaged ship, even those from the same class or batch, were uniquely painted. In the bottom two photographs, the *SS Osterley* on the left may look identical to the *SS Empress of Russia* on the right, but closer inspection will reveal that they are not the same.





# Royal Naval Artificer Training Establishment (RNATE)


The Royal Navy Artificer Training Establishment (RNATE) is an organisation I don't remember coming across before and I suspect not many of you have either. This is a branch of the Royal Navy that has, or had, a responsibility for Artificer training, now known as Engineering Technicians. Some of these bases were opened in response to the outbreak of WW2 in 1939.

The picture on the right is a Sweetheart Badge that was bought by servicemen for their nearest and dearest as a reminder when they went away on service.

The principle RNATE shore establishments;

HMS Fisgard: General artificer training establishment that closed in December 1983.

HMS Caledonia: Marine Engineering Artificer training at Rosyth, Scotland. Commissioned in 1939 and closed down in 1985.

HMS Condor – Aircraft Artificer training carried out at the former Royal Naval Air Station at Arbroath, Scotland. The site was first established in 1938 as RNAS Arbroath with Condor Barracks dating from 1940. The name was changed to RM Condor in 1971 when it became a base for 45 Commando.

HMS Collingwood – Electrical Artificer training. Now the Weapon Engineer Training Group (WETG) facility. This site opened in 1940 to train "Hostilities Only" seamen, however in 1946, the Naval Electrical Branch was formed and Collingwood became its training establishment. 1948 was the year when the Electrical Artificer Apprentices moved from Caledonia.

HMS Aerial (Daedalus): Radio & Aviation Electrical Artificer training at Lee-on-the-Solent, Hampshire. The HM Naval Seaplane Training School was established and opened in 1917, it was transferred to the RAF in 1918 and returned to naval command in 1939. For further details of this fascinating and interesting look at the history of the site, follow this link — www.fleetairarmarchive.net/daedalus/History.html. In 1948, HMS Ariel was the Air Electrical School at Warrington in Lancashire and was made up of 3 camps. South Camp was for Air Electricians, West Camp for Basic Electronics and Air Radio and East Camp was for Air Radar. In 1957 the school moved to an Army camp just outside Winchester. Final move was to HMS Daedalus at RNAS Lee-on-the-Solent. After that all Naval Electrical/ Electronic training was housed at HMS Collingwood. Electrical and Radio Electrical Artificer Apprentices (Air) go on to H.M.S. ARIEL, the Royal Naval Air Electrical School near Winchester, Hants.

HMS Raleigh – this shore establishment at Torpoint in Cornwall was commissioned in 1940 and is now a major training centre for Royal Navy recruits. HMS Raleigh became a main training base for Artificers from the early 1980's when Fisgard was closed.

# General Secretary's Report

By Cliff Fiander

Progress on the proposals for a "Safety through Engineering" award has stalled somewhat during the change of CSO(E) and is now taking a back seat to the work that is going into Project Faraday.

The project, the promotional flyer for which is produced over the page, aims to address the shortfalls in engineering support that the present engineering personnel are able to provide and the dissatisfaction of many of those personnel with their career prospects. It would appear that the project will lead to the creation of an "artificer"- like technician (although the 'A' word will never be used) endowed with all the skills, knowledge, flexibility and pride that so many of us remember, and that the Society continues to advocate.

The following are a few points about the Project, albeit from a GS ME perspective rather than MESM or WE. They are following a very similar path although the fine details will of course be different.

Faraday will see an increase in skill of hand training provided to ETs during their Phase 2 Training at Sultan, as part of an overall increase in course length. Current intention is for this to roll out ~May this year

- LETs will receive a longer course to prepare them to act effectively as Deputy Section Heads. Roll out ~May 15. This will have strong echoes of the old Mech's course, with the intention that an LET (as opposed to a POET) will be fully technically trained, prior to taking up their sea going billet as a LET.
- POETs course will be much shorter, and administration based, i.e. "How to run your Section."
- The WO2 rate will be phased out with most billets becoming a WO1 but with some reverting to CPOET.
- There will be a fast track scheme, which individuals can be selected for prior to joining, but can also be entered and left at various points through an individual's career. This will enable a "gifted" recruit to reach POET in 5 years rather than the present 10.
- There will be streaming of MEs into ML and EL.

Some thoughts on where Faraday may lead:

- PQEs will return replacing the OPS Board. In reality, this is almost a reflection of what was being seen in the Fleet, where a lot of OPS boards felt more like an old PQE for advancement, rather than checking the rating was competent in their current rate.
- There will be a PQE and a Fleet Board for WO1, probably headed by a Cdr/SMEO. On completion of WOs course, there will be a certificate of some form awarded, which may or may not have an association with the word 'Charge'.

The Branch Badges will return with that for the MEs being a 3 bladed propeller, but maybe this time on its docking marks

Generally, Faraday's thrust is to improve the Navy's ability to Operate, Maintain, Diagnose and Repair, and everything appears to be written around those 4 words. There is a drive to get away from relying on the manufacturer's rep to carry out repairs and to regain the skills that appear to have been lost. To support this aim training is being uplifted and, to an

extent, front loaded. This will give junior MEs a greater skill-set earlier in their careers and the ability to build on that using practical experience at sea. (Sound familiar?)

Clearly there is a great deal of effort going into the Project and such efforts deserve the Society's support. The Project's general thrust is in the right direction, there is justifiable optimism in its outcome and we can be hopeful for the long term future of Naval Engineering.

The cynics amongst us may ask that whilst the engineers are getting on with fixing the defect, who broke the system in the first place and how can they be prevented from doing so again?

Comments on any aspect of engineering in the Fleet are, as always, welcome and can be addressed to me directly via the Society's website, e-mail to cliff.fiander@mail.com or by letter to:

The General Secretary, Royal Naval Engineers' Benevolent Society, 33 Goldfinch Road, Melksham, Wiltshire SN12 7FL

## The 1562 Statute of Artificers

In 1562, an Act of Parliament, introduced legislation that sought to restrict wages, freedom of movement and to regulate training. One of the 48 provisions was the control of artificers, labourers, handicraftsmen, servants of husbandry and apprentices. This Elizabethan proclamation created a national system of technical training, with controlled occupational entry, standards of workmanship and trade secrets (Lane, 1996). The new law replaced the medieval system of absolute and total control by the guilds and can be looked as a Tudor breakup of the 16th century union organisations.

During Elizabeth's reign, the population of England rose from 3.0 million in 1558 to 4.2 million in 1603, a rise of 40% in 45 years. At the same time food prices rose by about 75% and manufactured goods by about 45%. So it can be seen that with a rapidly expanding population and spiralling prices that there was a need for cope with these social problems so this Act could also be viewed as a government master plan to restrict the mobility of labour and for promoting national development.

However the attempt to regulate labourers was not a new concept even back in those days. Due to the rapid depopulation in England after the Great Plague of 1348, Edward III introduced *The Ordnance of Labourers* in 1349, a year later *The Statute of Labourers* fixed the wages of artisan and labourers and four years later there were *The Regulations for the Trade of Masons*. 1360 saw the *Prohibition of Annual Gatherings and in* 1369 the seemingly ridiculous statute, *Artificers not to Import Wine*. In 1377, during the reign of Richard II, *Restricted Freedom of Serfs* was introduced, in 1402, Henry IV introduced *Prohibited Hiring by the Week*, in 1416, Henry V *Limited Penalties for Excessive Wages*. Successive kings continued to limit wages for free and rough masons and master carpenters and eventually in 1548, Edward VI introduced a statute that prohibited meetings for the purpose of fixing wages and determining qualifications to work.

The Statue of Artificers remained on the books until 1819, but had been mainly ignored for over a century. It was repealed primarily because of the structure of contact law, devised by Lord Mansfield in 1783 and because of groups of workers (London tailors) who sought to use the judgement to collectively raise their prices.

# Project Faraday

## PROJECT FARADAY - SO WHAT IS IT ALL ABOUT?

We need the confidence to be able to keep our ships on task, away from home in all environments during peace, crisis and war. Project Faraday is about giving us the tools to do this. It aims to ensure that we all have the relevant skills for the Navy of today and in the future. The Project Faraday Team is looking at seven different improvements which are explained in this flyer. Collectively they will deliver better training, employment and career development. The detailed work is not yet complete, but information will be announced as policy and guidelines are established. This is your opportunity to shape your branch, if you have any questions or views on Project Faraday then feel free to contact the project team, their details are on the back of this flyer.

### Individual Competence Framework (ICF)

- Designed to set the competence requirement for the Branch; to Operate, Maintain, Diagnose, Repair (OMDR) and Mentor, at all rates and for officers up to sea charge assignments.
- Training courses will be restructured to deliver ICF requirements.
- Replaces the OPS task based requirement, removes pay Qualification Point (QP) and mandatory OPS checks.
- PPE and PQEs will replace OPS checks to demonstrate professional readiness for promotion.
- Taking a PPE or PQE is an individual's choice, but is the route to realise promotion aspiration.
- Accreditation through formal training and service experience.

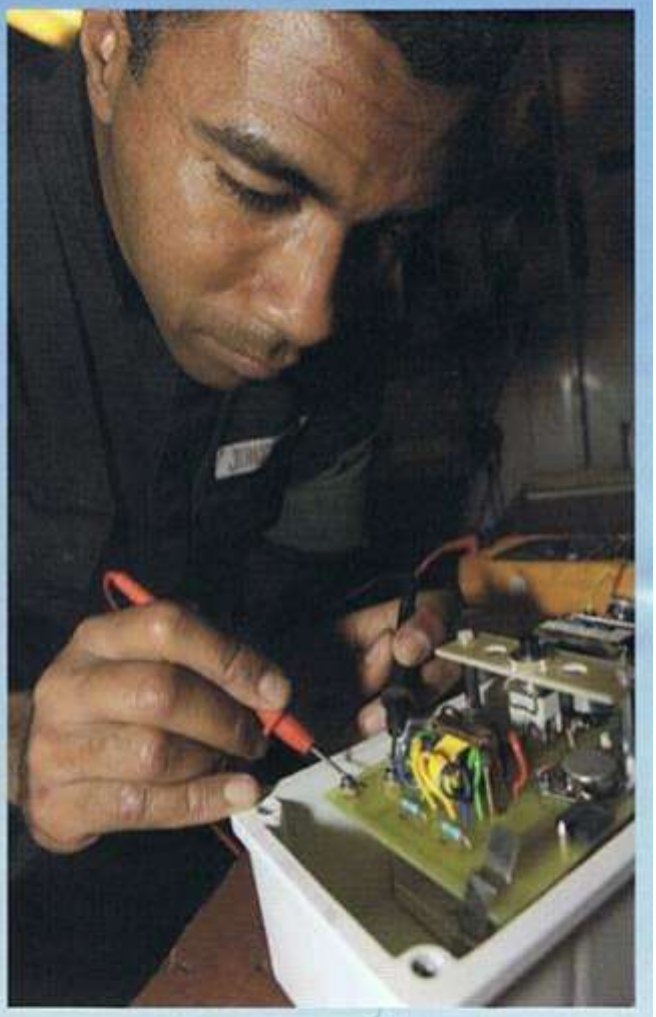
## HOW IMPORTANT IS PROJECT FARADAY?

*To support the Future Navy Vision, we must develop the technical capability of the Naval service, properly supported by a professional, qualified, operationally experienced engineering cadre committed to delivering battle winning capability. From my visits and discussions with you, it is clear that across the General Service Engineering Branch, there are several areas on the people front requiring attention if we are to deliver our part of the 'vision'. Project Faraday will drive co-ordinated change in training and employment across the Branch. All of us must play our part.*

**Rear Admiral Simon Lister CB OBE CEng, FIMarEST**
**Chief Naval Engineer Officer (CNEO)**

**Revised Career structure (single QC)**

- Career courses deliver skills and competences earlier.
- Increased practical engineering content in ETICC and LETQC, including diagnose and repair skills.
- POETQC reduced in length and focused on section head managerial responsibilities.
- Career courses principally delivered at LET, much less time on course as a SR.
- New courses will be accredited.



**Group Streaming (ME x 2, WE x 3)**

- Streaming of training and employment at sea.
- Career development better focused on developing depth of skill within a stream, rather than dilution through breadth.
- MEs streamed ML or EL.
- WEs streamed Comms/IS, Sensors and Weapons.
- Implementation reflecting the trials in HMS PORTLAND and HMS LANCASTER.

**Fast Track (FT)**

- Provides a faster route for advancement for the more able and ambitious.
- Use of RT scores will identify candidates at careers office.
- Several points of entry maximise flexibility in service.
- Interim scheme applies to those in service now.
- Enables earlier identification and selection of UY and SUY candidates.

*We are all engineers and technicians who want the pride, satisfaction and recognition that comes from being able to deliver operational engineering anywhere in the world, often in challenging environments. It is what we do best. Project Faraday offers us a real opportunity to make our Branch better by giving you the right training at the right time, and an interesting and demanding career which meets your aspirations. The improvements we will all see are not only common sense, but also what our Branch needs today and for the future.*

**Captain Jonathan Fry RN**
**Chief Staff Officer (Engineering) Surface Ships**

**WO employment**

- Formal definition of the WO competence requirement in the ICF.
- Introduction of a Fleet Board PQE to formally award a WO Charge Qualification.
- Review of WO employment to ensure we have our skilled WOs in the right jobs.

**PCP rollout to shore positions**

- Employment ashore that complements sea going roles.
- Shore employment that matches the competence requirement of each rate.
- Ensuring we have sea/shore ratios in balance.

**Journeyman's Time (JT)**

- JT competencies included in the ICF.
- Shore employment in Base Port to develop practical skills and competencies, through delivery of waterfront engineering support.
- Work will be targeted at your SQ and form part of ICF.

**Key Dates**

- Q4 2013 Guidance and policy for PPE released.
- Q4 2013 Interim Fast Track policy issued.
- Q4 2013 ICF published, log books issued.
- Q1 2014 ICF and PPE/PQE replaces OPS.
- Q1 2014 commence streaming EGS personnel.
- New ET and LET Career Courses commenced by Apr 2015.

If you have any thoughts, views or comments on Project Faraday then we want to hear them.

You can either contact WO1 ET(ME) Sharky Ward (Project IC co-ordinator)
**T** 023 9262 8981 **Mi** 93832 8981

Or via e-mail at the following address:

**DII** NAVY PERS-EGS CAMPAIGN MAILBOX (MULTIUSER)

**E-mail** navypers-egscampaignmailbox@mod.uk

## New Element Discovered At Imperial College !

The heaviest element known to science was recently discovered by physicists at Imperial College. The element tentatively named Administratium, has no protons or electrons and has an atomic number of 0. However it does have 1 neutron, 125 assistant neutrons, 75 vice neutrons and 111 assistant vice neutrons. This gives it an atomic mass of 312. These 312 particles are held together by a force that involves the continuous exchange of meson like particles called morons.

Since it has no electrons, Administratium is inert. However, it can be detected chemically as it impedes every reaction that it comes into contact with. According to the discoverers, a minute amount of Administratium caused one reaction to take over four days to complete, when it would normally occur in less than one second.

Administratium has a normal half-life of six months, at which time it does not actually decay, but instead undergoes a reorganisation in which assistant neutrons, vice neutrons and assistant vice neutrons exchange places. Some studies have shown that the atomic weight actually increases after reorganisation. Research at other laboratories indicates that Administratium occurs naturally in the atmosphere. It tends to concentrate at certain points, such as large corporations, government departments and in particular Educational establishments such as Imperial College. It can even be found in the newest, best maintained or refurbished building.

Scientists point out that Administratium is known to be toxic at any level of concentration and can easily destroy any productive reactions where it is allowed to accumulate. Attempts are being made to determine how Administratium can be controlled to prevent irreversible damage, but results to date are not promising.

## The Cost of Light

How many of you are still using old style incandescent (filament-burning) light bulbs at home? As you may have noticed over the last couple of years, it is getting harder to source the larger wattage bulbs as government legislation is restricting their manufacture and trying to get people to use low energy devices instead. However, if you want to really reduce your energy consumption you need to switch to LED bulbs and although they do cost more you will save on the running costs.

I did a survey of my house last year and worked out that the 60 bulbs I have running off of the upstairs and downstairs lighting circuits (that includes 4 x 28w energy saving bulbs), consume 2,668 watts if they are all switched on at the same time. This is approx. 11.12 amps and pushing the limits of the two 5A circuit breakers. Replacing them all for long life LED's has reduced this figure to 274.5 watts—1.14 amps, a reduction of 90% in energy consumption. The other advantage is that you can get LED bulbs in the normal shapes—standard, candle and reflector with all of the various fittings, E27, E14, B22, B15, GU10, G9, GX53 etc. LEDs also produce very little heat, showing that most of the energy is used to provide illumination.

I have tried a variety of energy saving and halogen replacement bulbs over the years but I have found that the higher wattage varieties do not seem to last very long.

# The Electromagnetic Rail Gun

Think of a gun system that does not have to use a charge to move a bullet, shell or warhead vast distances. How else could you move a mass through the air without using some kind of mechanical energy? The answer is electricity, or rather electromagnetic energy.

Railguns consist of two parallel metal rails, between which a projectile held in an armature is loaded, completing a circuit between them. A massive electrical current of the order of one million amperes is applied, creating an electromagnetic field, which in turn produces a force that accelerates the projectile along the rails.

A railgun offers a number of potential advantages over traditional explosive projectile weapons. The accelerating force is applied to the projectile for the entire time the projectile is between the rails of the launch device, as opposed to explosive forces which, however powerful, have a limited duration.


This means much higher velocities can be reached than can be achieved through explosive forces, potentially Mach 10 at sea level, which is more than three times the muzzle speed of an M16 rifle. This could result in a projectile having a range of 220 miles, which is about ten times more than any other large gun currently in use today.

Railgun projectiles are generally non-explosive, relying on their enormous speed to destroy the target and thus reducing the risk of a fire on board a ship, and comparatively small and lightweight, so they can be more readily transported and stored. The kinetic energy they deliver could do as much damage as a Tomahawk missile, enabling them to travel clean through a ship.

High speeds mean projectiles are much less affected than conventional weapons by factors such as wind, allowing them to retain pinpoint accuracy across a large distance, rather than needing on-board trajectory correction, making them considerably cheaper.

The principle of using an electromagnetic force to propel projectiles at high velocity has been

around since World War I, when French inventor Louis Octave Fauchon-Villeplee invented an electric cannon in 1918, based on the principles of the linear motor. German scientists also designed, but never developed, an electric anti-aircraft gun during World War II.

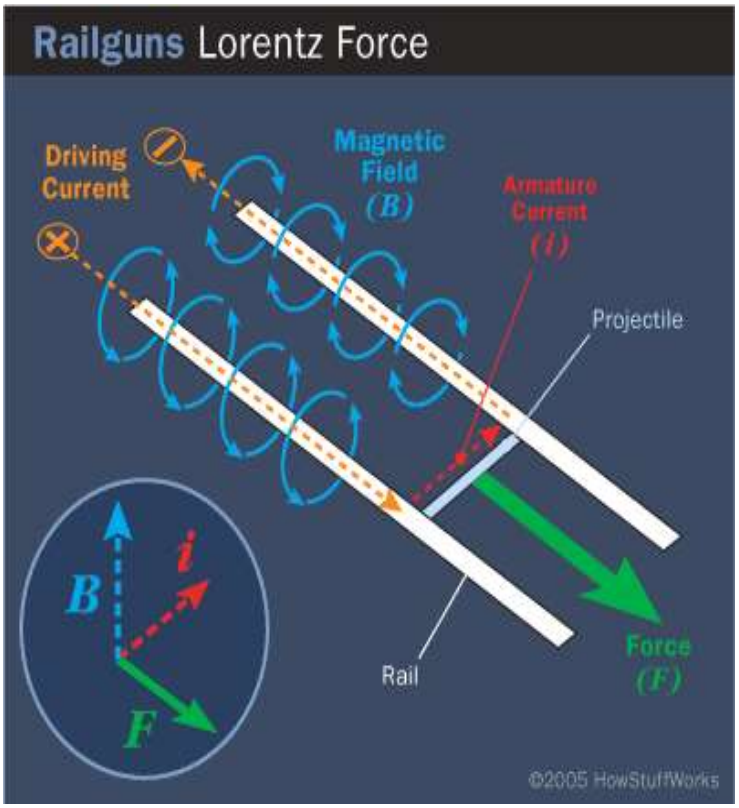
To give an idea of the potential power of modern systems, in December 2010 General Atomics set a new world record during a test-firing of its Blitzer electromagnetic railgun. The company gained experience of powerful electromagnetic technology through work it carried out to support the nuclear industry, having worked on electromagnets for the International Thermonuclear Experimental Reactor (ITER).

The projectiles, which were subjected to acceleration levels exceeding 60,000g, reached speeds of Mach 5. The force with which the projectiles left the muzzle was 33 megajoules -- a single megajoule is roughly equivalent to a one-ton car travelling at 100mph.

In June 2011, the US Navy came within an inch of having to drop the railgun programme altogether following the authorisation of the fiscal 2012 defence authorisation bill by the Senate Armed Services Committee. However, the other three committees overseeing military budgets decided the project was worth continuing. There is still a risk the railgun may suffer further reductions in funding as other budget cuts are announced, but for now it is safe.

In early February 2012, BAE Systems delivered the first of two prototype advanced railguns to the US Naval Surface Warfare Center Dahlgren Division (NSWCDD) for testing, two years after being awarded the contract by the Office of Naval Research (ONR). The first of two, month-long test series began later in the month, with each firing testing its extended range capabilities against surface, air and ground targets at various energy levels.

The second General Atomics-built prototype launcher was delivered in April 2012 with trials progressing to firing an aerodynamic round developed by Boeing.




Lorentz Force (after the Dutch physicist Hendrik A. Lorentz). The Lorentz force is directed perpendicularly to the magnetic field and to the direction of the current flowing across the armature. You can see how this works in the diagram on the LH side. Notice that the Lorentz force is parallel to the rails, acting away from the power supply. The magnitude of the force is determined by the equation F = (i)(L)(B), where *F* is the net force, *i* is the current, *L* is the length of the rails and *B* is the magnetic field. The force can be boosted by increasing either the length of the rails or the amount of current.

Because long rails pose design challenges, most rail guns use strong currents - in the order of a million amps - to generate tremendous force. The projectile, under the influence of the Lorentz force, accelerates to the end of the rails opposite the power supply and exits through an aperture. The circuit is broken, which ends the flow of current.

It achieved speeds of Mach 5, and with zero gun elevation it penetrated a steel plate an eighth of an inch thick 100 yards away, then travelled seven kilometres down range before it stopped.

Tom Hun of General Atomics indicated that in discussions with the navy, General Atomics had identified the USS Arleigh-Burke (DDG-51) as a likely candidate test platform for sea trials.

For the next phase the ONR recently awarded $10m contracts to Raytheon, BAE Systems and General Atomics to develop a pulsed power system for launching projectiles in rapid succession. Targeting a firing rate of six to ten 50mm rounds a minute, the naval power system is expected to be operational by 2025.

In addition to the prohibitive costs of build and operation, several technical problems still need to be overcome to make the railgun a viable weapon.

A source of powerful electrical current is required, which limits its use to fixed locations, and the massive bank of capacitors required to generate the charge would easily take up any room on board a ship saved by smaller ammunition. Furthermore, the current itself damages the rails every time the system is used, due to the enormous force between the rails and the arcing, which vaporises the surface. The magnetic fields generated during launch can cause damage to electronic equipment, so the ship must be shielded, and the power could even blow the device apart.

In addition, the friction between the projectile and the rails generates heat, which can make the railgun easy to detect and further damage the rails, leading to inaccuracy. If similar guidance systems to modern missiles are to be added to overcome this, they would need to be highly temperature-resistant so as not to melt during the hypersonic electronic launch.

The target rate of six to ten rounds a minute could be ambitious as some technicians believe it could take at least a minute to charge up between shots.

The safety aspect of the Railgun is one of the greatest potential advantages of programme. No propellant is required to fire the projectile, and no explosive rounds are stored in the ship's magazine.

On December 10, 2010, the U.S. Navy made history at the Naval Surface Warfare Center-Dahlgren Division with the BAE Systems developed Laboratory Railgun. A 33-Megajoule shot was fired, the energy equivalent range of 110 nautical miles.

Main source: Berenice Baker, Naval Technology.com , 2012

# Artificer branches throughout the ages.

(Dates in brackets are when the branch was instituted and when it closed down).

Engine Room Artificers (1868—1969)
Torpedo Artificers (1877—1892)
Electrical Artificers (1913—1946)
Ordnance Artificers (1919—1948)
Ordnance Artificers (Air) (1940—1941)
Engine Room Artificers (Metal Workers) (1940)
Ordnance Artificers (Optical) (1940)
Air Artificers (Ordnance) (1940)
Air Artificers (Airframes & Engines) (1943-1947)
Air Artificers (Electrical & Ordnance) (1943-1945)
Air Artificers (Electrical) (1943)
Air Artificers (Ordnance) (1946)
Electrical Artificers (Air) (1946-??)
Electrical Artificers (Air) (Electricity) (1946-1947)
Electrical Artificers (Air) (Radio) (19??-??)
Electrical Artificers (Electricity) (1946-1947)
Electrical Artificers (Radio) (1946-1947)
Electrical Artificers (Special) (19??-??)
Radio Electrical Artificers (Air) (19??-??)
Aircraft Artificers (1947-1970)
Aircraft Artificers (Ordnance) (1947)
Artificer Apprentices (1947-1983)
Electrical Artificers (1948-1961)
Radio Electrical Artificers (1948-1979)
Shipwright Artificers (1948-1969)
Ordnance Artificers (Gunnery) (1948)
Ordnance Artificers (Torpedo & Anti-Submarine) (1948)
Ordnance Artificers (1948-1961)
Ordnance Artificers (Control) (1953-1961)
Ordnance Artificers (Weapons) (1953-1961)
Electrical Artificers (M) (1959)
Electrical Artificers (Air) (M) (1959)
Control Artificers (Weapons) (1961-1967)
Aircraft Artificers (Ordnance) (Electrical) (1967)
Control Electrical Artificers (Electrical) (1967)
Control Electrical Artificers (Ordnance) (1967)
Control Electrical Artificers (1967-1979)
Ordnance Electrical Artificers (Electrical) (1967)
Ordnance Electrical Artificers (Ordnance) (1967)
Ordnance Electrical Artificers (1967-1979)
Marine Engineering Artificers (Hull) (1970)
Marine Engineering Artificers (Propulsion) (1970)
Marine Engineering Artificers (1970-Extant 2004)
Aircraft Artificers (Airframes & Engines) (1970-1980)
Electrical Artificers (Air Weapons) (1973-1980)
Marine Engineering Artificers (Electrical) (1979)
Marine Engineering Artificers (Mechanical) (1979)
Weapon Engineering Artificers (1979-Extant 2004)
Air Engineering Artificers (Electrical) (1980)
Air Engineering Artificers (Ordnance) (1980)
Air Engineering Artificers (Weapons) (1980)
Air Engineering Artificers (Mechanical) (1980-Extant 2004)
Air Engineering Artificers (Radio) (1980-Extant 2004)
Air Engineering Artificers (Weapons Electrical) (1980-1992)
Artificer Apprentices: Artificer Candidates (1983-Extant 2004)
Air Engineering Artificers (Electrical) (1992-Extant 2004)

# Propeller Innovation—Contrapel

The high-speed propeller was invented over 170 years ago and has dominated the propulsion market ever since. Despite 60 years of development, water-jets have struggled to make significant inroads. The Contrapel Hybrid drive is about to change that. The system is so advanced that it carries out all the functions of both propellers and water-jets with none of the drawbacks of either.  Externally it resembles a traditional water-jet, however internally the method for developing thrust has much more in common with conventional propeller systems.

The Contrapel drive uses a pair of contra-rotating, fully enclosed hybrid propellers, capable of operating above the water-line. The mode of operation of the hybrid propellers is to accelerate the water from out of the intake (pick-up) duct and then discharge it through the outlet, requiring only enough back-pressure downstream from the propellers to keep the system primed. This contrasts with the traditional jet which does not accelerate the water until further downstream in the nozzle section, which requires the generation of high pressure.


The Contrapel Hybrid propellers produce lift in a similar way to open water propellers, by using slippage. The use of hybrid propellers enables the mass component for each revolution to be maximized and the plume velocity to be minimized, thus meeting the fundamental laws of Froude efficiency. This contrasts with the low-mass per impeller revolution and high-plume velocities present in conventional high-speed water-jet designs.

In order to get to this point however, major design considerations still needed to be addressed.  Producing linear flow with no stator section, requires a pair of counter-rotating hybrid propellers one positioned directly in front of the other. Both operate in tandem to

produce the desired axial flow, but they also must accelerate the water across their blades and generate significant lift.

When the first prototypes were attempted, a perplexing conundrum became apparent. In order for the propellers to generate this lift, a drop in the pressure forward of the leading blades was required. As one propeller is located directly in front of the other, this then caused the downstream propeller to lower the pressure on the wrong side of the upstream propeller.

Counter-rotating propellers in open water do not have this problem, since water is replenished from the surrounds, as the acceleration occurs. In an enclosed tube however, the only source of usable water is directly upstream. Consequently the downstream propeller was scavenging against the upstream propeller causing it to stall. Reversal of the pressure gradient on the blade was disastrous, as a huge amount of energy was being absorbed. Once again the solution was counter-intuitive, being resolved by increasing the speed of the upstream propeller, so that the pressure correction could be made.

Unlike a standard propeller, the Contrapel system is a complete solution for the entire global industry, since it's scalable to all sizes and works equally well above or below the water-line. It boasts all of the operational advantages of a water-jet with few of the limitations. There are several pre-existing elements inherent to the Contrapel system which have enabled this development. Low propeller speeds, extremely high mass through-put, ability to operate with large blade-tip clearances, propeller rather than screw characteristics and an engineering structure that supports the counter-rotating propellers both fore and aft, culminate to create a very unusual and unexpected effect.

The Contrapel Oscillator is designed to allow the counter-rotating propellers to oscillate out of axial alignment as they turn. The outcome is a dramatic reduction in the energy necessary to rotate them, an effect which is unmistakable to the operator. The observed performance improvements are particularly significant considering the early stage of this development cycle. Most surprisingly, the oscillation of the impellers does not produce a detectable vibration. The very low frequency between anti-nodes combined with the slow rotational speeds of the hybrid impellers gives an extremely smooth action and all this happens below any damaging cavitation limit.

When the US Navy's Riverine Squadrons, part of the Navy Expeditionary Combat Command, were operating in Iraq's Tigris and Euphrates rivers between 2003 and 2011, they found their jet engines were blowing out well before their use-by date. They needed their boats to work effectively in shallow silt- and sand-laden water but the jet units were only lasting about three weeks, with maximum speed dropping from 42 knots down to just 17 in that time — not a good proposition with angry insurgents around. They needed something better, and Christchurch-based Contrapel has a solution — a solution with wide-ranging applications across the entire marine industry. As Contrapel inventor Barry Davies summarises, "The unit can operate in sand, weeds and even withstand exposure to gravel with no drop in performance or longevity."

The company owns three patents across 15 countries, and people across the industry are starting to sit up and take notice. The sort of interest they're getting is a tribute both to the innovation inherent in the invention and the hard work Davies and the team have put in over the years. As Davies says: "This is not in any way speculative or purely theoretical. The performance gains can be demonstrated, are quantifiable and backed up by [ten] years of research and two-million dollars in the design and development of the invention. "

Main source material from Barry Davis and Peter Sillifant at Comtrapel.com

# Sea Ceptor - **Likely new missile for Type 23's and 26's**


Sea Ceptor is a ship based supersonic missile defence system featuring the common anti-air modular missile (CAMM) and system equipment, currently being developed for the Royal Navy as a direct replacement for SeaWolf. A land based version is also being developed to replace Rapier and will evolve into a future air-to air weapon for the RAF.

Capable of being deployed on various platforms ranging from 50 miles offshore patrol vessels to large surface vessels, the 3.2m-long supersonic missile can intercept combat aircraft and missiles moving at supersonic speeds and neutralise them while protecting the host ship. Sea Ceptor, which can travel at speeds of more than 2,000 miles per hour, can intercept multiple targets and protect an area out to a range of about 15.6 miles.

The UK Ministry of Defence (MoD) has awarded a contract to MBDA to provide Sea Ceptor in support of the Royal Navy's Type 23 vessels and the future Type 26 global combat ship. Under the contract, MBDA will deliver and install Sea Ceptor on to the Type 23's from 2016 and then be deployed on board the type 26 GCS as the primary air defence system.

An agreement signed in 2010 with MBDA has also been extended by the UK MoD to manage the UK's complex weapons portfolio. Chief of the naval staff and First Sea Lord Admiral, Sir George Zambellas, said: "This state-of-the-art missile system is part of an exciting renaissance in our naval equipment programme, and when fitted to Royal Navy frigates it will further enhance our global authority as a leading maritime power." In January 2012, MBDA received a £483m demonstration contract from the Royal Navy under the future local area air defence system (FLAADS) programme.

MBDA stated that "This weapon system provides the Royal Navy's Type 23 frigates, and subsequently the Type 26 with a step change in operational capability and through life cost benefits, whilst delivering better value for the UK taxpayer."

Sea Ceptor differs from Sea Wolf in a number of respects but the most significant is the

elimination of a requirement for dedicated fire control radar. By removing this reliance on fire control radars, the data link and two-way active radar homing seeker is designed to overcome saturation attacks and has the additional benefit of removing a piece of equipment from the support chain. Although range will of course be classified MBDA have declared it as being in excess of 15 miles, which in any case is better than Sea Wolf and Rapier but then it should be, at 99kg it is nearly 20kg heavier than Sea Wolf and over 50Kg heavier than Rapier. The ability of Sea Ceptor to use many different radars for initial target information should provide an advantage on the export market, as will its flexible siting and quad packing, if customers need it.

It has been reported that each missile in its sealed canister will have a shelf life of ten years and although MBDA claim it can be quad packed in either a SYLVER or Mk 41 launcher, on the Type 45's and Type 23's, however it is likely they will be installed on the Type 26's in a bespoke low cost launcher.

The soft vertical launch system that ejects the missile to a height of about 30m before small thrusters fire to orientate the missile with the target location. This method is safer, removes the need to manage hot gas efflux in the launch silo and ensure all of the main rocket motor fuel is used for arriving at the target.

Using the principle of a Common Data Link (CDL) the missile doesn't necessarily have to use a two way data link to the launch vehicle, and could take mid-course corrections from any number of suitably equipped land or air platforms and then switch to active homing when it gets close enough to the target. The original launch platform could very well have moved out of range by the time the missile hits.

With the Sea Ceptor missiles on board, the Type 45 ships regain competitiveness with its air-defence peers by hosting a formidable 3-tiered defence of 16 x long-range Aster-30s, 20 x medium-range Aster-15s, and 48 x CAMM (Sea Ceptor) missiles.

In late 2013 it was announced that the Royal New Zealand Navy is to become the first export customer for the Sea Ceptor missile. The primary reason being that the upgrade will restore the ship's combat capability and utility to a comparative level to that of a current generation, new release combat system. This is required to counter the combined challenges of an increased level of threat sophistication coupled with obsolescence of some of the current systems.

Source material from MDMA Missile Systems

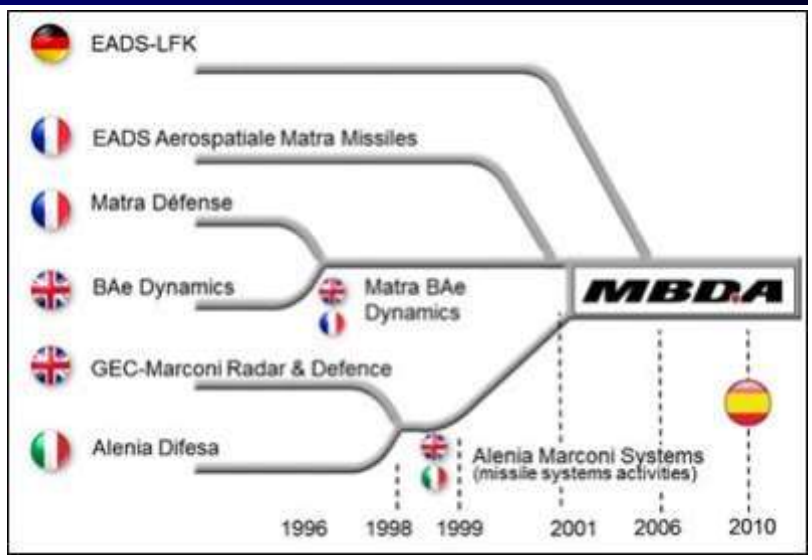
Benefits of using a common solution for multiple platforms and services include:

- Common components can be used to create a modular weapon system
- Broad target set including high speed, manoeuvring, low signature targets in high level
- countermeasure environments
- Can be used with a variety of surveillance sensor systems
- Command and Control system common to all surface deployments
- Cost benefits of sharing missile stockpiles between the Services
- Affordable due to low procurement and through-life costs

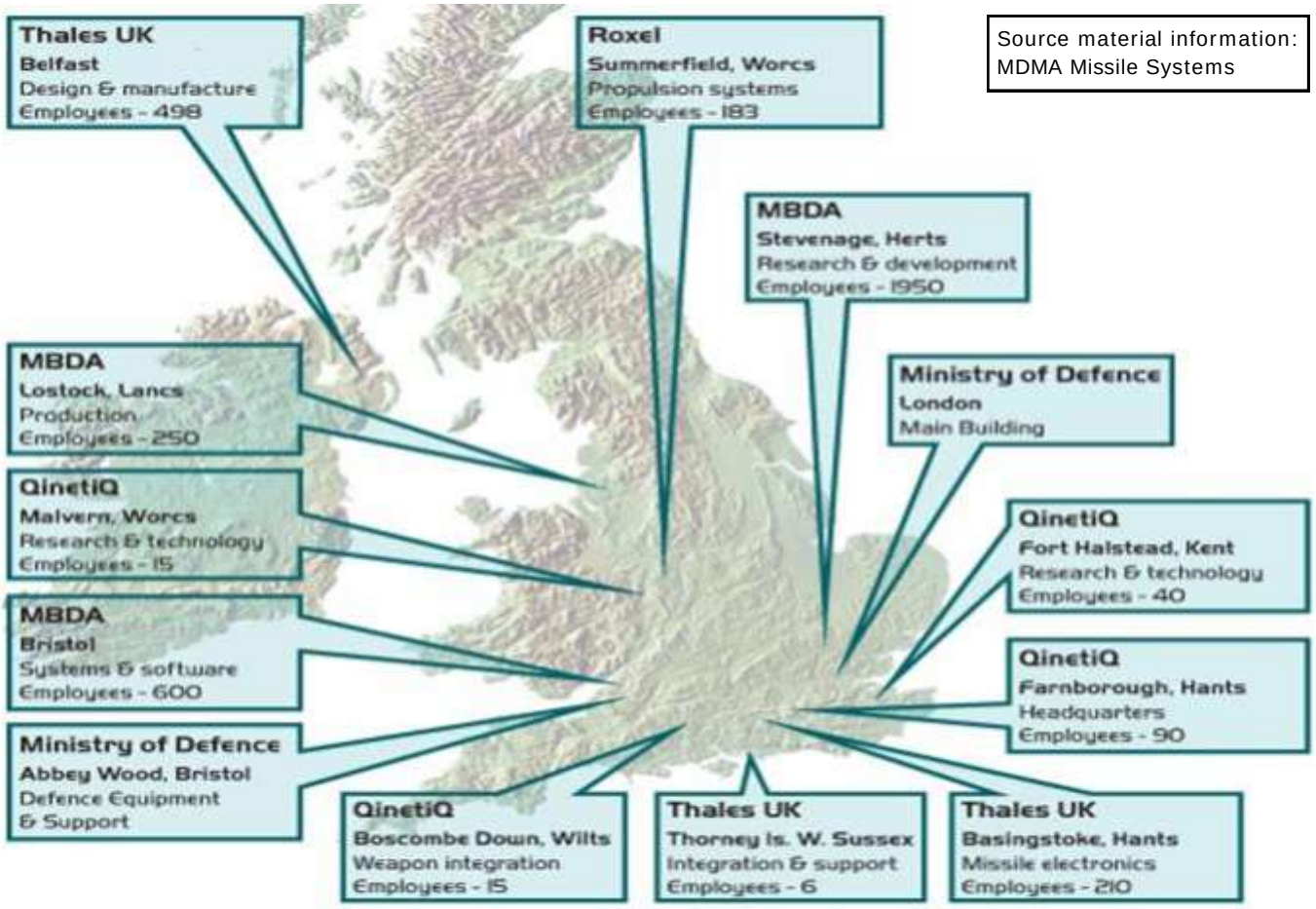
Missile characteristics

- Weight: 99 kg
- Length: 3.2 m
- Diameter: 0.16 m
- Range: In excess of 25 km
- Speed: Supersonic

# MBDA Missile Systems




MBDA, a world leader in missiles and missile systems, is a multi-national group with 10,000 employees on industrial facilities in France, the United Kingdom, Italy, Germany and the United States. MBDA has three major aeronautical and defence shareholders - Airbus Group (37.5%), BAE Systems (37.5%) and Finmeccanica (25%), and is the first truly integrated European defence company. MBDA works with over 90 armed forces worldwide. MBDA was created in December 2001, after the merger of the main missile producers in France, Italy and Great Britain. Each of these companies contributed the experience gained from fifty years of technological and operational success. The restructuring of the industry in Europe was completed with the acquisition of the German subsidiary EADS/LFK in March 2006. MBDA is the only Group capable of designing and producing missiles and missile systems to meet the whole range of current and future operational requirements for the three armed forces (army, navy, air force). Overall, the Group offers a range of 45 products in service and another 15 in development. Team Complex Weapons is a grouping of MBDA, Thales UK, Roxel, QinetiQ and the UK Ministry of Defence who are working together on an innovative approach for delivering future complex weapons requirements for the UK armed forces whilst retaining sovereign skills within these sites and the wider supply chain.




Source material information:
MDMA Missile Systems

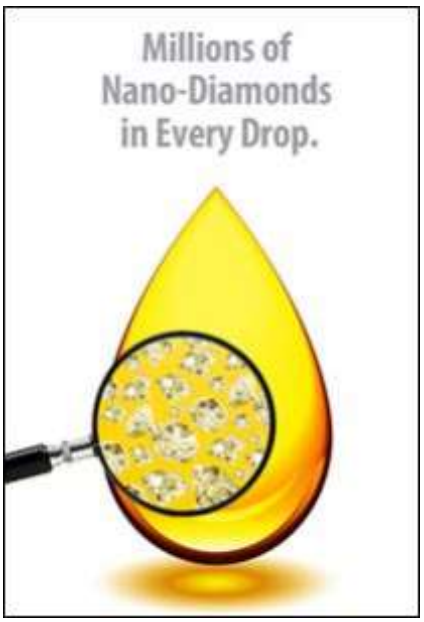
# Nano Diamond Lubrication

Even though diamonds are considered one of the hardest substances known to man, at nanometre size (a nanometre is one billionth of a metre) they actually polish and keep debris from attaching to the metal. Manufacturers are able to infuse billions of 4-to-6 nanometre sized diamonds into oils where the Nano-diamond material functions like ball bearings by transforming the sliding friction that normally occurs between metal surfaces into rolling friction, thereby substantially reducing friction, heat, wear and early oil failure.

Each Nano-diamond is encapsulated in oil and while residing in the pores of the metal, they help seal out moisture and debris that would otherwise attack metal surfaces. Unlike Molybdenum, Graphite, or other additives being used today, Nano-diamonds will not break down or flatten out during use helping to protect the metal surfaces of engines, equipment and other machinery.

In 1962, Russian scientists began working with Nano-diamonds to help their tanks last longer. Using out-dated military explosives, scientists began the "explosion based production" method in order to manufacture Nano-diamonds. Rapid explosions of TNT and RDX with carbon in a controlled confined area produced Nano diamonds in varying sizes from 4-to-10 nanometres.

Many conditions can affect diamond yield, for instance, the higher the cooling capacity after detonation, the higher the diamond yield. After the cooling process, diamond is extracted from the soot using high-pressure and high-temperature chemical processes where metal contamination originating from the detonation chamber as well as non-diamond carbon, are removed in order to obtain a higher Nano-diamond yield.




In later years it was discovered that Nano-diamond materials could be the perfect solution as a lubricant for space travel, because they are not affected by high heat, sub-zero temperatures or atmospheric changes. Civilian use of nano-diamonds began to increase after the Cold War with production of high-end grades reaching 8 tons in 2008. The main applications for Nano-diamonds today include polishing applications, galvanic applications, medical delivery of medications to cancer patients and of course, lubricants.

Richard Stribeck, a German engineer analysed full fluid-film lubrication and demonstrated his results through what is still known today as the Stribeck Curve. Full-fluid-film lubrication is similar to a vehicle's tyres hydroplaning on water at higher speeds. As the vehicle's speed increases, the tyres ride up on top of the water film between the tyres and pavement, thus causing less control of the vehicle. This same principle takes place in engines, as the internal moving parts increase in speed they will begin to ride on an oil film, reducing metal to metal contact and thus providing the best lubrication. This is especially important during engine start up and shut down when the oil film is very thin and causes a great deal of sliding friction between the metal parts. So as we have always known, diamonds can be an engineers best friend.

There are other Nano-particles that are being developed for use in engines and include molybdenum disulphide with canola oil, tungsten disulphide, the carbon Nano-onion, transition-metal dichalcogenides and some copper alloys.

Main source material: Nanotech Lubricants, LLC

# Bluebird DC50

The DC50 may sound like a version of a Dyson vacuum cleaner but it is in fact a new electric car that will hopefully make its appearance during 2014.

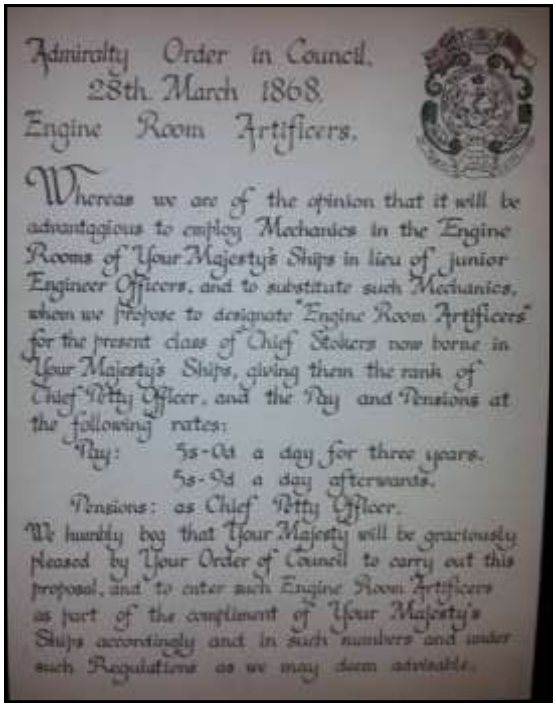
The two seat coupe is predicted to have an electric engine capable of producing 240, 280 or 360 bhp, depending on engine version, a top speed limited to 140 mph with a 0—60 time of less than 6.0 seconds and a range of 200 miles.

To coincide with the 50th anniversary of Donald Campbell's speed records in 1964, only 50 cars will be produced and available in just the one colour—Bluebird Blue. The car will be built at a site in Oxfordshire and half of them have already been allocated to customers. No prices is available at this time.

The car is using technology that was originally developed for the Bluebird GTL electric racing car. This car has been designed to conform with the FIA's Formula E series that starts in September 2014. Although the ten teams and their cars have been announced, the Bluebird car is not listed as one of the entrants.


# Naval Memorabilia

A carved RNERA badge and a framed copy of the 1868 Admiralty Order were handed over to the RNEBS by David Eton, who works as a volunteer in the National Museum of the Royal Navy in Portsmouth Dockyard. These items have been relocated to 113 North Hill for display in the office. If anyone has any similar memorabilia or knows of anyone who wants to pass such items on to the society, please let us know.

Admiralty Order in Council.
28th March 1868.
Engine Room Artificers.

Whereas we are of the opinion that it will be advantageous to employ Mechanics in the Engine Rooms of Your Majesty's Ships in lieu of junior Engineer Officers, and to substitute such Mechanics, whom we propose to designate "Engine Room Artificers" for the present class of Chief Stokers now borne in Your Majesty's Ships, giving them the rank of Chief Petty Officer, and the Pay and Pensions at the following rates:

Pay: 5s-0d a day for three years.
5s-9d a day afterwards.

Pensions: as Chief Petty Officer.

We humbly beg that Your Majesty will be graciously pleased by Your Order of Council to carry out this proposal, and to enter such Engine Room Artificers as part of the complement of Your Majesty's Ships accordingly and in such numbers and under such Regulations as we may deem advisable.

# Feedback from Members

Mark

Just wanted to give you some feedback that the Bulletin was a good read on a Sunday morning in Australia. Say hello to Tony Worsfold for me. Great to serve with him when I did, HMS Sovereign I think.

In terms of feedback on letters after your name, (AKA Post Nominal's), I have pondered on this for two decades. Prior to leaving the service I sought membership with the Institute of Plant Engineers, now known as the Society of Operational Engineers, and with an HNC gained IEng registration with UK Engineering Council.

In my opinion unless you are to work in an industry such as a pressure vessels Inspector for example, someone signing off on justifications 'Post Nominal's have very little weight unless you have Chartered status which in my opinion is a whole other matter. In most cases I have found that IEng is little known or understood.

In terms of applying to IMechE, I have been waiting five months to see if they will accept me, and I still have a current IEng registration but seek to gain recognition from **'Engineers Australia'** as the IEng equivalent CEngT. To do this you must belong to an Association that has a '**Mutual Recognition Agreement'** with EA. The reason for this is that I believe that in Australia unless you have Australian accreditation they simply are not interested in any qualifications/prior learning you may have unless you have it recognised here, so in this case I do see value in 'Post Nominal's!

A note you may wish to pass on to members is that if those are seeking to migrate, make sure you join a UK Engineering body that has mutual recognition with the engineering council of the country you chose to migrate to! Makes life so much easier to transfer.

Hope there is something here for your article.

Regards

Chris Alexander

Hello

In answer to your question about whether it's worth joining any of the organisations that give you letters after your name, my answer would be a resounding no!

I left the RN in June 13 and went straight into an offshore job as a Maintenance Supervisor (Head of the Engineering Department in Navy speak).

At no stage during my selection was I asked about any formal qualifications and certainly nothing was mentioned about membership of any organisations. I think, in the offshore world, it would be regarded as a bit pretentious as the emphasis is definitely on whether you can deliver.

So, I'm certainly glad I didn't spend money on any memberships. I'm on a six figure salary now so it certainly hasn't hindered my earning capacity. Just my opinion of course but I found that there are plenty of people waiting to snap up any resettlement money. I wasted an ELC and my grant on a ROV course - it was a rip off.

Cheers

Dave Carter

Ex WO2 MEA

# RNEBS Affiliated Charities

The following personnel were awarded prizes during 2013.

SEMC

Chatham Memorial Prize

Spring: Lt Armstrong

Summer: SLt Cator

Autumn: Lt Ives

POET

Chatham Memorial Prize

Summer: Cpl Drewett

LET Connely

Captain Marrack Prize

Summer: LET Dickens

It was recently announced by Jon Jefferis, the corresponding trustee and treasurer for both the Chatham Memorial Fund (since 1998) and Captain Marrack Prize funds (since 2005) of his intention to retire from these roles.

As there has been no interest from other persons in taking ownership of the funds, there is the likelihood that the charity accounts will be liquidated and the monies transferred to the RNEBS general account. The RNEBS will then take over the responsibility for the provision of prizess and liaison with the establishments.

These arrangements will be discussed at the next EC meeting in June, where there is every intention to continue with the process of awarding prizes.

On behalf of the membership, I would like to thank Jon for his hard work and dedication in keeping these two funds going for so long and to wish him a full and happy retirement. Perhaps an "illuminated scroll" could be presented to him in due course.

Since retiring from Rolls-Royce, John Arthur has been working as a volunteer at the National Memorial Arboretum and is keeping an eye on the RNEBS memorial.

"I am pleased to say that it now appears cleaner than it was towards the end of last year and attracts considerable public interest."

~ John Arthur


## Crossing the Bar

Those members who have passed on since October 2013;

David Edward Williamson, 12628, joined the Society December 1983, died February 2009.

Stanley William Clarke, 09540, joined the Society February 1967, died February 2014.

R. G. Maddern, XP005, joined the Society October 1950, died February 2014.

## 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. T's & C's apply.