AUTUMN 2013

WEB EDITION

ROYAL NAVY

THE NAVAL ENGINEER

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WEB EDITION

WARRANT OFFICER OF THE NAVAL SERVICE (WONS)

WO1 AET Steve Cass

Warrant Officer Steve Cass has reached the top rung of the ladder in the Senior Service. The outgoing First Sea Lord, Admiral Sir Mark Stanhope, approved Steve's appointment as the new Warrant Officer of the Naval Service (WONS) from December 2013. This will be the first time any Engineer or member of the Fleet Air Arm has reached such an influential position.

WONS is the most prestigious role for a Warrant Officer in the Royal Navy. His primary responsibility is to act as a channel between the non commissioned ranks and the most senior Naval officers, ensuring top level policy messages are understood and comprehensive, honest feedback is provided in return. Steve will also carry around a remarkable badge of office; the Ceremonial Cane which goes with the job is made out of wood from the oldest still-commissioned warship in the world, HMS Victory.

WO1 Cass is an Air Engineering Technician whose 27 years service includes numerous front line tours with Sea King and Merlin Squadrons.

Entering the RN as an Air Engineering Mechanic Second Class in 1986, he spent much of his early career serving with 820 NAS onboard HMS Ark Royal and RFA vessels during operational service east of the Suez. He was selected for Artificer Qualifying Course, which commenced in 1991, and gained his certificate of competence to supervise aircraft maintenance in 1994 whilst on 771 NAS. When serving on the Merlin Intensive Flying Trials Unit in 2000 as a Watch Chief, he was called upon to assist the Marine Salvage and Accident Investigation Units with the post-crash management of a Merlin that ditched into the Kyle of Lochalsh. Promoted from CPO to WO2 in 2005, he became the Senior Maintenance Rating on 700M Operational Evaluation Unit and was involved with numerous trials, embarked and ashore, for the Merlin Mk1 development programme. Deployments in a variety of RFA ships for several NATO and UK ASW exercises as well as HMS Ocean for APT(N) followed prior to the Squadron disbanding.

An appointment as the Senior Maintenance Instructor at the Merlin Training Facility in 2008 gave the opportunity to apply front and second line experience to modifying elements of engineering training, resulting in greater efficiency and better prepared students passing through the school. Following promotion to WO1 in 2009, he spent five months as the Explosive Storage Area Manager and was also responsible for the Station Aircraft Weighing Team and Non Destructive Testing Section in support of all aircraft types based at Culdrose. In October 2009 he worked for two years with AgustaWestland Yeovil as the Structural Integrity Engineering Authority for Merlin Mk1, 3 and 3A. This demanding role saw his Safety and Airworthiness Letter of Authority used to provide technical support and policy direction to RN and RAF squadrons and flights operating in Afghanistan and elsewhere around the globe.

Returning to Culdrose in 2011, he assumed the role of Base Warrant Officer and President of the WO and SR Mess and left this rewarding appointment in September 2013 prior to starting at Leach Building.

WO1 Cass is a proud Cornishman who is married to Alison, who is an equally proud Yorkshirewoman. They have three daughters aged 18, 14 and 6. His interests include walking their energetic spaniel across the Cornish cliffs, pilot gig rowing and working with local schools to support children of deployed Service personnel.

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THE NAVAL ENGINEER

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• The magazine is published for information, entertainment and to promote discussion on matters of general interest to engineers of all sub specialisations (Air, Marine, Weapon and Training Management).
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The cover: Front – HMS Illustrious sails from Portsmouth for Cougar 13 deployment – see Page 17 – photo by POA(PHOT) Owen Cooban; Back – HMS Protector, holder of the 2012 Fleet Engineering Excellence Award – See Page 33– photo by LA(Phot) Arron Hoare.
Acknowledgements to the Fleet Photographic Unit who supply most of the general photographs.
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The Naval Engineer

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Editor's Corner

This issue is the first to be published since the change to a termly, rather than a quarterly, frequency; an alteration decided upon due to the availability of contributions. As the RN downsizes to meet the manpower limitations imposed upon it, the pace of operations continues unabated, as does the requirement to support those operations – and that puts increasing pressure on all of us, whether in the front line, supporting the front line or in procurement or training areas (although, strictly, those areas are also in support of the front line, or we wouldn't be doing them!). As a result, time is at a premium, but it remains vitally important that we remain aware of developments and ideas in the engineering field, hence the reason why the RN provides *The Naval Engineer* as one of the means of communication. That communication, whether top down or bottom up, is reflected in the contents of this issue; TNE issues cover lessons to be learned (re-learned?) as well as instructions, background articles and information.

If you have a message to get across to others in the community, then put pen to paper (fingers to keyboard) and draft an article – all contributions are welcome. The Editor will respond to a phonecall, email or other contact, and can advise on the best way of putting an article together.

Bottom line – there are lots of reasons to write an article – it's your magazine!

Thinking of writing for TNE? Deadline for articles or letters is Friday 19 January 2014.

The Naval Engineer is also available on the Intranet at *http://defenceintranet.diif.r.mil.uk/Organisations/Orgs/Navy/Organisations/Orgs/FOST/Pages/TheNavalEngineer.aspx*

A full index of The Naval Engineer, and of Review of Naval Engineering, and soft copies of recent back issues are available at: *http://cwd-r-web-001.cwd.dii.r.mil.uk/mws_csg/publications/naval_engineering.html*.

Back issues of the Journal of Naval Engineering (JNE) can be found through the JNE Internet webpage: *http://www.jneweb.com/login.aspx*.

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By the Editor

As part of the Fleet Air Arm commitment to Continuous Professional Development, nearly 200 Air Engineers and Warrant Officers gathered at HMS Sultan for the biennial RN Air Engineer Officers' Conference. Themed '**Capability *through* Engineering Excellence**', the Conference facilitated shared situational awareness of important Training and Personnel issues affecting Air Engineers through a series of operationally focused lectures. Chaired by Commodore Malcolm Toy, Head of Specialisation for Air Engineers, the lectures covered a wide spread of topics including personnel employment, air safety and training management matters – all aimed at sustaining a capable, effective and professional Air Engineering cadre to meet the Navy's maritime competence needs now, and in the future.

Attendees were given an update on the exciting changes and new challenges coming to the FAA from Wildcat and Merlin Mk3 now entering RN Service and, most significantly, the return to fixed-wing carrier operations when the Lightning II operates from HMS Queen Elizabeth in the near future. Also, in conceptual terms, attendees received an important update on the development of the Naval Engineering Strategy (addressed elsewhere in this issue).

The Conference was honoured to have Rear Admiral Lister, Chief Naval Engineer Officer and Director Submarines give the keynote address. He recognised the positive benefits of the ability of Air Engineers to play a major part

Conference business – the formal session

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in maintaining the 'fighting edge' through engineering excellence in many theatres of operation, and encouraged cross-fertilisation between sub-branches – and, indeed, with other branches and Services. He reminded delegates that they were war fighters first and foremost who needed to maintain the quality of engineering through leadership, and by ensuring that RN engineers are skilled, confident and competent to carry out the tasks required of them; with the ability and authority to innovate safely when necessary.

Conference business – informal networking

The prepared briefs and presentations were, as is the case in most such events, only part of the value of this Conference. Much animated discussion and networking took place in the breaks, and a most enjoyable dinner was held in HMS Sultan's Wardroom that evening. The Conference was delighted to have Rear Admiral Harding, COS Aviation and Carriers, as the guest speaker at the Dinner and his speech, setting out the forthcoming challenge to Air Engineers with new equipment arriving, blended perfectly with the conference theme. The dinner was followed by an amusing 'Battle of the Atlantic' skit by the SEMC students; they had spent the day helping to ensure the smooth running of the Conference, which had been organised and led by OC RNAESS, Commander Nick Bowser.

Reflecting upon the event, Commodore Toy said "*It was an honour to chair the Air Engineer Officer's Conference of 2013. Following a large AE attendance at CNEO's Conference, I was delighted to see numbers also up on 2011 for the AE Conference, such that a large number of us we were able to consider what CNEO's Engineering Strategy means for the AE sub-branch; and how we can best contribute to the future Navy. With AEs thinly spread across different Front Line Commands and Headquarters, and mainly in joint areas of the DE&S, it is really important to find time to focus on our role in the Royal Navy at this conference. To have Admiral Lister as our Conference Keynote Speaker and Admiral Harding as our after dinner speaker made the day a complete success.*"

Post-Conference business – the Engineers, the output and the establishment

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TOO MANY SATELLITES? NO LONGER AN ISSUE

NEW NAVAL MILITARY GPS

By Lieutenant Duncan Turner BEng IEng MIET RN Naval Applicator – Maritime Navigation Systems Communications and Situational Awareness

Lieutenant Duncan Turner joined the RN as a University Cadetship Entrant in October 2000, serving Fleet time in HM Ships Portland and Exeter. He spent three years at the University of Birmingham gaining a BEng in Computer Systems Engineering. On completion of SEMC he was DWEO of HMS Montrose, leading the Boarding Team on various deployments, followed by a shore appointment as the IS Manager in HMS Raleigh and BRNC. Shortly after this he became the OC Board and Search School based at HMS Raleigh, working within the remit of 1 Assault Group Royal Marines, redesigning the course to meet the future RN vision. He joined DES in May 2012 post ICSC(M) as a Naval Applicator in the Maritime Combat Systems Communications and Situational Awareness Team undertaking the Project Manager role for NAVFIX mid project design in November 2012.

Outfit QYF. The bane of many an OOW wanting a quick fix, the bane of many a maintainer struggling with user controls and poor equipment design, the bane of the Equipment Project Team dealing with obsolete equipment and robbing Peter to pay Paul on 15 year old technology.

Roll out its successor – NAVFIX. Primarily designed as a fit, form, function replacement for QYF, NAVFIX might have the same space envelope with the same serial outputs, but it has been redesigned to meet the future Navy's needs.

Initially designed as a stopgap replacement, NAVFIX has developed into what QYF should have been. At its heart is a Rockwell Collins MPE S II GPS receiver capable of receiving military P(Y) code GPS and its successor M code. This is coupled with bespoke software produced by the OEM, Drumgrange, to ensure compatibility with all current class specific interfaces and with a 10 port Ethernet panel a future proof capability for DTS, shared networking and interfacing equipment upgrades.

Within the redesigned and user-friendly user interface (Figure 1), the configuration can be set for different output data rates, allow lever arm settings to be manually adjusted, provide the existing intercept (Figure 2), man overboard and a new anchor watch functionality which could be utilised by OOWs as an alternative/addition to WECDIS. A clear and concise colour LCD display providing the critical information in an easy to understand manner coupled with a battery which now endures for six hours and logical configuration menu options means the shortfalls in QYF are now finally being addressed. Add to this a satellite acquisition time of less than four minutes compared to QYF's more than 15 minutes means this will become the OOW's new best friend.

So why spend millions for something that can be done through any smart phone? The difference is significant. The advantage of NAVFIX over any standard GPS receiver is primarily the use of military spec P(Y) code.

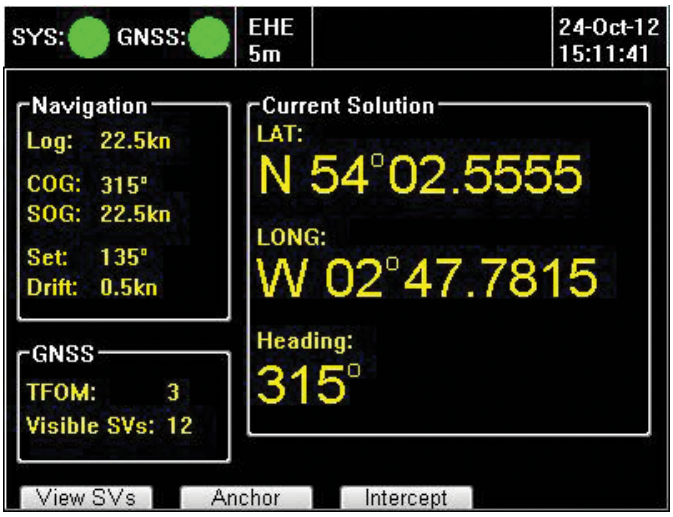

Figure 1: New navigation user interface

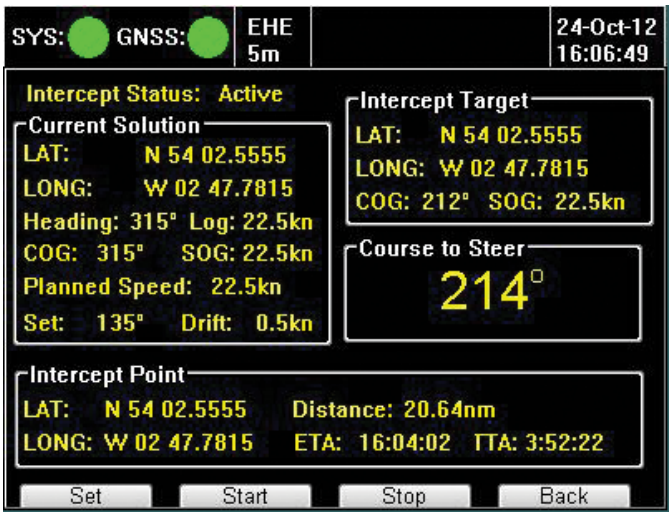

Figure 2: Intercept screen

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To begin, an explanation in layman's terms:

- There are three levels of GPS accuracy – Standard Positioning Service (SPS) – used in commercial receivers with an accuracy of 8-13 metres, Differential GPS – with an accuracy of 3-4 metres, and the Precise Positioning Service (PPS) for military users. The PPS uses the Precise 'P' Code which is approx 26 terabytes long and this pseudorandom binary sequence cycle takes 267 days to complete. Each satellite generates an exclusive seven-day section of the cycle[1] of approx 720 gigabytes with an encryption sequence to generate the Y code, and the signal is therefore referred to as the P(Y) Code.

- The P(Y) Code was encrypted to provide a more secure GPS signal which was less susceptible to unauthorised access (selective access has been granted to various nations by the USA) and to interference via spoofing. This has resulted in a signal which is more accurate and resilient to jamming and can remain on in times of war when a commercial GPS signal is switched off. Add to this the mass of legacy and new navigation and weapon system interface requirements to demonstrate why a simple COTS GPS has never been a viable option (Figure 3).

- NAVFIX has been designed with future proofing in mind: a bank of 10 ethernet ports are currently undergoing CTAS accreditation for inclusion into the final product; it will be capable of receiving M-code (replacing P(Y) code) when roll out occurs; and will link into the NAVWAR requirements for Controlled Reception Pattern Antenna (CRPA) onboard ships.

- The CRPA provides the anti-jamming capability which has long been in use with minesweepers from a previous UOR, however not used widely throughout the Fleet. Depending on the antenna chosen, it will provide between three and six 'nulls' for anti-jamming capability. A variety of options have recently (June 2013) undergone testing at the anechoic test facility for performance comparison against the existing non-anti-jamming QYF Fixed Reception Pattern Antenna prior to selection. It is envisaged that the antenna chosen will be based not just on its technical merits, but on the ability to provide equipment convergence and positively reduce the number of single-equipment-specific GPS antennas on the bridge roof – possibly via breakout boxes for other equipments to feed directly off the received P(Y) Code.

1. BR45(3) para 0221.

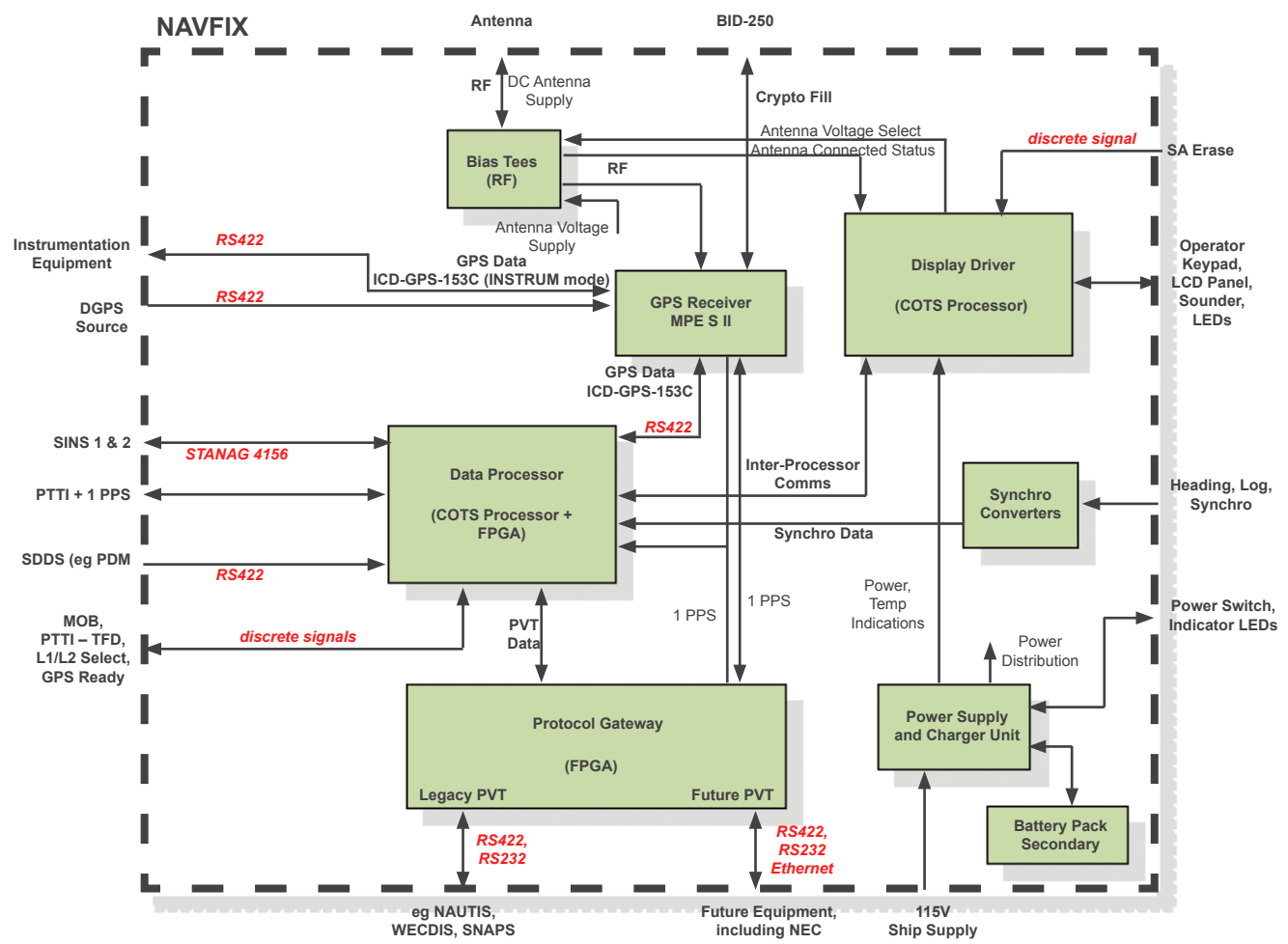

Figure 3: System schematic

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Figure 4: the rapid prototype produced by DrumGrange, without interfaces present

NAVFIX is currently in the manufacture stage. The rapid prototype has been produced by DrumGrange to test component dimensions and connectivity, with the display currently being utilised on a test harness which can simulate various environmental conditions to determine how well the GPS receiver performs.

NAVFIX will commence roll out Q2-Q3 2014 with an In Service Date of November 2014 and Full Operational Capability scheduled for January 2016. It will be fitted to all existing QYF ships (Type 23, MCMV, capital ships, RFA, T and V class) with the option for other ship classes to be included. Type 26 is a key example of this with a mixture of new buy "prime pump" units and Type 23 GFX units as the new ships come into Service.

WANT TO KNOW MORE?
For further information please contact:
Lt Duncan Turner on DESSHIPSMCS-CSA-MNS-NA@MOD.UK 967939393.

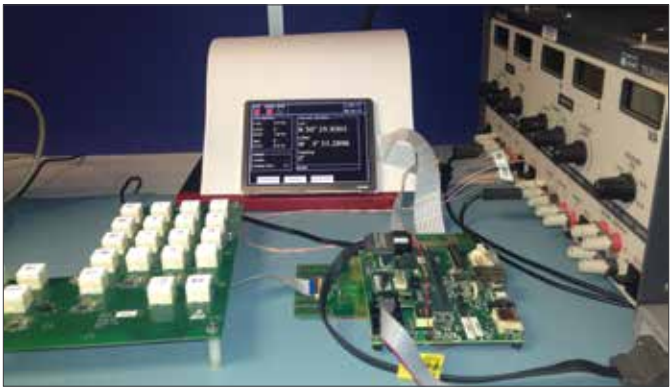

Figure 5: the test system in use

Figure 6: the new display in operation

GLOSSARY OF TERMS

CRPA	Controlled Reception Pattern Antenna – antenna able to conduct anti jamming
CTAS accreditation	Communications Electronic Security Group (CESG) Tailored Assurance Service
DTS	Data Transfer System
FRPA	Fixed Reception Pattern Antenna – generic antenna with no anti jamming capability
GFX	Government Furnished Equipment
GPS	Global Positioning System
LCD	Liquid Crystal Display
Lever Arm Settings	Distance data input into the system to align the antenna location with Polaris datum
MCMV	Mine Countermeasures Vessel
MPE S II	GPS receiver card made by Rockwell Collins
NMEA messaging	National Marine Electronics Association – combined electrical and data specification for communication between marine electronic devices
OEM	Original Equipment Manufacturer
PPS	Precise Positioning Service
PRN	Pseudorandom binary sequence
QYF	Existing military/naval GPS receiver
Spoofing	Ability to broadcast fake GPS signals
SPS	Standard Positioning Service
UOR	Urgent Operational Requirement

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OUTPOST OF EMPIRE? THE RN'S SOUTHERLY NAVAL BASE

By the Editor

Photo by Olaf Tausch

Gibraltar has been the scene of much naval engineering over the years – and centuries. Perhaps the best-known occasion was a major battle damage repair activity in 1805 after Trafalgar, when the late Admiral Nelson's flagship, HMS Victory, was anchored in Rosia Bay; there she was made seaworthy enough to return to Portsmouth, famously carrying the Admiral's body in a barrel of brandy (although some sources say the liquid was rum!). In more recent times, the list of RN warships and submarines which have received major or minor engineering support in Gibraltar is long, and includes most major, and not a few minor vessels; the author recalls an emergency drydocking in a deploying frigate to have a stern seal replaced "at the rush", and there are many other similar stories.

This article, one in an occasional series, summarises the history of the dockyard on the small enclave, which has been British territory since the Treaty of Utrecht was signed in 1713; it will not address the background to that Treaty, and the ongoing diplomatic issues between Britain and Spain; nor will it discuss the operational use of the British facilities on (and inside) the Rock.

Although an important base for the sailing navy during the Napoleonic Wars and before, Gibraltar's shore facilities were not well suited to support the steam navy which had developed during the Victorian period. In 1894 the small and antiquated base had a small Navy Yard, a victualling yard, a hospital, two small moles, each partially sheltering a small part of the Bay, and no drydocks. After much debate, the Admiralty sought Parliamentary approval in 1894 to spend some £1.4 million on a significant expansion. This was agreed in 1895, and the following year a new government agreed to an even larger scheme costing £4.5 million, to include building a significant extension to the New Mole (today known as South Mole), a Detached Mole and a new North Mole (thus enclosing a sheltered and protected area of water of some 440 acres), together with new workshops, stores, offices, slipways for destroyers, coaling jetties and three (later four) drydocks; major dredging works were also required to allow the larger warships to use the facilities. This work took until 1906 to complete – it required the reclamation of 43 acres, some for buildings, some for working space and some for the new docks (the southern half of No 1 Dock was excavated from the existing dry land, most of the remaining area of the three docks was originally in the sea). The engineering effort to achieve all this was colossal, but, since this was

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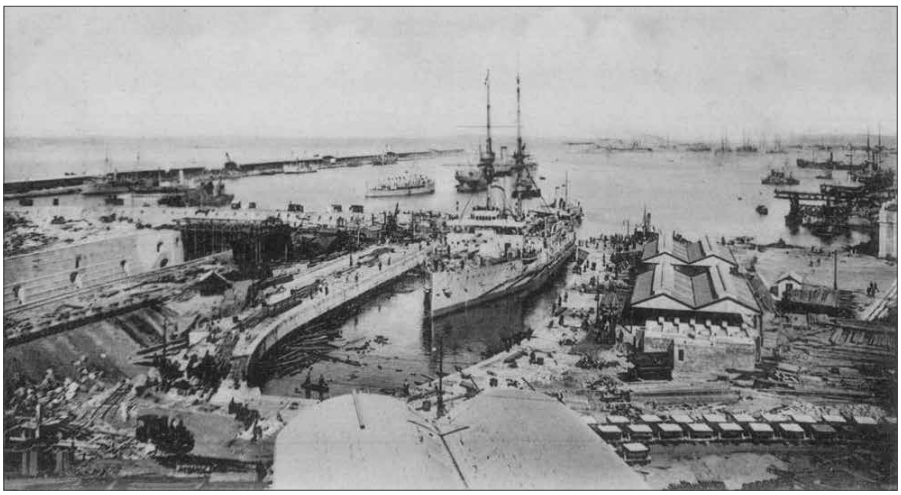

No 3 Dock in use for the first time – the battleship King Edward VII enters the dock on 1 November 1905, with Nos 1 and 2 Docks still under construction.

effectively civil engineering, it will not be covered further.

By the time the contractors finished in 1906, Gibraltar had one of the finest Admiralty dockyards. Short of actually building ships, there was nothing that could not be supplied or made in the yard. The intention was to provide the Navy with anything that it might need, at any time. Well outfitted, the facilities included Machine Shop, Foundry Shop, Gun Mounting Stores, Gun Mounting Shop, Smithering Shop, Electrical Welding Shop, Shipwrights' Shop, Boiler Shop, Galvanising Shop, Saw Mills, Coppersmiths' Shop, Rigging House, Joiners' Shop, Engine Fitters' Shop, Electrical Fitters' Shop, Paint Shop, Plumbers' Shop, Pattern Makers' Shop, Ship Fitters' Shop, Laundry Shop, General Storehouses, Chain Store and Inflammable Stores. The yard had its own Electrical Generating Station and Dock Pumping Station. 100 ton sheerlegs were provided for lifting large machinery into or out of vessels under maintenance or repair.

Less than a decade later, the Gibraltar Dockyard was to prove its worth in conflict. One of the first tasks was to repair the armed merchant cruiser HMS Carmania, damaged in action when sinking the German raider Cap Trafalgar off Brazil in September 1914; a month later the battlecruiser HMS Inflexible needed dockyard attention after the Battle of the Falklands – just two of many warships to be supported during the Great War. This included the smaller craft based in Gibraltar, many of them involved in patrolling the Strait, attempting to prevent transit of German submarines. Not just ships, either; the Royal Naval Air Service, predecessor of today's Fleet Air Arm, established a base for seaplanes in the harbour.

Between the wars, the military establishment in Gibraltar (as elsewhere) was considerably reduced. In the late 1930s, however, funds were found to extend two of the docks so that the larger battleships and cruisers built during and after the Great War could be docked down – this work was (fortunately) completed in 1938. Much of the North Mole was turned over to civilian use, providing coaling facilities to merchant shipping and other tasks. Various ship repair work by the Dockyard was required during the Spanish Civil War. To list just a few of the repair jobs needed, HMS Hunter detonated a Spanish Nationalist mine off Malaga, and was towed into Gibraltar where she was docked for major repairs; the Italian cruiser Gorizia was repaired after a petrol explosion and the German panzerschiff[1] Deutschland arrived in Gibraltar after being bombed by Spanish Republican forces, with 31 of her ship's company dead and 74 wounded.

The outbreak of the Second World War led to major use of the facilities of the Rock, although initially most of naval activity was elsewhere, and patrol work was the main task of ships based in Gibraltar. The services of the Dockyard, however, soon found themselves in demand; one of the first tasks was repairing HMS Ajax's battle damage suffered at the hands of the Graf Spee, another German panzerschiff, in the Battle of the River Plate.

Although Gibraltar was initially far from major scenes of maritime action, this was to change when Italy declared war in June 1940, followed shortly afterwards by the

1. Colloquially know as a "pocket battleship".

HMS Hunter after mine damage, and under tow en route to repairs in Gibraltar in May 1937

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1941 – ships of Force H heading east from Gibraltar for the bombardment of Genoa, Operation Grog

capitulation of France. It became necessary to base a powerful RN force to guard the approaches to the Strait, and cover the western basin of the Mediterranean. This force, a balanced squadron of at least one battleship or battlecruiser, a carrier, one or more cruisers and a destroyer flotilla, was termed Force H, and became a household word; it fought in many well-known actions such as the Bismarck chase, Malta convoys and the unfortunate Operation Catapult, where Force H was ordered to sink a powerful French squadron in an Algerian harbour.

Despite the threat of German attacks on the Rock which had led to the evacuation of all non-combatants (some 13,000 Gibraltarians had left by the end of June 1940), support to Force H and the other locally-based patrol forces continued, under conditions of considerable overcrowding at certain stages of the conflict – for example, during the buildup to Operation Torch, the Anglo-American invasion of North Africa.

Gibraltar was a convenient assembly point for convoys re-supplying Malta, or transporting troops, equipment and supplies to other conflict areas in the Mediterranean. With her fuel tanks, stores and ammunition depots within caverns deep inside the rock, Gibraltar had a vital role to play in replenishing the hard-pressed escort forces as well as repairing action or weather damage. Other, less well-known activities were also taking place; amongst the latter was the preparation of food and other supplies for Malta, sealed in watertight tins before loading into merchant ships bound for Malta. If sunk by enemy action, Maltese divers were able to retrieve and salvage the much-needed supplies.

However, with the ending of the conflict in Europe, although there was still a flow of warships on their way to join the East Indies and Pacific Fleets, the level of activity again reduced. The eastwards procession of warships reversed after Japan's surrender, as many (but not all) of the ships returned to UK to pay off, or on trooping voyages returning servicemen from the Far East.

Post-war, the North Mole, which had been returned to RN control during the Second World War, was again leased to civilian authorities. The reduction in RN force levels meant that less use was being made of the Dockyard, although ships continued to be repaired there; indeed a number of refits of such ships as light cruisers and Leander class frigates were conducted in the yard.

1953 – the battleship HMS Vanguard enters No 1 Dock for maintenance

April 1982 – the liner SS Uganda enters No 1 Dock for conversion

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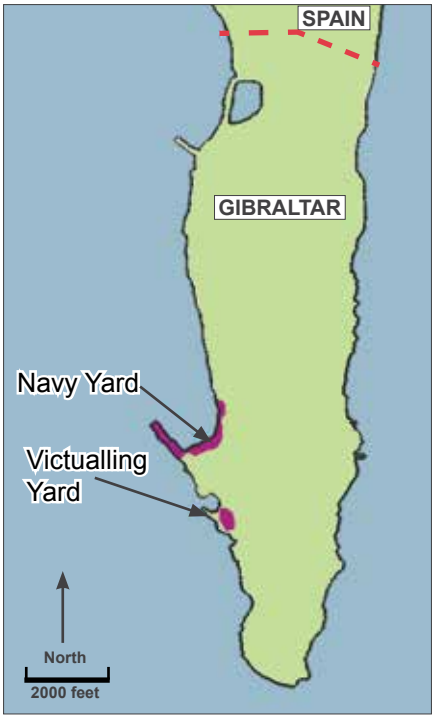
2001 – HMS Talent alongside the South Mole for repairs

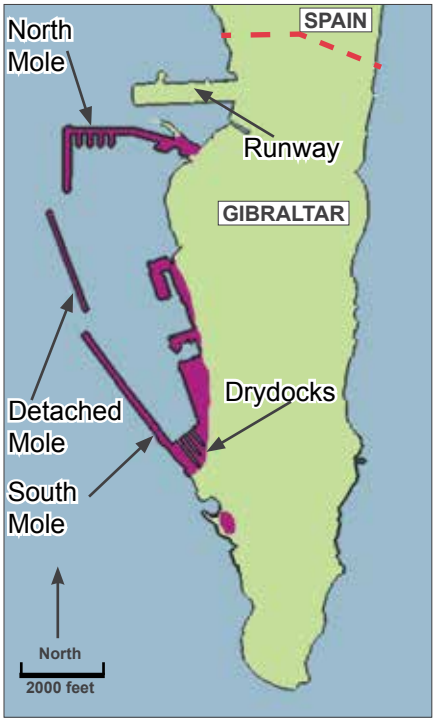
2011 – HMS Westminster alongside, opposite Admiralty Tower, for replenishment

However, in 1981 the British Government announced that the Dockyard would close in 1983, with the majority of it being handed over to the Government of Gibraltar. Despite opposition, particularly from the local trades unions, this plan was set to go ahead when, in April 1982, conflict broke out in the South Atlantic. As elsewhere, engineers immediately set to work to prepare forces for deployment; Exercise Springtrain was in progress and ten of the escorts involved were stored and ammunitioned for war, and follow-on shipping given all necessary support. Amongst that effort, the conversion of the cruise liner SS Uganda into a fully-fitted hospital ship by Dockyard personnel in the incredibly short period of 65 hours was just one of many noteworthy achievements. Nonetheless, this effort was not allowed to stand in the way of Dockyard closure (although it was to be delayed until the end of 1984) and the Naval Base now comprises the area near the Admiralty Tower, including jetties (one of them a base for the Gibraltar Squadron's ships and boats) and adjacent workshops and stores, and the outer part of South Mole, where larger ships and submarines can berth. It remains a very convenient staging post and maintenance facility for units deploying to the Mediterranean, the Middle East and beyond; there are few RN warships larger than patrol craft which have not called in in recent years!

Gibraltar in 1800



Gibraltar in 1858



Gibraltar in 1944

Gibraltar in 2013

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Bravo Zulus

Congratulations to the RN and RFA Engineers who were awarded honours:

In the 2013 Birthday Honours List:

Commander of the Most Excellent Order of the British Empire (CBE)

Commodore D. Preston Royal Fleet Auxiliary

Officer of the Most Excellent Order of the British Empire (OBE)

Captain M.S. Harrison
Commodore W.J. Keegan

Member of the Most Excellent Order of the British Empire (MBE)

Lieutenant Commander S. Heap
Chief Petty Officer Engineering Technician (Mechanical Engineering) R.E. Stecko
Acting Lieutenant Commander A.J. Thomas
Lieutenant D. Valvona

In the October 2013 Operational Honours List:

WO1ET(ME) M.J. Hinton

Congratulations to the RN Engineers who have recently been awarded the Meritorious Service Medal (MSM):

WO1(AET) S.P. Cass
CPOWEM(O)(SM) G.R.E.B. Moore
WO2ET(ME) S.N. Patridge
WO1(AET) B.E. Peet
WO2(AET)(M) A.D. Shepherd
CPOAET(M) A. Wardle

Congratulations to the RN Engineers who have recently been awarded commendations:

Commander Joint Operations Commendation

Lt J.D. Sutcliff

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WHAT'S HAPPENING TO TRAINING?

By Commodore David Elford BSc MSc MA CEng FRAeS MIET RN
Commandant, Defence College of Technical Training

Three years ago, an article[1] in TNE's predecessor addressed Defence technical training and the plans then in place to improve the existing training process. Time marches on, and since then, much has happened. Several factors conspired to affect those plans, and the Defence Technical Training Change Programme continues to address the issue – the following article, drawn from a recent strategy paper and a presentation given in July 2013[2], summarises the current position. The strategy paper sets out the rationale for, and the strategy to achieve, the transformation of Defence Technical Training (DTT) so that it is sufficiently flexible, affordable, modern and effective.

The efficient delivery of the right training and education to the technicians and engineers of the country's Armed Forces is vital for the safe and effective conduct of UK military operations around the world. At the same time, it is important to ensure that the training methods employed are continuously developed so that they capitalise upon modern technology, are tailored to complement the educational and other life experiences of the trainees and are sufficiently flexible to cope with the changing requirements of the Front Line Commands (FLCs). Finally, particularly in the current economic environment, it is imperative that the nation is able to achieve the very best value for its taxpayers' money.

1. *Defence Training Review* by Capt R.C. Rusbridger in *Review of Naval Engineering* Spring 2010.
2. *DCTT Change Programme*, by Cdre D.G. Elford, Commandant, Defence College of Technical Training, at AEO's Conference, 17 July 2013.

Commodore Elford joined the RN in 1981 and, after initial training and university education, was awarded a Certificate of Competency as an AEO in 1987. His first complement post was as the DAEO of 815 NAS, a Lynx squadron. He then lectured at RNEC Manadon before undertaking a Computer Science MSc in preparation for what became two appointments as an Engineering Sponsor for the Merlin helicopter. In 1996, he became the AEO of 820 NAS, spending the majority of his 18-month appointment embarked in HMS Illustrious. He was promoted to Commander in mid 1998, spending two years based in Naples on the staff of NATO's Southern Regional Headquarters. After an appointment at Abbey Wood responsible for future aircraft support strategy, he returned to sea in 2002 as Cdr (AE) in HMS Invincible. Following 2½ years working in the Defence Logistics Transformation Programme, he joined what was the Defence College of Aeronautical Engineering as the Director of Support. He was Navy Command's Chief Air Engineer for 2½ years from 2009, where he was heavily involved with the implementation of the recommendations emerging from the Haddon-Cave review. He joined the Lynx/Wildcat Project Team (the largest helicopter PT in the MOD) in March 2012 as the Team Leader. On promotion to Commodore in April 2013 he became the Commandant of DCTT.

THE BACKGROUND

The deductions of the Defence Training Review from 1999 were revisited by the Defence Technical Training Change Programme (DTTCP) and, where needed, updated. It was agreed that current training methods:

- Were out of date.
- Were not sufficiently flexible.
- Could not be afforded due to a shortfall in funding over 30 years, although, by its own admission, the financial analysis did not have the rigour of an Investment Appraisal and made various assumptions which have not been validated since.

WHERE ARE WE NOW?

- In October 2012, DCTT became a unified College distributed over a number of geographic sites (see Figures 1 and 2).
- The following Training Business Change (TBC) targets were set for the DCTT:
    - Compression: 15% by 2015; 25% by 2020.
    - Distribution: 20% of Phase 3 training by 2020.
- For DTTCP Tranche 1, the 2015 target is a lever for driving down Standing Student Population (SSP) size and so TBC has become primarily an enabler to estates rationalisation rather than an end in itself.

THE ENDURING CASE FOR CHANGE

The imperative for a large and complex organisation to deliver affordable services whilst simultaneously developing and improving is not at all unique.

DCTT must be more agile than the current model in its ability to meet the training needs of the FLCs, both in terms of what training is required and how much. Additionally, proper account must be taken of the changing environment, both inside and outside DTT; for example, the MOD's New Employment Model and Future Force 2020 structures (including the initiatives on the Reserves). Whilst it is likely that technical training is unaffordable, the precise affordability challenge must be determined with far better confidence. In the absence of funding for inter-estates rationalisation, best use will need be made of the high quality estate that does exist and rationalisation within (intra-) estates must be pursued.

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Figure 1: DCTT locations

Technical training must be brought up-to-date (through TBC) in terms of both the underlying requirements (are we over- or under-training?) and the delivery methods employed in order to capitalise on technology and to meet modern trainees' needs. This TBC will also address affordability.

In summary, defence technical training must be transformed so that it is flexible, affordable, modern and effective.

ENDURING DTT PRINCIPLES

- **Phase 2**. Phase 2 training is to facilitate the inculcation of Service ethos and relevant military training in parallel with technical training. As such, Phase 2 training is best delivered in single-Service cadres.

- **Phase 3**. By definition, Phase 3 training is delivered to personnel who have successfully achieved Phase 1 and 2 training and who have worked within '*the trained strength*'. Therefore, during Phase 3 training, Service ethos is of less importance and the training may be delivered to mixed groups and may be distributed.

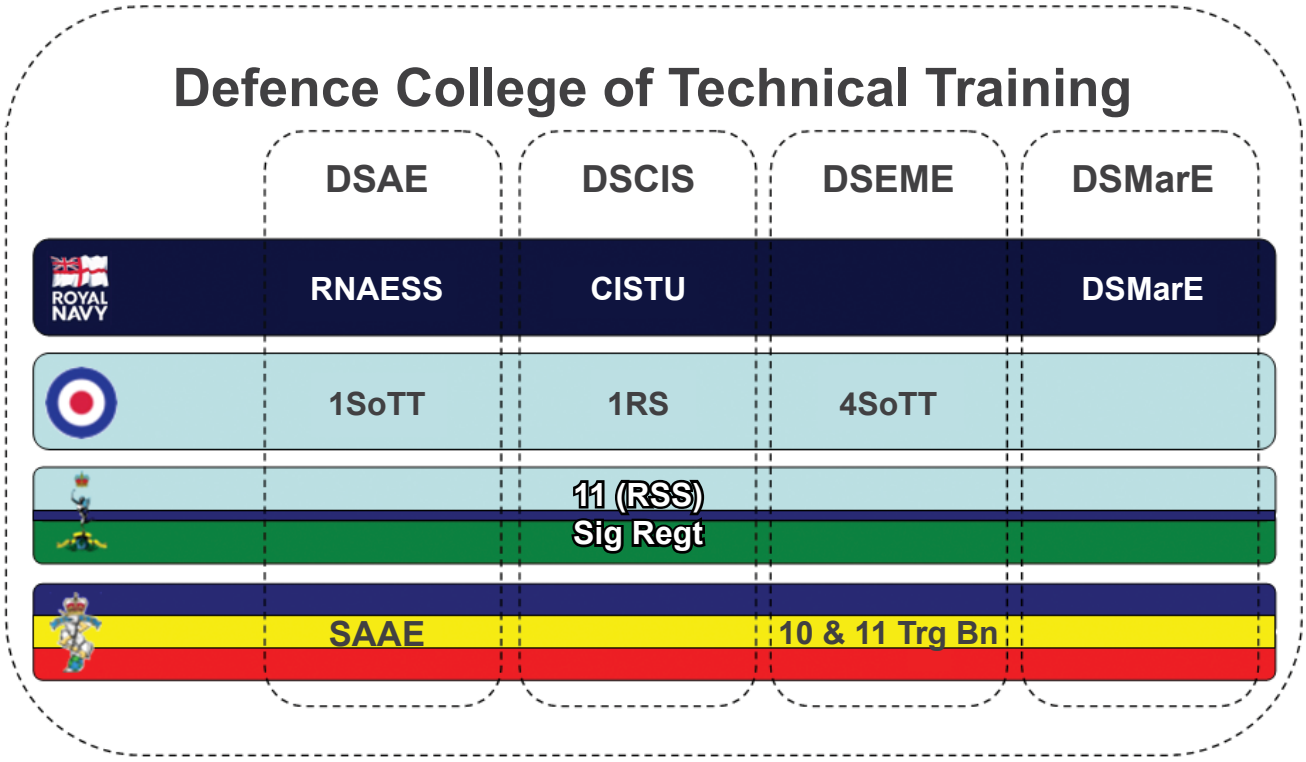

Figure 2: DCTT sub-units

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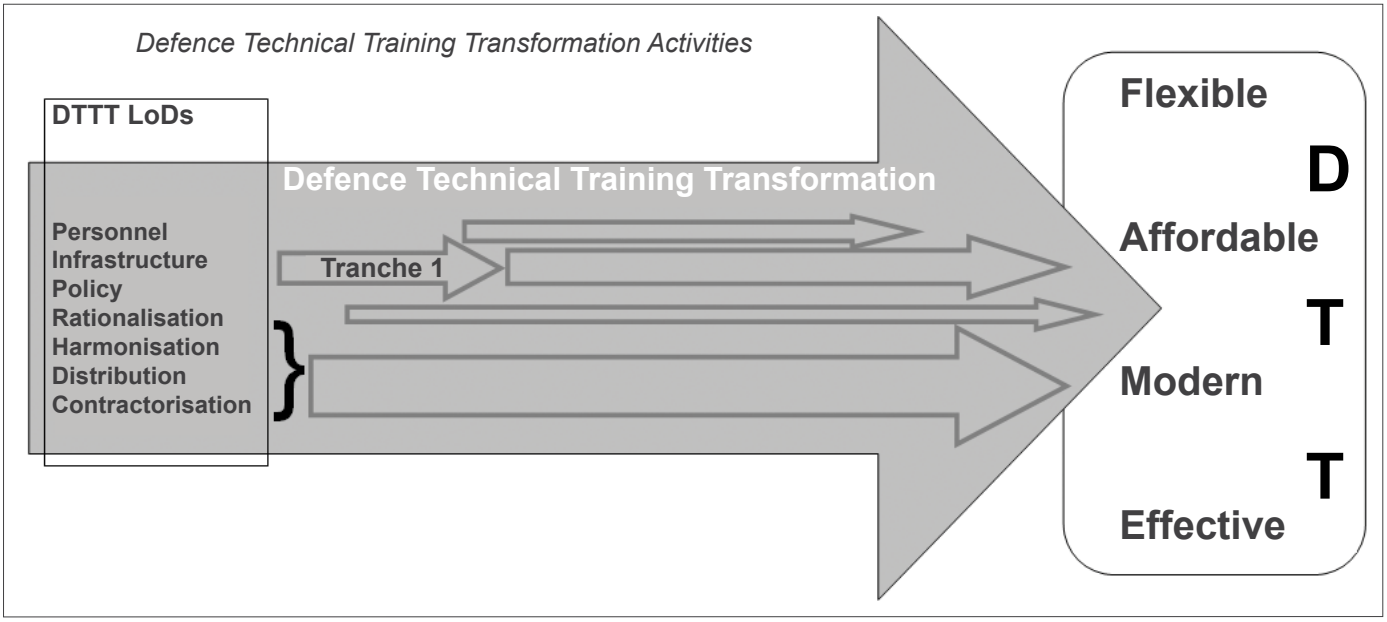

- **Transformation metrics**. Although SSP is a key driver of overall cost, within the DTTCP it has become most strongly associated with new estate size. However, given the likely affordability challenge, the overall cost of training is a better metric against which to assess the progress of transformation activities.

- **Use of military personnel**. DCTT is developing a Role of Military in Technical Training policy to apply during D3T.

D3T STRATEGY

Since the need for change endures, future transformation activities will need to comprise a range of initiatives and so '*post Tranche 1*' is a better term than '*Tranche 2+*' which has become prominent. Post Tranche 1, D3T will require a broad approach which must not become seduced into concentrating on inter-estate rationalisation at the expense of other initiatives[1]. In particular, addressing affordability will require DCTT to focus on all those reforms which will best improve value for money and overall cost. It is envisaged that D3T will include, but not be limited to, the following '*D3T lines of development*' which should not be assumed to be interdependent:

- **HQ optimisation**. The centralisation of common, pan-College functions into a revised DCTT HQ structure (Project Napier).

- **Optimum resource utilisation**. All training resources, including time, will need to be better employed.

- **Training rationalisation**. Rationalisation is defined as the process by which training courses are analysed and content is changed to exclude unnecessary content (eg duplicated, not relevant to the TPS). In essence, DCTT must deliver the right training.

- **Training distribution**. Distribution is defined as instructor-led or -facilitated training that is conducted away from primary training establishments at a temporary, permanent or mobile facility. It can be conducted individually or as a class of trainees in one location or networked training across multiple sites. Appropriate distribution of Phase 3 training will allow personnel to be trained at, or close to, their units rather than at existing training establishments.

- **Training harmonisation**. Common subjects, wherever they are taught, will use the

1. DTTCP experience so far is that wider training transformation initiatives have been stifled or suppressed in the expectation that DTTCP estates rationalisation will force transformation; this effect can be thought of as 'initiative blight'.

GLOSSARY OF TERMS

1RS	No 1 Radio School
1SoTT	No 1 School of Technical Training
4SoTT	No 4 School of Technical Training
CISTU	Communications and Information Systems Training Unit
D3T	Defence Technical Training Transformation
DCTT	Defence College of Technical Training
DSAE	Defence School of Aeronautical Engineering
DSCIS	Defence School of Communications and Information Systems
DSEME	Defence School of Electro-Mechanical Engineering
DSMarE	Defence School of Marine Engineering
DTT	Defence Technical Training
DTTCP	Defence Technical Training Change Programme
FLC	Front Line Command
LoD	Line of Development
RNAESS	RN Air Engineering and Survival Equipment School
RSS	Royal School of Signals
SAAE	School of Army Aeronautical Engineering
SSP	Standing Student Population
TBC	Training Business Change
TPS	Training Performance Standard

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same course documentation and media. Each course will have a designated owner who will be responsible for maintaining its documentation and media.

- **Training modernisation**. Enabled through new ICS, future DTT will seek to exploit the best blend of technologies and techniques, including simulation, interactive courseware, Evidence Based Teaching, student-centred learning and so on.

- **Intra-estate rationalisation**. Rationalisation within otherwise well-found estates, for example, the optimum use of the better buildings and the closure and demolition of redundant, energy-inefficient and high-maintenance buildings.

- **Commercial provision**. An appropriate increase in the level of contractorisation of training support and delivery.

Achievement within each of the D3T LoDs will be measured by assessing how each initiative improves the flexibility, affordability, modernisation and effectiveness of DTT.

SUMMARY

The only constant in this world is that change is inevitable. This applies to technical training just as much as in any other sphere. We must move to a solution which is Flexible, Affordable,Modern and Effective – or we stand to fail in our task of providing the means for the RN to fight and win. DTT is working to achieve this goal.

DEFENCE TECHNICAL TRAINING CHANGE PROGRAMME UPDATE

By Captain Bob Rusbridger MSc, RN Programme Manager, DTTCP

In the preceding article by Commodore Elford, there are a number of references to Tranche 1, which is the first stage of the programme to establish the physical reality of the DCTT at Lyneham. The scope of Tranche 1 covers the redevelopment of the now vacated site of RAF Lyneham, and the physical move of REME training and REME Home of Corps to Lyneham, by the end of 2015. This will then enable the transfer of the Arborfield and Bordon sites to civilian authorities.

The Tranche 1 programme achieved formal Ministerial and Treasury clearance on 27 September 2013, which anticipates the contract for the development at Lyneham to be in place by November 2013. The programme is very much now in the delivery space, against a very pressing timeline.

It would be easy to assume that Tranche 1 is all about building and construction. There is no doubt a large part of it is, but once the buildings are delivered, Lyneham will still be unsuitable for provision of training. Lyneham at present is an empty site, with no 'life support' or services that one might take for granted at a 'running' establishment. All of these need to be set up in parallel with the real estate development to ensure that Lyneham is ready to accept the REME by September 2015. Additionally the physical move from Arborfield and Bordon of personnel and training resources, and their establishment at Lyneham requires careful planning.

Tranche 1 continues to be on the schedule set at its Initial Gate in August 2012, and is now delivering. For the future, work now continues to look at the validity of the future physical moves, within the overall intent of the Change Programme.

It is a wonderful opportunity to be part of something that is developing, and providing a modern facility for the DCTT.

... with no 'life support' or services that one might take for granted ...

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HMS ILLUSTRIOUS 6J SWITCHBOARD FIRE

By Lieutenant Ed Raffle BEng(Hons) PG Dip Nuc RN
Primary System Engineer, HMS Illustrious

Ed Raffle joined the Royal Navy in September 2006 having attended the University of Birmingham. Following his initial training package including SEMC (MESM) and Nuclear Reactor Course at HMS Sultan, he joined HMS Vigilant for training and then HMS Victorious as AMEO in 2008. Transferring to General Service in 2010, Ed joined HMS Illustrious in refit in Rosyth in 2010. He has served as Hull and Auxiliary Systems Engineer before assuming his current post as Primary System Engineer.

BACKGROUND

HMS Illustrious sailed from Portsmouth on 12 August 2013 for the Cougar 13 Response Force Task Group autumn deployment to the Mediterranean and the Middle East.

At 1103A on 13 August, a major electrical fire broke out in 6J switchboard. The underlying causes of the fire remain under investigation. This article concentrates on the immediate responses to the fire, the aftermath and the programme to recover capability.

THE INCIDENT

The first indication that a fire had broken out came via the automatic Minerva fire detection system. At the same time, the Main Communications Office (MCO), which shares the same forced vent system, began to fill rapidly with thick, black, acrid smoke. Within ten seconds the MCO was full of smoke with visibility reduced to only a few feet. All personnel were safely evacuated and a smoke boundary was established. Vent was crash stopped to prevent the smoke from spreading further around the ship.

Title picture: (what's left of) J4 DG supply breaker's contactors

ET(ME) Antony Brereton was the first to the scene of the fire. Despite a deafening explosion and the chatter of the switchboard breaker and the noise associated with electrical arcing, his loud vocal alarm drew instant clarity into the situation and allowed the seat of the fire to be established as 6J switchboard, and not 5J ATU[1]. In the face of considerable volumes of smoke, his only option was to close the door to the switchboard compartment to contain it. He said: "*At first I couldn't register what I was seeing. The noise was incredible and the smoke literally poured out of the breaker. We have only recently completed FOST covered sea training in preparation for the deployment and I guess that the training just kicked in.*"

Next on the scene was LET(ME) Daryn Jackson, as part of the attack BA party. Wearing his Extended Duration Breathing Apparatus, he entered the MCO to survey

1. Cdr (E) comment: "*In the first four minutes or so we thought the fire was in either, or all, of 5J ATU, MCO and 6J Switchboard. Confusion in the first few minutes is common, and he cleared it up.*"

The switchboard has seen better times, note the black deposits on the walls and Control Console

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the compartment, to check for secondary fires and seal the vent to prevent further ingress of smoke to the compartment. He then proceeded down to 6J switchboard where he relieved ET Brereton at the door. He used the Thermal Imaging Camera to confirm that the door remained cool and then rigged hoses to assist in containment. Critically, these hoses were not used.

The HQ1 team was now established. Having rapidly assessed the situation and cut through much of the initial confusion, it was clear that the priority was to stop the fire spreading and conduct electrical isolations. With Command approval, these isolations were made and full containment was established. Having isolated the power supplies, it was assumed at this point that the primary fire was extinguished. The main priority was then to assess the temperatures within the compartment to assess if the fire had spread into carbonaceous material.

This is where the senior command team earned their pay. Commander John Voyce closed up as the Internal Battle Coordinator (IBC). He was faced with a stark choice. Either re-enter the compartment with his team protected by a water wall in the sure knowledge that the contamination and potential damage would mean a lengthy repair period, or develop another plan. Having worked through the implications with his team and carefully assessed the risks, it was agreed with the Command that a dry re-entry to the compartment would be conducted. All of the normal firefighting team protection was available at immediate readiness at the scene, but the potential consequences of causing further damage to the switchboard and the compartment through salt water contamination were decided to outweigh the almost negligible risk associated with a dry re-entry.

ET (ME) Ryan McHale was part of the re-entry team, acting as team protector with his water wall hose. He said: "*When the door to the switchboard compartment was opened, the smoke billowed out. It was so bad I couldn't see anything – the team leader had to use a thermal imaging camera to direct the team safely into the compartment. All the way through the compartment re-entry it felt like an exercise. With the EDBA mask on, I couldn't smell the smoke. It only felt real afterwards once all the adrenaline was gone and we were coming off air in the safety of the boat bay. I will always remember the smell on my clothing. Even now, it is still lingering in the switchboard.*"

"*The FOST training definitely helped. I felt confident in both myself and the team when re-entering the switchboard. When the call was made to make a dry re-entry into the space, I didn't even think about it. I just concentrated on the job I had to do and got ready to open the water wall if I needed to. I knew that if I did, the entire switchboard would have been written off. The responsibility placed on me was tremendous.*"

The diffusers on the fluorescent lights had melted ...

Inside the breakers, there were large lumps of copper ... which had melted from the contactors.

Having safely re-entered the compartment and confirmed that the fire had extinguished, initial damage assessment and smoke clearance then became the priority.

DAMAGE ASSESSMENT

Those exposed to the smoke became immediately aware of the dangers and consequences. PO ET(ME) Simpson was one of the first engineers on the scene to conduct damage assessment. He said: "*I entered the compartment in EDBA. It was pitch black and the thing that struck me was the residual heat and the smoke. I literally couldn't see the end of my arm when I extended it. My next thought was that this was going to be a very long day indeed – someone was going to have to fix this!*"

... everything was covered in black dust ...

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PO Simpson went on: "*It was immediately obvious what had happened. The breaker door had blown open on J4 supply breaker and an arc flash had occurred. The diffusers on the fluorescent lights had melted and there were plastic stalactites hanging from the overheads. Inside the breakers, there were large lumps of copper at the bottom of the switchboard which had melted from the contactors*."

A smoke clearance plan was devised and executed, allowing a more detailed inspection of the breaker to be conducted. PO Simpson said: "*The Captain gave me six hours to make a full damage assessment and develop a recovery plan. The conditions in the compartment were terrible – everything was covered in black dust and this had got inside all of the other breakers in the switchboard. The air was dry and contained residual smoke that stung our eyes. We had to wear paper masks to prevent breathing in the dust. The working conditions were some of the worst I have been exposed to, but the team cracked on and by 2200, we were ready to report to the Captain.*"

"*We were very lucky. The fire had happened in the supply breaker for J4 diesel generator. An interconnector breaker located immediately beside the supply breaker looked like it had been affected. There was also some damage to high power cables immediately above the affected breakers, but these were used to connect the generators to shore loads or barges to test the generators and were therefore not an immediate priority to sustain Cougar 13.*" Given that assessment, it was decided that the ship's team could effect the necessary repairs to allow Illustrious to continue with her programme.

RECOVERY

Having cleaned the compartment overnight (although it will take more work to ensure it is up to the required standard for Captain's Rounds!) and cleaned the unaffected breakers, power was restored to 6J switchboard by 2200B on 13 August. At that time, the only shortfalls in capability were that J4 diesel generator could not be connected to the switchboard and 6J switchboard could not be fully connected to the electrical ring main. Overall, about 90% of the fighting capability of the ship was recovered within 11 hours.

The next element of the repair was to re-instate the interconnector breaker. A multi-disciplinary team visited HMS Illustrious during the ship's first operational stand down in Rota, Spain. Following a successful inspection which identified no major concerns, J2-K4 interconnector breaker was reinstated at sea on the night of 18 August. Overall, six hours were allocated to clean and recover the breaker and test the electrical ring main. This was successfully achieved, leaving only J4 supply breaker cabinet and the shore load connection cables to be recovered.

Clearly this would be no easy task. The breaker and its associated cabinet were well beyond repair (see title photo). In addition, there were no replacement stores available following the sale of HMS Ark Royal for recycling. DE&S identified that the breaker cabinet needed was still in situ in Ark Royal and acted quickly to secure the breaker just in the nick of time (see photos below).

Illustrious returns to Portsmouth in December. The repair plan to re-instate J4 supply breaker and the shore load testing connection cables is with Strike COM.

... to secure the breaker just in the nick of time.

Lift and shift – removing the breaker from the remains of Ark Royal

LESSONS LEARNT

The investigation into the causes of the electrical fire remains underway at the time of writing. The following lessons have been drawn out of the incident:

- Correct reactions saved lives. FOST training really works.
- Smoke is a killer. The nature of thick, black, acrid, poisonous smoke was not fully understood by many of the junior members of the ship's company. It is now.
- Heat and damage associated with electrical arc fires tend to remain highly localised.
- Careful thought needs to be taken when planning re-entry techniques. Peacetime safety remains the overriding concern, but rash actions can cause further damage.
- Our training and the capability of our engineering staff at sea is first class.

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MARITIME FORCE CAPABILITY ASSURANCE – A NEW VISION

By Lieutenant Kevin Tumilty MSc RN
Combat System Engineer, MCS-Integrating Authority

Kevin Tumilty joined the RN in 1985 as an Artificer Apprentice. On completion of his training as an Ordnance Control 'tiffy', he served onboard HM Ships Ark Royal, Nottingham and Illustrious. His shore assignments included instructional duties for the Goalkeeper Close-In-Weapon System at MWS Collingwood and as an Explosive and Magazine Trials Officer for CWTA. Kevin successfully passed the AIB in 2001 and was subsequently selected for a SUY (WE) commission. He served as DWEO in HMS Newcastle from 2003 until her decommissioning. He was then appointed to the TDLIPT as the In-Service Support Manager for Links 11 and 16. His next role was as the MCTA lead Trials Officer for Command Systems during which time he saw DNA2 introduced into service, and then went on to act as the lead System Engineer for Ships conducting Ship Performance Assessments and Operational Capability Confidence Checks during FORACS. In his current role, Kevin is employed within the Maritime Combat Systems Integrating Authority at the Land-Based Test Site where he acts the lead for C4I and gunnery/missiles systems.

INTRODUCTION

Operational Capability (OC) is the corporate effect that is delivered by the military and is the benchmark used when generating forces in preparation for operational tasking. Assurance is a key attribute in understanding if units have the posture to embrace the "... ready to fight and win..." ethos of the military[1]. Maritime Force Capability Assurance (MFCA) is the legacy initiative with the intention of understanding if platforms are ready to be deployed, through the determination of combat system performance in each platform. Conducting capability proving serials and completing the analysis of recorded data has allowed a level of system performance to be measured.

A Failure of Leadership, Culture and Priorities

On 2 September 2006, Royal Air Force Nimrod XV230 was on a routine mission over Afghanistan, when it suffered a catastrophic mid-air fire which lead to the loss of the aircraft and the death of all those onboard. The Haddon-Cave investigation[2] reported that this unnecessary loss was due to organisational failing at the highest levels within the Ministry of Defence and industry. An assumption was made that the aircraft was safe to operate, despite assurance of safe systems never being completed or fully understood, whilst business output was regarded as more important than airworthiness. Haddon-Cave highlighted the failings of the system for assessing Military Airworthiness and considered the regime was not fit for purpose.

Current Environment

The contemporary world is characterised by unpredictable and rapid changes to the environment we live in. Many challenges such as climate change, terrorism, nuclear proliferation, resource scarcity and piracy demonstrate how the global community is affected and how realistic potential conflict is for the future.

Also, the United Kingdom is a maritime nation, whose interests are based upon the prosperity, stability and security of the land, people and overseas territories. To maintain the status quo, it is vital that access to the sea and maintenance of an international system of law and free trade is upheld. The UK has a commitment as a global power to influence a more stable world where, British Maritime Power has been charged to provide a significant contribution to protect and promote national interests at home and across the world. This will be discharged by projecting power at sea to influence the behaviour of people or the course of events. It is recognised that future conflict is likely to occur in, or adjacent to a maritime area, where sovereignty of some overseas territories may be threatened. The maritime environment provides the area to enable the assembly of a force, with the intent of applying combative power necessary for achieving the UK's desired political objective. This is reliant on maritime forces being "...ready to fight and win..."' in the future combative arena.

JUSTIFYING THE INITIATIVE

"*Let us be masters of the Channel for six hours, and we are masters of the World*" – Napoleon Bonaparte, July 1804.

Maritime naval supremacy is fundamental and underpins Britain's vision of building a global commercial empire by safeguarding oceanic trade routes. British history showcases those events that defined our global supremacy. However, it is important to recognise that maritime domination did not transpire without sufficient preparation.

Battle of Trafalgar

The Battle of Trafalgar is arguably the UK's finest maritime hour[3]. The victory against the combined French and Spanish fleets ensured that Britain maintained naval supremacy throughout the 19th Century. There was a recognised inferiority of British ships compared to the fleets of the Spanish and French. However to

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... victory was not an achievement of pure luck ...

counter any attack by Napoleon, the British imposed a blockade of the enemy at Cadiz. This meant long periods at sea, but allowed seamanship, gunnery skills and ship manoeuvrability to be exercised. It is important to acknowledge that victory was not an achievement of pure luck, but was partly through understanding weaknesses, and making changes to improve performance. To an extent, this was assurance of capability in its infancy, as it ensured Britain was ready to wage war against her Napoleonic foes.

Falklands Conflict

In 1982, the UK was involved in a dispute over the sovereignty of the Falkland Islands. The UK had not engaged in regular warfare for 26 years. This was regarded as a considerable military and logical test of waging war. With little time for preparation, the attitude of the Commanders was "*...sail at the enemy and do not hesitate about the consequence...*"[4]

Although the Falklands conflict will be regarded as a key success in maritime history, there are many lessons that can be taken away. Why did the RN lose so many ships and why were more not lost. Did the lack of capability assurance and preparation contribute to these loses or did military commanders rely on luck? However, the UK had taken a massive gamble. If a capital ship had been lost, then the whole enterprise would have been jeopardised. This would have significantly dishonoured Britain's reputation as a global maritime force. Based on the lack of preparation demonstrated, this could have been a likely outcome.

MFCA – The first Iteration

A study by QinetiQ[5]established that during the life of maritime platforms, there were obvious gaps of capability assessment. It was realised that complex systems operating in a complex manner within a complex operating environment, were only operated and tested during the operational phase, when in harm's way. This lack of disregard for assurance meant that any potential equipment degradation and poor combat system performance, was likely to remain unknown prior to and during operational tasking of a platform. The potential for catastrophic impact is valid, as Haddon-Cave constantly reminds us.

There was a palpable need, for a balance of objective understanding and engineering to support assurance of maritime force capability. A proposal for a suitable regime for the assurance of maritime force capability was made, with the aim of providing benefits across the management, delivery, sustainment and employment of military capability. The initiative was authorised by Navy Command[6] and commended MFCA to the stakeholder community as the pivotal method in identifying platform operational capability. This was the first iteration MFCA, which developed into a series of events being assembled in a coherent package giving a structured approach towards understanding platform OC.

Criticising the Current Methodology

However, there are issues with this iteration of MFCA. Capability assurance is conducted on singleton platforms only, whilst there is an increasing need for platforms to operate collectively as a force. Current methodology does not make this possible. The air environment is the main beneficiary of MFCA, with little consideration given to the other operating environments. Finally, MFCA is provisioned for some surface ships only, and does not consider the whole range of platforms and other embarked forces, eg organic air and amphibious forces, that constitute the maritime force. There is a view, prevalent throughout the wider community, that the MFCA requirement has become confused in its implementation. Until MFCA gains full recognition as a means for providing platform, combat system and force level capability assurance, the poor perception will continue. A number of deficiencies have been highlighted with the current regime. These include:

- There is a real belief issue with the military benefit of MFCA amongst ship's teams. The belief is that during the conduct of combat assurance serials, MFCA considers the engineering aspects only and has little bearing on assessment of capability threads or actual operational tempo.

- Poor perception means ships are lacking in the initiative to take ownership in understanding their own capabilities. The serials that

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... a real lack of understanding and knowledge ...

are conducted for the purpose of MFCA are for the benefit of the ship, with assistance from external authorities. Ship's teams are generally allowing external authorities to take the lead in determining individual platform capabilities, meaning that they will never gain the knowledge, experience or the will to understand their own level of capability.

- Outside of the nominated MFCA events, it has become evident that there is no consistency in the level of self-assurance conducted by ships. During the conduct of serials, outside authorities are finding little evidence that Ship's Staff are conducting self-analysis of serials. Significant resource is expended to provide external assets to support these serials, which cannot yield their full benefit if the post serial analysis is not conducted and combat system degradation therefore goes undetected.

- There are tools provided to aid ship staff in analysis of their own combat system. These are combat system integration tools used by specialist Combat Systems Engineers (CSEs). However, there is no formal endorsed requirement, training or funding for further development of this tool as a ship staff tool, thus all support is achieved on a best endeavours basis by the Tools Design Authority.

- Whole combat system platform-to-platform and class-to-class interoperability issues tend only to be discovered when platforms are at sea. Shore-based testing has focussed on the acceptance of selected System of Systems (SoS) capability. However there is a real lack of understanding and knowledge towards the assurance of interoperable systems.

- With a shrinking fleet and short notice tasking, platform availability is at a premium. There is no appetite for increasing the time allocated to MFCA in ship programmes.

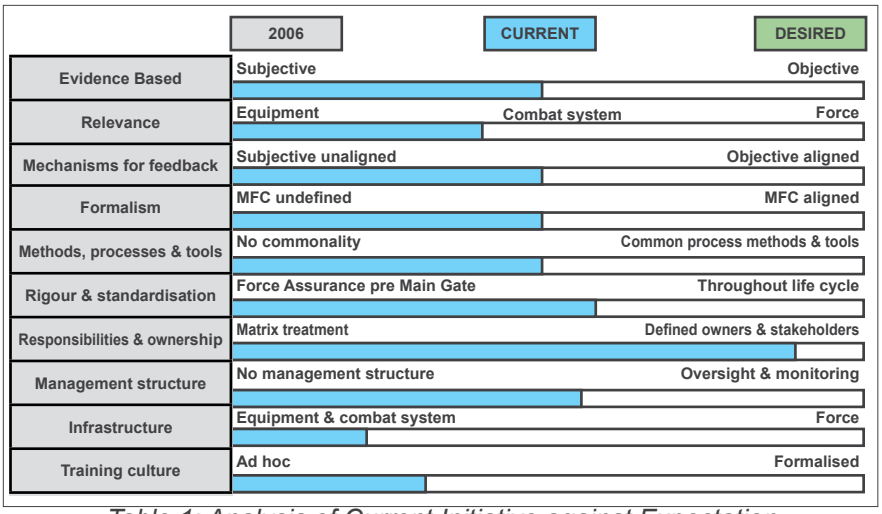

Table 1: Analysis of Current Initiative against Expectation

Analysis of Current Initiative

Table 1 below summarises the expectation of MFCA during its conception against where it currently stands. The analysis is based on the wider community opinion about which areas of MFCA was not fulfilling the expectation. The right-hand edge shows the coveted assurance of Force Capability, with objective assessment as the standard. The desired initiative requires the correct organisation to formalise the structures and processes, whilst the infrastructure must have sufficient rigidity to provide the means for implementation. Table 1 indicates the amount of effort still required for MFCA to reach its nirvana.

Development of MFCA Pillars

The vision for taking forward the next iteration of MFCA (otherwise known as Epoch 2) is based on three work steams plus the overarching governance as indicated by Figure 1 below. The intent is to make combat system performance better by identifying any failure/risk at equipment and combat system level and providing the mechanism for assuring capability.

In order to maintain the organisation, it is important that the correct championing of the vision is reinforced giving direction and leadership to the community. This role would be fulfilled by the organisation 'who feels the pain' when the initiative does not deliver Maritime Capability when required.

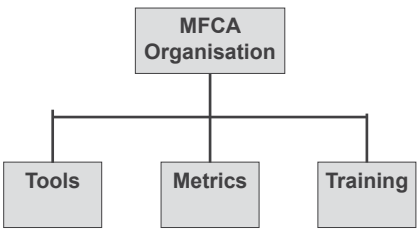

Figure 1: MFCA New Vision Work Streams

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This role is currently performed by the Chief Staff Officer Engineer (CSO(E)), who chairs a steering group giving direction to the wider stakeholder community on pan Defence Lines of Development issues, as well as directing the work for the tool, metrics and training work streams.

There are a number of established tools used by the RN that have potential application in support of the MFCA new regime. It is envisaged that these tools will provide the basis for any future MFCA regime. Tools are required to support the following roles:

- Data collection and recording.
- On-board Capability Analysis, including visualisation of analysis findings.
- Data transfer to enable off-board Capability Analysis.

The requirement is a set of metrics that allows combat system and force capability to be measured and monitored. This work stream is closely related to the tools work stream as ultimately the metrics will be encoded into the tools to allow automated analysis, trending and 'drill down'. The ideal set of metrics should measure an effective cross-section of capability rather than reflecting individual equipment performance. These metrics should measure impact and effect that users can appreciate and comprehend.

Central to the vision, is turning the ship's team back into genuine CSEs, who can not only use the tools to run analysis, but can interpret the results and initiate corrective action when deficiencies are revealed. The WEO must be able to present the outcomes of any analysis to the command team in a clear and concise manner and following engineer/user discussions, the PWO should be able to brief implications for current and future missions. This is reliant on getting the correct and appropriate training delivered to ship's teams.

... to present the outcomes of any analysis to the command team in a clear and concise manner ...

COMBAT SYSTEM ARCHITECTURE

DEFSTAN 21-88 endorses a through-life approach to the policies and procedures for the integration of a subsystem, into the platform combat system architecture[7]. Any departure can have a serious impact towards system acceptance and negate the ability of assurance.

Underpinning the delivery of military capability to the Maritime Force requires a combination of combat system equipment functioning in a harmonised architecture. The technological development of weapons and sensors has meant the existence of a number of disparate platform combat system architectures making the business of providing assurance of capability more challenging. The proliferation of Commercial Off the Shelf (COTS) equipment has seen a drive towards building analogous architectures, which will make the assuring effort much easier.

Legacy platforms (CVS, LPX and Type 23) are fitted with a Combat System Highway (CSH) architecture that is used for inter communication between processing subsystems. Organisation of highway protocols is conducted by the Highway Controller/Health Monitors along a highway and spurs cables via couplers and interfaces. Figure 2 below depicts a typical CSH architecture.

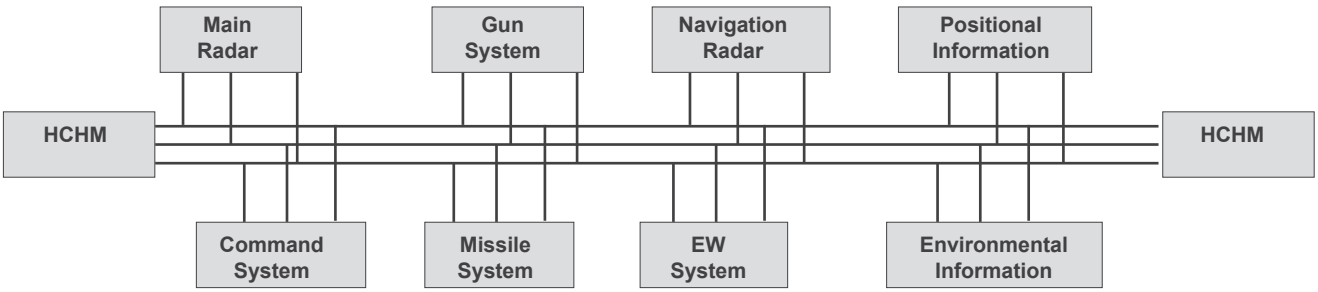

Figure 2: Combat System Highway Architecture

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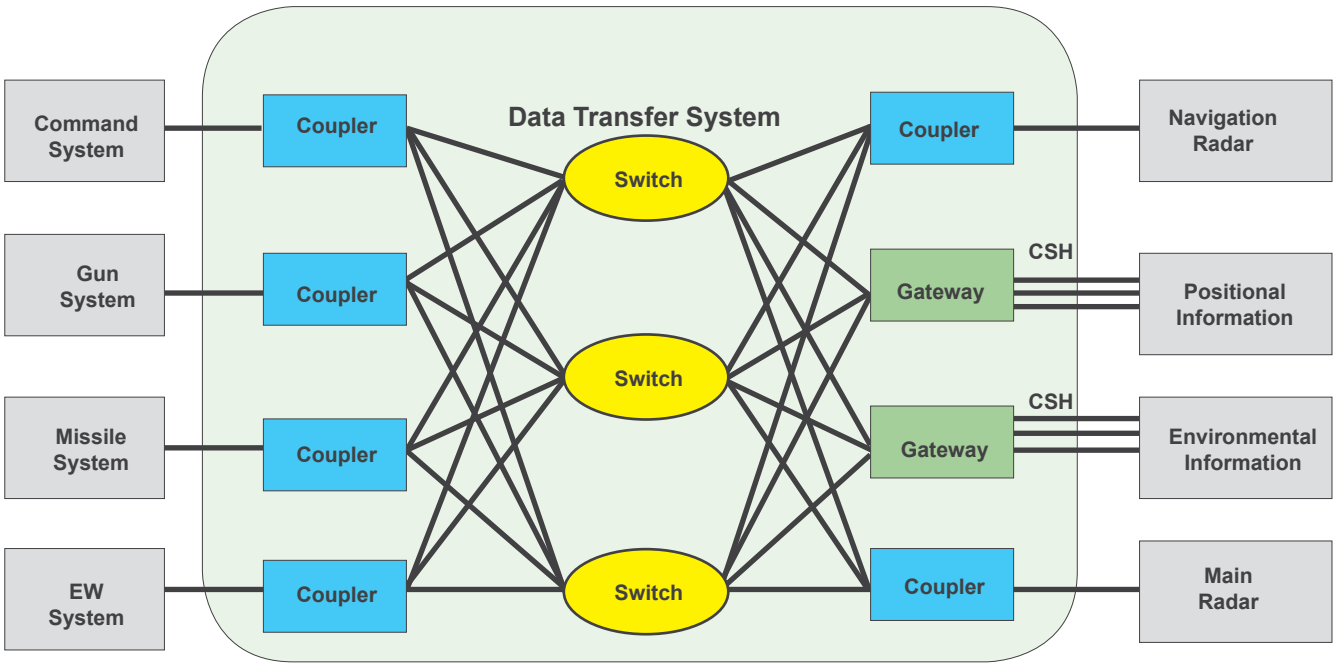

Figure 3: Data Transfer System Architecture

The RN's new Type 45 Platforms are fitted with a Data Transfer System (DTS) architecture utilising an ethernet-based network using COTS hardware. The Type 23 Command System is also fitted with an internal DTS. Future platforms (Type 26 and QEC) are expected to utilise DTS technology as part of their combat system architecture exploiting the use of ethernet/IP networking as a means of intercommunication between subsystems. The core of the DTS uses two or three identical backbones (for battle damage resilience) which comprise of switches and fibres optic cables. Intercommunication is provided by DTS couplers and gateways. The gateway is also utilised for Type 23 to bridge the interface between DTS and CSH so they appear as a network of systems. Figure 3 above shows the DTS architecture and its relationship to the legacy CSH.

MCS has initiated a formal programme change for pan-platform combat systems[8]. The vision is to establish a shared computing and network infrastructure on seven classes of warships in seven years. This enterprise will include convergence of equipments and utilising Modular Open Systems Architecture technologies to develop a common core architecture known as Shared Infrastructure across all RN platforms. This approach will provide huge benefit to MFCA, in terms of a better understanding of the assurance of capability across the breadth of RN platforms. Whilst the shift away from bespoke platform assurance will reduce cost, improve efficiency and spread corporate knowledge to a wider community. Ultimately, a common core combat system will better enable the drive towards force level assurance.

DEFINING THE METRICS

"*...Count what is countable. Measure what is measurable. And what is not measurable, make measurable...*"[9]

Investment on cutting edge technology is pointless, if there is no way in measuring performance or seeking improvement. To understand 'if good is good' requires properly defined and meaningful metrics and a benchmark of current performance for comparison[10]. If the standard is objective, then the measurement will be reproducible and meaningful, but if the standard is subjective and intangible, then the measurement will be un-reproducible and meaningless[11]. Engineering disciplines are defined by precise and well known measurements and are based on physical science[12]. Scientific communities have long accepted measurements such as length, voltage and pressure through standardisation and so these have become the norm. The later paragraphs will highlight that the measurement function will be delivered by the best breed of combat system tools. Rigorous assessment of performance will be provided through comparing the measure against the metric.

Selection of Good Metrics using a Framework

The generation of good metrics requires a comprehensive framework. An example is the Quality in Use Integrated Measurement (QUIM) as the model for usability measurements[13]. This has the benefit of better metric comparison/understanding and the definition of lower-level metrics. With some tangible conversion of application, this open-source framework could be exploited to provide the various combat system/operator metrics required for MFCA Epoch 2[14]. This model decomposes entities into factors, then into criteria and finally into specific metrics. In Table 2 opposite, some factors of typical combat system performance have been selected, complete with the relative description, showing how the QUIM model can be used for combat system metrics.

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Factor	Description
Accuracy	Capability to produce exact information data
Effectiveness	The capability of fulfilling whole task
Efficiency	The act of doing an activity with no wasted effort
Interoperable	Ability of one system to operate with another
Speed	Rate at which an event occurs
Trustfulness	Faithfulness of information/data

Table 2: Examples of Combat System Factors for Quality in Use Integrated Measurement (QUIM) Model

The QUIM model translates the factors in to measurable criteria (sub factors), which can be directly measured from combat system metrics. Again examples of combat system criteria have been offered as a candidate set, with the appropriate metric provided. The metrics can be provided by countable data or derived through mathematical functions and are outputted as a single numerical value. This example is presented in Table 3 below.

Table 4 below illustrates the relationship between the combat system factors and the criteria.

The relationships were derived from my own rational analysis for the purpose of promoting the consideration of the QUIM model. These assumptions remain subject to a more rigorous hypothesis to enable verification and validation. However, taking the accuracy factor as an example, there are seven corresponding criteria that can be measured by the associated metric. Also it can be seen, that correlation is related to four factors.

Combat System Tools

The combat system user needs recording and analysis tools which, when coupled with appropriate combat system engineering education and training, enable ship's and TG's command teams to assure and optimise their own combat system performance expeditiously. This captures the intent of the new vision.

Determination of combat system performance requires the appropriate tools to measure an attribute. Firstly, there must be a method of extracting accurate time-sourced data on to a tool suite. Furthermore, there must be an intuitive method to analysis the presented data. This will provide functional performance of the subsystems. There are a number of DRA toolsets currently available to RN platforms. Type 23 is fitted with Tools Architectures for Combat Systems (TACS) which is a portable machine connected to the CSH and is able to convert CSH data for a variety of subsystems, to a suitable format within the gateway processor. A data visualisation feature within TACS known as Trackview is able to present a variety of graphs/plots/textual information for the purpose of Quick Look Analysis or with the appropriate ground truth data a more detailed level of analysis. TACS has seen tremendous growth since its inception around 2006 and is currently undergoing further growth. TACS is also fitted into the Type 45 DTS via a coupler, but has a more limited DRA capability than in Type 23. However Type 45

Measurable Criteria	Metric
Coverage of picture	Completeness
Level of continuous tracking	Continuity
Level of dual tracking	Clarity (ambiguity)
Volume of clutter	Clarity (spuriousness)
Positional accuracy	Track position
Track Velocity	Velocity accuracy
Time	Time Accuracy
Count of operator initiation	Track initiation
Count of operator correlation	Correlation
Measure of tracks in correct state	Track identification correctness
Sensor range/bearing accuracy	Sensor alignment
Mode of each sensor set/changed	Sensor mode
Likelihood of sensor detection	Probability of detection

Table 3: Examples of Combat System Measurable Criteria and Metrics

Criteria	Factors					
	Accuracy	Effectiveness	Efficiency	Interoperable	Speed	Trustfulness
Coverage of picture		x	x			x
Level of continuous tracking		x	x			x
Level of dual tracking	x	x				x
Volume of clutter		x	x			
Positional accuracy	x	x				x
Track Velocity	x					x
Time	x					x
Count of operator initiation		x	x		x	
Count of operator correlation		x	x	x		x
Measure of tracks in correct state	x	x	x			x
Sensor range/bearing accuracy	x	x				x
Mode of each sensor set/changed				x	x	
Likelihood of sensor detection	x	x				x

Table 4: Examples of Combat System Relationship of Factors and Criteria

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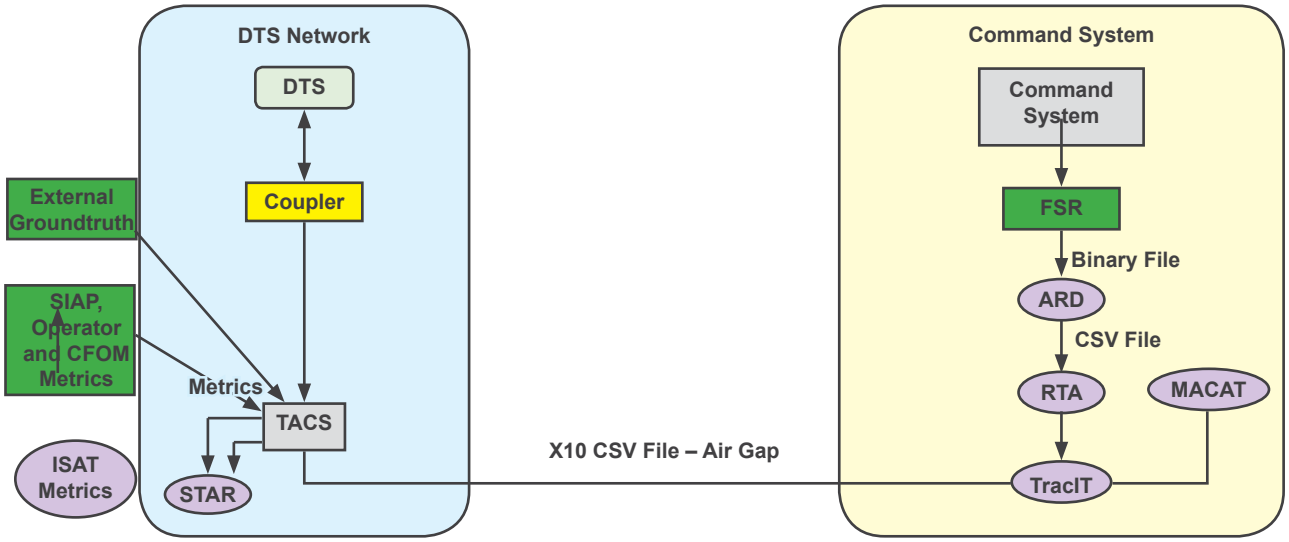


Figure 4: DTS network and Command System Tool Architecture using MAPAT

is fitted with an alternative version of a DRA toolset, known as Data Recording and Analysis System, which are industry-owned tools and are rarely used by ship's teams.

Measuring Combat System Performance

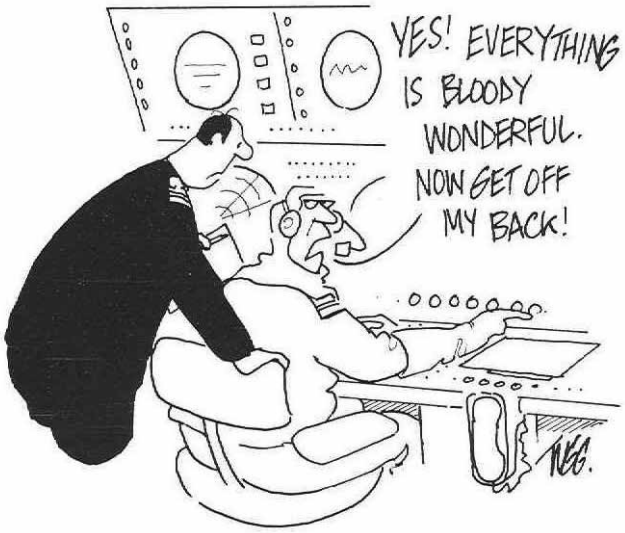
CSH and DTS recordings will only provide a subset of information. Specific radar data providing track identities plus any associated attributes and other important operator participation, is held within the Command System and this is not accessible to the existing DRA toolsets. This data grants information regarding man/machine harmony and is the essence of achieving the ambition for assuring combat system performance. The data is available through Full Shore Recordings (FSR) and is currently not exportable into the DRA toolsets.

A joint QinetiQ and BAE team has proposed the architecture (Type 45 only), which will enable a method of extracting FSR data and enable its importation into TACS via an air gap, for analysis purposes (Figure 4 above)[15]. This architecture is currently in the concept phase and is known as the MFCA Air Picture Assessment Tool (MAPAT). Future expansion is likely to incorporate direct interfacing of FSR into TACS. However, a method of importing FSR data into Type 23 TACS does currently exist. Eventually it is hoped that all combat system recording and analysis capabilities will reside within the Shared Computing Environment hosting the Command System, thereby enabling real time transfer of data. This would enable FSR and CSH/DTS data to be captured using the same output device, which could be employed to provide the analysis function.

A prototype of this tool has been demonstrated showcasing the strengths in the overall ability to conduct sensor performance assessment. This was the first occasion that truly objective assessment of the Combat System (air picture aspects only) could be made using a variety of combat system tools and a subset of operator and system metrics.

Of particular success was the Correlation Figure of Merit (CFoM) metric. The metric analyses the sensors that provide a track report and produces a resultant figure of how many of the sensors successfully correlated giving an indication of sensor accuracy. A figure of 1 indicates that all sensor tracks have successfully correlated whilst a figure of 0 indicates that there has been no correlation.

Using the MAPAT tools, the post analysis of CFoM produces a coloured graph (range versus height) giving the actual correlation performance in each of the domains. Black indicates a CFoM of zero, purple denotes a CFoM of one, whilst other colours are used to represent different figures. Figure 5 opposite shows the post analysis for CFoM of the Type 45 sensors



... information regarding man/machine harmony ..

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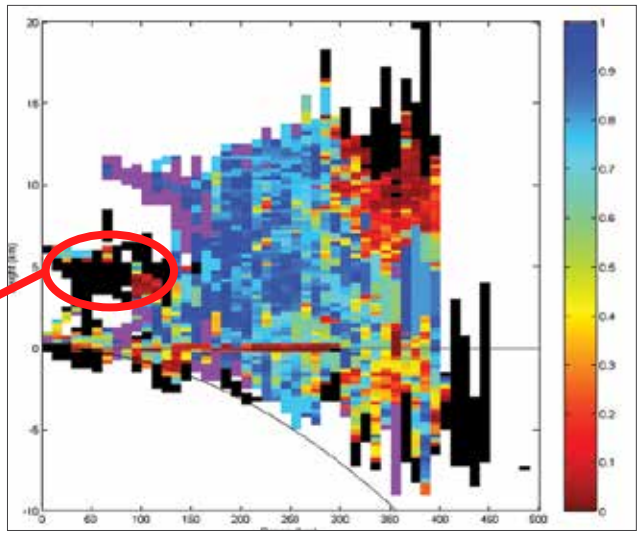

Figure 5: CFoM taken during Joint Warrior

during the tools demonstration. The graph shows mainly blue and green plots which are a good indication of accurate sensor performance, whilst the red area shows a reduction in sensor correlation. However there are other notable plots otherwise known as the 'Black Hole', which would suggest that some or all the sensors are not functioning correctly. The 'Black Hole' can be caused as a result of the following:

- Spurious tracks on one sensor.
- Misalignment between sensors which prevents correlation.
- A problem with the correlation algorithms/settings.
- Real world objects (such as large birds, hang gliders etc) being detected by only one sensor.

Figure 5 is of particular concern as this area of poor performance is out to approximately 100 kilometres and up to height of approximately 7,000 feet, the area that medium and long range radars are expected to operate. In this particular case only one of the ship's radar systems was reporting tracks in this area, all of which appeared to have similar flight profiles and may be attributed to light aircraft/helicopters. There was concern regarding performance of the other main radar and why it was not reporting any tracks in this area.

The 'Black Hole' phenomena is further highlighted below in Figure 6 showing the tracking continuity of the two main sensors where the left hand plot shows a break in continuity of a sensor tracking North-South (red circle) and East-West (purple circle). The right hand plot shows the other sensor to have a superior continuity performance.

The tools demonstration was successful showing the utility of the tools and the ability to conduct meaningful and reasonably rapid analysis of data in the Tactical Picture. It also served to highlight the additional records (ground truth, National Air Traffic Services radar records, environmental data, AIS) required to support analysis, leading to improved assessment of warfighting capability.

The intention is now to develop the MAPAT tool further towards a truly all-encompassing combat system assurance tool. The vision is the Collaborative Tools Architecture for Combat Systems (CTACS), which aims to cover all platforms, all environments, end-to-end capabilities and forces assessment. The project plans to use the tools that have been developed in research, equipment development and integration instead of

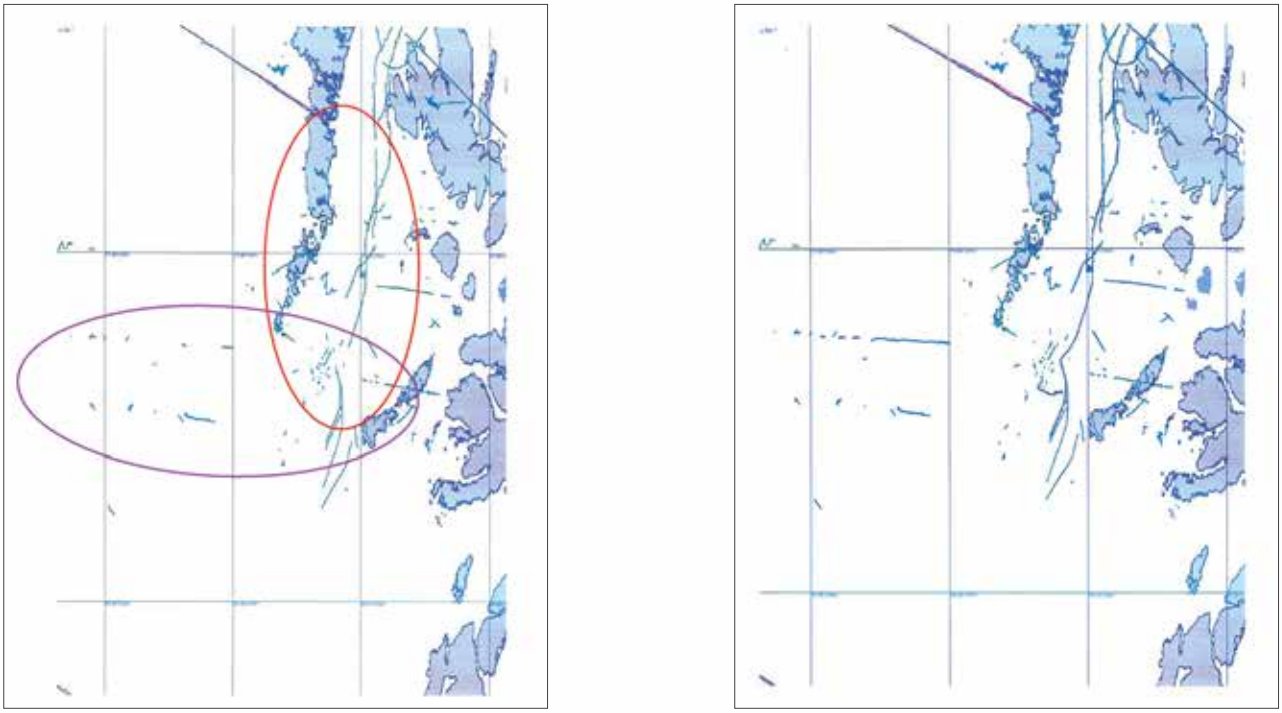

Figure 6: Radar Track Continuity Comparison

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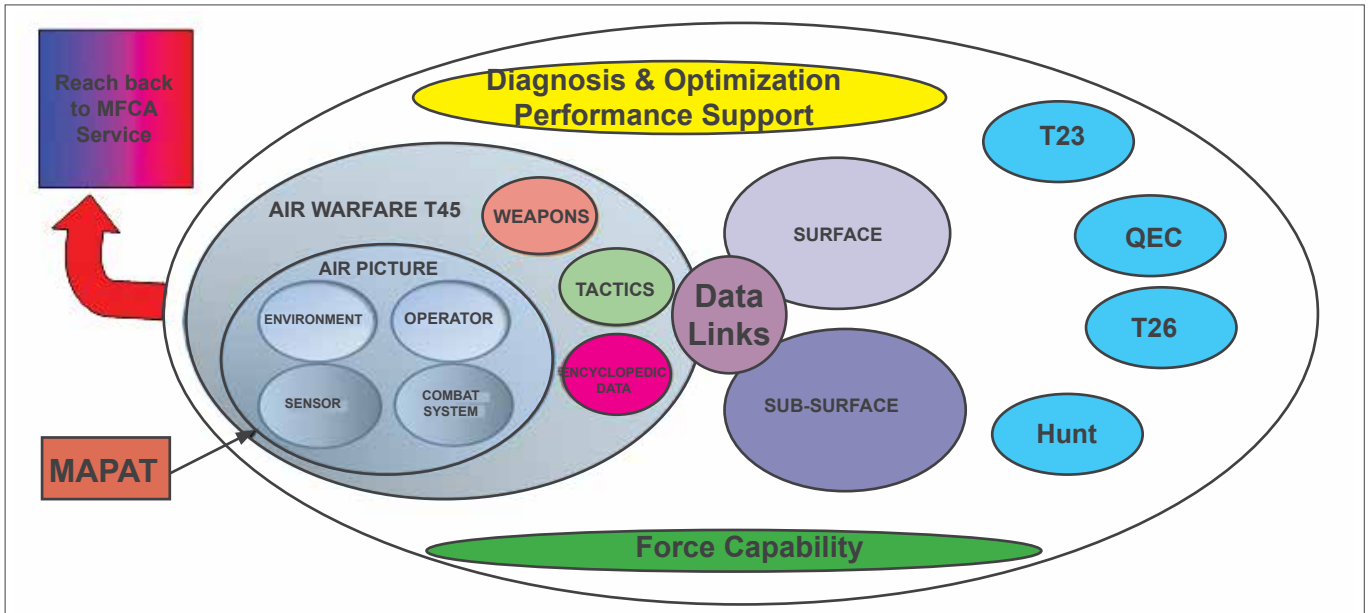

Figure 7: CTACS Spiral Development

developing from new. This builds upon the air picture metrics work completed to date but using a spiral development methodology. The vision is shown above in Figure 7[1].

The initial work will deal with the production of an overall User Requirements Document defining on the requirement for a toolset that supports MFCA Epoch 2, whilst building upon the work to date on the Type 45 air picture. This will focus on key issues such as near real time post processing and reach back facilities. Also the concept of a three tier tool user will be explored (basic, practitioner and expert). The intention is to deliver MAPAT as a product to the Fleet, including some better ground truth, better integration, better presentation, more operator metrics, environmental tools and a tool that may aid performance optimisation. There may also be a standard template for a post exercise brief to command completed by DWEO, with the appropriate automation. The endeavour is to complete one spiral each Financial Year.

IMPLEMENTING THE NEW VISION

MFCA requires leadership and direction to succeed. CSO(E) champions this role with the support of an appropriate stakeholder community acting as the MFCA Steering Group. The initial work would require redefining the MFCA policy and implementation of the new vision. The community must embrace a clear and coherent strategy to enable fulfilment of the new vision and must remain engaged throughout to ensure the former perception issues are eradicated. When implementation is achieved, the Steering Group should ensure that boundaries of the new regime remain 'unmuddied' otherwise the benefits may be lost.

Military Benefits

Implementation of the new vision would offer the following military benefits:

- The potential to unlock latent military capability from existing systems by understanding inefficiencies in uses and performance of legacy capabilities.
- Exploitation of platform component capabilities to form a force level capability giving greater fighting effectiveness.
- Provide a greater level of confidence/trust to warfare operators of platform/force level fighting ability.
- Provides more cohesive force operations, through better understanding of fighting capabilities and complex interaction dependencies, leading to better delivery of military effect.
- Readily available forces and better maintained/more capable combat systems, by recognising any deterioration in overall fighting performance throughout the platform lifecycle and providing sufficient time to implement corrective measures.
- Stakeholder access to a maintained evidence-based 'touchstone' will allow accurate and informed decisions to be made at highest levels.

MFCA post 2017 – The Vision of Epoch 3

Exploitation of information superiority is a strategic attribute that any forward-facing navy will need, in order to gain battle-winning advantage. This is about embracing the SoS approach and enabling the exchange of information at a multinational level. This concept is being employed by the United States in its Joint Vision 2020. Interoperability (IO) is the keystone for future combat systems and crucial for collaborative forces[16]. Although limited steps towards force level assurance will be progressed during Epoch 2, future operations will require the TG Commander to

1. Smith, A. G. (2013). *MFCA*: DES/NCHQ Bilat. Combat System Tools Presentation July 2013

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have a full understanding of the capabilities within his force. The next generation of MFCA must deliver assurance of the RN's force capability; otherwise the UK's ability to contribute to coalition operations is likely to be limited.

Future UK maritime operations within a coalition are likely to contribute to both the Single Integrated Maritime Picture and the Single Integrated Air Picture. IO will be required to provide common tactical pictures from subordinate platform sensors and Command and Control (C2), to give an overall integrated picture via distributed combat systems. Cooperative Engagement Capabilities is the zenith of IO, as shared sensor data passed over an entire battle group at never-seen-before speeds (O'Neil, 2007), will enable third-party engagements executed by the TG Commander. These embody the SoS approach (defined by Owens, 1996) at the highest level. However this is exceptionally challenging to the RN in terms of overcoming the associated problems with IO and establishing a methodology of assurance.

The US Navy employs a Distributed Engineering Plant (DEP) to characterise the IO capabilities of a force architected Fleet and provide the baseline performance to the TG Commander. This offers a force level assurance test bed, whereby any system or SoS is not authorised for ship use, if compliance is not met. The UK employs the Land-Based Test Site for acceptance/assurance of platform-level equipment and combat systems. To enable IO testing up to multinational level means the UK would need to consider its own adaptation of a DEP. The facilities already exist and have been temporarily utilised as part of a coalition DEP, via a military network.

CONCLUSION

The RN is required to operate as a frontline force and relies on the provision of cutting edge technology, as an enabler of OC. However, the military need for immediate delivery of state of the art equipment, can often mean that technological reliability is not always fully validated. Processes for acceptance of equipment into service are robust and generally ensure that testing and fit for purpose compliancy is met. However, the main issue is during the in-service phase, when the equipment becomes older and deterioration threatens vital performance. Assurance of capability is therefore a key attribute for understanding whether maritime forces are able to fulfil the military task to the required effect. Future maritime operations will have a more joint and coalition focus. This will be the catalyst towards developing a force level assurance approach; with initial progression completed during MFCA Epoch 2. If the UK is to continue to participate in coalition operations, it is imperative that the momentum towards achieving a force level approach in assuring the RN's warfighting capability is maintained.

GLOSSARY OF TERMS

CFoM	Correlation Figure of Merit
COTS	Commercial Off the Shelf
CSE	Combat Systems Engineer
CSH	Combat System Highway
CSO(E)	Chief Staff Officer Engineer
CTACS	Collaborative Tools Architecture for Combat Systems
DEP	Distributed Engineering Plant
DTS	Data Transfer System
FSR	Full Shore Recordings
IO	Interoperability
MAPAT	MFCA Air Picture Assessment Tool
MFCA	Maritime Force Capability Assurance
OC	Operational Capability
QUIM	Quality in Use Integrated Measurement
SoS	System of Systems
TACS	Tools Architectures for Combat Systems

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Letters to the Editor

Sir,

In the words of Admiral George Anderson (USN – 1 August 1961), "*The Navy has both a tradition and a future--and we look with pride and confidence in both directions.*" Where has the Royal Navy got it wrong? We trade on tradition that is centuries out of date, yet only follow such traditions when it suits (my last two promotions for example, came in the post). We then disjointedly and unrelentingly plan changes for a future with no regard for the reality of the modern world.

We know the problems we face – gapping, suitably qualified and experienced personnel, pay structures, housing, pensions, ships operational tempo, harmony, civilianization, redundancies, notice givers with key skills, civilian companies targeting our personnel, to name but a few. The current Royal Navy is in crisis, but what can be done to fix it?

One option is to continue along our current trend where we bring in a New Employment Model, put a survey online and ask 12 questions mainly about the subject of housing even though the model changes all facets of Naval life. Where we tell Royal Navy Officers to fix the Navy but fail to give them any training or experience in this type of work. This goes double for contract writing and procurement. We run a huge number of change programs and don't link them up to share information or even admit a trial fails so we can learn what doesn't work. We could continue to use a watchkeeping system that worked on HMS Victory, launched in 1765, 3,556 tons and crewed by 850, as many personnel as are predicted for HMS Queen Elizabeth, which is 65,000 tons.

There are many, many more examples of where we are getting it wrong; however, what we need to do is to start getting it right. In the Engineering sphere we have recently become aware of Project Faraday. This is a fix-all solution to long-running problems at the core of which is the question "How do we keep our Engineers?" We are told the announcement is due sometime in mid-October, however I feel the streams that are being looked at do not tackle the core issues and ultimately will not stop the outflow of Engineers, particularly in the short term. If we do not stop this outflow, there may be no turning back. Engineers by their very nature are realists and most will probably agree that to dig ourselves out of this hole will take time. Being realists, they realize that the next five years will get worse before starting to get better. Will these people wait? I suggest not. There is a skill shortage of Engineers worldwide and specifically in the Oil and Gas/ Renewables/Seafaring sectors. This skill shortage is at the 10–30 year experienced IEng level … Senior Rate RN Engineers. Our Engineering skills are hugely transferable into many sectors, which offer better terms of employment, remuneration and harmony than the Navy currently does. There is still something to be said for serving your country; however in my opinion this level of blind faith in the system to sort things out has all but emptied, particularly when job offers of around double the amount of pay now seem to be the rule rather than the exception. We seem to have systematically beaten the loyalty out of our Engineers.

I believe we need to look to these comparable industries, their work patterns and levels of pay and use this information to massively overhaul our current systems to better reflect the Engineer's role in the Royal Navy. Not for one minute am I suggesting that we become civilianized and I feel that we should still observe our traditions, but we need to move to a time where the individual Engineer is valued whilst also modernizing a creaky, out of date Naval system.

What are the consequences of not listening to our Engineers? Currently we have one DD/FF at sea without a WO2(ME), with another due in November this year which will be deployed, plus many other units with gapped WE and ME Group Heads. The number of experienced personnel at sea is dropping rapidly and it seems that we are happy to bear this skills shortage. Will it take an accident to put some emphasis into solving this problem properly and once and for all? It is not far away and I for one do not want that on my conscience.

I am not currently in a position to see all the factors that affect these decisions. There will obviously be financial constraints, manning issues, cross-branch and even cross-force issues to resolve. I am, however in a position to see the factors that affect our Engineers on a daily basis and to get a unique perspective of how we treat our Engineers and how they feel they are treated. The longer this process takes, the higher the level of dissatisfaction among our Engineers.

Yours Aye,

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FTE Portsmouth
PP69
Tiger Road
HMNB Portsmouth

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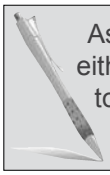
WO Barnard's letter raised several matters which warrant a response, and it was passed to the Deputy Chief Naval Engineer Officer, who replied as follows:

I very much welcome WO Barnard's contribution to the important debate of how we train, employ and retain our technicians and engineers across all engineering disciplines of the Royal Navy. I have taken the opportunity to discuss the issues in detail with him but it's a debate in which we must all engage if we're to meet the challenges of today's problems and make ourselves fit for the future. Mr Barnard is right to suggest that one initiative on its own will not turn things around and I completely agree that we must make RN employment conditions attractive and free from hidebound tradition. So how do we structure ourselves to give people a worthwhile and rewarding career, how do we meet the demands of introducing new ships, submarines and aircraft, how do we build and retain our seagoing experience to give us a battle winning edge? In the meantime, how do we cope with today's manpower situation, how do we put basic stores on the shelves, get the diagnostic tools and allow ourselves the space to innovate and overcome the many problems to which we already know the solution but lack the means to implement? The answer to all of these questions has to start with a clear vision of what we want and a strategy of how we're going to achieve it. Once we've got that, it needs to be backed up with detailed, co-ordinated plans to address each of the problems both in the short and the long term. In other words, we need a strategy for Naval Engineering.

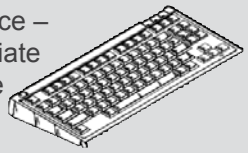
Anyone who attended CNEO's conference earlier in the year will have helped to produce the Naval Engineering Strategy which Adm Lister aims to launch before the end of this year. It sets out a vision that re-establishes the importance of people – us – to engineering and to the delivery of operational capability. Separate plans linked to the Engineering Strategy are being launched to resolve both short term and structural problems in procurement, manpower, training, support and policy; you'll see much more of these in the coming weeks.

We've made a start but there's a lot to do; your senior leaders recognise the importance and urgency of this work and we are listening. We need to turn energy into action and that requires your active engagement at every level. The strategy and detailed plans won't make things better on their own but they will set the conditions for you to help yourselves. I urge you to contribute to the wider debate on our future by getting involved in the various launch and rapid improvement events over the next few months to help shape your Branch by feeding your thoughts and ideas back to me through your divisional systems. In the meantime none of us are victims and where ever we serve, at what ever level, we can make a difference. Be bold, take risk and remember it's sometimes better to seek forgiveness than to ask for permission.

Commodore Ian Shipperley RN
Assistant Chief of Staff Ships and Submarines
Deputy Chief Naval Engineer Officer



As always, the Editor welcomes correspondence – either on this topic, or any other issues appropriate to *The Naval Engineer*. Contact details can be found on the Contents Page.



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BZ – 2012 FLEET ENGINEERING EXCELLENCE AWARD HMS PROTECTOR


Photo by LA(Phot) Arron Hoare

The Engineering Department in HMS Protector was awarded the Engineering Excellence Award after the challenging and unusual generation of a platform taken from trade. The exceptional and singularly taut force generation timeline is distinctive in vessel procurement as the ship was leased and converted from merchant duties in form, fit and function from March 2011. This transformation culminated in the generation and deployment of the Royal Navy's ice patrol vessel, deploying on time to the South Atlantic on 28 November 2011.

The engineering Head of Department is junior in rank but rich in experience, and he and his team have overcome many significant hurdles in the run up to deployment. With such a short period of time available from Protector's delivery voyage, the normal opportunities to prepare detailed guidance and invoke equipment fitting in dedicated periods alongside were somewhat compressed. Equipment fits matured at different rates or suffered technical challenges towards acceptance and the engineering team were dealing with a range of stakeholders including the prime Norwegian contractor alongside BAe and associated sub-contractors who were responsible for the fitting of government furnished equipment or commercial variants. Specifically:

- Management of an appropriate pumping and flooding solution for Protector.
- The installation and generation of military communications was fraught with difficulty but the team, acting as the customer have continued to demand the standards required for this problematic and challenging fit.
- Management and acceptance of an explosives stores solution which is unique to this RN platform.
- Overcoming adversity across commercial dockyard management structures whilst dealing with the delineation of Contractor Logistic Support alongside Superintendent Fleet Maintenance in Portsmouth.
- Taking on additional duties on behalf of shore authorities, such as formalising the Unit Establishment List, identifying correct competencies, implementation of the Unit Maintenance Management System and ensuring appropriate training is now in place for members of the department.
- Filling the void in the absence of onboard documentation and Standard Operating Procedures.

Protector's team built a healthy rapport with stakeholders, which in turn generated significant praise from the ship owners and legacy Chief Engineers. However, despite this strong relationship and somewhat inevitably during work up, many capabilities were not available and this presented varying degrees of operational risk to Command for a sea going platform. This risk was assessed and mitigated across all departments but managed exceptionally well by the engineering team who provided timely and accurate advice to facilitate informed decision making onboard. The onboard approach to generation and a common desire to succeed through training was recognised by FOST and earned the team a commendable VSAT at BOST.

Throughout this extremely challenging period, this team has driven the programme forward from the front. There is no doubt that without their proactive and flexible approach to 'Navalising' a merchant vessel, Protector would have been at significantly greater risk to deploying on time. A close working 'Big E', all of one company, approach to business by a rank-junior team fully deserves the Surface Ship Engineering Excellence Award this year.

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DEATHS IN COLLINGWOOD COMMEMORATED

On Tuesday 18 June HMS Collingwood held a commemorative event to mark the 70th anniversary of the day a German bomb hit an accommodation hut and 31 sailors lost their lives. At that time, Collingwood was a new entry training establishment, and the young men killed and injured had joined the RN a mere two weeks previously – so recently, in fact, that many had not yet been issued with uniforms.

Survivors and relatives and friends of those who lost their lives came to remember and say a final farewell to their loved ones. The event began with a service of remembrance in the chapel, where a memorial board giving names of those who lost their lives is displayed. Following this, the guests visited the memorial tree, planted in 1993 at the 50th anniversary event, before being escorted to the site where the bomb struck on that fateful day, once the location of accommodation huts for the 10,000 sailors for whom Collingwood was home and now the site of Marlborough Building. The Act of Remembrance was read by Mr Sidney Anderson, nephew of Sidney Charles Heath, one of the young sailors who lost his life. This was followed by the Last Post and a minute's silence when guests and personnel across the establishment paused to remember those who lost their lives. Wreaths and flowers were then laid by Commodore Mike Mansergh, Commanding Officer of HMS Collingwood, and several of the guests.

Mike Crowe, the Chairman of the HMS Collingwood Association, who coordinated visitors to this event, said "*We should remember not only the sacrifice made by the dead and the wounded, who were mainly young volunteers, but also that of the families who have lived with the memory for so long.*"

Commander Andy Phenna, Executive Officer HMS Collingwood, said "*If we don't remember the sacrifice our forebears made we cannot move on to the future.*"

RISK ANALYSIS

Something engineers do all the time – formally or informally – consciously or sub-consciously? How does your perception of risk match up to that of other analysts? Study the attached list of twenty activities and technologies, and rank them in order of risk (highest risk = 1, lowest risk = 20) – and then see how your perception compares with that of health and safety professionals (see bottom of this page)

ACTIVITY	YOUR RANKING	ACTIVITY	YOUR RANKING
RAILWAYS		MOTOR VEHICLES	
SCHOOL & COLLEGE FOOTBALL		ALCOHOLIC BEVERAGES	
LARGE CONSTRUCTION		MOUNTAIN CLIMBING	
SURGERY		CONTRACEPTIVES	
FOOD PRESERVATIVES		COMMERCIAL AVIATION	
HOME APPLIANCES		FIRE FIGHTING	
POLICE WORK		X-RAYS	
SMOKING		SWIMMING	
NUCLEAR POWER		ELECTRIC POWER (NON NUCLEAR)	
SPRAY CANS		VACCINATIONS	

Risk Analysis: The Experts' View

1 - Motor vehicles; 2 - Smoking; 3 - Alcoholic beverages; 4 - Surgery; 5 - X-rays; 6 - Electric power (non nuclear); 7 - Swimming; 8 - Contraceptives; 9 - Large construction; 10 - Food preservatives; 11 - Commercial aviation; 12 - Police work; 13 - Firefighting; 14 - Railways; 15 - Nuclear power; 16 - Home appliances; 17 - Vaccinations; 18 - Spray cans; 19 - School & college football; 20 - Mountain climbing

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WEB EDITION

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