WINTER 2012

WEB EDITION

ROYAL NAVY

THE NAVAL ENGINEER

OLYMPICS ISSUE

THE NAVAL ENGINEER

Contents

• 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).

• Articles and letters are welcomed and may be submitted in any format from handwriting to e-mail, CD or DVD.

• All correspondence to: The Editor, The Naval Engineer, HMS Collingwood, Fareham, Hants PO14 1AS.
Tel 01329 333895 (Military – 93825 3895): Navynet MWS-TNE-EDITOR, Internet – mws-tne-editor@fleetfost.mod.uk

• All enquiries concerning distribution should be addressed to: Ministry of Defence, Forms & Pubs Commodity Management, Building C16, C Site, Lower Arncott, Bicester, OXON, OX25 1LP, copy to the Editor.

Photographs:
The cover: Front – Members of HMS Ocean's Ship's Company form the Olympic Rings as she enters London and the Offshore Raiding Craft Boat Group, part of the security arrangements for the Olympic sailing events at Portland – see article on Page 2; Back – A "retro" warning from a 1960s issue of TNE's predecessor – still equally valid today.

Acknowledgements to the Fleet Photographic Unit who supply most of the general photographs.
Other photos supplied by the authors or as credited.

The Naval Engineer

EDITOR

Commander T.J. Stoneman BSc, MA, RN (Retd) *HMS Collingwood*

93 825 3895 (BT 01329 333895), fax 93 825 2712 (BT 01329 332712)

E-mail: MWS-TNE-EDITOR (Internet E-mail: mws-tne-editor@fleetfost.mod.uk)

Editor's Corner

Have you ever re-invented the wheel? Of course not, you're much too intelligent to spend time producing an answer to a problem that's already been investigated, discussed and laid to rest, with a solution devised, put into operation and proved to be effective – or are you?

Twice in the last month, I was party to discussions where "new" processes were being put in place to deal with "new" problems when, in fact, those problems were very similar, if not identical, to those experienced in a previous generation.

As an example, those charged with overseeing the operation and maintenance of new, technologically advanced equipment in a front-line warship were bemoaning the lack of system knowledge held by those with hands-on tasks to perform. Nothing new there, then – I recall, in the early days of the Seawolf system, endlessly drilling my team in the intricacies of secondary and tertiary modes, capabilities and limitations of the kit, how to get the best out of the picture presented and how to provide the Command with the best possible service – and it paid off. Similarly, an article in this issue of TNE speaks of the (re)introduction of DC Drills, rounds, revitalising leadership training and the like in career courses – didn't we used to do those things years ago?

I was once advised by an "old and bold" colleague that, if faced with a problem, I should look back in the records for, say, seven or eight years, and I might well find a solution in what our predecessors had done – but that I should always be alert to the value of new developments as well.

Just because a solution or remedy is one that was developed many years before, that doesn't necessarily mean that it's no longer valid, or can be safely consigned to history. We must (obviously) consider new and better ways of doing things, but always remember that our predecessors also devoted time and effort to solving problems (in many cases similar to some of today's concerns) – and while modern technology and new thinking often produces improved ways of achieving the aim, sometimes the existing processes may do the trick or, with minor changes, may still be useful today.

Thinking of writing for TNE? Deadline for articles or letters is Friday 25 January 2013.
This issue of The Naval Engineer is also available on the Intranet at _http://defenceintranet.diiweb.r.mil.uk/DefenceIntranet/Library/_ (search for TNE)
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_.

LONDON 2012 – ENGINEERS AND ENGINEERING

For many, the most memorable part of the summer of sport in 2012 was the Olympic opening ceremony. Others recall the efforts of Olympic and Paralympic athletes in achieving their peak performances in many fields of sport, whilst still others found themselves amongst the many thousands of individuals making the events run (as far as the world-wide audience could see) smoothly and efficiently. In each of these spheres, RN engineers could be found, some carrying out engineering functions and others participating or contributing in ways which had nothing whatsoever to do with their professional role. To give a flavour of what was involved, here are some of their stories.

THE OLYMPIC FLAG CEREMONIAL TEAM

By Lt Jamie Weller

Lieutenant Weller, a Weapon Engineer Officer from DE&S Abbey Wood, was one of 16 specially selected military personnel from across Defence who were chosen to raise the Union and Olympic Flags in the Opening Ceremony of the 2012 London Olympics Games. A former competitive gymnast with many competition titles to his name, who, upon retiring from competing, has turned to dedicating his free time to the British Schools Gymnastic Association developing gymnastics within schools across the country.

Lieutenant Weller and his seven colleagues parade the Union Flag at the Olympics Opening Ceremony

"The whole experience made me immensely proud and I was incredibly excited to be part of an event that signalled the start of the 2012 Olympic Games. Even though we spent weeks training for the event, it still couldn't prepare me for the overwhelming euphoria that hit me as we started to march into the stadium. The atmosphere generated by 80,000 people was immense and the noise levels were indescribable. Listening to all of those people cheering for you and knowing in the back of your mind that you were live in front of an estimated TV audience of four billion people. If I had made a mistake or fallen out of step it would haunt me for the rest of my career!

I was also fortunate to be selected as I/C of the Naval ceremonial team at the O2 arena for the remaining period of the games, where the team undertook ceremonial duties for 18 finals including Gymnastics, Trampoline, and Basketball. It was a privilege to represent the country and my Service; being able to participate in this once in a lifetime opportunity is something I will never forget."

OCEAN'S EXPERIENCE

By Cdr J.J. Bailey, Cdr (E) and Lt Oli Fairbairn, SSEO

Preparing for and deploying on Joint Operations is something HMS Ocean and her Ship's Company have extensive experience of; operating from open sea, transporting an embarked force into the littoral and flexing her Ship to Objective Manoeuvre (STOM) capabilities is what she does.

HMS Ocean deployed from Plymouth to Greenwich, on the River Thames on completion of an early summer leave period, passing the Thames Barrier inbound on Friday 13 July 2012 (!) without incident or more than a few metres to spare. On station the task was to operate helicopters for both the Air and Maritime security plans in support of the Metropolitan Police and provide accommodation for our TAG and up to circa 500 Venue Security Personnel (mostly Army) as embarked forces who made up the Venue Security Force for the Greenwich Olympic Equestrian site. The air group, for the most part at five minutes notice to launch, reducing to up to 45 minutes on occasions, provided both Air STOP and Maritime STOP capabilities to complement the high speed interception capabilities of the Eurofighter Typhoon squadron forward deployed to RAF Northolt. This meant support systems were required to be maintained at, or very near to, immediate notice in support of aviation throughout the time on task upriver of the barrier.

Preparations for Ocean's Op Olympic deployment were methodical and broad thinking. Exercising high tempo aviation operations from Greenwich for an exercise week in May 2012 provided opportunities for lessons to be identified, solutions generation in slow time and areas that may develop issues during sustained operations to be probed and understood. The engineering challenges of running a system to its design threshold are well known and broadly understood. Often however, in the envelopes of military tasking these thresholds are stretched to use assets in new ways, maximising the efficiency of the Armed Forces personnel and equipment. Mooring in the shallow waters of the River Thames at Greenwich, with no ability to produce our own fresh water, a salt water cooling system and firemain system that was highly effective at dredging most of our mooring for us coupled with the task of accommodating up to 1100 personnel in total and maintaining their hotel services with embarked forces on continuous watchkeeping cycles was no textbook amphibious operation – effectively we delivered exactly what Ocean was designed to do, moving a company's worth of personnel ashore on a daily basis. The majority of the embarked force had also never lived on a ship before so education was the key to maintaining safety and to support their security of the Greenwich Olympic Venue. This was ably provided by a forward thinking and a prepared engineering team all set up to rectify all manner of issues possible on a self-contained, command and control, aviation, transport, accommodation and public engagement platform.

With a Chippy's party of only 11 (two senior rates, one leading hand and eight ETMEs) to cover a full 22,000 tonnes of operational real estate, the team stepped up to the challenge. Heads defect rectification over the 10 week period in London alone got through over 300 bobbins (ordered ahead of deploying to tackle emergent defects) and 1120 man hours alongside 210 HPSW strainer cleans without starting on the DG plate coolers that acted like sieves for the silt drawn through our LPSW cooling system; another 72 man-hours cleaning to maintain the material condition of ship's systems. The most critical deployment defect, loss of two of three sewage transfer pumps, leading to a B2 OPDEF on our ability to sustain heads facilities to over 200 of our embarked forces personnel, was dealt with professionally and timely with the fragility of the remaining pump unknown growing the risk against Ocean's Op Olympic accommodation tasking. Support availability for one-off systems and non-patternised stores with the strains on personnel supporting equipment ashore were felt but the RN organisation held firm and achieved risk reduction against the defect to sustain Ocean and all services for her embarked service personnel. Ocean operates at the high end of UK maritime influence activity (approx 20,000 visitors onboard in the Op Olympic effort) and her personnel, modestly "just doing their job", remained the key to success of her activities and deployment through Op Olympic and back to Devonport where she is now deep into preparations for her third major refit, that were on going long before Op Olympic preparations.

HMS Ocean moored on Greenwich Reach in preparation for Operation Olympic

TRIUMPH!

By WO1 ET(ME) Andy Cray MBE, OCRN SP TP 10 TRG SQN and CPO ET(ME) Darby Allan, Group Head ORC Section

10 (LC) Training Squadron, based in Poole, Dorset is responsible for conducting, amongst other things, the Landing Craft vocational courses for the LC specialisation of the Royal Marines. As a relatively small but efficient squadron and part of 1 Assault Group RM, we were tasked with providing security measures for the 2012 Olympic sailing events at Portland, Dorset.

The Task Group

From the initial planning meetings it soon became evident that there would be a requirement for 13 Offshore Raiding Craft (ORC) and two PAC 24 to be operated and maintained by 10 Training Squadron based in RFA Mounts Bay in Portland Harbour. Our craft would form part of a larger Task Force of small craft operated by military personnel and the Police force, with the overall command being the responsibility of HMS Bulwark. Further recces identified what equipment would be required to be deployed and how the craft would operate from an LSD(A) which was docked down alongside a jetty with a floating pontoon tied to the outboard side of the ship.

With only eight ORC initially available at Poole, the first act was to co-ordinate the safe return of our two craft used for training in the Falkland Islands back to the UK, where upon they were serviced and inspected for hull damage. (An unfortunate occurrence when dealing with inexperienced learner RM boat drivers!) To augment the flotilla further we “borrowed” three ORC from our sister units, 539 ASRM and 43 Cdo FPGRM, based at Turnchapel and Faslane, along with two PAC 24s for boarding operations.

With all the pre-deployment preps completed – craft fully serviced, equipment such as trailers and containers transferred by landing craft to RFA Mounts Bay, extra personnel trained and additional equipment, such as blue lights and positional awareness GPS systems, fitted – the flotilla was ready to sail. However nobody had booked suitable weather and the British summer struck again; due to the poor conditions the initial attempt at sailing around to Portland had to be aborted until later in the day!

Eventually the flotilla from Poole, including around 10 RN engineers (consisting of all ranks from WO1 to ET), arrived in theatre and embarked in RFA Mounts Bay, along with hundreds of other service and civilian personnel supporting the Olympic sailing events – accommodation onboard by this time was at a premium; all available EMF beds and cabins were accounted for. After the initial planned practice and training evolutions, the daily pattern of work soon emerged for the small team of engineering technicians looking after their steeds. A routine was soon established which would ensure that all the boats were checked over and fuelled by 0700 hours every morning, with any defects rectified such that the craft were fit for purpose and ready in all respects for the day’s tasking on the waters off Weymouth and Portland. A full craft status report was communicated to Bulwark at the end of every day.

The high tempo operational tasking required maximum craft availability, which therefore required any reported defects which occurred during the daily patrols to be immediately rectified, where possible, after the day’s activities. Craft coxswains were regularly interrogated to ensure that any emergent defects were captured and dealt with accordingly. This often kept the team busy well into the night to ensure that maintenance routines and defects were driven down to a minimum, ensuring the craft were available for the next day. Some reliability issues were identified, the biggest concern being the continued unreliability of the standard fit Raymarine GPS units, with several items requiring replacement. Many other defects were successfully rectified by the team; these included anything from oil leaks, bilge pump issues and engine circ water pumps to complete engine changes.

Unfortunately two ORC required engine changes, but thankfully these were due to rare failures to the tune of a cracked piston in one and a low lube oil pressure indication in another. To carry out this evolution, the craft required extraction from the water via the mother ship’s floating dock at the stern of the vessel to its maintenance cradle on the vehicle deck. Initially, this proved to be challenging and too time consuming due to the requirement to utilise two separate lifting gantries to successfully carry out the procedure in a safe manner. Given the extremely tight time frame to complete the engine change, a decision was taken to adapt and utilise an existing launching trailer (held in Poole) which significantly improved the process to extract the craft from the dock and transfer it to the maintenance cradle on the vehicle deck. A piece of ingenuity that saved valuable time!

Such was the engineering prowess displayed by the engineering team that the CO of HMS Bulwark commented on how impressed he was with the reliability and availability demonstrated by the ORC during the Olympic and Paralympics campaigns – not one single tasking was missed! (Little did he know of the technical dramas that were unfolding behind the scenes; which is often the case with the ME world of engineering.) A good analogy which sums up the operation is that of a swan – sleek and elegant on the water but paddling like mad to keep things moving underneath! Operation Olympics in Portland was deemed very successful, and upon completion of the tasking all craft were successfully delivered back to their respective parent units in one piece, unlike our stores container onboard RFA Mounts Bay which was last seen in Gibraltar! The Offshore Raiding Craft not only proved their worth and fit for purpose, but the Engineering team proved to be a valuable asset and justifiably proud of their achievements, whilst enjoying the once in a lifetime experience.

OPERATION MINERVA – TRAINING MANAGEMENT SUPPORT TO THE OLYMPICS

Lt Cdr K L Mehta, NETS OPS OC

Operation Minerva was initiated by the Army Education and Training Service (ETS) branch to deliver accredited exams to Armed Forces personnel employed as part of the security force for the London 2012 Olympics.

As part of Operation Olympics, 7500 armed forces personnel were deployed to support venue security for the London 2012 Olympics. After engaging with the deployed troops, Commander Land Forces (CLF, General Sir Nick Parker KCB CBE) decreed that all personnel who had completed the G4S Venue Security Force training should be given the opportunity to achieve the same accredited awards as the G4S security guards. The RN adopted the same stance within a day of CLF's announcement and as a result the Army ETS branch initiated 'Operation Minerva'. The accreditation given consisted of three multiple choice papers and a practical assessment, with the theory paper exams given to the personnel 'in situ' at Olympic sites and accommodation areas and the practical to be conducted by each service on return to units. Successful completion would result in two City & Guilds awards from the Security Industry Authority; Security Guarding Level 2 and Door Supervision Level 2.

To support the ETS and to cover the Naval contingent deployed to Op Olympics, a team of TMs, led by the Naval Education and Training Service (NETS(OPS)), was deployed to London, HMS Ocean, Weymouth and HMS Bulwark. With two days notice, the RN team went armed with sleeping bags and kit to London for a briefing in ETS HQ in the Royal Artillery Barracks, Woolwich. What followed was a full-on fortnight of ground recces, troop briefings, exam administration and exam invigilation. Impressively, after a lot of Ops planning and leave juggling, seven NETS(Ops) personnel and two volunteers from elsewhere in the TM specialisation were released – an impressive number at such short notice which maintained RN visibility throughout Op Minerva.

Accommodated in a variety of locations, the RN team was able to cover most central London Olympic sites and the main camp (Chickerell) in Weymouth. After the initial HQ brief and a City and Guilds presentation it was clear that the Operation had been organised at very short notice and initial recce and set-up work was still required. This led to the first couple of days being spent accessing sites, gaining security passes, speaking to Comms Centre military personnel from all Services and briefing troops on the accreditation and what we were trying to achieve. The key was to do as much work up front and to get as many contacts in place to aid the future exam work, and the RN excelled, swiftly gaining entrance and setting up initial programmes of testing that ensured the success of the later weeks.

With so many troops to test it was always going to be a challenge. The exams were not compulsory, but initial indications showed that most

Ops Room at Woolwich RA Barracks

would want to take them. Overall, the takeup completed in two weeks was around 3000 personnel – considering that a large proportion of contingency personnel left early, this was a good number of initial assessments.

The main challenge was finding suitable City and Guilds approved exam testing venues. In some instances, exams were conducted in security search tents or in temporary dining halls between meals. The areas covered included Weymouth, Greenwich Park, Tobacco Docks, Chatham Docks, HMS Ocean and Horseguards Parade. Logistically this made daily work complex but was eased by the free travel for military personnel across London during the period.


A converted Search Bay area!

Overall, Op Minerva was very busy but enjoyable and provided an excellent opportunity to contribute to the military contingent for the Olympics. Additional testing continued throughout the Paralympics, and work is still ongoing for all three services on the overall accreditation, practical intervention assessments and the administration of results, re-sits and awards.


Testing in Horseguards Parade


Testing in Tobacco Docks dining area

PORTLAND SECURITY

By Lt Billy Ralston
Learning & Development Officer, DISC

The Venue Security Force (VSF) at the Olympic Sailing Venue in Portland, Dorset, consisted of six Royal Navy officers as Command and Control and approximately 200 other ranks from 42 Commando Royal Marines, 30 Commando IX Group, the Royal Marines Band Service and the Royal Wessex Yeomanry. The command and control element was based in 'Venue Bronze Command.' Venue Bronze was manned 24/7 for the duration of both the Olympic and Paralympic Games and enabled empowered members of the Armed Forces, Police, Fire, Ambulance, local Council, G4S and the London Organising Committee of the Olympic Games to communicate, organise effectively and escalate issues to Silver and Gold Commands as required. At some points, especially during the between-games period, the 12 hour night shift dragged and was only brightened by watching live, 'You've Been Framed' moments on the Weymouth CCTV: highlights included a stumbling drunk getting his head stuck between a wall and a drainpipe and an amorous couple on the beach.

After the area went into security lock-down, which involved above- and underwater bomb sweeps, sealing drains and erecting security fences around the area to control access and egress, the VSF stood up. Interestingly, there were also state of the art Kevlar booms and sonar systems to prevent unauthorised boats and warn off unauthorised swimmers and divers. The booms and sonar systems were controlled from Venue Bronze.

Duties undertaken by VSF members at the Athletes' Village and venue were vehicle searching, personal searching, X-ray scanning, static guarding and perimeter patrolling. The Portland site was significantly different from the other Olympic venues in that knives were regularly allowed through the search area as competitors and rescuers might have needed them to untangle themselves in an emergency situation. The other main difference from other areas was that no spectators came through the venue as the spectator area was three miles away in Weymouth itself: this significantly improved throughput of the search areas as people got to know what activated the scanners and what they could retain on their person.

When not on duty there was the opportunity to explore the Chesil Beach area and walks and runs on the Jurassic Coastal path were popular, as was sampling the nightlife in 'Weybiza.' Interestingly, the local taxi drivers spoke of the trade being down on a normal summer. In their opinion, visitor numbers were overestimated, resulting in hotels cancelling their normal coach-trip companies in the promise of better paying guests who did not appear.

Personnel Search Area

ARCHERY AND BOXING FLAG CEREMONIAL TEAM

By WO2 Stirling "Spike" Way
Submarine Admin + Personnel, NBC Devonport

I am WO2 Stirling "Spike" Way and was nominated as the team leader for flag raising duties at the Olympic archery and boxing victory ceremonies.

Initial training took place at MWS. This included a baseline flag-raising drill along with plenty of other briefings about security, the media and what to expect from LOCOG. We were then all left until the seemingly chaotic roll-call at Feltham Barracks a week before the event. We were all perhaps a little concerned because there were literally thousands of troops milling about and all apparently living in huge field tents bolted into the parade ground!

Upon arrival at Woolwich Barracks our fears were allayed, being accommodated in real buildings, with real facilities like running water, showers even! Compared to the horrors of Tea Wharf where 1500 personnel were 'living' in a warehouse, we were indeed living the dream! OK it was a Transit Accom dream but certainly not the nightmare most others were likely to be experiencing.

Training for flag-raising was patience draining but you know there are worse places to be left waiting for something to happen than the England changing room at Lords. Lunch was a pretty arduous affair also… You can imagine the trauma we felt eating it while looking over the hallowed turf from the executive lounge. Tough times indeed.

After the training we were quickly into the detail with Archery starting straight away. There were plenty of highlights with respect to the sport, but for us a lot of the enjoyment was derived from watching how the 'Professional Event Organisers' rushed around, while we pretty much chilled out as everyone else seemed to be losing their heads. Some were quite taken aback at how relaxed we were and how quickly we could switch to "Doing our job" role – for us it wasn't exactly rocket science.

At the ExCel centre it was very different because we were right in the pugilistic mix. Again the Organisers rushed around while we were able to take the opportunity of interacting with the boxers. Meeting the British and Irish winners was certainly a highlight along with speaking at length with Wladimir Klitschko, the Super Heavy Weight Champion of the world. And with a roof over us the atmosphere was almost overwhelming; certainly the proudest moment was being able to salute the Union Flag raised for Nicola Adams, the first female boxing gold medallist in Olympic history.

For us all the organisation was good with regard to accommodation and travel arrangements. Indeed it was a joy to be so readily welcomed wherever we went, certainly members of London Transport and the Police were all keen to acknowledge us in uniform, while the public frequently just started speaking with us or wanted a photograph with them surrounded by Servicemen.

For us in Team 8, it was brilliant!

RIB COXSWAIN

By POMEM(L) "Morph" Clayton
SFM Defiance Workshop
HMS Drake

Following a request for volunteers in March of this year, I put my name forward for RIB Coxn, for the sailing at Weymouth.

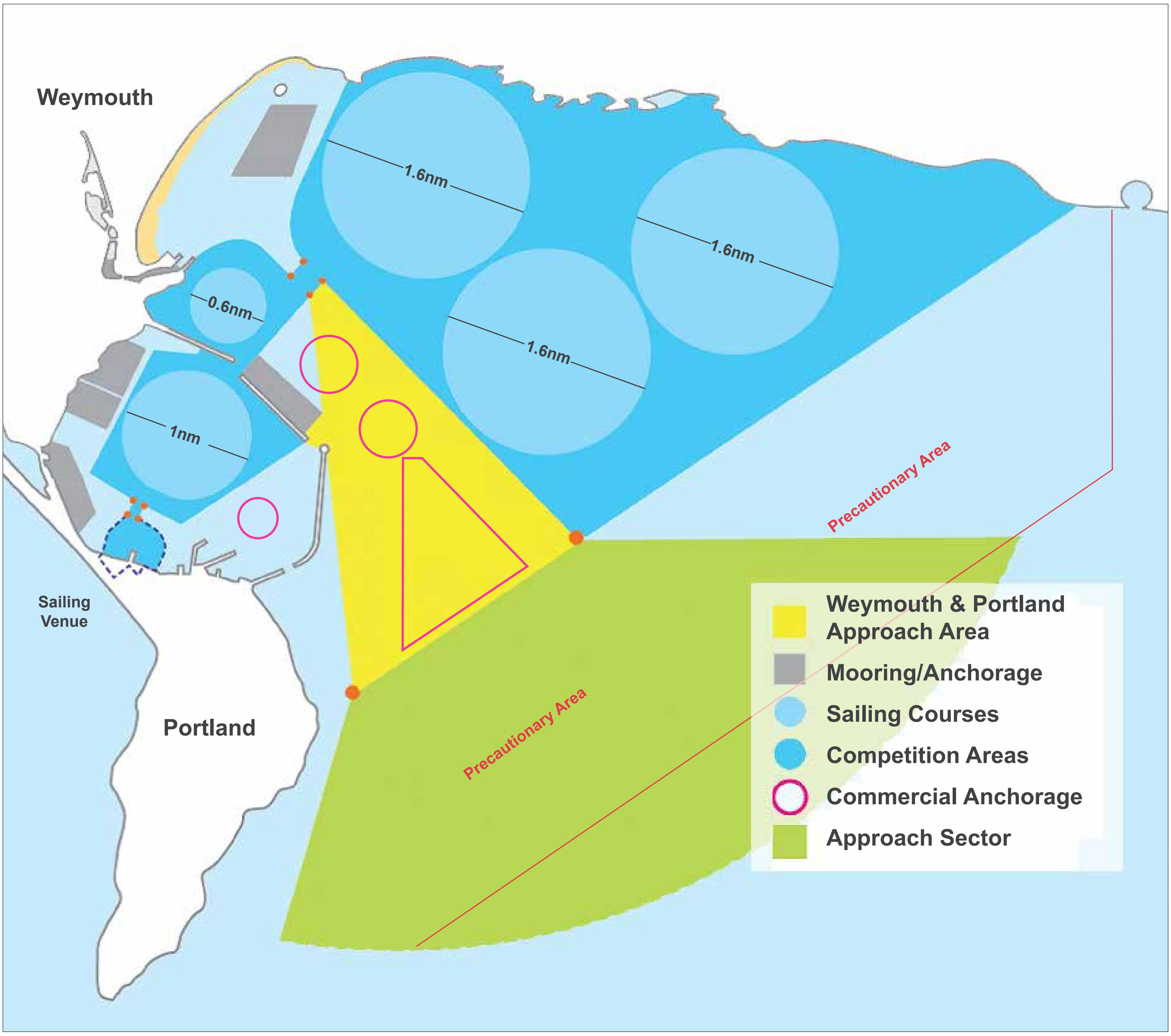
At this point the Olympic Manpower Command structure seemed to "have disappeared" and no information was forthcoming despite constant requests.

Finally, three months later, on the Thursday prior to the Double Bank Holiday I received a phone call to say my three week training course would start the following Monday. Along with the rest of the course, this was inconvenient timing and was not popular with families losing our Double Bank holiday at such short notice, due to someone else's poor planning.

With no choice, I rocked up at Jupiter Point the following Monday, as instructed, with about another 25 equally disgruntled potential coxns. There was a varied mixture of young and old, junior rates up to a Lieutenant, with the only thing in common being the Thursday phone call. The training staff at Jupiter Point were equally in the dark about what to teach us and had only just received the boats that we were to use. Fortunately the staff utilized their experience and put together a good course. We were all desperate for information, and finally a Colonel RM from HMS Bulwark came to speak to us about what he believed would be happening. Although we all left the course as qualified coxns, we were still pretty much in the dark about the details of what we were going to be doing.

The most senior members of our course, an MAA and the Lieutenant, took it upon themselves to find out more information and forward it via email or phone. Information started to trickle through as the event got nearer.

Four weeks later we had our kit packed, and caught a coach to Portland. We were accommodated on RFA Mounts Bay which was perfectly adequate for this task. We were issued specialist clothing items from the Mounts Bay. It was fortunate that we had three Seaman Specs as part of the group, as they



Weymouth and Portland Sailing Areas

were able to ensure our safety equipment was in good order as it had been "storob'd" from around the fleet and some items were blatantly "second hand". We spent the next few days having lots of briefs and getting to know the police crews that we would be teamed up with.

Prior to the Olympic sailing events starting for real, we spent two days in our shift patterns, doing exercises, and learning the local areas. There was a layered defence system in place to protect the sailing areas from being encroached, whether accidentally or deliberately. The first layer being local fishing boats directing vessels via radio. The RN contingent was the second layer in unarmed RIBs, accompanied by two Police Officers. There were also a number of armed police RIBs, and the RM ORCs. This was all backed up by a Merlin helicopter and we were under the control of HMS Bulwark. The exercises consisted of various scenarios from "blatantly clueless" boats encroaching on the sailing areas to "rogue terrorist vessels" attempting to break the cordon.

The early shift started at Portland Marina at 0700 for briefing. Each crew were allocated a different boat each day, and this was the time to find out our area, and to obtain an up to date weather report. The Coxn would then draw the keys for the boat and sign out a Police radio. The other crew also received their individual briefs, and then we would proceed to our allocated vessel. We would check the boat over, make ourselves comfortable and then proceed to our allocated area. We were to be on station by 0800 to allow two hours to secure the cordon before allowing the Olympic sailing boats and their support vessels uninterrupted access from 1000. We would eagerly anticipate the arrival of the "Shuttle" boat which would bring our bag meals out to us. This was the highlight of any shift. We would patrol our allocated area, listening out on the radio for any possible instructions from Bulwark. Depending on the day's area, we could be out there until between 1400–1700 before relief. The afternoon shift would start with the brief at 1300, and then a succession of shuttle boats to carry out handovers. There was one shuttle for four boats, and we could carry two crews in the boat. Due to strict speed limits in the harbour and around the cordon, it would take over half an hour to reach the furthest point with the first two crews, and if you were last it could be 1700 before you were back alongside. The procedure did improve towards the end to reduce this time. The racing would typically finish between 1700 and 1800, and once all Olympic vessels were safely back in harbour we would "stand down".

Most of the days were uneventful, however my vessel was twice tasked with a "Blue Light" response. The first time was to head off a yacht that had not responded to instructions. The Skipper was a little upset that the cordon was in place and thought he "knew best", acting like a petulant child. The police officer on board pointed out the error of his ways and that was the end of the incident. The second one was much more exciting, with a rogue RIB approaching the cordon at 40 knots, ignoring all radio requests to slow down and identify himself. Three RIBs were dispatched to intercept as well as the Merlin. As soon as the Rogue RIB realised all the Blue Lights were heading his way he immediately slowed and was compliant, apologising for his lack of awareness regarding the cordon.

Overall it was a good experience, and a chance to do something different. It was a shame that those that volunteered had to fight for every scrap of information leading up to the event, and that we lost our Double Bank holiday at such short notice. The armed forces may have gained good PR overall from the Olympics, but the families of those involved in the Sailing security at Portland are not so impressed with the Navy's organization or communication.

SENIOR MILITARY REP

By Cdr Mike Toft
DES Ships

THE TASK

Contrary to the impression that might have been gained from the media, a lot of Service personnel were earmarked for Olympics duties long before the G4S shortfall occurred. I was fortunate enough to be one of those people, swayed by the opportunity of a "home draft" for the first time in 16 years and the rather grand title of Venue Senior Military Representative, Weymouth and Portland. Responsible to the London Organising Committee of the Olympic and Paralympic Games (LOCOG) Venue Security Manager, this role put me in the privileged position of Commanding Officer of the 200 military personnel who would form the Venue Security Force (VSF) for the Olympic and Paralympic Sailing Venue. Our mission – to deliver a safe and secure games, whilst enhancing the reputation of the Armed Forces.

A great deal of preparatory work had already been done by the staffs of the Joint Military Commander (Dorset), the Army Brigadier I would be working for, and the Naval Regional Commander Wales and Western England. However there was still plenty to be done and from April I was quickly immersed in numerous training and planning exercises, supplemented with a plethora of staff work. The scope of the task was immense, drawing me into such things as VSF training plans, force generation, accommodation, logistics, transport, feeding, uniform, legal powers, policing and discipline. All fascinating topics, and supported by more Warning Orders, Op Orders and Fragmentary Orders than I've


The White Ensign flies alongside the Union Flag over Chickerell Camp

ever seen. Just three months after I started work, we were ready to deploy.

THE VENUE

Meanwhile LOCOG was working hard to transform the Weymouth and Portland National Sailing Academy into a secure Sailing Venue and Olympic Village. The Venue and the Village were two separate locations, with the Venue secured by the MOD VSF and the Village secured by G4S. The race sites around Weymouth Bay were secured by the Maritime Force Commander Dorset, the CO of HMS Bulwark. LOCOG requested a small MOD VSF contingent to start work earlier than originally planned, so schedules were quickly re-arranged and we moved into our accommodation at Chickerell Territorial Army camp on 30 June, ready for duty on 1 July. Unfortunately extreme weather and technical problems meant that the Venue wasn't ready to commence security operations; however this gave us time to familiarise ourselves with the area and proved invaluable for our next big challenge – supporting G4S.

THE CHALLENGE

Initially G4S was able to provide sufficient personnel at Weymouth and Portland; however backlog in the accreditation process meant that they hadn't been vetted properly and in very short order some 40% of their staff had to be withdrawn. With the athletes due to arrive at the Olympic Village on 16 July, the decision was made to move the MOD VSF into the Village to provide support. As well as overcoming the G4S shortfall, this had the additional

The Olympic Venue and Village

The Ceremonial Team

benefit of presenting a much more robust security appearance to the public. Many of the Olympic teams gave positive feedback on how glad they were to see such professional and efficient security provided by the military after all the scare stories in the press. Watch routines had to be swiftly amended and additional manpower provided at short notice from the Contingency Force. The MOD VSF covered the gap for a further 12 days, until G4S was able to resolve its difficulties and resume full duties in the Village.

THE HIGHLIGHTS

Once into our routines, there was some opportunity to take in the enormity of what we were supporting, from visits by Royalty and other VVIPs through to the sailing and medal ceremonies. It was certainly a once in a lifetime experience, but most of all I was proud to be heading up such a fine body of men and women. Throughout the trials and tribulations everyone performed to the highest standard both on and off duty, proving once again how resilient and professional our people truly are – the single most important factor.

Ben Ainslie Gold Medal Ceremony

The Olympic Flame

Bravo Zulus

Congratulations to the RN Engineers who were awarded commendations for outstanding contributions to Operation Olympics:

Standing Joint Commander's Commendations

Lieutenant N. Muyambo
Lieutenant Commander A.J. Thomas
Commander M.D. Toft
Lieutenant Commander R.P. Wallace
Commander N.S. Wright

Maritime Component Commander's Commendations

Lieutenant M.A. Wakefield
Warrant Officer 1 ET(ME) G. Moss

CUTTING EDGE INTEGRATION FACILITY OPENS

FIRST SEA LORD OPENS QE CLASS MISSION SYSTEM INTEGRATION FACILITY

By the Editor

Lieutenant Commander Alastair Graham, DE&S Maritime Combat Systems, QEC Acceptance officer, demonstrating the key capabilities offered by the Lyster Building integration facility to the First Sea Lord

Admiral Sir Mark Stanhope, the First Sea Lord, opened Lyster Building, the Queen Elizabeth Class Mission System Large Scale Integration Facility, at HMS Collingwood on 12 September 2012. The facility, established at a cost of £1m, will allow full-scale testing of the ships' mission system, using the actual hardware which will subsequently be fitted in HMS Queen Elizabeth, thus de-risking the installation at an early stage, and increasing confidence that the Mission System (MS) will be fit for use in the planned timescale. Investing in shore integration facilities reduces the time required to conduct costly mission system acceptance trials on the ships from years to months.

The Mission System is the "brain" of the ship, which enables it to conduct air traffic control, navigation, tactical picture compilation, communications, mission planning for the embarked F-35 Joint Strike Fighters and Merlin helicopters and to carry out engineering maintenance and logistics support. Whilst the MS's complexity is a step change from existing systems, much of its capabilities are described as evolution, rather than revolution; operators familiar with Type 23 or Type 45, or with aircraft control at airfields ashore, will find that many of the "building blocks" of the new MS are not unfamiliar – but the scale of the system is significantly greater than any predecessor. The MS will bring together the combat management, communications and visual surveillance systems on the ship's fibre-optic network and integrate these key capabilities on a scale never undertaken in previous ships – the QEC MS has twice as many interfaces as Type 45's CMS.

The equipment in Lyster Building will allow engineers to test the MS in all its roles and functions – they'll be assisted by trainees from the Maritime Warfare School, both as operators, who will stress the system by putting high-intensity loading on the various elements, and as maintainers to look at the impact on maintenance requirements. Once the tests are complete, and the relevant compartments in HMS Queen Elizabeth are ready to receive the kit (currently planned for the second and third quarters of 2013), the hardware and software will be packaged up and sent to Rosyth for fitting. The hardware will be slid into its racking on board, powered up, and a similar series of tests run on board to prove the MS *in situ*, using the same control system for emulation as in Lyster Building (which, incidentally, uses the same system as is used in MWS' MCTS[1]).

Just a few facts about the system:

- Those familiar with older ships will not find a computer room – instead there are a large number of node rooms which provide considerable redundancy on a network that is designed to heal itself following action damage.

- 300 cameras are provided for surveillance of unmanned spaces and visibility of "out-of-sight" areas (eg under the flare of the bow, or flight-deck overhangs) and all of these are linked to the MS – and all of them are part of the testing taking place in Lyster Building (the ones to be fitted on weather decks are known as "Metal Mickeys" – a nickname which will only mean something to those familiar with certain 1980s TV shows).

1. See the Winter 2011 edition of TNE.

A "Metal Mickey" – one of the weather deck surveillance cameras

Illustrations courtesy of Photography Department, HMS Collingwood

The First Sea Lord formally opening Lyster Building. Left to right: Steve Dowdell, BAE Mission System Director, Rear Admiral Steve Brunton, Director Ship Acquisition DE&S, 1SL and Commodore Mike Mansergh CBE, Commodore Maritime Warfare School

WHY "LYSTER BUILDING"?

Vice Admiral Sir Lumley Lyster, KCB, CVO, CBE, DSO, captained the aircraft carrier HMS Glorious in the late 1930s, during which time he developed plans to attack the Italian Fleet using carrier-based air power, in the event of hostilities, in its base of Taranto. Subsequently, as Rear-Admiral Aircraft Carriers in the Mediterranean Fleet in 1940, flying his flag in HMS Illustrious, he commanded Operation Judgement, the attack on Taranto by Swordfish torpedo-bombers; based on his earlier planning, this attack knocked out half of the Italian Fleet's battleships and materially altered the balance of maritime power in the Mediterranean.

- Four integration facilities for various elements of the QEC's systems are now up and running, at Portsdown, Crawley, Cowes on the Isle of Wight and Collingwood.

- Some elements have already been proven – for example, HMS Prince of Wales's Link 16 has already linked from BAE Cowes to the Type 45 reference set at Portsdown, and has just successfully completed collaborative over-the-air testing with HMS Illustrious.

In opening Lyster Building, Admiral Stanhope paid tribute to its namesake: "*Lyster was a leader and innovator in delivering Air Power from the Sea; and this will be the primary role for the Queen Elizabeth class carriers, as part of our Future Navy 2020 vision. It is apt therefore that the Aircraft Carrier Alliance should take him as their inspiration in developing this world-class engineering and training facility that will help ensure HMS Queen Elizabeth enters front line service before the end of the decade.*"

After declaring the building open, he presented Rear Admiral Steve Brunton, Director Ship Acquisition DE&S, with a "Queen Elizabeth" cap tally which Admiral Brunton would, in turn, present to the first member of her Ship's Company, who would join her in October 2012 – the first of her RN engineers was to join in March 2013. (The cap tally was subsequently presented to Leading Writer Claire Butler on 2 October 2012 in a ceremony at Rosyth.)

WANT TO KNOW MORE?

For further information please contact:
Commander Steve Roberts
Maritime Combat Systems – QE CSM
Tel 0306 793 5459 or 9679 35459
DII: DES SHIPS MCS-SSCSG-QE-CSM

GLOSSARY OF TERMS

CMS	Combat Management System
MCTS	Maritime Composite Training System
MS	Mission System
MWS	Maritime Warfare School
QEC	Queen Elizabeth class

Letters to the Editor

C-DOCS – SUBMARINE COMBAT SYSTEM DOCUMENTATION

Dear Editor,

Just a brief comment about "Editor's Corner" in a recent issue of TNE:

In the TNE Summer Issue, you mention the distribution of *The Naval Engineer* in its various guises. An additional method of distribution, which was not mentioned in your article, is the inclusion of the three most recent issues of TNE within C-DOCS. Aimed primarily at the submarine fraternity, C-DOCS provides technical information about the Combat System and is distributed to all submarines by Restricted CD-ROM media, as well as being available on the RLI[1].

Regards,

Steve Osliff MBCS, MInstLM
Combat System Senior Engineer
SSMG Combat Systems
Babcock Integrated Technology
Devonport House
PO Box 77
Keynsham BS31 2YH

1. http://www.dgsm.dii.r.mil.uk/cdocs/cdocs.htm

INNOVATIVE ALL-ELECTRIC LAUNCH SOLUTION FOR FUTURE ELECTRIC SUBMARINE

By Daniel Pettitt MEng MIET
R&D Manager – Defence Systems Technology, Marine & Technology Division, Babcock International Group

Daniel Pettitt holds a Masters of Engineering degree in Electrical and Electronic Engineering from the University of Nottingham. He joined Babcock in 2009 and has undertaken a number of projects focused on the development of electric actuation for submarine systems and equipment. He now manages the Research and Development department within Defence Systems Technology, with the responsibility to deliver a range of development projects for both submarine and surface ship applications.

EDITOR'S VIEW

This article discusses the outcome of company-funded R&D work; there is currently no MOD-sponsored capability development activity to which it relates, and the subject is included in TNE in order to inform you, the reader, of possible future developments. As always, the Editor would welcome your comments.

Developments in the use of electric technologies for naval applications present an opportunity to explore all-electric payload launch solutions for a submarine of the future, with potential benefits including improved operational capability, and low through-life cost.

A critical and substantial element of a submarine's operational capability is the ability to launch a payload, from weapons to countermeasures and, in the future, potentially, unmanned underwater vehicles. The launch system is therefore a fundamental component, with specific design requirements. In addition to providing sufficient exit velocity to enable the payload to clear the host submarine and go on to perform its mission, the launch must also be performed in a functionally safe manner (particularly if crossing the submarine's pressure boundary, as with torpedo launch), and the system must be available when required, and must not compromise the submarine's stealth.

Typically, weapons and other payloads are launched from a horizontal tube that provides an interface between the internal stowage compartment and the external environment, in various arrangements for different payloads and tending to use compressed air to provide the launch power.

A submarine's weapons handling and launch system (WHLS) is one such example, with Babcock's WHLS design, for instance, using an air turbine pump (ATP) to provide the motive power to the weapon, controlled by a programmable firing valve (PFV) to make the most efficient use of the firing air, according to the weapon to be launched, and providing a covert means of launching a weapon in a compact volume. Other payloads, such as countermeasures, are typically launched from a single-shot launcher mounted under the casing, or through a submerged signal ejector.

Future launch systems may be different, potentially becoming 'all-electric', in line with moves towards electric systems on naval platforms. With an increasing focus on the benefits to be gained by electrification of power, propulsion and auxiliary systems (including reduced through-life cost and potential for increased operational capability), plus on-going developments such as electric weapons and aircraft

Figure 1: HMS Astute's state-of-the-art weapons handling and launch system is supplied by Babcock. Future payload launch systems may become 'all-electric' in line with moves towards electric systems on naval platforms

UK MOD/Crown copyright 2012

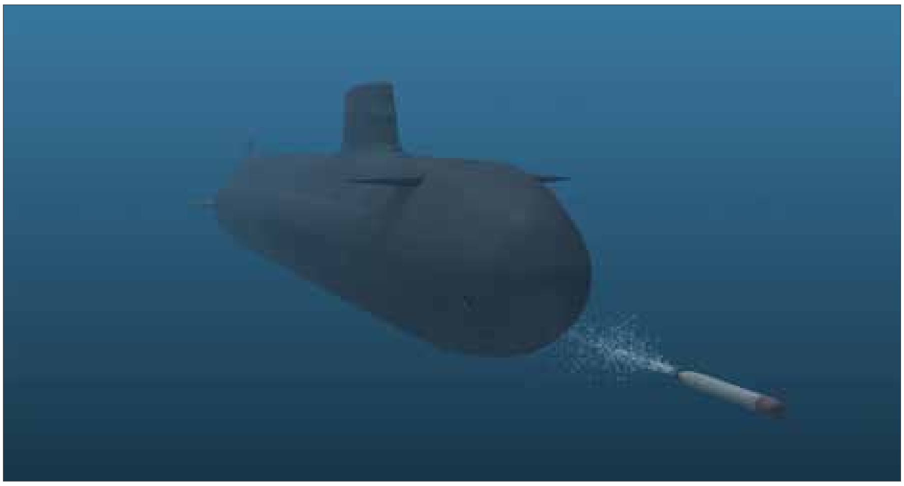


Figure 2: The submarine of the future may be predominantly, or entirely, electrically actuated. This may present some challenges for the payload launch system, but also some valuable opportunities

launch on surface ships, it may be that the submarine of the future is predominantly, or entirely, electrically actuated. For the payload launch system this may present some challenges, but also some valuable opportunities.

NEW TECHNOLOGY OPTIONS

The possibility of a future electric submarine presents an opportunity to use developing technology; in particular, the electric linear motor and the 'rodless cylinder'. The linear motor, working on a similar principle to the typical rotary electric motor, has a stator and rotor (commonly referred to as a reaction plate) in a linear rather than a rotary form. The two main variants – the Linear Induction Motor (LIM) and Linear Synchronous Motor (LSM) – have various differences, but the major distinction lies in the LSM being smaller and lighter but requiring use of permanent magnets in the reaction plate, whereas the LIM uses a conductive plate. LIM technology has been widely used in the commercial sector and also in designs for naval applications such as the EMALS (General Atomics) and EMCAT (GE Power Conversion) aircraft launch systems for aircraft carriers, and the EMKIT Unmanned Air Vehicle launcher demonstrator (GE Power Conversion).

The cable-type 'rodless cylinder', operating using compressed air (as demonstrated on the Babcock single-shot countermeasure launcher), is also of interest, being adaptable to make it suitable for launching larger payloads, and with the potential to use a 'slit' mechanism suitable for repeatable launch operations.

Combining LIM and rodless cylinder technology can overcome the traditional size disadvantage of linear actuation methods for launch systems. By integrating the LIM stator into the launch tube, the force-producing equipment is contained within the tube itself, providing a launch system with a very compact volume, that can be referred to as the Integrated Electric Launch Tube (IELT).

The IELT arrangement provides various benefits. The pressure hull penetrations for the force-generating equipment (being power and control cables only) are reduced compared to existing methods. Additionally, the launch tube is the same for both payload launch methodologies and the speed and acceleration of the launch operation can be electronically controlled (similar to the capabilities of the ATP and PFV combination) providing an adaptable solution that can launch a number of payloads.

HARMONISING PAYLOAD AND LAUNCHER

Importantly, the payload and launcher must be considered as sub-systems of a 'payload launch system' in order to achieve a solution that recognises the practical constraints of each. This leads to two variants of the solution. In the first, the reaction plate is integrated with the payload. This is the most elegant variation from a launcher perspective, reducing the number of components and simplifying the launch solution, but has some disadvantages for the payload, making it complex to achieve as a system. Firstly the reaction plate (a conductive sheet) must be integrated with the payload in a physically suitable manner to allow the payload to meet its operational requirements, and the launch force required could be large, which could increase the payload mass, limit its manoeuvrability, or reduce the capacity available within the payload body. Further, heating of the reaction plate during launch must be managed. Multiple payload types would require a defined interface standard for incorporation of the reaction plates which could affect payload capability, and the electromagnetic field emitted by the LIM also needs to be closely managed, particularly with respect to electromagnetically sensitive munitions and weapon control systems, which may make it unfeasible for some payloads.

The second variant sees the reaction plate integrated into a separate 'reaction unit'. With this approach the design of the payload is not compromised, although it will still need to accept a launch force applied at the rear. Equally, the separate reaction unit means the electromagnetic field is more local to the reaction unit, and the effect on sensitive equipment is minimised.

The reaction unit itself could be either disposable or re-usable. A disposable unit would simplify the control and power system solution, having no requirement for energy dissipation or recovery, and loading of payloads into the tube would be easier. By avoiding the need to handle the stresses of continuous heating and cooling cycles, the size and cost of the reaction unit could also be minimised. On the other hand, a re-usable unit would mean no requirement for stowage and handling of multiple reaction units, but the mechanism to install a weapon past the reaction unit would need close consideration, and the unit is likely to be larger than a disposable option, to combat the effects of multiple operations. The control and power system would also need to be capable of braking and recovering the reaction unit from within the tube, which would increase launcher length to accommodate a braking zone.

A key benefit is that the IELT design is the same for both variants, the only major difference being the position of the reaction plate with respect to the payload. A single tube can therefore be used to launch payloads with an integrated reaction plate or a separate reaction unit, providing an adaptable system.

DESIGN CONSIDERATIONS

Among the technical challenges involved in realising the integrated electric launch tube configuration is the need to achieve sufficient force to launch a weapon within a compact system volume. However, as the launch force is applied directly to the payload, the system is more efficient than current methods, reducing the power needed to achieve equal performance. Given that a launch operation is discontinuous, analysis of the duty cycle would allow the system to be optimised to use the peak rating of the motor. It is also anticipated that cooling would not be required, due to the thermal mass of a typical launch tube, and the fact that the tube is flooded internally and externally provides a good thermal heat sink, although a demanding salvo launch requirement could affect this.

The LIM stator, which is typically formed from a multi-phase winding in a laminated iron core, is another factor. It must be integrated within the launch tube without compromising its structural integrity, while also maintaining corrosion resistance in a seawater environment. This can be addressed by encasing the stator in a non-magnetic material to provide corrosion resistance.

A further consideration is the ‘airgap’ between the stator and reaction unit, which needs to be flooded for the integrated launch tube. However, the concept is already in use with canned rotary induction motors that operate while flooded, so is not considered a major design issue. The acceleration of the payload within the flooded tube during launch, and the consequent movement of water as a result, may, however, have an effect on the airgap specification. The tube must also be capable of providing follow-up water behind the payload as it is launched.

With regard to the power system design and control, multiple LIMs connected via power switches to the launch inverters provides the most cost-effective and efficient method of transferring power to the reaction unit, and has been proven to operate successfully in various applications, notably GE Power Conversion’s EMKIT UAV launch demonstrator. This methodology enables the speed and acceleration of the payload to be controlled during a launch operation, allowing different payloads to be launched from the same tube.

Also relating to power, the pulsed demand (payload launch being a high power, discontinuous operation) is likely to be too high to derive directly from the submarine electrical supply and therefore requires a local energy storage system. Developments in the surface ship sector to provide energy storage for UAV launch, as well as developments for aircraft, rail gun and directed energy weapon applications, are of interest here. A number of technologies exist, such as ultracapacitors and advanced battery technology, with the potential to provide a submarine energy storage system, after necessary development and proving for the operating environment.

MISSION MODULARITY

The IELT concept is scalable in terms of both the launcher mechanism and the energy storage, enabling it to be used to launch a variety of payloads, from countermeasures using a smaller scale system to weapons using a larger scale one, as well as being applicable to UUV launch and recovery. This aligns well with a mission modular approach, as additional tube modules and energy storage could be added to adjust the capability of the launcher to the platform’s operational requirements.

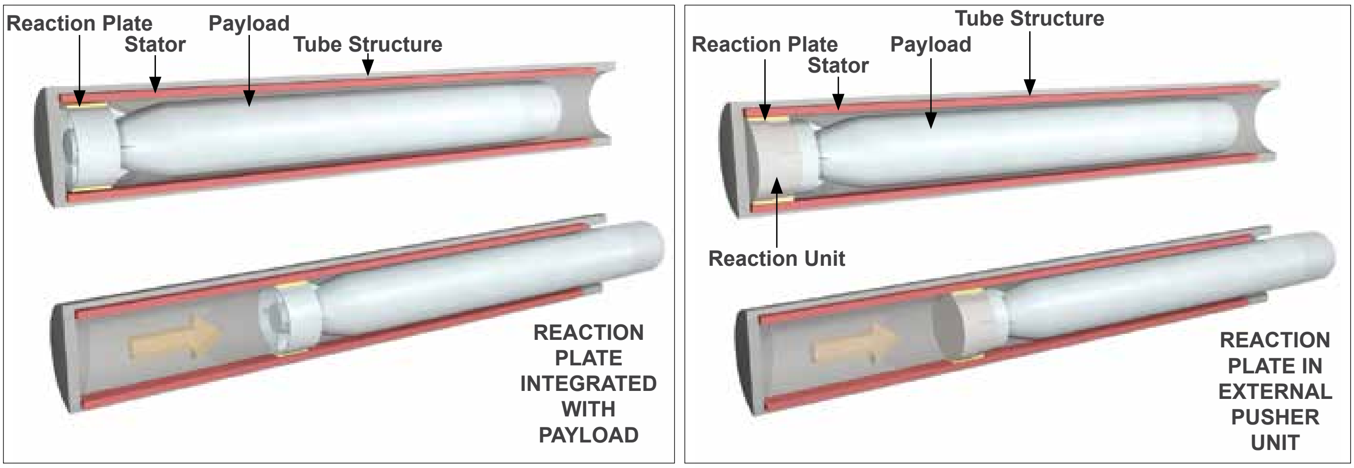


Figure 3: Diagrams showing the LIM integrated with a launch tube and payload, the Integrated Electric Launch Tube concept. The reaction plate may be integrated with the payload (left) or in a separate ‘reaction unit’ (right)

Importantly, the development from the current state-of-the-art ATP with PFV launch system to an electric system to meet the interface requirements of a future all-electric submarine can be achieved in a series of incremental steps by electrifying individual sub-systems. This will ensure minimised risk, while ultimately providing an all-electric system with a compact volume, and contributing to a low through-life cost at platform level. Moreover, there is further potential for the IELT concept to be developed into a true external tube that aligns with the mission modular submarine concept, enabling the submarine to adapt its payload launch capability according to mission requirements. In short, the development of an all-electric payload launch system for submarines is not without its challenges, but also presents valuable opportunities.

WANT TO KNOW MORE?

For further information please contact:

Daniel Pettitt, R&D Manager, Babcock International Group
Ashton House, Ashton Vale Road, Bristol BS3 2HQ
+44 (0)1173 449 312 daniel.pettitt@babcockinternational.com

GLOSSARY OF TERMS

ATP	Air Turbine Pump
EMALS	Electromagnetic Aircraft Launch System
EMCAT	Electromagnetic Catapult
EMKIT	Electromagnetic Kinetic Integrated Technology
IELT	Integrated Electric Launch Tube
LIM	Linear Induction Motor
LSM	Linear Synchronous Motor
PFV	Programmable Firing Valve
UAV	Unmanned Aerial Vehicles
UUV	Unmanned Underwater Vehicle
WHLS	Weapons Handling and Launch System

RECOLLECTIONS OF WORLD WAR II

THE EASTNEY MICROWAVE "OVEN"

The advent of the 1 megawatt peak power 10 cm magnetron heralded almost a quantum leap forward in radar development. Harnessing the actual radio frequency power and transferring it to the aerial was in itself quite difficult, and many designs were tried and tested before a satisfactory solution was found. A Polish major was instrumental in designing a suitable launching device which projected the radio frequency power into a 3 inch x 1 inch rectangular brass tube known as a wave guide. The design and dimensions of the wave guides resulted from advanced mathematics, much of which stemmed from the pens of some Polish mathematicians who had escaped from Poland and had joined the Admiralty scientific teams.

George King was given the task of co-ordinating all the other components of a new high power centrimetric radar which was to be the nucleus of a new generation of land based and sea borne sets.

Taken from *Journal of Naval Science* Vol 16 No 4.

Whilst all the separate components such as pulse transformers, modulators, aerials, wave guide rotating joints, receiver protection water vapour switches and the TRE[1] developed Plan Position Indicator (PPI) were going through their natural progressions, George King hand-made a wave guide and horn to transmit the power of the new high power monster into the laboratory – just above our heads.

The embryo transmitter and modulator were sited in a 15 ft x 15 ft wooden hut on the flat roof of one of the laboratories at EFE[2], the access to which was by a 20 ft vertical steel ladder – rather like climbing up a ship's side.

One of the first tasks was to assess the life expectancy of the new magnetrons now being produced by the GEC[3] factory and to this end we started a life test, taking it in turns on a watch keepers' basis to continuously monitor results. Our natural curiosity took over during the tedious hours of watch keeping and we soon found that the bones inside a finger placed in front of the "aerial" horn became unpleasantly warm and painful. We progressed from this by cooking potatoes, sausages, toast (on the inside like the finger) and tomatoes – all in the space of a few minutes. We had a visit during this testing period from a Professor F.E. Terman (who was the Dean of the School of Engineering of Stanford University in the States): a venerable figure, who although not in the first flush of youth had no difficulty in shinning up the 20 ft vertical iron ladder to inspect our new high power monster.

He seemed more impressed with our cooking menu than the rest of the technical breakthrough which we had achieved! If only we had taken out a patent then for microwave cooking! One could not delve into the economics of kilowatt/potato costs!

Scanning Professor Terman's post war editions of his famous Radio Engineering volume, I have not been able to find reference to Radio Cooking! One wonders what stories he told when he returned to the States to pass on the data gained during his UK visit!

A.H.G. Oberman

1. Telecommunications Research Establishment.
2. Eastney Fort (East) – used during the war by the Admiralty Signals Establishment for development of naval radar.
3. General Electric Company.

WHO IS MCTA?

By Lieutenant Mick Hawkes MSc RN
NPA2, MCTA (Maritime Capability, Trials and Assessment)

MCTA is a Fleet unit, made up from Service and civilian Suitably Qualified & Experienced Personnel (SQEP), engaged in providing independent engineering capability assurance across the maritime domain. More information about MCTA can be found on the Intranet at MCTA's team site and full details can be obtained from the *MCTA Trials Guide* (BRd 9463), accessed via BR1 web. The intention of this article is to refresh the readership about MCTA's services.

Lieutenant Mick Hawkes joined the Royal Navy as an artificer apprentice in 1989. On completion of the four-year apprenticeship at HMS Sultan he served in various Type 22 and Type 23 frigates including HMS Lancaster as WO2MEA. During periods working 'shoreside' he has been employed in the Noise Test Cell and the Refrigeration section at HMNB Clyde; in addition, he has been a member of the Afloat Repair team and a Ship Manager at DFTE Portsmouth. He was selected for a commission in 2007 and joined BRNC Dartmouth in January 2008. On completion of SEMC he joined HMS Montrose, during upkeep, as DMEO. This appointment was especially rewarding, as it provided valuable and varied experience of the upkeep, regeneration and deployment of a FF/DD. He subsequently joined the Capability Assurance Group in MCTA in February 2011 as a New Platform Assessor, mainly involved in the QEC build project. In addition, he is also acting as Assurance Officer for other UK and non-UK projects including a small, high-speed patrol boat and a vessel under construction for the Royal Navy of Oman.

KEY THREADS

Three key threads run through all of MCTA's output:

- **Operational Focus** – Correct equipment and system performance is fundamental to the delivery of Operational Capability (OC). During MCTA trials, performance is measured against original design aim and military need. In other words, if an MCTA trial is successfully completed and Standards[1] are assessed as Achieved, the user and other stakeholders are assured that the kit is 'Fit for Purpose'. The best example of this work is an Operational Capability Confidence Check (OCCC) or a Propulsion Performance Assessment.

- **Independence** – MCTA has built up a reputation of professionalism and fairness throughout Fleet, MOD and Industry. MCTA trials reports present the facts, which sometimes make uncomfortable reading. However, by being consistently independent, MCTA occupies an invaluable position being both referred to and deferred to by Industry and MOD authorities alike. Additionally, MCTA was established in 2011 as a recognised organisation (RO) for the Naval Authority Groups covering Explosives, Fire, Escape & Evacuation and Propulsion & Manoeuvring systems.

- **Safety** – MCTA plays a very significant role in providing Level 2 assurance information that forms part of the safety case for all Fleet activity. All inspections, Harbour and Sea Trials, weapon firings, assessments and advice are predicated upon safety. As an example, the Machinery Vibration Analysis Unit (MVAU) identified a significant adverse, and potentially unsafe, vibration characteristic present on Type 45 GTAs. Following detection of this issue, MVAU's independent and objective recommendations led to corrective action that safeguarded the build, trials and delivery programme for HMS Diamond and avoided significant adverse effects on the remaining Type 45 delivery programme.

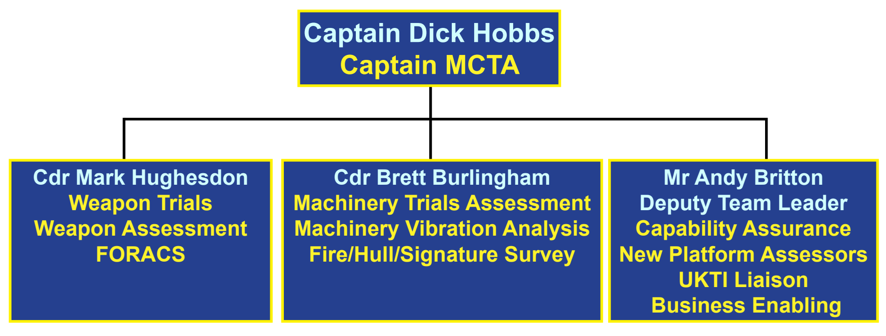
"MCTA trials reports ... sometimes make uncomfortable reading"

MCTA GROUPS, RESPONSIBILITIES AND LOCATIONS

The majority of MCTA personnel are based in Victory Building within Portsmouth Naval Base. There are also outstations in Faslane, Rosyth, Barrow, Glasgow (Govan and Scotstoun) and Devonport. Despite being mainly located in Portsmouth, more than 70% of MCTA activity takes place elsewhere, for example weapon firings from submarines in the Atlantic, acceptance trials in the Falkland Islands, post upkeep trials of RFAs in Singapore and land based Phalanx system trials in the Arizona desert. However, a significant number of trials taking place during winter months or in UK waters balance these more exotic locations!

MCTA is commanded by a Captain; working directly to him are a Commander (ME) leading the Marine Systems Group, a

1. Standards are iaw BRd 9463, *MCTA Trials Guide*.



MCTA's Command Team

Commander (WE) leading the Weapon Systems Group and a Band B2 Civil Servant as lead of both the Capability Assurance Group (CAG) and the Business Enabling Group (BEG).

CORE FUNCTIONS AND OUTPUTS

MCTA's main output is assurance. The definition of assurance is 'a positive declaration intended to give confidence'. Following MCTA's recommendation, MOD stakeholders can be confident that new and legacy systems and capabilities will be safe, effective, fit for purpose and operationally acceptable for Fleet introduction (or re-introduction) and employment in-service.

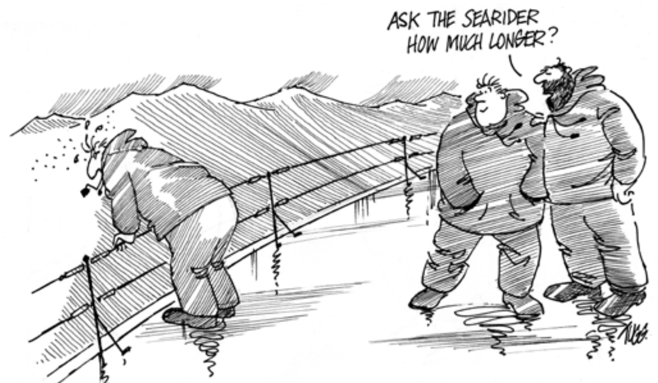
MCTA aims to maximise OC by ensuring that individual equipments and whole systems are not only acceptable but are also optimised in performance terms to deliver their maximum potential.

As previously mentioned, MCTA is also a RO, providing support to Naval Authority groups, especially Explosives, Fire, Escape & Evacuation and Propulsion & Manoeuvring Systems, thereby ensuring that the correct standards in these areas are achieved.

Additional benefit provided by early MCTA involvement in new build projects is in obtaining value for money for the UK taxpayer. MCTA experience can identify problems early before costly re-work becomes necessary. A recent example of this is the Teekay pipe coupling system used in Type 45 seawater systems. In QEC the use of Teekay has been extended to include most fluid systems. Because of concerns raised by MCTA, further trials took place on large bore (> 300mm) pipe installations. The results showed that the coupling is not suitable for pipes in excess of this diameter. More generally, MCTA's early involvement in the build process assists with the maintenance of engineering standards. Evidence of this benefit is visible in the defect data from the Type 45 project. High numbers of defects are identified, recorded and tracked throughout the programme, allowing the contractor plenty of time to rectify them before an acceptance event.

MCTA'S CUSTOMERS

The main customers of MCTA are Ship's Staff, Navy Command HQ (NCHQ – as Operating Duty Holder and Command Duty Holder), Project Team (as Materiel Duty Holder), Capability Sponsors and UK Trade & Investment (UKTI). NCHQ is the primary customer for operational and safety assurance; this is predominantly delivered through Maritime Force Capability Assurance (MFCA). A full description of MFCA for MCMVs was given by Lieutenant Commander Paul Maddison in the Summer 2012 issue of TNE. The individual activities which combine for MFCA are:



"... trials taking place during winter months or in UK waters ...

- Post Upkeep Combat System Trial
- Maintenance Audits
- Combat Systems Confidence Check
- Ship's Performance Assessment (SPA) – ME and WE
- FORACS (alignment trials and/ or OCCC)

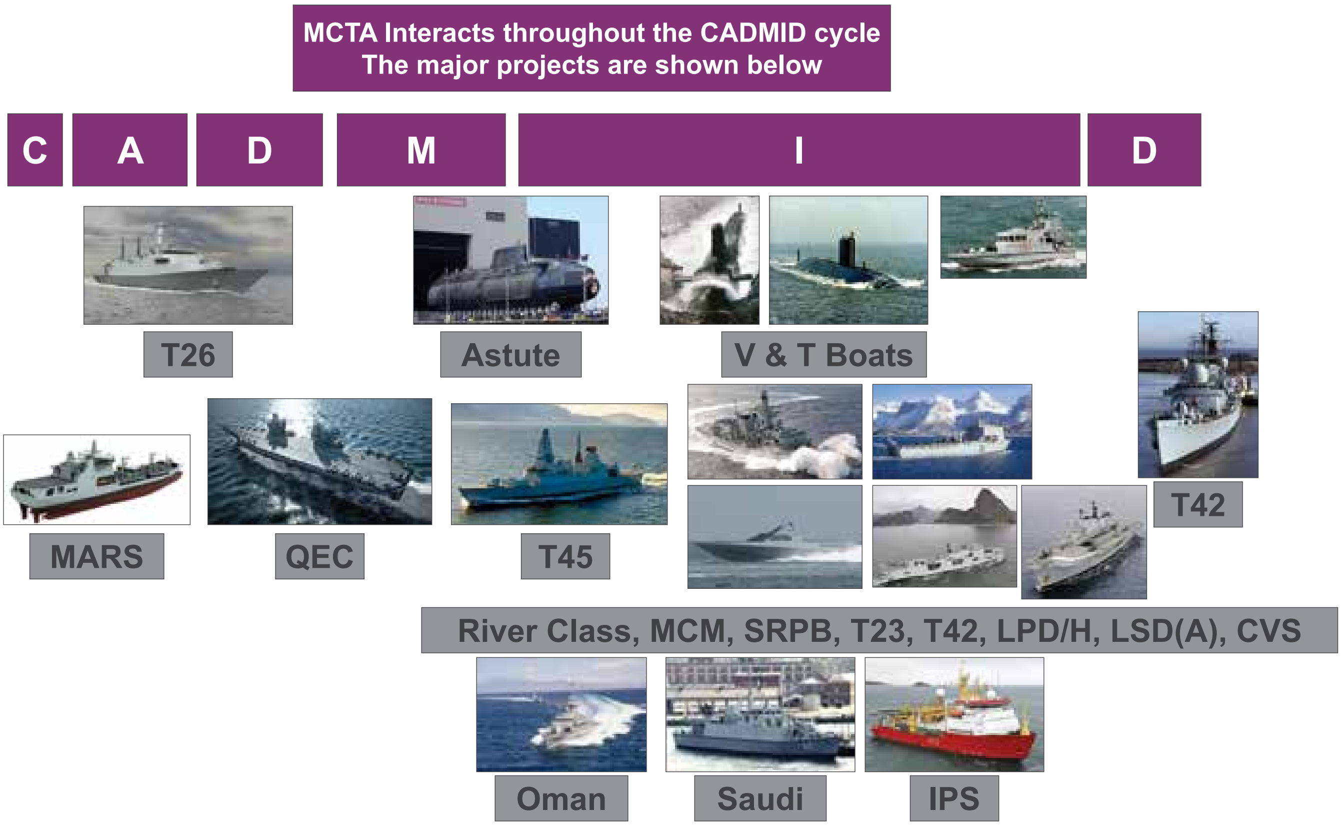
MCTA's analysis of weapon firings and practices is passed to Capability Sponsors; it is often MCTA analysis that highlights any shortfalls that require to be addressed.

Defence sales is an important part of MCTA's work, supporting UK plc; together with UKTI, MCTA provides advice and support for foreign customers under terms set down in Government to Government contracts. BAe is currently building three Offshore Patrol Vessels for the Royal Navy of Oman (RNO) and MCTA has been assisting the RNO team throughout the procurement process. MCTA have been involved from the outset, attending factory acceptance trials in the very early stages of the project, right through to Installation Inspections (IIs), development of trials documentation and finally, attending the customer Sea Acceptance Trials (SATs). This role helps support UK plc and also our overseas allies.

INTERACTION DURING THE CADMID CYCLE (see diagram overleaf)

CADMID = **C**oncept **A**ssessment **D**emonstration **M**anufacture **I**n-service **D**isposal

MCTA plays a major role in the cycle and early involvement in a project is critical to ensure that the Integrated Test Evaluation and



MCTA's involvement throughout the CADMID cycle

Weapon Systems

Acceptance and Development Trials

- Development trials in support of PT and Industry
- Installation Inspections, HAT/ Naval Weapons Harbour Trials, SAT/Naval Weapons Sea Trials
- Naval Authority Inspections

Platform Evaluation and Operational Capability Trials

- FORACS ranging (measurement of system performance and alignment); 3 NATO ranges
- OCCC
- SPA (System Performance Assessment)

Weapon Assessment

- Weapon firing assessments and Annual Surflot Practice Firings Summary
- Assessment of non-firing practices
- Heavyweight Torpedo Analysis

Marine Systems

Machinery Inspection & Trials

- New Build & major project assurance
- In service Pre/Post Upkeep
- Fleet time trials including Ship Performance Assessments (ME)
- Evidence in support of Naval Authority Propulsion Certification

Machinery Condition Based Monitoring & Vibration Analysis

- New installation, upkeep & in-service surveys
- SM Noise Ranging Support
- OPDEF Support
- MIMIC tools and process assurance

Platform Materiel Assessment

- SM periodic noise & shock surveys
- Upkeep installation noise & shock
- Naval Authority Material State Inspections covering Fire safety and Escape & Evacuation

The outputs of MCTA's Groups

Acceptance Plan will demonstrate the capability to meet the requirement but also ensure that the requirement is realistic and measurable. This is where MCTA's reputation for independence is especially important as our independent assurance benefits both the customer and contractor, because early capability deficiencies can be highlighted, thus providing a cost benefit to the project.

TRADITIONAL TRIALS OUTPUT

One of the more traditional areas for MCTA, and where you are most likely to have seen MCTA before, is during the conduct of marine and weapon system inspections and trials. For readers who remember the old approach of 'box ticking' it is worth highlighting how much MCTA has moved towards working with other parties to provide solutions to problems rather than simply assessing and reporting.

The central pillars for MCTA trials output are Harbour Acceptance Trials (HATs) and SATs, although MCTA still conducts IIs on some new equipment types. The current approach is that MCTA should not duplicate industry activity for basic quality assurance, as this should be provided commercially, but experience shows that the involvement of SQEP MOD staff is still important. Haddon-Cave commented in his report on the 2006 Nimrod crash[2] on the importance of the MOD's intelligent customer capability.

GLOSSARY OF TERMS

BEG	Business Enabling Group
CADMID	Concept, Assessment, Demonstration, Manufacture, In-service, Disposal
CAG	Capability Assurance Group
FORACS	Forces Sensors And Weapons Accuracy Check Site
HAT	Harbour Acceptance Trial
II	Installation Inspection
MFCA	Maritime Force Capability Assurance
MVAU	Machinery Vibration Analysis Unit
OC	Operational Capability
OCCC	Operational Capability Confidence Check
RNO	Royal Navy of Oman
RO	Recognised Organisation
SAT	Sea Acceptance Trial
SPA	Ship's Performance Assessment
SQEP	Suitably Qualified & Experienced Personnel
UKTI	UK Trade & Investment

As part of Ship's Performance Assessment (SPA), MCTA also provides support for practice firings, Gunnery Alignments and Maintenance Audits. It is also worthy of note that MCTA is the **only** SQEP organisation authorised to advise on material state assessments of magazines and explosive handling facilities, advising the Naval Authority Explosives on the relevant safety certification.

NEW BUILD PROJECTS

MCTA's involvement in new build projects is focussed through the CAG. The CAG gathers information from within MCTA and from other MOD Authorities and assesses this data against the capability requirement for vessels. Any anomalies that could delay the programme and cause the in-service date to alter are highlighted. The CAG represents Captain MCTA at all Programme Boards, Capability Working Groups (Acceptance) and at any other significant gatherings. A fortnightly rolling report is produced, covering all equipment and platform projects being assessed. Although there is a 'no surprises' policy, its contents can sometimes make uncomfortable reading. The key sources of information for the CAG report are the New Platform Assessors (NPAs) who are based in the construction yards and monitor the build progress, but inputs are collated from all weapon and marine systems teams, as and when specific trials/acceptance events are carried out.

2. Haddon-Cave QC C, *The Nimrod Review: an independent review into the broader issues surrounding the loss of the RAF Nimrod MR2 aircraft XV230 in Afghanistan in 2006* report, October 2009.

BOTTOM LINE

Being part of the MCTA team means employment in an interesting and vital engineering role with the excellent opportunity to directly assist frontline units in optimising equipment and systems to deliver full operational capability. MCTA is protecting the frontline by safeguarding engineering standards and operational performance for both ships and submarines throughout the entire CADMID cycle. The multi-disciplined SQEP team offers a professional and flexible output and the organisation continues to build its activities in Fleet Time and new build assurance to ensure that we, as a Service, get it right both now and in the future.

WANT TO KNOW MORE?
For further information please contact:
Lt Mick Hawkes (9380 24093)
Email: DES MCTA-CAG-NPA2

"... multi-disciplined SQEP team ..."

OPTIMISING FLEET FUEL USAGE – HULL REVIEW

By Steve Marshall CEng RCNC
Naval Authority Group

Steve Marshall has been a naval architect in the MOD for 20 years, having worked in both submarine and ship project offices. He is currently the Ship Stability Naval Authority providing safety certification for the fleet and is also the lead on ship hydrodynamics.

INTRODUCTION

The initiative to Optimise Fleet Fuel Usage to Maximise Effectiveness (OFFU) was created in 2006, triggered by activity cuts. The need was strengthened in 2007 by the dramatic increase in the cost of fuel at the time. The programme addressed an array of fuel efficiency measures including operation & ship handling, training, machinery configuration, hull fouling, use of shore supply & changes to hull design (eg transom flaps). Progress on the hull fouling aspects has been previously published in the Review of Naval Engineering[1], however this article provides a review of the performance of all the hull aspects introduced and the associated increases in availability. Whilst the cost of fuel is fairly stable at the moment (Figure 1), it is likely to increase again as the global economy starts to expand once more, as it does the extant gains from OFFU will become more significant.

1. See *Optimising Fuel Usage By Reducing Hull Resistance* by Michael Walker (RNE, Summer 2008).

BACKGROUND

In 2007 the Fleet's activity was being cut, and prioritisations of activity over capability led to the approach of OFFU to buy back previously imposed "activity" cuts and further develop the existing culture among the operators to use fuel more efficiently. It was CinCFleet's intention to recover the loss of 20% of Fleet activity as far as possible and not reduce fuel allocations in order to sustain current reduced activity levels.

The success of this programme was dependent upon a wide range of naval organisations doing their bit to achieve the common goal, it also lead to a change in behaviours eg spending resource for no individual direct benefit. The edict "costs fall where they lie" was decreed and waterfront organisations now had to find budget to perform unscheduled hull cleans. As part of this initiative it was felt that the greatest savings could be gained from improving the efficiency of the hull and reducing the effects of fouling. Other areas would also contribute and every percentage would make a difference. The hydrodynamic aspects of the initiative were:

- Hull fouling & cleaning
- Anti-foul paints
- Propeller polishing
- Stern flaps
- Displacement and trim

At cruising speeds the majority of ship resistance is due to friction, it being mainly influenced by the area of wetted surface and its associated roughness. The influence of fouling increases the roughness, requiring more power which in turn increases fuel consumption.

ANTI-FOUL PAINTS AND HULL FOULING

In 2006 self-polishing anti-fouling paints on RN warships had an effective life of approximately three years. This did not tie in with the change in docking cycles from two and a half years to five or six years. As a result the paint wore out midway between dockings and the hull became fouled. It was evident this needing managing and the fouling trigger system was launched. This compared in-service resistance with clean hull values; immediately four ships reported high increases in resistance and thus fuel consumption. It was evident a change was needed when a Type 22 OPDEF'd a two knot

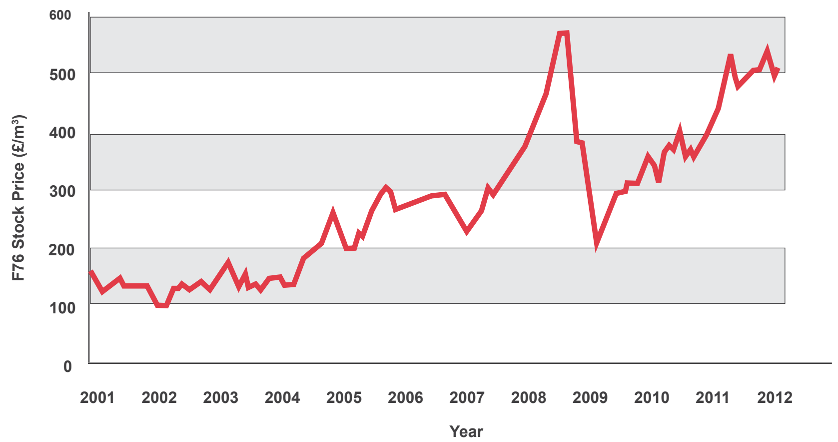


Figure 1: Marine Dieso (F76) Stock Price 2001 – 2012

Figure 2: HMS Campbeltown – top of sonar dome

Figure 3: HMS Daring – Foul Release coating after six years in service

reduction in top speed … the ship had a 70% increase in skin friction. The photograph from a Type 22 (Figure 2) is now a thing of the past. Monitoring shaft power once a month led to informed timing on cleaning decisions and a 20% increase in availability during the two and a half years prior to a docking period, without the need to uplift fuel allocations.

At the same time as the hull fouling management system was being introduced, two ships were trialled with the new foul release silicone-based anti-foul paint being used by the Merchant Navy. This works by providing an ultra-smooth surface which prevents fouling from adhering strongly to the hull. If ships are alongside for an extended period fouling will attach itself, however once the ships exceed a threshold speed, typically 10–15kts (depending on coating specification), the fouling will wash off. This foul release coating does not damage the environment (unlike conventional anti-fouling paints which kill fouling life with toxins) and is easier to maintain as well as lasting for the period between docking. Some confidence in this paint system had been gained from the operation of the trimaran demonstrator RV Triton. During a docking (now with a commercial owner) the hull was inspected and "one was able to move the barnacles around with your hand". The coating was seven years old. However there were risks for RN ships, which regularly experience extended periods alongside, unlike their merchant counterparts, that foul release may not be as effective. The completion of the first coating trials around 2008 on HMS Northumberland and HMS Montrose were, however, a success and the decision made to adopt foul release across the fleet. An example of its effectiveness is illustrated in Figure 3, which shows HMS Daring after six years in the water without any cleans.

Nearly all RN ships are now coated with foul release coatings with projected benefits in the order of £600k to £1m of fuel over ten years of operation for each destroyer or frigate. This does not include any allowance for manufacturers' stated claims that the lower skin friction of the coating can reduce the frictional resistance by up to four percent. In general the move to the new coatings has been an overriding success; there of course have been the odd occurrences of application issues and on one occasion an MCMV with one engine down was unable to steam above the paint threshold speed thus entering an ever worsening spiral of fouling. These issues are rare however, and are compensated by the overall cost savings achieved through application of the new coatings.

The regime of detecting fouling and managing hull cleaning needed to adapt with the implementation of foul release, the key concern being the extended period of inactivity. Another navy had trialled this coating and found it to be ineffective, but the ship on which the trial was conducted had spent nine months inactive in a tropical climate and the calcareous growth had taken a stronghold going through the coating and would not wash off. The Standard Manoeuvre and RN operational doctrine in high risk fouling areas is adequate to avoid the imposition of any new condition monitoring processes such as a routine "full ahead".

The monthly shaft power "trigger" returns used to inform the hull fouling management system (identifying ships with 18% increase in resistance) will continue in order to detect any coating damage or fouling accumulation, and where fouling is suspected the ship is advised to steam at full power for an hour to remove the growth. The E-Flubcon system has simplified the return system for these trigger results, however the number and quality of returns made is below par and the practice not yet completely embedded. Figure 4 overleaf contains actual data showing how the monitoring is used to inform decision making for each individual ship.

PROPELLER FOULING

Polishing propellers annually is routine, noting that during a year a fouled propeller can add up to 4% to fuel consumption. There has always been nervousness about following the merchant marine

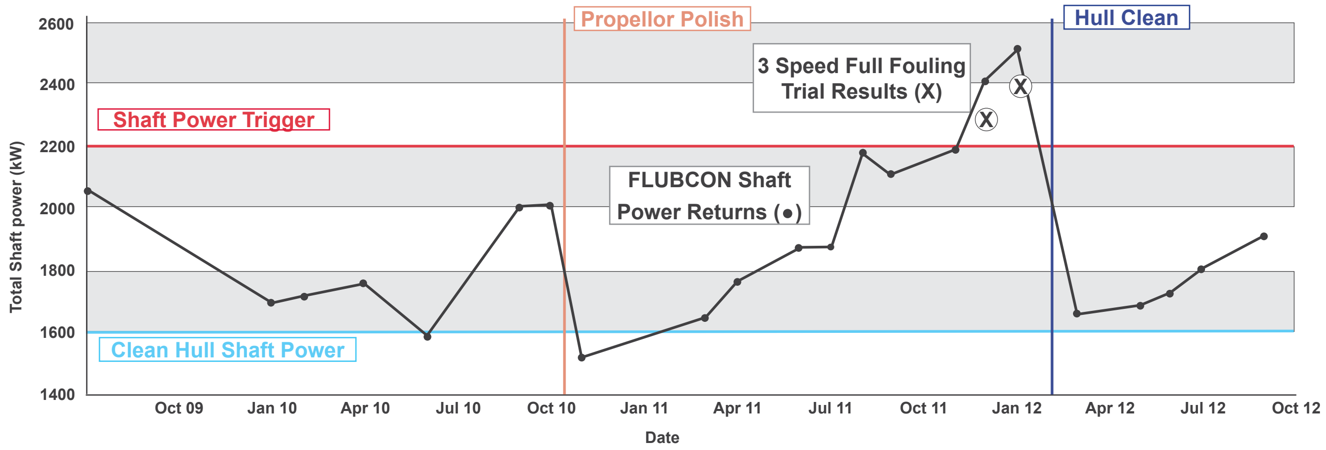


Figure 4: Example of ship shaft power returns

with anti-fouling propellers and the impact it may have on naval capabilities. To assess the issues of adherence, performance and signature, HMS Chatham had one of her propellers coated with foul release as part of a minor trial (Figure 5). Unfortunately the ship was decommissioned whilst only 18 months into the trial. Another trial on a Type 23 is nearly a year old and she has had the first diver survey; in general the adherence is good, as expected there has been some loss of coating at the propeller tips, but not enough to cause concern, and no significant growth was seen in the exposed areas, most probably as it will have been washed off by the same mechanism that removed the coating. The diver's video showed that the build-up of slime from recent inactivity was washed off easily by the diver's hand. The ship has been noise ranged and the results show no differences from before.

TRANSOM FLAPS

Transom flaps create a vertical lift force at the transom, and modify the pressure distribution on the after portion of the hull. These flow field changes cause a reduction in drag on the ship's afterbody, and modify the wave resistance of the ship. This relatively inexpensive change to the ship can significantly reduce fuel consumption. The transom flap fitted to the Type 23 (Figure 6) provides, on average, a reduction of 6% in resistance in the speed range of 7–13 knots and 13% at speeds above 13 knots. On the basis of the success of the Type 23 trial, transom flaps were also fitted on Type 42 and CVS.

The reductions in resistance are worth in the order of £60m over 10 years for the fleet at £500/m^3 fuel costs, this represents a good return for £100k fitting costs per ship.

DISPLACEMENT AND TRIM

The payload in proportion to the Basic Ship is small in warships, as most operate at relatively constant displacement, however reducing unnecessary payload will deliver savings in a similar manner to a car. The ability to capitalise on these savings is more limited for RN ships as they carry fuel and munitions necessary to expedite immediate tasking. The percentage reductions can be scaled linearly up to a 10% reduction in displacement (eg if a 1% reduction in displacement reduces shaft power by 1%, then a 10% reduction in displacement reduces shaft power by 10%).

Most ships of the Fleet are considerably heavier than designed, due to capability insertion through life, as was the case for the Type 22s. This meant they sit deeper in the water, with transom stern immersions much greater

Figure 5: HMS Chatham propeller foul release coating

Figure 6: Transom Flap being fitted to a Type 23 frigate

than desired. At speeds below approximately 20 knots the flow of water off the bottom edge of the transom does not break away cleanly to leave a “dry” transom, but becomes entrained and is dragged along by the ship. This results in significant parasitic drag. Conversely, at speeds above 20 knots the flow breaks away cleanly, leaving a void behind the ship. This gives the ship a virtual increase in effective length which reduces resistance.

Optimising trim has a relatively small effect; a level to slight stern trim is best, but managing trim is difficult for warships as most are not designed with extensive ballasting capacity.

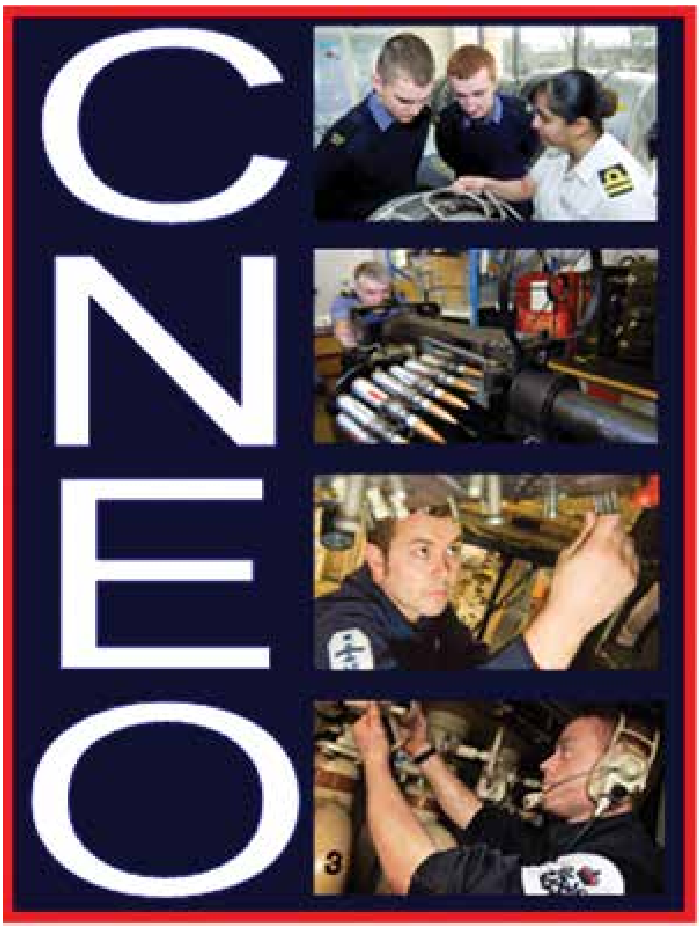
THE FUTURE

The majority of solutions offering major hydrodynamic savings have been explored and implemented, and it is likely that future developments in this area will be limited only to small percentages. These will be worth pursuing where through life cost/benefit demands, potential examples being new propulsion devices and onboard condition monitoring of fouling. The RN will continue to follow, and most likely adopt, new mercantile anti-foul coatings as they arise, with developments driven by profitability due to the rising cost of fuel. Future sustainability targets are pending with a government-wide operational fossil fuel consumption reduction of 18% by 2020 and 20% by 2030. Unfortunately the baseline date for these targets already includes the implemented savings outlined in this article and with bigger ships replacing the existing RN fleet, fuel consumption savings on current allocations will be a real challenge.

SUMMARY

When the Hull Fouling Management Programme was instigated in 2007, four heavily fouled ships were immediately identified. Over the following two years cleaning hulls became routine, but since 2009, as awareness about managing the issue grew and furthermore as a result of the implementation of new anti-foul technology, cleans have reduced dramatically. Now, with the majority of hulls having the silicone-based foul release (where the fouling has difficulty attaching and washes off at cruising speeds), no demands for hull cleans have been received in the past two years. The programme commenced following demands for increasing activity by 20% with no uplift in fuel allowance. By combining the hydrodynamic initiatives of hull fouling monitoring, new anti-foul coating, transom flaps, reducing displacement, optimising trim and ensuring propellers are polished, this target has been met.

WANT TO KNOW MORE?
The Hull Fouling Management Programme is run by Steve Marshall, Ship Hydrodynamics, Naval Authority Group. For further information regarding the Programme please contact desnag-shipstab@mod.uk



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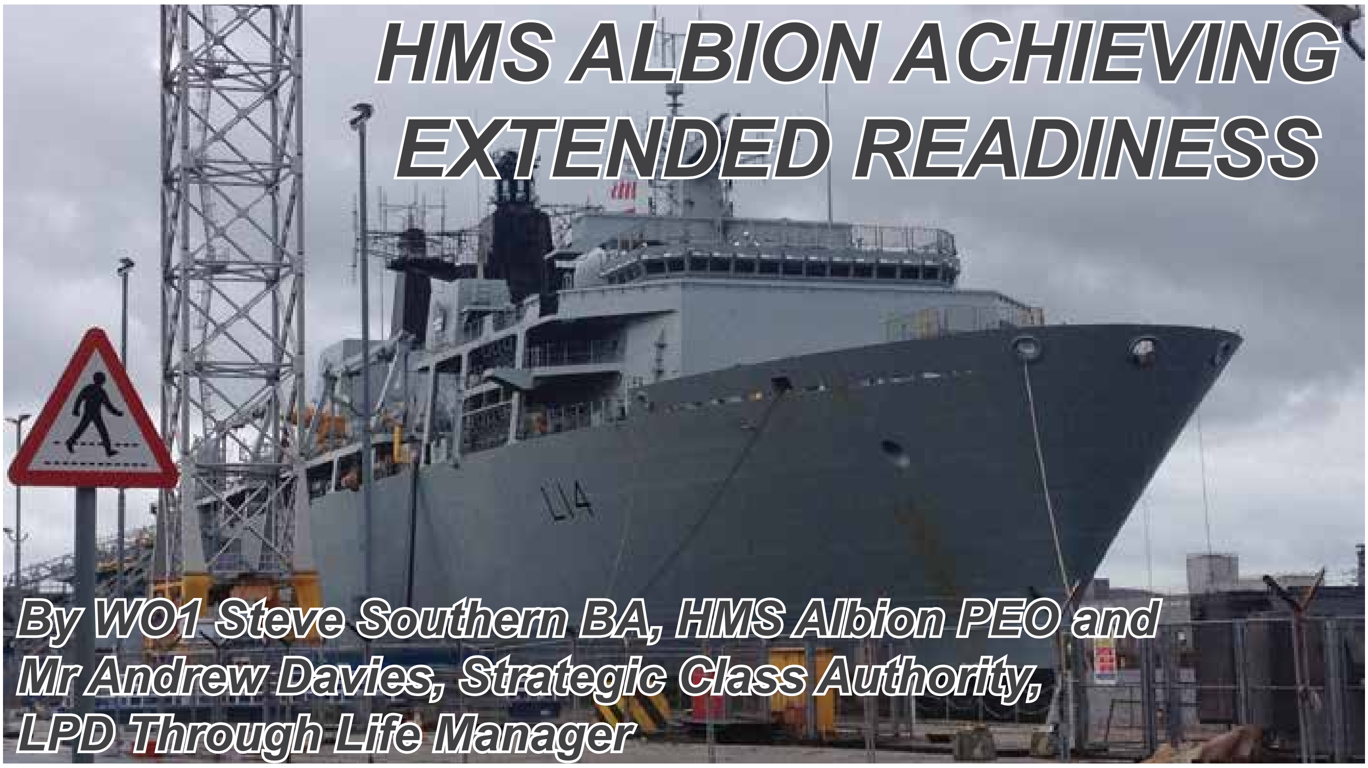


HMS ALBION ACHIEVING EXTENDED READINESS

By WO1 Steve Southern BA, HMS Albion PEO and Mr Andrew Davies, Strategic Class Authority, LPD Through Life Manager

Joining up as an Artificer Apprentice in 1984 and completing an apprenticeship at the RNSME in 1987, Steve followed an extended period of training across Marine Engineering platform aspects in the HM Ships Sheffield and Broadsword until passing a CPO PQE. This was quickly followed by drafts to HMS Montrose as the propulsion artificer and a Hunt class minesweeper in the Northern Ireland patrol as DMEO. After completing Charge Course, he experienced the pleasures of rejoining Montrose, taking her out of Upkeep and to the Middle East before taking HMS Ocean out of Upkeep and to the Far East. Selected for WO1, he was drafted to HMS Albion in time to join the early deployment for Cougar, including a period supporting Op Ellamy. This included being involved at the outset in the planning and delivery of HMS Albion into Extended Readiness. Away from the RN he now continues to raise three children and as an outlet for other talents has recently graduated from the Open University with a First Class History Degree.

Andrew joined the Ministry of Defence in 1997 as an Apprentice Airframe and Propulsion technician at RAF St Athan in South Wales. On completion of his training joining the Harrier maintenance facility working on Pegasus gas turbine engines. In 2002 moving away from aviation to marine engineering in service support as part of Major Warships Integrated Project Team as it was then known. Providing Design Authority support for the Propulsion systems of the LPD. From there promoted and took on the role of Gas Turbine Propulsion manager caring for the not quite so modern Type 42 Destroyers and CVS Propulsion systems. In 2009 a brief spell working back in the Aviation side of life in Saudi Arabia. However, after a year of this returning to the creature comforts of Abbey wood and took up the role of the Through Life Manager for the LPD. Success's to date have included delivery of Bulwark through her first upkeep and the lay up of HMS Albion. An avid cyclist, both mountain and road disciplines, getting out whenever free from injury; friends and colleagues will say he falls off a lot!

INTRODUCTION

As engineers, artificers or technicians our professional life is centred on the ability to keep a ship at sea, fully capable of any tasking or operation that can be asked of it, adopting a mindset centred on maintaining that operational capability. Laying a ship up and putting it into "mothballs", as it has become known, goes against the grain. Davits, landing craft and the embarked military force form the function to fight in a ship such as the Landing Platform Dock (LPD). The ship is equipped with many sensors and weapons honed in order to protect such a fighting ship. Her engines, generators and chilled water systems supply the movement and power that facilitate her fighting ability. Finally, without getting the recognition they deserve are the equally essential but unglamorous support systems fundamental to ship's habitability and fighting ethos; refrigeration for food, domestic equipment in the galley, air conditioning, ventilation, fresh water production, fire fighting systems and the sewage systems, without which a ship will cease to function.

The October 2010 SDSR set out a reduction in fleet numbers. In order to balance the nation's overdraft one of the casualties of the SDSR was HMS Albion. However, such a valuable asset was not to be condemned to a Turkish breakers yard; instead HMS Albion has been placed into Extended Readiness (ER) for a period of 33 months. She will then be regenerated as part of her natural upkeep cycle and return to the Fleet in March 2016. The current plan shows Bulwark entering a similar period and an indicative timeline for the various phases and cross over of the ships is given in Table 1 below.

	2012	2013	2014	2015	2016
Albion	LPP	R11 (U) Extended Readiness	Support Period 2	R4	R2
Bulwark	R2 High Readiness LPD	LPP			

Table 1: LPD Readiness Plan

The process of laying up a ship and keeping her in ER is not new to MOD; however, laying up a High Voltage (HV) LPD certainly was uncharted territory. Completely counterintuitive to our Service engineering ethos, it required a complete change of mindset for those involved. It tested the planning and teamwork of all stakeholders to the limit and proved to be one of the most unusual engineering challenges of the 21st Century.

PLANNING

Planning involved all of the HMS Albion stakeholder community and from the very outset was conducted against the clock, as the ER date for HMS Albion was fixed for 31 March 2012. The first decision to be made was which ER option would realise the best value for money. Three main options were considered:

- **Hot lay-up** – A lay-up that maintained a ship's crew and essential systems. This included keeping the ship's HV system live. This method was deemed as the best course to de-risk future regeneration. Systems would be maintained by Ship's Staff and the ability to train engineers and technicians would ensure a high level of SQEP. This also afforded the quickest regeneration and subsequently would incur the smallest costs. These positives were offset by the large running costs at a time when manpower redundancies dictated personnel drawdown. This option was ultimately considered unfeasible in the current financial climate, but may be deemed feasible for future projects.

- **Cold lay-up** – This included the preservation of all systems, removal of equipment including shafts, blanking of all underwater fittings and leaving the ship unmanned and uncared for over a period of 33 months. Whilst this generated the greatest short term savings, it was quickly recognised that the increased risk to regeneration in terms of equipment overhaul and set to work was counter productive. Given the added real risk to regeneration of having to identify LPD qualified personnel to support the work package, set to work and subsequent sea trials, this option was also considered unfeasible.

- **Warm lay-up** – Unlike the majority of committee decisions that attempt to create an unsatisfactory middle ground, the option of a warm lay-up contained some very real benefits. In the first incidence the ship's crew could be reduced to just fifteen, allowing the rest of the crew to move to other essential Fleet tasking. The ER crew would be able to perform the required maintenance to equipment left in place such as main generators, shafting and pumps thereby reducing the need for removal, replacement or inordinately expensive overhauls. It would also allow an LCVP davit to be kept live, offering the opportunity for training of the Fleet's davit maintainers, operators and Royal Marine LCVP Coxswains. A ship's personnel presence would also lead to greater continuity and clarity during the regeneration planning. This was clearly the preferred course.

Key stakeholders were quickly inducted into the planning process to determine the best lay-up solutions for the various equipments. This included Capital Ships (now the Strategic Class Authority) from the DE&S organisation which owns the project, its delivery and the ER Duty Holder responsibility. Equipment IPTs were involved to determine the most suitable course of preservation for equipment. In a number of cases, this involved exploring the support of British industry for the most recent advice and suitable guidance. The salient area where this was evident and proved most challenging occurred around the HV preservation policy. There is very little documented evidence of successfully laying up a HV ship, either within the MOD or in industry. Others Stakeholders included SFM(D) and Babcock Marine as the project to put Albion into ER was to be conducted in Devonport by the Fleet Time Support Group. They used the combined efforts of the Royal Navy and Babcock Marine under the Warship Support Modernisation Initiative (WSMI). Naval Base services were also engaged in order to manage the removal of fuels, lubricants, ballast, grey and black water. Engagement with Ship's Staff proved to be pivotal in highlighting misunderstandings and potential conflicts at an early stage.

The process for identifying these misunderstandings was conducted primarily through the medium of e-mail, given that Albion was deployed to the Mediterranean in support of Op Ellamy and spent time East of Suez thereafter. The method employed included forwarding to the ship an outline of the ER requirements that were to form the basis for the engineering lay-up plan. These were discussed by Ship's Staff who then detailed and submitted a number of focussed questions. Albion's Senior Engineer formed the central communication node for Ship's Staff with regard to questions and answers in and out of the ship. Issues raised by Ship's Staff were directed through Capital Ships and then distributed out to the appropriate EIPTs. This process ensured engagement and an open transparency with the wider engineering community. A first iteration of the work-package was conducted whilst on passage between Malta and Palma and a series of normal Dynamic Machinery Trials were undertaken between Palma and Albion's return to Devonport. Following leave, and conforming to a more normal planning evolution, a two week FTSP was overlaid with a PUMA, including a paint survey to help form the spine of the SP2 work-package and complete the input to the lay-up package. These were all fundamental steps in enabling an integrated lay-up plan that was shaped to fit the time allowed and identify the resources required.

The warm lay-up option also created further challenges that needed to be managed which included some path-finding options and undertakings. The need to control Albion's internal humidity levels to prevent condensation and corrosion introduced a need for a dehumidification system. This would need to cover large areas of real estate with the exception of the vehicle deck and well dock. As an added complication, it was identified that HV rotating machinery and switchboards needed to be in a temperature controlled environment as well as a dehumidified one. Dehumidification would involve the siting of 23 dehumidification units (including three heater units) around the upper-deck of the ship (see Figures 1 and 2). In order to ensure that areas that were not covered by

Figure 1: Dehumidification trunking feeding the ship

Figure 2: Constant temperature (18ºC) de-humidified air supply to HV Systems

the dehumidifiers were appropriately preserved "HITEK Solutions" employed various methods of applying corrosion inhibiting foam into enclosed areas to ensure the internals of electrical cabinets were protected from the ingress of moisture. In some instances large pieces of upperdeck equipment could not sensibly or cost effectively be removed and stored so in effect they were shrink wrapped and sealed with corrosion inhibiting foam. This came as a welcome solution to an issue that had attracted some significant head scratching after initial plans of storing the Caley davits on the vehicle deck were scuppered when they would not fit through the side ramp (see Figures 3 and 4). Given the manning and regeneration

Figure 3: HITEK Solutions wrap with chemical impregnated foam to absorb moisture

Figure 4: Caley davit wrapped and foam inserts applied

intention for Albion, it was identified that the ship's Platform Management System could provide an excellent fire and flood detection system if supplied with 24V. This would involve running 24V to the output of seven Transformer Rectifier Units in order to power the 25 Remote Terminal Units that provided the fire and flood sensor monitoring. In order to do this a power container was designed, manufactured and commissioned, which weighed in at seven tonnes. This container included all of the transformers and converters required for the 440V, 115V and 24V systems, which are used to power both the ship's organic Minerva fire detection system with 24V and the dehumidification units with 440V. It also houses its own built-in fire detection system and fixed gaseous extinguisher system for safety (see Figure 5). The power supply container allowed power to be applied to the various systems whilst minimising the fire risk to ALARP by not having power running through the normal systems on an unmanned ship.

Figure 5: Power supply container. This ensures that the fire risk is reduced as there is only a 24V supply feeding the Platform Management System within the ship. All other supplies are external

In conjunction with this was a separate strand of planning, including risk meetings, developing a ship's safety and operating plan for the ER period, a procedure for rotating shafts on a dead ship and identification of the appropriate power supplies required for equipment such as plummer bearing jacking pumps and the port aft davit. The compilation of an UMMS maintenance package that would accurately reflect the keep-alive systems and maintenance required during the ER period was also undertaken. A simple paragraph does not give justice to the level of planning, oversight and management that went into laying the foundations of a lay-up plan.

To further add to the organisational problems, Ship's Staff planning took another twist. It was quickly identified that a key milestone was the "Ship's Staff move ashore" date. Given the difficulty of managing a total de-store, the need for a Ship's Staff Wharfmaster was identified to control the choke points of the jetty and the vehicle deck. A tank plan was produced, in order to manage the different arms of the Naval Base Services including the removal of fluids, control of vent and cleaning of tanks. Detailed meetings were undertaken, to clarify the HV lay-up policy for inclusion in the overall lay-up work-package. During this time the ship continued with normal Service programming such as performing ceremonial functions in Liverpool and Copenhagen. Finally, the end berth for the lay-up preparations period was decreed by Babcock Marine as 5 Basin (East).

The ship would cold move into the Basin following her arrival and de-ammunition in Devonport ready to commence this most unusual engineering package.

EXECUTION

"*No plan survives first contact with the enemy*". The lay-up plan that had given a number of people sleepless nights proved no exception. All ship's plans had been based on the preparations berth being at 15 Wharf in Devonport's Weston Mill Lake followed by a later cold move into 5 Basin. This provided easy access for defuelling barges, the Tank Cleaning Vessel and vehicles required for the de-store. This was ideal given previous lessons learnt from the constraints that had affected the de-fuel of HMS Ocean with limited barge access into 5 Basin. Unfortunately, these plans were all dislocated at the very start by the late notification that Albion had to be placed directly in 5 Basin on completion of de-ammunitioning, in order to allow the refitting V-Boat to flood up and move from her dock. Immediately Ship's Staff, Babcock Marine and Base Services subcontractors had to work together on the defuel and tank cleaning operations to ensure the overlapping evolutions of emptying, ventilation, cleaning and ragging out kept each party engaged and none of the interested parties waiting on each other.

All of these evolutions were conducted with severe machinery space access restrictions as Albion undertook the pioneering High Voltage testing regime. Under the direction of the EIPT, all of the HV equipment was surveyed with Pannell and Partners conducting Partial Discharge of the HV rotating machinery. This involved utilising an 11kVA transformer in the machinery space to test the rotating machinery. A second regime of Oscillating Waveform Testing was also conducted on all the HV cables fitted to the ship. The purpose of this highly intrusive testing regime was to take a system baseline of Albion's HV system before she entered ER. A repeat of this evolution will be conducted at the mid point of the ER period to ensure that degradation to the sensitive equipment is not taking place. By conducting this at the mid point of the ER, if any issues are identified the team can look at putting further mitigation in place and have the benefit of an early heads up before the regeneration work package is finalised. The path-finding evolutions of HV testing proved educational for all parties. Pannell and Partners learnt much about the "hands-on" attitude of Royal Navy technicians and their adherence to Naval engineering standards, including safety, and the constraints that these sometimes impose. Ship's Staff also expanded their portfolio of HV knowledge and understanding of why these tests were important, how they were conducted and analysis of the results. The equipment group's intention is for the tests conducted to form a HV benchmark for LPDs (Albion in particular) and would allow greater testing to be undertaken that was far less intrusive and destructive than the previous regime. It was from the results obtained that the first emergent large scale work came to light: both Auxiliary DGs were discovered to have tracking on the ends of the windings indicating the presence of dirt/debris; this would lead to a requirement to cryogenically clean both Auxiliary DGs prior to entering ER. This would ensure that they were in the best possible condition when laid up.

Particularly testing for the project was the managing of the overlapping work during the docking period. The paint survey had identified bilge preservation that could only be completed with the hull out of the water. At the same time all the water systems and coolers were to be drained into bilges to facilitate chemical cleaning and drying out. All of the 169 underwater valves were to be removed and blanked during the same period as a safety measure; these valves are notoriously unreliable and have proved problematic on both vessels during fleet time and upkeep (see Figure 6). Adjacent hydraulic remotely-operated valves were to be disconnected, with the pipe-work looped out and flushed through with preservative oil. The plethora of work strands

Figure 6: All underwater valves are removed and solidly blanked with steel. LPD underwater valves fail to hold in Fleet time

being undertaken resulted in the unusual abomination of bright orange vent trunking, temporary lighting and power cables running through many doors and hatches. This would eventually became the source of some pointed discussions and required rapid action from Ship's Staff and Babcock Marine as flood up and undocking deadlines approached.

The late arrival of the power container from British industry delayed the establishment of the dehumidification system. The removal of the vast majority of weather deck doors, with wooden doors put in their place, caused some concern. This was required to accept the 350mm diameter supply and exhaust trunking that was to wind itself across decks, into the ship and down ladder chains. Original planning had been undertaken by the company from ship's drawings, but constructive discussions with Ship's Staff on site soon identified better dehumidification routes to machinery spaces, utilising the straight drops of the machinery space uptakes. Babcock and subcontractor ability to adopt these recommendations at short notice saved time and proved better as engineering solutions. Maintaining the Ingress Protection

Figure 7: Engine de-coupled to allow generator to be rotated by hand

integrity to rotating HV machinery and HV units proved a challenge that was overcome again by the close teamwork between Babcock Marine and Ship's Staff which allowed sensible solutions to be achieved for all problems encountered.

Other notable achievements during the period included: the removal of the fwd and aft Goalkeeper mounts and their associated equipment (see Figure 8), the fitting and wiring of an externally mounted cathodic protection system (see Figure 9), the fitting of a temporary safe lighting system throughout the ship giving light to areas requiring to be accessed during the ER period, ie airlock access, machinery spaces and main passageways (see Figure 10). Babcock Marine took the lead in devising and completing a Configuration Management system to account for the whereabouts of every pipe, valve or other piece of equipment removed to ease the regeneration jigsaw puzzle. All items removed were bar-coded and their position and storage location were recorded on each item.

Figure 8: Goalkeeper was removed from the ship

Figure 9: Stand alone Cathodic Protection Unit

Figure 10: Temporary lighting (shown here fitted to 2 Deck) is also utilised in main machinery spaces

External factors were also taken into account. As an isolated unit, Ship's Staff undertook all the additional lay-up engineering preparation tasks required of them in the respective engineering policy documents. On top of this, Ship's Staff also had to return stores, completely de-store the ship, close down cash accounts, affiliates and PLRs, complete Divisional write ups for all personnel, drive to ensure all personnel had future drafts and were accounted for, and close down the ship's computer and telephone systems. There was also the need to move the Ship's Company off the ship, establishing and managing personnel in new accommodation and in new office facilities, which in turn also eventually had to be closed down.

Planning for the ER period was also a concern. It was important to ensure the equipment deemed necessary for the ER period was reflected by an UMMS package that was accurate and up to date. Establishing the 15 personnel that were to remain with the ship and setting up their new positions, routines and management chains in JPA also took a concentrated effort. A permanent base was established for the Albion 15, with lines and means of communication.

CONCLUSION

HMS Albion is now in ER, but she continues to provide invaluable support to the operational fleet, giving an operational davit to train the Fleet's operators and maintainers, both Royal Marine and Royal Navy. Watching the Olympics unfold on the television it was hard to imagine that Albion played a vital role in training both MOD and civilian security forces, and providing engineering support and hardware to her amphibious sister ships Bulwark and Ocean on a regular basis. Albion supports not only the operational fleet but also the wider aspects of in-Service life, hosting a RN Equality and Diversity film crew. Given the current world financial climate, Albion has even managed to find an international role by demonstrating many of the pathfinding initiatives and solutions to a similarly financially challenged French Naval delegation. She now rests in 5 Basin (East), high in the water and dominating the basin and surrounding area. To proud engineers schooled in fighting and maintaining warships, she looks a forlorn sight, tied up, upper deck doors and hatches closed, ribbons of bumblebee coloured dehumidification trunking snaking down her waists and into wooden doors as if plugged into some sort of emergency medical life support system. However, whatever the financial climate that has driven the MOD to lay-up one of its most valuable assets, don't feel sorry for HMS Albion, because she is not forgotten and the job is not complete. 15 people now keep HMS Albion alive at the coal face, but far more people are standing by with the defibrillator to shock her back to life when the regeneration period commences in 2014. Clearly the task of putting HMS Albion into ER was complex, difficult and counterintuitive. It was achieved through hard work, flexibility and at times sheer bloodymindedness, but the real pride for a job complete lies in the future, in 2016 when Regeneration completes, HMS Albion takes her rightful place as the Fleet Flagship.

WANT TO KNOW MORE?
For further information please contact:
Andrew Davies,
DES Ships SSA-SCA-LPD-TLM1
(9352-32099)
or
WO1 Steve Southern
DES NBCD-SFM-ALBION-DOIC
(9375-54770)

MOBILE PHONE TECHNOLOGY IN A CLOCKWORK WORLD

A Swordfish of the RN Historic Flight

Scientists at the Defence Science and Technology Laboratory (Dstl) have used technology similar to that found in mobile phones to assess the structural usage of some of Britain's most famous aircraft.

The technology used in a mobile phone to flip the display on the screen from horizontal to a lateral display has been adapted by Dr Steve Reed from the Physical Sciences Department of Dstl, to measure the structural usage of aircraft in flight.

Steve Reed, said, "*The traditional approach to gathering this type of data can be extremely costly. The aim of this work is to provide a cost-effective approach to understanding the structural usage of historic and small-fleet fixed-wing aircraft by adapting technology that is already available*".

Working with MOD aircraft project teams and defence contractors, Dstl has carried out a series of laboratory tests and flight trials with a Modular Signal Recorder® (MSR) data logger. The small, lightweight, battery powered MSR165 unit is being used to capture basic structural information on several aircraft fleets, including Islander and Defender and the Lancaster and Swordfish historic aircraft. The flexible and affordable unit contains a three-axis micro-electro-mechanical-system accelerometer, found more commonly these days in mobile phones. The unit also has pressure, temperature and relative humidity sensors incorporated in it.

Reducing the burden on maintenance crews is also important in today's military. "*One of the key benefits of the MSR165 unit is that it can be fitted very simply and remain autonomous for up to 75 flying hours or two months*", continued Steve. "*The units have been programmed to start recording acceleration data automatically from engine start until engine shut down, at a rate of 50 samples per second. It will also sample pressure, temperature and relative humidity continuously at a rate of one sample per second.*"

After the 75 flying hours or two months, the MSR units are removed and sent to Dstl for analysis. The data are processed and used to allow a direct comparison with historic data and fatigue-test results.

Steve has been very pleased with the results from the initial data capture programmes. "*So far we have over 1000 hours of flight data from the Defender and Islander fleets and over 100 flying hours from the Battle of Britain Memorial Flight Lancaster and the Royal Navy Historic Flight Swordfish aircraft. These data are being used to support the airworthiness assurance of these fleets. Also, several other air platforms are considering the application of this technology in the near future.*"

This article first appeared on the Dstl website and is repeated with permission.

An Army Air Corps Islander aircraft

The Lancaster of the Battle of Britain Memorial Flight

THE RE-INVIGORATION OF ME OFFICERS' TRAINING

By Lieutenant Pete Still BSc, PGDip, IEng, MIET RN
Officers Course Manager (MESM), DSMarE

Lieutenant Peter Alan Still joined the RN in 1986 as an Artificer Apprentice, and following specialisation as a Marine Engineering Artificer (Electrical), spent time at sea in HM Submarines Turbulent, Talent, Sovereign and Spartan, interspersed with time spent instructing nuclear systems at HMS Sultan in Gosport up until 2005. He filled spare time in the latter of these years studying sciences for a first degree before gaining a commission as an Engineering Training Management Officer. Following his first job as the Management Training Officer in the RN Leadership Academy in HMS Collingwood, he transferred specialisations to Marine Engineering (Submarines) (MESM) Officer where he assisted in the recommissioning and subsequent regeneration of HMS Triumph as an Engineering Officer. Leaving Triumph after operations in the Mediterranean in 2011 he took up his present assignment as the Officers Course Manager (MESM) in HMS Sultan. Peter lives with his wife Suzette and sons Harrison and Lauchlan in Gosport.

INTRODUCTION

The demise of military-centric, undergraduate, academic engineering training[1] and the gradual erosion of operational platform-based sea training from Phase 1 and Phase 2 Initial Officer Training[2] (IOT) has resulted in a need to address the shortcomings that such changes have brought about, so that we as trainers can deliver a better product to the Fleet.

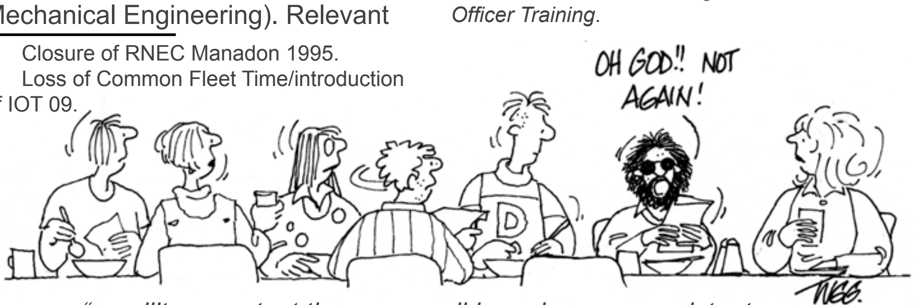
THE PROBLEM

To some extent, we can look back towards the source and specifically undergraduate studies. Our graduate engineering Officer Cadets now come from a wide field of universities with a broad spread of engineering degree types (such as Civil Engineering, Electronics and Mechanical Engineering). Relevant degrees in recent years have begun to lose much of their practical elements, which have required the student to design and physically produce engineering projects, and, as a result, have suffered a reduction in contact time with industry.

1. Closure of RNEC Manadon 1995.
2. Loss of Common Fleet Time/introduction of IOT 09.

The modern day graduate Engineering Officer will pass out of BRNC having completed 28 weeks of Phase 1 IOT[3]. Other than this, military contact time may well have been nonexistent or minimal (if graduated from a Defence Training University Scheme). Those Officers will then be presented for Phase 2 professional engineering training here at HMS Sultan without the benefit of having lived within a wardroom environment and being afforded the time and opportunity to develop the Officer-Like Qualities (OLQs) and Command, Leadership and management (CLM) skills introduced during Phase 1 training.

3. 2008 DIN07-171 *Changes to RN Initial Officer Training*.



"... military contact time may well have been non-existent ... without the benefit of having lived within a wardroom environment ..."

Within the Marine Engineering Branch Officer Corps, we have seen the attrition of professional engineering standards in recent years. These standards can be improved through stronger leadership and core values as expected from a modern day Naval Officer.

This has been highlighted by the Defence School of Marine Engineering (DSMarE)[4] which has (as directed by DFOST) taken ownership of RN values and standards during Phase 2 Systems Engineering and Management Course training, in order to underpin engineering standards.

THE SOLUTION

Whilst it is acknowledged that a strong leader cannot be 'grown' or trained within a set timeframe (Training Objective 1.1 – Produce strong leader), individual leadership skills and OLQs can be developed further through time investment, intelligent selection of training tasks and robust mentoring.

DSMarE made recommendations[4] for additional Naval General Training that could be partly inserted into existing training pipelines as well as added to them, with a pipeline extension of five training weeks. The pipeline extension attracted little resistance and much support from a variety of stakeholders.

4. DSMarE Paper, *Improving Phase 2 Officer Development in Support of Engineering Standards during the Systems Engineering and Management Course*, dated 20 September 2011.

"Revisit of AIB practical leadership tasks ..."
(MESM Trainees are in the red helmets)

Since then Officers' Course Managers have implemented the extensions and have populated the additional training time with diverse leadership-centric elements to typically include:

- Revisit of AIB practical leadership tasks, utilising AIB staff for feedback.
- Programming JOLC 1 into the Phase 2 training pipeline.
- A week of structured and challenging AT resulting in a formal qualification.
- A sea ride with the FOST organisation to experience operational DC drills.
- Guided and assessed platform machinery EOOW rounds.
- Assessed duty-watch plant flash-up exercise within HMS Sultan.
- Senior Officer fireside chats focussed on leadership real-life situations.
- Planned discussions with Chaplaincy on Emotional Intelligence.

"... practical leadership tasks ... structured and challenging AT ..."

"... experience operational DC drills."

The pipeline changes have been briefed to a wide audience that has included the Second Sea Lord and our customers at Fleet, so that we can provide assurances that the situation is being addressed at the Phase 2 level and that we are fulfilling our remit to reduce, as far as is reasonably practicable, the passing on of training risk to the front line.

To complement the enhanced training pipeline, a more robust and ultimately logical warning system has been introduced within DSMarE. As a result, the Course Manager's level of training warning has been removed. Only two levels of warning (Commander ME and Commandant DSMarE) now exist for professional and character & leadership training warning prior to Establishment CO and Admiralty Board Warning, as outlined in BR3 Chapter 57.

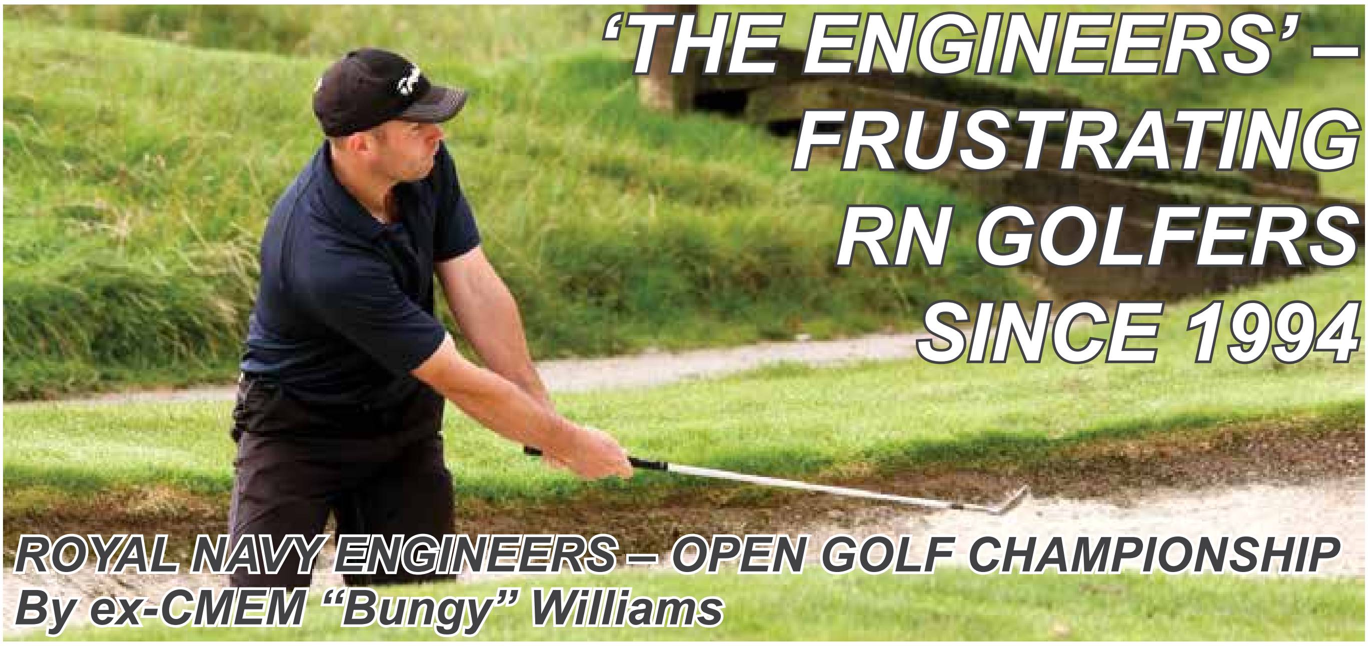
This system of training warnings not only helps UTS ME Officers realise the gravity of further shortcomings, but is also more intelligent as to how and when warnings are reviewed. Automatically lowering a warning level following a three month period, during which only the original shortcoming had been addressed, allowed potential training risks to 'saw tooth' along the bottom of the warning structure and not draw suitable attention to their progress. Officers under warning will now only be reviewed at quality control points within their pipeline structure as close to three monthly as possible. It is quite likely that this period will provide insufficient evidence to justify the removal of the warning and so the officer will be advised as to his or her progress but will remain on that level of warning. This level of 'protection' allows far better control of training risk and helps to highlight potential risks earlier, so that rectifying action can be taken.

CONCLUSION

Whilst dealing with a reduction in platform availability with which to train our Junior Officers, we can mitigate to some extent the shortfall in Naval General CLM Training through the insertion of additional leadership-bias elements embedded within Branch specific pipelines. However, we are very much driven by varying human factors and success can only be sustained through continuous and determined application of quality training that changes in-tune to the needs of the current raw product from universities, as well as assigning our best people to train and mentor these individuals.

Photos courtesy of S/Lt B.M. Gray RN

WANT TO KNOW MORE?
For further information please contact:
Lieutenant Pete Still
(email SULTAN-OCMMESM
Tel 93843 2989)



‘THE ENGINEERS’ – FRUSTRATING RN GOLFERS SINCE 1994

ROYAL NAVY ENGINEERS – OPEN GOLF CHAMPIONSHIP

By ex-CMEM “Bungy” Williams

En-gi-neer:

a) A person trained and skilled in the design, construction, and use of engines or machines, or in any of various branches of engineering.
b) A person who operates or is in charge of an engine.
c) A member of an army, NAVY, or air force specially trained in engineering work.
d) A skilful manager.

En-gi-neer-ing:

a) The art or science of making practical application of the knowledge of pure sciences, as physics or chemistry.
b) The action, work, or profession of an engineer.
c) Skilful or artful contrivance; manoeuvring.

Mark ‘Bungy’ Williams Joined RN as a JMEM2 in 1978 at age 16, and served over 30 years, in seven classes of ship (12 different platforms), including drafts as Chief Shipwright in HMS Glasgow 2000/2002 and HMS Ocean 2005/2006. He has been RN Engineers Open Golf Championship Secretary in 2004, 2005 and 2008 and was RN Engineers Open Golf Champion in 2003 Since leaving the RN in 2009 he has worked as an NVQ assessor for Babcock International in HMS Sultan as part of the Accreditation Team, administering the Apprenticeships and Advanced Apprenticeships offered to ET MEs, AETs & LET MEs through their RN career course training.

The modern game of golf has travelled a long way since the days of hickory shafted clubs and hand stuffed feather & leather balls. Pure science & engineering has played a huge part in the development of the games latest equipment and courses. Balls have become a work of scientific wonder; one-, two- three- and four-piece balls using many combinations of resins, rubbers, plastics and polymers, finished with up to 500 precisely placed dimples to create lift, promoting desired flight patterns, partnered with clubs designed to the very highest of engineering standards these go a long way to make the game what it is today. A coefficient-of-restitution (COR) of 0.83 has been set as an upper limit for the newest family of thin faced titanium drivers, with a COR of around 0.78 combining to set the initial velocity standards for the 42.67mm Ø spherical object all golfers endeavour to putt into a hole precisely measuring 107.949999mm Ø.

Is it this link to science and engineering that draws RN engineers to the game of golf and in particular the ‘Royal Navy Engineers Open Golf Championship’? Do golfing engineers sit around discussing the latest Merlin helicopter, the marvels of Type 45 or the wonders of the 21st Century weapons and sensors? Answer: they certainly do not! ‘The Engineers’, as this golfing icon has affectionately become known, provides a many-faceted arena where golfers of all standards from Air, Marine and Weapon Engineering disciplines gather to test their skills and maybe, with the required elements of good play and luck, walk away with the title of ‘Engineers Open Champion’. For many who have now come to realise their best golf is long behind them, ‘The Engineers’ purely serves to provide a platform where old friendships can be revitalised over a friendly practice round and the mandatory libation(s) on completion.

Founded in 1994 the first ‘Royal Navy Engineers Open Golf Championship’ was played at the newly opened China Fleet Golf and Country Club (CFGCC) in Plymouth. CFGCC, built using funds raised from the sale of the Royal Navy China Fleet Club, Hong Kong, opened in 1991 and proved to be the perfect venue for

Photos courtesy of PO(Logs) SC Darren Oswald

Sponsor, "Sid" Eyre, applies the minimum amount of force required to crack the nut

the first 14 years of the event's life. In 2008, following contractual problems with China Fleet the decision was made to move away from the spiritual home of 'The Engineers'.

Like the game of golf itself, to survive in an ever changing world 'The Engineers' had to evolve. Originally a pure gross Strokeplay competition, by 2004 organising committees started to realise the nature of the golfer attending the event was changing and a format change had to be made to allow all serving engineers participating the opportunity to become champion. The Engineers Open was no longer the preserve of the single figure golfer! As with all change, some disagreed, but in time the decision to make the event a 36-hole combined Nett/ Stableford competition has been proven to be the right one.

2009 saw further change, when for the first time, participating ex-RN Engineers were eligible to become champion. Also in 2009 'The Engineers' moved away from the West Country, finding itself at Botley Park Golf Club (near Southampton) where Tracey 'Ticker' Hart took full advantage of the new rules by becoming the first non-serving RN Engineer to win the tournament. By 2009 'The Engineers' had also started to utilise the latest media methods available, ensuring information regarding the event was available to all. Traditionally the RNTM was the only method of informing golfers of the up-coming RN Engineers Open Golf Championship; in 2005 'The Engineers' went online! Today information will be found in the previously mentioned annual RNTM and a DIN but much more can be found at http://www.engineersopen.net.

The annual YMCA dance competition gets off to a poor start

2 September 2013, as reported by the event organisers (via the website), will see the tournament return to China Fleet Golf & Country Club. Always played on the first Monday of September, RN Engineers from across the nation will again make the journey to the West Country, many arriving on Friday to take the opportunity to play several practice rounds on local courses as well as at China Fleet and to partake in the much loved 'catch-up' with old shipmates and comrades!

The Royal Navy Engineers Open Golf Championship is for many RN Engineers the Holy Grail of golfing events; three time champion and now retiree 'Rod' Teagle continues his annual quest to become not just the first three time winner but to win what would probably be an insurmountable fourth title; 19 tournaments have witnessed 15 different champions, with only three repeating the feat. Further testament to the event's prestige is upheld by the longstanding connections with a large number of sponsors; the event would not be possible without the generosity of the many and varied sponsors, several of whom participate at each year's event and who kindly provide the exceptional array of prizes on offer. The event committee is always looking for new sponsors, especially those who wish to take an active role in the event.

Serving RN/RFA ME/WE/AE/MT, ex-RN Engineers & Past Champions are all eligible to play. The RN Open Golf Championship truly is one of a kind – with no direct funding, 'The Engineers' remains arguably the biggest event of its kind in the RN and serves not only to provide a creditable, demanding and valuable sporting challenge for serving personnel but, maybe more importantly, an opportunity for many to maintain essential links with old shipmates and the Service in general.

WANT TO KNOW MORE?
For further information please contact:
WO1 John 'Taff' Reha
(email john.reha831@mod.uk)
or go to
http://www.engineersopen.net

ITIL NEVER WORK!

ITIL SERVICE MANAGEMENT IN THE ROYAL NAVY

By Lieutenant David Nguyo RN
DIST Service Performance 4 (DII Maritime Deployed)

David Nguyo joined the Royal Navy in September 2000, having graduated in Electrical and Electronic Engineering from the University of Nottingham. On receiving his officer's commission from Britannia Royal Naval College, he joined HMS Sutherland where he completed Common Fleet Time followed by Specialist Fleet Time in HMS Cardiff. David then studied with the System Engineer Management Training unit at HMS Collingwood in 2002.
His first role was as a Weapon Section Officer and Deputy Weapon Engineer Officer in HMS Cornwall. From there, he was appointed to MOD Abbey Wood as the Combat System Engineer for Communications within the Frigates Team. During this time he was seconded for a year to join the industry-led Naval Design Partnership as a Combat System Engineer supporting the Future Surface Combatant programme. He now supports the Fleet on DII Maritime Deployed matters.
David is married with three children and enjoys the demands and rewards of family life. He actively participates in team related sports such as basketball and volleyball. His other interests include employing Open Source and sustainable development principles.

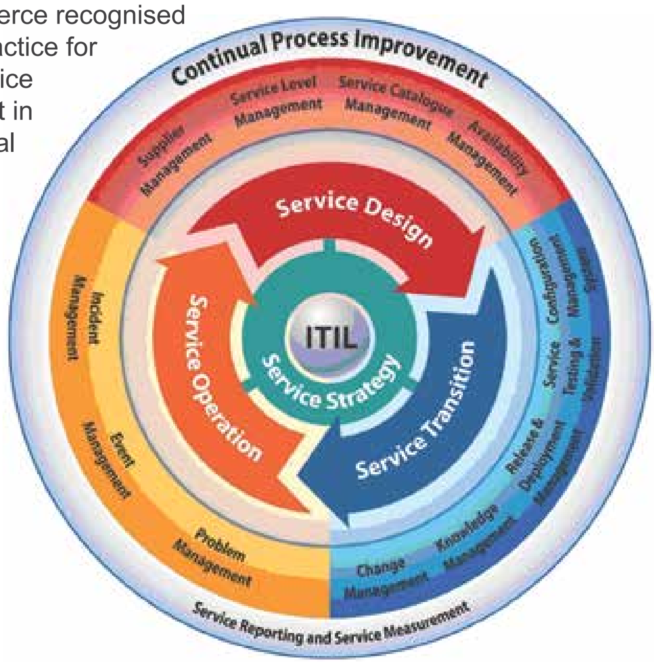
This article describes ITIL Service Management and how it affects managing IS in the RN. The article will provide a background of ITIL, definitions of the key lifecycle stages and its effect on managing IS in the RN.

So what is ITIL? ITIL stands for Information Technology Infrastructure Library. It is a public framework that describes best practice in IT service management[1]. This covers the governance of IT, the service wrap, and focuses on the continual measurement and improvement of the quality of IT service[2] delivered, from both a business and a customer perspective. It provides a practical, no-nonsense framework for identifying, planning, delivering and supporting IT services to the business.

What does that mean to the average person? If followed correctly, it means there will be increased user and customer satisfaction with IT services, improved service availability, financial savings from reduced rework, lost time, improved resource management and usage, improved time to market for new products and services and, improved decision making and optimised risk.

That is why ITIL enjoys worldwide success; it is used by many international organisations. ITIL is the most widely adopted approach for IT Service Management in the world. It may be hard to believe ITIL is more than 20 years old. In the early 1980s, the evolution of computing technology moved from mainframe-centric infrastructure and centralised IT organisations to distributed computing and geographically dispersed resources. While the ability to distribute technology afforded organisations more flexibility, the side effect was inconsistent application of processes for technology delivery and support. The Office of Government Commerce recognised that a consistent practice for all aspects of a service lifecycle could assist in driving organisational effectiveness and efficiency as well as predictable service levels and thus, ITIL was born. ITIL was published between 1989 and 1995 by Her Majesty's Stationery Office. Its early use was principally confined to the UK and Netherlands. A second version of ITIL was published as a set of revised books in 2001. ITIL v3 is the latest iteration, and was published in July 2011.

The ITIL best practices are detailed within five core publications which provide a systematic and professional approach to the management of IT services. These five publications map the entire ITIL Service Lifecycle, beginning with the identification of customer needs and drivers of IT requirements, through to the design and implementation of the service into operation and finally, on to the monitoring and improvement phase of the service. The service lifecycle consists of: Service Strategy, Service Design, Service Transition, Service Operation and Continual



ITIL Service Management life cycle

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1. Service Management is a set of specialised organisational capabilities for providing value to customers in the form of services.
2. A service is a means of delivering value to customers by facilitating outcomes customers want to achieve without the ownership of specific costs and risks.

Service Improvement.

The lifecycle starts with Service Strategy – understanding who the IT customers are, the service offerings that are required to meet the customers' needs, the IT capabilities and resource that are required to develop these offerings and the requirements for executing successfully. IT must always try to assure that cost of delivery is consistent with the value delivered to the customer.

Service Design assures that new changes to services are designed effectively to meet customer expectations. The technology and architecture required to meet customer needs cost effectively is an integral part of Service Design. Additionally, processes required to manage services are also part of the design phase. Service management systems and tools that are necessary to adequately monitor and support new or modified services must be considered as well as mechanisms for measuring service levels, technology and process efficiency and effectiveness.

Through the Service Transition phase of the lifecycle, the design is built, tested and moved into production to assure that the business customer can achieve the desired value. This phase addresses managing changes, controlling the assets and configuration items (underlying components – hardware, software, etc) associated with new and changed systems, service validation and testing and transition planning to assure that users, support personnel and the production environment has been prepared for the release to production.

Once transitioned, Service Operation then delivers the service on an ongoing basis, overseeing the daily overall health of the service. This includes managing disruptions to service through rapid restoration of incidents, determining the root cause of problems and detecting trends associated with recurring issues, handling daily routine end user requests and managing service access.

Enveloping the Service Lifecycle is Continual Service Improvement (CSI). CSI offers a mechanism for IT to measure and improve the service levels, the technology and the efficiency and effectiveness or processes used in the overall management of services.

It is worth paying closer attention to Service Operations because it is only during this stage of the lifecycle that services actually deliver value to the business (customer), and it is the responsibility of Service Operation staff to ensure that this value is delivered.

The purpose of Service Operation is to deliver agreed levels of service to users and customers, and to manage the applications, technology and infrastructure that support delivery of the services.

The Service Desk provides a single central point of contact for all users of IT. The Service Desk usually logs and manages all incidents[3], service requests[4] and access requests[5] and provides an interface for all other Service Operation processes and activities. Specific Service Desk responsibilities include logging incidents and requests, categorising and prioritising them, first-line investigation and diagnosis, managing the lifecycle of incidents and requests, escalating as appropriate and closing them when the user is satisfied and keeping users informed of the status of services, incidents and requests.

It is important any incidents – unplanned interruptions to an IT service, or a reduction in the quality of an IT service – are resolved promptly. The purpose of Incident Management is to restore normal service as quickly as possible, and to minimize the adverse impact on business operations.

As mentioned earlier, ITIL has been adopted by many organisations in different nations. The MOD is one beneficiary of this framework. The Defence Information Infrastructure (DII) developed for the MOD by the ATLAS Consortium follows ITIL principles.

DII has now been in service for over three years. Most of the establishments have DII/F and 22 ships are using DII Maritime Deployed (MD). The support model

3. An incident is unplanned interruption to an IT service, or a reduction in the quality of an IT service.
4. A service request is a request from a User for information, or advice, or for a standard change or for access to an IT service eg to reset a password, or to provide standard IT services for a new User.
5. An access request takes place when the User needs authorised access to use a service, while preventing access to non-authorised users. Access management is rights management or identity management on the IT service.

... incident – unplanned interruptions to an IT service ...

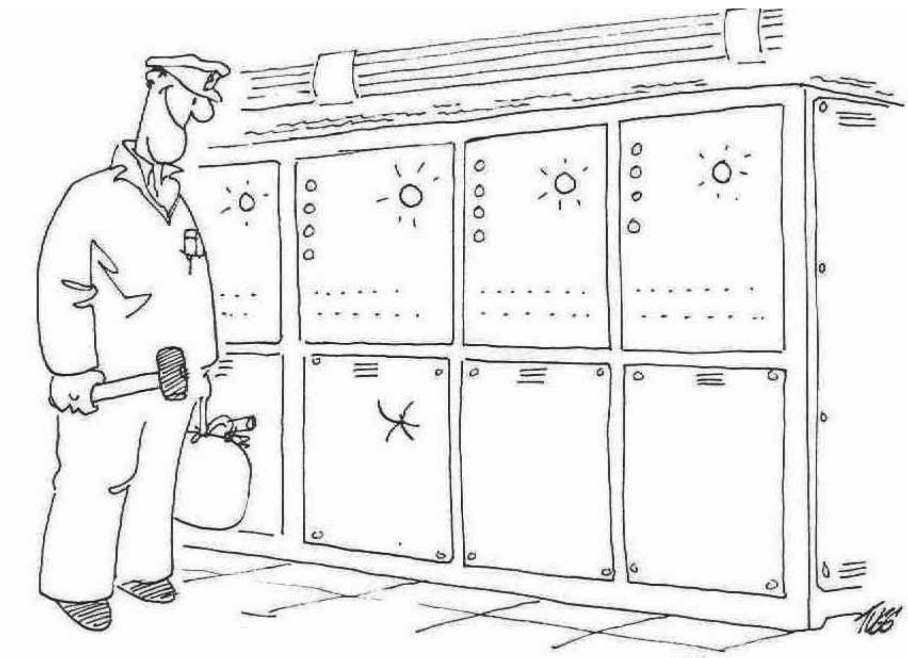
is simple: find anything that does not work as expected, call the service desk or the SPOC. For personnel on ships, the Single Point of Contact (SPOC) is the Military Service Provider (MSP), a member of the Communication and Information Systems (CIS) or WE branch. They will log the call, prioritise and resolve the issue using the standard incident management process mentioned earlier. Any issues that cannot be resolved are escalated to the ATLAS Deployed Service Management Team based in Newcastle. This team operates 24/7 and supports DII MD and other legacy deployed IS.

On ships and submarines, all equipment faults are managed within the platform by use of the Defect Book/Log. The departmental head escalates issues to shoreside design authorities via the standard engineering processes, such as OPDEF or S2022. For ship-borne systems, the maintainers onboard ships provide the first line of support. When a user identifies a fault, they usually inform the appropriate maintainer directly. The maintainer will then attempt to resolve the fault, depending on the perceived priority. If not within his capacity to resolve, the maintainer will inform his departmental head, and this fault is escalated to the equipment delivery team for further support.

The delivery team in this case, Defence Information Systems Team, are not directly involved in incident management. All incidents are managed within the ATLAS service management service wrap. There are few exceptions where complex issues need support from other vendors for network faults or non-DII applications such as JPA or UMMS. Operational Level Agreements do exist with other organisations, again in line with ITIL principles, to provide support and coordinate resolution activity. Managing relationships between delivery teams and partners is vital to provide valuable service to the Fleet, the end-user. The RN needs to adopt this subtle change in culture to benefit fully from the ITIL Service Management support model.

Interestingly, ISS has loosely adopted the ITIL Service Management model in relation to Service Operations. The Global Operations Security Control Centre primarily deals with incidents which affect the availability of CIS service to the end-user. ISS Svc Ops maintains a close watch on how these organisations react and manage the delivery team repair activity for high profile issues. The Incident Management Group coordinates the efforts of the delivery teams and partners until the service is restored.

All DII incidents are recorded and stored in a database. This information is used to identify trends and, in this case, opportunities for improvement. Proactive management of these trends ensures that incidents are minimised through system improvements or further training to users and MSPs. This continual service improvement process becomes critical to ensuring user satisfaction and experience.



The maintainer will then attempt to resolve the fault ...

GLOSSARY OF TERMS

CIS	Communication and Information Systems
CSI	Continual Service Improvement
DII	Defence Information Infrastructure
ITIL	Information Technology Infrastructure Library
MD	Maritime Deployed
MSP	Military Service Provider
SPOC	Single Point of Contact
UMMS	Unit Maintenance Management System

WANT TO KNOW MORE?

If you want to become an ITIL wizard, or want further information regarding training, qualification and examinations, please visit http://www.itil-officialsite.com/

GROWING ROYAL NAVY ENGINEERING TECHNICIANS OF THE FUTURE

By Lieutenant Commander Paul O'Shaughnessy BEng MSc MIET RN RMSO2 WEGS, NPT(E)

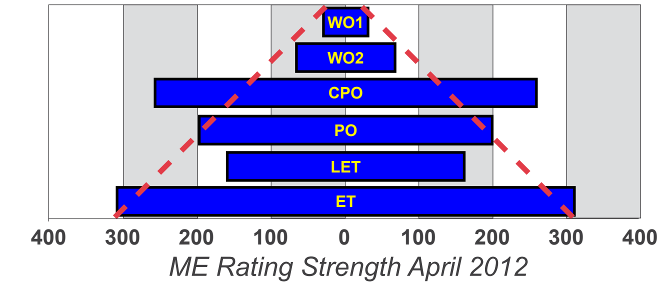
FOREWORD

The Royal Navy's Personnel Change Programme (PCP) introduced the Engineering Technician initiative in 2005, at which time it was clear that the 'shape' of the General Service Engineering Branch would require further modification to ensure longer term sustainability. Today, analysis of the current liability and strength show them to be a long way from the 'ideal' sustainable pyramid structure – more Portsmouth's Spinnaker Tower than Egypt's Pyramids (see graphs and photographs on this page).

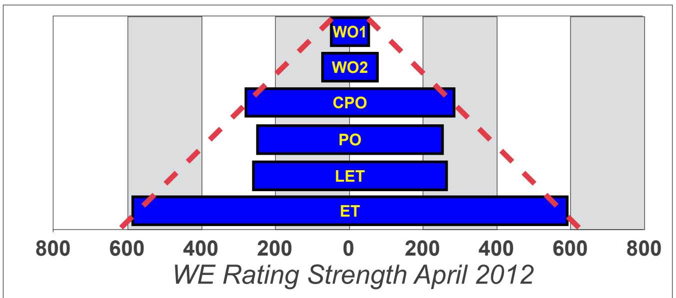
Within both specialisations, the relationship between the number of Leading Hand (LHs), Petty Officers (POs) and Chief Petty Officers (CPOs) indicate that it will become increasingly difficult to satisfy selective promotion requirements. Furthermore, as the reserved rights of legacy Artificers come to a natural end, long term manpower modelling identifies the need to address this structural problem. The purpose of this article is to explain the structural change being trialled through the Weapon Engineering Manning trial in HMS Lancaster and Marine Engineering trial in HMS Portland.

It is import to understand that there are a number of contributory factors behind the shapes illustrated below:

- Legacy Artificers will retain reserve rights to automatically advance to CPOET on successful completion of Professional Qualification Examinations until December 2015 (WE) and December 2016 (ME).
- Shore-side employers have not realigned their positions to a post PCP paradigm whereby the PO (vice the CPO) is the deliverer of Operational Capability (OC).
- A sea requirement that retains equipment maintenance responsibility at the CPOET level.



ME Rating Strength April 2012



WE Rating Strength April 2012

WHY NOW?

The need to review, test and tune the branch structure now is driven by a maturing PCP Engineering Technician (ET) structure; personnel initially recruited as ETs are now reaching the rate of Petty Officer and the numbers of legacy Artificers with reserved rights to CPOET is diminishing; future POETs and

CPOETs need to be grown via experience during time spent at sea as ETs and LETs.

In three years we will have 'grown out' all non-selection advancements resulting in a branch based entirely upon the PCP construct. These trials aim to identify improved ways to man and operate current platforms to capitalise on these changes, to put the future structure of the branch on a sustainable footing.

In a nutshell, if we do not address the underlying structural integrity of the Branch now we will be unable to develop sufficient numbers of people with appropriate skill sets and levels of experience to retain the responsibility of the Engineering departments to safely operate, maintain, diagnose and repair equipment in the future.

SCOPE

The following work strands, developed under the Naval Board Personnel Change Programme (NBPCP) Next Steps initiative, are being investigated:

- **Reinvigoration of the Group Head Concept**. Responsibility for individual equipment sections to be held at lower levels, generating capacity for CPOETs to contribute fully at a management level and ensure consistency across sections within their group.

- **Warrant Officer Employment**. Refine the requirement for and employment of technical Warrant Officers in front line platforms.

- **Leading Engineering Technician Employment**. Increasing the responsibility given to LETs will generate the higher levels of experience anticipated by the principle of PCP; matching this to increased employability in shore-side roles will assist development of experience as people develop towards promotion to POET.

BENEFITS

This work will inform further development of the Engineering Branch in such a way that it more accurately realises the original direction and intent of the Naval Board PCP.

These benefits, which should deliver effect in current platforms and inform the options to man and operate future platforms, will be:

- **Improved Operational Capability**. CPOET workload will be reallocated to provide sufficient headroom for Group Heads to properly mentor and guide their subordinates; LETs will be introduced to equipment responsibilities at an earlier point in their career to prepare them better for future roles as Senior Ratings.

- **Improved manpower sustainability**. The numerical balance between Senior Ratings (SRs) and Junior Ratings (JRs) will more accurately reflect the 'sustainability pyramid'.

- **Improved employment conditions**. The Group Head will have a clearer more defined role, which gives due recognition to their experience and enhances their position within the department and platform. LETs will receive a greater challenge and be provided with an opportunity to develop their maintenance and management skills en route to becoming a Senior Rating. Empirical evidence from an alternative structure will be available to inform the wider debate on the best method of discharging the technical Warrant Officer function in front line platforms.

Success of these trials is not just the short term delivery of OC within the trial ships; success will also be defined by the assessment of the risk inherent in refining the structure of the engineering departments at sea and in rolling that out across the DD/FF force.

TRIALS STATUS

Weapon Engineering (WE) Manning Trial – HMS Lancaster

The WE manning trial commenced in April 2011 and will run for two and half years. Thus far, her timely regeneration from upkeep supported the following key achievements:

- Successful, on time, regeneration following a significant investment in uplifting HMS Lancaster's equipment fit during an extensive refit period.

- Flexibility of training pipeline to deliver sufficient Suitably Qualified and Experienced Personnel (SQEP) as required by the revised departmental structure.

- High-end warfighting State One manning posture revised to ensure the revised structure supports defect repair organisation in most demanding war-like scenarios.

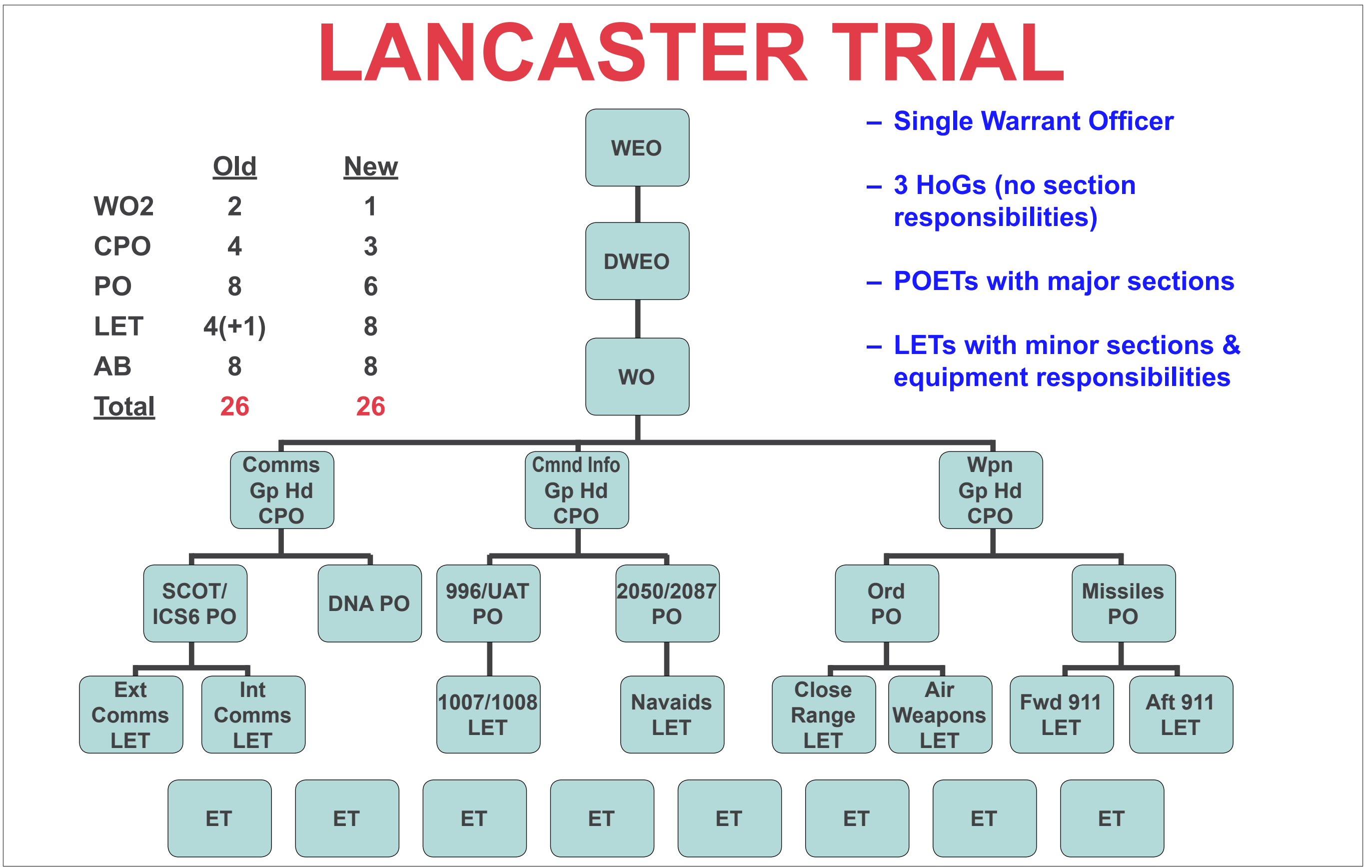
- Credible performance in the preparation for, and completion of Operational Sea Training; tangible benefit witness due to the revised Head of Group role underpinning improved consistency of performance across sections.

- LET response to increased responsibility is sustaining high levels of engineering standards.

- The SURFLOT wide WE/CIS Phase 1 integration has been successfully implemented, and will illustrate the additional benefit of CIS and WE communication maintainers working under a single Group Head.

Manpower – Roles

- **Single Warrant Officer**. Reduction from two Warrant Officers to one is enabled by increasing management responsibility held at CPOET level. Early evidence gained from the trial demonstrated



the increased loading of the Departmental Coordinator (DEPCO) role was detracting from the technical Warrant Officers output; accordingly the DEPCO responsibility is now being successfully discharged by the Command Information Group Head.

- **Group Heads**. Generating spare capacity at the Group Head level by removing direct equipment responsibility has been achieved by empowering POETs as Section Heads and LETs with equipment responsibilities. This provides space for the Group Heads to contribute to the management of the Department whilst retaining focus on oversight of their group, through guidance and mentoring. Gapping at Section Head level has impacted this aspect of the trial.

- **LETs**. Increased responsibility given to LETs sees equipment responsibilities discharged at this level following enhanced training packages; two LETs are performing well as Officer of the Quarters, responsible for safe custody of explosives and ammunitions. All LETs have embraced the additional responsibility with initial assessments returning positive feedback.

Way Ahead

The trial will continue to optimise the manning structure during a period of national tasking and generation for, and execution of, NATO tasking through 2013. The resilience of the new structure to sustain support to operational capability during an extended period will be assessed prior to endorsement of the finalised profile and subsequent rollout to the remainder of the Fleet.

In the near term, work to test and tune the Type 45 WE departmental structure is underway ahead of assessing feasibility of a revision to Type 45 manning in 2013.

Marine Engineering (ME) Manning Trial – HMS Portland

HMS Portland was selected as she emerges from Upkeep, enabling the ME department to be trained and mentored such that the trialled structure is the closest representation of a true ET construct and can be rigorously tested, assessed and, where necessary, adjusted prior to a wider implementation across the surface Fleet. The modified trial structure is detailed in the diagram overleaf.

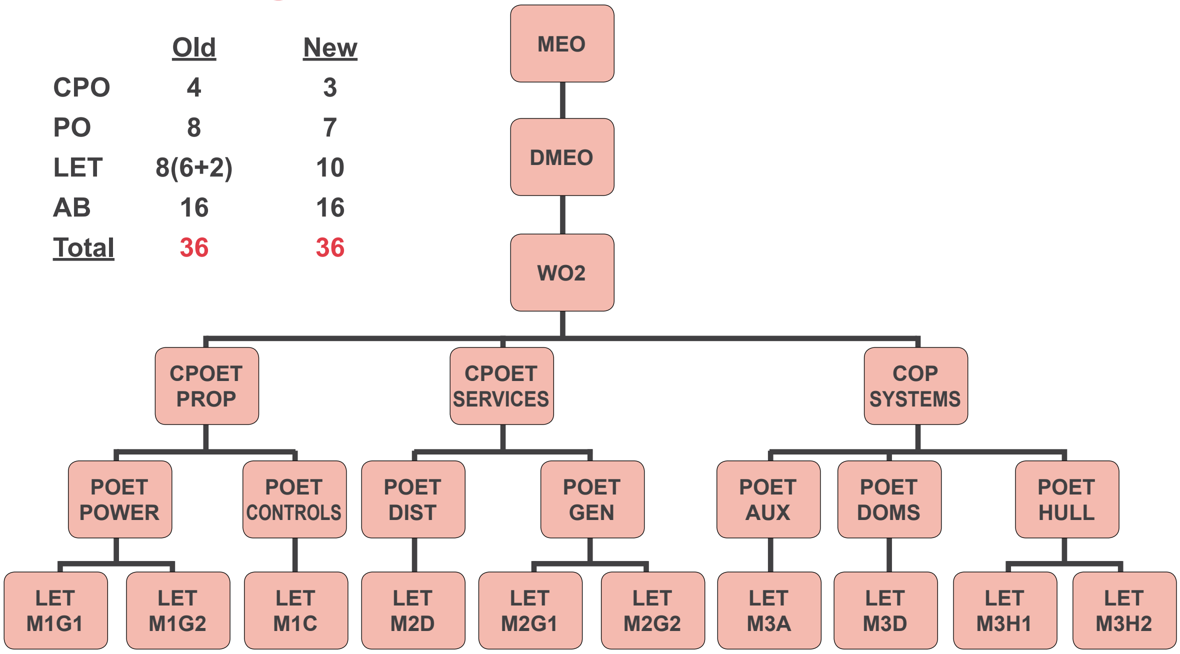
The trial commenced in May 2012 and aims to generate branch sustainability whilst ensuring (and potentially improving) the fundamental responsibility of the ME department to operate, maintain and repair equipment to provide the highest level of Operational Capability.

The benefits expected to deliver effect in current platforms and inform the options to man and operate future platforms are:

- **Improved Operational Capability**. Group Heads operating with capacity to manage, mentor and guide their Section Heads (POETs) to sustain equipment operational capability. LETs will be delegated equipment responsibilities at an earlier point in their career to prepare them better for future roles as Senior Ratings. LET elevated responsibility and greater

PORTLAND TRIAL

	Old	New
CPO	4	3
PO	8	7
LET	8(6+2)	10
AB	16	16
Total	36	36



equipment ownership will develop essential experience for future Section Head role.

- **Improved manpower sustainability**. The numerical balance between SRs and JRs will more accurately reflect the 'sustainability pyramid'.

- Evidence to support and inform the future employment initiatives and manning constructs that include Type 26, journeyman time for LETs ashore, training pipeline time refinement and early streaming.

- HMS Portland's regeneration from upkeep remains on track with Ship's Staff move onboard achieved on time.

- The Department is now fully manned in line with the revised departmental structure (see diagram); although some personnel are awaiting completion of minor training packages to fulfil required competencies.

- Terms of Reference for department continue to be assessed throughout the trial to optimise lines of demarcation and delegated responsibility.

Manpower – Roles

- **Single Warrant Officer**. WO2 ME coping with increased loading associated with DEPCO responsibility, supported by designated LET(ME) acting as the Assistant DEPCO.

- **Group Heads**. Spare capacity at Group Head level is used to contribute to the management of the Department, whilst retaining focus on the running of their group, via guidance, mentoring as well as using any spare capacity to conduct secondary duties that in the past were traditionally conducted at the WO2 level.

- **LETs**. Although at the embryonic stage, it is clear LETs are starting to embrace the increased responsibility with initial assessments encouraging.

SO WHAT HAPPENS NEXT?

Under the direction of the Navy Board Personnel Change Programme the outcome of the engineering manning trials will be assessed. Work is underway on options for implementation of the final endorsed Departmental structures – which, in the interim, will continue to be tested and tuned under the direction of their Project Boards.

WANT TO KNOW MORE?
For further information please contact:
Lt Cdr P.C. O'Shaughnessy
RMSO2 WEGS
02392 62 8963 | Mil 93832 8963
FLEET-DNPERS-NPTE-RMSO2WEGS@mod.uk

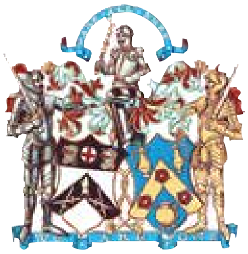
IN MEMORIAM

Engineering Technician (MESM)2 Peter Roberts — Petty Officer Air Engineering Technician (M) Christopher Jones

Lieutenant David Tilson — Petty Officer Marine Engineering Mechanic (L) Philip Dale

These four members of the Engineering Branch have died in Naval Service during the past year.

ARMOURERS AND BRASIERS MEDAL



Since 1997 the Royal Naval Engineering Sponsorship Scheme has received academic prizes from the Worshipful Company of Armourers and Brasiers. As the Sponsorship Scheme has transformed into a joint organisation, the Worshipful Company believed that the future of this prize lay elsewhere and looked to the Maritime Warfare School, and specifically the System Engineering and Management Course, as the natural home for the prize.

The prize, consisting of a cheque for £250, a certificate and an Armourers and Brasiers Medal, is awarded annually to the Section Officer or DWEO who has achieved their Recommendation for Charge and gained the greatest professional success during their time onboard. It aims to recognise an individual's performance during their initial period in a complement assignment at sea and also takes into account the contribution made to a unit's operational capability.

The prize for 2010 was awarded to Lieutenant Robert Richards, of HMS Astute (now serving in FASFLOT). His expert contribution as CISE and then as DWEO, and as the SCOOW, greatly assisted the continuing success of first of class trials. Of note is his leadership and preparation of the WSC team in support of the successful firing of 17 Spearfish and two TLAM. He was also a key player in assisting the new WEO after the Southampton tragedy and displayed resilience and deep professionalism, helping to drive through the DRP in the immediate aftermath. Richards is imbued with deep specialist weapon system knowledge and maintains a keen wholeship overview which bodes very well for his Charge Assignment.

He has been a major influence on wholeship training, providing coaching and inspirational mentoring for qualifications ranging from Part III, Basic Ship's Qualification, OOD, SCOOW, planesmen, panel and TWS. He keeps a sharp focus on command priorities and uses his intuitive engineering judgement and deep TWS knowledge to ensure that OC is kept as high as possible through the vigorous pursuit of defects.

The Master of the Worshipful Company presents the award to Lieutenant Richards

WOULD THIS HAPPEN IN YOUR SHIP?

An example of how ships get it wrong – these photos were taken recently.

Don't see a problem? See the box at the bottom of Page 49

NAVAL ENGINEERING

Welcome to another edition of *Lessons Identified*. The authors are Lieutenant Commander Duncan McDonald (FLEET-CAP SS OSG SO2) (GS) and Lieutenant Scott Redpath (FLEET-CAP SM E ASSUR SM SO3) (SM), to whom any immediate queries should be addressed.

The above named officers and Commander Philip Parvin (SM) (FLEET-CAP SM E NPOS SO1) are the current Navy Command HQ sponsors for this series of articles; they welcome feedback or material for future editions of *Lessons Identified*.

— LESSONS IDENTIFIED —

Editor's Comment – When Will We Ever Learn?

Reading these reports of disasters, near-disasters and near misses, whether surface, sub-surface or air, and reviewing previous *Lessons Identified* articles, your Editor has been struck by the number of types of mishap which recur in similar guises, despite being well-documented problems (and, often, with equally well-documented procedures to avoid them). There are many examples where an incident reported here was the subject of a recent article in TNE or elsewhere, and/or where the correct procedure is covered in detail in the relevant handbook or manual. It's no accident (pun intended) that this section of TNE is called *Lessons Identified* rather than the more usual *Lessons Learned*!

LESSONS IDENTIFIED FROM THE SURFLOT: RISK MITIGATION AND THE ROLE OF SOPs

INTRODUCTION

Standard Operating Procedures (SOPs) are key to the effective management of Hazards. The term SOP is used here to define any operating procedure no matter how described, including equipment and maintenance procures and planned responses to set situations. The link between hazard management and SOP is fundamental but, in recent months, this link has proved not to be as robust as previously thought. Building this link will be a significant challenge, and one that must be led by the Operating Duty Holder and the Platform Duty Holder, but will require engagement and effective management of SOPs by those who face the hazards they are designed to protect against.

TYPE 23 STEERING GEAR FAILURE AT SSD

A ship experienced a steering gear failure during a recent sailing from a base port. The ship was conducting a standard outbound pilotage and had just passed the narrowest section of water when they suffered a steering gear control system failure; the rudder remained at 20º to Port with only two cables of clear water ahead and two cables clear to port. The ship quickly established emergency lever steering before conducting an emergency anchorage. Subsequent investigation found the cause of the failure to be air in the hydraulic system and a number of actions have been pursued to prevent reoccurrence.

The ship's response to the emergency was effective but, of note, one of the findings of the investigation was that the steering gear SAFER cards had been pen-amended. Whilst this did not contribute to the incident, it is nevertheless of significant concern. Such amendments will inherently either make operation more safe or less safe. If more safe, these amendments should be endorsed as policy and applied across all relevant units; if less safe, local procedures can represent an uncontrolled hazard. Either way, suggestions for such changes should be properly reported so that the impact can be fully assessed by an appropriate SQEP panel and endorsed accordingly. The aim of considering hazards by a SQEP panel, as opposed to by an individual, is to ensure all implications of such hazards are considered. Are any of your SOPs pen-amended?

TYPE 23 STRAINER BOX FLOOD

A Type 23 frigate experienced a flood during a main machinery space strainer box clean. The ETs conducting the task correctly checked the hull valve was closed in the local position and left one butterfly clip on the strainer lid to allow the residual pressure to disperse. Unfortunately the internal mechanism of the hull valve failed and the hinge pin of the strainer box lid was missing, rendering both precautions useless. The resultant flood required concerted effort from the Duty Watch to control – an effort which is, in itself, worthy of praise. The presence of two relatively minor defects in the system, although individually hard to spot, led to a potentially very significant incident. The SOP for this activity, which is by nature high hazard, had been generated locally and did not, with the wisdom of hindsight, properly mitigate against the hazard (this is being actively addressed). Although this incident has prompted a review of strainer cleaning procedures, it also prompts the wider question of what other hazardous activity has yet to be appropriately controlled. In attempting to move from a blame culture to a just culture we, as the engineering community, have the opportunity to try and address some of these issues before they lead to an accident. This is easy to say and hard to do but if you recognize the next strainer box issue in your ship – hazardous activity not properly controlled by SOP – you should raise the issue by Safety S2022 or other means.

INJURED YO

During a set of Machinery Breakdown Drills, a Young Officer (YO) witnessing the drills leant on the top of a filter pack 'for balance'. In doing so he inadvertently released the securing mechanism of the filter pack lid (which was not properly padlocked shut), and the steel lid, forced open under residual pressure, hit him in the chest. The YO had not attended the pre-drills safety brief nor had he completed his ship's induction or undergone any machinery space familiarisation. Machinery Spaces are dangerous places and personnel who are not familiar with them must be properly briefed and supervised; supervision cannot be done properly if concurrent with another task. Who is going into compartments that you control – are they safe to do so? Again a number of standard procedures had been by-passed, the individual had not conducted the mandated ship safety training; more fundamentally this reinforces the requirement to conduct the full range of safety induction and to do so to a high standard – what is happening on your ship?

SW FLOOD DURING MAINTENANCE

A ship identified a defect on an HPSW pressure transducer which required the removal of an associated section of small bore pipe. Unfortunately the section of pipework in question had not been isolated correctly and the subsequent flood when the union of the small bore pipe was undone required Duty Watch action to control. Although a relatively minor incident it is indicative of how easily correct procedures can be left undone (and the same mistake made elsewhere could have been much more serious). The supervising Petty Officer had stated to the LET conducting the task that isolations would be required but had not been explicit about the use of Tag Out. The LET then failed to inform the SCC or conduct a Tag Out. The use of safe systems of work cannot be left to chance and the appropriate system must be used unless there are overriding extenuating circumstances and deviation from the safe system of work has been properly authorised. Responsible individuals throughout the full chain of command must make it their business to know that safe systems of work are being followed – the essence of JSP 430.

INADVERTENT OPERATION OF MAIN MACHINERY SPACE MULSISPRAY

Over the last few months there have been several reported instances of inadvertent operations of Mulsispray systems into main machinery spaces. Although these incidents have not caused a casualty, they have caused significant damage, loss of equipment availability and represent an error set that has the potential to cause injury in other circumstances. In the most recent case, an ET(ME) operated the wrong valve whilst conducting 'de-isolation' of the space following a fire exercise. He was experienced, had the correct de-isolation 'card' (ie SOP), had been properly briefed and was not excessively fatigued. Understanding this type of 'failure to follow SOP' can be difficult; a guide to Human Factors will be issued shortly which is intended to be the first stage in developing Naval Service thinking in this area and will support better understanding and hence prevention of this type of accident.

DAMAGED HANGAR DOOR.

A hangar door on a Type 23 was damaged when it was operated by the duty ET(WE) with the wind post in the incorrect position. On closing the door the ET, who was not familiar with the operation of the door, heard a loud noise from the port side, whilst the starboard side of the door was a metre lower – the result was a great deal of damage to the door. Clearly, before any equipment is operated it must be checked to ensure that it is in a standby state and 'safe to operate'; this requires an understanding of the equipment involved. Operating procedures are only effective if those conducting the task understand and follow them. In some cases there may be ambiguity about who is SQEP to conduct such tasks – it is the responsibility of all those involved in hazard management, at sea and ashore, to eliminate this ambiguity.

FINAL THOUGHT

Unless an SOP has been properly endorsed it may not be fit for purpose – question the status quo – if a procedure hasn't been written down or is only written down locally, ask yourself whether it is fit for purpose. It is easy to identify where SOPs have been ineffective in hindsight but much harder in advance, hence the requirement for all involved in conducting and supporting equipment operation to be involved. SOPs are there for your safety, as part of a range of risk control measures that mitigate risks to ALARP – ensure they are fit for purpose and use them.

LESSONS IDENTIFIED FROM THE SM DOMAIN

The following events have been reported through the Submarine Safety Feedback Report (SSFR) mechanism over the last term. The reports identify key lessons that can be transferred across all domains.

A T-CLASS SUBMARINE (SM) CONDUCTING COIX

The SM was on COIX and conducting FOST(SM) assisted training. The Sea State was moderate, the SM was in the Half Power State and the 'Safeguard Rule' was in force.

A Main Precipitator Wash had taken place nine hours before the event, after which the Precip' Drain Tank had not been blown due to other conflicting evolutions.

The SM was established at PD with the intention of Ventilating VS-Yellow for training as part of the COIX. The order was given to drain the Snort Induction System. An experienced Forward Staff Watchkeeper conducted the evolution and reported "Full Bore" in both the Vent Line and Drain Line tundishes.

After four minutes and with a full bore of water in both tundishes still being reported, the SCOOW ordered a ‘Stop Snorting Drill.’ Concurrently a member of the Ship’s Company saw water issuing from around the shut door of the Garbage Ejector Space. He promptly raised the alarm and the Manual Flood Alarm was initiated from the 2-to-3 Deck ladder.

This alarm was received before the ‘Stop Snorting Drill’ had begun and so the Ship Control Team conducted an Emergency Surface. The Full Ahead order was passed to Manoeuvring and the Battleshort Switch made.

Once established on the surface, the source of water issuing from the Garbage Ejector Space was found to be coming out of the compartment’s scupper drain, caused by the overfilling of the Precip’ Drain Tank from the Snort Induction System.

Although the Precip’ Tank had not been Blown Prior to Snorting, the cause of this event was due to SW ingress to the Precip’ Tank via the Snort Induction System. The cause of this remains unknown though it is speculated that the Snort Head Float may have been temporarily obstructed in its free travel.

The emergency surface was conducted in response to the Manual Flood Alarm and the actions taken by SCOOW were correct. However the volume of water and rate of ingress were not significant and need not have been identified as a flood.

The event may have been avoided if the indications (full bore in the Vent Line tundish) and its subsequent report had been correctly understood and acted on by the Control Room Team.

Clear reports. Positive communication and correct, prompt actions – any abnormal indications on any system must be actioned and reported appropriately – in this case, positive reporting (report and acknowledgement) and action within the CR team for an excessive SOP drain time may have averted the situation. If SOP Precautions & Limitations or normal system dynamics are being exceeded, in this case a drain time of two and a half minutes, then this must be questioned and acted upon.

Standard submarine routines. If these are not conducted to restore system datum conditions, this will inevitably reduce the margins for error on subsequent routines & system operations, and will be compounded by defects. Whenever presented with this situation, mitigate by fully considering foreseeable, downstream actions, routines, failures and their potential impact, eg I have a high tank level: what will potentially cause an overflow, how/when will this become an issue, how do I control/mitigate this unwanted event?

Assessment. A correct, dynamic assessment, particularly in potentially emergency situations, is fundamental to ensuring the correct and appropriate response. Fundamentally, situations requiring possible EOP action for a ‘Flood’ require such an assessment based on the following principles:

- Is the water coming from an internal source/direct from sea (ie breach of seawater system)?
- Is the volume of water significant?
- Is the rate of water flow significant?

AN ASTUTE CLASS SSN CONDUCTING A DIVED TRANSIT TO THE GULF OF MEXICO

The submarine was conducting a routine depth change from Safe Depth to continue passage in accordance with the Safe Manoeuvring Envelope (SME) when she experienced a flood in the Main Machinery Space (MMS) on the stbd circ water pump.

Following a PD run the submarine went deep, caught a slow speed trim and made preparations to continue the dived transit. In order to increase speed, and remain within the SME, there was a requirement to increase depth further.

As the submarine was descending, a Full Main Broadcast pipe was made by the Manoeuvring Room Supervisor (MRS) bringing the submarine to emergency stations for a flood in the MMS. EOP actions were conducted by the SCOOW and EOOW, which resulted in a Full Ahead telegraph order and the Battleshort Switch being made. MBTs were blown in Normal and Emergency and the submarine surfaced safely. However during the course of the incident both Main Engines and both TGs tripped on loss of vacuum. Follow-up actions isolated the leak to the Stbd Circ Water Pump and restored propulsion and electrical systems to the submarine.

This event highlighted a number of specific issues in the conduct of, and plant response to, the Flood EOP.

- **Identification of the Flood**. As the MMS watchkeeper was investigating a slow ingress of seawater on the circ water system, he witnessed a plug bolt on the Starboard Circ Pump fail. He then incorrectly reported the incident as a flood on the Port Circ Water system over internal communications. This resulted in the incorrect side being repeated over Main Broadcast by the EOOW. Although not critical in this incident, mis-identification of the flood site may have proved pivotal in subsequent EOP actions in other circumstances.

- **Impact on Propulsion of Shutting Circ Hull Valves**. Shaft revolutions were increased immediately after the initial receipt of the Full Ahead. At two to five seconds after the circ hull valves were shut by the SCCO, both main engines tripped in quick succession on low vacuum (-0.34 bar falling). The RPO, who was focused on achieving the maximum shaft rpm, had not had sufficient time to put in place the MS201/202 low vacuum overrides (consistent with the Full Ahead order). Furthermore, vacuum fell sufficiently to trip both TGs on low vacuum (-0.2 bar falling), resulting in a loss of both non-essential busbars. In this incident, all main propulsion and both TGs were lost well within this timeframe and before the submarine was safe on the surface.

- **Hydraulics – NE7**. Following the loss of both non-essential busbars, the SCOOW identified that both the rudder and Stbd After planes had lost hydraulic supplies. The SCOOW forced all control surfaces onto the external hydraulic system to restore instant control before instructing the SCCO to put the HS&D DC pump to Line control. This enabled the control surfaces to be returned to the NSGLU and restore full submarine control. Although adequate control of the afterplanes, supported by the accumulator back-up, was maintained, the failure of the DC pump to adequately manage the hydraulic demand in this circumstance is of concern. An intended modification to the HS&D plant to put a changeover switch of the AC pump supplies (from NE7 (normal) and NE8 (alternative)) would not have benefited in this case since both non-essential busbars were lost.

- **Internal Communication System** (ICS). During this incident, Aft Broadcast from manoeuvring was lost on two separate occasions. This resulted in difficulty in communicating with the space watchkeepers and directly slowed the accurate report of the leak site to the starboard circ system. In both cases, Main Broadcast was checked clear from both ship control and DCHQ (Main automatically ‘locks out’ Aft Broadcast once the key is made and has to be manually cancelled before Aft Broadcast can be cleared and re-selected). Overall the ICS did not support the actions of the watchkeepers well. A S2022 has been raised to detail the specific shortcomings.

- **Bulkheads**. The Flooding Accident Dived EOP calls for bulkhead doors to be shut on immediate receipt of the alarm, coupled with considerations for operating compartment blows. Excluding the RC bulkheads, the two remaining bulkheads in ASTUTE Class submarines are Damage Control Bulkheads (ie not designed as pressure/ watertight). The shutting of 26 and 88 DCB doors prevents the movement of personnel and slows the response to the emergency down. The benefit in shutting the doors to allow the use of compartment (self salvage) blows may be questionable, since the blows are only designed to be “… applied when the vessel is approaching the surface or is on the surface.” 26 and 88 DCBs are designed to withstand 2 bar differential pressure only. On balance, therefore, the risk associated with leaving the bulkhead doors open during the initial stages of a flooding incident may be outweighed by the benefit of getting personnel to investigate support the initial actions at the scene.

Recommendations raised in the SSFR submission are under consideration by the relevant Authorities. The following are offered as generic key lessons:

- **Operating in a confused, dynamic situation**. Accurate reporting of system failures is essential to ensure subsequent, correct actions. It is inevitable that communications will be complicated in noisy and stressful situations, but this is when the consequences of failing to correctly identify and report failures are likely to be more severe. Acting promptly and correctly ‘first time’ is aided by calmness and clarity.

- **System and equipment dynamics and limitations**. Watchkeepers must remain aware of dynamic effects when the system status is changed, particularly when submarine safety relies on the capability provided by that system. When system/equipment trip overrides are selected, operator vigilance and corrective actions are essential to ensure design limits are not breached. The ability to recover from a flood is dependent on propulsion availability, which is clearly impacted when Main Circulating Water System hull valves are shut and vacuum starts to collapse; retaining vacuum to maintain main engine propulsion is key.

- The number of occasions that submarines surface in emergency (for flood EOP 13) is being reviewed and the conclusions of this study will be reported in due course.

- The importance of timely reporting of unusual plant dynamic behaviour to the Platform Duty Holder. TA advice should be sought if necessary to fully investigate and establish the root cause of all events.

- The importance of recognising the distinction between nuclear event reports and ISIs, together with the need for investigating and reporting wider issues. It is important to learn all lessons from all events, take an overall view and not just focus on mandatory reporting aspects.

AN SSN ALONGSIDE AT HMNB DEVONPORT

The submarine had just completed Day 3 of a FOST Fast Cruise where problems had been experienced in raising the periscopes. In order to de-conflict with the FOST programme, the defect investigation was delayed until the end of the training day and conducted by two experienced CPOETs. Collectively, they decided to initiate defect prosecution by proving the operation of all masts and periscopes first.

At approximately 1815Z, permission was obtained from the OOD to cycle the Search and Attack periscopes and raise the Snort Induction and Diesel Exhaust masts. The OOD granted permission, briefing that the ‘normal safety precautions’ were to be in place before any mast movements. Knowing that CPOET 1 was a fully qualified CPOOD, the OOD was content that this was a sufficient brief for the task to be undertaken safely.

Prior to entering the fin, CPOET 1 believed that he had checked that EHS 629 (shutter supply hydraulic isolation to ESM and Radar Masts) was shut. However, this was not the case and neither the experienced CPOET 2 nor Lower Deck Trot (LDT) had checked the position of EHS 629 beforehand.

CPOET 1 then proceeded to the Bridge in order to observe the operation of the Search and Attack periscope shutters (which cycled successfully). He then left the Bridge and proceeded into the Radar Mast Well (RMW) before attempting to remove the RMW shutter strongback (a physical barrier that stops the shutter from closing). Hydraulic interlocks associated with the Radar and ESIX masts prevent the shutter from closing when either mast is raised but on this occasion, both masts were lowered (resulting in hydraulic pressure still being applied to the shutter that was now only held open by the strongback). Finding the strongback wing-nut too stiff to loosen by hand, CPOET 1 returned to the Control Room for a spanner before proceeding back to the RMW. Using the spanner, he released the wing nut, but could not remove the securing bolt. He then freed the strongback by hitting it which then allowed the RMW shutters to move under hydraulic pressure. This then caused an injury when the shutters closed against the head of CPOET 1.

At this point, loud screaming from the RMW was heard in the Control Room and on the jetty/casing. CPOET 2 (located in the Control Room) was mindful of operating the shutters without first ascertaining the position of CPOET 1 and went into the fin to check it was safe to open them. Observing CPOET 1’s head trapped in the shutters, CPOET 2 made his way back to the Control Room shouting for the shutters to be opened.

The LDT opened the RMW shutter by local operation of the hydel, ensuring that EHS 629 was open prior to pressing the hydel. Opening the shutters released CPOET 1, who then moved unassisted into the fin. It is assessed that his head was trapped in the shutters for approximately one minute.

CPOET 1 was an experienced CPOOD / CPOET(WESM) and also a qualified Risk Assessor. As such, he was a Suitably Qualified and Experienced Person and should have been fully conversant with safe operation of masts, periscopes, shutters and the hazards and safety precautions associated with working in the RMW. He requested the OOD’s permission to operate masts but did not state his intention to enter the RMW and remove the strongback. The mandated precautions were not taken prior to entering the RMW and EHS 629 was not tagged shut. Although detailed in more than one publication, the laid-down control measures for working in the RMW are adequate but were not followed in this instance which directly contributed to the accident.

Immediately following the incident, the external hydraulic plant pressure was 180 bar. Hydraulic oil to the shut side of the RMW shutters passes through a variable restrictor which reduces flow and allows the shutters to close in a smooth controlled manner. If this restrictor was not fitted, it is highly possible that the injuries sustained could have been fatal.

This event was entirely avoidable and could have easily resulted in a death. The injured person did not follow the formal safety procedures and this was the primary cause of the incident. However, there were others who should have realised that unsafe practices were taking place but did not interject. Although the OOD was not aware that a RMW entry was about to take place, the order to follow ‘normal safety precautions’ for mast operations is essentially meaningless. Whenever safety precautions are required, it is important that they are stated explicitly and monitored thereafter.

AN SSN AT SEA EXPERIENCED A LOSS OF CONTROL OF THE AFTERPLANES

The submarine was dived, conducting high speed planesman training with the boat in level trim and at approximately 17 knots. The foreplanes were centred, the afterplanes were in automatic control, and the rudder was in hand control.

The Officer of the Watch (OOW) ordered the planesman to take the submarine deep using a 1° bow down angle. The planesman took the afterplanes into hand control and used a 6° dive plane angle to achieve 1° bow down. As the bow down angle began to exceed 1°, the planesman put rise onto the afterplanes to correct the pitch angle. The afterplanes misaligned and then dropped into position control hydraulic. On attempting a misalignment drill, the afterplanes remained at 6° to dive. The pitch angle of the submarine continued to increase. As the auto pilot was still set to a previously-used depth, the Ship Control Officer of the Watch (SCOOW) put depth back into automatic control in an attempt to regain control of the submarine. This had no effect and the afterplanes remained at 6° to dive.

The SCOOW initiated the EOP action for the afterplanes jammed to dive, and the OOW ordered full astern. The trainee planesman experienced difficulty selecting air emergency, at which point his qualified supervisor completed the correct actions.
Due to the delay, the Commanding Officer (CO) took the submarine and ordered Starboard 30 and a two second blow into No 1 Main Ballast Tank (MBT). The submarine levelled out approximately 20 seconds after the initial failure. The afterplanes were centred using air emergency

and the submarine returned to safe depth using the foreplanes. The afterplanes were then realigned and tested correct in both electric and hydraulic control.

The submarine returned to her previous depth in order to maintain Speed of Advance, and depth control was returned to automatic. To aid fault diagnosis, the decision was made to return to safe depth for further testing. With fully qualified and briefed watchkeepers in all positions, the afterplanes were taken into hand control and the planesman put rise on the planes in order to achieve a 1° bow up pitch angle. Once again the afterplanes misaligned and then dropped into position control hydraulic. The correct EOP was initiated for the afterplanes jammed to dive. The OOW ordered “50 revolutions half astern” and the SCC operator to put a one second blow into No 1 MBT. The planesman selected air emergency and centred the afterplanes. The CO again took the submarine and ordered “Starboard 30” in order to further reduce the pitch. The maximum bow down angle achieved was 7°, and the submarine regained a level trim approximately 15 seconds after the misalignment. The submarine was returned to safe depth and again the afterplanes were tested in all modes of control and functioned correctly.

A careful search of Technical Documentation revealed that the symptoms could be caused by an overcharged hydraulic accumulator in the OMC hydraulic system.

During the transit, sea water temperature had risen from around 12°C near the UK to a high of 22°C as the submarine neared the Equator. As a result, the temperature in the Main Machinery Space had risen considerably, causing thermal expansion of the Houghtosafe oil and, with the relatively small bore of pipework in the Engine Room, caused a significant rise in accumulator level. The significance of this was not understood at the time.

Changes in Main Machinery Space temperature can greatly affect the level in the afterplanes accumulator. Accumulator levels should be carefully monitored and drained as required to ensure that they remain below the maximum level.

Continuous reviewing of on board procedures and documentation is part of ensuring that submarines continue to be operated safely. As a result of this incident the boat ensured that OMC accumulator levels are checked hourly by the SCC Operator and recorded on the Control Room Log Board allowing trends to be monitored and corrective action to be taken before failure, and an amendment the Control Room Log Board was proposed.

The first incident highlights the need for continuous and careful supervision of trainees by qualified watchkeepers. The qualified planesman was able to select air emergency when his trainee was struggling.

Modes of failure will not always have been observed by personnel onboard but this doesn’t mean that they won’t happen. It is therefore just as important to understand engineering basics and principles as it is system knowledge and EOPs; it is the combination of these that will allow for rapid diagnosis and rectification of problems at sea.

LESSONS IDENTIFIED FROM THE FAA

The following events have been reported recently in the Fleet Air Arm Briefscan system. The reports identify key lessons that can be transferred across all domains.

ACCIDENTAL DAMAGE TO RADAR TRANSMITTER SET

Whilst refitting overhead soundproofing an AET lost his balance and his foot impacted the Radar Transmitter set. The Transmitter set was inspected and found to be leaking Nitrogen which was beyond unit repair and placed unserviceable.

Human Factors (Maintenance)

Layout of equipment in the cabin forced the AET to work in a constrained position, from where he overbalanced. Fortunately this avoidable incident did not impact the operational tempo. Have you found yourself working in confined areas where an incident like this could happen? Did you highlight the problem to your supervisor? If not then you should have.

BRAKE MASTER CYLINDERS OVERFILLED DURING SERVICING

After taxiing for approximately 200m, the brakes of the aircraft seized causing the aircraft to nose forward severely. A strong acrid smell from the brakes was noticeable directly after the incident. Checks were then carried out on the system and the brakes remained in the locked position. There was a noticeable lack of pressure in the system which did not allow the parking brake to be applied. The aircraft was hover-taxied to dispersal and shut down.

Human Factors (Maintenance)

Port and starboard brake master cylinders were inspected and the fluid level was found to be overfilled: the system was drained to the correct level. The overfilling of the master cylinders had occurred as a result of non-adherence to a well-documented technical process. Do you follow the documented technical process? If not WHY NOT? If you feel the process is wrong, report it to your supervisor.

WOULD THIS HAPPEN IN YOUR SHIP? Problems with the shore cable in the photos on Page 43

The phase tape on the cable lugs was hiding corrosion and heat damage. The lugs are also in a poor condition through frequent use. The cable lugs became detached when the cables were being connected to a shore generator. Had these been inspected regularly and protected when not in use, this incident may not have happened.

DO NOT ASSUME THAT ELECTRICAL EQUIPMENT IS SAFE – TEST IT