SEA POWER 2014

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LHD and AWD updates
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ADM Exclusive
FROM THE SOURCE
MBDA Australia Managing Director
Andy Watson speaks to ADM
Daring and Perth: ops rooms and upgrades

Both HMS Daring and HMAS Perth were on hand for the International Fleet Review last year in Sydney to help celebrate the 100 years of the Royal Australian Navy. I was lucky enough to sail from Jervis Bay into the Sydney heads on Daring and spend some quality time on Perth during her IFR stay.

There are more than a few differences between Daring and Perth. Both ships boast phased array radars and new concepts when it comes to the design of their operations rooms and both are fantastic ships in their respective roles. This article seeks to understand the importance of cutting edge technology when it comes to the design and layout of operations rooms (ops room), combat management systems and weapons employed on each.

HMAS Perth (III) was the eighth and final Anzac Class frigate (FFH) to be built by Tenix for the Royal Australian Navy (RAN) based on the German Meko class design. Two other ships of the class were also commissioned into the Royal New Zealand Navy (RNZN); Te Kaha and Te Mana. The first of class, HMAS Anzac, was commissioned in May 1996.

The first steel for Perth was cut in August 2000 and the keel was laid in July 2003. Perth was launched on 20 March 2004. She was commissioned into the Royal Australian Navy In August 2006. At the 3,700-tonne mark, the frigate is able to operate one naval helicopter (currently a S-70B-2 Seahawk which will be replaced by the MH-60R 'Romeos' once they enter service – see P34 for more on Romeos). While Perth was being built, plans for the Anti-Ship Missile Defence (ASMD) upgrade project, under Sea 1448 Phase 2, were already being scoped, having been identified in the 2000 White Paper and approved in 2003.

ASMD compromises an upgraded Combat Management System (CMS), new Infra Red Search and Track (IRST) and Navigational Radar System, together with a state of the art, locally developed Phased Array Radar (PAR). This suite of technologies was adopted for the technical solution to provide the required levels of protection against the threats that have appeared since the Anzac class was specified in the mid-80's. The project was defined as potentially high risk by its many stakeholders (BAE Systems, Saab Systems, CEA Technology – the plus the defence interests of the RAN, DMO and program office) due to its complex technical nature.
PAR solution – a ‘new to world’ capability. In fact, overall the ASMD project represents a good risk management approach to common maritime integration problems. The risk management model employed by the team (government, DMO, Saab, BAE, CEA) ensured that risk was managed at appropriate milestones before proceeding.

At this time, and given all the work that was being done in and around the system affected by ASMD, the RAN also took the opportunity to update the ops room. This was a separate project with a separate funding stream which was integrated into the ASMD development and upgrade process.

Saab’s John Hind, the Combat Systems Integration Lead Engineer for the program, who has been involved with the ANZAC class for the past two decades, outlined the specs for ADM.

“The pre-ASMD Anzac class had already been upgraded to the Evolved Seasparrow missile during the build program,” Hind explained. “The initial two RAN ships – Anzac and Arunta, and the RNZN equivalent, the Te Kaha and Te Mana, were fitted with NATO Seasparrow missile. Then from Warramunga through all stakeholders to ensure all concerns were addressed through to the acceptance of the lead ship, Perth, including both the Stage 1 and Stage 2 capability.

The development and integration utilised a two-stage approach. Stage 1 delivering the major platform modifications coupled with basic missile control functionality, a capability which was delivered at IOR in June 2011. The stage 2 capability consisted of a software upgrade only for the CMS and PAR, delivering enhanced missile control capability, with successful OTRE completed at PMRF in August 2013, and Operational Release anticipated for March 2014.

Following the success of the demonstrated Stage 1 capability on the lead ship, and the government approving a real cost increase to modify the remaining seven ships, a secondary DMO project team was established to operate out of the Henderson shipyard in Western Australia to manage the physical upgrades to the remaining seven ships.

But back to what ASMD has made Perth into. According to Hind, she now 'looks pretty slick' after all her work.

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After initial systems engineering design reviews in 2007, it was determined that based on the capability and extensive systems and platform modifications required it would be difficult to proceed with an eight ship program. As a direct result, the project was modified to a single ship installation that would need to prove the capability at sea before consideration was given by Government to install the remaining seven ships within the Class.

Government agreed to the (1+7) acquisition strategy in July 2009 and the project was placed on the DMO's Projects of Concern (POC) list so it could be closely monitored given its assessed high level of technical risk associated with the development of the

to Perth, and retrofitted onto Anzac and Arunta, Evolved Seasparrow missile was integrated, along with the CEA Technologies solid state CWI Illuminator. That also took the ships' surface-to-air missile load from eight missiles to 32 using the ESSM quad-pack capability.

“The evolution from then until the start of ASMD was individual system changes originally out of the Underwater & Surface Warfighting Upgrade (USWUP) program. That included the addition of the Harpoon missile and mine obstacle avoidance sonar, as well as the Australian-developed Nulka decoy system, the last of which significantly improves the air defence capability of the class. That effectively was the Anzac class at the time of the introduction of the ASMD program.”

While the class was not without teeth, ASMD provided an excellent opportunity to retrofit Perth, and then based on the success of the program, upgraded the rest of the fleet. Under the revised acquisition strategy, thanks to the POC framework, a dedicated Project Authority was set up in Canberra. This dealt directly with all

“ASMD removed the target indication short to medium range radar, replacing it with the CEAFAR phased array radar and the addition of the CEAMOUNT Illuminator.

“Perth now has multiple channels of fire, full 360 degree coverage, simultaneous channels of fire, with CEAMOUNT also overlaid with the original fire control director which continues to be used for ESSM and gun air and surface engagement.

“The other aspect of ASMD was a full CMS refresh – modernisation from the early '90s technology and display systems through to current generation COTS processors and equipment. Most of the software is common between the 9LV-Mk3 and the MK3E generations.

“One analogy is that we've lifted the house up, replaced the foundation, put the house back down again, so it runs faster and cleaner and tidier, an activity that could be done effectively and efficiently due to the architecture of 9LV already supporting multiple hardware and operating system environments. There are also significant software upgrades in the CMS to integrate the new CEA PAR and phased
array illuminator, and to optimally employ the new ESSM modes providing the teeth of the ASMD upgrade.

"In parallel with that was a Datalinks program under JP2089," Hind said. "Legacy Anzacs had Link 11 only. The Multi-Link program integrates a Datalink processor from Northrop Grumman providing Link 11, Link 16, and Variable Message Format (VMF), along with the Joint Range Extension A, B and C over satellite infrastructure."

In terms of the layout of the ops room, Navy took the chance to redesign the space, primarily where certain operators were sitting but also assessing the other ops room functions and how they are conducted. There were cost constraints in terms of some consoles being moved (ie the ESM and sonar consoles had to remain in specific positions given cabling constraints on the ship) but there were some primary goals such as locating the warfare officers closer to the commanding officer. A lot of the initial design work was out of the RAN's Anzac user group and then out of DSTO.

"DSTO talked to the users, finding out for each of the missions that an Anzac does, who has to work with who," Hind said to ADM. "So when and how does the PWO need to talk to the air picture supervisor? What about the ASSC talking to the sonar operator? And so they broke it down into each of the missions such as naval gunnery, ASW, air warfare, and did a set of network diagrams of each operator role and who they have to work with - a process supported by CMS which allows any operator to use any function at any console at any time. From that they iterated a few layouts and also generated a digital virtual operations room so you could walk around inside this new ops room."

The ops room now is a place of relative light and space compared to the previous effort. Each of the 10 consoles has a display larger than the previous double screens and there are no overhead compartments to impede line of sight between the various operators. Despite having various comms links over headsets, having direct line-of-sight between personnel or speaking directly to another operator are still important in modern naval warfare. There are large multifunction displays on the walls to provide ancillary system information to the operations team and less equipment in the space overall. If anything, Hind believes the efficiency of the operations room could have been improved further by reconfiguring more equipment but cost driven constraints (effectively, it's cheaper to leave it where it is) were an ongoing concern. These improvements may be able to be introduced on the back of planned upgrades that remove the legacy system constraints such as introduction of the 3701 ESM system into Anzacs.

"The new ops room is a significant part of the ASMD upgrade," Captain Lee Goddard, Perth's captain told ADM. "It's significantly different from the classic Anzac. The original Anzac class operations room was efficient but didn't maximise the full capabilities of the sensor inputs. The information now displayed and available to command through a layout which was designed as a result of significant industry input and detailed DSTO analysis far better meets the requirements to actually fight the warship based on all this sensor information."

"Compared to when I was in command of HMAS Parramatta a few years ago I now have an exponential appreciation of the tactical situation and my kinetic and non-kinetic options in terms of responding to that tactical situation."

Perhaps the most telling comment came from an NCO aboard Perth during the IFR.

"I worked on the Anzacs in the 90s and couldn't wait to get off them. Now I want to stay on Perth till I leave the Navy."

ADM has covered the benefits of the CEA Technologies contribution to ASMD with CEAPAR/CEAMOUNT in detail in past editions and on P28. Head to www.australiandefence.com.au and check out the archives to refresh your memories of this excellent Australian developed and made capability.

From trial to combat

HMAS Perth has moved in from her trial days in regard to ASMD to a fully functional combat footing.

"I've seen where these warships have come from a Tier 2 concept in the 1990s to an extremely capable warship in 2014," CAPT Goddard said, "We've just completed"
missile threats,” CAPT Goddard explained. “This gave me confidence and just as importantly, it gave me team confidence. At the Pacific Missile Range Facility in Hawaii (the PMRF as utilised for the RIMPAC exercises), some of my young sailors were very positively surprised about the performance of the system. And I know the buzz has gone around the Fleet about that confidence, that the upgraded Anzac’s can defend themselves and others in the task group very effectively.”

At the time of writing, Perth was in a maintenance period but should be out of such arrangements by the time this edition of ADM lands on your desk. Throughout the 2013 experience of Perth, perhaps the most interesting element to note was that even her Captain admitted “we [RAN] have a natural inclination, for peacetime safety reasons more than anything, to try and manually manipulate the system or put limitations on it. What we need to do is allow this very automated and proven system do what it’s been designed for”. This was brought home when dealing with a supersonic threat where you don’t have time for manual input.

There is little doubt that the work done on the Anzac class under ASMD will feed into the future Frigate program under Sea 5000 when the time comes. As to what shape this takes, Capability Development Group is working the details.

A Daring time

Another operations room success story can be found on the Royal Navy’s Type 45 Daring class ships. First of class, HMS Daring visited Australia for the International Fleet Review (IFR) as part of her nine-month world trip. At around the 8,500 tonne mark and coming in 152 metres long, she is about the same size as Australia’s Hobart class AWDs currently under construction.

Commissioned in 2009, Daring was an experiment in many ways. Just over 80 per cent of the technology that went to sea was new and/or developmental, including the Sampson PAR as part of the wider Sea Viper air defence system. A core component of the Type 45’s Sea Viper air-defence system is the Aster missile, composing of the Aster 15 and Aster 30, with the Aster 15 with a range out to 30 kilometres and the Aster 30 with a range out to 120 kilometres. Presently the Daring-class destroyers are equipped with a 48-cell A50 Sylver Vertical Launching System allowing for a mix of up to 48 Aster 15 and 30 missiles.

The Sampson radar rotates at 30 revolutions per minute, meaning no part of the sky lacks coverage for more than one second on average - the precise time varies as the beams can also be swept back and forth electronically. In addition, the use of a smaller number of arrays allows the system to be much lighter, allowing placement of the arrays at the top of a prominent mast rather than on the side of the superstructure as in the US ships (both Arleigh Burke and Ticonderoga classes). Placing any radar emitter at higher altitude extends the horizon distance, improving performance against low level targets; Sampson is at approximately double the height above the waterline than the arrays of its US equivalents.

“We wanted our PAR at height to give us sea skimming capabilities so effectively the weight restriction was such that you ended up with two base phased arrays,” Commander Angus Essenhigh, Daring’s Captain explained. “Also the way the processes work, we almost simultaneously, because of the rotation rate of the aerial, are able to provide almost 360 degree coverage all the time. So effectively we don’t see any massive degradation based on not having a steering based array.

“The other thing is if one of your flat panel arrays which covers 90 degrees of your horizon was to have a defect, then you were going to be down to 200 degrees coverage, whereas because our spars, if one of the panels is down, you continue to spin in a standard fashion, just with a slower uptake rate which is still good enough for fire control solutions.”

The highly developmental Sampson system has its detractors (the ‘dunce cap’ design of the huge mast that dictated many other design elements of the ship was much maligned) but the wider system has proven its mettle according to operators. And Daring is in a unique position, her Captain CMDR Essenhigh, served two years on the Arleigh Burke class USS Winston Churchill and can directly compare the Aegis ship to what the Type 45s offer.

“Whilst it does a very similar sort of function, you would expect after 10 years of extra developments since the Aegis ships started coming into service, a generational leap in technology and the family of systems,” CMDR Essenhigh explained. “What we have in the Sampson Radar through to the Sylver Launcher and the Aster Munitions is a very, very capable system and one that the Royal Navy should be very rightly proud of at the moment because it is world-leading technology in their defence.”

And getting back to the operations room where all the technology comes together, this writer must admit that it felt more like the bridge of a Star Trek ship than a Navy vessel. Bank after bank of consoles, each with at least two screens if not three, the ops room has the same elements as Perth in terms of layout for ease of communications between positions. A noticeable difference is that the Daring ops room has two connected rooms where the intelligence/briefing team and communications specialists can operate in close contact to the wider ops room role. And despite only
being in service for five years, *Daring* will be going in for a maintenance period in March/April that will see the ops room upgraded even further as well as the addition of the Harpoon missile and associated measures. Most of the ops room upgrades relate to the further integration of secure communications channels into existing consoles where there are separate.

**From the operators**

During the voyage from Jervis Bay into the heads at Sydney for the IFR, Air Warfare Officers Lieutenant Jason Hannigan and Lieutenant Commander Teilo Elliot-Smith explained the differences between previous RN classes, their experiences throughout their careers and why the Type 45s are such a formidable asset to the RN.

The primary role of the Type 45 in any mission is that of air defence of the task group, which may contain a number of military and civilian high value assets, including the Type 45 itself. There was even some concern amongst the crew that when she was first rolled out the cost and ability of the ship would mean that she would not be put in harms way but this hasn’t proved to be the case, with deployments to the North Arabian Gulf and other hotspots.

Both AWOs were impressed with the layering of coverage that the multiple radars were able to produce for surveillance and fire control solutions. Between the Sampson multi function radar (MFR) and the S1850M long range radar (LRR), *Daring* has 360 degree coverage out to approximately 400 kilometres, according to her Weapons Engineer Officer Lieutenant Commander Marcel Rosenberg. Both radars also have plans for upgrades as technology progresses and being software driven they can be optimised for the very latest threats relatively quickly.

“It’s about loading, so the long-range radar is purely used for surveillance whereas the Samson MFR can do ‘stare’ at targets as well as conduct surveillance,” LCDR Elliot-Smith said. “So for those threats that are fast moving and requiring more regular updates ready for a missile engagement, the system will dedicate more look time on those targets.

“Ultimately we call it the MFR because it provides a surveillance capability, threat evaluation and weapon allocation, target acquisition, fire control and missile uplink for engagement...all simultaneously, with minimal degradation to any of those functions. This is the utility of MFR and its principally part of the Sea Viper weapons system and it’s there ultimately to cue those missiles,” LEUT Hannigan said. “It actually happens to be extremely good at air surveillance as well. That’s not why it’s there but it is a good correlation to the long range radar (LRR – the S1850M from Thales) and that’s where LRR is fundamentally about situational awareness. And all the radar feeds can be displayed on a single console, anywhere in the ops room.”

Just like the *Perth*, the level of automation of the weapons system is extremely high but again, there is always a human in the loop to satisfy Rules of Engagement. The system will come up with the entire fire control solution from target identification through to weapon choice and launch.

“Based on the kinematics of the object coming towards us and determining the PK (probability of kill) value, we could engage at a given range but the system will only fire when it has a sure shot,” explained LCDR Elliot-Smith. “It will wait so that PK is at an optimum point. Even though we’ve got long-range missiles, invariably the actual engagement will be much closer to securing the kill and preserve weapon stocks. The exact range will also take into account the disposition and location of the other ships we are there to protect.”

Both AWOs went to great pains to point out that the system, as well as when it’s doing threat evaluation on weapon allocation, it’s not just doing it with *HMS Daring* in mind but an entire task group. It will also not just track those contacts with a view to what threat they present to *Daring* but every other unit designated an asset in the radius.

“We know that if we get the task group within there, anything that is threatened will be defended equally with equal primacy by the system,” LEUT Hannigan said.

Note: The writer would like to thank Commander Essenhigh of HMS Daring and her most excellent crew. It was an honour and a pleasure to sail with you. Many thanks are also extended to Adam Thomas of UKTI and support staff at the British High Commission for their support.