ASMD LIVES UP TO ITS EXTRAORDINARY POTENTIAL

Some of the most potent weapon systems available today are anti-ship missiles. They are fast, relatively inexpensive and difficult to detect because of their small size. Many navies have tried to develop effective layers of protection, but even the most modern of these has remained vulnerable to simultaneous attacks from multiple supersonic sea skimming weapons. However, it looks as if the Royal Australian Navy is now in the process of implementing a solution – after a lengthy development phase – that has eluded many other countries.

OPERATIONAL ACCEPTANCE TRIAL

The Department of Defence issued an historic media release on August 30 that received little media attention, even though the content is remarkable:

The Royal Australian Navy (RAN) and the Defence Materiel Organisation (DMO) have recently completed the final Operational Acceptance Trial for the Australian-designed Phased Array Radar and Combat Management System upgrades to the ANZAC Class frigate Anti-Ship Missile Defence (ASMD) system.

The trial included a number of successful Evolved Sea Sparrow Missile (ESSM) firings from HMAS Perth at the Pacific Missile Range Facility (PMRF) in Hawaii. During the trials, the ASMD system was challenged by a number of demanding firing scenarios. These included successful missile engagements against multiple sea-skimming targets including, for the first time in the RAN, an engagement by an ESSM against one of the world’s most advanced supersonic targets.

Perth’s Commanding Officer, Captain Lee Goddard, said the firing clearly demonstrated the effectiveness of the upgraded ASMD system.

"The targets were detected by the Australian designed and built CEA Phased Array Radar and the missiles were successfully launched and controlled in flight by the ship’s ASMD systems, resulting in the destruction of the targets," Captain Goddard said.

"This proves the accuracy and precision of the upgraded systems to guide the weapon in a complex warfighting scenario."

Perth is the first of eight ANZAC Frigates to enter the ASMD upgrade to improve her weapons systems and sensor arrays.

The Chief of Navy, Vice Admiral Ray Griggs, said "The ASMD upgrade provides the ANZAC class with a significantly enhanced level of self and local area defence against modern anti-ship missiles. The complexity of the firing scenarios is unsurpassed in the RAN's history, particularly the successful firings against supersonic targets. The results from this activity are a ringing endorsement of the capability flowing from the ASMD program."

The RAN and DMO acknowledge that the success of the program has largely been due to the outstanding efforts and collaboration by Navy, the DMO, Canberra-based CEA Technologies, SAAB Systems and the Defence Science and Technology Organisation.

THE MISSILES

To gain a better understanding of the nature of the trials, one only has to look at the performance of the incoming missiles used against HMAS Perth. These were two supersonic GQM-163 Coyote targets built by the US company Orbital Sciences. Naturally,
realistic target missile has to replicate the performance of a genuine threat – and the Coyote definitely does that.

A Coyote travels at speeds of Mach 2.5 (around 900m/s) and as low as 16 feet (5 metres) and up to 50,000 feet (15,000 metres). It has a diameter of a mere 35 cm and a range of up to 110km.

The performance of the Coyote is similar to that of several leading edge supersonic anti-ship missiles such as Brahmos, SS-N-22 and a number of Chinese systems. To be able to detect, track and shoot down two of these with HMAS Perth’s RIM-116 Evolved Sea Sparrow Missiles (ESSM) is an extraordinary achievement. Given that the ESSM has a stated speed of greater than Mach 4, the closing velocity between it and a Coyote means that the entire engagement would have been very fast indeed.

As an aside, the Australian Government paid $7 million just for the two GQM-163s – let alone the cost of hiring the test range – so there was obviously a high level of confidence before the trial that the expense would be worth it.

THE ROLE OF CEA
From the perspective of the radar supplier, CEA Technologies, the trials have also been a great success. Speaking to APDR at the company’s Canberra headquarters, Deputy CEO Merv Davis confirmed that this final series of tests demonstrated the full capabilities of CEAFAIR and CEEAMOUNT. He explained:

“From our point of view, this is the second phase of the ASMD upgrade project – which is all about making sure that the ships can survive in a more demanding, high threat environment involving multiple targets. While our radar hardware has remained the same, we have been doing a lot of work on the software side of things.

“The entire sea trials process – which started in February 2011 - has seen a calculated increase in the threat scenarios. We started with a number of RAAF Hornets flying low and fast, working our way up with different challenges to finally these most recent trials off Hawaii with small supersonic targets – probably the first time that ESSMs have been used to counter this sort of threat.

“From our point of view the trials have shown that the system lives up to its promise and does everything that we said it would do. We have been able to show the versatility and expandability of the radar – so it seems to be a case of everyone being pleased with the results.

“The Hawaii trials mark the end of the formal ASMD missile testing phase, so it has been a key milestone for us.”

The RAN has invested heavily in proving that the ASMD solution works. The cost of using trial aircraft and missiles is considerable – as mentioned above – as is the expense of using various ranges. As a consequence, it can now be argued that the ANZACs will have a local area defence capability against missile attack, which will make them much safer platforms should they ever be deployed in a high threat environment.

CEA has completed the second and third ship sets. The second is being installed on HMAS Anzac, and work is underway on many other parts of the program. The company is also gearing up to provide support activities for the radars, which are already proving to be highly reliable and easy to maintain as well as operate.

The company is not standing still – on the contrary, it has hopes that because of the scalable nature of the technology they might be able to provide a solution for SEA 5000 Future Frigate, whenever that starts to take shape. Indeed, at the conclusion of the visit APDR was shown a test radar face made up of 8x8 tiles, compared with the 4x4 arrays that are being installed on the ANZACs.

Now that the technology can be considered mature, the company is also looking at ground-based applications and has submitted a bid for AIR 5431, which is RAAF’s future air traffic management (ATM) system. While the advantages of phased array radar have long been recognised for combat applications – and especially fourth generation products such as the digital CEAFAIR – other domains such as ATM continue to be based on traditional large, mechanically-rotated radars, CEA is hopeful that it can make inroads into this domain and it is interesting to speculate about the prospect of both the RAN and RAAF operating a leading edge Australian product. Certainly AIR 5431 will be an interesting test case.

CEA believes that as well as developing a high performance radar, they have been able to design something that is affordable. The company is therefore hopeful that they might be able to win new business in applications that were once considered beyond the scope of electronically scanned arrays because of perceptions about cost. It currently has an ongoing research project funded 50% internally - with the balance coming from the Government – to further migrate the technology to the ground domain. This also potentially opens up the way for a number of air defence applications.

CEA started work on phased array radar two decades ago – and all the early hopes for the technology now look as if they are being realised.

SAAB
Adelaide-based ANZAC Combat Management System supplier Saab and CEA have continued with design and development work to successfully deliver the final ASMD capability on HMAS PERTH.

The initial ASMD capability included the upgrade to the latest version of the Saab 9LV Combat Management System (CMS) to provide an integrated combat system that utilises the CEA active phased array radar system. It also included sensor upgrades for ASMD including a dual infra-red search and track sensor (IRST) to greatly enhance passive missile detection and improve self protection.

For the initial ASMD capability, the combination of the multi-face Continuous Wave Illumination (CWI) and inertial mid-course guidance gives the ship added channels of fire, with enhanced ESSM weapon system control in the CMS. The final capability now delivered under ASMD Stage 2 provides a world leading ASMD
capability utilising the ESSM X-Band Mid-Course Guidance mode which allows updated target data to be sent to the missile during flight, improving the reactions to target manoeuvres and the probability of kill, and further increasing the available channels of fire.

The controlling element of the combat system is the Saab 9LV Combat Management System. This has been stepwise improved over two decades of parallel projects, to provide Link-16, VMF and JREAP multi-link capability that provides extensive command and control, extended range and joint force interoperability. Harpoon Block II upgrades have also been integrated.

The upgrade to the remaining ANZACs is making good progress, and these will be provided with the enhanced capabilities now proven on HMAS PERTH.

Preparations are underway to integrate future capabilities into the ANZAC Frigates including the ESM Upgrade under SEA 1448 Ph 4A.

The 9LV CMS on HMAS PERTH is a fully proven and integrated combat system that utilises the full capabilities of the CEA active phased array radar system. The overall success of this project proves that Australian industry is capable of producing world class designs and implementing leading edge technologies into the ADF. Saab’s Australian-based combat systems design and integration capabilities ensured that the ASMD upgrade worked first time and its emphasis on engineering quality means that the combat system can reliably be added to new ships.

The ASMD project is therefore a natural baseline from which to further evolve the existing capabilities to develop a cost effective and high risk option for future programs such as SEA 6000 (Future Frigate).

BAE SYSTEMS

BAE Systems was awarded a $270 million contract in 2011 to upgrade the seven remaining Royal Australian Navy ANZAC class frigates, with the Anti-Ship Missile Defence (ASMD) capability already implemented on the first of class. The contract followed the successful upgrade of HMAS Perth which was completed on time and on budget. The follow-on contract is being executed through the ANZAC Ship Integrated Material Support Program Alliance comprising BAE Systems, Saab Systems and the Defence Materiel Organisation (DMO).

Director of Maritime for BAE Systems, Bill Saitzer said the scope of the project includes ship integration of the leading edge CEA Phased Array Radar (PAR), the Vampir NG Infrared Search & Track (IRST) system, the SharpEye Navigation Radar System (NRS), and an upgraded Saab Combat Management System (CMS) including an improved Operations Room layout. “The platform integration of these systems will require significant structural modifications including replacing the forward and aft masts on all ships,” he said.

Mr Saitzer said that an experienced and dedicated Project Team working at the facilities available at the company’s Henderson Shipyard in Western Australia enables BAE Systems to carry out this massive project to its completion in 2017.

“Our Henderson shipyard has the ability to dry berth two ANZAC Frigates simultaneously and this enables the first upgrade program to be accelerated with operational and cost benefits to the Commonwealth.”

Late last year, BAE Systems was awarded an additional $65 million contract for further upgrades that were needed on the ANZACs which will be implemented by the same project team during the same docking period, again reducing total cost to the Commonwealth as well as maximising ship availability. Included in these upgrades are:

- solid ballistic installation;
- enclosure of the quarter deck;
- installation of a new solid waste management system;
- incorporation of new high frequency broadband system;
- upgrade from Link 11 to ANZAC Multi-Link Upgrade Link 16 system;
- replacement of existing fire alarm system;
- replacement of exhaust gas turbine exhaust system and;
- installation of new gas bottle storage to coincide with enclosure of quarter deck.

The ASMD alliance team is now co-located at the BAE Henderson facility. Currently, there are two ships in production - HMAS ARUNTA with a contract handover due in June 2014 and HMAS ANZAC with a contract handover date in November 2014. HMAS WARRAMUNGA is due to dock in December 2013.

CONCLUSION

Given the scalable nature of the both the radar and combat system technologies, the ANZAC solution could be applied to smaller platforms and larger ones.

Watch this space.