

SEA 5000 COMBAT SYSTEM DETAILS EMERGING

For the future frigates, Defence has not only chosen the most modern hull design available, but is also investing in a highly capable combat system that is attempting a “best of breed” approach for all of the critical elements involved in fighting the ship and defending it. But while the key companies involved have been identified there is still some way to go in defining precise roles in domains such as anti-air warfare (AAW); anti-submarine warfare (ASW); anti-surface warfare (ASuW); and electronic warfare (EW).



CGI of 'Hunter' class frigate (BAE Systems image)

The overall structure of the combat system has been defined by the Government - and as the project advances much more fidelity is becoming available about what it will look like in practice. Once the contract is signed, BAE Systems will be the prime for delivering the 'Hunter' class frigates and will do this via what will be its wholly owned subsidiary, ASC Shipbuilding - which is currently owned by the Department of Finance. The reference design for the Australian ships is the Royal Navy's Type 26 frigates, the first of which is under construction in Scotland, though with some significant differences, especially in sensors and weapons.

Both BAE Systems and Defence are confident that the initial contract for the nine approximately 7,000 tonne frigates will be signed before the end of 2018 and negotiations appear to be going smoothly. The company is simultaneously working through a number of matters relating to the purchase of ASC Shipbuilding - which has two important contracts of its own that need to be transferred: completing the build of the Air Warfare Destroyers (AWD) and constructing the first two Offshore Patrol Vessels under SEA 1180.

Completing the final AWD is relatively straightforward: construction is almost done; the risks are understood; commercial outcomes are well defined; the process for the forthcoming contractor trials is well detailed and proven. SEA 1180 contract negotiations are trickier because this is a much newer project - though on timing Defence is very confident that construction of the first OPV will also start before the end of 2018.

The purchase of ASC Shipbuilding is inherently complex because of its Government ownership (the shares are actually owned by the Minister of Finance for any lawyers reading this) - while the customer (the Department of Defence) also has to agree to all of the new arrangements. Nevertheless, all parties indicate that progress has been positive.

As well as being the prime contractor for SEA 5000, BAE Systems will also be the overall combat system integrator (CSI) and to manage this complex undertaking has sought and received offers from three companies already heavily involved in advanced Australian naval electronic work: Lockheed Martin Australia; Raytheon Australia and Saab Systems Australia. It is possible that the prime contractor will be partnered with at least two of these entities – and possibly all three, given the size of the task. It is expected that a decision will be announced this year: perhaps at the same time as when the head contract is signed with the Commonwealth.

The principle above water sensor will be the enormously capable active digital phased array radar suite developed by Canberra-based CEA. APDR has outlined this world leading technology on several previous occasions, especially in the context of the ANZAC frigate anti-ship missile defence (ASMD) program, with the system able to detect, track and successfully engage multiple simultaneous supersonic threats. The mandated combat management system is 'Aegis'. The Saab 9LV product will be used to underpin the development of the Australian Interface (AI). Defence indicated at the Pacific Conference in October 2017 this breakdown and context. The AI is akin to the ATI (Australian Tactical Interface) on the AWD, where it provides integration of Combat System equipment which is not directly integrated within 'Aegis' – an interface for exchange of tactical data between the AI and 'Aegis' and a level of command and control for those elements integrated to the AI. The distinction is the level of capability to be delivered under the Hunter Class AI will expand on the capabilities delivered under the AWD ATI implementation, but designed in a way that makes it available to support utilisation as a fleet wide product.

Older generations of naval combat systems relied on separate fire control radars to guide defensive missiles – such as ESSM and the SM-1/ SM-2 and new SM-6 family – to intercept incoming threats and destroy them at a safe distance from the ship. By rapidly switching from target to target, systems such as 'Aegis', typically using two fire control radars, can defeat a number of incoming threats, but run into problems as the number and speed of incoming targets, including decoys, is increased – and the ship runs the risk of being overwhelmed by sheer force of numbers. This problem is further compounded because fire control radars have blind arcs – the size depends on where on the superstructure they are located – meaning that in many scenarios the ship also has to violently manoeuvre in specific directions to defend itself.

Anti-ship missiles are becoming faster, longer range, cheaper and smarter. They can be launched from aircraft, helicopters, other surface ships, submarines, increasingly from land based mobile systems – and potentially from UAVs. It is relatively easy to coordinate an attack so that numerous missiles fly at the ship from different directions and at very low levels to take advantage of the radar horizon, which is often less than 20km and only slightly more than the visual horizon. Supersonic sea-skimming missiles can cover this distance in a matter of seconds. Protecting the future frigates from these rapidly multiplying threats requires an extremely capable defensive system – particularly given that Australia's ships will often be operating alone and not in a massive USN armada with aircraft carriers and a screen of protective submarines.

The 'Hunter' class combat system will be designed to defend against these sorts of scenarios that might be considered extreme today but will become increasingly likely in the future. The central part of the AAW element of the combat system is the ability of the CEA radar suite to not only provide extremely rapid detection and tracking information, but for the combat management system to form numerous simultaneous defensive radar beams to guide outgoing missiles. The radar could also be used for a variety of electronic warfare (EW) functions, the most obvious of which is high powered jamming. The number of targets that could be engaged with these sorts of hard and soft kill functions is virtually limitless, though the ship can only carry a finite number of protective weapons. These could eventually be supplemented or replaced with directed energy systems – but that is a topic for another day.

The combination of CEA and Saab has been sufficient for the ANZAC frigates – impressively so – but the RAN has taken the view that there are advantages to adding Lockheed Martin and 'Aegis' to the combat system mix. There are numerous components to this, including that 'Aegis' has been fitted to the 'Hobart' class Air Warfare Destroyers and it has a proven record in being able to control not only medium range SM-2/SM-6 missiles but also the mighty SM-3 that can be used for theatre ballistic missile defence (TBMD) and hit targets at distances of up to 2,000km and at altitudes outside the earth's atmosphere. The ANZAC frigates only carry ESSMs and are considered able to realistically protect themselves, but the +160km range of SM-2 / SM-6 means that ships with them could provide a protective bubble around a naval task group.

There are some other attractive features of 'Aegis' such as it's built-in cooperative engagement capability (CEC) and it can be networked with any

SEA 1180 TIMING UNCERTAINTY

Despite best efforts in obtaining an update on progress for the Offshore Patrol Vessels, this has proven more difficult than expected. Neither prime contractor Luerssen nor the builder of the first two ships in Adelaide, ASC Shipbuilding, were prepared to answer any questions about the project. This level of secrecy is surprising, though since these two entities have apparently still not finalised contract negotiations there might be some sensitivity about the state of play.

Under the circumstances, Defence seems surprisingly upbeat, with a spokesperson telling APDR:

"The SEA 1180 project is currently on schedule and on budget. Construction of the first Offshore Patrol Vessel (OPV) is on track to commence mid-November 2018 at the Osborne Naval Shipyard in South Australia.

"Luerssen Australia is continuing to engage with suppliers for the build program, with the majority of principal sub-contractors now engaged. The first batch of steel from Bluescope has been received by Cvmec at its Henderson facility in Western Australia. Cvmec will commence preparing and cutting the steel in September.

"Saab Systems Australia is supplying the Situation Awareness system (based around the 9LV combat system) for the OPVs and L3 Communications Australia is supplying the integrated communications and navigation suite. Luerssen Australia is in the final stages of negotiations for the suppliers of the weapon system.

Significant milestones for the project over the next six months include:

- Steel preparation and cutting
– September 2018- Cvmec, WA
- Commence construction of OPV 1
– November 2018, Osborne, SA
- Keel laying for OPV 1
– February 2019, Osborne, SA

other similarly equipped ships to provide functions such as third party targeting. These platforms include not only those of the USN, but potential allies such as Japan and South Korea. In the US inventory, 'Aegis' can also be connected with other assets such as F-35 and P8-A aircraft and exchange data with them, forming an extremely powerful network that Australia could also be part of. Additionally, 'Aegis' can exploit the directional high capacity datalink used on the MH-60R helicopters that will be embarked on the 'Hobart' and 'Hunter' classes.

Both CEAFA 2 and the 'Aegis' combat

systems. Under the auspices of Capability Acquisition and Sustainment Group and the US Navy, Lockheed Martin and CEA have commenced engineering efforts towards the integration of Australia's CEAFA PAR radar with the Baseline 9 Aegis Combat System.

"Lockheed Martin Australia is continuing to grow a workforce dedicated to maritime combat system integration, with more than 180 engineers and technicians principally based in South Australia. We are also investing significantly in training our Australian workforce on Aegis, resulting in high value transfer of technology and skills. This investment is

in particular has a formidable reputation in anti-submarine warfare (ASW) circles and is widely regarded as the best of its type in the world. Low frequency gives the system enormous range and the submerged towed body is able to put a lot of power into the water at depths optimised for propagation and detection. The passive part of the system is able to detect even very faint echoes and by use of a technique known as coherent processing is able to screen out false returns – basically a method of matching the exact sound profile of the outgoing signal with what is received from a reflected object such as an enemy submarine.

The bow mounted sonar is also able to listen for returns from the towed array as well as having the ability to transmit and receive its own signals. It also has the ability to play a vital role in torpedo defence, should the 'Hunter' class ever have the misfortune to be directly attacked by a submarine. Along with Thales, Ultra also has an Australian footprint through its presence on the AWDs as the ASW supplier, so the level of local content for this part of the combat system should be very high.

The number of submarines – conventional and nuclear – in the Asia Pacific region will grow rapidly during the next few decades and will constitute a major potential threat should a hostile power use them against Australia. While the technology of submarines continues to improve with them becoming quieter, so do countermeasures in the form of ASW. The advent of powerful variable depth sonars on surface ships and with helicopters such as the MH-60R equipped with low frequency dipping sonar – the Raytheon AN/AQS-22 – some of the previous advantages enjoyed by submarines has either been completely removed or at least greatly minimised.

Even if an enemy remains undetected, the combination of a Type 2087 towed array and one or more helicopters with dipping sonar will in all likelihood force the submarine to keep its distance – and if that is the case then the ASW suite will have done its job. If the submarine is forced to remain outside the range of its torpedoes and/or missiles from the ship or the task group it is protecting then all it can do is shadow the force hoping for some sort of break in the protective sonar screen that it can then penetrate, which might never eventuate.

Looking at the big picture, this combat system takes the best available Australian, US and European elements and seeks to maximise the potential of each. While not without risk, all of the companies involved are not only at the leading edge of technology, but have cultures of transparency and cooperation – which bodes well for the outcome of this critical part of SEA 5000.

As well as being the prime contractor for SEA 5000, BAE Systems will also be the overall combat system integrator (CSI) and to manage this complex undertaking has sought and received offers from three companies already heavily involved in advanced Australian naval electronic work: Lockheed Martin Australia; Raytheon Australia and Saab Systems Australia.

management system will be supplied as Government furnished equipment (GFE) – the latter via the US Foreign Military Sales process. Discussing this possibly complex approach with BAE Systems, the company explained that they have considerable experience with this sort of contractual structure, pointing out that for the Type 26 various items including cryptographic equipment will be GFE. For the earlier Type 45 destroyers – for which the company was also prime contractor and combat system integrator – the entire Principle Anti Air Missile System (PAAMS: a co-development between the UK, France and Italy) was GFE. In addition, BAE Systems has a great deal of experience in integrating various US products that will be on the 'Hunter' Class, such as such as the Mk41 Vertical Launch System (VLS), Mk45 Mod 62 Main Gun, and Mk15 'Phalanx' close in weapon system (CWIS).

Asked to summarise progress to date, Lockheed Martin Australia said:

"The US Navy and Lockheed Martin are delivering the Aegis Combat System to the Royal Australian Navy for Australia's Hunter Class Future Frigates. We are delighted to be a part of the Future Frigate program, as it will deliver exceptional capability for Australia. We are collaborating closely with the Royal Australian Navy, the US Navy and industry to deliver the best possible program for Australia. We are already working closely with CEA and Saab, and we have a long history of successfully partnering with BAE Systems on complex maritime programs and

enabling local industry to perform Aegis integration, test and sustainment right here in Australia."

The company will also be heavily engaged in the forthcoming upgrade of the 'Hobart' class that will see their current 'Aegis' Baseline 7.1 configuration replaced with Baseline 9, which is an open architecture approach making greater use of COTS technology. The upgrade will also involve hardware changes, including more modern consoles.

The credentials of Raytheon and Saab are also well established. Raytheon is the combat system integrator for the AWDs; Saab supplied the original combat system for the ANZAC frigates and has been so successful with upgrades and improvements carried out in Australia that the company will be present on the RAN's entire surface fleet. The two companies are also involved in the Collins submarine combat system, along with Lockheed Martin – and that might continue for the SEA 1000 combat system, which is in the process of being defined. All three companies will be working together on the AWD upgrade, mentioned above.

Another vital area that has been clarified is the underwater warfare suite, telling APDR that:

"Australia's Hunter class frigates will be equipped with the same sonar as the United Kingdom's Type 26 frigates."

In essence, this will be the advanced Thales 2087 low frequency active and passive variable depth towed array sonar and an Ultra Electronics Type 2150 bow mounted sonar. The towed array