Technical Meeting — 20 May

Levi Catton, Managing Director/SEA5000 Technical Advisor Ship Integration, Gibbs & Cox Australia, gave a presentation on *Design and Construction of the RAN's New Hunter-class Frigates* as a webinar hosted by Engineers Australia with Phil Helmore as MC on 20 May. This was our first webinar presentation, and attracted 600+ registrations, with 400+ actually participating on the evening! This is an order of magnitude more than attendances at our face-to-face meetings, helped along by Engineers Australia advertising the presentation to their members as well.

Introduction

Levi began his presentation with a disclaimer, saying that the content of his presentation had been developed by himself, and that the views expressed were his own and did not necessarily represent the views of, and nor was the content endorsed by, any agency of the Commonwealth of Australia, or Gibbs & Cox Inc.

Levi began his presentation with an overview of Gibbs & Cox's history and participation in Australia. Gibbs & Cox have had more than 90 years of design excellence, with designs including the Mahan-class destroyers in the 1930s, the Liberty ships in the 1040s, SS *United States* in the 1950s, the *Sea Legs* hydrofoil in the 1960s, the FFG7-class frigates in the 1970s, the DDG 51-class destroyers in the 1980s, the DDG 51 flight upgrade in the 1990s, the Freedom-class LCS in the 2000s, Aegis Ashore in the 2010s, the 9 m EOD with Donald L. Blount and Associates in 2015, and the FFG(X) in 2020. Gibbs & Cox has designed nearly every frigate and destroyer in the US Navy since World War II and is continuing that participation into the future.

In addition, Gibbs & Cox have 50 years of partnership with the Royal Australian Navy, designer of the Perth-class DDGs, class design agent during detail design of the Adelaide-class FFGs, warfighting improvement program on the Anzac-class FFHs, designer for the evolved design and on-site support for Navantia for the Hobart-class DDGs, and currently providing technical and program advisory services on the SEA1000, SEA1180 and SEA5000 Programs. Gibbs & Cox has been involved with every surface combatant program for the RAN since the Perth-class DDGs.

By way of background, the Hunter-class frigates are replacing the Anzac-class vessels, which are currently the mainstay of Australia's surface combatant fleet. The Anzacs are light general-purpose frigates based on Blohm & Voss' MEKO-200 design. There were eight vessels commissioned into the RAN between 1996 and 2002, and they are generally considered to be a successful and cost-effective asset in the fleet. The vessels have benefitted from the Warfighting Improvement Program (WIP), and the Anzac Midlife Capability Assurance Program (AMCAP), which includes integration of the CEAFAR2 active phased-array radar to improve their capabilities. These vessels will be in service into the 2040s, some 60 years after completion of the design.

Port bow of the Hunter-class frigate
(Image courtesy BAE Systems)

Port quarter of the Hunter-class frigate
(Image courtesy BAE Systems)

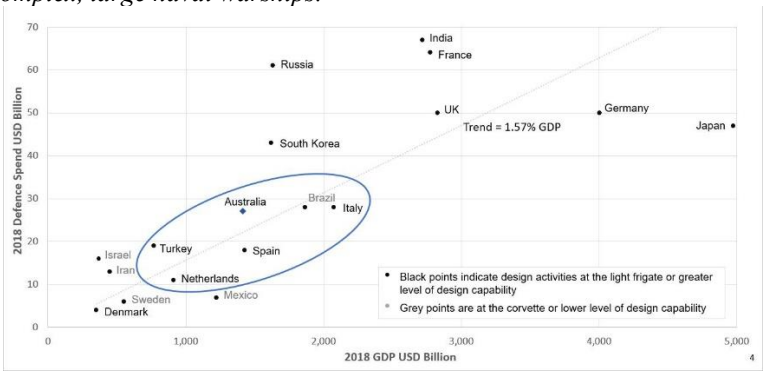
Anzac-class HMAS *Arunta* at Henderson during AMCAP work
(Photo courtesy Defence)

Government Considerations

Considerations which influenced the Government's decision on the Hunter-class frigates included the 2009 Defence White Paper for the Defence of Australia and the security of the immediate region, the concerns in the early 2010s about the loss of manufacturing jobs, especially in South Australia, the post-Hobart-class "valley of death" and the lobbying by the shipbuilding labour force and trade unions, the Government's Hobart-class experience, the 2013 Defence White Paper on the implications of the changing strategic circumstances in the region for Australia's national security and defence, the Hobart-class reference design study, the 2015 RAND report on Australian naval shipbuilding, and the 2017 National Naval Shipbuilding Plan.

The National Naval Shipbuilding plan addressed sovereign capability considerations, saying *"Delivering the Naval Shipbuilding Plan will result in a national approach to the delivery of affordable and achievable naval capability through a sovereign Australian industrial base that is reformed, secure, productive and cost-competitive. Achieving this objective will result in future Australian Governments being able to plan and execute: the design, construction and sustainment of future fleets of major surface combatants and minor naval vessels; and the acquisition, construction and sustainment of submarines (designed in conjunction with an international partner) in Australia."*

The Minister for Defence, Senator the Hon. Marise Payne, said in 2018 *"By the conclusion of the frigate build, ASC Shipbuilding will be a strategic national asset capable of independently designing, developing and leading the construction of complex, large naval warships."*



Sovereign capability considerations
(Graph courtesy Gibbs & Cox Australia)

Why do nations maintain a warship development capability? The ability to design a competitive warship takes multiple decades to develop. There is a variety of measures and significant investments in skilling and technology necessary over a significant period in order to achieve a credible national capability. In addition, allies and partnerships must be considered and the inter-relationship between sovereign warship development capability and operational capability of a navy. We must also consider how to mature Australia's naval development capability and the operational capability of the RAN in a manner which responds to present strategic uncertainty. Accordingly, there is a range of opportunities and challenges for Australia's naval sector.

The Government's strategic interests in the Hobart-class frigate program (HCFP) have driven the acquisition strategy:

- Incorporation of key systems to which Australia has already made a significant strategic commitment.
- Development of sovereign shipbuilding capabilities.

- Early commencement of production work to minimise impact on industry capacity and jobs.
- Controlling program risk to protect cost and schedule.
- Contractor accountability for project success.

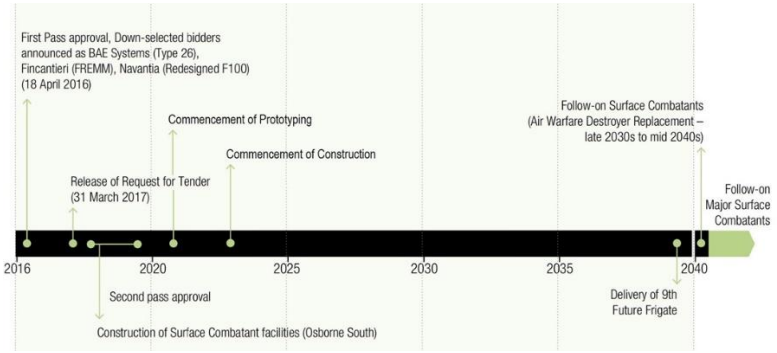
Objectives of the HCFP

The Request for Tender set out the following key objectives for the project, which have shaped the contract structure:

- Deliver nine anti-submarine warfare frigates based on a military-off-the-shelf (MOTS) design with minimum change.
- Contribute to a continuous naval shipbuilding industry in Australia.
- Maximise Australian industry capability.
- Commence construction in Adelaide in 2020 (to be achieved by commencing prototyping activities in 2020 with ship construction to commence within 24 months following this).
- Establish commercial arrangements that are affordable, taking into account price, payment arrangements, and allocation of risk.
- Achieve overall value for money for the Commonwealth.

Schedule

An aggressive development schedule is a fundamental characteristic of the program. Production work is to begin as quickly as possible to re-establish jobs and minimise loss of capability from the shipyard and sector following the end of Hobart-class production. This will involve using a "prototyping" pre-production program to commence production work and de-risk production processes. As a result, five blocks of various complexity will be constructed over about four years starting from late 2020, with cutting steel for Ship 1 programmed to occur in late 2022.



Major surface combatant continuous build program
(Adapted from a Defence image)

Key Changes

Like any MOTS program, effectively managing and containing change remains central to the success of the program. The Government has sought to contain change to the reference ship design. Australia is beginning to take a system program approach to combat systems. The Government has mandated specific changes to align the Hunter class with systems into which Australia has made significant strategic investments. The overall platform system design is well preserved. The combat system is substantially re-designed from that of the BAE Systems' Type 26, although with some Type 26 elements retained, and is broadly comparable to the Hobart-class architecture.

Changes include incorporation of the Aegis combat system (now produced by Lockheed Martin), the CEAFAR2 active phased-array radar, the MH-60 Romeo helicopters, and Australian weapons set, the communications suite, and changes required to meet Australian laws and standards.

Participation and Commercial Arrangements

The presentation provided an overview of some of the participants in the program and their roles and contributions.

ASC Shipbuilding is the Head Contractor, and holds overall responsibility for design, production and integration of the ships, and is a subsidiary of BAE Systems Australia.

Australian Naval Infrastructure owns and manages the Osborne South shipyard, which it leases to ASC Shipbuilding.
BAE Systems Naval Ships (UK) provides the Type 26 reference design IP and performs a large portion of the design engineering for the Hunter class as a subcontractor to ASC Shipbuilding.
CASG Combat Management and Payload Systems acquires the integrated Government–furnished combat system equipment (Aegis, CEAFAR2, etc.)
CASG Naval Construction Branch provides production assurance and manages acceptance for the Commonwealth.
CASG SEA5000 Phase 1 Project Office manages the Head Contract with ASC Shipbuilding and performs program and technical assurance.
CEA Technologies develops and supplies the CEAFAR2 active phased-array radar to CASG.
Gibbs & Cox Australia provides technical and program advisory services to CASG.
Lend Lease delivers the Osborne South shipyard-expansion project.
Lockheed Martin Australia provides combat system integration services as a subcontractor to ASC Shipbuilding.
Lockheed Martin Inc. (US) supplies Aegis systems via the NAVSEA-managed Foreign Military Sales case.
NAVSEA PEOIWS 4.0 acquires and delivers Aegis systems to CASG under a Foreign Military Sales case.
Navy Capability develops and maintains Navy's requirements and manages Government funding processes.
Odense Maritime Technologies is the designer for the shipyard.
Raytheon Australia provides combat systems technical support and assurance services to CASG.
Saab Australia provides combat systems development and integration services as a subcontractor to ASC Shipbuilding.

Combat Systems Overview
The combat management system is Aegis, with the Australian interface to be developed primarily by Saab Australia.
Warfare sensors include CEA Technologies' CEAFAR2 multi-band active phased-array radar, electo-optical infra-red (EOIR) search and track, Ultra S2150 bow sonar array, Thales' 2087 CAPTAS-4 variable-depth bistatic towed-sonar system, and a range of electronic-warfare systems.
Soft-kill effectors include the Nulka active missile decoy as well as chaff and flare launchers.
Weapons include:

- 32 strike-length Mk41 VLS cells (SM-2, ESSM and SM-3, with SM-6 probable in due course).
- Likely eight naval strike missiles (to be selected by separate program).
- Two dual launchers for the MU90 impact lightweight torpedoes
- Mk 45 Mod 4 5-inch gun.
- Two stabilised remotely-operated 30 mm auto-cannons.
- Two Phalanx CIWS 20 mm rotary cannons.
- 0.50 calibre machine guns

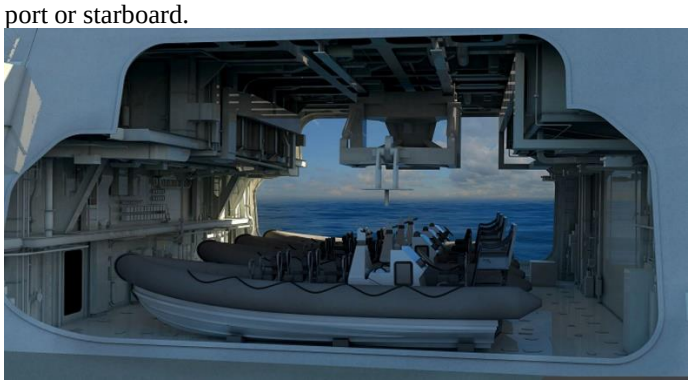
The MH-60R helos carry a Mk 54 lightweight torpedo, Hellfire missiles and Advanced Precision Kill Weapon System guided rockets. The combination of the Hunter-class vessel and the MH-60R helo is a highly-capable and lethal ASW system!

Platform System Overview
Principal particulars of the Hunter-class vessels are

Length	149.9 m
Beam	20.8 m
Displacement:	9000 t full load displacement
Propulsion	Combined diesel-electric or gas turbine (CODELOG) 1×Rolls-Royce MT30 gas turbine 4×MTU Type 20V 4000 M53B high-speed diesel generators 2×electric motors
Speed (maximum)	27+ kn
Range	7000 n miles
Complement	180 personnel, with accommodation for 208

Construction is welded steel with an aluminium mast, classified to Lloyds Register's Naval Ship Rules.
These vessels have world-class surface-ship acoustic performance, with robust shock resistance.

Patrol and cruise speeds are obtained on diesel-electric drive, and sprint speed is achieved on the MT30 gas turbine to 27+ kn.
The mission bay extends across the beam of the vessels, four RIBs, and the davit can access either side, allowing deployment to port or starboard.



Mission bay on the Hunter-class frigate
(Image courtesy BAE Systems)

RIB being deployed on the starboard side of the Hunter-class frigate
(Image courtesy BAE Systems)

Osborne South Shipyard
ASC Shipbuilding operates out of the Australian Naval Infrastructure's shipyard at Osborne South. The site is Australia's largest naval shipbuilding hub incorporating a critical mass of world-class warship design and construction skills. It is the most advanced and modern shipbuilding facility in Australia.
Key features of the yard include:
Outfit Support Towers
Similar to the maintenance support towers at ASC North, the outfit support towers allow easy access to all levels of a vessel during construction. They run alongside the ship and, in addition to providing quick and easy access, they also contain support facilities to the tradespeople which are located adjacent to the work front. The support facilities include tool cribs, workshops, amenities, material stores and supervisor office space. The outfit support towers also provide efficient access to vital services such as industrial power, hotel power, welding gas, water and compressed air.
Construction and Assembly Halls
Prior to blocks being consolidated onto the ship structure, outfitting work is conducted on blocks and equipment in workshops which surround the shipyard. Fabrication work can be completed in all weather conditions with full access to all areas of blocks. Outfitting and fabrication completed in workshops as opposed to on the shipyard or wharf, saves time and reduces cost.
Abrasive Blasting and Painting
Paint and blast facilities allow continual work on components and blocks away from the main ship structure which allows work to continue unimpeded. The blast and paint chambers can accommodate large sections of vessels to be processed at one time.
Cranes and Lift Equipment
Equipment allows handling and transportation of blocks and components weighing up to 864 t. The Manitowoc 21000 crane is configured to lift 600 t and lift ship blocks weighing up to 400 t during the ship consolidation process. Two Tadano GR-1450EX cranes can lift 145 t each and have sufficient mast length to reach across the ship's hull whilst dry docked. The cranes play an important role in supporting the ships during construction, after float-off and while berthed at the Common User Facility wharf. Experienced rigging teams are on hand to undertake complex engineered lifts in support of shipbuilding operations.

Extensive Support Facilities

Osborne South has a range of support facilities including multiple trade workshops, security offices, maintenance workshops, plate storage areas and module storage areas. There is over 18 000 m^3 of warehouse storage site wide.

Shipyard Wharf Facilities and Dockside Maintenance

Once a ship is in the water, it moves to the wharf to undertake final fit out and set to work of equipment and systems before sea trials. The shipyard wharf facilities include shore-power supplies, water, gas and air supplies, telephones and communication equipment and alarm services. The wharf support building contains small workshop areas, tool cribs, offices, canteen, lunchroom and amenities.

The Osborne South shipyard
(Image courtesy Australian Naval Infrastructure)

Conclusion

The Hunter-class frigate program will deliver a highly capable and flexible surface combatant fleet with advanced ASW capability and a world-class layered anti-air warfare capability based on the Aegis combat system and Australia's advanced CEAFAR2 active phased-array radar system.

The Australian Government has mandated an aggressive development schedule for the program, with pre-production activities commencing at ASC Shipbuilding's Osborne South yard in late 2020, and first-of-class construction commencing in late 2022. The nine-hull program represents a major element of Australia's Naval Shipbuilding Plan and supports the introduction of a system program approach to naval combat systems in Australia.

Questions

Question time was lengthy, and elicited many more interesting points. However, in the space of half an hour, we only managed to get through about half the queries; sorry if yours was one of those unanswered but, if you are still interested, then you can always contact Levi.

The certificate was subsequently posted to Levi, and the "thank you" bottle of wine delivered via an eGift card.

Levi's presentation was recorded, and is now available to webinar registrants on the Engineers Australia On Demand website.