Hunter Class Frigate Project – the Path to Designing and Building an Australian ASW Frigate

Authors

Mr Simon Fleisher* MBA MEng CEng FIMechE CPEng FEngNZ
CMDR David Crane BE (Mechanical) CEng CMarEng MIMAREST CPEng MIEAust RAN
Dr Tawfek Mahmoud PhD (Electrical) FIEAust CPEng NER APEC Engineer IntPE(Aus)
Mr James McKenzie BE (Mechanical)

* Gibbs & Cox (Australia)
* Corresponding Author. Email: simon.fleisher@gibbscox.com.au

Synopsis

The Hunter Class Frigate (HCF) is the Australian variant of the Global Combat Ship (GCS) Anti-Submarine Warfare (ASW) Frigate based upon the UK Reference Ship Design (RSD) for the Type 26 Frigate (T26). The project will build 9 ships for the Royal Australian Navy (RAN) to replace the current fleet of 8 ANZAC Frigates, with construction to be undertaken in the Osborne Naval ship yard in Adelaide, South Australia by BAE Systems Maritime Australia (BAESMA). The paper will focus primarily on the HCF characteristics that are different from other GCS variants, and will outline indicative project milestones on the path to designing and building HCF Batch 1.

From a design governance perspective, the Department of Defence Capability Acquisition and Sustainment Group (CASG), in collaboration with BAESMA, is progressing though a series of structured design reviews. In November 2021, the project successfully passed the Mission System (MS) System Definition Review (SDR), allowing the design functional baseline to be struck, which is a key step in platform system design maturity. Achieving this milestone is also an enabler for a whole series of design, procurement and production activities that all need to be planned, choreographed and scheduled precisely to support cutting steel on the first ship production blocks by June 2024.

The HCF design has deviated away from the RSD in several significant areas (integrating the AEGIS Combat System in conjunction with the Australian Interface (AI), the CEAFAR Phased Array Radar (PAR) and MH-60R Seahawk Helicopter) to take advantage of existing weapons, sensors and aircraft types that are already in service with the RAN. Good use has also been made of experience gained from recent ship acquisitions and mid-life upgrade programmes, including the Hobart class Air Warfare Destroyer (AWD) and the ANZAC Frigate Midlife Capability Assurance Programme (AMCAP).

This technical paper will review the progress thus far from a platform system design and combat system integration perspective, and will highlight the challenges and compromises necessary to achieve an efficient and effective design. This will focus in three technical areas; (a) hull form and structural changes, (b) the evolving design of the electrical power generation and distribution system and (c) the impact upon cooling systems (noting the broad diversity across the platform).

The approach to construction within the Osborne ship yard will be covered, including the division, layout and sequencing of HCF into 12 Design Zones and 22 Blocks, and the associated spatial design process underway that will lead into production. In addition, the paper will also outline the broader HCF procurement and infrastructure implications of the Australian Industry Capability and the National Naval Shipbuilding Enterprise.

Keywords: Warship Design, Shipbuilding, Australian Industry Capability (AIC), Royal Australian Navy (RAN), Hunter Class Frigate (HCF),

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Authors Biographies

Simon Fleisher is a Principal Mechanical Engineer and Chartered Professional Engineer with Gibbs & Cox (Australia) in Canberra, and joined the HCF Platform Engineering team in January 2021. He previously served as a Marine Engineering Officer for 20 years in the Royal Navy and the Royal New Zealand Navy, and is a Fellow of the Institution of Mechanical Engineers and Engineering New Zealand.

CMDR David Crane joined the RAN as a Marine Engineer in 1994 and has served in a variety of sea and shore postings, including two Charge roles as the Marine Engineering Officer of HMAS Stuart and HMAS Perth. He is currently the Deputy Director Engineering Management within the HCF Branch, having also worked in Glasgow as part of the HCF Resident Project Team.

Dr Tawfek Mahmoud is an Electrical Systems Project Team Leader with the Department of Defence (joined in February 2021). He has a PhD, MSc, and BSc in Electrical Engineering from the University of Sydney (2017), Cairo University (2007), and Al-Azhar University (2001) respectively. He is a Fellow of Engineers Australia, a Chartered Professional Engineer, an International Professional Engineer, and a senior member of the IEEE.

James McKenzie is the HCF Mechanical Auxiliaries Engineering Manager with the Department of Defence (he joined the Australian Public Service in 2016, and commenced his current role in January 2022). He has worked in Naval shipyards in Australia and the UK as part of the HCF Resident Project Team, and previously worked as a Platform System Design Acceptance Representative on the Hobart class Air Warfare Destroyer and build quality assurance with Naval Construction Branch for Offshore Patrol Vessels.

1. Introduction

The Hunter Class Frigate (HCF) is the Australian variant of the Global Combat Ship (GCS) Anti-Submarine Warfare (ASW) Frigate based upon the British RSD for the Royal Navy (RN) Type 26 Frigate (McCallum, et al., 05 October 2020). The project will build 9 ships for the Royal Australian Navy (RAN) to maintain the Navy's Surface Combatant capability and replace the current fleet of 8 ANZAC Frigates. Construction will be undertaken by BAE Systems Maritime Australia (BAESMA) in the Osborne Naval ship yard in Adelaide, South Australia.

A Head Contract and Phase 1 activity with BAESMA came into effect in February 2019 to design and productionise HCF Batch 1 (Australian Government, 2020). In addition, the Australian Government mandated a specific set of requirements (embodied as design changes to the T26). These included:

- Integration of the USN Aegis Combat System alongside the Saab Australia-developed Australian Interface (AI),
- Integration of the Australian designed and built CEAFAR2 Phased Array Radar,
- Integration of systems to support Australian weapons,
- Integration of the Seahawk Romeo Maritime Combat Helicopter (MH-60R),
- Integration of Australian communication systems, and
- Adoption of Australian legislative requirements (including Work, Health and Safety).

The scope of the current contract includes design activities to incorporate Australian requirements, prototyping of ship blocks in the new shipyard under construction at Osborne, and ordering of long-lead items for the first batch of ships (Department of Defence, January 2021).

From a design governance perspective, the Department of Defence Capability Acquisition and Sustainment Group (CASG), in collaboration with BAESMA, is progressing though a series of structured design reviews. In November 2021, the project successfully passed the Mission System (MS) System Definition Review (SDR), allowing the design functional baseline to be struck, which is a key step in platform system design maturity. Achieving this milestone is also an enabler for a whole series of design, procurement and production activities that all need to be planned, choreographed and scheduled precisely to support cutting steel on the first ship production blocks by June 2024.

The next structured Mission System design review is planned for 2023 (Preliminary Design Review) To support the plan to cut steel in 2024, it is critical to progress system design, supply chain activities to procure systems and equipment, and the spatial design process (which is undertaken sequentially by Design Zones) in order to ensure production block design is sufficiently mature for manufacture purposes.

From a medium-term perspective, the first-of-class ship (HMAS HUNTER) is scheduled to be delivered to the RAN in 2031, noting the requirement to progressively replace the aging ANZAC Frigates.

The build philosophy of the Hunter Class Frigates follows Government strategic direction with associated priorities that encompass both HCF capability and aspirations for a National Naval Shipbuilding Enterprise (Department of Defence, 2017) and Australian Industry Capability (Australian Government (CoA), 2021).

In terms of build strategy from a capability perspective, the core aim is to deliver 9 ASW Frigates in 3 batches of 3 ships for the Royal Australian Navy (RAN). The delivery of 9 ships meets two primary Government objectives, namely:

- Sustainable and continuous naval shipbuilding to establish a sovereign shipbuilding capability, and
- Allowing the RAN to remain agile in terms of deployable capability to ensure the ASW Frigate capability keeps pace with the evolving maritime threat environment.

2. Design Philosophy

The basic premise for the HCF design is to utilise the T26 RSD modified as required to accommodate Australian-specific requirements, including integration of the AEGIS Combat System in conjunction with the Australian Interface, the CEAFAR Phased Array Radar (PAR) and MH-60R Seahawk Helicopter). This has been done to ensure operational and support coherence with existing weapons, sensors and aircraft types that are already in service with the RAN. Good use has also been made of experience gained from recent ship acquisitions and mid-life upgrade programmes, including the Hobart class Air Warfare Destroyer (AWD) (Department of Defence, June 2020) and the ANZAC Frigate Midlife Capability Assurance Programme (AMCAP) (Kuper, 10 June 2020).

The RAN has a proud history of operating various Surface Combatant ship classes that have a strong design influence from both the RN and the United States Navy (USN). The ship build class immediately prior to HCF was the AWD which use the USN Aegis Combat System, and it is entirely logical and prudent for the RAN to maintain coherency with the AWD and integrate Aegis in the HCF.

Since the T26 was selected as the RSD, the concept of utilising a mature design with '*Minimum Change*' has been a key feature of the acquisition strategy. The intention of '*Minimum Change'* is to manage proactively the overall risk to HCF capability performance, cost and schedule presented by modifying an existing warship design. This has been done by stipulating the Government-directed Areas of Change that are defined in the Capability Requirements, as well as meeting other requirements, including legislative compliance.

Australian legislation also has a strong influence on the HCF, particularly with respect to Health and Safety. This has been evident in many of the material selection choices that have been necessitated by specific legislation that impacts upon system design and production processes (for example, the need to eliminate the use of steel containing Hexavalent Chrome in ventilation systems). A pictorial representation of HCF is at Figure 1.

Figure 1: Image of Hunter Class Frigate

3. Impact of Changes from the RSD to the HCF Design

The major design changes from the RSD to HCF have necessitated discrete alterations to ship structure and systems in a number of areas. The T26 RSD was designed in 12 Design Zones and HCF has followed a similar methodology. A pictorial representation of the 12 Design Zones and associated production blocks for construction is at Figure 2. The impact of HCF changes upon the General Arrangement and platform systems has been considerable, requiring in excess of 200 Product Changes (PC) to formally transform the design and its associated engineering data artefacts required for manufacture. The Main Mast (embodied within Design Zone 12) is completely new, 7 Design Zones have been significantly affected, and the remaining 4 Design Zones have a low degree of change from the RSD.

Major structural changes from the T26 include complete replacement of the mast and modifications to the hull form, Mission Bay and Hangar, as well as various changes to weapons, sensors and magazines in discrete locations. As the HCF design has evolved, the Low Voltage (LV) Electrical Distribution System has been extensively modified, including revisions to the 690 V consumers, and the Zonal Power Supply Units (ZPSU) embedded within the 440 V system. There have also been significant changes to cooling systems to support the Aegis Combat System with the Australian Interface (AI), as well as the CEAFAR2 Phased Array Radar.

3.1 Hull Form and Structural Changes

During the build of T26 and the integration of HCF changes, it became apparent that the ship's weight was predicted to be higher than originally expected, with the impact of potentially reduced weight margin. To alleviate this and regain weight margin, the hull form's beam at the waterline was increased for the aft $^{2}/_{3}$ of the length of the vessel (the forward part of the hull remained unchanged to retain the existing geometry). This was carried out on the proposition that increasing the hull volume will increase the weight margins through life, and increasing the beam will improve the stability performance and hence the Vertical Centre of Gravity (VCG) margins.

The specific benefits of this are:

- Improvement to the transverse stability due to a wider beam providing more resistance to overturning moments, and
- Increase in the limiting displacement due to an increase in hull volume up to the limiting draught.

The HCF Main Mast is entirely different from T26 and has been re-designed to accommodate the CEAFAR2 PAR supporting structure, equipment rooms, its own dedicated cooling system (Demineralised Cooling Water System, DCWS), Heating, Ventilation and Air Conditioning (HVAC) system Air Treatment Units (ATU) and Electrical Distribution system. The PAR cooling system is unique to the HCF, and is covered in Section 3.3.4.

The mast design has been contained within Design Zone 12 (DZ12) as illustrated in Figure 2, and utilises Aluminium structural material from 03 Deck upwards. The size and geometry of the CEAFAR2 has required a relatively large mast superstructure, which has required balancing the competing interests of minimising impacts to the VCG whilst retaining sufficient structural strength and rigidity. Careful choices have had to be made in terms of managing fire risk in the mast (including choosing the most suitable thermal and structural insulation material) whilst saving weight wherever practicable.

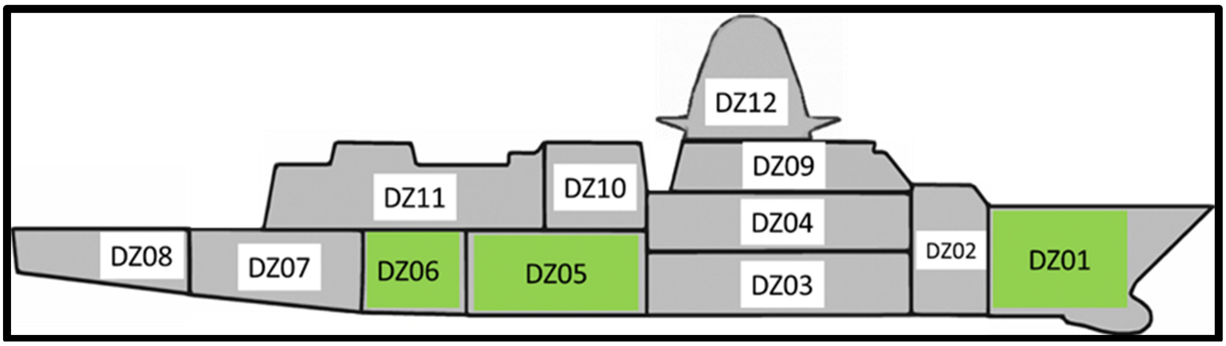

Figure 2: Pictorial Representation of HCF Design Zones

3.2 Electrical Power Generation and Distribution (including Propulsion)

The integration of the CEAFAR2 PAR System has also seen significant modifications to the distribution and power management of the Low Voltage (LV) Electrical Distribution system. The system comprises a 690 V, 60Hz, 3-phase system, a 440 V, 60Hz, 3-phase system, and various lower voltage sub systems to suit specific combat system equipment and other miscellaneous systems (including lighting). Figure 3 provides a generic representation of the ship's electrical power generation and distribution system.

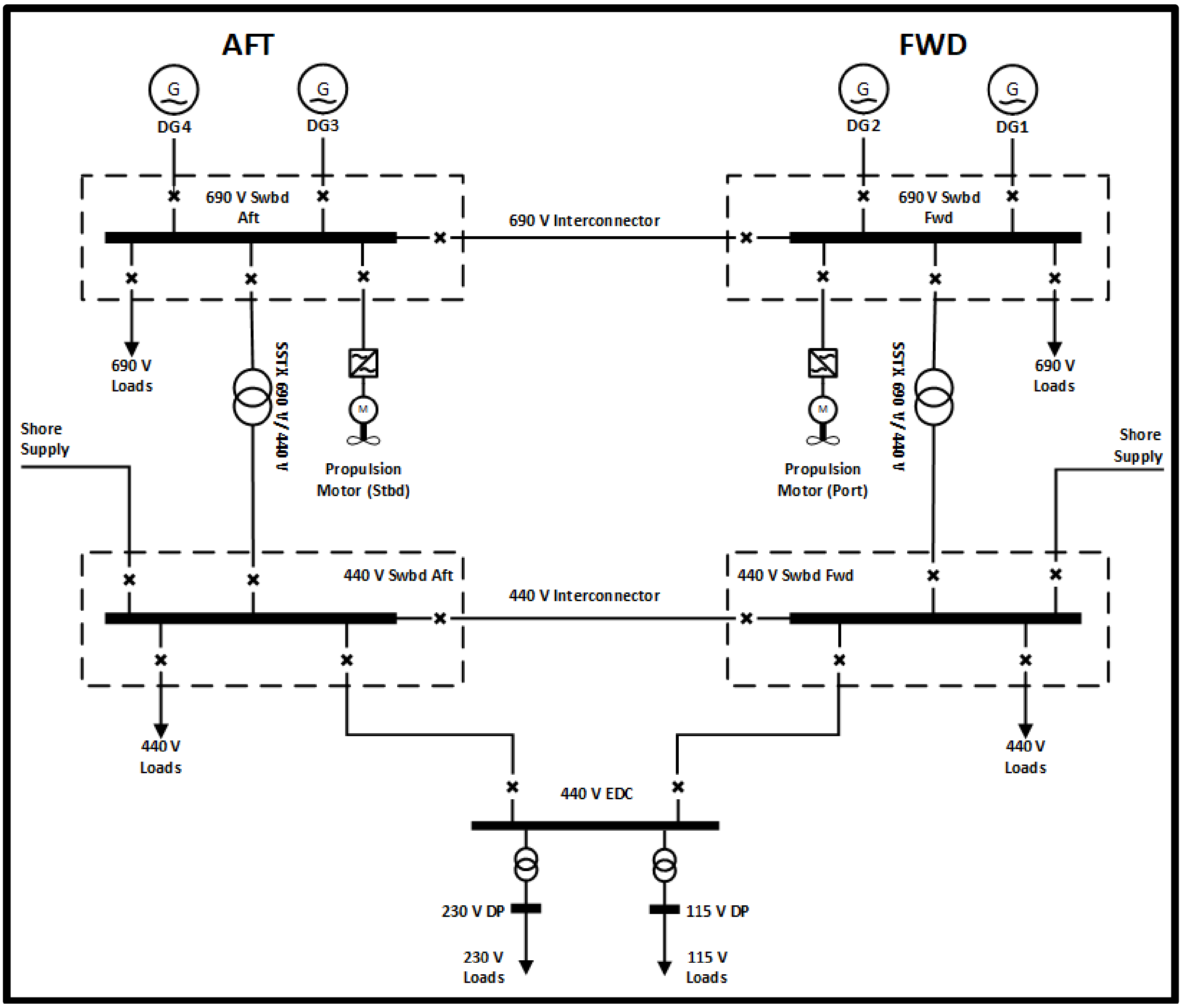

Figure 3: Generic Schematic for the LV Generation and Distribution System (690 V and 440 V)

3.2.1 690 V System

One of the main differences between HCF and T26 is the CEAFAR2 Phased-Array Radar which is supplied from the 690 V distribution system instead of 440 V (for the T26-equivalent). Putting CEAFAR2 on the 690 V switchboards improved resilience of the electrical system redundancy, particularly whilst in twin island operation. Consequently, two of the four Chilled Water Plants (which are all supplied from the 690 V switchboards on T26) are now supplied from the 440 V switchboards, and two new Radar Electrical Distribution Boards (REDB) were added to the 690 V distribution system.

3.2.2 440 V System

The HCF ship services load is somewhat higher than T26 due to the increased size of HCF (which primarily affects the HVAC and the Chilled Water systems) and the cumulative effect of changes in combat system equipment, and discrete weapons and sensors. This has put some pressure on the overall loading of the Ship Services transformers, particularly when operating in reversionary modes (for example, whilst recovering from a Partial Electrical Failure (PLF)).

There are also additional combat system requirements for higher quality power supplies, electrical ride through and maintained supplies. These are provided via a number of Zonal Power Supply Units (ZPSU) featuring energy storage battery systems located throughout the ship, which are specified to different standards than the generic LV distribution system. Redesign activity is currently in hand to increase the number of ZPSUs to reduce the power loading on the existing ZPSUs, improve system flexibility and rationalise the use of bulky batteries for electrical ride through and maintained supplies. The ship's electrical supplies are designed to meet Lloyd's Register's Rules and Regulations for the Classification of Naval Ships (Lloyd's Register, 2020), and the power quality from the ZPSUs has been specified to UK Defence standards (UK Ministry of Defence, 14 August 2018).

3.2.3 Power and Propulsion System

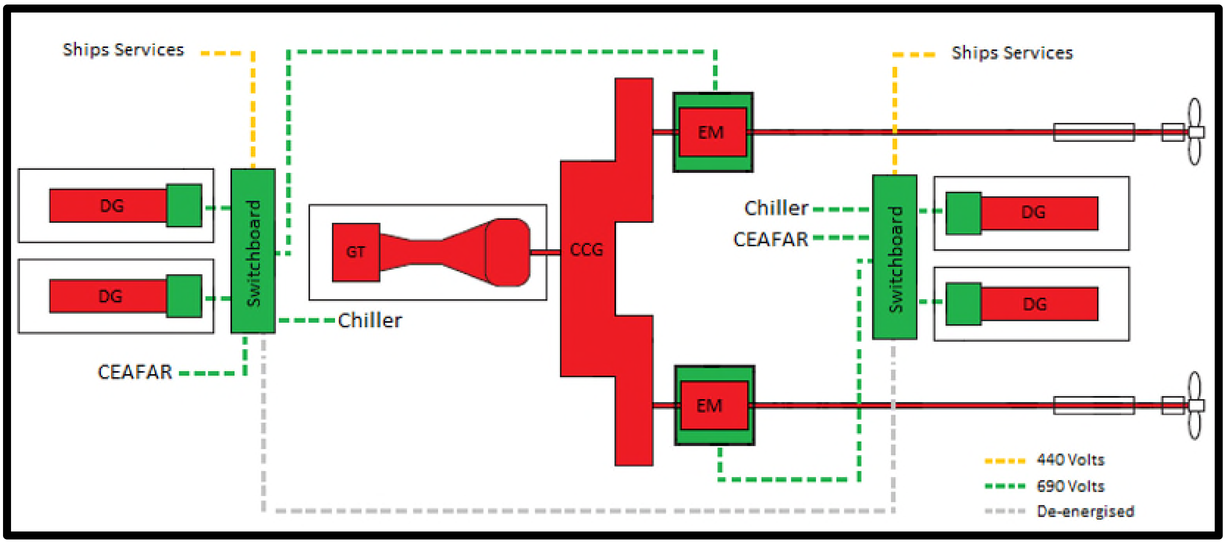

Figure 4: HCF CODLOG Propulsion Schematic

HCF Power and Propulsion is nearly identical to T26 but HCF has a greater displacement than T26, and there have been minor corresponding changes to the maximum speeds in Electric Motor drive and Gas Turbine drive. The transmission and shaft line arrangements are virtually identical to T26 in terms of fit, form and function, however there has been a small increase in the Thrust Block rating to allow for increases in maximum shaft line power required whilst operating and manoeuvring at high speeds. This minor change to the Thrust Block will be achieved by internal modifications to the bearing geometry and, externally, the equipment is the same fit and form as the T26 design.

The basis of operation for control of the propulsion system is that it is operated remotely through the Integrated Platform Management System (IPMS), via the Power and Propulsion Management System (PPMS). The PPMS provides the requisite control of the prime movers, generators, transmission and shaft line systems and equipment, including all of the various control algorithms and schedules to permit engine start/stop, changes in propulsion mode, and reversionary control as required.

There has been one distinct change to the HCF PPMS to provide an additional capability to allow the Command to prioritise 690 V power allocation between the electric propulsion and CEAFAR2 at higher powers. The overall control strategy is to keep the distributed electrical power within set operating limits based on the power available from online generators, noting the various 690 V consumers as documented in section 3.2.1). The priority can be given by the Officer of the Watch (OOW) on the Bridge to either propulsion or radar as required dependent upon the Command Aim.

3.3 Cooling System Design and Integration

HCF Cooling system design retains many of the core features of the T26 RSD, namely, the Chilled Water (CW), HVAC, and Low Pressure Sea Water (LPSW) systems, plus Self Contained Units (SCU) to cool the Zonal Power Supply Units. There have been some modifications to the CW and HVAC systems in areas of high change (in particular, the Mast, DZ12 and the Hangar, DZ11), and there have also been overall increases in load, driven by increased ventilation requirements in some Design Zones, changes to the Combat System equipment, and hull volume increase due to the beam change.

3.3.1 Impact upon Cooling Loads

In a similar fashion to the overall HCF electrical load requirements, CW and HVAC cooling loads are somewhat greater than the T26 equivalent systems but, with some system modifications, can be accommodated within the constraints of the platform. The HCF upper and lower limits for sea water and air temperatures are wider than previous RAN vessels reflecting the aspiration to deliver Surface Combatant capability across the globe in support of Australian Government interests.

3.3.2 HVAC

The HVAC system has been designed such that the Citadel can be sub-divided into four Damage Control Zones, and capacity of some of the Air Filtration Units are tight but are acceptable for Batch 1 ships. There has been some additional system complexity resulting from General Arrangement redesign in some locations, including the need to provide HVAC dual redundancy for changing compartments requirements. This has led to an overall increase in the number of Fan Coil Units utilised within the HVAC system.

HVAC has the unique challenge of responding to thermal changes introduced from virtually every product change introduced to the platform. Altering the General Arrangement and/or moving equipment from one compartment to another requires reiteration of the HVAC design to balance cooling loads throughout the ship, noting that heat transfer between boundaries can also influence results. Hence, HVAC design typically lags the design maturity of other ship systems, driving the need to perform rapid integration impact studies.

3.3.3 Chilled Water

Similar to T26, the HCF main reticulated CW system comprises four 1,100 kW Chilled Water Plants (CWP). Overall cooling load has increased compared to T26 but is still within the required limits for HVAC load and for direct-connected loads. There is a separate dedicated water cooling system for the mast, described in Section 3.3.4). Chilled water can directly cool equipment reducing the wild heat released to the compartment that the HVAC system needs to cool or heat. This can be optimised to balance Chilled Water direct cooling and indirect air-cooled loads from the HVAC system to maximise available cooling margins.

The CWPs (and other refrigerated systems) on HCF utilise R134a refrigerant gas, and consideration is underway as to the optimum time to replace this, noting the potential supply chain impacts upon Hydroflourocarbons (including R134a) due to the European Union F-Gas Regulation (European Environment Agency, 2022). When this is undertaken, the feasibility of also increasing CWP capacity will be investigated.

3.3.4 New HCF Cooling Systems

There are two new systems specific to HCF – the Electronic Cooling Water (ECW) system which arises from a specific requirement to maintain commonality with other platforms using similar systems, and the Demineralised Cooling Water System (DCWS) that cools the CEARFAR2 radar.

DCWS replaces the T26 Mast Chilled Water system and is an evolution of previous designs utilised in earlier RAN warships to cool the CEAFAR2 Phased Array Radar. Sea water supplied by dedicated pumps is used to cool a closed-circuit, demineralised water system providing direct cooling to the radar and equipment rooms, via two heat exchangers.

4. Build Strategy

A core objective of the HCF project is to contribute to Continuous Naval Shipbuilding (CNS) through the construction of 9 ASW Frigates at the Osborne Naval Shipyard in South Australia. The build program will also help to grow and sustain Australian Industry Capability (AIC) by supporting Australian suppliers of systems and equipment where practicable within project constraints. The build of highly complex warships also requires investment in shipbuilding infrastructure and development of a capable, productive workforce. In doing this, the Australian Government is laying the foundations for an Australia-wide, continuous National Naval Shipbuilding Enterprise, ending the boom-bust cycle that has previously afflicted the Australian naval shipbuilding and sustainment industry. This will provide certainty to domestic businesses and shipbuilding workers and provide direct and indirect employment opportunities for generations to come.

4.1 Approach to Shipbuilding Infrastructure

The Osborne Naval Shipyard (ONS) was originally designed by OMT, Denmark to deliver the Surface Combatant shipbuilding capability required before the T26 was selected as the RSD for HCF. Its capacity was based around building 7,000 Tonne displacement vessels with steels of 5 different thickness, embracing modern, digital shipbuilding practices. HCF displacement will be approximately 10,000 Tonnes and some further modifications to facilities will be required over time.

The CNS strategy means that these facilities will see concurrent activity at the ONS across all stages of production. It is intended to deliver the HCF vessels with a periodicity of one Frigate every 18 months, with a throughput time of 60 months.

There were existing facilities on-site from the previous construction of the Hobart class Air Warfare Destroyers (AWDs) and the Offshore Patrol Vessels (OPVs). These were upgraded and supplemented with 4 new major buildings. The overall aim of the facilities is to achieve world class shipbuilding across all stages of production, including:

- Steel Preparation and Unit Fabrication – raw steel plate and profiles are blasted, primed, marked, cut, formed, erected, and welded together into units.
- Block Assembly, Painting and Outfit – consolidation of units into blocks; hot outfit of pipe hangers, equipment mounts, seats, outfit of pipes, cables, equipment, plus blasting and painting of blocks.
- Ship Consolidation – blocks consolidated into whole ship; and remaining production work such as outfitting is completed.
- Set to Work, Test and Evaluation, and Acceptance – ship systems are set to work and then undergo formal tests to evaluate their performance, with all the various Objective Quality Evidence (OQE) collected progressively throughout the build process informing the decision to accept systems and, ultimately, the vessel.

The T26 facilities in the UK required the consolidation of grand blocks due to spatial constraints. The ONS is capable of this approach, but benefits from a 190m consolidation hall that is capable of consolidating the entire ship with the exception of the mast, which will be added onto the hull while the ship is outside on the hardstand. This has several benefits for production efficiency and manufacture accuracy, as the improved temperature control inside reduces ship movement due to asymmetric thermal expansion. The fabrication line at the ONS also has robotic welders that improve weld consistency, quality, and repeatability. HCF will have dedicated blast and paint facilities which will see further improvements in production quality and efficiency compared to T26.

4.2 Approach to Manage Production Risks prior to Cutting Steel on Ship 1

The Project has the following project phases currently underway:

- Design and Productionisation – this includes development of HCF Batch 1 design and prototyping; and
- Batch 1 Build Planning and Scheduling

Prototype blocks have been under construction in Osborne since December 2020 which provides ongoing learning opportunities and confidence to CASG and BAESMA that the facilities, workforce, processes and systems are suitable for commencement of the full shipbuilding construction program. Consolidation of the first prototype units through the facility has already begun and reduces risk for both design for manufacture and digital integration of ship design artefacts with the production facilities (Figure 5) (Australian Manufacturing Forum, 13 April 2022).

Key supporting activities essential to mitigate production risks prior to cutting steel on Ship 1 include:

- Design Separation of discrete HCF Design Zones from T26 in the FORAN 3D Computer-Aided Design (CAD) model used for spatial design and integration;
- Placement of procurement contracts with suppliers for Systems and Equipment; and
- Design maturation through engineering reviews such as Preliminary Design Review and the Zonal Review process managed by BAESMA.

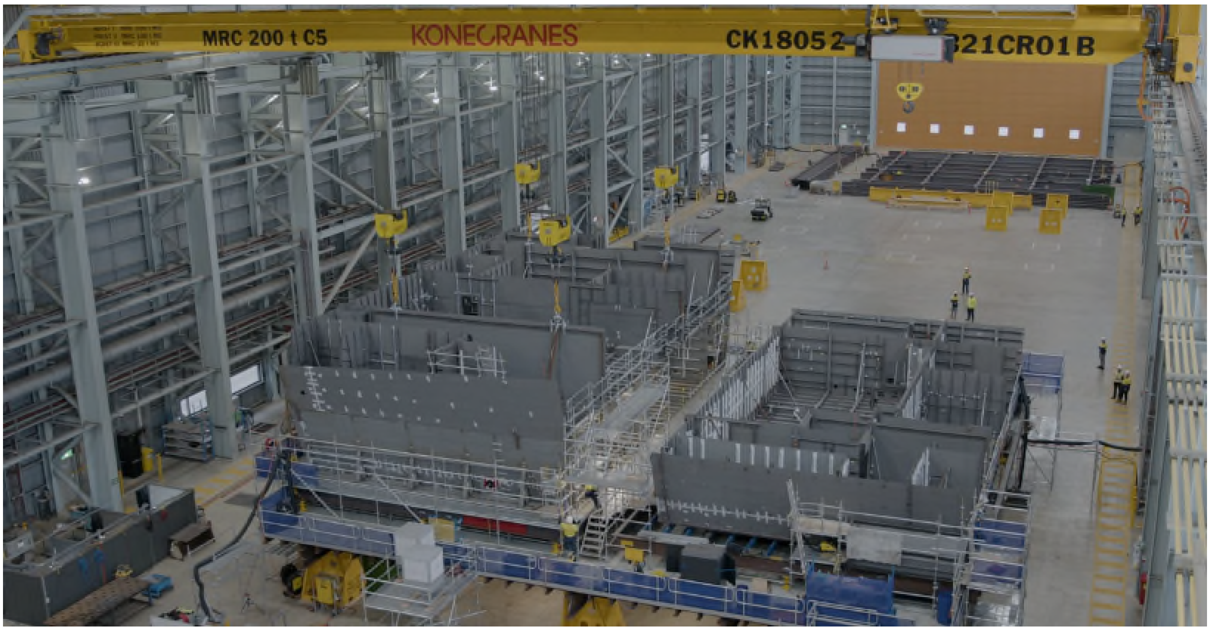

Figure 5: Consolidation of Prototype Units into Blocks (Source: BAESMA)

4.3 Approach to Modular Design and Construction

The HCF design is made up of 12 Design Zones which allows construction to commence on a zone, once its design (and associated interfaces with neighbouring zones) is deemed to be sufficiently mature. This approach allows for a more flexible and efficient use of the workforce and facilities as it avoids the need for the entire design of the ship to be completed before construction commences. It also avoids the delays inherent in a sequential design and construct approach.

For production purposes, the Design Zones are split into smaller sections to optimise the production flow through the various facilities. HCF splits the Design Zones into 22 Blocks, which is necessary to align with the capacity and size of the ONS outfit, blast and paint facilities. These Blocks are further split into 79 total Units, which aligns with the capacity and size of the fabrication line. The benefits of smaller Unit assemblies include improved work fronts and access for production staff, easier transport of Units through the facility and installation of large items, and greater efficiency/productivity driven by more frequent/consistent pulses in production as Units complete in the fabrication hall.

4.4 Approach to Production Optimisation

HCF will optimise the build sequence and schedule through the adoption of shipbuilding best practice, lessons learnt on previous ship builds, and improvements identified through prototyping. The productivity gains from minimising overhead work have also been realised on previous Australian ship builds. Units and Blocks will be built upside down to increase the amount of production work/outfitting that is done at the worker's level. They will then be inverted to complete the remaining work and consolidated into the ship structure. Digital shipbuilding practices and 3D scanning of Units will provide sufficient confidence and accuracy to enable early hot outfitting with locating pipe hangers, equipment seats, and other fittings.

The HCF build will construct bespoke modules containing walkways, pipes, ducts, and cables off the ship wherever possible, and then install these later as an assembled item. This optimises the work space, tools, and use of facilities provided modules are built within acceptable tolerances. The digital shipyard has become industry best practice and the HCF will use digital design artefacts to improve production quality and efficiency for specific work streams such as pipe bending, and plate marking / forming / cutting. These are just a subset of the production optimisations that are already underway to maximise production cost efficiency and performance, and minimise rework.

5. Conclusions

The paper documents the arrangements in place (Head Contract and Phase 1 activity) between CASG and BAESMA to undertake design and productionisation activities to support the Australian Government's strategic direction to:

- Replace the 8 ANZAC Frigates with 9 Hunter Class ASW Frigates (using the T26 as the RSD), and
- Support Continuous Naval Shipbuilding and the National Naval Shipbuilding Enterprise.

The design philosophy notes the concept of utilising a mature design with 'Minimum Change', the intention to maintain coherence with other RAN platforms that use the USN Aegis Combat System and the Australian CEAFAR2 PAR, and the influence of Australian legislation, particularly with respect to Health and Safety.

An assessment of the impact of change between HCF and T26 noted the large number of Product Changes and associated engineering data artefacts to support manufacture of HCF in Osborne once design is finalised. Significant changes include (a) structural modifications (mast and hull form), (b) modifications to the LV Electrical Distribution system and the Power and Propulsion Management System (PPMS), and (c) Cooling system alterations, including the addition of Demineralised Cooling Water System (DCWS) and Electronic Cooling Water (ECW) to support the PAR and the Combat System, respectively.

The build strategy notes the significant efforts required to ensure that that the construction facilities in Osborne and the personnel resources are in place to meet the projected HCF build schedule, whilst also dovetailing with the broader outcomes mandated under the Continuous Naval Shipbuilding strategy (including Australian Industry Capability). Lessons learnt from prototyping already in hand at Osborne, and their influence on the approach to optimising production were outlined, noting the confidence in the production facilities that are currently being enhanced to meet the production schedules and periodicities for ship building.

There is no doubt that the path to designing and building an Australian ASW Frigate is a complex task, and one that requires precision planning, scheduling and aligned thinking between CASG and BAESMA. It requires Engineers, Supply Chain, Schedulers, Production, Commercial and Finance personnel to work together seamlessly to achieve common goals. CASG and BAESMA are well on the way to finalising design and commencing production by June 2024 to meet the Australian Government's direction to build 9 HCF ASW Frigates to replace the ANZAC class commencing in 2031.

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