WARSHIP TECHNOLOGY

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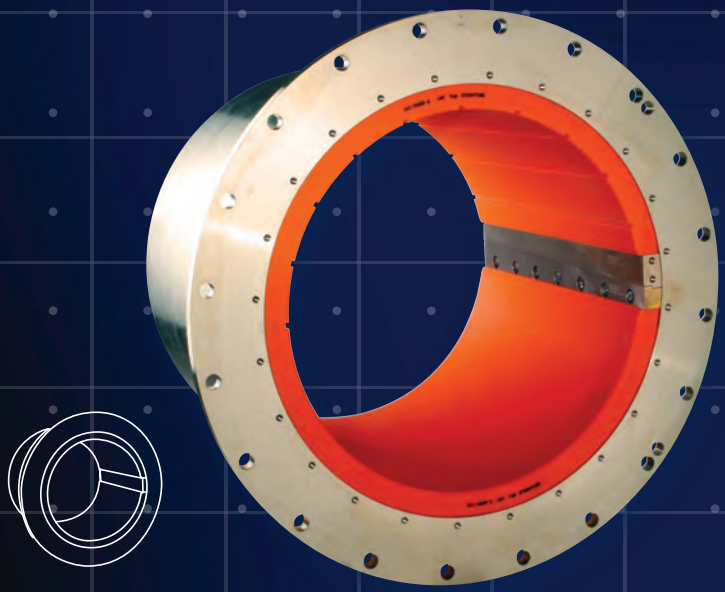

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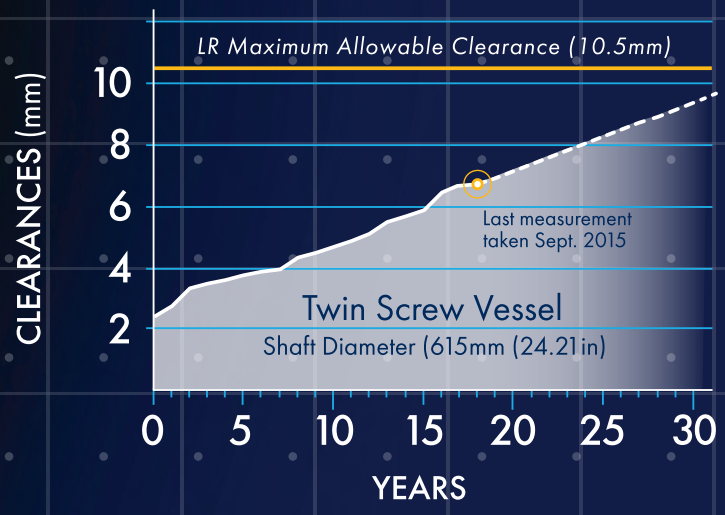

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AUSTRALIA LEADS BY EXAMPLE WITH EXPANSIVE NAVAL INVESTMENT

Shortly before this issue of *Warship Technology* was due to go to press, the Australian Government announced an increase in the number of warships in the Royal Australian Navy to what will be its largest fleet since the end of World War II. But it is not only investing in more ships: it is also investing in naval shipbuilding and in new technology, in the form of new-generation optionally crewed vessels.

In an announcement that will be the envy of many other navies in which the number of surface combatants continues to decline, the Australian Government has clearly recognised that it needs to respond to evolving threats. You can read more about how it intends to do so elsewhere in this issue, but suffice to say that at the moment, the Royal Australian Navy has 11 major warships and that as a result of the new plan it will have 26, with six new Hunter-class frigates at the core of its future fleet, all of which will be built at the Osborne Naval Shipyard in Adelaide, with the first of those ships delivered in 2034. The Australian Government also announced that it will acquire 11 examples of a new general-purpose frigate, a new class of ship for the Royal Australian Navy, and six large, 'optionally crewed' surface vessels (LOSVs) of a type that are already in development with the US. They will operate in combination with the Hobart-class anti-warfare destroyers and in conjunction with the Hunter-class frigates. These ships in combination with the three existing air warfare destroyers will bring the Royal Australian Navy's fleet of warships to 26.

When the Albanese Government was elected last year, the first surface combatant that was due to come into service under the plan it inherited was the first of the Hunter-class frigates, which was due to come into service in 2034. The Government says that timeline will be met and, because of the strategic circumstances it faces today, the government will be accelerating the procurement of the general-purpose frigate. This will see the first general-purpose frigate in service by the end of the decade.

The plan announced by the Government will also underpin continuous naval shipbuilding at the Osborne Naval Shipyard in Adelaide. The Hunter-class frigates will be built there, with the last to be completed and entering service in 2043. The replacement for the Hobart class, the new Air Warfare Destroyers, will also be built at Osborne, after the completion of the Hunter-class frigates. Together, the new programmes mean that there will be a multi-decade pipeline of shipbuilding in place for the Osborne shipyard. And, in addition, the Government is also committing to continuous naval shipbuilding in Perth, at the Henderson Naval Precinct. In 2023, the government announced that Austal would be the Government's strategic shipbuilder in Western Australia and that two Evolved Cape-class vessels would be built by Austal along with two classes of Army landing craft. That will continue and once that work is complete, the general-purpose frigates will be also built at the precinct, as will the LOSVs, providing a multi-decade pipeline of work there.

THE AUSTRALIAN GOVERNMENT IS PLANNING TO RECAPITALISE ITS NAVY, BOOSTING NAVAL SHIPBUILDING IN THE PROCESS

Recognising that it will take time to consolidate and establish the required facilities in Perth, and the need to accelerate the acquisition of new vessels, the first three examples of the general-purpose frigate will be built outside Australia, with four potential designs – from Spain, Germany, South Korea and Japan – already down-selected and a decision on which design to build to be made in 2025.

All this means that, despite building the first three general-purpose frigates offshore, a person beginning their working life now in the naval shipbuilding industry has the prospect of being able to work in that field for their entire working life. Unlike so many Western countries, where shipbuilding capacity has dwindled, Australia's naval shipbuilding industry will become a national asset, ensuring a sovereign capability that many countries cannot match, building industrial capability in the broader economy.

And of the funding required to build so many warships – whilst also funding the AUKUS nuclear-powered submarine programme – the government said in a statement: "There's no make believe in this. This is real money, which will be allocated in the budget." Over the course of the next decade, the cost of equipping the Royal Australian Navy's new surface combatant fleet will be A$54 billion (US$35.4 billion), requiring an additional A$11.1 billion.

"These decisions will see a significant increase in defence spending," said the Government. "And it is needed, given the complexity of the strategic circumstances that our country faces." ■

NEWS

SUBMARINES

Congress passes key AUKUS legislation

NOW THAT THE NDAA HAS BEEN PASSED BY CONGRESS, THREE VIRGINIA-CLASS SUBMARINES CAN BE TRANSFERRED TO THE ROYAL AUSTRALIAN NAVY

In late December 2023, the US Congress passed the National Defense Authorization Act (NDAA), which will see the transfer of nuclear-powered submarines to the Royal Australian Navy, as part of the AUKUS submarine programme.

The NDAA will also see streamlined export control provisions between the US and Australia.

The deal is the first time in US history that it has agreed to the transfer of nuclear submarines to another country and will see three Virginia-class submarines transferred to Australia as part of the 'AUKUS pathway'.

The NDAA will also allow Australians to work in the nuclear enterprise in the US to gain skills and experience whilst allowing Australia to maintain American-flagged nuclear-powered submarines in Australia.

Critically, it also exempts Australia from defence export control legislation, which will help to enable the expansion of the defence industrial base in Australia.

As highlighted in the January 2024 issue of *Warship Technology*, concerns about the effect that sending Virginia-class submarines to Australia might have on the US Navy were detailed in a recent report by the Congressional Budget Office (CBO), 'An Analysis of the Navy's Fiscal Year 2024 Shipbuilding Plan'.

As the report noted that, because Australia could take decades to build its own attack submarines, the AUKUS pact calls for the US to 'export' a limited number of Virginia-class nuclear-powered attack submarines to Australia as an interim step.

The CBO reported noted, the US Navy's 2024 shipbuilding plan states that the service "anticipates building additional Virginia-class SSNs in the 2030s as replacements for submarines sold to Australia."

However, the US submarine industrial base is currently struggling to meet the US Navy's demand for submarines, and it could be difficult and expensive for the US submarine industry to increase production of attack submarines during a period when it must also build Columbia-class strategic ballistic missiles submarines.

IN-SERVICE SUPPORT

Support contract for F125 extended by five years

The Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) has extended a contract with the ARGE F125 for the technical and logistic support of the German Navy's F125 frigates.

The duration of the contract has been extended by a further five years until 1 March 2029. The contract covers the four ships and a testing/training centre in Wilhelmshaven. The F125 consortium awarded the contract consists of thyssenkrupp Marine Systems and NVL Group.

BAAINBW HAS EXTENDED A CONTRACT WITH THE ARGE F125 FOR THE GERMAN NAVY'S F125 FRIGATES

IN-SERVICE SUPPORT

Kongsberg awarded Norwegian frigate framework agreement

Kongsberg Naval Services, part of Kongsberg Maritime and Kongsberg Defence & Aerospace, has been awarded a framework agreement with the Norwegian Defence Material Agency for operational support, maintenance and life-extension services for Norway's frigates. The agreement extends to 2040.

Under the agreement, Kongsberg is responsible for management and technical maintenance, modifications and life-extensions for the Fridtjof Nansen-class frigates.

Kongsberg will coordinate activities with partners through integrated and long-term cooperation with the Norwegian Armed Forces and the Norwegian Defence Material Agency.

The company has formed a consortium consisting of the Westcon Yards and Coast Center Base (CCB) shipyards, WilNor Governmental Services and Wilhelmsen Ship Management. Kongsberg also has a cooperation agreement with Navantia to ensure support services from the shipyard that originally built the ships.

KONGSBERG WILL BE RESPONSIBLE FOR MAINTENANCE, MODIFICATIONS AND LIFE-EXTENSIONS FOR THE FRIDTJOF NANSEN-CLASS FRIGATES

SHIPBUILDING

Future USS *Kingsville* completes acceptance trials

On 31 January, the future USS *Kingsville* (LCS 36) returned pier side after completing acceptance trials in the Gulf of Mexico. During the trials, comprehensive testing was conducted on the ship's major systems and equipment in order to demonstrate their successful operation and mission readiness.

Kingsville will be the 18th Independence-variant Littoral Combat Ship to join the US Navy. This leaves the future USS *Pierre* (LCS 38) as the final LCS under construction at Austal USA, bringing the Independence-variant line to a close. *Pierre* will be christened in the coming months.

REPAIR & CONVERSION

Naval Group completes modernisation of La Fayette frigates

Naval Group in France has completed the modernisation of the third and last La Fayette-class frigate, *Aconit*, after six months of work followed by dockside and sea trials.

With the re-delivery of the refurbished vessel, Naval Group has completed a modernisation programme that has given the vessels new anti-submarine warfare capabilities. The modernisation programme has also extended the ships' operating life by five years.

Naval Group was awarded a contract for the modernisation by the General Armament Directorate (DGA) in 2017. The contract covered three frigates – *Courbet*, *La Fayette* and *Aconit*. In addition to upgrading the ships' anti-submarine warfare capabilities the programme of work undertaken by Naval Group also addressed a number of obsolescence issues.

The ships' combat systems were replaced and their optronic surveillance capabilities were upgraded. The modernisation process also enhanced the ships' structural strength and stability and replaced their Crotale anti-air defence system with two Sadral systems with the latest-generation Mistral very short-range air defence missiles.

NAVAL GROUP HAS COMPLETED THE MODERNISATION OF THREE LA FAYETTE-CLASS FRIGATES

Sea trials undertaken once the work was carried out demonstrated the ships' enhanced manoeuvrability despite their increased displacement and the addition of a sonar dome.

REPAIR & CONVERSION

HMS *Dragon* refit reaches major milestone

HMS *DRAGON* IS THE FIRST OF THE TYPE 45 FRIGATES TO UNDERGO PIP IN PORTSMOUTH

The UK Royal Navy destroyer HMS *Dragon* is expected to return to operation later in 2024 after work to install new engines reached a notable milestone.

The Type 45 destroyer has been undergoing a major upgrade in Portsmouth since March 2022. Nearly two years on, one of *Dragon*'s new engines has been started for the first time as part of the trials process.

The ship is the latest in the class – after HMS *Dauntless* and HMS *Daring* – to go through the Power Improvement Project (PIP), which addresses the resilience of the engines and power generation.

To make the necessary upgrades, the two original diesel engines were removed and replaced with three more reliable, more powerful, cleaner generators. Ultimately, the ship will be more powerful, reliable, greener and ready to embark future weapons.

Before returning to sea, *Dragon* is undergoing trials afloat in a non-tidal basin in Portsmouth which test each of three engine installations is correct, integrated effectively into the workings of the ship, can be controlled remotely and, eventually, that they can all work together to power and propel the ship.

HMS *Dragon* is the first of the Type 45s to undergo PIP in Portsmouth, with HMS *Dauntless* and HMS *Daring*'s work taking place at Cammell Laird. HMS *Dauntless* returned to the fleet at the beginning of 2023.

The PIP is being delivered under a design and manufacture contract between the Ministry of Defence and BAE Systems and delivered in collaboration with BMT Defence services and Cammell Laird.

AMPHIBIOUS VESSELS

Defence Committee welcomes assurances on HMS *Albion* and *Bulwark*

The Defence Committee in the UK has welcomed news that amphibious assault ships HMS *Albion* and HMS *Bulwark* will remain in service well into the 2030s, as confirmed by Ministers in the House of Commons Chamber in early 2024.

As a result of these assurances, the Committee has decided to postpone a session on UK amphibious capabilities and the Royal Marines.

Chair of the Defence Committee, Sir Jeremy Quin MP said: "I and my colleagues on the Defence Committee welcome the Government's clear and unequivocal assurances that neither HMS *Albion* nor HMS *Bulwark* will be mothballed or scrapped before their out-of-service dates in 2033-34.

"We had called an evidence session because this vital capability seemed to be under imminent threat. We are seeking further information from the Secretary of State for Defence and will not hesitate to return to this issue if it becomes necessary again. We look forward to seeing the direction of the First Sea Lord's plan for the Royal Marines and will continue to monitor broader concerns around recruitment and retention."

The Defence Committee decided to hold an evidence session after news reports that Defence Secretary Grant Shapps was considering retiring the assault ships HMS *Albion* and HMS *Bulwark* and the consequences for Royal Marine capabilities. Defence Minister James Cartlidge told the House of Commons that "no final decision has been made on these platforms".

The two assault ships are amphibious Landing Platform Docks, designed to transport the Royal Marines and their equipment ashore. On recent plans, they were expected to remain in service until 2034.

In its 2018 report, *Sunset for the Royal Marines*, the Defence Committee's predecessor Committee warned that the disposal of HMS *Albion* and HMS *Bulwark* would be "militarily illiterate" and "totally at odds with strategic reality".

ROYAL AUSTRALIAN NAVY

AUSTRALIA TO MORE THAN DOUBLE THE SIZE OF ITS SURFACE FLEET

Massive recapitalisation planned for Royal Australian Navy, including wide-ranging upgrades and new-generation 'optionally manned' vessels

THE BLUEPRINT FOR AUSTRALIA'S FUTURE FLEET INCLUDES THREE HOBART-CLASS AIR WARFARE DESTROYERS WITH UPGRADED AIR DEFENCE AND STRIKE CAPABILITIES

On 20 February 2024, the Australian Government unveiled a blueprint for what it described as "a larger and more lethal surface combatant fleet" for the Royal Australian Navy.

The blueprint is the government's response to recommendations made in an independent analysis of the Royal Australian Navy's surface fleet that was initiated following the recommendations of a Defence Strategic Review.

That analysis suggested Australia's new strategic circumstances require a larger and enhanced lethality surface combatant fleet, complemented by a conventionally armed, nuclear-powered submarine fleet. The analysis also took into account the current and 'deteriorating' state of the Royal Australian Navy's Anzac-class frigates, accelerating the acquisition of a new, more capable general-purpose frigate to replace the Anzac class. If the full programme set forth in the blueprint is implemented, the Royal Australian Navy's surface fleet will more than double in size and Australia will have its largest number of surface combatants since World War II.

In addition, the Australian Government has also committed to increase spending by the Defence Department, increasing funding in the 2024-25 Federal Budget by A$11.1 billion (US$7.2 billion) over the next decade to ensure the enhanced lethality surface combatant fleet is funded.

Speaking at a press conference on 20 February 2024, Deputy Prime Minister and Minister for Defence Richard Marles and Minister for Defence Industry Pat Conroy said the Albanese Government had carefully considered the recommendations of the independent analysis of the Royal Australian Navy's surface combatant fleet, commissioned in response to the Defence Strategic Review. They said the independent analysis "lamented the current surface combatant fleet was the oldest fleet the Royal Australian Navy has operated in its history," and emphasised the need for immediate action to boost its air defence, long-range strike, presence and anti-submarine warfare capabilities.

In line with independent analysis' recommendations, the Royal Australian Navy's future surface combatant fleet will consist of 26 major surface combatants. This will include:

- Three Hobart-class air warfare destroyers with upgraded air defence and strike capabilities.
- Six Hunter-class frigates to boost the Royal Australian Navy's undersea warfare and strike capabilities.
- 11 new general-purpose frigates that will provide maritime and land strike, air defence and escort capabilities.
- Six new Large Optionally Crewed Surface Vessels (LOSVs) that will significantly increase long-range strike capacity.
- Six remaining Anzac-class frigates, with the two oldest ships to be decommissioned as per their planned service life.

TWO TIERS, GREATER CAPABILITY

The authors of the independent review suggest that the Royal Australian Navy has a total of nine 'Tier 1' surface combatants, comprising three Hobart-class destroyers and six Hunter-class capable of providing air defence, long-range strike, presence and undersea warfare.

They recommend that the Royal Australian Navy therefore proceed with the SEA 5000 Phase 1 Hunter-class frigate project and negotiate terms to acquire one batch of six Hunter-class frigates of the current design.

To leverage the capabilities of the Tier 1 combatants and to enhance the lethality and sustainability of the force, they also recommended that the following integrated investments should be made.

Firstly, the planned Destroyer Capability Enhancement programme to significantly upgrade the Hobart-class destroyers' Aegis Combat System from Baseline 8 to Baseline 9 should be undertaken 'urgently.' This will reduce the risk of obsolescence and increase the range of missions that the Hobart class destroyers can conduct.

The LOSVs will have 32 vertical launching system cells, providing enhanced lethality through additional multi-domain strike capacity and directly increasing survivability, lethality and endurance. This investment will increase distributed fleet lethality with a lower cost and crewing impact. These vessels will rely on Aegis Baseline 9 or later, which is the combat system planned to be operated by the Hunter-class frigates from delivery, and by the Hobart-class destroyers post-upgrade.

In addition to the Tier 1 ships, there will be at least seven Tier 2 vessels, optimally 11, optimised for undersea warfare, to operate independently of and in conjunction with the Tier 1 ships when required, to secure maritime trade routes, Australia's northern approaches and escort military assets. The authors of the report said it is 'essential' that these vessels include the ability to operate a maritime combat helicopter; provide undersea warfare through a depressed active/passive towed array sonar and have the ability to store, handle and employ lightweight torpedoes; provide air defence through a limited number of point and self-defence systems; provide maritime and land strike; and provide force protection.

The Government has also accepted the independent analysis' recommendations to have 25 minor war vessels to contribute to civil maritime security operations, which includes six Offshore Patrol Vessels (OPVs).

The Hunter-class frigates will be built at the Osborne shipyard in South Australia and will be followed by the replacement of the Hobart-class destroyer. The Hobart destroyers will be upgraded at Osborne with the latest US Navy Aegis combat system.

The new general-purpose frigate will be accelerated to replace the Anzac-class frigates, which means that the ship's 'Transition Capability Assurance' (TransCAP) upgrades are no longer required. These new general-purpose frigates will be modern, capable and more lethal, requiring smaller crews than the Anzac.

Consolidation of the Henderson precinct at which new vessels will be built is already underway, as recommended by the Defence Strategic Review. Successful and timely consolidation will enable eight new general-purpose frigates to be built at the Henderson precinct and will also enable a pathway to build six new LOSVs in Western Australia.

The Ministers reiterated that the Albanese Government is committed to continuous naval shipbuilding in Australia and said the design of Royal Australian Navy's future fleet will provide a stable and ongoing pipeline of work to the 2040s and beyond.

In order to implement the recommendations of the independent analysis, the Albanese Government has committed to funding the planned acquisition and sustainment of the future surface fleet.

This will see the Albanese Government inject an additional A$1.7 billion over the Forward Estimates and A$11.1 billion over the next decade in Defence for an accelerated delivery of the Royal Australian Navy's future surface combatant fleet and to expand Australia's shipbuilding industry. This comes on top of the Albanese Government's investment

ONE OF THE KEY FEATURES OF THE NEW PLAN FOR THE AUSTRALIAN SURFACE FLEET IS A NEW, MORE CAPABLE GENERAL-PURPOSE FRIGATE TO REPLACE THE ANZAC-CLASS

of an additional A$30.5 billion to Defence's Integrated Investment Programme out to 2032-33. This additional A$11.1 billion of funding for the future surface fleet alone brings both acquisition and sustainment investment in the fleet to A$54.2 billion in total over the next decade.

Deputy Prime Minister Marles said: "The enhanced lethality surface combatant fleet will ensure the Royal Australian Navy is optimised for operations in our current and future environment, underpinned by the meticulous assessment conducted by the Independent Analysis Team.

"Australia's society and economy rely on access to the high seas: trade routes for our imports and exports, and the submarine cables for the data which enables our connection to the international economy. The Royal Australian Navy must be able to ensure the safety and security of our sea lines of communication and trade routes as they are fundamental to our way of life and our prosperity."

Minister Conroy said: "This significant advancement in capability that will be delivered under this plan requires a strong, sovereign defence industry. This plan ensures that the Royal Australian Navy's future fleet can meet our strategic circumstances by delivering a larger and more lethal fleet sooner and secures the future of naval shipbuilding in Australia, supporting 3,700 direct jobs over the next decade and thousands of indirect jobs for decades to come."

Chief of Navy, Vice Admiral Mark Hammond said: "A strong Australia relies on a strong Navy, one that is equipped to conduct diplomacy in our region, deter potential adversaries, and defend our national interests when called. The size, lethality and capabilities of the future surface combatant fleet ensures that our Navy is equipped to meet the evolving strategic challenges of our region."

As the Ministers noted, Australian shipbuilders and industry will be at the centre of delivering this future fleet and the new ships included in the blueprint will provide a clear pipeline of work and setting the conditions for job creation, technology investment, export opportunities, supply chain resilience, infrastructure enhancement and economic prosperity.

Over the next 10 years, they said, investment in new surface combatants will support more than 3,700 direct jobs and deliver critical infrastructure required at the Osborne shipyard in South Australia and Henderson shipbuilding complex in Western Australia, delivering on the Government's commitment to continuous naval shipbuilding. In South Australia, the construction of the Hunter class frigates at Osborne will sustain at least 2,000 jobs and create at least 500 new jobs over the next decade.

Under the plan, the Albanese Government will enter into a build contract for the Hunter-class frigates that sees construction start later in 2024, with the final Hunter frigate to be delivered by 2043. The Hunter class will be immediately followed by construction of the replacement for Royal Australian Navy's Hobart class destroyers.

A DESTROYER CAPABILITY ENHANCEMENT PROGRAMME TO UPGRADE THE HOBART-CLASS DESTROYERS SHOULD BE UNDERTAKEN 'URGENTLY,' THE REPORTS SAYS

Combined with more than 4,000 estimated jobs created to build the new Submarine Construction Yard in South Australia that will build conventionally armed, nuclear-powered submarines, Osborne will be at the epicentre of a naval shipbuilding jobs revolution in the country.

As highlighted above, consolidation of the Henderson precinct is currently underway, as recommended by the Defence Strategic Review. Successful and timely consolidation will enable eight new general-purpose frigates to be built at the precinct and will also enable a pathway to build the LOSVs in Western Australia. This is in addition to the strategic shipbuilder pilot which will see Army's Landing Craft Medium and Heavy (Littoral Manoeuvre Vessels), as well as the decision to acquire two new Evolved Cape-Class Patrol Boats, all of which will be built at Henderson by Austal. These projects will create at least 1,200 new local jobs over the next decade.

Two Anzac-class vessels will be decommissioned close to their original planned withdrawal from service. The six remaining Anzac-class frigates will be upgraded with enhanced maritime strike capabilities. Defence will work with industry partners to redeploy the Anzac-class sustainment workforce across the Henderson precinct.

The Ministers also announced that an updated Naval Shipbuilding and Sustainment Plan will be released this year. ■

IF THE BLUEPRINT COMES TO FRUITION, OPERATIONS BY MANNED VESSELS COULD BE COMPLETED BY OPTIONALLY CREWED SURFACE VESSELS WITH LONG-RANGE STRIKE CAPACITY

PROPULSION

PROJECT PROVIDES TOOLS TO TEST NEXT-GENERATION, LOW-NOISE PROPELLERS

Tri-national project validates tools to model quieter, composite propellers with built-in, maintenance-saving sensors

Three countries that undertook a three-year project to validate tools to determine the performance of low-noise naval propellers, manufactured from composites rather than metal, have published a final report on the project.

Conducted under the auspices of the European Defence Agency (EDA), the Next Generation of Propellers (NextProp) project was undertaken by Norway (lead nation), Poland and Italy. The project was led by Forsvarets forskningsinstutt (FFI, the Norwegian Defence Research Establishment) in Norway, with a number of co-contractors and subcontractors. These included FiReCo, Light Structures and SINTEF Ocean in Norway; Consiglio Nationale delle Ricerche – Instituto di Ingegneria del Mare (CNR-INM, Institute of Marine Engineering), Centro per gli Studi di Tecnica Navale (CETENA) and Politecnico di Milano, all in Italy; and Akademia Marynarki Wojennej (Polish Naval Academy), Centrum Techniki Okrętowej and LQS Energy People, in Poland.

The final meeting of the NextProp project took place in Brussels in December 2023, at which models and tools for the design of low-noise naval propellers were reviewed. Initiated in December 2020, the start point for the project was the need to develop a new generation of quieter propellers for naval vessels, propellers being a primary source of a vessel's acoustic signature, and the need to develop tools to predict and assess their performance.

NEXT-GENERATION NAVAL PROPELLERS COULD BE MANUFACTURED OUT OF COMPOSITES RATHER THAN METALS, AS HERE ON THE US NAVY CARRIER

As the project partners note, composite materials are regarded as a possible direction for the next generation of naval propellers for a number of reasons. Composite propellers would weigh much less than metal ones and are expected to have improved acoustic performance. The use of composites rather than metal can also reduce corrosion and cavitation damage, hence reducing lifetime maintenance costs whilst reducing a vessel's acoustic signature.

"Composite propellers offer several advantages compared to metal propellers in terms of weight/inertia reduction that will impact bearing loads and shaft/bearing dimensions, allowing for bigger propeller diameters with increased efficiency," state the participants in the project. "Other clear reasons are advantages in terms of non-acoustic signature and not having to consider corrosion protection. The latter is advantageous in terms of maintenance cost and reduced acoustic signature. Moreover, composite propellers can enable structures to be designed with great flexibility, resulting in cavitation reduction and increased cavitation inception speed."

Designing modern naval propellers involves many considerations, such as efficiency, weight, durability, cost, and detectability. Testing these propellers through experiments, using either scale models or full-size prototypes, is crucial but can be expensive and time-consuming and, as the authors of the project executive summary state, with the potential use of composite materials "the number of possible design parameters increase significantly, and modelling tools are crucial to be able to obtain the optimal combination of these advantages".

Fortunately, advancements in high-performance computing now enable numerical simulations and modelling to be used, but creating a model for the acoustic field generated by propeller motion is a complex task and encompasses factors such as the flow around the hull, turbulence, fluid-structure interaction at the propeller blades, and the interaction between the hull wake and propeller. This complexity defines a multi-physics and multi-scale problem that needs simplification in a computational model.

The main objective of the project was to develop and establish the required hydro-elastic software and design tools for the modelling of next-generation low noise naval propellers. Advanced models for new and modern materials, such as composite materials were integrated in the numerical tools, to aid the design of composite

propellers. The work also included computational fluid dynamics, finite element analysis, fluid-structure interaction, and theoretical models, with models validated through controlled prototype experiments on a generic foil and a typical propeller. In addition to the main objective, several secondary goals were set, these included: improving the current understanding of the primary mechanisms for sound generation/propagation from naval propellers; improving overall competence with composite propellers; using integrated sensors as a first step towards a condition-based maintenance programme; and improving test methods and the experimental set-up for modern propellers.

In order to ensure that future composite propellers are effective, several capabilities were investigated during the project, such as fluid-structure coupling (how the blade deforms under hydrodynamic load, and how in turn the flow field changes due to blade deformation) and a deeper understanding of the material properties. The project also provided increased capability regarding numerical and analytical prediction tools for noise generation and propagation.

The primary project outcome is an improved software tool for the minimisation of the acoustic signature of naval propellers. To this end, models based on hydro-elastic physics were used to predict the behaviour of typical propeller materials, including metals and advanced composites, under operational conditions.

The participants in the project say the results obtained from NextProp have improved understanding of sound generation and propagation from naval propellers and will support advanced low-noise propeller design. Beyond this, NextProp has enabled the development of new methods and setups for experimental propeller tests as well as advanced knowledge of sensor integration for condition-based maintenance. "New materials can open new possibilities for integrating sensors inside the structure of the propeller for structural health monitoring, starting from the production of the propeller and throughout its lifetime," said the authors of the executive summary. "Such sensors will be essential in a condition-based maintenance programme, which will reduce the cost and time for repair and overhaul, as well as increase the overall operability of the naval platform."

DESIGNING PROPELLERS INVOLVES MANY CONSIDERATIONS, SUCH AS EFFICIENCY, WEIGHT, DURABILITY, COST AND VESSEL SIGNATURES, AND TESTING MODELS OR FULL-SIZE PROTOTYPES CAN BE EXPENSIVE

Now that the project has been completed, several EU member states have expressed their support the continuation of research lines investigated in NextProp with the aim of further optimising and validating the design and fabrication of composite and isotropic polymer propellers. A follow-up project is currently being prepared. ■

ABB TO SUPPLY POWER AND DISTRIBUTION FOR ASW FRIGATES

ABB has secured a contract with Damen Shipyards Group for the supply of an integrated power and distribution system for four new anti-submarine warfare (ASW) frigates.

The vessels – two of which will be built for the Royal Netherlands Navy and two for the Belgian Navy – are due for delivery between 2028 and 2031, with the first ship entering service in 2029.

In collaboration with Damen Naval, ABB will supply a versatile electrical distribution system designed to deliver significant performance and sustainability benefits, with the flexibility to support a wide range of mission requirements as well as various loads and energy sources including future energy sources.

Centred on ABB's Onboard DC Grid and featuring energy storage, transformers, motors and generators, the system will enable reduced emissions, increased operational range, enhanced safety and weight and space savings. The system has been ruggedized for naval operations in harsh environments and conditions, with enhanced shock and vibration resistance, improved electromagnetic compatibility and reduced electromagnetic interference levels.

A decade on from its first installation, ABB's Onboard DC Grid has become established in multiple vessel segments and has lately made headway in the naval and coast guard segments. Recent market breakthroughs include ABB's first contract with Damen Naval – to supply Onboard DC Grid for four F126 frigates under construction for the German Navy – and an order with Meyer Turku to deliver the system platform, along with Azipod propulsion technology, for two patrol vessels for the Finnish Border Guard.

CAVITATION-ELIMINATING BOSS CAP COULD PROVIDE BIG GAINS IN EFFICIENCY

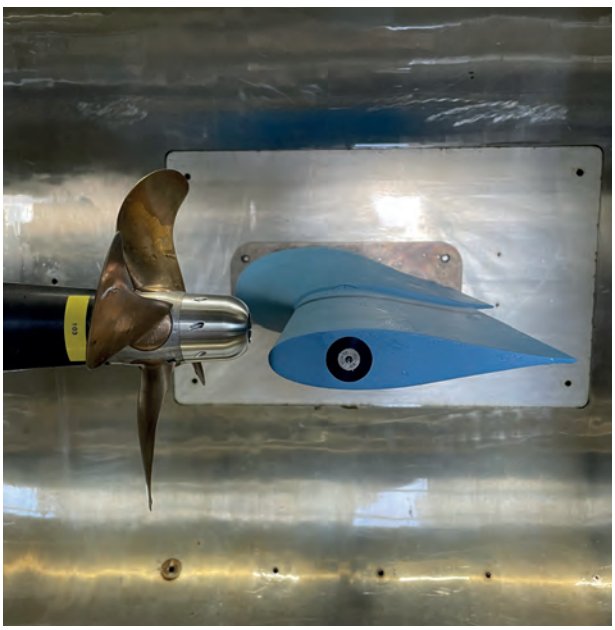
Holy Boss Cap said to be more efficient than existing propeller hub caps

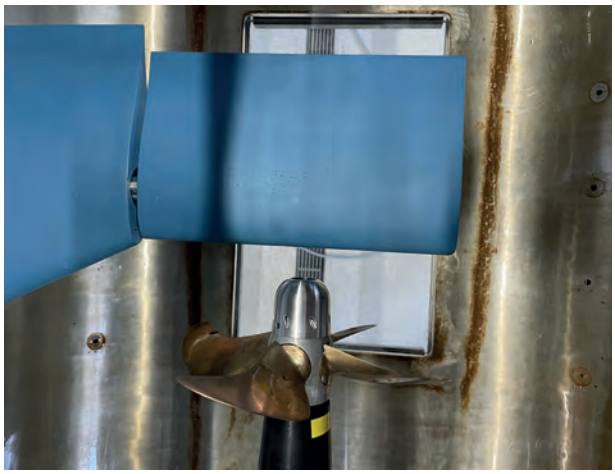
What is described as a 'revolutionary' propeller hub vortex cavitation-eliminating boss cap has successfully completed validation tests at a hydrodynamic research centre in Sweden.

The propeller hub – which could provide gains in propulsive efficiency for a wide range of vessels, including warships – will now undergo ship model basin trials to verify the efficiency gains on larger commercial and naval vessels.

Hub vortex cavitation can be a problem because excessive swirl will result in a pressure reduction across the downstream face of the slipstream relative to the ambient pressure and thus will create an undesirable drag force on the propeller. The swirl may be so significant that the energy imparted to the fluid near the hub will produce no axial thrust but will be dissipated by turbulent mixing. It is a large cavity and not 'solid' water so that a rudder or control surface placed in line with the propeller-shaft axis loses part of the lift force that it is intended to produce. It is a source of undesirable vibration, noise and erosion on any object that may lie its path, including a ships' rudder, which, if subjected to severe hub vortex cavitation may experience undesirable vibration and noise and, in extreme cases, erosion on the rudder.

Initial computational fluid dynamic (CFD) tests based on a typical twin-screw vessel with V-brackets and a 90m general cargo ship showed that EcoMarine Innovations' Holy Boss Cap (HBC) – named thus to indicate the holes bored into the conically shaped hub – increases propulsion efficiency by up to 5%, compared to conventional propeller boss caps.





THE HOLY BOSS CAP HAS HOLES BORED INTO THE CONICALLY SHAPED HUB

Tests also assessed the patent-pending HBC against more advanced energy efficient boss caps currently in operation, and found they are at least 3% more efficient.

"Overall, compared to the propeller boss caps that are currently available, the HBC improved propeller efficiency by 3.1% and thrust by 1.1%, while reducing torque by 2%, rudder cavitation by 10%, and propeller induced noise by 1-3dB," explained Dr Batuhan Aktas, CEO of EcoMarine Innovations, a ship research and development group at the University of Strathclyde, Glasgow.

"The Holy Boss Cap completely eliminates propeller hub vortex cavitation, the main source of rudder erosion, and reduces associated propeller efficiency losses, which can be as much as 8%.

"Considering the investment levels required for other energy saving devices currently in the market and the potential fuel savings, we believe that the Holy Boss Cap is a game changer with and ROI of less than six months," he said.

He explained that the holes channelled into the HBC affect the high pressure in the hub vortex, redirecting the flow downstream. The resulting low-pressure swirl flows in the opposite direction to conventional hubs, behind the propeller blades, reducing propulsive drag, fuel consumption and maintenance costs.

"With shipowners grappling with new environmental legislation and emissions reporting rules, zero propeller hub vortex cavitation can help towards ESG, EEXI and CII goals, improve efficiency and reduce the costs associated

THE HOLY BOSS CAP ELIMINATES PROPELLER HUB VORTEX CAVITATION BY REDIRECTING WATER FLOW, INCREASING PROPULSIVE EFFICIENCY

DR BATUHAN AKTAS, CEO, ECOMARINE INNOVATIONS

ECOMARINE INNOVATIONS' CHIEF TECHNICAL OFFICER DR AHMET GURKAN

with cavitation induced rudder erosion," said EcoMarine Innovations' chief technical officer Dr Ahmet Gurkan.

"What's more, the Holy Boss Cap is less expensive than propeller hub cap fins that incorporate small blades or fins to hydrodynamically deflect the water flow. This is because the Holy Boss Cap is easier to cast and requires less material.

"What we have designed is a propeller boss cap that is 5% more efficient and costs 50% less to manufacture than current conventional propeller hubs. Considering the minimal investment required, this is a significant level of saving," Dr Gurkan said.

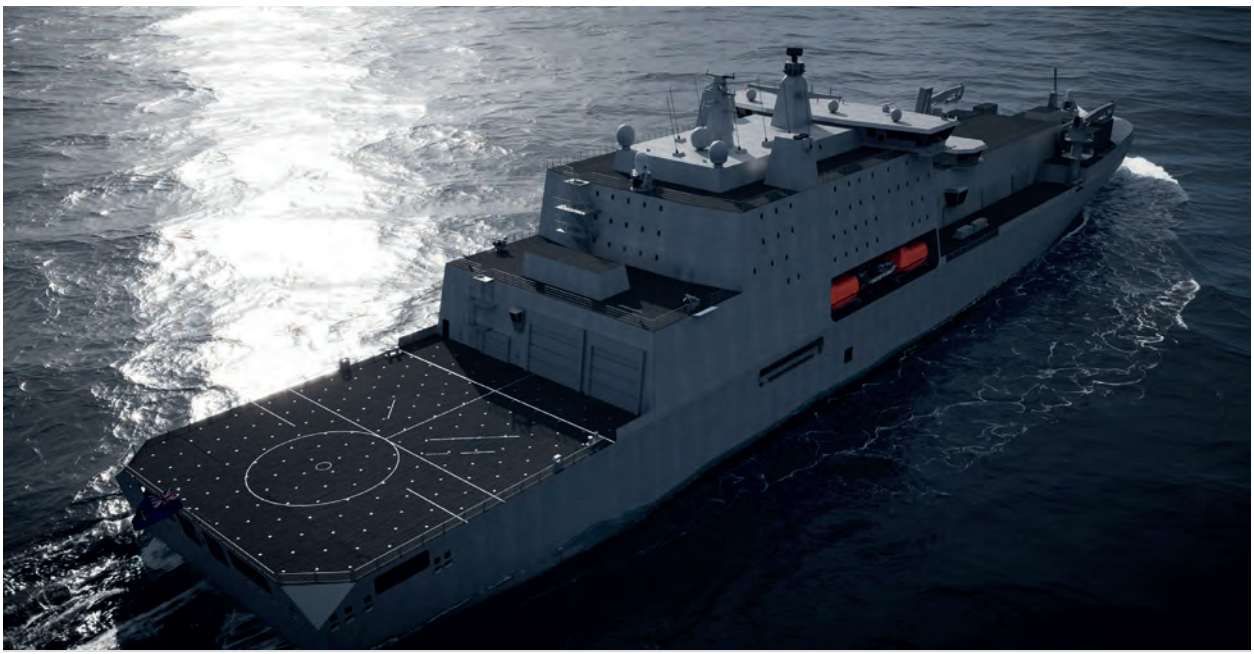
"We are delighted that CFD trials have validated the concept and will now take the development to the next stage and start secondary model tests." He said the tests were due to start in March 2024.

"We will scale up hole areas by 60% and expect to achieve improved performance by eliminating any negative scale up effects," Dr Gurkan concluded. "We are also in advanced discussions with several shipowners that have expressed interest in installing HBC on their vessels as early adopters."

EcoMarine Innovations is now looking for partners to help take the product to market. ■

FLEET SOLID SUPPORT SHIPS TO HAVE HYBRID-ELECTRIC PROPULSION TECHNOLOGY

Team Resolute consortium choses GE Vernova to provide hybrid-electric propulsion technology for Royal Fleet Auxiliary vessels



THE FSS SHIPS FOR THE ROYAL FLEET AUXILIARY ARE BEING DESIGNED WITH AN EMPHASIS ON ENERGY-EFFICIENT TECHNOLOGY

GE Vernova's Power Conversion business in the UK has been selected by Team Resolute to provide hybrid propulsion technology for three Fleet Solid Support (FSS) ships for the UK Ministry of Defence.

Team Resolute is a consortium created by Spanish shipbuilder and defence company Navantia, shipbuilder Harland & Wolff and naval architects BMT to deliver the FSS programme, for which Navantia UK, the UK subsidiary of Navantia, is prime contractor.

The 216m ships for the Royal Fleet Auxiliary (RFA) are being designed with an emphasis on minimising carbon emissions. Equipped with energy-efficient technologies to reduce power consumption, they will be able to use low-carbon, non-fossil fuels and future sustainable energy sources.

GE Vernova's hybrid-electric propulsion technology will play a key role in realising these objectives, helping to optimise energy efficiency, power utilisation and availability. Delivery of the electric propulsion equipment for the first FSS ship is scheduled for 2025, with the second and third vessels planned for 2026 and 2027.

Under the terms of the contract, GE Vernova will design and manufacture 'SeaPulse' active front-end (AFE) power converters and power take-off/power take-in (PTI/PTO) hybrid electric induction motor-generators with resilient shock mounts and flexible coupling and hosing.

The scope of GE Vernova's contract also includes commissioning, testing, sea trials, certification and integrated logistics support (ILS) services to help ensure the seamless integration of the hybrid-electric propulsion technology into the FSS ships.

"Selection of suppliers for FSS ships' key equipment, such as propulsion technology, is a clear indication that the programme is well on track and is aligned with the timetable required by the Ministry of Defence," said Juan de la Cueva, CEO of Navantia UK.

"GE Vernova's background in naval engineering and contributions to the RFA's Tide-class fleet tankers establishes the business as a reliable partner for this important programme," said Andy Cooper, managing director of GE Vernova's Power Conversion business, UK.

"We are confident that our hybrid-electric propulsion technology will enhance the Royal Fleet Auxiliary's operational efficiency, aligning with the UK's commitment to sustainability."

The FSS programme is delivering new solid support ships to replace RFA *Fort Austin* and RFA *Fort Rosalie*,

which were sold to Egypt, and RFA *Fort Victoria*, which is currently due to retire in 2028. The new vessels will increase the capability of the UK Maritime Strike Group to operate globally by replenishing stores, ammunition and provisions while underway at sea, and as such represent the last major component of the carrier-led maritime strike group recapitalisation.

The FSS programme is an important step in enhancing the RFA's capabilities and ability to support carrier strike vessels. They will deliver munitions, supplies and provisions to the Royal Navy while at sea and provide logistical and operational support, including counter-piracy and counter-terrorism missions and will collaborate with allies on operations. Each ship will have a core RFA crew of 101, with accommodation provided for an additional 80 personnel operating helicopters, boats, or performing other roles when required. The new vessels will have a range of 11,000n miles, will be 216m in length, have beam of 34.5m and displacement of 39,000tons.

Construction of the first FSS is expected to begin in 2025 at three shipyards, in the UK and Spain. Long-term improvement in UK shipbuilding capacity and capability will be supported through an investment of £77 million (US$96.9 million) in shipbuilding infrastructure at Harland & Wolff in Belfast.

CONSTRUCTION OF THE FIRST FSS IS EXPECTED TO BEGIN IN 2025, AT THREE SHIPYARDS, IN THE UK AND SPAIN

Blocks and modules will be built in Harland & Wolff's shipyards in Belfast, Northern Ireland, and Appledore in Devon, and at Navantia's shipyard in Cadiz, Spain. The majority of the ship build – along with final outfitting, integration of blocks and modules and sensitive systems, plus all testing and commissioning – will take place at Harland & Wolff, Belfast.

All three ships will enter service after final equipment fits and military trials by 2032. ■

SUBMARINE RESCUE

INDONESIAN GOVERNMENT TO ACQUIRE UK-BUILT SUBMARINE RESCUE SYSTEM

Hybrid system is designed to reduce time-to-first rescue (TTFR) compared to earlier concepts

A British company, Submarine Manufacturing and Products (SMP), a manufacturer and supplier of diving and subsea rescue equipment, has been awarded a contract to provide its new submarine rescue system to the Indonesian Navy.

The rescue system will be hosted on a mothership designed by independent design and engineering consultancy Houlder and delivered by its Indonesian strategic partner, BTI Defence.

The three-year build contract – announced during the Defence and Security Equipment International exhibition in London in late 2023 – will include the UK design and manufacture of the rescue system, which is based on SMP's new SRV-F Mk3 rescue submersible.

Construction of the mothership will take place in region, along with the associated expert training for the Indonesian Navy who will operate the system when it is in service.

The SRV-F Mk3 is a hybrid system capable of deployment by air and on the mothership. The hybrid system can be used to react to a wide range of emergency scenarios, covering larger operating areas and minimising time-to-first rescue (TTFR) compared to earlier submarine rescue systems.

SMP said the rescue submersible can be towed to and from the distressed submarine's location without needing to be recovered to deck. "This reduces the time, risk and complexity of a rescue mobilisation and also greatly increases the likelihood of a suitable support ship being available on location," said SMP. "This hybrid approach saves critical time for stranded crews facing diminishing life support supplies and avoids the integration challenges and dependencies associated with flyaway-only or mothership-only rescue systems."

The SRV-F Mk3 can dive to depths of 500m and can carry up to 50 rescuees at a time. "The adoption of a 'one out, all out' philosophy facilitates the rapid rescue of an entire crew from a conventional submarine in a single mission, in contrast with other rescue systems which require repeated trips to the distressed submarine," said SMP.

In addition to the SRV-F Mk3, the new mothership is fitted with a suite of support equipment, including a handling system, a transfer under pressure (TUP) system and a dedicated decompression chamber, enabling the immediate medical attention and treatment of rescued personnel.

The SRV-F Mk3 is a free swimming, manned submersible capable of untethered rescue operations. It is operated by three crew members. Connection to a DISSUB is achieved by a NATO ANEP MNEP 85/85.1-compliant mating skirt with an innovative soft seal capable of mating to the DISSUB at angles up to 45degrees.

Houlder said it had developed the technical requirement outlining the vessel role, performance and endurance, as well as specify the main equipment

THE SRV-F MK3 IS A HYBRID SYSTEM CAPABLE OF DEPLOYMENT BY AIR AND ON A MOTHERSHIP

THE MOTHERSHIP DESIGNED BY HOULDER WILL HAVE A PERMANENT HYPERBARIC CHAMBER, 10-BERTH HOSPITAL AND ACCOMMODATION FOR UP TO 90 PEOPLE ALONG WITH SEPARATE ACCOMMODATION FOR RESCUED PERSONNEL

required. "We extensively investigated different options across the whole design and produced a concept design package including specification, general arrangement drawing, main structure, CFD powering analysis and full intact and damage stability assessment," the company explained.

"The vessel's operational requirements are different from many current rescue vessels. To fully understand its systems and their use we held in-depth discussions with the SMP team which is vastly experienced in submarine rescue. As a result, we were able to clearly identify the key drivers for the ship design.

"We have developed an inventive concept that meets the submarine rescue needs of the Indonesian Navy, including maximising safety and efficient deployment. With the system requiring a bespoke dedicated rescue vessel, it allowed us to design and incorporate specific features that enhance the ship's rescue capabilities, operability and safety."

The vessel includes an optimised aft working deck arrangement and a large, dedicated operations room with communications suite, which has a clear view over the working deck to support rescue operations. The design also incorporates multiple small boats for rescue duties and a helipad that takes the appropriate medium-to-large sized rescue helicopters.

The mothership will have a large permanent hyperbaric chamber and a dedicated 10-berth hospital. Permanent onboard accommodation for up to 90 people is also incorporated. This allows for total numbers to swell beyond the normal crew as required during a rescue operation. There are more than 30 spare berths available and separate accommodation for rescued personnel, with up to 50 berths.

The vessel arrangement is heavily focused on function and the flow of personnel in order to minimise the time before rescued personnel are transferred to the appropriate medical facilities on the vessel from their point of entry onto the ship.

The hyperbaric chamber is located next to the hospital, and this in turn is just a single compartment away from the accommodation for medical staff, all of which are on the same deck. There is direct access from the small boat rescue zone to the medical facilities.

The vessel will also have a dedicated closed hangar with climate control for rescue equipment. This ensures the equipment is protected from the environment and remains in optimal condition. It can also be maintained more easily and ensures crew comfort is maximised whilst conducting rescue tasks – an important consideration for equatorial operations.

"It is imperative that the vessel is highly reliable," said Houlder. "The ship provides for heightened redundancy – providing for multiple rescue systems, multiple launch and recovery methods, and multiple options for emergency power.

"Maximising the ship's capabilities has been paramount for our team – especially having been inspired by passionate accounts from those involved in rescue attempts. The space demands that this generates were a key challenge to overcome within in a smaller platform package, all at the right cost.

"We have drawn on our hydrodynamics expertise to design a vessel that maximises speed without

THE SRV-F MK3 CAN DIVE TO DEPTHS OF 500M AND CAN CARRY UP TO 50 RESCUEES AT A TIME

compromising seakeeping performance to increase the operational envelope – both key capabilities for successful rescue missions.

"The iterative hull form optimisation process, for example, will continue to find every percentage gain, as for this ship time will be of the essence. In tandem with the hull design, we investigated many different power and propulsion options to achieve maximum speed while maintaining reliability."

Houlder said the next phase of its work will be to develop the concept into a basic design pack to a level where the shipyard will develop this into a fabrication ready design. During this detailed design phase, the company will provide technical support and plan approval to BTI Defence leading up to the vessel construction.

Speaking at the time that the deal was first announced, Ben Sharples, managing director at SMP said: "We are delighted to have been selected to support the Indonesian Navy to provide their submarine rescue system and are grateful for the support from UK Export Finance (UKEF) throughout the process.

"The market is evolving, and countries operating conventional submarines do not need complex systems on the massive scale of nuclear navies. The logistical challenges that come with these larger systems take up time in an emergency.

"Our approach is to think differently and innovatively about our products and to provide solutions which deliver against the specific needs of our customers, and ultimately help to protect or save lives."

Also speaking at the time that the deal was announced, Lord Dominic Johnson, Minister for Investment from the UK Department for Business and Trade said it was "fantastic" to see UK companies securing a prominent international contract and being supported by the UK Government along the way to achieve this success.

"This impressive deal to provide the Indonesian Navy with new life-saving equipment is testament to UK's innovative and attractive business and investment ecosystem," said the Minister. "The programme will not only bring capital to the North of England, but also deepen our collaboration with our Indonesian partners. I look forward to seeing the project go from strength to strength."

The Director General for Defence Potential, Indonesian Ministry of Defence, Major General Mohammad Fadjar said the realisation of the submarine rescue project was "a new era for the Indonesian Navy." He said the SRV-F Mk3 would be a "critical capability" and "an important step for Indonesia's domestic defence industry capability."

The Director General said working closely with SMP and BTI Defence and partners, the Ministry of Defence "has ensured that in the process of introducing this important rescue capability, we will also be expanding our local defence manufacturing capabilities through the introduction of new skills, new knowledge, and new technologies, particularly in the field of sub-surface operations.

"The industrial cooperation offered by this solution will have a huge impact and add value to the Indonesian defence industry, with a network of supply chain

ABB TO POWER NEW SPANISH NAVY SUBMARINE RESCUE VESSEL

ABB has secured an order with Spanish state-owned shipbuilder Navantia to supply the Spanish Navy's forthcoming submarine rescue vessel, *Poseidon*, with a DC-based power and distribution system.

The vessel, which is due to be delivered in 2026, will be responsible for executing and supporting submarine missions, including diving operations, intervention and rescue, and underwater surveillance, including protection of cultural heritage.

Comprising ABB Onboard DC Grid, transformers, alternators, battery system, and ABB's PEMS power and energy management system, ABB's scope of supply will enable the vessel to meet the Spanish Navy's demanding requirements for dynamic positioning and position-keeping capability, reliability and redundancy.

The Onboard DC Grid will deliver the high efficiency and platform flexibility to support the vessel's varied operations, with a battery system covering peak power demands during rescue missions.

companies supporting the through-life and after sales service support," the Director General said. "This is in-line with the Minister Prabowo's vision of a forward-looking, modern, independent, and competitive Indonesian Defence Industry. What is being achieved and delivered through this project will serve as an example for others to follow and that is something that everyone involved in this project should be proud of."

Peter Tjahjono, director at BTI Defence, said winning the contract is a significant milestone for BTI Defence. "For years, this was one of the most coveted and actively pursued contracts on the Ministry of Defence's agenda," he said. "For BTI Defence to win it shows how far we have come as a company. We all knew that this project was well within our reach, because from the beginning we believed in the technological merits of our proposed solution, we had absolute faith and trust in our key partners, and we were at all times guided by our commitment to give Indonesia an advanced, adaptable and rapidly deployable submarine rescue system."

As Julian Mason, director of Ship Design & Engineering at Houlder explained, the company has worked closely with SMP and BTI Defence to carefully understand the requirement for the bespoke submarine rescue mothership and has developed what he described as "an inventive concept design" that meets Indonesia's needs, maximising safety and efficient deployment.

The contract with the Indonesian Navy follows a recent change in ownership at SMP resulting from the sale of the company to a team of shareholders. Former owner, Phil Connolly, remains chairman of SMP. The new management team now comprises several of the world's leading submarine rescue experts, subsea and diving specialists, engineers and naval architects.

Recent months have also seen SMP awarded a contract for the supply of a containerised, IMCA-compliant, twin-lock barochamber system for the Estonian Centre for Defence Investments (EDCI), to support divers within the Estonian Navy. The decompression chamber is supported by associated machinery and controls and facilitates the connection of an emergency transport chamber.

SMP said that, although relatively conventional in terms of the chamber design, the extreme operational temperature requirement of the Estonia Navy will drive the container design which will include diesel and underfloor heating, partition walls, and air heater which is ducted to both the chamber and machinery rooms. A support container is also part of the supply, which includes a generator, providing power to the decompression system, along with a workshop area for light maintenance. ■

UNCREWED VESSELS

EU STATES MAKE PLANS TO TEST MEDIUM-SIZE, SEMI-AUTONOMOUS VESSEL

10-nation project to develop modular, multi-role vessel kicks-off in Estonia

A 10-nation project to develop a modular, semi-autonomous surface combatant that will enhance maritime security in Europe and help build expertise in uncrewed vessel technology on the continent got underway in January 2024.

Led and coordinated by Estonian shipyard Baltic Workboats and funded to the tune of €65 million (US$69.9 million) through the European Defence Fund (EDF), the aim of the EUROGUARD project is to develop a remote-controlled platform that can strengthen defence capability around Europe.

Under the project, a prototype of a medium-sized, semi-autonomous vessel is due to be completed and tested in Estonian waters, with the collaboration of the Estonian Navy, by the end of 2027.

Although the capabilities of the prototype have yet to be determined, the vessel will be able to navigate autonomously, detect obstacles and threats, avoid collisions and perform mission-specific tasks.

The prototype will also be modular, enabling production versions of the design to be assembled to meet the needs of specific roles and missions.

The EUROGUARD project will also focus heavily on propulsion system innovation and on environmental sustainability and will contribute to the need for more rapid response capabilities by coordinated EU vessel fleets with advanced platform and weapon systems. It will also integrate innovative EU technology, enabling it to carry modular mission modules to demonstrate, in a representative environment, semi-autonomous operation. The project will also enable EU navies to further explore the feasibility of using medium-sized semi-autonomous vessels, either working independently or as part of a fleet.

THE EUROGUARD PROJECT WILL SEE A PROTOTYPE OF A MEDIUM-SIZED, SEMI-AUTONOMOUS VESSEL TESTED IN 2027

With a total budget of €95 million – €65 million of which is from the EDF and €30 million from the participating countries – the consortium led by the Estonian shipbuilder includes a total of 23 companies, from Belgium, Denmark, Estonia, France, Italy, Poland, The Netherlands, Norway, Spain, and Sweden.

At the kick-off meeting for EUROGUARD in January 2024, more than 70 stakeholders from participating companies and EU member states were present. The meeting was also attended by Kusti Salm, Permanent Secretary of the Estonian Ministry of Defence, and Commodore Jüri Saska, Commander of the Estonian Navy.

Participants reviewed and discussed the innovative technology that will be focus areas in the EUROGUARD project, including but not limited to system architecture, green propulsion, mission modules, autonomy and cyber security.

“The EDF-funded, four-year project EUROGUARD is a major step forward in EU cross-border cooperation at both industrial and governmental levels in the naval sector,” said Francisco Casalduero, programme manager at the European Commission’s Directorate General for Defence Industry and Space.

“EUROGUARD reinforces the European defence industrial and technological base and fosters concrete cooperation, providing EU navies with a multipurpose, cost-effective capability for operations in the littoral environment."

“With modularity and adaptability at its core, the EUROGUARD project is a great platform for demonstration of seamless integration of mission modules and payload systems using the CUBEDIN concept,” said Thomas Eefsen, chief commercial officer of Odense Maritime Technology (OMT), one of the participants in the project.

“The specific capabilities of the prototype will be determined through multi-year research and development activities, but in general, the vessel should be capable of autonomous navigation, obstacle and threat detection, collision avoidance, and other mission-specific tasks.”

The CUBEDIN concept is being developed by CUBEDIN A/S, a joint venture between OMT and Systematic, aimed

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In December 2024, the International Maritime Organization (IMO) will host 109th session of the Maritime Safety Committee (MSC) where the Maritime Autonomous Surface Ships (MASS) group will meet again. The Royal Institution of Naval Architects and the Danish Society of Engineers (IDA Maritime) are organising the 3rd Autonomous ship conference on 20-21 November 2024 ahead of the IMO meeting.

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Principal Guest & Speaker

Mr Arsenio Dominguez, Secretary General, International Maritime Organization (IMO)

Mr. Arsenio Antonio Dominguez Velasco (Republic of Panama) has been elected by the IMO Council as the Secretary-General of the International Maritime Organization (IMO). After approval by the Assembly at the end of November, he has started his duties from 1 January 2024, for an initial term of four years.

https://rina.org.uk/events/events-programme/annual-dinner-2024-2/

US NAVY AWARDS ANDURIL CONTRACT FOR AUVV

The US Navy has selected Anduril and its 'Dive' family of large autonomous underwater vehicles (AUVs) to prototype distributed, long-range, persistent underwater sensing and payload delivery in contested environments.

"Our selection takes place at a critical moment for the Department of Defense," said Anduril CEO and co-founder Brian Schimpf. "In an era of strategic competition, AUVs like Dive-LD provide urgently needed capability to deter maritime threats. We are excited to work with our US Government partners as we look to building advanced, affordable, autonomous capabilities at scale in support of US Navy priorities."

The contract follows-on from a demonstration of the capabilities of its AUVs by Anduril to the Defence Innovation Unit (DIU). During the demonstrations, Dive-LD carried out government-defined missions at the Naval Undersea Warfare Center in Newport, Rhode Island as part of 'swim-off' competition that evaluated vehicle capabilities.

Anduril engineers successfully tracked and shared the location of the Dive-LD asset with operators around the world in real-time, leveraging 'Lattice,' Anduril's AI-powered software platform for command-and-control of autonomous vehicles, highlighting how multiple operators and units can leverage Lattice for remote mission monitoring and execution. After the demonstration, Dive-LD was down-selected for a contract under DIU's Commercial Solutions Opening process.

at creating integration solutions that support adaption of a vessel to a specific mission. The aim is to enable vessels being reconfigured in a matter of hours, for a range of tasks such as patrol, mine-sweeping or environmental protection.

Apart from Baltic Workboats and OMT, the EUROGUARD consortium also includes: Aircraft Development and Systems Engineering; Akademia Marynarki Wojennej (the Polish Naval Academy); Damen Schelde Naval Shipbuilding; dotOcean NV; Elettronica; Fincantieri; Kongsberg Maritime; Leonardo; Marduk Technologies; Naval Group Belgium; Naval Group; Navantia; TNO; Osrodek Badawczo-Rozwojowy Centrum Techniki Morskiej; RHEA System; Safran Electronics & Defense; SH Defence; SSPA Sweden; Stichting Maritiem Research Instituut Nederland; Technische Universiteit Delft; and Thales DMS France.

The European Defence Fund aims to strengthen the European defence industry and promote research and development in the field. The fund supports the development of innovative projects aiming to improve and increase defence capabilities across the EU. ■

US NAVY LAUNCHES PURPOSE-DESIGNED AND BUILT UNCREWED SURFACE VESSEL

OUSV3 is first purpose-built unit in growing fleet of uncrewed vessels and key step in plans for large USVs

An 'Overlord' uncrewed surface vessel (USV), *Vanguard* (OUSV3), launched by Austal USA's shipyard in Mobile, Alabama early in 2024 is expected to play an important role in the US Navy's ongoing plan to build and operate large uncrewed vessels.

Vanguard is the first USV for the US Navy that is purpose-built for autonomous operations. It is being jointly developed by a team led by Austal USA and L3Harris.

Once outfitting and testing is completed, *Vanguard* will autonomously transit to San Diego, joining sister ships, OUSV2 *Ranger* and OUSV4 *Mariner*, as part of the Navy's USV Division 1, the Surface Navy organisation responsible for the experimentation and tactical development of USVs. The unit also operates two additional USVs, *Sea Hunter* and *Seahawk*, which were developed separately from the Overlord programme.

"We are excited to see the progress the L3Harris and Austal teams are making on the construction of *Vanguard*," said Captain Scot Searles, programme manager of the Unmanned Maritime Systems (PMS 406) programme office. "Designed and built as a USV from the beginning, *Vanguard* will bring new, built-in capabilities that our previous OUSVs did not possess."

The Overlord programme is managed by the US Navy's Program Executive Office for Unmanned and Small Combatants (PEO USC) and executed by PMS 406. It has played a key role 'jumpstarting' US Navy experimentation with USVs and accelerating fleet knowledge and experience in using USVs in operations. The knowledge gained from Overlord plays an important role in the development of requirements for the US Navy's future Large USV (LUSV) programme.

The Program Office for Unmanned and Small Combatants

VANGUARD (OUSV3) IS THE US NAVY'S FIRST PURPOSE-BUILT USV AND IS EXPECTED TO PLAY AN IMPORTANT ROLE IN PLANS TO OPERATE LARGE UNCREWED VESSELS

(PEO USC) and the Unmanned Maritime Systems Program Office (PMS 406) lead the Navy's efforts to develop, deliver and sustain capable and affordable unmanned maritime systems to meet Fleet requirements.

Among the US Navy's programmes for developing and acquiring USVs and uncrewed underwater vehicles (UUVs) of various sizes are two large USVs – the LUSV and Medium Unmanned Surface Vehicle (MUSV), and a programme for a large UUV called the Extra-Large Unmanned Undersea Vehicle (XLUUV).

As highlighted previously by *Warship Technology*, the US Navy wants to develop and acquire LUSVs, MUSVs, and XLUUVs as part of an effort to shift to a more distributed fleet architecture and a mix of ships that spreads its capabilities over an increased number of platforms and avoids concentrating a large portion of the fleet's overall capability into a relatively small number of high-value ships.

According to a recent report from the Congressional Research Service, '*Navy Large Unmanned Surface and Undersea Vehicles: Background and Issues for Congress*,' dated 30 December 2023, the US Navy's proposed FY2024 budget requests US$117.4 million in research and development (R&D) funding for the LUSV programme, US$85.8 million in R&D funding for the MUSV programme, US$176.3 million in R&D funding for LUSV/MUSV enabling capabilities, US$104.3 million in R&D funding for the XLUUV programme, and US$71.2 million in additional R&D funding for core technologies for UUVs including but not limited to XLUUV.

The US Navy envisions LUSVs as being 200ft to 300ft in length and having full load displacements of 1,000tons to 2,000tons, which would make them the size of a corvette – larger than a patrol craft and smaller than a frigate. It wants LUSVs to be low-cost, high-endurance, reconfigurable ships with ample capacity for modular payloads – particularly anti-surface warfare (ASuW) and strike payloads, meaning principally anti-ship and land-attack missiles.

Each LUSV could be equipped with a vertical launch system (VLS) with 16 to 32 missile-launching tubes. Although referred to as uncrewed vehicles, LUSVs might be more accurately described as optionally or lightly manned ships, because they might sometimes have a few onboard crew members, particularly in the nearer term as the US Navy works out LUSV enabling technologies and operational concepts.

The US Navy has been using LUSV prototypes to develop LUSV operational concepts. The FY2024 budget submission programmes the procurement of production LUSVs through the US Navy's shipbuilding account, with the first LUSV to be procured in FY2025 at a cost of US$315.0 million, the next two in FY2026 at a combined cost of US$522.5 million (an average of about US$261.3 million each), the next three in FY2027 at a combined cost of US$722.7 million (an average of US$240.9 million each), and another three in FY2028 at a combined cost of US$737.2 million (an average of about US$245.7 million each).

MUSVs are defined as being 45ft to 190ft long with displacements of roughly 500tons, which would make them the size of a patrol craft. The US Navy wants MUSVs, like LUSVs, to be low-cost, high-endurance, reconfigurable ships that can accommodate various payloads. Initial payloads for MUSVs are to be intelligence, surveillance, and reconnaissance equipment and electronic warfare systems.

US Navy sources describe the LUSV as "capable of semiautonomous operation, with operators in-the-loop or

THE US NAVY HAS BEEN OPERATING AND TESTING A NUMBER OF UNCREWED VESSELS, SUCH AS *SEA HUNTER*, FOR SOME TIME

on-the-loop." Command and control will be maintained via an afloat element (embarked on a US Navy combatant/other assigned afloat asset) or via an ashore element (a C2 station ashore).

First extra-large undersea vehicle delivered

The US Navy also recently accepted delivery of the first Extra Large Unmanned Undersea Vehicle (XLUUV) Test Asset System, designated XLE0, from manufacturer Boeing. In a statement, the US Navy said the XLUUV, also known as Orca, "marks a significant milestone in advancing undersea capabilities".

The delivery of the first Orca XLUUV Test Asset System is the culmination of nearly a decade's worth of research, design, manufacturing and testing by the Program Executive Office for Unmanned and Small Combatants and the Unmanned Maritime Systems Program Office.

XLE0 began in-water testing in early 2023 in Huntington Beach, California. Lessons learned from XLE0's testing will be applied to Orca XLUUV 1 through 5, which will be built and delivered to the US Navy in the future.

The Orca XLUUV is an autonomous, uncrewed diesel-electric unit with a modular payload section to execute a range of missions critical to enhancing undersea prowess. Configured to accommodate various payloads, the Orca XLUUV allows for the seamless integration of sensors, communication systems, and other mission-specific components, adapting to the evolving requirements of naval operations.

With its long-endurance capability, the Orca XLUUV is designed to operate autonomously for extended periods. This allows for sustained operational presence and increased mission effectiveness in challenging undersea environments. ■

NAVAL GROUP TO BUILD AUTONOMOUS UNDERWATER DRONE

In December 2023, France's Naval Group was awarded a contract to design, develop, build and test an autonomous underwater drone demonstrator for the Defence Procurement Agency (DGA).

The contract for the uncrewed combat underwater vehicle (UCUV) demonstrator follows on from a contract awarded to Naval Group in May 2023 for a study focusing on the main use cases and system architecture of the UCUV. The objective of the May contract was to conduct studies and evaluate the technology identified and its ability to meet the French Navy's main use cases, and thus design and develop the UCUV demonstrator.

Naval Group director of drones, autonomous systems and underwater weapons Aurore Neuschwander said the company will leverage know-how acquired in naval unmanned systems over the last decade, and in particular with the XL-UUV demonstrator. "This ambitious project will contribute to the creation of a French centre of excellence in naval unmanned systems," she said.

The new contact will run for 24 months and will enable the development of a version of the autonomie décisionnelle contrôlée (autonomous decision-making process) designed for mission planning and monitoring and surface and underwater navigation.

"Follow-on contracts are planned in order to develop the technologies needed to meet the challenges of long endurance, underwater detection," said Naval Group.

Sea trials with the XL UUV demonstrator were completed in Q3 2024.

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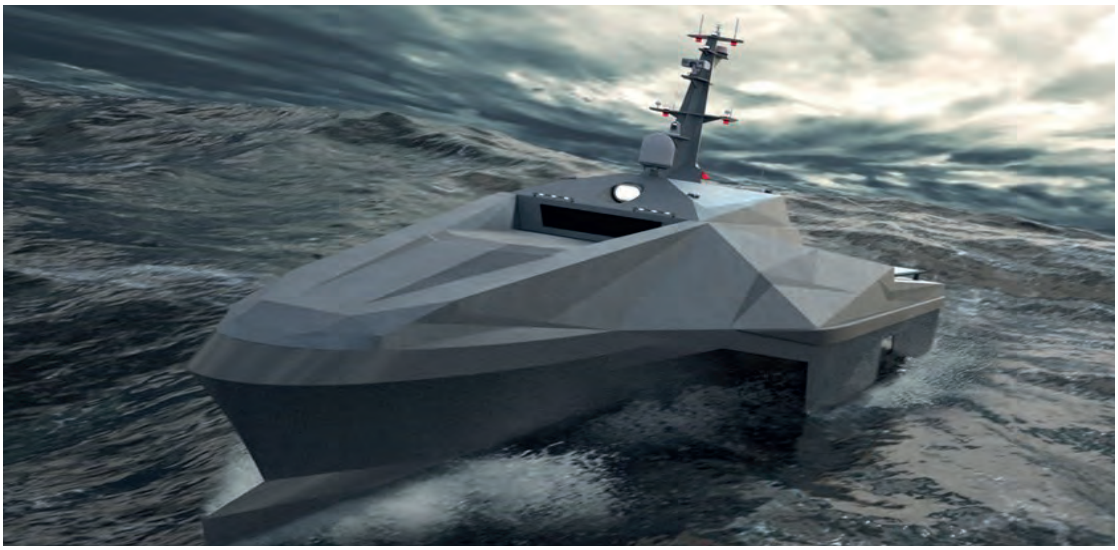

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Sponsored by BMT, Babcock, Defence SA, and ANSYS and Supported by the RINA Australian Division, the Royal Institution of Naval Architects is once again hosting the highly popular Warship International Conference in June 2024.

The increasing complex warship design requires an effective engineering assistance, design configuration control, supply chain and inventory management to meet operational requirements. With the introduction of autonomy and disruptive developments such as quantum technologies, could future operating concepts evolve leading to a step change in design requirements. With vessel design lives between 25 and 50 years naval architects need to consider the effects of current and future technological and operational developments now.

For the first time, RINA Warship Conference will be a 2-stream event with more talks available to hear from than ever before! The event will be a fantastic learning and networking opportunity, filled with many presentations, interactive Q&A panel discussions, and chances to catch up with old friends as well as make new connections from the Warship industry

Keynote Speakers

Rear Admiral Rachel Durbin CSC, RAN

A distinguished leader in the Royal Australian Navy, RADM Durbin's career encompasses pivotal roles in marine engineering and strategic naval operations. With her extensive experience in naval capability development and engineering workforce management, her insights will be a cornerstone of the conference.

Glenn Callow, Chief Technology Officer, Austal Limited

An expert in autonomous systems and naval technology, Glenn brings a unique perspective from his time at BAE Systems and Rio Tinto, where he led innovative projects in autonomous and digital technologies. His expertise is vital in understanding the future of warship design and construction.

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