WARSHIP TECHNOLOGY

A publication of **THE ROYAL INSTITUTION OF NAVAL ARCHITECTS**
For more related news please visit: **www.rina.org.uk**

JAN 2024

CARRIERS TEST CREWLESS AIRCRAFT

HMS *PRINCE OF WALES* LAUNCHES 'MOJAVE' FIXED WING UNIT

SSN-AUKUS 'AN IMMENSE CHALLENGE'

New submarines to be built from early 2030s

NAVALIA

INTERNATIONAL SHIPBUILDING EXHIBITION

21st - 23rd May

Vigo (Spain)

2024

www.navalia.es

Sponsors:

Partners:

Organised by:

CONTENTS

January 2024

Front Cover

THE UK ROYAL NAVY HAS BEEN CONDUCTING TRIALS OF LARGE, FIXED-WING UNCREWED AIRCRAFT FROM ITS AIRCRAFT CARRIERS (SOURCE: ROYAL NAVY)

FEATURES

WARSHIP TECHNOLOGY

Editor: David Foxwell
Production Manager: Nicola Stuart
Publications Sales Coordinator: Henry Owen
Publisher: Neil Hancock

Advertising Sales
Email advertising: advertising@rina.org.uk
Telephone: +44 (0) 20 7235 4622
Published by:
The Royal Institution of Naval Architects
Editorial Office:
8-9 Northumberland Street
London, WC2N 5DA, UK
Telephone: +44 (0) 20 7235 4622
Telefax: +44 (0) 20 7245 6959
E-mail editorial: editorial@rina.org.uk
E-mail marketing: marketing@rina.org.uk
E-mail subscriptions: subscriptions@rina.org.uk

Printed in Wales by Stephens & George Magazines.

The Naval Architect Group (English Edition)
Average Net Circulation 8,195 (total)
1 January to 31 December 2022
ISSN 2513-8227

Digital Editions
Warship Technology is published in print and digital editions.
The current and archived digital editions may be read on PC, iPad or other touchpad.
Visit **https://rina.org.uk/publications/warship-technology/** to read the digital editions.

ROYAL NAVY REPORTS DEFICIT AGAINST 'UNAFFORDABLE' MOD EQUIPMENT PLAN

The UK Royal Navy says the full predicted cost of the capabilities the UK Ministry of Defence (MoD) expects it to deliver far exceeds the funds made available to it.

The Royal Navy's budget deficit partly reflects the way it now calculates it, after it reconsidered its previous policy of only including forecast costs it can afford. Its new policy is to include the full predicted costs for the capabilities the MoD expects it to deliver. As a result, it is reporting a deficit of £15.3 billion in 2023's Ministry of Defence Equipment Plan, compared with a surplus of £0.7 billion in 2022.

The Royal Navy deficit is just part of a larger problem for the UK's armed forces. The Ministry of Defence Equipment Plan (the Plan) for the next decade is 'unaffordable' and it is facing the largest budget deficit since it was first published in 2012, according to a new report by the National Audit Office (NAO).

The NAO report – The Equipment Plan 2023–2033 – reveals that forecast costs exceed the current budget by £16.9 billion. At the end of March last year, the estimated costs were £305.5 billion compared to a budget of £288.6 billion. This contrasts with the previous year's Plan, for 2022 to 2032, in which the forecast costs were £2.6 billion less than the available budget. The Plan is unaffordable because forecast costs have risen by £65.7 billion (27%) compared with the previous Plan, outstripping a budget increase of £46.3 billion (19%).

The largest cost increases are in nuclear and naval programmes, whose combined costs have risen by £54.6 billion. The NAO found that the MoD's decision to prioritise delivering the replacement nuclear deterrent on schedule has led to cost increases at the Defence Nuclear Organisation (DNO) of £38.2 billion, a rise of 62% compared with last year's Plan. The creation of a ringfence around nuclear funding helps protect the MoD's highest defence priority but puts greater pressure on programmes not included in it. Forecast costs for the UK Royal Navy – which delivers parts of the nuclear capability – have risen by £16.4 billion, 41% up on the previous Plan.

The NAO said inflation has contributed to the Plan's increased costs, but the MoD has not received additional funding for inflationary pressures, so the Top Level Budgets (TLBs*) must manage the effects of it within their existing budgets.

The NAO said TLBs have taken different approaches to preparing their forecasts in the Plan: some include full predicted costs for the capabilities that the government expects the MoD to provide, while others only include those they can afford. What this means is that the Plan does not disclose the full funding gap between government's objectives and the budget available, and therefore underestimates the cost pressure that the MoD faces. According to the NAO, the MoD 'does not know' what the forecast costs would be if the Plan included all capabilities outlined in the Integrated Review and Defence Command Paper.

PRIORITISING THE REPLACEMENT OF THE UK NUCLEAR DETERRENT CONTINUES TO SIGNIFICANTLY AFFECT THE DEFENCE BUDGET

"None of the six TLBs has an affordable equipment plan," states the NAO, "and their overall forecast costs, including workforce and estates as well as equipment, also exceed their budgets. Every TLB has a deficit in its individual plan.

"The MoD acknowledges that its Equipment Plan for 2023–2033 is unaffordable, with forecast costs exceeding its current budget by almost £17 billion," said the NAO, noting that this is a marked deterioration in the financial position since the previous Plan.

"Deferring choices on spending priorities until after the Spending Review, while understandable given the government's ambitions expressed in the updated Integrated Review, risks poor value for money if programmes continue which are later cancelled, scaled down or deferred because they are unaffordable. The MoD should consider how future Plans can achieve their core purpose: providing a reliable assessment of the affordability of its equipment programme and demonstrating to Parliament how it will manage its funding to deliver equipment projects."

At least for the time being, the MoD is not planning to cancel programmes, but of further concern for the Royal Navy is that the Plan includes costs for some projects that are not yet fully funded. For example, new entries into the shipbuilding pipeline – including Multi-Role Ocean Surveillance ships, Type 32 frigates, Multi-Role Support Ships, Type 83 destroyers and Future Air Dominance System – are unaffordable by £5.9 billion against currently allocated budgets.* ■

**Managing equipment programmes is the responsibility of the front-Line Commands, including the Royal Navy, Army etc. These organisations are known as 'Top Level Budgets'.*

NEWS

SHIPBUILDING

Construction of new facility underway in Glasgow

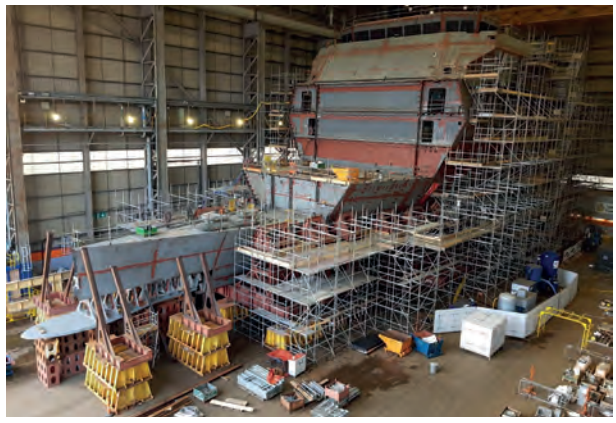
Construction has begun on a new shipbuilding hall at BAE Systems in Glasgow. The new hall at BAE Systems' Govan shipyard is beginning to take shape now that the basin has been filled and piling has begun. Measuring 170m long and 80m wide, the facility will be large enough for two Type 26 frigates to be constructed side by side.

In November 2022, BAE Systems secured a £4.2 billion (US$5.3 billion) contract with the Ministry of Defence to build five more Type 26 ships, building on an initial contract for the first three vessels.

"The new hall will give us some of the best facilities in the world and completely modernise our approach to shipbuilding. Alongside investments already under way to digitise our processes, it will ensure Govan continues to be something that the city of Glasgow can be truly proud of," said Simon Lister, managing director of Naval Ships at BAE Systems.

The shipbuilding hall is being constructed by McLaughlin and Harvey and will use more than 6,000tonnes of steel and 20,000m^3 of concrete. With two 100tonne cranes and a further two 20tonne cranes, the facility is designed to accommodate up to 500 workers per shift.

The hall is a key element of the £300 million modernisation and digitalisation of BAE Systems' shipbuilding facilities at Govan and Scotstoun. Alongside a range of infrastructure and automation improvements, the company is introducing digital technology such as tablets and kiosk screens on the shop floor to streamline processes.



THE NEW FACILITY AT BAE SYSTEMS WILL BE ABLE TO BUILD TWO TYPE 26 FRIGATES SIDE BY SIDE (SOURCE: BAE SYSTEMS)

Steel was cut on the fourth Type 26, HMS *Birmingham*, in April 2023, and work on the first three ships is already well under way. First-of-class HMS *Glasgow* is at BAE Systems' Scotstoun shipyard having complex systems installed, HMS *Cardiff* is currently being assembled and HMS *Belfast* is in its early construction phase.

All eight frigates will be built in Govan and Scotstoun with the work sustaining approximately 1,700 jobs in Scotland with a further 2,300 jobs across the wider UK supply chain.

WEAPONS & EQUIPMENT

BAE Systems to equip Hunter frigates with naval guns

BAE Systems is to deliver multiple Mk 45 naval guns for the Royal Australian Navy's Hunter-class frigates.

The company has received a contract to deliver multiple shipsets of the Mk 45 Medium Calibre Gun and automated Ammunition Handling System (AHS) for the frigates.

The Mk 45 gun system combines the 5-in, 62-cal Mk 45 Mod 4A naval gun with a fully automated AHS that continuously supplies the gun with ammunition, in high sea state conditions. The automated gun system increases productivity, reduces risk and increases the operational capability of the Mk 45 at sea.

Work on the contract will begin in 2023 and finish in 2036. Engineering work will be completed in Minneapolis, Minnesota and production will occur in Louisville, Kentucky.

PATROL BOATS

Samoa takes delivery of Guardian-class unit

Samoa took delivery of a Guardian-class patrol boat, SPB *Nafanua III*, on 22 November 2023.

Samoan Minister for Police and Prisons Faualo Harry Jeffrey Schuster accepted *Nafanua III* on behalf of the Government of Samoa during the handover at HMAS Stirling in Western Australia.

The vessel will reinforce the work of the Samoa Police Maritime Wing, undertaking maritime security and surveillance activity, tackling illegal and unregulated fishing and crime. The vessel can also support humanitarian assistance and disaster relief efforts.

Nafanua III is the 18th vessel delivered under the Australian assistance programme.

WEAPONS & EQUIPMENT

Joint test sees multiple targets intercepted

In October 2023, the US Navy's Arleigh Burke-class destroyer USS *Carl Levin* (DDG 120) successfully intercepted multiple targets in an Integrated Air and Missile Defense (IAMD) test executed by the Navy Program Executive Office Integrated Warfare Systems and the Missile Defense Agency (MDA). The test was undertaken on the Pacific Missile Range Facility, Kauai, Hawaii.

The joint test, known as Vigilant Wyvern, demonstrated the capability of a ballistic missile defence-configured Aegis ship to detect, track, engage and execute intercepts of two short-range ballistic missile (SRBM) targets while concurrently demonstrating an Anti-Air Warfare (AAW) engagement of two subsonic anti-ship cruise missile drone targets.

The live-fire raid scenario was one of the largest IAMD events ever conducted in the US Indo-Pacific Command Area of Responsibility and demonstrated for the first time a concurrent Ballistic Missile Defense and Anti-Air Warfare raid.

The test, designated Flight Test Aegis Weapon System-48 (FTM-48) by the MDA, demonstrated the IAMD engagement of two SRBM targets with two Standard Missile 3 Block IA (SM-3 Block IA) interceptors, and engagement of two subsonic anti-ship cruise missile drone targets with four SM-2 Block IIIA interceptors.

"The success of Vigilant Wyvern is a huge milestone," said Rear Admiral Seiko Okano, Program Executive Officer Integrated Warfare Systems. "The US Navy and MDA successfully demonstrated the tremendous capability of Aegis ships defending against an IAMD scenario. This test event is the first of its kind and an excellent example of collaboration between organisations, further progressing a unified mission to increase capability."

As part of the IAMD 'Priority Mode,' ships can integrate classic air defence with new discrimination and tracking capabilities to defend against coordinated, simultaneous missile attacks.

"The success of this joint test represents a critical step in defending against multiple targets in a realistic raid scenario," said Rear Admiral Douglas Williams, MDA acting director. "The Aegis weapon system successfully defeated multiple concurrent attacks, showcasing the incredible versatility of both this system and the crew of *Carl Levin*."

CORVETTES

Austal, Civmec, Navantia team up for Australian corvettes

Austal, Civmec and Navantia Australia have teamed up to offer the Australian Government a proposal to deliver six corvettes.

The companies said the corvettes, which are designed by Navantia, "combine the manoeuvrability of a Tier 2 vessel with the powerful weaponry of a major surface combatant". It noted that corvettes require a smaller crew than larger vessels, "without compromising on integrated anti-air, anti-surface, anti-submarine, electronic and asymmetric warfare capabilities".

The companies have been collaborating to develop a detailed proposal since November 2022. A proposal was first presented to the Commonwealth in response to the 2023 Defence Strategic Review (DSR) and the independent analysis of the Royal Australian Navy's surface fleet. The companies are now updating and expanding the proposal.

The Tasman-class corvette s would be constructed entirely in Henderson, Western Australia, with production able to start rapidly as work on the design is well advanced and based on an operational reference vessel.

Navantia's proposed corvette is based on a proven design, referencing the Avante-class family. The proposed Australian variant has several key capability characteristics important to Royal Australian Navy that set it apart from other corvettes. These include superior endurance and range allowing effective regional force projection; greater seakeeping capabilities; and enhanced strike capabilities through NSM launchers and Mk-41 vertical launchers. The corvettes would also integrate existing Australian payloads, including the Saab 9LV combat management system, CEA FAR OPVR radar, newly announced Naval Strike Missiles, and the MH60-R Seahawk helicopter.

AMPHIBIOUS VESSELS

US Navy takes delivery of Ship to Shore Connector LCAC

The US Navy accepted delivery of the Ship to Shore Connector (SSC) landing craft air cushion (LCAC) 108 from Textron Systems on 3 November 2023.

Delivery took place after successful completion of acceptance trials conducted by the US Navy's Board of Inspection and Survey, which tested the readiness and capability of the craft to effectively meet its requirements. Delivery represents the official transfer of the ship from the shipbuilder to the US Navy.

SSC LCACs are built with configurations, dimensions, and clearances similar to the legacy LCACs they replace, ensuring that this latest air cushion vehicle is fully compatible with existing, well deck-equipped amphibious ships, the Expeditionary Sea Base and the Expeditionary Transfer Dock.

The SSC LCACs are capable of carrying a 60- to 75-tonne payload and primarily transport weapon systems, equipment, cargo and assault element personnel. Textron Systems is currently in series production on LCACs 109-120.

AUXILIARY VESSELS

SIGINT vessel delivered to Swedish Armed Forces

The Swedish Armed Forces have taken delivery of a new signals intelligence (SIGINT) vessel, HMS *Artemis*. The ship replaces HMS *Orion* as a signals intelligence resource at sea.

THE VESSEL WAS HANDED OVER TO THE SWEDISH DEFENCE MATERIEL ADMINISTRATION IN NOVEMBER 2023 (SOURCE: FMV)

Compared to its predecessor, *Artemis* has better manoeuvrability and will provide personnel with a better on-board environment. In addition to signals intelligence equipment, the ship will be equipped with a range of sensors.

The vessel was handed over to the Swedish Defence Materiel Administration in November 2023, and will be fitted with signals intelligence equipment by the Defence Radio Establishment (FRA).

The new vessel is 74.6m long with a breadth of 14.0m. It has a total of 25 cabins and is powered by a quartet of diesel generators.

SUBMARINES

US Navy commissions *Hyman G Rickover*

THE FUTURE USS *HYMAN G RICKOVER* (SSN 795) HONOURS ADMIRAL HYMAN G RICKOVER, KNOWN AS THE 'FATHER OF THE NUCLEAR NAVY'

The US Navy commissioned its latest Virginia-class fast-attack submarine, the future USS *Hyman G Rickover* (SSN 795), on 14 October 2023.

The commissioning ceremony took place at Naval Submarine Base New London in Groton, Connecticut.

The future USS *Hyman G Rickover* (SSN 795) honours Admiral Hyman G Rickover, known as the 'Father of the Nuclear Navy.' This is the second nuclear-powered fast-attack submarine named in recognition of Rickover. The first *Hyman G Rickover* (SSN 709) was commissioned in 1984.

Hyman G Rickover is the fourth Block IV Virginia-class submarine to enter service, designed with enhanced stealth, sophisticated surveillance capabilities and special warfare enhancements to meet the US Navy's multi-mission requirements.

OPVS

MINDEF signs deal with Fassmer for new OPVs

The Singapore Ministry of Defence (MINDEF) has signed a contract with Fassmer in Germany to build four new offshore patrol vessels (OPVs).

The new vessels will replace the Singapore Navy's Sentinel-class maritime security and response vessels (MSRVs).

The ships are based on a proven OPV design operated by the Bundespolizei (Germany's Federal Police) and are designed to be highly manoeuvrable in Singapore's congested waters.

They will be equipped with a suite of lethal and non-lethal capabilities to provide flexibility and calibrated response against a wide spectrum of maritime threats.

The four OPVs will be delivered progressively from 2028 onwards and the MSRVs will remain in operational service until the OPVs are delivered and operational.

WEAPONS & EQUIPMENT

Norway, Germany to develop 'Super Missile'

The Norwegian government has announced it is starting development of a next-generation strike missile, in cooperation with Germany and Kongsberg Defence & Aerospace as lead industrial partner.

Kongsberg, which developed the Naval Strike Missile (NSM), will take the lead role in developing the new missile, which will complement the NSM, the Ministry of Defence said in a statement. The new missile will be known as the SuperSonic Strike Missile (3SM) 'Tyrfing' and is scheduled to be ready to enter operation in 2035.

The NSM was developed in the early 2000s and delivered to the Norwegian Armed Forces between 2011 and 2015. The missile has also been selected by 13 other countries.

The government is proposing to initiate and complete the initial design phase of the project, before returning to the Norwegian Parliament with a recommendation to continue.

DESTROYERS

First Flight III Arleigh Burke-class destroyer delivered

INGALLS RECENTLY STARTED FABRICATION OF ANOTHER ARLEIGH BURKE-CLASS DESTROYER, *THAD COCHRAN* (DDG 135)

The US Navy commissioned the first Flight III Arleigh Burke-class guided missile destroyer, USS *Jack H Lucas* (DDG 125), on 7 October 2023.

USS *Jack H Lucas* was built for the US Navy by HHI's Ingalls shipyard. The shipbuilder has delivered 35 destroyers to the US Navy, with four currently under construction.

Shortly after the vessel was delivered, HII announced that Ingalls had received a cost-plus-award fee contract from the US Navy for follow yard support of the Arleigh Burke-class destroyer programme.

The contract, which allows for the continuation of technical management and support functions that enable coordinated production of DDGs under existing construction contracts, includes four option years with a total potential contract value of US$185 million if all options are exercised.

The shipyard recently started fabrication of another Arleigh Burke-class destroyer, *Thad Cochran* (DDG 135).

REPAIR & CONVERSION

Australian Navy signs support contract with Thales

The Albanese administration in Australia has signed a A$2 billion (US$1.3 billion) contract to maintain and sustain Australia's naval fleet in Sydney.

Thales Australia has been appointed as the Regional Maintenance Provider for a new Regional Maintenance Centre East at Defence's Garden Island Precinct.

The deal will create up to 120 direct defence industry jobs and around 800 jobs in the broader industrial ship repair workforce and will help ensure that Australia has the sovereign industrial base to maintain and sustain the Royal Australian Navy's fleet into the future.

The seven-year contract includes incentives to ensure local and regional small and medium businesses are given a fair opportunity to compete for work.

The new maintenance centre will support the sustainment of the Canberra-class Landing Helicopter Docks, Hobart-class Guided Missile Destroyers and the landing ship dock HMAS *Choules*.

It is a part of a new national approach to sustainment, establishing a consolidated network of maintenance centres around Australia, to support continuous naval shipbuilding and respond to a more challenging strategic environment.

OPVS

Piriou delivers Senegalese vessel

Piriou delivered a second OPV 58 S-class vessel, *Niani*, to the Senegalese Navy in November 2023.

The contract for the vessel was signed in November 2019 and covered the acquisition of three OPVs. The first, *Walo*, was delivered in June 2023 and the third, *Cayor*, is being fitted out at Piriou's Concarneau facility.

THE ROYAL INSTITUTION OF NAVAL ARCHITECTS

Scan the QR code for more information

EILY KEARY AWARD

The Institution is committed to ensuring that all individuals, regardless of gender, faith or ethnicity, have equal opportunity of being part of the global maritime community.
To raise awareness on this important topic, RINA is launching the Eily Keary Award for 2024.
The award will distinguish an individual, company, or organisation who has contributed to increasing equality, diversity and inclusion in the maritime industry.

HOW TO PARTICIPATE?

Nominations may be made by any member of the global maritime community. Individuals may not nominate themselves, although employees may nominate their company/ organisation.
Nominations should include a 750 word summary, describing the nominee´s contribution towards the advancement of equality, diversity and inclusion in the maritime industry.

in association with bp

Nominations are open until the 31 January 2024.
Online at: https://rina.org.uk/about-rina/medals-prizes-awards/eily-keary-award/
Or, by **email**: awards@rina.org.uk

A panel of members of RINA will deliberate and the winner will be announced at the Institution's Annual Dinner.
For queries about this Award please contact the Chief Executive at: **hq@rina.org.uk**

2024
rina.org.uk

THE ROYAL INSTITUTION OF NAVAL ARCHITECTS

Scan the QR code for more information

2024
rina.org.uk

PETER CONTRAROS AWARD

This Annual Student Award was established in 2022 in honour and memory of Peter Contraros for his contribution to the aim and values of the Royal Institution of Naval Architects.

It is to be awarded to the best nominated paper on the ***Strength, Safety or Reliability of Marine Structures***, including but not limited to the application of structural rules, the historical development of such rules and analysis of events that stipulated their development, innovations and use of new materials, corrosion, fatigue, or other relevant subjects.

HOW TO PARTICIPATE?

The nominees should be undergraduate or postgraduate students whose research has pushed forward the boundries of knowledge in the Strength/Safety/Reliability/ of Marine Structures and related fields. Nominations are now invited for the 2024 Peter Contraros Award. Individuals may not nominate themselves. The nominated paper should be by an individual describing the research and its potential contribution to improving Strength, Safety or Reliability of Marine Structures.

Nominations are open until the 31 January 2024.
Online at: https://rina.org.uk/about-rina/medals-prizes-awards/peter-contraros-award-2/ Or, by email: awards@rina.org.uk
A panel of members of RINA will deliberate and the winner will be announced at the Institution's Annual Dinner.
For Queries about the Award contact the Chief Executive at: hq@rina.org.uk

SUBMARINES

TECHNICAL, POLITICAL, ECONOMIC AND INDUSTRIAL CHALLENGES FACE SSN-AUKUS PLAN

Designing and building the SSN-AUKUS is an immense technical challenge, one made more challenging still by industrial and other challenges faced by the participating countries

Much has been accomplished since the US, UK and Australia announced plans to develop a new generation of nuclear-powered attack submarines together, under the AUKUS Pact, but much more remains to be done, as a November 2023 report* published by the House of Commons Library explains.

The report details many of the challenges facing the AUKUS nuclear submarine programme (SSN-AUKUS) that will see the Royal Australian Navy acquire nuclear-powered attack submarines for the first time and the UK build the successor to its Astute-class submarines.

SSN-AUKUS (also recently referred to as SSN-A in the UK) will be based on the UK's next-generation submarine design, but that design will incorporate technologies from all three nations, including cutting-edge US submarine technologies, largely from the Virginia-class SSN, including propulsion technologies and components, a common vertical launch system and weapons. The AUKUS partners will also develop a joint combat system for the submarines. Design work on the UK's next-generation submarine was already underway as part of the Submersible Ship Nuclear Replacement (SSN-R) programme.

The submarines will be built in the UK and Australia, with work due to begin by 2030, with a view to them entering service toward the end of the 2030s (UK) and the early 2040s (Australia). In the interim, the US – pending Congressional approval – will sell Australia three Virginia-class SSNs, with potential for the sale of a further two.

The last of the UK Royal Navy's Astute-class SSNs is expected into service by 2026, but a decision on how many AUKUS submarines the UK will require has yet to be made and will be based on the strategic threat assessment at the time. As such, an estimated cost of the programme has not been provided by the UK government, although it has announced significant new funding (£3 billion [US$3.7 billion]) to underpin the SSN-AUKUS programme, and the wider Defence Nuclear Enterprise (DNE), over the next two years.

To deliver the AUKUS SSN capability at the earliest opportunity, including the necessary Australian infrastructure, technical capabilities, human resource and experience required to operate and support it (what the partners refer to as 'sovereign ready'), the programme will adopt a phased approach.

SSN-AUKUS WILL BE BASED ON THE UK'S NEXT-GENERATION SUBMARINE DESIGN, BUT INCORPORATE TECHNOLOGY FROM THE US NAVY'S VIRGINIA-CLASS

IN ADDITION TO ITS NEXT-GENERATION SSN, THE UK IS ALSO PLANNING BUILD A NEW CLASS OF SSBNS

From 2023, Australian military and civilian personnel will be embedded with the US Navy, the Royal Navy and within the US and UK submarine industrial base. The US will increase its number of SSN port visits to Australia where Australian naval personnel will join US crews for training and development. The UK will increase its SSN visits to Australia from 2026.

From 2027, and once Australia has developed the necessary infrastructure and stewardship capabilities, the US and UK will begin forward rotations of SSN to Australia to accelerate the development of a sovereign SSN capability. One UK Astute-class submarine and up to four US Virginia-class SSNs will establish a rotational presence at naval base HMAS Stirling, in Western Australia. UK participation in SRF-West will require a bilateral status of forces agreement.

In the early 2030s, and pending US Congressional approval (see page 16), the US will sell three, possibly more Virginia-class SSNs to Australia to help grow its sovereign SSN capability and to address the potential gap between the retirement from service of its diesel-electric Collins-class submarine fleet and the entry into service of SSN-AUKUS. The potential exists for a further two Virginia class submarines to be sold to Australia if required.

Work on the construction of the first SSN will start in the UK in the early 2030s. Knowledge and expertise will be shared with Australian engineers in the early years of construction to allow the subsequent domestic manufacture of their own fleet. Some components for the Australian SSNs, including all the nuclear propulsion reactors, will be manufactured in the UK.

In the late 2030s, the UK will deliver its first SSN-AUKUS (SSN-A) class submarine to the Royal Navy. Australia will deliver the first domestically built submarine to the Royal Australian Navy in the early 2040s. While in service with the Royal Navy and the Royal Australian Navy, submarine crews will train and patrol together and undertake joint

THE LAST OF THE UK ROYAL NAVY'S ASTUTE-CLASS SSNS IS EXPECTED INTO SERVICE BY 2026

CONCERNS RAISED ABOUT AUKUS' EFFECT ON US SUB FORCES

Concerns about the effect that selling 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,' in a section entitled, 'The Potential Effect of the AUKUS Security Pact on the US Navy's Inventory of Attack Submarines.'

As the report notes, because Australia could take decades to build its own attack submarines, the AUKUS pact calls for the US to sell a limited number of Virginia-class nuclear-powered attack submarines to Australia as an interim step. Though details of the sale, including the cost of the ships and the timing of deliveries, are still undetermined, some Australian and US government officials have suggested that the first ships would be transferred in the early 2030s.

The CBO states that the sale could involve as few as three used submarines or as many as five submarines, which would include used and newly built units. It notes that 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".

Those replacement submarines are not included in the 2024 plan's three alternative long-range projections of the US Navy's future fleet. According to that plan, between 2030 and 2039, the US Navy would buy 16 SSNs under Alternative 1, 21 under Alternative 2, and 18 under Alternative 3. To purchase three to five additional replacement submarines during that period, the report notes, it would need to build 1.9 to 2.6 SSNs per year, depending on which alternative it followed.

However, the US submarine industrial base is currently struggling to meet the US Navy's demand for submarines. Since 2011, the Congress has authorised and appropriated funds for the US Navy to buy two Virginia-class submarines per year and to begin building a class of 12 Columbia-class ballistic missile submarines (SSBNs).

The US Navy ordered the first Columbia class unit in 2021 and expects to order the second in 2024; the remaining submarines are due to be ordered between 2026 and 2035 at a rate of one ship per year. However, currently, the shipyards are building fewer than 1.5 SSNs per year in addition to beginning construction of Columbia class units and are facing a backlog of work.

Over the past several years, the time between the appropriation of funds for SSNs and their delivery has increased from six years (when the US Navy was building one SSN per year) to nine years. "Therefore, it would be very difficult and expensive for the US submarine industry to increase production of attack submarines during a period when it must also build one Columbia class ship per year," the CBO says. "Moreover, SSBNs are the US Navy's highest acquisition priority. As a result, the sale of SSNs to Australia would reduce the number of attack submarines available to it."

Using the 2024 shipbuilding plan's Alternative 1 as a baseline, the Congressional Budget Office developed three illustrative scenarios to show how the AUKUS pact could affect the size of the attack submarine force. In the first two scenarios, the US Navy would not buy submarines to replace those it sells to Australia, whereas in the third scenario it would.

QUESTIONS HAVE BEEN RAISED ABOUT THE EFFECT SELLING VIRGINIA-CLASS SUBMARINES TO AUSTRALIA MIGHT HAVE ON US FORCE STRUCTURE

In Scenario 1, the US would sell three Virginia-class SSNs – two used and one new one – to Australia in the 2030s. The used subs would have roughly 20 years of remaining service life, so they would probably come from the recently completed or soon-to-be-completed group of submarines known as Block IV. The new SSN would be the first ship completed from the group of submarines the US Navy plans to order between 2030 and 2036, known as Block VII. In Scenario 2, the US would sell five attack submarines to Australia between 2032 and 2044 – two used subs from Block IV and three new ones from Block VII. Under Alternative 1, in the US Navy's current shipbuilding plan, the SSN force would consistently number 50 or more subs by 2034 and would grow to 60 by 2053.

THE ROYAL AUSTRALIAN NAVY WANTS TO REPLACE ITS COLLINS-CLASS DIESEL-ELECTRIC SUBMARINES WITH NUCLEAR-POWERED BOATS

maintenance and support. Components and parts will be shared with the US.

In the UK, the Ministry of Defence has acknowledged that delivery of the SSN-AUKUS within the timeframe envisaged will require an increase in the capacity and capability of all three nations' submarine industrial infrastructure. SSN-AUKUS will also overlap with the Dreadnought strategic ballistic missile submarine programme in in its early years, so significant investment will therefore be made in the UK's defence nuclear enterprise in order to support submarine delivery.

In March 2023, in conjunction with the refresh of the integrated review and the announcement of the AUKUS pathway, the Prime Minister confirmed that a further £5 billion would be provided to the Ministry of Defence over the next two years. £3 billion of that funding has been earmarked specifically for the defence nuclear enterprise and to fund the next phase of SSN-AUKUS programme. That additional spending was confirmed in the 2023 Spring Budget, which saw an overall increase to the defence budget of £11 billion (£5 billion over the next two years and an additional £2 billion per year in subsequent years to 2027/28). Further,

sustained, funding will be provided to the SSN-AUKUS programme over the next decade. Australia will also make 'a proportionate financial investment' in the UK submarine industrial base to accelerate production and accommodate the manufacture of the nuclear propulsion plants for the Australian SSN-AUKUS submarines, in the UK.

As with the current Astute and Dreadnought programmes, the UK's SSN-AUKUS submarines will be built by BAE Systems at Barrow-in-Furness and the nuclear propulsion units at Rolls Royce in Derby. Rolls Royce will also build all the nuclear reactors for Australia's submarines.

Given the expected pressures from overlap in construction between the Dreadnought and SSN-AUKUS, and the extra capacity required in the US Virginia class SSN programme, specific opportunities will be identified for Australian industry to participate in the SSN-AUKUS supply chain. In doing so, 'this will help ease pressure on the supply chains of the UK and the US, leverage the existing strengths of Australian suppliers and boost their capacity ahead of the commencement of Australia's build programme.'

In September 2023, the AUKUS nations issued a joint statement to mark the second anniversary of the agreement. While welcoming the progress made so far, the statement also noted the outstanding legislative action required to make AUKUS a success, namely in enabling submarine cooperation and defence trade between the AUKUS nations.

In October 2023, contracts worth £4 billion were awarded to BAE Systems, Rolls Royce and Babcock to progress the design and procure long lead items for the first UK submarines. As part of those contracts, the MoD also indicated that infrastructure at Barrow in Furness and Raynesway would be "developed and expanded where needed to meet the requirement of the future submarine build programme." Of the £4 billion, £3.95 billion was awarded to BAE Systems and will cover development work to 2028, "significant infrastructure investment" at Barrow in Furness, investment in its supply chain and the recruitment of more than 5,000 people.

Despite these first steps at collaboration, full implementation of the AUKUS agreement still requires US Congress to pass enabling legislation that will approve the transfer of Virginia-class SSN to Australia, allow the US to accept US$3 billion in funding from Australia to strengthen the US submarine industrial base and allow for the training of private sector Australian personnel in US shipyards and naval facilities.

In May 2023, the Pentagon presented AUKUS-related legislative proposals to be included in the National Defense Authorization Act for Fiscal Year 2024 (NDAA). At the time of writing, the NDAA is still before Congress, and concerns have also been raised in Congress over the ability of the US submarine industrial base to address its own challenges in Virginia-class SSN production, which is currently two-years behind schedule, while meeting its new commitments under AUKUS.

Following delays in the programme, the US Navy estimates that the domestic goal of constructing two Virginia-class SSNs, in addition to one Colombia-class SSBN, per year will not be achieved on current schedules until 2028. Accounting for AUKUS commitments, the production of the Virginia-class SSN will need to rise to 2.33 vessels per year. The US Navy acknowledges that "the recapitalisation of the US Submarine Force, plus the investment in AUKUS, requires continued and significant investments in US facilities, infrastructure, and workforce".

During the Senate's consideration of the NDAA in July 2023, leading Republican on the Senate Armed Services Committee, Senator Roger Wicker, blocked two provisions authorising the transfer of Virginia-class SSNs to Australia and to allow Australian investment in the US submarine industrial base. Citing industrial base concerns, he called for their approval to be contingent on the allocation of extra funding for the submarine industry, beyond what is already set down in the NDAA.

In October 2023, a bipartisan group of US Senators, led by Senator Wicker, called on the US Department of Defense to publish its estimates of the level of investment required in the US submarine industrial base to sustain both US domestic submarine requirements and the commitments to Australia set down in the AUKUS agreement. The October 2023 letter said that: "understanding the scope of the generational investment required [...] is critical for development of AUKUS-authorising legislation this year."

On 20 October 2023 the US administration issued a supplemental funding request to Congress asking for, among other things, an additional US$3.4 billion for the submarine industrial base, specifically with a view to the supporting the implementation of AUKUS.

At a hearing of the House Armed Services Committee on 25 October 2023, US Navy officials said that AUKUS is a "generational opportunity", and that Congress is a "critical AUKUS partner" if the initiative is to succeed.

Last but by no means least, the US International Traffic in Arms Regulations (ITAR) regime establishes rigorous restrictions on sensitive defence exports. The UK and Australia have certain ITAR waivers, established in 2013 and 2012 respectively, but the only country currently with a blanket exemption from ITAR is Canada.

Modification of ITAR to allow for technology transfers between the AUKUS nations, will be required. While primarily intended to enable advanced capability collaboration under Pillar 2 of AUKUS, the Department of Defense has indicated that it will also expedite elements of submarine cooperation. ■

**This article is based on an edited version of 'AUKUS submarine (SSN-A) programme,' Research Briefing, 22 November 2023, Number 9843, by Claire Mills, as published by the House of Commons Library*

AIRCRAFT CARRIERS

CREWLESS AIRCRAFT TRIALS OFFER 'GLIMPSE INTO THE FUTURE' OF CARRIER OPERATIONS

Recent months have seen UK Royal Navy aircraft carriers expanding the envelope of air operations, including trials with large uncrewed aircraft

THE MOJAVE IS A VERSION OF THE MQ1C GRAY EAGLE AIRCRAFT ADAPTED FOR SHORT TAKE-OFF AND LANDING

Trials of the largest uncrewed aircraft ever launched from a UK Royal Navy aircraft carrier could pave the way for the next generation of UK naval air power.

The specially modified aircraft – operated remotely by a 'pilot' at a computer terminal, codenamed 'Mojave' – took off and landed safely on HMS *Prince of Wales* in a unique trial off the east coast of the US.

No crewless machine its size – 9m long, with a wingspan of 17m (6m wider than an F-35B Lightning stealth fighter) and weighing more than 1.5tonnes fully loaded – has ever flown from an aircraft carrier other than the US Navy before.

The UK Ministry of Defence said the trial off the coast of Virginia "further unlocks the potential of the UK's Queen Elizabeth-class aircraft carriers, demonstrating how modern uncrewed air systems can operate alongside fifth-generation crewed aircraft like the Lightnings".

Rear Admiral James Parkin, Royal Navy Director Develop, whose team planned and led the trial said: "The Mojave trial is a European first – the first time that a remotely piloted air system of this size has operated to and from an aircraft carrier outside the US.

"The success of this trial heralds a new dawn in how we conduct maritime aviation and is another exciting step in the evolution of the Royal Navy's carrier strike group into a mixed crewed and uncrewed fighting force."

Royal Navy Second Sea Lord Vice Admiral Martin Connell said embracing autonomy "is the next logical step to ensuring that the Royal Navy can continue to fight and win in an increasingly complex operating environment".

He continued: "With so many international partners interested in the results of these Mojave trials on board HMS *Prince of Wales*, I am delighted that we are taking the lead in such exciting and important work to unlock the longer-term potential of the aircraft carrier and push it deep into the 21st Century as a highly potent striking capability."

The Royal Navy has two decades' experience in operating pilotless aircraft from its ships, but the Fleet Air Arm's existing systems – such as the hand-launched Puma, and the new Peregrine miniature helicopter set to enter service in January – are designed for short-range surveillance operations on land and at sea.

MOJAVE IS FROM THE SAME FAMILY OF UNCREWED AIRCRAFT AS THE ROYAL AIR FORCE'S NEW PROTECTOR RG MK1

Mojave, a version of the MQ1C Gray Eagle aircraft adapted for short take-off and landing from runways even shorter than the flight deck of Queen Elizabeth-class carriers, is a much larger and more complex aircraft.

Produced by US company General Atomics Aeronautical Systems, Mojave is capable of performing numerous long-endurance missions from medium altitude. It is from the same family of aircraft as the Royal Air Force's new Protector RG Mk1 – such 'medium-altitude long-endurance' remotely piloted aircraft are capable of conducting long-range surveillance and strike missions.

Months of planning by experts from the Royal Navy, General Atomics and HMS *Prince of Wales*' crew went into the trial – one of several involving crewless aircraft and F-35s to push the boundaries of operations involving the UK's two carriers.

"My team and I are excited and proud to be the first to launch and land a Mojave from an aircraft carrier," said Commander Martin Russell, in charge of air operations aboard HMS *Prince of Wales*.

"During a deployment centred around experimentation and expanding the envelope of the Queen Elizabeth class, this is one of the highlights. Integrating Navy Develop and General Atomics personnel into the *Prince of Wales* team was key to enabling such a large remotely piloted air systems to operate from the deck during this trial, with the capability feeling like a glimpse into the future of these ships."

Describing the trials, engineers at General Atomics Aeronautical Systems said they were confident that the short take-off and landing demonstrator could take-off from the aircraft carrier and land on it. They explained that the uncrewed aircraft was modified with a different engine, wings, control surfaces and landing gear in order to be able to take off in a shorter distance than the MQ1C Gray Eagle.

"The British government is a world leader in innovative medium-altitude, long-endurance, remotely piloted aircraft systems," said the company, noting that the Royal Air Force is taking delivery of its MQ-9B Protector RG Mk 1 aircraft, manufactured by GA-ASI with significant industrial input from British companies, and the Royal Navy was interested in seeing what Mojave could do aboard HMS *Prince of Wales*.

"That meant, first, an analysis about how best to operate the aircraft from the ship's flight deck," said the company. "One thing the study returned was the conclusion that, even though HMS *Prince of Wales* has an inclined ramp at its bow to help launch manned aircraft, Mojave wouldn't need that.

"Rather than driving the aircraft to a conventional starting position and then running straight down the normal launch axis of the carrier, Mojave could take off in a run from the stern at an angle toward the port side of the flight deck."

Another factor to consider was the difference between the way remotely piloted aircraft typically are flown – from a ground control station on land – and the way Mojave's pilots would need to be situated on the ship. To simulate this GA-ASI engineers built a ground control station on the back of a truck bed and drove it at speeds similar to those used by the *Prince of Wales* when underway at sea for flight operations.

Using more than 100 real-life take-off and landing cycles at a test facility, as well as new software for the aircraft, the engineering team at General Atomics developed great confidence in their ability to take the Mojave from land to sea. "We were hitting the box every time," the company said. "We knew it was going to go good." So it proved during trials from HMS *Prince of Wales*.

For General Atomics, carrier operations were part of a broader effort to prove the potential of medium-altitude, remotely piloted aircraft, which have been used extensively, flown from land for warfare, intelligence, disaster response, lifesaving and other missions. "Deploying a new aircraft such as the short take-off and landing, or STOL, variant of the MQ-9B SeaGuardian

GENERAL ATOMICS BELIEVES MEDIUM-ALTITUDE UNCREWED AIRCRAFT COULD CONTRIBUTE SIGNIFICANTLY TO NAVAL OPERATIONS

– a larger and more capable unit than the Mojave demonstrator – will revolutionise how navies operate," the company claimed.

The current version of the MQ-9B can fly for 40 hours, in some configurations, far longer than any conventional human-occupied aircraft. It has already logged many operational successes in service with the Japan Coast Guard, the Indian Navy and in exercises with the US and international navies. A sea-based STOL version would take those capabilities anywhere allied warships, like the HMS *Prince of Wales*, need to operate.

"The MQ-9B STOL could contribute to fleet defence, serving as an intelligence, surveillance and reconnaissance platform for a carrier strike group," said the company. "It might scout ahead to be sure waters are clear ahead of a ships' transit through a choke point or serve as a communications relay, or it might help hunt for enemy submarines."

Following the trials with the uncrewed aircraft, HMS *Prince of Wales* conducted intense training and trials activity with the US Marine Corps. In October 2023, a specially modified F-35B Lightning stealth fighters joined Britain's biggest warship to begin further pushing the boundaries of carrier aviation, the aim being to use data gathered during trials to enable the UK's aircraft carriers to launch more sorties by more heavily armed stealth fighters faster and in more extreme weather conditions.

Test pilots from the Naval Air Warfare Center Aircraft Division (NAWCAD) Air Test and Evaluation Squadron Two Three (VX-23), Naval Air Station Patuxent River (NAS Pax River), Maryland, joined the carrier off the Eastern Seaboard of the US for the trials, known as Developmental Test phase 3 (DT-3).

In recent months, the UK carriers have also played host to US Super Stallion heavy helicopters and tilt-rotor Osprey aircraft. ■

NAVAL CLASSIFICATION

DNV CONTINUES TO BUILD ON WORK IN NAVAL ASSURANCE

2023 saw class society DNV undertake work on a series of contracts for classification and technical advisory services

In 2023, as geopolitical tension rose amid continuing war in Ukraine and armed conflict in the Middle East, DNV continued to work to ensure that naval vessels and future vessels are safe and secure for those who serve on board and fit for any challenge they need to address.

Contracts related to newbuilds for navies who are expanding, modernising and re-equipping fleets were secured from markets in Northern Europe and Asia. New contracts for classification and technical advisory services for newbuilds and existing fleets in Australia and the Americas demonstrated that the company's geographical reach was paying dividends.

In Germany, DNV provided class and statutory certification for the 121.1m frigates *Al-Qahhar* (F-905) and *Al-Qadeer* (F-909), built by thyssenkrupp Marine Systems for the Egyptian Navy.

Al-Qahhar was delivered in spring 2023 with handover of *Al-Qadeer* (F-909) expected in December 2023. Both vessels are Al-Aziz-class (MEKO A-200 EN). They carry anti-aircraft, anti-surface and anti-submarine weapons systems and are designed for multiple missions and tasks, versatility being a key factor sought by today's navies.

DNV's work scope for the German Navy's 89m K130 Köln-class corvette *Köln* (F-265) included examining construction documents, drawings, and computations; testing and inspecting material, components, and equipment; and construction supervision before the vessel's delivery last August. It is one of five such corvettes being built for delivery between 2023 and 2025 by the ARGE K 130 joint venture led by Naval Vessels Lürssen (NVL). As part of fleet modernisation, they are updated versions of the Braunschweig-class corvettes commissioned between 2008 and 2013.

DNV provided full classification for four newbuilds delivered to Germany's Defence Technical Department for Ships and Naval Weapons, Maritime Technology and Research (WTD 71) as it modernises its fleet. Two were the 51.7m SVK survey vessels *Kalkgrund* (Y898) and *Stollergrund* (Y899). The others were the 20.1m 744-class *Schleswig* and *Holstein* workboats for towing, securing sea areas, transporting personnel, supporting research, and enabling other boats to use underwater equipment and divers. Built by Fassmer, *Kalkgrund* and *Stollergrund* are designed to civilian standards with military research and testing needs factored in, including bow thrusters and fully rotatable rudder propeller drives for manoeuvrability. *Schleswig* and *Holstein* were built collaboratively by Tamsen Maritim and SET.

DNV also provided class and statutory certification for two new 60m Pulau Fani-class mine countermeasures vessels (MCMVs) built by Abeking and Rasmussen in Germany and delivered in 2023 to the Indonesian Navy. The two vessels, KRI *Pulau Fani* (731) and KRI *Pulau Fanildo* (732), are modified variants of the MHV-60 design developed from the German Navy's Frankenthal-class MCMVs. The Indonesian variants have non-magnetised steel hulls and hybrid propulsion systems comprising diesel engines with hybrid power-take-in (PTI) systems for silent minehunting.

IN 2023, DNV PROVIDED CLASS AND STATUTORY CERTIFICATION FOR TWO FRIGATES FOR THE EGYPTIAN NAVY

DNV UNDERTOOK EXTENSIVE WORK ON THE GERMAN NAVY'S KÖLN-CLASS CORVETTE

DNV also reached an agreement with the Royal Dutch Navy to renew DNV's fleet assurance agreement for its fleet. This covers some 67 vessels, for 20 years.

The year closed with the signing of a classification contract with Damen Naval in the Netherlands for the construction of four anti-submarine warfare frigates two each for the Royal Netherlands and Belgian navies. Two will be delivered to the Royal Netherlands Navy starting 2029, and the others to the Belgian Navy in 2030.

Having submitted a proposal for the classification intake of the two Royal New Zealand Navy MEKO 200 ANZAC frigates, *Te Kaha* and *Te Mana*, both in service since the late 1990s, DNV was selected as the winning service provider. The vessels are now undergoing a thorough class entry process.

In June 2023, DNV signed a classification contract for six Multi Role Combat Vessels (MRCV) for the Singapore Navy with construction from ST Engineering in Singapore. The

THE CLASS SOCIETY PROVIDED CLASS AND STATUTORY CERTIFICATION FOR TWO NEW 60M PULAU FANI-CLASS MINE COUNTERMEASURES VESSELS BUILT BY ABEKING AND RASMUSSEN

design is based on a collaboration between Sweden's Saab Kockums and Denmark's OMT and reflects the modular aspects of both the Royal Danish Navy Absalon-class and Iver Huitfeld-class frigates.

DNV also secured a classification contract for two amphibious and military sea transport vessels for the Chilean Navy to be constructed at the ASMAR shipyard in Talcahuano, Chile. These ships are based on a design developed by Canada's Vard Marine.

New navy ships need more complex cable systems that can handle a broader set of capabilities and with stricter safety requirements. Highlighting the Components Manufacturer Certification (CMC) aspect of its business, DNV provided CMC approvals for Üntel's cables for the Turkish Navy's newbuild TCG *Anadolu* amphibious assault ship under construction at the SEDEF yard in Turkey and launched in 2023.

Rapid design approval

In a non-naval development that could have positive implications for defence procurement costs and naval project management, Damen Engineering, 3D design software company NAPA, and DNV collaborated on using a 3D model-based approval to streamline ship design approval.

DNV notes that, the earlier classification is involved in the design-approval process, the easier it is to find rule-compliant design solutions in cooperation with yards. Using the OCX file format to exchange information on 3D design models also allows DNV to more efficiently interact and cooperate with designers and yards early in the design development phase.

Advising navies

DNV's maritime advisory business applied the company's Naval Technical Assurance framework on a broad range of international newbuild and ship-in-operation projects in 2023.

To enhance the safety of navigation in Polar waters, DNV worked with a UK-based yard in the development of a sensor-based operations system for a newbuild polar research and patrolling vessel. The project covered everything from early set-up of the system to its implementation and eventual verification.

"The wide range of activities across our advisory business show the significant increasing complexity, time pressure and requirements of today's naval projects, driven by the current geopolitical situation. Our services have proved their worth in this highly demanding environment," said Dr Olaf Doerk, head of DNV's Advisory Center Hamburg, Germany.

Investigation and measurement services

DNV's measurement services were successfully deployed on several naval projects. In sea trials for newbuildings or after conversions, the measurement team worked with customers in several areas, including performance, noise and vibration, to provide evidence that targets

in the vessel specifications were achieved. This service also extended to troubleshooting, not only in identifying root causes but also, and most importantly, on providing practical on-the-spot solutions.

Applicable in both a commercial and naval context, DNV's noise and vibration analysis looks at the origins of sounds and vibrations and their propagation both into the vessel and beyond the ship's structure. The results can then be used to undertake modifications to minimise the vessel's noise and vibration signature, improving comfort for the crew, contributing to the service life of components and systems on board.

A related investigatory service – shock simulations – analyses the ability of components or structures to withstand underwater explosions and assesses their impacts on a hull, its appendices and components, as well as on systems inside the hull.

DNV provided several navies with a combination of noise and vibration calculations and shock simulations during the sound design process phase in the newbuilding programmes of a variety of corvette and offshore patrol vessels.

The advisory business continued its longstanding support to navies in the submarine market, including a fire safety assessment of an engine room, based on advanced heat and smoke propagation simulations. The analysis provided the basis for an improved fire-safety design and enabled verification of the fire safety-related requirements.

"We had a substantial focus on submarines in 2023 and will continue to offer safety assurance services according to the Naval Submarine Code," said DNV naval business director Christian von Oldershausen. "DNV is one of the few qualified service providers in this respect." ■

RINA DIVES DEEPLY INTO NAVAL UNDERWATER PROJECTS

Italian classification society RINA says demand for classification services for naval underwater systems is growing quickly

Like other classification societies, RINA is playing a growing role in the underwater domain, responding to the need for vessels and equipment used to protect infrastructure such as subsea cables and pipelines.

It says the uniqueness of the underwater environment has led to the development of a wide range of advanced technologies that need to operate with an unparalleled level of safety and reliability.

"Italy has always been one of the leading nations conducting underwater operations," says RINA, "both in civilian and military contexts, employing submersible vehicles. So, it is natural that RINA is now supporting the underwater industry with certifications that ensure safe operations underwater.

"Where safety of submarines is concerned, one of the most important capabilities is the provision of rescue capability. In order to undertake submarine rescue operations, more and more navies are developing and introducing into service submarine rescue systems that are capable of being deployed at short notice."

ARTIST'S IMPRESSION OF THE 'SAVER' SUBMARINE RESCUE SYSTEM

The Italian Navy recently started a replacement programme for its submarine rescue assets, including the 40-year-old rescue vessel *Nave Anteo*, which has reached the end of its operational life. *Nave Anteo* will be replaced by a highly specialised unit capable of providing support for a range of underwater activities, both military and civilian, as well as special operations.

A new Special and Diving Operations – Submarine Rescue Ship (SDO-SuRS), to be named ITS *Olterra*, is under construction at Mariotti Shipyard. A keel-laying ceremony took place on 26 April 2023. The ship will have a length overall of 128m and a full load displacement of approximately 12,000tonnes and will have a large working deck aft and a helicopter deck amidships. The key feature of the vessel will be its saturation diving system, to be supplied by Livorno, Italy-based Drass, which will be capable of saturation diving in water depths of up to 300m.

ITS *Olterra* is classed by RINA as a diving support vessel with a number of additional class notations for vessel characteristics such as its dynamic positioning capability – the vessel will have a DP3 station-keeping system – helicopter handling, comfort class with regard to noise and vibration, and enhanced pollution prevention solutions (GREEN PLUS). The saturation diving system is also fully

RENDERING SHOWING THE 'SAVER' SYSTEM IN OPERATION

certified by RINA in accordance with its rules for underwater units and the IMO Code of Safety for Diving Systems.

RINA says the SDO-SuRS is not the only innovative rescue asset to be operated by the Italian Navy, however. Another is the 'Deployable Assets for the Submarine Rescue,' known as SAVER, which was also designed and built by Drass, working closely with oil and gas contractor Saipem.

SAVER is designed to be very versatile and can be deployed in a standard container suitable for transportation by air and on a vessel of opportunity, to provide rescue operations in water depths of up to 600m. The system is also highly modular in nature, and most elements of the system can be employed as stand-alone units.

RINA is responsible for the classification of the deployable system, the modular capability of which was developed using a certification approach introduced under RINA's rules for underwater units. RINA was also responsible for overseeing the technology qualification process for the submarine rescue capsule or 'Capsule for Intervention and Rescue Operation' (CIRO), and the ROV.

RINA is also actively engaged in the classification of submarines. It is a member of the Submarine Technical Committee in the International Naval Safety Association (INSA) and is currently engaged in the classification of midget submarines, including two projects about which details remain classified.

Based on its experience, RINA is developing its own set of rules for the Classification of Naval Submarines, based on the benchmarks in the Naval Submarine Code (NATO – ANEP-102 High-Level Safety Code for Naval Submarine).

Apart from its work in the underwater sphere, in 2023 RINA achieved significant progress in the classification of a range of naval surface vessels, including fleet renewal programmes for the Italian Navy and Qatari Navy.

For the Italian Navy, RINA is providing classification services for the PPA-class multi-role vessels. The third vessel of this type, *Raimondo Montecuccoli*, was commissioned in September and the sixth, *Ruggero di Lauria*, was launched in October 2023.

Two FREMM frigates out of a total of 10 for the Italian Navy for which RINA is providing classification services are currently undergoing outfitting and, in November, the ninth vessel of the class, *Spartaco Schergat*, was launched at Fincantieri Shipyard in Riva Trigoso.

RINA also provided classification services for the landing helicopter dock vessel *Trieste*, the largest ship in the Italian Navy with an overall length of 245m and a full-load displacement of 38,000tons. The vessel is currently undergoing final sea trials and is scheduled for delivery in early 2024.

The Italian classification society is also involved in the classification of ITS *Atalane*, the second logistic support vessel for the Italian Navy, the keel of which was load in June 2023 at Fincantieri Shipyard in Castellammare di Stabia. The society has been awarded a contract for the classification of a new oceanographic vessel for the Italian Navy and a new generation of offshore patrol vessels, Project PPX, which consists of an initial three ships plus three optional vessels.

RINA is also involved in the preliminary design phase for a new class of mine-countermeasures vessels for the Italian Navy. This will be a class of 12 vessels, six dedicated for coastal operation and six for seagoing operations, to be built by Intermarine Shipyard in Sarzana.

The Qatari Emiri Navy's fleet renewal programme is due to be completed in 2024 with the delivery of the last vessel, a landing platform dock (LPD), with an overall length of 144m. The LPD is derived from a proven design already implemented for the Algerian Navy. In May 2023, the fourth out of four corvettes classed by RINA, QEN *Sumaysimah*, was commissioned into the Qatari Navy. ■

ARTIST'S IMPRESSION OF THE SUBMARINE RESCUE VEHICLE BASED ON THE DRASS RESCUE CAPSULE AND SAIPEM ROV

FRIGATES, CORVETTES & DESTROYERS

CONSTRUCTION OF FIRST POHJANMAA-CLASS CORVETTE GETS UNDERWAY

The corvettes forming the basis of the Finnish Navy's new Squadron 2020 will provide a significant increase in capability

RMC IS CONTRACTED TO BUILD FOUR POHJANMAA-CLASS MULTI-ROLE CORVETTES

Construction of the first of four Pohjanmaa-class multi-role corvettes has started at Rauma shipyard (Rauma Marine Construction, RMC), a major project for the Finnish Navy that has been significantly delayed.

A contract was awarded to RMC to build the corvettes in 2019, but in late 2021 the yard announced that it would need up to 12 months to complete the design of the vessels.

RMC finally held a steel cutting ceremony for the first ship in the class on 30 October 2023. The new corvettes are a key plank in the 'Squadron 2020' project. The first of the new vessels is due to enter service by 2029. The new class is due to remain in service in the Finnish defence forces into the 2050s.

The high-performance vessels are designed to operate year-round in the Baltic and will be capable of sustained operations in all weather conditions regardless of how much ice there is in the Baltic. The vessels are capable of repelling surface targets and submarines, laying mines and acting as command centres for naval operations.

Equipped with a layered self-protection system based on air-defence missiles, the vessels' surveillance capability will be complemented with signal intelligence capability, naval artillery, decoys and chaff.

Introduction into service of the new corvettes will also bring about changes in the Finnish Navy's operating doctrine as well. The new capabilities that the vessels provide will enable use of fire against ground targets, and more extensive cooperation with other units in the Finnish defence force. In addition to participating

FIRST GOWIND CORVETTE DELIVERED TO THE UAE

A delivery ceremony for the first Gowind corvette for the United Arab Emirates (UAE) took place on 21 October 2023 in Lorient in the presence of a delegation from the UAE.

The corvette, *Bani Yas*, is the first of the two Gowind corvettes ordered by the UAE from Naval Group in 2019. The vessel was built in Lorient, France.

Bani Yas was launched in December 2021, left Lorient on 23 October 2023 and, at the time of writing, was due to arrive in the UAE in early December 2023. The second corvette, *Al Emarat*, launched on 13 May 2022 at Naval Group's Lorient site, will soon be starting sea trials.

FINLAND'S NEW CORVETTES WILL BE 117M IN LENGTH WITH A BREADTH OF 16M, DRAUGHT OF 5M AND SPEED OF 26KNOTS

in domestic operations, the vessels will also be able to participate in operations with NATO's Standing Naval Force.

The corvettes are being constructed in a newly built multipurpose construction hall that was built specifically for the corvette project. The hall will ensure excellent conditions for production. RMC has also made significant investments in steel production, which will allow for the welding of thinner plate used in the new vessels.

RMC president and chief executive Jyrki Heinimaa said the new construction hall "will guarantee our ability to build the vessels entirely indoors, where they will be protected from the eyes of outsiders. This project is extremely important for both the shipyard and Finland, and we want to ensure the security of construction work in every way possible."

RMC project director Timo Ståhlhammar said the design of the corvettes "pays particular attention to shock resistance, noise levels and stealth technology." The multi-role corvettes are also the first vessels in the Finnish Navy that have been designed and constructed according to the rules and regulations of the classification society. This includes the ship's performance in ice.

The new corvettes will be 117m in length with a breadth of 16m, draught of 5m and speed of 26knots. They will have a crew of 70 and will be equipped with four MAN 12V175D-MEL gensets with a total output of 7,700kW (4 × 1,920 kW) and a single GE LM2500 gas turbine in a CODLAG arrangement.

The gensets will be resiliently mounted to and be installed in noise enclosures for silent operation. The engines will be suitable for Arctic operation and capable of functioning in extremely low air-intake temperatures.

The vessels will have a 57mm Bofors main gun, two Trackfire remote weapon stations, and an ITO20 surface-to-air missile system comprising a Mk41 launcher and Evolved SeaSparrow missiles. They will also embark Gabriel anti-ship/surface-to-surface missiles and Saab lightweight torpedoes. The new corvettes will also be capable of hosting a helicopter and unmanned aerial vehicles. ■

DAMEN NAVAL INITIATES BUILD OF GERMANY'S FIRST F126 FRIGATE

Steel-cutting ceremony held for first of four vessels that will be built by three yards and completed at Blohm+Voss in Hamburg

Damen Naval and its partner NVL Group have commenced construction of the German Navy's first F126 frigate.

A steel-cutting ceremony for the first F126 frigate took place on 5 December 2023 at NVL Group's Peene-Werft shipyard in Wolgast.

Parliamentary State Secretary at the Federal Ministry of Defence of Germany Siemtje Möller said: "With the F126 frigates, the German Navy will have a modern asset that will serve as an effective deterrent and defend our own security and that of our allies, conducting maritime operations around the world."

Damen Shipyards Group Chief Executive Arnout Damen said: "We are proud to be able to start cutting steel on schedule. We were able to complete the development phase in record time, something that is partly due to the excellent cooperation with BAAINBW, the German Navy and the German authorities."

NVL Group CEO Tim Wagner said: "We are delighted to start production of the F126 and to contribute our shipbuilding skills and expertise to the project together with prime contractor Damen.

"Our yard in Wolgast is a reliable partner for the German Navy in the construction and repair of highly complex naval vessels. Thanks to targeted support measures, extensive investment in infrastructure and motivated employees, Peene-Werft has a clear prospect for the future. Our role in the construction of the ships will secure employment until 2028, with positive effects for the entire region."

In June 2020, the BAAINBw (the Bundesamt für Ausrüstung, Informationstechnik und Nutzung der

THE F126 FRIGATES WILL BE THE LARGEST IN THE GERMAN NAVAL FLEET

Bundeswehr, Germany's Federal Office of Bundeswehr Equipment, Information Technology and in-Service Support) awarded a contract for the construction of four F126 frigates to Damen Naval as prime contractor, with Blohm+Voss and Thales as principle sub-contractors. The contract for the quartet of vessels includes an option for two more frigates.

Over the past three and a half years, Damen Naval and partners have developed the design for the vessels which are being built at shipyards in Wolgast, Kiel and Hamburg. Steelwork and pre-assembly for the stern sections of the vessels will take place at Peene-Werft. The foreship will be built in Kiel, where it will be assembled with the stern and towed by sea to Blohm+Voss in Hamburg. Final outfitting, commissioning, testing and delivery, along with the outfitting of the on-board systems, will take place at Blohm+Voss. Delivery of the first ship is scheduled for 2028.

With a length of 166m and displacement of 10,000tonnes the F126 frigates will be the largest in the German naval fleet and are designed to operate globally, from the tropics to the Polar regions.

The F126 frigates will have main engines provided by MAN Energy Solutions, which has been contracted by Damen Naval for the delivery of eight MAN 32/44CR propulsion engines, two for each of the four frigates. The 32/44CR engines will form part of a combined diesel-electric-and-diesel (CODLAD) propulsion system, providing a top speed of more than 26knots.

Each vessel will have two MAN 32/44CR engines fitted with a proprietary MAN selective catalytic reduction system, in order to comply with IMO Tier III regulations. The engines will be mounted on a resilient mounting system to comply with the latest regulations regarding shock and noise. MAN Energy Solutions will also supply engine control systems. The first engines will be delivered in early 2024.

Damen Naval placed a contract with Rolls-Royce's power systems business for mtu gensets for the F126 frigates. The company will supply a total of 16 mtu 20V 4000 M65L gensets manufactured in Germany. The gensets will meet the requirements of the IMO III emissions directive and will be supplied along with Rolls-Royce onboard power and automation solutions. Like the main propulsion engines, the gensets will be fitted with SCR systems. The deal with Rolls-Royce also includes an integrated logistics support package. Rolls-Royce is also supplying the frigates with mtu NautIQ Master and mtu NautIQ Foresight automation systems.

Renk was awarded a contract to supply gearboxes and electric propulsion systems for the frigates. The Augsburg, Germany-based propulsion specialist has a decades-long relationship with the German Navy, including propulsion machinery for the F125 and F124 class frigates. The propulsion system for the F126 differs in a key respect from the earlier vessels, being a (CODLAD) propulsion system.

In addition to the gearboxes for the F126s, Renk is also supplying the ships with an advanced electric drive (AED) in the form of electric propulsion motors that will drive the propellers, either individually or together with the ships' diesel engines. This is the first time the German Navy is utilising this propulsion concept.

The CODLAD configuration also provides a proven combination of increased power density, noise reduction through soft-elastic bearings and flexible couplings, in addition to reduced weight and installation height. ■

THE BAAINBW AWARDED A CONTRACT FOR THE CONSTRUCTION OF FOUR F126 FRIGATES TO DAMEN AND PARTNERS IN JUNE 2020

The Royal Institution of Naval Architects Presents:

Annual Dinner 2024

16 May 2024, London, United Kingdom

REGISTER NOW

The Annual Dinner is a major event in the Institution's diary and is well supported by the maritime industry, as well as members of the Institution. Members and guests represent designers, builders and operators across the entire spectrum of the global maritime industry. RINA Annual Dinner 2024 is one not to be missed – with the Principal Guest & Speaker Arsenio Dominguez, the awards ceremony, drinks reception and a 3-course dinner, there will be plenty of fantastic opportunities to catch up with your old colleagues, clients, guests and make new connections from the industry.

The event will be held at the gorgeous De Vere Grand Connaught Rooms in the heart of Central London – Covent Garden, with great transport links and easy access for you and your guests.

RINA Annual Dinner 2023 was attended by more than 80 companies and 300+ industry professionals. Don't miss out and book your ticket as soon as possible – this will be a great opportunity for you to catch up with your colleagues, clients, guests and friends in the maritime industry.

Scan the QR Code
for more information

Principal Guest & Speaker

Mr Arsenio Dominguez

Mr. Arsenio Dominguez Velasco is Director of IMO's Marine Environment Division. He joined the IMO Secretariat in 2017, first as Chief of Staff to the Secretary-General, Kitack Lim, before being appointed in 2020 as Director of the Organization's Administrative Division.

Mr. Dominguez Velasco was born in the Republic of Panama. He graduated in 1988 with a Bachelor of Science degree from the Fermin Naudeu Institute in Panama. He went on to study Naval Architecture at the University of Veracruz, Mexico, graduating in 1995. Mr. Dominguez Velasco also holds an MBA from the University of Hull, and a Certificate of Higher Education in International Law and European Politics from Birkbeck University, both in the United Kingdom.

His maritime career began in 1996 as a port engineer at Armadores del Caribe in Panama before moving to become a Drydock Assistant Manager at Braswell Shipyard.

In 1998 Mr. Dominguez Velasco moved to London to join the Panama Maritime Authority as Head of the Technical and Documentation Regional Office for Europe and North of Africa. He went on to represent Panama in a variety of roles at the organization, culminating in 2014 with his appointment as Panama's Ambassador and Permanent Representative to IMO until 2017.

Between 2014 and 2017, Mr. Dominguez Velasco chaired IMO's Marine Environment Protection Committee (MEPC), and in 2015 he chaired the Technical Committee of the 25th session of the IMO Assembly. Prior to this, between 2010 and 2014, he chaired the Maritime Security – Piracy and Armed Robbery Working Group under the auspices of the organization's Maritime Safety Committee.

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 should start his duties from 1 January 2024, for an initial term of four years.

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

25TH sea WORK MARINE CIVILS

11 TO 13 JUNE 2024 | Southampton United Kingdom

Seawork celebrates its 25th anniversary in 2024!

The 25th edition of Europe's largest commercial marine and workboat exhibition, is a proven platform to build business networks.

Seawork delivers an international audience of visitors supported by our trusted partners.

Seawork is the meeting place for the commercial marine and workboat sector.

- 12,000m² of undercover halls feature 400 exhibitors with over 70 vessels, floating plant and equipment on the quayside and pontoons.
- Speed@Seawork on Monday 10 June in Cowes offers a sector specific event for fast vessels operating at high speed for security interventions and Search & Rescue.
- The European Commercial Marine Awards (ECMAs) ceremony celebrates individuals and innovative companies on Tuesday 11 June.
- The Conference programme, chaired by industry experts, helps visitors to keep up to date with the latest challenges and emerging opportunities.
- The Careers & Training Day on Thursday 13 June 2024 delivers a programme focused on careers in the commercial marine industry.

Speed@Seawork Sea Trials & Conference

ecm awards european commercial marine

For more information visit: seawork.com
contact: +44 1329 825 335 or email: info@seawork.com

#Seawork

mercatormedia magazines|events|online

Media partner MARITIMEJOURNAL COMMERCIAL MARINE BUSINESS

25TH sea WORK MARINE CIVILS

JOIN US FOR

Speed@Seawork Sea Trials

10 JUNE 2024 | Cowes, IOW United Kingdom

Supported by SMI

- A full day showcasing an international field of fast vessels operating at high speed in the arena of security intervention and Search And Rescue.
- Demonstrations of all the latest technology and equipment in this significant specialist sector of the commercial marine business.
- Day of sea trials from Cowes, Isle of Wight, UK.
- Informal networking with military procurement, defence attachés and end users.
- Presentations from key specifiers, government agencies and military personnel.
- Demonstrate your high speed vessel or equipment. Attend as a delegate.

SIGN UP

www.seawork.com or call the Seawork Sales Team at +44 (0)1329 825335

Sponsored by: RSI