

Mission-critical solutions from Kongsberg Maritime

Horizon



KONGSBERG

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Promas is the positive choice

Waterjet is perfect for propulsion

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Resupplying ships in a better way

A business with strength in depth

On a mission

Delivering quality solutions to 70 navies worldwide

Your mission is our mission

Patrolling Protecting Preserving Empowering

70
Serving 70 navies worldwide



KONGSBERG



Welcome

Lisa Edvardsen Haugan,
President – Kongsberg Maritime

Welcome to this special issue of our new magazine *Horizon*, focused on the equipment and technology we offer our naval and governmental customers.

Kongsberg Maritime is a provider of mission-critical products and systems to customers around the world. Our experience goes back more than 80 years and today we provide equipment, support and technology to 70 navies.

Our equipment can be found on all types of naval platforms. Kongsberg is a technology company and we can draw on a wealth of expertise to support the naval missions of today and tomorrow.

In recent years, we have seen a shift towards digital technologies, and we recognise how navies are now embracing new ideas to transform their operations. We are leaders in developing digital solutions for remote and autonomous operations, and we're talking with navies about how such technology can be deployed in future.

We have extensive experience in integrating multiple products on board ships, and our engineering teams work closely with shipyards and navies to ensure Kongsberg Maritime solutions match the demanding mission requirements.

With an unrivalled portfolio of technology, our equipment is installed on more than 30,000 vessels. For our naval and governmental customers, we can draw on that experience to meet the requirements of today's navies.

Those requirements naturally focus on the core defence objectives of our customers, but we're seeing more interest in navies wishing to improve their environmental performance too. Sustainability is a key pillar of our technology, and this is where we can enhance naval operations. Our products and systems drive down energy consumption and emissions.

One example of how a commercial product can benefit navies is our Promas propulsion system. An innovative combination of propeller and rudder, Promas is operating on more than 200 vessels, delivering reduced fuel consumption and improved manoeuvrability.

We're now offering Promas to the naval market, and the ability to potentially save 5 per cent on fuel usage can instantly translate to an extension of range, something considered a key capability in the naval space. Read more about Promas on pages 22 and 23.

The geopolitical security situation is evolving and somewhat unpredictable. This means many nations are increasing their investment in maritime defence capability, and we stand ready to support their requirements.

We're pleased to introduce our new Mission Bay Handling System in this issue, developed in response to the need for ships to be versatile. Requirements to broaden the scope of naval operations are driving demand for multipurpose ships which can quickly adapt, and our new system could be the answer.

Today, we're providing equipment to some of the most advanced naval programmes. We're proud to see our technology being selected for these mighty ships and we're dedicated to delivering highly capable products, backed by exemplary in-service support.

As a technology leader, Kongsberg drives innovation and our promise is protecting people and planet. Those 70 navies that put their trust in us do so knowing that we understand their mission.

Your mission is our mission.



Scan the QR code to find out more about Kongsberg Maritime.

Contact

If you're interested in talking to us about our products and systems, please contact us:

Björn ten Eicken
VP Naval (global)
bjorn.teneicken@km.kongsberg.com

Per Bruun
VP Aftermarket
Sales - Naval
per.bruun@km.kongsberg.com

Aileen Kehoe
VP Sales, (Americas)
aileen.kehoe@km.kongsberg.com

David Kemp
VP Sales (global)
david.kemp@km.kongsberg.com

Patrik Kron
Chief of Naval Systems
patrik.kron@km.kongsberg.com

Publisher
Kongsberg Maritime
Kirkegårdsveien 45
3616 Kongsberg
Norway

Editorial Team
Craig Taylor
Nigel Allen

Design & print
Connect Media



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Naval products

Kongsberg Maritime offers navies an extensive range of products, to suit all naval platforms. From the propeller to the bridge, we supply mission-critical technology to help meet your operational goals. Our graphic shows our potential scope of supply for a large naval combatant, but we supply much more to naval platforms large and small.

Strength in depth

Propulsion

We're leaders in the provision of controllable pitch (CPP), adjustable bolted (ABP) and fixed pitch propellers (FPP). We also supply an unrivalled range of thrusters and podded propulsors, with mechanical and electric drives.

Electrical power systems

Our digitalised marine power components create a fully integrated dynamic energy management system for ships, and can include hybrid and energy storage solutions.

Steering gear

A robust hydraulic system suited to twin-screw combatants. Electrical steering gear for smaller vessels is also available.

Waterjets

Our large S-series stainless steel waterjets are popular on patrol vessels, and our smaller aluminium jets are suited to smaller fast attack and rescue craft.



Ship automation and bridge systems

These systems provide advanced features such as remote monitoring and control, energy-efficient power management and fault detection and diagnosis.

Deck machinery

Our extensive range of mooring winches, capstans and cranes offers safe solutions for port operations.

Moveable High Point

Receiving points for RAS (replenishment at sea) and FAS (fuelling at sea) systems.

Stabilisers

Our retractable and non-retractable fin stabilisers are suitable for a broad range of vessels and reduce roll when under way.

Mission Bay Handling System

Our innovative systems provide a modular approach to the efficient handling of in-sea assets and containerised cargo.

Solutions

Kongsberg Maritime has been perfecting propulsion for navies for more than 80 years. With an extensive range of propulsors on the market, the company can supply propulsion for all types of naval platform, from fast, agile patrol craft to large aircraft carriers.



The foundation for the success of our naval propulsion range is the Kongsberg Hydrodynamic Research Centre (HRC) in Kristinehamn, Sweden, on the shores of Lake Vänern.

The HRC is one of the world's leading marine research facilities, specialising in the development of marine propulsion systems including the design and testing of propellers and waterjets.

Patrik Kron, our Chief of Naval Systems (pictured), explains how this unique research facility continues to play a key role in developing bespoke propulsion solutions to 70 navies worldwide.

Perfecting propulsion

The Kongsberg Hydrodynamic Research Centre (HRC) puts us at the forefront of marine technology research and makes a significant contribution to the efficiency and mission-critical performance of many of the world's navies.

The HRC features two cavitation test tunnels, where water is circulated to assess the performance of a ship's propulsion system. The tunnels simulate a wide range of vessel operating conditions, replicating different sea parameters, water flows and situations for the propulsor.

We are unique in that we are the only propulsion manufacturer to have our own in-house research facility. This gives us a number of advantages that are popular with commercial and naval customers alike. We can take close control of the full testing regime, we can react quickly to design changes and it gives us an additional form of verification.

We have developed, tested and delivered more than 1,500 propeller designs for commercial, governmental and military vessels. Our engineers develop propeller designs digitally using the latest computational fluid dynamics (CFD) technology. Such is the computing power available at the HRC, propellers can be modelled in minute detail and in combination with the hull form and operating profile of any ship. We also create scale models of propellers, which are tested in the tunnels, and this gives extra validation on the performance of new designs.

Depending on the results of these tests, propeller profiles can be altered and refined to give optimum designs suited to specific vessels and operating conditions.

Each navy has its own distinct requirements and while we can draw on a huge amount of data, the propellers we produce for navies are bespoke items and not off-the-shelf solutions as is sometimes the case in the commercial shipping environment.

The propeller design is adapted to the size of the ship, its speed, noise and vibration requirements and whether it needs to be able to go through ice. For navies, the sound signature of the propulsion system can be a key factor, as can the speed requirements. Often, there is a need to finely balance these

Propellers are designed to suit specific ships and operating conditions, and are tested in our HRC



requirements and we work closely with our naval customers to develop propellers that match their specific mission requirements.

Fuel efficiency is also becoming a more important issue for navies, more so than it was just a few years ago. We can learn from the work we've done in commercial shipping, where fuel cost reduction is a priority, and small changes to propeller designs and operating profiles can bring relatively quick savings. For navies, any fuel saving translates into a key capability – range extension. Our Promas propulsion system (see pages 22 and 23) is a great example of where a product with more than 200 references in commercial shipping can bring benefits for certain naval platforms. ●

Ice-class expertise

One recent example of how we draw on decades of research and operational experience to create a propeller design to suit a navy's requirements is the Finnish Navy Pohjanmaa-class corvette programme. Part of the country's Squadron 2020 project, each of these four ships will feature Kongsberg

Maritime controllable pitch propellers and shaftlines.

For any ship operating in the Northern Hemisphere, and particularly the Arctic, its 'high-ice' capability is a crucial factor. We have supplied ice-class propellers to a range of vessels in the commercial and governmental sectors. These include bulk cargo, offshore, coastguard and research vessels, and those years of knowledge and a wealth of operational data helped to design a bespoke solution suited to the Finnish Navy's exact requirements.



Our knowledge has helped deliver high-quality results for the Finnish Navy

Mission ready around the world

Kongsberg Maritime provides mission-critical equipment and systems to 70 of the world's navies. Our equipment features on a wide range of ships and specialist craft, from large combatants like aircraft carriers and destroyers, through to support ships and other specialist governmental craft. Here are just a few of the notable naval and governmental platforms with our technologies that protect people and planet.



Royal Navy: Queen Elizabeth Class

Flagship of the Royal Navy, first-of-class *HMS Queen Elizabeth*, and sister ship *HMS Prince of Wales*, feature a comprehensive range of Kongsberg equipment. Each of the 65,000 tonne, 284-metre long ships have our twin adjustable bolted propellers (ABP) and shaftlines. The scope of supply also covers steering gear and rudders, retractable fin stabilisers and the complete low voltage electrical system. The carriers are equipped with our Heavy RAS (replenishment at sea) receiving equipment, which can transfer loads of up to six tonnes at 25 loads per hour. A Royal Navy training facility has also been installed with our Heavy RAS equipment. Read more about RAS on pages 24 and 25.

Image: © UK Ministry of Defence Crown Copyright, 2022



Swedish Navy: Visby-class corvette

Powerful and highly efficient steel series S125SII Kongsberg Kamewa waterjets propel the striking Visby-class corvettes of the Swedish Navy at speeds of up to 35 knots. The five-strong Visby-class has attracted international attention for its stealth capabilities, thanks to its low visibility radar signature and striking angular design.



HMS Glasgow. © 2023 BAE Systems. All rights reserved.



Royal Navy: Type 26 / Global Combat Ship

The Type 26 / Global Combat Ship will be a highly capable and versatile multi-mission warship designed to support anti-submarine warfare, air defence and general-purpose operations. Developed by BAE Systems as a platform with export potential, the Type 26 / Global Combat Ship is currently in build for the UK Royal Navy and has been selected by Australia and Canada. We are supplying controllable pitch propellers, steering gear and retractable stabilising fins for the Royal Navy variant, along with the replenishment system's moveable high point for transfer of materials and equipment to and from support ships.





Royal New Zealand Navy: HMNZS Aotearoa

With a displacement of 26,000 tonnes, *HMNZS Aotearoa* is the largest vessel in the Royal New Zealand Navy. The Polar-class Logistics Support Ship has been designed to operate in Antarctica, and features an innovative wave piercing hull form, designed by Kongsberg Maritime. The ship includes a hybrid electric propulsion system, with an extensive range of our integrated equipment which covers switchboards, the replenishment at sea (RAS) system, steering gear, rudders Kongsberg Kamewa controllable pitch propellers and bow thruster.





Republic of Korea Navy: FFX Batch II

The first of the Daegu-class guided missile frigates was commissioned in 2018. This class of eight ships is the first Korean warship to feature a combined diesel-electric or gas (CODLOG) propulsion system. Kongsberg Maritime has supplied a pair of controllable pitch propellers and shaftlines to each of these 3,100-tonne displacement ships. These are capable of 30 knots, with a range of 4,500 nautical miles.



Italian Navy: SDO-SuRS

A new 120-metre Special and Diving Operations – Submarine Rescue Ship (SDO-SuRS) being built by the T. Mariotti shipyard for the Italian Navy will feature a range of Kongsberg solutions. This includes a pair of Elegance electric propulsion pods, which combine the direct electric permanent magnet (PM) motor driven pods, with a Kongsberg electric power system, including batteries and power management. The Elegance pods provide propulsion for precise and efficient vessel operation. The compactly designed pods have a low oil content and double barrier seal solution, to protect the ocean while offering vessels the ability to operate in fully electric zero emissions mode in port or for limited offshore operations. We will also supply three tunnel thrusters, our Mcon propulsion control system, a DP3 Dynamic Positioning system and single and multibeam echo sounders.



German Navy: F-126 Frigate

Kongsberg Maritime is supplying four shipsets of controllable pitch propeller (CPP) systems along with associated hubs, blades, hubcaps and shaftlines, for the German Navy's new F-126 frigates. The four ships, each with two propellers and shaftlines, will be constructed by Damen Naval in Germany. The propeller/shaftline system is the successful result of close cooperation between Damen Naval, Kongsberg Maritime, the HSVA test institute from Hamburg and the classification society.





US Coast Guard: National Security Cutter (NSC) & Offshore Patrol Cutter (OPC)

Kongsberg Maritime equipment has been selected for current and future US Coast Guard platforms. The National Security Cutter (pictured), in service since 2008, is equipped with controllable pitch propellers and tunnel thrusters. The Offshore Patrol Cutter (OPC) programme represents a significant investment in future international maritime security. The OPCs will be 360 feet long and capable of 22.5 knots. Kongsberg equipment selected to date includes rudders, steering gear, fin stabilisers and tunnel thrusters.



Royal Norwegian Navy: CB90-Class fast assault craft

More than 250 of the CB90 craft have been delivered to several navies, from the Dockstarvarvet shipyard in Sweden. The CB90 is a fast and agile boat, known for its tight, high-speed turn capability. It's fitted with twin Kongsberg Kamewa FF waterjets. This lightweight craft can decelerate from its full speed of 40 knots in just 2.5 boat lengths, thanks to the reversing bucket technology of the Kongsberg Kamewa jets. In addition to the Swedish Navy, the CB90 has been selected by the navies of Norway (pictured), Greece, Malaysia, Mexico and the United States.



Support beyond the horizon

As naval vessels patrol ever farther from home, support from their key suppliers needs to move with them to ensure longevity and peak operational performance.

Building effective navies requires more than upfront investment in the latest designs and technology. Modern, blue water navies need support and competent technical assistance for ever longer periods of time, especially as deployments are increasingly global in nature and vessels' service lifespans are growing.

These are the kinds of tasks that Kongsberg Maritime's dedicated naval aftermarket team is geared to achieve.

"We see that our clients want to have a system working perfectly on the day they buy it and working just as well throughout the lifetime of the vessel," says Per Bruun, Kongsberg Maritime Vice President of Aftermarket Sales – Naval. "We follow the vessel for its lifetime, and we ensure that all the functionality we have sold will continue working the same way."

Our support for naval vessels allows longer deployments away from home waters. That ensures that newer vessels and older vessels alike continue to perform to the standard expected when the vessels were commissioned.

Just as importantly, we provide navies with customised solutions. Whether it is a frigate that needs servicing in home waters or a carrier-class vessel on patrol in the South Pacific needing upgrades, we are in a position to take care of it.

Kongsberg Maritime has offices and service centres in 32 countries that provide support and aftermarket sales as needed to naval clients, with engineers in all product segments prepared to provide support 24/7.

Those centres provide everything from spare parts and onboard service, to overhauls and upgrades. We also provide crucial training for crew and officers on engineering and bridge systems, both remotely and onboard a vessel.

"We are doing midlife upgrades, retrofits and refits, and that is part of our support and planning throughout the lifetime of the vessel," says Bruun. "We will do retrofits when required, depending on the type of system and products we have onboard that specific vessel. We can ensure that it remains compliant with all the rules and the functionality requirements."

Bruun adds that this work is the key to the relationship between us and our naval clients. "It is a very important role for us. Our clients need to know that they can trust us to guarantee that the systems we supply will work as expected, even if the vessel is 40 years old."

Bruun points out that Kongsberg Maritime has three regional hubs that offer the full spectrum of sales, technical support, service and spare part support to any naval vessel. One is in Singapore covering the all-important Asia-Pacific region, while another is in Norway and a third hub is in New Orleans, supporting vessels in the Americas.

This level of service gives naval commanders and decision-makers the confidence they need to deploy their vessels for extended periods away from home waters.

We will continue to rise to the occasion, with development focused on providing the after-sales support blue water navies need to maintain operations in remote regions.

"We will always ensure that we are present wherever our customers' global operations take them," says Bruun. ●



Today's navies need flexibility. They want multi-purpose ships that can quickly adapt to the ever-changing battlespace. Add to that the rapid growth in varieties of manned and unmanned craft being deployed from modern naval ships. Kongsberg Maritime's all-new Mission Bay Handling System has all the elements that can transform naval capability.

Your

Our

mission

Unmanned equipment, such as our Hugin AUV, is easily deployed

W

ith more than 30 years' experience in developing advanced handling systems for the safe and efficient deployment of subsea equipment, Kongsberg Maritime has drawn on its rich pedigree to develop a flexible handling solution specific to today's naval requirements.

"Modularity is the buzzword," says Robert Breivik, Kongsberg's Senior Sales Manager – Naval. "I speak to a lot of navies, and the one thing they all want is modularity. Navies want platforms that can easily be transformed to meet the mission requirements, so the days of ships that are dedicated to a small range of tasks are over.

"The global security arena is changing, and navies must be ready to adapt quickly. Areas like underwater surveillance and the monitoring of



The latest technology means the best possible results for our customers around the world



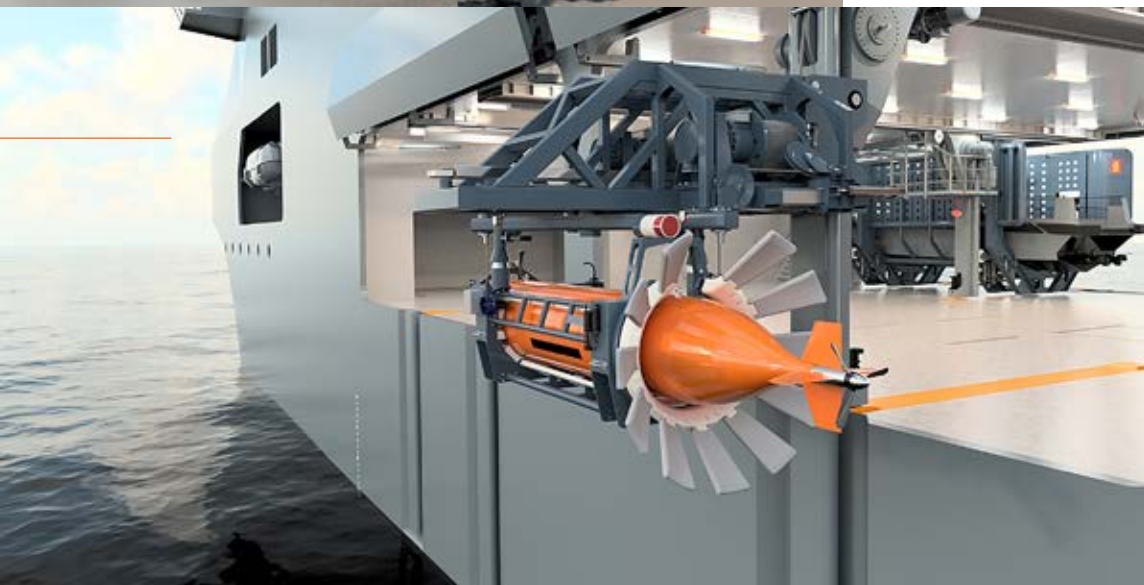
seabed utility assets like pipelines and cables, is an urgent requirement. Modern ships need to be multi-role, and that means carrying a growing suite of newer, high-tech in-sea assets.”

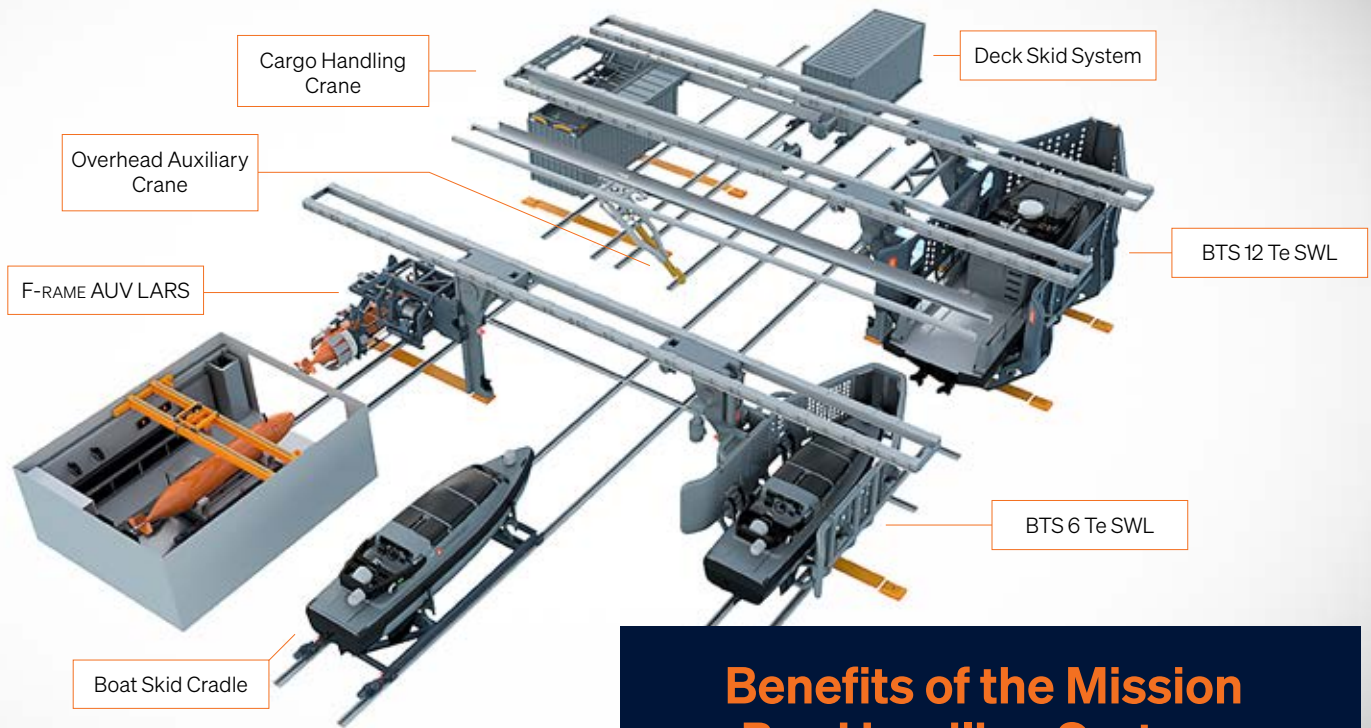
Getting those assets from and to the mothership in a way that’s quick, safe and effective, is at the core of the thinking behind our new Mission Bay Handling System. Suited to a wide range of naval ships, and fully adaptable to suit the size of the mission bay, the new system comprises three elements: a frame system; overhead crane system and stand-alone cargo handling solutions.

First, the frame system offers a fully interchangeable rail system that is fixed to deck above the mission bay, meaning in-sea assets are suspended from the rails and can be moved easily from their storage spaces within the mission bay.

The overhead system has a standardised interface with the ship, which comprises the rails and an ‘interface unit’ which is suspended from the rails and connects to a range of tools. The tools are all interchangeable, and it’s easy to change the handling tools without altering the frame.

There is a choice of a single or dual rail system. With a single rail,





Our all-new Mission Bay Handling System

loads of six tonnes can be handled, and if doubled up to two rails, a 12-tonne capacity is achieved.

The Mission Bay Handling System also offers an overhead multi-purpose hangar crane option. It can handle 10' and 20' ISO containers up to 15 tonnes for general cargo. The crane can rotate through 360 degrees, and with a telescopic boom can extend to the water level. The task of deploying and retrieving 'daughter' craft, with personnel aboard, is easily achieved, with a capacity of 10 tonnes.

"Through our extensive experience from a lot of similar systems we have developed for oceanographic and research ships, this crane is not only very capable, but it gives navies options. It can handle cargo in standard shipping containers, and switch to deploying subsea and surface craft, quickly and safely," adds Breivik.

The third element of the handling system is a series of stand-alone cargo solutions, which can be added to the mission bay to supplement those mentioned above. There are three solutions available: Deck Skid System; a cargo handling crane for containers, and an overhead auxiliary crane, for lighter loads up to 1.2 tonnes.

The Deck Skid System is fully electric, modular and adaptable to suit the easy movement of ISO containers, pallets or a boat cradle.

The ceiling mounted cargo handling crane can lift 20' ISO containers, and features two electric lifting winches and dual telescopes for increased flexibility and reach. ●

The handling system ensures containers can be moved easily

Benefits of the Mission Bay Handling System

Clean deck – no permanent tripping hazards or obstacles installed on the deck.



Adaptive – designed to fit hangars with different dimensions and shapes.



Modular – built from a variety of flexible handling systems.

Cost reduction – no need for costly rebuilds between each mission setup.



Time saving – mobilisation and demobilisation made easy.





Waterjets

The need for speed

Kongsberg Maritime's focus on research and development keeps its Kamewa waterjet range the number one choice for navies seeking fast and effective propulsion.

Waterjets



Time is everything in most naval missions. For those in coastal waters, the demand for rapid response is often matched by the requirement for naval craft to safely access shallow waters. Waterjets are ideally suited to operating in these challenging environments and Kongsberg Maritime offers jets in a wide range of power outputs, suited to search and rescue, troop carrying and rapid attack missions.

More than 10,000 Kongsberg Kamewa steel and aluminium waterjet units, with power ratings from 260kW up to 36,000kW, have been delivered since the 1970s.

Waterjets need less maintenance due to the fewer number of moving parts. And waterjet nozzles can redirect the jet efficiently, making waterjet-powered craft more manoeuvrable. At speeds over 20 knots, waterjet propulsion lets a vessel travel more efficiently with less fuel than a traditional propeller and shaft system.

With an extensive range of propulsion products available for all naval platforms, our waterjets are developed with the same laser-sharp focus on detailed hydrodynamic research and testing, to ensure the efficient performance matched to the customers' requirements.

The Kongsberg Hydrodynamic Research Centre (HRC) in Kristinehamn, Sweden, has played a key role in ensuring the company's waterjet range is at the forefront of developing and refining propeller and pump technology, including those that are used in waterjet systems. HRC researchers look at every possible way to squeeze out better performance and develop the next generation of waterjets (read more about the HRC on pages 6 and 7).

“Our customers are drawn to waterjet propulsion because of the very specific advantages they offer”





Kongsberg Maritime supplied its stainless steel series waterjets to three versions of the 'Hercules' Fast Patrol Craft and Offshore Patrol Vessels (OPV) operating with Qatar's Coast Guard. Designed and built by the ARES Shipyard in Antalya, Turkey, the ARES Hercules craft feature a composite hull. The ARES 150 Hercules OPV, the largest in the range, is capable of speeds up to 35 knots.

Each of the three ARES Hercules variants (ARES 75 and ARES 110 Fast Patrol Craft, and ARES 150 OPV) are powered by three Kongsberg Kamewa 50S3 waterjets.

Waterjet news in brief



FF375s for Finnish Navy

Kongsberg Maritime has secured an order for its Kamewa FF375 aluminium waterjets from Finnish boat builder, Marine Alutech. The waterjets will provide propulsion for 17 new Jurmo-class landing craft for the Finnish Navy (above).

The Jurmo-class was first developed in the 1990s and the Finnish Navy has once again ordered this versatile craft to bolster the capabilities of its coastal armed forces.



US manufacturing

Kongsberg Maritime has established a dedicated manufacturing facility and service team to provide in-country support for its waterjet customers in the United States. It will now offer a step-change in support for its North American customers, including local manufacturing of waterjets, local service support and spare parts, from its facility in New Orleans.



Scan the QR code to find out more about our waterjets.



"We make a lot of advances from one generation of waterjet to the next. By doing that, we challenge the previous design, and then we can get to something new," says Reima Aartojärvi, a senior hydrodynamicist at the HRC.

"We are already working on the next generation of waterjet propulsion systems, trying to answer questions such as 'how to make waterjets work at lower speeds', or 'how can we get the most efficiency out of an electric drive for waterjets'?"

"Our customers are drawn to waterjet propulsion because of the very specific advantages they offer, and right now our S4 series is the best there is in the market in terms of propulsive efficiency," he adds.

Waterjet propulsion is also safer than traditional propellers because it eliminates the risk of a propeller accidents to swimmers or marine life. And as waterjet propulsion systems don't require appendages below the hull, waterjet powered craft can operate in shallower water. ●



A step beyond

The state-of-the-art customer-specified Vanguard is an innovative maritime surveillance and protection system designed to address national security requirements in territorial waters.



Vanguard meets modern threats and demands in naval operations

The ability to draw on a world-class portfolio of products sets us apart in what we can offer the world's naval forces.

Across the Kongsberg Group, the breadth of technology and capability is underpinned by an ethos of customer-first collaboration.

Arild Skoge, Business Development Manager at Kongsberg Defence &

Aerospace, explains how the company has combined its latest technology into a highly effective integrated naval system – Vanguard.

“Securing a nation's interests within a regional and global maritime environment is more complex than ever. Conflicting international interests in accessing and controlling sea-based trade routes, ownership of maritime territories and resources, the ever-existing threat of military action, coupled with highly capable threats and rapidly advancing technologies are driving the need for more advanced, flexible and interoperable maritime assets.

“Our Vanguard system is the answer to the rapidly changing naval and maritime challenges of today and tomorrow, through the use of vehicles in all domains – underwater, surface and in the air. Vanguard supports a range of missions, including maritime surveillance, anti-surface warfare, anti-air warfare and more. A focus on interoperability for joint operations, cross-service and multi-national operations enables the system to operate effectively in all types of missions.

“The Vanguard system will provide a capable, adaptable

“Our Vanguard system is the answer to the rapidly changing naval and maritime challenges of today and tomorrow”

Game-changing missile capabilities

The Kongsberg High Mobility Tactical Missile System for sea and land targets combines a state-of-the-art Naval Strike Missile with a simple, fielded and proven C2 structure capable of integrating any national or international command structures or sensor capabilities. It's a low observable missile designed for multi-domain operations, with no active signature and standoff range in littoral waters providing true game-changing capabilities. The weapon's ability to identify and engage time-sensitive targets are matched by a responsive and user-friendly mission planning system.



Unmanned underwater deployment

The UUV is based on the HUGIN® family of AUVs. The primary differences between systems are the size, weight, endurance, depth rating and sensor complement. The UUVs can be deployed and recovered in different ways, by crane or by various configurations of launch and recovery systems. HUGIN can carry a significant number of different sensors, ensuring that one platform can be used for multiple types of missions, such as seabed mapping, infrastructure inspection and detection of sub-surface vehicles.

and affordable solution to homeland defence by using deployable sensors and weapons. Sensors and effectors are easily integrated based on an open architecture network-centric structure, enabling interoperability between surface-to-surface missile systems, air surveillance, air control and air defence systems.”

The Vanguard system consists of a host vessel and embarked mission vehicles, equipped with deployable sensors and effectors underwater, on the surface and in the air, all of which can be operated from the host ship or land.

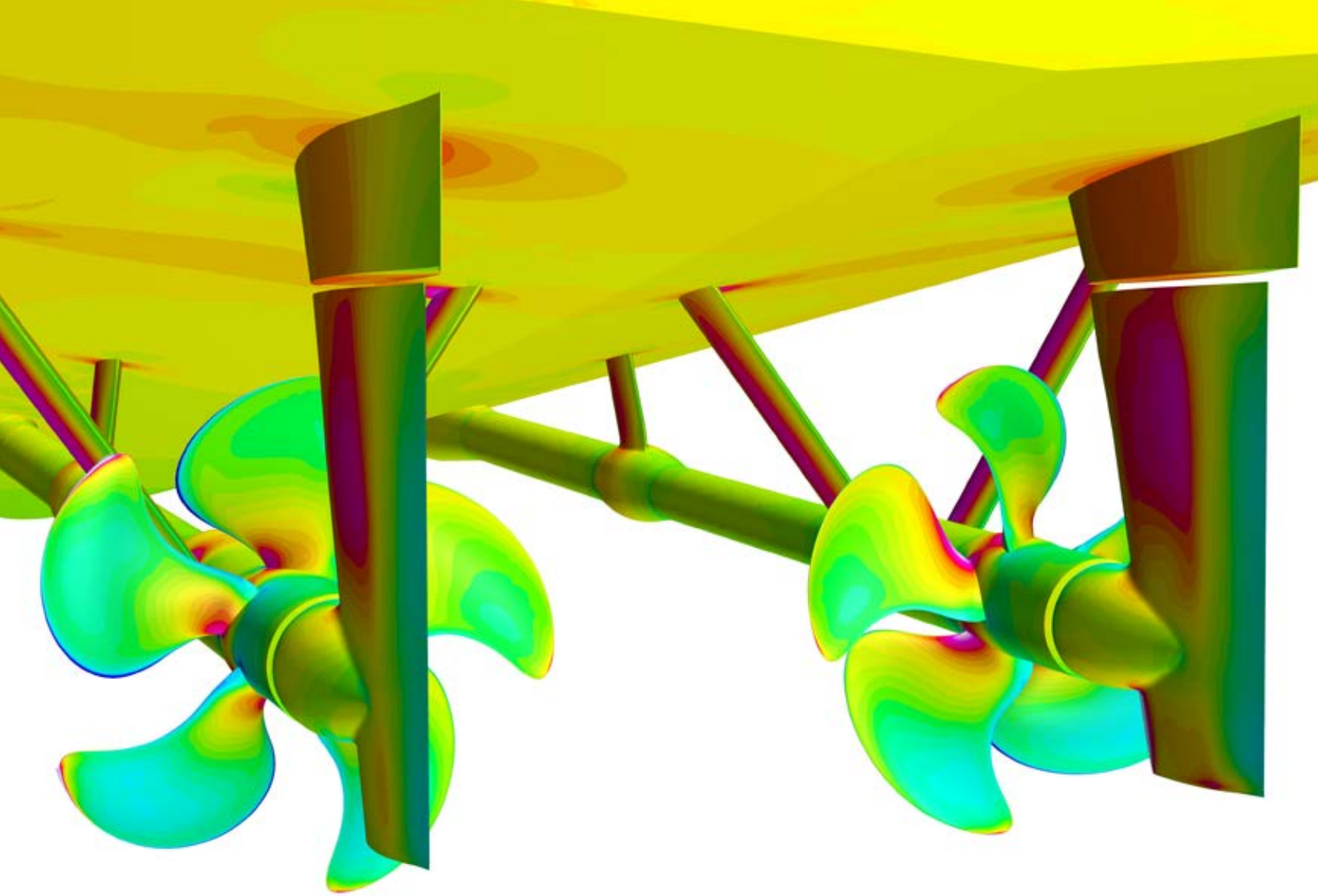
“As the Vanguard system integrator, we will ensure integration of customer-specified capabilities. We offer a wide range of equipment to support different missions from the company's product range, ensuring low risk, high operational effectiveness and quality.

“Deployable vehicles equipped with sensors and weapons can be operated and controlled in a network from the mothership to increase the area of coverage. Two examples are the Naval Strike Missiles (NSM) and the HUGIN® family of AUVs.

“The flexibility and modular design of the Vanguard platform provides for easy integration of national solutions, allowing for industrial participation and intellectual property. Future maintenance, repair and overhaul activities can be supported by national industry, securing operations of critical assets. Vanguard is adaptable and ensures use of modular solutions by equipping the vessel with the needed capabilities in a changing environment.

“Our focus on joint and combined approaches in all domains, interoperable with other services and nations, allow the Vanguard system to plug and play into different kinds of operations through the use of deployable sensors and effectors.

“The Vanguard system is the next generation naval ship, a step beyond the traditional navy ships of today.” ●



Propulsion

Promas is the positive choice

Kongsberg Maritime has completed a research programme that shows its Promas propeller and rudder system can deliver increased fuel efficiency, better manoeuvrability and extended range for naval platforms.



Originally designed for commercial ships, and with more than 200 references across a range of ship types, Promas combines rudder and propeller into one propulsion system. It has proved a popular solution across a range of ship types, and now Kongsberg Maritime is offering Promas to naval customers.

Recent research has shown that naval vessels relying on traditional rudder and propeller systems can increase their efficiency and manoeuvrability with the adoption of our Promas propeller and rudder system. Promas can deliver fuel savings of more than 5 per cent which can translate into increased range, boosting the capability of naval platforms.

Kongsberg Maritime's Hydrodynamic Research Centre (HRC) in Kristinehamn, Sweden, tested and compared the Promas bulb-rudder system and the conventional off-centre rudder system used by navies on a typical naval aft ship dummy design. The dummy design consisted of an open shaft configuration with V-bracket and a high shaft inclination angle to produce a typical wake field for a naval twin screw vessel.

The testing conducted by the HRC compared propulsive efficiency, rudder forces, cavitation inception speed, cavitation, pressure pulses and noise levels between Promas and conventional navy propulsion for ship speeds up to 25 knots.

The tests showed the Promas system offered efficiency increases of between 5 and 6.3 per cent compared to a conventional naval system with an off-centre rudder. The savings depended on the speed. At 25 knots, the Promas system reduced power consumption by 6 per cent.

The rudder forces with Promas are also much higher. The system demonstrated less drag at small rudder angles and a higher lift at larger angles than a conventional navy system. This improves slow speed and harbour manoeuvring.

The measured pressure pulse (PP) levels were lower with the Promas set-up compared to the conventional system and noise levels were lower for the Promas system at frequencies below 1 kHz. At 25 knots, the cavitation patterns on the propeller blade were similar for both the conventional system and the Promas set-up.

For 15 years, the commercial shipping industry has used Promas to save fuel. But for naval vessels with a top speed between 20 and 25 knots, the results of HRC's research point to significant increases in system efficiency that are within reach. Calculations done for naval vessels indicate that improvements in efficiency could go beyond the 6 per cent achieved in testing.

“Vessels are able to extend their range, something which can be crucial on longer missions”



Promas features on a new Belgian research vessel, the RV Belgica, which entered service in 2022

Image © The Belgian Navy/Jorn Urbain 2022

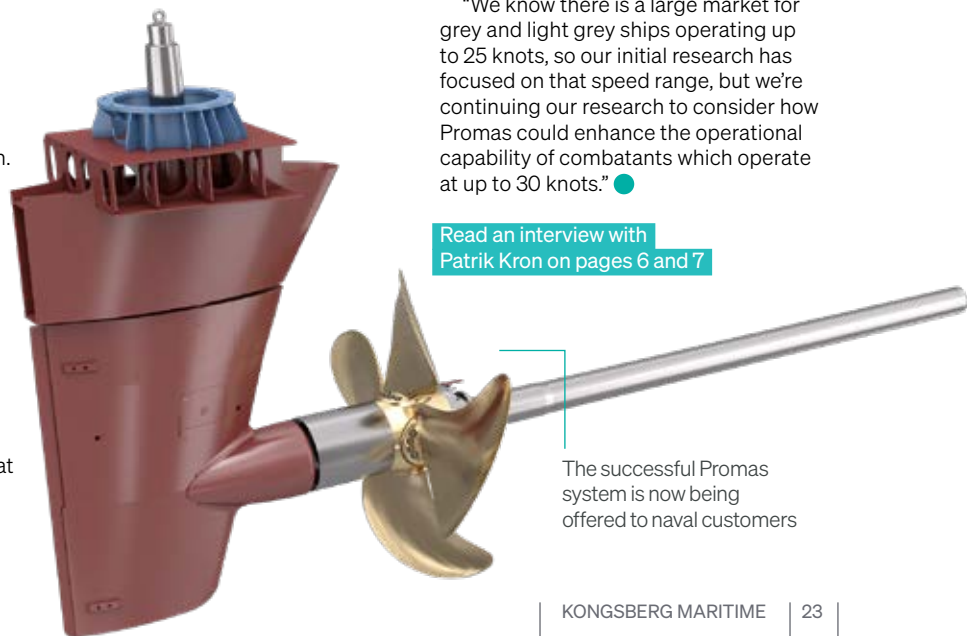
Patrik Kron, Kongsberg Maritime's Chief of Naval Systems, says: “We're delighted with these results. We've known for many years how Promas brings a quick improvement in efficiency for commercial operators, and this latest research, where we pitched Promas against a more conventional naval propulsion configuration, demonstrates how these benefits can be offered to our governmental customers.

“One of the main advantages of Promas is that the propeller and rudder are treated and designed as one unit. Most naval twin-screw vessels use conventional rudders placed off-centre from the shaft centreline.

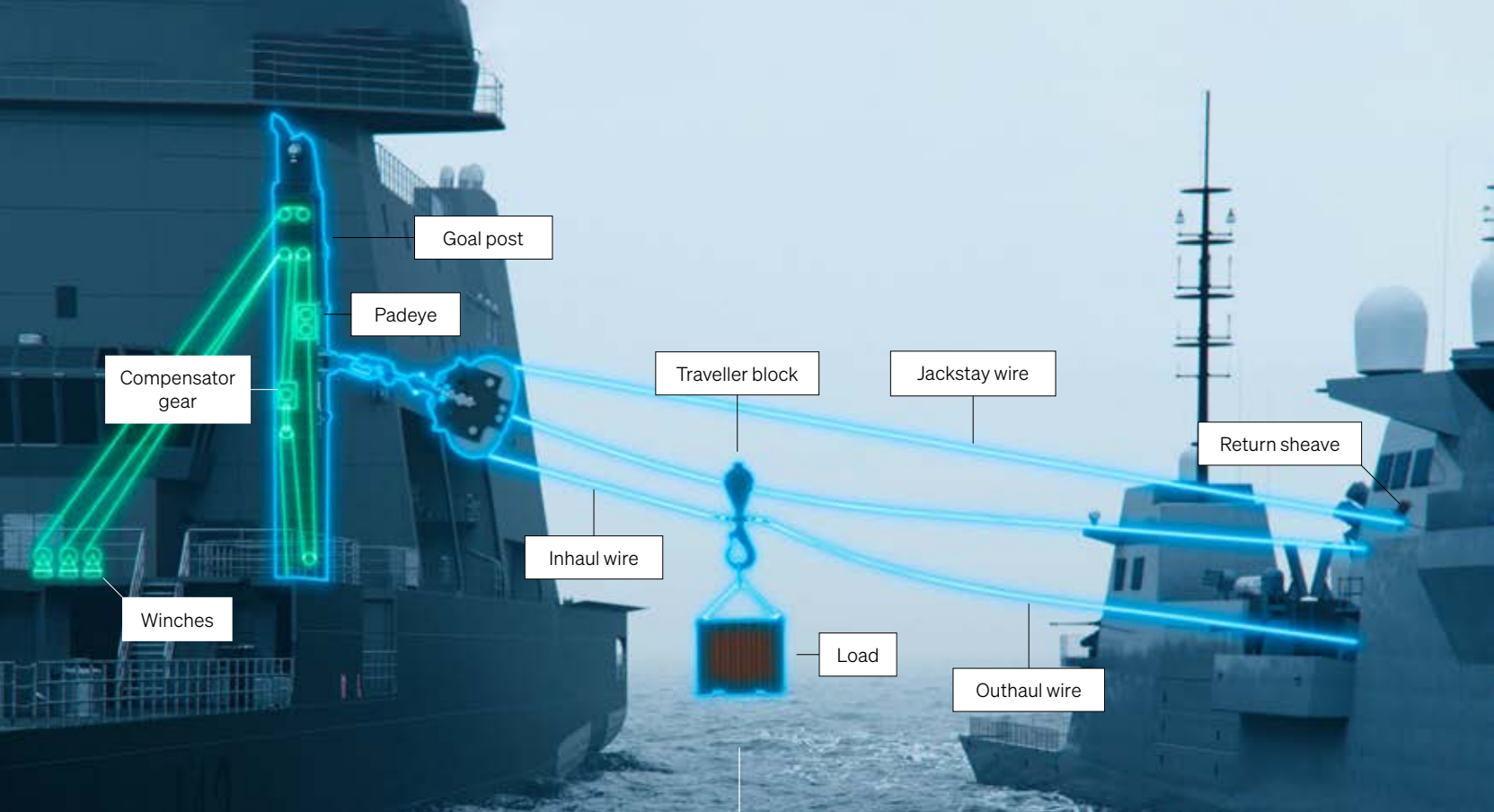
“By being able to demonstrate an improved efficiency of around 6 per cent, for navies this means their vessels are able to extend their range, something which can be crucial on longer missions.

“We know there is a large market for grey and light grey ships operating up to 25 knots, so our initial research has focused on that speed range, but we're continuing our research to consider how Promas could enhance the operational capability of combatants which operate at up to 30 knots.” ●

Read an interview with Patrik Kron on pages 6 and 7



The successful Promas system is now being offered to naval customers



RAS is a complex and potentially dangerous task, but we have the technology to successfully deliver supplies from vessel to vessel

Delivering

Electric RAS system:

fast, safe, reliable

Innovative technology from Kongsberg Maritime is helping successfully resupply naval vessels, while reducing the overall costs for our customers.

Kongsberg Maritime's RAS systems – key facts



A Royal Navy training facility has been installed with our Heavy RAS equipment, which can transfer loads of up to six tonnes at 25 loads per hour.



A receiving ship's equipment can be enclosed with a folding door and integrated into the ship's superstructure. This protects the equipment from extreme weather and preserves the radar cross section reflection stealth characteristics of the vessel.



Our RAS liquid system can deliver up to 1,000 cubic metres of fuel per hour; 2,000 if the resupplied vessel is long enough to have two delivery stations.



We have also developed special winches for the load-bearing line that generate additional electricity during RAS operations. That electricity can be used to help power operations or support the hotel load.



We have installed electrically operated RAS systems for the Royal Navy in the UK, as well as other global navies. NATO navies are adopting systems standards to allow supply vessels from one navy to replenish vessels from another. We are already helping one major European navy switch from traditional, hydraulic RAS systems to electrical systems.

A

part from providing a stable platform for force projection and defence, one of the most important tasks of any naval vessel is RAS (replenishment at sea). RAS is a force multiplier that extends the range and time at sea of both surface combatants and amphibious vessels, especially during multi-role operations, when vessels go

through munitions, food and fuel at exponentially faster rates.

RAS is also one of the most dangerous tasks that naval vessels perform. Ships in a resupply configuration are restricted in their ability to manoeuvre and will have to rely on others within the task group to provide operational defence while resupply operations are undertaken. Station keeping between large naval ships during abeam replenishment is a safety critical operation due to repulsion and attraction forces on the hulls caused by pressure wave interaction between the ships as they sail in close proximity.

Traditional hydraulic RAS equipment is under high pressure during operations and that risks leaks and spills during mission-critical evolutions. Kongsberg Maritime has developed the engineering and design basis behind electrical RAS equipment.

Electrical RAS systems can also be deployed quickly and are significantly more reliable than hydraulic systems when installed in an open deck marine environment. They require less maintenance and overhaul periods in service, which also reduces overall lifetime costs of the system. The marine environmental risk of volume oil spillage is also eliminated.

One of the greatest examples of long-range naval operations came during the

“We continue to develop the technology and capacity of our RAS systems”

1982 Falklands Conflict, in which the Royal Navy went into action over 7,000 nautical miles from home. The lessons learned from that deployment were behind the initial designs for our electrically operated RAS equipment.

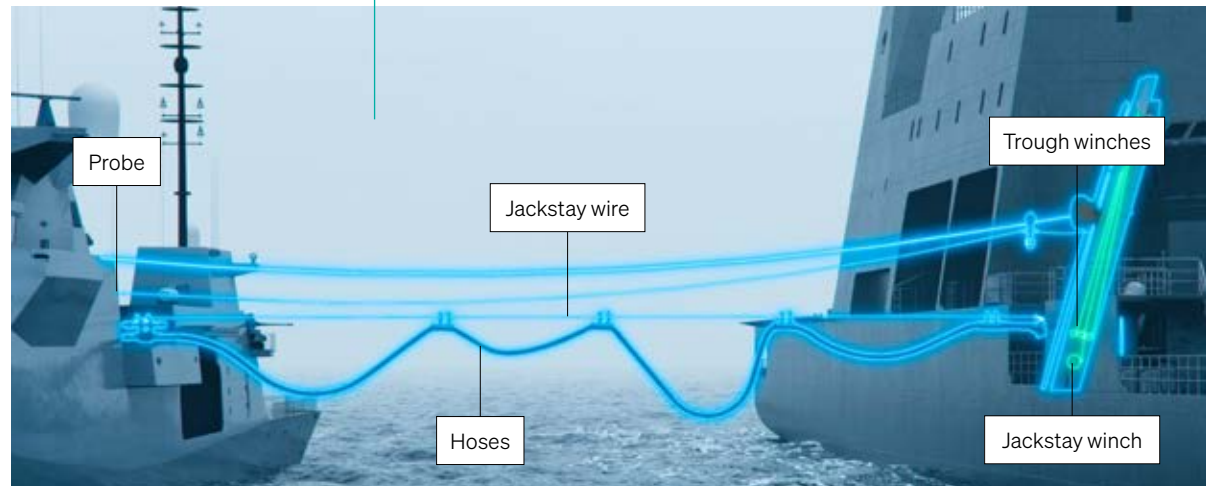
Since then, Kongsberg Maritime has continued to pioneer and develop the use

of electric motors powering the winches and stays on a RAS system. Today, we are the leading supplier of electrically operated RAS systems because it is the proven way to get better RAS results over the lifetime of a resupply vessel.

We continue to develop the technology and capacity of our RAS systems, with a focus on making sure the maximum amount of supply gets to warships in the minimum amount of time, while maintaining a high level of safety, reliability and system integrity.

A dedicated team works exclusively on RAS equipment and design from our Gateshead facility in the UK, while providing close support for our customers. ●

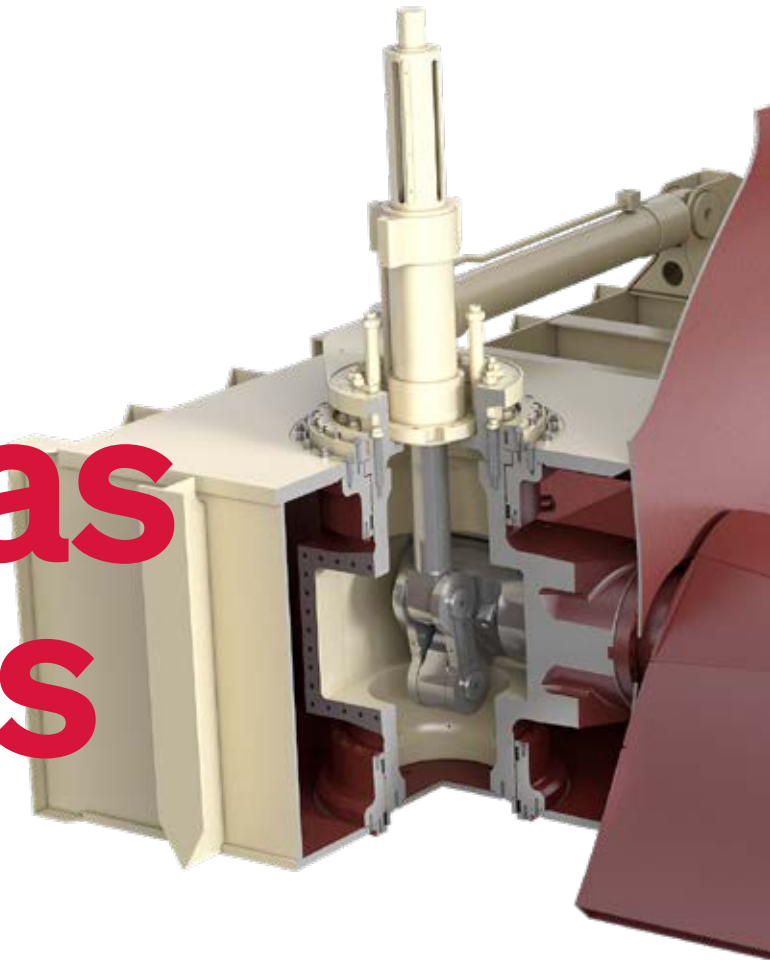
Fuel can be better delivered between vessels without the risk of spillage



Experience

Our range of stabilisers is designed with the customer in mind, and our facility in Scotland has a proud history of delivering ship stability systems.

Steady as she goes



Kongsberg Maritime produces a range of retractable and non-retractable stabilisers for naval and governmental craft, as well as for the commercial market.

From its manufacturing facility in Dunfermline, Scotland, the company has a long history in the manufacture of ship stability systems, dating back to 1871 in nearby Edinburgh, when Brown Brothers was responsible for some of the most significant advances in steering gear.

A proud heritage

As sail gave way to steam, and then to diesel engines, manual steering became harder, and dangerous. It was the Browns who transformed the industry by introducing hydraulic steering gear systems. The overcapacity in shipping, and the consequent slump in the inter-war years, then saw the company diversify into launching systems for aircraft from ships, and, significantly, a joint venture with one of their old partners, Denny Brothers, to build a retractable fin stabiliser.

Today, the facility is the centre of production for the stabiliser and naval linear actuator steering gear product ranges.

For naval ships, it's important to have a stable platform both for sensitive equipment and also other mission-critical activities such as landing helicopters. Kongsberg's commercial retractable stabilisers cover fin areas of 1.4m² to 22.3m² and derive from two basic families. Firstly, the Aquarius, which is targeted at smaller ferries, cruise vessels and large yachts. In addition, Aquarius has been used extensively on smaller naval vessels where the fins have the benefit of being able to be retracted when not in use.

The Neptune range is larger in size and has been supplied for cruise ships, yachts and ferries. It has also been supplied to naval vessels such as the UK Royal Navy's Type 31 frigate, using our Neptune 200 size, and for the Queen Elizabeth Class aircraft carriers, with two pairs of our Neptune stabilisers.

“For the naval market, we regularly need to meet stringent noise and vibration criteria”

Other Neptune systems have been used in the export market to various navies.

There are two ranges of non-retractable products. The Gemini non-retractable stabilisers are normally used on offshore patrol ships, coast guard ships and various military vessels. The fins for non-retractable stabilisers are trapezoidal in shape and designed to fit within the beam of the vessel.

In addition, the Modular range is designed to meet military standards of noise, shock and vibration. Kongsberg modular stabilisers have been supplied to many of the world's navies including Brunei, Malaysia, India, United States, Australia and the UK Royal Navy, clearly demonstrating the commanding position the product holds in the naval field. The non-retractable stabilisers cover fin areas of 2 m² to 16.5m². Both ranges offer a standard feature of all Kongsberg non-retractable fin stabilisers, which is the inclusion of the hull closing plate as an integral part of the fin unit. Accurately shaped to fit the hull lines, the installation procedure is simplified so that expensive seating structures and finishing work are avoided.

Naval linear actuator steering gear is similarly shock qualified for military use, to various customers around the world. Current projects are delivering to the Royal Malaysian Navy and the Royal Navy for their Type 26 programme. Other company facilities produce the rotary vane steering gear range, which is also used on naval ships.



Neptune stabilisers are fitted on a range of navy ships

Pioneering products

Paul Crawford, Vice President – Naval Sales at Kongsberg Maritime, says, “The selection of our retractable fin stabilisers on a growing number of modern naval platforms is a further demonstration of our pedigree in the naval market, where the retractable-fin solution we have come up with is truly pioneering.

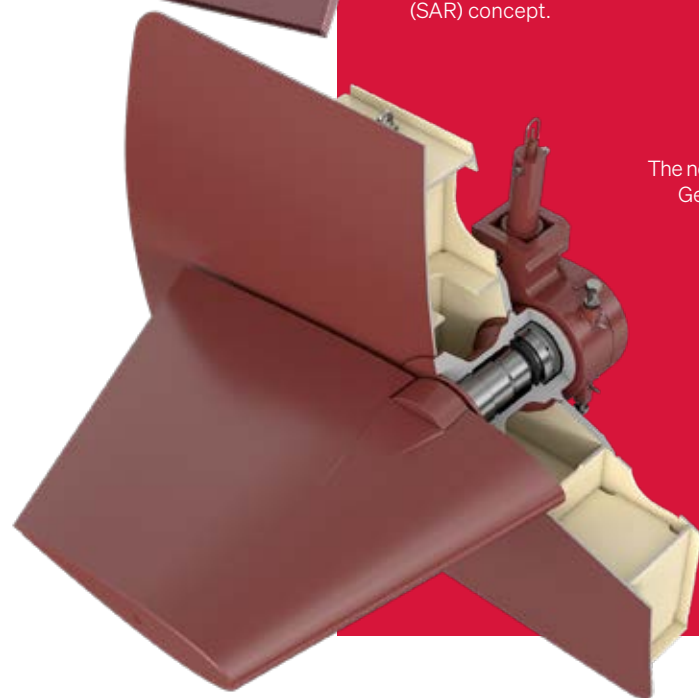
“We supply stabilisers and steering gear to many international navies. Our fins can be adapted to customer requirements and while the product itself is standard, each ship, and each ship type, has different hull lines so we work closely with navies and shipyards in developing solutions, that exactly match the ship and mission requirements.

“For the naval market, we regularly need to meet stringent noise and vibration criteria to ensure our system complements the mission-critical activities of naval ships. In addition, we can supply Integrated Logistic Support to meet the requirements of the customer.” ●

About the Kongsberg naval stabiliser range

Various types of Kongsberg Maritime stabiliser technology can be selected to match the vessel and its operating requirements.

- Fin stabilisers are popular and suitable for a broad range of vessels and reduce roll when under way and at rest (using retractable fins).
- The Neptune range uses a retractable fin that folds into slots in the hull and is ideal for large combatants and support ships.
- The smaller and lightweight Aquarius range is suitable for smaller platforms such as OPVs.
- Fin designs have also been modified and control systems developed to provide stabilisation at rest capability for both the Aquarius and Neptune ranges, up to Neptune 300 size where this is requested.
- Where it is not necessary or required for the fin to retract, a range of non-retractable stabilisers are available for military vessels.
- A range of ice-class retractable fins is available, to allow ice-class ships to benefit from the Stabilisation-at-Rest (SAR) concept.



The non-retractable Gemini stabiliser



KONGSBERG

Protecting people and planet

We are the maritime domain expert.

We are technology pioneers.

We are enabling a more sustainable future for our oceans.

We are Kongsberg Maritime.

Our integrated technologies solve our customers' toughest problems.

With unrivalled competence, knowledge, innovation and market reach, we are the go-to maritime partner, trusted on more than 30,000 vessels globally and by more than 70 of the world's navies.

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