



Rolls-Royce

in-depth

THE GLOBAL MAGAZINE FOR MARINE CUSTOMERS

ISSUE 23 2014

POWERING PRELUDE

ROLLS-ROYCE THRUSTERS
ARE READY FOR THE
WORLD'S LARGEST
EVER FLOATING
STRUCTURE

SPECIAL REPORT

COMPLETE CONTROL

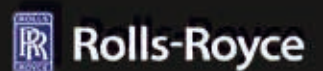
STEP INSIDE THE FIRST
VESSEL EQUIPPED WITH
THE ROLLS-ROYCE
UNIFIED BRIDGE



KJELL HARLOFF · KNUT EILERT RØSVIK · HAAVARD ULSTEIN · OTTAR ANTONSEN · STIAN BJØRGE · STIG OLE BORGUNDVÅG · TORILL KLEPPE KLEVEN · GAUTAM CHELLARAM · STIG REMØY · LARS IVAR BØE
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Thank you to the names behind the stories

UT The ship that launched
 a thousand stories
www.rolls-royce.com/UTstories





MIKAEL MÄKINEN, PRESIDENT – MARINE, ROLLS-ROYCE

ANTICIPATING THE FUTURE

Rolls-Royce technologies are continually evolving to make ships simpler and safer to operate, as well as more profitable for our customers

What will the bridges of vessels look like in 10, 15 or 20 years' time? The new Unified Bridge on UT 776 *Stril Luna*, illustrated on the cover of this issue of In-depth, is an example of how we apply science to push the boundaries and anticipate future needs. By effectively harnessing technology, customer feedback, human factors and experience, we now have an advanced bridge system in service and we will continue to gain more operational input for the next round of improvements. We can make a difference in making ships simpler and safer to operate as these systems continue to evolve.

Technology is also a key issue for me from a business management viewpoint. When is a company a technological leader? When it continues to develop new products, sells them in significant numbers and is profitable. It is profitability that gives a business the opportunities to invest in the future, and the strength to develop and grow. That is something we aspire to, and when we pause to look back on our progress in the recent past, I see strength in depth, with exceptional

capabilities and creativity, with many ideas waiting to be exploited. We must listen to our customers to ensure we make the right decisions and invest in the right technologies. I also see the potential that greater co-operation across the wider Rolls-Royce group can bring.

This issue of In-depth shows how we can harness the mass of operating data we have onboard today, and the role this will play in the way we operate ships in the future. We have become much better at monitoring equipment health and condition and energy use on board. But that is a small part of the information flow ships must cope with. There is a need for intelligent systems that can run themselves, with the crew role potentially changing to managing the exceptions and reviewing decisions based on experience. That means ship intelligence will be a key technology area that we will invest in. Not just the technology, but the role it can play in our products and systems, and in enhancing vessel operations, helping our customers meet the challenges they face in improving revenue generation.



COVER: *Stril Luna*, a UT 776 CD owned by Simon Mokster, is the first of two vessels to enter service equipped with the new Unified Bridge, setting new standards for safety and comfort.

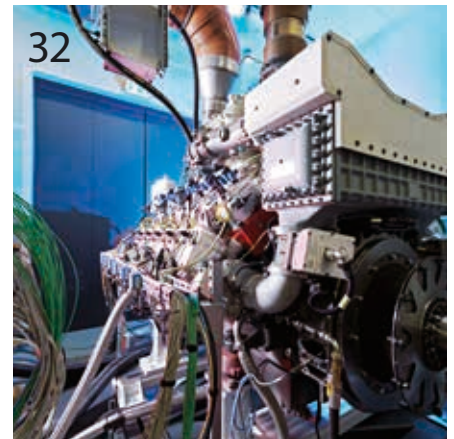
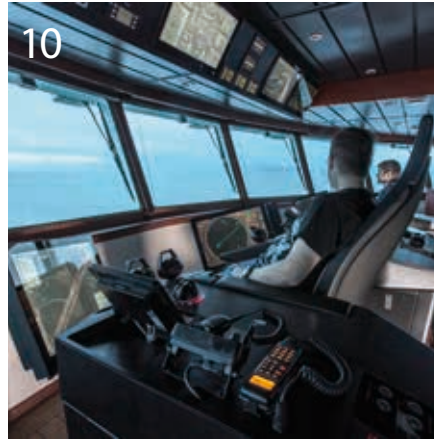
Our azimuth thrusters have been providing reliable propulsion power for a growing range of vessels since they were introduced more than four decades ago. New application challenges continue to present themselves, requiring fresh thinking. The largest floating facility ever built, Shell's *Prelude* floating LNG production facility, was a recent example. We look at the project and the solution developed to install and facilitate the overhaul of three of our largest thrusters. They will ensure *Prelude* can keep its heading against external forces to allow safe tanker berthing.

Our support facilities and service offerings have grown along with our products. Our centre for thruster overhaul in the Gulf of Mexico is at Galveston, with additional regional support from centres in New Orleans and at Veracruz in Mexico. We continue to invest in our facilities and people to ensure we meet our customers' demands.

Enjoy reading this issue of In-depth. I hope you will be inspired by the way our different technologies and products find their way into a variety of applications around the world. ■

in-depth

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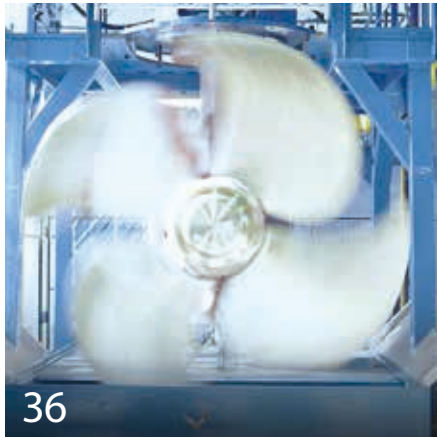
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ABOUT

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First Jackson PSV in Gulf service

The first of four highly advanced offshore support vessels, *MV Breeze*, has entered service with Jackson Offshore Operators in the Gulf of Mexico. Rolls-Royce supplied and integrated the full propulsion and control systems package.

Built at BAE System's shipyard in Jacksonville, Florida, *Breeze* is 76.8m long with a beam of 18.28m. It is the first of the GPA 675J series of PSVs designed by Guido Perla & Associates to enter service. *Breeze* and its three sister vessels will all be equipped with an integrated Rolls-Royce propulsion system featuring two 1,950kW Azipull azimuth thrusters, tunnel thrusters and a low-voltage active front end diesel-electric power system.

The scope of supply also includes the advanced Acon automation system, the Icon DP2 dynamic positioning system and the provision of a detailed integrated electrical engineering package with "start-to-finish" project management, on-site advisory services, planning and commissioning.

Throughout the build Rolls-Royce worked closely with Jackson Offshore Operators, GPA and BAE Systems to help deliver a vessel that met and exceeded the designer's expectations.



MV Breeze equipped with a full propulsion system integrated by Rolls-Royce is now in service for Jackson Offshore Operators.

Lee Jackson, President and CEO of Jackson Offshore Operators, said: "We selected the Rolls-Royce systems package based on several key factors. There are efficiencies gained during the build process through the use of a single source supplier of major ship systems, especially one with great experience in complex ship systems integration. Additionally, the operating profile of the vessels with a low-voltage active front end diesel-electric power system and Azipull propulsion thrusters is extremely fuel efficient yielding reduced exhaust emissions as well as economic benefits to our clients."

Breeze has now started a multi-year charter in the Gulf of Mexico.



Norwegian company Ramoen has selected the NVC372 trawler design, with integrated propulsion system.

Stern trawler for Ramoen

Spanish shipbuilder Astilleros Armon is to build a new 75m stern trawler for Norwegian fishing company Ramoen. The Rolls-Royce NVC 372 design and will carry out traditional fishing operations for whitefish and shrimps and will be equipped for both bottom and pelagic trawl.

In addition to the vessel design, Rolls-Royce will supply the vessel's main equipment, incorporating many of its newest products. They include hybrid shaft generator propulsion system (HSG), a new Bergen B33:45 L6P diesel engine and Promas system to provide fuel efficient propulsion. Low pressure hydraulic trawl winches will also be supplied.

"This is now the second NVC design trawler we will supply to Ramoen," said John Knudsen, President Commercial Marine. "We are very happy with the longstanding co-operation we have with this innovative owner."

Service expands in Las Palmas

Rolls-Royce and the Astican Shipyard in Las Palmas, Canary Islands, have signed a co-operation agreement which will enhance the service capabilities of both parties in order to meet growing demand from rig and drillship owners.

A new 2,100m² service facility will be built by Astican for Rolls-Royce to service and overhaul the complete Rolls-Royce product range, including the simultaneous reconditioning of up



Antonio Germán Suárez, President of Astican (left) and Knut Hovland sign the agreement.

to six large azimuth thruster units.

Coupled with Astican's extensive ship repair facilities, the new custom-built service centre at the crossroads of the Atlantic, linking Europe, Africa and the Americas, will allow Rolls-Royce to better serve customers operating in these regions.

Antonio Germán Suárez, President of Astican, said: "We are delighted to join with a reputable partner such as Rolls-Royce in this new venture. We strongly believe that this agreement will help recognise the port of Las Palmas as a one-stop-shop for the offshore industry in West Africa."

Knut Hovland, Senior Vice President Marine Services Europe & Africa, said: "The Canary Islands is an important location for the offshore industry and this new partnership will allow us to deliver an unparalleled level of service and skill to our customers. We are delighted to develop our relationship with Astican, one of the leading ship repair yards in the region."

Both Rolls-Royce and Astican customers will benefit from the integrated approach offering full vessel overhaul capabilities in one location.



Largest single subsea contract for Rolls-Royce

Rolls-Royce will supply a complete subsea module handling system for the subsea construction vessel *Aker Wayfarer*, the largest single subsea vessel project ever undertaken by the company.

The contract is with Ocean Yield ASA, and the vessel is under long-term charter with AKOFS Offshore. The 157m long, 16,000gt *Aker Wayfarer*, built by Vard Søviknes in 2010, will now undergo project modification work at Kleven's Myklebust Verft yard in Norway. It will allow the deepwater installation and retrieval of subsea trees and modules, including manifolds.

Ståle Rasmussen, CEO of Kleven,

said: "Myklebust Verft's location, in the heart of the maritime cluster on Norway's north west coast, is a great advantage for all parties involved, and serves as a great example of local co-operation between Kleven, Vard and Rolls-Royce."

The Rolls-Royce system comprises a complete tower structure, skid system and deepwater lifting system, plus power units and controls. The lifting system is a Fibre Rope Deployment System (FRDS), based on patented Cable Traction Control Unit (CTCU) technology and is due for delivery in the first quarter of 2016.

John Knudsen, President Commercial Marine, said: "This a

significant contract and shows that the offshore industry has taken yet another step in accepting the superior performance of synthetic fibre ropes for lifting operations in deep and ultra-deep waters."

A similar system was installed in 2009 on the AKOFS-operated subsea support vessel *Skandi Santos*. It has installed and retrieved subsea trees and modules in depths up to 2,300 metres with Petrobras.

Geir Sjøberg, CEO of AKOFS Offshore, said: "The track record of *Skandi Santos* makes us confident in the decision to install the handling system from Rolls-Royce on *Aker Wayfarer*."

ABOVE: The deepwater lifting system uses fibre rope and Cable Traction Control Unit (CTCU) technology.

2015 Marine Events

For further information, contact:

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January
13-15
SNA, Arlington, USA

March
11-14
Europort,
Istanbul, Turkey

16-19
Cruise Shipping,
Miami, USA

17-21
LIMA, Langkawi,
Malaysia

April
13-15
Navy League,
Washington DC, USA

14-17
LAAD, Rio, Brazil

21-23
Sea Asia, Singapore

May
4-7
OTC, Houston, USA

5-8
IDEF, Istanbul, Turkey

June
2-5
Norshipping,
Oslo, Norway

GLOBAL AND RESPONSIVE

As the new President Commercial Marine, John Knudsen is committed to providing customers with a global service that is responsive to individual needs



John Knudsen took up his new role as President Commercial Marine earlier this year and leads the marine business's non-naval customer-facing activities. He was formerly President – Bergen Engines, before moving to head the Rolls-Royce Offshore business.

In-depth editor Andrew Rice spoke to Knudsen about his aspirations for the global commercial marine business, how the business is changing and what inspires him about the new job.

AR: You come to this role from Bergen Engines. What

experiences there have helped you integrate into this new role?

JK: Moving into this role from the engine business means I have a good understanding of the market and know a number of customers. I also benefit from a background in the marine industry from earlier in my career. It helps moving from another part of Rolls-Royce. I know the company and what is expected.

I was involved in the integration of MTU and Bergen from the start, as well as the development of the Bergen B33:45. This engine is an excellent example of technology, developed to meet design goals

JOHN KNUDSEN

"All parts of our business must work closer together and we need to prioritise, concentrating on the programmes our customers have told us they want."

set by first listening to customers. Having a wider range of engines to offer customers is exciting.

AR: You have now been in the position for around nine months, what is the future focus for Commercial Marine?

JK: The marine sector has many segments with different needs. We will concentrate on meeting those needs. So we will be looking at the short and long-term opportunities these represent.

All parts of our business must work closer together and we need to prioritise, concentrating on the



programmes our customers have told us they want.

Making our operations leaner and fitter, while getting people to concentrate on what is truly value adding. Customer focus is at the top.

AR: Can customers expect changes as a result of streamlining our internal organisation?

JK: We have one aim – to be more responsive to our customers from quote to final commissioning, and then support when in service. As we serve both the merchant and offshore sectors, I am structuring the business to do this well, with a focus on understanding what services our customers want and where they want them. Strengthened regional teams will be dedicated to taking proven best practice effectively into their region.

The quality of all our products is vital. We have manufacturing centres around the world and replicating proven processes to

deliver consistent quality is a prime focus. For example, in Brazil our local training centre in Rio is successfully replicating what we do in Ålesund.

We get demands for innovation from many directions so what we do in product development and identifying the needs of the market must be aligned – alignment is very important if we are to be efficient in providing what our customers want at a price they are prepared to pay.

AR: You regularly meet marine customers, how do you perceive the industry is changing and what key challenges will need to be addressed?

JK: I think that over time the industry will gradually consolidate around the operators and suppliers who perform best and deliver results. Today's competitive pressures are focusing everyone on efficiency in all aspects of business, particularly as the lower cost countries are now raising their games. We must demonstrate the value we can add due to our greater

experience and engineering depth.

Environmental issues and standards will remain prominent – there is still a massive amount to do. We need to be flexible and agile to meet the new trends and anticipate them better. Then we will have the right products in development to meet the challenge.

AR: Do you see systems becoming a more integral part of the way we meet customer requirements?

JK: It is important that we have ship design skills and strong capabilities in propulsion system development. This helps us provide packages of equipment that are integrated with the vessel and designed to work efficiently together. Providing this regionally with strong product ownership is key. When we are involved from the outset we can identify and offer the best solution.

Although we have well-known and proven ship designs of our own, I understand they will not always fit the requirement, and customers have preferences. But our experience means we are able to put the same discipline and commitment into providing a system or package of equipment that is tailored to the vessel, no matter who designs it.

AR: What do you like most about your job?

JK: I like meeting customers and being involved in the sales process, where you know that the decisions you make can influence events and impact a number of people. Rolls-Royce is a technology leader. There is an opportunity to develop the solutions customers want and plan the innovations that we anticipate the market will demand.

AR: Do you find time to relax?

JK: Yes I think so! I like sport, particularly skiing, but also have a wife and three daughters, so time to participate is limited.

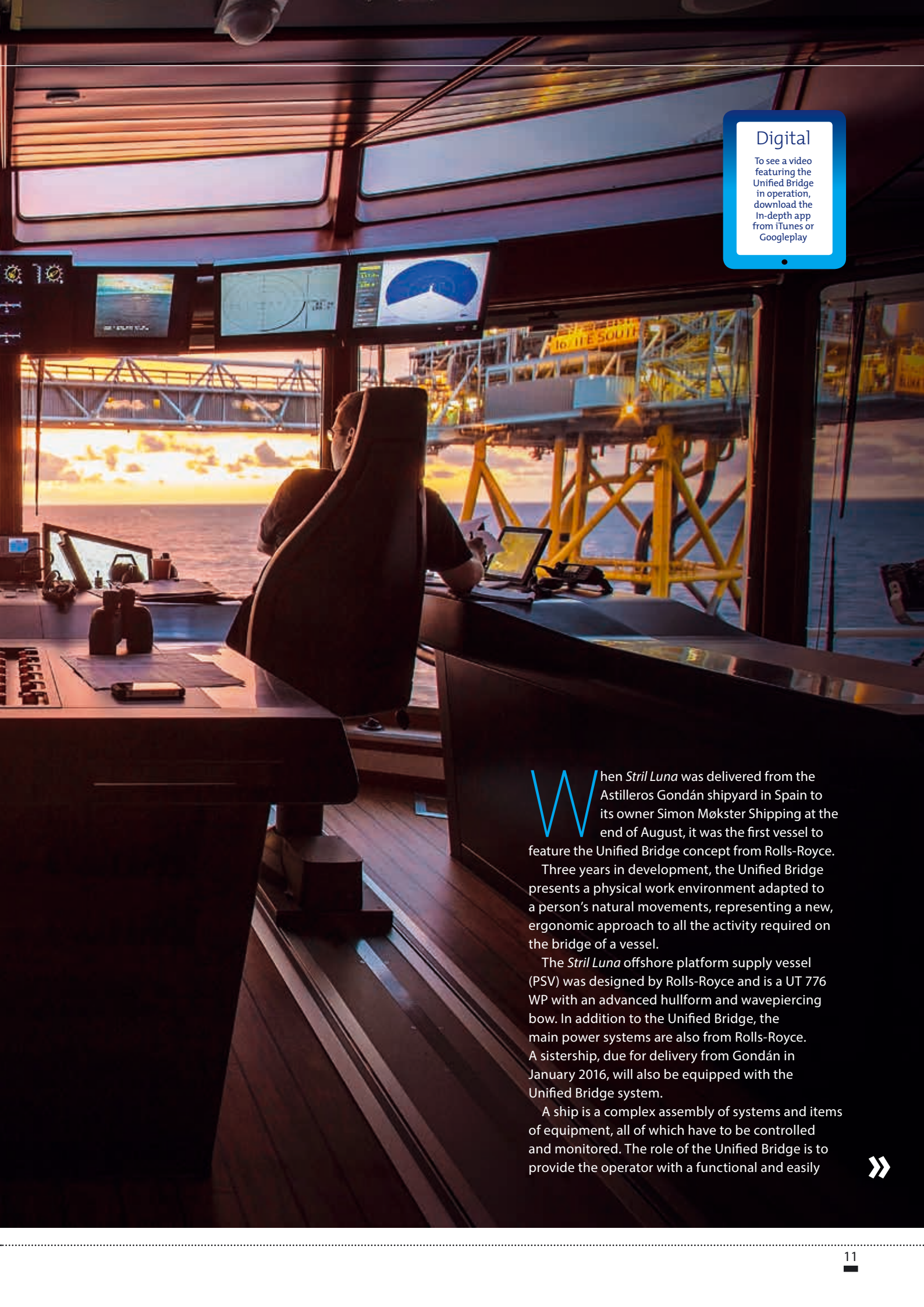
One of my daughters has a horse so I become a truck driver on weekends. In spare moments I enjoy listening to music and reading. But it goes without saying, I enjoy being in a dynamic business. ■

“WE HAVE ONE AIM – TO BE MORE RESPONSIVE TO OUR CUSTOMERS”



A BRIDGE TO CONTROL, COMFORT AND SAFETY

As the first vessel featuring the ergonomic Unified Bridge system from Rolls-Royce enters service, its captain reflects on a combination of improved conditions and safer operations



Digital

To see a video featuring the Unified Bridge in operation, download the In-depth app from iTunes or Googleplay

When *Stril Luna* was delivered from the Astilleros Gondán shipyard in Spain to its owner Simon Møkster Shipping at the end of August, it was the first vessel to feature the Unified Bridge concept from Rolls-Royce.

Three years in development, the Unified Bridge presents a physical work environment adapted to a person's natural movements, representing a new, ergonomic approach to all the activity required on the bridge of a vessel.

The *Stril Luna* offshore platform supply vessel (PSV) was designed by Rolls-Royce and is a UT 776 WP with an advanced hullform and wavepiercing bow. In addition to the Unified Bridge, the main power systems are also from Rolls-Royce. A sistership, due for delivery from Gondán in January 2016, will also be equipped with the Unified Bridge system.

A ship is a complex assembly of systems and items of equipment, all of which have to be controlled and monitored. The role of the Unified Bridge is to provide the operator with a functional and easily

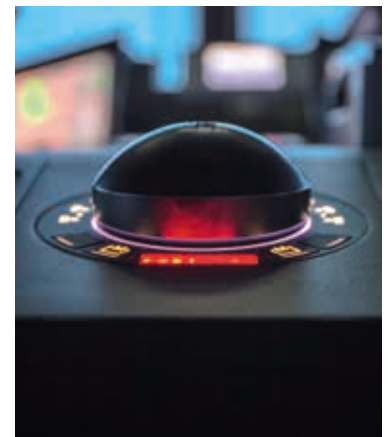




TRAINING FACILITIES

There will also be a land installation. The Unified Bridge will be a key part of a new simulator being set up in Fosnavåg, a town on the west coast of Norway that is a centre of offshore vessel and fishing boat ownership. Training for all Rolls-Royce systems is provided at the Rolls-Royce training centres in Ålesund, Singapore and Rio de Janeiro.

“CONTROLS ARE EASY AND LOGICAL TO HANDLE AND INFORMATION PRESENTED ON THE SCREENS IS CLEAR”



used interface between the operator and machine, with ergonomically placed control levers, touch screens to call up and control the systems and logically present their status.

“Our aims in designing the Unified Bridge have been to offer the operator performance, simplicity and safety with proximity, with an improved view of the aft deck,” says Ludvig Kåre Øyen, Technical Manager, Automation and Control. “We have not only focused on providing a variable working position but a clear and simplified graphical user interface, where only the data needed by the operator for the task in-hand is displayed, using a philosophy of ‘what you see is what you need’. Data not required for the decisions being made is not on screen, reducing the potential for errors.”

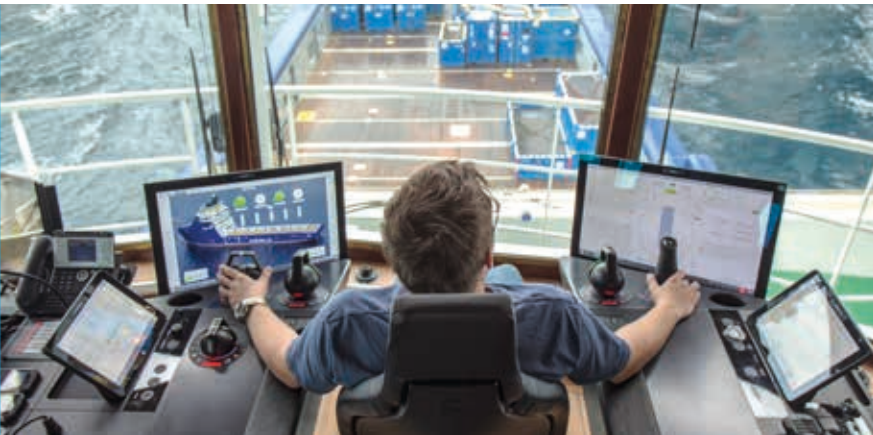
The Unified Bridge is built up from a series of modular

consoles with controls and screens. In the case of *Stril Luna* it is optimised for PSV operations and the owner's requirements and preferences. But this is just the visible face of a high level of system integration.

That integration covers both Rolls-Royce and third party equipment and systems, from propulsion controls to the horn. The Rolls-Royce bridge also incorporates and controls the latest version of a MFD (multi-function display) integrated navigation system.

“Both the ship and the Unified Bridge are working well,” says Lars Aure, Captain of *Stril Luna*. “A few teething issues have been sorted out and discussions are now at the level of fine tuning things like screen heights for the best sightlines, within classification society rules. Controls are easy and logical to handle and information presented on the screens is clear.

ABOVE: The Unified Bridge is designed to improve the whole working environment for the crew, enabling them to perform safer and more efficient operations.



MORE ORDERS

Rolls-Royce Unified Bridge systems are also on order for a number of other vessels now in build. Volstad Shipping has selected Unified Bridge for its Skipsteknisk ST259 design Offshore Construction Vessel now being built at Tersan ship yard in Turkey (NB 1063). Kleven shipyard will install a Unified Bridge in a Marin Teknisk MT5006 ESV design expedition vessel it is building for an owner from New Zealand, Robyn and Graeme Hart. The first Unified Bridge for an anchorhandling tug supply (AHTS) vessel is also in place, to be installed on a UT 782 WP for owner Secunda Canada. The vessel will be built at the Remontowa shipyard in Poland.



TOP: The aft bridge commands a good view of the working deck.

“Simon Møkster Shipping has a culture and tradition of taking part in the development of innovative solutions in co-operation with shipyards and equipment suppliers. The Unified Bridge takes the working environment seriously, and helps to give better working conditions on board and safer operations. *Stril Luna* is currently on contract for Statoil supporting various rigs.”

The layout of the Unified Bridge for the Simon Møkster UT 776 WP *Stril Luna* is a good example of how the operator interface is designed for an offshore vessel, with both fore and aft bridges. A forward-facing transit station focuses on ship control and navigation. There are two operator chairs on slides, on each side of a centre console. Outside each chair is an outer console. This open-fronted layout gives the watchkeepers an excellent view. The joysticks and control handles are positioned so

that the operator can work comfortably from a standing or sitting position. Essential data such as the radar picture and electronic charts are displayed on 26-inch touchscreens, while other systems are monitored and controlled from a series of smaller touchscreens located in the consoles.

The setup is flexible so that different screens can be used for different systems and functions as the operators prefer. Because most functions are accessed via touchscreens, the number of buttons on the consoles is greatly reduced. Those that remain are typically where push buttons and indicator lights are either mandatory or desirable, for instance fire alarms. Main controls and screens are also located in consoles on the bridge wings.

The Rolls-Royce common control platform allows systems to be easily interfaced with each other, minimising the amount of cabling and simplifying installation at the shipyard and subsequently maintenance in service. Ethernet and CAN bus are the main tools for this.

Third party products such as auxiliary control systems are integrated and controlled via various other communication links including ethernet, serial bus and analogue or digital input/output. Due to the number of control units of various sizes normally fitted in the control desk, they are now housed in a separate auxiliary controls cabinet on the bridge. They can all be controlled from a multi-function touchscreen called the auxiliary screen, which is shared with the bridge alarm system.

The Unified Bridge collects the controls and status information for all these systems and presents them to the crew responsible for operating the ship in a clear and logical way. This helps to reduce fatigue, prevent mistakes and misunderstandings and so improve safety at sea.

To speed and simplify the shipyard’s work in installing the bridge equipment, which is usually a major task towards the end of the outfitting process, a bridge mock up was built in the Ålesund workshop. After factory testing of the individual items of equipment, everything was installed in the mock up so modules could be interconnected and Unified Bridge tested as a complete system. Modules were then transported to the yard and rapidly fitted in *Stril Luna*’s wheelhouse. Commissioning was therefore reduced to connecting the equipment the bridge controls and verifying the response of the complete installation. **RW**

Flexible propulsion **ON PATROL**

The new flagship of the Finnish Border Guard has an innovative propulsion system designed for economy, manoeuvrability and flexibility



IMAGE: MEYER TURKU OY

ABOVE: The centreline CPP is fully feathering, flanked by two Azipull 120 steerable units, which provide sufficient thrust for lower speeds.

When it entered service in June this year the OPV *Turva* at 5,000GT became the largest and most advanced vessel in the Finnish Border Guard (FBG) fleet and the only one with a helipad on the front deck. It will primarily operate in the Gulf of Finland and the Northern Baltic Sea.

In addition to the Border Guard, *Turva* was designed in cooperation with the Finnish Environment institute and several ministries to undertake a wide variety of tasks, each of which puts radically different demands on the 96m long and 17m wide

vessel and its propulsion system.

Among the roles that *Turva* will undertake are border security duties, maritime search and rescue missions, marine pollution response including oil and chemical recovery, and emergency towing. It has large capacity tanks for recovered oil, an extensive fire fighting capacity and is equipped to rescue large numbers of people from the sea or another vessel. Several daughter craft are onboard and include a covered search and rescue (SAR) patrol boat located starboard for operations in cold conditions, a fast rigid inflatable boat (RIB) and a workboat located aft for oil recovery operations.

For unlimited Baltic operations year-round there is a requirement to break ice up to 0.8m thick at 3 knots. In addition to its own patrol and environmental protection capability and survivor rescue capacity, *Turva* is also equipped to act as an on-scene command centre.

These tasks involve different speeds and powers, for which Rolls-Royce devised a propeller and thruster combination plus a multifunctional propulsion control system that caters for the load change response of the dual-fuel engines.

Various propulsion options were considered, but the final choice was a Rolls-Royce system combining electrical

“AMONG THE ROLES THAT *TURVA* WILL UNDERTAKE ARE BORDER SECURITY DUTIES, MARITIME SEARCH AND RESCUE MISSIONS, MARINE POLLUTION RESPONSE AND EMERGENCY TOWING”



IMAGE: FINNISH BORDER GUARD

and mechanical transmissions for greatest efficiency.

Under the stern is a centreline propeller aft of the skeg, flanked by two Azipull 120 steerable thrusters with pulling propellers. There are no rudders as such, all rudder effect being provided by the foil-shaped Azipull legs. For most of the lower speed work and manoeuvring only the electrically driven Azipull units are in action, each transmitting up to 2,400kW to their 2.85m diameter CP propellers. Under these conditions the centreline propeller is fully feathered for minimum drag.

But in situations calling for the full speed, which is over 18 knots, for towing casualties where the bollard pull of over 100 tonnes is

required, or for icebreaking the centreline propeller is brought into service. It is a Rolls-Royce CP unit 3.4m diameter rated for 5,400kW, mechanically coupled through a reduction gearbox which also drives a shaft generator. The control system regulates power to both the propeller and Azipull thrusters.

A tunnel and a retractable thruster at the bow work with the main propulsion system to meet DP2 dynamic positioning requirements.

The vessel's bridge has 360-degree visibility with a command and control centre located centrally. Operations on the aft deck of 350m² are supervised from the aft bridge. The deck can take a range of cargos including up to nine TEUs and is

ABOVE: OPV *Turva* is the only vessel in the fleet which is equipped with a helipad on the front deck.

serviced by two cranes, one with active heave compensation.

Capable of operating in the most extreme conditions for more than 300 days a year, *Turva* has two crews. The basic crew is 18 and there is accommodation for up to 42.

Turva is the first FBG vessel to enter service painted in the organisation's new blue-and-white livery, based on the colours of the Finnish flag. All four OPVs of the Finnish Border Guard are capable of operating in all weather conditions throughout the year. At the forefront in planning for *Turva* was the risk picture in the Baltic, and possible collision scenarios with ferries crisscrossing and a steady stream of east-west tanker traffic. **RW**

BELOW: OPV *Turva* is the largest and most advanced vessel in the Finnish Border Guard fleet, and will primarily operate in the Gulf of Finland and the Northern Baltic Sea.



IMAGES: FINNISH BORDER GUARD

POSITIONING A GIANT

The world's first floating liquefied natural gas production facility is now under construction and will be fitted with three Rolls-Royce electrically powered thrusters

Rolls-Royce thrusters are in place to power Shell's *Prelude*, the largest floating structure ever built, which will move liquefied natural gas production off land and out to sea.

Owned by oil giant Shell, the *Prelude* floating liquefied natural gas (FLNG) production facility is the world's first FLNG development and construction is well under way.

It will be fitted with three Rolls-Royce electrically powered USL 455 azimuth thrusters at the Samsung Heavy Industries shipyard in Geojje, South Korea, one of the few yards in the world big enough to build the vessel. The thrusters completed factory acceptance testing (FAT) during November, and are due to leave the Rolls-Royce factory in Rauma at the end of the year.

FLNG technology is a significant innovation for the LNG industry. It

combines two existing proven technologies – offshore gas production and LNG processing – in a single facility. This means that extensive gas pipelines to onshore processing facilities, compression facilities to flow gas to shore, dredging and jetty construction and onshore infrastructure including roads can be eliminated.

Prelude is 488m long, 74m wide and 44m deep from the keel to the main deck and will have a displacement of 600,000 tonnes, when all internal tanks are fully loaded. Offshore gas is received via insulated production flowlines and flexible risers, and impurities such as water, mercury and CO₂ are removed. It is then chilled to -162°C, reducing its volume 600 times and changing it from its gaseous state into a liquid, which is then stored in insulated tanks. LNG tankers can then dock to offload and export the LNG to world markets.

Once towed into position 200km off the coast of Western Australia in an area



known as the Browse Basin, the production platform is not expected to see land again for over 20 years. It will remain operational around the clock and the thrusters will ensure it can keep its heading against the wind, current and waves to allow safe tanker berthing. It is moored at the bow via a turret, the largest ever built, with four groups of mooring chains anchored by 16 driven piles.

Novel thruster installation

This 24/7 operation means any maintenance of the underwater mountable thrusters, which are each rated at 5.2MW, will have to be carried out on board over the coming years, demanding a unique approach to how thrusters are installed.

"Teamworking within Rolls-Royce, the Shell technical team and the Samsung shipyard team was essential in arriving at the best solution, with safety our number one concern," says Knut Eilert Rosvik, VP Propulsion - Commercial Marine.

"Together we were able to develop a



Photography courtesy of Photographic Services, Shell International Ltd.



concept that will allow each thruster to be lifted from its operating position, 23m below sea level, into a dedicated workshop on a higher deck for maintenance. We had previously delivered a somewhat similar thruster arrangement for a much smaller floating production storage offshore vessel (FPSO), working with subcontractor Beacon Finland. So we were able to draw on this experience and working arrangement.”

Rolls-Royce teams in Norway, Finland, Korea and the UK were involved in tailoring the solution. To facilitate thruster overhaul or replacement while at sea, each thruster is located at the base of a purpose-designed trunk (fig 1), which links to the higher workshop area with its dedicated crane. The maintenance space has all the functions and tooling found in the Rauma production facility.

Condition monitoring

Thruster condition monitoring system (CMS) is also part of the Rolls-Royce supply, type approved by ABS, Lloyds Register and

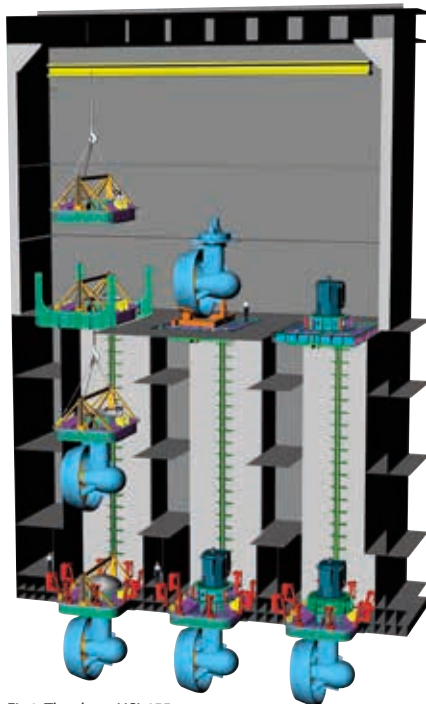


Fig1. The three USL455 thrusters are installed in a novel arrangement which allows removal and maintenance to be carried out onboard. Image courtesy of Beacon Finland Oy

DNV GL and in service on over 100 similar units around the world.

CMS data can be used to determine the actual condition of the thrusters through life, without the need for internal and visual inspections. Maintenance and overhaul intervals can be extended to match the operating profile of the vessel. The CMS is wirelessly linked to an onshore Rolls-Royce operations centre, where the data is analysed to produce the trending and operational information.

The data analysed represents a carefully considered balance of thruster information, highlighting potential operating anomalies before they can be seen or heard.

Prelude is a large floating facility. Every effort is being made by all concerned to maintain the highest quality standards, for the best in reliability to minimise the risk of any downtime. Once operational it is expected to produce 3.6 MMT/a of LNG, enough to meet Hong Kong's annual natural gas demand – as well as 0.4 MMT/a of LPG and 1.3 MMT/a of gas condensate. **AR**

Safer DECKS

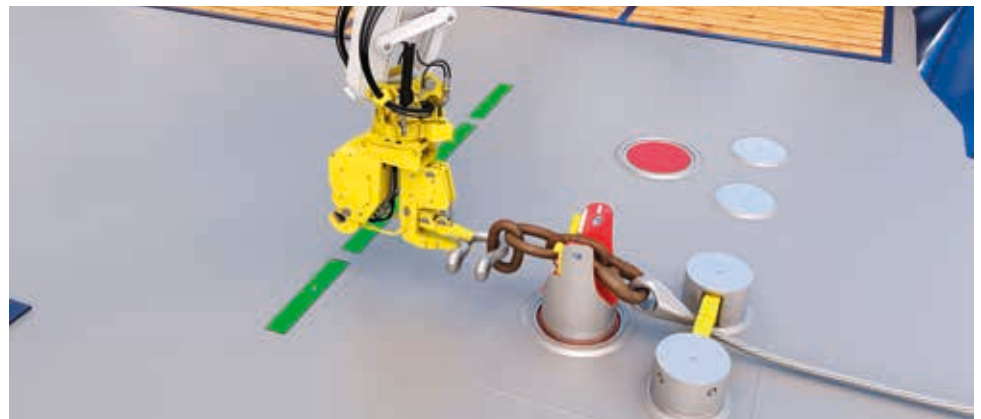
Anchorhandling operations are among the most dangerous tasks undertaken at sea. Now older vessels can benefit from proven equipment, previously only available for newbuilds

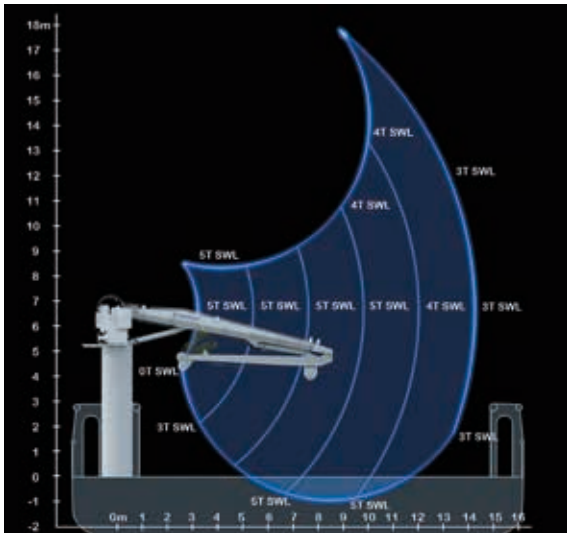
Over the past decade Rolls-Royce has been expanding its Safer Deck Operations (SDO) systems portfolio, aimed at reducing the risk to crews working on the decks of offshore vessels. It has been a big safety improvement which is well supported with statistics that show a reduced number of crew injury incidents.

The latest development is a crane with manipulators for handling wires and chains, similar in principle to other Rolls-Royce SDO cranes, of which around 140 examples have been sold to date. But this version has been designed for retrofitting to older anchorhandling vessels which do not have suitable cargo rails.

This unit is a dual jib knuckle boom crane rotating on a fixed pedestal, located on one side of the deck near the stern. Its jibs can command the whole deck area where shackling and other operations on anchors and associated chains and wires take place.

Its two jibs are equipped with manipulator hands, similar to other cranes in the Rolls-Royce SDO range. The difference is that SDO cranes are typically supplied mounted on carriages that traverse the full length of the working deck of an anchorhandler, running on tracks on top of the vessel's strongly plated cargo rails. Older vessels often lack these cargo rails, having only tubular guard rails, hence the need for a





fixed pedestal unit. The reach of the new crane is however substantial, as the load diagram shows.

First into service will be model AH-50-F, with a maximum working radius of 14m and capable of lifting five tonnes at 3-10m radius and three tonnes out to 14m radius. The crane can rotate about the pedestal 360 degrees without limitation. Designed for the tough conditions offshore, it can operate safely in wind speeds to 20m/sec normally or 30m/sec extreme. A larger version, type AH-100-F, with a higher working load and longer reach is also available.

A typical candidate for the new crane is an older anchorhandler which was usually equipped from new with a general marine lifting crane near the aft end. The new SDO crane pedestal can be fitted on the existing foundation, replacing the old and worn crane with one that has far more functionality. The AH-50-F is remote controlled by the deck crew from a safe vantage point, and it can be supplied with a mini-simulator. This enables the crew to practise using the crane and its manipulators for the various anchorhandling operations during any spare time onboard.

A ten-year-old anchorhandler, the UT 722 L BOS *Turquesa*, will be the first to have the pedestal SDO crane installed, in January 2015. **RW**

FIND OUT MORE ~

Email nils-reidar.vale@rolls-royce.com



ABOVE: The AH-50-F has a maximum working radius of 14m, is capable of lifting five tonnes at 3-10m radius and three tonnes out to 14m.

LEFT: The new crane incorporates proven SDO technology to safely handle wires and chains.



The cranes run on powered trolleys mounted on tracks on the vessel's cargo rails to move cargo over the entire deck.

More orders for dual-draglink PSV cranes

Rolls-Royce has signed a contract with Detroit Chile SA to supply offshore cranes to nine Platform Supply Vessels (PSVs) under construction at Detroit Brasil Ltda. shipyard, in Itajaí, Brazil.

The delivery will include nine ship sets of the award-winning dual draglink crane, making 18 cranes in total. Upon completion, the vessels designed by Guido Perla will enter service on an eight-year contract with state-owned Brazilian oil company Petrobras. Brazilian Starnav Serviços Marítimos Ltda, a subsidiary of Detroit Chile, will operate the vessels.

Dual draglink cranes are optimised for safer and more efficient load handling in harbour and on the ship's deck while at sea. The parallelogram linkage provides

efficient vertical and horizontal load handling and a wider operating envelope than conventional cranes.

John Knudsen, President Commercial Marine, said: "We are pleased to be selected by Detroit Chile to supply this new and highly innovative PSV crane. A ship configuration with two cranes provides safe and highly efficient load handling. These offshore vessels will have the advantage of being able to load and unload using their own equipment and not being reliant on dockside facilities."

Launched in 2012, the Rolls-Royce dual draglink crane is already in service on Farstad Shipping's vessel *Far Solitaire*, one PSV under construction at Keppel Singmarine Brazil SA, as well as four PSVs already being built at the Detroit Brasil shipyard, in Itajaí.

Digital

To see Safer Deck Operations in action, download the In-depth app from iTunes or Googleplay



BIG BOSS

The Finnish navy has turned to a combination of Marine Alutech design and Rolls-Royce waterjet propulsion for its high-speed vessels as it adapts to challenging defence budget constraints

When the Finnish navy was looking for power and dominance for its high-speed vessels, it turned to a combination of Marine Alutech design and Rolls-Royce waterjet propulsion.

Today's navies are adapting to the challenges of ever-changing world security and defence budget constraints. In many cases, smaller, agile craft are being favoured over the more traditional, larger naval combatants.

The market for fast craft, vessels that can be deployed quickly and effectively in a variety of scenarios, is particularly buoyant.

Rolls-Royce is a leading supplier of waterjets for such craft, with the characteristics of responsive

manoeuvrability, rapid acceleration and deceleration, and their suitability for shallow waters making them the favoured propulsion over propellers and thrusters.

The latest type of high-speed craft to enter service, designed and produced by Marine Alutech, is the Watercat M18 AMC. The first of 12 Combat Support Service Vessels (CSSV), No. U701 will officially be handed over to the Finnish navy by the end of the year.

Marine Alutech, located in the south of Finland near the small town of Salo, has been in business for 25 years and is a regular user of Rolls-Royce waterjets across a range of their designs. The company specialises in aluminium hulled high-speed craft for governmental

ABOVE: U701 is the first of 12 support craft being built for the Finnish navy. The Watercat 1500 fast pilot boat destined to work in Spitsbergen is in the background.

“THIS DESIGN OFFERS SOMETHING DIFFERENT, BUT CAPTURES ALL THE CAPABILITIES THAT MODERN NAVIES ARE LOOKING FOR”



customers, such as navies, coast guards, port authorities and sea rescue services.

This summer, In-depth had the opportunity to witness first hand two of their newest and most impressive craft, as they were put through their paces in the waters of one of Finland’s numerous salt water inlets.

Watercat M18 AMC – agile troop deployment

In 2012, Marine Alutech secured the contract to develop and deliver 12 Watercat M18 AMC multi-purpose vessels. These high-speed troop-carrying landing craft are propelled by twin Rolls-Royce Steel series 40A3 waterjets with mixed flow stainless steel pumps.

These impressive and highly agile boats are capable of supporting missions such as troop transportation, medical and evacuation tasks, landing operations as well as patrolling and escort work in the Gulf of Finland, along the Baltic coast as well as globally.

With a displacement of 26 tonnes, which can increase to around 32 tonnes with a full payload, they are powered by two 660kW main engines. The waterjets’ steering capability allows the M18, which is 19.9m long, to turn in a radius of less than two boat lengths, at speed. With a full complement of 26 troops and equipment, the publically declared speed is more than 40 knots.

Niko Haro, CEO Marine Alutech, sees export potential





for the M18. He says: “We’ve had a lot of interest from navies outside our usual ‘home’ markets of Northern Europe. This design offers something different, but captures all the capabilities that modern navies are looking for.

“In the past, navies typically specified what they wanted for their craft, but that can be expensive, and in most countries, that approach is changing. There is a shift to buying proven technology – this takes away the risk of buying something that’s completely new, so being able to offer a design virtually off-the-shelf can be beneficial in some markets. We’ve already had serious interest in the Middle East and South America.”

Rigorous sea trials for the first of the series, number U701 were carried out during the summer.

Jouni Hirvenkivi, Marine Alutech’s Project Manager for the M18 contract, explains: “Firstly, we thoroughly test the whole propulsion train from the engines, through the gear boxes to the waterjets.

“These vessels need to be fast, so we have to ensure we have the power required during early sea trials before going any further. We also monitor the general seakeeping of the boat – how it handles in the water. And we try it out in calm and rough seas. Essentially, we have to prove the capability of the design.”

In order to secure the contract for 12 craft, Marine Alutech produced its own prototype vessel – the M16.

BELOW: The Watercat M18 AMC is propelled by two Rolls-Royce Steel series 40A3 waterjets, which give it a fully-loaded top speed of over 40 knots.



This provided the opportunity to take a design from the drawing board and prove the overall performance, manoeuvrability and speed. The M16 is actually lighter than the M18 production craft, so is a little faster.

The M18 is equipped for a variety of combat situations, offering a mix of protection for the crew and passengers, and suitable firepower for offensive deployments. On the roof there is the main armament – (RWS) remote controlled rapid-fire 50 calibre machine gun and co-axial 7.62. The latter stage of the sea trial programme covers weapons tests, and this is a period when the Navy must be present.

Jouni adds: “During weapons trials, we go out into open sea, and the vessel is under Finnish Navy command and proudly carries the Finnish Navy ensign.

“We’ve been in some rough waves following the wake of one of their much larger craft, and such is the power of the M18, we’ve jumped clean out of the water, which is pretty exhilarating, and I’m proud to say she handled like a dream.”

While these boats will spend most of their time in Finnish waters, they’re actually equipped for missions in international waters.

Naval boats of this size aren’t typically graced with names – these 12 will be numbered in sequence U701-U712, and will collectively be known as the ‘Jehu’ class.

Jouni says: “There are many meanings for this word, but there are a couple I like and they fit the capabilities of these mean-looking boats – ‘destruction’ and ‘big boss’. I’m not sure which suits them best, but when you’re behind the wheel at 40 knots with the bow rising with the sheer power, there is a certain air of dominance about these highly agile craft.”

Marine Alutech has invested in a purpose-built production building for this project, which allows for three craft to be in the various stages of build at any one time. They will all be delivered by the end of 2016.

In service, the M18 will typically have a crew of four: master, helmsman, navigator and weapons operator, but can manage with two if needed.

The vessels are fighting craft and are designed and built to cope with the rigours of a modern combat zone. They feature advanced ventilation and filtration systems so they can operate safely in areas contaminated by nuclear, biological or chemical warfare.

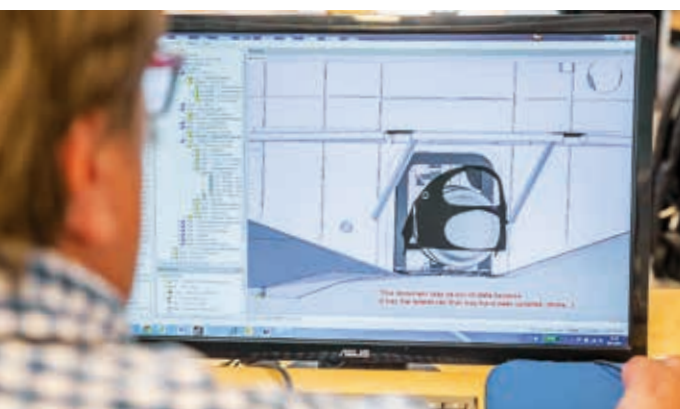
“The boats are fully fly by wire,” says Niko, “It’s a bit like being in an attack helicopter. We actually studied military

“IN SOME ROUGH WAVES WE’VE JUMPED CLEAN OUT OF THE WATER, WHICH IS PRETTY EXHILARATING, AND SHE HANDLED LIKE A DREAM”



Digital
 Watch an interview with Nico Haro and see the U701 in action in our digital version, available via iTunes

ABOVE: Nico Haro, CEO Marine Alutech, at the controls of U701.



operations from helicopters and combat vehicles when fine tuning the design."

Pilot duties – fast in the far north

Also on the water when In-depth visited was another high-performance craft, but one designed for a more peaceful life than the M18 and smaller. The first of a new class of high-speed pilot boat – the Watercat 1500 Patrol – is about to be delivered to the port of Longyearbyen in Svalbard (Spitsbergen), where it will carry out pilot duties escorting cargo ships in and out of the difficult waters.

So why the high-speed requirement? "There is an extensive archipelago in the region, which means ships requiring a pilot can often be up to 200 miles away. To minimise delays, the pilot needs to reach them quickly, so a combination of high speed and the ability to handle rougher seas are key characteristics of this workmanlike vessel," says Niko.

It is fitted with twin Rolls-Royce Steel series 40A3 waterjets and the Rolls-Royce compact control system. This striking yellow craft can also undertake patrol and rescue duties, with a top speed of around 40 knots. **GT**



FIND OUT MORE ~
 Email masi.maattala@rolls-royce.com

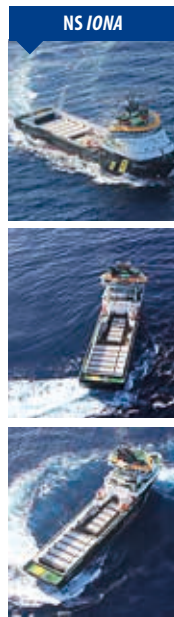
BP takes delivery of high-spec PSVs

Hyundai Mipo Dockyard has delivered the final vessel in a four-ship contract to BP Shipping, built to the Rolls-Royce UT 776 CD design

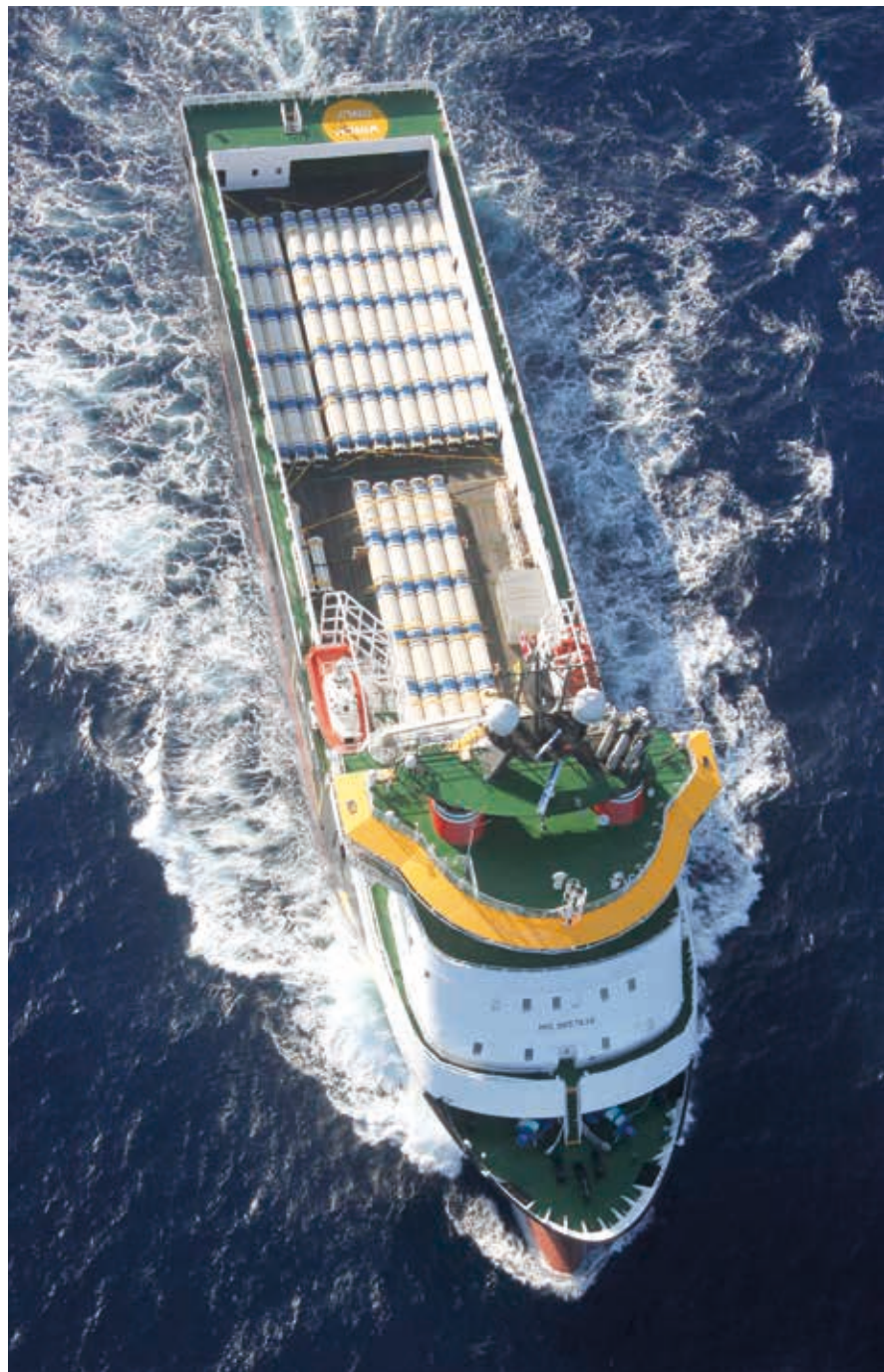
NS *Frayja* is the final platform supply vessel (PSV) built to the Rolls-Royce UT 776 CD design of a batch of four, built by the Hyundai Mipo Dockyard in Korea. The 97m long, 20m beam, UT 776 CD is a popular PSV, with over 12 delivered or contracted to date, and within the generic design there is plenty of scope for owners to specify particular requirements.

The four BP vessels are built to a high specification. Two, including *NS Iona* (pictured), are intended for operation in the British sector of the North Sea, primarily west of Shetland. The other two, including *NS Frayja*, are for the Norwegian sector. There are small differences in rules and regulations between the sectors, and in general all the vessels meet the strictest interpretation, especially where safety is concerned. The UK vessels have some extra stainless steel tanks for special cargoes. These tanks and the mud and brine tanks on both the UK and Norwegian vessels are arranged for nitrogen blanketing. All can carry a large deadweight of cargo, just over 5,000 tonnes at maximum draught, and 2,700 tonnes can be taken as load on the 885m² deck.

BP specified a high standard of accommodation and facilities in line with attracting high quality crews. Cabins are large and exceed MLC 2006 requirements. This has required an extended superstructure, compared with a standard UT 776 CD. All have comfort notation to COMF V(3)C(3).



NS Iona was the third UT 776 CD delivered to BP Shipping.





THE SUPERSTRUCTURE HAS BEEN EXTENDED, AND THESE VESSELS HAVE THE HIGHEST COMFORT CLASS NOTATION

Diesel-electric propulsion is designed to minimise emissions over a wide range of operating conditions. Four Bergen C25:33L6ACD generator sets totaling 7,680kW provide power for propulsion, positioning and services, and are equipped with SCR systems to meet IMO Tier III emission requirements. Two Azipull AZP100 CP azimuth thrusters aft, two tunnel thrusters plus a retractable azimuthing thruster forward with the Rolls-Royce redundant drive system, fulfil DP2 dynamic positioning requirements. The ACON system handles control and automation.

All four vessels have oil spill clean-up capability with DNV's OILREC notations. The Norwegian sector vessels have 2,080m³ of recovered oil capacity and the UK ones 1,815m³. All meet the strict NOFO 2009 rules. In addition to normal PSV work, BP ships plans to have them certified as field standby vessels.

A foredeck mounted towhook and line are provided so that in an emergency drifting vessels can be towed away from the exclusion zone around an offshore installation.

These UT 776 CD PSVs are owned by BP Shipping and chartered to BP Exploration. As *In-depth* went to print NS *Frayja* was on the voyage from the yard in Ulsan, Korea, to the North Sea. **RW**

FEEL THE FORCE

The Promas + nozzle system offers a bollard pull increase of 4-6 per cent compared to a conventional nozzle propeller system and also cuts power in transit by 15-20 per cent.

Promas + nozzle – a winning combination

Tests in connection with an offshore construction and anchor handling vessel to be built by Vard Brattvåg in Norway for REM supply, and other recent tests for similar projects show that combining InnoDuct™ nozzles with the Promas system offers a bollard pull increase of 4-6 per cent compared to a conventional nozzle propeller system, and also cuts power consumption in transit by 15-20 per cent.

This system unites a new type of nozzle profile with an optimised propeller, hubcap, rudder bulb and special rudder profiles. All components are designed to work together to maximise efficiency.

"The profile of the nozzle for the new Promas system has been developed through CFD analysis and testing, and represents a major advance on the 19A profile which has been widely used for conventional nozzle propellers installations," says Robert Gustafsson, Hydrodynamic Research and Design Manager. "Water leaving the nozzle interior passes over a rudder of special profile developed to provide very high steering forces yet minimum drag. Depending on the exact requirements the rudder

may be either a one-piece design or a medium flap type."

REM's newbuilding will be the first to the combination of Promas and InnoDuct™, but the nozzle design has already been successfully applied to conventional shaftlines on a UT 731 anchorhandler operated by Farstad.

Extensive model testing has been carried out to match the Rolls-Royce system to the Vard ship design, and verification of cavitation properties is being done at the Rolls-Royce Hydrodynamic Research Centre in Sweden.

The REM vessel has been developed for subsea construction work and anchorhandling operations in Arctic waters. The expected bollard pull is in the 380-400 tonne range. In addition to Promas propulsion and steering gear, Rolls-Royce will supply two Bergen B32:40V16 main engines, each delivering 8,000kW with reduction gears, tunnel and retractable thrusters and Helicon X3 propulsion control system.

Deck machinery comprises the 500 tonne 3-drum low pressure hydraulic main winch, stern roller, towing pins, shark jaws, centring device and hydraulic anchorhandling cranes, complete with the mechanical and electrical control systems.

Safe and STABLE

Stian Bjørge is Captain of UT 787 LCD *Island Valiant*, and gives his views on the vessel's performance over five years of being in charge

The Captain's view

I have been captain on board this vessel, *Island Valiant*, for five years and have been working for Island Offshore since 2004. Before joining *Island Valiant* I was on the *Island Frontier*. I started my career at sea in 1992 and took the mate school around 2000.

This vessel has been operating in the North Sea, from Denmark to Barents Sea, since delivery in 2007. A key feature of this vessel is its flexibility to undertake various types of work. It's built as a mid-size anchorhandler, but has done a lot of smaller subsea construction work as it has an onboard ROV.

Island Valiant has mainly been doing anchorhandling work. As the vessel is a mid-size deep water anchorhandler, it has a great capacity on deck, which gives us benefits in subsea construction work like PA (plug and abandonment) campaigns, cable repair, trenching, pipe handling and ROV support for the oil industry in the North Sea.

What is most important is the safety of the crew, especially when anchorhandling. The weather changes quickly. The height of the cargo rail helps protect the crew from the weather and we also have a high freeboard, so there is less water coming over the stern. We also have a range of safer deck equipment like the shark jaws, guide pins and centring devices for getting the wire or chain into the shark jaws in a much safer way. Also the width of

the vessel gives you better stability in bad weather, reducing roll. The ROV is inside in a hanger, so you can just close the door in rough weather if something happens.

The DP capability of the vessel is good. We have a retractable azimuth thruster at the bow and conventional units at the stern. This gives us plenty of thrust, and when using Azimuth units we get an extra 38 tonnes of bollard pull. Our size and draft gives us the stability needed for DP operations. The DP system has the highest rating set by DNV, ERN number 99.99.99, which is excellent, and we can work safely inside the limits which are set from charterers.

The vessel does not move around a lot. The length gives us the advantage of not pitching too much, in most wave periods, which gives us the potential to work longer. And the width gives us stability, less roll, so it's a good vessel. In terms of movement, it is one of the best vessels I have been on – even in rough seas, you feel safe. The UT 787 LCD is heavy and it doesn't move too much. Compared to similar vessels I have been on there is a noticeable difference in roll and pitch.

The best feature on this vessel for the type of anchorhandling we are doing must be the winches with the gipsies in the centre, with centring devices and the shark jaws, which are easy to access. You don't need safety pins and it frees up a lot of space on the side of the vessel for more equipment.

The North Sea can be a rough place, you can compare it to a



ABOVE: Stian Bjørge, Captain of UT 787 LCD *Island Valiant*.

roller coaster sometimes, but you feel the safety and the stability of the vessel – I haven't been afraid yet. But you need to respect the weather conditions.

Our shipowner Island Offshore is innovative and willing to try new things. We were among the first to order an AHTS vessel with the ROV hangar integrated in the vessel. We were also among the first to try out the centring gipsies on the winches, and maybe second or third with the safe deck with shark jaws from Rolls-Royce. So our owner is not afraid to try new things, which improves efficiency and makes for safer working conditions for the deck crew. We are

FAR RIGHT: Ottar Antonsen, VP Anchorhandling and Supply.



Even after 40 years of successful operations, the UT design continues to evolve to provide the highest levels of security and efficiency in the most challenging conditions

Deck machinery has developed in parallel with the UT design. Ottar Antonsen, VP Anchorhandling and Supply, tells the story

A new era of anchorhandling

Norway's background in winches started with the fishing fleet in the 1940s and evolved rapidly to meet the needs of the oil industry in the 1960s. We delivered our first anchorhandling winch in 1972, and since we have delivered over 1,000 ship sets.

The development of deck machinery went 'hand in glove' with the advancing vessel designs, enabling them to do more tasks. The UT design was built for North Sea conditions, as were our winches. As oil exploration increased with finds in other areas of the world, these vessel and winch packages were attractive on the spot market and moved, so today our products are found supporting all of the world's oil fields.

The North Sea was a good place to learn and work with our customers to develop equipment not only suited for today's global needs but those of the future. We had to

provide the equipment that would make these vessels attractive for the next 15-20 years.

Anchorhandling was a dangerous task 40 years ago when we were working at depths of 100 to 150m, but today it is 3,000m. Everything has increased in size. Winch capacity has increased many times and pull capacity has gone from 100 tonnes, for our first winch, to over 600 tonnes, with the potential for more. Vessel bollard pull has gone from 50 to over 400 tonnes.

Around 10 years ago, in recognition of the dangers, students, working with an oil major, were trying to define anchorhandling best practice, and had categorised all accidents and near misses. I was invited to a focus group, along with Sigmund Borgundvåg, designer of the first UT vessel, and it was a real eye opener for us. As a result we started a project called 'Safer deck

operation'. The goal was not to remove the crew, but to ensure they were in a safe zone when cables were under high tension, securing shark jaws or handling anchors and wires. The range of equipment updated and developed has now become standard, not only making decks safer but improving the

efficiency of anchorhandling.

As waters get deeper and subsea development and infrastructure increases there will be a need to deploy and service more heavy equipment on the seabed. This will be a roll for big subsea vessels but also for anchorhandlers, equipped with adequately sized winches and secondary winches designed for fibre rope, that can reduce overall weight. We are already well prepared for this with fully-working fibre rope systems that have a pull capacity of around 170 tonnes and a capacity close to 2,000m of 230mm fibre rope. ■

FIND OUT MORE ~

Email ottar.antonsen@rolls-royce.com



Digital

To watch video interviews featuring both Stian Bjørge and Ottar Antonsen, download the digital edition of In-depth from iTunes or Googleplay



all hoping to get the bigger version of the *Valiant*, more powerful, more deck space and more capacity on the winches. On the next one we also hope to get super-silent tunnel thrusters.

When not at work I have a wife, three children, a grand daughter and three dogs at home who need my attention. I like to go walking and we have a cabin in the mountains, which I use for skiing in the wintertime or for recreation.

I look forward to going to work. I enjoy the challenges it brings to be on board the *Island Valiant*, especially when we can combine anchor handling and subsea work. ■

SMARTER SHIPPING



Digital

Watch an interview with Oskar Levander in our digital edition, available from iTunes and Googleplay

The way ships will be operated in the future is part of a constant evolution, and one of the keys to lower costs is the ability to effectively harness the mass of operating data into a central system. Oskar Levander, VP Innovation, Engineering & Technology, shares his views on ship intelligence

We are now in an era where we have the ability to look at the bigger picture, embracing everything that impacts on a vessel's ability to generate revenue – the era of ship intelligence. We are using many tools to measure, analyse, provide decision support and to automatically control different functions and services onboard, but they are not designed to work

together, so the benefits one system can get from using the 'intelligence' from the others is not being utilised. As systems have evolved we have become much better at equipment health and condition monitoring (CMS) and optimising onboard energy use. Systems that provide condition monitoring, energy optimisation, weather routing, interactive chart displays and power management are helping us sail and maintain vessels more efficiently. Individual vessels are

benefitting and some fleet operators are rolling these systems out across the total fleet.

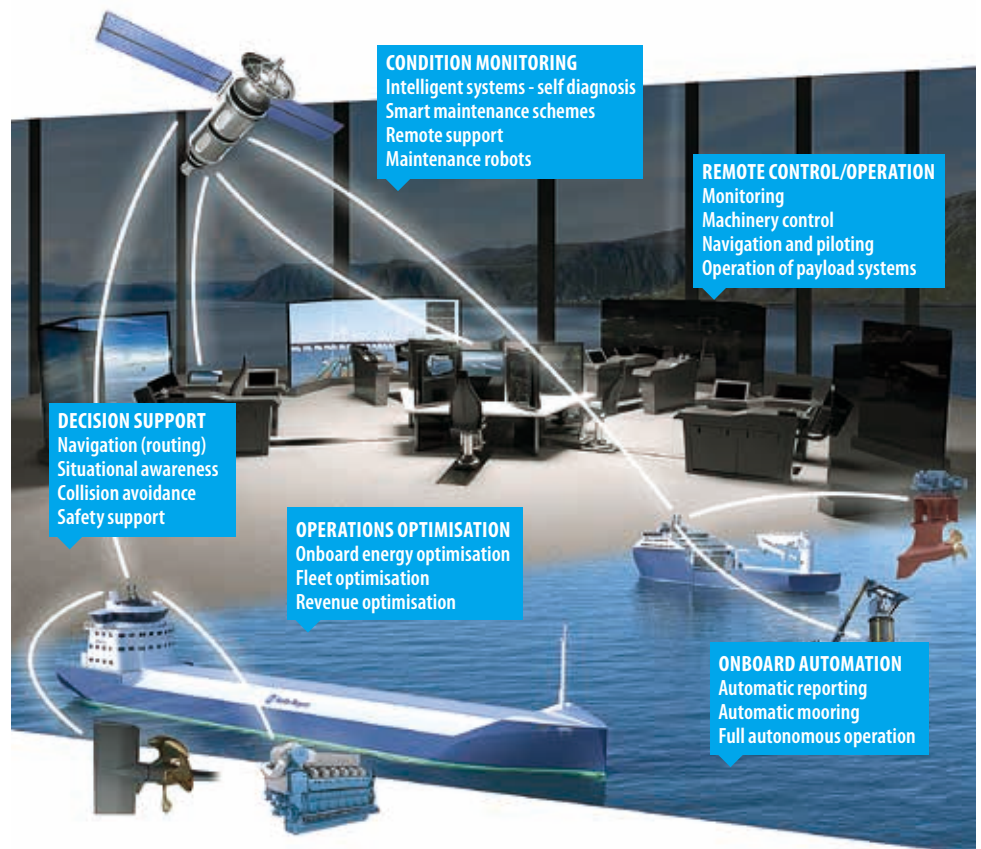
Ships now contain more and more equipment that is increasingly complex. Ballast water treatment systems and exhaust gas treatment are just two additions crews will have to manage in the future. As crews get smaller they will not be able to cope with everything. Therefore automation levels are increasing, and the more complex systems are using smarter user interfaces. The Unified Bridge from Rolls-Royce discussed on page ten is a good example.

So there is a need for intelligent systems that can run themselves, with the crew becoming supervisors, concentrating on managing the exceptions when they arise and reviewing decisions with the human experience machines don't have. The technologies that enable experts on land to be placed in the centre of problems onboard are already with us, and developing technologies such as augmented reality are also likely to play a bigger role.

Ships are bombarded with information from multiple sources. Electronic Chart Display & Information Systems (ECDIS) and Automated Identity Systems (AIS) are just two of them. Intelligent systems will move us from equipment level to system level and will be capable of differentiating between important data that requires some action, and routine data that is just building the operational picture. They can then make the decisions to the level programmed, managing the other events by exception.

IBM's supercomputer Watson has already demonstrated how vast amounts of data can be used to make informed predictions better than humans in certain medical fields, and is now being offered to businesses to help with complex investment predictions. Ship intelligence will help bring this capability onboard.

But these systems will not develop



overnight, it will be a step-by-step approach, and they will not develop themselves. Software parameters need to be set, to select which data sets are deemed to be running normally and what gets identified for escalation. Therefore ship intelligence will be a key technology area for us in the near future – not just the technology, but the role it can play in our products and systems.

Near term

There is a possibility certain functions will move onshore. We are already becoming more reliant on pilotless drones and unmanned underwater vehicles; therefore the number of non-safety related tasks undertaken by crews is likely to reduce. A logical start point would be payload systems, which could be updated in logical steps to reach unmanned operation, where all systems work together.

Ship intelligence will make greater use of CMS and sensors located around the ship, to make the crew aware of what is happening around them, for example in hull stresses

TOP: Ship intelligence will make greater use of ship systems and sensors to enhance both crew and vessel operating efficiency.

and the performance of all the systems, which will help identify the best speed for the conditions.

Fatigue onboard can also be a problem. Therefore systems that monitor crew activities may well become more commonplace.

Data will then be available for analysis and comparison, and can be utilised with discretion to improve crew effectiveness and identify training needs.

Ready for change

More people are now accepting the case for increased automation, but some see it as a threat. As with any introduction it will be gradual, so the need for smaller crews will be slow. Many captains now at sea would welcome the chance of going ashore if they could continue to operate vessels, so it may well aid retention.

As ships become smarter, they become safer, helping tackle one of the industry's biggest issues, the safety record. With human error responsible for more than 75 per cent of today's vessel accidents, that is good news.

Ship intelligence will be the enabler for machines to do some of the jobs done by humans today, and it may well do them better and more safely. ■

“MORE PEOPLE ARE NOW ACCEPTING THE CASE FOR INCREASED AUTOMATION”

Digital

See the RAS rig in operation in the digital In-depth, available free from iTunes and Googleplay



WE'RE OPEN FOR BUSINESS

A new era of Royal Navy training has begun at HMS Raleigh, near Plymouth, England, with the opening of a Replenishment-at-Sea/ Fuelling-at-Sea facility designed and built by Rolls-Royce

For more than a year the Replenishment-at-Sea (RAS) rig, the centrepiece of the new HMS Raleigh training facilities, has been proving the Heavy RAS concept is capable of safely transferring five-tonne loads. This was a key requirement for the Royal Navy's new QE Class aircraft carriers, where a system capable of handling larger stores volumes with improved transfer rates was required.

It was designed from by Rolls-Royce to be firstly a land-based demonstrator, and then to be converted to a facility for land-based training.

"We needed a rig to prove the new Heavy RAS system before it went to sea," says Tomas Leahy, Programme Director. "By building a land-based demonstrator we were able to do that, while at the same time providing the Royal Navy with a new training facility that should have a life of over 25 years, providing greater value for our customer, the UK MoD."

With the successful completion of the Heavy RAS trials programme earlier this year, which has demonstrated the system as being capable of transferring five-tonne loads at a rate of 25 or more loads per hour, the rig is now known as Royal Navy's Replenishment-at-Sea/

ABOVE: The rig's first use was to train crews in refuelling at sea.

Fuelling-at-Sea (RAS/FAS) training facility. It has undergone modification to teach sailors how to transfer stores, munitions and fuel safely from ship-to-ship when underway at sea.

"The ability to take on stores and fuel at sea is vital in allowing ships to remain on sustained operations rather than returning to port," says Captain Rob Bellfield, Commanding Officer of HMS Raleigh. "It is one of the most dangerous seamanship tasks the Royal Navy and RFA are involved in. RAS operations are conducted using high tension wires strung between two underway vessels, in all sea states both day and night. It's therefore important that we are able to train people in a safe and controlled environment to ensure the transfers run smoothly at sea. This new facility is world-class and is the most up-to-date training system available for this type of operation."

The new equipment consists of a

RIGHT: Captain Rob Bellfield, Commanding Officer of HMS Raleigh.

25m steel mast of a Rolls-Royce dual function RAS/FAS rig that can transfer both liquids and solid stores. The control rooms on either side are the same as those on today's RFA vessels.

Across a divide of 55m are three structures which represent the reception points for transfer of stores and fuel on a Type 23 frigate, a Type 45 destroyer and in the centre the larger receiving point of a QE Class aircraft carrier.

A fully-functioning representation of a Type 23 fo'c'sle was also provided. To the side is a dedicated building for administration and classroom-based tuition.

It will be used to teach Royal Navy and RFA personnel how to carry out this complex seamanship task on these in service and yet to become operational ships. International navies will also use the facility while undergoing training in Plymouth with Flag Officer Sea Training. **AR**

FIND OUT MORE ~
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"THE ABILITY TO TAKE ON STORES AND FUEL AT SEA IS VITAL IN ALLOWING SHIPS TO REMAIN ON SUSTAINED OPERATIONS"



ABOVE: Replenishment operations at sea are some of the most dangerous, therefore effective training is vital.

Digital
To see a video interview with Captain Rob Bellfield, download the in-depth app

Heavy RAS – handling five-tonne loads

Rolls-Royce designed the HRAS system primarily for the replenishment of QE Class carriers. It is capable of transferring loads of up to five tonnes when transiting at 10-14 knots. On-shore testing of the system has demonstrated it has met the design requirement and is able to transfer 25 loads per hour for up to five hours in sea-state five – which equates to safely transferring loads with a 4-5m swell and in up to 30 knot winds.

The main delivery platform, which supports



the 25m steel supply mast with control rooms on either side, replicates those on today's RFA vessels.

The test rig mimics sea-state five conditions through a hydraulic motion simulator which introduces significant displacement into the tensioned wire ropes of jackstay, inhaul and outhaul, to replicate vessel movement. The distance between the simulated ships is 55m, although the average RAS operating distance is normally between 36 and 42m.

HRAS payload requirements were based around the

volume of an engine change-out module and the weight of a fully loaded mechanised handling pallet. Key to the system is the automatic-tension jackstay winch and drive, which keeps the jackstay wire at the correct tension as the two vessels roll. To take the high load, the jackstay is tensioned to 18 tonnes, whereas the current in service RAS rigs work on six and a half tonne tension.

When transferring solid loads, they are connected to a traveller block that carries the payload along the jackstay wire. Water cooled AC in-haul and out-haul winches control its movement. In automatic mode the system controls the acceleration, deceleration and stop positions of the payload, with the operator only having to provide the 'transfer' or 'return' commands.

Note: The motion simulator was removed on completion of HRAS trials

PULLING ON GAS

Rolls-Royce brand MTU's high-speed gas engines are set to power a harbour tug for the first time, with an ultra-modern design which combines performance with environmentally-friendly operations

The world's first harbour tug powered by MTU high-speed marine gas engines based on MTU's proven workboat series 4000M63 diesel engine is due to enter service in Rotterdam port in 2016. It is being built by Damen in the Netherlands and will be operated by the Danish shipping company Svitzer.

The high power density of the gas engines, together with the innovative vessel design, will make the tug compact and very manoeuvrable. For MTU engineers, the development process has involved combining the crucial new gas engine components with existing modules from the MTU Series 4000 unit, which is already available as a diesel or stationary gas engine.

The new MTU marine gas engine is now running on an ultra-modern and specially designed test stand in Friedrichshafen. It is being tested under near-real marine conditions, to ensure it can meet the exacting demands of the marine market. When installed, a pair of 4000 gas engines will deliver 70 tonnes of bollard pull.

MTU engineers started development in 2011, as Dr Philippe Gorse, Team Leader in the development of new engine concepts at MTU, explains: "The turbocharging system, running gear and the easily modified exhaust system were



carried over from the Ironmen marine diesel engine.

"The cylinder heads, ignition system and throttle valves originate from the Series 4000 stationary gas engine for power generation."

In addition, the research engineers introduced some components from the C&I engines so the gas engines would also operate safely at low loads.

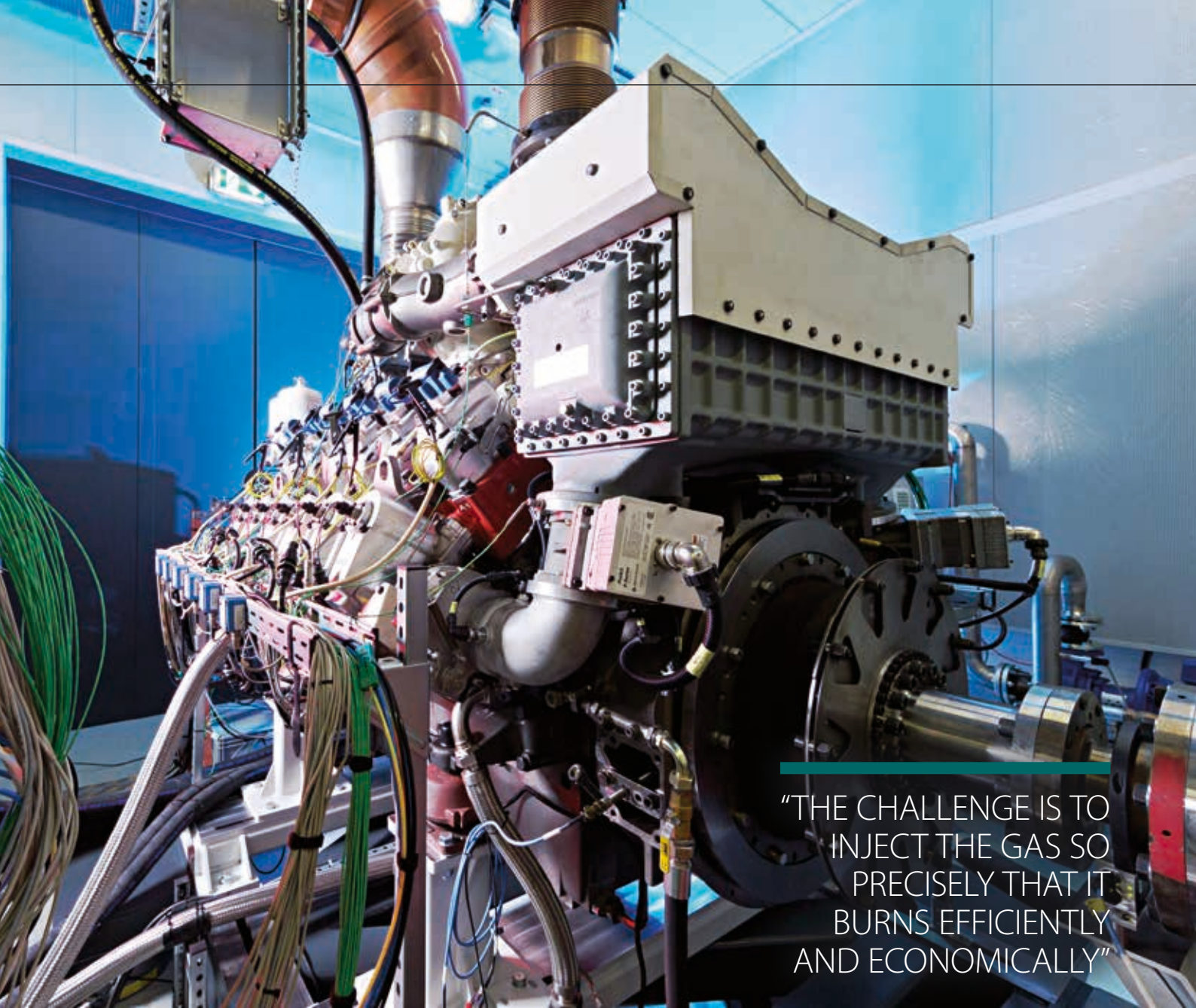
In the space of two years, the project team developed the engine management concept and gas injection system, and designed

ABOVE: Peter Friedl, Product Manager for gas engines, MTU Friedrichshafen.

the engine for various gas qualities to achieve good transient response characteristics. By the end of 2014, the pilot engine is due to be handed over to MTU series production development.

Performance

"The new design of the MTU gas engine for marine and mobile applications differs from its diesel counterpart essentially in terms of the fuel system and engine management," says Dr Gorse.



“THE CHALLENGE IS TO INJECT THE GAS SO PRECISELY THAT IT BURNS EFFICIENTLY AND ECONOMICALLY”

While in a diesel engine the fuel is injected directly into the combustion chamber, where it mixes with air and is ignited by compression, the natural gas fuelling the gas engine is injected into the intake air before it enters the cylinder head. This means the air and natural gas is mixed thoroughly before entering the combustion chamber, where the homogeneous mixture is compressed and ignited. As a result, virtually no soot particles are produced. Similarly, the gas engine emits 25 per cent less CO₂, substantially less NO_x and no SO_x.

A feature of the fuel delivery system on the gas engine is that metering of the natural gas-air mixture can be varied according to the engine load.

“The challenge is to inject the gas so precisely that it burns efficiently and economically, enabling the engine to handle varying load

conditions and at the same time meet the specified emissions limits,” says Dr Gorse.

In terms of performance, the new high-speed gas engine easily matches its diesel equivalent.

“At 1,800rpm the 12-cylinder version delivers 1,500kW and the 16-cylinder version 2,000kW, and it satisfies the IMO tier III emission requirements without exhaust aftertreatment,” explains Peter Friedl, Product Manager for gas engines at MTU Friedrichshafen.

World first

The world’s first harbour tug powered by high-speed gas engines using CNG is being developed jointly by MTU, Damen and Svitzer, and is due to enter service in 2016. It will be powered by two 16-cylinder gas engines driving Rolls-Royce azimuth thrusters.

ABOVE: The MTU 12V4000 gas engine will deliver 1,500kW and the 16-cylinder version 2,000kW.

Martijn Smit, Sales Manger Europe at the Damen shipyard, says: “Damen is proud to be part of this project to build the world’s first compressed natural gas (CNG) harbour tug.”

Kristian Brauner, Technology Director at shipping company Svitzer, adds: “The ability to innovate in the area of reliable and environmentally safe operations is absolutely essential to us. So the decision to develop this new type of CNG tug is the logical continuation of our philosophy of combining the tug business and environmental protection.”

It is anticipated that the number of vessels running on natural gas will increase to around 3,200 by 2015. **NFK**

FIND OUT MORE ~

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BRIDGING THE GULF

With three service centres spanning the Gulf of Mexico, Rolls-Royce is in a perfect position to support customers in the region, whatever their requirements

Rolls-Royce has been present in the Gulf of Mexico ocean basin since the 1980s, supporting drilling rigs and the UT vessels which moved there from the North Sea, and is growing the services it offers to customers from three service centres.

The need to provide immediate and responsive services to support customers with routine maintenance or overhauls resulted in a significant extension to the Rolls-Royce service centre in Galveston during 2008 and further recruitment at the St Rose service centre in New Orleans. Five years ago the service centre in Veracruz, Mexico opened.

“Being close to our customers and listening to their needs is more important today than ever,” says Dave Miller, VP Service Delivery Americas.

“As a result we have grown our technical services and continue to invest in our workshops and service infrastructure. We have demonstrated over a number of projects that we can cost effectively deliver overhauls on our largest products to very tight deadlines and shorten drydocking times. Effective training remains a vital factor to ensure we can deliver the quality service that lives up to the Rolls-Royce standard.”



Galveston, US – centre of excellence for thruster overhauls

Earl Johnson, Service Manager

The Galveston workshop, with over 3,000m² of workshop space and its factory qualified service team, is our centre of excellence on the Gulf for large UUC azimuth thruster overhauls. Its footprint and design gives us the flexibility to carry out a variety of work on all other Rolls-Royce products. During times when certain skills are in great demand we pull in resources from our other North American sites and if needed from our product centres. Our St Rose and Veracruz sites are linked by a strong commitment to common customers to ensure they get the service they need wherever they may be operating. To ensure

concentration on customer issues we have a weekly service managers’ conference call.

As our installed base of thrusters has expanded – they power many of the region’s drill ships and semi submersible rigs – we are well prepared to undertake the overhaul work that will be necessary as they approach their planned maintenance periods. We can handle 12 large UUC thruster overhauls at one time. A standard overhaul of a UUC thruster set (six to eight units) is a four to six week project. We manage all aspects of the overhaul, including the parts supply chain, and have excellent relationships with local machining and painting vendors. This ensures we can bring the right skills to bear, throughout the overhaul period.

Most of our customers’ corporate offices are just north of the facility, and we are 50 miles south of most of the ‘drilling corridor’ customers centred in the US. We are also close to two shipyards and have an excellent supportive relationship with them. Being so close to many customers, they are welcome to visit us to see for themselves what we can do.

Ongoing training for the UUC product line is our current priority. In North America we are developing a highly-qualified and agile team of engineers who can move as the demand increases, with Galveston as the hub.



New Orleans, US – engine component exchange centre

Tom Kilgour, Service Manager

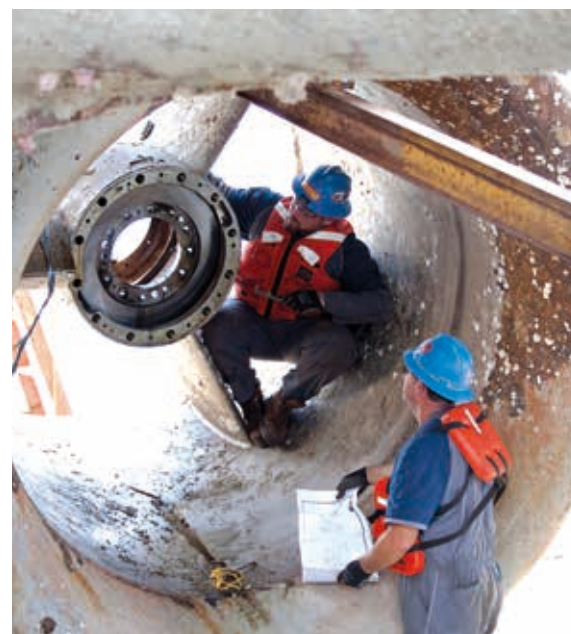
Located close to New Orleans

International airport and about 90 minutes north of Port Fouchon, the 500m² service workshop and offices based in St Rose enables our team of product centre-trained engineers fast access to most locations around the Gulf. The team is very experienced, with field and workshop capabilities across the full marine product range, concentrated mainly on propulsion.

We are part of the Bergen Engine exchange programme and provide a regional solution to



ABOVE: A view of the Rolls-Royce service centre at Galveston in the United States.



specialist engine work. At the facility we carry out equipment repair as well as holding a range of exchange components, including cylinder heads. We focus on providing a local centre for engineering expertise, as well as a noted quality of service and abilities that support our customers.

With a large concentration of deck machinery in the region, and the needs of our customers, we are developing a deck machinery support cell, to ensure we have the right repair and overhaul capabilities here to provide a responsive level of service.



Veracruz, Mexico – local experienced support
Sergio Huesca, Service Coordinator

From Veracruz we provide support to the whole country including the Pacific coast.

Our location, 15 minutes from the biggest shipyard in Mexico, is also close to ports and other major shipyards.

We regularly service products, from Z-drives, CPPs and waterjets to control systems, steering gear and diesel engines.

As our trained service engineer team is mobile we have containerised workshops that move with us from location to location, wherever our customers are drydocking their vessels. With the oil industry here likely to open up for foreign investment, our service centre is prepared to grow with it. **AR**

RIGHT AND ABOVE: The Galveston workshop is capable of overhauling multiple large azimuth thruster units.

FIND OUT MORE ~

Email david.m.miller@rolls-royce.com



INSET: Thrusters are spin-tested after overhaul to check noise levels and ensure full functionality.

TOTAL THRUSTER SUPPORT

As the range of thrusters supplied by Rolls-Royce has grown, so has the extent of customer support programmes designed to shorten drydocking times

A substantial part of the Rolls-Royce marine business is involved in thrusters – designing them, manufacturing them and overhauling them.

An increasing number of ships and drill rigs depend on reliable fully-functioning thrusters. These may be azimuth thrusters for main propulsion, or auxiliary units for

manoeuvring and dynamic positioning.

A merchant vessel on long routes may be equipped with a single tunnel bow thruster for assistance when berthing. At the other end of the scale, an offshore vessel with the highest dynamic positioning class DP3, will have multiple redundancy in its thruster outfit. For example, one recently-delivered construction vessel has nine Rolls-Royce

thrusters of different types to cover its propulsion and positioning requirements.

After years of service, any thruster will require an overhaul. In the case of offshore vessels, there will be a stipulated maintenance plan if a vessel is to retain its propulsion redundancy class notation.

Customer exchange

Drydocking a semi-submersible rig or drillship is an expensive business. Therefore owners favour Rolls-Royce azimuth thrusters which can be demounted and installed with the rig afloat, with no need to

drydock. In this case, it is normal for customers to have a rolling exchange programme for the six or eight thrusters which propel and position the rig. One or two at a time will be removed for overhaul, with exchange units on the spot to replace them. At the next service, another one or two thrusters will have the same treatment, and so on through the life of the rig.

Working in close association with customers that have Rolls-Royce UUC units installed, the exchange units can be stored at an agreed Rolls-Royce service location, where they are kept in condition for immediate shipment. They are then shipped to where the shipowner is going to dock the vessel, so they are on the quay waiting for its arrival, ready for a rapid swap-out to replace a damaged or worn unit.

The removed units are then returned for overhaul in specialised Rolls-Royce service centres in Rio, Galveston, Ulsteinvik or Las Palmas, which will open in 2015 (see page seven for more).

To offer customers a more comprehensive service, a full turnkey programme for thruster replacement and overhaul will be introduced next year.

Thruster exchange

For vessels equipped with smaller Rolls-Royce azimuth thrusters and tunnel thrusters, any thruster exchange is normally a matter of waiting until a vessel has a planned drydocking. They are then removed and overhauled at the nominated repair yard before being refitted.

Despite the best planning for spares and the necessary labour, the time required to do this can creep.

To alleviate this uncertainty, Rolls-Royce is expanding an exchange pool of the more common Azipull, azimuth and tunnel units, starting with those powering UT vessels, ferries and cruise vessels.

Geir Sundal, Business Manager in Ulsteinvik, sums up the advantages of the programme. "Customers who use our exchange service get a unit which has been returned to factory OEM standards in our workshops at a competitive price, eliminating acquisition costs, downtime and

warranty exposure," he says.

"Normally the right service parts can only be procured when a thruster is removed for overhaul and the internal condition determined through inspection. With the thruster pool the vessel owner has guaranteed availability of a replacement unit, minimising downtime and avoiding costly waiting time for parts and labour."

Factory standards

On arrival for overhaul, thrusters are pressure washed to remove marine growth, together with scrapping of spent corrosion-protection anodes. Next the unit is sandblasted to clean off the paint and a coat of primer applied. Only then is the clean thruster taken into the workshop for dismantling, inspection of the housing and examination of the internal components.

"Some parts, such as the propeller shaft seal, bearings and o-rings, are renewed automatically," says Espen Richardsen, Production Planning Manager. "Shafts are subjected to crack detection, and if sound but worn they are approved for reclamation procedures followed by refinishing to as-new tolerances. Gears are checked for tooth mesh and problems like scuffing, fatigue failure or other damage. If they are deemed fit for further long service they are refitted, but if there is any doubt crown wheel and pinion are renewed. Decisions are made in consultation with the relevant classification societies."

"ROLLS-ROYCE IS EXPANDING AN EXCHANGE POOL OF THE MORE COMMON AZIPULL, AZIMUTH AND TUNNEL UNITS, STARTING WITH THOSE POWERING UT VESSELS, FERRIES AND CRUISE VESSELS"



Re-assembly of the thruster with new gaskets, seals and oil follows. An advantage of overhauling in a Rolls-Royce workshop is that rebuilt thrusters are spin-tested to check noise levels and verify everything is functioning correctly and returned with an OEM warranty – not the case if the overhaul is done by a shipyard. With new zinc anti-corrosion anodes and approved anti-fouling coating, the thruster is ready for continued service, and will either be shipped out for installation or put into exchange pool stock.

Smaller tunnel units and Azipulls can be transported by road in special transport frames. Large units, with propellers up to 4.2m diameter in nozzles, normally come and go by ship, a straightforward process for our waterfront workshops.

Notably, it is not just the thrusters themselves that can be upgraded, so can their control systems. There have been enormous developments in electronics, control technology and on the human/machine interface. Ships equipped with old control systems can often profit by upgrading to Helicon X-3, especially if there is conversion work, such as fitting additional thrusters. The advantage is that it is easy to integrate with other Rolls-Royce equipment. **RW**

FIND OUT MORE ~

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Refloating HISTORY

When it was built in 1938, *Shemara* was one of the world's largest and most luxurious yachts. Rolls-Royce has been instrumental in a comprehensive programme to restore the historic vessel to its former glory

Shemara's original owner, the colourful industrialist Sir Bernard Docker, had little time to enjoy his extravagant new yacht when she was delivered in 1938 by J I Thornycroft in Southampton, UK.

With the outbreak of the Second World War, HMS *Shemara*, as she became, was requisitioned by the Royal Navy for anti-submarine duties, only reverting to its yacht role when peace came.

Sir Bernard Docker used the 64.7 metre yacht extensively for the next 20 years, and *Shemara* was often in the news when visited by royalty and celebrities. The yacht was then acquired by Harry Hyams in 1965 and in the early 1980s was laid up for years in Lowestoft, with crew on board.

The present owner purchased her in 2010 and commissioned a complete rebuild. *Shemara's*

superstructure, interior and machinery were removed and the bare steel hull repaired and refinished. At the same time the hull was modified to take electrically driven azimuth thrusters for main propulsion, replacing the original conventional twin screw system that was turned by heavy Imperial Atlas engines. A new superstructure was fabricated in alloy to help improve stability. The result is that *Shemara* has kept her original stylish appearance but meets today's expectations in terms of safety, efficiency and comfort.

"Rolls-Royce was chosen to supply the complete propulsion and motion control systems as well as the detailed engineering to integrate them with the old hull, the first time Rolls-Royce has provided such a yacht refurbishment package," said Sindre Kvalvaag, Contract Manager Ship Design & Systems, Commercial

Marine. "The hull of *Shemara* was laser mapped and the hull lines developed from the process used to ensure the newly fabricated stabiliser fin boxes would fit exactly in the hull."

Shemara now has a modern diesel-electric propulsion system, including twin contra-rotating azimuth thruster propulsion with a bow thruster for manoeuvring and dynamic positioning operation.

The power electric system for thruster drive incorporates active front end technology for speed control and the Rolls-Royce Acon automation system. DP-0 dynamic positioning was also part of the package, together with a pair of retractable fin stabilisers in a stabilisation-at-rest system.

The five gensets that supply power for all purposes were also provided as part of the contract.

The extensive rebuild was carried out on the site of the former Vosper Thornycroft yard in Portsmouth harbour. *Shemara* was then moved onto the yard's shiplift, lowered into the water, and towed to Southampton for final fit-out.

Following commissioning and sea trials she is now in service in the Mediterranean. **RW**

ABOUT SHEMARA

The graceful *Shemara*, which was built in 1938 and saw service in the Second World War, has now been refitted with a complete Rolls-Royce propulsion and motion control system package as part of a comprehensive rebuild.



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