May / June **2024**

SHIP & BOAT INTERNATIONAL

Uncrewed vessels Patrol & rescue boats Yachts Electric propulsion

The Royal Institution of Naval Architects Presents:

Warship 2024: Future Surface Combatants

18-19 June 2024, Adelaide, Australia

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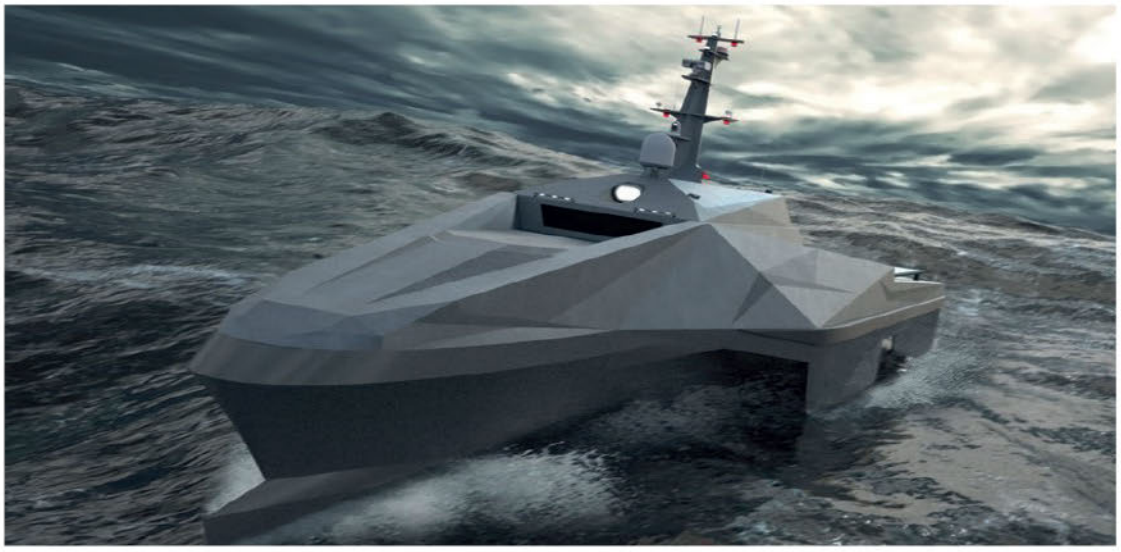

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Sponsored by BMT, Babcock, Defence SA, ANSYS, and SH Defence, and Supported by the RINA Australian Division, the Royal Institution of Naval Architects is once again hosting the highly popular Warship International Conference in June 2024.

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

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

Keynote Speakers

Rear Admiral Rachel Durbin CSC, RAN

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

Glenn Callow, Chief Technology Officer, Austal Limited

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

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SHIP & BOAT INTERNATIONAL

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The Royal Institution of Naval Architects Presents:

ICCAS 2024:

International Conference on Computer Applications in Shipbuilding

10-12 September 2024, Genoa, Italy

REGISTER NOW

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As environmental demands and increasing regulatory compliance requirements place additional pressures on ship owners and operators, advancements in digital technologies are being exploited by ship designers, builders, and operators to develop and evolve effective and sustainable green ship solutions. Increasing amounts of data are collected, managed, and used across all stages of a ship lifecycle, to continuously improve quality, performance, efficiency, and compliance environment requirements.

ICCAS 2024 will offer delegates a fantastic opportunity to discuss common problems with peers from the global shipbuilding and marine industry and how they are being addressed. The list of accepted abstracts is now available to view on the event website.

All aspects of applying Digital Technology across the industry are addressed, such as:

- Improved design to satisfy the environmental and performance requirements of the ship-owner
- Transitioning current computing systems with future developments, to maximize the use of captured data
- Collaborative working and data sharing across all platforms and regulatory bodies
- Enhanced methodologies for accuracy, quality, and productivity.
- Advancements and Innovative applications of visual technologies.
- Use of digital data to optimize ship operational performance and cost effectiveness.

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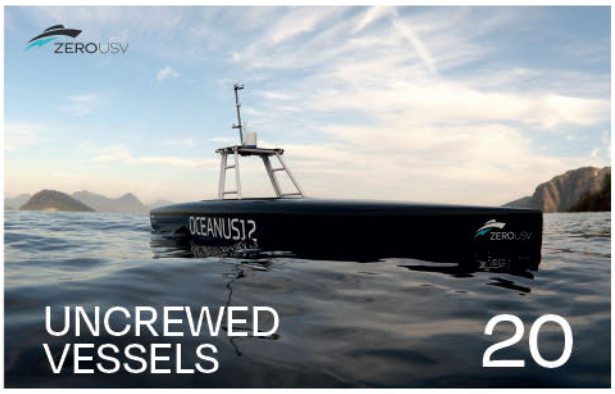

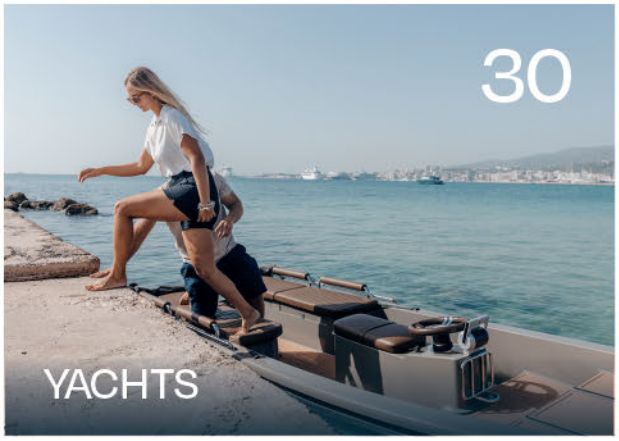

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NEWS

BUNKERING VESSELS

LNG BUNKERING BOOST FOR WEST JAPAN

Japan's Mitsubishi Shipbuilding Co has delivered a liquefied natural gas (LNG) bunkering vessel to KEYS Bunkering West Japan Co – a coastal shipping joint venture formed in 2022 to supply and sell LNG as a marine fuel, with stakeholders including NYK Line, Kyushu Electric Power Company, Itochu Enex and Saibu Gas Co.

The new bunkering vessel, *KEYS Azalea*, was launched in late 2023 and delivered to the operator on 28 March this year, following outfitting work and sea trials. According to KEYS Bunkering West Japan, it will be the first dual-fuel (LNG-MDO) vessel to operate in western Japan. The 4,744gt vessel has an overall length of 82.4m, a breadth of 18.2m and a draught of 4.8m, and can store up to 3,500m³ of LNG. Mitsubishi Shipbuilding Co says that it relied on "the gas-handling technologies and experience [we have] accumulated from building LNG carrier vessels" to perfect the newbuild.

LNG bunkering vessel *KEYS Azalea* will be the first dual LNG-MDO vessel to operate in western Japan

KEYS Azalea will provide domestic coastal shipments of LNG to consumers in the Kyushu and Setouchi areas, and LNG bunkering to oceangoing ships calling at ports within the region. The vessel's construction was subsidised by the Japanese Ministry of Land, Infrastructure, Transport and Tourism's FY2021 LNG Bunkering Base Formation Project. Demand for LNG remains robust in Japan, in comparison to Europe. ■

BOATBUILDING NEWS

AI "AS STANDARD" FOR DIVERSE MARINE BUILDS

UK boatbuilder Diverse Marine has announced that it will integrate Hefring Marine's AI marine solutions into all its newbuilds "as standard", following the signing of a strategic partnership between the two groups.

Iceland-based Hefring Marine's main product is IMAS, an AI-driven onboard system developed to capture vessel data for real-time decision support, which has found customers in the pilot boat, fishing vessel and workboat sectors. Diverse Marine, which specialises in offshore wind CTVs, says it will use this tech to reduce fuel consumption and CO_2 emissions while enhancing passenger safety.

The builder comments: "Sensors integrated into Diverse Marine's platforms monitor impacts and vibrations from the vessel's movement through the water, providing real-time alerts to the master and shore-based teams if impact thresholds are exceeded. The system also displays up-to-the-minute weather and sea state information." Future enhancements will likely include route guidance features, with the software selecting the most fuel-efficient, comfortable course based on real-time sea conditions – hopefully preventing seasickness among the vessels' turbine technician complements.

Shoreside technical teams will be able to remotely monitor and track individual CTVs and entire fleets, drawing on data such as motion and turbine impact metrics, engine performance and fuel consumption rates, for example. Ben Colman, Diverse Marine director, says: "After discussions in both the UK and the US, we shaped the system to meet [our] specific needs for the offshore wind crew transfer vessel sector. The software adapted to this new configuration effortlessly. Additionally, we managed to incorporate turbine approach impacts." ■

Diverse Marine will integrate Hefring Marine's AI tech into its offshore CTV newbuilds

RESEARCH AND SURVEY VESSELS

NEW CAT FOR THAI FISHERIES MONITORING

***Incat Crowther 25* was delivered to Thailand's Department of Marine and Coastal Resources**

Thailand's Department of Marine and Coastal Resources has taken delivery of a new aluminium research catamaran to help monitor the country's fisheries and marine resources. Constructed domestically by Seacrest Marine, and designed by *Incat Crowther*, the cat, referred to as *Incat Crowther 25* at the time of going to press, measures 25m x 9.5m, has a depth of 3.95m and draws 2.2m.

The newbuild can accommodate 12 crew and 16 passengers, spread across six onboard sleeping quarters. Three of these sleeping quarters are situated on the main deck, as are five bathrooms, a large mess, an outdoor dining area, a galley and a storeroom. The upper deck features an office and operations control room with a day head and an *en suite* cabin for the captain. Incat Crowther adds that the wheelhouse has been designed to optimise the captain's line of sight, while the upper deck provides storage for a tender and jet ski, both deployable by crane. The hull deck features three crew cabins. Tank capacities include 8,000litres of fuel oil, 4,000litres of fresh water and 200litres of sullage.

The vessel is fitted with: twin MTU 12V 2000 M96 main engines, each rated 1,342kW; two propellers; and a pair of 97kW Deutz generators. This arrangement permits a service speed of 20knots and a top speed of 30knots. ■

OFFSHORE SUPPORT VESSELS

HYBRID SOV FOR CYAN RENEWABLES

Cyan Renewables' forthcoming SOV will be based on the Vard 4 19 class, modified for a diesel-electric powertrain

Taiwanese offshore fleet operator Cyan Renewables expects to take delivery of a new service operation vessel (SOV) in Q2 2026, which it will deploy on a 15-year charter contract at the Hai Long 2 offshore wind park, part of Taiwan's larger Hai Long offshore wind project site.

The SOV will be constructed by Norway's Vard as a variant of its Vard 4 19 class, albeit modified to incorporate a hybrid diesel-electric powertrain. Typically, this design includes an overall length of 85.1m, a moulded breadth of 19.5m and a depth of 7.4m. Vard adds that is the first time that a Vard 4 19 unit will have been fitted with a pair of retractable azimuth thrusters. By using a single variable-speed generator and batteries, the vessel will be able to operate with low emissions and low noise at the turbine array, the builder explains.

The SOV will also be equipped with a motion-compensated, 30m-long, fixed-pedestal walk-to-work gangway. Produced by Vard's Seaonics subsidiary, the gangway will feature a cargo elevator and a safe working load of 3tonnes.

The vessel will be built and outfitted at Vard's Vung Tau facility in Vietnam. Lee Keng Lin, founding CEO of Cyan Renewables, comments: "This addition brings us another step closer to doubling our fleet in the coming years." The Hai Long development is expected to come online between 2026-2027, with an initial capacity of 1,022MW. ■

EQUIPMENT

ENGINES

YAMAHA TO START HYDROGEN OUTBOARD TESTS

Yamaha Motor Co, Japan is pushing ahead with plans to develop a hydrogen-powered outboard for recreational boats, first announced in December last year, with the goal of becoming "a leader in this space" within the next few decades, the company states.

The manufacturer has developed a prototype hydrogen fuel system in partnership with US-based Roush Performance, which has previously overseen the integration of such systems aboard land speed record vehicles and spacecraft. The goal is to test this fuel system aboard a small newbuild vessel this coming summer. The vessel has been built by project partner Regulator Marine Boats of North Carolina, using a hullform based on Regulator's 26XO offshore sports fishing craft. Normally, this class measures 8.2m in length and 2.8m in breadth, but the hull has been slightly modified to accommodate the hydrogen tanks for the prototype outboard.

"Yamaha is trying to determine if hydrogen can successfully be used in this market, and I think we will find out the answer is 'yes'," comments Matt Van Benschoten, VP for advance engineering at Roush. Meanwhile, Joan Maxwell, president of Regulator Marine Boats, says: "As we design boats in the future, if this proves what we think it will, it could be very possible that we are designing hulls around hydrogen fuel tanks." ■

Yamaha aims to develop a hydrogen-powered outboard for recreational boats

LIFE-SAVING EQUIPMENT

MORSE CODE STROBE

Daniamant has launched a new high-intensity electronic visual distress signal (eVDS) for man overboard (MOB) casualties, branded the ODEO SOS. This strobe light is powered by four lithium AA cells, and produces an SOS morse code signal to alert rescuers to the casualty's position. This latest model has been designed to meet US Coast Guard (USCG) requirements and to offer an alternative to the use of pyrotechnic flares, when used alongside a distress flag, in certain territories (including the UK, Finland and Australia).

The ODEO SOS weighs 150g and incorporates LED technology, with an output of 2,500candela peak equivalent. It can maintain this intensity for up to nine hours; the USCG currently requires a fixed intensity of six hours, Daniamant says. The light is waterproofed to a depth of 5m for one hour, and has survived drop tests from 2m.

The manufacturer adds that the eVDS incorporates a "user-friendly design...with intuitive controls... allowing users to activate distress signals quickly and efficiently, even in high-pressure situations with cold, gloved hands". The eVDS is also supplied with a 900mm x 900mm distress flag, featuring the internationally recognised orange background with black square and black circle pattern, which can be displayed by hand, attached to a mast (or boat hook) or laid flat on the deck to attract the attention of passing aircraft. ■

The ODEO SOS is designed to meet US Coast Guard light intensity requirements

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WHERE THE GLOBAL LEISURE MARINE INDUSTRY COMES TOGETHER

DRONE TECH

SUBSEA SURVEYING

A SECOND 'SUPERIOR' FOR ARGEO

Kongsberg Discovery will supply a second HUGIN Superior AUV to Argeo Subsea, through CSI Nordics, following an agreement reached at Oceanology International (pictured)

Kongsberg Discovery has signed an agreement to supply a HUGIN Superior AUV to CSI Nordics, for subsequent lease to ocean surveying and inspection specialist Argeo Subsea. The agreement was reached at this year's Oceanology International event in London.

This will be the second HUGIN Superior unit that Argeo Subsea puts on the water. Trond Crantz, Argeo CEO, predicts that the additional drone will boost his company's operational capacity and strengthen its presence in the offshore oil & gas and renewables segments, enabling the company to use both drones for tasks such as seabed mapping and imaging. Argeo plans to amass a fleet of seven high-spec AUVs to achieve this goal.

The HUGIN Superior measures 6.6m (length) x 875mm (diameter), has a typical speed range of 3-4knots and is rated for a depth of 6,000m. Both Argeo AUVs are fitted with the group's Argeo LISTEN electromagnetic sensor system, which can be used to inspect cables and pipelines, whether buried or on the seafloor, and to collect accurate data with low noise levels.

Each HUGIN Superior is also equipped with: a HISAS 1032 dual receiver; an EM2040 Mk2 multibeam echosounder; an ultra-high-definition (UHD) still image camera; a laser profiler and sub-bottom profiler; and a magnetometer. The AUV also carries gas sensors to detect methane, CO_2 and oxygen, among others. ■

INSPECTION, REPAIR AND MAINTENANCE

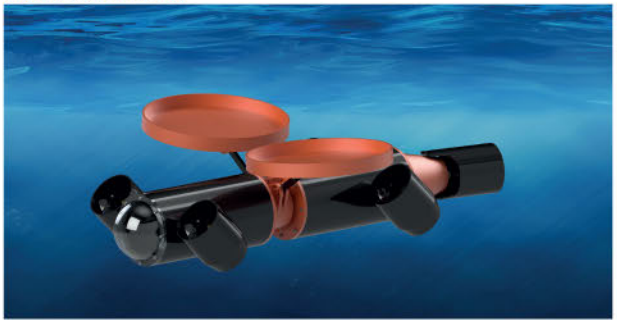
BOT TECHNOLOGY SCRUBS UP

UK start-up ScrubMarine has developed an AI-enhanced underwater cleaning ROV, designed to remove biofoulings from vessels' hulls. The company has received support from Heriot-Watt University's DeepTech LaunchPad pilot programme, a scheme created to assist AI and robotics entrepreneurs in bringing their concepts to market, which includes access to the National Robotarium at Heriot-Watt's campus in Edinburgh.

ScrubMarine founder Clyne Albertelli comments: "Our underwater robot, powered by deep-learning, aims to scrub away biofouling challenges, reducing fuel costs and environmental impact." The proof-of-concept version of the bot measures 700mm x 400mm x 400mm. Albertelli tells *Ship & Boat International*: "Due to the high energy requirements of the high-pressure cavitation, the device will be operated with a tether. We're unsure at this stage of the efficacy of its cleaning action; however, we're aiming to cover a small vessel's hull in a single eight-hour shift."

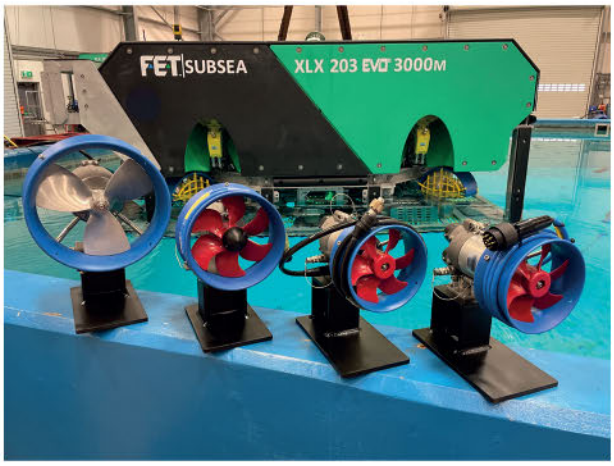
Albertelli adds that the robot's final weight will largely depend on which control systems and pressure vessels are fitted to the bot. "The intention is for the ROV to be as high-tech as possible without compromising ease of use," he says. "There will be various positioning systems, cameras and sensors to also detect types of biofouling and cleaning efficacy." The ROV will be launched and recovered from the water by onboard jib cranes. ■

A render of ScrubMarine's prototype cleaning bot, which could cover a small vessel's hull "in a single eight-hour shift"



ROV PROPULSION

FET AND SAFEEN SIGN THRUSTER MOU



FET launched updated versions of its 300Vdc and 600Vdc thrusters for ROVs in March

Texan thruster specialist Forum Energy Technologies (FET) and Abu Dhabi-based underwater inspection company SAFEEN Survey & Subsea Services have signed a memorandum of understanding (MoU) to jointly develop and fine-tune "cutting-edge" electric thrusters for ROVs.

As part of the agreement, these new thrusters will be "tailored specifically to the requirements of SAFEEN's submersibles", FET states, via extensive cycle testing to validate these units' functionality, durability and integration capabilities. The MoU was announced at the Oceanology International trade show, hosted in London in March, as FET also launched updated versions of its 300Vdc and 600Vdc direct current thrusters.

Kevin Taylor, FET VP for the group's KMS and Subsea Robotics divisions, comments: "We are pleased to collaborate with SAFEEN on this groundbreaking industry initiative. Our shared commitment to excellence...will drive the advancement of electric thrusters, redefining industry standards to ensure safety and efficiency during offshore operations." FET's ROV thrusters are rated for depths descending to 3,000m, and their control circuitry has been configured to reduce underwater noise, so as not to interfere with sensitive survey equipment.

SAFEEN is a joint venture formed between Abu Dhabi Ports Group and NMDC Group, specialising in surveying, inspection and exploration services. ■

SENSORS AND CAMERAS

MICRO CAM SOLUTION FOR SURVEYS

The Rayfin Micro 500m camera has been developed for observation-class ROVs

SubC Imaging has launched a new high-performance camera, the Rayfin Micro 500m, specifically designed for installation on observation-class ROVs undertaking subsea inspections and surveys. The camera features a length of 165mm, a width of 64.5mm and a diameter of 77.5mm, and weighs approximately 0.46kg in water. The camera's '500m' handle reflects its maximum water depth rating.

Capabilities include real-time transfer of digital stills, HD video over Ethernet and image enhancement. SubC says: "Users can access images and videos instantly with no downloading required. Crucial survey data is logged with precise date and time stamps, while GPS data embedded in EXIF facilitates geo-referenced images." The Rayfin Micro 500m can also be customised with optional upgrades, including: LEDs, for strobe and extra lighting; lasers, for precise measurements; and a digital video recorder, for multi-channel capability. The camera can also be combined with SubC's Real-Time Streaming service, enabling live monitoring and remote inspections.

SubC reports that the camera's angle of view is 81° diagonal, with less than 3.4% distortion. The camera also features a scratch-resistant sapphire lens, paired with SubC's in-house-developed LiquidOptics technology, which was developed to offer high sharpness, accurate colour depth and minimal chromatic aberration. ■

OFFSHORE SUPPORT

DOWNSIZING FOR EFFICIENCY GAINS

BMT's methanol-ready 48m SOV concept aims to significantly reduce operational costs while maximising environmentally sound, low-noise operations across a wide range of offshore wind farms

While the global offshore wind market continues to thrive, support vessel operators are still feeling the pressure when it comes to reducing overall Opex while cleaning up their act in terms of emissions control and reduced fuel consumption.

One proposed solution has been the creation of a 'halfway house' between traditional crew transfer vessels (CTVs), which carry the turbine technicians from shore to offshore site and back, and service operation vessels (SOVs), which typically remain on station at the site, acting as offshore motherships for long-term technician deployment. As reported in *Ship & Boat International* January/February 2024 (page 28): "While SOVs are useful in eliminating daily return trips between site and shore, they require a substantial investment...this high rate of Capex could see the energy majors try to pass the increased costs on to the consumer, but there is no guarantee that they will be willing to pay for this."

This has prompted naval architect and designer BMT to develop the concept for a mid-sized, 48m-long vessel, sitting somewhere between a CTV and an SOV as a cost-effective, safe, comfortable and operationally efficient 'best of both worlds'. The company's proposed 48m SOV has been modelled on a diesel-electric platform and an optimised hullform, but also incorporates a methanol-ready design, in anticipation of increased future reliance on this potent alt-fuel.

Mini-sized SOVs

For Noel Tomlinson, global business development lead, commercial shipping, mid-sized CTV/SOV hybrids stand a good chance of becoming the 'new normal' in the offshore wind sector. "There is no doubt SOVs around the 48m length will play an important part in the sector in the near term," he tells *Ship & Boat International*. "In the development of our design, we have spoken to a multitude of vessel and wind farm operators, and what we have put together reflects a lot of what the industry expects to need in terms of Capex, Opex and innovation to reduce the overall environmental impact."

He continues: "Smaller SOVs are becoming increasingly relevant due to their cost efficiency and reduced environmental impact, catering well to the incredibly diverse needs of modern offshore wind farms that vary widely in scale and geographical conditions. These vessels serve not just as transportation but as multi-functional platforms—acting as hotels, storage units and workshops. This flexibility makes them invaluable for prolonged operations at sea, enhancing efficiency by reducing the downtime associated with travel back to shore."

As another benefit, these mini-sized SOVs (alternatively described as 'midi-SOVs') can also be produced with significantly lower construction costs compared to their traditional, 70-90m-long cousins – thereby offering "a pragmatic solution during times when budget constraints are a concern", Tomlinson adds.

> Mini-SOVs could be pragmatic in times "when budget constraints are a concern"

SWATH hullform

However, filling the niche between conventional CTVs and SOVs came with its own specific set of challenges. "It was part of our brief, from day one, to come up with a vessel design that would require reduced Capex whilst providing comparable capabilities provided by larger SOVs," Tomlinson recalls. With approximately 70 CTVs under its belt to date, BMT is well-versed in this type of boat design – but lining everything up to produce a viable, smaller SOV type also required a bit of a fresh perspective.

"Vessel stability is at the core of our thinking," Tomlinson explains. "Designing the 48m SOV posed unique challenges, particularly concerning stability and safety in the harsh conditions typically managed by larger, 70m+ SOVs. Our approach was centred on ensuring that the vessel could perform reliably across a broad spectrum of environmental conditions without compromising safety.

"In order to provide vessel operators with a broad range of operating conditions, we had to come up with a hullform that would be able to operate well and reliably in tough conditions."

With this in mind, BMT opted for a small waterplane area twin hull (SWATH) design, following an extensive parametric study conducted to assess how different hullform types would perform in offshore conditions.

"The SWATH design was chosen for its superior stability and seakeeping capabilities, which are crucial

BMT's 'mini-sized', methanol-ready 48m SOV design has been developed to meet current and future energy requirements

for maintaining operational effectiveness and safety in rough waters," Tomlinson says. "This innovative hullform allows the SOV to deliver enhanced performance, ensuring safe and efficient operations even in adverse sea conditions."

This not only spells more comfortable transits, and a more pleasant working environment, for the vessel's 40 turbine technicians (not to mention its 16-strong crew): it provides a safer platform for personnel during ship-to-turbine transfers, while also minimising noise and vibrations.

Add-on specs

Given the relative novelty of the mini-SOV concept, BMT worked closely with class to develop the 48m vessel. Tomlinson explains: "Whilst looking at the early stages of classification for this concept, BMT meticulously analysed requirements across all the major classification societies to ensure compliance without introducing regulatory complexities for the vessel owners. While the SWATH design presents unique challenges, the vessel is fundamentally classed as an OSV, with additional specifications tailored to its specific roles in the offshore wind farm sector."

These additional specifications include its 'walk-to-work' capabilities, its lower environmental impact and its enhanced crew comfort notations – "all aligning with the stringent regulations and standards expected in offshore operations," he says, adding: "Our extensive experience in regulatory design and commitment to innovation allow us to effectively integrate these advanced features, ensuring the vessel not only meets but exceeds the operational and comfort requirements of the offshore wind industry."

As one example, the design process saw BMT partner closely with walk-to-work system developer UpTime, resulting in the installation of a 30m telescopic, motion-compensated gangway for safe ship-to-turbine personnel transfers. The gangway also comes with an underslung crane, to enable safe transfers of small-to-medium-sized cargo.

BMT also specified an ergonomic vessel layout, to maximise seamless and safe workflows throughout the working day. In terms of technician comfort, the vessel has been designed to feature spacious, single-occupancy cabins and access to entertainment hubs, lounges, a gym and a sauna.

Drone control

The 48m SOV features a dedicated bay for an 8.5m daughter craft, which can assist with personnel transfers when the sea and wind are calm. Additionally – and reflecting the growing reliance of many offshore operators on robotic solutions – the vessel features a dedicated 'drone room', located on the port side, aft of the daughter craft bay.

This space comes equipped with an overhead launch and recovery system (LARS), capable of launching and retrieving ROVs, AUVs and USVs of up to 5m in length. In this way, crew and turbine technicians – or even scientists and researchers, utilising the vessel on a temporary basis – can conduct underwater inspections and maintenance tasks.

All drones are controlled from an onboard central operations room. Tomlinson highlights: "The space is also configured to support aerial drone operations, should the project requirements extend to such applications" – meaning that technicians can launch UAVs to conduct turbine blade inspections, for example.

Methanol-ready

Key to the vessel concept's green kudos is its diesel-electric arrangement. "We have developed a number of options for this design, the idea being that we

can adapt the set-up to the particular requirements of each vessel operator, but also the shipyards that will be building it," Tomlinson says. "The propulsion system is designed to be flexible, incorporating advanced battery packs for enhanced energy efficiency and reduced emissions. These battery packs are supported by high-efficiency diesel-electric engines, providing reliable power and redundancy crucial for offshore operations.

"Our approach ensures that the 48m SOV can adapt to both current and future energy requirements, with the possibility of integrating alternative fuels as they become viable."

As mentioned, BMT is looking closely at methanol as a fuel source for this boat class, with various options on the cards. Tomlinson explains: "This design allows for the integration of methanol-ready engines, which can also be fitted with conventional engines that are adaptable to methanol with future upgrades. Our engineering approach ensures that the vessel is prepared for both current and emerging fuel technologies."

As such, methanol storage tanks have been incorporated into the arrangement. "The tanks are designed to hold sufficient volume to ensure operational efficiency without compromising vessel performance," he says. "This set-up not only supports the vessel's green credentials but also provides flexibility in fuel use, enhancing the SOV's operational readiness in varying conditions."

Alt-fuel flexibility

This flexibility is a crucial consideration, given the varying formations and layouts of the multiple global offshore wind farms, both existing and under development.

"We can adapt the vessel configuration to meet the needs of the local infrastructure," Tomlinson says. "While the logistics of methanol production and supply at offshore wind farms are still evolving, our engineering team is watching developments closely so we can optimise the design around the local logistical infrastructure – ensuring that our SOV designs can integrate seamlessly with existing and future methanol fuelling frameworks.

"This ensures that our vessels are prepared to leverage on-site methanol production where available, enhancing operational efficiency and reducing environmental impact."

While the 48m SOV concept was formally announced in February, BMT confirms that is has already entered into "advanced discussions with several prominent industry players" regarding potential collaborations, and that announcements can be expected later in the year. **SBI**

TECHNICAL PARTICULARS

BMT 48m SOV

Length, oa	48m
Length, wl	35.5m
Breadth, moulded	22m
Design draught	5.5m
Service speed	10knots
Max speed	12knots
Propulsion	2 x 1,100kW azimuthing podded propulsors
Bow thrusters	2 x 22kW
Generators	4 x 940bKW + 1 x 430bKw
Crew	16
Technicians	40
Tank capacities	
Fuel	114,000litres
Fresh water	28,500litres
Black water	14,250litres
Classification society	Bureau Veritas
Notations	AUT-UMS, SP56, SDS, Dynapos, Unrestricted Navigation, Green Passport, Cleanship

A dedicated drone room is located aft of the daughter craft bay

ENVIRONMENTAL PROTECTION

SPECTATOR BOATS UNDER SCRUTINY

International sailing events must take measures to mitigate underwater noise, in order to preserve marine wildlife, states new research from Heriot-Watt University, Scotland. Catherine Backhouse reports

New research led by Heriot-Watt University, Edinburgh has found that the noise impact from large groups of spectator boats at marine events is significant enough to impact upon marine wildlife, with potentially serious consequences for fragile sub-aquatic ecosystems.

Marine mammals, fish and other invertebrate species which rely on their complex hearing systems to reproduce, feed, communicate and avoid predators are at particular risk from underwater noise pollution, especially from motorised vessels. Matt Pine, an honorary research fellow who led the research on behalf of Heriot-Watt's Institute of Life Sciences, states: "Studies have found [noise] increases stress levels in many marine species and can reduce their success in reproduction, foraging and social interactions. Noise pollution can also cause some species to avoid or move away from their original habitats.

"When sailing events like larger regattas are being planned, the potential impact of underwater noise pollution from spectator flotillas should be considered, especially for events happening in ecologically significant areas."

New Zealand research

The research has implications for all large sailing events, both in the UK and internationally. With the Scottish Series Regatta underway in May 2024, the Plymouth Regatta coming up in July and Cowes Week taking place in the Solent in early August, UK event organisers have been urged to consider the environmental impact of their events in the light of this newly published research.

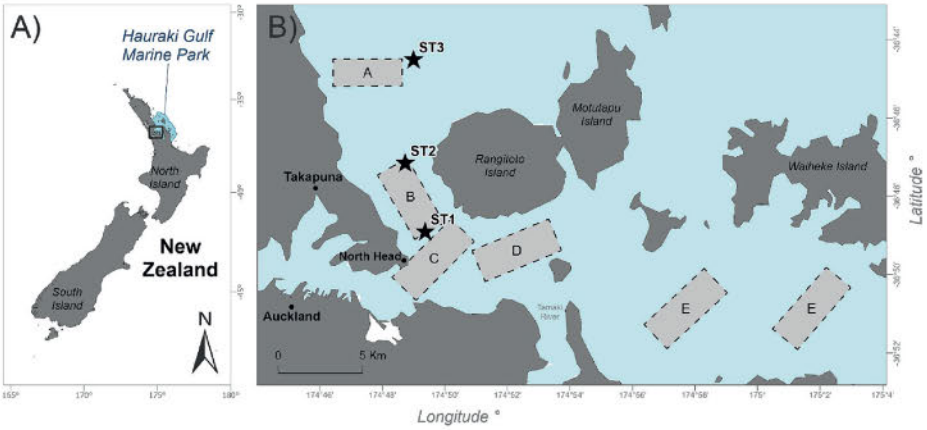
Published in the journal *Marine Pollution Bulletin*, the research involved measuring acoustic recordings taken around racecourses in the Hauraki Gulf, New Zealand during the 36th America's Cup in 2021. Between December 2020 and March 2021 the event was attended by an estimated 10,468 vessels, and saw up to 1,300 vessels a day sail to and from the racecourses at regular intervals.

Increased sound levels were recorded several kilometres beyond the racecourse boundaries, remaining high well beyond the duration of the races themselves. On a typical race day, sound levels around the racecourse were recorded as being 5dBA higher than on a 'control day' when no racing took place – more than three times the sound energy level expected on a normal day.

Suggested actions

While researchers acknowledge that existing protective measures such as restricting spectator vessel speeds to 5knots to reduce the risk of striking marine mammals will already have helped to reduce underwater noise levels, they conclude that further measures are necessary to mitigate the threat to wildlife. These could include introducing designated areas where spectator vessels are encouraged to congregate, as well as adopting marine detection platforms to visually or acoustically identify when marine mammals are near spectators, to ensure best practice is monitored and adopted in mitigating noise pollution.

Other adaptations could include staggering the exit of vessels to break up large flotillas into smaller groups, or making greater provision for spectators to watch from on-land locations. Spectators could also be given guidance on voluntary measures to reduce noise from their vessels, such as avoiding sudden speed changes and turning off echosounder navigation devices while idling. **SBI**



The researchers collected and measured acoustic recordings from racecourses in the Hauraki Gulf, New Zealand during the 2021 America's Cup (image: Herriot-Watt University)

UNCREWED VESSELS

SOLID AS A ROC

Every successful uncrewed vessel relies on a well-coordinated remote operation centre (ROC) – but what are the main issues facing these shore hubs in terms of design, security and ergonomics? *Ship & Boat International* speaks to Kongsberg Maritime

ROC design means factoring in good ergonomics and a strong security set-up

Uncrewed vessel R&D continues to gain pace in the 2020s, performing complex tasks with precision and winning over growing numbers of maritime players. However, these advancements wouldn't be possible without the 'brains behind the brawn' – namely, the shore-based remote operation centres (ROCs) that act as the eyes, ears and guiding hands for these crewless vessels.

Besides its extensive involvement in the EU's AUTOSHIP initiative (see *Ship & Boat International* July/August 2023, pages 16-19), Kongsberg Maritime has also played an important role in the development of these ROCs, partly drawing on the earlier work of Rolls-Royce, which Kongsberg acquired in 2019. Much of this work has been undertaken through the Massterly venture, launched by Kongsberg Maritime and the Wilhelmsen Group in 2018, which this year established a ROC in Horten, Norway – marking "a crucial transition from the testing phase to fully-fledged operational capabilities", Massterly reported. The Horten ROC will provide remote support to the vessels *Yara Birkeland, MS Marit* and *MS Therese* (all covered in previous issues), as well as the new 24m Reach Remote USVs, to be launched by Reach Subsea this year.

What are the key issues for ROC management, though, and how might they evolve in future? *Ship & Boat International* caught up with two members of Kongsberg's remote and autonomous solutions team to find out exactly what's ticking inside these shoreside control hubs – and what we might expect to see 10 years down the line.

Good ergonomics

For Kongsberg, autonomous vessel operations depend on "three building blocks": the first being the autonomous systems and sensors installed on the vessel (including video streams); the second, the connectivity between the vessel and the ROC; and the third, the ROC itself.

"Our first and foremost consideration is the cognitive load placed on the operator, when s/he transfers from the vessel bridge to the ROC," says Vesa Lankila, Kongsberg UI/UX lead for Remote Operation Solutions. "It's important that this cognitive load remains at a reasonable level."

Remote multivessel operation by one person looks simple enough on paper, but the process can burn out the most switched-on of personnel. While it's true that multiple operations can be conducted "via only one mouse and one keypad" in the ROC, Lankila

Vesa Lankila, Kongsberg: "The ROCs can open up opportunities for people interested in the marine sector but who don't want to go to sea"

***Yara Birkeland*, delivered in 2021, is being supported remotely by the new Massterly ROC in Horten, Norway**

warns: "A single vessel operation can have up to 10 different systems that the operator needs to monitor. There is no way that one person can watch three vessels and constantly monitor 30 systems. We have to work out how to make cognitive load manageable and ensure the operators have all the info they need at any given time."

It's also important to ensure good ergonomics. To achieve this, Lankila says, Kongsberg has sifted through various existing standards, regulations and guidelines to develop the best solution. This includes requirements related to: the viewing distance between the remote operator and the multiple screens; the reach distance between the operator and all devices on the desk (including desk height); operator posture; and safe work hours.

Work shifts

"The main standard for control centre design is ISO 11064-4:2013," Lankila explains. This specification places a special emphasis on layout and dimensions and has been a backbone of much ROC design. "The remote operators will be working 'normal office hours' and taking breaks: it won't be one person at the screens 24/7," he says. "We've been discussing ideal and suitable shift durations with our existing and future customers, to achieve the correct balance."

Ville Vihervaara, Kongsberg VP for Remote Operation Solutions, adds: "We're not aiming to completely duplicate the ship's bridge in the ROC, as such. Onshore technology is often more dynamic and up-to-date than that on the average vessel bridge. Our aim is to develop a ROC environment that can cater for different needs – not just tug and ferry use, but offshore oil and gas, for example.

"We want to make the ROC as scalable as we can, to capture different business opportunities and support as many types of remote operations as we can."

In this way, the back-end of the ROC would remain the same, but users could adjust the front-end workstations to suit their particular mission types, be they short-hop coastal deliveries or offshore inspections. It's an approach Vihervaara likens to VTT's 'common cockpit' concept: a workspace in which versatile operators can undertake multiple jobs in a day – "perhaps flying an aerial drone for a set period, before switching to a marine drone for the remainder of the shift", Vihervaara hints.

Operational liabilities

One fuzzy area that continues to tax advocates of uncrewed vessels is the allocation of liabilities: what happens in the event of an incident involving a remotely controlled vessel, and who gets the blame should a connectivity glitch, or a control room error, lead to a collision or accident?

Obtaining clarity on liabilities will no doubt take a few more years (plus substantially more IMO and flag state discussions), but Kongsberg is trying to put safeguards in place at this early stage. "Each ROC will be fitted with the equivalent of a vessel voyage data recorder [VDR], gathering all data relevant to activities in the ROC," says Lankila. "If there is an incident, investigators can look back at and analyse the data, to check that everything in the ROC worked as it should have."

Another possibility, Lankila says, is to transfer bridge navigational watch and alarm system (BNWAS) technology from the ship to the ROC. Just as an onboard BNWAS monitors bridge activity and detects operator disability, so a shoreside BNWAS could be used to confirm that the ROC operator hasn't dozed off in his/her seat.

Vihervaara says: "There are no real global guidelines at the moment. For instance, if a vessel is sailing in Australia, remotely controlled from Norway, Finland or the UK, and something happens to this vessel, we need to be very clear on who's responsible, and to know the flag state's position: they might argue that, if the vessel is in Australian waters, it is being operated 'from' Australia and is therefore subject to their national rules. Maybe you could have a representative in Australia to get around this, but this lack of clarity needs to be resolved at some point."

The security angle

Physical and cyber-security are also vital, as Vihervaara points out: "Vessels and ROCs are critical facilities: lives are at stake." Operating as an enclosed network, the ROC should ensure end-to-end encryption for all communications between the centre and the vessel, and enforce back-end access rights.

"You need firewalls in place to make sure that nobody can remotely access the vessels, but it's also important to ensure that these firewalls don't compromise latency," Vihervaara says.

Lankila adds: "There will always be issues as long as there is connectivity. We will always have cases where the bandwidth drops and we struggle to get video signals or data from the vessel side. However, we have the means to prioritise the data we do get from the vessel side – so, when we're experiencing low bandwidth, we can determine that we only receive the most important data and skip the unimportant stuff." Ongoing work and dialogue with the satellite and telecommunications companies are also expected to yield new solutions for remote and autonomous shipping, he states.

ROC technology

As mentioned by Vihervaara, building a shoreside control room is not simply about cloning the bridge: new and emerging technologies can be adopted to enhance the ROC experience.

For example, Kongsberg has developed its own camera solution, "to be installed aboard the vessel to replace the bridge windows", Lankila says. "Following discussions with end users, a view of the outside world is one of the main things they want – but we can also introduce new info for users, such as graphical overlays."

Vihervaara adds: "AR and VR tech is interesting. We could even replace all screens with a simple headset." This chimes with comments made by Casey Sapp, VideoRay VP of strategy and emerging technology, who predicts that headsets will take over from tablets and smartphones for ROV operations in the next five to 10 years (see *Ship & Boat International* January/February 2024, pages 16-17).

However, Vihervaara cautions: "AR/VR-tech headsets aren't quite there yet: some feedback we've received is that personnel can only wear these headsets comfortably for an hour, before their heads start hurting, or else they get sweaty under the headset." Like Sapp, he believes that it will take at least five years before such headsets (or AR/VR-enhanced glasses) are technically adequate and comfortable to wear. "We also need leaps in connectivity and latency to get the best out of AR and VR," he opines.

Once that issue has been resolved, though, "the possibilities with AR and VR are almost endless", Vihervaara says. At its simplest, this would enable ROC operators to assume views from different sections of the vessel. Additionally, Vihervaara highlights: "As well as the ROC being a window to shipboard information, it could be a window to third-party services. As more operators turn to remote ship operations, more ROCs will crop up and will need to start talking to each other – coordinating to direct traffic, for example. You could then create a platform to enable ROC-to-ROC connectivity; like an app store for the ROCs, perhaps provided by Kongsberg. Third parties could use this platform to sell apps related to weather data, or pilotage services, across these ROC-to-ROC networks."

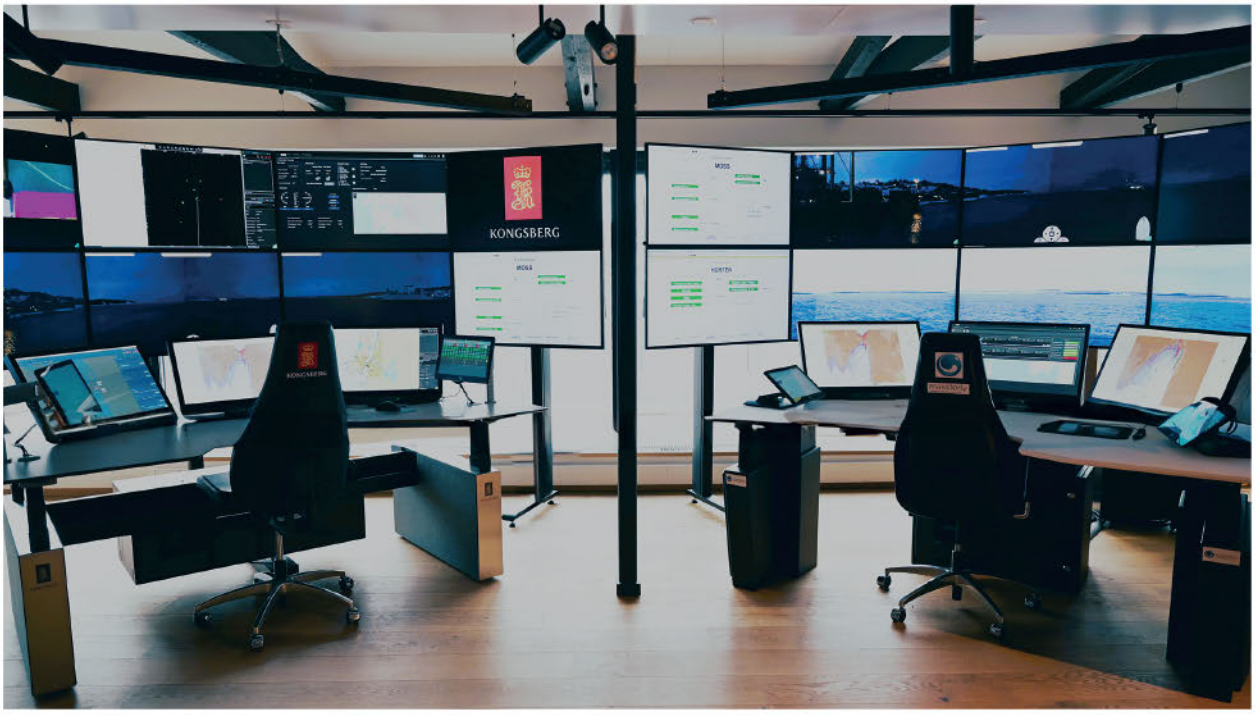
Haptics and motions

Lankila and Vihervaara also suggest that tomorrow's ROCs may incorporate greater use of haptics – the use of technology to create an experience of touch. This can create a greater feeling of 'authenticity' for the remote operator – an advantage, perhaps, for those who have previously served at sea, and who know well the physical and motion-related 'tells' associated with certain vessel manoeuvres and actions.

Lankila recalls: "Back in our Rolls-Royce days [before it was acquired by Kongsberg in 2019], we placed a small engine beneath the remote operator's chair – so, when the operator used the levers to accelerate the vessel, the engine was actually shaking the chair."

Kongsberg is also working on technical tweaks to limit the potential for 'remote seasickness'. "In the ROC, operators have no sense of vessel motion: they don't feel the vessel moving or rolling in the waves," says Lankila. "With the cameras installed, though, capturing the view from the vessel bow, we noticed that people were getting motion sickness just by staring at the screens, even if they were not physically experiencing rolling. So, our colleagues in Norway have created a solution to

Ville Vihervaara, Kongsberg: "We need leaps in connectivity and latency to get the best out of AR and VR"



Increased use of haptics could be one direction for future ROCs, to generate a greater feeling of 'authenticity' for remote operators

stabilise the camera image so that, even if the vessel is rocking and rolling around, the video feed is stabilised, and personnel feel comfortable when viewing it."

Management models

Another issue to be resolved is how each ROC will be managed. Vihervaara explains: "At present, Kongsberg just delivers the desks, the workstations and the sensors required on the vessel side. Our customers supply the remote operators and it is their responsibility to create and define the operational procedures, such as work shift periods: we simply provide the tech to enable that."

A prime example of this approach is Kongsberg's contract to supply an integrated remote and autonomous solution, including navigation/control systems and collision avoidance technology, to the Swedish Transport Administration (Trafikverket), which will use this kit to control a quartet of 86m-long, autonomous electric ferries, scheduled for delivery later this year. The actual ROC for this project will be installed inside Trafikverket's Stockholm facility, and the administration will oversee remote operations independently, with no assistance from Kongsberg nor Massterly.

However, there may be cases where operators require varying degrees of help and training, or choose to offload the navigation work to a third party, and so these scenarios would also need to be considered. "In the next five to 10 years, we will see how this whole thing develops, especially as more AI-type intelligence is baked into the process," says Vihervaara.

Tomorrow's operators

AI aside, who exactly will comprise the human ROC workforce? The majority of operators, unsurprisingly, will be drawn from the global fleet, Vihervaara underlines.

"We're gradually bringing vessel roles on shore, starting with the chief engineer, than the navigator, then the master, and so on," he says. "The process is proving more gradual than rapid, as the maritime industry can be quite conservative, and many of these existing vessels have long lifespans – but we're getting there."

The effectiveness of each ship-to-shore transition will largely depend on each candidate's mindset, Vihervaara adds. "Some seafarers are sceptical, and reluctant to operate from the ROC; others are excited and recognise that there are lots of possibilities," he says.

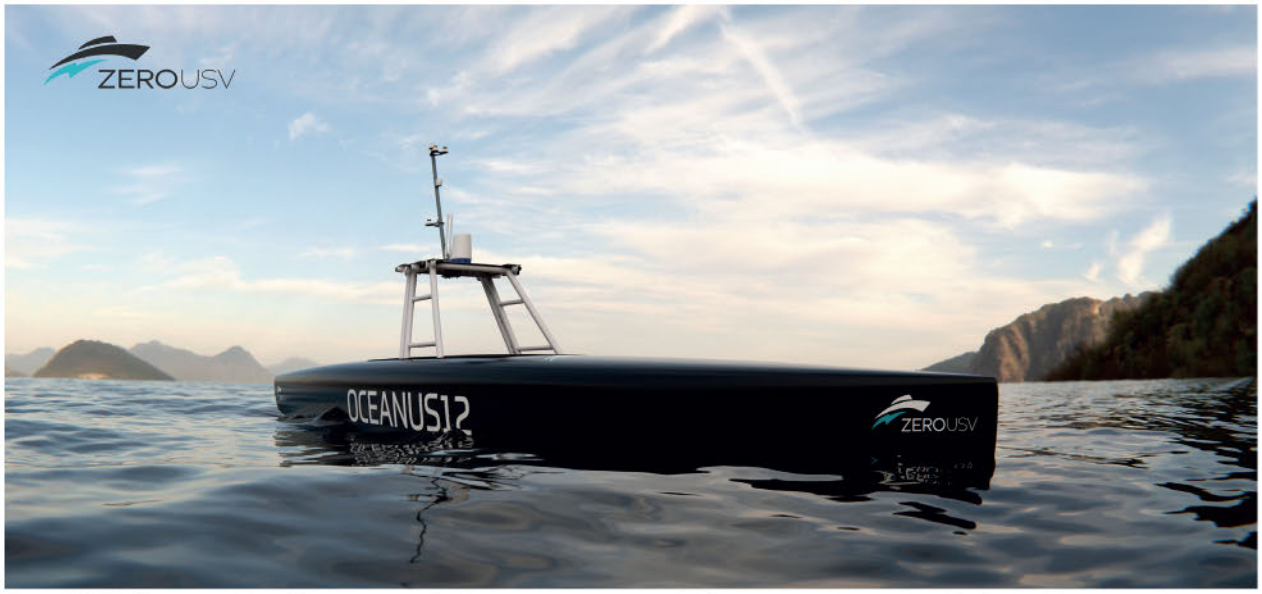
A second wave of recruits is expected from the non-maritime world: this could range from UAV/aerial drone pilots and military personnel straight through to youngsters who've grown up playing video games. Vihervaara notes: "We're still in the early stages of understanding the role of the ROC remote operator, and finding the best way to train them."

And, Lankila says, a properly designed ROC could prove a means for wheelchair users – many of whom may have previously had no means of making it onto a boat's bridge – to pursue a maritime career. "The ROCs can also open up opportunities for people interested in the marine sector but who don't want to go to sea," he says: a fairly substantial group if one accepts the latest Drewry's report, which indicates that 2023 seafarer labour shortages stand at a 17-year high.

"We're providing operator manuals, including info on how the ROC bridge station works, and, in future, could increasingly use simulators to provide guidance and training, based on DNV's framework for training and assessing personnel working in remote-control centres," Lankila adds. **SBI**

SURVEYS BY THE DOZEN

For a compact, aluminium monohull, the Oceanus12, developed by Zero USV, promises an extensive reach when it comes to truly autonomous, AI-supported missions in high sea states, Stevie Knight discovers



Zero USV's Oceanus12 will be a genuinely autonomous, multifaceted and standardised platform, made available on a hire basis (image: Zero USV)

Zero USV's autonomous Oceanus12 offering, launched in March this year, is so far out of the ordinary that it's hard to know where to begin.

To start with, Zero USV has initially committed to a fleet of a dozen fully autonomous boats, but these will be 'guns for hire': the group is not setting itself up as a survey company. Further, it is utilising a rather unusual build process which will allow global market reach.

Finally, the design is a straightforward monohull. That's a departure from its predecessor, the 14.8m, 2020-launched *Mayflower*, which made it all the way from the UK to a safe landing at Plymouth, US in 2022, minus crew – but which did so with three, sleek and rather futuristic-looking hulls (see *Significant Small Ships of 2020* for more on that groundbreaking vessel).

So, why the change? When it comes to creating a working fleet rather than a long-range one-off, "you don't gain that much from a multihull design", Matthew Ratsey, MD of Zero USV, tells *Ship & Boat International*. In fact, there can be distinct disadvantages to taking a multihull approach. "You dramatically increase your build time and costs," Ratsey explains, and, further, while they might yield a tad more stability and beam, multihulls typically don't move 'with' the sea so well. "They can present some rather odd behavioural characteristics in larger waves," he adds. This can reduce their usefulness for certain activities: for example, both survey and lift equipment have an easier time when adjusting to a smoother motion.

In contrast, Ratsey points out: "The advantages of a single hull are quite significant, including reduced build expenses and generally better performance in higher sea states. Yes, it means a very wet deck, but the vessel is self-righting, after all...and, since there's nobody on board, that genuinely doesn't matter."

The result is an 11.5m x 2.3m monohull with a load-carrying bay at the rear, scaled to hold two standard Euro pallets. However, Ratsey underlines, this sizing is all about maximising flexibility. "What people do with that space is totally up to them," he says. "For example, you could put in a winch and towing array – or, if range is the most important element, you can install a bladder to hold additional fuel. All kinds of things are possible."

COLREGs-compliant

A less obvious point, though, may be that the USV has true over-the-horizon autonomy. "A lot of what's out there at the moment is effectively operating by remote control," Ratsey explains. "But, in the real world, you're going to get potentially significant outages, which could be 12+ hours at a time, so the boat has to be able to carry on, avoiding other ships. You can't have everything coming to a stop just because there's a satcom drop-out."

As a result, the Zero USV team has put enough intelligence inside the vessel to allow it to continue working within the COLREGs framework, no matter the state of the satellite link. This 'edge computing' model was installed aboard and proven by *Mayflower*, which

embarked on its transatlantic crossing with nothing more than an Iridium installation, "which is a bit like going back 30 years to a dial-up modem," Ratsey says.

In fact, the Guardian AI software behind it all was supplied by Zero USV's sister company, Marine AI. Not only has this ditched reliance on a continuous connection but, by today's standards, it doesn't require huge amounts of either physical or computing power. "You don't need anything like a server rack to run it," Ratsey underlines. Guardian AI was developed to combine features such as real-time weather, current and AIS data with local sensors, computer vision and complex modelling to make automatic decisions related to speed, course and direction in order to optimise safe navigation and fuel efficiency, as well as ensuring full compliance with the necessary regulations.

Meanwhile, digital tech company Hexagon has provided the Oceanus12 with an LD900 GNSS receiver and a survey-grade inertial measurement unit (IMU).

Energy storage

Inside the hull, the Oceanus12's powertrain comprises two gensets that can run on hydrotreated vegetable oil (HVO). Alongside this will be 60kWh of energy storage: this is fairly modest, Ratsey admits, commenting: "We couldn't begin to put enough capacity in it for the boat to operate completely on batteries alone for any great length of time." However, this installation will act as a buffer for the generator loads, and will permit low-speed, silent running for shorter periods; this is particularly handy for scientific experiments or observing nature, as well as journeys in environmentally restricted or sensitive areas.

On the back are twin 40kW units from RAD Propulsion. These yield two advantages: the first is that, along with forward and reverse, the 'leg' can rotate through a half-turn. "The result is very much like an azipod, as it effectively gives you a 360° drive," Ratsey says. "It's quiet

TECHNICAL PARTICULARS

Oceanus12

Length, oa	11.55m
Length, wl	11.4m
Breadth, oa	2.33m
Draught	1.76m
Displacement	4tonnes
Speed	6knots (cruise mode) 10knots (sprint mode)
Endurance	2,000nm+
Payload	>1tonne
Fuel capacity	1,200litres

and efficient, with lots of torque". The other, less visible benefit is that RAD Propulsion's technology is designed to be fully integrable: "It can 'talk' digitally to the onboard power," Ratsey comments. "That solves a lot of problems."

All this is configured through a high-voltage, 400V distribution which allows for much smaller cable sizes. That was one of the takeaways from the *Mayflower* project: "Those ran at 48V and some of the cables were like an elephant's trunk," says Ratsey. "Here, they're probably no thicker than your finger."

Aluminium build

Below the hull is a removable strut that fits into a section at the bottom of the boat: this holds keel-cooling channels and a place for sub-surface sensor arrays. "As this strut is secured by two very large conical bolts, we can say to our customers, 'Okay, just send us whatever unit you're going to use and we'll load that onto the keel'," Ratsey explains, adding: "You can have multiple keels pre-fitted with different sensors, which means you can swap them over in a couple of hours rather than it taking days."

While this extra strut only increases the draught by 1.2m from the canoe bottom, it's still useful to be able to remove it for transporting in a standard container. One of the key reasons this USV has been tailored to a 12m length is to make these vessels available through standard shipping routes.

The final point is that the build is aluminium – in a way, one of the most important design elements. "These boats need to be tough," says Ratsey. "My guess is that, at first, people are going to justify using them in extremes – in high latitudes, dangerous seas and/or in places where you don't want to put crew...so I think these boats are going to be employed doing the hard stuff before the easy stuff."

Matthew Ratsey, Zero USV (left, pictured with Dan Hook of RAD Propulsion): "The result is very much like an azipod, as it effectively gives you a 360° drive"

It also suits the build. "Going down the GRP route means making a plug and a mould," Ratsey says, "so you're committed to two levels of tooling before you even get to make a boat." As such, it leaves little elbow room to sort out potential issues: something that's best done during development. "I'm quite old-school," Ratsey admits, "but with all the new 3D design possibilities, 'thinking time' has become a lot cheaper than 'doing time', especially as you can make your mistakes on the screen long before you press 'go'."

He adds: "There are also the horrendous issues related to recycling GRP. We don't want to add to that." The company's solution, then, is a complete, prefabricated aluminium package. "It means that your use of metal is very efficient: you can identify your material requirements and cost it very accurately," he explains. Plus, it's fully recyclable.

However, there are more significant advantages. "When it arrives at the yard – for example, at Manor Marine in Portland in the UK, which is building the Oceanus12 units – the kit is ready to go, with everything from the keel to the fit-out," says Ratsey. "It means we know that they're being built to a known standard and known tolerances."

Kit form option

That's important for autonomous vessels, but this takes on even more significance because the business is scaling up, fast. Ratsey elaborates: "We're currently tying together partnerships in different areas of the globe. We've already reached agreement in principle with a partner in Halifax, Canada, who will take a number of boats and operate them on our behalf." There are further collaborations firming up on the US West Coast, and even in Australia.

It's therefore particularly useful that Zero USV could eventually send a partner the Oceanus12 in kit form, allowing them to build it at their own facilities without having to make and ship a new tool. After all, in this business, standardisation is everything. "If something goes wrong, you don't want to be chasing gremlins because someone's decided to fit a different breaker or bilge pump, or whatever," says Ratsey. "You've got to have continuity in your supply chain so you know exactly what you're up against."

All this is aimed at making a genuinely multifaceted platform available on a hire basis: that means survey, inspection and even defence companies won't need to think about availability - or even maintenance. That's all part of the promise. **SBI**

OFFSHORE INDEPENDENCE

Eliminating reliance on expensive crewed surface ROV support vessels is the chief goal of MCS' autonomy-capable Ocean Aurora: a submersible launchpad for drones tasked with inspection and maintenance work

If the subsea deployment of ROVs, AUVs and UUVs can reduce Opex and emissions, it makes sense that using an uncrewed vessel to launch and recover these drones could boost operational efficiency even further. That's the rationale behind the design of the Ocean Aurora: a remotely operated 'drone launchpad' conceived by offshore survey/inspection services provider MCS.

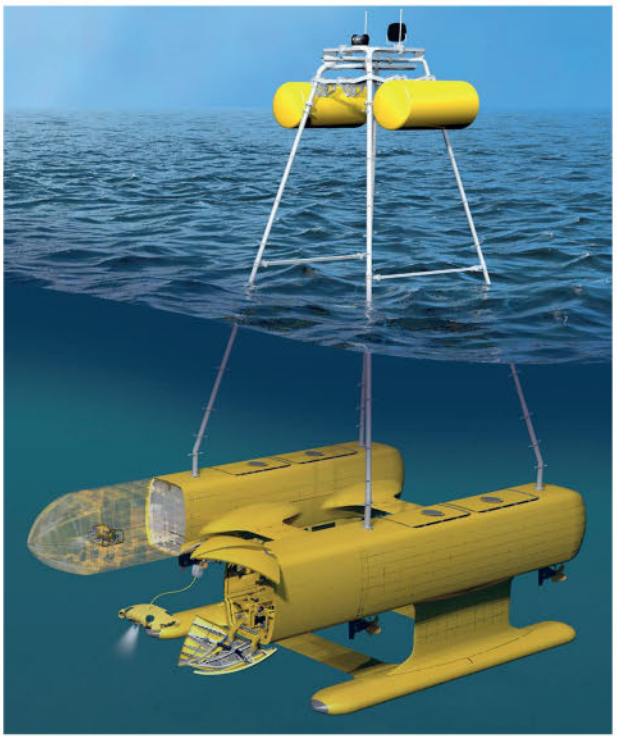
Speaking at the Subsea Expo 2024 show, hosted in Aberdeen (UK) in February, Alasdair Cowie, business development director at MCS, said that the Ocean Aurora concept could cut costs "by 50% or more", through "doing away with dependency on manned ROV support vessels [RSVs]" – a crucial factor, Cowie said, given offshore inspectors' growing need for instant response and "schedule independence", and especially so considering that "the days of huge budgets are gone".

The sea state 7-capable Ocean Aurora measures 17.5m x 10.18m, weighs 130tonnes and has an operational displacement of 153tonnes when submerged. The vessel's draught is recorded as 5.5m when operating in surface mode, or 11.7m when in submerged mode, and it has been built (at MCS' facility in Egypt) to support a 4tonne payload. MCS tells *Ship & Boat International*: "The hull was built in high-strength steel, while some parts, such as the mast and superstructure, are made of aluminium."

The Ocean Aurora uses ballast pumps to control its ascent and descent: when deballasted, the unit can descend to 5m beneath the surface. The RSV incorporates a hybrid diesel-electric powertrain and has an endurance of more than 30 days, MCS claims. The vessel also utilises VSAT, VHF and/or 4G to stay connected to MCS support teams at remote operation centre (ROC) control rooms situated in Egypt, Malaysia and the UK, thereby enabling extended and 24/7 surveys, drawing on a global pool of 80 engineers for back-up.

ROV deployment

The RSV will be able to carry two MCS ROVs/AUVs simultaneously, and the remote operators can operate both at the same time. These vehicles will inevitably include MCS' 850mm x 851mm, 45kg, semi-autonomous MiniSpector drone, which features inbuilt photo realistic 3D cloud (PRC) technology, allowing accurate measurements "to the nearest mm and degree", Cowie said. Primarily aimed at tasks including offshore platform/jacket inspections, ultrasonic thickness readings, metal surface cleaning and marine growth removal, the MiniSpector has a payload of 14kg and an 8kW electric propulsive system, and can operate in 3knot currents. This mini-ROV comes with a 300m tether and its own tether management system.



The Ocean Aurora was designed to launch and recover ROVs without having to rely on crewed surface support vessels

Similarly, the Ocean Aurora will be used to deploy MCS' ProSpector ROV, which is typically used to perform buried pipeline and cable inspections. The ProSpector has the ability to descend to 300m at a top speed of 6knots. In the future, the Ocean Aurora will also support MCS' fully autonomous AutoSpector ROV, which is currently undergoing beta testing. The AutoSpector will be able to descend to 500m, and is slated for launch in or by Q1 2026.

MCS adds: "The Ocean Aurora is equipped with state-of-the-art sensors, navigation systems and AI algorithms for automatic collision avoidance, target detection and optimum path planning." The vessel has three working modes – remote control, semi-autonomous and fully autonomous – "all designed to be performed with no need for a mother vessel, while being monitored by the onshore ROC", MCS says.

The first Ocean Aurora unit has been undergoing sea trials between March and May this year, with deployment scheduled for June, Cowie said. "We're concentrating on the Middle East and Far East markets, with the first two units expected this year," he explained. "Further units will then be built in 2025 and 2026." **SBI**

SEAL OF APPROVAL

Summer will see Sea Machines launch the first of its new Selkie class of USV workboats, developed to handle tasks ranging from surveys to search and rescue in either crewed or uncrewed mode

A render of the Selkie 7, the first in Sea Machines' new Selkie range of USV workboats

Boston-based tech firm Sea Machines Robotics plans to launch a diesel-electric USV workboat class this summer, dubbed the Selkie. The first in the series, the Selkie 7, will feature a length of 7m, a breadth of 2.35m and a 0.4m draught, and will rely on Sea Machines' SM300 autonomous command and control system for operations in crew-free mode.

However, there will be an option to crew the vessel with a single person at the helm, should the owner prefer this method for certain tasks. The Selkie is named after a mythological shapeshifting creature with the power to switch between human and seal, which Sea Machines views as an apt metaphor for the boat's crewable/uncrewed flexibility.

Sea Machines has described the Selkie as its "first turnkey autonomous vessel", following nearly a decade of collaborations with companies including US boatbuilder Metal Shark, marine transport firm First Harvest Navigation (whose 19m hybrid cargo vessel *Captain Ben Moore* was retrofitted with an SM300 system in 2020) and, more recently, Zelim, developer of the uncrewed Guardian rescue craft (see *Ship & Boat International* May/June 2023, pages 48-49).

SM300 system

Sea Machines believes that the Selkie range will prove its worth across a varied range of missions, including, but not restricted to, security and surveillance, hydrographic surveys, offshore asset inspections and environmental studies – or, indeed, any applications requiring "persistent long-duration on-water work," the company states. The USV has been approved for use in coastal and open water, in conditions up to sea state 5, and will be fitted with a Seakeeper 1 gyrostabiliser, a unit designed to significantly reduce boat roll for craft as small as 7m.

The SM300 package can be programmed to follow specific routes, enabling vessels to undertake jobs such as seabed or underwater pipe surveys. Utilising cameras and sensors, the technology can build up a picture of the boat's surroundings, helping it to detect and avoid obstacles (including floating objects) and to stay safe.

Should a shore-based operator need to step in and assume control, they can easily do so. Connectivity is possible via wireless IP radio, or through LTE, Iridium or Starlink services. Additionally, the SM300 solution can be used to monitor internal engine and winch performance, for example. In 2022, US class society ABS granted approval in principle to the SM300 kit when it was retrofitted aboard the 30m Foss harbour tug *Rachael Allen*.

Onboard outfitting

The Selkie's hull will be constructed in high-density polyethylene (HDPE), to cope with knocks and bumps in the field, and will feature a weatherproofed cargo hold, accessed via a remotely controlled hatch, for long-range transits. The hold spans 2m x 1.3m x 1m and will be sufficient to store two Euro pallets. The USV will also be equipped with: a 150hp (112kW) OXE Diesel outboard; an under-keel mount for sonar or hydrophone; side pole mount locations; a conductivity, temperature and depth of water (CTD) winch; GNSS poles; and aerial antenna mount spots.

Starting with the Selkie 7, the Selkie range will initially incorporate a 12V battery with a capacity of 4.7kWh, receiving 1.5kWh from the engine alternator and 3.2kWh from an auxiliary diesel generator. This will grant the USV a range of 500nm and an endurance of up to 15 days. Sea Machines says that future units will offer options for fully electric and pure-diesel versions. In terms of speed, the Selkie range will be capable of a cruise speed of 25knots, increasing to 32knots max.

It will be possible to transport the Selkie USVs by trailer, four-point lift or basket slings, Sea Machines adds. **SBI**

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20-21 November 2024, Copenhagen, Denmark

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

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VAISALA

The current use of alternative fuels and renewable energy sources within the shipping industry is still relatively scarce. Growing environmental legislation and concerns are driving the need to develop and apply innovative alternative power and propulsion technology for ships. Now, industry players are increasingly putting a modern spin on one of the oldest concepts in shipping: harnessing the power of wind for ship propulsion.

Since the inaugural conference in 2019, the annual event has attracted a high level of interest in the maritime community. Attending speakers and delegates span the technology companies, academia, ship owners and industry associations. Over 100 delegates gathered at the IMO HQ for the Wind Propulsion 2023 Conference to hear presentations from companies including MOL; bound4blue; Anemoi Marine Technologies; Norsepower; Wärtsilä; RISE; Bureau Veritas Solutions M&O; MARIN and many more.

The 2024 conference agenda promises to bring those attending fully up to speed with recent technological, design and policy developments, and cast the minds of attendees into the future landscape for wind propulsion technology.

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PATROL AND RESCUE BOATS

EXTRA MUSCLE FOR FINNISH PATROLS

Two forthcoming offshore patrol vessels for the Finnish Border Guard will be lengthened and strengthened to handle icy seas, oil recovery and mass evacuations from stricken ships

The new pair of OPVs for the Finnish Border Guard will be capable of providing near-continuous rapid response, in all conditions (image: RAJA)

Two new vessels mark a significant step up for Finland's border patrols. However, given the country's rough and icy waters, it's a far from cushy number.

Currently under construction at the Meyer Turku shipyard in Finland, both boats will also face near continuous operation. In fact, these boats are "typically at sea for 300 days a year", underlines Olli Posti, deputy project manager of the Finnish Border Guard's Ship Technical Unit.

The 98m vessels are far more than one-for-one replacements of two older ships: reading the specifications makes it obvious that the new pair will be relied on to embrace a huge swathe of requirements. Although the main remit covers border patrol, emergency assistance and environmental incidence response, the brief doesn't stop there.

These offshore patrol vessels (OPVs) will also need to be ready to serve as the command base for other vessels, helicopters, rescuers, divers and, when necessary, public security authorities during joint operations. Additionally, search and rescue duties may involve mass evacuations from oceangoing ships in distress, so the OPVs could find themselves sheltering up to 600 people at any one time. Integrating these demands has been one of the most challenging points of the new design, Posti admits.

Tough conditions

Starting with the outside, it's worth noting that these OPVs have to take on pretty much anything that the environment can throw at them; their role means there can be no weather limitations. Moreover, when it comes to the Baltic Sea around Finland, conditions can be tough: although waves over 8m swh have been recorded, the largest has been estimated at a colossal 14m. Understandably, Posti points out: "Seakeeping is the most important factor for the hull."

However, there are other issues to address: the north of the country has extremely cold winters. To meet this, the 17.6m-beam, 5.1m-draught hull is being strengthened, earning a 1A Super notation - the highest class under Finnish-Swedish rules. "We will be able to travel at 3knots in 80cm-thick ice, which means we won't usually need icebreaker assistance," adds Posti.

This hasn't got in the way of hydrodynamic efficiency in open water, he underlines – as that's where these ships will be spending 90% of their time. So, while the sides and stern are sloped from near the waterline to shift the ice during reverse and turning manoeuvres, it hasn't drastically impacted the bow shape. "Experiences from our existing ship, OPV *Turva*, have shown that a bulbous bow still is sufficiently good in ice when designed correctly: the bulb actually breaks the ice upwards," he explains.

Still, there have been some tweaks since *Turva*'s delivery, back in 2014: for example, the bow stem of this new design is a little more vertical in order to lengthen the waterline: this will yield better energy efficiency and, again, enhance seakeeping.

Internal affairs

While the hull and weather conditions set some of the fundamental parameters, these OPVs also have to pack a lot inside. Starting from the stern, each has a large aft deck set close to the waterline for easy sea access. The deck has been tailored for multiple roles: it will be home to emergency towing kit, two cranes, oil recovery systems and associated tanks, with room to install containerised mission equipment as necessary.

However, it's not a straightforward matter of fitting it all in. For example, the environmental response creates another sizeable demand: "We'll need to be able to recover 1,200m^3 of oil from the water," comments Posti, and that has meant further consideration for the hull's deadweight requirement during the design process.

At the other end of the ship, the raised foredeck – just a few steps down from the bridge – has enough room to act as a helipad, and may also be used as a base for new technologies.

Behind that, taking up around a third of the overall length of the vessel, is the main superstructure: this holds 20 cabins, a galley and recreational areas for a typical crew of 24, along with a variety of operational and workshop facilities. Flanking the outside are covered spaces and hangars with room for three daughter craft: this also means that apart from the working decks, almost all of the ship remains sheltered from the weather.

Extra power

In the engine room below, there's a 12MW installation comprising four Wärtsilä 34 generating sets, which can utilise both LNG and diesel. As Posti notes, sufficient engine power and podded propulsion are both "helpful" in icy conditions, so the boats will be fitted with ABB Azipods, giving the vessels both manoeuvrability and enough grunt to deal with sea ice, plus a typical operating pace of between 10-12knots in open water. The extra power means these OPVs should also be capable of a turn of speed; the anticipated maximum promises to exceed 18knots.

The 98m x 17.6m vessels are under construction at the Meyer Turku shipyard, with expected handover dates of 2025 and 2026 (image: Meyer Turku)

The layout of the new OPVs has been challenging, given the numerous roles they are expected to fulfil (image: RAJA)

While (initially at least) the propulsion will be fully diesel-electric, at anchor the hotel loads will be supplied by a 4MWh energy storage system, which will be charged by the engines during transit or via a shore hook-up at berth. This gives the batteries an additional role: they will be powering the two pumps which feed the hydraulic deck equipment when the main generators are at rest.

The flexibility of the design partly comes from configuring the electrical distribution around an onboard DC Grid (also provided by ABB). This set-up allows for straightforward integration of additional equipment, as and when requirements dictate, and it will also support the eventual adoption of alternative energy sources, future-proofing the OPVs.

Above all this, the spacious bridge has to embrace more demands than might be expected on a 'standard' patrol vessel. Along with the 360° views and comms equipment, these OPVs will also be kitted out for monitoring transport and locations of special interest, as well as acting in a domestic military capacity. As a result, the remit includes tying together information from very sophisticated sensor and detection systems. And, not to put too fine a point on it, these OPVs will be capable of defending themselves, though the full details remain classified at the time of going to press.

The first of the duo is expected to reach the water by the end of 2025, and the second by the end of 2026. **SBI**

Sweden prepares

While not strictly part of Scandinavia, Finland, which became part of NATO in April 2023, is just one of the Nordic nations working to strengthen its maritime capabilities in the Baltic Sea region. Sweden, for instance, has ramped up its military spending significantly, with the stated aim of reaching the NATO defence spending target of 2% of GDP – a portion of which will be allocated to new surface vessels, submarines and coastal defences.

YACHTS

FOREWARNED IS FOREARMED

Factoring in yacht security at the earliest stages of the design phase could not only give yacht owners a huge advantage in keeping their assets safe, regardless of their budgets: it could also save them hundreds of thousands in avoiding system retrofits

Factoring in security during the design/early build phase could save 10-15% in overall costs, Priavo says

While superyachts and megayachts offer unparalleled luxury and adventure for their high-profile owners, these multi-million floating assets are vulnerable to various threats, from piracy, theft and kidnapping to onboard spying and cyberattacks. Attackers' intentions are equally diverse, ranging from financial extortion and paparazzi surveillance to geopolitical tensions and environmental protests.

There's a catch, though: yacht attacks are rarely reported, making it hard to know how common they are. Owners often keep incidents quiet to avoid spooking future guests or investors, resulting in a lack of quantifiable data. Pete Murphy, CEO of consultancy Priavo Security, tells *Ship & Boat International*: "One of our constant battles has been trying to get yacht owners to put measures in place before these attacks happen – getting them to take a proactive rather than reactive approach."

Another battle is addressing complacency: indeed, many yacht owners seem genuinely unaware of how badly they may be compromised. "We carried out a risk assessment programme in Monaco and, of 617 yachts we assessed, only 22 were secure," he says. His team also found three hidden cameras on one megayacht, showing a surprising lack of basic precautions. "Most follow the 2017 IMO MSC.428 resolution guidelines on cyber risk, but it's mostly just a 'tick the box' exercise," he says.

Multiple risks

While piracy is a concern, yacht security goes way beyond guarding against boarded attacks. Murphy cites the 2023 hack on German yacht builder Lürssen as an example of how an unforeseen cyberattack can compromise thousands of vessels' private information related to design features, layout and equipment. "The attacker could have also mimicked the yard and sent emails 'from' Lürssen, with attachments and links to spread Trojans – it's far easier to send out spyware through a trusted email address," he says. "The attackers might wait years for the right opportunity to strike, by which time the original hack may be long forgotten."

Every point of access, then, provides a level of risk that must be assessed. Again, this is not just about the yacht's crew vs pirates; hostile parties could infiltrate the vessel via boatbuilding yards or suppliers, or even by joining the target vessel as crew and working their way up into positions of trust, where it is easier to obtain sensitive boat information.

Similarly, the guests of high-net-worth celebrities might plant cameras or listening devices on board. Murphy says that most security breaches come down to three factors – "insiders; outsiders; and insiders working with outsiders" – hence the importance of vetting crew. "Yacht companies do basic background checks but no real deep dives," he continues. One of Priavo's services includes detailed analysis of crew members' social media content, for example. "Our analysts can gauge personality and intent from some of this content and the way things are written, to flag any potential problems," he explains.

Early involvement

Murphy stresses that adequate yacht security planning need not be "super-expensive". He says: "Some clients want the full array of solutions, but you can adjust your level of security depending on your budget.

"If a client doesn't have much budget, we'd advise them, then, to just train the crew in situational and security awareness. If you have 50 crew looking outwards instead of inwards, an attacker will recognise that: they'll see a really aware crew keeping lights on the water, locking doors and securing entry points, and will consider it more difficult to make an approach. It's comparable to how you'd make your home look as secure as possible. There's an element of 'BS baffles brains' for any would-be attackers: negativity migrates to the path of least resistance."

The key factor, he says, is that the best security plan is built into the yacht from the beginning of the design process. Adding security features at a later date can prove expensive and time-consuming. Security consultants can help assess risks and design a customised plan if they work with naval architects from the offset.

"To ensure a duty of care to their clients, security should be at the forefront of naval architects' and boatbuilders' minds: they should be asking and advising, 'Have you considered installing security systems?' and 'Have you had a risk assessment for this design?'," Murphy comments. "It's far more expensive and involves much more work to retrofit security systems afterwards."

Cost savings

For example, he recalls one yacht retrofit where an extensive security overhaul – which included fitting the vessel with aerial drones, underwater object detection equipment and CCTV upgrades – amounted to €10 million. Murphy reveals: "A huge part of that expense was actually retrofitting the cables. Those cables are drilled to perfection, with no space to spare: then, we often have to move the radars around. Everything's fighting for space up there, so we may have to rebuild a radar to fit it in. If these security features are planned and factored in during the architectural phase, it saves time, effort and money."

Priavo estimates that factoring in the security arrangements during the design/early build phase could save around 10-15% in overall costs. In addition to avoiding wiring/cabling costs, or the hassle of cutting sonar holes in the yacht's bottom, the group identifies mast design as a significant point of savings.

As for what a security consultancy can bring to the table, Murphy says: "We'll come in and give an assessment at every stage, throughout the build process. We'll ask: what are we trying to achieve? Who's the client, and what's the threat? And do we need to install everything now, or just put in 'the bare bones', such as a plug-in system, so the owner can add to it at a later date, if they want?" He adds that, even if a yacht owner doesn't intend on installing a full-blown security system, they could do so as a 'bonus feature' when they come to selling it, as long as the infrastructure to do so exists.

Miltech transfer

As a former member of the Special Boat Service, Murphy has used his naval background and insider knowledge to stay up to date with naval defence technology, stating: "Even the latest commercial drone systems are redundant compared with what the naval sector can offer." He adds: "Detecting hostile drones is one thing; intercepting them is another." One trend is a transfer of naval/military technology into the yacht security market, including the use of sonar and thermal cameras.

One worrying development, Murphy explains, may be an increase in remote piracy – a scenario hinted at by recent developments in the Gulf of Aden, where Yemen's Houthi rebels have been launching successful drone and missile strikes on passing ships. "Usually, when drones are operated over a WiFi network signal, the yacht can use technology to jam this signal, causing the drone to return to base," he says. "My concern now is that the Houthis are using motorised drones. The Houthis can track a vessel through its AIS, watching its speed, distance and bearing. Then, when they know the vessel will be in a particular area at a particular time, they send a motorised drone to that area. The drone is unlinked and controls itself, and will lock onto a heat signature at that particular time – which will be the vessel.

"The Bab al-Mandab Strait in Yemen is 20 miles wide, and some of these drones fly at 200mph. That leaves the target yacht 20 seconds to intercept the drone." Similar threats are presented by waterborne IEDs, conveyed by remote skiffs and boats, or mines. Murphy believes these tactics could be emulated by pirates in extortion rackets, with, say, an aerial drone carrying explosives menacing a yacht until the owner agrees to transfer crypto to the attacker.

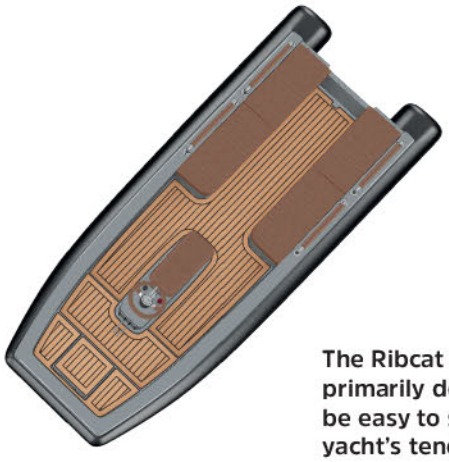
This is where a greater reliance on military and naval technology may become crucial, with yachts carrying multiple attack drones to defend themselves. "Fighting fire with fire may well be the best solution," he says. **SBI**

Shipyards and marinas can become easily become points for a security breach

CATS IN THE GARAGE

Yachtwerft Hamburg's Ribcat tenders have been designed to fit neatly into yacht garages, without hogging space or pushing up overall vessel weight

The Ribcat can inflate/deflate its air tube within 45 seconds



The Ribcat was primarily designed to be easy to store in a yacht's tenders garage

Tenders are common cargo for most yachts, enabling the owner and his/her guests to cast off and explore more restricted waters and beachfronts – or, in the case of high-speed tenders, to let rip on surrounding waters. However, tenders can pose a challenge when equipping larger yachts *vis a vis* weight and space.

For example, German dinghy- and boatbuilder Yachtwerft Hamburg explains: "Finding the right tender for a large motor or sailing yacht is a challenge for many owners or their captains. On sailing yachts, the size and weight of tenders are often detrimental to performance." Additionally, the company says: "Motor yacht owners prefer stable tenders that lie well in the water and that are also compact enough to fit in the yacht's garage."

To address these issues, the builder has developed a series of lightweight RIBs, tailored for the owners of larger yachts sized approximately 21-37m loa. The tenders in the Ribcat series feature catamaran hullforms for enhanced stability on the water, and have been made available in two sizes (see Technical Particulars), both compliant with CE Category C requirements for inshore operations in coastal waters, lakes and bays with Force 6 winds and significant sea heights of 2.1m.

Catamaran hydrodynamics were selected to ensure that the tenders do not tip on their sides when yacht passengers are boarding: a problem sometimes encountered with monohull tenders, the builder says. Johannes Malzahn, Yachtwerft Hamburg MD, comments: "This criterion is almost the most important for owners of large yachts. They and their guests should be able to get on and off comfortably without anyone feeling uncomfortable or unsafe."

He adds: "By shifting the steering position towards the bow, the Ribcat's guests can sit comfortably in the stern on two benches; at the same time, there is still enough storage space for shoppers or luggage."

Speedy inflation/deflation

Another bonus of the Ribcats' catamaran hullforms, low heights and relatively compact dimensions is that they should be easy to pack inside a yacht's tenders garage. Each Ribcat comes with the option for a built-in compressor that can automatically inflate/deflate its air tube within 45 seconds, allowing for quick and convenient stowage (or, alternatively, speedy inflation, enabling guests to launch the Ribcat with minimum fuss in less than a minute). "When the tube is empty, the width of the tender is thus reduced by 350mm, resulting in a better pack size," the builder says.

The tender's catamaran hullform provides enhanced stability for yacht guests stepping on and off

TECHNICAL PARTICULARS

Ribcat 3.6

Length	3.65m / 3.3m (deflated)
Width	1.8m / 1.55m (deflated)
Height	1m
Draught	0.27m
Weight	170kg (carbon) / 230kg (GRP)
Max power	20kW
Max payload	320kg

Ribcat 4.3

Length	4.3m / 4m (deflated)
Width	1.8m / 1.5m (deflated)
Height	1m
Draught	0.28m
Weight	230kg (carbon) / 290kg (GRP)
Max power	25kW
Max payload	400kg

The compressor can be integrated into an onboard side locker and permanently attached to the Ribcat's tubes from the inside, being activated by push button, Malzahn tells *Ship & Boat International*, adding: "[This] allows us to offer a tender with a maximum capacity for up to six people."

The Ribcat design is customisable: buyers can opt for emissions-free electric drives or conventional diesel outboards at the stern. Discussing the electric option, Malzahn explains: "The Ribcat 3.6 will be fitted with a Torqeedo 12kW Cruise 12 RL Torque Link outboard engine, powered by 10kW/48V commercial batteries from Torqeedo, and equipped with a 2,900W fast charger. The Ribcat 4.3 can be fitted with a twin electric engine arrangement, powered by 20kW/48V commercial batteries and equipped with fast chargers, and also with a 25kW electric outboard or a 37kW combustion engine." These electric set-ups should enable a range of roughly 20nm when travelling at 8knots, or 13nm at 15knots.

The hull and deck incorporate a polyester gelcoat together with vinylester/glass laminate and recycled PET core sandwich. The cockpit floor has been designed with a non-skid surface as an additional safety measure, and storage locker space is provided beneath the tender's side benches.

The deck features three pad eyes – two aft, one in the front – for lifting and mooring the tender, and there is also an option for a stainless-steel bimini for the deck. **SBI**

ELECTRIC PROPULSION

WATTS IN STORE FOR ARGENTINA

The EcoLancha project has ambitious plans to build more than 170 new battery-powered passenger vessels to replace older, diesel-fuelled boats in one of Argentina's most eco-sensitive zones

The Delta Eco One, designed by Argentina's Naval Electric, is hoped to spearhead the transition of Paraná Delta passenger craft from diesel to electric propulsion

The Paraná Delta is a fascinating ecological zone, located where the Paraná River meets the River Plate in Argentina. While most deltas empty into oceans, the Paraná Delta flows directly into the River Plate, a freshwater estuary, creating a unique ecosystem with a mix of freshwater and wetland habitats, spanning more than 21,755km² and located an hour away from Buenos Aires.

As such, the Delta is a hotspot for biodiversity, supporting species such as marsh deer, capybaras, giant otters, jaguars and numerous birds. The wetland complex comprises 1,000 tiny islands, plus marshes, lagoons and *camalotes* – the latter being floating vegetation mats. These *camalotes* are particularly important: they serve as a breeding ground for fish and a nesting area for birds, as well as filtering pollutants from the water, dampening wave action (reducing erosion) and regulating flooding.

However, the Paraná Delta ecosystem faces various pressures from human activity. Until now, the residents of the delta's island network have relied on *lanchas colectivas*, or diesel-powered wooden ferries, to get around. These boats have become a staple of the area, having been designed and produced for this region for more than 100 years.

Now though, Delta Argentina Uruguay, the region's second-largest ferry operator, is spearheading an ambitious project to completely replace these traditional vessels with a fleet of brand-new, all-electric, aluminium-built passenger vessels. The scale of the EcoLancha initiative is enormous, covering the construction of 174 newbuilds – and that's just the start of the project's longer-term goals for a cleaner marine sector in Argentina, with anticipated major reductions in exhaust fumes, noise, vibrations and risk of water pollution.

"Growing sector"

EcoLancha project partners include marine e-motor manufacturer Torqeedo and Buenos Aires-based e-propulsion specialist Naval Electric, whose CEO and naval architect, Nicolás Fothy, designed the forthcoming e-vessel class.

The prototype of this boat type, the Delta Eco One, has already undertaken test runs on the Paraná River and River Plate in Q1 this year – trials hailed as "a success" by Leonel Falcón, president of Delta Argentina Uruguay.

TECHNICAL PARTICULARS

Delta Eco One

Length	11.9m
Breadth	3m
Depth	1.5m
Draught	0.66m
Max speed	9knots
Passengers	22
Crew	2
Classification society	Lloyd's Register

Each of the new electric boats will be powered by twin Torqeedo 12.0 motors and Power 48-5000 batteries

Naval Electric and Torqeedo have previously worked together on electric boat projects in Argentina, though none quite as prodigious and groundbreaking as EcoLancha. "Electric vessels are very rare in Argentina, but this is a growing sector," Fothy tells *Ship & Boat International.* Perhaps the groups' most notable collaboration was on the E-Delta 650, a pure-electric, 6.5m x 2.05m day cruiser, described as Argentina's first 100% electric vessel. Launched in 2022, the E-Delta 650 has the capacity for six persons and a range of 35nm at 6knots, with a 10kW Torqeedo engine enabling a maximum speed of 12knots.

"In the case of the E-Delta 650, we observed that the [Argentinian] market did not offer specific boats for electric propulsion," Fothy recalls. "Most were planing boats that sailed very badly at displacement speeds. So, we decided to make a hull with good displacement and speed efficiency, but also with good planing performance."

Three goals

These design considerations have now been fed into the current initiative. The EcoLancha project is based on "three big goals", Fothy explains. "First is the reduction of noise," he says. "In the old *lanchas colectivas,* we measured noise levels of 100dB inside the boat, so passengers couldn't have conversations when on the water. The second goal is the reduction of ambient air pollution, and the third is the reduction of coastal erosion caused by the waves: the older boats are producing big waves and, because there are more than 130 of these boats, moving 100km each day, they are constantly making these waves many times daily in the same rivers."

The first two goals will be addressed by replacing the older diesel motors with new electric Torqeedo propulsion systems. "The third we achieved by making a very detailed design of the hull, verified by CFD trials." Further verification will be attained through channel trials, which will be conducted throughout spring and into summer this year.

The 11.9m Delta Eco One was built domestically by Unidelta, an aluminium ferry specialist, and will carry up to 22 passengers. The propulsive package includes two Torqeedo Cruise 12.0 motors and Power 48-5000 batteries, which will enable a top speed of 9knots. The vessel will also feature a roof-mounted solar panel, rated 1,100W, to capture power for the onboard equipment and air-con system.

Fothy adds: "We are also working with a boatbuilder which specialises in composite materials, called M Boats." This collaboration will see the production of a larger variant of the Delta Eco One, capable of carrying up to 60 passengers and powered by a single Torqeedo Deep Blue 100kW e-motor.

Regulatory challenge

So far, the project has got off to a good start. However, as Fothy concedes, EcoLancha constitutes a "big task", and one that will involve close cooperation and dialogue with multiple partners.

For example, Fothy explains, Naval Electric and Delta Argentina Uruguay are working with the Argentine Chamber of Boatbuilders (CACEL) and the Argentine Coast Guard to develop new national regulations for electric vessel propulsion. "Also, we are participating in electric mobility discussions organised by our government, and with the Argentina Association of Electric Vehicles [AAVEA], presenting proposals for electric mobility legislation," he says. "It's about fostering a culture of electric mobility on water in South America."

This is expected to be quite a painstaking task, he reveals. "Unfortunately, regarding legislation in Argentina, all the prototypes should be approved by our Coast Guard [aka Prefectura Naval Argentina], and this institution is not very proactive when it comes to creating electric propulsion regulations. So, our company is involved in providing as much information as they require and participating actively in the inspections."

Fothy adds: "We are using European standards, such as the Technical Requirements for Inland Navigation Vessels, as a guide." Due to the dependency on these multiple bureaucratic organisations to get the roll-out approved, Fothy estimates that the Paraná Delta fleet overhaul could take five to seven years to complete. As the country's first major e-boat experiment, however, the EcoLancha project could well sow the seeds for more widespread adoption of electric propulsion across both Argentina and South America. **SBI**

The Delta Eco One can carry up to 22 passengers, though a larger, 60-pax version is also planned

POWER SURGE FOR CTVS

Deliverable technology, futureproofed vessel designs and advanced charging solutions are making it the ideal time for electrification of the offshore wind CTV sector, claims operator Tidal Transit as it picks up its last ever diesel-fuelled boat

The 27m *Arabella Jane*, built by Penguin in Singapore, is intended as the last ever diesel-powered CTV to join Tidal Transit's fleet

Late March saw the 'end of an era' of sorts – not to mention, a new beginning – as UK offshore wind CTV operator Tidal Transit purchased what it intends to be its last ever diesel-powered crew carrier, in line with its plans for a transition to a fully electric fleet.

The 27m x 9m newbuild, christened *Arabella Jane*, was constructed by Singaporean shipbuilder Penguin International as a slightly modified version of Incat Crowther UK's WindFlex-27 CTV class. Fitted with four Volvo Penta D13 IPS units, equating to 2,060kW of combined power, *Arabella Jane* will serve as "the frontrunner for future electric builds" due to its 'retrofittable' nature, Tidal Transit says. The newbuild also constitutes the operator's first 24-pax-capacity vessel.

"We've invested in our last diesel burner, which is exactly what we want to be doing right now," Leo Hambro, Tidal Transit commercial director, tells *Ship & Boat International*. "We believe the tide has turned – with all the companies we work with having very clear net-zero targets, and battery technology now being deliverable, there isn't a reason why we shouldn't be doing this." And, with one of the company's oldest CTVs, *Ginny Louise*, currently undergoing a retrofit to pure-battery power, the group's plans to 'green up' its fleet appear well on track.

Design evolution

It's been a long journey, involving a significant learning curve, to get to this point. Following its formation in 2011, Tidal Transit's early years saw the company proactively pursue a new breed of CTV, capable of handling offshore wind farm runs with optimal safety and efficiency. "Whilst the initial wind farm industry was talking about converted angling boats with tyres on the front, we brought about a change of vessel type and a change of accessibility, through innovative hullforms from the Spanish sector," Hambro says.

In fact, it was Mercurio Plastics Shipyard of Cartagena, in south-east Spain, that constructed one of Tidal Transit's first dedicated offshore wind CTVs, in the form of the 20m x 8m, fibreglass CTV *Ginny Louise*, which entered service in 2012. "After we did that, many competitors came in with bigger and bigger boats," Hambro explains. "So, we took a step back and investigated Umoe Mandal's surface effect ship [SES] designs." As an experiment, Tidal Transit assumed management of the 26.6m SES *Umoe Firmus* in 2016 (see *Ship & Boat International* January/February 2021, pages 12-15, for more on the evolution of SES as offshore support craft).

"We saw the SES technology as being very valuable, especially for wind farm projects located further offshore," Hambro recalls. "Unfortunately, technically, an SES is very complicated and difficult to maintain. When you're going from A to B, it's incredibly valuable for transiting at, say, 50knots. It's when you throw in additional trips to turbines C, D and E that an SES becomes problematic, because of the high fuel consumption involved."

However, the operator's brush with SES deployment at least granted it a good insight into the technology: learning what doesn't work can be as valuable as learning what does. "The experience helped us re-evaluate where we should be going," Hambro says – and so, come 2018-2019, the company had a clearer vision of the direction it wanted to take.

Retrofittable solution

"We didn't want to copy what everyone else was doing: bringing more and more vessels into the sector," he says. "We'd been forerunners in this sector, but we still needed 'a frontrunner': a frontrunning technology to keep our clients, and investors at HICO, happy. Because our vessels were now sitting in that older category, we didn't have a larger, 24-pax, fully classed vessel to fall back on."

The solution came when Penguin informed Tidal Transit of its plans to build a stock CTV, based around a Volvo Penta quad IPS system. Penguin, of course, is no stranger to hybrid- and pure-electric builds, have produced battery-powered ferries (see, for example, *Penguin Refresh* in *Significant Small Ships of 2023*)

and hybrid patrol vessels, such as *MPA Guardian* (see *Ship & Boat International* September/October 2022, pages 40-42). This chance conversation with the yard proved to be fortuitous for Hambro, ushering in the contract for the construction of *Arabella Jane*.

"We thought 'Wow, this is amazing' – it was exactly the same quad IPS we've been using for our retrofit, and we knew that the Incat Crowther hull shape, designed to carry 35,000litres of fuel, would provide a vast capacity for carrying batteries in the future," he says. "We strayed away from the other fixed-pitch propeller, controllable-pitch propeller and waterjet stock builds we'd been offered – for us, the Volvo Penta IPS was the best way of ensuring a retrofittable vessel. It meant we wouldn't have to change the CTV's propulsive system, just the energy source – and we would simply have to swap the engine for a motor. Also, we'd have all the necessary spare parts to hand."

Why electric?

While Tidal Transit may now be gaining attention and accolades for its march towards fleetwide electrification, it hasn't always been this way: Hambro remembers a time when he felt very much in the minority when advocating adoption of electric CTVs.

"Over the last few years, some of our competitors have been laughing at me, saying 'It's never going to happen'," he says – recalling an attitude that dogged the concept of electric vessels *full stop* for much of the early 2010s. However, attitudes are changing fast with operators including NOS and MHO-Co now actively eyeing up electric CTV opportunities, the latter company having recently bolstered its fleet with a series of China-built, hybrid-powered newbuilds.

TECHNICAL PARTICULARS

Arabella Jane

Length, oa	27.1m
Breadth	9m
Design draught	1.4m
Max draught	1.65m
Min. water depth	1.8m (for operation)
Bow height	3.5m
Lightship displacement	93tonnes
Engines	4 x Volvo Penta D13
Total installed power	2,060kW
Service speed	25knots (22knots@1.5m Hs)
Max speed	26.5knots (24knots@1.5m Hs)
Max significant wave height for operations	2m
Bollard push	17tonnes
Crew	<3
Turbine technicians	24
Cargo capacity	15tonnes (fore) 5tonnes (aft)
Crane	Palfinger PK23500MB, 9m reach over side
Fuel capacity	35,500litres
Fresh water capacity	3,500litres
Classification society	Bureau Veritas
Notations	+ Hull. Mach, Wind Farm Service Ship-M0-Sea Area 3

So, why opt for electric power instead of the other alternative fuels currently in development and testing? For Hambro, the issue is fairly clear-cut. While hydrogenated vegetable oil (HVO) has been mooted as one way forward for smaller vessels, for instance, concerns have been raised over unsustainable, unethical palm oil production methods, and a question mark hangs over long-term availability of used cooking oil. "We don't eat enough chips to create HVO to power ships," he notes.

Similarly, the use of hydrogen as a fuel has attracted some operators, but Hambro counters: "The amount of energy consumed in producing, storing and transporting hydrogen makes it incredibly expensive, in terms of cash and the electricity used." Meanwhile, the problem with methanol, he says, is that "the energy density is problematic for small vessels." He continues: "Methanol is a stepping-stone fuel. It's by no means zero-carbon; it's a reduction of carbon. We're trying to avoid the 'stepping stones', and leap straight to where the technology allows us to today.

"While the batteries we're putting in our boats today might not be the 'holy grail' that revolutionises fleet operations worldwide, in 10 years' time they will be repurposed as quayside batteries, providing shoreside

Leo Hambro, Tidal Transit: "The Volvo Penta IPS was the best way of ensuring a retrofittable vessel"

One of Tidal Transit's oldest CTVs, *Ginny Louise*, is being retrofitted with an all-electric system, to be reborn as *e-Ginny* in 2025

energy storage and office back-up power. We can then fit the boats with new batteries with greater energy density, giving us improved range, while the onboard propulsion system stays exactly the same."

The bigger picture

The drive towards electric power is being mirrored by an evolution in battery-charging tech. In fact, the next few years could see CTVs (and, Hambro emphasises, SOVs) drawing electricity directly from offshore assets at the wind farm – be these substations or the turbines themselves.

"In the industry we're in, it's very clear that if our client is producing electricity at the place we're going to every day, what can be done electrically should be done electrically," Hambro says. He cites industry developments such as Damen's forthcoming 7017 E SOV (see *Ship & Boat International* January/February 2024, pages 26-27) and the new fast chargers produced by MJR Power & Automation, Stillstrom, Ocean Charger (Vard), Apollo and Oasis.

Hambro adds: "Talking to some SOV operators, they say the interesting thing about the SOVs built in the past five to 10 years is that there are empty spaces in the hull. These empty spaces are future technology spaces; even on existing SOVs, you can easily install 10+MW of batteries, allowing these ships to run their day operations on pure electric power, as they're all hybrid diesel-electric vessels anyway."

This is a particular advantage when it comes to electrifying the fleet without drastically overhauling proven vessel designs. "Our principal aim is to minimise the change to operations, because our clients only care about 'time on tower' – the more time technicians spend on the tower, the more uptime the turbines have," Hambro says. "So, we want to retain the high speed that CTVs enjoy, while also taking advantage of opportunities to save energy – such as slow sails home, loitering in the field, and so on."

This will require a 'mind shift' for crew, he believes. "The changes will be small but far more evident," he says. "When you're looking at the tank of a diesel burner, you don't really care about a litre here or there. However, noticing that your 100% remaining range has dropped to 30% means a lot more – as electric car owners are finding.

"I hate the term 'range anxiety', but it's not about this: it's about planning. If you plan properly and have the right charging infrastructure to allow you to operate for the required period, the anxiety disappears." In this respect, personnel will benefit from more training related to energy usage, battery storage and charging times.

The other change we might expect to see, as battery power becomes more commonplace, relates to the designs of the offshore CTVs themselves. Hambro views foiling technology as one interesting development, and as a potential shake-up for the development of new hullforms, "which have become a bit static over the past few years", he says.

The *e-Ginny* project

In a major boost for Tidal Transit's electric ambitions, October 2023 saw the operator secure more than £6 million of funding through the UK government's Zero Emissions Vessel and Infrastructure (ZEVI) competition: a cash injection that is currently being used to support the *e-Ginny* project, involving the conversion of Tidal Transit's stalwart *Ginny Louise* to pure electric power.

It's an opportunity that Hambro has not taken for granted. He says: "Across our sector, electric propulsion retrofit potential is relatively limited – of about 400 CTVs on the market, only 20 to 30 are worth considering retrofitting, because of their hull shapes or energy densities and the costs involved. So, we're very fortunate to get the funding to go ahead and do this."

Ginny Louise will continue to operate as usual until September this year, as Tidal Transit orders in the parts necessary for its conversion. The vessel will then enter the facility of local boatbuilder Goodchild Marine Services, which will chop out its stern underwater section and replace it with a new section to accommodate the Volvo Penta IPS. "Goodchild has phenomenal experience in working with fibreglass vessels, so we're delighted to be working with them", says Hambro. The yard will also handle the entire installation of the batteries and motor.

e-Ginny should be completed and built in time for March 2025, he adds. As part of the funding agreement, Tidal Transit is committed to a demo period for further evaluation, before beginning service on an as-yet unspecified UK offshore wind farm for three years.

Danfoss is supplying *e-Ginny*'s power management system, with Corvus Energy contracted to provide the CTV's batteries. The project is also being supported by MJR and Artemis. MJR will provide the 1.2MW-capacity offshore charging gear, installed on a turbine or substation at the CTV's target site. This offshore charging system is controlled by MJR's offshore charging portal and real-time control system. This will feed four 300kw DC/DC converters on board the vessel.

When a CTV or SOV 'pushes onto' the turbine, the system lowers a cable and connector plug to the vessel. Power is then transferred directly from the energy generated by the wind farm to the vessel's onboard battery pack. Connection and disconnection are both conducted hands-free, with no manual handling involved. Tidal Transit conducted trials of this particular charging system last year, utilising its 20m CTV *Tia Elizabeth*.

Artemis, meanwhile, will provide the 320kW shore-based multiplug charging system. "We want this charger to be as multifunctional as possible, so see it charging vans and cars during the day, and charging *e-Ginny* by night," says Hambro.

Bold new era

It was worth asking Hambro: did he feel any apprehension regarding this surge towards e-propulsion? Announcing your last ever diesel vessel delivery could be considered a bold move, given that battery propulsion is still a relatively new phenomenon for the CTV sector – and, despite the great gains made in electric propulsion over the course of the past 15 years, sceptics do exist.

Hambro replies: "If our clients insisted us on bringing another diesel burner to market because they were not ready for an electric alternative, we'd still look to order a vessel that's retrofittable, for future all-electric use. To me, it would be disappointing if they ordered another diesel vessel, but I understand that, in an industry that's growing as much as this one is, there's still demand to be filled.

"If we had to go for another diesel burner, it would grate on me for life! But we just see it as another step towards the eventual change. Some of our clients are saying they have to be net-zero by 2030 – so, if we don't start now, we're never going to get there."

There's a real sense, though, that the CTV sector could be on the forefront of making maritime history. "I feel that, in this crazy little world of offshore wind, we can lead an area of decarbonisation for the marine sector," Hambro states. "Admittedly, a container ship going across the Atlantic is never going to run on pure electric power – not in my lifetime, anyway. However, as battery tech evolves and offers more energy density, we'll see more and more vessels, including ferries, going electric. Energy islands in the North Sea could become the fuelling stations of the future – there is so much development going on." **SBI**

Arabella Jane **will serve as "the frontrunner for future electric builds", as well as Tidal Transit's first 24-pax capacity vessel**

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Dr Rafet Emek Kurt, Reader, in Maritime Safety and Human Factors, Department of Naval Architecture Ocean and Marine Engineering, University of Strathclyde

Dr. Kurt also serves as the Director of the Maritime Human Factors Centre, further demonstrating his commitment to advancing research in this field. Additionally, he holds the position of Associate Editor in Ships and Offshore Structures, showcasing his dedication to the dissemination of knowledge within the maritime community. Dr. Kurt is also a member of the International Ship and Offshore Structures Congress (ISSC), where he collaborates with peers to develop ship design criteria informed by human factors, further highlighting his commitment to the advancement of maritime safety practices.

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