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northern Baltic

AURORA BOTNIA





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Founder
Arne Steving, in 1965



A VERY SPECIAL FERRY!

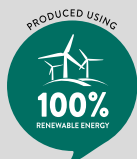
The AURORA BOTNIA is a very significant ferry - the first ro-pax vessel ever to be purpose-designed and built for the northerly Vasa-Umeå route across the Gulf of Bothnia. The vessel has been long-anticipated by Shippax and, of course, now that it has entered service, it is greatly enhancing the connection between Finland and Sweden over the Baltic's northerly arm. Increased business and tourism activity have ensued and, once again, the usefulness - indeed vital importance - of ferries for local and regional economies is being amply demonstrated by the significant upswings in passenger numbers and freight vehicles shipped across.

The AURORA BOTNIA is the result of years of close cooperation between Wasaline and the RMC shipyard in Rauma, which built the vessel. Both the operator and the shipyard have much to be proud of; as the articles in this supplement show, the AURORA BOTNIA is of a state-of-the-art design and equipped with the most up-to-date technologies to provide optimal operational effectiveness with minimal environmental impact. It is also a smart-looking ship, both inboard and out and is yet another compelling advertisement for Finnish design and making 'know-how' in the shipbuilding sector.

Shippax congratulates RMC on delivering the AURORA BOTNIA and wish Wasaline every success with the vessel.



Elizabeth Mandersson
Owner & CEO



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ONBOARD AURORA BOTNIA

In winter, dark for most of the day and freezing cold, but with 24-hour daylight in summer, the northern Baltic area, known in English as the Gulf of Bothnia is the most climatically extreme sphere of European ferry operation. The completion of the new Wasaline ro-pax ferry AURORA BOTNIA for the Vasa-Umeå route, the most northerly year-round international large ferry crossing in the world, is a notable event for not only the operator but for the region as a whole.

TEXT: BRUCE PETER
PHOTOS: SØREN LUND HVIID

The Vasa-Umeå route is actually among the oldest car ferry lines on the Baltic Sea, it having first commenced in December 1958 when the steamship KORSHOLM III was delivered after being converted into a side-loading car ferry at the Rauma Repola shipyard. It was the precursor to today's Rauma Marine Constructions, which nearly sixty-three years later delivered the AURORA

BOTNIA. Remarkably, the KORSHOLM III – which daily traversed the Gulf of Bothnia each summer until 1966 – still survives today as the excursion ship STOCKHOLM of Strömma Kanalbolaget. (Maybe one day it will even be possible to see it and the AURORA BOTNIA parading together, representing the historic extremes of northern Baltic ferry design).

The new Wasaline

In 2012, the municipalities of Umeå and Vasa, respectively Umeå Kommunföretag AB and Vasa Stad, formed a jointly-owned shipping company, NLC Ferry Ab Oy, to recommence the route. This formed part of a wider European Regional Development Fund project to stimulate growth and prosperity in the areas around the



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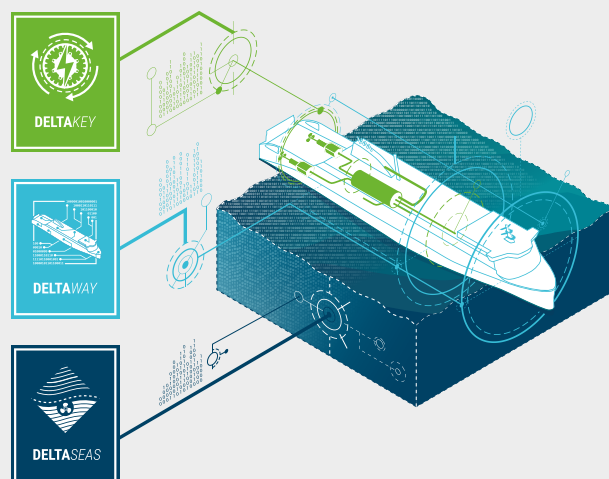
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Gulf of Bothnia. For marketing purposes, the well-known 'old' Wasaline brand and colour scheme, as applied to ferries there until 1993, was revived in only slightly modified form. Through brokers, a suitable vessel was found, it being a 32-year-old ro-pax that actually had been Finnish-built by Wärtsilä in Helsinki as the TRAVEMÜNDE for Denmark-Germany service over the Southern Baltic. Since the early-1980s, it had had many names, owners and charterers, though (indeed, it had once before briefly served on the Vasa-Umeå route back in 1997 and so was known to be effective there). With an ice-strengthened hull and two full-height vehicle decks offering just over 1,100 lane metres of space, plus accommodation for over 1,000 passengers, it could both transport cargo in satisfactory quantity and also passengers for mini-cruise and transport purposes. Renamed as the WASA EXPRESS, it entered service in January 2013. In the first year, a loss of 3.3 million Euros was recorded. Following managerial changes, in 2014, the operation broke even and in the following year a profit of 2.5 million Euros was attained as freight hauliers, passengers and holidaymakers came to appreciate the time, cost and comfort benefits of taking the ferry, rather than making lengthy detours by car.

From concept to reality

With local support, good marketing and a high level of shipboard service that made the best of the WASA EXPRESS's quite limited facilities, the new Wasaline prospered but the old ferry, with its obsolescent mechanical systems, was viewed as a stop-gap, pending the construction of a state-of-the-art, purpose-built



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replacement – the first ever to be entirely designed from scratch and built anew for the route.

Towards the end of 2013, the first tentative renderings for such a vessel were released, showing an all-white ship with a sharp bow and remarkable styling of the superstructure to suggest fractured ice of the kind that covers the Gulf of Bothnia during the cold and dark winter months. The eye-catching concept impressed local politicians and helped to generate enthusiasm, but it was deemed impractical by Wasaline's new CEO, Peter Ståhlberg, who initially had served as the company's Technical Manager and, after a break, was appointed to the top job in 2014. It was under Ståhlberg's direction that the project was developed and the ferry eventually delivered as AURORA BOTNIA took form. To own the project, in 2015 a new company named Kvarken Link Ab was founded by the Umeå municipality (a Finnish counterpart was later on created by the Vasa municipality).

Ståhlberg decided to modify the initial design to produce a solution that could feasibly be built at reasonable cost. He therefore contacted the experienced Finnish ferry naval architect Ari Huttunen of the Foreship consultancy to advise, but the underlying concept remained for a vessel with just 800 lane metres' capacity, as per the original concept. After this failed to achieve funding, the opportunity was taken to re-think the project more fundamentally and to produce a specification for a more capacious vessel, better optimized to achieve commercial viability. This involved not only Ståhlberg and Huttunen but also the naval architect Christer Schoug of BoCS Consulting. The outcome was a 1,500-lane-metre design

with an 800-passenger capacity. With a suitable specification achieved, there followed a very rapid European Union official procurement process, which commenced in June 2018 and whereby 10 shipyards expressed interest. With the assistance of the Foreship and Deltamarin naval architecture consultancies, these were whittled down by the objective means of a scoring system. In the end, it was Rauma Marine Constructions that won on account of its precision of steelwork fabrication and its high technology competency. A Letter of

“ The AURORA BOTNIA is a smart-looking ferry that both inside and out impresses on account of the typically Finnish attention to quality and detail with regard to fit and finish.

Intent was signed in January 2019 and the final design, engineering and technical solutions were made by Rauma Marine Constructions, interpreted from Wasaline's specification and developed in close cooperation with their eight-strong project team. RMC then appointed Johanna Kaijo as Project Manager; previously, she had been involved in several major ferry renovation projects at the Meyer Turku shipyard.

The final design for the AURORA BOTNIA was, as one would expect, further rationalized from the previous concepts while nonetheless retaining hints of the initial intention. The contract for construction was signed in January 2019 and the production of steel sections began in September with the keel-laying in February 2020, just on the verge of the outbreak in Europe of the COVID-19 pandemic.

COVID modifications

According to Håkan Enlund of Rauma Marine Constructions, the project was an opportunity to showcase Finnish ferry design and construction expertise. As Enlund puts it 'a successful ferry is much more than just a steel box filled with equipment. It is a holistic system and it needs people with expertise and imagination to breathe life into it. Not only is the AURORA BOTNIA's configuration state-of-the-art in terms of power supply and propulsion, but there are also novel

ideas in the outfitting of the passenger accommodation, the design of which even took into account the need to avoid the spreading of droplet and air-borne infections such as COVID'. RMC's desire was to incorporate learning from hospital design and indeed, as the local Satakunta University of Applied Sciences (SAMK) in Rauma are world-leaders in research in aerosol spread, their advice was sought as to what best to do. (Unfortunately, RMC found that some suitable virus-resistant finishes and fittings used in hospitals lacked marine certification and so, in certain instances, the application of what would have good solutions was frustrated by this problem).

A more prosaic consequence of the COVID situation was the inability of shipyard staff to travel overseas to visit suppliers to approve equipment, fixtures and fittings before installation and so, force majeure, it was necessary instead to rely on local agents instead. Yet, as around 80 per cent of the vessel's inventory was sourced in Finland, most could be inspected in the usual way.

The AURORA BOTNIA is a smart-looking ferry that both inside and out impresses on account of the typically Finnish attention to quality and detail with regard to fit and finish; the steelwork is smooth and all of the elements are precisely crafted. It appears to be a ship that, given equal attention to ongoing maintenance, will last for many decades and, although initially representing a substantial outlay, will prove its worth over a lifetime.

Stylish and spacious accommodation

The passenger accommodation, comprising a range of public rooms, cabins and a shop, fills the greater part of decks 7 and 8. Its design is the work of the Finnish interior design firm Kudos Dsign of Turku, for which it is the first ferry interior



The main stairway on AURORA BOTNIA, adjacent to the reception hallway.



The reception/information desk.

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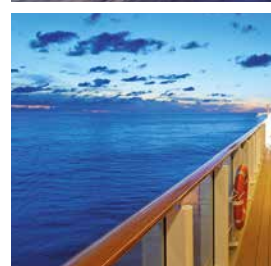
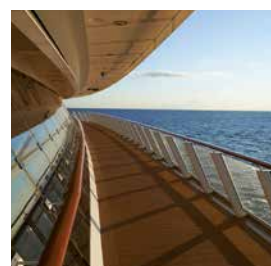
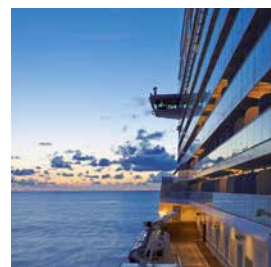
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project (though since its formation in 2015, it has produced interiors for cruise ships built in Turku, as well as for those of luxury hotels around the world). Pia Litokorpi, its CEO and the lead designer on the project, is proud of the fact that the project has involved the ingenious use of recycled materials – for example, the carpets were made from old fishing nets that were pulped and re-woven. In terms of colours, forms and finishes, the overall design approach is, however, comparable to that of other contemporary Finnish ferry interiors. Unlike the overnight Baltic cruise ferries operating further south, the AURORA BOTNIA combines the roles of shuttle ferry and day-cruise ferry, requir-

ing passenger facilities suitable both for those in transit (reclining seats, cafeteria) and those making day-return or even overnight mini-cruises (restaurants, entertainment and shopping).

To begin touring the interiors on Deck 7, the main stairway from the vehicle decks and the passenger gangways give direct access to a large entrance hall with an information counter and bureau de change forming part of an 'island' aft of the stairs. Aft, there are parallel arcades on either side of the centerline casing, off which several of the vessel's facilities may be accessed. The grey colour scheme and carpeting resembling broken ice reflects not only the current fashion for interior

coloration, but also the cool light and frozen winter conditions found so far north. In the stairwell, a large screen shows images of aurora borealis, the northern lights, and this forms a theme that is repeated throughout.

At the forward end of Deck 7 is the main lounge and entertainment space, a commodious saloon filling the entire width of the superstructure. Decoratively up-to-date with a very dark scheme likely to be cosy on winter nights, the set-up is otherwise that of a classic ferry nightclub with a stage and dance floor in the front port-side corner, a fan-shaped expanse of surrounding seating and a bar counter along the rear bulkhead, between the entrance doorways. The curving, slanted form of the superstructure with large windows on three sides reminds of lounges on Scandinavian ferries of more than half-a-century ago, but the overall solution is one that works most effectively and cannot be bettered in that it provides a large seating capacity and multi-functional day and night-time usage. Its detailing includes abstractly-shaped ceiling panels over the dance floor with back-lit 'halo' effects around their edges, reflecting both broken ice and the aurora borealis theme. Hanging globe lights over the tables in the rear corners and drinks tables of an unusual design somewhat resembling open braziers with bowls of light shining up add to the convivial atmosphere. Reflective of the COVID situation, the seating groups are more generously spaced than in equivalent spaces most other recent comparable ferries.

Immediately aft on either beam are two smaller lounges – one an extra-tariff space for business travellers, which is to port, and the other, a convivial pub with its own small stage where a guitarist can entertain, to starboard. The Business Lounge is very swish; the monochrome palette with black walls and ceiling and high-backed chairs upholstered in light grey is elegant and understated and the large windows with the spandrels in slanted patterns add interest and drama. The 'broken ice' carpet design effectively ties the various elements together.

The Pub likewise makes use of black as a background colour but it has an open ceiling, exposing some of the service ducts that would normally be hidden from view, and there are groups of hanging lamps with large metal shades on retractable 'pantograph' frames, the whole ensemble giving a decidedly hipster-ish look while retaining a cosy appeal for a quite traditional Finnish ferry clientele who will enjoy their beers seated on the upholstered benches, chairs and stools below.

On the centerline between the Business Lounge and the Pub, there is a well-consolidated 'island' of toilets, a pantry and beer store to enable the two bars and the Business Lounge snack and drinks counter

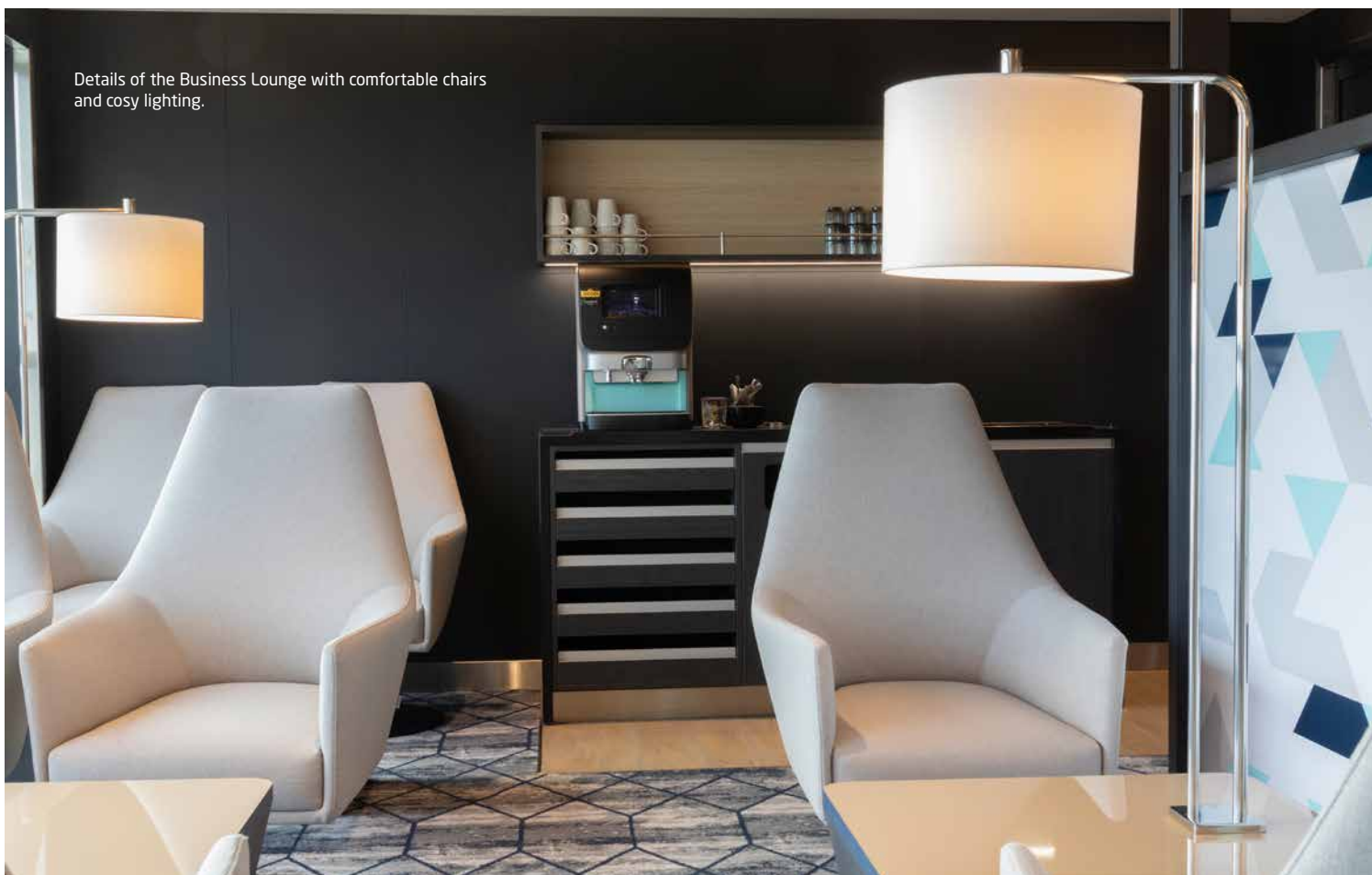


Part of the AURORA BOTNIA's pub.



A general view of the forward main lounge and entertainment space.

Details of the Business Lounge with comfortable chairs and cosy lighting.



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A view across the forward lounge, looking towards the port side and stage.



The AURORA BOTNIA's rest lounge.



The children's playroom.

to be replenished. The toilets are worth remarking upon because, when they are not being used, ultra-violet lighting is automatically switched on to kill all viruses and bacteria.

Returning to the entrance hallway and its adjoining arcades, the perimeters of these are surrounded by a reclining seat lounge, a children's play area, a large shop and conference rooms, one of which can be temporarily converted into a 'pop-up' shop too, presumably so that more sales can be generated during the summer holiday months when there are fewer conferences but more leisure travellers.

Diverse dining options

Moving up to Deck 8, all of the catering outlets are grouped around a single capacious galley, located in the middle of its forward half, while the aft half contains mostly passenger cabins. Dining is a very important aspect of the Wasaline shipboard experience and, indeed, the owner's Project Manager for the development of the AURORA BOTNIA's interior, Markus Backlund, has a background in the restaurant trade in Finland.

The 200-seater Archipelago Buffet is located directly above the forward lounge and is likewise a reworking of another classic Baltic ferry interior environment, the essential ingredients of which would have been recognizable to passengers of the 1960s. Unlike the lounge, it has a light and airy feel with panoramic views ahead and on either side and, reflecting a desire to control infection, it features an abundance of wipe-clean surfaces and quite utilitarian steel-framed seating. Rather than the free-standing 'island' buffet counters found in most Baltic ferries, the buffet runs along the rear bulkhead and therefore can be re-stocked directly from the galley, while another potential advantage in COVID times is that serving staff can handle the dishing out of the food, meaning that cross-contamination is reduced through passengers not doing this themselves. The colour scheme and lighting soften the otherwise quite clinical look.

Immediately astern on the port side is the cafeteria which is ingeniously arranged in two sections. The servery (with island counters) is forward of the main entrance, adjacent to which

is what is described as a 'Family Café' for those travelling with children. Experience has taught that, when with small ones, it is best to have seats near to the source of food and the AURORA BOTNIA is a rare example of 'best practice' in this regard – a very simple but good innovation. Further aft is a larger main seating area with chairs, benches, stools and tables in a variety of configurations. Character is lent by some of the groups in the centre being within open-sided 'cabanas', giving a seaside-like impression that is accentuated by shades of yellow in addition to the unifying grey tinges found throughout the vessel. Considerably more swish than either the cafeteria or buffet is a comparatively small a la carte restaurant on the starboard side, accessed from the same wide passage as the buffet restaurant and thereby perhaps encouraging those milling around outside to decide on a spur-of-the-moment 'upgrade' to waiter service. (Incidentally, the crew mess room is between the buffet restaurant and the cafeteria).

The aft half of Deck 8 contains 52 passenger cabins and their interiors and those of the corridors continue the aurora borealis theme with images on the walls and on the undersides of the berths. They are neatly finished and with a higher level of visual and sensory appeal than is typical.

Moving aft, there is quite generous outside deck space on two levels towards the rear of decks 7 and 9.

The AURORA BOTNIA entered service at a timely moment in the summer of 2020 when the proportion of populations in Sweden and Finland vaccinated against COVID reached a critical level to enable overseas travel to begin again and so, after more than a year's hiatus, people began to book ferry trips once more. Hopefully, pent up demand will ensure satisfactory trade well into the winter, when the vessel's 1A Super hull will for the first time require to crunch through ice conditions. So far as freight is concerned, following the vessel's entry into service, the number of units shipped in September 2021 was 40 per cent greater than in the same month the previous year. For Wasaline and for Rauma Marine Constructions, the project is a notable success and one that amply demonstrates what up-to-date ferry design and state-of-the-art shipbuilding can achieve in stimulating regional prosperity. ■



The forward section of the AURORA BOTNIA's buffet restaurant.



A view across the tables in part of the cafeteria with an illuminated mural on the rear wall.



The a la carte restaurant, prepared for the feeding of the next intake of passengers.



HI-TECH AMBASSADOR

Vaasa, despite its northerly location, has against all the odds become one of Finland's tech hubs. Not on the scale of Nokia but the city has had to re-invent itself, ploughing a lot of investment into higher education and research. It is therefore unsurprising that the new Wasaline ferry would act as an ambassador for cutting edge tech solutions as it is probably the most advanced environmentally friendly ropax so far delivered. While Finland is a small country, it boasts a hugely capable maritime cluster with Vaasa itself being the home for Wärtsilä, ABB, Danfoss, WeTech and others. No other recently built ferry of any size can boast so much local sourcing of components but also the entrepreneurial and cooperative spirit to achieve the lofty environmental goals of the project.

The vessel has been tailor designed for the unique requirements of the Vaasa – Umeå (Sundsvall) line, the northernmost year-round international ferry operation in the World. The 3hr 30 minute, 53 N.M. crossing requires a service speed of close to 20 knots. The vessel makes two daily

roundtrips on the busiest days, but with no overnight sailings for most of the year. The last 19.30 sailing from Sundsvall arriving in Vaasa at midnight and earliest morning departures are at 08.00 so the AURORA BOTNIA usually spends 8 hours in port, plugged into the shore power supply.

A star feature of the new ship is its “zero emissions sailing mode”. While being a technological marvel and an environmental “holy grail”, it is also a remarkable experience for the passenger. To sail in near silence through the UNESCO World Heritage Kvarken archipelago is completely



PHOTO: SØREN LUND HVIID

unique. In winter, the loudest noises will be the cracking of the ice.

Following on from their important first contract with Molslinjen for a medium sized ropax, the securing of the €120m order from Wasaline in January 2019 was incredibly important for Rauma Marine Constructions (RMC). The yard's own technical department was able to refine the design together with Deltamarin, who brought their considerable expertise in designing ropax vessels. Dimensionally, the AURORA BOTNIA is very similar to RMC's previous delivery, the HAMMERSHUS, but is slightly shorter and beamier at 26.0m rather than 24.5m. With an overall length of 150.0m, the vessel occupies a niche which has had few newbuildings in the last 20 years but is likely to be much more popular in the coming years as fleet renovation in Greece and Italy gathers steam.

LNG but Biogas for the future

Despite its limited length, the vessel is

a technical "tour-de-force" below the waterline and will be a reference point for viable environmental solutions and ferry design going forward. At the time of the order, LNG was seen as being the greenest possible solution so the vessel is designed from the keel up to operate on gas, including biogas when it becomes available. LNG bunkering takes place in Vaasa, so far using road tankers. Energy company Gasum has entered into an agreement with the City of Vaasa, Wasaline's owner, NLC Ferry and Wärtsilä Finland to supply LNG to the ferry from a local LNG terminal in Vaskiluoto. The plant producing biogas from wood based biomass is only 10km from Vaasa so Wasaline aims to use it as much as possible as it is considered to be virtually carbon neutral, initially mixing liquified biogas with LNG. Sufficient quantities should be available from 2023. With the combination of batteries, also used when manoeuvring, and LNG/Biogas, the total emissions of the AURORA BOTNIA are calculated to be at half the level of the 1981 built WASA EXPRESS.

The ro-ro decks

With a total of 1500 lanemetres, the AURORA BOTNIA has a significantly greater freight and car intake compared with the BOTNIA EXPRESS. 741 cargo lanemetres of 3m width are available on the 4.9m high maindeck, with 3 lanes provided on each side of the 2.8m wide central casing. Access into the maindeck is via a wide MacGregor designed stern ramp/door having a clear driving width of 15.6m. The ramp has a length of 7.7m plus a double set of flaps of 1.2m and 0.35m

length. The double flaps are employed to provide a smooth driving interface between the ramp and the quay as no link-span or shore ramp is provided in either port. As the quay level is lower than the ship's deck, the maindeck has been given a short slope at the aft end to improve access and avoid interface problems with low-slung vehicles. This can also be seen externally by the downturn in the fender towards the stern. The ships berths stern – to in Vaasa, employing the bow ramp in Sundsvall. The bow ramp and door have a clear driving width of 6.0m. Comprising three hydraulically activated sections plus the flaps, the unfolded length is 16.2m plus double flaps of 1.5m and 0.45m length.

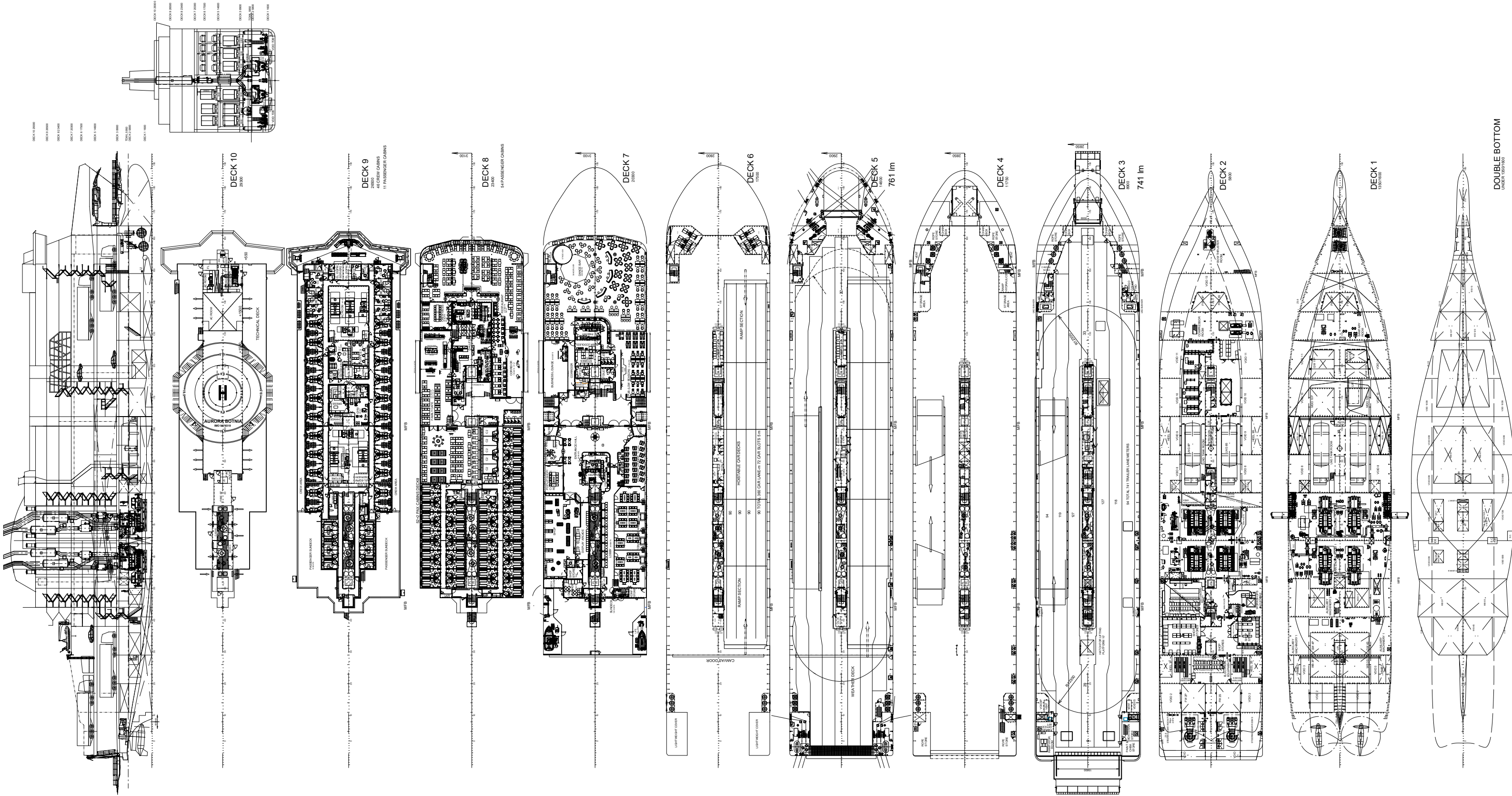
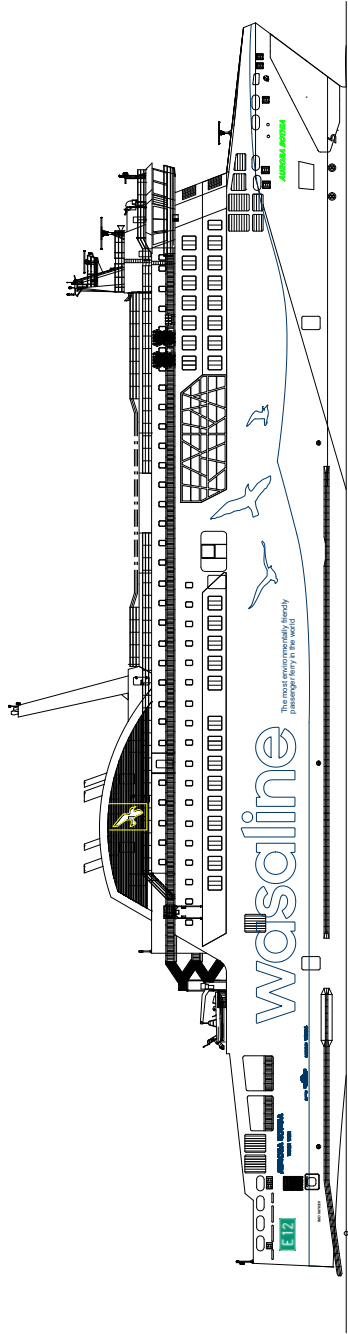
The vessel is designed for double level access at bow and stern even though the port facilities in Vaasa and Sundsvall have not yet been upgraded. The upper vehicle deck must therefore be accessed via a MacGregor double lane tilting ramp on the portside, located in the midships area. The jigger winch operated ramp has a length of 44.5m plus 4.0m long flaps at either end and a clear width of 6.3m. The ramp can be lifted into its stowage position loaded with up to 200t of trucks. 761 lanem of trucks can be parked on the 4.9m high upper deck (No.5). The ramp opening is structurally supported by slim pillars linking decks 3 and 5, freeing up a single narrow lane between the pillars and the centre casing. Wasaline transports all kinds of freight vehicles. Apart from the normal driver accompanied trucks or drop trailers, the route is used by the longest 24m trucks permitted on Swedish and Finnish roads.



From ship to shore.

PHOTO: CHRISTOFFER BJÖRKLUND

AURORA BOTNIA



Main details AURORA BOTNIA, IMO 9878319

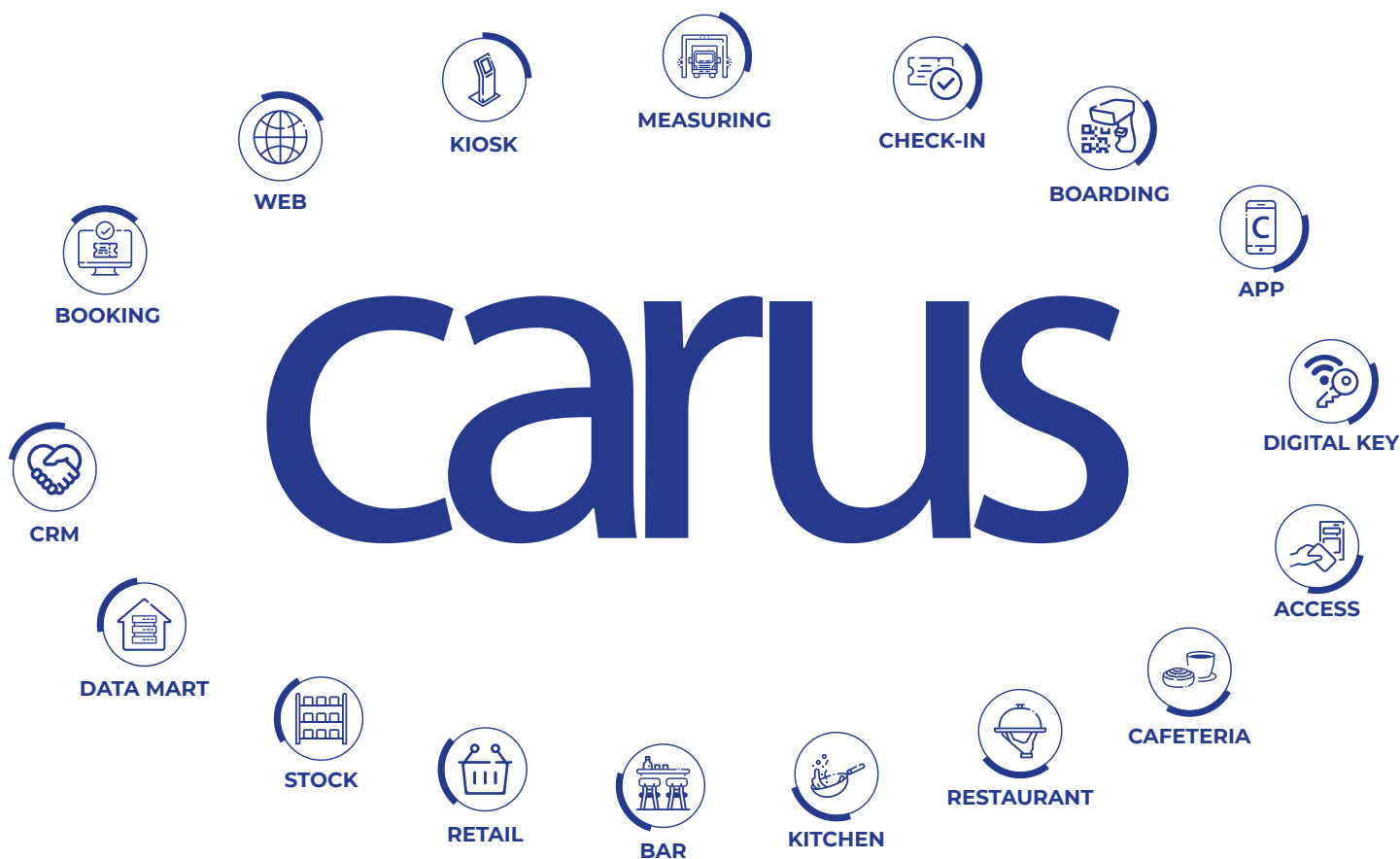
Classification	DNV ✦ 1A Super Iceclass
Dimensions	
Length oa	150.00m
Length wl	137.80m
Beam mid	26.00m
Draught	5.95m
Depth to main deck	8.90m
Gross Tonnage	24,036
TOW	3,380t
Max. passengers	800
Cabins	68

Speed	20.00 knots
Trial speed	16.00 knots
Service speed	
Vehicle deck	741m
Main deck	741m
Upper deck	
Machinery	
Propulsion	2 x ABB Azipod
Main Engines	4 x Wärtsilä 8V31DF

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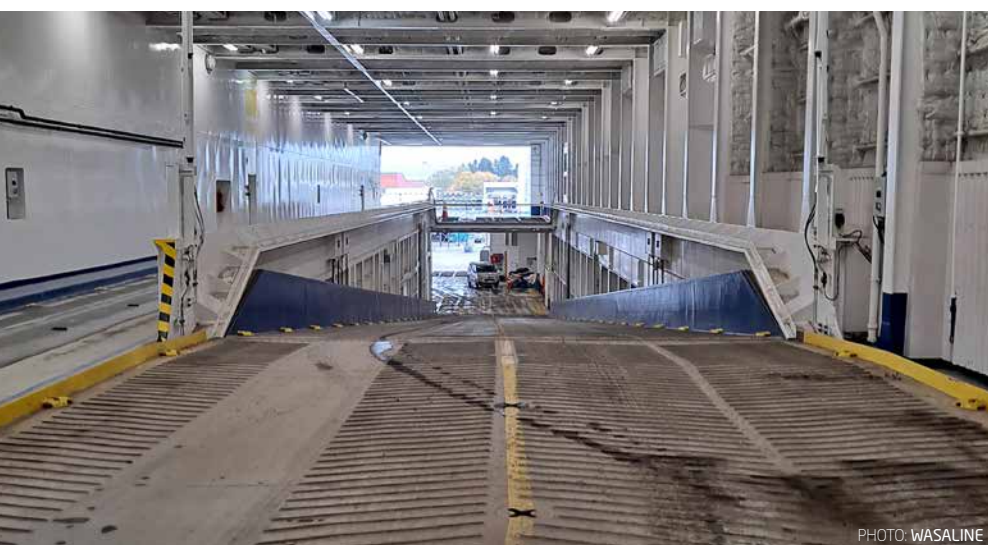
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Deck 5 with tilting ramp.

PHOTO: WASALINE



24m road trains welcome.

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On the starboard side of the upperdeck, 5 hoistable cardeck panels provide four car lanes of 90m length on the cardeck and the same below. The end panels are employed as ramps. The net result is that AURORA BOTNIA offers a well balanced intake of freight and passenger cars. As on any ferry service, some departure times are favoured by the transport industry while others are more popular with passengers. At frame 29, directly aft of the end cardeck panel, a canvas door has been provided which separates the undercover part of deck 5 from the open aft area. The door has a dual a function. Firstly, to protect vehicles from the elements during the very cold winters where outside temperatures can descend to -40C. If any wind is blowing, or even the ventilation system, the upperdeck can feel like an arctic wind tunnel. In addition, the vessel is used to transport trailers with IMO classed hazardous cargoes which must be separated from the passenger area. Access from the vehicle decks to the passenger accommodation is via 3 stair casings on the centreline as well as two passenger lifts.

THE HEART OF THE SHIP

The AURORA BOTNIA has been equipped with four Wärtsilä 8V31DF gensets, each with a maximum electrical output of 4,225 kW at 750 rpm. Two gensets are located in the forward main engine room and two in



Deck 5 aft with canvas door.



Deck 3 with a mixed load.

the aft main engine room. The generators operate at 690V and 50 Hz. These are the most economic medium speed engines in the World, assembled at Wärtsilä's own Vaasa factory. The engines are very compact in length and to extract the maximum possible efficiency employ common rail fuel injection and two-stage turbocharging. Apart from the small Cummins emergency genset, the 4 gensets provide all the power needed for propulsion, manoeuvring and the hotel loads although it is rare for more than 3 of them to be in operation at any one time.

Beyond the impressive hardware itself, Wärtsilä has also supplied two LNG Pac type "C" LNG tanks located forward of the engine rooms between B/5 longitudinal bulkheads. Each tank has a modest 80m³ capacity and incorporates a tank connection space at its aft end in which the gas valve units (GVU) and heat exchangers are also incorporated. The ventilation system for the double walled gas pipes is exhausted via the elegant mast located just forward of the funnel. On those rare occasions that the vessel will run on diesel fuel, an advanced green fuel filtration system is used rather than separators.



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Vent mast.

PHOTO: SØREN LUND HVIID



One of the four main generators.

PHOTO: WASALINE



A compact Wärtsilä V8 31 DF main engine.

PHOTO: WASALINE

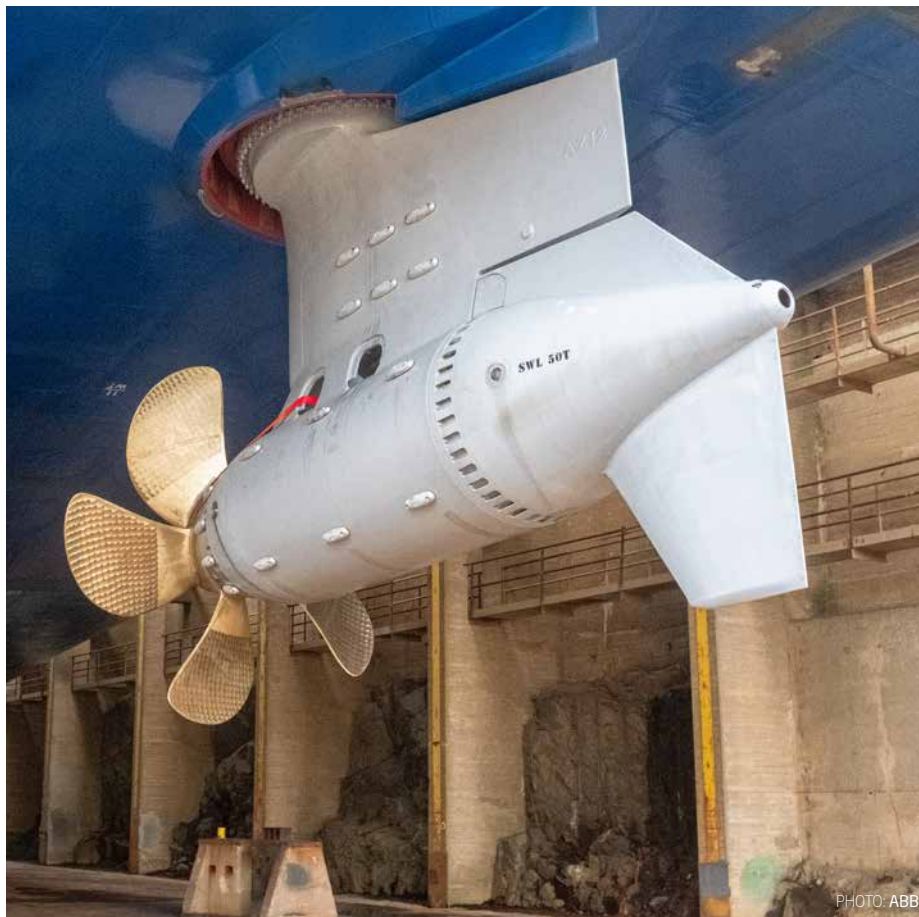


One of the 80m³ type "C" LNG tanks.

PHOTO: SØREN LUND HVIID

AZIPODS ON AN ICECLASSED ROPAX

While Wasaline could have opted for a cheaper conventional propulsion solution using a gearbox, shaftline, propellers and rudders, the requirement to sail in heavy winter ice conditions was the extra factor that tipped the decision in favour of using Azipods. Over the last 30 years since the first installation on the Finnish icebreaker SEILI, Azipod equipped ice going vessels have



One of the Azipod units.

demonstrated much better manoeuvrability in ice conditions. In Baltic winter conditions, ferries and ro-ro ships often encounter a build-up of broken ice near the berth, making it hard to manoeuvre and accurately align the vessel to lower the stern or bow ramp. However, the azipod propellers can easily flush ice blocks away from the quay and even mill any ice ridges that may have formed. The robust nature of the Azipod construction withstands shock ice loads hitting the propeller and the resulting high torque peaks in heavy ice conditions.

With most modern cruiseships equipped with Azipods, the evidence of their superior manoeuvrability is clear to see. But for shortsea ferry operations, time savings are equally as important, translating into lower emissions. Back-to-back simulator testing has proven the real time savings over traditional rudder and propeller layouts with crabbing manoeuvres being particularly advantageous. Twin Wärtsilä 1,500 kW bow thrusters with fixed pitch propellers are driven by DC motors, giving precise control and greater reliability.

A photograph of an Elomatic office interior. In the foreground, a large, detailed model of a ship's hull is visible on a table. Several people are working at computers in the background. The office has a modern, professional look with blue and green accents. The Elomatic logo is prominently displayed on the left side of the image.

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ABB claims a higher propulsive efficiency for Azipod equipped vessels. Eliminating the shaftline, brackets and tunnel openings for thrusters improves efficiency but also has other benefits such as lower noise and vibrations. With a length/beam ratio of below 5.3, a comparatively high Froude number but also an above average block coefficient for a ropax of its size, the design of the AURORA BOTNIA's hullform required a lot of CFD work followed by model tests. The hull form was optimized with the help of Finnish consultants Elomatic who conducted CFD calculations for the design draught and for minimum fuel consumption in deep water considering the operational speed profile of the vessel. Good seakeeping and manoeuvring characteristics, low propeller induced pressure pulses and low noise levels were also taken into consideration. Particular attention was paid to bow flare angles to avoid excessive wave impacts. The aftbody and orientation of the Azipods and bow thruster openings was optimised using RANS-CFD. Streamlines over the hull surface, especially in way of the bow thruster tunnels, bilge keels, and headboxes of the Azipods were also calculated by RANS-CFD.

ABB's Azipods have been used on ropaxes before but these installations were marred by a necessary intrusion of the machinery casing into the maindeck space. However, the newest versions of the Azipod, in particular the medium sized D series, are much more compact and allows the units to be installed completely beneath the vehicle deck with no obstructions. The height of steering module is only 1,785mm which is little more than typical rudder steering gear. Large flush hatches have been located on the maindeck above each steering unit. Each Azipod DO1400P unit installed on the AURORA BOTNIA has a maximum output of 5.8 MW and weighs 65t. By virtue of the vessel's high 1A Super iceclass, the Azipods are ice rated to Polar Code 6. The bearing and shaft is therefore protected by a substantial ice knife. They are located as far aft in the hull as possible with the tail of the Azipod extending below the short ducktail. The 5 bladed fixed pitch propeller has a 3.65m diameter with the blades having a very mod-

erate skew. For the best possible alignment with the waterflow under the stern, the Azipods are tilted by 6° from the vertical.

The new D series offers other advantages beyond its compact height. For the first time, ABB is employing permanent magnet motors rather than synchronous motors. These offer greater efficiency over a wider speed range as well as longterm reliability benefits. Previous Azipods were simply air cooled but the new generation benefits from a combination of air and water cooling.

Peter Ståhlberg, Wasaline CEO, remarked that "We chose ABB's Azipod® electric propulsion for several reasons. Superior maneuverability will save time and increase productivity, enabling precise schedules to be maintained on this route. We calculated likely annual time savings of close to four days of operation, which was compelling. The solution also saves valuable space on board and simplifies hull construction."

The choice of the diesel/gas – electric machinery combined with the Azipod propulsion system gives a lot of flexibility as far as the design of the compartmentation below the maindeck. The vessel fulfills all the latest IMO Solas 2020 and Safe Return to Port (SRTp) regulations as well as the "Stockholm Agreement" stability rules. The main engine room compartments are connected via a machinery corridor on deck 2, with Tebul watertight doors sealing the compartments.

Very unusually, Wasaline have specified that NOx emissions should be even lower than international IMO Tier III requirements and so, a catalysator unit has been fitted to two of the four exhaust lines. Supplied by Wärtsilä, the compact Nitrogen Oxide Reducer (NOR) is based on selective catalytic reduction (SCR) technology and can typically reduce NOx emissions by up to 90%. This comprises a reactor unit housing the catalyst which, together with an Urea reagent, reduces nitrous oxides in the exhaust into their component parts of nitrogen and water vapour. The optimum operating temperature in the reactor needs to be between 300 - 450°C, so it has to be located as close to the engine as possible. The Urea tank is located in the auxiliary machinery room.



An Azipod steering unit under deck 3.



A Pyro auxiliary boiler.



PHOTO: WASALINE

The Leclanche battery rack system.

For any vessel sailing in the Northern Baltic, onboard heating systems are probably even more important than air conditioning. Employing waste heat is therefore critical for improving the vessel's overall energy efficiency. Ultamec Pyro have supplied two auxiliary boilers, one of which can also operate on gas, but these are only used as a back-up. The two exhaust gas economisers extract the maximum possible energy from the exhaust stream as part of Pyro's waste energy recovery system which also uses heat from the HT engine cooling water. This is then used to heat the ship's central heating system which supplies the HVAC system, the heating of cabins and public spaces, potable water and for tank heating. It is possible to store surplus energy in thermos tanks for when the ship is in port.

THE HYBRID SYSTEM

In any hybrid vessel incorporating battery power and shore power connections, the electric power and energy management systems assume a critical role. WeTech was chosen to be the main designer and electrical package supplier. Their DPMS controls the energy flow and operation modes as well as the interface with the automation system. The Energy Storage System (ESS), which is connected to the common DC-link of the main propulsion drives, provides power for peak-shaving and back-up functionality, and as the unitary supply when in Zero Emission Sailing Mode. Also, the vessel's two bow thrusters are fed via dedicated inverters connected to the common DC-link. Leclanché have supplied two 1.1 MWh battery packs, located in rooms aft of the main switchboard, below the shore charging stations on the maindeck aft. The high lifecycle lithium-ion G-NMC battery cells are stacked in Leclanché's proprietary Marine Rack System which include special safety systems. These include a cell laminate design, ceramic separators and a cooling system designed to prevent heat runaway. In addition, a high performance active fire extinguishing system can be used as a last resort.



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PHOTO: WASALINE

The forward Kone stores lift.

In any hybrid vessel, the presence of frequency converters is guaranteed and the AURORA BOTNIA is no exception. The Danfoss plant in Vaasa has supplied their latest generation of sophisticated frequency converters for the Azipod control systems, as well as for various fan and pump motors, making sure that they run efficiently and with a high level of redundancy.

Wasaline uses battery power only, the “zero emissions mode”, when entering and leaving port and while manoeuvring. Once

berthed, shore power is automatically connected via Cavotec charging stations which both charges the battery packs and provides sufficient power for the hotel load. The shore power has been generated by onshore wind turbines so is 100% green energy. Of course, the shore power has a higher voltage than that used on board, requiring transformers and other specialized electronics to make sure that there is complete synchronisation. So the reality is that noise and harmful emissions have been eliminated. For any ferry service, this represents a significant proportion of the total carbon footprint but Wasaline are now leading the World in cutting it to zero. It is therefore not hard to imagine the next step when the battery pack could be enlarged.

Hi-Fog have supplied a fire extinguishing systems using high pressure water mist. The Finnish company has enjoyed a large share of the passenger cruise and ferry market, protecting public spaces and cabins. However, on the AURORA BOTNIA, Hi-Fog have gone a step further beyond the 1,200 sprinklers in the accommodation area, also protecting the vehicle decks and engine and electronic rooms with both total flooding and local protection of vulnerable areas. Two electric pump units with minimized footprint have been supplied in accordance with IMO's SRtP regulations. The system uses relatively small volumes of fresh-water which are connected to the pump units via a network of stainless steel high pressure pipes. Unlike conventional sprinkler systems which rely on large volumes of water which can compromise stability, water mist has been proven to effectively douse a fire with comparatively small volumes of water.

STORES LOGISTICS

While alot of focus is rightly placed on the vessel's main revenue generating areas of ro-ro freight and passengers, “back office” functions such as stores logistics are also a vital part of the vessel's daily routine. As on many ropaxes, the availability of space on deck 2, beneath the main vehicle deck, is a compelling reason to locate the stores compartments there. The first area, reserved for shop stores, is located aft between frame 29 and 41, sandwiched between the switchboard room forward and the battery rooms and electrical equipment room aft. The 2 main store rooms are accessed via a large central lift from the maindeck. The 3 x 3m Kone lift can transport up to 4 pallets simultaneously which can then be distributed by small pallet transporters. A flush hatch closes off the maindeck opening. Access to the passenger decks is via a combined Kone stores/passenger elevator located in the next compartment forward, adjacent to the switchboard room.

Another stores area is located forward of the LNG tank room and is reserved for food, beverages and provisions. Also accessed by a 6m long Kone lift from the maindeck on the starboard side of the casing, it is designed to transport two 3m stores containers simultaneously. A small stores lift at the forward end of the centre casing distributes the food and beverages to the passenger decks, in particular a smaller stores area on deck 7 and beer storage area which serves the large forward lounge/bar area as well as the galley on deck 8. The same lift is also used to access the recycling stations located at the forward end of the centre casing on decks 5 and 6 where refuse is sorted for recycling. Also included are two UBP 80 high-capacity baling presses for cardboard which allow cardboard waste to be reduced by up to 80%. Food waste is processed by the Evac OWMS food waste management system that enables waste to be ground by macerators and transported by vacuum to a food waste holding tank.

While the northern Baltic does not often suffer from stormy conditions, the short wavelength waves can be steep, causing uncomfortable motions. For this reasons SKF have supplied



PHOTO: WASALINE

The aft double drum mooring winch.

retractable fin stabilizers. The “S” type fins feature flaps and anti-vortex tip fairings for maximum lift. A Framo pump based anti-heeling system connects two pairs of heeling tanks.

The AURORA BOTNIA has been outfitted with an electric mooring and anchoring system from Kongsberg Maritime. A compact arrangement of 14t capacity double drum winches are located aft, giving sufficient space between for 5 lane of cargo. Ropes from the portside winch can pass to the starboard side via channels underneath the deck. Forward, the combined anchor and mooring winches are located to give the widest possible driveway if double level access might be implemented in the future.

The AURORA BOTNIA is the first Finnish flagged ropax vessel to sail with no lifeboats at all. Normally a vessel of 800 passenger intake would require at least 6 lifeboats of 150 person capacity. They would take a minimum of 10 minutes to deploy in the event of an emergency and would each require 4 crew members. However, one Viking MES system is located on each side of the vessel midships on deck 7, taking no more than 90 seconds

to deploy, using just two crew members. The chute system is attached to large capacity liferafts. The MOB and rescue boats are located aft of the accommodation on deck 7.

In keeping with the vessel's pioneer status, the very advanced smart bridge system has the capability for autonomous or remote operations. Based on Wärtsilä's NACOS Platinum navigation and vessel control package, a Data Bridge platform has been added to continuously provide advanced data analytics of the ship's performance, thereby unlocking the potential for improving operational and technical efficiencies.

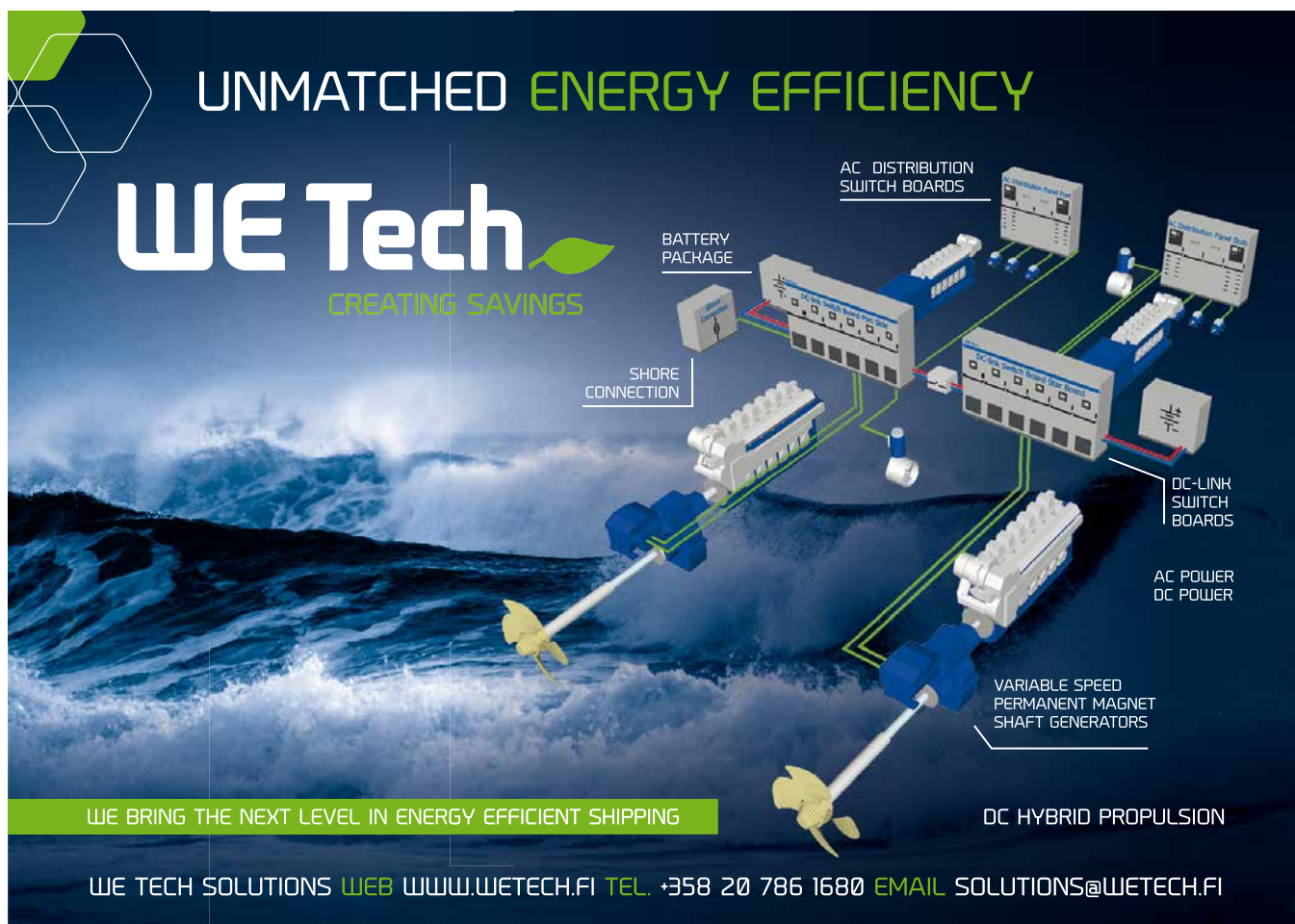
Despite all the hi-tech features, Wasaline considers that the AURORA BOTNIA will continue to be a testbed for future technologies. As new e-fuels become available, the vessel has built-in flexibility to swap or add new power sources such as a larger battery pack or even hydrogen fuel cells. An important part of the evolution of the ferry is that of the four main gensets, one is owned by Wärtsilä and is considered as a test bed to validate new technology and measure the performance and levels of pollution. It

will also help with R&D. Mr Ståhlberg describes it as being like a “floating lab”. This engine will be linked to the Wärtsilä smart technology hub in Vaasa that will allow real-time monitoring and management of the vessel. Peter Ståhlberg has a refreshingly positive outlook; “The journey has to go on after the delivery of the ferry. We have to keep getting better.” ■

Main particulars - AURORA BOTNIA

IMO	9878319
Class	DNV
Length overall	150.0m
Length pp	137.8
Beam	26.0
Depth to maindeck	8.9
Draft design	5.95
DWT	3,380
GT	24,036
Gensets	4 x Wärtsilä 8V31 DF
Output	4 x 4225kW
Battery pack	2.2 mWh
Thrusters	2 x Azipod 5,800 kW
Service speed	20 knots
Passengers	800
Cabins	68
Lanemetres	1,500

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RAUMA SHIPBUILDING: From postwar necessity to leading in technology

The AURORA BOTNIA's builder, Rauma Marine Constructions (RMC), is a remarkable company - one that is successful, resilient and a proud survivor in the European ferry design and construction business. A modern business, created less than a decade ago, it can trace origins stretching back over a century.

TEXT: BRUCE PETER



PHOTO: RMC

The company's earliest precursors were the Rauma-Raahe and Hollming shipyards in Rauma, the owning companies of which originated in 1912 and 1922 respectively but which first became involved in the building of large sea-going ships after the Second World War, when Finland was obliged to supply a seemingly almost impossible quantity of reparations in the form of ships and other items to Stalin's Soviet Union. With national sovereignty at stake, the nation's industrialists rose heroically to the challenge and met the Soviet demands with the result that the leadership in Moscow came to realise that Finland could be a useful supplier of ships and other industrial products in the longer term. From churning out the schooners

and trawlers that figured in the reparations programme, the Rauma-Raahe (which was soon renamed Rauma-Repola) and Hollming yards next came to build very large numbers of modern cargo ships and tankers for the burgeoning Soviet merchant fleets, which were ordered and delivered according to the stipulations of a succession of five-year plans. In addition, they built vessels for various Finnish shipping companies. It was not until the 1970s, however, that the two Rauma shipbuilders also began to receive orders from other Western shipowners too – and these included a succession of contracts to build a variety of types of ro-ro freight ferry.

With the gradual demise of the USSR in the latter 1980s and early-1990s, the Rauma-Repola and Hollming shipyards were forced to diversify, the former constructing icebreakers and the latter pusher-barges – but by the latter 1980s the Finnish government's desire was to engineer a merger between them and the larger Wärtsilä Marine yards in Helsinki and Turku. It was only Wärtsilä Marine's bankruptcy in 1989 that prevented this from occurring and instead Rauma-Repola and Hollming later were merged in 1992 to form Finnyards, which quickly became a major force in the construction of ferries, cruise ships, icebreakers and other advanced and sophisticated vessel types. Great achievements in the mid-1990s were three highly innovative HSS aluminium catamaran ferries for Stena Line – vessels which amply demonstrated the abilities in design and fabrication of the Rauma shipbuilders. In 1997-98, however, Finnyards was absorbed into the Norwegian Aker shipbuilding and engineering conglomerate, after which further cruise ship and ferry orders were received – for, among others, the BIRKA PARADISE, ULYSSES, SEAFRANCE RODIN, ROMANTIKA and VICTORIA I, plus smaller examples for Northlink in the UK. While Aker Finnyards' work was beyond criticism, the Aker parent company had expanded too quickly and in 2007-2008, it sold its Finnish shipbuilding interests, including the yards in Rauma, to a South Korean conglomerate, STX, which likewise grew at a prodigious rate. Under STX control, the construction of ferries was perpetuated, vessels delivered including the GALAXY, the exceptionally large cruise ferry COLOR MAGIC and the

Dover Strait vessels SPIRIT OF BRITAIN, SPIRIT OF FRANCE, which were the first of their type to incorporate 'Safe Return to Port' measures. Unfortunately, STX too soon was revealed to be financially over-stretched and the 2008 economic downturn only made matters worse. The situation came to a head in 2012-2013 when a lack of new orders brought a sudden cessation of shipbuilding at what was by then the STX Rauma shipyard.

In January 2014, the Rauma Municipality purchased the shipyard's site with a view to redeveloping it as a business park for marine technology industries. Most fortunately, however, a former managing director of the yard, Aarno Mannonen, together with the local businessmen, Ari Salmi, Harri Putro and Tuomas Kaitila, intervened by establishing Rauma Marine Constructions, which negotiated successfully to lease the premises. While RMC had high ambitions of re-entering the newbuilding market, in an initially challenging economic and business climate, it at first had difficulties in securing contracts and so instead concentrated on ship conversion work.

THE EMERGENCE OF RMC

In December 2015, RMC received a large capital injection when the private investment companies Finda and Taaleritehdas, alongside the Finnish State's investment company Teollisuussijoitus, acquired substantial shares in the company for a total of 19 million euro, raising its total capital to 25 million euro. The six million euro investment by the Finnish State, in particular, was strategic: RMC was the sole remaining Finnish-owned shipbuilder capable of building ocean-going vessels, and by investing in it, the State ensured there was a company to compete with the Russian-owned Arctech in Helsinki for new icebreaker contracts. Indeed, RMC aimed to become an important builder of ferries, icebreakers and military tonnage alike.

The Finnish investors were far from being the only ones to have shown interest in RMC. Among the other potential shareholders were the Hong Kong-based cruise operator, Genting/Star Cruises, which wished to establish its own shipbuilding division to decrease dependancy on existing cruise ship



Håkan Enlund.

builders, a Russian company wishing to build river ships and a Norwegian group wanting to build oil and gas drilling vessels. RMC's founders, however, strongly desired to maintain the company under Finnish ownership; as Aarno Mannonen stated, foreign ownership 'would have returned [the] Rauma [shipyard] into the same position as with STX: a colony to be stripped of profits and know-how.' In June 2016 RMC secured its first newbuilding order from the Danish ferry operator Mols-Linien which ordered a 158-metre-long ro-pax vessel, the HAMMERSHUS, for services to the island of Bornholm. Both designed and built at Rauma, the ship was delivered in the summer of 2018. In September 2016, a memorandum of agreement was

signed with the Finnish Navy to build four new multi-purpose combat vessels as a part of the Laivue 2020 (Squadron 2020) programme; these were to be the largest in the navy's history, in fact. The contract to design the new ships, with a value of 7.5 million euro, was confirmed in April 2017. The new vessels are due to be operational by 2026-2027 at latest. Håkan Enlund, who at that time was RMC's sales director, predicted that more ferry orders would follow. The AURORA BOTNIA project was one of these, and it very obviously built upon experience gained with the HAMMERSHUS contract. Another was an order from Tallink for a new Tallinn-Helsinki shuttle ferry, the MYSTAR, which will be a near-sister of the existing, highly successful Meyer Turku-built MEGASTAR. A third, even larger, contract to build two very large and fast ro-pax ferries for TT Line of Tasmania has taken longer to achieve. RMC first offered to construct the vessels back in 2017 but instead the owner elected to place its orders with Flensburger Schiffbau Gesellschaft of Flensburg. When the German yard subsequently got into financial difficulties, the contract was cancelled in March 2020 and RMC came back into the picture as an alternative builder. Back in Australia and Tasmania, politicians applied pressure to force TT Line to consider building entirely different vessels of a lightweight catamaran type there – but once it became clear to them that only the ro-pax ferries that RMC was offering would

suffice, the order was eventually placed with the Finnish builder in April 2021. The 48,000gt vessels are scheduled for delivery in 2023 and 2024.

FUTURE POTENTIAL

Given that the world ferry fleet is ageing and that there are now strong incentives for operators to invest in 'greener' tonnage, there should be opportunities for RMC to build many more such vessels. The fact that the yard has a strong focus upon the design of vessels incorporating clean propulsion systems using batteries and other elements of new technology is a clear benefit. Meanwhile, with disease a widespread concern, it has also developed 'hygienic' ferry interiors with ultra-violet light to kill viruses and bacteria and with special attention paid to finishes that do not harbour germs. (In the wake of COVID, moreover, it is highly arguable that the ro-pax sector will be more resilient and therefore lucrative for shipyards than the cruise industry has been until now). While many ferry operators have in recent years elected to build in China, the Finnish product remains as a benchmark of quality and technological innovation. Of course, in line with the Finnish shipbuilding tradition, RMC also has special competencies in designing ice-strengthened ferries for use in extreme environments. As has been proven time and again, ferries built in Rauma have lengthy and successful careers and are excellent long-term investments. ■



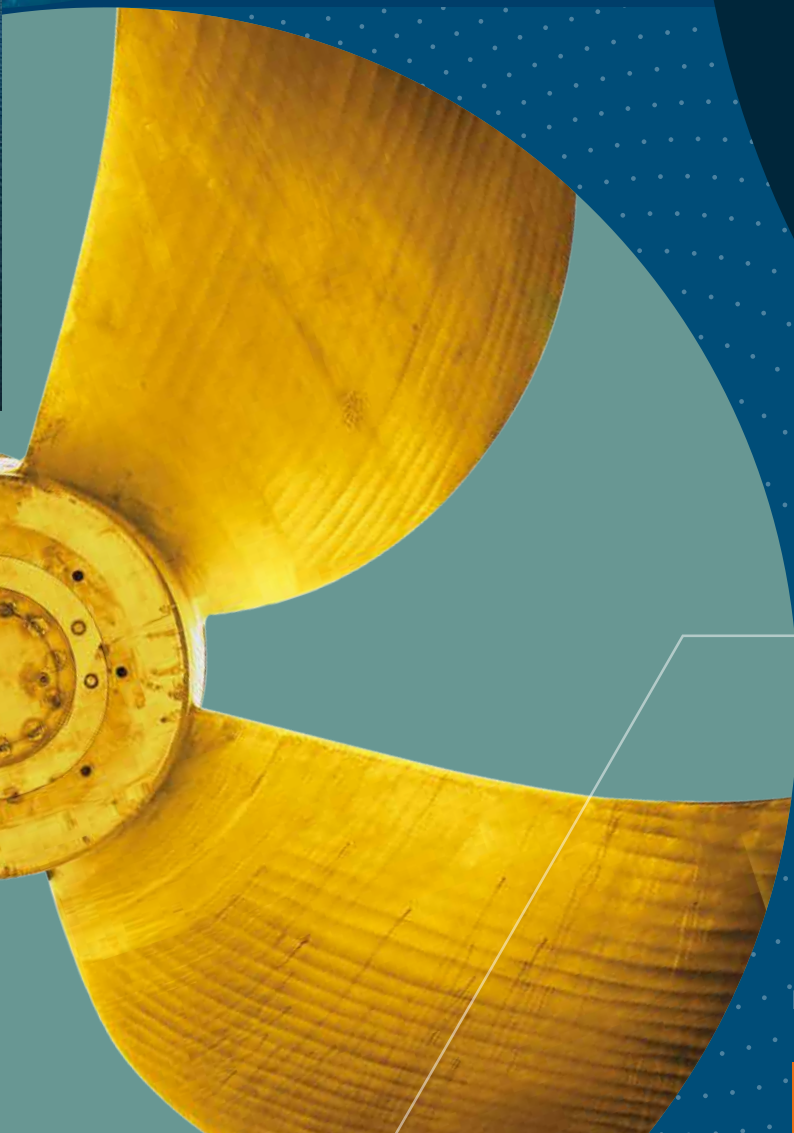
PHOTO: RMC

An impression of how the forthcoming SPIRIT OF TASMANIA ferries will appear.



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