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MARITIME REPORTER AND ENGINEERING NEWS

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GREAT SHIPS 2018

Diamond Gas Orchid

Sayaringo STaGE type LNG carrier

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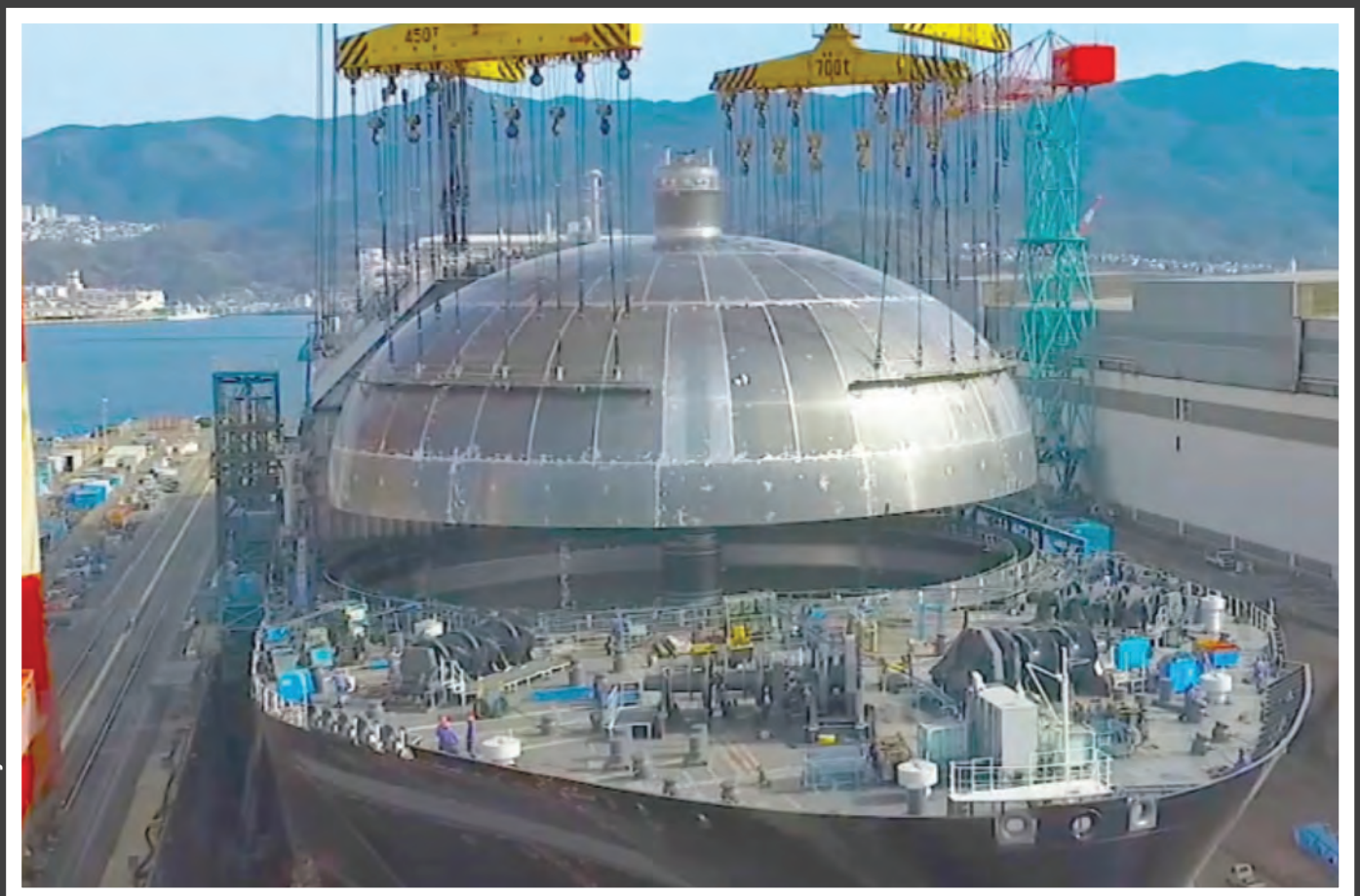
GREAT SHIPS 2018



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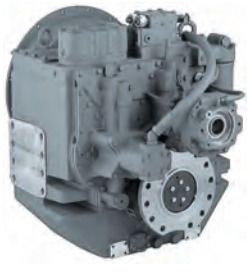

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THE COVER

Great Ships of the Year

Mitsubishi Shipbuilding Co., Ltd. (MHIMSB) built and delivered the first Sayaringo STaGE type liquefied natural gas (LNG) carrier, named Diamond Gas Orchid in June, 2018. The ship was built for owner Diamond LNG Shipping, operator NYK, classification ABS. Story starts on page 27.

Photo: Mitsubishi Shipbuilding Co., Ltd.

In this Edition

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Giving 'Thanks'

Closing out the year 2018 has been more manic than ever, with nearly 10 straight weeks of travel interrupted only by our Thanksgiving holiday break in the U.S. That was a timely interlude, as it gave me ample time to reflect on the year and ponder what I had to give 'thanks' for in the maritime sector. In no particular order, it goes something like this:

- **'Thanks' for the IMO:** The International Maritime Organization (IMO) has been the driver in one of this industry's most dramatic shifts ever, that being the reduction and eventual elimination of greenhouse gas emissions from ships. There are many strong feelings within the industry regarding the IMO itself and some of the recent IMO decisions, particular the rapidity of the decision to reduce sulfur emissions from marine fuels to 0.5% by January 1, 2020. While many shipowners continue to struggle with making the best short and long-term decision for their fleets in this regard, this rule and the new proposed mandate to reduce GHG emissions 50% by 2050 has sparked an incredible amount of technology study and development, with Danish shipping giant Maersk recently announcing its own emission mandate for 2050: Zero.

- **'Thanks' for LNG:** This has been, and will be, the year of LNG. When we talk LNG, it's not only as a marine fuel, because the jury is still out on which fuel or combination will emerge as the 'winner' in the bid to replace diesel. LNG in overview has been and will continue to be a driver in investment, from port infrastructure to ship design and construction to marine equipment.

- **'Thanks' for Offshore Wind:** The U.S. is a full generation behind Europe in the exploitation of renewable energy sources in the offshore sector, but I am decidedly bullish on the near- and long-term prospects for offshore wind's growth in the United States, a trend that will impact everything from maritime construction, employment and logistics support in and around U.S. ports. During my most recent travel swing, two events in particular stood out in this regard: Blue Tech Week in San Diego and the 2018 Maritime Risk Symposium – Energy and Maritime Risk, held at Oak Ridge National Laboratory. Both events were small but packed with "A-List" executives, and it was at the latter event where I had the chance to have a great conversation with Jim Bennett, BOEM's Chief of the Office of Renewable Energy, which solidified my thoughts on the prospects for offshore wind.

- **'Thanks' to You:** When I sit back and think that I've been in this seat for 26 years, I am somewhat amazed and humbled. Maritime is an incredible and tight-knit community, and the people that work in it are drivers in keeping global commerce humming. To our loyal readers and advertisers; to our biggest supporters and our harshest critics, thanks to you for your continued interest and support.

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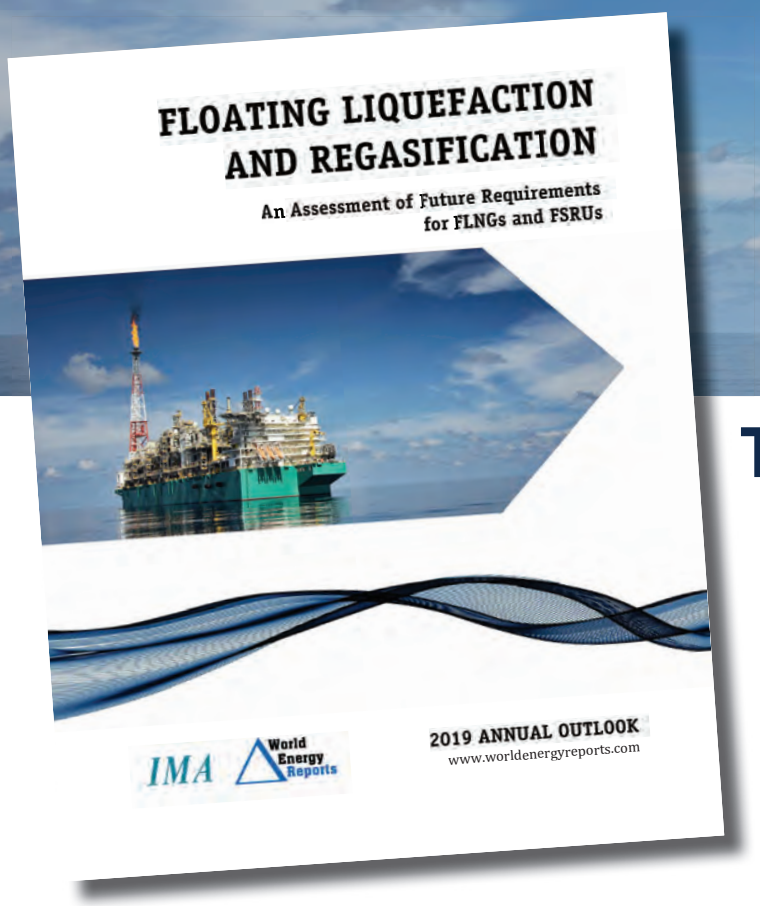
REAL TIME ANALYTICS & REPORTS FOR THE FLNG/FSRU MARKETS

The LNG industry is going through a dramatic transformation. Our 2019 Annual Outlook and real-time FLNG/FSRU database is unique. It is not simply a static report, rather a dynamic and ever-changing database with a continuously updated wealth of data, statistics, exclusive insights and analysis and critical project management contacts designed to keep you a step ahead of the competition.



THE 2019 ANNUAL OUTLOOK

76

FLNG Projects Tracked

There are numerous FLNG and FSRU projects in the planning stage. Not all will move to development. To sort the likely from the unlikely we developed a methodology to rate projects based on specific "success drivers".

130+

Exhibits & Infographics

The 2019 Annual Outlook contains over 55 exhibits and more than 70 infographics, so that you can easily visualize the market data being presented.

150+

Pages of Analysis

There are numerous FLNG and FSRU projects in the planning stage. Not all will move to development. To sort the likely from the unlikely we developed a methodology to rate projects based on specific "success drivers".

THE ONLINE DATABASE

We don't just provide a snapshot of the floating liquefaction and regasification sector. Our online fully searchable LNG database updates all of the project information on a 24/7 basis. As we receive new information about projects from our network of industry contacts, the database is immediately updated to reflect the latest situation.

Database users are able to select any combination of data about projects and export the data to excel for evaluation – or use the sorting and graphics provided with the database for making comparisons and benchmarking.

The FSRU database is a revolution in market insight, it provides real time analytics and information... Everything you need to stay informed of developments in the Floating Liquefaction and Regasification sector.

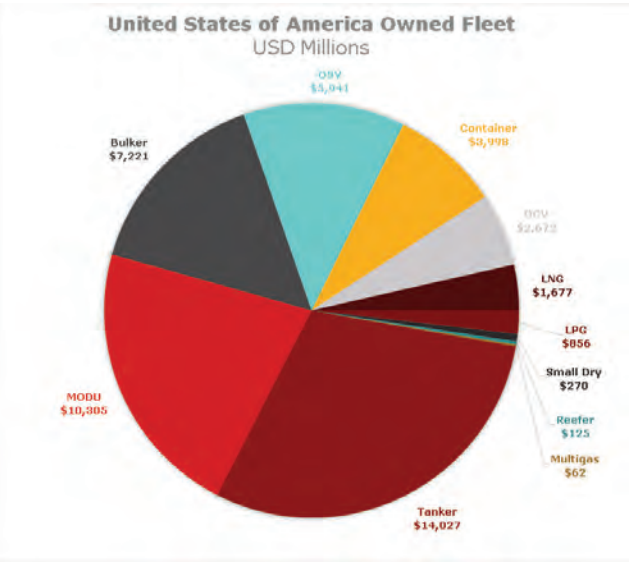
NO OTHER RESEARCH FIRM PROVIDES MORE INSIGHT INTO THE FLOATING LIQUEFACTION AND REGASIFICATION MARKET. CONTACT US TO LEARN MORE AT:

www.worldenergyreports.com

USA Owned Fleet by Value

Source: VesselsValue.com

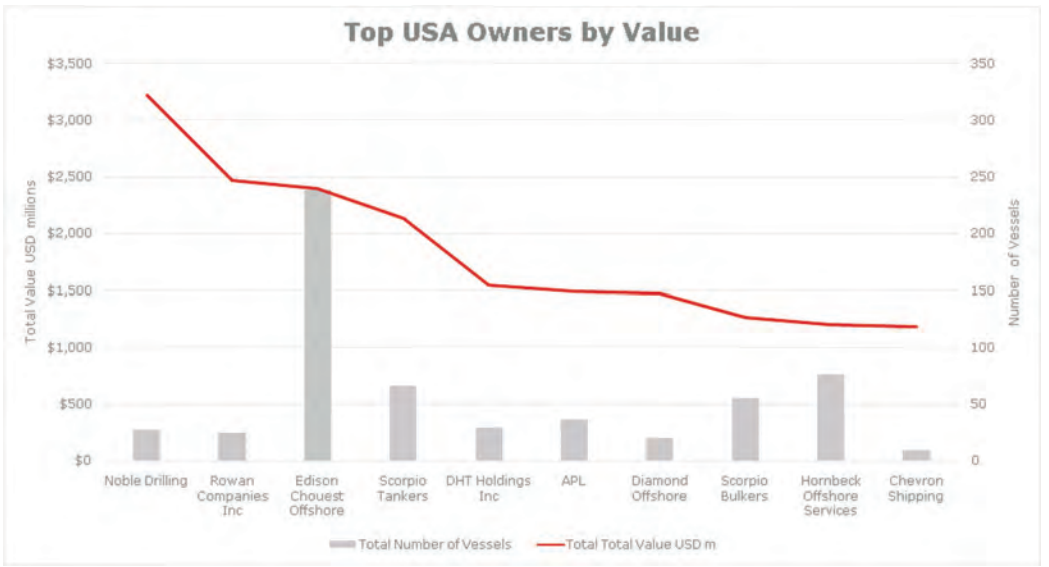
Type	Live		On Order		Total	
	# of Vessels	Value ($)	# of Vessels	Value ($)	# of Vessels	Value ($)
Tanker	448	$13,390	12	$636	460	$14,027
MODU	124	$9,494	5	$811	129	$10,305
Bulker	356	$6,178	23	$1,043	379	$7,221
OSV	1,295	$5,557	21	$385	1,316	$5,941
Container	159	$3,394	8	$604	167	$3,998
OCV	108	$2,342	5	$330	113	$2,672
LNG	14	$1,677			14	$1,677
LPG	9	$183	6	$673	15	$856
Small Dry	82	$223	4	$47	86	$270
Reefer	21	$125			21	$125
Multigas	2	$62			2	$62
Grand Total	**2,618**	**$42,625**	**84**	**$4,529**	**2,702**	**$47,154**



Top USA Owners by Value

Source: VesselsValue.com

Type	Live		On Order		Total	
	#	Value ($)	#	Value ($)	#	Value ($)
Noble Drilling	27	$3,225			27	$3,225
Rowan Companies Inc	25	$2,467			25	$2,467
Edison Chouest Offshore	231	$2,201	7	$198	238	$2,399
Scorpio Tankers	66	$2,132			66	$2,132
DHT Holdings Inc	29	$1,549			29	$1,549
APL	36	$1,488			36	$1,488
Diamond Offshore	20	$1,478			20	$1,478
Scorpio Bulkers	55	$1,268			55	$1,268
Hornbeck Offshore Services	74	$1,055	2	$144	76	$1,198
Chevron Shipping	9	$1,185			9	$1,185



Top USA Owners by Number of Vessels

Source: VesselsValue.com

Type	Live		On Order		Total	
	#	Value ($)	#	Value ($)	#	Value ($)
Edison Chouest Offshore	231	$2,201	7	$198	238	$2,399
Tidewater Marine	196	$975	6	$80	202	$1,055
SEACOR Marine Holdings	83	$246	4	$30	87	$277
Hornbeck Offshore Services	74	$1,055	2	$144	76	$1,198
Scorpio Tankers	66	$2,132			66	$2,132
GulfMark Offshore	66	$345			66	$345
Genco Shipping and Trading	64	$1,103			64	$1,103
Harvey Gulf Marine	61	$749	2	$101	63	$850
Scorpio Bulkers	55	$1,268			55	$1,268
Eagle Bulk Shipping	46	$652			46	$652

Jones Act Fleet by Value

Type	# of Vessels	Value ($)
OSV	916	$4,305
Tanker	63	$3,922
OCV	69	$1,740
Container	29	$902
Bulker	36	$169
Reefer	3	$54
Small Dry	10	$21
MODU	7	$17
Grand Total	**1,133**	**$11,130**

Top Jones Act Owners by Value

Type	# of Vessels	Value ($)
Edison Chouest Offshore	195	$1,898
Hornbeck Offshore Services	63	$1,008
American Petroleum Tankers	10	$904
Harvey Gulf Marine	63	$850
Kinder Morgan	6	$644
American Shipping Co	10	$594
Matson Navigation	19	$551
Marathon Petroleum Corporation	4	$451
Seabulk Tankers	9	$441
Otto Candies	21	$389

Top Jones Act Owners by # of Vessels

Type	# of Vessels	Value ($)
Edison Chouest Offshore	195	$1,898
Hornbeck Offshore Services	63	$1,008
Harvey Gulf Marine	63	$850
SEACOR Marine Holdings	44	$174
Adriatic Marine	24	$116
USA Government	24	$93
GulfMark Offshore	24	$121
Otto Candies	21	$389
Matson Navigation	19	$551
Crosby Tugs	18	$28

Source: VesselsValue.com

USA Owned Fleet Age Profile

Age Group	# of Vessels	Value ($)
On Order	84	$4,529
0-4	480	$19,669
5-9	609	$14,499
10-14	485	$4,917
15-19	366	$2,050
20-24	160	$462
25-29	56	$83
30-34	43	$235
35-39	165	$317
40-44	155	$204
45-49	47	$91
50-54	21	$22
55-59	13	$30
60+	18	$44
Grand Total	**2,702**	**$47,154**

Source: VesselsValue.com

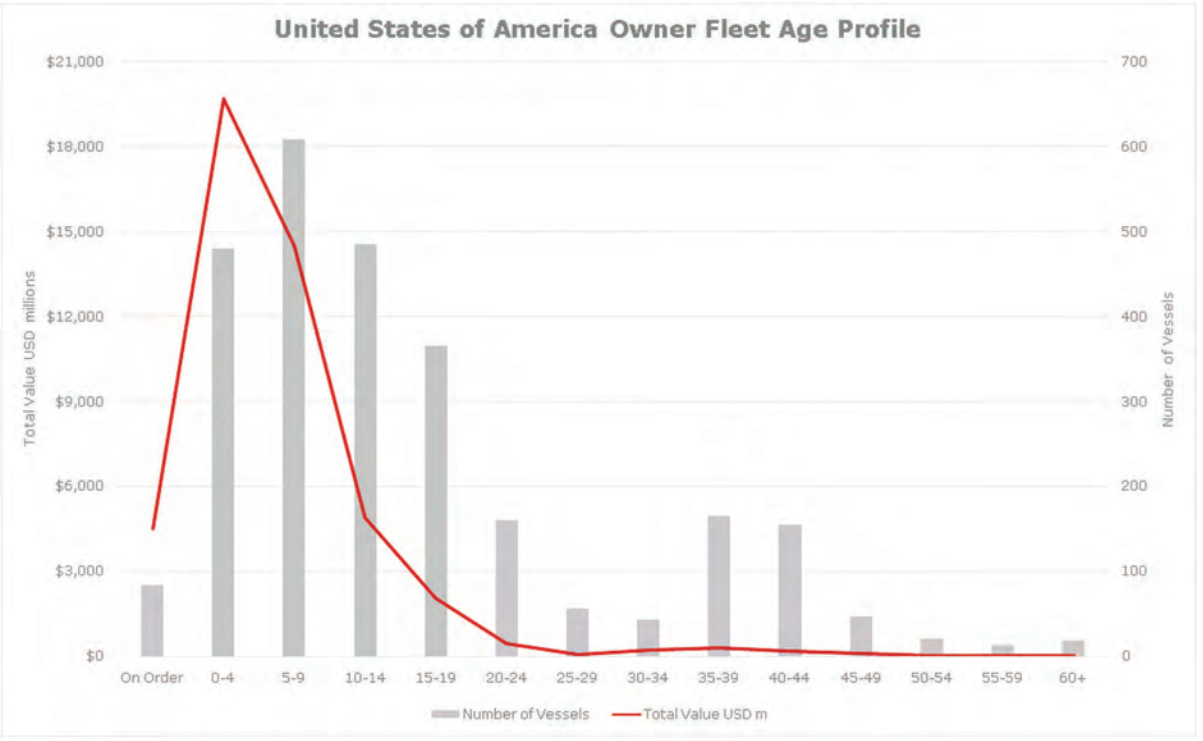


Image: Googlemaps.com

French Frigate Shoals

A canary in the coal mine

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French Frigate Shoals are located in the northwestern Hawaiian Islands, between Kauai and Midway. The atoll consists of a 20-mile long crescent-shaped reef, with thirteen coral and sand islands and the 120-foot high volcanic rock Perouse Pinnacle, named for French explorer Jean-Francois de la Perouse, who charted the atoll in 1786 and nearly grounded his two frigates. Tern Island is the largest, covering 105,276 square meters or 26 acres. Second largest is (or was) East Island, with 35,853 square meters or nine acres when last measured.

Native Hawaiians fished and hunted in the Shoals for hundreds of years. In the late nineteenth century, American and European entrepreneurs became interested in the possibility of mining guano on the islands, but that proved to be impractical. On March 4, 1942, the Japanese Imperial Navy used the Shoals to refuel two Kawanishi H8K 'Emily' flying boats from submarines. The large flying boats then flew to Oahu in an attempt to bomb Pearl Harbor. Due to heavy cloud cover and black-out conditions, one plane dropped its bombs near Roosevelt High School, shattering several windows. The other plane dropped its bombs offshore. Both planes then returned to base in the Marshall Islands. The US Navy then build an airstrip on Tern Island and the US Coast Guard operated a Loran Station there, providing navigation aid for Allied forces. In 1952, a more powerful Loran Station was established on East Island. The Coast Guard disestablished the station in 1979 and the facilities were converted into a field station operated by the Fish and Wildlife Service (FWS) to monitor bird and marine life in the Shoals.

In October 2018, Hurricane Walaka swept over the Shoals. It was one of the most intense Pacific hurricanes on record, a Category 5 storm with recorded winds of 160 miles per hour. On October 2, seven researchers on East Island studying Hawaiian monk seals and green sea turtles were evacuated by the Coast Guard. The hurricane struck on October 4. Low-lying East Island suffered a direct hit from the powerful storm surge and was completely destroyed with sediment scattered across coral reefs to the north.

While East Island in the French Frigate Shoals was not the first island lost to environmental degradation, its loss was dramatic due to its speed and visibility. Sea level rise had made it more vulnerable, but it was the intense hurricane, with its high winds and storm surge, which doomed the island.

Hurricanes world-wide have increased in intensity over the past 40 years, although their frequency has remained relatively stable. For the continental United States in the Atlantic Basin, models project an increase in the frequency of Category 4 and 5 hurricanes by the end of the century in excess of 40%. Warmer sea surface temperatures can intensify tropic storm wind speeds and cause both rapid intensification in strength and greater storm surge. Rainfall rates are also expected to increase due to faster evaporation of warmer sea water into the atmosphere. Combined, these increases in intensity can result in exponential, not additive, elevation in potential damage. Of the fifteen most expensive (in terms of property damage) hurricanes to make landfall in the United State, twelve occurred between 2004 and 2017 [property damage from 2018 hurricanes is still being calculated].

Storms are sometimes behaving strangely these days. In late September, a gale-force windstorm, called a 'Medicane' having formed in the Mediterranean and was named Zorba as it struck Greece and Turkey, causing considerable damage. On October 13-14, the remnants of Hurricane Leslie struck Portugal and Spain after days of wandering around the central North Atlantic. It was referred to by some as a zombie storm as it came back to life several times in its extended history. Hurricane Harvey in Texas in August 2017 was the wettest tropical cyclone on record in the United States. It dropped so much rain (upwards of 60 inches in Nederland alone) the National Weather Service had to add two new colors to its rain index. Other recent tropical cyclones are dropping more precipitation than normally expected. The number of super-typhoons in the western Pacific has reached unprecedented levels.

For years, Hawaii, located in the central Pacific, was considered to be located in a sweet-spot. Hurricanes forming to its east tended to track northeast toward Mexico and California, while typhoons forming to its west tended to track northwest toward the Philippines, Japan, and China. Four or five tropical cyclones form in the Central Pacific Basin each year, but few normally approach Hawaii. Between 1950 and 2017, only 14 hurricanes have passed within 200 nautical miles of the main Hawaiian islands. During 2018 though, two hurricanes (Lane and Olivia) made landfall on the main islands. Three others, including Walaka, passed the main islands just outside the 200 mile limit.

The October 2018 destruction of East Island in the French Frigate Shoals by the combination of higher sea level and increased hurricane intensity should serve as a warning. Not just population centers, but rural areas and natural resources, and not just those at or near the shore, are at risk from the increased intensity of these storms. When the storm signal is raised, batten down the hatches.

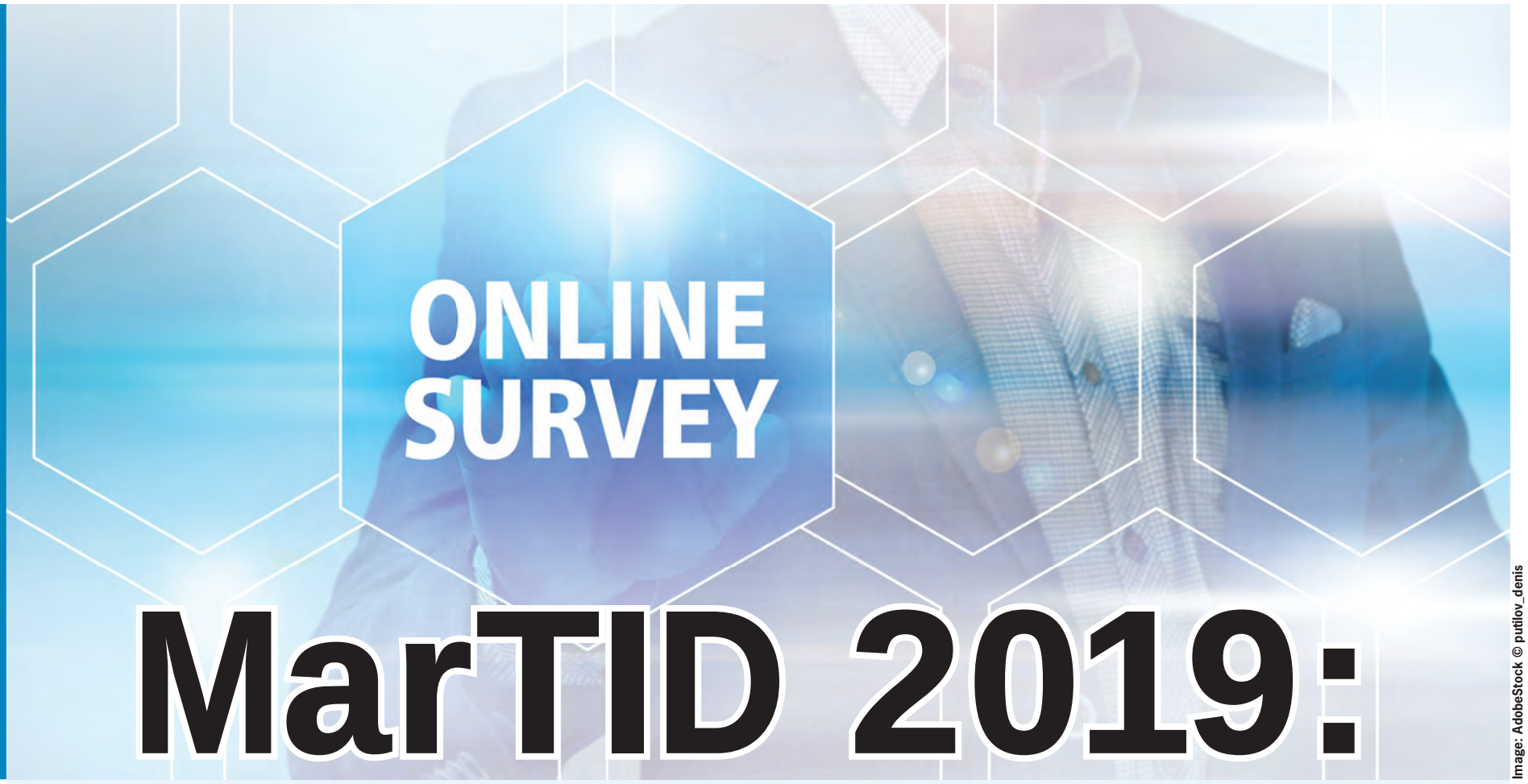


Image: AdobeStock © putilov_denis

MarTID 2019:

The Global Survey of Maritime Training Practices is Open

The second annual global Maritime Training Insights Database (MarTID) survey examines the impact of the autonomy trend in maritime operations on the training of future 'seafarers,' and as of November 26, 2018 the survey is officially 'open' for a period of approximately six weeks.

THE MARTID 2019 SURVEY

To facilitate a broader response, this year the MarTID steering group opted to both shorten the survey and to offer three, targeted versions: one for vessel operators, one for training institutions and one for seafarers.

- For Operators: https://www.surveymonkey.com/r/2019MarTIDOperator
- For Training Institutions: https://www.surveymonkey.com/r/2019MarTIDMETI
- For Seafarers: https://www.surveymonkey.com/r/2019MarTIDSeafarer

WHAT IS MARTID?

MarTID is a non-commercial, joint initiative of the World Maritime University, Marine Learning Systems and New Wave Media. Its core principles include ethical integrity, objectivity and confidentiality. It was launched in 2018 with the completion of the inaugural survey and publication of the 2018 Training Practices Report (which can be found at www.MarTID.org).

WHY IS MARTID IMPORTANT?

This MarTID initiative is the first of its kind in the world. There is broad agreement that roughly 80% of maritime accidents involve human factors causes. As such, vessel operators and maritime training centers are pouring significant resources into creating best practice and innovative training programs. The MarTID database will grow in breadth and depth annually with your participation, shining a light on the training approaches and successes of global vessel operators and training centers. Insightful, hard-to-get information inside the report include

- Global trends in training budgets?
- Average training amount spent per seafarer?
- Trends in training technologies and training models.

WHAT'S NEW FOR MARTID IN 2019?

The 2019 survey is designed to further the mission of MarTID 2018: to provide a global picture of maritime training that is not currently available. Last year's survey was designed to collect a broad set of foundational training data, this year's survey will be shorter and consist of two foci.

The first section of the survey will focus on collecting benchmark data tracked annually, revealing trends in core training issues. These include training budgets, training models, training staffing, the use of technology, major training initiatives, and seafarer demographics.

The second section will focus on this year's special topic: the impact of autonomous vessel operations on maritime training. This trend has already begun to impact operations and the need for training. The 2019 MarTID survey will explore the perspectives of vessel operators/managers, maritime administrators, maritime training experts and seafarers.

WHAT'S IN IT FOR ME?

As was the case in 2018, the 2019 survey will be followed by a series of publicly-available reports, broadly published. These reports will provide both high-level and deep-dive information covering both broad trends as well as deep coverage of the 2019 special topic. Although MarTID was founded and run by the three partner organizations, it requires community involvement to succeed. Your participation, approximately 20 minutes of your time, helps to broaden the depth of information.

- Vessel owner/operators will have a means to benchmark their own training initiatives.
- Maritime training institutions will be able to better gauge future needs.
- Seafarers will potentially have a clearer picture of evolving skills requirements.

TAKE THE SURVEY

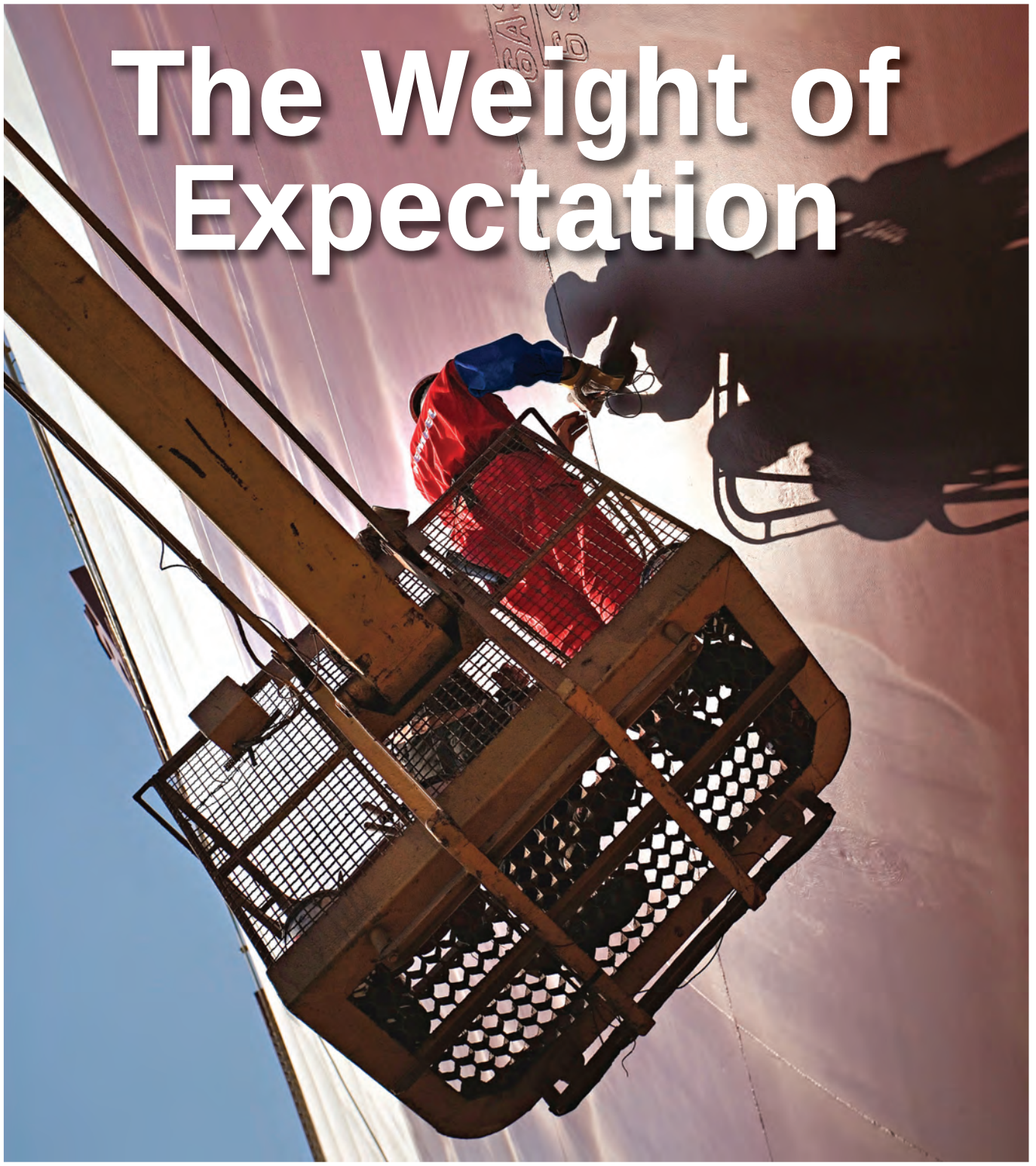
- For Operators: https://www.surveymonkey.com/r/2019MarTIDOperator
- For Training Institutions: https://www.surveymonkey.com/r/2019MarTIDMETI
- For Seafarers: https://www.surveymonkey.com/r/2019MarTIDSeafarer

Questions?

The MarTID partners are dispersed in several world time zones, and your question via email will likely be answered in 24 hours or (much) less.

Email: info@MarTID.org
Visit: http://scholar.wmu.se/martid

The Weight of Expectation



About the Author

Andreas Glud is the Group Segment Manager, Dry Dock for Hempel A/S.

The speed at which we live today has gathered significant pace since the smartphone has become ubiquitous worldwide as the essential tool for daily living. We have become accustomed to having what we want, when we want it and how we want it. For most of us, our use of digital technologies has infiltrated into every sphere of our lives – from how we communicate with each other to how we arrange our travel, pay for our lunch or exercise. We are, perhaps unwittingly, increasingly 'efficient' social beings. We have streamlined how we live, how we work, how we behave and consequently, our expectations as consumers and service users has also changed. We demand, perhaps above all else, efficient and cost-effective service provision.

Shipping operations, which are vital to the movement of 90 per cent of the world's goods, are therefore fundamental to just how efficiently and cost-effectively we can live. The pressure to drive down transportation costs, rightly or wrongly, then often falls at the feet of shipowners and operators, their charterers or ship managers who only have a handful of options for significantly lowering costs by increasing their own operational efficiency. In a highly competitive operating environment, further constrained by increasingly stringent

Photos: Hempel

and costly environmental regulations and unpredictably consumer demand, the weight of responsibility can drag even the most robust shipping business backward.

A burden of responsibility

This is why proactively seeking opportunities to enhance operational efficiencies, to reduce costs and build long-term sustainability into the framework of every vessel is now a pre-requisite for every savvy shipping company. To operate at optimal efficiency, ship operators and managers need to be able to carefully monitor and control the fuelling requirements, energy consumption and operational performance of each vessel. This requires tangible evidence of how a vessel operates against set criterion or key performance indicators (KPI's) and baseline measurements for the vessel, which can be compared over time and in comparison, with its equivalent competition.

More so, the insight is gained by analysing how performance is improved or inhibited by control factors such as the operating environment or the application of performance enhancing technologies. With eco-efficiency technologies for commercial vessels – which are designed to improve performance and reduce costs – data is key. This is very much the case with hull coating solutions.

Fouling can dramatically affect a ship's hydrodynamics and the frictional resistance from the roughness caused by slime on a ship's hull can result in an increase in fuel consumption. Shells, barnacles, oysters and mussels on the hull can lead to a huge drop of 18 per cent in efficiency (on average over five years), as the ship burns more fuel just to maintain a given speed. This problem is exacerbated on vessels with unpredictable trading patterns and longer idle periods.

Using intelligent software and working closely with coatings experts, long-term trends can be monitored using in-service KPI's to develop and deliver an optimum protective coatings solution for that vessel. Importantly, the empirical measurements that result can be utilised to showcase a vessel's performance to customers, financiers and other stakeholders; to show how a vessel stacks up against its competition. This data intelligence is evidence of the latent efficiency savings to be made.

Tracking progress

This is where Hempel, the global coatings manufacturer's, new hull performance system SHAPE (Systems for Hull and Propeller Efficiency) comes in. The system is founded on the ISO 19030 framework which defines a methodology to measure changes in hull and propeller performance and details a set of relevant performance indicators for hull and propeller maintenance. This process provides shipowners with extremely detailed and accurate information on the performance of their vessels – translating what is happening below the waterline into hard, empirical facts.

Six key stages comprise the SHAPE measuring and monitoring system. First, the vessel's individual speed power reference curves are established. This is followed by collecting in-service data which is then cleansed and purified to eliminate extreme operating conditions and the effects of environmental factors. Next, a precise speed loss calculation is performed. This is a critical measure for understanding vessel performance and fuel efficiency as power increase and speed loss are directly related. From this, the four KPIs are calculated:

- Dry docking performance – calculates the changes in hull and propeller performance over drydocking periods.

- In service performance – calculates the effectiveness of the vessel's hull and propeller solutions.

- Maintenance trigger – calculates the change in hull and propeller performance over a given period between drydocking and in-service use.

- Maintenance effect – calculates the change in hull and propeller performance before and after a maintenance event.

Delivering optimal efficiency

Following this in-depth analysis, Hempel can offer solid, valuable technical advice to the ship operator, advising them on the operational decisions they can take to positively impact their fuel efficiency and ensure best practice in vessel maintenance. This includes ensuring the right hull coatings are selected to optimise particular aspects of vessel performance, in line with the trading requirements of the particular vessel. This is very important, as not all hull coatings are created equal, nor will they deliver the same efficiency gains.

Hempel's Hempaguard® range, for example, is particularly suitable for vessels tasked with moving regularly between warm and cooler waters, and those which routinely switch between steaming at slow and regular speeds or sit idle. Hempaguard is an innovative fouling defence product containing 95 per cent less biocide than traditional antifoulings, but still offers outstanding resistance to fouling during idle periods (of up to 120 days). Hempaguard retains its effectiveness when steaming at slow or at regular speeds; and when alongside in port. This gives shipowners enhanced flexibility over their fleet utilisation.

The product provides these benefits through Hempel's patented innovative low friction Actiguard® fusion technology which integrates silicone-hydrogel and full diffusion control of biocides in a single coating. An innovation that can deliver a six per cent fuel savings across the entire docking interval and a maximum speed loss of 1.4 per cent over five years. With fuel costs set to increase for vessels burning low sulphur fuels from 2020, this amounts to a considerable reduction in fuel bills – and optimal efficiency in service delivery for customers who expect to receive what they want, when they want it, and exactly how they want it.

Addressing the Elusive Issue of Comfort Onboard

About the Author

Enrico Della Valentina is senior project manager for the Yacht team at MARIN. MARIN offers simulation, model testing, sea trials and training to the shipbuilding and offshore industry and governments.

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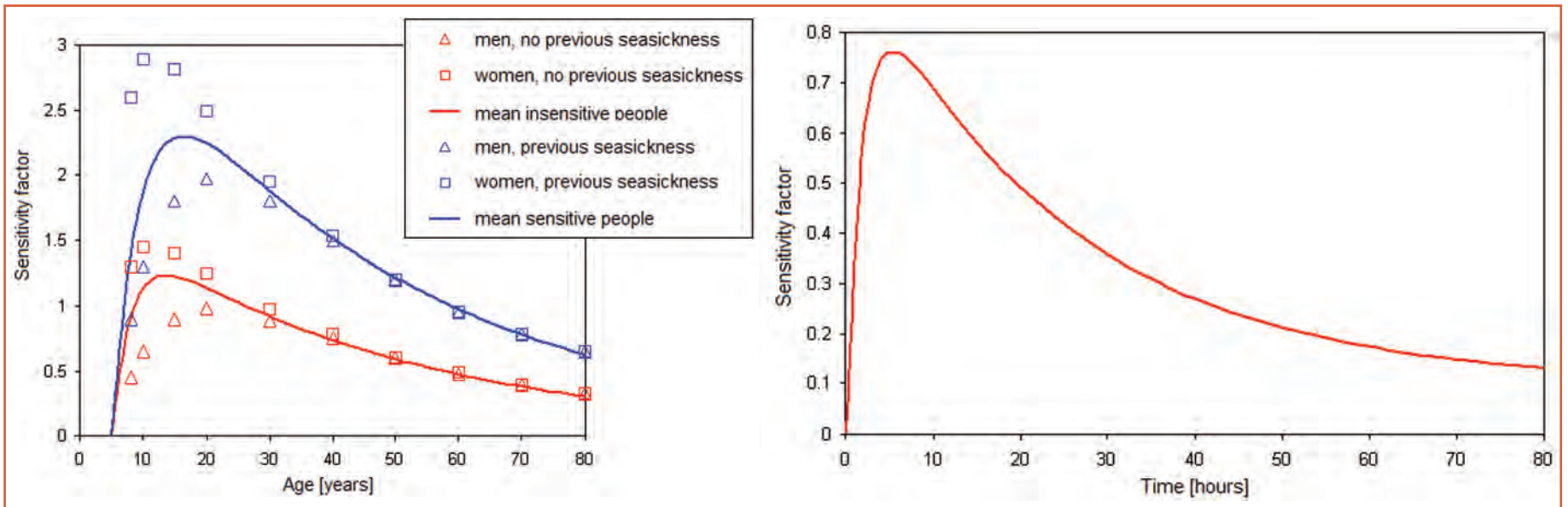


Figure 1/2: Seasickness sensitivity factor as function of age (left); sensitivity factor as function of exposure (right)

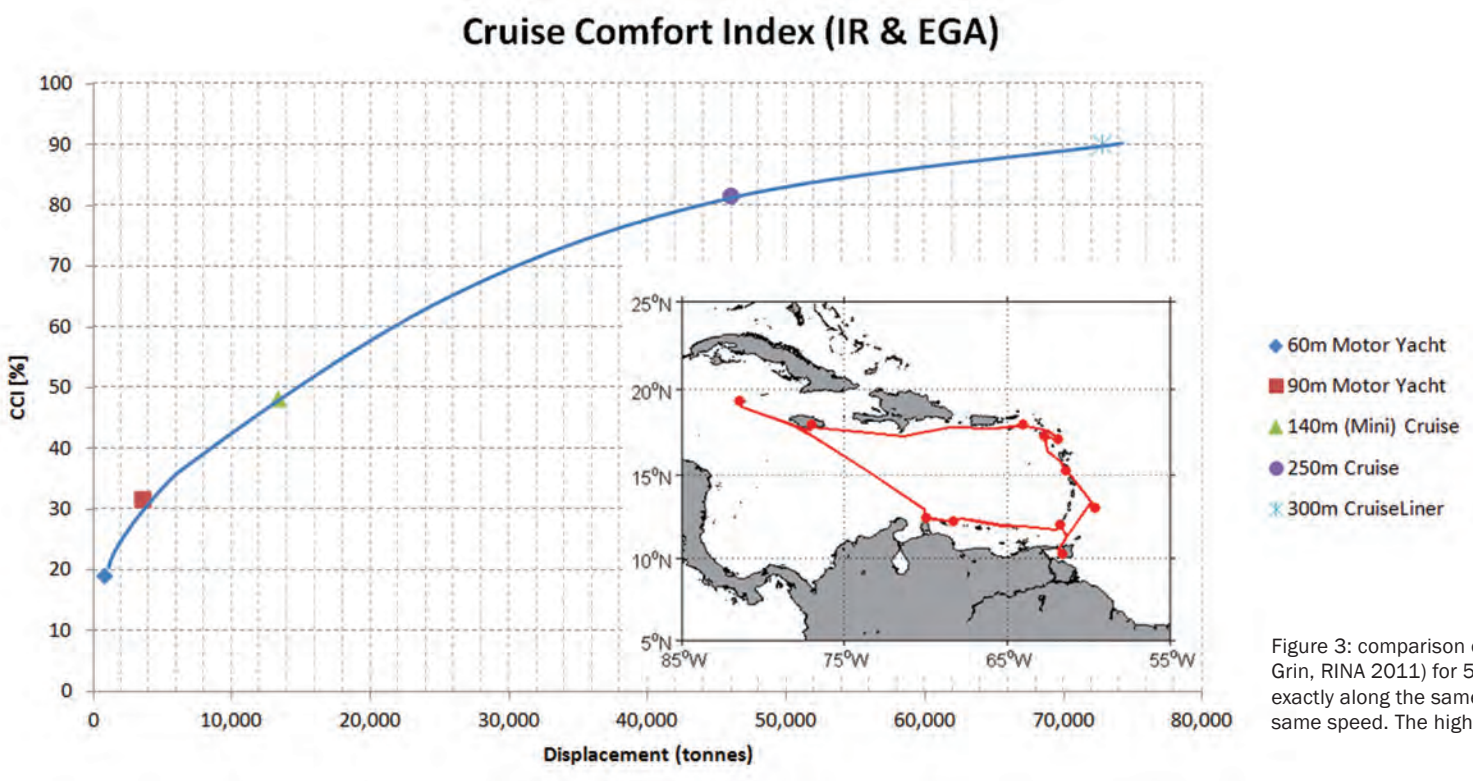


Figure 3: comparison of Cruise Comfort Index (R. Grin, RINA 2011) for 5 vessels of different size sailing exactly along the same route at the same time, at the same speed. The higher the CCI the better.

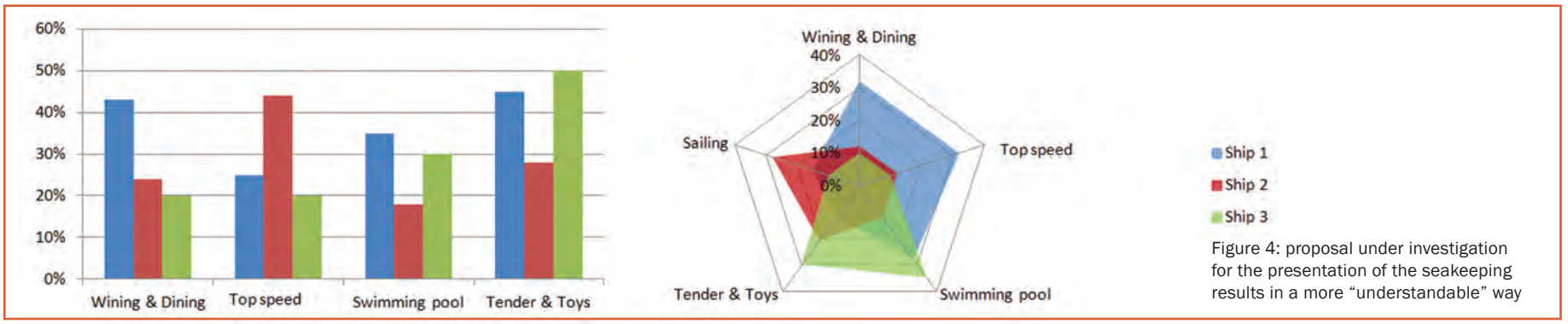


Figure 4: proposal under investigation for the presentation of the seakeeping results in a more “understandable” way

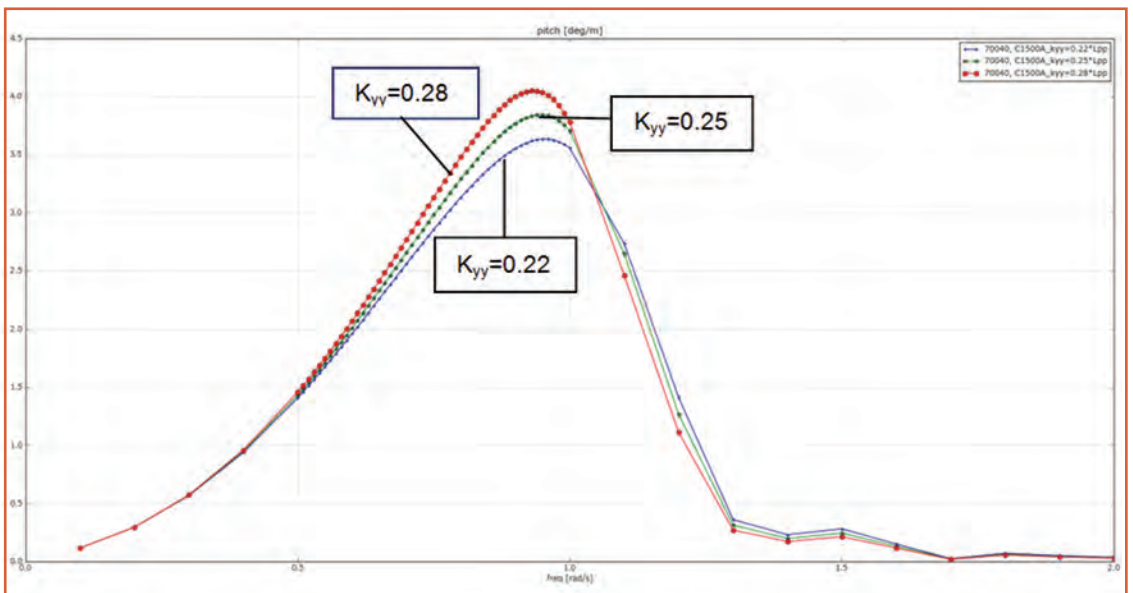


Figure 5: RAO of pitch response for different radii of inertia (kyy) for the upper most hull of figure 5 (H = 180 deg, Hs = 3.0 m, Vs = 12 kn)

In a world that brings pretty much anything to you at the press of an app, we are often asked why it is so difficult to assess comfort onboard a yacht.

That the assessment of comfort onboard is not an easy task is also shown by the fact that there is no industry standard as yet. This problem has already been identified by the International Organization for Standardization and a new working group (ISO (TC8/SC12/WG 5 AWI 22834) led by MARIN is aiming to develop a comfort standard for yachts in the next three years.

ISO Comfort standard

On a parallel track, MARIN has initiated the dedicated Joint Industry Project “Comfort”, which will develop tools, and obtain and analyse data related to comfort levels. This JIP aims to obtain comfort criteria that not only give a numerical value but also include the human interpretation of this comfort level. These criteria can then be applied when designing new ships.

After many years of research we know that a ship’s size does matter (the bigger the better), that the longitudinal weight distribution (figure 4) plays a more important role than the shape of the bow (figure 5), and that men and women react to the same stimuli in different ways and that this changes with age. We also understand that the most “comfortable” area is often located at a third of the ship’s length from the stern.

New frontier

There is more understanding about the important role the ship’s parameters play and about which actions the captain should take to make the yacht more comfortable. The new frontier of MARIN’s research is combining our hydrodynamic knowledge with active control systems and onboard advisory tools to assist with the comfortable operation of a yacht.

Figure 6: Hull forms used to evaluate the influence of a bow shape on the general seakeeping behaviour of a yacht

Stabilisation systems have become the “most wanted” system onboard, but which one is the most suitable one for a specific yacht? Despite the fact that we are able to numerically and experimentally reply to these questions, we recognise that certain concepts need further explanation and research.

We feel it is our duty to keep researching the contributions of ship motions and accelerations. As mentioned, we have already launched the Comfort JIP and as a “teaser” we have started to develop an application named “Comfort Mate”, which will become available to all participants. Contact us when you would like to participate in our research to achieve optimal comfort at sea.

Deciphering the Autonomous Vessel Debate

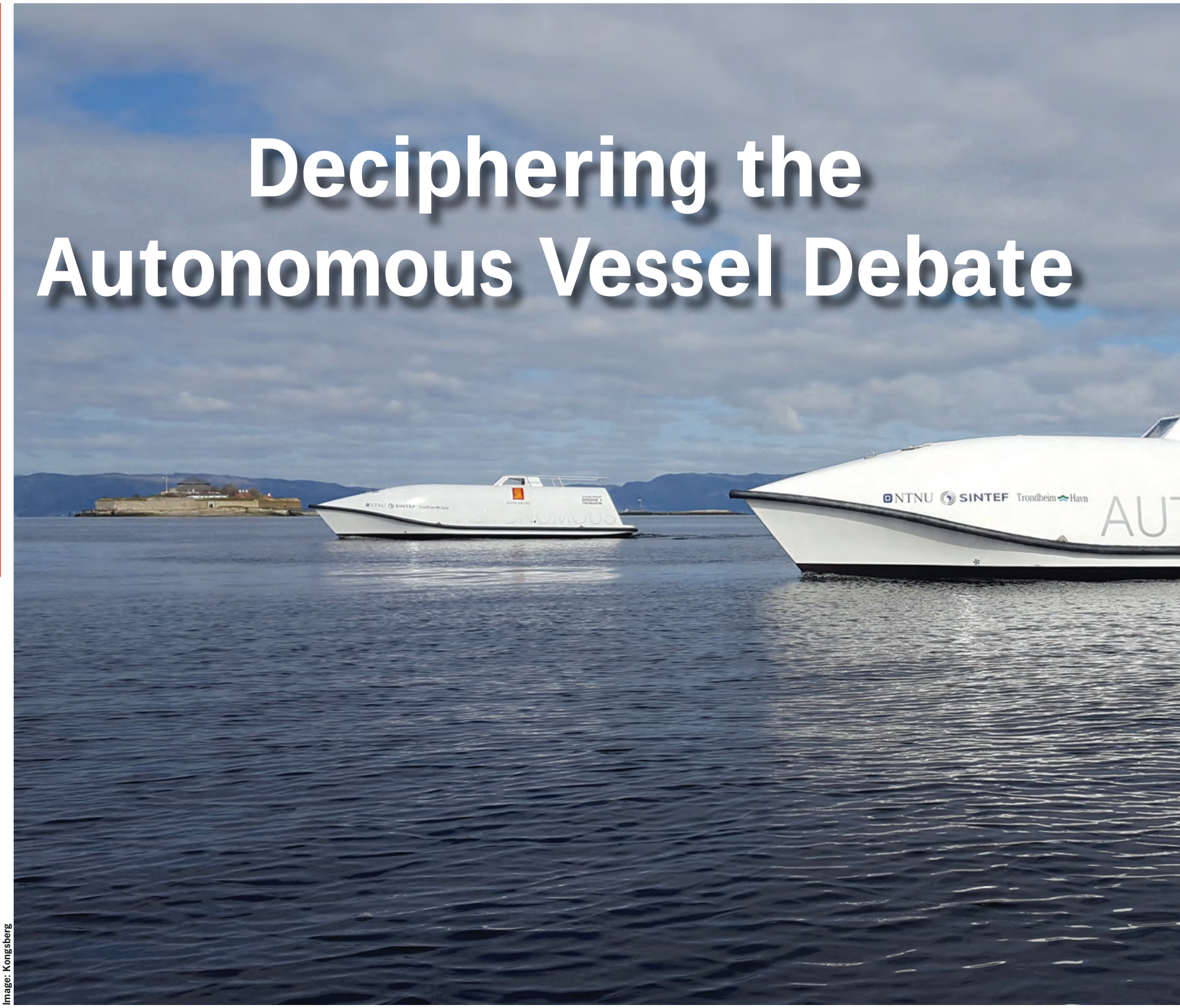


Image: Kongsberg

Confusion reigns in the ongoing debate on autonomous and remotely operated vessels. Before constructive dialogs can take place, the parameters of the discussion need to be agreed upon. Bottom line: in order to understand each other, we need to be speaking the same language.

There are two recent publications that I strongly advise all maritime professionals review, as they offer valuable guidance and insight into this rapidly developing segment of the Marine Transportation Industry.

The first is a study prepared by HSBA Hamburg School of Business Administration for the International Chamber of Shipping. The paper, which was published in October of 2018, focuses on the potential social and practical consequences of autonomous shipping and digitalization on seafarers.

The second is a DNV GL Class guideline — DNVGL-CG-0264. Edition September 2018; Autonomous and remotely operated ships, which provides guidance for:

1) Safe implementation of novel technologies in the application of autonomous and/or remotely controlled vessel functions;

2) Recommended work process to obtain approval of novel concepts challenging existing statutory regulations and/or classification rules.

The overall intention of the DNV paper is to provide a framework to ensure that the application of such novel concepts and technologies result in a safety level equivalent to – or better than – conventional vessel operations.

From Marine Insurance and Loss Control standpoints both of these publications provide important guidance and raise valuable points of discussion. They provide different viewpoints of how to evaluate and address these new technologies into existing operations, and more importantly how to interface with the current tasks, duties and responsibilities of current shipboard crews.

The DNV GL Guideline addresses the Build and Integrate Phase, while the ICS Study addresses the current status of Autonomous Shipping by acknowledging that all means of transportation are undergoing accelerated development toward automation and automated movements. One key issue the ICS Study addressed is the need to understand that "autonomy" is not necessarily "unmanned"; however we will see more autonomous operations aboard a ship. A key to understanding this is to review the Lloyds Register "ShipRight" Procedure guidance, particularly the six Autonomy Levels (AL 1 to AL 6). In brief, these range from AL 1 with "On-board Decision Support with all actions taken by human operator, but decision support toll can present options." To AL 6 with "Fully autonomous with unsupervised opera-

About the Author

Captain Andrew Kinsey, Senior Marine Risk Consultant, Allianz Global Corporate & Specialty

tion." This is just a starting point, and there are other definitions in use.

In addition, the IMO is developing its own definitions and methodology to review degrees of autonomy. Meanwhile, the DNV GL guideline provides a list of "Potential Minimum Risk Conditions" as well as a "List of Potential Autoremote Functions". Both of these lists are important because they serve to highlight the vast array of scenarios and functions that are at play, especially for emergency operations.

While these two documents may appear to be quite dissimilar, combined they do a very good job of capturing both the near-term and long-term challenges that Marine Insurers, and our assureds, are facing. How do we implement this new technology in a way that maximizes the benefits while minimizing the risks? At the same time, how do we both effectively utilize our existing shipboard manpower and continue to attract trained and motivated crews in the future?

A key to understanding the current landscape is to understand that **this will not be an all or nothing approach. We will see hybrid approaches to marine operations** *that will both address vessel safety and fit within global regulations. From an insurance standpoint, our goal is to help ensure safe and efficient vessel operations both now and in the future.*

The ICS Study addresses a crucial point on human capital that was raised recently in the 2018 AGCS Safety and Shipping Review:

"The most frequent source of errors and cause for accidents are reported to be human failures. However, it would be trivial to assume that the human element is about failure. Countless safe voyages and avoided accidents are due to the positive contribution of humans. Humans on board enable ships to sail, they are not a problem. It must also be considered that autonomy will never completely remove "human error" as it will purely be shifting it to other areas such as the shore based controllers and the hardware and software designers. Some could argue this may result in a potential increasing likelihood of human error as these people would have considerably less maritime experience making them potentially more risk prone.

Human capital is better invested to enhance productivity by interpreting data, avoiding repetitive tasks and reducing the impacts of human error on productivity."

When shipboard systems are evaluated for potential implantation of this new technology they should be subject to a standardized evaluation, qualification and approval process. This will take both time and money. In the meantime, global commerce shows no sign of slowing down and goods will continue to move in the traditional manner. However, these traditional manners of shipping will also be undergoing change, albeit at a slower pace.

One key area where we see tremendous immediate potential is the use of a networked environment between vessels. In this environment, we can utilize the data from a Voyage Data Recorder (VDR) of a vessel that has successfully completed a Northern Sea Route transit to other vessels that are planning the same voyage. It is now commonplace for investigators to utilize VDRs in accident investigations. Isn't it time we start utilizing data from voyages that are successful?

Moving forward, all sectors of marine transportation will face economic pressures from a myriad of factors. Be it environmental change or business pressures from the rise of non-classical shipowners, all aspects of marine operations will need to adjust to new data centric business models; this will include both shipboard and shore side operations. Given all these drivers of change, it is inevitable that the job description of the future seafarer will change, but it is unlikely that the job will cease to exist.

THE VISION OF AUTONOMOUS SHIPPING

Image: Rolls-Royce Marine

About the Author

Jussi Siltanen is Product Manager at NAPA Safety Solutions. He currently oversees the management of NAPA's on-board solutions for stability and safety.

The end of 2018 provides an excellent opportunity to highlight some of the measures that have been taken by the maritime industry over the past year to develop a better understanding of autonomous shipping. A drive towards autonomous shipping has been embraced by many major players such as Rolls Royce and Wärtsilä, and this has led to numerous new strategies, visions, and projects that are pushing the boundaries of technological innovation. It's no longer a matter of whether technology can achieve this next step, but rather how the technology is used to accomplish it, and what we need to do as an industry to ensure that autonomous operations are safe and efficient.

Autonomous shipping has evolved tremendously in recent years. To take a local example for me, in Finland the government decided in 2017 to support an initiative called One Sea, which aims to operate autonomous maritime ecosystems by 2025. In addition, ÄlyVESI - Smart City Ferries has started working on a project that will eventually provide the foundations for the class requirements for autonomous vessels.

With numerous development projects currently underway, we're going to see models that will feature differing levels of automation and autonomy. These prototypes will ultimately work towards generating a practical autonomous vessel suitable for daily tasks within the shipping industry.

The interest in autonomous shipping was evident at the recently concluded Society of Naval Architects & Marine Engineers (SNAME) conference, where I delivered a presentation on autonomous ships that explored the importance of stability; a factor that is crucial for any ship. In this article I will go beyond that and also examine the evolving regulations, design, and technology within autonomous shipping. These key areas will all need to cooperate in order to produce the best possible outcome.

The Regulations

The technical boundaries to autonomous shipping are, by and large, less formidable than the regulatory ones. The work to change this, however, has begun. The 99th session of the Maritime Safety Committee took place in May 2018, which officially commenced work on addressing a regulatory framework and will continue to take place during the following four sessions until mid 2020. The committee is also focused on safety, secure and environmentally sound Maritime Autonomous Surface Ships (MASS) operations. MASS has been defined as a ship which, to a varying degree, can operate independently of human interaction.

The current international maritime regulation on ship stability is largely stipulated with the assumption that a ship is manned and based on the SOLAS Chapter II-1 titled "Construction – Structure, subdivision and stability and stability, machinery and electrical installations". However, some requirements for building a safe ship in terms of stability will still apply for unmanned ships such as double bottom.

The autonomous industry will also have to contend with the fact that the speed of technological developments is outpacing global regulatory development, as seen in the length of time it has taken to sustain clear 2020 sulphur cap guidelines. Many national regulators have encouraged the shipping industry to trial autonomous or remote controlled ship operations within national waters, which is a positive initiative. This has led to many countries developing their own regulations during the initial trial stages. However, in the long run cooperation is needed between different countries to ensure consistent regulations are in place.

The Advanced Autonomous Waterborne Applications Initiative

One example of research that has been conducted is the AAWA initiative - or Advanced Autonomous Waterborne Applications. From February 2015 – June 2017, a joint industry and academic research project on autonomous ships gained funding for €6.5 million from the Finnish Funding Agency for Technology and Innovations. The project sought to analyse different scientific challenges related to autonomous ship operations; technology needs, risks, incentives and regulations/liabilities. It was through this initiative that autonomous and remote operations for ship navigation, machinery and all on-board operation systems could be developed. Rolls Royce and other leading industry players, including NAPA, DNV-GL, Deltamarin, and Inmarsat led the project, and the research partners included Aalto University, Tampere University of Technology, Åbo Akademi University, and VTT technical Research Centre Finland.

The first phase of the AAWA initiative concluded that hybrid variations between remote and autonomy solutions will happen. However, as previously mentioned, the technology to make ships autonomous current exists, but much still needs to be done to ensure it is reliable.

For example, autonomous ships may reduce the risk of human error given there's no crew, but new types of risks will be created, and this means that vessels will need to be as safe as existing ships, possibly even more so. A great amount of work is still needed to address the risks with new or adapted technologies. A major topic that was addressed in the AAWA initiative was marine situational awareness and autonomous navigation. At present, a pair of human eyes and ears is currently used as the main sensors for decision-making and operations, whether a ship is equipped with digital sensors or not.

This means that a logical starting point is to analyze the current extensive portfolio of sensor products onboard ships to assess whether they are available and suitable for automation - why focus on developing new products if a suitable product already exists?

What are the next steps? Technological solutions will need to be analyzed in greater depth to understand new risks, legal challenges and the stakeholders involved in autonomous operations. Ultimately, change is possible, but political willingness is needed, and liability issues need to be addressed.

This initiative's actions triggered a clear understanding that stability will remain vital regardless if a ship is autonomous or not.

Autonomous Shipping Stability Management

Stability management remains a critical part of the design process whether it is for a manned or autonomous vessel. Designers will need to start understanding new technologies, such as sensors, big data and artificial intelligence if more decisions are taking place ashore. New tools, software for monitoring stability, longitudinal strength and movement may also be considered by maritime professionals. It will be important for them to look beyond the current processes of ship design and consider the impact of autonomous operations.

Stability computers, which typically process data for up to 200 sensors sources, will also have a greater impact due to the significant increase in the number of sensors being used due to the autonomy on the ship. This will create better situational data and predictions being processed, with the possibility of introducing increased monitoring for weather, cargo displacement, and other technical areas. NAPA Fleet Intelligence is a present day example of allowing onboard software to help monitor and improve a ships performance. This can then be analyzed from ashore using cloud based software; which increases awareness of forecasted weather along the sea passage, optimizes the ships performance, and increases cargo and ship safety. All of these are the ultimate functioning goals and processes of an autonomous vessel or remote controlled ship. This kind of onboard technology has helped pioneer automated and reporting for monitoring ships.

The stability computer will also become the base for providing stability solutions and making plans automatically based on the supplied data from these sensors - once again highlighting the fact that a stability officer and crew will not be needed on-board. However, alternatively, different scenarios from the computer could be transferred via the cloud to shore, leaving the decision making to a shore-based team.

The Design

The original design of autonomous ships is still in its infancy, as progress is continuously made on the technology side. However, naval architects are considering numerous factors and studies to understand how it will affect ship stability and safety. For example, autonomous vessels designs do not need to factor in crew spaces, control rooms and bridges, but must be adapted to suit automated operations and alternative propulsion systems instead. Naval architects will also need to ensure that autonomous vessels are fit for purpose, which is why development is focused on smaller vessels, rather than passenger vessels to begin with, as there will be less associated risks.

A new design need is also emerging; rather than the ship itself, this one focuses on the requirement for the design of land-based centers for controlling ship operations, as these may differ slightly from normal fleet operations centers. This highlights, once more, that the autonomous shipping industry will need time to determine best operational practices.

Where Next?

With research and simulations now transitioning to trials with existing and new solutions, the future of autonomous shipping is slowly but surely progressing. Stability solutions will be one section of a vast network for operating autonomous vessels, and solution providers as well as shipping companies will still need to work on increasing the level automation and intelligence in decision making in order to aspire for totally machine-controlled vessel. Ultimately, autonomous shipping will start to redefine the maritime industry.

Striving for perfection:

new engines to meet new demands

Marine engine manufacturers are not just responding to but are anticipating tighter performance demands from the U.S. EPA and the IMO by introducing both new and upgraded systems based on state-of-the-art propulsion technologies. Tom Mulligan reviews the latest engine product launches.

AIP FOR MAN CRYO LIQUID HYDROGEN FUEL-GAS SYSTEM

MAN Cryo, a subsidiary of MAN Energy Solutions, has developed a marine fuel-gas system for liquefied hydrogen in cooperation with Fjord1 and Multi Maritime 0f Norway .

Multi Maritime's hydrogen vessel design for Fjord1, including the fully integrated 'MAN Cryo – Hydrogen Fuel Gas System,' which was granted preliminary approval in principle, "AIP," by the DNV-GL, significant in that the system is the first marine-system design globally to secure such an approval.

"As a solution for vessels employed on relatively short maritime routes, such as ferries, this technology is a world-first," said Dr. Uwe Lauber, CEO, MAN Energy Solutions. "Hydrogen is a clean fuel whose profile fits perfectly with the general desire within the industry to move towards cleaner technology."

MAN CRYO, in cooperation with Fjord1 and Multi Maritime has developed a marine fuel-gas system for liquefied hydrogen.

Image: MAN Cryo

The operational compliance of Baudouin Advanced Engines with the latest IMO and EPA standards is achieved through the use of an innovative Selective Catalyst Reduction (SCR) system on offer from the company.

Image: Moteurs Baudouin

MAN Cryo developed the Liquid Hydrogen Marine Fuel Gas System design in-house at its headquarters in Gothenburg, Sweden. The system has a scalable design that allows easy adaptation for different shipping types, sizes and conditions. The design is suited for both above- and below-deck applications, offering ship designers the flexibility to optimise their designs in relation to efficiency, and to cargo or passenger space.

Liquefied hydrogen has a temperature of -253° Celsius and is one of the coldest cryogenic gases there is, which places system components and materials under extreme stresses. Another design challenge was hydrogen's explosive nature, with the MAN Cryo engineering team accordingly placing top priority on safety. Once liquefied, hydrogen is reduced to 1/800th of its volume, compared to that of its gas phase, facilitating a more-efficient distribution. As a fuel, hydrogen does not release any CO2 and can play an important role in the transition to a clean, low-carbon, energy system. Liquefied hydrogen can be used to charge batteries for electrical propulsion via fuel-cell technology.

www.man-es.com

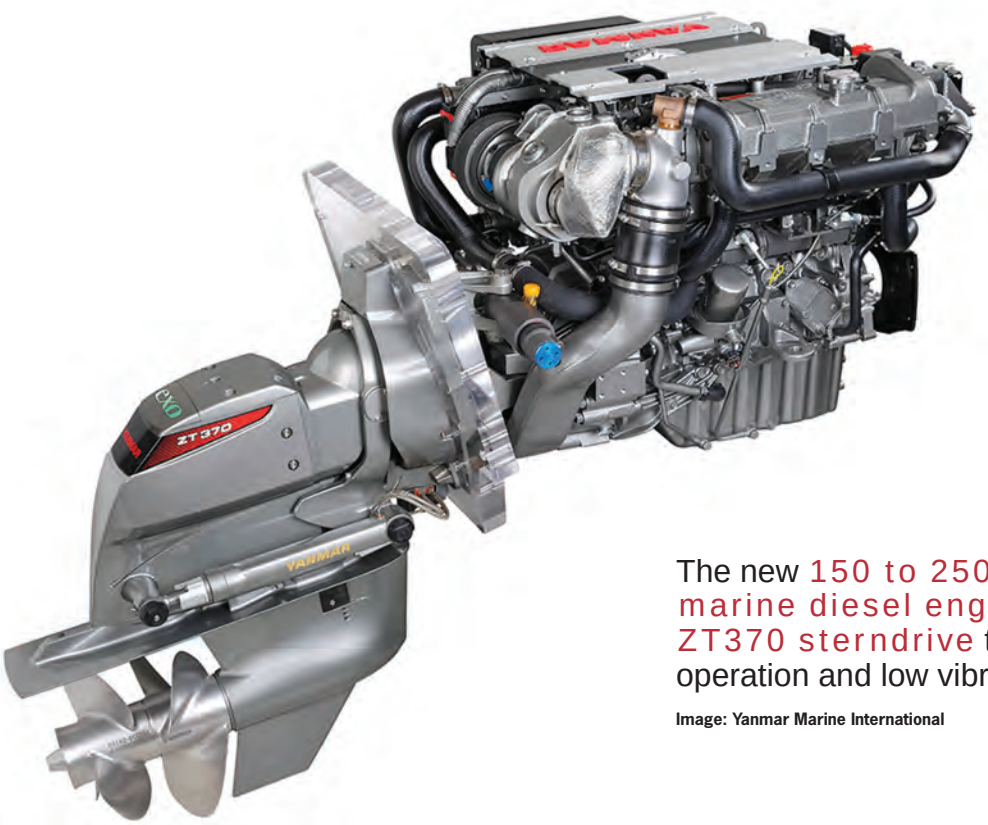
SCR SYSTEM FOR BAUDOUIN ADVANCED ENGINES

Cassis, France-headquartered Moteurs Baudouin is offering an innovative Selective Catalyst Reduction (SCR) system on its range of Advanced Engines to enable compliance with the latest IMO and EPA standards including the IMO's 2016 demand for further reductions of NOx emissions in some areas of the world. The company's Advanced Engines with SCR offer a cleaner engine without compromising on power, the company claims, with an up to 2% reduction in average fuel consumption and up to 25dB noise reduction, all with a compact, modular design. The Baudouin SCR system is small, light and flexible, thereby reducing costs and space requirements while maximizing product reliability.

Engine system designers can choose to place the tank, pump and cabinet up to 60 meters away from the catalyst and the system can be installed over the gearbox, over the engine, or in a stand-alone configuration which gives freedom and flexibility for both newbuilds and repowering projects.

Moteurs Baudouin is owned by Chinese company Weichai Power Co. Ltd. and as well as its French facility has additional manufacturing based in Weifang, Shandong Province, China and product sales and servicing available in more than 130 countries worldwide, across six continents.

www.baudouin.com



The new 150 to 250 mhp five-engine 4LV sterndrive marine diesel engine range combines with the YANMAR ZT370 sterndrive to offer high acceleration, fuel efficiency, quiet operation and low vibration to suit a wide variety of vessels.

Image: Yanmar Marine International

ROLLS-ROYCE BATTERY SYSTEM POWERS MARINE PROPULSION

Rolls-Royce has launched a new lithium-ion-based energy storage system to provide shipowners with a complete clean, safe and cost-efficient system that includes intelligent power control. The company has been delivering energy storage systems since 2010, however the actual energy storage units were previously supplied by an external party and the company is now offering its SAVe Energy system, a cost-competitive, highly efficient and liquid cooled battery system with a modular design that enables the product to scale according to energy and power requirements. SAVe Energy complies with international legislation and regulations for low- and zero-emission propulsion systems.

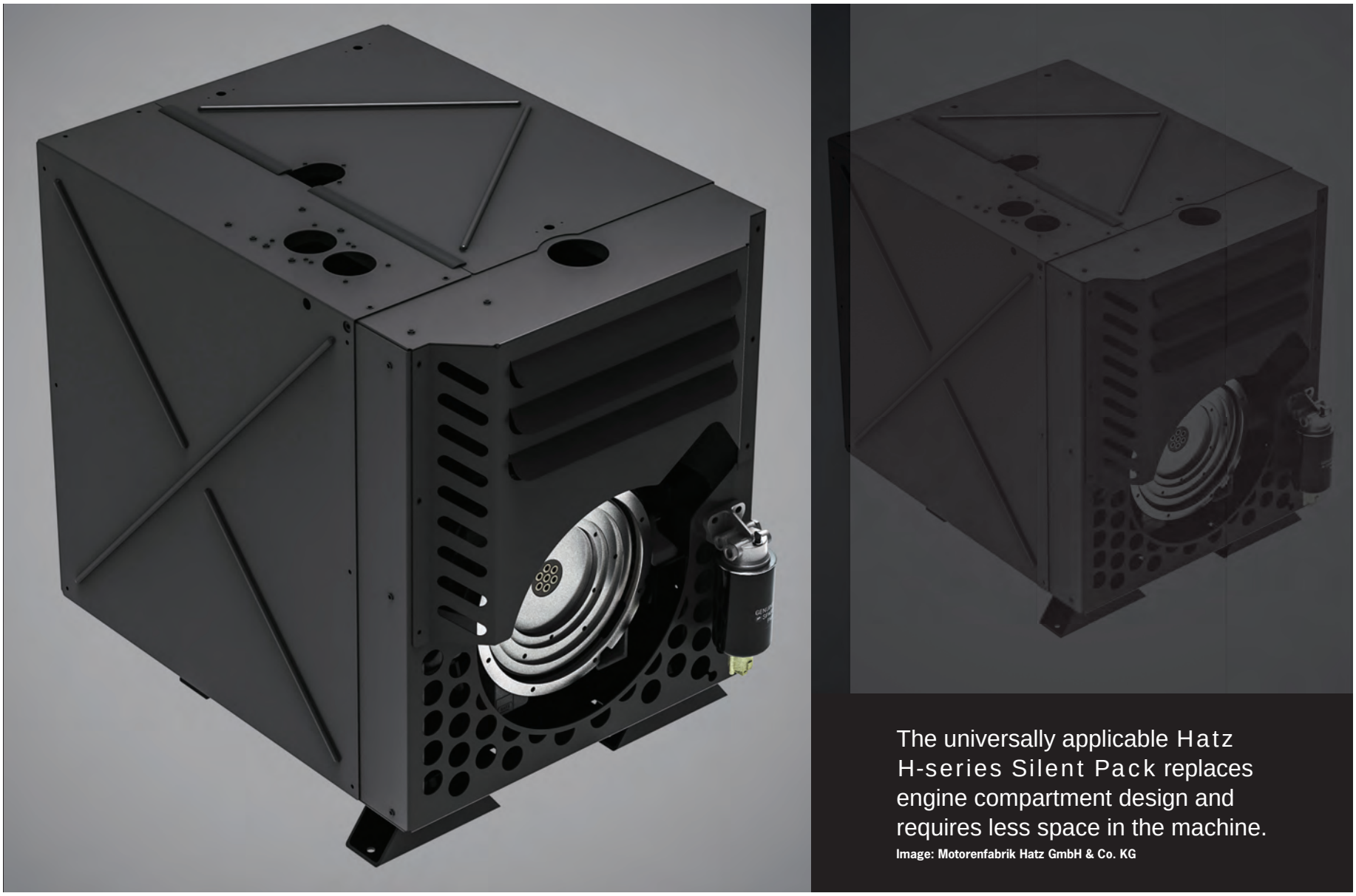
The development of the system was partly funded by the Norwegian Research Council of Norway's ENERGIX program. Three shipowners, Color Line, Norled and the Norwegian Coastal Administration Shipping Company, were partners in the development, ensuring that the energy storage system covered a wide variety of marine applications, including ferries, cruise vessels and multipurpose vessels.

SAVe Energy is delivered from the Rolls-Royce Power Electric site in Bergen, Norway as part of the company's offering of complete ship systems. The potential deployment of the patent-pending SAVe Energy system in 2019 is estimated to be in the 10-18 MWh range.

SAVe Energy can be applied to several areas, including peak shaving, spinning reserve and battery-powered vessels. Combined with an LNG- or diesel-powered engine in a hybrid solution, it will increase efficiency and reduce emissions, and can be coupled with most types of propulsion units. In a hybrid set-up, SAVe Energy handles the peak load, while the main power generators will relate to the average load and not reduce the propulsion units' thrusting capabilities.

SAVe Energy is classed as an Energy Storage Unit system (ESU), and was recently class-approved by DNV GL, confirming that it had been developed in compliance with the newest 2018 rule-set, and is acceptable for installation on all vessels classed by DNV GL.

www.rolls-royce.com/products-and-services/marine



The universally applicable Hatz H-series Silent Pack replaces engine compartment design and requires less space in the machine.
Image: Motorenfabrik Hatz GmbH & Co. KG

YANMAR LAUNCHES 4LV STERNDRIVE COMMON-RAIL DIESEL ENGINES

YANMAR MARINE INTERNATIONAL has launched a full line-up of 4LV sterndrive marine diesel engine models to complete its 4LV series of ultra-refined common rail (CR) engines. The new 150 to 250 mhp five-engine range combines with the YANMAR ZT370 sterndrive to offer high acceleration, fuel efficiency, quiet operation and low vibration to suit a wide variety of vessels.

Complementing the YANMAR 4LV inboard engine range introduced earlier this year, the corresponding 150Z/170Z/195Z/230Z/250Z mhp sterndrive models feature the latest in electronically-managed CR fuel injection systems and the next-generation system uses Thermo Swing Wall Insulation technology to provide maximum thermal efficiency, leading to more complete combustion and more efficient fuel consumption, torque and lowered emissions. The 150 to 250 mhp power range marine diesel engines are all based on an identical engine block with the same dimensions and weight, making it easy for boatbuilders to install various options.

The new models are fitted with the YANMAR ZT370 sterndrive with hydraulic multi-disc clutch for smooth and quiet gear engagement, plus a standard EXO hard-anodization coating to provide protection against corrosion. Ensuring optimal performance for a range of boats for recreational and light-duty commercial applications, the ZT370 sterndrive is available in various gear ratios. Other features include precision-forged gears with extra-long service life, the choice of electrical or mechanical shift models, and an integrated exhaust system.

All YANMAR 4LV engines with ZT370 sterndrive offer a selection of control systems, including full electronic or standard mechanical controls for commercial and recreational applications, and the models are also available with the YANMAR JC10 joystick system for easy maneuvring. Offering customers a simple display solution, the YANMAR NMEA connection ensures engine data are available for all NMEA 2000 compatible multi-function display units. All models exceed both EPA Tier 3 and EU RCD Tier 2 emissions regulations, being virtually smoke- and odor-free.

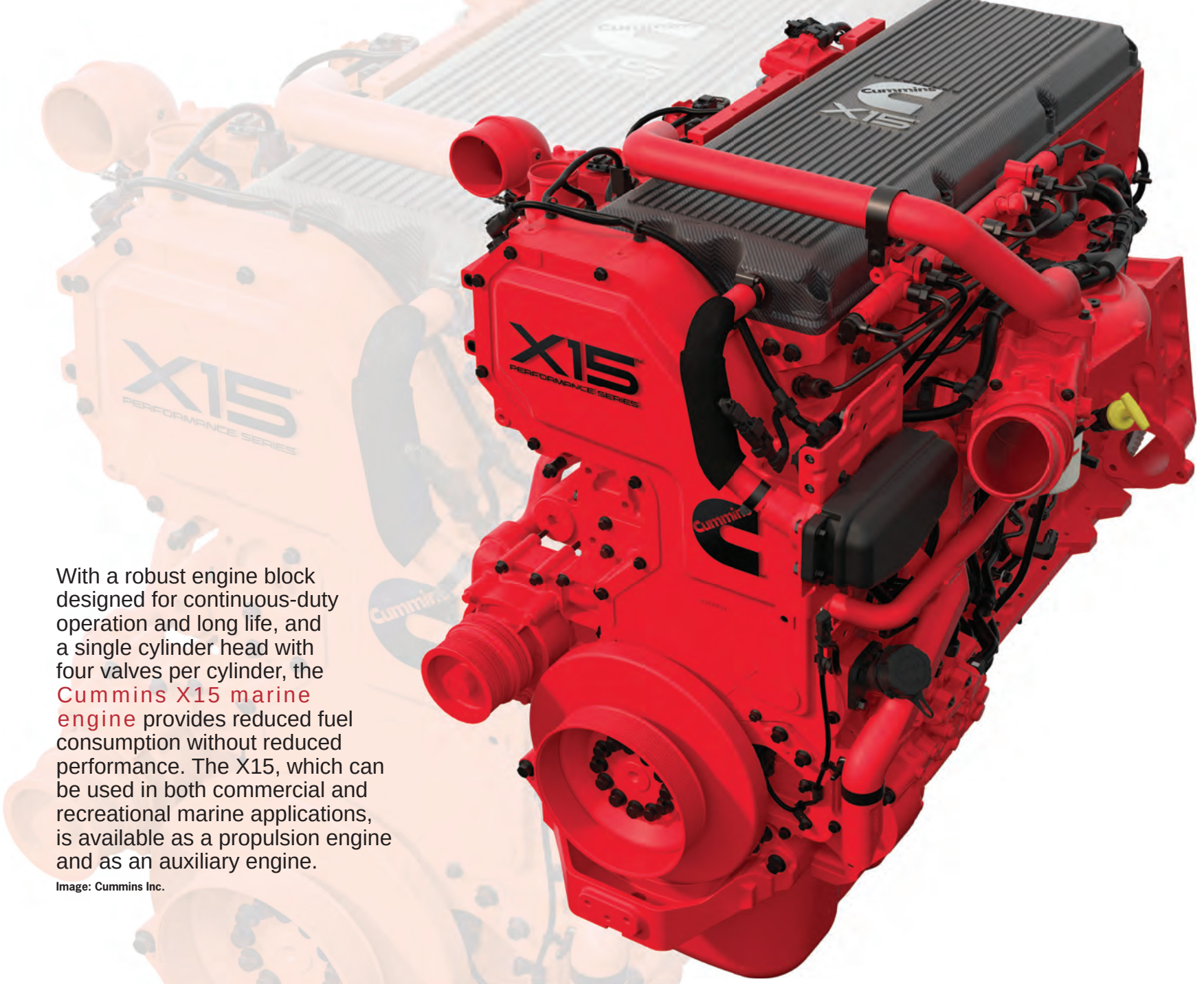
www.yanmar.com

NEW SILENT PACK FOR HATZ H-SERIES ENGINES

Motorenfabrik Hatz recently introduced the New Silent Pack for its H-series of three- and four-cylinder engines. The plug-and-play solution combines sound insulation of more than 60% with protection against contact, rain, dirt or vandalism, and is based on open power unit (OPU) engines, meaning that it can be ordered as complete and ready-to-install ex works. The New Silent Pack can also be used to retrofit existing machines. The New Silent Pack has a modular structure and is suitable for the Hatz H-series engines 3H50TI, 3H50TIC, 3H50TICD, 4H50TI, 4H50TIC and 4H50TICD. Because of this universal design, it is very easy to include it in the machine structure or to equip machines with different engines with the same encapsulation. Virtually all its parts are identical for all H-series engine variations and a suitable cover for the diesel particulate filter (DPF) is available for the EU Stage V-compliant Hatz TICD models. The maintenance hoods are adapted to the dimensions of the three- and four-cylinder engines. The New Silent Pack has been redesigned from the ground up and offers significant benefits to both machine manufacturers and operating companies: the low weight of less than 100 kg supports, in particular, manufacturers that need to keep their machines as light as possible. In the three-cylinder TI and TIC model versions, the encapsulation weighs only 91 kg, while in the largest version, the Hatz 4H50TICD, the encapsulation weighs 98 kg.

As regards the dimensions, those of the encapsulation were reduced by more than 10% compared to the predecessor during development. In addition, Hatz has striven for the greatest possible ease of maintenance with the New Silent Pack as the maintenance opening can be quickly and easily removed and provides easy access to the operating side and top side, making all maintenance points such as the oil filter, oil dipstick, oil filler neck and main fuel filter easily accessible.

www.hatz-diesel.com



With a robust engine block designed for continuous-duty operation and long life, and a single cylinder head with four valves per cylinder, the Cummins X15 marine engine provides reduced fuel consumption without reduced performance. The X15, which can be used in both commercial and recreational marine applications, is available as a propulsion engine and as an auxiliary engine.

Image: Cummins Inc.

CUMMINS INTRODUCES X15 MARINE ENGINES

Cummins Inc. has introduced a version of its X15 engine for marine applications. The Cummins X15 is designed to withstand the high-hour, continuous-duty operation demanded by inland waterways, commercial fishing and passenger transportation vessels.

The marine X15 engine is suitable for newbuilds and repowers.

The X15 features variable- and fixed-speed ratings between 450 and 600 hp (336 and 447 kW) while meeting U.S. EPA Tier 3 and IMO Tier 2 emissions standards. The X15 utilizes the latest Cummins fuel system technology, XPI, designed to provide an efficient fuel burn for clean emissions and optimized fuel economy. In addition, the X15 for marine uses the CM2350 Cummins engine control module to provide advanced diagnostic and monitoring capability, including de-rates and automated engine shut downs to prevent catastrophic failures.

www.cummins.com/marine

UPGRADED WÄRTSILÄ 20

Wärtsilä reports receiving a number of orders for the upgraded version of its Wärtsilä 20 engine, with more than 30 engines having been ordered for merchant auxiliary power applications in three major shipbuilding projects. The orders have been contracted with Wärtsilä Qiyao Diesel Company Ltd. (WQDC), the joint venture company of Wärtsilä and Shanghai Marine Diesel Engine Research Institute. The contracts cover three engines for four Very Large Crude Carriers (VLCCs) being built at CSIC's Dalian Shipbuilding Industry Corporation (DSIC) shipyard for China COSCO Shipping Energy; three engines for each of three Suezmax Oil Tankers being built at DSIC for China COSCO Shipping Energy; and three engines for each of four Large Ore Carriers (VLOC) being built at CSIC's Tianjin Xingang shipyard for COSCO Shipping Bulk. The Wärtsilä input includes complete auxiliary generating sets and all related engineering, with delivery of the equipment beginning in 2019.

www.wartsila.com

Photos: Volvo Penta

Volvo Penta's 'Full Charge' into Electric & Hybrid

Volvo Penta has a reputation for pioneering innovations in marine propulsion. To learn more about what the company has on its drawing boards we talked with ***Ron Huibers, president and CEO of Volvo Penta of the Americas****.*

Please give us a snapshot of your commercial marine business in North America?

Our marine commercial business in the Americas has seen great growth, and it now represents a significant portion of our business, along with our leisure marine and industrial engine segments. We have a broad offering of commercial-grade diesel engines, including traditional shaft drives, sterndrives, water jets and – of course – our own IPS steerable pods. We are doing very well in high-speed patrol boats and pilot boats, especially with IPS. Field data shows that IPS provides 20 percent faster speed, 30 percent lower fuel consumption and 15 percent faster acceleration when compared to a traditional inboard shaft drive. It also reduces noise and vibration levels on board up to 50 percent. The new Gladding Hearn 55-ft. pilot delivered this year to the Virginia Pilot Association is a good example. The vessel is powered by twin 13-liter 700 hp EPA Tier 3 engines with IPS30 pods, integrated with our EVC electronic steering and control system, including joystick. We are also seeing a growing number of repowers with our EPA Tier 3 diesels, including inland and coastal towing vessels, as well as commercial fishing vessels. In Europe we're broadening our range of IMO Stage III compliant engines to meet pending emission regulations. We also see a major growth market opportunity for support vessels as the U.S. offshore wind farm industry starts to ramp up.

What lies in the near-term future for Volvo Penta and the marine diesel industry.

For our segment of the commercial marine market we envision the future as a "three-legged stool:" Connectivity, Automation and Electromobility.

Let's start with connectivity?

The Internet of Things (IoT) revolution is in full swing, but the marine industry has lagged behind terrestrial markets in IoT largely because of the greater difficulty and expense of data connections on the water. But the next generation of very small lightweight, low-Earth-orbit satellites – numbering in the hundreds, or even thousands – will deliver fast, reliable and ubiquitous high-bandwidth data links across the entire globe. We foresee a not-too-distant future when all on-board systems, including the engines, will be fully connected, even far from shore, giving shoreside operators real-time 100% visibility into onboard systems.

And automation?

As you know, the maritime media are full of stories about robotic ships, and there is a great deal of R&D going into this area. Indeed, the first unmanned commercial ferry is already under construction in Norway. Still, the technological and regulatory barriers are formidable, and unmanned ships are probably still a long way off. But there is plenty of room for developing more automated systems that may reduce manning requirements and optimize efficiency in marine operations. To that end, we expect to see more integrated on-board systems that will automate many functions. We will see more integration of systems and increasing levels of automation in the pilot house, in the engine room and throughout the vessel. At Volvo Penta, our strategy is to deliver a complete helm-to-prop solution tied together in an electronic control platform. This summer we demonstrated self-docking technology for a large motor yacht. This technology can easily scale up to commercial vessels.

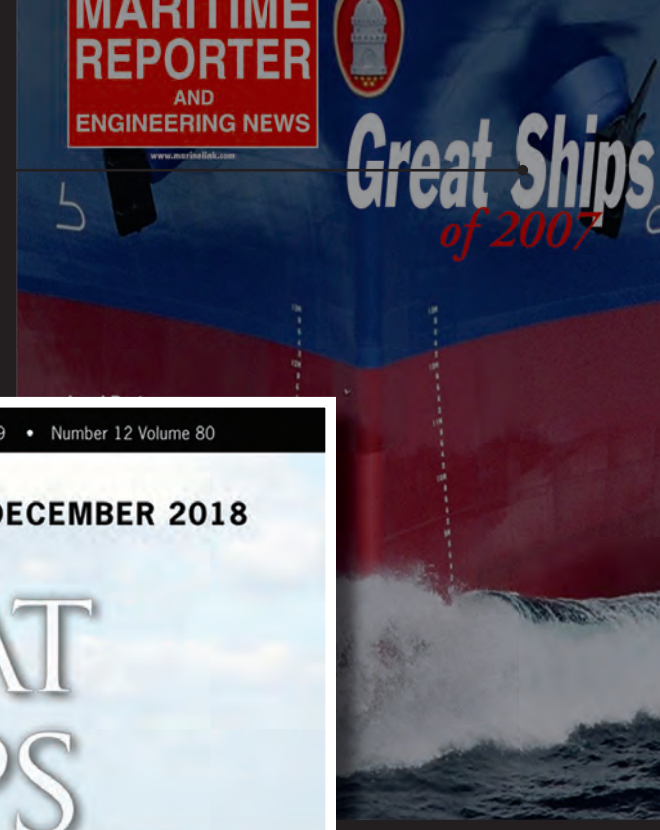
Now for your third leg – electromobility.

We are 100% committed to electromobility. This summer Volvo Penta issued a statement of intent to go "full charge" into hybrid and electric propulsion with products on the market in 2021. This summer, Volvo Penta unveiled a concept for an IPS hybrid system. It uses technology that was developed within the Volvo Group and which we are adapting and certifying for marine applications. We are initially planning to offer it in our 8-13 liter engine range, focusing on vessels like ferries, pilot boats and offshore supply boats. We are already testing prototypes, and our plan is to have a test boat in sea trials by early 2020 with availability in 2021.

The technical barriers to electromobility are falling fast. Battery technology, in particular, is progressing very rapidly, largely driven by automotive-level R&D programs in the high-volume electric vehicle market. It has been predicted that energy density in lithium ion batteries will increase by 70% over the next two years, while the cost of a lithium ion battery pack will decrease at a similar rate, yielding a lower cost-per-kW hour ratio. And lithium is not the only candidate. There is a great deal of R&D going into alternative energy storage architectures and materials, including graphene balls, protons, supercapacitors and even water-and-salt.

We are making great strides in our electrification journey at Volvo Penta. Over the last several years we have been quietly building competencies and establishing the technologies required to create a sustainable power solutions road map.

GREAT SHIPS of 2018



THE FIRST Sayaringo STaGE type LNG carrier

Mitsubishi Shipbuilding Co., Ltd. (MHIMSB) delivered the first Sayaringo STaGE type liquefied natural gas (LNG) carrier, named Diamond Gas Orchid in June, 2018. The Sayaringo STaGE, which was developed based on MHIMSB's cutting-edge technology, has a continuous cover over the cargo tanks, a feature inherited from its predecessor the "Sayaendo", and while keeping this merit, incorporates apple-shaped MOSS-type cargo tanks and a twin-shaft hybrid propulsion system "STaGE" plant, enhancing economic efficiency, environment friendliness, and versatility. The Sayaringo STaGE was developed by enhancing the highly regarded Sayaendo LNG carrier, which was also developed and built by MHIMSB. Sayaendo retains the reliable configuration and sloshing resistance of spherical cargo tanks, while integrating a continuous tank cover to improve the carrier's overall structural efficiency, thus achieving a lightweight and compact design. The Sayaendo was named after sayaendo (podded peas) because its (pea)-like spherical tanks are covered with a continuous saya (legume)-like cover. On the other hand, the Sayaringo STaGE also has a continuous cover over the tanks. The reason for the naming is the upper semi-sphere of the tanks is larger than the lower semi-sphere, and the swelling shape of the tank seems like a ringo (apple) in the saya (legume)-like cover. Other inherited advantages are the lightweight hull, low-wind resistance, and good maintainability. By combining the inherited features with the newly adopted propulsion system concept "STaGE," the Sayaringo STaGE dramatically enhances its fuel efficiency. The Sayaringo STaGE aims to ship LNG from North American shale gas deposits, which have recently been in the news regarding expansion of LNG resources, to Japan. The apple-shaped LNG tanks are based on a highly reliable MOSS-type tank with extensive track records. MHIMSB improved the MOSS-type tank into an apple-like shape to increase the volumetric efficiency and maximize the cargo capacity along with meeting the New Panamax limits on dimensions. The ordinary tank consists of semi-spheres and a cylinder, and the apple-shaped tank consists of a donut-shaped torus as well as semi-spheres and a cylinder. Because of the lower height, the center of gravity of the apple-shaped tank is at a lower position than the ordinary one despite the same volumetric capacity. STaGE is an abbreviation for Steam Turbine and Gas Engine, and is a hybrid propulsion plant that consists of an ultra-steam turbine (UST) plant on the port side and a combination of a dual-fuel diesel engine (DFE) and an electric propulsion motor (PEM), DFE-PEM plant, on the starboard side. The exhaust-gas and jacket waste heat from the DFE are recovered to heat the feedwater going toward the UST plant, achieving significant improvement in fuel efficiency. In the UST plant, the heated feedwater flows to the boiler to generate steam to be used to drive the turbine. The electricity generated by the DFEs drives the PEM. Ordinarily, a huge amount of waste heat from DFEs is dumped into the exhaust-gas and jacket cooling water. But the STaGE plant uses the waste heat to heat the boiler feedwater, enhancing the plant's total efficiency. The waste heat from the DFEs is also recycled to generate auxiliary steam as well as the drive steam for the main turbine, also enhancing total efficiency. As such, the STaGE plant achieves significant efficiency enhancement by combining two different propulsion engines and by optimizing the waste heat energy.

Main Particulars

Yard	Mitsubishi Shipbuilding Co., Ltd. (MHIMSB)
Type	LNG Carrier, Sayaringo STaGE type
Name	Diamond Gas Orchid
Owner	Diamond LNG Shipping 1, Pte. Ltd.
Operator	NYK
Classification	American Bureau of Shipping
Length (OA)	293.5 m
Breadth	48.94 m
Depth	27 m
Draft	11.05 m
Speed	19.5 Knots
	Propulsion
Main engines	MHI Ultra Steam
	Turbine plant x 1 unit, Electric Propulsion Motor x 1 unit
	Cargo Tank Capacitym300 cu. m.

Photos: Mitsubishi Shipbuilding

MITSUI O.S.K. LINES, LTD.

Photos: Mitsui OSK Lines

Beluga Ace:
New Design Car Carrier with Six Liftable Decks

Beluga Ace, the first vessel of next-generation FLEXIE series car carrier built by the Minaminippon Shipbuilding Co., Ltd., was delivered to Japanese shipowner Mitsui O.S.K. Lines, Ltd. (MOL) in March 2018. The space onboard was rearchitected using the design concept. The six liftable decks, compared with two on conventional car carriers, allow loading of vehicles with different heights. As a result, loading efficiency was improved by 6.25% from the conventional type of car carrier, which enables the vessel to meet demand for more diversified vehicle and high and heavy cargo transport.

The FLEXIE series vessels adopt an array of advanced environmental technologies, which were developed in the MOL Group research and technology project, "Senpaku ISHIN project," successfully achieving a reduction of 13.7% in CO2 emissions compared to conventional vessels. As part of the reduction, the rounded bow shape will minimize wind resistance and is expected to reduce CO2 emissions by about 2%.

The FLEXIE series aims to realize safer, more reliable, and more secure operations by introducing a navigation information display system that adopts augmented reality (AR) technology for the first time to support the officers steering the ship, and adopting vibration sensors to spot defects machinery before they cause a breakdown. These have great potential in realizing future automatic ship operation. The hull design is a complete departure from current car carriers, boldly presenting "MOL" and the letter "A", representing a global brand of "MOL ACE (MOL Auto Carrier Express)", and a white line, which expresses the company's determination to connect its long history of customer service to the future in a seamless manner. As of November 2018, three vessels in the series are in operation, and the number is to increase to four by March 2019.

Main Particulars

Ship's Name	BELUGA ACE
Ship Type	6,800RT Pure Car Carrier
Ship Builder	Minaminippon Shipbuilding Co., Ltd.
Ship Operator	MOL
Ship Designer	Minaminippon Shipbuilding Co., Ltd.
Delivery Date	March 15, 2018
Classification	NK
Flag of Registry	Panama
Length (OA)	199.95 m
Length (BP)	191.55 m
Breadth (molded)	32.2 m
DWT (at Scantling Draft)	15,425 MT
Depth (molded)	37.4 m
Design Draft (molded)	9 m
Speed (at Design Draft)	19.90 knots
Main Engine	MITSUI-MAN B&W 7S60ME-C8.5

Kawasaki Kisen Kaisha, Ltd.

Photos: Kawasaki Kisen Kaisha

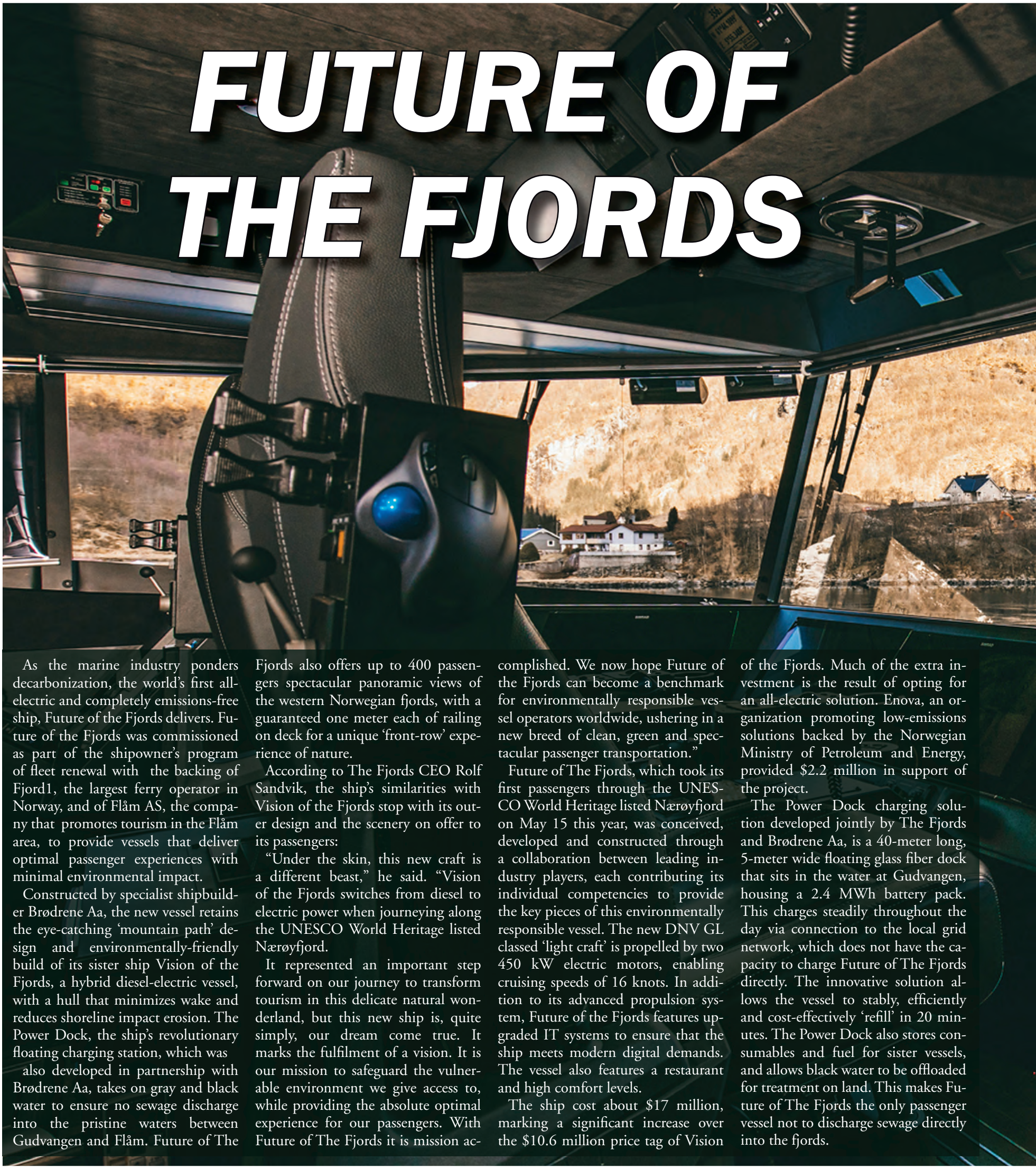
THE WORLD'S LARGEST MOSS TYPE LNG CARRIER

Main Particulars

Ship Name	PACIFIC BREEZE
Ship Type	LNG Carrier
Ship Builder	Kawasaki Heavy Industries, Ltd.
Ship Owner	Kawasaki Kisen Kaisha, Ltd.
Delivery Date	March 8, 2018
Classification	Bureau Veritas
Length (OA)	299.94 m
Length (BP)	286.50 m
Breadth	52 m
DWT	92,830 Tons
Depth	28 m
Draft	12.2 m
Speed	about 19.5 Knots
Fuel Type	Fuel gas/Diesel oil/Heavy Fuel Oil
Main engines	(Main propulsion unit :) Main propulsion motor x 2 sets
Propellers	1 set of fixed pitch propeller
Generators	(Main generator diesel engine) KAWASAKI-MAN 8L51/60DF x 5 sets

Pacific Breeze, a 182,000 cu. m. capacity LNG carrier, is the world's largest MOSS type LNG carrier ever constructed, built at Kawasaki Heavy Industries, Ltd., Japan (KHI). This capacity was achieved by extending the equatorial ring section of No. 3 and 4 cargo tanks by 1.6m in height from the conventional spherical shape, which increases approximately 5,000m3 from the second largest MOSS type LNG carrier constructed by KHI. Kawasaki Panel System was adopted for the thermal insulation system of the cargo tanks, which offers outstanding LNG boil-off rate performance of no more than 0.08% per day. This ship is equipped with a Tri-Fuel diesel (TFD) electric propulsion system performing excellent fuel efficiency across a broad range of speeds. PACIFIC BREEZE is time-chartered by IT Marine Transport Pte. Ltd., a joint-venture company of INPEX Shipping Co., Ltd. and Total Marine Transport B.V. and engaged in transportation of LNG produced at the Ichthys LNG Project in Darwin, Australia.

FUTURE OF THE FJORDS



As the marine industry ponders decarbonization, the world's first all-electric and completely emissions-free ship, Future of the Fjords delivers. Future of the Fjords was commissioned as part of the shipowner's program of fleet renewal with the backing of Fjord1, the largest ferry operator in Norway, and of Flåm AS, the company that promotes tourism in the Flåm area, to provide vessels that deliver optimal passenger experiences with minimal environmental impact.

Constructed by specialist shipbuilder Brødrene Aa, the new vessel retains the eye-catching 'mountain path' design and environmentally-friendly build of its sister ship Vision of the Fjords, a hybrid diesel-electric vessel, with a hull that minimizes wake and reduces shoreline impact erosion. The Power Dock, the ship's revolutionary floating charging station, which was also developed in partnership with Brødrene Aa, takes on gray and black water to ensure no sewage discharge into the pristine waters between Gudvangen and Flåm. Future of The Fjords also offers up to 400 passengers spectacular panoramic views of the western Norwegian fjords, with a guaranteed one meter each of railing on deck for a unique 'front-row' experience of nature.

According to The Fjords CEO Rolf Sandvik, the ship's similarities with Vision of the Fjords stop with its outer design and the scenery on offer to its passengers:

"Under the skin, this new craft is a different beast," he said. "Vision of the Fjords switches from diesel to electric power when journeying along the UNESCO World Heritage listed Nærøyfjord.

It represented an important step forward on our journey to transform tourism in this delicate natural wonderland, but this new ship is, quite simply, our dream come true. It marks the fulfilment of a vision. It is our mission to safeguard the vulnerable environment we give access to, while providing the absolute optimal experience for our passengers. With Future of The Fjords it is mission accomplished. We now hope Future of the Fjords can become a benchmark for environmentally responsible vessel operators worldwide, ushering in a new breed of clean, green and spectacular passenger transportation."

Future of The Fjords, which took its first passengers through the UNESCO World Heritage listed Nærøyfjord on May 15 this year, was conceived, developed and constructed through a collaboration between leading industry players, each contributing its individual competencies to provide the key pieces of this environmentally responsible vessel. The new DNV GL classed 'light craft' is propelled by two 450 kW electric motors, enabling cruising speeds of 16 knots. In addition to its advanced propulsion system, Future of the Fjords features upgraded IT systems to ensure that the ship meets modern digital demands. The vessel also features a restaurant and high comfort levels.

The ship cost about $17 million, marking a significant increase over the $10.6 million price tag of Vision of the Fjords. Much of the extra investment is the result of opting for an all-electric solution. Enova, an organization promoting low-emissions solutions backed by the Norwegian Ministry of Petroleum and Energy, provided $2.2 million in support of the project.

The Power Dock charging solution developed jointly by The Fjords and Brødrene Aa, is a 40-meter long, 5-meter wide floating glass fiber dock that sits in the water at Gudvangen, housing a 2.4 MWh battery pack. This charges steadily throughout the day via connection to the local grid network, which does not have the capacity to charge Future of The Fjords directly. The innovative solution allows the vessel to stably, efficiently and cost-effectively 'refill' in 20 minutes. The Power Dock also stores consumables and fuel for sister vessels, and allows black water to be offloaded for treatment on land. This makes Future of The Fjords the only passenger vessel not to discharge sewage directly into the fjords.

Images Courtesy of Brødrene Aa

Future of The Fjords Technical Specs

Name	Future of The Fjords
Type	Zero Emission Ferry
Shipbuilder	Brødrene Aa
Owner	The Fjords
Building material	Carbon-fiber sandwich/ Vinylester
Vessel type	Passenger catamaran
Hull No.	291
Flag	NOR Fartsområde 2
Class	DNVGL 1A1 HSLC R5 Passenger
Passenger capacity	400
IMO Number	9830214
Length o.a.	42.49 m
Length p.p.	40.85 m
Beam o.a.	15.2 m
Gross tonnage	770
Fresh water	1x 3000 liter
Gray water	1x 2000 liter
Black water	1x 3000 liter
Bilge water	1x 200 liter
Main engines (Electrical)	2x Ramme 450 kW
Propulsion system	Servogear Ecoflow Propulsion
Reduction gearbox	Servogear HD220
Bowthruster	2x Sleipner SAC350
Stern thruster	2x Sleipner SAC450
Battery installations	ZEM – 1800 kWh Lithium ion
Power management	Westcon Power & Automation
Anchor system	MB Hydraulikk 1-AV-24K2 / SEC Anchor 237 kg/Mørenot
Gangways	Brødrene Aa

"Green Cruising" with AIDA Cruises

BIGGEST AIDA CRUISE SHIP OPERATES ENVIRONMENTALLY

337 meters long, 42 meters wide, 8.8 meters draft, 183,900 GT, four main engines transferring in total 62 MW on two PODs: These are the most important particulars of AIDAnova, the latest Meyer Werft-built cruise ship for AIDA Cruises.

During the laying of the keel Carnival Corp. announced that it was going to build a total of seven new cruise ships which can "in port and at sea" operate with natural gas/methane.

The seven new builds will be built at yards of the Meyer Group in Papenburg, Germany, as well as at its Turku, Finland plant for the brands of the Carnival Cruise Line, AIDA, Costa Crociere and P&O Cruises delivered betwee 2018 and 2022.

With this, Meyer Werft has the largest order backlog for natural gas driven cruise vessels.

AIDAnova marks the launch of the Helios-Class series. According to AIDA the vessel is the largest ever builtin Germany with a capacity for more than 6,000 passengers in around 2,600 cabins in 20 different cabin categories spread on 20 decks.

AIDA Cruises will be the worldwide first cruising company to operate their new Helios-Class ships "up to 100% with natural gas."

Prerequisite are dual-fuel engines which can be operated with natural gas /methane.

Zeppelin Power Systems provided for the AIDAnova a complete solution with Caterpillar/MaK DF engines. It consists of:

- *four 16 cyl MaK DF engines of type M46DF, in vee-configuration, each 15,440 kW at 514 rpm. In total 61.760 kW.*
- *two emergency gensets of type CAT 3516 C-HD, each 2.095 kW at 1,800 rpm*
- *the complete LNG processing plant.*

Each engine fulfills the IMO III exhaust limit values in gas mode.

The MaK M46DF engines are operating in gas mode according to the Otto principle, which means that the engines need a pilot ignition system to ignite the gas/air mixture in the combustion chamber. This ignition system is a Common Rail system which injects a small amount of MDO fuel.

The LNG tank concept

Three LNG tanks feature in total 3.550 cu. m. LNG and ensure a secure fuel supply for the engines. The three tanks are an in-house development and self-build from Neptun-Werft. The tanks are located in an 120 x 42 meter, four deck-high hull-module. Two of the tanks feature each a length of 35 meters with a diameter of around eight meters and have a content of each 1,500 cu. m. The third tank features a length of 28 meters with a diameter of 5 meters and a capacity of 550 cu. m.

With this amount of LNG the AIDAnova will be able to operate, depending of their speed, 10 to 14 days up to the next bunkering.

AIDAnova main particulars:

Ships name	AIDAnova
Yard	Meyer Werft Papenburg
In service	November 2018
Launching	August 31, 2018
Length	337 m
Width	42 m
Depth	8.8 m
Gross tonnage	183,900
Engine power	61,760 kW
Drive power	37,000 kW
Fuel	LNG/MDO
Speed	17 kn
Decks	20
Cabins	2.626 (21 different categories)
31 suites; 1,655 balcony cabins; 198 cabins with sea view; 312 inner cabins	
Restaurants	17
Bars	23
Crew	1,400

Image: ©AIDA Cruises

Always operating 'bow first' – *a new Paradigm in Harbor Towage*

Image: ©Damen shipyard

The first of Damen's revolutionary new RSD 2513 harbour tugs is a real innovation as its name says:

MV INNOVATION

The radical new design of the RSD Tug 2513 is the result of extensive industry consultation at every level to find solutions to the general demand for tugs that are compact for operations in and around harbors and terminals, yet have the power and flexibility to maneuver even the largest vessels safely, quickly and efficiently within restricted waters.

The 25-meter RSD Tug 2513 is the result of years of research and development by Damen by listening to the harbor towage industry's needs and cooperation with its research institute partners. The design combines elements of tractor tugs and ASD tugs to create a class of vessel that effectively has two bows, enabling it to always operate bow first. The result is a tug that is equally effective at bow assists and stern assists. A Damen Twin Fin skeg also contributes to the effectiveness of the design, giving the RSD Tug 2513 excellent course-keeping characteristics. Bollard pull is 75 tonnes ahead (push) and 71 tonnes astern (pull).

This 'bow first' capability gives tug operators a vessel that is exceptionally efficient.

The design brings additional benefits including a higher freeboard than is usual on a tug of this size. This improves safety and stability. The RSD Tug 2513 also features a wide range of additional features including the new Damen Safety Glass for the wheelhouse. This is shatterproof glass similar to that used in cars and it represents a huge step forward in crew protection because the glass does not fragment when struck by a heavy object. Other innovations include the glued superstructure to counter noise and vibration, and Damen's remote monitoring system.

Main Particulars

Yard number	515001
Delivery date	April 2018
Basic functions	towing and mooring
Class	Bureau Veritas
Flag	Netherlands
Length (OA)	24.73 m
Beam (OA)	13.13 m
Draft aft	5.5 m
Displacement	525 to
Bollard pull ahead	75.3 t
Bollard pull astern	71.2 t
Speed ahead	13 knots
Speed astern	12.8 knots
Main engines	2x MTU 16V 4000 M63L
Total power	4.480 bkW (6.008 bhp) at 1.800 rpm
Thrusters	Rolls Royce US 255
Propeller diameter	2.700 mm
Forced ventilation	60,000 cu. m./hr.
Generator set	2x Caterpillar C4.4 TA, 81 kVA, 400/230 V, 50 Hz
General service pumps	2x Azcue CA 50/3A 20 m3/h at 2.35 bar
Anchor	1x 360 kg Pool (High Holding Power)
Anchor winch	Electric 10 m/min
Towing winch	Hydraulically driven split drum 31 ton pull up to 11 m/min, reduced pull up to 38 m/min, 175 ton brake
Fendering	Cylinder + block bow fender, D-fender side/aft
Searchlight	1x Norselight, 2000 W
Radar system	1x Furuno FAR-1518-BB
Compass	Cassens & Plath Reflecta 11
Autopilot	Simrad AP-70
Satellite compass/GPS	Simrad GN70/HS80A
Echosounder	Furuno FE-800
Speed log	Furuno DS-80
VHF	2x Sailor 6222
VHF	hand-held Jotron TR-20
Navtex	Furuno NX-700
AIS	Furuno FA-170
EPIRB	Jotron Tron-60S
SART	Jotron Tronsart20
Anemometer	Gill Instruments GMX 500
VSAT	Intellian v60G

Superyacht ARTEFACT is a real "arte factum"

Image: ©Nobiskrug

NOBISKRUG's Project 790 is one of the first yachts built under the new strict IMO Tier III emissions regulations. The name and visionary design of the 80-meter hybrid superyacht was unveiled at the Monaco Yacht Show 2018: MV ARTEFACT.

Less than a year away from completion, Nobiskrug's new superyacht MV ARTEFACT will be one of the first yachts built under the new IMO Tier III low emissions regulations with an array of first-of-their-kind technology features and engineering advances that reflect the owner's desire to create an experience as breathtaking as the seas it explores.

"From the beginning of the project, a primary focus of the owner was to minimize the environmental impact of the vessel using advanced technology. As a result, there are many unique and environmentally friendly aspects of both the operational and engineering design in this project," said Captain Aaron T. Clark, who is acting as the owners representative. For example, the owner understood the significant efficiency, environmental and comfort advantages of Electric Pod propulsion using a DC bus system with both batteries and variable speed Diesel-Electric generators. Among the other significant efforts taken to protect the environment:

* The use of solar panels and a large battery storage system allows the vessel to operate for a limited time with no internal combustion engines operating.

* An electric pod propulsion combined with a dynamic positioning system can hold position without dropping anchor to protect sensitive sea floor. The owner believes ARTEFACT should make little to no impact on the seafloor.

* Waste water can be reused as technical water.

"Being involved from the early stages of the project, our in-house engineering team brought this innovative and technologically challeng-ing vessel design to reality while meeting all the owner's expectations," said Holger Kahl, managing director of Nobiskrug. "The composite superstructure and the extensive use of custom large and curved glass panels throughout is monumental, ensuring that the visual experience from the interior is uncompromised with minimal mulli-ons to obstruct the panorama. ARTEFACT is a perfect marriage of art and science through innovative architectural design and advanced engineering."

For example, the quest for silent operation and maximum stability has been a driving force behind the concept for this vessel. In a major departure from convention, the Master stateroom is situated in the aft rather than the bow and all guest entertainment areas are situated in low-acceleration zones. Extensive hull development and testing have ensured that the vessel will ride comfortably.

In addition to environmental and advanced technology unprecedented in this class of vessel, the 80-meter superyacht's distinctive exterior created by Gregory C. Marshall Studio features large architectural windows and noticeable design elements that create a distinctly remarkable profile. The composite superstructure and the special use of large custom and curved glass – the highest ratio of glass used to date in this size category – further differentiates this striking superyacht.

ARTEFACT has so much glass, and so many unusual windows, to ensure far better experiences while cruising.

Her exceptional interior was designed by the passionate and creative team at Reymond Langton Design - a studio that has been involved in the exterior styling and interior design of many award-winning superyachts.

The technical challenges behind ARTEFACT, with a steel hull and composite superstructure, are many. For instance, the above-mentioned glass totals 70 tons, according to Marshall. For another example, ABB developed the hybrid propulsion system that, while a first for yachting, is proven technology. It employs a DC bus and batteries, along with azipods and variable-speed Caterpillar 3516 gensets that are Tier III compliant. The hybrid system reduces sound, vibration, fuel consumption, and emissions, plus mimics Dynamic Positioning.

Main Particulars

Yard	Nobiskrug, Germany
Yard number	790
Ships name	ARTEFACT
Ships type	Yacht
Naval architec	Nobiskrug
Exterior design	Greg Marshall Design
Interior design	Reymond Langton Design
Length	80 m
Breadth	16.8 m
GT	2,998
Drive system	2 Caterpillar gensets of type 3516 and 2 Caterpillar gensets of type C18

Fast and comfortable to Heligoland with

Image: © Flensburg Förde Reederei, FRS

HALUNDER JET

The work took just over a year, the big day becomes finally reality: the successor to the former HALUNDER JET is ready. Around 250 shipyard employees and 60 employees from Förde Reederei Seetouristik, Flensburg, Germany, worked on the catamaran in the AUSTAL shipyard in Cebu. After 15 years of loyal service, the company, FRS, finally said goodbye to the old HALUNDER JET in the fall of 2017. It was hauled to the west coast of America, where, as CLIPPER V, it will carry traffic between Seattle in the USA and Victoria on Vancouver Island (Canada).

Halunder means Heligoland and is the dialect of the North Frisian language spoken on the German island of Heligoland in the North Sea. The new catamaran sets new standards, in particular when it comes to comfort: wider seats, more legroom and, above all, an even better view. The captivating interior was designed by Australian design office Spear Green. Its bright and friendly atmosphere invites visitors to linger. Nine panoramic windows, a 4-zone air-conditioning system, several flat screens and a roughly 200 m2 open-air deck ensure that Heligoland fans will enjoy an even more modern and comfortable trip in future – indeed, for many their arrival on board becomes the vacation. Measuring 56 meters in length, the new vessel can accommodate around 680 Heligoland lovers – 20% more than before. Four MTU engines (type: 16V4000M63L), four auxiliary generators (type: Volvo D5A TA) and four Kamewa S71 waterjets propel the catamaran to a maximum speed of 36 knots (67 km/h).

New features:

- 20 % more seats
- 228 qm suddeck on the upper and bridge deck (Compared to former HALUNDER JET the open spaces have increased by a total of six times.)
- VIP Balcony for Comfort Class guests
- 4-zone air-conditioning system
- comfortable seats with USB port

Main Particulars

Type of vessel	HSC, passenger B type
Classification	DNV-GL
Year, No of built	2018, hull #418
Building Yard	Austal Philippines
Length	56.4 m
Breadth	14.0 m
Max draft	2.5 m
Tonnage	1.223 GT
Crew	18
Main engines	4 x MTU 16V4000M63L, each 2.240 kW
Aux. engines	4 x Volvo D5A TA, each 85 kW
Jets	4 x KaMeWa S71-4
Gearbox	4 x ZF 7650 NR2H
Service speed	34.6 knots
Passengers	680 plus 12 wheelchair spots
Charter of Class	Hull, 1A1 HSLC R2 Passenger EO cat B
Flag	Cyprus, Limassol

Image: Nichols Brothers Boat Builders/Lindblad

LINDBLAD'S M/V NATIONAL GEOGRAPHIC VENTURE

Nichols Brothers Boat Builders (NBBB) recently delivered National Geographic Venture, number two of two 100-passenger expedition cruise ships contracted by and built for Lindblad Expeditions for exploratory cruising in Alaska; Baja, California; the Pacific Northwest; Costa Rica & Panama and Belize. Both vessels have joined the Lindblad Expeditions fleet. The first vessel, National Geographic Quest, was delivered in July 2017 and has voyaged to Alaska, Costa Rica and Panama.

National Geographic Venture measures 238.5 x 44 x 10-ft. and is a Jones Act coastal cruise vessel, purpose-built for exploring coastal waters, shallow coves, and fast-moving channels where wildlife congregate; while sailing with the luxury of supreme comfort.

National Geographic Venture is a U.S. flagged, USCG Subchapter K, SOLAS compliant cruise vessel fully classed with Bureau Veritas. It is powered by two MTU diesel engines developing 1,600 hp each, driving Wärtsilä propellers through Reintjes reduction gears. Ship's power is provided by two Volvo Penta generators providing 477 kW each, backed-up by a 230 kW emergency generator. Additionally, a 300 kW Schottel bow thruster is installed to assist mooring evolutions, and Quantum Maglift stabilizers were added to this second vessel.

NBBB contracted with:

- Jensen Maritime Consultants for functional engineering
- BMT Nigel Gee for production engineering for modifications on the sun and lounge decks of the National Geographic Venture, and
- Jamestown Metal Marine Services (JMMS) for interior systems design and material services.

"This is another important milestone for us, and many people have worked tirelessly in the making of one of the most sophisticated ships built in the U.S.," said Sven Lindblad, CEO of Lindblad Expeditions. "We are extremely grateful for their collective efforts, and are excited to share this spectacular vessel with our guests and crew."

CROWLEY TAKES FIRST LNG-Powered ConRo

Images: Crowley

VT Halter Marine in Pascagoula completed a unique project when Crowley Maritime took delivery of El Coquí, the first of two combination container/RoRo (ConRo) ships powered by liquefied natural gas (LNG). The ship is the first of two Commitment Class, LNG-powered ConRo ships being built for Crowley's shipping and logistics services between Jacksonville, Fla., and San Juan, Puerto Rico. Sister ship Taino is currently being built at VT Halter, scheduled to enter service in 2018.

The new ships measure 219.5m long with a 26,500 deadweight tons (DWT), able to transport up to 2,400 TEU at a cruising speed of 22 knots. A wide range of container sizes and types will be accommodated, including 53-foot by 102-inch-wide, high-capacity containers, up to 300 refrigerated containers, and a mix of about 400 cars and larger vehicles in the enclosed, ventilated and weathertight RoRo decks, a unique type of garage offered by Crowley in the trade.

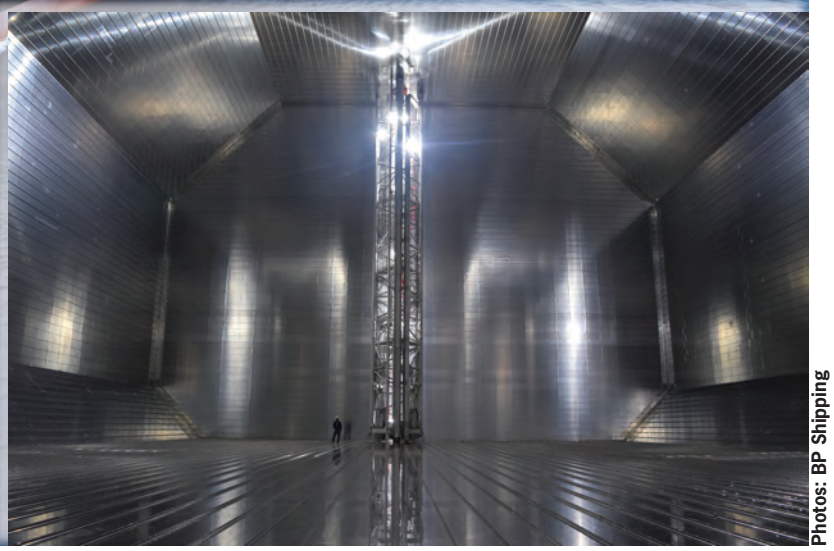
Construction of El Coquí, which is named for the popular indigenous frog on the island, was managed in the shipyard by Crowley's solutions group, which includes naval architects and engineers from company subsidiary Jensen Maritime.

Working with Eagle LNG Partners, the ships will be bunkered from a shoreside fuel depot at JAXPORT.

Mackay Marine collaborated with owner Crowley Maritime and VT Halter Marine, the shipbuilder, in the design, supply and installation of advanced integrated bridge systems (IBS), complete with consoles, and ancillary electronic systems onboard El Coquí and sister-ship Taíno. Mackay Marine's Project Integration team, in concert with Crowley and VT Halter Marine's naval architects and engineers, developed an efficient state-of-the-art bridge suite, specifying the comprehensive communication and navigation electronic equipment package necessary to integrate into 13 system consoles.

Additional electronics provided by Mackay Marine, include the Public Announcement, CCTV for security and asset tracking, IP Telephone (IPTV) Systems, Sound Powered Phones, LAN (local-area-network), and a UHF Radio System.

First of Six New LNG Carriers Delivered to BP



Photos: BP Shipping

BP Shipping took delivery of British Partner, the first of a half dozen new 173,400 cu. m. capacity liquefied natural gas (LNG) carriers to be delivered through 2018 and 2019 from the DSME shipyard in South Korea. BP Shipping, which launched a fleet rejuvenation program in 2016 that includes 32 new vessels for delivery over a three-year period, said the six new Partnership class ships will increase its ability to transport LNG in emerging new markets, such as Pakistan, Jordan, Egypt and Bangladesh, in addition to established markets, such as India, China, the U.S. and Australia.

British Partner and the five other 295-m ordered in October 2017 are bigger, more powerful and have a larger carrying capacity than the predecessor vessels they are replacing. BP adds they're also more efficient and, therefore, more environmentally-friendly and cost-effective, with greater flexibility in terms of the places where they can operate.

Each of the new Partnership vessels is fitted with two M-type, electronically-controlled, gas-injection (ME-GI) propulsion systems and a full reliquefaction system (FRS) designed by DSME. The slow speed tri-fuel engines, each of which has its own shaft, propeller and rudder, use compressed boil-off gas from cargo tanks as fuel.

While older LNG carriers use boil-off gas to power either steam turbine or dual fuel/diesel electric engines, the Partnership vessels have a five-stage compressor that raises the pressure of the gas from just above atmospheric pressure to 300bar to be sent to the engines for fuel or to the reliquefaction system.

When the reliqufaction plant is in use, up to 70 percent of the gas discharged from the compressor is cooled to a temperature where it returns to liquid form and pumped back to the cargo tanks. BP says these features add to an easy-to-operate system, which burns less cargo gas than its predecessors and improves fuel efficiency by around 25 percent.

The vessels also feature significant improvements in hull design, which improve speed and maneuverability, an exhaust gas recirculation system that reduces nitrogen oxide emissions and a gas combustion system to minimize the potential for releasing methane to the atmosphere.

For waste management, engine room sludges and waste water are processed to minimize the use of the incinerator and galley waste passes through a macerator and shredder, producing slurry that is retained in a tank until it can be safely discharged. Dry waste is treated with shredders, glass crushers and a compactor for baling and landing ashore minimizing ship discharges.

Also, to minimize the threat of piracy, the crew accommodation and engine room structures are designed and built to make it extremely difficult for potential attackers to gain access. Some of the measures adopted include the removal of external means of access to the ship's bridge and other decks and the provision of metal shutters to external windows.

The new Partnership class tankers have been built big enough to take advantage of the 2016 Panama Canal enlargement – a major global transit route for LNG – their design, technology and environmental improvements mean they are also far more nimble than their Trader and Gem class predecessors. This means they will be able to load and discharge cargoes at a far wider range of LNG ports and floating facilities worldwide, including those that are just coming on line.

THE MEIN SCHIFF SERIES EVOLVES:

Meyer Turku Delivers for TUI Cruises

Photos: Meyer Turku

TUI Cruises' new 315 m flagship was delivered from Finnish shipbuilder Meyer Turku, the fifth Mein Schiff cruise ship to be built by Meyer Turku for German owner TUI Cruises, but the new Mein Schiff 1 is based on a new design created as an evolution from the existing Mein Schiff series.

The builder's architecture and engineering team, working together with TUI Cruises and its architects, used the previously delivered Mein Schiff 3 and Mein Schiff 4 as a starting point when beginning to work on the Mein Schiff 1 design in 2015. The outcome was a 20m lengthened ship combined with a substantial redesign of the passenger spaces and a number of new features like the new Diamond, which now spans the almost 50m breath of the ship, a sun deck area, a covered sports center, and an elevated jogging track with a spectacular view.

"The impressive new 50m wide steel and glass window structure that makes up the new Diamond at the aft of the ship just above the propellers is a good example how we combine architectural design with our engineering skills supported by sophisticated computer models," said Jan Meyer, CEO, Meyer Turku.

Engineered for a 10 percent energy efficiency improvement compared to last year's Mein Schiff 6, Mein Schiff 1 is one of the first cruise ships to be equipped with catalytic converters for the main and auxiliary engines, reducing nitrogen oxide emissions.

MV Fehn Pollux:
From MV to Sailing Ship

"We are very much satisfied with the perfomance of the Flettner-Rotor and the vessel," Ralf Oltmanns, the man behind and the driving force of the project, is enthusiastic after finishing the test series. "We are considering alternative propulsion systems already for a long time," said Matthias Hesse, Managing Director of Fehn Ship Management in Leer. "We therefore didn't hesitate when asked to participate in this project. "

FEHN POLLUX trials are part of a Wind Hybrid Coaster project aimed at developing a new generation of short sea multi-purpose motor-rotor-sailing ships of around 4,000 dwt. The project involves the Emden/Leer University of Applied Sciences, MARIKO and MariGreen which groups a cluster of regional concerns, among them Fehn Ship Management. The work is being part funded by the EU, the Netherlands and Germany.

The Eco-Flettner system on the 4,200 dwt multipurpose coaster FEHN POLLUX, part of the fleet of Fehn Ship Management, consists of an 18m high and 3m diameter composite fiber cylinder weighing about 100 tons, with a 70kW electric drive motor and a power consumption of 20-30kW.

The EcoFlettner WHC is a lightweight construction and uses a wide range of wind speeds to produce energy, helping to reduce fuel consumption and emissions. The construction has been completed in May 2015 and detailed tests ashore have been successfully completed. "The EcoFlettner rotates with a maximum of 280 times per minute. But that doesn't always make sense, because the rotor itself uses electrical energy to move around. Therefore, an algorithm takes over these calculations," says Moritz Götting from the Department of Maritime Sciences at the University of Emden/Leer, who programmed the control system. As sailing power increases, power from the ship's MWM Deutz SBV 9M 628 main en-gine can also be reduced, Fehn Ship said.

The vessel has also been installed with a fuel meter to measure fuel con-sumption and verify fuel savings, and a control system to operate the rotor either manually or automatically. Also the vessel's crew has completed ship handling training at the Faculty of Maritime Sciences in Leer. Using the ship handling simulator at the faculty crews has been able to better handle the maneuvering characteristics of a Flettner Rotor vessel. Meanwhile FEHN POLLUX returned to normal duties operating between ports in the Mediterranean, the Black Sea, Northern Europe and the Baltic.

Main Particulars:

Type of vessel	General cargo ship with double hull, singledeck
Classification	GL +100 A5 E, general cargo ship with doublehull, G SOLAS-II-2, Reg. 19 DBC, equipped for the carriage of containers, strengthened for heavy cargo, +MC E AUT
Built	September 1996, Santierul Naval Galati S.A., Galati, Romania, yard no. 739
Length	89.77 m
Breadth	13.17 m
Draught	5.7 m
Air draft	28.00 m (basis full ballast)
Gross tonnage	2,844
Main engine	MWM Deutz SBV 9M 628, 930 kW
Generators	2 Diesel generators 136 kW 1 shaft generator 336 kW 1 emergency generator 62 kW
Speed	abt. 10 kn
Flag	Antigua & Barbuda
Port of registry	St. John's

Image: ©Fehn Ship Management

Matson's LNG-Ready Containership

Photos: Matson/Philly Shipyard

Matson and Philly Shipyard, Inc. (PSI), christened the largest containership ever built in the U.S. in a ceremony at the Philly Shipyard on June 30. The new vessel is named Daniel K. Inouye in honor of Hawaii's late senior U.S. Senator, who was a longstanding supporter of the U.S. maritime industry and its important role in supporting Hawaii's economy. It is the first of two new ships being built for Matson by Philly Shipyard at a total cost of approximately $418 million for the pair, and the first of four new vessels that Matson will put into its Hawaii service during the next two years.

Built to serve Hawaii and with LNG-compatible engines, the 51,400 metric ton, 850-ft. long, 3,600-TEU ship is Matson's largest ship and the largest containership ever constructed in the U.S. It is also Matson's fastest vessel, with a top speed of nearly 24 knots.

This is Matson's first "Aloha Class" containership, and in addition to fuel engines it features double hull fuel tanks, a fresh water ballast systems and a fuel efficient hull design.

Symphony of the Seas

Photo: Royal Caribbean

At 362 meters long, 66 meters wide and 70 meters high, Royal Caribbean's new 228,081 GRT cruise ship takes the "world's largest" title.

Mega ship Symphony of the Seas was delivered to Royal Caribbean International from French shipbuilder STX France who has been constructing the vessel since 2015.

The new cruise liner, which boasts 18 decks total with capacity for 6,800 passengers in 2,747 staterooms and is crewed by more than 2,000 staff members, takes the size crown from her slightly smaller sister vessel, Harmony of the Seas.

The delivery comes barely two years after the delivery Harmony of the Seas, and will be followed by another of her class due in 2021.

"The Oasis Class has been a trend-setting design, but the team has evolved the design to build on that success to provide even more incredible family adventures," said Royal Caribbean Cruises Ltd. Chairman and CEO, Richard D. Fain.

"[Symphony of the Seas] is now the largest cruise ship ever and she's leaving Saint-Nazaire's yard after reaching outstanding finishing levels," said STX France chief executive, Laurent Castaing.

Among the ship's notable features are a 10-deck-tall slide, a zipline, laser tag, a large selection of dining options and Broadway musicals. She is also the first cruise ship to be granted with the "SILENT-E" class from DNV-GL for her low level of underwater noise.

Symphony of the Seas will debut in Barcelona, Spain and spend her inaugural summer season sailing the Mediterranean before being heading to the Caribbean.

WORLD'S LARGEST LNG BUNKER SUPPLY VESSEL

In mid-October 2018 Kairos, the world's largest LNG bunker supply vessel with an LNG capacity of 7,500 cu. m., started its voyage from the shipyard in South Korea to Northwest Europe.

The construction of the vessel started in 2016 when the joint venture of Nauticor and Klaipėdos nafta (KN) signed a time-charter agreement with ship owner Babcock Schulte Energy (BSE). In February 2018, steel cutting took place at Hyundai Mipo Dockyard (HMD) in Ulsan, South Korea.

In addition to being the world's largest LNG supply bunker, the vessel has several other unique features, including the ballast-free design and installation of a CNG tank to store vapor return gas from customer vessels.

‘Dead Fish’ to Power Cruise Ship

As shipowners globally explore new means to cut emissions and stay competitive, Norway’s Hurtigruten has a potential solutione: Dead fish and other organic waste as fuel for its 17-vessel fleet of green cruise ships.

Courtesy of its Norwegian heritage, Hurtigruten is already one of the world’s largest expedition cruise line, heavily invested in green technology to better serve the pristine aquatic environments where it conducts its business.

As the maritime world looks to the IMO mandate to cut greenhouse gas emissions by 50% by 2050, Hurtigruten is already enacting its green vision, powering cruise ships with liquified biogas (LBG) – fossil-free, renewable gas produced from dead fish and other organic waste.

“By introducing biogas as fuel for cruise ships, Hurtigruten will be the first cruise company to power ships with fossil-free fuel,” said Hurtigruten CEO Daniel Skjeldam (pictured).

By 2021, Hurtigruten plans to operate at least 6 of its ships on a combination of biogas, LNG and large battery packs. “Biogas is the greenest fuel in shipping, and will be a huge advantage for the environment. We would love other cruise companies to follow,” said Skjeldam. Other environmental milestones for the company include:

- The ban of single-use plastic.
- Introduction of the world’s first battery-hybrid powered cruise ship, MS Roald Amundsen, custom built for sustainable operations in some of the world’s most pristine waters such as Antarctica.
- The start of a large-scale green upgrade project, replacing traditional diesel propulsion with battery packs and gas engines on several Hurtigruten ships. In addition to liquified natural gas (LNG), these ships will also be the first cruise ships in the world to run on liquified biogas (LBG). Hurtigruten is currently building three hybrid powered expedition cruise ships at Norway’s Kleven Yard. MS Roald Amundsen, MS Fridtjof Nansen and the third, unnamed sister, will be delivered in 2019, 2020 and 2021.

Hurtigruten expects to invest more than $850 million in building the world’s greenest cruise line.

Photo: Hurtigruten; Inset Photo: Rune Kongsro/Hurtigruten

GREEN UPGRADE: Hurtigruten will power their ships with liquified biogas (LBG), fossil-free, renewable fuel produced from dead fish and other organic waste.

Left: Hurtigruten CEO Daniel Skjeldam.

Mat Boat Source Sought

The U.S. Army Corps of Engineers (USACE), Marine Design Center (MDC) will soon be releasing a sources sought notice for the construction of the Mat Boat, a 188 x 74 x 10-ftl. deck barge, for the Mat Sinking Unit (MSU) located on the Mississippi River. The barge is to be built to American Bureau of Shipping (ABS) Rules for Service on Rivers and Intracoastal Waterways. The sources sought notice is only for the construction of the barge, and not for the final product which incorporates a government furnished robotics package shown to the right. The sources sought notice will be released on the FedBizOpps.gov website.

In 2015, Bristol Harbor Group, Inc. (BHGI) was tasked through an Indefinite Delivery/Indefinite Quantity (IDIQ) contract with the USACE, to design, size, and specify details for the new Mat Boat, Mat Assembly Process and Mat Placement Process. BHGI first visited the MSU to gain a better understanding of its current operations. The Mat Sinking Unit’s purpose is to lay a protective overcoat of concrete mats to shield the riverbank from erosion and sloughing. USACE’s goal is to minimize the environmental impact and improve the safety of USACE’s personnel who operate the MSU by incorporating automated technology.

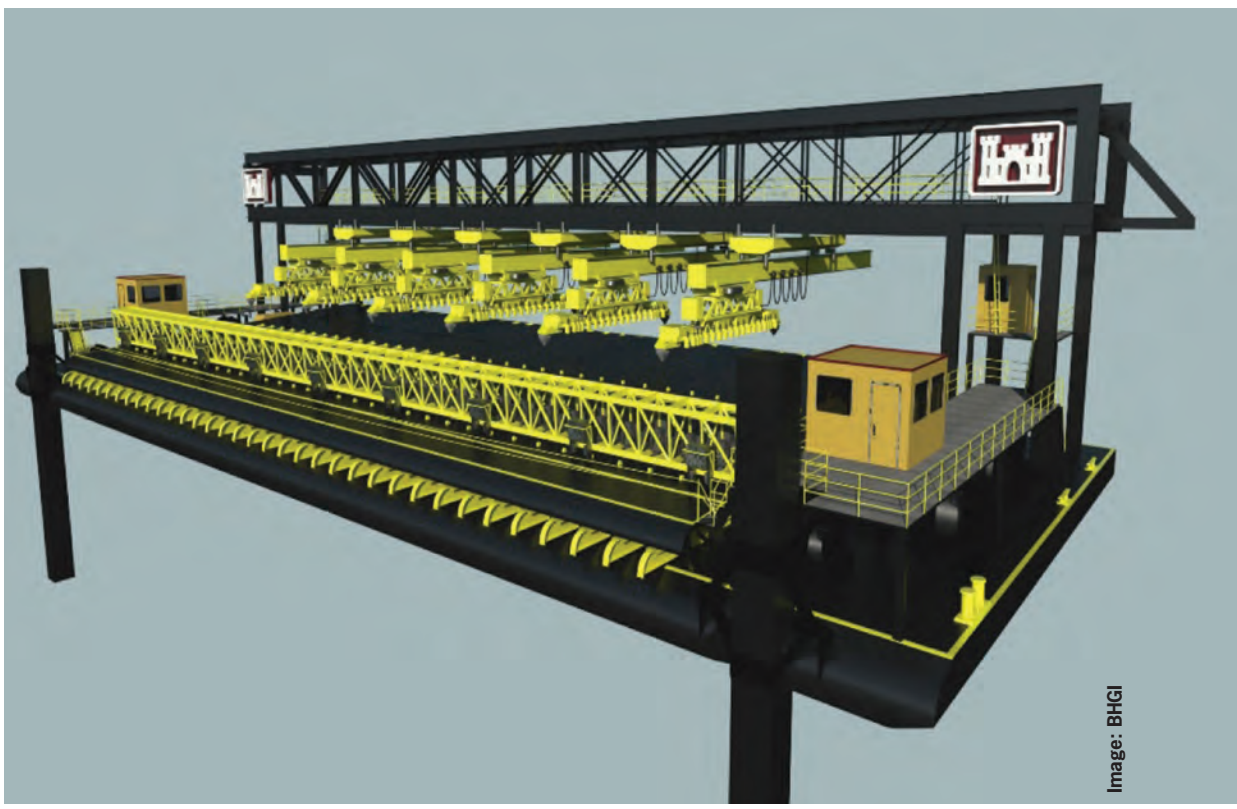


Image: BHGI

Mat Boat with Robotics System

RMK Expands Tugboat Presence

RMK Marine Shipyard, a subsidiary company to Koç Holding, the only Turkish company to be listed in Fortune Global 500 list, has furthered its place in the tugboat segment by receiving an order for a pair of 70 TbP tugboats from a local client. RMK Marine had realized a workboat project including five boats in 2008-2009 and another workboat project including a total of two tugboats, two service boats and five mooring boats in 2005-2016 for the same client previously. As a continuation of the client's satisfaction, RMK Marine has been recently placed another order which includes two powerful tugboats having 70 TbP power each. The vessel is a Robert Allan's RAmparts 2500-SD Tugboat designed and sold globally. ASD type high-quality vessel is designed for harbor and terminal operations, and coastal towing. It measures 25.4 x 11.9 m with a 4.6 m depth, and is powered by a pair of MTU 16V4000M63L diesel engines developing a total output of 2 x 2.24 kW at 1,800 rpm with a free sailing speed of 12 knots and bollard pull of 70 tons. Two Margen gensets provide a total of 2 x 140 ekW electrical power for vessel services, including the deck machinery. Each of the vessels is driven by two Rolls Royce Azimuth Thrusters US 255 CP with controllable pitch propellers of 2,600 mm diameter. Two main diesel-driven fire-fighting (FiFi) pumps for the tug's FiFi 1 system is mounted on the main engines and can deliver 2 x 1350 m3/hour to two electrically-controlled monitors with a 2 x 1200 cu. m./hour capacity. Data Hidrolik supplied one hydraulic fore towing winch and one hydraulic aft towing winch as well. Both winches have 45 ton pulling capacity and 180-ton brake capacity.

Photos: RMK Marine Shipyard

Maersk Supply Service Names Thorngren CFO

Karl Thorngren has been named Chief Financial Officer (CFO) of Maersk Supply Service effective April 29, 2019. He is currently the CFO of Svitzer Australia.

McAllister Towing Appoints Ginsberg CFO

McAllister Towing appointed Alan Ginsberg, currently the Treasurer of the Seaman's Church Institute, as CFO. Eric McAllister, former CFO, will remain as Treasurer.

Stephaich New Chairman of WCI

The Waterways Council, Inc. (WCI) named Peter H. Stephaich, Chairman and CEO of Campbell Transportation Company, Inc. (Pittsburgh, PA), as its Chairman of the Board.

Liberian Corporate Registry Appoints Perea New MD

Anthony Perea was appointed Managing Director of the Liberian Corporate Registry. He was previously MD at global corporate and fiduciary services provider AMICORP

Metal Shark Completes Passenger Ferries

A pair or 105-ft., 150-passenger high speed aluminum ferries built by Metal Shark have completed construction and are ready to enter service for the New Orleans Regional Transit Authority (RTA). The first boat was completed earlier this year and delivered to New Orleans in July. The second vessel is 100% complete at Metal Shark's Franklin, La., shipyard.

Photos: Metal Shark

Obituary

Sheldon Murdock

Just prior to the workboat show in New Orleans the *Maritime Reporter* staff was saddened to learn of the passing of a good friend, Sheldon Murdock of Scania, U.S.A. On Thursday, October 25, 2018, Sheldon Murdock, husband and father of two children, passed away at the age of 43. Sheldon was born on March 3, 1975 in Ogden, Utah to Bob and Dana Lee (Gurr) Murdock. He graduated from Layton High School in 1993 and later furthered his education at both the Davis and Ogden Applied Technology Centers. Sheldon was a Quality Assurance Manager at various companies in Utah before joining Scania-USA. Sheldon started his career with Scania USA in 2008 as the Marine Sales Manager, and did a phenomenal job working with Scania's distributors to build up the marine segment business. In 2016, Sheldon was promoted to Senior Industrial Sales Manager – Key Accounts. He continued to do a wonderful job in his new position and helped grow the business dramatically with several of his key customers. Sheldon is survived by his wife, Kristen, his son Levi and daughter Amiya, his father Bob and his mother Dana Lee, his brothers Steve and James, and his sister Candis (Pope), as well as several extended family members.

MARITIME REPORTER AND ENGINEERING NEWS

2019 Editorial Calendar

JANUARY

AD CLOSE: DEC 21

Ship Repair & Conversion: The Shipyards

MARKET FEATURE: **Tankers and Bulkers**

TECHNICAL FEATURE: **Hybrid Drives**

PRODUCT FEATURE: **Ballast Water Treatment Systems**

THOUGHT LEADERSHIP: **Fuels & Lubricants**

EVENT DISTRIBUTION
PVA Maritrends: Jan 17-20, New Orleans, LA
Surface Navy Association: Jan 15-17, Crystal City, VA

FEBRUARY

AD CLOSE: JAN 24

Ferry Builders

MARKET FEATURE: **Inland Push Boats & Barges**

TECHNICAL FEATURE: **Loading and Unloading: Cranes, Conveyors, Davits & Hoists**

PRODUCT FEATURE: **Passenger and Crew Safety Equipment**

THOUGHT LEADERSHIP: **TOP 10 Ferry & Riverboat Owners**

EVENT DISTRIBUTION
Ferry Safety & Technology: Feb 20-22, Bangkok, Thailand
Inland Waterways Conference: Cincinnati, OH

MARCH

AD CLOSE: FEB 21

Cruise Shipping

MARKET FEATURE: **Satellite Communications**

TECHNICAL FEATURE: **Maritime Simulation**

PRODUCT FEATURE: **Clean Water Technologies**

THOUGHT LEADERSHIP: **Coatings & Corrosion Control**

EVENT DISTRIBUTION
Seatrade Cruise Global: Apr 8-11, Miami Beach, FL
CMA Shipping 2019: Apr 2-4, Stamford, CT
NACE Corrosion: Mar 24-28, Nashville,TN
INMEX Vietnam: Mar 27- 29 Saigon, Vietnam

APRIL

AD CLOSE: MAR 21

Navies of the World

MARKET FEATURE: **Offshore Support Vessels**

TECHNICAL FEATURE: **RIB & Patrol Boat Report**

PRODUCT FEATURE: **Deck Machinery**

THOUGHT LEADERSHIP: **Autonomous Ship Technology**

EVENT DISTRIBUTION
Sea-Air-Space: May 6-8, National Harbor, MD
MACC 2019
OTC: May 6-9, Houston, TX
Ballast Water Mgmt
Intermodal Asia 2019: May 22-24, Shanghai, China

MAY

AD CLOSE: APR 21

Propulsion Annual - Green Marine Tech

MARKET FEATURE: **Tug and Tow Boats**

TECHNICAL FEATURE: **Ballast Water Management**

PRODUCT FEATURE: **Emission Scrubbers**

THOUGHT LEADERSHIP: **2019 Engine Guide**

EVENT DISTRIBUTION
Norshipping: Jun 4-7, Oslo, Norway
MegaRust 2019: May 14-16, Norfolk, VA
Inland Marine Expo: May 20-22 St. Louis, MO
Tugnology: May14-15, Liverpool, UK
Bari Ship 2019: May 23-25, Imbari, Japan

JUNE

AD CLOSE: MAY 24

80th Anniversary World Yearbook

MARKET FEATURE: **Cyber Security**

TECHNICAL FEATURE: **Offshore Renewable Energy: Wind Wave, Tidal**

PRODUCT FEATURE: **Navigation: Marine Electronics, Radar & ECDIS**

THOUGHT LEADERSHIP: **Top 10 Shipowners**

EVENT DISTRIBUTION
Electric & Hybrid Marine World Expo: Jun 25-27, Amsterdam
MAST Asia: Jun 17-19, Tokyo, Japan
CIMAC Congress 2019: Jun 10-14, Vancouver, Canada
Marine Money Week: Jun 17-19, New York, NY

MARITIME REPORTER AND ENGINEERING NEWS

2019 Editorial Calendar

JULY

AD CLOSE: JUN 23

Cruise Vessel Design & Outfit

MARKET FEATURE: Expedition Cruise Vessel Construction

TECHNICAL FEATURE: Training and Simulation

PRODUCT FEATURE: Autonomy, Robotics & Drones

THOUGHT LEADERSHIP: Maritime Software Solutions

AUGUST

AD CLOSE: JUL 25

The Shipyard Edition

MARKET FEATURE: Heavy Lifting: Cranes, Winches, Windlasses & Capstan

TECHNICAL FEATURE: Icebreakers

PRODUCT FEATURE: Welding & Cutting Equipment

THOUGHT LEADERSHIP: Energy Efficiency Systems

EVENT DISTRIBUTION

Offshore Europe: Sep 3-6, Aberdeen, Scotland
Seatrade Europe: Sep 11-13, Hamburg
NEVA 2019, Sep 17-19, St. Petersburg
Seatrade Offshore Marine & Workboats: Sep 23-25, Abu Dhabi, UAE

SEPTEMBER

AD CLOSE: AUG 24

Satellite Communications

MARKET FEATURE: Containership Technology

TECHNICAL FEATURE: Marine Firefighting, Safety & Salvage

PRODUCT FEATURE: Controls & Bridge Automation

THOUGHT LEADERSHIP: Maritime Port & Ship Security

EVENT DISTRIBUTION

Shipping Insight: Stamford, CT
Clean Gulf: Houston, TX
Interferry 2019: Oct 5-9, London, UK
KORMARINE: Oct 22-25, Busan, Korea

OCTOBER

AD CLOSE: SEP 22

Marine Design Annual

MARKET FEATURE: Alternative Marine Fuels

TECHNICAL FEATURE: Coatings: Deck, Hull and Tank

PRODUCT FEATURE: Software Solutions: CAD/CAM

THOUGHT LEADERSHIP: Ship Classification Societies

EVENT DISTRIBUTION

SNAME: October 29 - Nov 2, Tacoma, WA
Europort: Nov 5-8, Rotterdam
Blue Tech Week: Nov 4-8, San Diego, CA

NOVEMBER

AD CLOSE: OCT 25

Workboat Edition

MARKET FEATURE: Propulsion, Thrusters & Gears

TECHNICAL FEATURE: Multi Mission Boats; Patrol, Escort, Fire and Search & Rescue

PRODUCT FEATURE: Deck Machinery Product Guide

THOUGHT LEADERSHIP: Offshore Wind Power

EVENT DISTRIBUTION

Workboat Show: Dec 4-6, New Orleans, LA
Marintec China: Dec 3-6, Shanghai China
INMEX China: Dec 12-14, Guangzhou, China

DECEMBER

AD CLOSE: NOV 22

Great Ships of 2019

MARKET FEATURE: Top 10 Shipbuilders

TECHNICAL FEATURE: Digitalization in Ship Design & Construction

PRODUCT FEATURE: Bridge Electronics and Communications

THOUGHT LEADERSHIP: Maritime Emission Reduction

EVENT DISTRIBUTION

SNA 2020 - Crystal City, VA

Information may be subject to change

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This directory section is an editorial feature published in every issue for the convenience of the readers of MARITIME REPORTER. A quick-reference readers' guide, it includes the names and addresses of the world's leading manufacturers and suppliers of all types of marine machinery, equipment, supplies and services. A listing is provided, at no cost for one year in all issues, only to companies with continuing advertising programs in this publication, whether an advertisement appears in every issue or not. Because it is an editorial service, unpaid and not part of the advertisers contract, MR assumes no responsibility for errors. If you are interested in having your company listed in this Buyer's Directory Section, contact Mark O'Malley at momalley@marinelink.com

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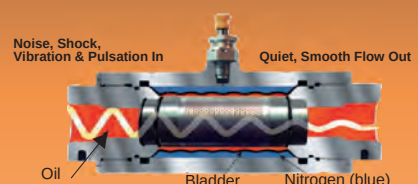

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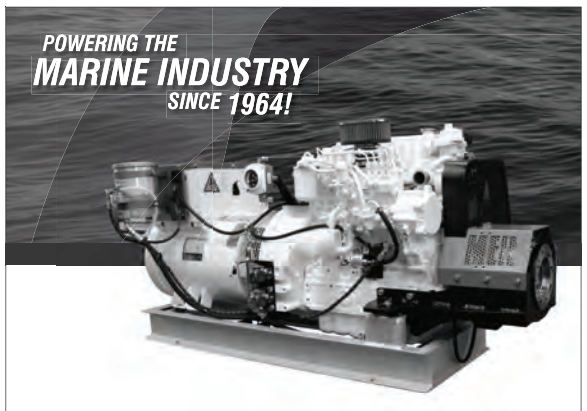

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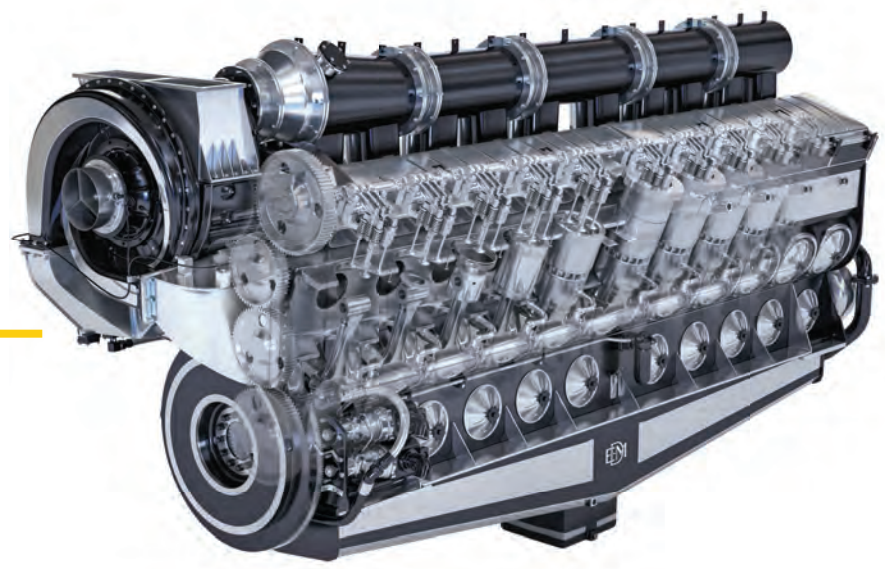

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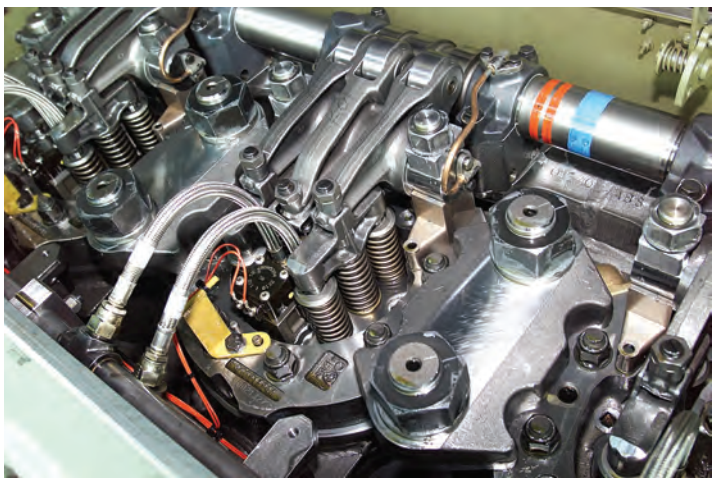

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