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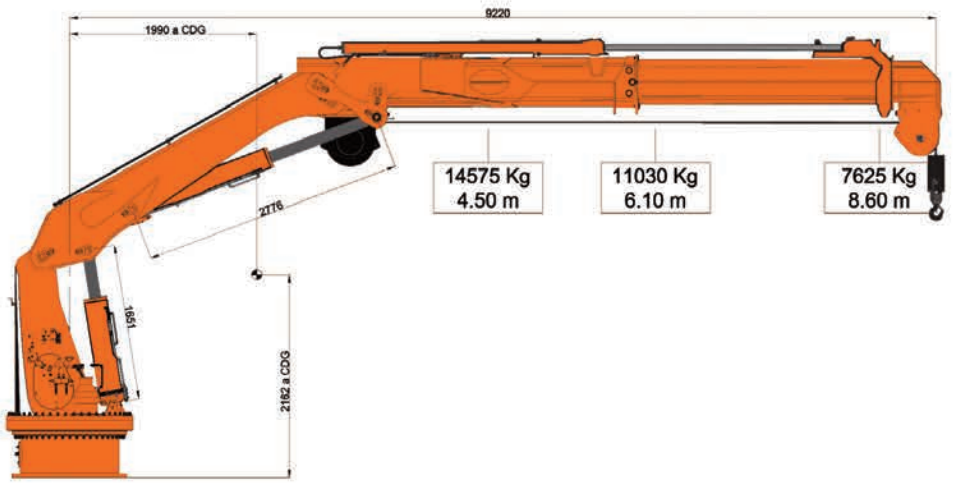

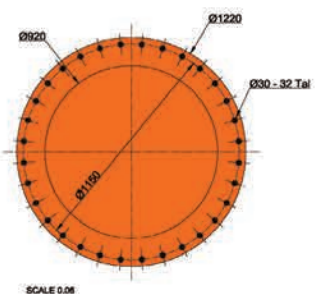

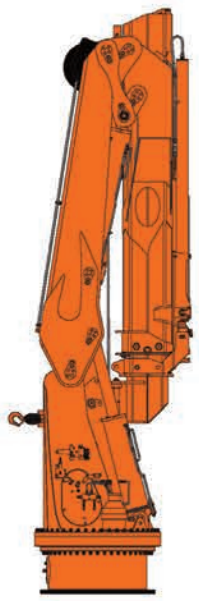

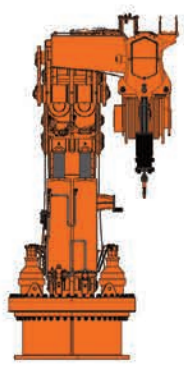

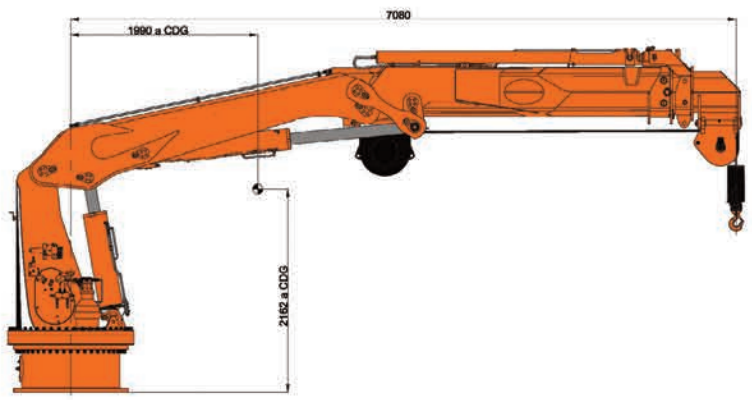

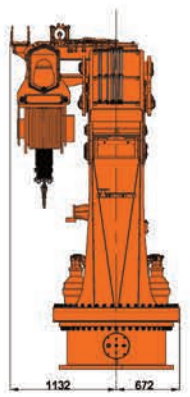

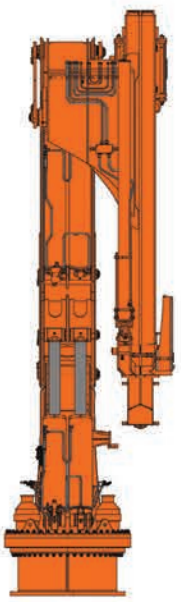

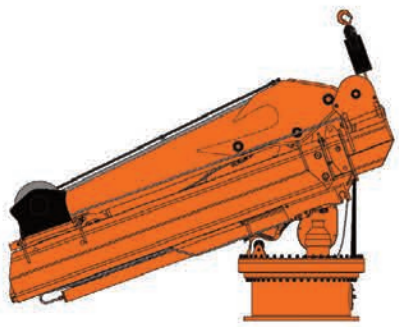

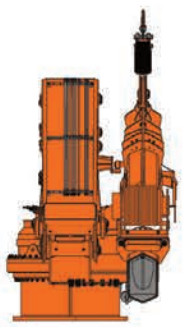

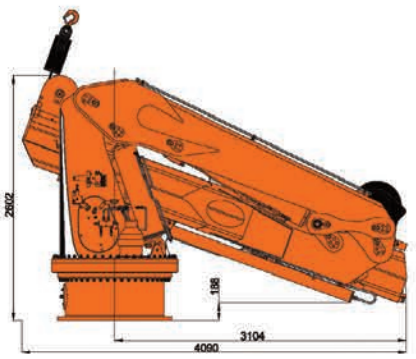

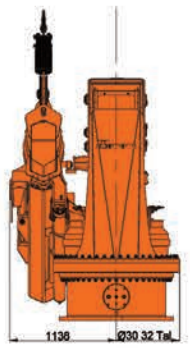

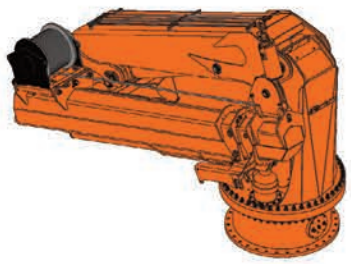

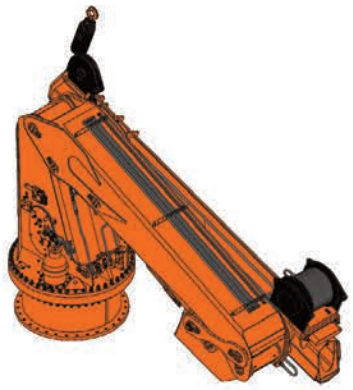

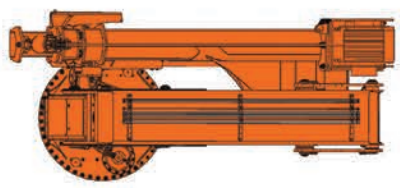

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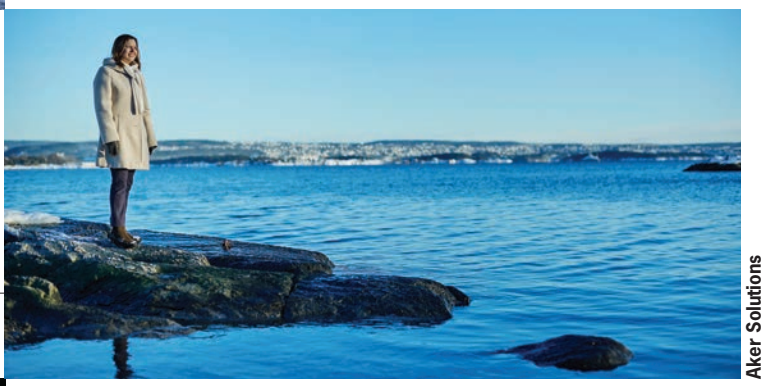

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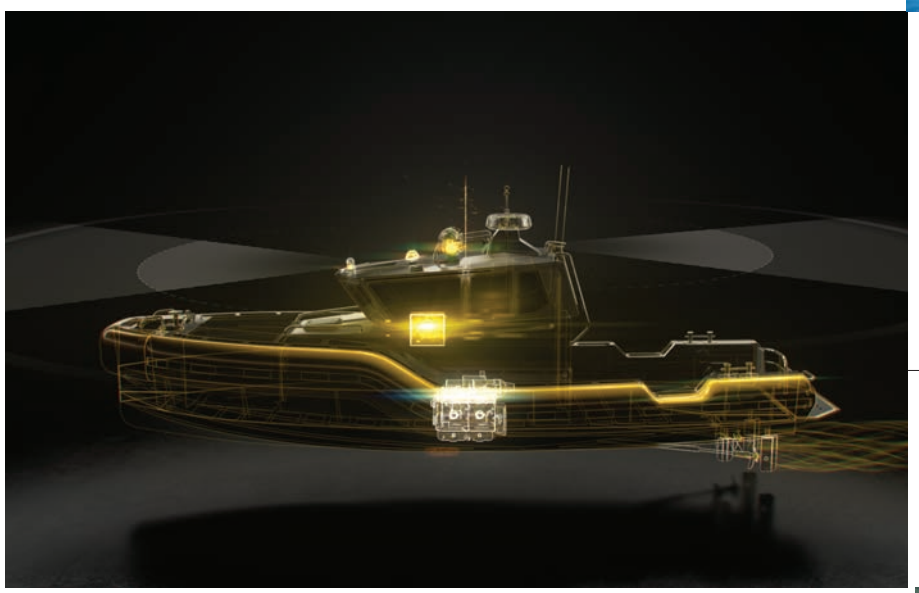

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Editorial

Ships, Humans & Technology

A common refrain at maritime conferences and media globally is the need to monitor and in some respects mimic the 'airline model,' which is admirable with its commonality of systems and well-orchestrated logistics chain.

But this month, as we examine the evolving role of autonomy in the maritime sector, specifically systems that increasingly take on decision making capabilities from humans, the question begs: what can we learn from the recent Boeing 737 MAX airline crashes, air disasters that – while still under investigation with no concrete conclusions – seemingly involved a faulty automation and sensor system.

The notion of autonomy in the maritime sector is endlessly fascinating, sure to provide fertile editorial fodder for years to come. While there is general agreement that the technology aspect of autonomy has arrived, there are still many critical hurdles ahead, including: regulatory agreement among international players; proper insurance; and the creation of technical standards so that all systems onboard vessels can efficiently and effectively 'talk' to one another. While serious work is underway, you can be sure that true autonomy in the oceangoing maritime sector will be debated and worked on for the coming generation.

To get a better perspective this month's 'Thought Leadership' is focused on autonomy and we are pleased to offer insights from several leading corporations and individuals driving change, including Siemens, Kongsberg, ABB and Sea Machines, primarily addressing the technology behind the trend. In addition, last year I had the opportunity to interview **Hideyuki Ando**, Senior General Manager, Maritime Technology Division, Doctor of Engineering, MTI Co., Ltd., which is the R&D unit of shipping giant NYK. He better than any other I talked to on the matter summed up the current shape and direction of the autonomous debate by saying: "We are a shipping company, so to achieve an autonomous ship is not our objective: our goal is safer, energy efficient operations and more reliable logistics. Our goal is to be the most reliable cargo carrier. We see automation technology as supporting our objective." This story starts on page 28.

Another technology making headlines is the advent of offshore wind. Renewable energy via offshore wind is in fact 'old hat' for Europeans, the clear leader in the sector with an approximate 20 years head start on the U.S. But all indicators point to a vibrant and growing offshore wind market in the U.S. for the coming 20 years, particularly off the shores of the Northeast U.S. in the Atlantic ocean. Starting a few months back we commissioned **Tom Ewing**, who is a master at navigating government offices, documents and bureaucracy, to write a monthly column for our pages documenting progress in the offshore wind sector. This month he examines developments in our home state of New York with his story starting on page 20.

On the technical side, I was fortunate to meet **Astrid Skarheim Onsum** last year at Blue Tech Week in San Diego, a high-quality 'Blue Economy' event put on by The Maritime Alliance. She is the SVP, Head of Wind for Aker Solutions, and a feature interview in this edition to discuss Aker Solution's long history in engineering solutions for the offshore sector in general, and specifically her view on the promising future of floating offshore wind units. Our interview with Onsum starts on page 25.

Finally, we have not forgotten the original offshore sector, even though conditions in offshore oil and gas remain challenging to say the least.

Barry Parker, our resident finance insights guru, delivers a candid look at the still suffering OSV market starting on page 14. While the OSV picture is not pretty, it is improving. The size, speed and length of recovery is truly anyone's guess, but this month Parker delivers a black and white vision of the current situation with insights from several industry insiders on the pace of things to come.

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Mass Maritime Honors Gallagher

*IRI's **William Gallagher** headlined the Massachusetts Maritime Academy's annual presentation of the Emery Rice Medal at the Plaza Hotel in New York City. Gallagher's belief in the value and concept of a public education, coupled with a life of achievement for the global waterfront was the perfect match for the 128 year old academy's values and mission set.*

New York, NY: On Monday, April 1, 2019, at the Plaza Hotel in the city that never sleeps, **Admiral Fran McDonald**, proud graduate of Massachusetts Maritime Academy and now president of what he insists is the best maritime university in the nation, extolled the virtues of the storied school and also had the honor of introducing this year's MMA Maritime Person of the Year.

The annual gala event, first and foremost, serves as a spectacular way to link the true giants in the industries that the academy serves with tomorrow's leaders – today's cadets – in those very industries. It is also the largest and most important industry recognition event and, concurrently, serves as the school's largest fundraiser for cadet scholarships.

Making it all possible, in part, were industry sponsors such as Clean Harbors Corporation, the Marshall Islands Registry, the American Bureau of Shipping, Able Services, Kelliher Group/Morgan Stanley, industry icon Gerhard Kurz, McAllister Towing and Transportation, Moran Towing, Noragh Analytics, Norton Rose Fulbright, Poten & Partners, Ridgebury Tankers, Scorpio Tankers, Seward & Kissel, GT Wilkinson Companies and scores of additional donors.

Photo: Greg Trauthwein

William Gallagher (fourth from right) was joined by six previous Emery Rice Medal recipients, who were in attendance at this year's Mass Maritime gala. Admiral Fran McDonald (far right) recognized each in turn, including the inaugural Emery Rice medal recipient, Admiral William Bud Flanagan.

The Captain Emery Rice Medal

The Academy strikes the **Captain Emery Rice** medal in the name of one of the most noteworthy alumni in the history of the college. Captain Rice, an 1897 graduate of the Academy, and as Captain of the US Mongolia, is credited with being the first steamship to sink a German submarine in World War I. During the Great War, Captain Rice made more than 40 voyages across the Atlantic in support of the US troops. Captain Rice was recognized twice by Theodore Roosevelt for his maritime skill and bravery as a shining example of American courage and fighting spirit.

The Medal was first awarded in 1995. On Monday night, six previous Emery Rice Medal recipients were in attendance. McDonald recognized each in turn, including the inaugural Emery Rice medal recipient, Admiral William Bud Flanagan.

IRI's William Gallagher

Clay Maitland, the Managing Partner of International Registries, was the clear choice to say a few words about Mr. Gallagher to the gathered throng, and his usual witty and gregarious style, he did not disappoint. Maitland started out by saying, simply, "Bill made the Marshall Islands." And, he added, Gallagher did so with humility and modesty. Never one to take the spotlight, Gallagher has instead spent a career assembling and managing the best of industry under the IRI umbrella, eventually taking the registry from tough times all the way to the second largest in the world.

For his part, Gallagher, and in his usually understated style, said, "I didn't have prepared remarks for tonight but instead wanted to say some good things about our staff. We have great people who are the reason for our success." Indeed, insists Gallagher, the key to IRI and the Marshall Islands flag has always been, and always will be, it's people. Nevertheless, we pressed and asked him to reflect on his long and successful career. Gallagher offered, "My proudest achievement as a registry was the RMI shattering the duopoly that had previously been the province of Panama and Liberia for sixty years."

MMA by the numbers ...

On Monday night, ADM McDonald also schooled the audience with a sense of where the school has been, and how far it has come. For example, the Acad-

emy holds four core mainstays in its education model; 100% Bachelor of Science programs, hands on labs and cutting edge technology, 100% co-operative education – six months for each and every cadet, 100% membership in the Regiment of Cadets and 100% civic engagement and volunteerism. MMA's cadets generously make time to give back. Indeed, said McDonald, last year alone, the school's cadets volunteered over 10,000 hours to charitable organizations, not-for-profits and to those who have a steeper climb in life.

For the typical cadet, that's a lot to handle in addition to academics and an otherwise highly disciplined college lifestyle. At the same time, it is no accident that those very same graduates find themselves in demand. For example, and in March, over 140 organizations with more than 500 job openings descended on the Buzzards Bay campus to recruit from that impressive collection of eager skill sets. Before all that can happen, however, it is clear that nights like this first help to make it all possible.

Real Purpose: Bill Gallagher & MMA

Eventually, it was time to formally introduce this year's honoree. **Jim Lawrence**, the founder of Marine Money and the MTI Network, and long time host of this week's world-renowned CMA Shipping conference, got the nod. Like Maitland, he also did not disappoint. As Gallagher donned the Emery Rice medal, it was a memorable moment; well deserved and enthusiastically received by the gathered group maritime stakeholders. Meanwhile, and back in Buzzards Bay, Massachusetts – in the administration building of the Massachusetts Maritime Academy – there is a plaque that commemorates the words of the nation's first Maritime Administrator, **Joseph P. Kennedy**. First year MMA cadets are required to memorize it. It reads simply, "You can have a Merchant Marine with first class men even if they sail second class ships, but second class men can't be trusted with the finest ships afloat."

In truth, Gallagher and MMA are more than a good match for one another. A product of public schools himself; this year's Emery Rice winner shares the same set of values and early years as most of Mass. Maritime's student body. And, as proud as he was of being chosen for the honor, Gallagher characteristically pointed the spotlight onto others, saying, "As far as our real purpose tonight, Mass. Maritime is a wonderful institution offering a first rate maritime education within a state school system. I am a product of the Maryland Pennsylvania State school systems and am a firm believer of a public education, as that is the great equalizer in our society."

I don't think anyone could have said it better. Bravo Zulu, Bill.

Dennis L. Bryant
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Fatigue & Band Aids

On 24 January, the IMO issued updated guidelines on fatigue. This is just another in a long series of band aids that attempt to cover over the problem without providing a solution. Fatigue is a long-standing weakness in the maritime industry. It is recognized as a major or contributing causal factor in the majority of maritime casualties. As is well-known, fatigue is caused by a lack of sleep and relaxation. These, in turn, are the result of too few people being tasked with too much work. Guidance on how to recognize and manage fatigue is meaningless.

The root cause of fatigue among the personnel on merchant vessels is that those vessels are insufficiently crewed. The minimum manning levels recommended by the IMO and mandated by flag administrations are inadequate and have been so for years. No one ship operator can afford to crew its vessels above the minimum level because that would put those vessels at an economic disadvantage against its competitors. All vessels operating in similar trades must increase their crew levels simultaneously.

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Attempts at fatigue management

The IMO and the flag administrations have taken a helpful step in addressing the fatigue problem by establishing maximum work hours and minimum rest hours.

In 1997, the IMO adopted major amendments to the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (STCW Convention), along with the accompanying STCW Code. Among other things, the Convention stated that each Administration shall, for the purpose of preventing fatigue, establish and enforce rest periods for watchkeeping personnel. The Code was more explicit, stating that watchkeepers shall be provided a minimum of 10 hours of rest in any 24-hour period and not less than 70 hours of rest in each seven-day period. The 2010 Manila Amendments to the STCW Convention and Code, which came into effect on 1 January 2012, expanded the rest requirement to a minimum of 77 hours in any 7-day period. Administrations are further enjoined to require that records of daily hours of rest of seafarers be maintained in a standardized format to allow for monitoring and verification of compliance by the Administration and during port state control examinations.

The US National Transportation Safety Board (NTSB) has long-recognized the dangers presented by fatigue in the transportation sector. It stated in a recent report:

Because "powering through" fatigue is simply not an acceptable option, fatigue management systems need to allow individuals to acknowledge fatigue without jeopardizing their employment. Likewise, the UK Maritime and Coastguard Agency (MCA) considers seafarer fatigue to be a potentially serious issue which is detrimental to safety at sea and the health of seafarers.

The Australian Transport Safety Bureau (ATSB) found the following:

Everyone has experienced fatigue at some point, but in the transport industry, where there's often high pressure to deliver, fatigue can have very real, very dangerous implications. Fatigue can have a range of adverse influences on human performance, such as slowed reaction time, decreased work efficiency, reduced motivational drive, and increased variability in work performance. Fatigue can lead to lapses or errors associated with attention, problem-solving, memory, vigilance and decision-making. Most people generally underestimate their level of fatigue. Studies have found that people experiencing fatigue are not able to evaluate accurately their own fatigue level or their ability to perform. Instead, they tend to overestimate their abilities.

The time is overdue for flag administrations and port state control regimes to vigorously enforce those recordkeeping requirements. There are suspicions that, on many ships, the watchkeeping hours are underreported and the hours of rest are overreported. Only detailed and careful review of those records can reveal the truth.

Crewing Levels

Only when the crewing level of ships is increased to an appropriate level will crew fatigue become manageable.

The IMO should immediately undertake a thoughtful analysis of vessel crewing requirements. Technological advancements may have reduced the level of physical labor on ships, but it has had minimal impact on work hours. For example, ECDIS, when operating properly, may have made it easier to identify where a vessel is located. The watch officer is still expected, nay, required to verify this visually and by radar. Instruments may tell the engineer that a motor has failed, but repairs must still be done manually.

Vessel owners and operators for years have pushed, successfully, for reductions in minimum crewing levels. The time has come for flag administrations, port states, and the IMO to push back. Covering over the fatigue problem with yet more management guidance is not a solution.

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

Autonomous Ship Technology

Opportunities, Risks & Considerations

There have been numerous articles and opinion pieces speaking of the potential application areas of maritime autonomous technology, the elimination of "human error", and the resulting safer operations that will supposedly be realized. The question of whether autonomous ships will offer safer solutions than crewed ships remains to be answered, and will not be resolved today. However, there is an important issue regarding levels of autonomy in vessel operations that needs to be addressed.

Many vessel operators feel that this technology will not impact their particular operating environment, and therefore there is no reason for them to worry about it. But the reality is that all vessel operators should stay abreast of developments in the arena of autonomous vessel operations. There are several reasons for this, including trickle down impact as well as potential impacts on the regulatory landscape.

We all need to realize that many of the major players in the autonomous vessel debate have the potential for significant financial benefit when this technology is implemented. We also need to understand that it may not be just a business decision that is the deciding factor in initiating autonomous vessel operation. We cannot discount the potential power of legislative lobbying on the issue of increased automated onboard operations in the name of vessel safety. This is one reason why it is important to stay educated on the developments, and proactively adopt improved safety and navigation technology and procedures. As an industry we must drive this discussion and help to steer the innovation so that it will help us operate safety and more efficiently. Keeping the status quo is not a viable option, nor is just looking to be "grandfathered" in.

To the many naysayers who feel that increased automation of vessel operations, or outright autonomous vessel operations, are science fiction pipedreams, I urge you to take a moment to reflect on the role that technology and innovation has taken in reshaping our touch points in modern business. While autonomous vessels may not reflect the dynamics addressed in Professor Clayton Christensen Theory of Disruptive Innovation, it does have the potential to significantly impact the way that goods are transported.

The fact is for many operators the choice to employ autonomous ships will, in large part, be driven by the bottom line. In today's shipping environment, it is a fact of life that spreadsheet analysis of EBITDA calculations is the deciding factor in many operating decisions. The question of manned vs. autonomous vessel operations will be no different. It is also important to realize that just as Minimum Manning Guidelines have become Maximum Manning complement on many vessels, minimum levels of autonomous vessel automation will likely be adopted as the default equipage level.

Just as in today's safety management environment where many operators embrace an acceptable level of loss, that principal will continue to be a guide even with autonomous vessel operations. The simple fact is that this technology will not usher in a Zero Loss Operating Environment. There will continue to be a cost benefit analysis between a zero loss operation vs. an acceptable level of losses. That is truly the behavior that we need to address. Ignoring developments, or outright dismissal of the technology, could place operators in the unenviable position of appearing to push back against proposed "Safety Regulations" that are in fact unproven operating systems that will lead to increased costs without demonstrated safety benefits.

Now what does this mean from a Marine Insurance standpoint? The key point should be to stay engaged with your Broker and Underwriter. At Allianz Global Corporate & Specialty (AGCS), we strive to understand our client's particular needs from their operational standpoint. This is not a one size fits all business, and every operating environment presents unique challenges. By staying engaged and understanding your current operations, insurers like AGCS are able to help companies in the maritime industry navigate the challenges that lay ahead.

Find an Underwriter who understands your market and will work with you to address your particular needs. Ensuring that you have properly trained and credentialed crew aboard your vessels will continue to be one of the most effective steps that you can take to have a safe and efficient operation, both now and in the future.

Wei Huang
Wei Huang is ABS Director, Global Offshore, Market Sector Lead, Offshore Support Vessels . As the OSV Market Sector Lead, she provides strategic insight and direction on the changing market conditions that drive client initiatives and programs. She joined ABS's engineering department in 1998.

OSVs: Restarting Idled Vessels

Owners of offshore support vessels (OSV) are beginning to examine the possibility of reactivating some of their fleet even as the consistent volatility of oil prices and a healthy stream of ships projected from global shipyards keeps their enthusiasm in check.

According to Clarksons, demand for the versatile ships, which support offshore exploration and production activities around the world, edged up 3% in 2018, with marginally higher day rates tempting some units out of lay-up.

Most of the idle OSV fleet is unlikely to become active this year, but related movement in this area has rekindled demand for technical support for reactivation efforts as owners look to position themselves with charterers for any potential market upswing in the offshore sector.

© Iain Cameron

Getting an OSV back to work – whether it's an anchor-handling tug, platform or multi-purpose supply vessel, or another derivative -- after a lengthy lay-up can be complicated. From ABS's perspective, it includes a class-reactivation survey to confirm that the ship still conforms to the associated rules and requirements.

Ultimately, the decision to reactivate an OSV is an economic one, with the cost of the process itself weighed against the length of any service contract the vessel may attract. With multiple vessels potentially in competition for the same contracts, a fast activation is often critical, even if the state of asset readiness varies significantly.

With so many variables, owners will need to combine realistic plans to renew class and resume operations with solutions that are tailor made to the asset's condition and desired reactivation dates. There is no one-size-fits-all template for this process; customization is a key, as is having the technical resources to fulfill the plan, and a thorough understanding of the regulations.

Typically, the process includes assessments of the hull, machinery, electrical and industrial equipment, control systems and instrumentation. Sea trials also may be needed. But while the survey tends to be resource-intensive, all activities do not all have to represent an added cost: some can be credited to a future special periodical survey for the vessel.

Because an effective strategy for reactivation depends on the detailed plans and preparations that support operational safety, asset owners must carefully assess all of their options before beginning. The vessel's age, the condition of its equipment, imbedded technology and whether it was warm or cold stacked when laid up are all factors that should influence the strategy chosen by the owner.

If the vessel's operating and repair history isn't well documented – or if relationships with those who played a part in the supply chain of its components are weak – the challenges of OSV reactivation can grow, along with the risks.

Depending on its ownership history, the latest lay-up may have been undertaken with varying levels of technical ability and attention to detail; the quality of those efforts and whether they were conducted with reactivation in mind will have a material impact on the current project.

In a market where demand can be suddenly impacted by the volatility of oil prices, reactivation is not without financial risk. Aside from the material and labor costs of the reactivation, they can include extraneous costs such as transporting work teams to the vessel or facility, or the implied costs of missed opportunities when activation delays see the charter contract awarded to rivals.

Factors that impact the time to market once the decision to reactivate is taken can include: the availability of materials, the readiness of class, flag state and vendors, as well as any plans to enhance software and the vessel's automated capabilities.

Modern OSVs often include complex technology such as dynamic positioning units, power management and control systems. These may need to be brought up to date, along with any software and IT systems that can impact compliance with company or industry cyber-security measures.

These requirements are not only dictated by the length of the lay up, age of the vessel and complexity of the systems, they are also influenced by how the vessel was laid up -- with or without an approved the lay-up plan -- and the types of maintenance carried out while it laid operationally idle.

While boats that are less complex mechanically will be simpler to reactivate, they are also likely to be less in demand from tough-minded charterers. The highest demand will be for modern vessels, especially those that have been laid up for shorter periods.

In gauging the attractiveness of sophis-

ticated ships, how they were laid up is the key; if they underwent limited preparation before lay up, the prospects for a quick reactivation fade.

In this state, activation is unlikely to be a quick process, as they will require thorough and systematic checks on a series of features and components, including but not limited to: oil analyses, hydraulic systems, all electronics, drives, switch gears, cooling systems, thrusters and stern seals.

The review will need to be measured and thorough; any omissions can result in early and costly failures, potentially negating the incentives for chartering the vessel.

Structural issues to be addressed during reactivation can include hull condition, corrosion, wastage and the replacement of parts. It is not unusual to find doors and hatches rusted and corroded on ships that have been idle, or general corrosion on deck, in ventilators and air pipes. The vessel must be checked for any unapproved modifications and repairs made during the lay up, or before.

The depth of the class-reactivation survey – whether the vessel requires a failure mode and effects analysis, or an audit under the International Safety Management or International Ship and Port Facility Security codes – needs to be fully understood by the owners and their technical support teams. If the vessel has been laid up for more than six months, an interim audit will be required by its flag state, too.

A few years of shrinking demand for OSVs since the decline in oil prices also may have prompted operators to scale back on more than just vessel capacity. Many may have had to reduce their workforces, a vital source of the kind technical expertise they need to restart vessel operations when signs of life come back to the market.

This is the technical gap that class aims to fill, especially those with significant offshore experience. ABS classed the first workboats to venture into the Gulf of Mexico in the early days of US offshore exploration; today it classes about one-third of the world's OSV fleet.

To support owners as they develop plans to reactivate vessels and renew class, ABS draws on deep working knowledge of this specialist fleet, with decades of experience with specialized vessels, including anchor handling, supply, firefighting, dive support, pipelay, heavy lift, well intervention and stimulation, and oil-spill recovery vessels.

According to Clarksons, the global orderbook for OSVs represented about 10% of the active fleet at the end of last year, vs 14% at the end of 2017. Supply side pressures appear to be moving in the right direction for the reactivation-minded, but there is still considerable fragility in the market.

OSV owners will no doubt be watching those numbers and the price of oil as they consider the next steps for their idle fleet.

OSVs: Which way is Up?

By Barry Parker

Any analysis of markets for offshore service vessels (OSV) usually begins with analogies to rough weather, best of times/worst of times or similar. OSV expert Seabrokers, with a home base in Stavanger, Norway, in the February edition of its Seabreeze market report follows this convention with a description of the "feast or famine" conditions in the North Sea. Recent day rate action highlights the localized nature of markets for anchor handlers (AHT), platform supply vessels (PSVs) and similar equipment, while also capturing the supply and demand dynamics which breed volatility.

A RECOVERY IS COMING, BUT ITS TIMING, BEYOND ITS FREQUENT CHARACTERIZATION AS "EVENTUAL" IS UNKNOWN. RESEARCH ANALYSTS AT CLARKSONS TITLED A JANUARY, 2019 REPORT "HOPE SPRINGS ETERNAL".

Volatility & Uncertainty

There has been recent upward movements of day rates seen in certain international OSV sectors, the problem is determining if they are temporary spikes or sustained cyclical upturns. In the March market report, the Norwegian intermediary Seabrokers said "… trading conditions turned rapidly, with the market quickly moving in owners' favor. It became quite common for there to be less than a handful of vessels available on any given day, and this provided owners with an opportunity to increase their rates."

The capacity utilization numbers tell the story; for large PSVs which it defines as having deck capacities of greater than 900 sq. m. (equivalent to roughly 5,000 dwt), went from a worrisome 58% in January up to a healthy 82% in February. Day rates for these vessels responded in kind, with the broker estimating a jump in hires from $6,800/day in January up to $14,400/day in February.

For perspective, equity analyst James West, who covers the sector at New York based investment bank Evercore ISI, re-

OSV THUNDER, owned by Jackson Offshore, serving floater Deepwater Conquerer.

Source: Jackson Offshore

minded clients that: "… the prior peak in worldwide fleet utilization was nearly 87% in 2013…"

The dynamics which underlie activity in the service segment stem from oil exploration and actual production, both of which are tied to perceptions of future oil prices. Economics 101 applies here, with the anticipation of sustained lower prices, certain projects become uneconomical; OSV owners then put their vessels into "lay-up". In the last "healthy" market for offshore assets, circa mid-2014, the ratio of OSVs to working rigs was roughly 4.5x – 5.0x.

The logistics of "cold stacking", where systems are disconnected and the asset is basically left to sit for a lengthy period, are where OSV economics become unique compared to other maritime asset classes. As reactivation becomes a lengthy and expensive process, relatively small shifts in demand lead to magnified volatility around a supply side that's been semi-permanently reduced by cold stacked equipment.

Overall, asset values for international OSVs are weak, having declined since the oil price tumble of 2014/2015, but they failed to turn upward with the price of crude oil. Looking at a notional large anchor handling tug (described as one between 10,000 BHP and 13,000 BHP) the analysts at VesselsValue have presented a data series which looks at the asset price going back to 2014, prior to the major move down in the oil price. The hypothetical 10-year-old vessel (left axis), then priced at $20 million, followed the price of crude oil (right axis) downward . However, as the oil price bounced back upward, the OSV price moved sideways along a floor, mired at around $4 million since early 2017. The analysts pointed to extensive building in China (and a lack of scrapping). VesselsValue has also looked closely at the market for the 21 assets recently sold in the liquidation of Toisa (which entered bankruptcy in early 2017), back-casting the present $276 million valuation to early 2017, when the same fleet would have been worth nearly $400 million.

Disappointing asset prices in the face of volatile day rates are not necessarily a bad thing, enabling the brave to get positioned for the recovery. Seacor Marine Holdings (symbol SMHI) noted in a Q3 presentation at an investment conference that it has invested $230 million ahead of a hoped-for market upturn, adding vessels at deep discounts to replacement value, some through "distressed" sales. SMHI also noted that "consolidation has improved the competitive landscape". SMHI, which refinanced debt in Q4 2018 (picking up some $28.3 million of cash that could be used for acquisitions) has been a consolidator.

In late 2018 and into early 2019, it acquired 14 vessels through a joint venture in the Brazilian market (with savvy

financial structuring that saw SMHI putting up only $5 million of its own capital), acquired three Fast Support Vessels from a onetime pool partner, paying with SMHI shares, and, most recently, bought three 2018 built PSVs from a company within the COSCO group. For others, it's more about cost savings and staying power. Tidewater (TDW), restructured after its 2017 bankruptcy filing, and now the world's largest OSV operator after having acquired Gulfmark International in late 2018, talked about "value creation in a down market… " through post-merger synergies, in a January conference presentation. SMHI reported average 2018 day rates for its fleet of just above $9,700/day (for those units working) but with a disappointing utilization of around 60%.

A recovery is coming, but its timing, beyond its frequent characterization as "eventual," is unknown. Research analysts at Clarksons titled a January, 2019 report "Hope Springs Eternal".

In recent equity research for investors in Hornbeck Offshore (HOS), Evercore ISI's West explained to clients: "The exact timing for a recovery to occur in the offshore vessel space is opaque although a number of indicators point to early 2020 as the inflection point given the increasing pace of activity in our offshore drilling coverage."

After stressing the impact of the Brent oil price on oil company budgets, pointing to levels around $60 - $65/bbl that would keep E&P budgets intact, West goes on to say: "The offshore transportation market, a second derivative of offshore exploration and development activity has started to improve albeit at a slower pace as a previous oversupply of vessels begins to work itself out via attrition and market consolidation."

IN LATE 2014, THE BAKER HUGHES DATA SHOWS 57 DEEPWATER RIGS WORKING, MORE THAN DOUBLE THE PRESENT NUMBER, WHICH, IN RETROSPECT PROVIDES A BENCHMARK FOR FULL OSV UTILIZATION.

TDW, in its presentation, and referring to the OSVs / working rigs, suggested that "…the market is likely tighter than it appears…" citing the high probability that vessels stacked for more than three years, or those more than 15 years old, would not return to service.

Markers can be found in the sale of the Toisa asset liquidation, an ongoing liquidation sale of nearly two dozen vessels trading internationally, primarily anchor handlers and PSV. Analytical work by the VesselsValue analysts noted: "… 21 assets were sold during the 12 month period, totaling almost $220 million in one of the largest court auctions of any offshore owner in recent history … VesselsValue prices the market value of the assets today at $276 million, however it is important to note that many vessels were sold in layup condition out of class and in need of reactivation."

At a high level, this analysis suggests that $2.66 million, on average, would have been required to reactivate each vessel to trading readiness.

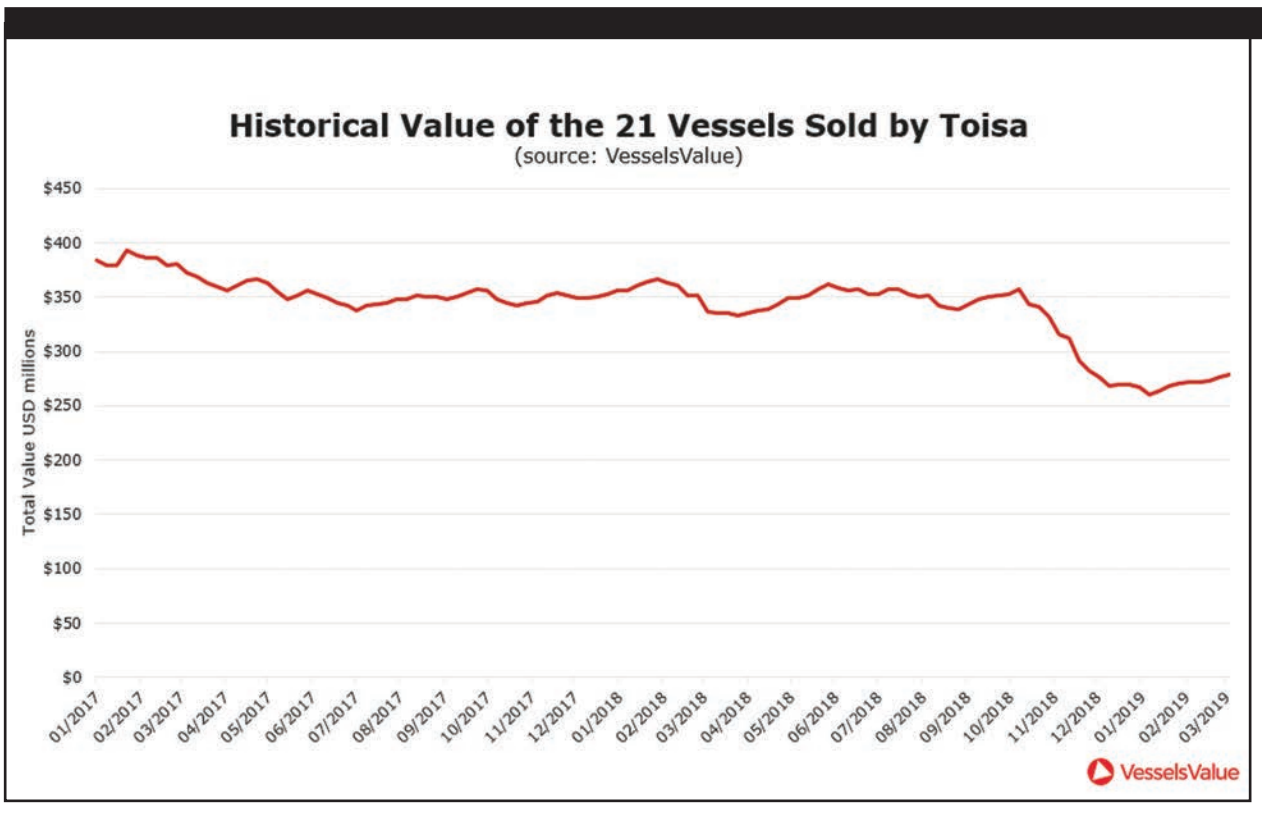
Hornbeck Offshore, along with well-known owners including Harvey Gulf International Marine and Edison Chouest, also participate in the Jones Act market, where the constrained supply dynamics for PSVs lead to a slightly different volatility contour. The big picture, much like the international arena where assets can move around, is one of an oversupplied market. For Hornbeck, its 2018 results show that its "new generation" OSVs averaged $19,150/day when working, adjusted for the poor utilization (24 units working out of 64 vessel fleet), the effective day rate falls to $5,036/day.

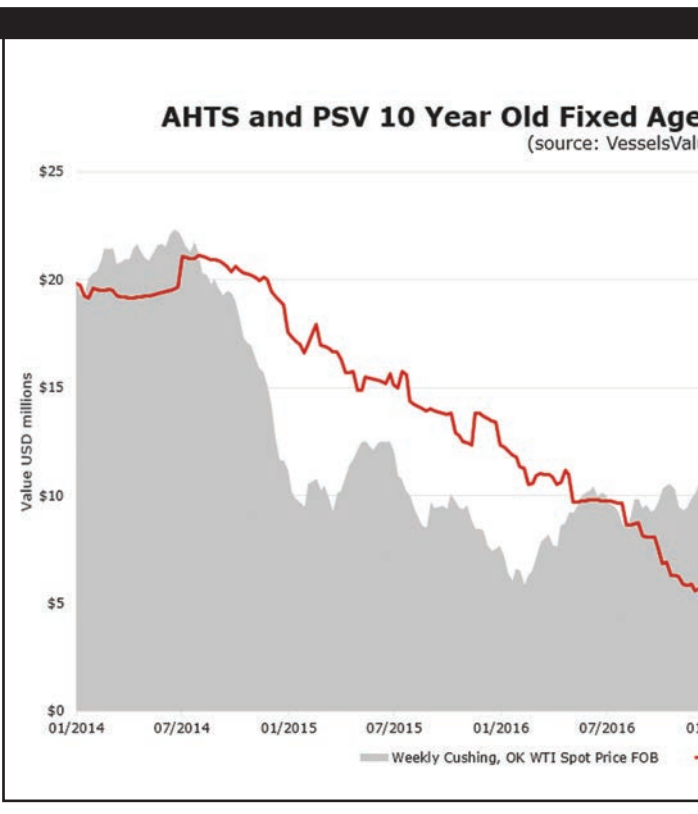
Rigs & Boats

Demand for service vessels in the U.S. Gulf of Mexico stems from working rigs. In theory, the deepwater rigs presently working would give rise to demand for roughly 100 OSVs to serve them, far less than the overall availability. Baker Hughes, which provides monthly updates on the rig count, showed 22 floating rigs (drillships and semi-submersibles) working offshore in early March, 2019- little changed from levels of September/October 2018 (but up from the 17 logged at the beginning of 2018). Unstacking boats requires a judgement that upticks in day rates (and boats working) are not merely temporary spikes, and, importantly, a commitment for owners to pay for drydock costs.

Matthew M Rigdon, Executive Vice President and Chief Operating Officer of OSV owner Jackson Offshore Operators, discussing deepwater OSVs, told Maritime Reporter & Engineering News: "Supply is tightening, as I suspected at the time of a presentation I gave in late November 2018, due to the large number of dry-dock requirements coming due in 2019. There is little spot availability and our competitors are not willing to offer vessels for short term requirements. They are requiring longer term commitments from charterers to even offer the few vessels that are immediately available. This has resulted in rate support into the $20,000 / day range. Rates will need to get into the mid $20,000/day range to allow vessel operators to break even and recover dry-dock costs. "

Todd Hornbeck, in his company's mid-February 2019 investor call (reviewing 2018 Q4 results) offered a similar sentiment, hoping that OSV operators take the longer-term view before re-activating equipment. He told investors, "Financial discipline and attention to ROIC over the long haul necessitates that as we unstack vessels, we do so in such a way that the cost of unstacking, i.e. drydock-

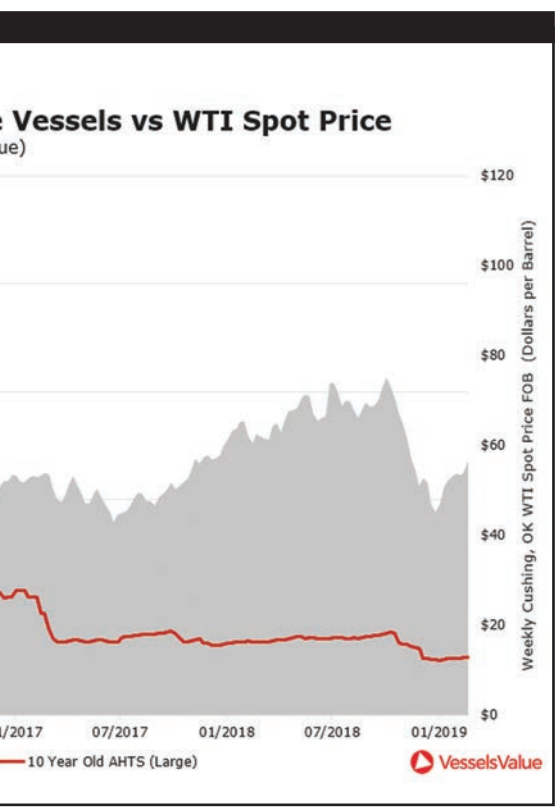


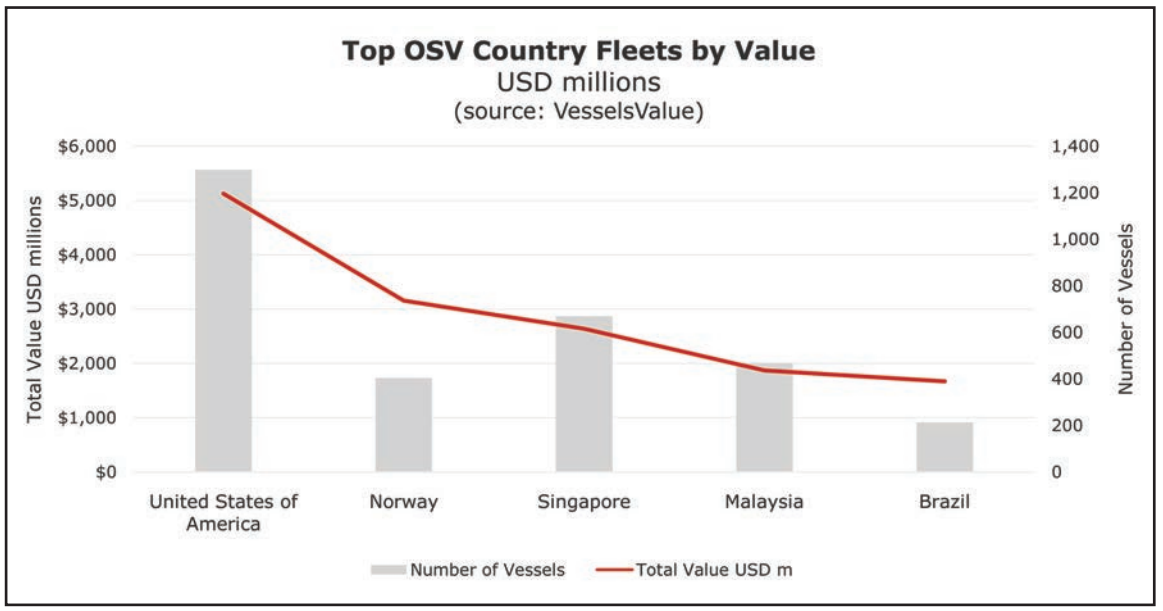


ing, recrewing, training, resupplying the vessel is contractually covered or otherwise strategically justified….We see no logical reason to unstack a vessel for a contract that cannibalizes the value of not only that vessel, but the other vessels we have deployed in a given market."

In late 2014, the Baker Hughes data shows 57 deepwater rigs working, more than double the present number, which, in retrospect provides a benchmark for full OSV utilization. In its end-2018 Form 10-K (including its annual report to investors), HOS estimated that 80 U.S. flag OSVs were cold-stacked.

A GOM turnaround is not without its challenges. At the end of 2018, analysts at leading energy consultants Wood Mackenzie had turned positive, provided that the oil majors moved forward with some mega-projects. Though production costs in the GOM have come down, economic prospects continue to be uncertain, so Final Investment Decisions are far from a sure thing. Wood Mackenzie's senior research analyst, William Turner, said: "We expect 2019 to be a strong year for the Gulf of Mexico. In addition to exciting new project sanctions, which could usher in more than $10 billion of investment into the region, a couple of historic firsts set to occur next year could set the stage for years to come." They said that: "Shell and Chevron will lead the way, but the actual growth in exploration will come from new entrants – Kosmos Energy, Equinor, Total, Murphy and Fieldwood." But the majors' eyes are also looking to the west, on the landside, specifically to the Permian Basin, where both Chevron and Exxon both plan to ratchet up oil production dramatically in the next few years. As Permian pipeline connections to the Gulf Coast open up, the majors looking at the big offshore projects may pause before pulling the trigger on big offshore commitments.



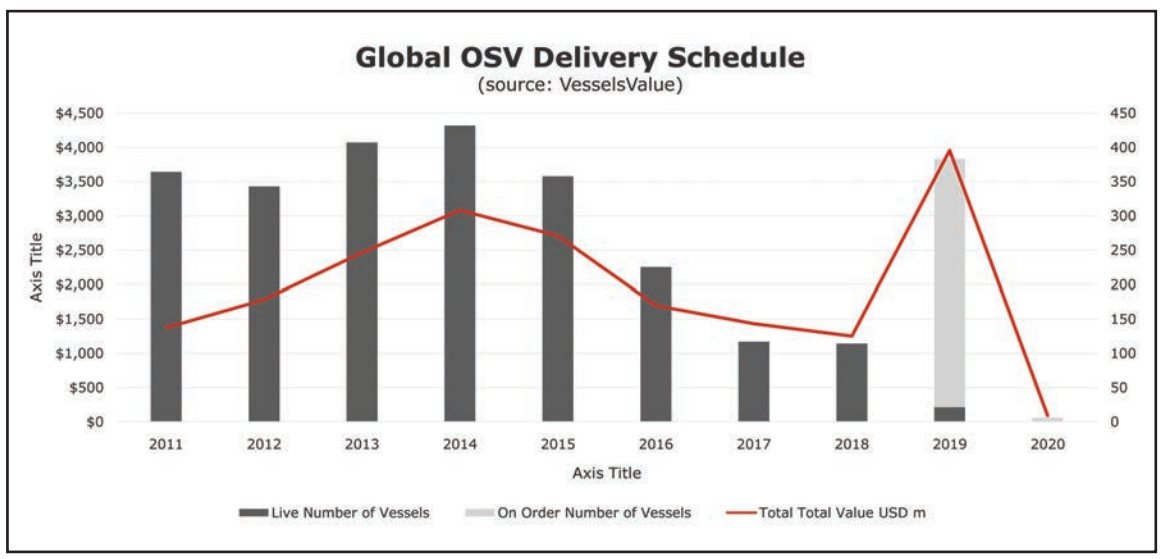


Top OSV Country Fleets by Value

Company	# of Vessels	Value $m
United States of America	1,299	$5,128
Norway	405	$3,155
Singapore	670	$2,638
Malaysia	469	$1,870
Brazil	213	$1,667

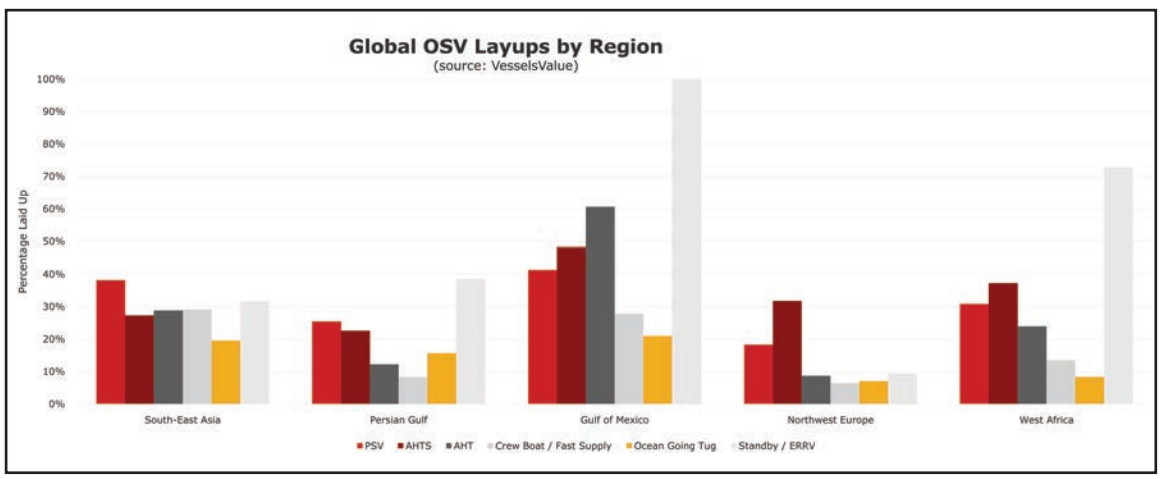
Top OSV Company Fleets by Value

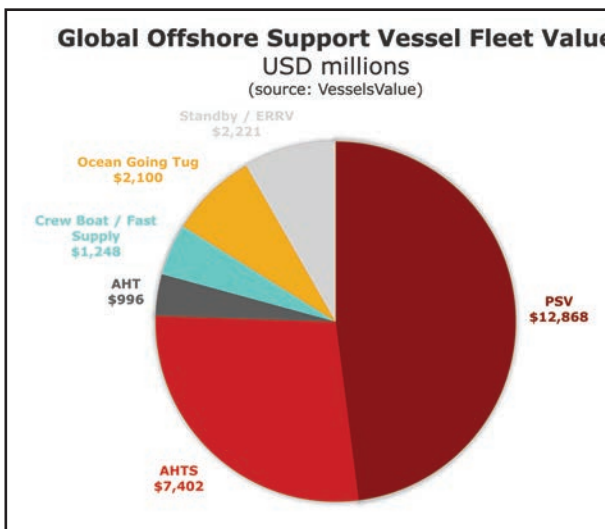
Company	# of Vessels	Value $ m
Edison Chouest Offshore	222	$1,619
Tidewater Marine	185	$874
Solstad Offshore	99	$737
Nam Cheong International Ltd	70	$687
Sovcomflot	10	$552



Age Profile of OSVs Operating in GOM

Age Group	# of Vessels	Value $m
0-4	66	$970
5-9	200	$1,510
10-14	258	$616
15-19	154	$151
20-24	119	$74
25-29	28	$7
30-34	12	$3
35-39	97	$26
40-44	76	$20
45-49	16	$4
50+	3	$0.4
Grand Total	**1,029**	**$3,381**





Global OSV Layups by Region

Region	Percentage Laid Up					
	PSV	**AHTS**	**AHT**	**Crew Boat/ Fast Supply**	**Oceangoing Tug**	**Standby/ ERRV**
South-East Asia	38.2%	27.3%	28.8%	29.1%	19.5%	31.6%
Persian Gulf	25.5%	22.5%	12.2%	8.3%	15.7%	38.5%
Gulf of Mexico	41.3%	48.2%	60.6%	27.8%	20.9%	100.0%
Northwest Europe	18.3%	31.7%	8.7%	6.4%	7.0%	9.3%
West Africa	30.8%	37.2%	23.9%	13.5%	8.3%	72.7%
Grand Total	**33.1%**	**29.4%**	**21.3%**	**18.8%**	**15.6%**	**17.2%**

Sonardyne's PIES to Monitor U.S. Gulf Current

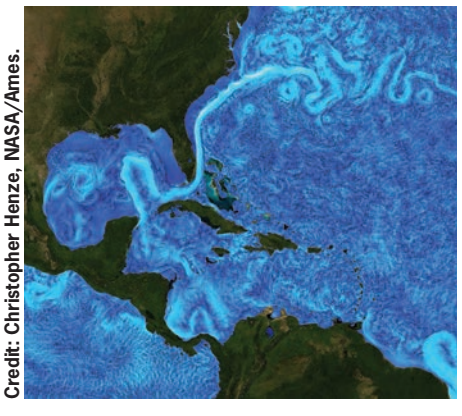
Sonardyne International will be used as part of a $2 million scientific study of disruptive ocean currents in the US Gulf of Mexico. The multi-year deployment, led by the University of Rhode Island (URI)'s Graduate School of Oceanography, will monitor the Loop Current System (LCS) using Sonardyne's Pressure Inverted Echo Sounders (PIES).

The LCS is the dominant ocean circulation feature in the Gulf of Mexico. It influences all ocean processes in the Gulf and has implications for a wide range of human and natural activities, from oil exploration to coastal eco-systems, but, knowledge of its underlying dynamics is limited. URI's initial study aims to improve the understanding and prediction of the LCS by deploying a seabed network of PIES plus near-bottom current meters to monitor the central Gulf's deep waters.

PIES work by transmitting an acoustic pulse from an instrument on the seabed upwards. The pulse is reflected off the water-air boundary at the sea surface and returns back down to the seabed where it is detected by the PIES. This enables an exact measurement of the two way signal travel time to be calculated. At the same instant, an accurate measurement of depth is made using highly precise internal pressure sensors. Combining data from an array of PIES instruments and near bottom current meters with historic water profile data can be used to calculate currents throughout the full water column.

A total of 25 of Sonardyne's and URI's own PIES and current meters will be deployed in the summer of 2019, in waters down to 3,500m depth, with an initial data retrieval using acoustic through-water communications to a surface vessel planned for autumn 2019. Instrument recovery is scheduled for autumn 2020. The results of this study will be used to inform how best to deploy a larger array for a planned 10-year-long research campaign.

URI's LCS study is being funded by the U.S. National Academies of Sciences, Engineering and Medicine's Gulf Research Programme, which was founded in 2013, as part of the legal settlements with companies involved in the 2010 Deepwater Horizon oil spill. The long term objective is to improve forecasts of the LCS in order to increase the safety of operations in the Gulf.



Credit: Christopher Henze, NASA/Ames.

A visualization of the Gulf of Mexico Loop Current.

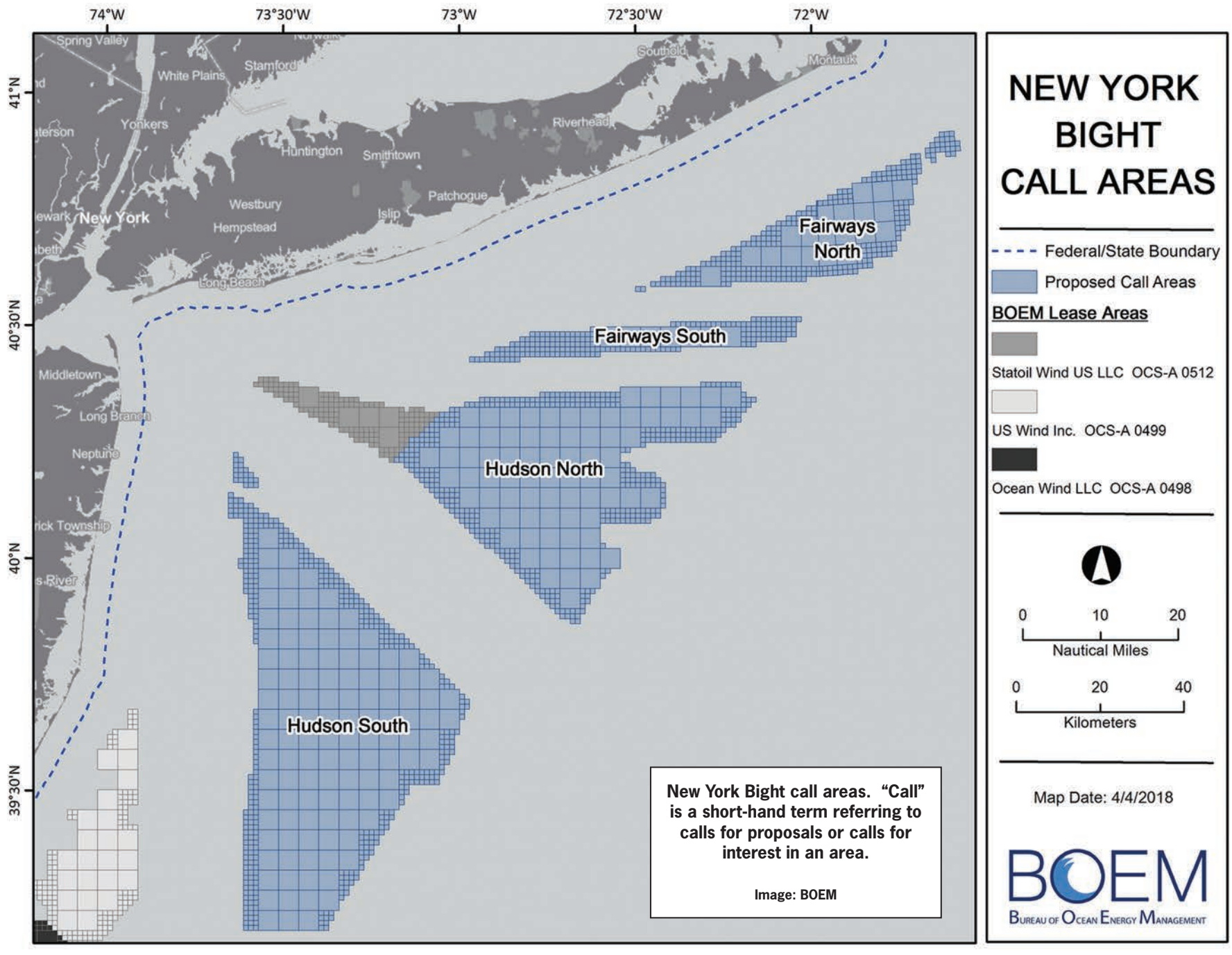
Tom Ewing
Tom Ewing is a freelance writer specializing in energy and environmental topics. He has been a regular contributor to MarineLink publications for the past two years. He has extensive experience working on legislative and public policy issues, both at the state and federal levels.

A New York State of Mind

"A new industry is being established in New York, with the primary stimulus being a state-driven procurement process."

New York State Public Service Commission (PSC), July 12, 2018.

To a great extent, this PSC comment provides direct insight into the dynamics behind New York's pace-setting moves to establish offshore wind. First, this new energy development is deliberate – not left to chance or laissez faire markets. Second, state officials are in control,



New York Bight call areas. "Call" is a short-hand term referring to calls for proposals or calls for interest in an area.

Image: BOEM

from choosing a contractor to securing money for payment. Third, state utility commissions act on projects. To that end, New York's Public Service Commission's "Order Establishing Offshore Wind Standard and Framework for Phase 1 Procurement", July 2018, is about action, not discussion. This PSC Order created a framework that started a remarkable and fast-moving set of events.

- On November 8, NY Governor Cuomo directed the New York State Energy Research and Development Authority (NYSERDA) to issue a request for proposals (RFP) seeking 800 megawatts or more of new offshore wind projects.
- By deadline, February 14, four major developers submitted proposals:
    1. *Atlantic Shores Offshore Wind*
    2. *Empire Wind Project – Equinor US Holdings, Inc.*
    3. *Liberty Wind - Vineyard Wind*
    4. *Sunrise Wind – Bay State Wind LLC, a joint venture of Ørsted A/S & Eversource Energy.*
- By March 31 New York's LSEs – "Load Serving Entities" – investor owned utilities as well as municipal systems and power cooperatives – were to formally commit to purchasing the offshore wind power. That guarantees a customer base from Montauk on eastern Long Island to Buffalo. LSEs will buy power in proportion to each utility's annual total load.
- In the spring, NY will select a developer.
- Contracts are expected by summer.

This could hit a brick wall if the economics/prices aren't right. Right now, finance is a mystery – except to state reviewers – because the public versions of the developers' proposals are heavily redacted, making it impossible to review generation costs or wholesale/retail costs or what kind of subsidy New York ratepayers might have to pay.

Still, in the years ahead, New York will need new and replacement electric generation capacity. Natural gas is the only other viable generation fuel but even gas has been marginalized because of constant and increasing opposition related to safety, environmental and climate issues. Plus, New York officials are confident that wind prices will be competitive, that U.S. projects will mirror the steep price declines seen within recent European wind projects.

When asked about costs, NYSERDA staff (not otherwise identified in an email), provided an indirect, comparative answer, referencing generation costs for an upcoming Massachusetts project of around $65/MWh, implying that that figure would be competitive and favorable for NY. Again, NY will need new generation. So now, goes this official reasoning, is the time for bold leadership in a new, green energy industry. Eventually, the PSC argues, because of timely

moves, New Yorkers could have relatively inexpensive, competitively priced power. The PSC writes that NY's programmatic "jump-start should produce great value when it results in a large and affordable renewable resource within simple transmission distance of downstate loads."

New York will not own any energy infrastructure. NYSERDA is authorized to buy ORECS – "offshore renewable energy credits" – from an eventual power supplier. In turn, NYSERDA will sell the ORECs to the LSEs. Renewable energy credits are complex. Until all funding details are open for review, it's hard to tell exactly how the ORECs will work in NY's energy market.

Economic development is a major part of New York's offshore wind planning. Among the developers' proposals, reviewers will weigh economic impact at 20%, price at 70% and "viability" at 10%. Importantly, that's local and regional economic development. The PSC's July Order, for example, writes that "due to the size of towers and blades, construction of offshore wind projects requires regionally based waterfront facilities."

This big picture has been closely studied. NYSERDA officials screened 65 port sites within the state and determined that New York Harbor, the Hudson River, and Long Island contain numerous suitable places and facilities for manufacturing, assembly, operations, and maintenance, including potential port sites as far north as Albany. Officials estimate that if 2.4 GW were deployed regionally by 2030, that build-out would result in up to 5000 jobs, including 2000 long-term jobs dedicated to operations and maintenance.

PSC writes further that "while New York has inherent advantages in attracting Atlantic coast offshore wind development, including its central location, the State will be proactive in developing workforce expertise, infrastructure, and other prerequisites to attracting offshore wind jobs."

This expertise holds payoffs. First, as noted, wind investments will be an economic driver, impacting everything from payrolls to local taxes. Second, PSC writes that "there is compelling evidence that costs will tend to decline sharply after a supply chain has been established." Therefore, the Commission writes, "offshore wind procurement needs to begin immediately in order to cost effectively secure the economic and environmental benefits."

New York is developing a wind energy supply chain. NYSERDA has a "Supply Chain Database" web page. That text includes a link to a database request form for a business to use to "request placement in this database" as well as to update or revise information. The database is searchable, with filters for organization, name and location. Questions? Send an email to: offshorewind@nyserda.ny.gov.

Labor officials have a close eye on upcoming developments. In a press release announcing NY's new wind effort State Department of Labor Commissioner Roberta Reardon said, "This (offshore wind) solicitation not only supports the state's ongoing commitment to the environment it also benefits workers by requiring project labor agreements, guaranteeing prevailing wage and incentivizing jobs." The PSC writes that project labor agreements "may be particularly valuable in the context of offshore wind procurements where time is of the essence. A PLA helps to assure timely compliance with contract terms and delivery of power by the specified COD."

Gary LaBarbera, President, Building and Construction Trades Council of Greater New York and Co-Founder, Climate Jobs New York, said, "The jobs created by this new industry will be good middle-class careers that provide excellent wages, health and retirement benefits, as well as safety and skills training for this new sector. New York State's plan for Offshore Wind procurement is a "win/win" for New Yorkers."

As noted above, New York's plan is to choose a developer by this summer.

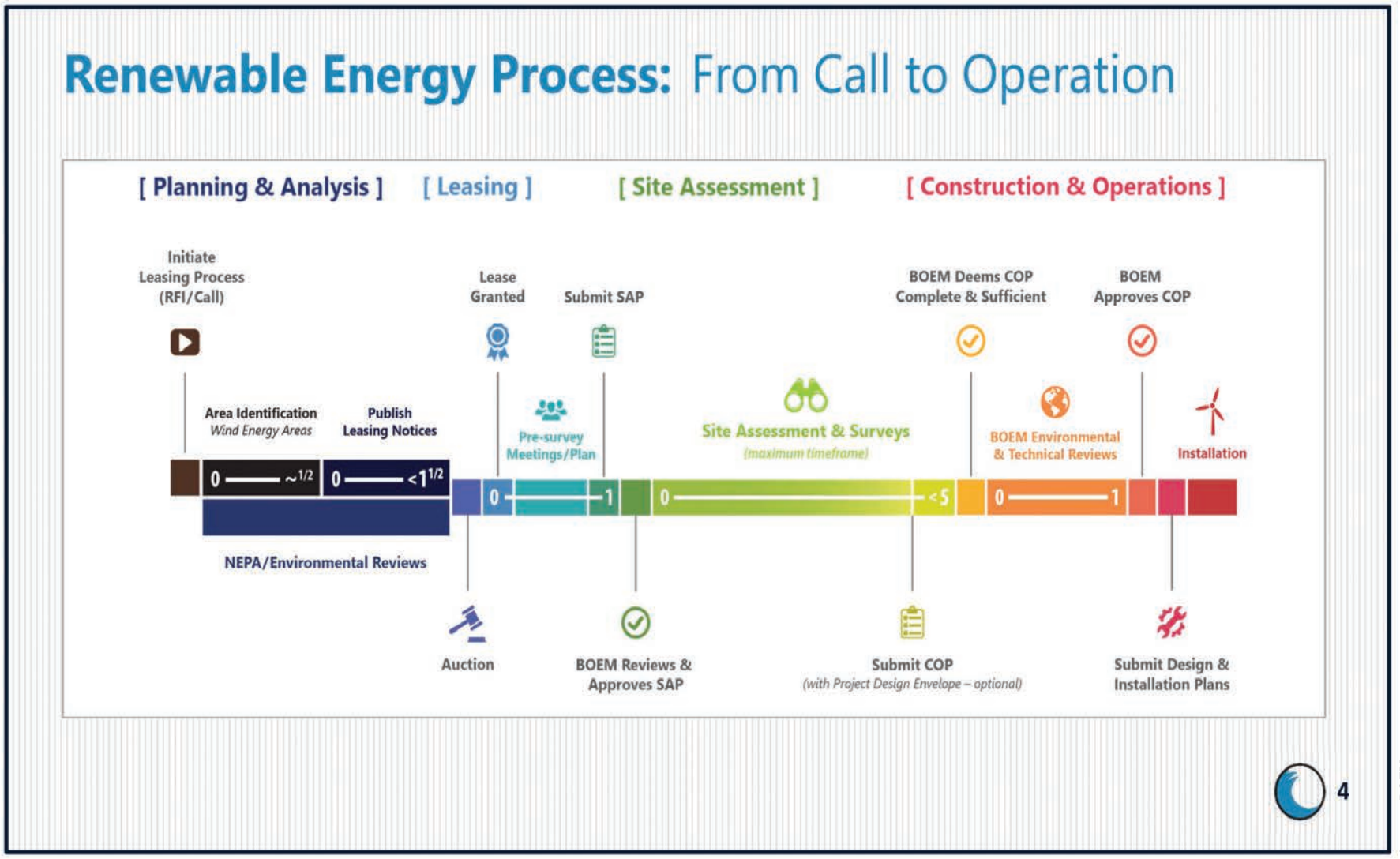


Image: BOEM

The build-out schedule after that is still evolving. One big-picture goal is to develop 2,400 MW of offshore wind energy by 2030. Again, NY officials believe that the sooner they start, the lower the total costs and New York will be steps ahead of other east coast states seeking the same economic benefits. The PSC authorized NYSERDA officials to spend almost $20 million between now and 2023 to cover related development costs.

Another pressing, timely issue is that the federal Investment Tax Credit (ITC) ramps down and expires in 2019. In its July Order, the PSC makes note of this, writing that "immediate action is needed to take advantage of hundreds of millions of dollars in potential savings." The ITC provides a credit for 30% of investment costs at the start of a project. It is especially significant for offshore wind because such projects are particularly capital intensive making up-front benefits important. Projects qualify if construction starts before the credit expires.

Project siting is still another unknown. Siting is a time-consuming process even if everything goes smoothly. (See timeline, previous page.)

In its RFP, NY writes that a prospective developer "must hold an irrevocable right or option to develop the entire Offshore Wind Generation Facility site footprint within a federal Bureau of Ocean Energy Management (BOEM) commercial wind energy lease area."

BOEM and east coast state officials are in the process of identifying WEAs – wind energy areas, an effort that might be completed soon. (The process was slowed by this year's government shutdown.)

Still, BOEM's graphic makes clear that many steps remain even after a lease is granted. These steps take time, measured in years in BOEM's timeline.

Interestingly, there is one leased area in the New York Bight, an area leased to Equinor (used to be Statoil, the Norwegian petroleum/wind energy giant) and, recall from above, Equinor is one of the four companies that responded to NYSERDA's request for proposals.

Equinor signed a 31-year lease with BOEM in March 2017, paying $42.4 million. Annual rent is $238,050, which changes when the site generates power. The lease has a 1-year "preliminary term" (passed now) and a 5-year "site assessment term." Then a 25-year "operations term."

Site assessment is a critical part of the BOEM process. But note that it can take up to 5 years. Again, to take advantage of wind tax policies, people are going to have to be working some overtime, starting ASAP. If NY cannot take advantage of the ITC, how does that change project economics?

For a big project, the end of 2019 is close. New York's big challenge is to maintain its great momentum.

Astrid Skarheim Onsum

Senior Vice President, Head of Wind, Aker Solutions

Astrid Skarheim Onsum, SVP, Head of Wind Aker Solutions sees a bright future in **offshore floating wind, which makes industrial, commercial and environmental sense.**

Image: Aker Solutions

Offshore renewable energy is gaining investment support in the United States, particularly on the east coast. While the U.S. is a full generation behind its European counterparts in tapping the wind as an energy source, if current plans come to fruition it could gain ground quickly. Recently we spoke with **Astrid Skarheim Onsum,** *SVP, Head of Wind Aker Solutions, for her view on the path ahead and the growing role and promising future of 'floating wind.'*

By Greg Trauthwein

Please give an overview of your responsibilities as SVP, Head of Wind, Aker Solutions?

Within my responsibilities fall the development of Aker Solutions' strategic position in the global wind industry, business and subsequent project development as well as wind engineering and technologies. It is an exciting time for offshore wind and especially for an emerging floating wind industry. We are looking at all ways we can help accelerate commercialization of floating wind through our experience, capabilities and technologies.

Aker Solutions is obviously large and diverse. Put in perspective the shape and size of the "Offshore Wind Energy" offering compared to traditional offshore energy segments.

We go back to 1841 with industrial and maritime transformation as a part of our DNA. Our origins are in understanding the oceans and managing the dynamics of water and the maritime environment. Shipbuilding and hydropower turbines are parts of our history. In the past four to five decades Aker Solutions has focused on solutions for the offshore oil and gas industry. The global energy sector is undergoing massive change and sustainability is front and center of the change agenda. We believe we are talking about a transition in the energy mix over some time. However, we see a world where renewables will play an ever-bigger role, and we have value to add. We have innovated and developed proven deepwater technologies that are now becoming highly relevant for the wind industry.

Through ongoing collaborative innovation projects, we are also seeing that floating wind power can help unleash a greater blue economy, including offshore aquaculture - where we have our own concepts - and green shipping.

To start, please share your 'big picture' view on Offshore Wind today as an industry. Specifically, where do you see the brightest opportunities for growth in the coming 1 to 5 years?

Over the last 20 years, there has been tremendous growth in bottom fixed offshore wind. The shallow water and good winds of the North Sea have created a test bed and industrial training center for what is now becoming a global industry. When we look at the fundamentals and large potential for offshore wind in the U.S., Europe and Asia, it is easy to be inspired by the IRENA projection of 500 GW by 2050.

We realize that floating is currently a smaller segment in offshore wind. However, we see floating wind energy as an emerging industry that has all the right characteristics to grow exponentially. Bernstein Research analysis recently quoted 7040 GW potential floating wind capacity across Europe, USA, Japan and Taiwan! At the moment we are engaging across the board and bringing our system integration capabilities to the table from technology development to project development. In five years we believe we will see a lot of projects being developed and perhaps the first commercial farm already in operation.

We also believe there is potential for utilizing wind power to electrify oil and gas facilities, and are engaging in this particularly in the North Sea and Brazil, to bring down the carbon footprint of production.

When we met in San Diego you said "our big bet right now is on offshore floating wind". Can you please explain what you meant.

We believe that offshore floating wind makes industrial, commercial and environmental sense. With the larger turbines being developed now, capacity goes up and economy of scale can be effectively realized. For Aker Solutions, the synergies between offshore floating wind farms and our capabilities from the offshore oil and gas industry are obvious. Over five decades, we have designed more than a 160 floaters (including spar buoys, TLPs, barges and 60% of the world's semi-submersible floaters) for all kinds of conditions across the globe; we understand and deliver power systems (cables and substations) that can take the dynamic forces that floating wind entails; we have relevant technologies qualified for installation on the sea bed and have a strong track record in unmanned offshore facilities. Offshore project execution as well as digital operations and maintenance services are core capabilities of our organization.

> **WE NEED SCALE TO BRING DOWN THE COSTS OF FLOATING WIND ENERGY.** THAT MEANS THAT WE HAVE TO RECOGNIZE THAT THE TIME OF PILOT EQUIPMENT AND DEMOS ARE NOW BEHIND US. **WE HAVE PROVEN TECHNOLOGIES READY TO GO COMMERCIAL** – AND NEED TO PLAN ACCORDINGLY.

We think we can add significant value in floating wind – the growth of the industry is our big bet. Should we see that our solutions can add value in fixed bottom offshore wind as well, then we will of course address that market as well. As an example, we were awarded maintenance contracts for TenneT's onshore and offshore converter stations in 2018.

Fixed versus Floating: I've read a lot about the evolution of Floating Offshore Wind installations. From Aker Solutions perspective, how do you see the market evolving? What are the pros and cons of each solution?

While we certainly recognize the impressive learning curve fixed bottom wind has achieved and how that industry has now reached a point of commercialization which includes the world's first subsidy free farms, we believe there are obvious benefits of floating wind for the longer term.

The fundamentals of floating allow for placement of farms where the wind resource is best. As the turbines rapidly grow in capacity, the structures get taller. Floating wind also offers the benefit of placing wind farms with structures almost as tall as the Eiffel tower outside of the field of vision from shore, while staying in proximity to the larger population centers and offtake needs. The near shore conflicts with other stakeholders are reduced and we leave coveted near shore acreage available for other industrial and recreational use.

While the cost of floating currently is higher, there are significant cost benefits. The obvious one is the removal of costly offshore heavy lift operations with a tow from shore solution. With scale and better capacity factors, we believe the cost curve for floating wind will see the same development as the cost curve for fixed bottom.

What one technology do you see as having the biggest impact on making offshore wind a more efficient and cost-effective solution. Why?

The obvious one short term: A tow-to-field semi-submersible floater with major repairs at quay side, due to the removal of the heavy lift offshore operations. We currently believe the semi-submersible floater is the fastest and most cost-effective way to harness reliable wind resource. You may have seen that we have invested in Principle Power Inc. (PPI) and currently hold an 11.8% stake in the company.

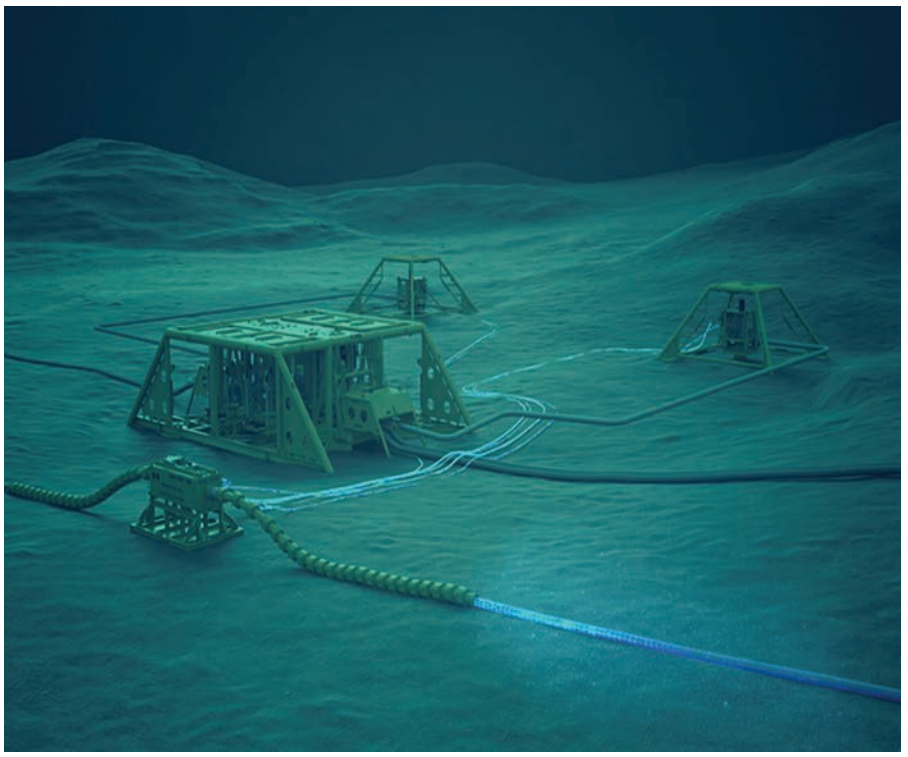
In your opinion, what remains the greatest challenge to the offshore wind energy solution?

We need scale to bring down the costs of floating wind energy. That means that we have to recognize that the time of pilot equipment and demos are now behind us. We have proven technologies ready to go commercial – and need to plan accordingly.

Can you share specifics on a recently completed or ongoing offshore wind projects that you think best exemplifies the Aker Solutions offering to the market. Please be specific.

We are looking to de-risk the commercial scale projects and bring them forward faster. A concrete example of this is our ongoing participation in the consortium for the development of a wind farm outside of Humboldt Bay, California. Together with EDPR and Principle Power Inc. we were selected by the local utility company, Redwood Coast Energy Authority, to collaborate on this potential flagship project for California.

And we are supporting the learning in demo projects like the Kincardine and WindFloat Atlantic by providing our experience in offshore project management as well as planning and execution of marine operations.



Meet: Astrid Skarheim Onsum

Astrid Skarheim Onsum, SVP, Head of Wind Aker Solutions is responsible for developing Aker Solutions' floating wind business under an ambitious growth strategy. She has more than 20 years of experience from the energy sector, including a range of technical and leadership roles, at onshore as well as offshore sites. As the managing director of Aker Solutions' engineering business in Norway for 5 years she oversaw delivery of some of the most complex offshore projects in the world. Ms. Onsum has also held the role of Chief Digital Officer for Aker Solutions for 2 years. She holds a MSc in Mechanical Engineering from the University of Trondheim (NTNU) in Norway.

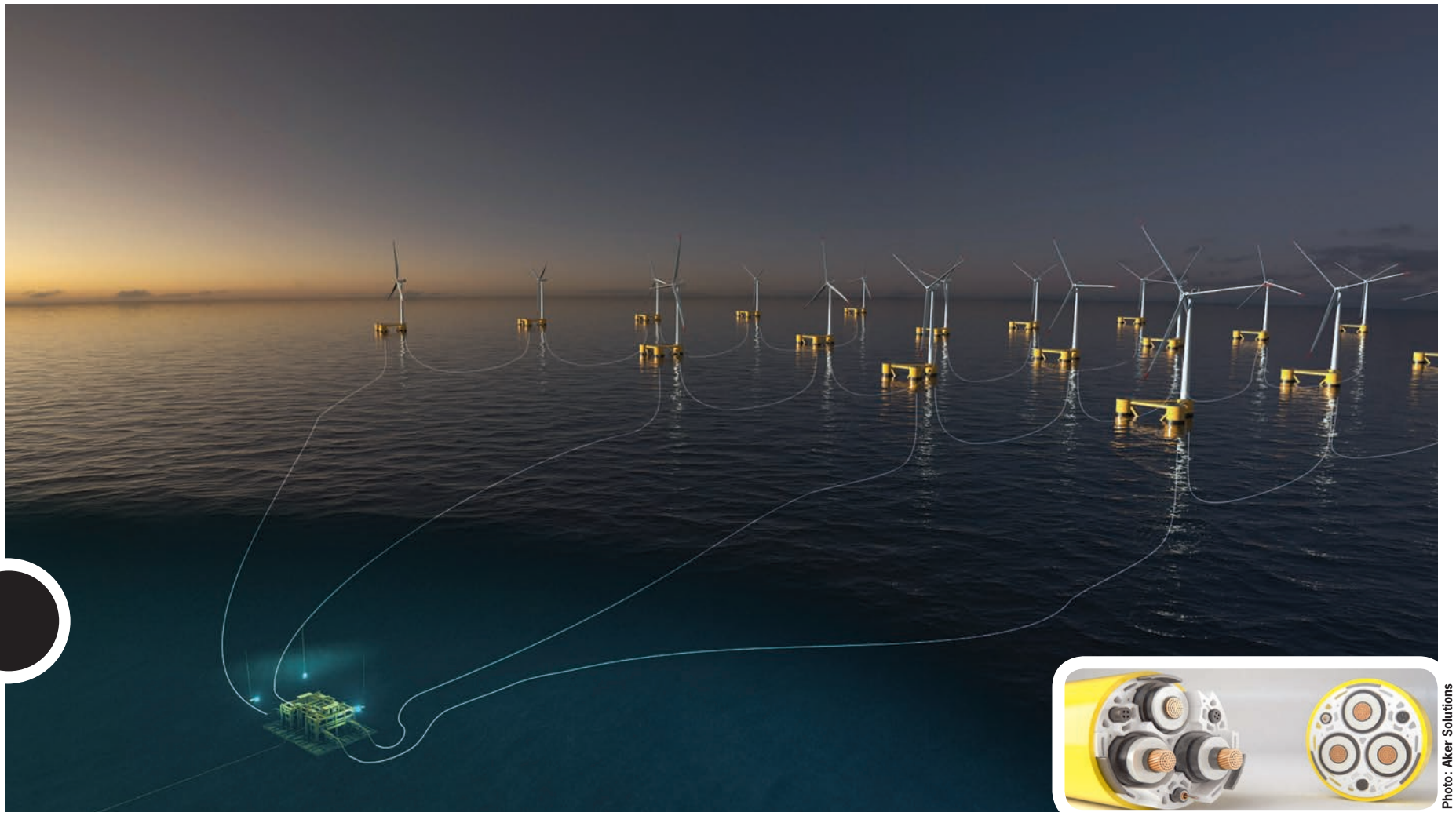


Photo: Aker Solutions

*au·ton·o·mous | \ ȯ- ˈtä-nə-məs *

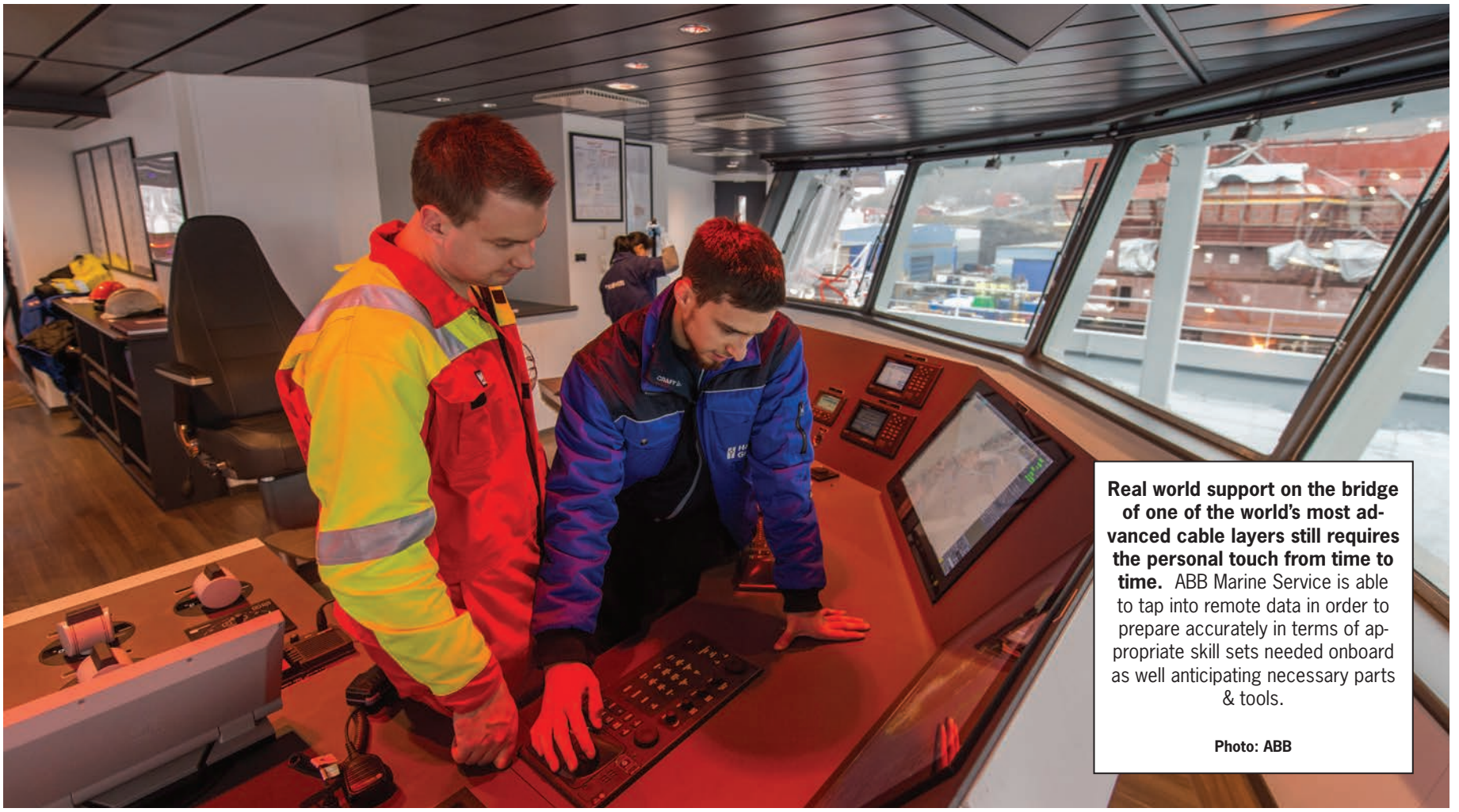
undertaken or carried on without outside control: SELF-CONTAINED

While merriam-webster.com is succinct in its definition of 'autonomous', ask 10 people in the maritime sector what 'autonomous' vessel means to them and the responses vary widely. Achieving autonomous, unmanned operations is not high, today, on the agenda of many (if any) shipowners. What does command their attention? Building ships that are increasingly 'smart,' with integrated, connected systems that take on additional decision-making processes while helping to reduce crew size (and cost), and ultimately helping to make ship operations safer and more efficient.

By Greg Trauthwein

While there are certainly a number of studies and project focused on commercial vessels and unmanned operations, generally when talk turns to maritime and autonomy it is positioned as a step-change technology where onboard systems become increasingly connected, increasingly 'smart' and increasingly enabled to make decisions with little or no human intervention.

"Autonomy does not necessarily mean 'unmanned' … I can see where an autonomous ship can still be a manned ship" said Mikko Lepisto, Senior Vice President, Digital Solutions at ABB. "Saying that autonomous is only 'unmanned' is incorrect. I see an autonomous ship that can perform any function without human involvement, but the human role is one of supervising what the autonomous control system does. It



Real world support on the bridge of one of the world's most advanced cable layers still requires the personal touch from time to time. ABB Marine Service is able to tap into remote data in order to prepare accurately in terms of appropriate skill sets needed onboard as well anticipating necessary parts & tools.

Photo: ABB

"We would develop products that used to have an expected lifetime of maybe 15 years, but ***today we are looking at the time frame for new product to last maybe four or five years,*** *and then it is being replaced by a new technology."*

Ketil O. Paulsen, Technology GM, KM Technology, Research & Innovation, Kongsberg Maritime AS

can be manned or unmanned."

Ketil O. Paulsen, Technology General Manager, KM Technology – Research & Innovation, with more than three decades of experience in various areas of technology development at Kongsberg Maritime AS, agrees. Today he evaluates new technologies to see if they fit into the portfolio of Kongsberg Maritime.

"We are developing functionality for ferries so that they can go from point A to point B and moor by themselves. But most of the 'autonomy' functions is supporting the crew onboard, not necessarily taking away the crew. It is making their operations safer and more efficient." Kongsberg is invested in a number of collaborative partnerships and studies on autonomous marine operations, with the pinnacle being the YARA Birkeland, the world's first fully electric and autonomous container ship, with zero emissions. (See related story on page 37).

Another leader in the field of autonomous ship development is Siemens, and according to David Grucza, Director, U.S. Marine, Siemens Government Technologies, Inc., Siemens' view differs slightly. "Some have a 'bridge centric' view of autonomy. Our view of autonomy is rooted in the fact that we are a vessel infrastructure provider around electrification, digitalization and automation. We look at it from integrated power and electrical systems. We look at autonomy from the infrastructure perspective."

While many of the companies leading the autonomous push in maritime are 'Fortune 500', there is a healthy dose too of young, innovative companies that move with enviable speed and force, such as Sea Machines, which in a very short time has been involved in some high profile trials, including with shipping behemoth Maersk.

"Autonomy is advanced automation that manages compound missions with consideration of multiple streams of real-time variable feedback," said Michael G. Johnson, Founder and CEO, Sea Machines. "As a comparative example, a traditional autopilot is considered simple automation, as it has very few if only one feedback signal to process – the actual course and heading versus set course and heading – and it aims to maintain the set heading without taking anything else into consideration, meaning that the human operator is required to manage perception duties of everything other than the heading. An autonomous autopilot is considered "more intelligent," providing more value to the operation as it takes more information into account, such as position of vessel in relation to charted risks, traffic in the domain and it's relation to the vessel's intended course, or the potential need to temporarily slow or alter course in order to successfully complete the mission. The "autonomy" levels refer to the overall intelligence or capability of the system to enable the human operator to extract from direct control. We refer to our current autonomy product, the SM300, as a Level 3 system, meaning there is an active human operator in parts of the perception and emergency control loop."

Looking at it from the perspective of class, Bjorn Johan Vartdal, Program Director of Maritime Research, DNV GL, is succinct. "Autonomous maritime operations is an operation controlled by an algorithm. A lot of people are mixing this with remote control and automation, but I think there is a distinction between that and autonomy."

What's Happing Now?

"It is moving fast, but people aren't

"The highest level of autonomy that I see in the near future are onboard small ferries and tug boats, very local. *Oceangoing ships will apply certain autonomous technologies but they will keep the people onboard: it will be used for situationally awareness and to increase safety and efficiency."*

Mikko Lepisto,
Senior Vice President, Digital Solutions at ABB

saying 'hey, I need autonomy'," said Grucza of Siemens. "They are taking the principles and applying them to newbuild designs. As people look at more robust and reliable power plants, which I think is a pre-cursor to autonomy, this naturally leads to adding energy storage systems onboard."

One of the world's largest shipowner/operators, NYK, is seemingly in step with this assessment.

"We are a shipping company, so to achieve an autonomous ship is not our objective: our goal is safer, energy efficient operations and more reliable logistics," said Hideyuki Ando, Senior General Manager, Maritime Technology Division, Doctor of Engineering, Monohakobi Technology Institute (MTI) Co., Ltd., a research and development company which is 100% owned by Japanese shipping giant NYK. "Our goal is to be the most reliable cargo carrier. We see automation technology as supporting our objective."

So where will we see autonomous ships develop first? General consensus points to local or regional routes due to fewer regulators and decision makers in play. "You will see local traffic – smaller ferries and tugs develop more quickly, because local regulators and operators can move much faster," said ABB's Lepisto, who's company is involved in an innovative autonomy project on the remotely controlled ice-class passenger ferry Suomenlinna II (See story page 34). "There you will see commercial operations in a few years. The place where autonomy and autonomous technology

Standardization will drive autonomy

Challenges to achieving autonomous operations in the maritime sector are numerous. But One Sea, a Finland-based 'Ecosystem for Autonomous Marine Transport' that seeks to establish itself as a hub for marine technology and ICT pioneers and owners, ports, safety organizations (including EMSA), class societies and academics, characterizes the main challenge in one word: standardization. Standardization suggests commercial neutrality and collaboration as winning attributes paving the path for autonomous ships, as Päivi Haikkola, DIMECC Ecosystem Lead for One Sea explains. "The One Sea ecosystem envisages autonomous maritime transport by 2025, and there is strong momentum for greater connectivity ship to shore and digitalization; but no single organization can reap the full benefits. It is in everybody's interest that different systems can talk to each other and that ship owners are free to choose their technology providers, for example. We believe that both can be achieved by standardizing interfaces; this is something that needs the buy-in of the companies providing the products."

This standardization also demands a regulatory framework to support buy-in from owners, achievable only through the International Maritime Organization (IMO), Haikkola believes.

A recent World Maritime University study suggested that, by 2040, autonomous ships will account for 11-17% of global shipping but that traffic growth over the period would actually create more jobs for seafarers. However, WMU said roles at sea would change, with crews taking a more supporting role while some tasks done today at sea would transfer ashore.

"We believe that autonomous shipping will improve the working conditions of seafarers," says Haikkola. "Some of the work done will be moved from ship to shore and there will probably also be more possibilities to specialize in specific areas on the ship; and, as in all other areas today, there will be a need for improved IT skills."

Another study from the World Maritime University – with partners Marine Learning Systems and New Wave Media, publishers of Maritime Reporter & Engineering News – will be released in early May 2019. MarTID is the second annual study of global maritime training habits, and this year's survey was focused specifically on the potential impact of Autonomy. Results will be published first exclusively in the May 2019 edition of *Maritime Reporter & Engineering News.*

"The One Sea ecosystem envisages autonomous maritime transport by 2025."

Päivi Haikkola, One Sea
Ecosystem Lead

"In our look back at major transitions that are based on products that give significant returns on capital, ***it will take approximately 20 years for the 'future ship' to be adopted by 70% of the industry.*** *As example, readers should consider the time it took the unmanned engine room to be adopted by a majority of the industry."*

Michael G. Johnson,
Founder and CEO, Sea Machines

"Progressive operators that are using their vessels in controlled or semi-controlled domain," said Sea Machines founder and CEO Michael G. Johnson. "Many of these are performing task-driven operations in situations where technology can perform better than a human in direct control."

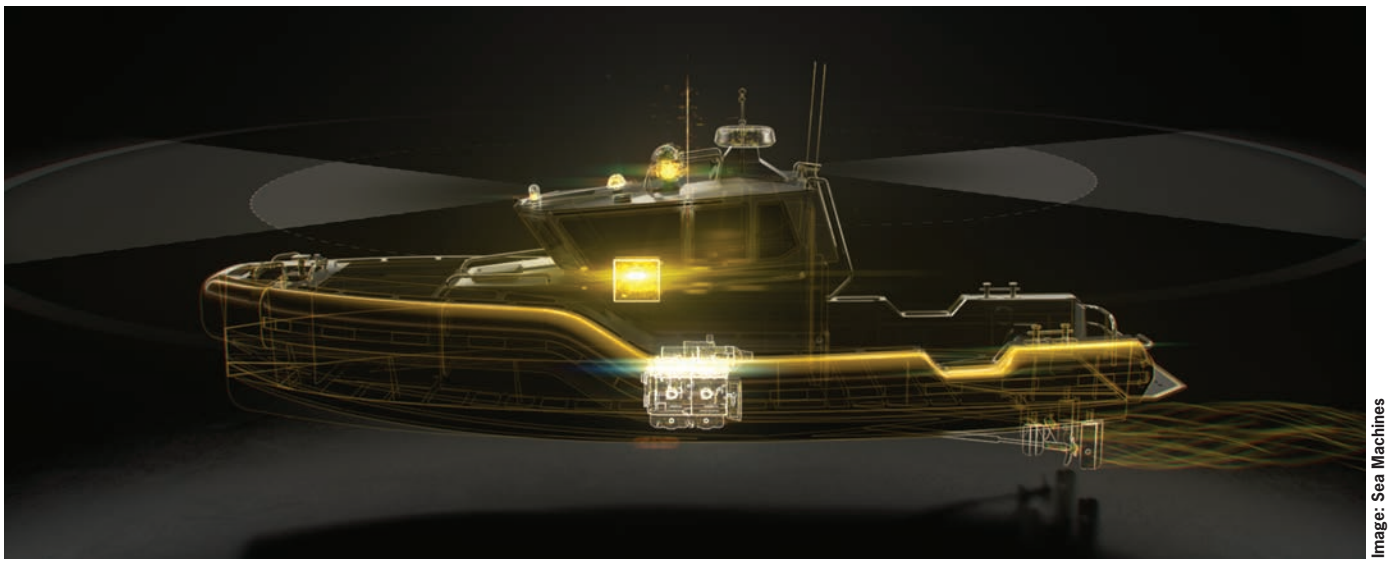


Image: Sea Machines

will develop most quickly is in instances where there are ships with smaller crews onboard, where 'autonomous' systems are being utilized to increase safety and efficiency. Those ships will have the same technology as autonomous ships, but there will be humans onboard … it is a complimentary system to the captain and crew. This will move the fastest because there are not regulatory obstacles."

Driving autonomy in all transport modes is the speed of technology evolution, a speed which is driving product and system obsolescence to a record pace.

"We would develop products that used to have an expected lifetime of maybe 15 years," said Paulsen or Kongsberg, "but today we are looking at the time frame for new product to last maybe four or five years, and then it is being replaced by a new technology."

Johnson of Sea Machines agrees. "OEMs that supply the industry are starting to announce the end of major analog and mechanical product lines that have served them for decades and the new technologies are being heavily marketed by leading legacy and young companies. In our look back at major transitions that are based on products that give significant returns on capital, it will take approximately 20 years for the "future ship" to be adopted by 70%

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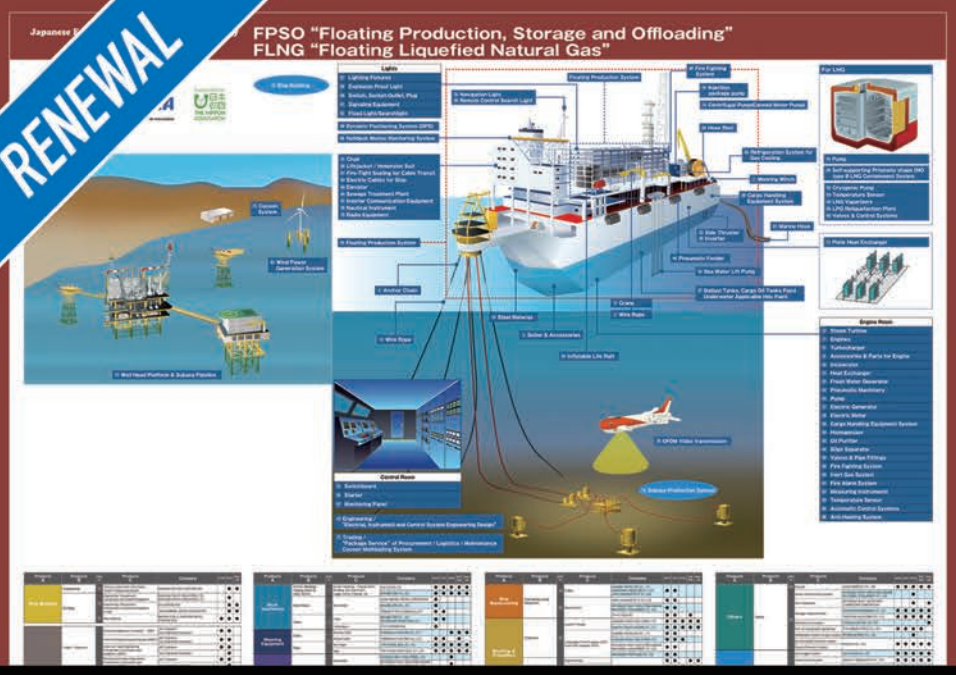

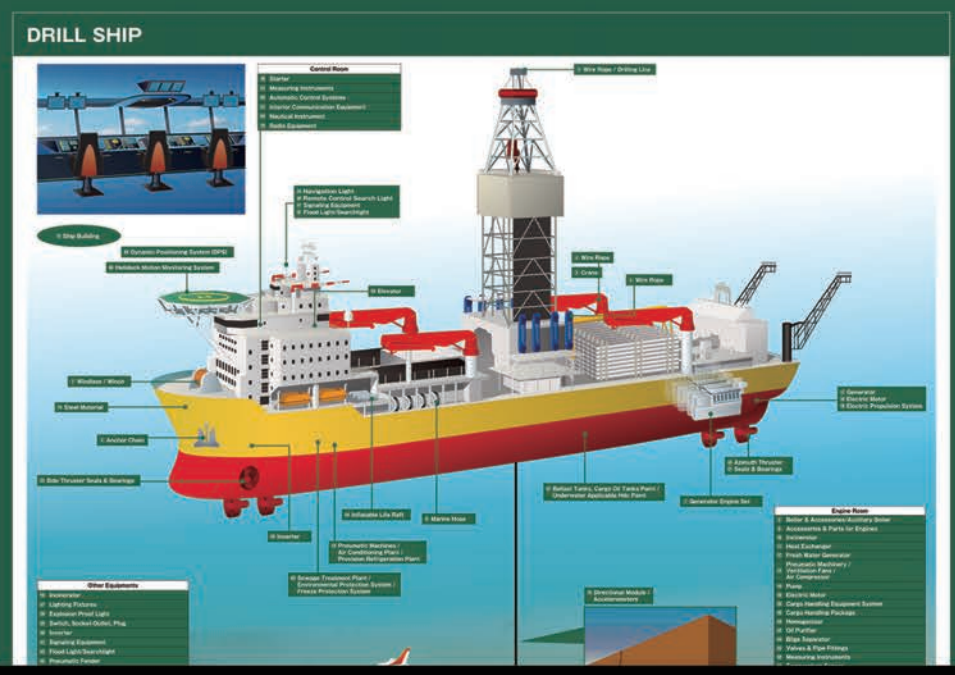

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"I would say let's look for vessel types that are regional where you can take the human element out of it because of either monotony or safety. I think you'll see it in survey vessels, I think you'll see it in workboats; I think you'll see it in coastal protection vessels. ***The Navy is looking at autonomous vessels and they don't have some of the regulatory burdens or liabilities that private companies have, allowing them to progress more quickly."***

David Grucza, Director, U.S. Marine,
Siemens Government Technologies, Inc.

of the industry. As example, readers should consider the time it took the unmanned engine room to be adopted by a majority of the industry," said Johnson.

This speed of technology has, in turn, driven a corporate consolidation in maritime as the big companies grow bigger, and fostered an era of cooperation and partnership. "We used to develop most everything ourselves, what we do now are more partnerships with different companies and research institutes," said Paulsen. And while technology is generally the center stage show-stopper, Paulsen argues that technology is not the main driver. "Years ago the drivers were technology; we are seeing now one of the main drivers is sustainability. Sustainability drives everything that we do today. It is all related to sustainability," and it also is tied to autonomy.

What are the Next Steps?

While terms like "digitalization" and "big data" have arguably already become old hat in maritime circles, make no mistake that the increasing availability, seamless transfer and efficient utilization of data is the primary technical driver in the maritime industry today. "Ten years ago, most of the projects (at MTI) were about hardware – a better propeller, a bulbous bow, energy saving devices – that were discovered, tested and trialed at sea in a conventional fashion. Most projects at the time focused on energy conservation," said Ando of MTI. "When we would run a (hardware) project about energy efficiency, for example, we realized that data is crucial to understanding the true performance of the vessel, now and in the future," he said. With NYK's fleet of more than 800 ships, the real 'eye-opener' came when the same technology was trialed on similar ships, and it was found that some ships literally consumed double the amount of fuel. "After we realized the importance of data, we (NYK) expanded the installation of data collection systems across the NYK fleet. We installed our own data collection boxes on our own ships, about

Image: ABB

CASE STUDY: Suomenlinna II

ABB & the remotely operated passenger ferry

A recent trial in Helsinki, Finland aimed to prove 'the next step' in autonomous shipping. The trial, with ABB and Helsinki City Transport, centered on a remotely controlled ice-class passenger ferry Suomenlinna II. In the remote trial, reportedly the world's first for an existing passenger ferry, ABB successfully tested the enhancement of ship operations with technologies that are already available for nearly any kind of vessel. For the trial, Suomenlinna II was retrofitted with ABB's new dynamic positioning system, ABB Ability Marine Pilot Control, and steered from a control center in Helsinki.

Suomenlinna II normally voyages from Helsinki to Suomenlinna fortress, the UNESCO World Heritage site on a nearby island. For the remote piloting trial, the ferry departed from Helsinki's market square, Kauppatori, and Captain Heinonen wirelessly operated Suomenlinna II with ABB Ability Marine Pilot Control through a pre-selected area of Helsinki harbor.

The trial took place during the vessel's off hours, away from shore with no passengers aboard, in an area free of other vessels. While it is now equipped with the new dynamic positioning system, the vessel will continue to operate via a set of conventional onboard controls, with the remote mode deployed during the trial only. Research and development will continue with the ferry and her crew.

Suomenlinna II, originally built in 2004, is fitted with ABB's icebreaking Azipod electric propulsion system. Additionally, the ferry was retrofitted with ABB Ability Marine Pilot Vision situational awareness solution in 2017.

"We are a shipping company, so to achieve an autonomous ship is not our objective: our goal is safer, energy efficient operations and more reliable logistics. *Our goal is to be the most reliable cargo carrier. We see automation technology as supporting our objective."*

Hideyuki Ando, Senior General Manager, Maritime Technology Division, Doctor of Engineering, MTI Co., Ltd.

200 vessels."

The original plan was to collect data in the name of improving energy efficiency, but "from 2012 we updated our system to also collect safety data as well as energy efficiency," expanding the sensor data output from about 50 sensor data points originally to 1000 to 2000 data points today. "We collect all available data," said Ando.

While data is the 'blood' of autonomy, it could be argued that power is the 'heart.'

"What I see as a next step is an adoption of these technologies on manned ships," said Lepisto of ABB. "On the development side there's going to be an increased focus on the machinery side. Today there is a big focus on the navigational aspects, but there is less discussion on the machinery area, such as maintenance processes of the ships being changed to accommodate autonomy? There has to be a change toward a more electric power train to improve redundancy and reliability. Electric sys-

CASE STUDY: AMPERE

Norled Ampere was the world's first all-electric car ferry, carrying up to 120 cars and 360 passengers across the 4.2-mile (6.8 km) Sognefjord channel that separates Norway's villages of Lavik and Oppendal and empties into the North Atlantic's Norwegian Sea. The 260-ft. vessel recharges its dual 450 kW/hour battery packs after each docking in less 10 minutes. Operated by Norled, a Norwegian shipping company under license from the nation's Ministry of Transport, the Norled Ampere includes a Siemens BlueDrive PlusC propulsion system that drives fore and aft screws.

"There have been several 'lessons learned' in the case of AMPERE," said David Grucza, Director, U.S. Marine, Siemens Government Technologies, Inc. "The first is that it is really quiet. Without the diesels, that was a learning for the crew to trust what they saw on the bridge. Without hearing the diesels, they had to trust what they saw on the bridge to know they had the power available."

Siemens also learned a lot about energy storage and battery system design, which was part of the reason it came out with its own energy storage design.

"There are many different opinions on batteries. When you talk to some people about the batteries they say 'it's a big investment, I want a 10-year life,'" said Grucza. "But battery technology is evolving so rapidly that some people want a 5 year life so that they can upgrade to a more efficient system."

tems require less maintenance and are easier to build in redundancy."

Grucza from Siemens agrees. "We look at the power and propulsion plant more holistically as a system. When you get to autonomous vessels, I think that dynamic starts to change, too. For example, how much of the electrical load onboard a ship is for people and people support systems. That ratio for power for propulsion versus power for support systems is going to change. In a workboat today, most of the power is for propulsion, with some for crews & auxiliary systems. That ratio will change, with more for propulsion, the key technology is to view it systematically instead of just pieces and components. It's about robust, it's about reliable, and power and propulsion are at the heart of the matter."

But according to DNV GL's Vartdal, the electronics and sensor side – the navigation – has garnered the lion's share of attention for a reason. "In terms of complexity, the navigation part is the most complex part to make autonomous because it requires situational awareness on a high level; It is a complex situation. With machinery functions it is much easier because there you can have a defined set of failure modes, whereas with navigation you have an infinite amount of possibilities. That's what makes it most complex."

"The next steps for Sea Machines are both continuous feature development on our existing products taken both from our roadmap and from customer feedback," said Johnson. "We are also deep into the advancement of vessel perception technology, namely long-range machine vision which utilizes large data sets and A.I. to "see" and interpret the domain around an operating vessel by identifying, classifying, and tracking traffic and obstructions. This Sea Machines technology is currently being trialed aboard an A.P. Moller-Maersk container ship in the Baltic Sea."

While the notion of ship traversing the waterways of the world yields some impressive artist renditions of the future, MTI's Ando maintains that the process forward, fueled by huge amounts of reliable data, is anything but glamorous. "Not many owners/ship managers are at the level of fully leveraging the power of data," he observed, adding "We believe in it, but it is a large effort to collect, clean up and effectively utilize data. It is a step-by-step, bottom up approach."

What's are the Challenges?

"Technically I don't think it is such a big challenge," said Ando of MTI. "I think the bigger challenge comes with regulation, insurance and liability, as well as social acceptance."

Ultimately getting stakeholders moving in unison – from the owners and operators to the ports and logistics providers to the technology makers to the legislators to finance and insurance – is tantamount to moving maritime autonomy forward, too.

Grucza of Siemens agrees. "I still see regulatory and legal issues as the big constraint to go fully autonomous. I would assert that we are already seeing many stages of autonomy in the infrastructure today. I think it's hard to get alignment on all of the different players in the chain," (from ships to ports to logistics globally) … "that's why you're seeing some of the current developments being more regional focused, because quite simply you have fewer regulatory bodies that you need to get together and agree."

"I think the main challenge is definitely on the market side," said Lepisto of ABB. "The business case has to be in place for the operators to move toward unmanned ships or ships with less crews. As we discussed also, the regulatory needs to be in place, and that will start local and grow to national and international. With this, I also think there needs to be standardization within the industry in regards to collision avoidance" for example.

While most say that legal and financial issues will pose stumbling blocks, Johnson of Sea Machines cautions that the technology to advance autonomy in the maritime space, for the long haul, is not a trifling matter.

"Building technology that safely man-

Image: Kongsberg

"I see more people have an interest in automating and making autonomous a part of the operation, not going fully unmanned but automating increasing systems onboard, operating onboard with less people and targeting specific parts of the operation such as machinery operations. **Some are looking into fully unmanned ships, but at the moment that is relatively limited."**

Bjorn Johan Vartdal, *Program Director of Maritime Research, DNV GL*

ages multi-ton vessels in dynamic environments is not something to take lightly in any aspect of the development path," said Johnson. "Our goal right now is to get enough SM200 and SM300 units into the hands of active operators because use in their worlds gives us feedback necessary to empower continued development."

While Paulsen of Kongsberg also views regulation as the major hurdle, he points to a second challenge that must be thought through, too.

"The second challenge is the mixing of manned vessels and unmanned vessels. For example in the automotive field, if all cars were autonomous and able to speak to each other, it would be fewer problems. As long as you have cars driven by people and autonomous cars, there are more problems."

And while conversation and much debate swirl regarding the technology, the regulation, the machinery and the hull, MTI's Ando sees the matter clearly and simply. "We can apply a fascinating technology, but if the crew does not understand (or use) the technology, it is useless. The captain, crew and ship management – all stakeholders – must be onboard for new technology upgrades for them to be effective."

CASE STUDY: YARA Birkeland

"The most exciting project today is YARA Birkeland; it will be the first unmanned autonomous vessel that we are going to deliver," said Paulsen of Kongsberg. To achieve that there is still much testing, risk analysis that will lead to making the project a reality. YARA Birkeland will be the world's first fully electric and autonomous container ship, with zero emissions. Kongsberg is responsible for development and delivery of all key enabling technologies including the sensors and integration required for remote and autonomous ship operations, in addition to the electric drive, battery and propulsion control systems. The design for the innovative ship was done by Marin Teknikk, finalized in 2017. The vessel is scheduled to be delivered from Vard Brevik in first quarter of 2020, and will gradually move from manned operation to fully autonomous operation by 2022.

Yara Birkeland Main particulars

Length x Width x Depth	79.5 x 14.8 x 10.8 m
Draft (full/ballast):	6 m/3 m
Service speed:	6 knots
Max speed:	13 knots
Cargo capacity:	120 TEU
Deadweight:	3,200 mt
Propulsion system:	Electric
Propellers:	2 Azimuth pods
Thrusters:	2 Tunnel thruster
Battery pack:	7 – 9 MWh

World Navies

Common challenges, different solutions

BY EDWARD LUNDQUIST

Navies operate on a spectrum between deterrence and defense, to include offensive operation, support of foreign policy, and power projection to civil affair and humanitarian assistance and disaster response. Many have constabulary responsibilities, and it could be argued that, with the exception of the largest navies, most are more like a coast guard than a military force in their normal responsibilities.

Every Navy is different. Yes, they all share similar challenges of acquisition, maintenance, manpower, basing, communications, information systems and the usual requirements of a military service, compounded by harsh maritime environment. Each nation and their navy has a different place to operate in, a different nation and resources to protect, and different threats to protect them from.

That's what makes studying the navies of the world interesting—to see how they have addressed their specific challenges with the resources they have applied to them. Here are several examples.

Peru Patrols Amazon Rainforest to deep blue Pacific

Peru is a maritime nation, with a 1,500-mile coastline, and a major ports such at Callao. It has a navy, and warships such as the Lupo-class frigates from Italy and Type 209 submarines from Germany. There are modernization efforts underway even as the Marina de Guerra del Perú also looks to recapitalize its fleet with more modern platforms and systems. Not surprisingly, there is a competition for resources from the other services, but Peru depends on the sea, and its navy. Most Peruvians live near the sea; most of its trade travels by sea; and 95% of all fuel used in Peru comes by sea.

So, Peru is not unlike many other navies in that regard. Few navies, however, have such extreme operating environments. Peru is a blue ocean-navy that has a significant riverine mission, with numerous humanitarian and constabulary functions on the remote Amazon and its tributaries, as well as a land-locked presence on Lake Titicaca, where it shares a maritime boundary with Bolivia (a land-locked nation, has a naval force of about 5,000 personnel) at an elevation of more than two miles above sea level. A large portion of the Amazon is within Peru, and 60 percent of the country is Amazonian rainforest.

Peru's navy is a study in contrasts. Peru has a former Dutch cruiser that was laid down before World War II, acquired by Peru in 1973 and commissioned as the BAP Admiral Grau, and is the last gun cruiser in service anywhere. Compare that to the hospital ship BAP Puno, operated by the Peruvian Coast Guard on Lake Titicaca. It was commissioned in 1872 (that's right—1872—that is not a typo), and still serves local communities in remote areas. She is reportedly fueled by dried llama dung (also not a typo). Compare that to its flight deck-equipped patrol boats for the Amazon basin, Icebreakers operating in the Antarctic region and amphibious ships capable of transporting and deploying Marines.

Because Peru's difficult geography makes it hard to support citizens in remote communities, the Navy operates vessels that are key enablers to sustain and protect them. "In some areas, the only presence of the state is the Navy," said Rear Adm. Ricardo Romero, Peruvian naval attaché to London.

But despite its unique challenges, Peru understands that it is not a singular naval entity, and must rely on, and participate actively in international cooperation. For example, BAP XXX took part in RIMPAC 2018, the major fleet exercise. And Peru views its international responsibilities as a Pacific nation, and even reciprocates with Singapore in stationing officers at their respective maritime domain awareness fusion centers.

Malaysia Downsizes the number of Ship Classes

Malaysia is also a nation dependent on maritime trade. As that Southeast Asian nation's maritime traffic grows, so do the threats such as piracy and transnational criminal terrorist activity. With the navy's resources stretched thin, maintaining and operating the variety of ship classes from different countries has become unsustainable. As maintenance costs on the older ships become more expensive, their combat capability is becoming degraded. That's why the Royal Malaysian Navy (RMN) is rationalizing its fleet from 15 different classes--built by 13 different shipbuilders in seven countries--to five basic types. That means moving away from the larger frigate type ships to small ships, still large enough to meet operational and training requirements and regional commitments, and able to coordinate and collaborate effectively with our partner navies in the region, such as Indonesia, Thailand, Philippines and Singapore.

The new classes will include 12 littoral combat ships (LCS); 18 littoral mission ships (LMS); 18 patrol vessels (PV); four submarines; and three multi-role support ships (MRSS). The first batch of LCS (six ships), based on the French Gowind OPV, is already in construction in Malaysia. The first four LMS is currently being built in collaboration between Malaysian and Chinese builders. The LMS will be smaller and less capable that the LCS, but will have a modular multi-mission concept suitable for many RMN requirements. The first batch of Kedah-class PVs, based on the German MEKO 100 design, is already in service. The MRSS will serve as the main platform to transport troops and equipment, support humanitarian assistance and disaster relief (HADR) operations, and be able to operate with the ASEAN Military Ready Group (AMRG). Malaysia hopes to do as much of the design and construction itself to enhance the domestic defense industry and become self-reliant and capable of building modern and reliable warships.

The RMN currently operates two British-built frigates, KD Lekiu and KD Jebat, which are being given a mid-life refit to be kept relevant until the new fleet is in place. Terma SCANTER 6000 radars have been installed on the two Lekiu-class frigates for navigation and helicopter control. The radar will also provide a data feed to the BAE Systems Nautis combat system and will be integrated with the Northrop Grumman Sperry Marine Vision Master automatic radar plotting aid (ARPA) display system. The RMN also selected the SCANTER 6000 for its two new Multi-Purpose Common Support Ships (MPCSS).

Belgium: Answer to Maritime Security is Blowing in the Wind

Belgium has outsized need for naval presence and maritime security. It's relatively short coastline—just over 40 miles—includes the approaches to some of the busiest seaports in the world.

Belgium and the Netherlands are currently cooperating on a joint warship program for frigates and mine warfare ships, with the Dutch taking the lead for the new surface combatant and Belgium's Navy in charge of the mine countermeasures ship effort.

Not only does Belgium have to monitor and protect a busy stretch of Europe's coast, but those waters are also full of offshore wind farms, with hundreds of wind turbines. But while those structures make navigation

The Peruvian navy maritime patrol boat BAP Ferre (PM 211) arrives at Joint Base Pearl Harbor-Hickam in preparation for Rim of the Pacific (RIM-PAC) exercise.

U.S. Navy photo by Mass Communication Specialist 1st Class Holly L. Herline

The Royal Danish navy frigate HDMS Peter Willemoes (F362) transits the Gulf of Aden.

U.S. Navy photo by Mass Communication Specialist 3rd Class Mario Coto

The Belgian mine hunter Primula (M924) conducts a diver exercise during BALTOPS 2016. BALTOPS is an annual recurring multinational exercise designed to improve interoperability, enhance flexibility and demonstrate the resolve of allied and partner nations to defend the Baltic region.

U.S. Navy Photo by Mass Communication Specialist Seaman Alyssa Weeks

Supersonic Hsiung-Feng III missile, developed by NCSIST.

NCSIST Photo

more complicated, the Belgian Navy sees them also as useful. "There is private owned infrastructure in place that could be shared with the Navy. Antennas and radars can be mounted on the structures, offshore camera images can be shared to increase the maritime awareness and maritime picture in our coastal waters," said Captain Jan De Beurme, Chief of Staff of the Belgian Navy. "In return the Navy can assure the security of these critical infrastructures that the wind farms are to Belgium."

Denmark Steers a New Course

Denmark is a small country of six million people, but strategically located at the entrance to the Baltic. It is a true maritime nation, and home to some of the world's largest merchant shipping companies and their fleets. During the Cold War, its naval fleet was optimized for homeland defense and to protect the sea lanes in and out of the Baltic. It led the way in modular capability, with its STANFLEX patrol boats. But when Denmark made a strategic change of direction to be able to conduct long-range missions in support of NATO and global multi-national coalition operations, it had to change its fleet with fewer but larger ships for protecting the maritime domain and also being an active member of the Alliance. Fortunately, the investment in modularity and a common C-Flex combat management system paid off. Guns and missile launchers were repurposed from the Flyvefisken class StanFlex patrol boats to the new, Absalon-class flexible support ships and close-cousins, the Iver Huitfeldt frigates. Now, Denmark is going further by bringing even more sophisticated integrated air and missile defense capabilities.

"After the end of the Cold War, we completely refocused on having fewer but larger ships for protecting the maritime domain and also being an active member of the Alliance," said Capt.) Claus Andersen, Chief Coordination Section, Maritime Division, Danish Defence Acquisition and Logistics Organization (DALO).

The larger ships can deploy wherever they are needed for months at a time to meet alliance and coalition commitments. NATO SeaSparrow, and the Evolved SeaSparrow Missile (ESSM) has served as the RDN's primary air defense system, and Denmark as be a key player in the ESSM Block II development and deployment. Now its ships will have new systems and missiles that will enable the Danish Navy to be a full participant in NATO IAMD operations, to include ballistic missile defense. This course change is not as radical as it may seem, thanks to the modular design of the ships and the interoperability and open architecture attributes of their Terma C-Flex combat management systems.

"We've got a good point defense system with ESSM, and we are part of the consortium to develop and operate ESSM Block II. Now our aspiration is to go a little further for area defense, and are installing SM2 on the frigates," said Andersen. "It's a huge step for us. It's a different capability.

Taiwan Develops Indigenous Combat Capabilities

The Republic of China (ROC), known to most people as Taiwan, in indisputably dependent upon the maritime domain. Taiwan must import 98 percent of its energy needs; and almost all of its exports travel by sea. Across the 100 nm Taiwan Straits is the Peoples Republic of China (PRC) and its 1.34 billion people.

The PRC has made it known that it intends to "reunify" Taiwan.

But for the rest of the region, Taiwan is the first obstacle standing in the path of Beijing's expansionism. The comparison between the two China's is stunning. The PRC 1.3 billion people makes it the most populous country on Earth, and it is the third largest in area at 9.59 million square miles. Taiwan, by comparison, has about 23 million people living in an area of about 13,892 square miles—bigger than Belgium but smaller than Switzerland. And it lies just 100 miles away across the Taiwan Straits.

Taiwan is still able to procure new weapons and hardware from friendly nations, including the U.S. But owing to its unique status, many nations have imposed restrictions on selling military material to Taiwan.

But to a growing degree, the nation is relying on its indigenous capability. Much of that is designed, developed and produced by Taiwan's National Chung-Shan Institute of Science and Technology (NCSIST) and its industry partners.

Despite the PRC's efforts to isolate Taiwan, it still has a strong economy and a very capable military, including a formidable navy. For many years The ROC Navy (ROCN) relied on U.S. hand-me-downs, and still has a number of former U.S. Navy ships, as well as French frigates and Dutch submarines.. While there are a variety of political complexities that prevent Taiwan from acquiring what they need from the global arms market, it still has capable and modern platforms with up-to-date sensors and weapons. But they have also learned the importance of having a strong indigenous capability to design and build new systems and ships, as well as modernize and maintain existing platforms. Much of this has been accomplished by Taiwan's National Chung-Shan Institute of Science and Technology (NCSIST) and its industry partners.

For example, Taiwan built eight Oliver Hazard Perry class FFGs under license, and recently acquired two more from the U.S. under Foreign Military Sales (FMS). These ships are gone from the U.S. fleet, and have systems that are no longer supported, like the MK13 missile launcher and SM-1 missile. But through NCSIST, Taiwan developed its own capability to sustain that weapon system, and today those frigates, as well as the ROCN's former U.S. Kidd-class guided missile destroyers and Knox-class frigates have more offensive capability than they did before being transferred to Taiwan.

Perhaps the best example of adding new capability to older platforms is the development of the land-based mobile and sea-based Hsiung Feng III supersonic anti-ship missile. And Taiwan is building a host of new ships, like the 600-ton, 40-knots-plus Xunhai I-class PGG wave piercing catamaran, which is heavily armed for its size with a 76mm gun, Hsiung Feng II and III missiles; CIWS; Mk-46 torpedoes, and a variety on unmanned air, surface and underwater vehicles; all integrated with a domestic combat management system.

MALAYSIA

The Royal Malaysian Navy frigate KD Lekiu (FFG 30) arrives at Joint Base Pearl Harbor-Hickam in preparation for Rim of the Pacific (RIMPAC) exercise.

U.S. Navy photo by Mass Communication Specialist 1st Class Jimmie Crockett

TAIWAN

ROCS Yueh Fei (PFG-1106) is one of the ROCN's surface combatants. It was built in Taiwan to the U.S. Navy's Oliver Hazard Perry guided missile frigate design.

ROCN photo

A Hsiung-Feng III is fired from ROCS Cheng Kung (PFG2-1101). Cheng Kung is one of eight Oliver Hazard Perry-class frigates built in Taiwan.

NCSIST photo

Brazil´s Riachuelo Submarine – S 40

BY CLAUDIO PASCHOA

Brazil is a country with a coastline over 7,000 km long, bathed to the east by the Atlantic Ocean. Along this coastline and offshore is where the country develops its fisheries activities, maritime trade and the exploitation of a variety of biological and mineral resources. The incredible environmental and financial wealth found in these waters, and under the seabed gave way to the term - Blue Amazon – relating to the Amazon Jungle. The Blue Amazon officially covers an area of 3.5 million square kilometers. However, Brazil is calling on the United Nations to expand its borders to the limits of the continental shelf, which should raise the sea area to about 4.5 million square kilometers - equivalent to half of Brazil's land area.

To protect this natural heritage and guarantee Brazilian sovereignty at sea, the Brazilian Navy (BN) invests in the expansion of its naval force and in the development of a viable defense industry. An essential part of this investment is the Submarine Development Program (PROSUB). The National Defense Strategy, launched in 2008, established that Brazil needed to have a major naval force, including a submarine with nuclear propulsion. In that same year, a technology transfer agreement was signed between Brazil and France in the area of submarine construction. The program is enabling the production of four conventional submarines (S-BRs), which will be added to the fleet of five ageing and obsolete conventional submarines, and the building of the first Brazilian submarine with nuclear propulsion (SN-BR), all made in Brazil at a purpose build state-of-the-art Navy shipyard on the south coast of the state of Rio de Janeiro.

Of the four conventional submarines already being built, the first to be launched was the Riachuelo (S40). Now going through a fitting out phase before beginning ocean trials, the S40 was launched on December 14, 2018. The last of the modern conventional submarines is scheduled be launched by the end of 2022. The Humaitá (S41) should be launched in 2020, followed by the Tonelero (S42) in 2021 and the Angostura (S43) in 2022. The name of the first submarine, Riachuelo alludes to the Riachuelo Naval Battle, considered decisive in the Paraguayan War (1864 to 1870), and an outstanding victory for the Brazilian Navy.

Control room of the S 40, Brazil´s most modern submarine.

Image: Gaúcha Zero Hora

Submarine S 40

The Riachuelo class submarines are based on the Scorpène class, measuring 71.62 meters long with a displacement of 2,200 tons in immersion. It has a capacity for 35 crew, is able to spend 70 days at sea and can submerge up to 300 meters.

"It is a great satisfaction to lead a crew that is very well prepared and will operate a very modern, technologically upgraded submarine and will certainly increase greatly our ability to defend the Blue Amazon," said S 40s skipper, Corvette Captain Edson do Vale.

The four S-BR submarines will be larger than the Scorpène class acquired by the Chilean, Malaysian and Indian Navies. "A review of the entire project was carried out and, thus, the need to incorporate an intermediate section was identified, in order to allow the expansion of berths, fuel oil tanks and storage spaces, thus increasing the original capacity of our submarines at sea on patrol," said Fleet Admiral Eduardo Bacellar Leal Ferreira. Admiral Ferreira was the Commander in Chief of the BN up to the end of 2018.

They will be armed with six 21-inch torpedo tubes for up to 18 F21 torpedoes and/or SM39 Sub Exocet missiles and underwater mines. It will also be equipped with two periscopes, one traditional and the other optronic, capable of sending images directly to the MFCCs (Multifunction Common Console). S-BRs will also have two Contralto-S countermeasure launchers for CANTO torpedo decoys.

When asked about the delay of nearly one year for the S 40 to be launched, Fleet Admiral Leal Ferreira explained that "The construction schedule for the first conventional submarine (S-BR1) was modified to include the time necessary to adapt to the French construction techniques and the design changes required to meet the operational requirements established by the Brazilian Navy".

The Scorpène has a hydrodynamic hull built with HLES 80 steel, derived from what is used currently in French nuclear submarines. Some technologies used in the "Amethyste" and "Le Triomphant" (nuclear) classes, such as the SUBTICS system, are also used in Scorpène.

Transfer of Technology

Transfer of Technology

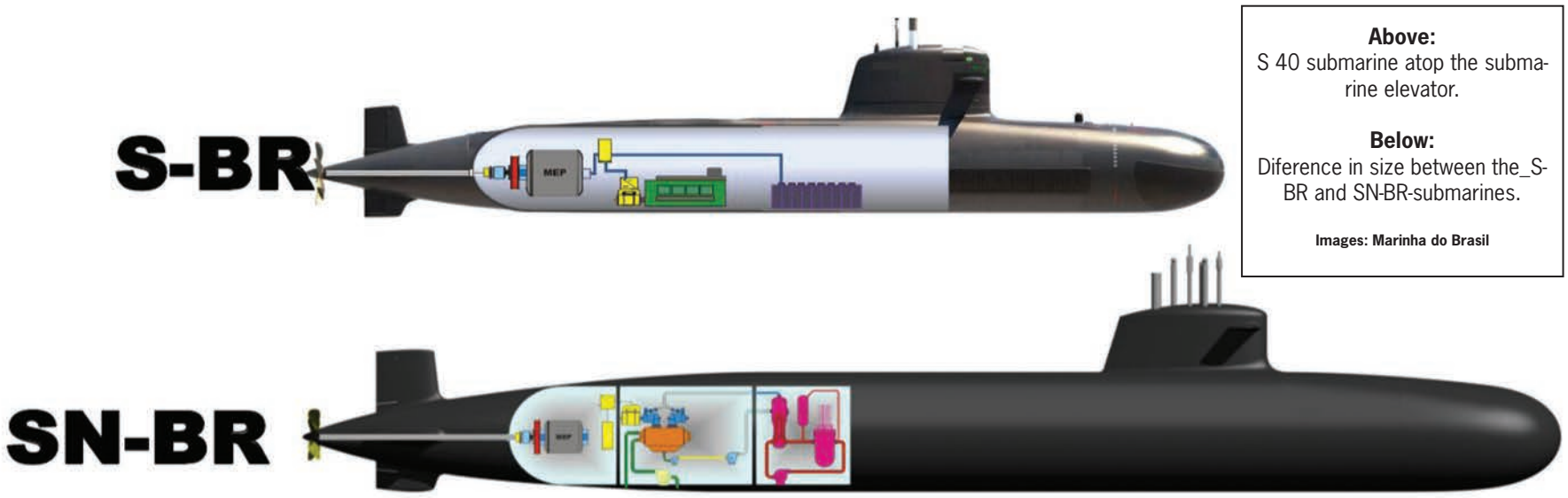
The agreement between Brazil and France for the Subsea Development Program (PROSUB) has three basic premises: technology transfer, nationalization of equipment and systems, and training of personnel. The technological transfer takes place in the areas of submarine design and construction and industrial infrastructure.

The ToT for the construction of the conventional submarines or S-BRs has been taking place since 2010 in the city of Cherbourg, France, where more than 250 engineers and technicians from the BN, NUCLEP (Nuclebrás Heavy Equipment) and Itaguaí Construções Navais (Navy shipyard) have already been qualified. The technology transfer process continues in Brazil, with the technical consulting activities during the project detailing the modified parts of the conventional submarine.

"PROSUB has as one of its main goals the ToT, through personnel training and the search for a high index of nationalization. This generates benefits for Brazil, of a technological and industrial nature, including not only the naval market, but also other segments that supply goods and services in the country," said Fleet Admiral Ferreira. The program has a total cost forecast at R$35.5 billion (US$9,36 billion) by 2029 when the nuclear submarine should be ready. So far, the Brazilian Navy has spent half of this budget.

S-BRs Specifications

Displacement: ..1,870 tons surfaced, ... 2,200 tons submerged
Length: ..... 71.6 m
Width: ..... 6.2 m
Draft: ..... 5.5 m
Propulsion: ... Diesel motors: 4 x MTU .....16V 396 SE84 (2990cv/hp) ..... 1 x Motor elétrico Jeumont .....Schneider (2.8MW)
Speed: .....20 knots (max)
Autonomy: 70 days at sea, 13c000 miles at 8 knots; can navigate 400 miles at 4 knots without use of snorkel
Depth: 300 metros (max)
Weapons: ....18 - 533 mm torpedoes; ..... 6 torpedo tubes .....8 - Exocet missiles - SM 39
Crew: 35



Above:
S 40 submarine atop the submarine elevator.

Below:
Diference in size between the_S-BR and SN-BR-submarines.

Images: Marinha do Brasil

RNLI's Shannon Class Lifeboat: *Speed, Maneuverability, Flexibility*

The latest lifeboat to join the fleet of the Royal National Lifeboat Institution, the main sea rescue service in the UK and Ireland, is the waterjet-propelled Shannon class, which the organization says is its most agile and maneuverable all-weather lifeboat yet to be deployed. Designed entirely in-house by RNLI engineers, cutting-edge technology has been used in this new boat to meet modern-day rescue service demands following the lead taken with the RNLI's introduction of the Shannon's sister lifeboat class, the Tamar, in 2005.

In 2013, the Royal National Lifeboat Institution introduced the Shannon class lifeboat to meet the modern-day demands facing a sea rescue service. At 13 meters long and weighing 18 tonnes, the Shannon is the smallest of the RNLI's all-weather lifeboats and, with an operational lifetime of 25 years, is expected to provide lifesaving cover around the coasts of the UK and Ireland for the foreseeable future: its hull and wheelhouse have a life expectancy of 50 years, thereby enabling the boat's

The Exmouth, UK-based Shannon class R and J Welburn being launched into the sea.

Photo: RNLI/Nigel Millard

The RNLI has also introduced a new launch and recovery tractor, designed in conjunction with high-mobility-vehicles specialist Supacat Ltd, specifically for use with the Shannon. It acts as a mobile slipway. Pictured is the Hoylake, UK Shannon class lifeboat being recovered from the sea.

Photo: RNLI/Dave James

"THE MANEUVRABILITY OF A JET-DRIVEN BOAT IS PHENOMENAL – IT REALLY HAS TO BE SEEN TO BE BELIEVED. THE LAUNCH AND RECOVERY EQUIPMENT HELPS US GET SAFELY BACK TO SHORE, NO MATTER WHAT THE CONDITIONS"

TREVOR BUNNEY,
MECHANIC AT RNLI, DUNGENESS LIFEBOAT STATION

lifetime to be extended beyond 25 years by having it undergo a refit. The Shannon is self-righting and can stay at sea for up to 10 hours in extreme conditions. The boat's hull shape was designed specifically to reduce the vertical and transverse slamming forces that affect boats in high seas, with a narrow bow that cuts through water and a wide aft to provide stability. Its hull, deck and wheelhouse are constructed of composite materials, predominantly an epoxy resin film infusion glass sandwich construction, carbon fiber being employed in areas of the boat that are under high load.

Integrated systems management

Both the Shannon and its larger sister, the Tamar, are fitted with a Systems and Information Management System, an electronic integrated bridge system that allows the crew to monitor, operate and control many of the lifeboat's functions such as the navigation of the lifeboat, including direction finding, radar and charting; radio communications and CCTV; and the boat's mechanics, including the engines, bilge and electrical systems, directly. Crews can perform these functions while seated in shock-absorbing seats, thus improving crew safety, and SIMS also promotes better task-sharing between crew members. The SIMS now used in the Shannon class boat was developed jointly by the RNLI and software and solutions provider SCISYS and communication solutions specialist Savox. The six SIMS workstations on board the Tamar and Shannon boats are located at the Coxswain, Helm, Navigator 1, Navigator 2, Mechanic, and Upper Steering Position (USP) crew positions: the first five of these positions are located within the wheelhouse: the USP is up on deck.

Launch and recovery system

A special feature of the Shannon lifeboat is that it was designed to be launched and recovered from a beach via a new faster and safer launch and recovery system: the vessel can also be launched from a slipway or it can lie afloat. The RNLI has also introduced a new launch and recovery tractor, designed in conjunction with high-mobility-vehicles specialist Supacat Ltd, specifically for use with the Shannon. It acts as a mobile slipway: it can be driven directly onto the beach for recovery, a major advantage for lifeboat stations without harbors, slipways or davit systems. Powered by a 450 hp engine, the 37-tonne tractor is able to carry an 18-tonne Shannon over rough beach terrain, including steep shelving shingle or wet, sticky sand, and can safely launch the lifeboat in up to 2.4 meters of water. In addition, the tractor is watertight and can be completely submerged in high-tide water up to 9 meters deep before being retrieved at low tide.

Speed and maneuverability

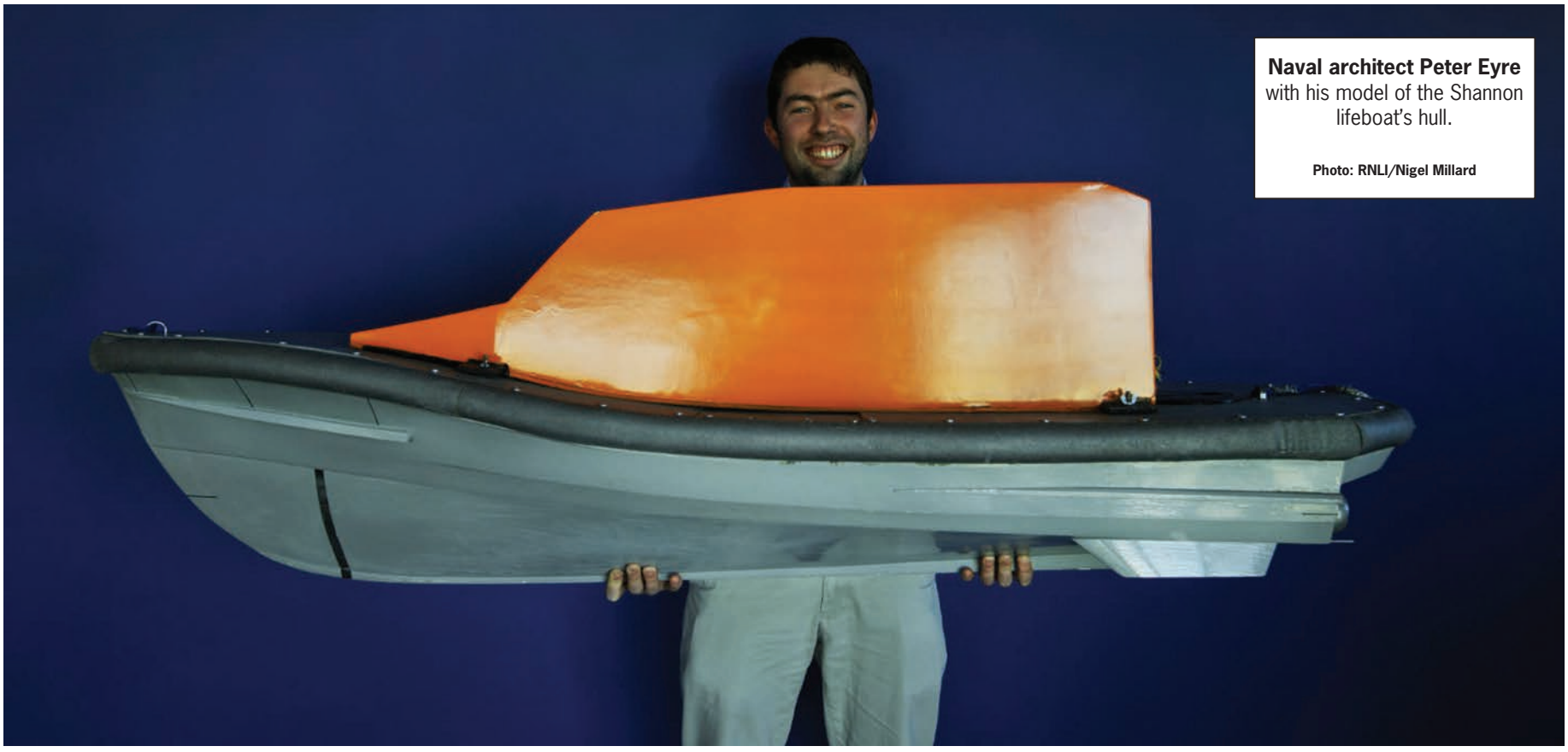
Two Scania D13 650 hp engines give the Shannon a top speedof 25 knots, making it almost 50 percent faster than the RNLI's older Mersey class vessels. The engines each have a 1,370-liter fuel tank, and refuelling can take place at rates of 200 liters per minute. Its twin Hamilton HJ 364 waterjets provide propulsion that makes the Shannon the most agile and maneuverable all-weather lifeboat in the RNLI fleet and give the boat its ability to operate in shallow waters and be intentionally beached, thus providing broad operational versatility.

The Shannon will gradually replace the RNLI's Mersey and Tyne class lifeboats. Once rolled out, the whole all-weather lifeboat fleet will be capable of 25 knots. The Shannon is not only fast but also highly maneuverable: "The maneuvrability of a jet-driven boat is phenomenal – it really has to be seen to be believed. The launch and recovery equipment helps us get safely back to shore, no matter what the conditions," said Trevor Bunney, Mechanic at RNLI Dungeness Lifeboat Station.

Rodney Burge, the RNLI's Lifeboat Operations Manager, commented: "We have all been very impressed with the Shannon – it's a completely new concept in life boating. When I started volunteer-

The RNLI's All-weather Lifeboat Center in Poole, Dorset, UK: carrying out the whole boatbuilding process under one roof.

Photo: RNLI/Nathan Williams



Naval architect Peter Eyre with his model of the Shannon lifeboat's hull.

Photo: RNLI/Nigel Millard

ing with the RNLI 45 years ago, we had a Watson class lifeboat that had a top speed of around 7 knots and no radar. This boat is more than three times as fast but still feels incredibly smooth in the water, even at top speed."

All-weather Lifeboat Center

The first Shannon class lifeboat was named Jock and Annie Slater, after a former RNLI Chairman, Sir Jock Slater, and his wife, Lady Annie Slater, and entered service at Dungeness Lifeboat Station in the south-east of England in 2013. The Jock and Annie Slater was the first lifeboat to be built at the RNLI's All-weather Lifeboat Centre in Poole, Dorset, UK, which opened in 2015. The Center carries out the whole boatbuilding process under one roof and aims to build at least six Shannon class lifeboats per year to produce a fleet of at least 50 such vessels.

The RNLI said its All-weather Lifeboat Center allows the organization to govern its own destiny and that because in the future there will be fewer specialist suppliers that will be able to meet its particular needs, the Centre will mitigate the risks to its lifeboat-building supply chain, give it greater control over quality, and make cost reductions of at least $4 million per year.

Facilities at the Center include two boat halls with flexible bays for manufacturing and maintaining lifeboats; a component manufacturing area; a launch, recovery and boat storage area; a paint preparation area with built-in extraction system and heat curing facility; a workshop for supporting the RNLI's inshore training fleet; office facilities; tools and equipment storage facilities; and a visitors' viewing area.

The UK stations of Dungeness in south-east England and Exmouth in the south-west of the country were the first to receive Shannon class lifeboats: the new class is now gradually being introduced across the UK and Ireland: at present, ten RNLI stations have a Shannon class lifeboat and there are four Shannon class boats in the organization's relief fleet.

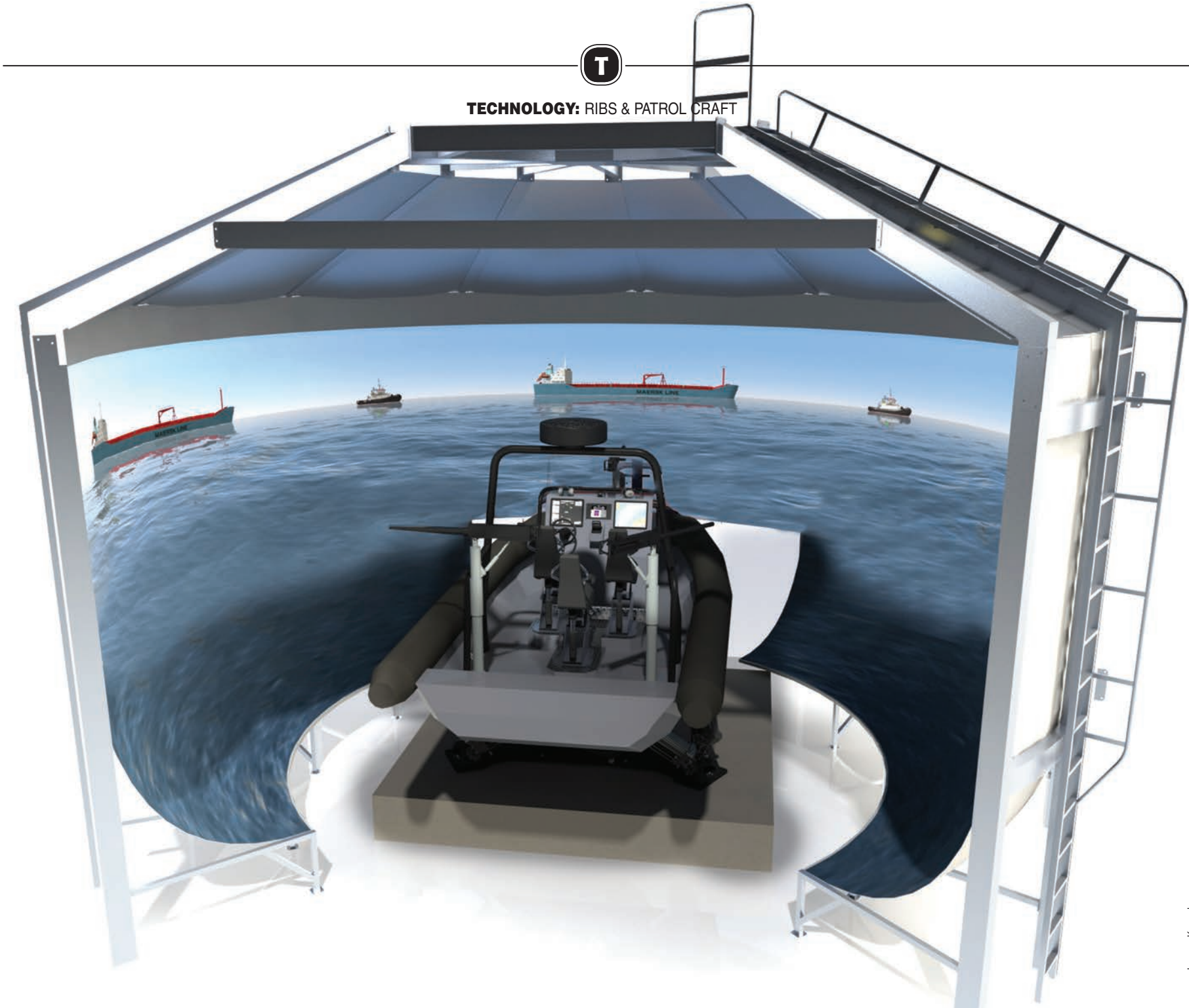


Image: Kongsberg

Getting 'Up to Speed'

Fast craft simulator training crew for operations where split-second decision-making on board high-speed vessels can be the difference between life or death

Few would argue that the most effective way to learn anything is to literally keep practicing the process until it becomes second nature. In the real world, however, this principle is often accompanied by a litany of practical, logistical and financial difficulties if training is to be carried out in situ, as it should be for maximum benefit. Additionally, rote learning doesn't always take into consideration the fact that circumstance has a habit of pitching curveballs; and these reasons help to illustrate why simulation technology has become such an irreplaceable training aid for maritime applications.

Some disciplines are more demanding than others and come with a commensurately high price to pay if mistakes are made; and in this kind of setting above all, simulator-based training offers inestimable value. Such a setting is represented by Singapore Coast Guard (SPCG) operations, and this has led to a record-breaking deal announced in October 2018 between Kongsberg Digital (KDI) and the Singapore Ministry of Home Affairs, for delivery of four K-Sim Fast Craft tactical boat handling and firing simulators to the SPCG by 2020.

The contract also includes installation, project management, commissioning, testing and a 10-year maintenance agreement written, with such a commitment showing how seriously the SPCG takes the business of ensuring its boat crews are as familiar as possible with their working environment, duties and the challenges they meet in daily active service on a continuous basis. Mounted on motion platforms and providing a cylindrical, low-radius visual projection system, the simulators form the central part of a facility which will also include two Instructor Operator Stations and two briefing/debriefing rooms. Additionally, the simulators are equipped with capabilities replicating weapons of various types, thereby enabling trainees to undergo viscerally authentic, in-depth tactical training.

"Our K-Sim Fast Craft simulator builds changeable, volatile conditions into its functionality as a means of honing trainees' alertness and mission-readiness, over and above the core schooling

the simulators provide in boat-handling and high-speed navigational skills," said Lars Klemmetsby, Vice President Business Development Defence, Kongsberg Digital. "This deep-level training in an immersive and startlingly realistic simulated environment encourages trainees to think and behave tactically as a team. In real life, this also translates to significant improvements in crew safety and equipment utilization."

According to Klemmetsby, numerous elements combine to make the K-Sim Fast Craft simulator such a credible training solution. In the first instance, recorded vessel performance data is used to validate the hydrodynamic vessel modelling capabilities: the motion platform is calibrated to match the propulsion system and hull-type characteristics of real boats at various speeds and in differing sea states, taking wave interaction and potential effects upon other vessels or objects into account. (In addition to the Fast Patrol Boat configuration, the simulator offers Interceptor and RHIB options plus custom models, replicating propulsion systems including stern drive, surface drive, water jet and outboards.) Real controllers, displays and indicators, specifically configured to the relevant boat type, can also be integrated to the bridge layout to enhance the authenticity of the interoperable onboard operator positions. The cylindrical, low-radius visual projection system provides a broad vertical field of view to render the perceptual sensation more lifelike for trainees.

The care taken in assembling a definitive user experience for trainees is matched by the comprehensiveness and functional ease of the K-Sim Fast Craft instructor, monitoring and assessment system, with a modified drag-and-drop electronic chart system as its basis for the construction of exercises. The training and assessment objectives can be adjusted so that they are fully applicable to a broad selection of user groups whose work involves operating high-speed vessels. This list would include search & rescue organisations, navies, marine police forces, customs and border patrols, fire departments and special operations forces. Automatic recording of training scenarios is integral to the assessment system, allowing instructors to perfect the exercises they set and provide the most detailed feedback to their students.

"KDI has thought of everything in the development of the Fast Craft simulator training solution," smiles Klemmetsby. "Starting with and building upon basic familiarisation with the vessel and equipment, the exercises take trainees all the way through to the point where complex procedures such as interception and boarding operations, search & rescue strategies or the escalation of force and weapon engagement become absolutely instinctive.

"Trainees can practice the rules of engagement in a safe and controlled environment, enacting missions from the planning stages to rehearsing operations, with a full debriefing thereafter. Going into simulator training programs at this granular level inevitably leads to more informed and confident decision making – as does the fact that the students can review the impact their judgement calls have made and assess their overall modus operandi accordingly," concludes Klemmetsby.

Image: Kongsberg

Innovative RIBs & Patrol Craft

Ribcraft

RIBCRAFT delivered a purpose built 25-ft patrol and rescue boats to a coastal Fire Department. The versatile center console configuration of the RIBCRAFT 7.8 now features fire suppression capabilities with a forward position fire pump. With the addition of fire suppression, the 7.8 now offers a total fire and rescue solution to the fire service. At 25 ft., the RIBCRAFT 7.8 provides a large open aft deck for rescue efforts, and firefighting capabilities without sacrificing maneuverability and functionality. Originally designed for tactical operations and patrol, the RIBCRAFT 7.8 with its long steep bow sheer and impressive deep V hull offers unparalleled rough water performance and safety. This specialized RIB features an all-aluminum extended T-Top with drop down canvas enclosure, antenna arch with an integrated dive ladder, forward tow post, complete electronics package with Garmin GPS, FLIR stabilized camera, loud hailer/siren, and VHF. Powered by a 250 hp Mercury Verado outboard, this boat will reach speeds in excess of 50 mph fulfilling its mission as a fast response boat. Extremely durable, stable, and reliable, RIBCRAFT RIBs with their heavy duty inflatable tube and deep V hull are an excellent platform for law enforcement, search and rescue, and marine interdiction.

Lake Assault Boats

From the shores of Lake Superior, Lake Assault Boats, a part of Fraser Shipyards, has delivered a 24-ft. patrol boat to the U.S. Air Force. The heavy-duty craft is a V-hull design powered by twin 200 hp outboard motors, and its estimated top speed is 40 knots. The hull and superstructure are constructed of marine grade aluminum that are MIG and TIG welded throughout. All water seams are welded 100% on both sides and longitudinal structural members are stitch welded on opposite sides. The hull includes dive relief cut-outs on both the port and starboard sides of the vessel. The craft is protected by a Gilman Ionomer foam collar system around the gunwales. The T-top pilothouse includes a center console, a heavy-duty wiper system, a weapons storage box, two shock-mitigating seats, and an overhead waterproof electronics box. The craft's electronics are protected with circuit breakers and all of its electrical switches are heavy-duty toggles. Lake Assault Boats are custom engineered in Superior, Wisconson. The company offers a wide range of hull designs and configurations suitable for use on inland lakes and rivers, and intercoastal and offshore waters.

The Vigor Fast Interceptor

The Vigor Fast Interceptor (VFI) is a 21 x 4.7 m multi-mission craft delivering speed, maneuverability and superior seakeeping in challenging environments. Powered by a pair of MAN V12 generating 1900 bhp each and driving two ZF SeaRex 130S surface drives, the 25.25-

Vigor

Bullfrog Boats

Tuco

ton displacement (lightship) boat is built for a 45 knot cruising speed and a 70 knot sprint speed. Developed in partnership with Michael Peters Yacht, the design is based on a proven platform to meet the followings needs of governmental agencies around the world:

- High-speed interdiction for the protection of territorial waters or illegal drug enforcement.
- Ability to launch and retrieve unmanned aerial vehicles, including ability to interface, control and transfer communications
- Address swarm threats from multiple targets
- Provide up to a 72-hour mission duration
- Carry out visit, board, search & seizure (VBSS)
- Search and rescue (SAR)
- Dive operations

Bullfrog Boats

Bullfrog Boats has produced more than 600 boats with ITS patented indestructible flotation collar. The company recently introduced its larger series of our Bullfrogs. The 22-27-ft. series all have a constant dead rise of 24 degrees and combined with the Bullfrog collar it is the most sea-worthy and driest ride boat for its size! We are also the most cost effective, the 22-ft. with Honda 200 hp sells for $70,000.

Tuco ProZero Series

Tuco Marine Group has added a new member to the ProZero series of carbon fiber-based workboats – the ProZero 7.5m SOLAS FRC MrK 3, showcasing Tuco Marine's trademark lightweight materials technology of Tuco Marine Group. The new FRC is a third-generation design built around the ProZero 7.5m Fast Rescue Boat. The first two iterations of the 7.5m FRC design have been developed and tested thoroughly during the ProZero development project for which Tuco received funding under the Horizon2020 SME Instrument program. This development project ended in 2018, but Tuco Marine has continued to refine the project results and implement them in the ProZero series.

The carbon fiber materials technology secures ultra-high levels of strength and durability at a very low structural weight. The new design presents a very large deck area which will accommodate large payloads or up to 16 persons. New bow and fender configurations have been added for improved safety during transfer operations across the bow.

The FRC outfitted with a single water jet installation as standard, with an optional twin water jet configuration upon request.

Tuco is planning to follow up on the new 7.5m FRC platform with both a 6.5m and a 8.5m version.

To achieve the best balance between design customization and delivery time, Tuco has arranged the entire design and building process around a module-based system.

MAN ES INVESTS IN HYDROGEN

Dubbed a historic milestone and its entry into the hydrogen economy, MAN Energy Solutions announced it is acquiring 40 percent of the shares of the electrolysis technology company H-TEC SYSTEMS. A contract confirming the partial acquisition was signed in Augsburg by Dr. Uwe Lauber, CEO of MAN Energy Solutions, and Ove Petersen and Heinrich Gärtner, executive managers of the GP JOULE Group. The contract also makes provisions for a majority or complete takeover of H-TEC SYSTEMS at a later date. The company will continue to be independently represented on the market with no change in the level of commitment to its customers. H-TEC SYSTEMS has more than 20 years' experience in the research and development of hydrogen technology. Across sites in Lübeck, Braak and Augsburg, a team of 20 employees develops and produces stacks and electrolyzers for manufacturing hydrogen with electricity. Since 2010, H-TEC SYSTEMS has been a subsidiary of GP JOULE, a project developer specializing in renewable energies and sector coupling that retains around 60% of the remaining shares. MAN Energy Solutions is receiving two seats on the newly established H-TEC advisory board.

Photo: MAN ES

e-Navigation & Passage Planning

"Passage planning" are two words sure to elicit groans from navigators globally. The vital yet frustrating process of developing a complete description of a vessel's voyage from start to finish, berth to berth, is an administrative burden, on average consuming 3.5 hours of officer time to collate a plan – manually adding elements such as ENC cells, journey waypoints and UKC calculations to a report for inspection by port state authorities and others.

Not only laborious, but with repetitive manual input, it is a constant source of human error. There is an alternative, and e-Navigation is the key.

Driving innovation

NAVTOR is involved in a number of research projects that create platforms for innovation in e-Navigation, helping to deliver on the promise of making life easier, safer and more efficient for navigators, shipowners and operators. These projects, in collaboration with partners globally, help to deliver insights into how technology can unlock automated processes and deliver improved ways of working.

For example, NAVTOR is the marine representative within the ENABLE-S3 EU initiative, whereby a multi-national team are working across transport sectors to explore the way forward for autonomous vehicles. It is also involved in SESAME-II, assessing possibilities for automating ship reporting, and M-AR, which is looking at Augmented Reality as an enabler for improved navigational perception. These projects sound futuristic, but the understanding they deliver helps create benefits today. Passage Planning is a case in point.

Steps to transformation

Passage Planning is a four-stage process, consisting of appraisal, planning, execution, and monitoring. The first two stages currently involve much of the administrative legwork, while the latter two have been partially addressed by the developments of ECDIS technology over recent years. It worth considering each stage in isolation to assess how e-Navigation can transform the whole.

1. Appraisal

Appraisal involves gathering relevant information for the upcoming voyage. This requires a navigator to navigate his or her way through a sea of available resources and information, assessing what is actually needed for a journey, ensuring the resources provide the latest, up to date material and then interpreting and applying the information in the correct way. The wealth of resources makes it challenging for the officer to know what is needed and what is not, with the result that many over subscribe, wasting time and money.

e-Navigation simplifies this complex start to the Passage Planning journey.

With a digital chart table such as NAVTOR's NavStation, all data is available and updated on-board, in one place. Everything that is required – including licensed ENC charts, updated ADP, AENP, and the latest NavArea warnings and weather forecasts – is at a navigator's fingertips, without the need to search, stress and update. Suddenly appraisal are transformed from a worrisome burden to an easy check.

2. Planning

After manually gathering all the relevant information, or the information they believe to be relevant, the traditional passage planner moves on to the actual voyage planning. Herein lies the core workload, and the greatest risk of human error. Each waypoint requires the manual logging and assessment of an array of different information. It is labor intensive and fraught with possibilities for inaccuracy. Again, e-Navigation can help, making it possible for the navigator to input relevant information into their system and automatically receive an optimized, safety-checked suggestion – one that includes information such as UKC, areas of heavy traffic, potential hazards, and so on. With integration into bridge networks the route can be sent directly from the planning station to the ECDIS, with the approved route and passage plan then automatically dispatched to the office on shore.

All of a sudden individual vessels and fleets have full efficiency, safety and transparency, without the risk of human error.

NAVTOR's involvement in the ENABLE-S3 EU's project demonstrated just how effective this could be, with a captain manually planning a passage from Barcelona to Las Palmas/Gran

With a digital chart table such as NAVTOR's NavStation all data is available and updated on-board, in one place.

Photo: Navtor

Canarias, and then repeating the process digitally through the NavStation.

3 and 4. Execution and monitoring

The final stages of passage planning involve the execution of the journey and necessary monitoring, which has, to a large extent already been simplified by the move from paper to electronic charts and ECDIS. However, NAVTOR's involvement in the aforementioned research projects provide a tantalizing view of developments waiting on the horizon.

As part of the SESAME-2 collaboration NAVTOR is exploring the concept of Maritime Single Window portals, meaning navigators could utilize a single portal (such as that operated by the Norwegian Coastal Administration) to submit all their documents for port and authority clearance. In addition, the project is investigating the possibility of developing systems whereby all documentation could be transferred via machine-to-machine interaction without the need for human input. This would address another major administrative burden and bridge-based headache – that of ship reporting. If this much-maligned process was automated the efficiencies enabled across the industry could be transformational … as could the sense of relief on vessel bridges worldwide.

Connected benefits

At the heart of e-Navigation lies connectivity. The ability to connect assets, offices, teams and data enables greater awareness, transparency and enhanced decision-making, for both vessels and businesses. So in the monitoring stage, e-Navigation becomes the cornerstone for the creation of onshore Fleet Operations Centers, whereby shore-based captains can monitor vessel progress in line with pre-planned schedules, checking weather conditions and feeding relevant information to crew. This kind of fully connected remote support will be a stepping stone on the path to reduced crew demands and greater vessel autonomy.

The software solution

Moving back from the future to the present, the passage planning possibilities detailed above are already a reality.

In 2017 NAVTOR launched the Passage Planning module on the NavStation digital chart table, updating it for improved performance in 2018. The new iteration automatically captures all necessary passage plan information as a navigator maps out a vessel voyage, without the need for searching for the right data, updating, stress, and thorough manual inputs and checks – the solution is seamless. A report can then be generated at the touch of a button for inspection by port state authorities and other necessary parties.

The automated process transforms administration duties on the bridge, cutting the time spent on passage planning tasks from 3.5 hours to about 30 minutes: designed to be simple and efficient, yet safe and compliant.

KVH: NEW VSAT ANTENNA

KVH introduced the TracPhone V11-HTS, and antenna that the company dubs 'the world's fastest' 1 meter Ku/C-band maritime VSAT antenna. The V11-HTS is designed to deliver data speeds as fast as 20 Mbps down/3 Mbps. The TracPhone V11-HTS is designed for KVH's mini-VSAT Broadband HTS network, which utilizes Intelsat's Flex Maritime service to deliver multi-layered Ku-band coverage, enabling vessels to see multiple HTS and wide beam satellites for maximum availability of broadband service. In addition, the TracPhone V11-HTS utilizes Intelsat's global C-band capacity for expanded maritime coverage. For commercial fleets, the TracPhone V11-HTS is also available as part of KVH's AgilePlans, a subscription-based Connectivity as a Service program that includes, for one monthly fee: global connectivity; VSAT antenna with free installation in select ports; training and daily news content delivered via satellite; and delivery of chart and weather content.

Photo: KVH

HGG: Ship Profiler Automates Cutting

HGG'S new UPC 450 Ship Profiler increases cutting and pre-fabrication productivity by eliminating the need to cut ship stiffeners and spools by hand. HGG production automation combines ship stiffener cutting, 3D profile cutting with optional tube cutting. The UPC 450 Ship Profiler also has a small machine footprint. The HGG UPC 450 Ship Profiler offers full process cutting integration through the HGG ProCAM Software Suite, integrating thermal cutting HGG ProCAD design, HGG ProGRAM work preparation coordination, and HGG's internationally recognized 3D plasma cutting intelligence. The UPC 450 Ship Profiler is a cutting machine with a small footprint, but a wide range of capabilities. The machine makes it easy to load material on a cutting table and then quickly cut it within the cutting cell, cutting ship stiffener profiles from flat bars, bulbs, and angles, as well as cutting spools from tubular pipes. The cutting cell includes a cutting trolley that controls all movement and HGG's patented cutting head and biaxial cutting torch, capable of precision accuracy. To maximize worker health and safety, the machine includes two fume extraction modules, safely capturing plasma dust and fumes. The UPC 450 Ship Profiler is designed to be versatile and can be easily configured to accommodate a variety of fabrication needs and footprint requirements. One person can quickly and easily convert the UPC 450 Ship Profiler from cutting stiffeners to cutting tubes.

Photo: HGG

www.hgg-group.com

New Navy Class Dubbed Navajo

Gulf Island Shipyards was awarded a $63.5 million contract for the detail design and construction of the new Towing, Salvage and Rescue Ship which will be based on existing commercial towing offshore vessel designs and will replace the current T-ATF 166 and T-ARS 50 class ships in service with the US Military Sealift Command. Secretary of the Navy Richard V. Spencer said the new class will be named Navajo in honor of the contributions the Navajo people have made to the armed forces. The first ship of this class will be named USNS Navajo and designated T-ATS 6. The contract includes options for potentially seven additional vessels. The T-ATS will serve as open ocean towing vessels and will additionally support salvage operations and submarine rescue missions. The first ship in the class will be built at the company's shipyard in Houma, La., and is expected to be completed in March 2021.

An artist rendering of the future USNS Navajo (T-TATS 6).

(U.S. Navy photo illustration/Released)

Schottel Propulsion for IMR Vessel Paul Candies

Paul Candies, a new Inspection Maintenance Repair (IMR) vessel built by Candies Shipbuilders and owned by its parent company Otto Candies, LLC, is equipped with three different Schottel propulsion systems: two Combi Drives; two transverse thrusters; and one retractable rudder propeller. Due to two type SCD 560 STP Schottel Combi Drive azimuth thrusters the diesel-electric vessel reaches a speed of 14 knots. The 2600 kW SCD 560 STP features the Schottel twin propeller concept. By sharing the load between two propellers, this concept is designed to increase propulsion efficiency and reduce fuel consumption over single propeller systems. Beyond this, two type STT 5 FP bow thrusters (each of 1,050 kW) and one 800 kW type SRP 260 R FP retractable bow thruster ensure precise and high maneuverability in DP mode.

Otto Candies, LLC deploys the MT6020 Marin Teknikk design vessel in the worldwide offshore industry. The 101.25 x 20.6 m wide vessel is named after Paul Candies, the long-time President of Otto Candies, LLC. The new IMR vessel joins the other 42 vessels in the Otto Candies, LLC fleet.

Paul Candies is a new Inspection Maintenance Repair (IMR) vessel built by Candies Shipbuilders and owned by its parent company Otto Candies, LLC. It is equipped with three different Schottel propulsion systems.

Image: Otto Candies, LLC

On Trial: Drone Deliveries to Ships @ Anchor

In partnership with Airbus, Wilhelmsen's shore-to-ship Singapore pilot project marks the first deployment of drone technology in real-time port conditions, delivering a variety of small, time-critical items to working vessels at anchorage.

Lifting off from Marina South Pier in Singapore with 3D printed consumables from Wilhelmsen's onshore 3D printing micro-factory, the Airbus Skyways drone navigated autonomously along pre-determined 'aerial-corridors' in its 1.5km flight to Eastern Working Anchorage. The drone landed on the deck of the Swire Pacific Offshore (SPO)'s Anchor Handling Tug Supply (AHTS) vessel, M/V Pacific Centurion and deposited its 1.5kg cargo without a hitch before returning to its base. The entire delivery, from take-off towards the vessel, to landing back at base, took just 10 minutes.

"The now proven, seamless operation of drone deliveries from shore-to-ship, in one of the world's busiest ports, proves the hard work, investment and faith we, and indeed our partners, placed in the Agency by Air drone delivery project over the past two years was not misplaced," said Marius Johansen, VP Commercial, Wilhelmsen Ships Agency says.

Wilhelmsen sees delivery by drone, rather than launch boat, as part and parcel of their continued evolution of the agency business. "Delivery of essential spares, medical supplies and cash to Master via launch boat, is an established part of our portfolio of husbandry services, which we provide day in and day out, in ports all over the world," said Johansen. "Modern technology such as Unmanned Aircraft Systems (UAS), is just a new tool, albeit a very cool one, with which we can push our industry ever forward and improve how we serve our customers." The ongoing pilot trial will for now, focus on offshore supply vessels at anchorage 1.5km from the pier. With operational safety as a priority, flights will be limited to this distance for the time being, before the flight range is gradually extended to as far as 3km from the shore.

The Maritime and Port Authority of Singapore (MPA) is facilitating the trial, which started in late November 2018, through the interim use of Marina South Pier as the launching and landing point for Airbus' delivery drone. At the same time, MPA has designated anchorages for vessels to anchor off Marina South for the trial. The Civil Aviation Authority of Singapore is also working with Wilhelmsen and Airbus to ensure safety of the trials.

Image: Airbus & Wilhelmsen

Wilhelmsen's shore-to-ship Singapore pilot project marks the first deployment of drone technology in real-time port conditions, delivering a variety of small, time-critical items to working vessels at anchorage.

Image: Airbus & Wilhelmsen

AUTONAV ROBOTIC BOAT

Yanmar has undertaken development of underlying technologies for robotic boats and auto-docking. The propulsion company has been working to meld the hardware side of its boatbuilding and recreational marine domains with basic development of underlying IT and robotics technologies, towards robotic boat technologies that can be used in the marine surveys and infrastructure inspection.

The Robotic Boat demonstration vehicle developed

Photo: Yanmar

by Yanmar uses the company's experience in Fiber Reinforced Plastic (FRP). The demonstration boat was developed under the Strategic Innovation Program for next generation technology for oceanic resources exploration and will be operated as an Autonomous Surface Vehicle by the Japan Agency for Marine Earth Science and Technology (JAMSTEC) for continuous marine resources monitoring.

Dimensions	4.4m × 1.9m × 1.8m
Weight	1.8 tons
Max. speed	5 knots
Nav speed	3 knots
Duration	more than 48 hours
Powerplant	Diesel generator / generation batteries

Royston Completes OSV Overhaul

Work on overhauling diesel engines on an advanced diving support vessel was recently completed by Royston. Engineers undertook the 30,000 running hour major service on the generator engines onboard the 140m Subsea 7 Seven Atlantic, as part of a comprehensive refurbishment and maintenance program. The work by Royston saw the Wärtsilä W7L32 diesel generator No.5 disassembled to install new cylinder heads, air start valves, indicator cocks, injectors, and cylinder seals. Relief valves, pistons and conrods, cylinder liners, bearing blocks, crankshaft and turbocharger were all sent to company's Newcastle work shop for checking and repair work before being returned ahead of the final reassembly and inspection of the engine. Engineers also overhauled the turbocharger on the Wärtsilä W7L32 diesel generator No.3.

Requiring 12,000 running hour overhaul, the NA297 Napier turbochargers from both engines were removed, stripped, cleaned, inspected and balanced at Royston's specialist test and repair facility, which features a Schenk H3BU horizontal balance machine alongside an IRD B5OU-290 instrument as part of a precision instrumentation capability to increase balance testing. Following completion of the servicing work, incremental load testing in line with the engine manufacturer's specification was also completed by engineers.

Photo: Subsea 7/Royston

Seven Atlantic's power plant package comprises six Wartsila 7L engines, each driving a 3360kVA Van Kaick generator, generating 6,6 kV (mains voltage). The propulsion installation runs on marine gasoil to provide power for propulsion, dive systems, crane activities and other consumers.

Port Optimizer

GE Transportation, a Wabtec company, announced new functionality to its Port Optimizer platform to make real-time cargo visibility a reality across the multimodal supply chain. Port Optimizer is a cloud-based platform designed to enhance supply chain performance and predictability by delivering real time data-driven insights through a single portal, is currently in use at the San Pedro Bay port complex, the busiest port complex in North America.

The latest updates include features that specifically benefit retailers (beneficial cargo owners, or BCOs) and trucking companies. With the ability to "flag" high-priority containers, BCOs can now track cargo across the lifecycle of its movement and receive notifications of delays. Advanced notifications, such as dwell time alerts, have been added to facilitate faster and more proactive pick-ups. As another new feature, trucking companies and BCOs can now automatically input delivery orders directly into Port Optimizer, replacing previous manual efforts and increasing efficiency of truck turns.

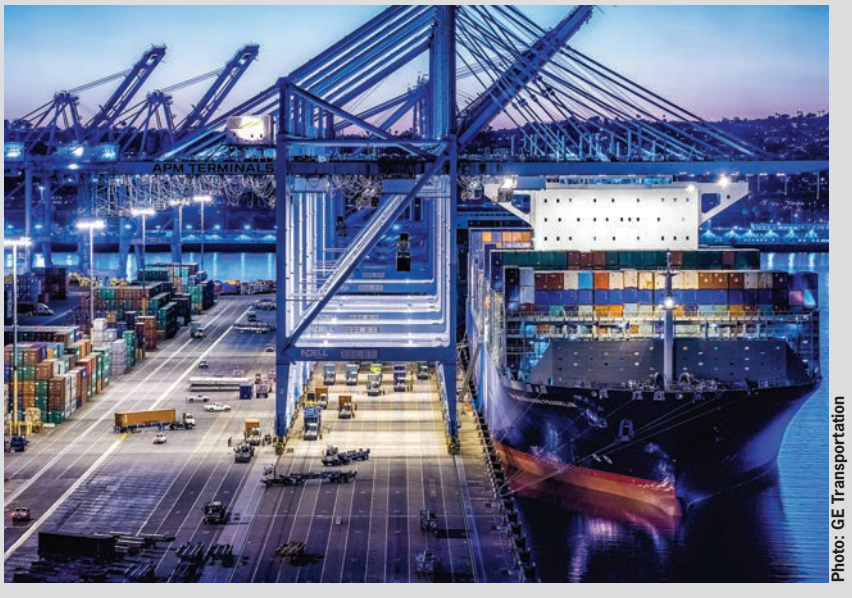


Photo: GE Transportation

Offshore Heavy Lift Refit

While the refit of heavy lift capacity onboard an offshore rig might sound mundane, Liebherr's project to replace and modernize cranes on the offshore platform Molikpaq operated by Sakhalin Energy, a unit subjected to some of the world's harshest conditions, is anything but mundane. The modernization project on Sakhalin Energy's offshore platform off the Russian island of Sakhalin includes two ram luffing offshore cranes, type RL 1500 that are going to be completely renewed. An existing crane, type BOS 1900 will be upgraded with the same generation control system as the RL 1500.

Molikpaq operated by Sakhalin Energy was the first Russian offshore oil production platform, with commercial oil production from the platform starting in 1999. Since December 2008 oil from the platform streams through the trans-Sakhalin pipeline system to the oil export terminal of the Prigorodnoye production complex. After two decades of continuous operation, the existing three Liebherr offshore cranes needed to be renewed.

Liebherr was tapped to completely replace two of the offshore cranes while the third device will be modernized for further operation, a unique and demanding project which involved weveral Liebherr companies. The contract drafting and signing were carried out by Liebherr-Russia OOO (Russia). Liebherr-MCCtec Rostock Gmbh (Germany) is responsible for the operational refurbishment of the platform. Liebherr-Werk Biberach GmbH (Germany) participates in the conversion with a tower crane which is used as a support crane for lifting large components. Since the start of the project in 2016, more than 6,000 planning hours have already been invested in the project.

To date, the replacement of the first crane (Liebherr BOS) with a new Liebherr RL 1500 has already been completed in the autumn 2018.

In order to be able to move large parts on the platform, Liebherr installed a tower crane of the type 230 HC-L 8/16 Litronic to be used as a support crane. In addition, a special sliding system was designed and built by Liebherr´s customer service team to move particularly heavy components and modules over the platform. Extreme weather conditions and limited space on the platform are primary challenges to the project, which is scheduled for completion by the end of 2020.

The second phase, the modernization of the existing BOS 1900, has also already been finished. The main reasons which triggered this modernization was to have the same software and handling for the crane operators as the two new RL 1500.

The third phase will include the installation of the second ram luffing crane until the end of 2019. Both RL 1500 cranes are characterized by a cylinder luffing box boom design and a diesel-hydraulic driven main engine. Considering the project specifics, the cranes can handle loads up to 65 tonnes, or 25 tonnes more than the standard lifting capacity of Liebherr RL 1500. This customized solution has been ensured by providing a three fall reeving. Equipped with a main and an auxiliary hoist the RL cranes have a maximum outreach of 42.6 meters.

Considering the geographic locale of the rig and the environmental conditions in which it operates, the cranes are equipped with an arctic temperature package which allows operation down to -36°C.

Photo: Liebherr

Double Duo Lift Method:

Scaldis lifts Norwegian Frigate out of Fjord

SCALDIS, the Belgian subsidiary of DEME, Jan De Nul Group and Herbosch-Kiere, in cooperation with BOA Offshore, completed the salvage of the Norwegian frigate KNM Helge Ingstad. SCALDIS developed a revolutionary lift method especially for this project, by combining its two heavy lift vessels Rambiz and Gulliver.

On November 8, 2018, the Norwegian frigate collided with the tanker Sola TS in the vicinity of Bergen and sank on the inclined slope of a fjord. The Norwegian marine called on the expertise of SCALDIS and BOA Offshore to salvage the shipwreck.

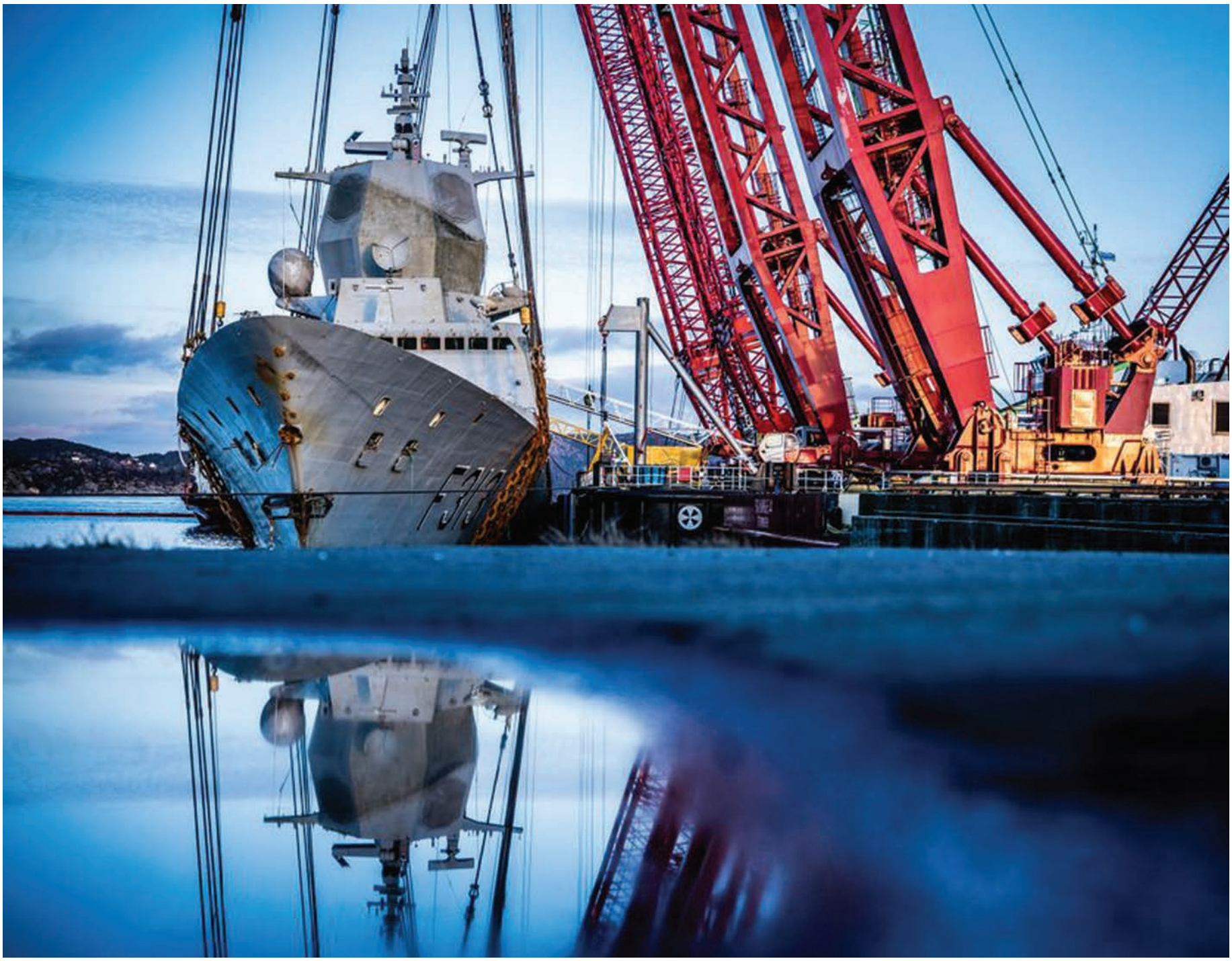
Especially for this project, SCALDIS developed a revolutionary lift method by combining its two heavy lift vessels: Rambiz, equipped with two cranes and a total lifting capacity of 3,300 tonnes, and the new heavy lift vessel Gulliver, also with two cranes and a total lifting capacity of 4,000 tonnes. With this unique "Double Duo Lift" method, SCALDIS has a combined total lifting capacity of 7,300 tonnes at its disposal.

This made it possible to lift the 133-metre long and 5,500-ton heavy frigate in one piece. In fact, the synchronous functioning of the four cranes allows to lift the wreck in one continuous operation and to move it into a horizontal position.

Missiles and fuel were removed from the frigate during the winter months while divers installed 16 hoisting chains under the wreck to be able to lift the ship out of the water.

To lift the frigate safely and completely out of the water, it was transported while hanging from the crane hooks of the heavy lift vessels to the nearest port, where it was placed on a submersible pontoon.

This partially submerged pontoon was subsequently de-ballasted, allowing it to re-emerge above the waterline while supporting the Helge Ingstad at its centre. During this operation, the hoisting cranes stabilised the ship until all sea-fastenings had been secured for subsequent transport.



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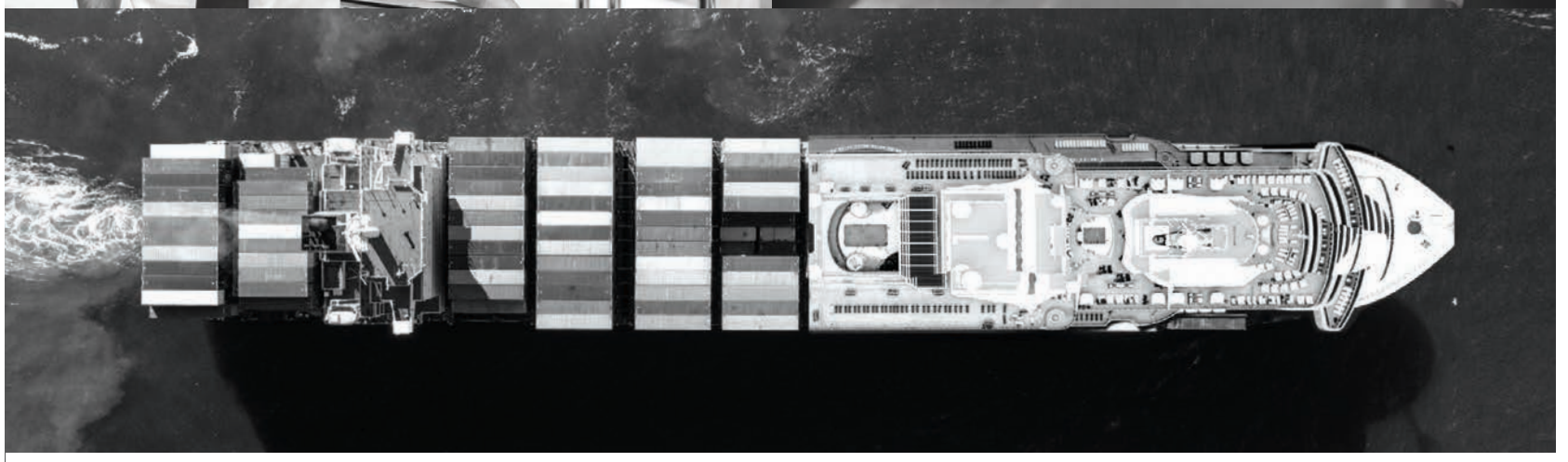

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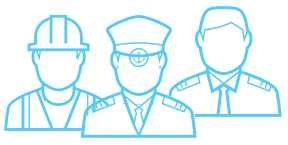

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