

September 2017

MARITIME REPORTER AND ENGINEERING NEWS

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Maritime Security

What should be on your radar?

Environmental Regulation
A Hammer Pounding the Waterfront

U.S. Navy
Inside the USS Gerald R. Ford

Port Operations
The Digital Transformation

Voices
Daniel Grunditz, CTO, Chris Marine

Drones
No Longer a Flight of Fancy

FPSOs
New Storage Tank Explosion Frequencies

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Tri Marine Fishing Management
Thierry Le Guennec - GM



"Just wanted to tell you how we were absolutely blown away with the fuel savings on the main engine once we were able to evaluate it. We see about a

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f/v St. Jude Fishing Vessel
Joe Malley – owner/operator



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F.A.S. Seafoods
Bob Fraumeni – President



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f/v Pinnacle
Mark Casto - Captain

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"Our chiefs installed Fitch units on the output of each boat's centrifuge to treat fuel in day tanks prior to our 2014 long lining season. Both reported fuel savings of 50 to 100 gals/day and cleaner centrifuges."

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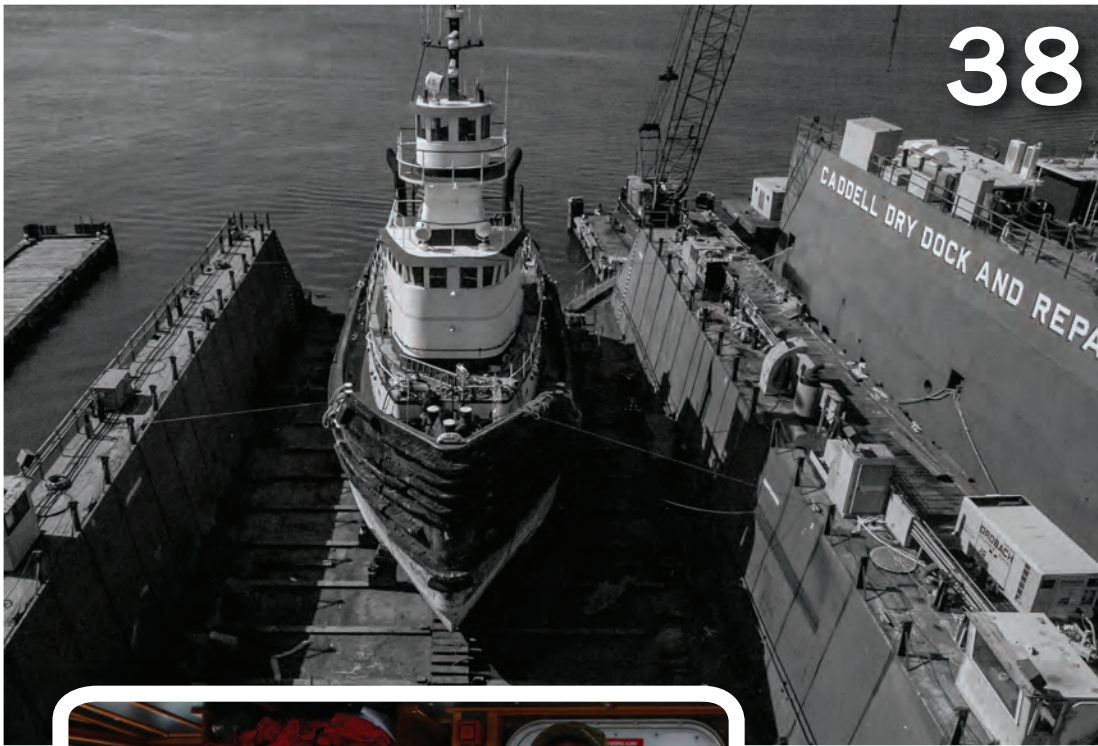
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ON THE COVER
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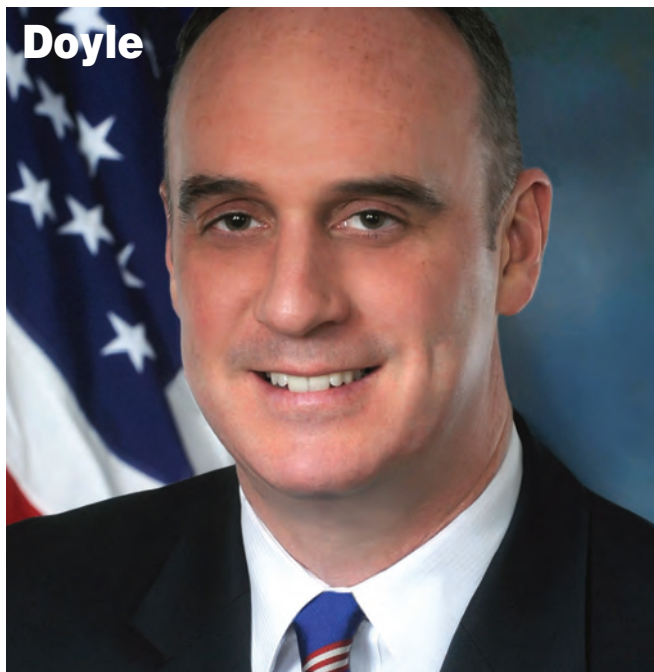
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Security is Job One

I, like many of you that have served this market for two decades plus, have had the opportunity to travel to Houston, Texas, several times each year, watching it emerge from the energy downturn of the early 1990s to become one of the major hubs in the U.S. for the energy, maritime and subsea markets, as well as this country's fourth largest city. I, like many of you, watched in amazement and horror as Hurricane Harvey delivered an unprecedented and punishing hurricane and flood of biblical proportions, impacting a wide swath of the Gulf Coast. Stories have been pouring in from our friends and colleagues in the region, and while recovery will be neither easy nor fast, southern Texas, like Louisiana and Mississippi in the wake of Katrina, will rebound.

Earlier this summer I was in Denmark and Sweden for a week, primarily in Malmö to put the finishing touches on our MOU with the World Maritime University regarding a global maritime training survey, full details coming in this space shortly. While in the area I had the opportunity to meet with a long list of executives, including Daniel Grunditz, the CTO of Chris-Marine. While I certainly knew of the Chris-Marine brand and reputation, on this occasion – as I have found many times in similar facility and shipyard visits around the globe – you really don't know a company until you sit with them in their office. Grunditz is the feature of our "Voices" focus starting on page 22. On the surface, the Chris-Marine premise is straight forward: diesel engine care. But when you dig a little deeper, as I was able to do in my few hours at the Chris-Marine headquarters in Sweden, you find that this company of 120 employees with traditional engineering and heavy machinery roots in fact transcends many of the topics and trends that we cover regularly in our pages, namely the use of 'Big Data' and information to help it serve its clients – vessel owners and shipyards – more efficiently and effectively.

Maritime Security is the main topic of this edition, and to be honest it could be the main topic of every edition, as it broadly encompasses so much that each of you see and do on a daily basis. The evolution cycle of the traditional ship owner is unlike anything we have seen in a generation, as the Amazon's, Google's and Uber's of the world are pressing the tech envelope, squeezing efficiency to dizzying new heights along the way. But with the promise comes peril, as connecting ship, machinery

and process exposes vessel owners to a litany of cyber security threats globally. William P. Doyle, a Commissioner with the U.S. Federal Maritime Commission (and, as my colleague Joe Keefe likes to consistently remind me, a graduate of the Massachusetts Maritime Academy) warns that the maritime industry must 'redouble' efforts to secure IT systems and data, lest they suffer the fate of Maersk when its services were disrupted by the Petya Virus. Following Doyle on page 28 is Jame Espino's breakdown of the USCG draft cyber guidelines for maritime facilities.

Maritime Security in another sense is covered by Edward Lundquist in this edition, with his overview of the new U.S. Navy aircraft carrier USS Gerald R. Ford, which houses an array of technologies to help support its mission in what is proving to be an increasingly unstable and unpredictable world.

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Photo: Paul Allen

AUV Helps Find USS Indianapolis

A team of civilian researchers led by Microsoft co-founder Paul Allen have found the wreck of the World War II heavy cruiser USS Indianapolis (CA 35), lost July 30, 1945. Aiding Allen's team in the discovery was a 6,000-m-rated autonomous underwater vehicle, the REMUS 6000. The AUV is manufactured by Kongsberg Maritime subsidiary Hydroid Inc., and it gathered the sonar data that helped locate the ship 72 years after it was torpedoed and sunk near the end of World War II. The wreckage was found 5,500 meters below the surface in the Philippine Sea.

www.marinetechnews.com/news/helped-indianapolis-552009

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Containership Retrofitted for LNG

The world's first containership retrofitted with a liquefied natural gas (LNG) engine was launched in August 2017. Since May 2017, the 1,000 TEU containership Wes Amelie, owned by Wessels Reederei based in Harem/Ems, has undergone an engine conversion at the German Dry Docks in Bremerhaven. The Hamburg based company Nauticor was selected to conduct the vessel's initial LNG bunkering at the Kühlhauskai in the Port of Bremerhaven. In total, four trucks of LNG were brought to the German port and transferred to the vessel.

<https://www.marinelink.com/news/containership-retrofitted428680>



Nauticor

Milestone for RRS Sir David Attenborough

The stern section of Britain's new polar research ship, RRS Sir David Attenborough, was transported by barge from A&P Tyne (Newcastle), part of A&P Group, to the Cammell Laird's shipyard in Birkenhead.

The transportation of the 899-metric-ton steel block (known as Block 10) – which is the equivalent weight of 71 London double decker buses, and more than 23 meters long and 24 meters wide – is a major engineering challenge and a significant milestone in the build, marking another milestone in the Cammell Laird construction program. The load-out operation is the outcome of a collaboration between Cammell Laird and A&P Group.

<https://www.marinelink.com/news/construction-attenborough428540>



Photo: Cammell Laird

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Marine Casualty Investigation

In the realm of marine casualty investigations the allocation of blame should be secondary to marine safety.

There are three important criteria for marine casualty investigations to be of value to the maritime industry. First, the report must be completed promptly. It does little good to see for the first time the report on a casualty that occurred three or more years ago. Second, the report must be publicly disseminated. The best report is of little value if it is available only to the principals. Third, the report must focus on the root cause of the casualty. The primary goal of the investigation process should be the prevention of future casualties. The allocation of blame should be secondary to marine safety.

this Act. Additionally, the Conferees direct the Coast Guard to begin publishing the remaining marine casualty reports by the end of fiscal year 2005.

The Conferees are concerned that marine casualty reports are currently not available in an electronic format that allows the general public easy access to information in the reports that could lead to improved boating safety. The Conferees acknowledge that one of the purposes of marine casualty reports was for enforcement and that the reports often contain personal information which cannot be released to the general public. The

records are made available in accordance with the Freedom of Information Act (FOIA). This requires a member of the public submitting a written request for a copy of a specific or reasonably identifiable marine casualty report. The record will not be released until it has received final approval from the Commandant, an action that can take years.

Policies

Marine casualty investigation policies are addressed primarily in the USCG Marine Safety Manual, Volume V – Investigations and Enforcement. Topics include, but are



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Security (DHS) Office of Inspector General (OIG) issued a report highly critical of the Coast Guard marine inspection process. The Inspector General found that there were significant deficiencies in the operations of the program. Specifically, the report stated that the program was hindered by unqualified personnel; by investigations conducted at inappropriate levels; and by ineffective management of a substantial backlog of investigations needing review and closure.

Later that month, the Subcommittee on Coast Guard and Maritime Transportation of the House Committee on Transportation and Infrastructure conducted a hearing on the Coast Guard casualty investigation program. In large part, it reiterated the OIG findings. The Summary of Subject Matter (SSM) accompanying the hearing report noted that the Coast Guard had yet to make its marine casualty reports available in electronic format. The SSM provided the example of the 14 July 2006 fatality on the sailing vessel Alabama, when a crew member fell from the rigging. The Incident Investigation Report (IIR) available electronically from the Coast Guard consisted of two pages of cursory information. A FOIA request for the same incident resulted in the full marine casualty report (privacy information redacted) identifying the probable cause and making two important safety recommendations, none of which was reflected in the IIR.

In May 2013, DHS/OIG published another report on marine accident reporting, investigations, and enforcement in the U.S. Coast Guard. Again, the report found that the Coast Guard did not have adequate processes to investigate, take corrective actions, and enforce federal regulations related to the reporting of marine accidents. The Coast Guard had not developed and retained sufficient personnel, established a complete process with dedicated resources to address corrective actions, and provided adequate training to personnel

Regulations define what marine casualties must be investigated, but there have been continuing complaints about how the regulations should be interpreted. With respect to making reports of marine casualties available to the public, the regulation simply state that the records are made available in accordance with the Freedom of Information Act (FOIA).

Statutes

Federal law provides that the U.S. Coast Guard shall conduct an immediate investigation of marine casualties to decide, as closely as possible, the cause of the casualty; whether an act of misconduct or negligence contributed to the casualty; and whether there is a need for new laws or regulations to prevent recurrence of the casualty. Reports of these investigations must be made available to the public. All marine casualty reports completed after 25 November 2002 must be published in an electronic form. The Conference Report accompanying the 2002 amendment to the marine casualty reporting law includes (at pages 106-107) the following:

The Conference substitute requires the Coast Guard to begin publishing all major marine casualty reports upon enactment of

Conferees also understand the Coast Guard concerns that electronically publishing these reports will strain current resources and require changes to technical procedures and additional human review to ensure that no personal information is inadvertently released. This phase-in period for all marine casualty reports is provided to allow the Coast Guard time to implement the technical and policy procedures needed to electronically publish these reports without inadvertently releasing important personal information.

Regulations

Regulations define what marine casualties must be investigated, but there have been continuing complaints about how the regulations should be interpreted. With respect to making reports of marine casualties available to the public, the regulation simply state that

not limited to: training and certification of investigators; levels of effort; fact finding and evidence handling; marine casualty analysis; and safety recommendations. A very short section addresses public and media relations. That section largely concludes that availability of marine casualty reports is handled under FOIA. More recently, and following a series of complaints from the marine industry, the Coast Guard promulgated Navigation and Vessel Inspection Circular 01-15, Marine Casualty Reporting Procedures Guide with Associated Standard Interpretations. The goal of this document was to provide stakeholders a uniform standard of what marine casualties are to be reported to the Coast Guard, so as to minimize confusion on this important issue.

External Review

In May 2008, the Department of Homeland

on enforcement of marine accident reporting. As a result, the Coast Guard has been delayed in identifying the causes of accidents, initiating corrective actions, and providing the findings and lessons learned to mariners, the public, and other government entities. At the time of the report, there were more than 6,000 open marine casualty investigations in the Coast Guard system. A number of the deficiencies identified in the 2013 report had also been identified in the 2008 report.

Practice

The Coast Guard posted a document entitled “Marine Casualty Reports 1904 – 2012”. This 13-page document contains links to 333 marine casualty reports over the 65 year period. One casualty, that of the fatal fire on passenger vessel General Slocum, occurred in 1904. The next oldest report dates from 1947, evidencing a gap of 43 years. Of the remaining 332 reports, 156 occurred in the 1950s.

The document includes a link to the Coast Guard’s MISLE database. This database allows one to search for marine casualties in the IIR file. Such a search though yields cursory information. And it is incomplete.

The most recent of the 333 marine casualty reports linked is that concerning the 31 December 2012 grounding of the MODU Kulluk in Alaska. That 152-page report shows a MISLE activity number of 4509675. If one goes to the MISLE database search page and types in 4509675 in the appropriate spot, the computer states that there is no such activity report. If one types in Kulluk in the vessel name box, the search reveals eight MISLE reports. Unfortunately, none of these concern the 31 December 2012 grounding. Only one of the eight is for a report that directly relates to Kulluk and that is for the accidental discharge of five gallons of hydraulic fluid into Elliot Bay on 12 June 2012. The most recent of the eight MISLE reports is for the 8 November 2012 loss of primary steering by the offshore supply vessel Aiviq in the Arctic Ocean while working the Kulluk’s mooring system.

Each of these reports, like others in the MISLE system, consists of two pages with very limited factual information.

In 1995, an internal Quality Action Team (QAT) analyzed the Coast Guard marine casualty investigations and enforcement program. Changes recommended by the QAT and implemented by the Coast Guard included the hiring of civilian marine casualty investigators and establishment of National Centers of Expertise (NCOEs) for Suspension and Revocation (S&R NCOE) and Investigations (INV-NCOE). It is difficult to determine how much improvement there has been subsequently in the marine casualty investigation and reporting process since complete marine casualty reports seldom are publicly posted.

Recommendations

The Coast Guard should devote more effort toward completion of marine casualty investigations in a timely manner. Part of the problem is undoubtedly due to resource constraints, but a significant issue is the entire lack of any direction or guidance placing

an emphasis on timeliness. The Coast Guard should also get its reports of marine casualty investigations posted on the Internet immediately after final action has been taken by the Commandant. New reports should be written so that privacy information (such as names and addresses) is in a separate appendix. Old

reports should be redacted prior to posting, but the redaction should be accomplished in a timely manner. Quality control efforts should be continued so as to ensure that marine casualty investigations and the reports of same accomplish their principal purpose: enhancement of marine safety.



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Digital Transformation of Port Operations

Liberating ENC Data for Nearshore Risk Management

Electronic Navigational Chart (ENC) data, also known as S-57 data, provides a great beginning for a national marine spatial data infrastructure (MSDI). Unfortunately, in much of the world outside the United States, national hydrographic office licensing restrictions on ENC data—implemented to ensure quality of navigation information for safety of life at sea (SOLAS) compliance—limit the official use of S-57 data for non-navigational purposes. In an analogous limitation, many ports—where the economic levers of maritime advantage for a region or nation are fulfilled—do not perform the requisite data management that leads to the explicit assessment of risks to their underwater infrastructure. However, the National Oceanic and Atmospheric Administration (NOAA) has been exceptional in its open data policy for S-57, and this has led to broad innovation in the use of ENC data in both navigation applications and non-navigational engineering and biological analysis.

Every port has depth information. After all, that's what differentiates a port from the non-port land around it; personnel know how deep a ship's draft can be for cargo transfer. This information needs to get to the mariner

and be sent upstream, respectively, to the cargo shipper; to the cargo contract holder; to the insurance agency; and, finally, to the reinsurer. Currently, the primary mode of delivery of that information to all parties is the ENC for commercial shipping. National hydrographic offices, such as NOAA's Office of Coast Survey, compile these information products and disseminate them by a variety of means. This ensures that the information meets certain requirements and can be legally substantiated. A significant amount of expertise and manpower is required to conflate and compile the data into these cartographic products, and making them has traditionally been a multimonth or, sometimes, multiyear effort. This degrades the value, however, because by the time the end product ENC is in use by the supply chain, the actual depth along the transit can change from what was reported to the mariner, the shipper and the insurer.

NOAA has moved to a vector-first production cycle to improve the velocity of the information product supply chain, and feedback on the NOAA National Charting Plan raised eyebrows when the option of eliminating printed charts was brought up. There are now

weekly releases of ENC updates, and NOAA is investigating a user-driven area-of-interest printing system that uses the same information stream. Usability could be improved by increasing the velocity of data from the ports. But what if a port could provide responsible data that has reliable metadata for inclusion in NOAA's compilation system? Taking this a step further, what if there were a local copy of the compilation system that the port could maintain and periodically check in to the NOAA system? Extending this pattern to computing clouds, an authoritative and role-based access subscription in a Federal Risk and Authorization Management Program (FedRAMP)-certified system would allow ports to easily participate in a national system that provides the best access to the most recent navigation information.

These assessments should be made using maintenance procedures that include the following: surveys performed prior to and after dredging to determine payment and identification of dredging periodicity requirements, accurate surveys of berthing areas for loading at lower stages of tide and determination of the threshold clearance depth in a common area for access to a port from the main en-



About the Author

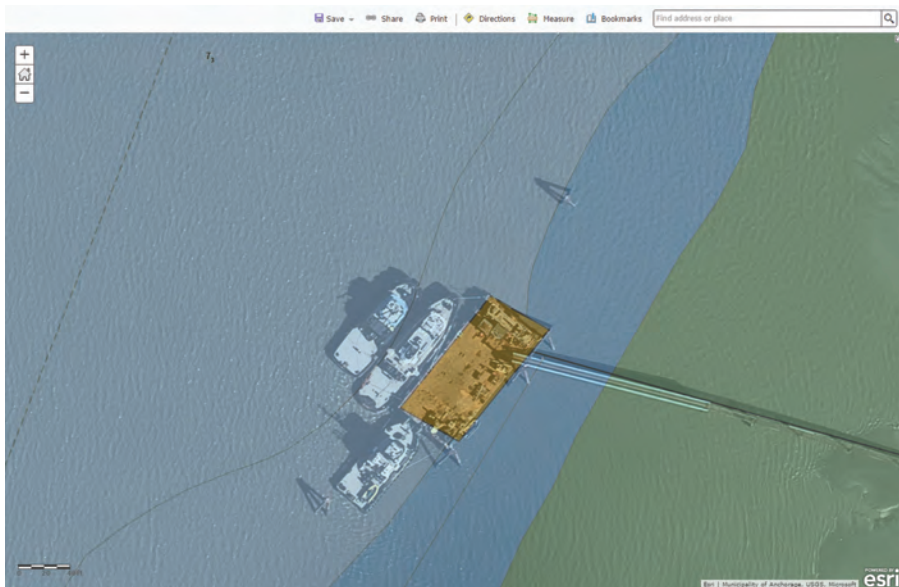
Guy T. Noll is Maritime Principal Consultant at Esri.

trance. If only performed as baselines or snapshots—and not surveyed with ample coverage or enough frequency to enable staff to understand change over time—port operations assume a time-varying risk relative to a variety of factors, including water levels, sedimentation rates, sea states and vessel draft.

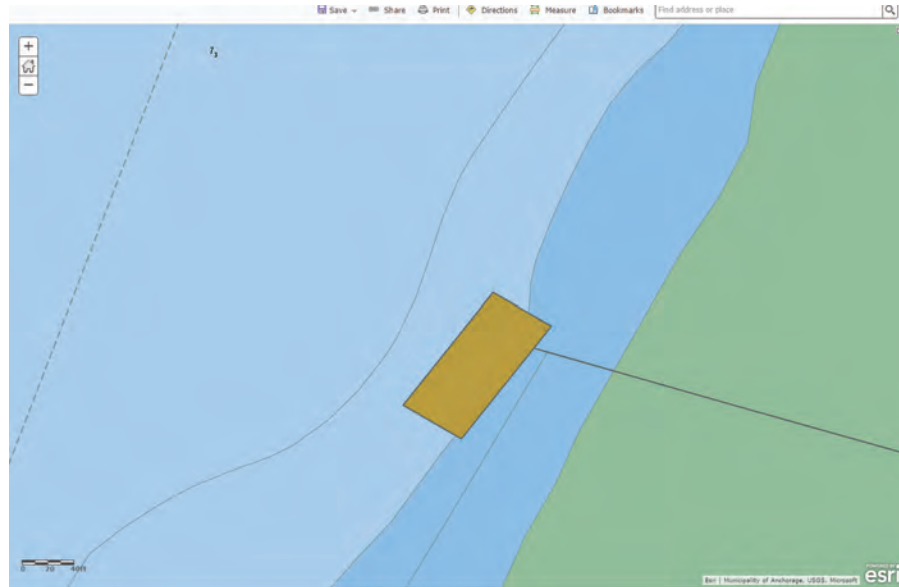
Reducing navigational risk by taking a more active role in underkeel clearance management is a goal of a prototype project undertaken by the Port of Los Angeles and NOAA's Office of Coast Survey. In this project, live measurements of the ocean swell at the port's entrance, combined with high-resolution bathymetric surveys, have helped define allowable ship drafts for the port and the pilots at sea and provided decision support guidance to reduce risk of grounding. Taking this prototype project to a national scale would require more instrumentation and a framework of activities that would overwhelm smaller ports' limited staff. However, there may be a way to leverage what has been learned in the Port of Los Angeles and apply that knowledge through a computing cloud-based data pattern, resulting in getting navigational information to the mariner in a

Bringing data 'up to speed'

A port may have a few surveys from past dredging projects—maybe from pier reconstructions—in formats such as comma-separated variable (CSV) text, spreadsheets, ASCII XYZ, AutoCAD or Terramodel format. As foundational datasets, these surveys need some descriptive text—such as the date of data acquisition, who did the surveying and what kinds of instrument and positioning were used—to become informative and retain value over time. Of course, vertical and horizontal reference points for the data are needed, too. If these points are all converted to a point cloud of XYZ and a grid is created from that cloud, when this data is combined with the attributed metadata, the result is a bathymetric surface that has attributes at each grid.



ENC data layered with imagery that illustrates actual structure and use.



ENC portrayal of dock without imagery—note the lack of mooring “dolphins.”

Images: ESRI

more timely manner. For many U.S. ports, this information could be added to the NOAA Physical Oceanographic Real-Time System (PORTS) observation network.

Such a system would give the port control over how often and to what extent the information reaching the supply chain would be updated. This then would afford a competitive advantage to the port’s operational infrastructure. Simultaneously, it would increase the value of the MSDI that NOAA contributes to the national Blue Economy along with the

river infrastructure maintained by the U.S. Army Corps of Engineers, the highway infrastructure maintained by state departments of transportation and the Aviation infrastructure maintained by the Federal Aviation Administration and airports.

A centralized geographic information system (GIS) can share compiled ENC information while maintaining the security of underlying data, thus ensuring that vector information can be used for nonnavigational purposes and not in chart compilation. GIS

allows the authoritative output of the hydrographic office to be shared with key stakeholders, whether those are national agencies responsible for safe navigation, regional authorities in charge of marine spatial planning or ports managing underkeel clearance risk.

The Information for Maritime Infrastructure (IMI) of ports, including the myriad silos of vessels’ real-time information, meteorological conditions, water levels and shoreside assets, should all be brought together into a unified common operating picture (COP) for

situational awareness. Also, this COP should be viewable by any authorized users—from anywhere, at any time, on any device—according to their role in the operational shipping activity. A flexible software platform with open data architecture and a holistic GIS can provide such a picture.



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B Rating – EM0780					C Rating – EM0779				
rpm	bhp	g/hr	bkW	g/bkW-hr	rpm	bhp	g/hr	bkW	g/bkW-hr
1800	375	19.3	280	219.1	2100	416	21.5	310	220.4
1600	371	18.3	277	209.4	1800	410	20.2	306	210.0
1400	319	15.7	238	209.2	1500	366	17.2	273	200.3
1200	225	11.3	168	213.3	1200	233	11.6	174	211.8
900	94	5.1	70	230.3	900	115	6.2	85	230.3
700	54	2.9	40	230.7	700	75	4.2	56	239.5

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C7.1



rpm	bhp	bkW	Rating
2700	425	317	D
2600	400	298	D
2500	350	261	C
2300	280	208	B

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The Art of Navigation

There are countless examples of how an over reliance of GPS navigation and the electronic charting systems, as well as the use of dead reckoning without a known fixed starting point - instead "eyeballing" the situation - are leading vessels in to danger.

August 21, 2017 was the Great American Eclipse, and the science fiction fantasy fan in me wondered if this is when I would get my superpowers back. The navigator in me pondered if I was in the zone of totality and took a sight of the sun and moon, at the moment of totality would it count as two lines of position on my chart. As I sat in the park and watched some clouds pass by, I was curious if I would see the eclipse at all. Luckily I did, but sadly no superpowers were awakened.

The event reminded me of recent conversations on how navigators and sailors of the past were better than modern mariners at reading the weather and computing navigation sights, a sentiment echoed by former instructors and contemporaries. Many owners, however, have proven reluctant to spend money on simple pieces of equipment required to get and keep these skills. Sextants, chronometers, magnetic compasses, nautical almanacs and sight tables all prove to be such a burden on owners that I realized the only way to convince them was to show the value of such purchases: "Prudent mariners will not rely solely on any single aid to navigation" is in almost every notice to mariners.

STCW Table II/1 specifies that a Navigation officer is to be able to determine their position and compass errors by use of celestial navigation. As any deck officer worth their salt knows, this is a skill that comes with practice and is maintained through even more practice. The problem is complacency. Although the general maritime public is aware of the problems caused by GPS spoofing, many refuse to acknowledge that celestial navigation is a suitable alternative means of navigation. SOLAS, Chapter V, Regulation 19 no longer requires the carriage of a sextant and a chronometer. These do however, fall in to the alterna-

tive means of navigation that every vessel is supposed to carry. In recent history that alternative meant Radio Direction Finders or LORAN. However with the discontinuation of LORAN in the U.S., and only a smattering of LORAN in Europe, the only truly alternative means of navigation are celestial and piloting, neither of which is dependent upon the GPS. Independence from the little magic box accomplishes two things: first, you have a secondary means of knowing your location should that box fail; second, officers are using their hard-learned skills and keeping sharp as navigators. My recent vacation on board a popular cruise ship here in NYC surprised me greatly. After speaking with the captain I learned that the Navigation Officers could not even use a sextant on the bridge, instead required to go one deck up since the bridge wing is completely enclosed. The often leaves gyro corrections to the occasional amplitude, verification by range, and comparison to the GPS.

One example of improper navigation is the case of the freighter Roger Blough on 27 May 2016 in Gros Cap Reefs, Sault Sainte Marie, Ontario, Canada. The final NTSB determination is that the officer of the watch did not use all available means to determine the position of the vessel, and Roger Blough ran aground while trying to overtake another vessel on the port side. Had they used alternate means of position finding, it may have been realized that the vessel was in actuality already outside of the channel, as the NTSB report stated that the marking buoys were off station at the time.

The watch officer failed to have another navigation officer on the bridge at the time, which was company policy. Although the ECDIS was on, it was not being monitored. Additionally the watch officer was "looking out the windows"

it is not evident that any bearings, running bearings, or range and bearings were done as a method of determining position.

Another example is the use of the depth finder for navigation. On May 4, 2013 the harbor tug Kaleen McAllister ran aground in NY during a simple undocking and getting underway procedure, a routine procedure done many times by the mate and the captain. The captain always proceeded along the most cautious route, while this mate did not, and this transit was in between a dolphin and collapsed pier.

There are countless examples of how an over reliance of GPS navigation and the electronic charting systems, as well as the use of dead reckoning without a known fixed starting point - instead "eyeballing" the situation - are leading vessels in to danger.

What can be done to remedy the situation?

Part of the problem is one of industry culture. As an industry we must remember to reinforce the use of skills and hone them over years of practice. Looking quickly at a screen to see where you will be in 30 seconds or 2 minutes does not take much effort. But it also allows the navigator and their watch team to become complacent. Master's should be monitoring how the vessels are being navigated and ensure that watch officers are doing their jobs properly.

Companies should institute policies to internally review navigation and vessel handling, and not simply to save time and money. Through review of voyage plans and their implementation, possible hazardous scenarios and trends can be caught early before a problem arises.

From Chapter 1 of Bowditch: "The science of Navigation can be taught, but the art of navigation must be developed from experience."



About the Author

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Nautical Risk Index Application



The Nautical Safety Profile

MARIN is working together with the industry to develop the Nautical Safety Profile for operations and risk management.

Liquefied Natural Gas (LNG) is increasingly being used as an alternative fuel, both at sea and on land, to reduce pollution from transportation.

In 2011 the first LNG carrier arrived at the Rotterdam Gate terminal, and last year the terminal was upgraded to facilitate the transfer of LNG to shuttle tankers. An extensive safety analysis was carried out prior to the development of the terminal and a dedicated harbour access policy has been defined.

But how should the access policy be defined when there isn't an LNG carrier in the harbor, but when there are multiple LNG bunker ships, or when numerous LNG-powered vessels are sailing through?

And how about international design criteria for LNG vessels that may operate in the harbor? In other words, how should a responsible balance between safety, environmental pollution and economic efficiency be continuously maintained?

In such a highly dynamic situation not every condition can be analyzed in advance. A practical solution would be if every LNG carrying ship was equipped with safety documentation describing the design and risks in different operating conditions.

The same can be done for terminals, river crossings, locks etc. This is the Nautical Safety Profile.

The Nautical Risk Index defines the risk of collisions between ships in the harbor. By combining the Nautical Safety Profile and the Nautical Risk Index, Vessel Traffic Centres are able to assess the risk of ongoing and planned operations.

Other ongoing operations and risk management options, such as emergency towing vessels, can be related to the Nautical Risk Index. While operators can use the Nautical Safety Profile to modify operations in real time to ensure the required safety level. Finally, the Profile can be used in the development of new infrastructure.

A collaboration between MARIN and industry partners has started to define the requirements for the Nautical Safety Profile. The applications of the Nautical Safety Profile are being defined and the integration with existing data sources such as AIS, is being examined.



Images: MARIN



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Ocean Guardian

A New Tool to Simplify Environmental Compliance

Environmental compliance challenges are nothing new to the cruise industry. Initiatives to enhance environmental compliance, from clean technologies to improved processes and procedures, have significantly reduced the impact cruise vessels have on the environment and improved the quality of discharge. These onboard initiatives address what is in the vessel's control, but cannot simplify the increasingly complex regulatory environment in which cruise lines operate.

Enforcement of environmental regulations is on the rise as international, national and regional regulatory bodies have taken a stronger line with compliance. Case in point: Last year, the U.S. Department of Justice Environment and Natural Resources Division continued its vigorous prosecution of shipping companies and crew for the intentional discharges of pollutants from ocean-going vessels in U.S. waters.

At the end of fiscal year 2016, criminal penalties imposed in these cases totaled more than \$363 million in fines and more than 32 years of confinement, according to the agency's 115-page report issued on Jan. 13, 2017.

Staying current with the wave of mari-

time environmental regulations has been challenging. Regulations vary dramatically between maritime borders and frequently are subject to change. Many ship operators rely on paper copies of regulations, e-mail communication, robust electronic workbooks and feedback from ship agents to stay current. These are viable solutions, but they have two distinct challenges: First, uniform updates are difficult to make. Second, fleet management and ship owners have no way to ensure an operator is using the most up-to-date manual.

With the ever-increasing vessel size and availability of amenities for passengers, the cruise industry is one of the most dynamic and innovative in the world. Always looking to improve efficiencies and innovate to improve workflow and reduce challenges, many felt that the industry needed a solution which not only would address today's complex regulatory environment, but also pave the way for a new era of industry collaboration.

Ocean Guardian is that solution. Created by Total Marine Solutions, a Fort Lauderdale-based environmental solutions and services company, Ocean Guardian is a simple and easy to use pro-

gram that is helping to shape the future of environmental operations and compliance.

To address today's complex regulatory environment, Ocean Guardian provides shipboard operators with the latest regulatory information in a digital format, making compliance significantly easier. The electronic application shows operators precisely what they must do to remain compliant, based not only on where they are, but also on where they are going. For fleet operations staff on shore, Ocean Guardian removes the risk of an operator missing an update or not having the latest policy directive.

Integrated with a ship's Global Positioning System (GPS), Ocean Guardian is location specific up to .25nm, removing the need to review numerous manuals, guides and environmental matrices to determine which regulations apply.

Ocean Guardian is an application that can be installed anywhere on a vessel to provide real-time environmental regulatory information for locations around the world. The straightforward user interface takes the guesswork out of compliance by making environmental regulations and related documentation instantly accessible. This significantly reduces the



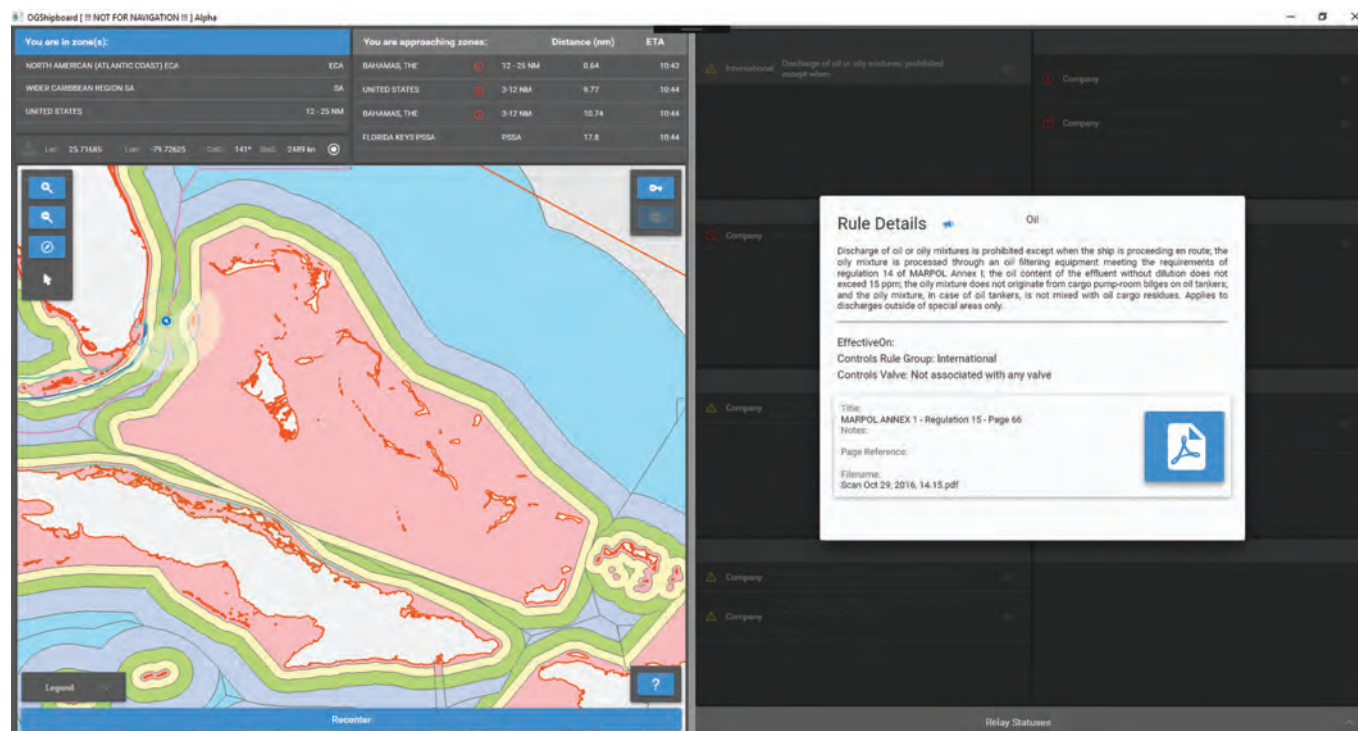
Alexandra Anagnostis-Irons is founder and president of Total Marine Solutions, an environmental products and services company. She started her shipping career in the cruise sector and spent 16 years in various executive roles.

time it takes for operators to understand the regulatory environment for their current location and increases the efficiency of workflow. If installed onboard and shore side, authorized personnel across the fleet can see exactly what is permissible at a vessel's location, enhancing communication, accountability and increasing the visibility of compliance-related actions.

To address the complexities of the regulatory environment, Ocean Guardian's developers created a comprehensive database that includes international, national, regional and client specific policies and regulations. Future versions will include port limitations and reception facilities. Updates can be downloaded immediately for vessels with internet connectivity or via a portable device sent to ships without internet access.

Understanding that the compliance environment at sea is ever-changing and that accuracy is critical when it comes to compliance, Ocean Guardian's global regulatory database provides clients with unparalleled assurance regarding regulatory data. The database not only is updated by experienced marine compliance professionals, but also verified and vetted by a third-party, independent maritime law firm.

In addition to its flexibility and ease of use, Ocean Guardian can assist owners and operators with preventing non-compliant discharge and improve efficiency of environment operations. The system does this in two ways. First, it can be programmed to manage the start and stop function of various equipment on board. Second, immediate access to regulatory data can simplify voyage planning, especially in cases of unplanned stops due to weather or medical emergencies on board.



Overlapping geographic claims and/or regulations are a particularly challenging aspect of environmental compliance at sea, especially for the cruise industry whose vessels often traverse multiple political and geographic area boundaries in one voyage. To address this challenge of compliance, Ocean Guardian displays regulations from areas relevant to the vessel's position. For example, if a vessel is in a wastewater control zone and it overlaps with a special area (e.g., National Marine Sanctuary), a user will be guided accordingly. The same is true for overlapping territory claims made by more than one country. Dedicated geographical experts have created the geodatabase for the application, with updates distributed at least annually.

Ocean Guardian was developed with Brenock, a leader in cutting-edge software solutions in the maritime industry and a long-time business partner of Total Marine Solutions. The complexity and breadth of the Ocean Guardian platform made it one of the most challenging projects Brenock has undertaken in the last 20 years and is being viewed by many as a game changer.

Having the opportunity to beta test it on five cruise ships, since its launch in March 2017, Ocean Guardian's developers further enhanced the platform to satisfy the feedback received. As a result, Ocean Guardian now offers a more simplified view and audible alerts, making it invaluable for onboard operators.

The Total Marine Solutions Ocean Guardian web portal offers further functionality and flexibility for a fast-paced maritime environment. This portal provides clients with administrative access to the detailed rules database for review, along with access to supporting documentation. The portal also is used to prepare regulatory updates for Ocean Guardian based on approved regulations. Logins are required to access the portal allowing specific users to be assigned responsibilities within their company's respective rules database for managing their workflow and controlling rules that appear on the application. To enhance the industry's dedication to having a culture of compliance, updates within the portal are electronically recorded, creating a full account of what a company, user and vessel have done to meet and exceed regulatory requirements.

Because flexibility is important for any maritime tool, Ocean Guardian can be set up on either hardware provided by Total Marine Solutions, or on hardware provided by the vessel's operator. It also can be used in fleet operations command

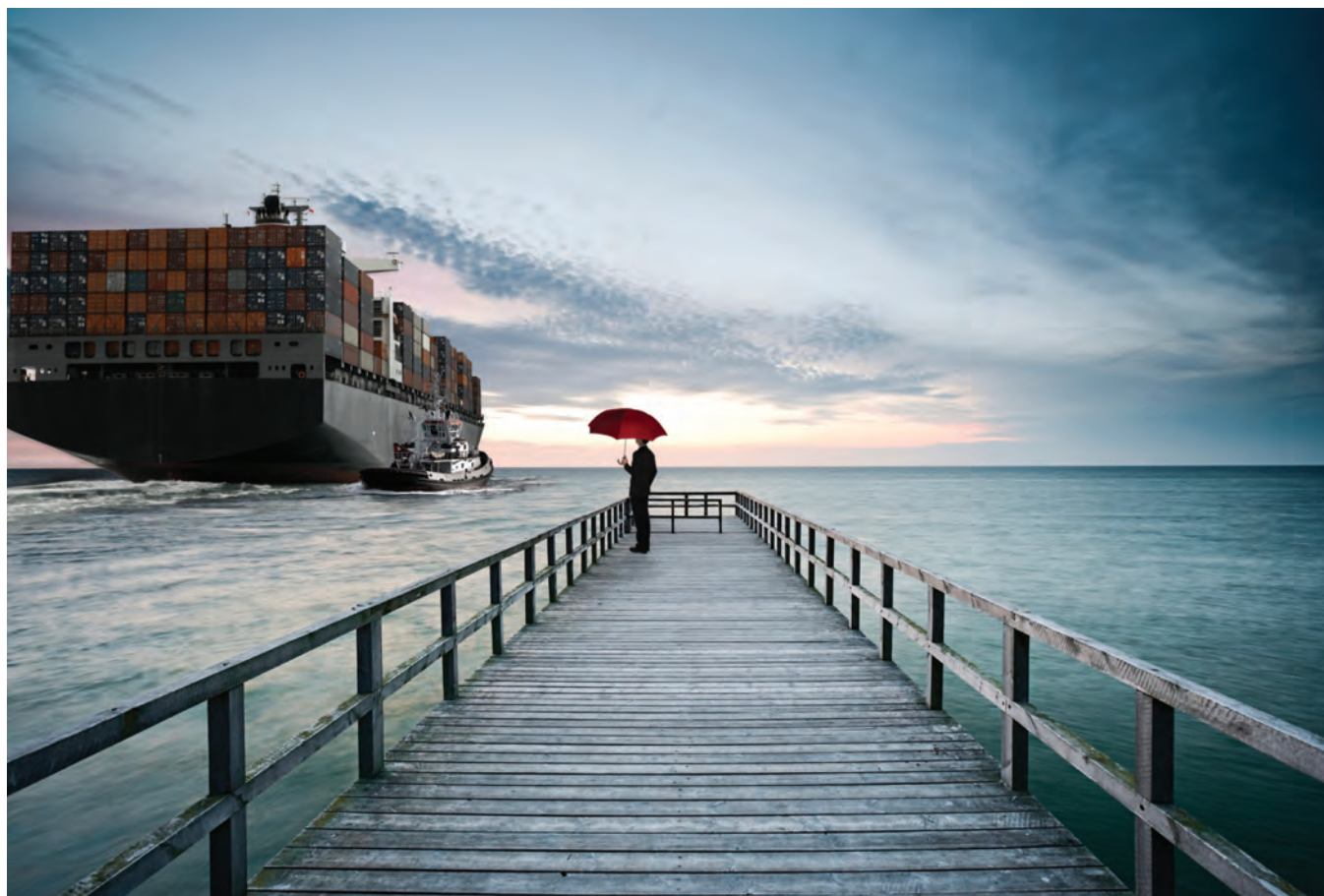
centers to enhance management and oversight of environmental operations and planning.

An effective, consistent, and transparent approach to pollution prevention not only will reduce the risk of non-compliance discharge, fines and possible prose-

cutions, but it also confirms the industry as a leader in environmental stewardship around the world.

Cruise industry leaders – arguably the most highly visible ownership group in the maritime sector – are keenly aware of their responsibility to comply with,

and in many cases exceed, existing environmental regulations. Although there are many challenges in environmental compliance, Ocean Guardian is helping to chart a new course by providing a proactive and forward-thinking platform that simplifies compliance.



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The Regulatory Hammer Pounds the Waterfront



About the Author

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You may have missed the memorandum, but it turns out that the maritime industry – you know, the one which moves 95% of what you use on a daily basis? – is bad for the environment. Very bad. I didn't actually know this until I read a recent article that asked, "Can one of Southern California's biggest sources of pollution turn itself into a model of green energy?" Not to worry: the ports of Los Angeles and Long Beach (prodded by the regulatory and political machines), above and beyond the remarkable progress they have already made to date, now seek to achieve, and where possible, accelerate to 100% zero-emissions cargo handling equipment by 2030.

Separately, a recent industry study, commissioned by the Pacific Merchant Shipping Association (PMSA), puts the cost of achieving this lofty goal at about \$16 billion locally, not including infrastructure costs outside the marine terminal gates. Like safety, you can't put a price on saving the environment. At least, that's what the environmental lobby will tell you. What they don't say is far more important. That's because unfairly painting the waterfront as 'a biggest source of pollution' is one thing; putting the supply chain at risk is quite another.

I suppose that one lesson or 'take-away' is that environmental efforts are hard. Sometimes they are expensive and sometimes, people don't look at the big picture as they push an agenda that a captive audience can scarcely afford, with long term benefits – and impacts – that are at best, uncertain. This was one of those times. I suspect that the ports of Los Angeles and Long Beach are experi-

encing a similar situation. In fact, I know it.

Predictable Decline: and Why?

On the U.S. West Coast – Los Angeles and Long Beach, to be sure, but there are other places facing similar challenges – local planners and statewide politicians would do well to look at what has happened to one of their more familiar trading partners – Hong Kong. Los Angeles recently boasted that it was the largest gateway in North America in terms of TEU throughput alone. Impressive stuff. Hong Kong, at one point enjoyed a similar regional perch. But, not anymore. And while the casual observer probably finds it difficult to feel sorry for a port that recently handled 20 million boxes in just one calendar year, that market share has declined and will continue to do so.

A local [Hong Kong] green initiative, looking to cut stack and industrial emissions in the port has 17 major freight liners signed up. The Fair Wind Charters (FWC), a voluntary commitment to switch from high-sulphur bunker oil to 0.5% sulphur diesel when berthing in Hong Kong, was the world's first shipping-industry led fuel switching initiative. That's nice, but it also costs money and gives an (unfair) advantage to other regional ports – Mainland China, for example, where the air quality is notoriously bad – and where they don't necessarily practice similar environmental stewardship.

If you followed the recent so-called 'Paris Accord' drama, you also know that China has promised to make sure its total emissions "peak" in the year 2030 –

ironically the same year that Los Angeles and Long Beach ports have been mandated to reduce theirs to "zero." Hong Kong, to its ultimate credit, is taking the bull by the horns well before that happens. Speaking of peaking, Hong Kong's TEU count peaked in 2008 (~24,500,000 TEU) and has declined ever since. In the meantime, and for shippers who care, at least one Hong Kong terminal operator has all ISO 14001 certified, environmentally friendly all-electric and/or LNG equipment. That's not happening in mainland China. Not even close.

Operators, ports and terminals everywhere all hope that 'green' produces another kind of 'green.' That doesn't always happen. What will be the impact of the West Coast Clean Air Action Plan (CAAP)? What if other regional ports don't follow suit? Food for thought.

Only in California

California leads the nation in many 'environmental' categories, well beyond their early adoption of cold ironing. Nominally, this is a good thing. On the other hand, the road to hell is almost always paved with good intentions. For example, and for more than eight years, the Golden State required ships to use distillate fuel within just 24 miles of the coastline. As with many statutes created to improve life at one end of the spectrum, the requirements also came with the usual unintended consequences. A well-documented increase in casualties involving Loss of Propulsion (LOP) dogged the policy. The myriad reasons for this trend, to one extent or another, center around the switching from heavy

fuel oil to distillates as the vessels enter the local 'ECA.'

California's Loss of Propulsion (LOP) incidents averaged 23 incidents per year on HFO prior to 2009. Following the enactment of regulations requiring distillate fuel use there, that number jumped almost 200 percent. Extrapolating this data to other places where similar regulations have taken effect provides some chilling conclusions. For example, the potential number of LOP incidents in the Gulf of Mexico could increase by 164 – or one every other day based on current traffic levels. All of this could occur within shouting distance of as many as 4,000 shallow water oil rigs, 800 manned oil rigs and 94 deepwater oil rigs in the Gulf of Mexico.

Switching from heavy fuel oil to distillates is, to be fair, a learning curve for many seagoing marine engineers. But, California gave that little thought when they implemented the program. And in that regard, they have been exceedingly fortunate that cleaner air hasn't (yet) translated into a preventable casualty that also meant dirtier water. Today, that fuel 'switch' occurs in most places some 200 miles offshore, when there is quite a bit more room for error should the loss of propulsion occur. Nevertheless, California's precise recordkeeping gives insight into quantifying the issues which arise when one regulation, intended to obviate one problem, inadvertently causes another.

The Golden State's progressive efforts don't end there. California's local effort to eradicate invasive species from local waters is certainly noteworthy, and ad-

mirable. But, when they called for and insisted upon equipment that could reduce invasive species to a level 1000X more stringent than the IMO's benchmark, it contributed in no small part to the gridlock that has delayed implementation of global regulations to get the job done. Indeed, California's Balkanized and radical approach was so severe that today, the equipment to verify that draconian (and, by most estimates, unnecessary) standard doesn't even exist. This was one of those times when folks said, "If we build it (the rule), then the technology to solve it, will come." Not so much, actually.

Arguably, and where this BWTS equipment should have already been installed on as many as 60,000 vessels worldwide, the task is only now gathering steam. It's why industry advocates and stakeholders – like AWO for example – are insisting on the so-called federal VIDA legislation aimed at unifying environmental regulatory regulations under one regulatory body so that this sort of nonsense can be avoided in the future. Which brings us right back to CAAP.

Can we hope that CAAP has been any better thought out than the examples laid out above?

What's the Real Story?

In just the past few years, it is a fact that tenants, customers, and vessel operators in the Port of Long Beach have reduced emissions faster than any other industrial sector. Without a doubt, this work needs to go on – and it will. But, calling the ports "one of the biggest sources of pollution" is beyond the pale. Cars are the largest source of pollution. That's got nothing to do with the port beyond the fact that most of those vehicles are on their way home from the electronics superstore with their flat screen TV which was delivered on a boxship just in time, the week before.

The port of Long Beach calls itself the 'Green Port.' And, the port's environmental efforts have been copied by seaports everywhere. Recognized internationally as one of the world's best and locally as a partner dedicated to helping the community thrive, community relations here are good. That sort of accolade is nice, but in January, we asked then interim Chief Executive, Duane L. Kenagy to put some data behind the green slogans. "Over the last ten years, we've cut diesel emissions by 84%, Sulfur Oxides by 97% and Nitrogen Oxides by almost 50%," says Kenagy, adding quickly, "We do get a lot of credit when you listen to the comments that come in. There is recognition of how far we have come, but

there's also recognition that this isn't the end of the road. We can do even better. The challenge is that the last bits are always the hardest and a lot of the low hanging fruit has already been taken. We believe that by working with industry, and as long as we don't specify the technologies or how to get there, we think industry will get closer to zero emissions."

That 'low hanging fruit' has produced a bountiful environmental harvest already. The attached chart – gleaned from South Coast Air Basin (SCAB) and Port of Los Angeles and Port of Long Beach 2015 Emissions Inventory Reports – is telling. In that chart, anything under the SCAB area includes everything except port emissions. SBPB – or San Pedro Bay Ports – data details emissions coming from the ports. The chart clearly shows just how much 'pollution' that can be attributed to the two ports that annually handle as much as 40 percent of the boxes that cross the collective wharf in the United States. It isn't anywhere near as much as the environmental lobby would like you to think.

Outside the port's gates – any port, for that matter – congestion is what is killing productivity. It is also creating its own considerable environmental footprint. With road and rail systems transporting volumes far beyond what they were designed for, gridlock and congestion are inevitable. For example, the American Transportation Research Institute has re-

Source	NOx	PM10	PM2.5	DPM	SOx	CO2e
SPBP						
Ocean Going Vessels	5.31%	0.310%	0.695%	4.71%	5.62%	0.374%
Harbor Craft	1.00%	0.106%	0.233%	2.06%	0.0200%	0.0736%
Cargo Equipment	0.716%	0.0333%	0.0736%	0.541%	0.0516%	0.192%
Locomotives	0.953%	0.100%	0.219%	1.95%	0.0216%	0.0816%
Trucks	2.05%	0.0254%	0.0582%	0.459%	0.114%	0.426%
SCAB						
Stationary Equipment	15.0%	78.2%	70.0%	2.28%	58.5%	41.1%
On road mobile (w/o SPBP)	51.3%	16.4%	18.9%	41.7%	10.6%	46.1%
Other Mobile (w/o SPBP)	23.6%	4.78%	9.78%	46.3%	25.1%	11.7%
TOTALS	100%	100%	100%	100%	100%	100%

ported that congested highways cost the trucking industry \$63 billion in 2015 and caused 996 million hours of lost productivity. That, they add, is equal to 362,000 trucks sitting idle for a year. Unknown is how many of those trucks are running their engines as they wait for the infrastructure to improve. I'd like to see that NOx, SOx and particulate matter output calculated. Spending that CAAP \$16 billion on the roads, rail and intermodal connections to save \$63 billion in lost productivity and increased pollution? Now, that's a CAAP plan that many could rally behind.

In their well-intentioned haste to clean up the environment, CAAP proponents

concentrate chiefly on the ports when far greater gains can be had – there's that low hanging fruit analogy again – by improving highways, rail intermodal connections, inland locks and dams. There is clearly work still to be done on the nation's collective waterfront, and if the progress achieved so far is any indication, that's not going to stop any time soon.

But laying the lion's share of cost on the maritime sector – ports and vessels alike – to clean up something that has already been improved by leaps and bounds is not only unfair; it's also foolish. And someday, it might just take down the supply chain along the way.

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Timo Koponen

As the maritime world increasingly mulls alternative fuel and propulsion solutions, *Maritime Reporter & Engineering News* discusses the path ahead for LNG with Timo Koponen, VP, Flow & Gas Solutions, Gas and LNG, Wärtsilä Wärtsilä.

BY GREG TRAUTHWEIN

The road toward acceptance of LNG as marine fuel has neither been short nor straight, but anyone who knows this market could not reasonably expect anything different. “Even though it (LNG) is very well proven both from the technology side and its benefit to the environment, nevertheless there are too many people who still doubt,” said Koponen. “If you look at it on an ‘S curve’ we are still on the first plateau. The steep hill is still to come.” There are compelling arguments on both sides of the LNG fence, as traditional ship owners are comfortable with diesel, the prohibitive favorite fuel of choice for generations, while a depressed energy market and the sub-\$50 per barrel for oil has muted one of the biggest drivers of LNG from the outset: tremendous fuel savings to offset higher capital expenditure for the LNG set-up. Nevertheless, the looming sulfur reduction regulations set to enter force in 2020, and the inevitable tightening environmental regulations to follow, has Koponen and his colleagues bullish on the future of LNG in the maritime sector.

“I believe that LNG is still the fuel of the future,” said Koponen, saying that environmental regulation will help drive the change to LNG and other alternative systems further faster.

Ever since the new sulfur reduction regulation was announced, “The number of inquiries we get has doubled,” said Koponen. “There is definitely interest, with new segments coming in, including product tankers showing interest in using LNG as fuel. It is gaining ground. It is clear that offshore is already convinced, and ferries are increasingly coming around, led by pioneers like Viking Line. You are starting to see movement in cruise shipping – for example Carnival has ticked the box.”

In the Name of Research

Most recently Wärtsilä announced the deal to supply the engines for a new LNG-fuelled research vessel being built for the German government. Wärtsilä will also supply exhaust cleaning systems based on selective catalytic reduction (SCR) technology and the LNGPac



A typical system arrangement with the Wärtsilä HY for a tugboat application, in diesel-mechanical configuration with shaft motor/generator.

system for complete fuel gas handling. The SCR technology will be needed when the engines are running on conventional marine diesel fuel if the vessel exhausts its supply of LNG on long voyages. The 75m Atair is under construction at the Fassmer shipyard in Germany and will be owned by Bundesamt für Seeschifffahrt und Hydrographie (BSH), the Federal Maritime and Hydrographic Agency. The contract was signed with Wärtsilä in June 2017.

In all Wärtsilä's will supply two 6-cylinder Wärtsilä 20DF dual-fuel engines capable of running on either LNG or conventional liquid fuels, one 6-cylinder Wärtsilä 20 engine, two exhaust cleaning systems, and a Wärtsilä LNGPac fuel storage, supply and control system.

The engines will have Tier III classification since the dual-fuel engines comply with this classification when running in gas mode, and all the engines will be compliant when operating on diesel because of the Wärtsilä SCR systems. In addition, as it is a research vessel and the reduction of noise is paramount to successful onboard operations, the engines will be double elastically mounted, a special Wärtsilä technique to enable the ship to fulfill the DNVGL classification society's 'Silent R' rating..

The Hybrid Solution

While Koponen is a champion of Wärtsilä's LNG and Gas efforts, he is adamant to say that there is no 'one-size-fits-all' solution, and there are a plethora of alternative fuels and hybrid solutions coming on the market. In Oslo earlier this year at Norshipping Wärtsilä debuted its HY Hybrid Power Module, a fully integrated hybrid power module combining engines, energy storage system and power electronics optimized to work together through a newly developed energy management system (EMS). While the company debuted the system in Norway, it also announced its inaugural order for installation on Rimorchiatori Riuniti's new tug boat. The system is designed to provide a range of benefits through increased operational efficiency and flexibility, resulting in lower fuel consumption, reduced emissions and improved vessel performance. When operating in 'Green Mode' zero emissions can be achieved. Smokeless operation is also achievable at all load points and in all operating modes, thanks to a new patent pending automation procedure. In addition, the reduction in engine operating hours lowers maintenance requirements and extends the intervals between over-

hauls. Lloyds Register (LR) has issued an Approval in Principle (AIP) certificate for the Wärtsilä HY, and the Wärtsilä HY will have dedicated versions for each category of vessels. While the first versions being made available will be

designed for tugs and medium sized ferries, the company also sees big potential in other types of vessels as well.

The first order for the new Wärtsilä HY has been placed by Italy based Rimorchiatori Riuniti, the biggest owner and

operator of tugs in the Mediterranean Sea region with a fleet of approximately 100 vessels.

The Wärtsilä HY will be dedicated to a project for a new 80 TBP (tons bollard pull) harbor tug.



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We invest a lot of money in becoming a learning organization. We have an impressive R&D department, and impressive sales organization which actually acts more as advisors, staying close to our customers.

Daniel Grunditz

Chief Technology Officer, Chris-Marine

Chris Marine is an innovative engineered solutions company, a company which works closely with its customers to identify problems and craft new solutions. Best known for its core business of cylinder honing, Chris Marine has expanded its product and service offering rapidly in recent years, but all roads lead still to its core tenet of providing reliable engine care. We met with Daniel Grunditz, Chief Technology Officer, in his Malmö, Sweden office to discuss the path ahead.

BY GREG TRAUTHWEIN

When you decided to join Chris Marine nearly six years ago, what was the attraction to the company, the position of CTO?

I knew Chris Marine from my former job working in the piston ring business, and Chris Marine was well known for cylinder liner maintenance. Chris Marine informed me of its plans to extend its business into new areas and product segments, and also into the power plant segment. This was interesting to me.

When you look back at the Chris Marine you joined compared to the Chris Marine today how is it most different?

We have two new products segments that have grown strong since then: the condition and performance monitoring segment, especially now with the Lemag acquisition in October of last year, and the cleaning segment with the ultrasonic

washing machines intended for workshop. Overall our offering to workshops and power plants has developed quite rapidly. Traditionally we were supplying onboard equipment to ships, and that was it. We moved to serving workshops and power plants too.

When you look at the company, what is the core competency and the breadth that you offer?

We supply equipment for engine care in an efficient, economical way. That means being able to detect when you have to do maintenance, and doing the maintenance with consistent quality and as quickly as possible. That is our offering, that is our core know-how. We are mainly directed toward the engines, and especially the fuel injection system, the fuel pumps and all of the hot parts in the engine: cylinder covers, cylinder heads and cylinder liners.





The mobile container workshop.

When you look at the marine market today, where do you see opportunities?

For newbuildings, especially the big ships, we have been facing local competition in Asia. One response has been to set up a local shop in South Korea, for example, where we are able to manufacture equipment at a slightly lower cost (compared to Europe), selling the equipment under a different brand. The main (driver for opportunity) is we moved to a different part of the business chain, specifically approaching all of the world's marine workshops. I think if you talk to marine workshops today they see a lot of opportunities, especially the big ones. So here we are seeing an increase in demand for maintenance equipment as well as condition monitoring equipment.

As much of your product development depends on input from your clients, helping them to solve their problems, put in perspective the importance of maintaining close customer contact.

I think it is the key to everything. We learn from our customers; we develop new products together with our customers. When I joined the company, we didn't see ourselves as advisors on the same level as we do today. Today customers increasingly turn to us to ask how they can save time in their workshops and internal processes. IT's a combination of procedure and equipment. I think any company has to stay close to its customers, otherwise it is the beginning of the end.

Can you discuss a product that Chris Marine has developed to help your customers save time and money?

We have a new Cylinder Honing Machine called Hone A, the A stands for automatic. We have been supplying a similar

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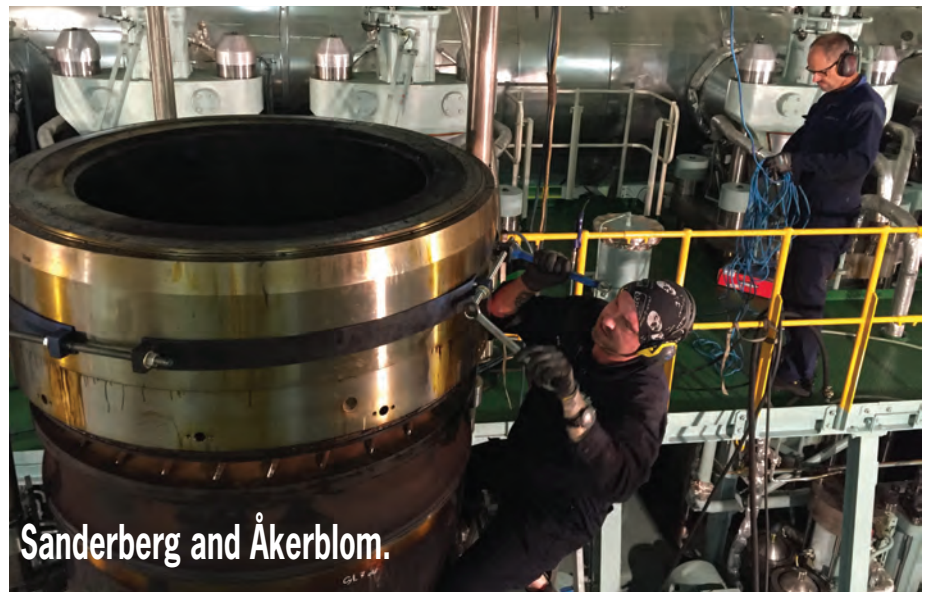
Image: Chris Marine

Hone A

Elite engine care is central to the Chris-Marine value proposition, and to that end it continually develops the tools and techniques in cooperation with its customers needs. Images (starting left and proceeding clockwise: The new Cylinder Honing Machine **Hone A** (the "A" stands for automatic); The Hone A in action; **LEMAG ECI** (electronic cylinder pressure indicator); Gustaf **Sanderberg** and Jörgen **Åkerblom** at work; and Klaes **Erixon** and Jesper **Ringby** are happy about the successful LDM release test onboard container vessel Mayview Maersk.



LEMAG ECI



Sanderberg and Åkerblom.



Erixon and Ringby

pneumatic machine for many years, but we realized that some customers have a problem with air supply, and some have found the pneumatic machine to be too noisy; a pneumatic machine is much noisier than an electric machine. We also saw the need to lower the barrier to learn how to do cylinder honing. So we decided to make it electric to make it silent. Then we needed to ensure uniform quality and we needed measuring equipment to verify that the surface is good, so we developed the equipment. Then we combined everything into an electronically controlled machine that guides you through the honing process, telling you which stones to use and how to use them. So it is a complete package that allows the customer to start the process easily, and complete the job with good quality.

You mentioned that on the four stroke engines that cylinder honing is a ‘bottleneck.’ What exactly did you mean?

For a 4 stroke engine, a 32/46 bore 4 stroke, the normal honing time was two hours for a skilled operators. We were able to bring that down to one hour, and I’m sure that the quality is improved, too, with the electronic control. This makes it attractive for our customers to continue honing their cylinder liners instead of simply replacing them.

There are many technical trends that drive your business. What do you see as the defining trends in this regard?

Basically all of our customers want to move from hourly based maintenance to condition based maintenance, so any type of equipment that supports condition based maintenance has a good future, and that’s why we will continue launching products into this segment.

The trend is you have to first have the monitoring mechanism in place before you do the maintenance. So any maintenance equipment supplier has to develop monitoring equipment as well, developing services around it.

Monitoring also raises a lot of questions that demand analysis. We increasingly see our customers asking us how to interpret the data.

That’s a good point. In reality, the digitization trend comes with promise and peril. When you look at the digitization trend, what do you see as the promise and peril?

Security is an issue. Privacy is an issue.

If you are a container operator, for example, you don’t necessarily want to share your data. We invite customers to keep their data, but we are happy to help them with it. For us, it (data management) is not yet a big thing but it is growing quickly. We’re focused now on collecting and understanding the data.

Looking at your suite of data collection products, what is leading the way at Chris Marine?

For performance monitoring we have the Lemag segment, including the electronic cylinder indicator, a portable device which measures the cylinder pressure. With this you can detect a problem in the cylinder, and it can be used to balance the cylinders. For vessel performance we have the Lemag Shaftpower and Lemag Speat systems. Shaftpower is measuring the torque and power of the propeller shaft, and a simple analysis can help determine if you have a propeller issue or a hull cleaning issue. When you combine it with vessel speed and fuel consumption, you can draw even more conclusions on a vessel, and throughout a fleet.

We also have a liner diameter measuring tool, making it possible to measure

a cylinder liner on a two-stroke engine in about one hour. This is a valuable tool to help minimize lube oil consumption while effectively managing corrosion and wear rate. It is a valuable tool also in preparing for dry docking the ship, as it can help you to determine if you need to replace or hone cylinder liners. On a two stroke engine, you’re talking about an eight ton cylinder liner, and just the cost of transporting them can be significant. This simple tool gives insight on the cylinder liner condition before you open the cylinder cover.

As we walked through the shop I see that you have a new cleaning segment of products to offer. Can you provide insight on this product line development and rationale?

Our cleaning segment started when we started selling equipment to workshops. We realized that there was a tremendous amount of time cleaning parts, so about five years ago we decided to offer cleaning solutions for them, our ultrasonic cleaning range. We also offer a spray washing range for really dirty parts that provide an initial wash before it goes into the ultrasonic machine. The big saving really is time, as you can save

up to 90% in cleaning time (depending on the part). We also offer our own range of cleaning chemicals, and together, really it comes back to what we know best: engine care.

Investment is obviously a point of strategy at Chris Marine: how would you describe the overall strategy?

We invest a lot of money in becoming a learning organization. We have an impressive R&D department, and impressive sales organization which actually acts more as advisors, staying close to our customers.

What one technology, in your mind, has been most transformational for the company?

The development of our liner diameter measuring tool was a big jump for us, our initiative to do something completely new and our move into the condition based monitoring area. We quickly learned that this would be an important part of our future, and it led to the Lemag acquisition. I’m sure you are going to see more products from the Chris Marine Group into this segment. If we hadn’t taken that one step, I don’t believe that we would be the company we are today.



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Cyber Threat

The maritime industry must redouble its efforts to secure IT systems and data.

BY WILLIAM P. DOYLE

In June, Maersk Line A/S's information systems were severely disrupted by the so-called Petya virus. FMC provided Maersk with relief to help them get through the difficult situation. In Mid-July, a researcher penetrated a ship's internet system through its very small aperture system (VSAT). The ship was operating in the South America trade.

VSAT Vulnerability

An internet security researcher identified as "x0rz" discovered that many ship-board VSAT systems can be penetrated through the public internet, making the findings live in real time on Twitter. Thus, ships can be tracked and identified through services like Shodan. Shodan is a search engine that allows users to find electronic devices and computer systems connected to the internet, i.e., power plants, traffic signals and even ships. x0rz found that some ships' systems are not securely configured thus allowing a remote attacker to gain access using default credentials.

According to TNW News, x0rz said "no ships were harmed during [his] experiments." The system x0rz obtained access to allow a review of the call history from the VSAT phone, ability to change the system settings, and even upload new firmware. The researcher logged the username "admin" then the password "1234" thereby gaining access to the ship's communication system.

I contacted x0rz through email connected to its Twitter account and asked for some tips and steps that shipping companies can take to make them more secure from cyberattacks. x0rz provided

the following suggestions, all of which involve simple common sense and are easy to implement:

- Do not use default password(s) (change them immediately after installation);
- Do not expose on the Internet the VSAT administration panel (keep it internal only);
- Keep software up to date;
- Have this tested by a cybersecurity firm (audit / penetration testing). Sometimes it is easy to think "it's now secure" when in fact there are ways to bypass security mechanisms.

Maersk Infected by the Petya Virus

FMC issued an order on July 19, 2017 granting Maersk Line's petition for a temporary exemption of service contract filings as a result of the so-called Petya virus. The cyber attack interrupted Maersk's ability to determine which shippers to contact in order to extend or renegotiate certain service contract rates. Further, even if Maersk were able to identify which contracts needed attention, the Petya virus prevented the company from electronically filing documents with the Commission.

By granting the petition, the FMC allowed Maersk some regulatory relief. For instance, Maersk would not require customers to pay the higher tariff rates to shipments tendered during the period of relief. Rather, FMC's order permitted Maersk to apply service contract rates to shipments that were agreed upon and filed after the date of cargo receipt with-

out violating the Shipping Act. More to the point, Maersk was able to provide service to its customers on the same commercial terms as it would have had it been able to conclude and file contacts and amendments.

These two cyber incidents can serve as teachable moments for the entire maritime and logistics transportation chain. We all need to redouble our efforts and secure the best available IT system protections and practices.

M&A Update

In July, China Ocean Shipping Company (COSCO) and Overseas Orient International Ltd. (OOIL) announced plans to merge. China-owned COSCO's move to absorb Hong Kong-based OOIL would create the world's third largest container carrier. OOIL is controlled by the Tung family, which founded Orient Overseas Container Line (OOCL) in 1969. The Tung family has a long history in the shipping industry predating modern day OOCL. In addition, the Tung family's Tung Chee-hwa was the first Chief Executive of Hong Kong. Tung Chee-hwa was elected in 1996 by the 400-member Selection Committee prior to the transfer of sovereignty over Hong Kong from the United Kingdom to China.

I had the opportunity to meet with the leadership of COSCO in Washington, D.C. in early August. According to COSCO executives, the parties have begun discussions with the U.S. Department of Justice on the potential merger. The price tag for the deal is valued at \$6.3 billion. COSCO intends to keep in place OOCL's listing on the Hong Kong

Exchange. The OOCL brand, headquarters and management structure is not expected to significantly change. Finally, all OOCL employees will be kept on board for at least two years.

FMC Updates its Controlled Carrier List

On July 19, 2017, the Commission updated its list of "Controlled Carriers," or, those ocean common carriers that are majority owned or controlled by foreign governments. The Commission is charged with monitoring foreign government control of ocean shipping lines. The FMC maintains a list of these companies which is periodically updated as circumstances warrant.

Over the past couple of years, the FMC has demonstrated regulatory flexibility in addressing the burdens for shippers who do business with controlled carriers. For instance, in 2015, United Arab Shipping Company (UASC) was granted the ability to lower tariff rates without waiting the requisite 30 days. However, if UASC wanted to raise rates then they would still be required to wait 30 days prior to implementation.

Recent consolidation in the container shipping industry has resulted in four notable changes among Controlled Carriers as listed below:

- China Shipping Container Line was integrated into COSCO Container Lines Company, Limited, which then changed its name to COSCO SHIPPING Lines Co, Ltd.
- Singapore's American President Lines, Ltd. and APL Co., Pte. is be-



Credit: William Doyle



“FMC issued an order on July 19, 2017 granting Maersk Line’s petition for a temporary exemption of service contract filings as a result of the so-called Petya virus. The cyber attack interrupted Maersk’s ability to determine which shippers to contact in order to extend or renegotiate certain service contract rates.”

ing removed from this list because it is now wholly owned by CMA CGM S.A. and no state entity is a majority owner

- United Arab Shipping Company Ltd. (formerly United Arab Shipping Company (S.A.G.) is being removed from this list because it is now wholly owned by Hapag-Lloyd and no state entity is a majority owner
- China’s Hainan P O Shipping Co., Ltd. is being removed from the list because it no longer operates in the U.S.-foreign trades

China’s COSCO SHIPPING Lines Co., Ltd. and Algeria’s CNAN Nord SPA remain on the Controlled Carrier list.

Natural Gas as a Marine Fuel: IMO Holds Fast

The International Maritime Organization (IMO) met in London July 3-7. A couple of countries moved to delay or alternatively utilize a “transitional period” for the enforcement of the January 1, 2020 date for the global 0.5% sulfur content cap. The proposal was rejected by the IMO/ Marine Environmental Protection Committee (MEPC). Thus, any suggestion that there may be any delay to the January 1, 2020 implementation of the 0.5% sulfur limit was ruled out.

To summarize, in 2008, IMO MARPOL Annex VI regulations were accepted lowering the global sulfur cap from 4.5% to 3.5% by 2012 and then again to 0.5% on January 1, 2020. The 2020 date was conditionally approved

with the inclusion of a look-back provision that would allow the IMO to delay implementation of the 0.5% cap from 2020 to 2025 pending a review on the availability of low sulfur fuel. A major step was taken in October of 2016 with the review finding no need to push back the original 2020 implementation date.

Shipowners and operators worldwide are making decisions based on IMO MARPOL’s sulfur cap regulations. There are a limited number of options

including LNG as a fuel, scrubbers or low sulfur fuels. Natural gas as a marine fuel substantially exceeds the other options with respect to air quality measures.

Liquefied natural gas (LNG) emits zero sulfur oxides (SOx). Moreover, using LNG as a fuel emits near-zero particulate matter into the atmosphere. When compared to heavy marine fuel oil, LNG emits 90% less nitrogen oxides (NOx).

Commissioner **Doyle** and Captain **John Murray**, CEO of Port Canaveral, tour the port and discuss, among other things, the advent of LNG as a fuel.

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USCG Releases Draft Cyber Guide for Maritime Facilities

Cyber risk has hit a critical peak within the maritime industry, and the significant impact of the Petya ransomware attack on scores of maritime entities only amplifies it. The attack effectively shut down major ocean carriers, including shipping conglomerate Maersk, and impacted marine terminal operations across the globe. Every maritime company, no matter the size or business function, is a potential target.

The industry has seen a recent wave of guidelines and resolutions from maritime regulatory bodies related to maritime security and cyber risk mitigation. The International Maritime Organization (IMO)'s Maritime Safety Committee approved a resolution in June that would require ship owners and managers to incorporate cyber risk management into their safety management systems by 2021. BIMCO released the second edition of "The Guidelines on Cyber Security Onboard Ships" the following month. In proper suit, the U.S. Coast Guard (USCG) announced a draft Navigation and Inspection Circular (NVIC) 05-17 entitled "Guidelines for Addressing Cyber Risks at Maritime Transportation Security Act (MTSA) Regulated Facilities" on July 12.

In accordance with existing MTSA requirements, regulated facilities, including port terminals and offshore oil platforms, must identify and assess security threats and develop a Facility Security Plan (FSP) that addresses and mitigates those threats. The USCG has interpreted these provisions to include cyber threats. The NVIC aims to provide guidance on incorporating cybersecurity risks into an effective Facility Security Assessment (FSA), in addition to recommendations for policies and procedures that may reduce cyber risk to operators of maritime facilities. It explains (I) the USCG's interpretation of the existing regulatory requirements under MTSA with respect to cybersecurity measures; and (II) the implementation of a "cyber risk management governance program." While not legally binding, facility operators can utilize this guidance until specific cyber

risk management regulations are put into place. Industry stakeholders have until September 11 to provide comments on the draft NVIC.

Enclosure I, "Cybersecurity and MTSA," states that the "existing MTSA requirements are applicable to cybersecurity related threats." The NVIC makes clear that cybersecurity is part of the vulnerabilities assessment and mitigation measures that must be part of existing Facility Security Assessments (FSAs) and Facility Security Plans (FSPs). As with existing MTSA requirements, regulated entities will need to demonstrate how they are addressing cyber risks. The guidance cites existing requirements for FSAs under MTSA to provide structure for the review of the NVIC. Enclosure II, "Cyber Governance and Cyber Risk Management Implementation Guidelines", describes best practices and expectations for all MTSA regulated entities. The guidelines cite the National Institute of Standards and Technology's Cybersecurity Framework (NIST CSF) to promote effective self-governance.

Cybersecurity challenges are a systemic risk to the maritime industry with the use of cyber technologies for communications, access control and other integrated control systems. Vulnerabilities within these technologies increase their risk for cyberattacks. Attacks targeting industrial control systems (ICS) increased more than 110% in 2016, per IBM. NVIC 05-17 is consistent with the U.S. government's effort to increase private sector preparedness for cyberattacks and reflects a trend towards using a risk management based approach to cybersecurity. It references existing MTSA implementation and its corresponding processes as well as using the NIST framework as guidance for the industry, which is consistent with recently published guidelines.

NVIC 05-17 should take the additional step of detailing specific aspects of an organization's technical implementation of cybersecurity safeguards. This belief is rooted in our company's cybersecurity philosophy consisting of the following

foundational pillars:

I. Cybersecurity is an organizational culture that allows technologies to succeed; not a technological solution that results in organizational success.

II. A holistic and risk management based systems solution is needed - no single application, tool, or methodology will adequately secure your system.

III. Implement state-of-the-market solutions, but remain current.

IV. A comprehensive maintenance and sustainment program is a critical component of keeping a high cybersecurity posture which minimizes cyber risk.

V. Automate as many processes as you can to minimize human error.

This philosophy is based on our 35 plus years of experience as a technology services provider for the defense industry, in particular improving the security posture of our Navy and Coast Guard customers.

NVIC 05-17 addresses Pillars I and II extensively since cybersecurity is as much cultural as it is technical.

For instance, the guidelines recommend the creation of a multi-discipline cyber risk management team.

Likewise, Pillar IV is somewhat addressed through the need to protect equipment and implement hardware and software updates and obsolescence management programs. However, not enough emphasis is placed on (III) implementing state-of-the-market cybersecurity solutions and (V) automated processes to protect maritime systems. With the understanding that this is a regulatory document versus a technical implementation guide, we believe that incorporating these two items within the regulation can be a catalyst toward reducing long-term cybersecurity costs while at the same time methodically increasing the maritime industry's security posture.

Requiring or recommending the need to implement state-of-the-market solutions to the maritime industry is a step towards eliminating obsolete software and equipment that have contributed to many cyberattacks in recent years. For example, Windows XP is still very prevalent



About the Author

James Espino is president of Gnostech Inc. A career Coast Guard Officer, he worked in maritime law enforcement, defense operations, and C4ISR development and procurement.

in many industries but particularly for the maritime industry. There are known exploitations within Windows XP and since Microsoft no longer supports this operating system, maritime industry companies still using this operating system are vulnerable to attack. Additionally, state-of-the-market solutions provide all facets of the industry a means to seamlessly and more easily implement NIST CSF into their FSP. Likewise, recommending the use of automated processes for cybersecurity related activities can contribute to reducing a company's long-term need to maintain a robust cybersecurity workforce; thereby, reducing labor costs. Including both state-of-the-market solutions and automated processes within NVIC 05-17 provide the maritime industry the needed guidance to build a robust cybersecurity program within their FSP. This also facilitates implementation of commercially available cybersecurity measures into day-to-day operations, determines a more accurate cyber risk posture, and ensures continuous monitoring of their cybersecurity program vice a periodic snapshot of their cyber risk posture at a given moment in time.

Regulatory bodies across the global maritime ecosystem are increasing their commitment to implement cybersecurity organizations, processes, and systems, and the trend will only continue. NVIC 05-17 is an excellent first step towards defining cybersecurity requirements similar to industries such as finance and healthcare. More precise technical cyber recommendations and requirements should be outlined in the same fashion as the organizational and physical security requirements are addressed in this and other regulations.

Data Analytics in the Maritime Space

BY WALTER MITCHELL, MARITIME DIRECTOR, SPARK COGNITION

Shipowners and operators, machinery OEMs, and regulatory entities are embracing much needed technological innovation as demand grows in protecting machinery and communications on maritime assets. Cognitive analytics is a game-changing technology that is now more widely available to the maritime sector. This is the latest evolution of data analytics: from the “days of yore” of logging data in a logbook, to sensing data and connecting to a central console, transmitting data ashore, and using artificial intelligence (AI)-enhanced tools to develop a deep understanding of how machines behave. These platforms have dramatically expanded the toolbox for fleet managers by creating the most in-depth analysis available in the marketplace.

It is estimated that 10-12% of maritime industry asset owners now use some form of predictive analytics, but only to a limited extent. While many executives understand the potential benefits—primarily as cost savings in maintenance and capital cost replacement—they often don’t know how to obtain this technology for themselves.

As data science continues its growth into more industrial applications, tech-savvy and forward-thinking operators are embracing the full reach and potential of AI-enhanced technologies.

The progression of analytics from the descriptive (what happened?) to diagnostic (why did it happen?) to predictive and prescriptive analytics (when is it likely to happen again—and what can I do to prevent it?) is changing the way industry addresses maintenance and operations. Predictive and prescriptive analytics are the logical next step in analytics, and an important new frontier for the maritime industry.

At SparkCognition, we are focused on the foresight presented by cognitive analytics, or analytics that use machine learning. Consider these “what ifs”:

- What if mechanical anomalies could be detected in real time?
- What if that detection was so granular that it could categorize those anomalies into minor, intermediate, or serious?
- What if those anomalies could be shown in 3D, displaying exactly which component of the machine was degrading?
- What if that detection could be built upon with automated model building so that it could predict when maintenance was actually needed, or when failure might occur?
- What if gigabytes of sensed data were streamlined from shipboard sensors, aggregated via IIoT functionality from all vessels in the relevant fleet, and transmitted to a central receiving point?

Cognitive analytic tools are capable of all of these applications. They detect anomalies in machine operations and predict failure with high degrees of confidence. Detection and forewarning greatly assist the operator by allowing for more precise planning of maintenance and capital replacement. The result is

that the life of the machine can be extended, yielding considerable cost savings.

Shipowners, operators, and others in the maritime space are increasingly interested in this new technology for the following reasons:

- Cognitive analytics can extend its understanding of the difference between traditional diagnostic maintenance and predictive and prescriptive maintenance.
- Shipowners and operators recognize that there exists the capability to ingest the (potentially) gigabytes of data that have already been generated and can use it to gain new insights into operations.
- Cognitive analytics allows shipowners and operators to intelligently plan major maintenance periods such as special surveys and drydockings, adjust spare parts and consumables inventories, and support seagoing staff in assessing in-voyage and longer-term maintenance needs.
- Shipowners and operators appreciate that there is a role in developing a deeper understanding of the machine and improving its overall health.

SparkCognition’s SparkPredict platform is an AI-based cognitive and prognostic system already in use in the aerospace, oil & gas, utility, and financial market sectors. It is physics and asset agnostic—it can use data regardless of the platform producing the data, or the format of the data. It ingests new and historical data (structured or unstructured), installs quickly and easily, and has a low learning curve for operators. Its automated model building feature allows for notification of suboptimal operating conditions before harm occurs to the machinery. Combined with natural language processing (NLP) technology, the platform ingests and presents free-form text from OEM manuals and service guides.

In one example, a ship operator had attempted to engage NLP across its 105-vessel fleet to digitize more than 35,000 technical manuals, but gave up as it was too large a task. The capacity needed to ingest that volume of information can overwhelm most platforms. This is not the case, however, with SparkPredict, which can easily handle datasets of that size and larger. Dependency on a new technology to inform machinery maintenance is a new way of thinking about overall machine health. Lloyd’s Register, in its “*Global Marine Technology Trends 2030*,” estimated a 4,300% increase in the annual data generated by ships by 2020, and says that “by 2030, that figure will have increased even further as this is an accelerating trend.”

The proper management and analysis of “smart data” will have a major impact on the maritime space. This trend is being driven by the demand for better use of information coming from the ship, and the need to provide the most cutting-edge tools to managers desiring to have stronger control over maintenance and capital equipment replacement budgets.

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USS General joins U.S. Fleet

BY EDWARD LUNDQUIST

An F/A-18F Super Hornet assigned to Air Test and Evaluation Squadron (VX) 23 flies over USS Gerald R. Ford (CVN 78). The aircraft carrier is underway conducting test and evaluation operations.

(U.S. Navy photo by Erik Hildebrandt/Released)

ld R. Ford



U.S. Navy photo by Mass Com



U.S. Navy photo by Mass Communication Specialist 3rd Class Mathew R. Fairchild/Released

President Donald Trump addressed the more than 10,000 people attending the ceremony where the Navy's newest aircraft carrier, USS Gerald R. Ford (CVN 78), was commissioned on Saturday, July 22 in Norfolk, Va.

"Wherever this vessel cuts through the horizon, our allies will rest easy and our enemies will shake with fear because everyone will know that America is coming and America is coming strong," said Trump. "American hands and American steel constructed a 100,000-ton message to the world."

Acting Secretary of the Navy Sean Stackley recalled President Theodore Roosevelt, who used to say, "Walk softly, and carry a big stick." Stackley then turned to Trump and said, "Mr. President, I present you with a big stick."

CVN-78 honors the 38th president of the United States and pays tribute to his lifetime of service in the Navy, in the U.S. government and to the nation. During World War II Ford attained the rank of lieutenant commander in the Navy, serving on the light carrier USS Monterey (CVL 26). Ford served in the U.S. House of Representatives and became vice president and then president in the aftermath of the Watergate scandal. He served as president from 1974-1977.

The ship's sponsor and President Ford's daughter Susan Ford Bales gave the traditional command to "Man our ship and bring her to life."

Many Technology Firsts

The Gerald R. Ford represents a leap in technology over the 10 Nimitz-class nuclear-powered aircraft carriers in operation. The first, USS Nimitz (CVN 68), was commissioned in 1975, but was designed using and with technology from the 1960s.

Fittingly, the President Gerald R. Ford presided over the commissioning of Nimitz in 1975.

Construction on Ford started in 2009. The ship cost about \$13 billion.

The Ford's hull is similar to the Nimitz-class predecessors, but what's inside, and on deck, is very different. In fact, Ford has many new critical systems not found on any ship.

"Gerald R. Ford has several technologies that are unique to the Ford-class, such as a redesigned reactor plant, dual band radar, electromagnetic launch system and advanced arresting gear," said Capt. Richard McCormack, the Ford's commanding officer. "The technologies were designed to ensure that our aircraft carrier is capable of meeting our nation's needs and project power for several decades to come."

According to Rear Adm. Brian Antonio, the program executive officer for carriers, CVN 78 has increased flexibility, with nearly three times the electric plant capacity; a bigger flight deck and hangar bay for flight deck operations and aircraft maintenance, and a 33 percent increase in sortie generation rate; and reduced manning and a 20 percent reduction in maintenance costs. And it requires a smaller crew.

Because of the way the ship was designed, it won't require the same periodicity for major maintenance. That means a longer time where the ship is operational before having to be brought into the shipyard for refit. The 43-month maintenance cycle and 12-year docking intervals means the ship will spend less time in the shipyard and more time deployed.

Navy officials say the total lifecycle operating cost is reduced by nearly \$4 billion per hull compared to the Nimitz-class, in large part due to a reduce crew size.

The Ford's integrated electric propulsion system includes a pair of A1B reactors that each generate 300 MW of power, three times what the Nimitz-class A4W reactors produced. That extra power also provides significant margin for future electrical loads. That's especially important when considering that the warships of tomorrow will have sensor and weapons power demands that rival the propulsion requirement. The CVN 78 electrical system operates at 13,800 volts of electrical power, compared to 4,160 volts found on Nimitz-class carriers, and features all-electric auxiliary services. This means steam heavy and maintenance-intensive hydraulic systems and pneumatic piping are eliminat-

ed. It has a zonal electrical distribution system and all-electric advanced weapons elevators. The steam catapult is replaced by an electro-magnetic aircraft launch system (EMALS), and aircraft will be recovered using an advanced arresting gear (AAG). The new dual-band radar (DBR) helps coordinate the ship's aircraft and defend itself and the strike group.

"Gerald R. Ford will leverage design changes from bow to stern and from keel to mast, enabling ships of the class to fly today's carrier aircraft with improved efficiency and ready to accommodate future manned aircraft and unmanned aerial systems," wrote Rear Adm. Bruce Lindsey, commander, Naval Air Force Atlantic. "With the Gerald R. Ford's island scaled down and set farther aft, the flight deck has more usable area than a Nimitz class aircraft carrier, with this improved flight deck geometry, she can more efficiently prepare, launch and recover aircraft of today and of the future."

"In all, 23 new or modified systems distinguish Gerald R. Ford from aircraft carriers of the Nimitz-class, bringing increased safety, effectiveness and efficiency to the ship's crew members, flight deck, propulsion system, electric plant, machinery control and integrated warfare systems," said Lindsey.

Some of the new technology has been controversial. Some has taken longer than anticipated to mature. Like all new technology, there are growing pains.

Following his visit to the carrier in March while in the Newport News Shipyard, Trump told *Time* magazine that he questioned the replacement of the traditional steam catapult systems with what he referred to as a "digital" system.

Trump said the system was too complicated. "You have to be Albert Einstein to figure it out."

He said that he told people on the ship that the Navy would have to return to the older technology for future ships. "You're going to goddamned steam. The digital costs hundreds of millions of dollars more money and it's no good," Trump said.

The "digital" system is actually the Electromagnetic Aircraft Launch Sys-

tem or EMALS, similar to a maglev system or railgun, which has fewer moving parts and avoids the troublesome pressure, leaks and corrosive nature of steam-driven piston systems and the associated hydraulic retrieval systems.

EMALS, made by General Atomics, uses linear induction motors and accelerates more smoothly, subjecting aircraft to less stress. The aircraft are connected to a carriage that runs between beams. Electro-magnets attracts and repels the carriage as it moves. It is purported to weigh less, cost less and require less maintenance than steam. Steam systems use a lot of fresh water, which is a valuable commodity on a warship at sea.

Within a week of her commissioning ceremony, Ford was underway and tested both the EMALS and AAG. As Ford marked a milestone by launching and recovering its first fighter jet, it also marked the first use of the Advanced Arresting Gear (AAG) and EMALS.

"AAG and EMALS have been successfully tested ashore at Lakehurst, N.J. but this is the first shipboard recovery and launch of a fleet fixed wing aircraft," said McCormack.

The AAG system will recover aircraft in a wider range of environmental and operational conditions than is currently possible," said Lindsey. "Using stored kinetic energy and solid-state electrical power conversion, EMALS provides greater control and precision when launching aircraft, expanding the ship's operational capability to launch more types of planes, from heavy strike fighter jets to light unmanned aircraft."

According to Lindsey, other design changes provide for the comfort and wellbeing of the Sailors in the crew, air wing and embarked staffs in Gerald R. Ford. "Crew members will find more privacy in redesigned sleeping areas with fewer racks per room and easier access to restroom and shower facilities. Separate spaces hold crew recreation and television viewing areas, providing consistent quiet for sleeping crew members. Wider passageways make travel through the ship more efficient in both peace and combat. Well-equipped gyms enable a variety of exercise routines. In-



U.S. Navy photo/Released

Far Left: Secretary of the Navy Richard V. Spencer speaks with Capt. Richard McCormack, commanding officer of the aircraft carrier USS Gerald R. Ford (CVN 78), during a tour of the ship.

Far Right: A crane moves the lower stern into place on the nuclear-powered aircraft carrier USS John F. Kennedy (CVN 79) at Huntington Ingalls Shipbuilding in Newport News, Va. John F. Kennedy is the second Gerald R. Ford-class aircraft carrier which is now 50 percent structurally complete.

creased air conditioning capacity adds to crew comfort and reduces maintenance caused by high heat and humidity. Even the lighting is better; 44,000 high-efficiency fluorescent T-8 light bulbs produces more light and last nearly twice as long as lighting on a Nimitz-class carrier.”

Digital Design

Traditionally ships have been designed with a series of blueprints. However, there’s a newer and better way to design and build ships today. The design process for CVN 78 has been different from other ships in general, and carriers in specific. Instead of physical paper drawings, the designs are digital. “CVN-78 was the first aircraft carrier to utilize a 3D product model as the design implementation tool for the entire ship. A 3D product model had been used for submarine design previously, and for discrete areas of carriers in the past, but never to the extent that it was used for CVN-78,” said Craig Byrum, Newport News Shipbuilding engineering director. “Also, CVN-78 started with a clean sheet space arrangement and was configured to optimize material movement, weapons handling, and allow for a reduced crew.”

The all-electric system eliminates steam lines and pumps, and reduces hydraulic systems, cutting down on weight and maintenance. CVN 78 has a third fewer valves than the Nimitz-class ships. Ship construction normally begins with a keel laying. When the keel — sort of the spine of the ship — is laid down, the frames can be built up, then the decks and the skin of the ship. When the ship can be floated, it’s launched into the water, where the rest of assembly and outfitting takes place.

In modern ship construction, instead of building the ship piece by piece from the ground up, sections are assembled into modules, which are completely outfitted with piping, wiring, lighting, ducting and furnishing. The modules are efficiently built on land, then assembled into larger units until it becomes a ship that can be taken into the water and floated, at a much higher degree of completion than before. Altogether, the ship has more

than 1,900 miles of electrical cable and more than 750 miles of fiber optic wire.

After completing builder’s sea trials in April, the Ford pulled into Naval Station Norfolk for the first time.

The second ship of the Gerald R. Ford-class, the future USS John F. Kennedy (CVN 79), is well along in construction, and the shipbuilder has begun work on the third ship, future USS Enterprise (CVN 80). These carriers will serve alongside and complement the Nimitz-class ships.

“The age of the Ford-class carrier has arrived, and I am confident that these ships will continue to push the envelope for technological advancements and enable the United States to not only maintain, but to increase our maritime superiority throughout the world for the next 50 years plus,” said Lindsey.

Lindsey said the commissioning of Gerald R. Ford was a “celebration of the contributions of tens of thousands of active duty Sailors, government civilians, and private sector patriots who envisioned, designed and built the lead ship of a new class of aircraft carriers, unmatched by anything else in the world.”

Huntington Ingalls Industries works with a network of shipbuilding suppliers that is 5,000 companies strong and spans all 50 states.

Integrity at the helm

“I could not be more proud of Ford Sailors and the effort and skill they have put into getting this warship ready for delivery to the fleet,” said McCormack. “The role of ‘plankowner’ is an important one. Getting a ship ready for service is a challenging business, and it is a challenge Ford Sailors have risen to meet head-on. No matter where they go in their career, they will always remember the experience and teamwork that goes into going from a ‘Pre-Commissioning Unit’ to a ‘United States Ship.’”

As a former test pilot, McCormack can attest to the challenges and growing pains that come with any first-in-class technology. “Many of the Sailors on board worked directly with the manufacturers and industry to establish processes for operating equipment that doesn’t ex-

ist anywhere else in the fleet. In doing so, they set the standard for the Ford-class carriers to follow. It’s a tremendous responsibility to get it right, and it’s a challenge Ford Sailors actively seek.”

And for the crew of Gerald R. Ford, they have higher purpose because of the constant inspiration provided by the ship’s namesake, the 38th president of the United States. The ship’s motto is

“Integrity at the Helm.”

“Integrity at the Helm means taking care of, and looking out for, our Shipmates. It is at the forefront of all that we do,” said Capt. McCormack. “It means that we operate – both in and out of uniform – with great character, that we do not take the easy way out, and that we make an ongoing commitment to give our best in all that we do.”

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Ports Ponder Public Private Partnerships



Port Everglades

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BY BARRY PARKER

Seaport and marine terminal finance draws from a wide range of funding sources, often combined to pay for a particular project. Ports are public goods, and as such, sometimes they also see varying contributions from Federal, state, regional and local entities. At its lowest common denominator, the port business is all about connectivity; hence port projects will frequently include an intermodal component, linking the actual dockside to the port's hinterlands – the typical origin of outbound cargo, or ultimate destination for inbound shipments.

Paying for all of that has evolved over time. In places like Long Beach, Calif., where a multi-billion dollar Alameda corridor project eventually provided ex-

cellent rail access into the port complex, the realization that much of port spending will actually be made outside the gates and away from the docks is the right thing to do. Earlier this year, interim Port of Long Beach Chief Executive Duane L. Kenagy said that, going forward, a great deal of the port's capital program – about \$1 billion – will be to invest in rail facilities. He added, "The first leg of that journey is on rail, and then a short drayage out into the inland empire." But, he cautioned, "That has to become commercially attractive in order for that to work." That kind of so-called P3 project also brings with a different risk model, for all stakeholders.

Infrastructure 101

U.S. infrastructure (which includes the waterfront and surface rail and road connections) is in desperate need of investment. In the American Society of Civil Engineers (ASCE) 2017 Infrastructure Report Card, ports earned the grade of C+, and the inland waterway system grade of D. About those grades, the ASCE report advised, "As ships get bigger, congestion at landside connections to other components of the freight network increasingly hinders ports' productivity. Similarly, on the water side, larger ships require deeper navigation channels ... to remain competitive globally and with one another, ports have been investing in expansion, modernization,

and repairs."

The ASCE estimates that ports plan to spend \$154.8 billion from 2016 to 2020 on expansion, but they point to a huge shortfall on the landside, which ASCE said is scheduled to receive only \$11 billion in new federal funding for freight improvements through 2020, in the face of projected needs totaling \$29 billion. Kurt Nagle, President and CEO of the American Association of Port Authorities (AAPA), said, "The port industry has identified a need of \$66 billion in federal investments to port-related infrastructure over the next decade."

Because of the sheer diversity of port ownership and organization, as well as geographic contours – there is no one



Public-private partnerships will not be the solution to all infrastructure needs, [but] they can help advance the nation's most important, regionally significant projects.

specific financing formula. Businesses (not governments) are responsible for movements of cargo. Quite often, port finance will include a private component alongside the government investment. Such deals are broadly referred to as Public Private Partnerships (P3), with each transaction having a unique structure. PPPs will only grow in importance under the Trump Administration. Lawyers Albert E Dotson, Jr. and Eric Singer from the Miami-based firm Bilzin Sumberg, wrote recently, “The new plan is anticipated to rely upon public-private partnerships (P3s) to bridge the gap between the cost of needed infrastructure and available government dollars.”

Government funding comes in a variety of flavors. An important initiative has been the Department of Transportation’s (DOT) Transportation Investment Generating Economic Recovery (TIGER) program, which has provided finance

for dozens of port projects since its inception in 2009. According to the DOT, the grants have provided \$5.1 billion of funding for projects since 2009. ASCE data says that port projects have comprised 11% of TIGER grants. However, the newly released Fiscal 2018 Budget does not provide any funding for TIGER.

Another set of DOT grants, dubbed FASTLANE, came out of the 2015 Fixing America’s Surface Transportation Act.

The ports, who are eligible to apply, have waxed enthusiastic because projects related to intermodal freight are eligible for the awards. Fiscal 2016 awards announced in July 2016 included the Port of Savannah (\$44 million for a multi-modal connector facilitating on-dock rail), Portland, Me (\$7.7 million for projects including upgraded rail and highway crossings), Boston (\$42 million for improvements at the Conley Con-

tainer Terminal) and New York (\$10.7 million for various rail connection enhancements). A Washington, D.C. group advocating infrastructure investment, the Coalition for America’s Gateways and Trade Corridors (CAGTC), applauded the 2018 budget, stressed that Federal grant programs attract private capital (at a ratio of 3.5x) and noted, “Public-private partnerships will not be the solution to all infrastructure needs, they can help advance the nation’s most important, regionally significant projects.”

P3 in Practice

The roster of projects in south Florida (a P3 friendly state), from the bigger access projects to the very specific business-related efforts, provides a good example of how varied funds sources – including those from the private sector – can be combined. In Miami, the new tunnel for trucks opened in mid-2014,

nearly four years after construction began. The tunnel, which links the interstate highway network directly with the containership berths on Dodge Island, enables trucks to circumvent the congested downtown streets. A ‘win-win’ for everyone.

Financing for the tunnel was done through a web of highly complicated deals. In classic PPP style (a structure known as “Design-Build-Finance-Operate-Maintain,” where construction risk stays with the private participants), an investor consortium, consisting of Meridian Infrastructure (a fund packager which raises money from institutional investors) and Bouygues (a construction behemoth worldwide, with headquarters in France) owner of the project’s equity, constructed the tunnel (and then got paid).

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“One of most successful public-partner partnerships has been with the Florida East Coast Railway and the State of Florida.”

Steven Cernak, President & CEO, Port Everglades

paid for 50% of design/construction (handled by the construction division of Bouygues), originally pegged at around \$670 million. The remaining 50% of the design/construction costs were divided up between Miami-Dade County (which oversees the port in its role as a “landlord”) and the City of Miami. The operations and maintenance are subcontracted to a private “concessionaire” until 2044, when ownership reverts back to FLDOT. According to the U.S. DOT, total capital cost of the project was \$1.1 billion, and total payments (including annual “Availability Payments” paid each year to the private concessionaire) are estimated to be \$2.65 billion – much of it coming from the state. The private investors – insurance companies and pension funds who have invested through the Meridiam Infrastructure North America Fund – see their return over decades.

Separately, and to accommodate the bigger post-Panamax vessels, a \$220 million dredging project for deepening the channel to 52 feet, was paid for by the state (\$112 million), with Miami-Dade County investing the \$108 million balance. The state also contributed \$20 million, approximately half the cost of four new cranes, with a reach of 22 containers, to serve the larger vessels. A related project – this one to improve intermodal freight connections – linking the port with the rail network, was paid for jointly by the state, the Florida Department of Transportation (FDOT), and the Port of Miami. TIGER grants played a role in funding this project, and privately owned Florida East Coast Railway also provided capital.

Further up the coast, at Port Everglades, which is operated by Broward County, expansion is in the works. Following a late 2016 authorization, the port has embarked on an expansion plan

(with completion in 2022) that includes dredging to deepen its entrance channel and turning basin from its present 42 feet depth to 50 feet. The estimated \$374 million cost is set to split mostly between the Federal government and the Port, with money generated solely from user fees. The state is contributing a small amount towards design. In late May, Port Everglades announced plans for a \$437.5 million expansion project where new berths for larger vessels would be added (alongside an expanded turning area), and crane rail infrastructure for new Super Post-Panamax cranes on order would be added.

Port Everglades has now received approvals from Broward County for its Port Everglades International Logistics Center, LLC (PE-ILC), a foreign trade zone (FTZ) that will be completed in 2019, replacing an obsolete facility. The port, which encompasses Hollywood, Dania and Fort Lauderdale, is no stranger to P3 arrangements. Steven Cernak, the port’s President and Chief Executive Officer, said, “One of most successful public-partner partnerships has been with the Florida East Coast Railway and the State of Florida.”

Mid-2014 saw the opening of an Intermodal Container Transfer Facility (near dock rail) that brings containers close to the berths via the FECR, instead of draying them through a congested part of Fort Lauderdale. In this deal, as described by the port, “Port Everglades contributed 42.5 acres of land ... valued at \$19 million. Construction costs are estimated to total \$53 million, which will be paid through \$18 million in grants through FDOT’s Strategic Intermodal System program, a \$30 million FDOT State Infrastructure Bank loan, and \$5 million from FECR’s capital plan. Cernak, who is also Chairman-elect of the

AAPA, noted, “Together, we were able to build a 43-acre Intermodal Container Transfer Facility that can handle both domestic and international freight.”

In the new PE-ILC transaction, a long time tenant at the existing FTZ, International Warehouse Services, Inc. (IWS) will be leasing a newly constructed facility which will offer a wide range of logistics services, including 3PL warehousing, government inspections and refrigerated storage. Eric Swanson, Florida-based Principal at Treadwell Franklin Infrastructure Capital, LLC (TFIC), described his firm’s role, saying, “TFIC is focused on the development of projects that are related to core infrastructure such as seaports, airports and other transit nodes. Our role is to structure, lead and manage the transaction, including attracting the appropriate financing.”

The deal’s structure sees a major private component, with Swanson saying “The local partnership that includes TFIC, IWS and ANF Group (a construction company) is doing the predevelopment work and will attract equity and debt financing to the project. The project is a 30-year lease with an option for another 20 years. IWS will be one of the anchor tenants of the project.” He added, “Port Everglades will be providing a milestone payment of \$3 million which is essentially to accommodate the site work required on the project as well as other needs. The port has been very cooperative in working with our group to allow private financing, but has not provided any other funding mechanism.”

The ABCs of PPPs

For all the publicity and attention given this unique type of financing today, Mr. Cernak stressed that port executives are still learning about the structuring of P3’s and that going forward, collabora-

tion would be the key to future successes. “Public-private partnerships are both a challenge and an opportunity,” he insists, adding, “We must come together to share experiences on benefits and risks that will help us progress in developing P3s and attract future investments.” Separately, TFIC’s Swanson offered that “P3 projects are essential to the growth and efficiency of port operations. Used properly by both private and public entities, P3s can be effective tools for the execution of port master plans and operations.” In a recently delivered AIG white paper entitled, “The United States: The World’s Largest Emerging P3 Market: Rebuilding America’s Infrastructure,” the future of P3 structured transportation and infrastructure projects is painted as the way forward for many reasons. But, if the U.S. Department of Transportation (USDOT) defines P3s as “contractual agreements formed between a public agency and a private sector entity that allow for greater private sector participation in the delivery and financing of transportation projects,” then the AIG advice that “All private sector participants will be challenged to accept risk beyond their comfort zone and what had traditionally been the regime in other project delivery methods; and a significant portion of that risk, will not be transferrable to conventional insurance coverage,” should be given equal attention. In the end, a lot of good is coming from new and innovative financing packages, especially where it involves ports and infrastructure. But, warns AIG in the same white paper, “P3s are never going to be enough to supplant government spending, but government expenditure is no longer enough if the breakdown of vital public facilities is to be reversed.” A cursory look at the state of the infrastructure on our inland waterways probably makes that clear enough.

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Flights of Fancy?

No longer a pipe dream, aerial drones find a home in maritime

Price Waterhouse Cooper estimates the global commercial drone market at \$127 billion. Shipyards, offshore wind-farm developers, cruise lines, blue water cargo agencies, maritime marketing departments, first responders, admiralty lawyers, shore-to-ship package couriers, insurers, classification societies, salvors, container ports and the military are all using or actively exploring drones to accomplish tasks heretofore impossible without greater risk or cost.

Whether used for noninvasive whale blow-hole mucous gathering or dangerous on-board fire investigations drones are reshaping many maritime missions.

As with most developing technologies,

potential drone use initially finds acceptance by completing missions already in the work flow, such as cargo hold inspections; more safely, with quicker deployment, and often more economical. To be sure, professional drone usage has its own ongoing costs. Engaging drones as an excuse to be “a cheaper” option can be faulty business thinking. When risk reduction and other advantages are factored into a mission, drone usage presents massive value.

Recently the Atkin Drone Team produced an aerial video, mapping paint needs of a small nonprofit coastal tanker. Previously this job required a half day with several mariners climbing masts

and ladders; using a launch, risks in bosun chairs, and scrambling over the wheel house. The Atkin Drone Team completed the mission in 30 minutes.

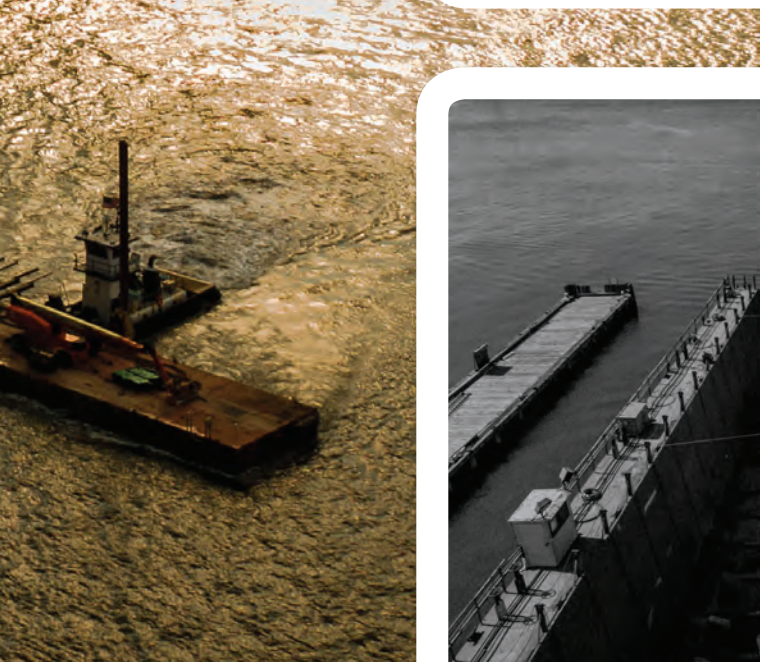
While military drone use is well established, mostly offshore with long range drone aircraft, coastal potential is enormous. Search and rescue, spill response, documentation, inspection, searching ship interiors that could be toxic and/or smoke filled prompted the USCG to discuss at the highest levels new usage potential. Admiral Charles Michel acknowledged to this writer, drone implementation in the USCG may have to “bubble up” from the needs of local Sector commanders. He envisions someday

that every USCG asset will have a drone ready to launch for SAR purposes, spill response and more. He acknowledged as drone technology is rapidly evolving, a system wide adoption of sUAS technology by any large military entity will be slow, until there is greater hardware, software and airspace rule making standardization. Drone technology on the “affordable level” of battery operated aircraft has moved rapidly to greater reliability due to redundancy of onboard computers (IMU), barometers, compasses, paired batteries (with heating of same), more powerful motors, longer flight time and precise radio controllers.

Interchangeable cameras and lenses



*Whether used for noninvasive **whale blow-hole mucous gathering** or dangerous **on-board fire investigations** drones are reshaping many maritime missions.*



with infrared, FLIR and other payloads make drones a multi-mission platform. Coupled with hardware, innovative software permits vector based search and rescue, mapping, analysis, 3D representations, thermographic imaging and more. Echoing Admiral Michel's concern, DJI drones now have ADS-B receivers, alerting the operator of nearby manned aircraft. Other systems and protocols for safe integration of airspace will undoubtedly become commonplace.

The largest challenge of maritime users is to apply due diligence to drone use as they do for all other maritime

missions. Whether contracting outside agencies or developing in-house drone teams, maritime agencies will no longer assign drone usage ad hoc by calling "Uncle Joe" with an amateur early Phantom to fly haphazardly, snapping photos or rolling the "video tape," at perhaps some risk to all.

The maritime sector requires vetted drone pilots, camera operators with FAA licenses, liability insurance, thorough experience in the care and feeding of complex drone equipment, batteries, maintenance, record keeping, complete competence in manual flying (with and

without amazing telemetry) and expertise with innovative software. Marketing divisions are using drones as great visual solutions, but they must be the right tool for the job. Drones are not a "cheaper" alternative to manned aircraft. They are indeed a unique and different tool for an immersive vantage point. Therefore, drone operators must be more than "techies" but marine savvy professional filmmakers and photographers, fused with a fundamental passion and in-depth knowledge of the marine sector and its unique needs to successfully complete maritime missions.



About the Author

Jonathan Atkin, NYC based; known for meticulously planned aerial media from manned helicopters enhances branding for blue water cargo shipping, cruise lines, towing companies, shipyards and the broader workboat sector with passion and knowledge throughout North America. With a fleet of hi-res camera drones, the Atkin Drone Team, (insured and licensed) offers clients options for drone assisted immersive aerial images heretofore unachievable with other photo platforms.

www.shipshooter.com

My Favorite Drone

From a life photographing from hot air balloons, kites, parasails and professionally from manned helicopters, Jonathan Atkin eagerly embraces drones as amazing photo platforms supplementing, not in place of manned helicopters. The Atkin Drone team includes Jeff Brink, an award winning cinematographer, FAA certified Pilot-in-Command, co-founder of Aerobo, a premier cinematography company. And several on call video editors. Our fleet includes six aircraft, and the state-of-the-art DJI Inspire 2, is our "beast." The X5s camera and lenses are brilliant. Love it. It is unfazed by moderate breeze, with massive telemetry redundancy and sounds really cool. Two other Inspire 1s are in the "Atkin hangar" as well. All Inspires retract landing gear, giving unobstructed views with full 3 axis gimbals. The latest Phantom 4 Pro has build quality that makes you want to feed it as a pet. An early Phantom 3 Pro with mounted flood lights and the small "fly-me-through the wheelhouse," DJI Mavic Pro. Round out the hangar. My fave? that's like which child? Inspire2 simply for quality, stability and show stopping awesomeness. The Mavic Pro for unequalled ease of set up, surprising capability, flyability and the grins elicited when its "transformer" character unfolds from a small package.

All images courtesy and copyright Jonathan Atkin, www.shipshooter.com

Boat of the Month



All Photos: McAllister Towing

EPA Tier IV tug Capt. Brian A. McAllister

Both McAllister Towing and Capt. Brian A. McAllister have been fixtures on the U.S. workboat market for generations. The man's presence was further etched in maritime lore with McAllister Towing announcing the arrival in New York of the tug Capt. Brian A. McAllister, significant in that the company claims that it is the first EPA Tier IV tug on the U.S. East Coast. Capt. Brian A. McAllister is the 31st and most powerful tug in the McAllister fleet, powered by 3516E Tier IV Caterpillar engines with twin Schottel SRP4000FP units. Packed into its 100 x 40 ft. hull is 6,770 hp and

more than 80 metric tons of bollard pull. Combining that power with a Markey class III escort winch on the bow and a Markey 2.25-in. wire winch on the stern puts the tug in a class of its own. State-of-the-art remote controlled fire monitors and deluge systems (ABS FiFi certified) complete the package.

Built by Horizon Shipbuilding in Alabama, upon its arrival in New York it was put to work on the recent ULCVs and SULCVs calling the port. On one of the boat's first jobs Mate Matt Jernegan was at the helm and said, "Her rate of turn was amazing. The power this tug

has and her capabilities, allows us to be more efficient and safely handle these monstrous container ships."

The steel hull tugs are designed as a modern harbor / terminal tugs outfitted and equipped to undertake open sea transits and harbor tug /near coastal services such as active escort, vessel towing, ship handling / maneuvering assist (both while alongside and by the fore and aft ends of a vessel), firefighting and other such assigned and/or related duties. The hull form has been specifically developed with ship docking operations in mind; including underwater contours

to ensure optimal stability under all loading conditions and the minimization of unsettling sea motions that would impair crew efficiency. Azimuth stern drive propulsion is delivered courtesy of twin Schottel Z-drives, driven by Caterpillar diesel engines.

Ship service electrical power is provided by three 125kW, diesel driven generators, with auto start, auto transfer and paralleling. A single drum hawser winch forward and a single drum tow wire winch aft provide the necessary deck gear for assisting, escorting and rescuing vessels.

Capt. Brian A. McAllister Main Particulars & Equipment List

Owner..... McAllister Towing & Transportation
 Builder Horizon Shipbuilding
 Length, o.a. /molded 104 ft. / 100 ft.
 Beam, o.a. /molded 42 ft. / 40 ft.
 Depth molded..... 16.3 ft.
 Max. Loaded Draft 18 ft. (Including Skeg)
 Fuel 58,710 Gallons
 Lube Oil..... 545 Gallons
 Urea..... 2500 Gallons
 Dirty Oil 1,444 Gallons
 Waste Oil..... 1,444 Gallons
 Potable Water..... 3,075 Gallons
 Foam Water 750 Gallons
 Black Water 2,744 Gallons
 Estimated Bollard Pull at MCR 80 MT Ahead
 Speed..... 12 knots Cruise
 14 knots Maximum
 Main Engines..... 2 x ABS Caterpillar 3516E Diesel Engines EPA Tier IV (MCR)
 Power 6770 BHP, 3386 BHP @ 1800 RPM ea.
 Z-Drives..... 2 x ABS Schottel SRP4000FP
 Drive Controls..... Schottel
 Generators..... 3 x Caterpillar Tier III C7.1 Keel Cooled Engines
 Classification ABS
 Hull Classification: Maltese Cross A1 Towing Vessel – Escort Service; Bollard Pull and FFV1 notations
 Machinery Classification: Maltese Cross AMS; ACCU notation
 Fire Monitors 2 x FFS 1200LB Fire Monitor rated @ 5,284 gpm Adjustable Fog Tip with Foam Capability.
 Fire Pump 2 x FFS SFP 250X350 rated @ 5,980 bpm, 185 PSI, Diesel Driven
 Fire Pump Prime Mover Caterpillar
 FiFi Equipment 8 x 1.5-in. fire stations, Four (4) fire suits w/ SCBA breathing apparatus and spare bottles
 Forward Hawser Winch Markey DESF-48-100 Electric Hawser Winches Capacity of 800 feet of 10-in.
 circumference line, fairleads, auto tension, render-recover, 558,000 lbs brake holding force.
 Aft Tow Winch Markey TES-40-75 Electric single drum Tow Winch, Capacity of 2500 feet of 2.5" wire.
 Anchor..... Danforth
 Compass..... Richie Globemaster
 Gyrocompass 2 x Anschutz Standard 22
 Autopilot..... Anschutz Pilotstar D
 Radar 2 x Furuno FR8122 w/ARPA & 4' antenna
 VHF Radios 2 x Standard Horizon
 Depth Sounder, Plotter/Recorder Furuno
 Depth Sounder 2 x FCV295 w/transducers forward & aft
 GPS 2 x Furuno GP32
 Chart Plotter Furuno TZTOUCH2
 AIS Furuno FA-300 series
 Loud Hailer Standard Horizon
 Marine TV Antenna Shakespeare
 Ships Horn Kahlenberg D2 w/Light

Ships Whistle..... Air Jack Whistle
 Ships Bell..... 12" Perko Brass Bell
 Clock / Barometer..... 6" Chelsea
 Inclinator 2 x Bubble Type Ritchie
 Steering Stations..... 2 x Fwd/Aft in Wheelhouse
 Sound Powered Telephones..... 5 x bulkhead mounted and 2 x Plug-in Head sets
 Staterooms 3 Doubles, 1 Single
 Berths 7
 Head..... 2 full, 1 half
 Bulkhead Covering..... Promarine Formica faced Promasound TL panels
 Pilothouse Deck, Galley & Main Deck Covering..... Rubber .125-in. Flooring over Sounddown tiles
 Insulation..... 3-in. Mineral Wool Insulation Delta T Anti-Sweat
 A-60 Insulation 3-in. Mineral Wool Insulation
 Sound Insulation 1.5-in. Mineral Wool Insulation, Lead Impregnated
 Pilothouse Windows..... ABS 10mm-19mm Thick Glass – Beclawat or equal w/ forward and aft heated.
 Port Lights ABS 16" w/ Hinged Deadlight Covers
 Lighting..... LED
 Bilge/Ballast..... 2 x Barnes
 Ballast/Fire..... Barnes
 Fuel Oil 2 x Viking Pumps
 Compressed Air 2 x Quincy QR-25 D325 5HP Compressors
 Air Receivers..... 2 x Manchester 200 Gal 250 PSI Air Receivers
 Lube Oil / Dirty Oil..... 2-in. Pneumatic Diaphragm Pump
 Potable..... 30 GPM Electric Pressure Set & HW Heater
 Sewage ORCA IIA-24 Type II MSD at 720 Gallons/Day
 Electrical 480 VAC, 60 Hz, 3-phase/3-conductor (delta) ship service electrical system.
 HVAC..... 2 x 5-ton Air to Air Mitsubishi City Multi Heat Pumps
 Engine Room Ventilation 2 x Cincinnati Electric Axial Fans
 Engine Jacket/AC Water Cooling..... Keel Cooled –Box Coolers – R.W. Fernstrum
 Hull Fender System..... Viking Rubber
 All Plate & Shapes..... Wheelabrated with Pre-construction Primer
 Exterior Coating below WL..... PPG Amerlock 2/400 and ABC3 Antifouling
 Exterior Coating above WL..... PPG 302H Zinc, Amerlock 2/400, PSX 700
 Tank & Interior Coating..... PPG Amerlock 2/400, PSX 700 in Engine Room
 Fire Stations 3 x Hose Stations, 50-ft. Hose, Nozzle and Wrench, with 3 Extra 50-ft. Lengths of Hose
 Fire Suppression Mach. Spaces ABS approved FM 200 fixed system and
 One (1) B-V Semi-portable extinguisher.
 Fire & Smoke Detection..... Zones (6) Zones ABS Heat Detection & (2) Smoke
 General Alarm USCG A0049E – IMS
 Navigation Lights & Panel SCG Approved Control Panel with USCG Aqua Signal
 Series 65 LED Navigation Lights
 Life Jackets..... 10 USCG Approved Type I Personal Floatation Devices
 Life Raft 10-Man Inflatable Life Rafts, USCG Approved
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 Fire Axes 2 x Axes w/Mounting Brackets
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Congratulations McAllister Towing
 on the newest addition to your fleet!



Photo courtesy of McAllister Towing

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FPSOs

New Storage Tank Explosion Frequencies

JOHN SPOUGE, DNV GL

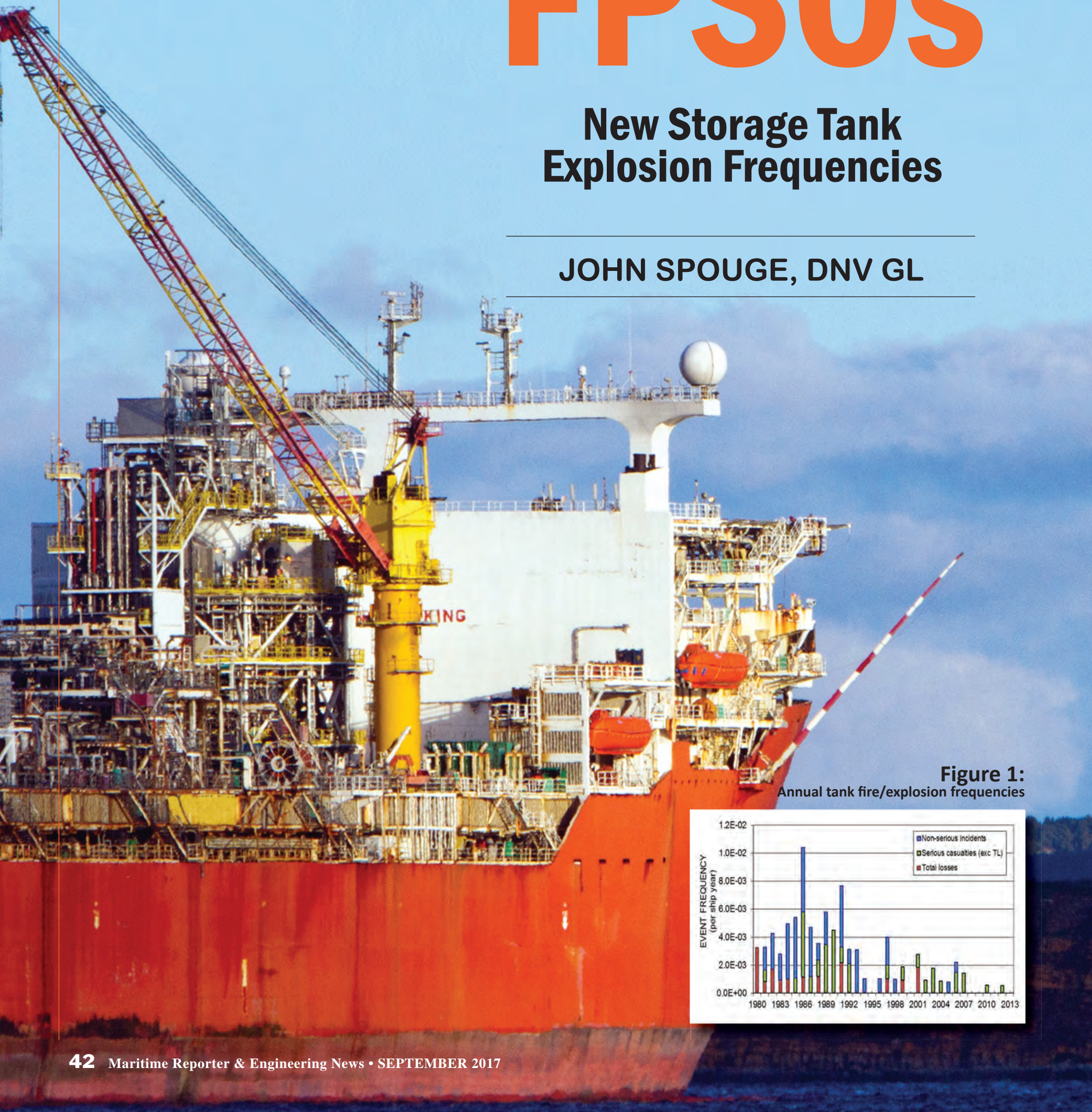
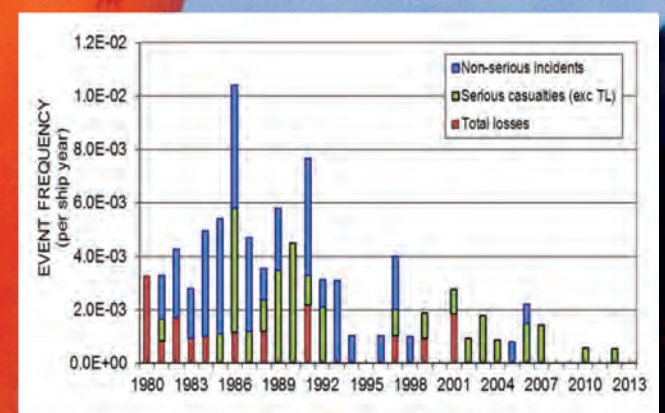


Figure 1:
Annual tank fire/explosion frequencies



The fatal explosion in the pump room on the Brazilian FPSO Cidade de São Mateus in February 2015, demonstrated the potential for major accidents on this type of unit. Although there has never been an explosion in the oil storage tanks of an FPSO, there is a potential for such an event and offshore operators should assess the risks of such events to design against them. It is therefore imperative that risk assessments of FPSOs address this type of event. For this, they need to estimate its annual likelihood of occurring. An early estimate of the frequency of cargo tank fire/explosion was 4.4×10^{-4} per FPSO year or one chance in 2,300 for each year of operation¹. This was based only on experience with trading tankers in port, which is not appropriately comparable with conditions for loading and offloading FPSOs at sea. A frequency of 2.2×10^{-3} per FPSO year can also be found in a risk assessment textbook². A recent study by the International Association of Oil & Gas Producers³ combined this with an assumption that FPSOs had half as many tanks as trading tankers, and estimated a storage tank explosion frequency of 8.8×10^{-4} per FPSO year. Both these sources used tank explosion experience on trading tankers during 1972-86, which is now severely outdated.

Using up-to-date data, in conjunction with a systematic consideration of the differences in risk between trading tankers and FPSOs, a new frequency estimate for storage tank explosions on FPSOs has been developed by DNV GL⁴.

Data selection

The DNV GL study selected data from large oil tankers, defined as those over 80,000 dwt, as these are comparable in size to FPSOs. Currently, there are roughly 1,200 such ships in service around the world. The IHS Fairplay casualty database was used as the basis for the analysis. Data was selected for the period 1980-2013, in all reported locations worldwide, including at sea, in port, at anchor and in construction, repair and scrapping yards.

The analysis covered events categorized as 'fires/explosions', as available accident descriptions do not normally distinguish rigorously between the two, and hence it is difficult to separate them. Events occurring in tank spaces have been identified from the details provided by IHS. This excludes events in the engine room, pump room, other equipment rooms, superstructure, transfer equipment or forecastle area, even if they subsequently escalate to affect cargo tanks.

Results

In total, 88 tank fire/explosions were identified. The exposed population

of oil tankers over 80,000 dwt during 1980-2013 is estimated to be 40,097 ship-years, based on the IHS database. The overall average frequency of tank fire/explosion is therefore estimated as $88/40097 = 2.2 \times 10^{-3}$ per tanker year. Table 1 gives the breakdown of these events by severity.

Of the 88 events, 17 resulted in total loss of the ship and 31 others were considered serious, sufficient to require repairs before the ship could continue trading.

Figure 1 (previous page) shows the fire/explosion frequencies in each year. Although there are many random variations year-to-year, it is clear there have been fewer accidents in recent years, and hence, the average frequencies may be pessimistic if applied to current operations. The reduction in frequency since the mid-1980s may be due to the progressive introduction of inert gas systems, segregated ballast tanks and double hulls. By 2010, these were fitted to the entire fleet, but as there have been so few accidents since, it is not yet possible to obtain robust results from this period alone. Using the population of double hull tankers alone, the frequency is 3.9×10^{-4} per tanker year, with an uncertainty range of roughly a factor of 2 higher or lower.

The DNV GL analysis considered the reasons why explosion frequency was much lower on double hull tankers than on the single hull tankers that were in service up to 2010. Double hulls are mainly intended to prevent oil spills and this may help prevent tank explosions originating from these. However, they introduce explosion hazards in the double hull spaces. The research found that the explanation is not related to the double hull as such, but to the fact that most double hull tankers are relatively new, and newer tankers tend to experience fewer accidents than older vessels.

Therefore, although the trend shows steady improvement over the last decade, it may be optimistic to expect the frequency to continue reducing. Recent regulations have resulted in a very high proportion of the fleet being new tankers, whose accident frequency is likely to increase as the vessels age. So, it is possible that the trend will reverse, as it did following the dip in accidents shown in Figure 1 shows around 1995.

Application to FPSO units

Oil storage tanks on FPSOs are broadly similar to cargo tanks on trading tankers. Although some FPSOs are new-build vessels, others are in fact converted single hull trading tankers, taken out of service due to recent double hull requirements. A systematic comparison of differences between trading tankers

Table 1:

Average tank fire/explosion frequencies from 1980-2013

SEVERITY	EVENTS (1980-2013)	FREQUENCY (per tanker year)
Non-serious incidents	40	1.0×10^{-3}
Serious casualties (exc TL)	31	7.7×10^{-4}
Total losses (TL)	17	4.2×10^{-4}
All events	88	2.2×10^{-3}

and FPSOs demonstrates that many of these differences depend on the specific design of the FPSO, as well as the specific service of trading tankers. Some would tend to increase the explosion frequency while others would reduce it. Making use of statistics on the causal breakdown of trading tanker accidents, the study concluded that most changes would have effects that are relatively small and less than the uncertainty in the original estimate. Overall, there are no strong reasons to make a major change in the explosion frequency from trading tankers. The study recommended that, until a more comprehensive analysis is available, it was preferable to avoid arbitrary adjustments and use the trading tanker data unmodified to estimate the frequency on FPSOs. The frequency of storage tank explosions on new-build FPSOs is therefore taken as 3.9×10^{-4} per FPSO year. This implies an explosion on average every 2,600 FPSO-years. Cu-

mulative experience with FPSOs to date is less than this, so the frequency is consistent with the absence of explosions to date. The trading tanker data suggests that almost half of serious casualties occur during repair and tank cleaning. If the scope of the FPSO study excludes these operations, this would justify making a further reduction in the frequencies by a factor of 2. Individual FPSOs may differ substantially, and need to be studied in detail to quantify the effects of their differences from trading tankers.

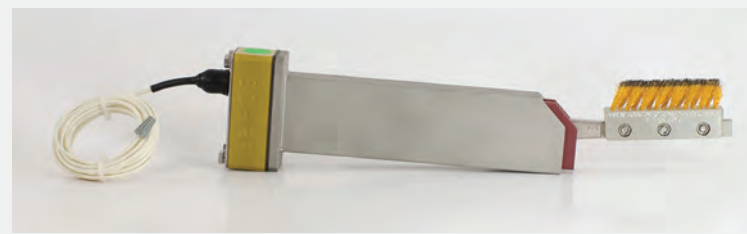
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Marine Design

ISA Sport 120

The worlds of private superyacht and expedition cruising are worlds apart, nevertheless there are interesting comparison. The superyacht ISA Sport 120 range is ready for its official debut at the boat shows in Cannes and Monaco. Launched in Ancona in July 2017, the 37-m superyacht, whose construction began in 2016, is the first yacht completed in the Ancona yard for ISA Yachts' new ownership, the Palumbo Group.

Clorinda represents an evolution of the 10 previous units of the series, and stands out for the introduction of restyled design elements, such as the dark fashion plates with glass inserts or the grey bottom line, and new functional ones, like a further fore solarium, and a skylight with blind to provide the master stateroom with even more air and light.

The architectural framework is conceived to enhance the relation with the environment and to enlarge the deck areas in contact with water and exposed to sunshine. The proportion between exterior and interior spaces is balanced, with large terraces above the sea, spacious cockpit and flying bridge, as well as a huge and bright salon and ample cabins. The fully-customizable interiors exploit the available space well: the master stateroom, for instance, is laid on two levels, conveniently using the fore sections of main and lower deck.

One of the key areas on board is the sundeck, proper of a much larger superyacht: forward is the relaxation area with two built-in sofas located behind the windscreen and the starboard navigation bridge; on port side a wet bar is equipped

with refrigerator, ice-maker, sink, and dumbwaiter connected to the galley. To starboard is a large Jacuzzi. The aft deck, like the main deck cockpit, features a sun bad which turns into a sofa when necessary. Clorinda can accommodate 10 guests in five cabins, while the crew quarters allows for a staff of five in three cabins on the lower deck.

The vessel is propelled by three MTU 16V 2000 M96 engines developing 1790 kW each, coupled to two side KaMeWa waterjets and a middle KaMeWa booster.

Top speed exceeds 34 knots; cruise speed is 27 knots.

Finally, ISA has developed and adopted on Sport 120 the ABT TRAC electric stabilizer, a sophisticated yet quiet system reducing pitch and roll and increasing on-board comfort.





Image: SunStone Ships

Expedition Cruise Ships Shape Up One-on-One with Tomas Tillberg

Today's expedition cruise vessel is not your father's expedition cruise vessel, as new levels of interior outfit and amenity sophistication are bringing yacht quality to the masses.

Maritime Reporter & Engineering News reached out to our industry expert 'go-to,' Tomas Tillberg of Tomas Tillberg Design for his thoughts on emerging trends.

In general, what is the overall design theme for expedition cruise vessels today?

Expedition cruise guests are getting more sophisticated in their taste and expectations. The design of public areas, suites and cabins reflect this through the selection of materials and design solutions. Overall design themes and general arrangements of the vessels are very much in keeping with the itineraries and seek to enhance the experience and excitement of cruising in areas such as Antarctica and the Arctic. Typical examples of this would be providing ample space both outside and inside from where one can easily view the wildlife and nature. Seating arrangements for dining areas, lounges etc. follow this general design theme too and help keep focus towards the outside rather than inboards. Even the artwork assists in this and is often a reflection of the itinerary of an expedition vessel, aiding in enhancing the overall experience.

You design passenger vessels large and small. What are particular design considerations for the expedition cruise sector?

Expedition vessels are smaller than other cruise ships, so they move more. We always have to think about this fact and design with that in mind. For example, chairs need fastenings so that they can be secured and must be designed to allow for this. A special feature on expedition ships is the area called the "mud room." It allows guests, coming onboard from an excursion ashore, to leave their dirty boots and bulky clothes there.

Looking at how and where expedition cruise vessels are built today, are

there any special considerations from an interior design perspective?

As the expedition vessel for Sunstone Ships, for example, is being built in China, it is necessary to keep in mind that much of the materials (textiles, laminates, furniture, fixtures, etc.) that are selected for the designs are also sourced in China. This is new and unique and a great challenge for us and the other members of the team.

So for this specific vessel, what do

you see as the biggest challenge?

The Sunstone Ships' expedition vessel will be the first cruise ship built and launched in China. To be sure, being pioneers has its own challenges. However, the companies involved - Sunstone Ships, Ulstein, Makinen, the shipyard and others, including our own team - have the experience and skills to get it done. We are very excited to be part of this project and to help create a great, first of several to come, expedition vessels built in China.



The hotel design of SunStone Ships, Inc. new fleet will be done by Tomas Tillberg Design International.

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Interferry Mission: Strength from Unity

Interferry CEO Mike Corrigan explains the Stronger Together vision behind the trade association's drive to extend its networking and lobbying influence.

Over the past four decades, Interferry's reach and purpose has evolved with increasing effect from its U.S. origins in 1976. Back then, it was formed as the International Marine Transit Association with a focus on networking among its members. Now it is highly respected and influential as the only body representing the ferry industry worldwide. The name and scope may have changed, but one thing above all has remained constant in driving its development – the power of working together.

The original vision of sharing knowledge and ideas remains a prime attraction for our diverse membership, which currently numbers more than 200 operators and suppliers of all sizes in 37 countries.

In more recent times, we have built on this background to become established as a major player on the political and regulatory stage. The strength we draw from unity is the essential key to reaching our networking and lobbying goals.

The benefit of a platform to network with industry peers is underlined year after year at our annual conference, which is recognized as the ferry sector's preeminent forum. In October our 42nd event takes place in Split, Croatia, where several hundred high ranking delegates from around the world – members and non-members alike – will gather to talk, listen and learn on the three main themes of ship technologies, safety and the customer experience. Meanwhile the value

of working together has been equally demonstrated by our lobbying success at the International Maritime Organization (IMO) this summer, when we teamed with various other parties to secure crucial changes to proposals that could have had negative impacts on our members.

In 2003 Interferry won consultative status at the IMO – enabling us to intervene on regulatory discussions - and in 2012 we strengthened this activity by opening an office for IMO and European Union affairs in Brussels. These activities are directed by an elected board and supported by expert committees that are likewise composed from senior personnel in our membership.

I knew and was inspired by the set-up

long before becoming CEO in April after 14 years in leadership positions with BC Ferries in my native Canada, the last five as president and CEO. During this time I was also an Interferry director and treasurer. As such, I had already experienced that a close-knit team was our most critical resource in attaining successful outcomes. Now it is my privilege to be at Interferry's helm as we set course for new landmarks and work together to accomplish what one company cannot on its own.

This guiding principle is vital in helping our members to take advantage of opportunities and overcome challenges because the ferry sector cannot claim to be the biggest in shipping and trans-



Photo Credit: Jadrolinija; Inset Photo Credit: John Nedwidek / Interferry



(Photo Credit: John Nedwidek / Interferry)

Interferry @ a Glance

What: 42nd Interferry Conference
When: October 7-11, 2017
Where: Split, Croatia
Web: www.interferryconference.com
Twitter: @Interferry

port. However, we could make a case for being one of the most important – very often we provide lifeline services to far-flung communities. And we are far from small ... globally we carry more than two billion passengers a year, almost on a par with airlines, and 32 million freight units. All the same, ferries are frequently in danger of being underrated and overlooked by politicians and regulators, so banding together helps us stress to them the full weight of our worth as a safe, eco-friendly and economically valuable asset to society.

To drive our networking and lobbying vision further forward, we are now rolling out an ambitious three-year strategic plan to advance the association's profile, which in turn will ensure the strength and benefits of membership. Among the prime objectives, we aim to grow Interferry's 'voice of the industry' role; to extend our safety and quality improvement campaign; to increase our part in developing international regulations; and to create more opportunities for knowledge exchange.

As mentioned earlier, we have already been instrumental in achieving significant changes to regulatory proposals that, after years of discussion, were again under the spotlight at the latest sessions of IMO's safety and environmental protection committees. In league with other prominent stakeholders, we argued that on three major issues – The Energy Efficiency Design Index, The Ballast Water Management Convention and Damage Stability – the potential technical solutions might be acceptable for deep sea vessels, but posed immense problems regarding the very different design and operational criteria for ferries. In each case we won agreement for sector-specific amendments that will safeguard the regulatory objectives without threatening our sector's commercial viability.

On the EEDI issue, Interferry was joined by several Flag States that echoed our concerns about the requirement for newbuild ships to be more energy ef-

Globally we carry more than two billion passengers a year, almost on a par with airlines, and 32 million freight units. All the same, ferries are frequently in danger of being underrated and overlooked by politicians and regulators, so banding together helps us stress to them the full weight of our worth as a safe, eco-friendly and economically valuable asset to society.

Mike Corrigan, Interferry CEO

ficient than the average of old designs. Our technical evidence demonstrated the difficulty of determining what is an average ferry – and resulted in the ferry requirement being reduced by 20%. An upper size deadweight tonnage threshold was also agreed in acknowledgement that the statistics used to define the original requirement included very few large ferries.

Concerns over the BWMC stemmed from our view that the threat posed by invasive species was not relevant to ferries operating in regional rather than inter-continental waters, which brought the requirement to fit expensive treatment plant into question.

In cooperation with the International Chamber of Shipping and various Flag States, we won agreement for the compliance timetable in applicable waters to be extended by several years. In addition, the IMO agreed a way forward for adoption of our alternative Same Risk Area concept – developed with Denmark and Singapore – for ships operating in common waters.

In similar vein, Interferry has long questioned damage stability proposals that, in effect, seek to produce the unsinkable ship by adding more steel. We would much rather see more research on avoiding collisions in the first place, but leaving that aside we were alarmed that the operational capability of ferries might be seriously impaired – for instance, if sub-division of their drive-through vehicle decks was required. We teamed up with Japan and other countries to ensure that the technical guidelines could be achieved, especially for smaller ferries. Our interventions secured a set of regulations that overthrew previously agreed levels of 'unsinkability' and which we believe to be reasonable for ferries carrying less than 1,000 passengers.

Sharing expertise and experience in such partnerships is, of course, also exemplified when ferry professionals come together on matters of common interest at our annual conference.

Our highly interactive program in Split features four keynote speakers among the presentations, as well as an extended

lineup of panel sessions. The ship technology theme will pay particular attention to electrification and other energy alternatives; the safety agenda will highlight Interferry's best practice guides and newly formed Safety Committee; and the customer experience sessions will cover a host of IT and other innovations designed to elevate passenger satisfaction.

Our keynote speakers are Markku Mylly, executive director of the European Maritime Safety Agency, with an update on the latest initiatives; John Wright, managing director of safety culture specialist WrightWay, who will explain why the safest companies are also the most successful; Brent Perry, head of Plan B Energy Storage, a world leader in alternative ferry fuels; and futurist David Rowan, UK editor of *Wired*, the U.S.-based future technology magazine, who will explore the 'next big things' that will propel the ferry industry into a new age. Topics in other sessions range from demographics, intermodal opportunities and fast ferries to digitalization, Big Data and cybersecurity, so I can safely predict there will be something to learn for each and every delegate!

Beyond the conference, Interferry is planning to provide additional networking platforms in the future. In particular, we want to establish regional meetings as a helping hand in attracting new members, especially from countries outside our core membership bases in the Americas and Europe.

In the meantime, if you're involved with ferries and whether or not you are part of the Interferry family, I really hope you are able to come to Croatia and see for yourself where togetherness can take us. Our industry is set for an exciting new era if it rises to the challenge of inevitable hurdles and to the potential of new opportunities. I believe this can best be realised with the collective power that Interferry offers – so I look forward to you joining us on our Stronger Together mission.



Stena Imperator with her sister Stena Imprimis. Top left, Godmother **Ylva Syrén Carlsson**, Stena Imperator. Bottom Left, Godmother **Denise Baum**, Stena Imprimis.



STENA BULK Twice is Nice

Stena Bulk

Two newly built vessels owned by Stena Bulk, Stena Imperator and sister ship Stena Imprimis, were named side by side at the Chinese shipyard Guangzhou Shipbuilding International (GSI) in Guangzhou in southeast China.

The two godmothers – for the Stena Imperator, Ylva Syrén Carlsson and

for the Stena Imprimis, Denise Baum – wished the vessels, their captains and crews fortune and prosperity on the seven seas and swung the bottles of champagne against the tankers' bows.

The two vessels are numbers 11 and 12 in a series of 13 IMOIMAX tankers ordered by Stena Bulk, the last of which

will be delivered in January 2018.

“It was a spectacular sight with the two sister tankers beside each other and the somewhat unusual situation as such made the naming ceremony a bit special and extra festive. We are now approaching the final delivery of our large order consisting of 13 IMOIMAX tankers.

We are very proud of and satisfied with our fleet, which now consists of 10 units in operation. Both the technical and the commercial concept have proved to be very successful,” said Erik Hånell, President & CEO, Stena Bulk.

The 50,000 dwt tankers measure 183 x 32 m.

FLNG Design Earns AIP

Wison Offshore & Marine Ltd. received Approval in Principle (AIP) from Bureau Veritas for its new large-scale Floating LNG Storage and Regasification Terminal. Featuring scalable storage capacity up to equivalent size of a Q-Max, this is reportedly the first large-scale FSRU barge design that has been granted AIP by a classification society. It also marks that Wison is now capable of providing comprehensive range of FSRU solutions catering LNG import markets with various scales of demand. This full-size FLNG terminal solution is designed to offer an economical alternative to the conventional LNG regasification vessels (LNG RV) especially for markets with long-term demand. The barge design lowers initial capital investments up to 20% compared with LNG RV of equivalent size, as well as O&M costs, while enabling uninterrupted service throughout project lifecycle. “Wison large-scale FSRU is a fit-for-purpose facility designed with practical operation considerations. It features scalable storage capacity from 150,000 cu. m. to 265,000 cu. m. and a base case design of 750 mmscfd regasification capacity expandable to fit project needs,” said David W. Chen, Senior Solution Manager at Wison Offshore & Marine. “Designed for near-shore/at-shore application, the FSRU can also be deployed offshore with a single point mooring system.”

Wison is soon to deliver world's first FSRU barge under an EPC contract and world's first FLNG barge achieved final delivery most recently.



Wison

Versatile Harbor Tug

Earlier this summer Sealink Marine Shipyards launched a versatile ASD tug from its facility in Miri, Sarawak, Malaysia. The 32 x 11.8-m tug has a 5.2-m molded depth. Mounted forward it a Macgregor: MG-HAT/GDG22-0115U02080 combination anchor and hawser winch with 150-ton braking. Mounted aft is a Macgregor: MG-HTW1-0218008048 towing winch also with a 150-ton holding brake. Power for this capable vessel derives from a pair of Cummins QSK60M diesels each generating 2,300 hp at 1,900 rpm. These turn 2.4-meter controllible pitch propellers on Rolls-Royce azimuthing drive units. This power gives the tug a 57.56-ton bollard pull ahead, a 53.87-ton bollard pull astern and a 13.6-knot free running speed. A pair of 110-kW Cummins QSB7-DM-powered generators provides electrical power. For additional versatility the tug is fitted with a dispersant system to comply with MARPOL I, IV, V and VI. External FiFi capability is provided by two 141 cu.-m.-per-hour monitors supplied by a fire pump with power takeoff from the main engine. The one-man operation bridge has a 360-degree view along with extensive electronic navigation and communications equipment. Accommodation for up to eight crewmembers is provided in two one-person and three two-person cabins. All accommodations are centrally air-conditioned.

For ship-handling the bow fendering included D-fendering all round with W push bow and pilot boarding platform. Class notification if ABS + A1, +AMS, Circle E, FFV1 and Towing Vessel (Harbour Service, Towing Service).



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SEACOR CrewZer Offshore in Comfort, Efficiently

Seacor

In 2017 SEACOR raised the innovation bar with the delivery of the second of their latest CrewZer Class-DP2 high-speed catamarans the Seacor Puma and Seacor Panther. With four 4,000-hp engines the Puma will have significantly more horsepower than her predecessors. This horsepower will be delivered by four of Cummins Marine's newest marine engine, the QSK95 marine engines which are each rated at 4,000 hp (2,983 kW) at 1,700 rpm. Each 95-liter engine is matched to a MGX-62500SC-H marine transmissions supplied by Twin Disc, Inc. and quad HT-810 water jets from Hamilton Jet, to achieve a maximum speed of 40 knots. The two for-

ward engines will run Jason FiFi 1 class pumps off the front of the engine.

The design of these two new 188 by 41-foot (57.5 x 12.5-m) vessels is very similar to the last two catamarans to join the SEACOR fleet. However, the Cummins QSK95 engines represent an increase in power. "These engines afford us with additional horsepower over the previous catamarans propulsion machinery," said SEACOR's Joe McCall. He went on to explain that "The mission of these vessels will be the same as the previous catamarans, to deliver time sensitive cargos and passengers at greater speeds than a typical crew-boat. Additionally, the sea-keeping qualities

afforded by the twin hulls, ensures that the passengers will have a very fast and comfortable ride."

Cummins is also providing auxiliary power; each vessel will have two QSM11-powered generator sets rated at 290 kWe, as well as a fully enclosed QSM11-powered deck generator rated at 270 kWe.

The twin hulls also allow for a huge 3,084 sq. ft. clear cargo deck capable of handling 200 tons of freight. Tankage is provided in the hulls for 25,437 gallons (96.3 cu.meters) of fuel oil and 6,870 gallons (26 cu.m.) of potable water. Crew accommodation includes 16 berths in eight cabins as well as a galley and

mess area with seating for 15 people.

Built at Astilleros Armon in northern Spain, the two new boats will add to an already significant list of innovative vessels delivered from the company's three shipyards.

The enhanced seating that is fitted in the passenger salon allows up to 138 passengers to rest in first class comfort or they can choose from the various amenities available to them, such as satellite TV, Wi-Fi or snacks from the refreshment area. The vessel is fitted with a hospital, so the vessel can also fulfill the role of medical evacuation platform if the need should arise.

Fincantieri Floats out MSC Ship

The second ship in the MSC Cruises' Seaside class, MSC Seaview, has entered the final phase of construction at the Monfalcone shipyard in Italy, where MSC Cruises and Fincantieri celebrated the vessel's float out.

MSC Seaview will sail her inaugural 2018 summer season in the Mediterranean, offering holidaymakers the chance to experience the jewels of this region like never before on a cruise ship.

At 323 meters long with a 154,000 GRTs, the ship will feature a maximum capacity of 5,179 guests. MSC Seaview is the second of two identical ships in the Seaside class. Her sister ship – MSC Seaside – is set to enter service later this year in November.

MSC Seaview will be the third next-generation ship coming into service in just 12 months, following on from MSC Meraviglia in June 2017 and MSC Seaside in December 2017.



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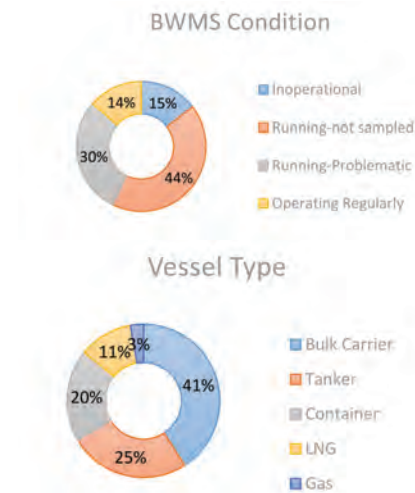
ABS Report: BWTS Revealed

ABS published a report providing insights into how industry is progressing with ballast water management (BWM) systems, based on input provided by owners and operators with BWM systems on board their vessels.

"It is important to share with all stakeholders the outcome of the ABS organized workshop on the issues and best practices with ballast water management systems," said ABS Executive Vice President for Global Marine Dr. Kirsi Tikka. "When we hear directly from owners and operators, we are better able to understand the challenges in the operation of the systems, and for those systems which are operational, what practices are being followed."

Survey results from approximately 30 owners and operators were aggregated to help identify trends and understand common practices while maintaining anonymity.

In analyzing the responses, ABS learned that 57 percent of the systems installed on the vessels were being operated. The remaining systems were either deemed 'in-



operable' or considered 'problematic.'

The report reveals that some of the major challenges that shipowners and operators face with BWM systems are related to software, hardware and the crew's ability to operate the systems correctly. System operators have had to develop plans to keep up with hardware maintenance and

maintain an inventory of spare parts on a vessel.

A recurring concern expressed by many owners relates to the chemical consumables used for determining residual oxidants in the ballast water. Proper storage and handling is critical to the operation of systems employing total residual oxidant (TRO).

Another major takeaway from the workshop was the importance and necessity of maintaining an effective training strategy to ensure crew members can operate these systems properly and safely. Improved training methods and system manuals will decrease the number of issues that stem from operational errors.

"This comprehensive report, based on feedback from our workshop, is an important assessment of the readiness of industry when it comes to ballast water compliance," said ABS Director for Environmental Performance Thomas Kirk. "It is important that the practices which are being used successfully by some vessel owners are shared with others in the industry."



Ecochlor Receives USCG Type Approval

Ecochlor's patented BWTS has received USCG Type Approval. The Ecochlor BWTS uses a two-step process that includes filtration and treatment with chlorine dioxide (ClO₂). It is designed to be effective on all aquatic invasive species regardless of water turbidity, salinity or temperature. The Ecochlor System provides shipowners with several unique features. One of these is low power consumption, perhaps the lowest in the industry. Typical power requirements for the Ecochlor System treating a total flow rate of 8,000 m³/hr is 12 kWh, with maximum requirements reaching only as high as 35 kWh. Another important feature of the Ecochlor System is a small footprint, which makes it space efficient, even for larger capacity systems. The BWTS offers a modular approach providing further flexibility in tight spaces.

Optimarin Demos

In the same week that a report from ABS revealed problems with almost half of installed ballast water treatment (BWT) systems, Optimarin gave a demonstration of its long-term system reliability on board Neptune Subsea's IMR vessel Larissa (pictured below). Optimarin has installed more than 300 of its systems worldwide, with more than 500 units ordered. The 334 cu. m. capacity system onboard the SX130 Ulstein design Larissa was one of the first, installed during its construction by Zhejiang Shipbuilding in 2010. Since that point it has only seen 140 hours of operation.

Given its prolonged idle time, Per Ivar Fagervoll, CEO of Golden Energy Offshore, which manages the ship for owner Neptune, thought Optimarin may have had work to do when it visited Larissa during a recent stop in Stavanger. This wasn't the case.

"We took over full technical and commercial management of Larissa and sister vessel Despina in late 2016," he notes. "Since delivery Larissa has been working consistently for super majors in the North Sea and West Coast of Africa. However we, and the previous ship managers, haven't really needed to run the BWT system."



"So when the Optimarin team came on board we thought it might have issues. Little did we know... the guys pressed the 'start button' and it came into action immediately - smooth operation and no problems at all. Considering its history we thought this was amazing. It's great for an environmentally focused service provider like Golden Energy Offshore to know that we have such compliant, effective and reliable systems available to satisfy all regulatory and customer requirements."

www.optimarin.com

Saudi Aramco Selects CTG

Saudi Aramco selected Chelsea Technologies Group (CTG) to provide benchmark testing for compliance with ballast water standards. This follows Saudi Aramco's announcement that all ships calling at its ports and terminals will be required to provide ballast water samples, in order to demonstrate compliance with the International Maritime Organization's (IMO) Ballast Water Management Convention (BWM Convention). TG's FastBallast portable ballast water analyzer has been chosen by Saudi Aramco and will be deployed as a benchmark testing device to conduct spot checks on indicative sampling undertaken by third-party sampling companies. Fast-Ballast was selected following a detailed technical review conducted by Saudi Aramco's in-house marine biology experts. Saudi Aramco ports and terminals are a high receiver of ballast water from ships, with over 180 million tons of ballast water discharged during cargo ops every year.

Bollfilter Nordic Prevails

According to Bollfilter, an arbitral award recently rendered has dismissed OceanSaver AS', Norway, claim for compensation against Bollfilter Nordic ApS, Denmark. In 2013, OceanSaver AS initiated an arbitration case in Denmark against Bollfilter Nordic ApS, claiming that Bollfilter Nordic ApS had delivered defective filtration machines with wire mesh filters to OceanSaver AS in 2010/2011.

The filtration machines, developed and manufactured by German Boll & Kirch Filterbau GmbH, were included in OceanSaver AS' BWTS sold by OceanSaver to ship yards in South Korea and China. Following installation, the filtration machines did not function properly, and OceanSaver AS claimed that this owed to defects in the filters, and that Bollfilter Nordic ApS had acted with gross negligence. Bollfilter Nordic ApS, on the other hand, claimed that the filtration machines had been thoroughly tested and were fully functional, and that the problems encountered were attributable to other factors, including inadequate piping on board the vessels.

After 4 years the arbitral tribunal decided in favor of Bollfilter Nordic ApS. The tribunal dismissed OceanSaver A/S' claim in its entirety, and OceanSaver AS was ordered to pay all arbitration costs and Bollfilter Nordic ApS' legal costs.

Evoqua Revamps SeaCURE BWM System

Using the same approved electrochlorination technology, Evoqua Water Technologies has remodeled its SeaCURE ballast water management system to provide optimum high flow rate performance from what is now one of the smallest electrochlorination system on the market. Introduced during the Nor-Shipping 2017 exhibition and conference, the next generation SeaCURE System is a skid-mounted, plug-and-play ballast water treatment system that is 76% smaller and 85% lighter than earlier generations of the system. Speaking at the introduction, Matt Granitto, business manager for Evoqua's ballast water business, said, "Without reducing the high flow rate capacity of the existing SeaCURE system, we have dramatically reduced the number of components to create a modular system mounted on a 2m x 1.5m, easy to install skid. It is one of the smallest ballast water management solutions available capable of treating flow rates of up to 6,000m³/h. I don't think anyone can treat the flow rates we can in the space we can."

Guam Bolsters Oil Spill Recovery Capacity

Lamor recently commissioned its LSC 4C Side Collecting Oil Skimming System for Guam's Oil Spill Response Operations Company (OSROCO) and T&T Marine Salvage (T&T) making it the largest skimming system in the region. OSROCO, a wholly owned subsidiary of Cabras Marine, and T&T operate the skimming system as well as an array of small crafts, and other specialized response equipment. OSROCO, Cabras and T&T employees are trained and certified in accordance with the U.S. Federal Government's oil spill response and safety standards. Additionally, the companies' comprehensive spill response program focuses on safe and compliant on-water operations for prevention, containment and protection of oil and fuel spills. The LSC 4C Side Collector is permanently mounted to the dedicated response barge Tabangao, increasing the region's Estimated Daily Recovery Capacity (EDRC) by an additional 12,000 bbls per day. The barge was recently overhauled by Cabras Marine Corporation's Ship Repair Facility. The barge will store approximately 4,700 bbls of recovered product in the event of a spill.

www.cabtug.com • www.teichmangroup.com • www.lamor.com



Lamor



Thordon Bearings

COMPAC Bearings

Thordon Bearings' distributor Coppedge Marine secured an order with Tropical Shipping for the COMPAC seawater lubricated propeller shaft bearing system. The COMPAC systems destined for two 300TEU box ships under construction in China, at the Guangzhou Huangpu Wenchong Shipyard, will represent a first reference for COMPAC with this ship owner. In addition to the COMPAC polymer bearings, the Tropical Shipping package includes Thordon's Inconel-equivalent shaft liners, Thor-Shield shaft coating systems, Thordon Water Quality Packages and a wear down poker gauge assembly.

Tropical Shipping's new vessels will form part of a wider fleet expansion program designed to improve service levels between West Palm Beach, Fla., Halifax, Canada and the Bahamas and Caribbean.

www.thordonbearings.com

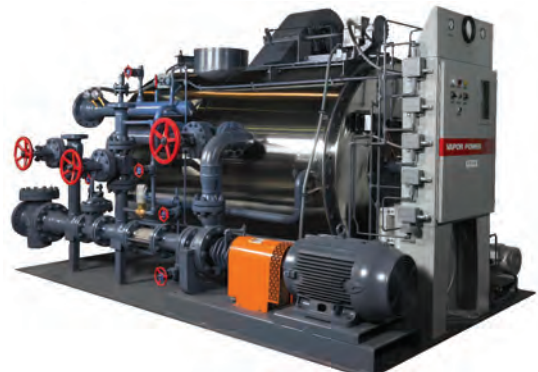


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Plasma Beveling

ESAB Welding & Cutting Products introduces the DMX Automated Plasma Beveller, a next-generation beveling system delivering significant performance improvement through a simple, compact design. The DMX Beveller provides high reliability, enhanced safety and ease-of-use. It cuts the full range of weld preparations, including V, Y, X, and K bevels, with cut angles up to 45° on materials up to 50 mm (view DMX video).

www.esab.com



Laborde Products

Vapor Power Heater

Vapor Power heaters are ASME, ABS and USCG approved. Computer simulation is available to size the perfect heater for your barge, achieving the highest efficiency possible so you don't buy more heater than you need. Standard skid package arrangements can be customized to fit the exact space requirements of any application including the retrofit of older heaters.

www.labordeproducts.com



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The MobileOps Platform is a cloud-based subscription solution that includes both a Web Application and an offline-capable iPad application called Voyager. The Voyager app allows data to be input, stored, and then synced with the MobileOps Platform once within cellular range, allowing for seamless and efficient communications with shoreside personnel.

<http://www.mobileops.co>



Argonics

Argonics and Cast Polyurethane Parts for Maritime

Although ship and boat building design engineers have traditionally specified parts made of rubber, plastic or steel when durability is required, many are considering a new alternative for the most demanding, high-wear, abrasion and impact applications: cast polyurethanes.

Cast polyurethanes, also broadly referred to as urethanes, are tough, elastic materials that combine many of the performance and ceramics along with the resiliency and flexibility of rubber parts and are ideal for ship/boat building components.

Urethanes can be poured as a liquid mixture into less expensive, low pressure molds. Using this technique, complex mold cavities can be filled without high-pressure molds and presses.

This provides a multitude of advantages, not the least of which are lower tooling and production costs than both rubber and plastic molding.

One does not simply specify a polyurethane part, for example. There are many formulations – some proprietary – that can be used to manipulate a range of variables such as hardness, resiliency, spring rate, and chemical resistance.

For this reason, ship/boat building design engineers interested in a possible switch to polyurethane from plastics, steel, ceramic or rubber parts are often best served by seeking out the assistance and guidance of experts in urethane formulation.

www.argonics.com



Buzby



Ljungström



Damen CEO René Berkvens (left) receives a CEMT award from CEMT Chairman Trevor Blakeley.



Deschenes



Lawson

Buzby Sworn In

Rear Adm. Mark H. Buzby, USN, Ret. has been sworn in as the Administrator of the Maritime Administration by U.S. Secretary of Transportation Elaine L. Chao. Prior to his appointment, Admiral Buzby served as president of the National Defense Transportation Association (NDTA), a global association of transportation and logistics professionals.

A career Naval officer with over 34 years of service, Buzby has an extensive background in maritime transportation and leadership, having served on the staffs of the Sixth Fleet, the U.S. Fleet Forces Command, the Navy staff, and the Joint Staff. Prior to his retirement from the U.S. Navy in 2013, Buzby served as the Commander of the Military Sealift Command (MSC) from October 2009 to March 2013.

Volvo Penta Names Ljungström VP

Lars Ljungström has been appointed to vice president of finance and chief financial officer (CFO) for Volvo Penta of the Americas, effective July 2017.

Damen CEO Receives Award

The Council of the Confederation of European Maritime Technology Societies presented Damen CEO René Berkvens with the CEMT Award. The Council bestows the award annually in recognition of the substantial contribution made to the success of the European maritime industry by an individual, company or organization. Berkvens received the award in recognition of his leadership of Damen and the contribution this has made toward the successes of the European maritime sector.

Deschenes Joins Bouchard as VP

Bouchard Transportation Co., Inc. said that Christopher Deschenes has joined the company as Vice President of Maintenance and Repairs. Prior to joining Bouchard, Deschenes served as a Project Engineer with Overseas Shipholding Group, Inc. as a member of the Worldwide Technical Service Group, supporting all new construction and capital projects for the foreign and domestic OSG tanker/ATB fleet.

Bekkenes Steps Down from Palfinger

Styrk Bekkenes, President of Palfinger Marine, has stepped down from his position, leaving the helm to his successors. Coming from the role of CEO of Harding Safety, Bekkenes has been the President of Palfinger Marine since January of this year.

Lawson Joins Bristol Harbor Group

Naval architect Ian Lawson has been hired to join the naval architecture and marine engineering practice of Bristol Harbor Group, Inc. (BHGI). Lawson holds a B.S. in Naval Architecture & Marine Engineering from Webb Institute, where he served as Class President and Honor Council Chairman, and participated on the Education Committee, sailing team, jazz band and choir during his time at Webb.

World Marine Divests Shipyard

World Marine, LLC completed a transaction divesting its Pascagoula shipyard on August 15, 2017.

World Marine purchased the assets

of Signal International in December of 2015, including shipyards in Pascagoula, Miss., and Mobile, Ala. World Marine's Pascagoula shipyard historically focused on offshore rig repair and conversions.

With the sustained reduction in rig repair work resulting from the downturn in the offshore oil exploration market, World Marine made the strategic decision to sell the Pascagoula facility. This divestiture will allow World Marine to focus exclusively on activities in its Mobile, Ala. facility.

Voith Opens 'Digital Campus' in U.S.

Voith recently opened the Digital Campus, the latest venture of the Voith Digital Solutions Division (DS): a campus where bright minds come together to learn, teach, discover and bring the Internet of Things to life for all of Voith's platforms.

Raleigh, being a geographic hub for research and technology, was chosen to be Voith's North American digital hub for the team there to lead the way for digitization and innovation.

Detyens: International Repair Work on the Rise

Detyens Shipyards, Inc (DSI) in Charleston, S.C. reports an increase in the number of dry dock inquiries and bookings from international vessel operators. "In the last two quarters, we've dry docked eight internationally owned and operated vessels," said Peter Browne, Vice President of Estimating.

As such, Marine Atlantic, Inc. and Bay Ferries Limited recently dry docked two ships each at DSI. Marine Atlantic, who first dry docked at DSI in 2015, dry docked the Atlantic Vision in March followed by the Highlanders in April. Atlantic Vision and Highlanders project manager for Detyens Shipyards Can "Johnny" Yazgan, "We had limited days in dry dock due to our dry docking schedule, so every minute counted and we worked around the clock to complete the work so they could depart on time." Regular routine maintenance was performed on both vessels along with parking deck coatings, propeller and hub work, ramp work, and paint, lots of paint. Ian McDonald, Director of Technical Services at Marine Atlantic said, "The Atlantic Vision sailed away from the drydock with only 18 days in the

dock (as scheduled) and a very fine job has been done."

Bay Ferries Limited whose international trading vessels have dry docked at Detyens Shipyards in past years recently dry docked the Fundy Rose in January and in April, the chartered Alakai "The Cat", which is owned by MSC and is U.S. flagged. "We understand that there was a scheduling conflict that arose and we were lucky enough to have availability for the Fundy Rose in January," said Dockmaster John Lyons. The Fundy Rose and Alakai both received underwater coatings, regular routine dry dock maintenance, and ramp and door work on the Fundy Rose. This is the second time the Alakia has dry docked at DSI. "The first time we dry docked the Alakai, we completely changed her exterior paint scheme and we very proud of how she looks," said Chris Donathan project manager at DSI. Gerry Stevenson, Technical Manager with Bay Ferries Limited said, "We've been coming to Detyens since January 1999 with the internationally trading vessel we operate and we have never been let down, no matter how difficult the circumstances Detyens always come through."



Photo: Detyens Shipyards, Inc.



Cammell Laird chief estimator Jim Clark.

Clark Celebrates 60th

Cammell Laird Chief Estimator Jim Clark, 76, has become one of the U.K.'s longest serving Chief Estimators after clocking up 60 years' in the ship repair industry and delivering more than 11,000 projects. He has delivered estimates for shiprepair projects worth circa \$130 billion in today's currency, and his influence at Cammell Laird has also been credited for helping secure the biggest shipbuilding project in the U.K. for a generation, the \$194 million Sir David Attenborough polar research vessel, currently under construction.

"There are immense complexities within the role of a Chief Estimator who essentially needs to prepare quotes at a lower cost than competitors, most likely within a shorter time period, while most importantly retaining a margin of profit," said Cammell Laird chief executive John Syvret. "We are very fortunate to still have Jim driving our Estimations Department. The shipbuilding industry is world renowned for its unpredictability and turbulent nature, but despite this, throughout his 60 years' of service Jim has only ever been out of work for a fortnight."

Clark started his career at Grayson Rollo & Clover in 1957 embarking on a five-year mechanical fitting apprenticeship.

In 1975, he was offered a Chief Estimators position at Blue Star Line, a role which he enjoyed for nine years before being offered a position at the firm's head office in London. However, he chose to remain in Merseyside and join a young, vibrant company called Seaforth Welding in 1984.

After Seaforth Welding closed its doors in 1986 Jim moved back to Birkenhead and Wright & Beyer later acquired by Cammell Laird Group PLC, which fell into administration following a down period for the company. Clark then took up a position at Northwestern Shiprepairers and Shipbuilders Ltd where he has remained for the last 17 years as the firm reemerged as Cammell Laird Shiprepairers and Shipbuilders Ltd.

"I have thoroughly enjoyed every step of the journey, and each and every company I have been involved with throughout my 60 years of work," said Clark. "The maritime industry is my passion and I have been able to fully immerse myself in it ever since I was an apprentice."

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Top Owner Nations by Fleet (Value \$bn)



Rank	Country	Number of Vessels	Total
1	Greece	4,553	\$95.7
2	Japan	4,265	\$86.2
3	China	4,896	\$74.0
4	United States of America	2,748	\$47.6
5	Singapore	2,814	\$42.7
6	Norway	1,799	\$41.0
7	Germany	2,816	\$34.4
8	United Kingdom	1,019	\$24.1
9	Denmark	1,044	\$23.0
10	South Korea	1,488	\$21.5

Top Danish Owners (Value \$bn)



Country	Number of Vessels	Total
Maersk Group	431	\$14,429
Torm	75	\$1,222
Celsius Shipping	40	\$898
Norden	47	\$860
Malt LNG	6	\$840
Others	445	\$4,716
Grand Total	1,044	\$22,965

Danish Fleet Age Profile

Age Group	# of Vessels	Value \$ m
On Order	88	\$4,136
0-4	177	\$8,527
5-9	313	\$6,381
10-14	227	\$2,826
15-19	130	\$879
20-24	45	\$154
25-29	25	\$42
30-34	17	\$14
35-39	6	\$2.5
40-44	5	\$1.4
45-49	5	\$1.0
50-54	2	\$0.1
55-59	3	\$0.1
65-69	1	\$0.1
Grand Total	1,044	\$22,965

Danish Purchase History



The Danish Fleet



	Live		On Order		Total Fleet	
	# of Vessels	Value \$ m	# of Vessels	Value \$ m	# of Vessels	Value \$ m
Bulker	111	\$1,411	11	\$247	122	\$1,658
Tanker	327	\$4,649	33	\$1,140	360	\$5,789
Container	237	\$6,748	24	\$2,326	261	\$9,074
Small Dry	79	\$330	13	\$118	92	\$448
LPG	44	\$825	2	\$112	46	\$937
LNG	6	\$840	-	-	6	\$840
Multigas	8	\$441	-	-	8	\$441
OSV	121	\$591	5	\$193	126	\$784
MODU	23	\$2,995	-	-	23	\$2,995
Grand Total	956	\$18,829	88	\$4,136	1,044	\$22,965

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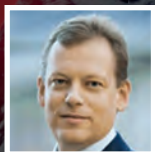
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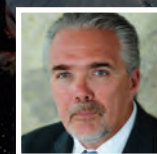
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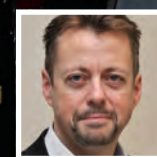
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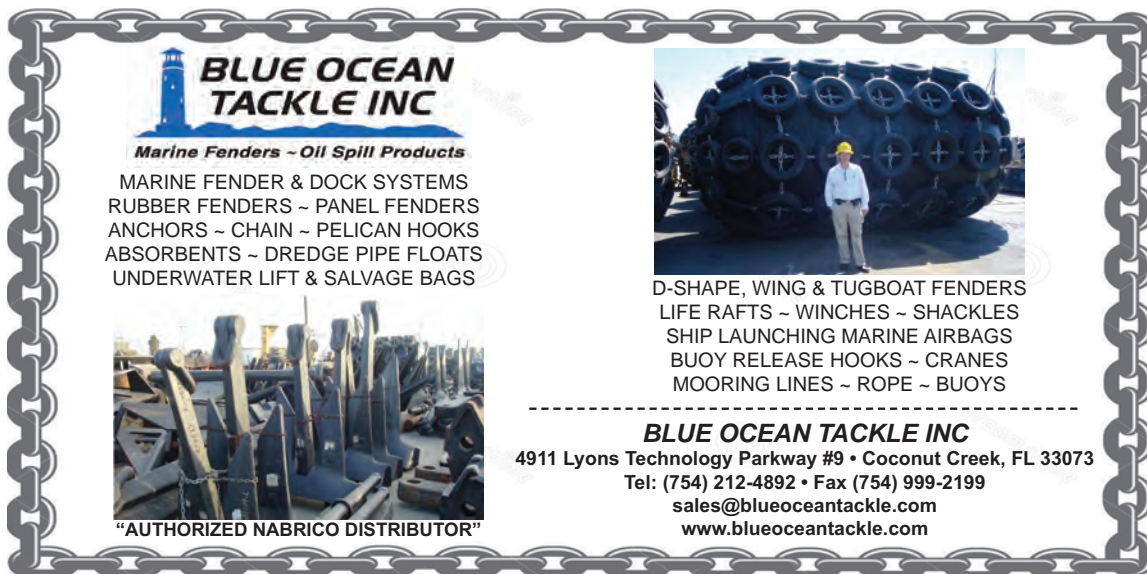
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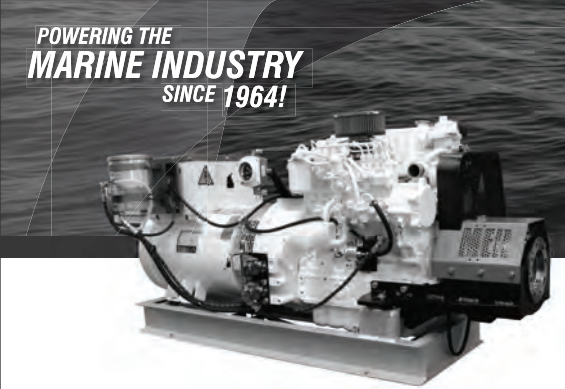
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