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Shipbuilding's Upswing

NASSCO's Parker Larson Talks LNG Ships

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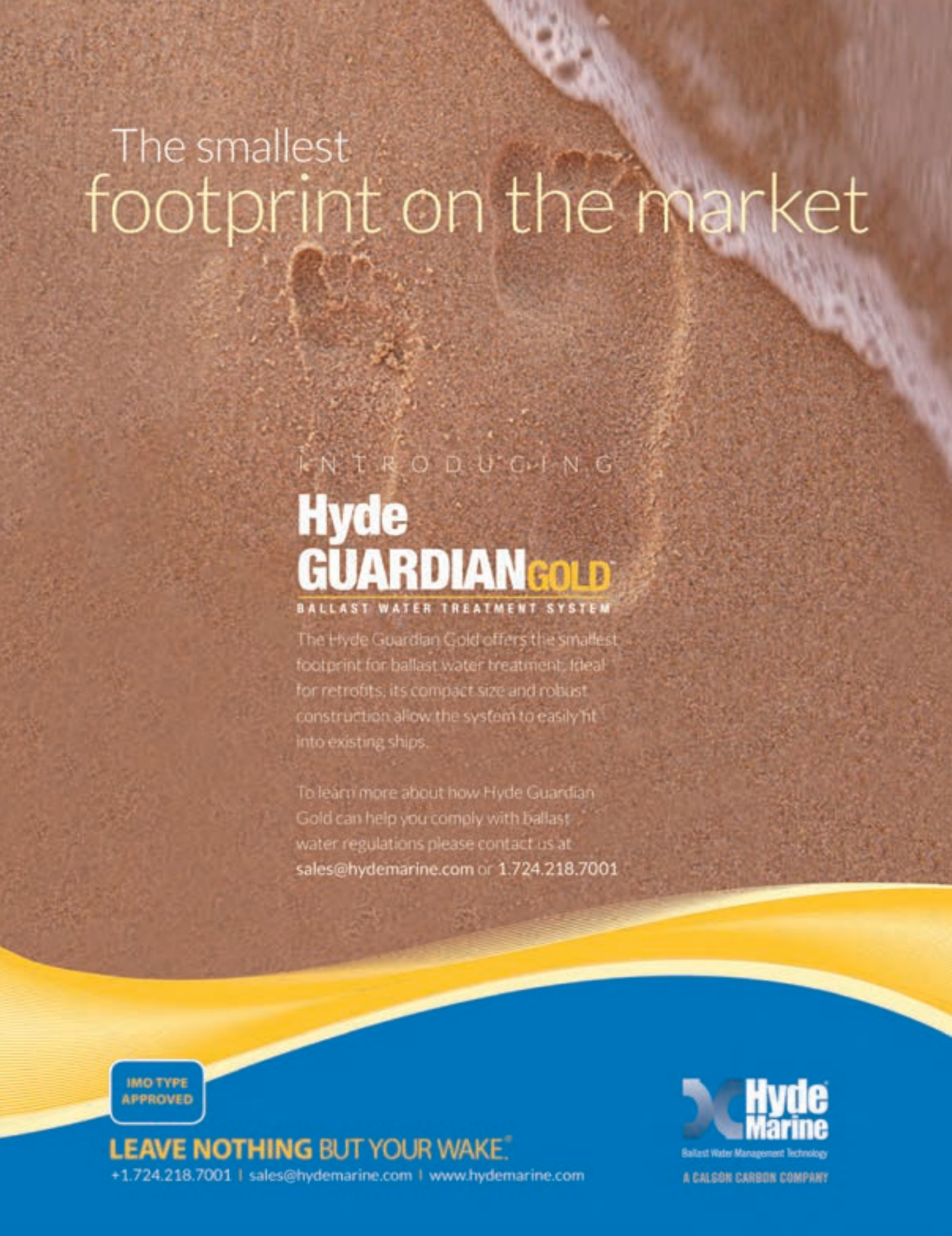
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(Source: Tanker "AFRODITE" by Christina Sun)

ON THE COVER

Parker Larson, the new Director of Commercial Programs at General Dynamics NASSCO, is directly involved in the transformation of NASSCO's business model for commercial new construction. MarPro convinced him to slow down in December, if only briefly, to get his take on all things shipbuilding. **p. 20**

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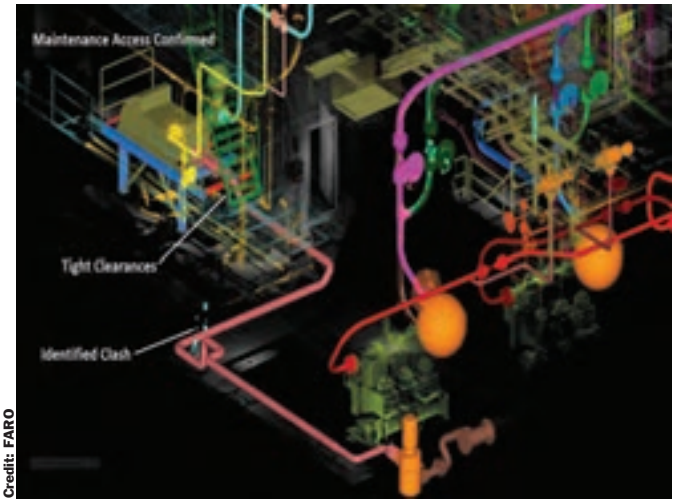

Credit: FARO

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3D Laser Scanning is helping maritime designers and builders with efficiency gains.

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GTT: The membrane solution for LNG as a fuel

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Aker Rhymes with "Soccer"

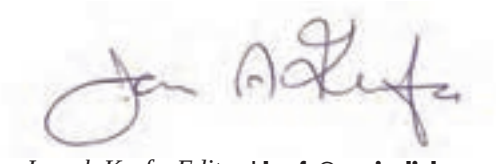
In an extraordinary end to an unusually buoyant year for U.S. shipyards, a flurry of new blue water, commercial orders flooded into Tier I shipbuilders in the 4th quarter of 2013. As the year comes to a close, the biggest problem facing U.S. builders was solving the quandary of how to find, train and ultimately retain qualified shipfitters to toil on the vessels sitting on those fat backorder books. While these are nominally 'good' problems to have, they are problems nonetheless. Industry is, nevertheless, finding imaginative ways to adapt existing human resources models as a way to cope. Within the pages of this edition, you'll find out how and why.

Small and large, brown water or blue water, East Coast, West Coast and Gulf Coast, everyone is busy. And, while the newbuild and replacement work going on in the OSV and inland sectors was perhaps easy enough to predict in a rebounding economy, the blue water commercial revival was not. U.S. yards are now accomplishing the seemingly unthinkable: flourishing in an environment that does not necessarily include a steady diet of government, Coast Guard and/or Navy hulls.

Leading the charge to redefine American shipbuilding is Aker Philadelphia Shipyard and its youthful CEO, Kristian Rokke. Riding an enviable backlog of pure commercial, deep draft hulls that stretches all the way to 2018, Rokke and his management team are not resting on their laurels. Nor have they forgotten from where they came: the nadir of 2011, when their total workforce shrank to just 300 employees. The completely modernized shipbuilder – already negotiating for more options with existing customers – has succeeded in this location where others could not. Utilizing innovative partnerships, public/private financing and profit sharing deals, Aker gladly shares risk with closely aligned customers. Arguably the model for the market that it serves, the story of Aker's remarkable resurgence begins on page 32.

Perhaps more interesting than the shipbuilding revival itself has been the seed from which the entire upswing has emanated. The so-called 'shale boom' and the supercharged energy production of the lower 48 states has changed not only global shipping patterns, but also redefined demand for U.S. tonnage in any number of vessel categories. Within these pages, Barry Parker's simultaneous look at energy and shipping explains how the equation of the energy transportation business and the countless variables that form the sum of its whole, are changing.

Finally, I can't look at success and the maritime markets without also noting that this edition marks our third full year of publishing *Maritime Professional* magazine. Our fully audited subscription list, coupled with the Web site of the same name, combines with our in-depth coverage to create industry's best business journal. As we tackle the most interesting and compelling aspects of today's maritime markets, I'm also mindful that we need to raise the bar even further. That we have the opportunity to do that is in large part due to the support and input of readers – like you. Join us in 2014 for more of the same.



Joseph Keefe, Editor | **keefe@marinelink.com**

THE LIST People & Companies in This Edition

Insights

Energy & Shipping

With "America's Energy Renaissance" oil trade patterns are changing. The impact is far reaching, but not easily defined.

By Barry Parker

Ship spotters around the Hudson River, which snakes north from New York towards Albany, have been abuzz since the middle of the year when the medium range (MR) tanker Afrodite, owned by Tsakos Energy Navigation, has been sighted regularly. The 2005-built 53,000 deadweight vessel commenced a two-year charter to Irving Oil, at a rate of $16,000/day, topped off by a profit-split. The Afrodite, along with a sister vessel, are hauling crude oil produced in the Bakken fields, in North Dakota. Since U.S. producers are not permitted to export crude oil, the limited quantities sent to Canada are one exception granted by the U.S. Department of Energy.

Along the U.S. Gulf Coast, around Corpus Christi /Aransas, the seascape there has also changed; tanker watchers have seen hordes of vessels lining up, waiting their turn to load cargoes of refined products destined for Europe and South America. As pipeline expansions and re-routings bring crude oil into Corpus and Houston, inbound capacity grew by nearly 1.5 Mbd in 2012 and 2013, according to RBN Consulting, based in Houston. These consultants anticipate a further growth of 1.9 Mbd in 2014 – 2015, much coming from the Eagle Ford and Permian Basins in Texas.

Symptomatic of all the optimism is a move by oil trader Trafigura, which recently announced plans to spend $500 million to increase capacity at its export docks at Corpus Christi, in conjunction with the conversion of a gas pipeline by Energy Transfer Partners that will move 100 Kbd to the port from Eagle Ford – some 80 miles inland.

Game Changer

Words like "game changer," "tectonic shift" and "new paradigm" have all been applied to developments that were underway, albeit under the radar, in late 2009, as energy prices ratcheted upwards, following the financial upheavals of a year earlier. Simply put, at sustained oil prices above $80/barrel, recently fine-tuned hydraulic fracturing technologies and enhanced horizontal drilling capabilities have enabled extraction of oil and gas from "tight" rock formations including shale.

The Energy Information Administration (EIA), part of the U.S. Department of Energy (USDOE) said, in a report released in mid November, "U.S. crude oil production averaged 7.7 million barrels per day (bbl/d) in October. Monthly estimated domestic crude oil production exceeded crude oil imports in October for the first time since February 1995, while total petroleum net imports were the lowest since February

Medium range tanker Afrodite has created a buzz, as it has been sighted regularly along the Hudson River. What's the excitement for a 2005-built 53,000 dwt ship? It has commenced a two-year charter to Irving Oil, at a rate of $16,000/day, topped off by a profit-split, hauling crude oil produced in the Bakken fields, in North Dakota.

(Source: Tanker "AFRODITE" by Christina Sun)

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1991." Enhanced drilling and hydraulic fracturing have made this possible. Crude oil produced in Eagle Ford reached 400 Kbd barrels/day by late 2013 - more than double its levels of two years ago. In November, the USDOE was forecasting that crude produced in the Bakken region would exceed 1 Mbd, nearly triple the pace of 2011. The USDOE added, "EIA forecasts U.S. crude oil production will average 7.5 million bbl/d in 2013 and 8.5 million bbl/d in 2014."

The International Energy Agency (IEA), representing a consortium of developed countries, looks for the U.S. oil (including gas liquids and condensate) production to reach 11.6 Mbd in 2020 (compared to 9.2 Mbd in 2012), exceeding that of Saudi Arabia. During the upcoming decade, China is forecast to become the world's largest oil importer. But, what does all of that actually mean?

Energy's Net Impact

Participants in the maritime business, ranging from fuel traders to ship spotters, have seen a multitude of impacts. Increased U.S. oil production has already led to reduced imports of crude oil; most dramatically, imports of crudes from West Africa (the same type of "light" oils characteristic of shale oil) have been reduced. These shipments (typically moving in Suezmax or VLCCs, have instead moved to Europe and Asia. VLCC shipments inbound from the Middle East (except for Saudi Arabia) have also declined. Imports into PADD 3 (the U.S. Gulf Coast) have dropped from a high of 7.9 Mbd in June 2005 to as low as 3.9 Mbd in February 2013. As imported oil has become more attractively priced (with a falling Brent – WTI spread), imports into PADD 3 rose up to 4.9 Mbd later in 2013.

Since 2005, product imports have fallen from 4 Mbd down to a rate of 2 Mbd. Exports have risen from around 1 Mbd to 3.3Mbd, as the U.S. has become a net exporter of products.

Perhaps the most vivid glimpse into the changing trades can be seen in the North Atlantic marketplace for MR tankers hauling refined products. Two important routes, Rotterdam/ New York and Houston / Amsterdam are both widely followed and closely analyzed by oil traders and shipowners. In the past two years, PADD 1 (East Coast) products imports have fallen from 1.6 Mbd down to 0.8 Mbd, while exports (llargely from PADD 3 representing the Gulf Coast) exports have risen from 1.5 Mbd to nearly 3.5 Mbd.

The actual time charter equivalent (TCE) hires experienced by operators of vessels in these trades have mirrored the USDOE statistics. Using calculations provided by the Baltic Exchange, which evaluates these routes (and many others) on a daily basis, shown in the graph, daily hires for the Rotterdam / New York route, with gasoline as the main cargo, have fallen steadily in 2013. The route now described as "the new front-haul" for such vessels, exports of diesel from Houston and Corpus Christi, to Amsterdam, has seen rising hires throughout the year. Indeed, it has bolstered the daily posting on the Baltic Exchange's "MR basket" for a notional tanker making 14 knots on 36 tons /day of IFO consumption. Industry analysts estimate that daily results for "Eco-tankers" would likely be around $3,000/day higher. For example, if the Baltic basket shows $22,000/day, a 2013 built Eco-tanker (which would consume far less fuel) would likely return $25,000/day to its owners.

Without a doubt, the Energy Renaissance has, in part, also fueled the robust rebound of domestic, commercial blue water shipbuilding. And not a moment too soon. Sequestration fears have some big shipyards scrambling to shift their government backlogs to something a little more balanced. But, the current situation belays the notion that U.S. yards cannot survive without a steady diet of Navy and/or government work. Beyond this, the energy renaissance has some Jones Act freight rates soaring to record highs. For the time being then; so far, so good.

Unanswered Questions

Energy issues and attempts at forecasting go hand in hand; a number of important issues- with an unpredictable locus of geopolitics, environmentalism and economics are looming in the future. Though this article has emphasized the here and now – with a focus on movements of refined petroleum products, natural gas (found alongside crude oil and condensates in shale formations) is also part of the story. Beginning as early as 2016, the U.S. will begin exporting LNG from a handful of newly approved terminals in the Gulf Coast. Observers should be watching the willingness of the USDOE to continue granting approvals for exports, as well as the efforts of domestic consumers of natural gas (led by chemical producers who benefit from its availability and low price) to stymie continued export growth. Some twenty additional applications are said to be in the works.

Other questions worth asking concern crude oil exports – presently prohibited (unlike refined products such as diesel fuel and gasoline), with a handful of exceptions. The American Petroleum Institute (API), a trade association led by major oil companies, has publicly stated that it supports a fresh look at the applicable rules, and will be aiming for the elimination of restrictions on exports of crude oil. But, loosening crude oil export controls could also have the unintended effect of ending the most pronounced U.S. domestic shipbuilding cycle in three decades.


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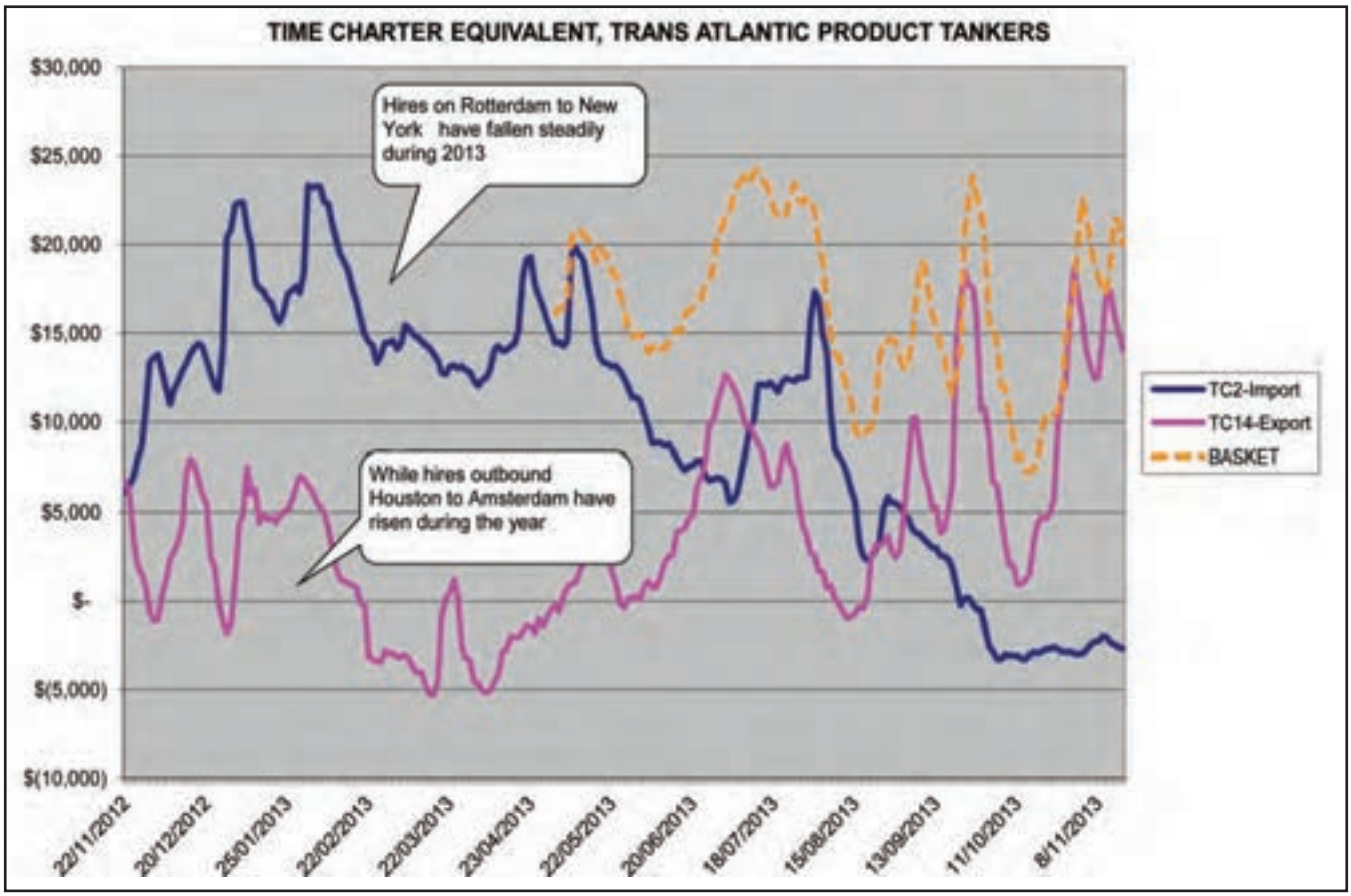
Aker Shipbuilding CEO Kristian Rokke, for example, embraces the "direct exposure to the shale boom and … the risk/reward of the investment."

Any loosening of crude oil export limits and/or a softening of the Jones Act would therefore likely spell an end to the kinds of creative newbuild deals emanating from Aker that also help to sustain the current shipbuilding boom. A variation on this approach is the suggestion that the U.S. export light crudes (produced from shale), in an agreed swap for supplies of heavy crudes- suitable for many U.S. refineries.

Tanker trade patterns over a longer period are also highly uncertain. Attendees at numerous industry events and symposiums have heard that product movements are set to grow, which in the short term, appears to be the correct call. Over time, as drilling techniques successfully finetuned in North America spread across the globe, major "importers," notably China, thought to be a big component of VLCC demand in the coming decade, may have their own versions of the Energy Renaissance. Likewise, LNG trades may be impacted by vast amounts of shale gas thought to exist in China, but also in Algeria and Argentina.

Another set of questions, presently without real answers, concerns the move of offshore oil exploration and production into deeper waters. Like "tight oil," tapping offshore reserves becomes economical at higher oil prices. But, with vast new hydrocarbon supplies available onshore, will moves into inhospitable regions (for example, the Arctic reaches) and ultra-deep waters continue to be viable? And, if not, is the OSV building boom for the expected deepwater play also sustainable? And, of course, the big elephant in the room is the price of crude oil – with futurists wondering what might happen in the event of a prolonged lowering of the prices across the entire hydrocarbon barrel.

In the end, there will be benefactors and casualties as the ultimate outfall from "America's Energy Renaissance." More immediately, it is changing the equation of the energy transportation business and the countless variables that form the sum of its whole.



Source: BDP1 Consulting

Insights

Maritime M&A: Financial Crisis to Present Day

Why the wild ride for company valuations?

By Harry Ward

The financial crisis and global recession that began in 2008 had a major impact on almost every major world industry. Its effects can be examined by analyzing historical data and trends for the highly cyclical maritime industry, including both public company values and mergers and acquisitions (M&A) transaction records. All major stock indices and deal metrics fell in concert at the outset of the crisis, which is usually marked by the collapse of Lehman Brothers on September 15, 2008. Over the ensuing five years, individual segments such as ocean shipping, marine terminals and offshore service vessels experienced varying market fluctuations and recovered at different rates for different reasons.

Boom to Bust

Figure 1 shows the effects of the crisis as the boom turned to bust from 2007 to 2009, with decreasing M&A deal flow and overall reduced company valuations. The red numbers on the graph in Figure 1 represent the average multiple of operating earnings, or EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) for each year. The *EBITDA* multiple enables us to compare transaction values by adjusting out non-cash items such as depreciation, and financial variables such as interest payments that can change from buyer to buyer.

Until late 2008, the deal environment was decent, with deals such as **Maersk Tankers**' $1.3 billion acquisition of Swedish **Brostrom AB**. At the time, Maersk CEO Nils Smedegaard Andersen was cited as saying that A.P. Moller-Maersk A/S was ready to grow via acquisitions of shipping companies. However, by the middle of the following year, stock prices had dropped across the board and Maersk fell 60% from its 2008 high to 2009 low.

Market dysfunction caused by the financial crisis resulted in a very low number of maritime deals in 2009, of which many were marked by relatively low valuations. In March of 2009, the **Dow Jones Shipping Index** (see Figure 2) hit a low EBTIDA multiple of 2.8X, meaning that the collective average multiple for the public companies that constitute that particular Dow index were trading at that low valuation. Later in the year, **Araltec SL** of Spain bought a $112 million stake in **Kirby Corporation (NYSE: KEX)** at an opportune time with an EBITDA multiple of 6.7X. Since that time, Kirby's stock price is up 280% and the dominant US inland and coastal liquid product carrier trades today at an expansive multiple of 11.1X EBITDA.

Trending Upward: with caveats …

In 2010, the market began to trend upward in completed deals, and stock prices had begun to rise steadily in anticipation of a market recovery. By Feb 2010, the Dow Jones Shipping Index was up 58% from its low point just a year earlier, and the stocks in the index traded at a very generous multiple of 8.9X EBITDA. The large gyrations evident in Figure 2 show that publicly-traded shares often experience more pronounced swings than those of private companies. Toward the end of 2010, the pace and value of deals had picked up in both large shipping and ports deals. In November, a consortium of investors acquired the **Port of Brisbane** in a $2.8 billion deal with a healthy 16.3X multiple.

Moving into 2011, deal multiples continued to rise overall and we saw a significant jump in the overall weighted average multiple for the year (Figure 1). Much of this was driven by a number of large port and port services deals, including two in Hong Kong and China with multiples north of 40X. A bit closer to home, **Forth Ports PLC** of the UK was acquired by **Arcus Infrastructure Partners** in a $1.3 billion deal that yielded a 14.9X multiple. However, it was during this period that the impact of excessive building and overcapacity in the ocean shipping markets became clear. New ship deliveries that had been booked during the boom in 2007-2008 continued on schedule, despite the slowing recovery in demand for international bulk and container transport. These conditions put pressure on carriers, and we can see a significant drop in the Dow Jones Shipping Index beginning in April, 2011.

Recovery and a Look Ahead

It wasn't until 2012 that the wild market fluctuations began to steady out a bit, though at stock and deal values somewhat lower than pre-crisis levels. From this point, the most noticeable trend is the divergence of company performance and values among the various maritime sub-segments. The sustained separation of public company values in the past few years includes containerships, drybulk, tankers and inland/offshore companies. Energy-focused companies in the inland/offshore workboat market have outperformed all larger shipping segments by a wide margin, while oceangoing tanker stocks have fared better than cargo and bulk carriers.

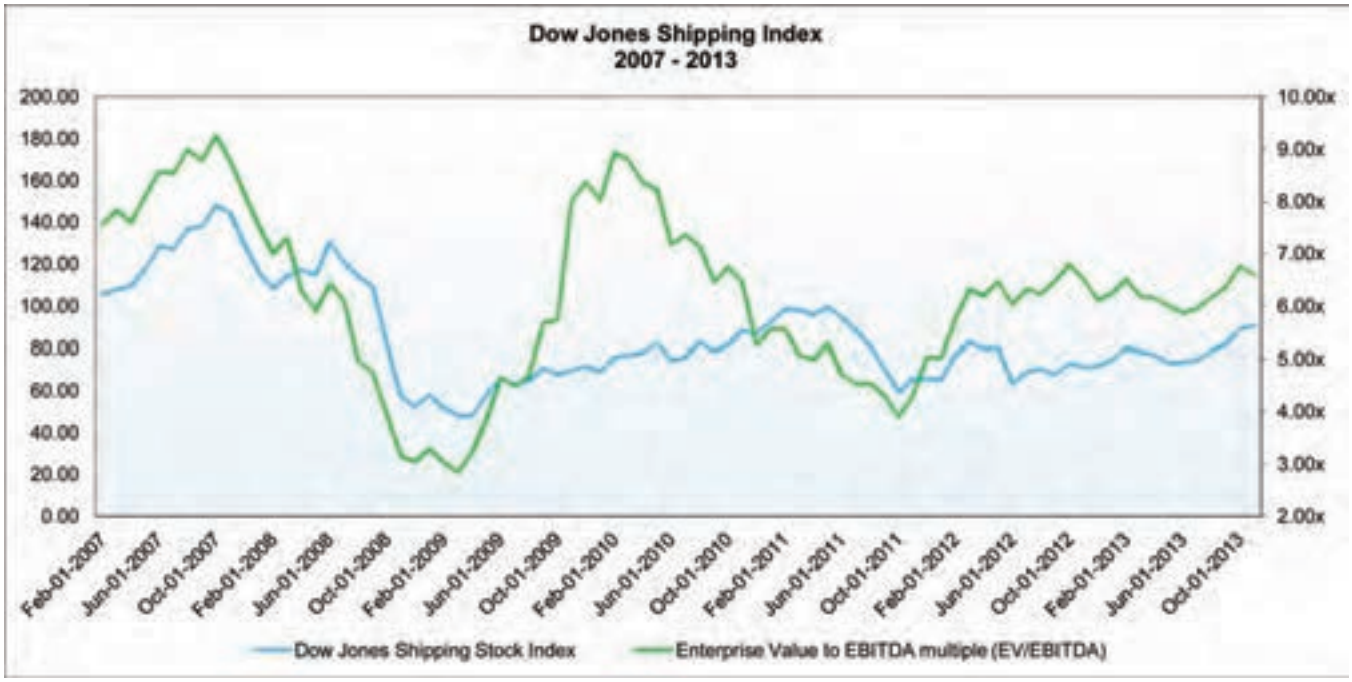
On the acquisition front, **Kirby Corporation** has been the most prominent player in the inland and coastal segment, with six acquisitions since 2008 totaling about $800 million. The most interesting story among the larger carriers has been the

workings of distressed asset investor **Wilbur Ross**. Mr. Ross has set his sights on the shipping sector, having acquired 44% of liquefied gas carrier **Navigator Holdings LTD** out of the Lehman Brothers bankruptcy for $110 million in 2012. He later increased his equity position to 60% of Navigator, which was recently valued at about $1 billion after a successful initial public offering (IPO).

Today, Mr. Ross and other investors see the potential for strong returns in the shipping sector. As the world economy seems to be slowly improving, international trade is increasing and the industry remains very fragmented. Despite poor performance over a longer period, containership stocks have mirrored the strong performance of the S&P 500 in 2013, and dry bulk carriers have bested the returns in all other maritime segments through November. The shale petroleum and fracking booms have driven increased demand for shipping in the US, and Gulf of Mexico oil production continues to drive the offshore market. Barring a major macroeconomic setback, maritime companies and deal flow are poised for a solid showing in 2014.

Figure 1

Figure 2



Insights

When is a Ship Not a Ship

Does your insurance coverage fit your operation?

By Christopher Cooke

No business likes to hear the word "denied" from their insurance company. But when a business purchases an insurance policy, it enters into a contract that carefully outlines what insurance protection is being offered to the business, and what is not. To avoid being caught off guard, it is especially necessary for marine businesses, and those that provide service to them, to make sure their insurance coverage fits their operations, and the scope of work they are providing.

Consider the hustle and bustle of a shipyard operation. It is a facility on or around a waterway, and filled with people coming and going. Some of those people are shipyard employees, others can be the crew of vessels being repaired, and many of the others are the numerous subcontractors performing various operations such as cutting or welding, engine installation and testing, electronics installation, or ship joinery.

To minimize their liability, most shipyards require each subcontractor to maintain liability coverage, and provide a certificate of insurance to assure that those companies or individual contractors working on their premises have the required insurance coverage. Because of the diversity of work being performed on site, how does a business assure that the insurance coverage that they require is the coverage that is really what is need? There are definitely exceptional insurance challenges when working on, or around waterfront – for any type business.

Complex Operations Demand Tailored Risk Assessments

In fact; the uniqueness and complexity of marine operations have prompted very industry-specific tailored insurance coverage(s) to address maritime risks. Contractors providing services to various industries might not be aware of the nuances involved in covering marine risks or might not even consider the work they are doing to be marine-specific. They may also assume that their standard general liability or workers comp policies will respond just fine. These assumptions, however, could prove costly in the event of a claim.

So when is a ship not a ship? Here's an example: A diesel engine manufacturer put engines in a ship being newly built. When the engines are test fired, a cylinder head blows through the engine case and the ensuing fire destroys the ship. The engine manufacturer presents the claim to their Ship Repairers Legal Liability insurer. Ship Repairers Legal Liability coverage provides protection against property damage to vessels in their care, custody and control for the purpose of being repaired. The claim, however, is rightfully declined. Why? According to maritime law, a ship is not a ship until it has launched and put to its intended use (which usually means it has been delivered to the owner). In this instance, this ship was being built and had yet to be delivered, or put to its intended use. Therefore, it was not covered by the Ship Repairers Legal Liability policy. So you need to ask yourself, do you work on new ships being built? Or maybe you work on the occasional diesel truck or crane. Does your Ship Repairers Legal Liability policy have an "Other Work" endorsement, which provides coverage for similar types of work on other than ships? Perhaps you work at other people's repair facilities? Does your Ship Repairers Legal Liability policy have a schedule of premises that coverage is subject to? Does your policy have a "Travelling Workman's" endorsement, which provided coverage for your work at other than scheduled premises?

Defining the Law – and the Risks

Work performed on or around the water often falls into a whole other jurisdiction than many businesses are used to – maritime law. Even though they might not consider themselves marine businesses, if they are working on a ship or near navigable waters, they may very well be considered a marine operation that requires particular marine insurance protection, not offered by standard policies.

Workers compensation coverage offers a prime example. If employees are performing an operation around navigable waters, state-mandated workers compensation would not apply but rather Longshore and Harbor Workers' compensation would. The Longshore and Harbor Workers' Compensation Act (LHWCA), enacted in 1927 provides employment-injury and occupational-disease protection to approximately 500,000 workers who may suffer bodily injury on the navigable waters of the United States, or in adjoining areas. It provides compensation to an employee if an injury or death occurs upon navigable waters of the US - including any adjoining pier, wharf, dry dock, terminal, building-way, marine railway or other adjoining area customarily used by an employer in loading, unloading, repairing, dismantling or building a vessel.

While originally enacted to protect workers engaged in stevedoring and ship building operations, the act has been expanded to encompass nearly any employee or company whose work takes them on "navigable waters." That can include marine contractors, diving contractors, service companies supplying equipment "on the water" and ship repair operations. And, it works entirely different than standard workers compensation coverage. While workers compensation is state

regulated, longshore claims fall under the jurisdiction of the US Department of Labor and more severe penalties and legal ramifications can be imposed for noncompliance.

When working on a vessel, individuals are typically covered with the Merchant Marine Act of 1920, more commonly known as the Jones Act. The Jones Act is a federal act, which provides benefits – similar to Workers' Compensation – to employees who are working on a US-flagged vessel, which can be defined as anything from a small watercraft to a larger tanker.

Specific Coverage

Marine insurers have developed marine general liability coverage for a variety of business risks that are either excluded or under-insured in GL policies. Marine general liability policies provide general liability coverage, and additionally property damage coverage for property in your care, custody and control. The c,c,c coverage sections of the policy can be titled Marina Operators, Wharfinger Legal, Stevedores Legal, Terminal Operators Legal, among others. Again, the right questions must be asked in order to define the proper policies. Is coverage limited to ships, or private pleasure-type watercraft, or marine cargoes? Is coverage marine operations specific? Is coverage location specific?

Quite simply, there is no blanket insurance coverage that protects everything equally. And that is not a bad thing. No business wants to pay for insurance coverage they do not need. Instead, their real aim is to buy insurance coverage that fits their individual needs.

For marine businesses, navigating the various insurance policies can be like moving through murky water. It can be especially challenging for businesses unfamiliar with maritime law that still significantly guides marine operations. With the experience they bring from servicing various marine operations and keeping a close eye on case law and legal precedent in marine coverage litigation, specialized marine insurance brokers and insurance carriers can provide some valuable guidance to assure insurance coverage fits the operation and or work at hand.

Because there are times that a ship may not be a ship, every business wants to be sure its insurance coverage is insurance coverage that is right, reliable, and appropriate to the expected risks.

Interview

MARPRO PROFILE

Parker Larson

Director of Commercial Programs
General Dynamics NASSCO Shipyard, San Diego, CA

By Joseph Keefe

When we caught up with NASSCO's Parker Larson in December, he had only just been promoted to Director of Commercial Programs at the sprawling San Diego, CA shipyard. Previously NASSCO's Program Manager for Commercial Contracts, he no doubt played a large role in the recent high profile deals won by NASSCO, in particular the two 3,100 TEU LNG-powered containerships for TOTE, Inc. Additionally, he was responsible for design, planning, and construction of over $1B in commercial new construction work at NASSCO that includes four 50K DWT product tankers for APT, two 50K DWT product tankers for Seacor Holdings, and the design contract for the conversion of two TOTE Orca Class trailerships to operate on LNG. The impressive commercial backlog promises to keep him even busier for the foreseeable future in his new role.

Starting his career at NASSCO in 2003 as a Production Associate for the Ship's Management Team, Larson then moved into roles of increasing responsibility including Production Area Manager on the T-AKE program for the Navy, Deputy Program Manager on the PC-1 product tanker program for APT, Manager of Commercial Engineering Projects, and Program Manager in Business Development & Strategic Planning.

Larson's love for shipbuilding began with his educational experience(s).Parker attended the United States Merchant Marine Academy in Kings Point, NY, graduating magna cum laude with a Bachelor of Science Degree in Marine Engineering & Shipyard Management. Along the way, he also received a Master of Science Degree in Oceans Systems Management from the Massachusetts Institute of Technology in Cambridge, MA where he wrote his thesis on LNG infrastructure in the United States. Parker has spent the past two years developing his knowledge of LNG propulsion in the commercial marketplace. He also completed the Program Manager's Course at the Defense Acquisition University in 2009.

Along the way, Larson has served in several shipyard roles including production, engineering, business development, and program management. Directly involved in the transformation of NASSCO's business model for commercial new construction through collaboration with Daewoo (DSME/DSEC) starting in 2006, he naturally hit the ground running in his new role. Nevertheless, ***MarPro*** convinced him to slow down in December, if only briefly, to get his take on all things shipbuilding.

Reflecting on his chosen career path, Larson told ***MarPro***, "Shipbuilding, as a facet of the maritime industry, is an incredibly satisfying career path. There are very few careers in the world where you can design and construct such a finely engineered product and then watch it become an operational entity that lives on for 30+ years. For me, being part of that process is uniquely special."

Perhaps the most interesting part of Larson's CV is his knowledge of LNG and how that eventually could play a big role in the construction of the containerships and trailerships. As he was promoted to Director of Commercial Programs at NASSCO earlier this year, that experience and knowledge base no doubt didn't hurt him on his climb up the food chain. More than Larson's job billet will change as he assumes a new role. He explained, "In addition to the program management responsibilities tied to NASSCO's existing commercial new construction backlog, I have direct production interface. For example, I will manage the commercial ship management team which serves as

the production organization responsible for the delivery of each commercial vessel. Additionally, I will be continually engaged in business development given my direct experience with LNG propulsion and commercial program execution."

As his career evolved, Larson has been witness to and a part of the many changes in shipbuilding, particularly on this side of the pond. Even in the midst of the most profound shipbuilding revival in this country has seen in some time, over the past decade, NASSCO has shifted its commercial shipbuilding business model. Larson says, "Prior to the mid-2000s, we designed and procured all material for our new construction projects at NASSCO. In 2005, NASSCO partnered with Daewoo Ship Engineering Company (DSEC), a subsidiary of Daewoo Shipbuilding & Marine Engineering (DSME), to collaborate on international projects. DSEC became the lead design and procurement agent and we lead the efforts to integrate DSEC's design into NASSCO's shipyard's planning, purchasing, and construction processes. Leveraging the world-class commercial design standards and purchasing power from DSME has helped NASSCO become more competitive in the Jones Act shipbuilding market."

Also during that time frame, NASSCO also adjusted its approach to construction schedules. Today, NASSCO does not cut a single piece of steel until the ship design is fully complete and a large portion of planning effort is finalized. NASSCO's Director of Commercial Programs insists, "This ensures we identify and address risks in new-construction programs as early as possible. As a result, we have reduced the construction cycle times and improved quality in our past three new-build programs."

As Jones Act shipbuilding sees what can only be described as a robust and arguably unexpected revival, we asked Larson how long this trend – a cyclical boom, really – can continue. Enthusiastically, he replied, "As more domestic oil and gas is recovered, there is increased demand to move the product between U.S. ports, which invokes the Jones Act and drives the need for additional tonnage in the market. With North American Emission Control Areas (ECAs) in 2015 (addressing SOx), Tier III regulations in 2016 (addressing NOx), and an Energy Efficiency Design Index (EEDI) currently in place (addressing CO2), ship owners need to evaluate their existing propulsion plants onboard. Ship replacement can be a cost-effective method to address these increasingly stringent emission regulations. There are still several ships in the U.S. coastwise fleet that are more than 30 years of age operating with

relatively inefficient power plants. This tonnage will need to be replaced over the next 5-10 years." Clearly, Larson, like other U.S. blue water builders, remains bullish on the markets for the near term.

Despite all the good news, however, a key 'knock' on U.S. yards has always been that they cannot compete with foreign builders in terms of efficiency, costs and a raft of other metrics. Larson's boss, Fred Harris, on the other hand, has always been a big believer in emulating the Korean art of the series build technique. Larson shares his enthusiasm. "Over the past seven years, NASSCO has learned a lot from our partnership with the expert shipbuilders at DSME and DSEC. As a result we've made several facility improvements, including a new blast and paint facility, usage of transporters and updated ground outfitting process lanes. We've seen a positive impact to both our commercial and government shipbuilding programs." He continues, "A key metric we follow is completing the design prior to starting construction. This becomes more important when building a series of ships. A shipyard must get the lead ship right or the impact of change will permeate negatively throughout the entire class of vessels. Changes made once construction has started impacts the design and directly affects the supply chain, schedules and quality."

Larson, without neglecting his other responsibilities, clearly has a passion for the TOTE ship projects. That's only natural, especially considering his affinity for LNG and the intended propulsion of this new class of vessel. He explained, "The TOTE ships are 764-foot-long, 3,100 TEU LNG-powered container-

NASSCO is arguably one the the nation's more progressive shipyards, with a healthy Navy and Commerical orderbook, including pioneering work in building state-of-the-art LNG-powered tonnage.

ships, which are setting a new benchmark in green ship technology. When completed they are expected to be the largest ships of any type in the world primarily powered by liquefied natural gas."

NASSCO and Larson approached these ships like any other program. After identifying the risks associated with the design, procurement, and construction, each one of those metrics was addressed through execution of a risk management plan. Larson adds, "For example, it is paramount that we work closely with United States Coast Guard (USCG) and ABS to understand any regulatory and design challenges associated with the LNG fuel gas system, from arrangement configuration to hazardous zone definition to trim and stability calculation. We have worked closely with USCG and ABS personnel since the outset of the program in conjunction with DSEC and our equipment suppliers. This program is on track and the design will complete on time before the end of 2013."

We finished up by asking about the 600 pound gorilla in the room – concerns over the potential cutbacks from the federal government and shipbuilding programs as a function of the ongoing sequestration battles. That discussion has NASSCO's Chief commercial executive square in the middle of it. For his part, Larson likes where the yard is sitting, saying only, "NASSCO has a well-balanced portfolio with commercial new construction, government new construction, and U.S. Navy repair projects. This provides NASSCO the ability to shift resources when the allocation of work changes between each business segment." Nevertheless, keeping that portfolio balanced going forward could be Larson's biggest challenge. He likes his chances of doing just that.

As NASSCO launches a new era for its upgraded facilities, filled with a fat backlog, Parker Larson is arguably the perfect candidate to lead the firm's commercial sector as it takes on some of the most exciting and cutting edge shipbuilding projects on the planet. And, there's no place else he'd like to be.

Training

Beyond Shipbuilding

Domestic shipyards get creative in its approach to finding, training and keeping qualified shipfitters.

By Joseph Keefe

The domestic, U.S. shipbuilding boom is here: blue water, brown water, offshore support, inland, and export maritime security platforms, too. The robust comeback has just about everyone on this side of the pond very happy; unless of course, you are in the 'human resources' department and find yourself scrambling on a daily basis to recruit, train and retain qualified help to competently build all those orders on your fat backlog. That said; these are good problems to have.

According to the Shipbuilders Council of America (SCA), private shipyards in the United States support 402,000 jobs and 36 Billion in GDP. Even with those staggering numbers the shipyards are still faced with a severe skilled worker shortage. Issues facing the industry include an aging workforce, lack of individuals entering the trades, a dearth of training opportunities and the rapidly rising cost of recruiting, hiring, testing, and training. There are answers out there. You just have to know where to look. Many shipyards have done just that.

Resources for Human Resources Professionals

For starters, the National Maritime Education Council (NMEC) is a Gulf Coast-based group seeking to standardize and improve craft training within the maritime industry. As the spearhead for efforts to standardize and provide credentials for shipyard workers, backed by a coalition of 20+ industry trade groups and companies, what the NMEC does next could well be the template for industry human resources development that we have been thirsting for.

The NMEC is funded by its members and a financial commitment is involved based on a company's headcount. There are five investment levels in addition to an annual membership

While shipbuilding is booming across nearly every sector in the United States, there remains a serious need for talented workers across several trades.

(Tradesmen International credit)

fee. There are also membership levels for academic institutions and affiliate organizations such as equipment manufacturers, suppliers, trade associations, etc. The funds collected are utilized to develop industry driven, modularized, craft specific standardized curriculum and assessments to meet the demands of the industry.

Through NCCER, the NMEC has programs that can be utilized to recruit and enhance the image of the shipbuilding and repair industry and generate national exposure. NCCER is a not-for-profit 501 (c)(3) education foundation created by the construction industry to develop standardized curriculum with portable credentials and to help address the skilled construction workforce shortage. NCCER is recognized by the industry as the training, assessment, certification, and career development standard for the construction and maintenance craft professional. And now, those standards are coming to the waterfront.

Another equally attractive way for shipyards to reach the Promised Land is contract with a group such as Tradesmen International. Tradesmen is recognized for their ability to supply contingent labor, but it is their consultative services – particularly Labor Productivity Consulting – that has gotten notice by construction businesses. That tried-and-true formula, using a contractor's historical labor data, enables companies to determine what their optimal permanent or core workforce total should be, and is also being applied to help the national shipyard industry. In essence, clients are ultimately able to run their businesses with a leaner permanent payroll and, through close interaction with Tradesmen, are capable of supplementing their core employees with Tradesmen's high-caliber craftsmen only as workload warrants it. The goal is two-pronged: substantially increase workforce productivity and project profit margins. This bottom line gain gets put back into growing the business, providing enhanced benefits for their employees and keeping up with technology.

Tradesmen: National Coverage & a Skilled, Diverse Workforce

According to Matt McClone, Tradesmen International Vice President Workforce Development, the key advantages of engaging Tradesmen as a staffing partner is rooted in their ability to meet the distinct trade requirements of shipyards, beginning with their national team of shipyard coordinators: former mariners, merchant captains, shipbuilding professionals, naval officers, and enlisted men. "With these insights, they have the unique ability to understand the unique and dynamic needs of the shipyard industry. That, along with our national reach including a permanent presence in 36 port cities allows us to access a very large pool of skilled marine craftsmen and provide uniform service in all shipyard locations."

Tradesmen International's screening process is stringent: a minimum of two interviews; skill-testing using MOCode tests and available hands-on testing; verification of a minimum three years of experience; reference checks with a minimum of three employers; background checks that meet client standards; drug testing as required by the client; E-Verification to prove U.S. Citizenship; a valid driver's license and reliable transportation verification and confirmation of PPE and appropriate tools-of-the trade ownership. Not just anyone gets to work under the Tradesmen umbrella.

Arguably the ideal fit for a cyclical industry such as shipbuilding, Tradesmen's biggest challenge is often just educating the clients to understand the benefits and importance of choosing the right staffing firm. McClone Adds, "With the severe shortage of skilled craft professionals weighing on the industry's shipyards, the emphasis is not on convincing shipyards to include a variable labor partner into their staffing solution; the recession did a good job of explaining that to the shipyards. The recession certainly opened the door for our business model but it also flooded the market place with staffing firms, temp agencies, and similar companies. It's important that shipyards choose the right firm researching the company's history, treatment of employees, standards of business and overall ethical standards. Can the firm do what they say they will and stand behind their employees? We can, and do."

Today, Tradesmen International's strong suits include shipyard and yacht trades; both repair and new construction. The firm prides itself on its ability to staff all size marine projects ranging from extremely specialized mega yacht construction projects that may only require a handful of niche craftsmen to large repair jobs that require several hundred craftsmen in a short amount of time. McClone calls it "local presence and national reach."

Bollinger Believes

According to Bollinger Shipyard Human Resources Manager Jerome Eymard, Bollinger's primary reason for becoming involved with NMEC was to actively support an association whose initiative is to address a major concern of the shipbuilding and repair industry; namely, workforce development. Eymard told *MarPro* in November, "Bollinger has been a member of Gulf States Shipbuilders Consortium (GSSC) since 2008 and we were involved in the GSSC's creation of the NMEC to address industry workforce development issues on a national level, so we were a member of the NMEC from its inception in 2012."

The NMEC/NCCER curriculum models offers flexibility with training. For example, member organizations can takes steps through the NCCER to become an approved accredited training sponsor and/or assessment center. With these options, companies can rate their current workers through assessments in order to identify areas for skill improvement. The assessments in turn determine what modules workers would need to complete in order to attain a higher classification. Also, companies can utilize their NCCER accredited local technical and community colleges to train their existing workers and extend the training to high schools to generate new skilled workers for the industry.

Bollinger's Eymard explains further, "Overall, we will use

the NMEC program to supplement our existing training programs. With the availability of a nationally recognized maritime curriculum, we can recruit new workers into our company that will be well-rounded and knowledgeable in the work we perform. These individuals can aggressively move quicker with on the job programs in addition to advancing their skill levels with after-hour NMEC courses."

Today, Bollinger's greatest need is for pipe fitters and ship fitters. Eymard adds, "Overall, we will need all crafts ranging from welders, fitters, marine electricians, operators, etc. in order to build the next generation of skilled workers for the industry." And, he says, "We are also actively participating in supplying subject matter experts for the creation of new curriculum and we are communicating with regional industry associations, informing them of the NMEC's initiatives in order to generate interest among other shipbuilders/repairers."

National Maritime Education Council (NMEC): A Template for Success

John Lotshaw is the Gulf Coast Director of Training and Workforce Development at Ingalls Shipbuilding, and is responsible for training all of Ingall's craft personnel. Beyond this, he also serves as the inaugural chair of the National Maritime Education Council (NMEC). As the spearhead for efforts to standardize and provide credentials for shipyard workers, backed by a coalition of 20+ industry trade groups and companies, what he and the NMEC do next could well be the template for industry human resources development that we have been thirsting for.

The new shipyard workforce development effort on the Gulf Coast is an exciting concept. The initial efforts at standardized curriculum development were started with a post-Katrina Department of Commerce grant in 2006. The Alabama, Mississippi and Louisiana Manufacturing Extension Partnerships (MEPs) joined together with gulf coast shipyards to form the Gulf States Shipbuilders Consortium (GSSC). Lotshaw explains, "After considerable effort and three years of development GSSC rolled out the Shipfitting Boot Camp. The program has been very successful with a 100% rate of employment for graduates."

GSSC wanted to expand the curriculum and credentialing effort from a regional to a national effort, launching what was named the Lighthouse Campaign to raise funds. NMEC was established in March of 2012 with 12 founding members representing the shipbuilding and ship repair industries. NMEC will, says Lotshaw, "… work from a common set of definitions, defining exactly what each craft does, documenting each craft's required skill sets, and based on those skill sets, developing curriculum and assessments that ensures craftsmen who are certified through the system can perform to industry standards."

"With the severe shortage of skilled craft professionals weighing on the industry's shipyards, the emphasis is not on convincing shipyards to include a variable labor partner into their staffing solution; the recession did a good job of explaining that to the shipyards. The recession certainly opened the door for our business model but it also flooded the market place with staffing firms, temp agencies, and similar companies. It's important that shipyards choose the right firm researching the company's history, treatment of employees, standards of business and overall ethical standards."

Matt McClone, Tradesmen International
Vice President Workforce Development

A key part of the NMEC effort is its partnership with the National Center for Construction Education & Research (NCCER). At the time of its inception, NMEC was searching for best practices to implement its vision, they looked at what NCCER was doing in industrial construction, pipeline and power line curriculum and credentialing.

John Lotshaw, Gulf Coast Director of Training and Workforce Development, Ingalls Shipbuilding, and chair of the National Maritime Education Council.

A key part of the NMEC effort is its partnership with the National Center for Construction Education & Research (NCCER). At the time of its inception, NMEC was searching for best practices to implement its vision, they looked at what NCCER was doing in industrial construction, pipeline and power line curriculum and credentialing. Lotshaw adds, "We found that when NCCER was formed as a non-profit education foundation in the early 1990's, those industries were facing the same challenges that the shipbuilding and repair industry is facing now. Their model is effective, efficient, and has made measurable impacts related to safety, profitability and workforce development in those industries. We were offered the opportunity to partner with them and build on their success."

Already in place is a secure National Registry where craft training, assessment records and credentials are available for review by potential employers (with applicant approval), and a proven track record. Hence, with NMEC standardization, and regardless of where the individual receives training, employers have assurance that persons with this credential are well trained and have the skill sets they need. Lotshaw further insists, "Partnering with NCCER gives our industry the best bang for the buck and the quickest, surest pathway to meeting our goals."

The Shipfitting curriculum at NMEC addresses – and standardizes – one of the most in-demand skills in the business.

(Tradesmen International credit)

Lotshaw defines shipfitting by saying, “Think of shipfitting as carpentry with steel or aluminum. A skilled shipfitter knows how to read a blueprint, measure accurately, and how to cut and join metal for form different structures. He understands basic metal working and is familiar with maritime terminology.”

GSSC’s successful shipfitting boot camp program and the shipfitting curriculum were the precursors to and the main reasons behind the establishment of NMEC. During the program’s pilot period, the boot camp was offered three times and graduated 31 entry-level shipfitters. Instructors used and vetted the shipfitting curriculum during the pilot. Lotshaw adds, “The outcomes were impressive. In addition to 100% placement of its graduates, after employment, employers reported savings on initial training costs and declines in probationary releases, disciplinary actions, and absenteeism. Perhaps a better indicator of employer satisfaction, though, is the fact that employers wanted more workers trained under the model using the curriculum. As a result, it has been adopted by at least three community colleges and one for-profit training provider, and the interest in the program continues to grow.”

Common Goals: Different Vehicles

One of the reasons NMEC was formed and then partnered with NCCER was to create a national approach to training, assessment, and credentialing. NMEC and John Lotshaw reason that the common skills sets required of craft workers in the maritime industry do not vary based on the region of the country and the curriculum used to train workers should not either. Today’s NMEC membership of 20+ organizations includes several trade associations, including GSSC and the Virginia Ship Repair Association and some larger, Gulf Coast-based shipyards. Once the programs have had time to prove their mettle and get benchmarked, that’s expected to grow.

Two levels of pipefitting completed this fall and two levels of shipfitting have been added to the curriculum. Lotshaw says, “We haven’t started marine electrical, or coatings, or other crafts that also need to be addressed. Our ability to do that is dependent on the industry’s coming together and supporting the initiative.”

Whether home-growing talent or engaging contract skilled labor from organizations such as Tradesmen International, the goals should be the same: producing skilled craft workers by offering individuals industry exposure and the opportunity to choose a career in shipbuilding/repair as early as high school, and offering them a career path through industry-and-craft-specific curriculum in order for them to be work-ready at point of graduation and/or after additional training in the community colleges. It’s all an important building block in generating a pipeline of skilled workers into the shipbuilding industry. And, it’s here now. Take your pick.

Op/Ed

We Need to Save Our Ships

By Matt Paxton

"We must show the world, both our enemies and our allies, that our Navy and its ships will continue to have a positive influence abroad and provide a stabilizing presence on the seas wherever it is needed."

Matt Paxton, President of the Shipbuilders Council of America

America's Navy is arguably the most powerful in the world, and the most immediate threat it faces may not be from China, Russia or Iran, but Congress. The use of sequestration as a budget reduction tool has resulted in a clumsy cost-cutting approach that will continue to have disastrous effects into the next year and beyond, as the nation's naval fleet will not be able to be maintained or repaired. The ultimate hypocrisy of this Congressional budget technique is that deferred maintenance on ships costs a lot more when it does not get done and will actually shorten vessel lifespan and cost the taxpayer much more in the coming, as these ships must leave service and need to be replaced prematurely.

Our nation's leaders must immediately address the disastrous effects of indiscriminately cutting core shipbuilding and repair functions that keep this country safe and secure. This critical maintenance is not only vital to national security, but it supports thousands of jobs and local economies. This is why the Shipbuilders Council of America (SCA) is issuing an "SOS" to Congressional budget conferees, led by Representative Paul Ryan and Senator Patty Murray, to "Save Our Ships."

The United States Navy plays a critical role around the world by providing a stabilizing presence to keep the seas free and open, which in turn allows global commerce to thrive. But the fleet relies on regular maintenance and repairs by the nation's shipyards to extend the life of these strategic and costly assets. Sequestration's funding cuts will force the Navy to reduce its vessel maintenance periods by fifty percent in fiscal year 2014 and threaten the health of America's shipyard facilities that perform this critical maintenance. This drastic reduction in scheduled service calls will force the industry into a critical juncture and push it toward potentially massive layoffs. The loss of these jobs will ripple across the country because America's shipbuilding and repair industry is made up of a network of parts and equipment suppliers from across all 50 states.

These layoffs will leave America with a lost generation of skilled workers while stifling innovation from reduced research and development spending. Workforce reductions will also mean higher prices for new assets like naval vessels because of forced consolidation in the defense industry and reduced competition. A shipyard or supplier that closes because of program cancellations will not be there when the Navy is ready to build new ships again.

Sequestration will not only damage our nation's shipbuilding and repair industry, it will cripple America's naval fleet. Deferral of one maintenance period at the 10-year point in a vessel's lifespan will shorten its overall service by about five years. As these vessels are retired early without ready replacements, the fleet will shrink by 30 to 40 ships over the next 30 years, leaving

our nation with a decreased global presence. This poses a dire threat to the future of U.S. naval operations because a smaller fleet will hobble America's ability to respond to critical global missions and crises. A weakened U.S. naval presence abroad makes delivering humanitarian aid more difficult while also increasing the potential length and cost, in dollars and lives, of future conflicts. Recent events in Syria, Libya and the Philippines underscore the need and importance of a stabilizing American naval presence around the world.

The Navy's surge capacity has already been significantly diminished because of sequestration according to the Chief of Naval Operations, and the situation will only get worse. Because of current budget cuts, the Service is no longer able to deploy multiple aircraft carrier strike groups simultaneously around the world. Previously, it had multiple strike groups with the ability to respond just days after being called up, where now it currently has only one. The last time the Navy's vessel numbers were this low was in 1916, before World War I. The Navy has said it will take years to recover from the current budget cuts required by sequester, without taking into account the next round happening in January.

These proposed cuts must be immediately replaced with targeted reductions before sequestration damages our nation's ship repair industry beyond recovery, shortens the overall life span of the vessels in our sea services, and leaves America without a robust and vibrant naval fleet. Maintaining these vessels, and retaining a capable and experienced U.S. workforce is vital to America's national and economic security. We must show the world, both our enemies and our allies, that our Navy and its ships will continue to have a positive influence abroad and provide a stabilizing presence on the seas wherever it is needed.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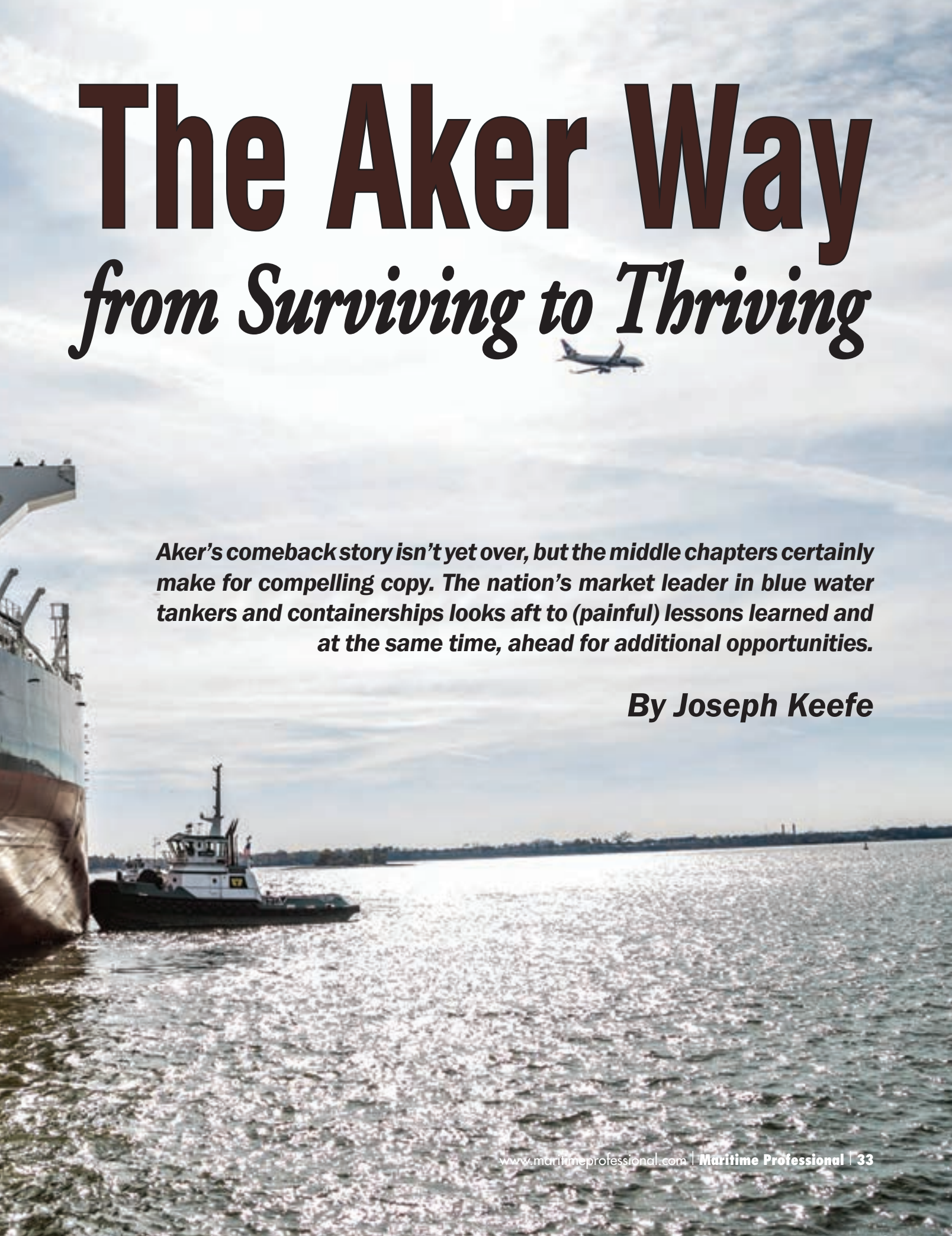
The Aker Way
from Surviving to Thriving



Aker's comeback story isn't yet over, but the middle chapters certainly make for compelling copy. The nation's market leader in blue water tankers and containerships looks aft to (painful) lessons learned and at the same time, ahead for additional opportunities.

By Joseph Keefe

Aker Philadelphia Shipyard (Oslo: AKPS) is the second-largest commercial shipbuilder in the United States, having built more than one-half of the large ocean-going vessels in the US market since 2003. The key word in all of that is "commercial." Aker Philadelphia is a Jones Act builder, and was hit hard in the wake of the recent financial crisis. At the nadir of the market crisis, the company was forced to make more than 700 layoffs.

In February 2011, Pennsylvania and Philadelphia taxpayers took a significant gamble, infusing $42 million into the company to build two oceangoing petroleum product tankers on spec. The gamble – Aker prefers to call it 'market vision' – paid off handsomely in August 2012 when Aker sold the two ships to Crowley. Since then, it's been fair winds and following seas for the Philadelphia-based shipyard. Figuring out what comes next requires a look back. How Aker (it rhymes with "soccer") went from merely surviving to its current condition of thriving is therefore one of the more interesting maritime stories of this year; if not the entire decade.

First time visitors to Aker's Philadelphia operation immediately notice the massive, modern 660 metric tonne, 64 meter (210 feet) tall Goliath crane. Only slightly less impressive is the gleaming infrastructure, reflecting a shipyard that has been completely refurbished and in some places, rebuilt from the ground up. Established first in 1801 – with a rich history with Navy work at its heart – the yard was eventually was closed in 1996. With several starts and stops and hiccups along the way, the location is now, like many other American yards, a thriving beehive of activity. In late November, ***MarPro*** traveled to Pennsylvania for a firsthand look at this pure commercial, Jones Act builder.

Market Conditions

A booming shale crude oil industry has created high demand for US-flagged ships for the coastwise transport of oil, gasoline and chemicals. Since the successful sale of the spec ships, Aker Philadelphia has landed contracts for two petroleum tankers for Exxon Mobil affiliate Sea River, as well as a $500 million agreement to build and share in the operation of up to eight additional product tankers for Crowley. And in November, Aker also inked a deal with Matson for two 3600-teu Jones Act containerships – the largest ever to be built in the United States. The contract price was reportedly $418 million for the pair, with deliveries quoted for the 3rd and 4th quarters of 2018.

With four of the Crowley tankers firmly contracted and both parties looking hard at the additional four options, these are heady times for Aker. The shipyard's solid backlog and strong cash position have pushed its stock price up more than 30 times its market low in mid-2012. Despite the large run-up in market capitalization, the company's debt load and Total Enterprise Value (TEV) to EBITDA ratio both seem to be reasonable, as compared with its peers. That said; major risks include cancelled contracts and changes to the Jones Act, neither of which seem to be likely in the current political and economic environment.

Steering the Ship

Just 30 years old, Kristian Rokke joined Aker Philadelphia Shipyard in 2007. Prior to that, the Aker CEO held various roles, including SVP Operations and Senior Shop Manager within the shipyard and has experience from offshore service and shipbuilding from several companies in the Aker group. A Board Member of TRG Holding AS, which owns 66.7% of Aker ASA, Rokke is currently completing his MBA at The Wharton School and has also studied economics and mathematics at Colby College, London School of Economics, and Political Science at the Norwegian School of Management (BI).

Joining Rokke is Scott Clapham, SVP Projects and Business Improvements and Jeffrey Theisen, the firm's Chief Financial Officer. Together, they have helped engineer the shipbuilding giant's remarkable turnaround, and they have done so in an arguably unconventional style. As a management team, the trio is remarkably closemouthed, but Rokke, in his own quiet, understated manner, summed up some key metrics in the box to the left.

The Aker Way: Lucky or Prescient?

Kristian Rokke eagerly looks ahead to what will come next. He told ***MarPro*** in November, "Our order backlog gives us a golden opportunity to strengthen the commercial edge of our shipyard and puts us in good position for whatever comes next." According to Aker's CEO, the shipyard's success in recent years has as much to do with Aker's attitude as anything else. He insists, "We believed in the product tanker market and put our own money behind that belief."

My Advice

Kristian Rokke
President & CEO, Aker

Quality
"Pleased, but never satisfied."

Government/Navy Work
"We offer value to our customers by focusing 100% on commercial projects."

Foreign flag newbuild bids
"Our attention is directed toward the Jones Act, but; never say never."

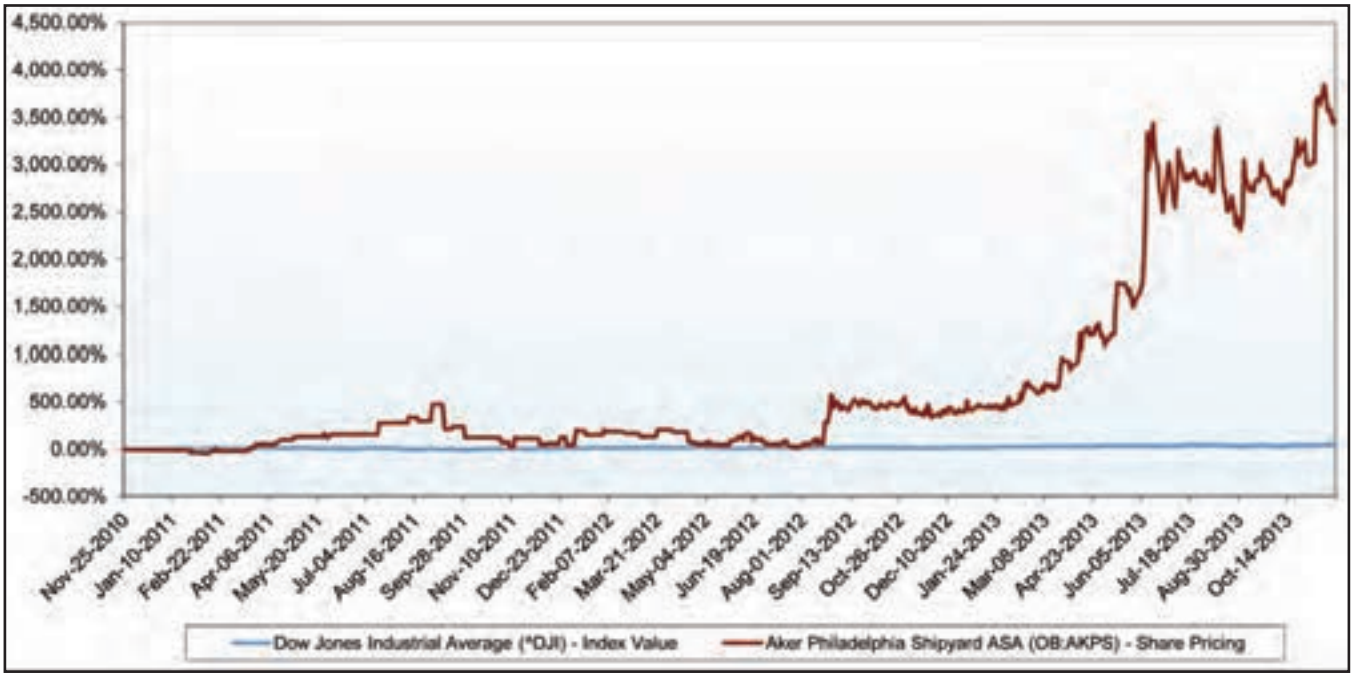
Repair Work
"We have been approached, and there is potential, but our current focus is on newbuildings."

"We're proud to be playing an important part in our country's oil boom, but at the same time, we remain humbled by the events of 2010 and 2011. Today we are seizing opportunities like never before, but we will not forget the lessons taken from those difficult times. We will build off the past, but not be tied to it."

Kristian Rokke, President and CEO, Aker

Rokke also describes his firm as nimble, creative, and opportunistic. Giving credence to that position, some of the deals put together by Aker in order to survive and indeed thrive, have not been uncomplicated. For example, the recent Matson deal is a straight sale, but others were not.

When Aker built the two product tankers on spec, it was widely considered by most analysts as "a leap of faith." No one, of course, could know what would come next, and so soon. Or, perhaps the Aker management team did. The public/private move, as a minimum, took courage. The yard had previously built 14 product tankers for OSG and then went from 1,200 employees to roughly 300 in the space of one year. Now looking back from a more comfortable perch, Rokke explains, "We're proud to be playing an important part in our country's oil boom, but at the same time, we remain humbled by the events of 2010 and 2011. Today we are seizing opportunities like never before, but we will not forget the lessons taken from those difficult



Source: The McClean Group LLC

times. We will build off the past, but not be tied to it."

In a nutshell, Aker had to put into place the public/private partnership in order to build hull numbers 17 & 18. These, in turn, yielded hull numbers 19 and 20 – the SeaRiver hulls. Scott Clapham, SVP Projects and Business Improvements, told ***MarPro*** during the same visit, "We aim to keep the equipment and the yard moving and working." But, unlike others trying to do the same thing elsewhere, Aker had to prove its mettle up front by building the spec hulls. Eschewing a larger short term payoff, the Crowley profit-sharing deal set up the long term benefit of a deeper Crowley relationship and with that, the longer term viability of the shipyard.

Hull numbers 17 and 18 involved profit sharing. And, while Rokke might have a lot of faith in the product tanker market, he certainly couldn't have known that just as these hulls hit the market that Jones Act freight rates would turn decidedly north, yielding some of the best numbers ever seen in this market. More opportunistic creativity would follow. Next came the joint venture; with 49 percent Aker / 51 percent Crowley ownership (IAW Jones Act compliance), a deal which began to increase cash flow consistent with the steady business. Aker's CEO added, "We have a history of being creative to maximize opportunities for our stakeholders. The spec vessels are examples of that."

Rokke explains the big picture even further. "It was by successfully delivering on our commitments to American Shipping/OSG that put us in position to build the spec vessels." And the spec hulls were important in that Aker chose a proven hull design from Korea, something that would appeal to risk-averse Jones Act potential buyers. Eventually, the spec boats were sold for $90 million each and a profit-sharing arrangement. Rokke adds, "Our long term belief in the market has our shipyard in a position to succeed."

Today, with Aker riding the meteoric climb in its stock (3,500 percent in comparison with the SP 500 over the same timeframe), Aker's joint venture with Crowley is just one more reason for Rokke to be optimistic. "We will also contribute significant amounts of capital to the project with Crowley in the driver's seat. It gives our shareholders direct exposure to the shale boom and we like the risk/reward of the investment. It is a partnership that we are very excited about. Crowley is first-class operator and we build quality ships. That adds value for the end user."

Best Practices: Here, Abroad and Internally at Aker

"Our goal is to always be better today than we were yesterday." That's Kristian Rokke's stock answer to queries about what Aker is doing better than the rest of the Jones Act shipbuilding market and what Aker – and the rest of the U.S. shipbuilders – need to do to catch up with their foreign counterparts. He added simply, "We focus on delivering on our commitments to the customer." That entails taking 'best practices' from other yards around the world, including Ko-

rea. Nevertheless, it was clear that Aker mostly closely aligns itself with a more European model.

Locally, the Aker shipyard has a very European feel to its atmosphere. This extends from the style of furniture in the reconverted office spaces to the distinct Norwegian accents that can sometimes be heard in the hallways. A small percentage of Aker's approximate 1,200 employees are in fact from Europe. Rokke declined to quantify that number, but it was clear that these involved management visas and the process of taking lessons learned from both European shipyards as well as its own Norwegian parent. And, he added, "We have also learned a great deal from our sister companies, both in the marine and oil and gas sectors." Aker Solutions, for example, has deep marine roots.

"We have put a high emphasis on harnessing best practices from other shipyards around the world since our start-up. For example, in 2005 we pioneered a partnership with the Korean shipbuilding industry which we continue to refine and develop today." Aker, he said, emulates some aspects of German automation and parts marking. He added, "We have invested over $400 million in our facilities from the beginning. It starts with an efficient shipyard set up and layout to optimize shipbuilding processes, work flow and material logistics. We melded best practices from many shipyards and ended up with a world class facility that we're proud of."

Asked about improvements in efficiency achieved over time involving the economy of scale afforded by repeat, series-build experience, Rokke again declined to be specific, saying only, "We have gone from delivering one ship annually to our present capability of producing three annually in a relatively short time period." Rokke's bottom line is simple: come 2018, Aker will be proven across multiple ship classes. At that point, he says, business should take care of itself. That remains to be seen.

At Aker, best practices also extend to giving virtually 90 percent of all shipyard employees off during the holidays (26-31 December), something which Aker says allows them to do necessary equipment maintenance and upgrades. It also makes for a happier shipyard worker. Jeffrey Theisen, the firm's Chief Financial Officer, told ***MarPro*** that Aker had invested as much as $350 million in its workforce, including training. All steel work is done in-house, with multiple plasma cutters and heavy assembly lines. Today, Aker can build vessels up to 116,000 tons DWT and 43 meters beam.

Finally, and with regard to the joint venture and profit sharing hulls, we asked Aker if these close relationships created extra incentives to do a better job and perhaps, a more motivated shipyard employee. Aker executives deny that this is the case, saying that their workforce does the same job on every single hull and regardless of the terms of the deal. And, while it shouldn't make a difference, it probably does. Especially when people know that the hull they are working on might be leaving the yard, but it won't leave the bottom line. That's not a bad thing.

The Rally: Sustainable or Cyclical?

The U.S. Department of Transportation recently said that 15 commercial tankers are on order or under construction at the

Aker Philadelphia Newbuilding Backlog – November 2013

Hull Number	Client	Type / DWT	Delivery
19	SeaRiver	Aframax Tanker / 115,000	Q2 - 2014
20	SeaRiver	Aframax Tanker / 115,000	Q4 - 2014
21	Crowley	Product Tanker / 50,000	Q3 – 2015
22	Crowley	Product Tanker / 50,000	Q4 – 2015
23	Crowley	Product Tanker / 50,000	Q2 – 2016
24	Crowley	Product Tanker / 50,000	Q3 – 2016
25 – 28	Crowley	Product Tanker / 50,000	(*) OPTIONS …
29	Matson	Containership / 3600 TEU	Q3 - 2018
30	Matson	Containership / 3600 TEU	Q4 - 2018

nation's shipyards, with half as many additional options are legitimately in play. The biggest commercial shipbuilding boom that the domestic industry has seen in more than three decades is being fueled, in part, by domestic crude shipments that have surpassed 600,000 barrels per day. And, although the so-called Tier II yards – those building smaller but equally important hulls – are also busy, producing wave after wave of OSV's, inland barges and maritime security hulls of one sort or the other, it is also true that shipbuilding is a cyclical industry.

As U.S. yards enjoy fat backorder books, foreign yards look on enviously as the foreign registered tanker and containership markets continue to exist in an overbuilt, and overcapacity mode. Can the domestic boom last, and if so, for how long? Aker is clearly betting that it will, at least in terms of the Jones Act markets. In the near past, Aker has built 14 product tankers and 4 containerships. Rokke insists, "There are many good shipyards in the U.S., but we are the market leader in those sectors." And, why not? Where others worry about sequestration and the loss of government dollars, Aker simply concentrates on what it does best. Its current backlog extends to 2018; not including options. Unanswered is what happens then.

Nominally, Aker has so far dispelled the notion that the big U.S. yards can only survive on a steady diet of U.S. government / Navy hulls. And, the federal government has its favorites to build large Navy vessels, destroyers and Coast Guard hulls. Those relationships are unlikely to change and it is also unlikely that nuclear newbuild or refit work could come to Philadelphia. The risks alone to the city and for a Navy that sometimes needs to put vessels out to sea as soon as is possible, seem to preclude that option. Aker will therefore continue down the Jones Act newbuild path; perhaps dipping their toes tentatively into the repair market when (and if) the going gets thin.

It has been a wild ride. Employment at Aker went from about 1,000 in 2010, down to 300 in 2011 and now, back up to almost 1,200 today. In total, the company has won orders for $1.5 billion, and has tripled in size since 2011. As other U.S. yards look to rebalance their portfolios to include a greater percentage of commercial work, Aker already has theirs exactly where they want it.

Separately, U.S. blue water shipbuilding continues to heat up on all fronts. As MarPro went to press, Crowley placed yet another shipbuilding order. Interestingly, and despite the reportedly close relationship with Crowley, Aker didn't get the recent conro order. That award instead went to VT Halter Marine, probably because Crowley apparently wasn't willing to wait as long as Matson for their deliveries. Certainly, they weren't about to get in line behind Matson, whose ships won't arrive until 2018.

Good relationships aside, business is business in the world of marine transportation. Aker's innovative partnerships and profit sharing deals may well be the wave of the future when it comes to fleet replacement and expansion plans. That's because while some private operators – like Harvey Gulf, for example – can afford to finance their own newbuild plans on the backs of Moody inspired credit lines, others cannot. Closer ties between builders and operators, each sharing the risks associated with operating U.S. flag tonnage in cabotage trades, will naturally follow. That's just one way to go from "surviving" to "thriving." It's also the *Aker Way*. – ***MarPro.***

The Product Tanker Florida was built for Crowley.

Converting for the Market

Deepwater Offshore Presents New Opportunities for Accommodation Vessels.

By Robert Kunkel

The U.S. Gulf of Mexico, offshore Brazil and West Africa have recently been tagged as the "Golden Triangle" of deepwater oil exploration. An interesting label, considering a triangular definition of success, prosperity and influence was last associated with Southeast Asia's opium and heroin trade. But, oil can (perhaps) be described as industry's opiate and with that said this addiction proves interesting with new geopolitical and economic patterns deepwater exploration and production is developing. No doubt, oil as we once knew it, is changing.

The Changing Landscape

Nigeria and Angola are leading African offshore and also developing a reputation as the continent's oil, gas exploration and production hub since the first explorations in the Congo Basin in 1994. Deepwater oil exploration in offshore West Africa has boomed, and the region has become one of the important areas in the world due to a collection of discoveries in recent years showing production growth from 58.9% in 2001 to 78.3% through 2011 when compared to worldwide fields. Nigeria's oil reserves were estimated to be approximately 37.2 billion barrels as of 2010, while proven natural gas reserves reached 185.3 trillion cubic feet during the same year.

Understanding both Nigeria and Angola have been OPEC members since the seventies, deepwater offshore development in this leg of the triangle can have a long lasting impact on the market, particularly in the Middle East. That success has one caveat: dealing with the "political" landscape of West Africa and its lack of qualified labor. And that issue may determine if the "Golden Triangle" is indeed isosceles when looking to balance the deepwater boom between the three geographic areas.

Any analysis of the new "Golden Triangle" is not complete without a mention of natural gas and oil being produced out of the shale fields in the United States. Though these new discoveries are not "offshore," they will have significant impact on the deepwater oil market in the U.S. Gulf and the country's ability to become energy independent. CNG prices have dropped 40% in the last year due to excess supply of the fuel and an inability to export the commodity from the United States. Reports are circulating of reduced costs of chemical manufacturing, industrial manufacturing and energy production as this new source is developed and Deepwater offshore will continue to grow to support those onshore discoveries. That growth brings increased requirements for support vessels, equipment and labor capable of remaining on station further offshore. The current support system for shallow water operation – where workers are housed on shore and transported by crew boat and helicopter to the rigs – has reached its operational limits. You need to look no further than the flurry of OSV vessels being constructed for this trade that also put a premium on bed space and have, as a result, increased the size of these vessels measurably.

New Requirements Call for New Solutions

While the United States wrestles with the concept of short sea shipping and its myriad of vessel types capable of supporting that market sector – RoPax, RoRo and Feeder containerships – Europe has found a new market to sell off their first and second generations of these so-called Roll-on, Roll-off passenger vessels into the Offshore oil fields. The ships are converted to provide DP2 and DP3 positioning systems, cabins and facilities for 400 plus men and equipment for transferring that maintenance labor back and forth from the rigs on a daily basis.

The accommodation vessel market experienced a period of significant stress following the global financial crisis and Macondo Blowout which significantly impacted offshore developments and their associated oil companies. However, the market has begun a recovery due to buoyant oil prices which in turn restore market confidence and a corresponding increase in deep offshore activity in new locations. As a result, vessel demand is expected to show strong and consecutive growth through 2017, with vessel utilization increasing by 32% compared to the periods working through 2008-2012.

The Conversion

The offshore accommodation mono-hull conversion is not an easy task and is affected by the regional dynamic of the vessel market; water depth and environmental conditions. Regulatory factors such as vessel age, cabin habitability and

Highclere Ltd, the new owners of the Bluefort, has recently completed continued conversion upgrades to their 141 meter, 450 man vessel in Naples, Italy with the help of Alternative Marine Technologies (Amtech).

cabotage requirements are also a consideration. Sponsons are installed to meet two compartment damage and stability and also to soften motion. Offshore cranes ranging from 50 to 200 metric ton lift capability are added to allow delivery and transfer of equipment. Heave compensated telescopic gangways are installed to deliver the maintenance labor from ship to rig. Most important is the development of the Dynamic Positioning (DP) plot and the required bow and stern thruster power needed to meet the environmental conditions of the location. In that market, Kongsberg Maritime is a regular player.

The European locations in the North Sea are generally considered to require the most advanced DP systems in the world due to harsh weather and water conditions. On the other hand, North America and Latin America have historically required a large supply of low specification accommodation barges focused on shallow water and limited dynamic positioning. High specification assets for the growing deep and ultra-deepwater market have moved towards semi-submersible rigs with several new construction projects being developed in Singapore and China. The large gap between high and low specification location requirements has therefore created the market that the monohull conversions look to fill with reduced capital and operational expense.

Laurtizen Offshore A/S was first to deliver the *Dan Swift*, a 150 meter European RoPax converted to an accommodation support vessel with cabins for 256 offshore workers and 11,000 kW of thruster power designed to maintain position on location. Edda Accommodation followed with the delivery

of the *Edda Fide* in 2011, capable of handling over 600 men offshore and stationkeeping capability powered with five Voith propellers of 12,500 kW and two 1450 kW bow thrusters forward. Highclere Ltd, the new owners of the *Bluefort*, has recently completed continued conversion upgrades to their 141 meter, 450 man vessel in Naples, Italy with the help of Alternative Marine Technologies (Amtech). Kongsberg Maritime attended to make recommendations to improve the vessel's DP Plot. U.S. Outfitters of Jacksonville, Florida attended to renew and upgrade 70 plus cabins and Rolls Royce and MAN attended for continued overhauls and repairs to the thruster and propulsion engines.

Bridge deck modified to comply with ECDIS and DP2 station keeping.

Up Next

The next generation Offshore Accommodation Vessel (OAV) with examples designed by Salt Ship Design, are 155 meters long and will have a total accommodation capacity exceeding 800 persons, all housed in one or two man cabins. The vessel standard now requires a living space of "executive standard" and includes office space as well as recreation areas, such as a modern gym, sauna, two swimming pools, conference rooms and an auditorium. Existing vessels will likely need to continue to upgrade their conversions to meet or exceed these standards. These vessels will provide construction support and additional living quarters for support personnel during commissioning, maintenance and decommissioning of offshore installations worldwide and are now being designed for operating in the Arctic.

In a case where the market defined the demand, vessel conversions are meeting the growing needs of a burgeoning offshore market. And this can include a variety of requirements. In the United States, for example, not one offshore wind farm – in stark contrast to the dozens in and around Europe – has yet to be constructed. That said, when the first one does go into construction, the speedy completion of the project will be paramount. That might mean the need to keep labor on site for extended periods of time. Regardless of the reason for an offshore labor presence, the day of the OAV has arrived. Converted or fit for purpose, the advantages are many and the drawbacks, few.

Rolls Royce thrusters; Kongsberg controls.

Energy is the Answer

As Damen looks offshore, the market leader in standardized hulls, spec series build techniques and (arguably) quality too, also spreads its wings into new markets.

By Eric Haun

If Damen Shipyard's standardized hulls are the hallmark of its existence, then providing customers with a proven and reliable product, based on years of research and the well-oiled ability to produce these hull forms on spec, economically and in series, is the rock upon which that considerable reputation was built. Today, the prolific shipbuilder and renowned designer of reliable hull forms is poised to once again export its dependability and knack for innovation as it plots international growth in a number of targeted market sectors. Jan van Os, offshore director at Damen, points to a number of niche markets in which the company sees its best opportunities, including offshore, offshore wind, ports, dredging, security, yachting and of course conventional and hybrid tugs. In U.S. markets, Damen is well known as the designer of the hull form for the U.S. Coast Guard's Sentinel Class Cutter. Based on the Damen Stan 4708 patrol vessel, the design was chosen by a risk-averse Coast Guard leadership in the messy wake of several high profile hull failures. Damen remains in the hunt for the Coast Guard's Offshore Patrol Cutter (OPC) sweepstakes, as well. Of late, however, Damen has exhibited an increased focus on the offshore sector, an area traditionally filled with specialty, built-for-purpose tonnage.

Looking Offshore

Damen currently collects just 10 percent of its $1.8 billion annual turnover from its offshore division, but with several new offerings catering to the offshore sector, that seems likely to change. That's because the company has launched several new offshore designs in recent years, ranging from Platform Supply Vessels, Construction Support Vessels and Fast Crew Suppliers to Offshore Carriers and Heavy Lift Vessels.

And just as with tugs and other workboats, Damen upholds its worldwide approach; the company's increased offshore production is not limited to region. "We see opportunities globally, that's our nature and way of doing business," van Os said. "However, there are some marked opportunities in South America, Western Europe and Scandinavia, a few North African countries, South Africa (where we have Damen Shipyards Cape Town and a Service Hub), Australia and Singapore." And, because Damen often partners with other builders to supply design models, the opportunities available to the Netherlands-based business probably exceed that which is immediately evident.

Damen's plans for a steady growth and development in the offshore sector incorporate "more advanced technological niches," van Os said, but still maintain a standardized production approach. "You'll probably see us moving from PSVs for simple transport/supply jobs etc., via lighter/underside-of-market OSVs/OCVs and via rather serious AHTSs and FIRMs, to more high-end OSVs/OCVs, subsea support/construction vessels etc.—but all in good time." He adds, "We know our place in the offshore market, and because we also know what we want and what we're capable of, we will move up in a gradual and modest way," van Os continued, emphasizing "quality for clients first."

A major point of focus for Damen's offshore series is its PSV 3300, the first of which, World Diamond, was built in Damen's Galati yard and delivered in June 2013 as part of a six-vessel order from Norwegian company World Wide Supply (WWS). The 3300, one of five Platform Supply Vessel offerings from Damen, features long, more efficient hull shape, diesel electric propulsion, dynamic positioning (DP2) capabilities and increased crew comfort amenities. The fifth PSV for WWS, World Opal, was delivered in November. Four of the PSV 3300s secured long term contracts for Petrobras, while the remaining two are expected to operate in the North Sea under the spot charter market.

Opportunity is Blowin' in the Wind

Damen has also made strides in offshore wind, bringing standardization to a specialty market that desperately needs it – and with good results. Damen delivered 25 FCS 2610 twin axe catamarans in 25 months and is currently building them for stocks as orders continue to come in. With the success of the 2610, Damen is now producing a smaller version, the FCS 2008. In a market categorized by specialty, Damen is essentially creating vessels that can be standardized, yet fit in with other vessel ranges or even other markets. "We have high hopes for the

World Diamond is a strong card in Damen's Offshore hand.

Walk to Work vessel," said van Os, referring to a new class of vessel aptly coined the Wind Farm Service Vessel (WSV). The purpose of the vessel is to support and accommodate turbine maintenance crews at sea and allow them to 'Walk-to-Work.' After industry-wide consultation, the vessel has been designed from first principles to provide on-site work facilities and accommodation for 45 maintenance personnel plus 15 crewmembers, for voyages of up to one month. Additionally, he said, Damen is building an offshore carrier for Van Oord in a pipe-laying outfit for windfarms.

Peter Robert, Damen's business development manager offshore wind, said, "The Damen W2W can as well be used in the Offshore Oil & Gas business, because we have foreseen a suitable tank arrangement in order to service the unmanned platforms in the North Sea."

Robert further explained that Damen already possesses a number of offshore wind products, including the Twin Axe 2610, 2008; DOC-range (based on this design, Damen is currently building a cable layer for Van Oord); a dedicated Array Cable layer; and a Damen Walk to Work vessel." Next to be added to the company's portfolio, Robert said, are a Maintenance Jack-Up for offshore wind, in addition to further looking into installing foundations with a free floating vessel on dynamic positioning, removing Jack-Ups from these kind of activities.

Proven Methods for a Changing Market

As far as Damen is concerned, it really doesn't matter what the market brings. Its time-tested standardized hull system, bolstered by the firm's solid series build record, will produce results for any niche. As new Damen products geared toward offshore operation emerge, the group will continue to challenge the modes of niche builders in the specialty offshore sector. "Over time, we can say to have set a new Damen Standard, like we have done with our tugs and other workboats," van Os said. Few would argue with his logic. Arguably, fewer still can compete with Damen's results.

3D Laser Scanning for the Marine Industry

FARO 3D laser scanning allows the Chief Engineer or Project Manager to work in detail with 3D model shots of machinery spaces with increased accuracy and reduced costs.

By Daryl Johnson

The time to install a Ballast Water Treatment (BWT) System or maybe an Exhaust Gas Scrubber is rapidly approaching. Or, perhaps, you are an inland vessel operator watching the subchapter M drama with great interest. In all of these cases, most vessels have limited space in which to install these items. That said; as the regulatory uncertainty with regard to the impending regulations dissolves, the high cost of installing these systems will not go away – unless, of course, emerging technologies can ease that pain somewhat. Fortunately, and just ahead of the regulatory enforcement, comes FARO's new 3D Laser Scanning system.

Even without new environmental requirements, the marine Industry is in great need of applying emerging technologies like 3D Laser Scanning to a myriad of new tasks. Tens of thousands of aging vessels will soon need equipment retrofits, most of which involves navigating narrow, tight, and limited space areas. Even for those owners who have archives of original drawings, those general arrangement depictions may not accurately reflect the current situation on a given vessel, especially one which has been around for a while and seen its share of repair yard insertions. Hence, equipment retrofit is typically extensive, costly, time consuming, and fraught with measurement errors. It doesn't have to be that way.

Old School

The typical approach when performing ship checks is to bring designers and/or engineers on board where, using tape measures, they record measurements of the existing systems and spaces. These measurements are then used in developing scope and construction documents. However, the uncertainty of the measurements requires allowances be included to account for discrepancies between the measurements and reality. These allowances can be expensive and/or prevent the installation of new equipment in a certain location because the space was considered too small, when in fact there was adequate clearance. Or, conversely, maybe not enough at the time of installation.

3D Laser Scanning

A better approach involves scanning ship spaces with a 3D laser scanner to create a very detailed and accurate 3D point cloud model. Today's high speed laser scanners are quite suitable for this purpose as they can take tens of millions of measurements in just a few minutes. Scans are taken from various positions in order to provide sufficient coverage around equipment. The scans are then registered together to bring them all into the same coordinate system. Done properly, with the latest FARO Focus3D scanner, the laser scan data can be accurate to within 3 mm over 10 meter distances.

Benefits of using 3D laser scanning:

- *Laser scanning can often be done while the ship is in operation.*
- *Vibration is one of the few limitations.*
- *Measurements: more comprehensive and precise compared to hand measurements.*
- *Reduces or eliminates the need for follow-up site visits.*
- *Design work can be carried out in office & within the created 3D Point Cloud Model.*
- *Data allows larger portion of new or replacement pipe spools to be pre-fabricated in shop @ lower cost.*
- *Data increases number of bolt-up tie-ins & reduces field welds, reducing shipyard costs & downtime.*

With all these benefits, the use of 3D Laser Scanning, despite its availability, nevertheless has not become a mainstream practice in ship repair and retrofit operations. The reasons why come down to three main issues. These include cost of hardware, capability and difficulty of use, computing power limitations and inconsistent workflow and software solutions. Fortunately, most of these issues have been addressed, as depicted below:

1. Hardware Cost and Difficulty of Use

Until recently, laser scanning equipment was cumbersome (multiple components with total weight over 150 lbs) expensive ($150,000+), requiring highly skilled crews to operate. With the recent offerings from FARO, however, the new Focus3D scanners weigh in at just 12 pounds, at about one-third the cost and are similar in operation to a high end digital camera. The new scanners can, with one person, take significantly better measurements in one day than a 'ship check' team can accomplish in a week's time. More significant, perhaps, is that every vessel can perhaps justify having a scanner on board, allowing the Chief Engineer or Project Manager to direct work in detail within 3D model shots of his machinery spaces. With this approach, the cost required to obtain accurate measurements has been greatly reduced – and can be accomplished from far out to sea, well in advance of the repair procedure.

2. Computing Power Limitations

Another barrier to wide acceptance of 3D Laser Scanning was the huge data sets that bog down computers and made it difficult for managers to visualize their projects in the 3D Point Cloud. Autodesk ReCap and Bentley Pointools among others have and are making great strides to overcome this barrier.

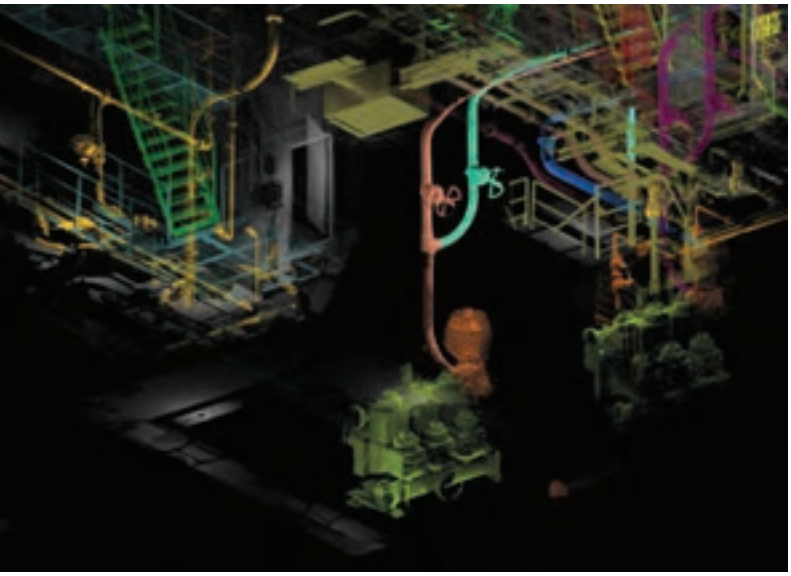
3. Difficult Workflow and Software Solutions

The next limiting factor is the work flow and software that allows CAD Designers to work directly in the 3D Laser Scan Point Cloud model and apply statistically valid algorithms to the point cloud data for feature extraction of system components such as piping, structure, and more. The software available on the market to meet this need has grown considerably over the last few years and is available from such companies as Kubit, Innovmetric, Edgewise and Kohera3D – just to name a few.

"We Haven't the Money, So We've Got to Think"

It was Ernest Lord Rutherford who is credited with saying, "We haven't the money, so we've got to think." A renowned Physicist, Rutherford proved time and time again that thinking saves money, but what drove him was his love of solving problems in more efficient and cost effective ways. The new 3D laser scanning technology is the perfect fit for this way of thinking.

In 2007, Summit Engineering and Design, LLC moved to FARO scanners and at the same time, began to develop software solutions so CAD designers could work directly in the Point Cloud model. Summit had learned the hard way that the further away from the Point Cloud the designer was removed, the more likely simple, yet costly design mistakes would be made. Data sets were needed that (a.) AutoCAD could handle, (b.) would allow clients to direct their project scope, and (c.) allow all to see the progress of the design efforts. Ultimately, this led to the ability to isolate (or classify or segment) the



Layered and decluttered 3D Point Cloud model used to visualize and define scope

Non-layered 3D Point Cloud model of machinery space to be retrofitted

point cloud model into individual layers where they could be worked with in AutoCAD and visualized in Navisworks.

By loading high resolution "corridors" or volume boxes of specific areas within the point cloud model, this provided designers with the detail they needed to "thread the needle" on tight pipe routings while at the same time maintaining reasonable stability and performance speeds of the CAD system. In other words, the perfect tool for that tight ballast water treatment retrofit.

But even with all these options, designers were still tracing and eyeballing the new design over the scan data. In response, Summit developed statistically valid feature extraction algorithms to give the designers "Basic Modeled Parts" which included such things as cylinder fits, pipe centerlines, face of flange and top of steel locations. These Basic Modeled Parts provided "snap-to-points" in AutoCAD. In addition to these Basic Modeled Parts, it was discovered that loading high resolution "corridors" or volume boxes of specific areas within the point cloud model also provided designers with the detail they needed, while at the same time maintaining reasonable stability and performance speeds of the CAD system.

Design & Retrofit – The Way Forward

Although it is possible to continue using the "brute force" methods of the past, 3D Laser Scanning has emerged as a valuable and accessible technology that will continue to make measurable strides in the shipyard industry, and beyond. But, if you've got all the time and money in the world, and you don't like to think too much, then continue on as before.

The FARO scanner features portability, light weight equipment and a surprisingly affordable price tag.

The Author

Daryl Johnson is a registered Professional Engineer in Washington State. He has 30 years of management, engineering and design experience in the refining, power, marine, process and integrated chip industry. He established Summit Engineering and Design, LLC in 1998 and was first introduced to 3D laser scanning in 2001.

New Equipment installed in 3D Point Cloud model. Note: a clash was resolved during installation and the tight clearances necessitated that the pump was shoehorned in under the stairway.

Behind the Curtain – Decision Support Tools

By Luke Ritter

Technology Can Drive Risk Management as Maritime Professionals Optimize Security

The job responsibilities of Maritime Professionals inevitably include the requirement to understand risks, analyze options for risk mitigation, and make strategic and tactical decisions to ensure the viability of the enterprise. Business leaders must also do this while balancing goals and objectives related to profitability, and return on investment. But how do you get that done? Today, promising decision support tools that enable executives to simplify the process of risk management – and reduce the time and cost associated with those tasks – are now on the market.

A Decision Support System (DSS) can be defined as "a computer-based information system that supports business or organizational decision-making activities." These so-called decision support systems, or decision support tools, are designed to support various planning functions within the management and operations layers of a business enterprise. A DSS is typically most useful when an operational environment is dynamic, and metrics used to drive business decisions are rapidly changing and not easily specified in advance. The maritime domain clearly fits this description.

Every senior executive in the maritime industry, with strategic risk management responsibility, should have access to these kind of tools that facilitate the decision making process.

What Constitutes Business Risk?

Vulnerability is a physical feature or operational attribute that renders an entity, asset, system, network, or geographic area open to exploitation, or susceptible to a given hazard. Marine managers must continually evaluate natural and man-made risks that have the potential to disrupt operations, or threaten employees, fixed assets, assets in transit, proprietary data, or even the environment. Maritime assets that are typically considered to be "critical," are those transportation networks or systems that support core business functions, and if lost, could result in catastrophic damage to an enterprise.

We also know that risk exposure has two primary elements that must be considered when pursuing risk mitigation strategies: Likelihood and Consequence. Likelihood is simply an estimate of the potential that a disruptive event will occur. Consequence of a disruptive event takes into consideration the impact that the event has on business operations.

These metrics are often easy to define, but can be much more difficult to actually calculate.

The amount of risk exposure that an organization is willing to accept, as a normal course of business, is referred to by the insurance industry as "risk appetite." Tolerance for risk exposure can vary greatly from one company to another within the maritime industry. When executive decision makers focus on risk management, it is not uncommon to find that a company's exposure to risk is not aligned with the actual policies, plans and procedures in place for risk mitigation. This is where decision support tools can play an important role.

When executives have access to intuitive, easy to use software tools that manage and manipulate data, they can expose gaps, establish focus points for minimizing their firm's exposure, and pursue risk management strategy options that emphasize security optimization.

Optimization is the Key

The Quality Management movement ultimately boiled down a complex methodology for continual incremental improvement into a simple, four-word chain that is easy to recall:

PLAN / DO / CHECK / ACT

Although the steps required to implement these organizational management initiatives are complex, the underlying process is simple. The most effective decision support tools for security and risk management use this same basic model. ARES Security Corporation, for example, has a decision support tool on the market called AVERT.

This solution has been validated by the U.S. Government, has been granted a Safety Act designation by the U.S. Department of Homeland Security, and is currently being employed to protect some of the most sensitive critical infrastructure assets in the United States. The AVERT tool uses a similar, fundamental process to produce results that optimize security posture:

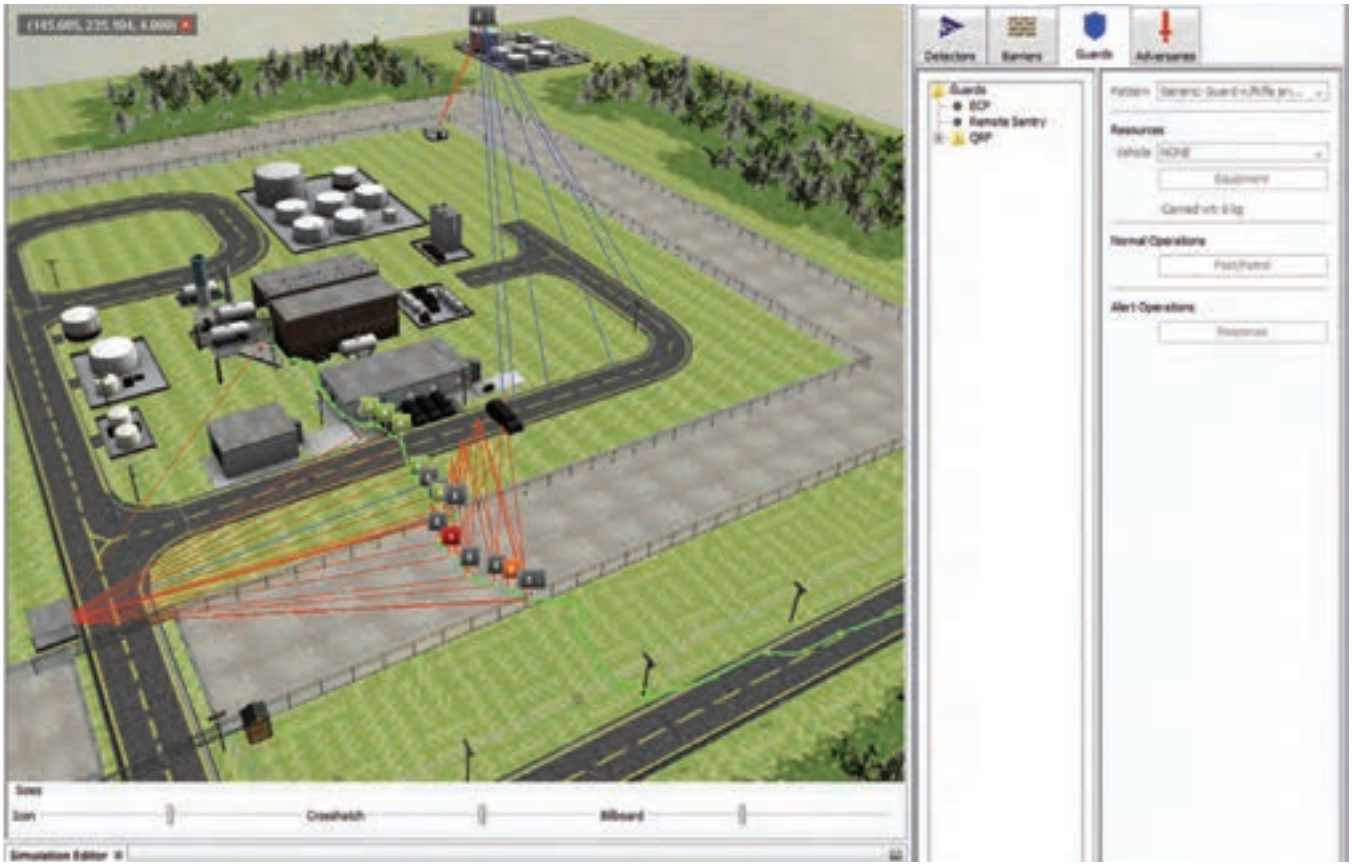
CHARACTERIZE / SYNTHESIZE / ANALYZE / OPTIMIZE

'Characterize' is a starting point that establishes a baseline, for an existing security posture, by modeling a firm's current risk environment. The AVERT tool creates a detailed, 3D model of an asset that need to be protected. Interview "wizards" are used in this solution to guide users through the process of inputting facility diagrams, terrain details, critical areas, and existing security and risk management features. Drag and drop functions allow decision makers to select features from a certified library of more than 50,000 security resources. This tool also helps users establish a 'Concept of Operations', for risk mitigation, that can be tested and validated in follow-on steps. Without the help of a decision support tool like this, experts typically have to build a baseline profile manually. These tools save time, and money, and allow for non-expert users to participate directly in the risk management process, from the start.

'Synthesize' has to do with testing various risk mitigation options using simulated incidents and threat profiles. Once a baseline profile has been established, a decision support tool can simulate both natural and man-made hazards, as well as other operational disruptions that have the potential to result in losses. One size does not fit all when it comes to risk mitigation strategies. Decision support tools can become a "force multiplier" for decision makers by enabling users to virtually configure and test hundreds of different options. The AVERT tool, for example, uses probabilistic algorithms and Monte Carlo analysis to identify and quantify a wide variety of security vulnerabilities and mitigation choices. Maritime security decision makers need to know where and how vulnerabilities are most likely to occur. It is essential to understand how existing security systems will respond to different threats, and where the best opportunities may exist to enhance security. Decision support tools use the power of modern computing to sort through the myriad of variables and options, and then present the results in a way that facilitates decision making.

'Analyze' is the area where the best decision support tools really shine. Simply presenting reams of analytical data is not necessarily useful. And data does not become "intelligence" until it is analyzed and disseminated. AVERT combines quantitative analysis with comprehensive visualization tools and intuitive output such as graphs, heat maps, pie charts, and

Screenshot depicting a particular attack path along with billboards and shot traces. Shot traces show in red shots from adversaries and blue, shots from guard force. The billboards can be accessed to detail what happened at the particular point in the simulation and is used to analyze the attack and response.



When executive decision makers focus on risk management, it is not uncommon to find that a company's exposure to risk is not aligned with the actual policies, plans and procedures in place for risk mitigation. This is where decision support tools can play an important role. When executives have access to intuitive, easy to use software tools that manage and manipulate data, they can expose gaps, establish focus points for minimizing their firm's exposure, and pursue risk management strategy options that emphasize security optimization.

cost-benefit tables to present decision makers with actionable intelligence. Using this tool, reports can be produced that provide executives with specific information related to things like critical detection points, probability of interdiction success, total cost of ownership, and overall system effectiveness.

'Optimize' is the phase of the process where decision support tools can truly provide a real return on investment. Since the best decision support tools are designed to present executives with meaningful decision points, the emphasis should be on quality and validity of the output, not necessarily quantity. AVERT, for example, generates extremely accurate metrics, reports, and visualizations that are derived from a security library that has been accredited by the U.S. Department of Defense for assessment of nuclear storage facilities.

In order to ensure that decisions are made that support security optimization, executives must have access to accurate information. Expected results of specific risk mitigation initiatives, as well as the associated cost of those upgrades, are both important metrics to be considered. Maritime professionals that have the ability to accurately and efficiently prioritize risk mitigation options, using expected performance and cost data, have a true advantage in the market place.

Show me the Money

Business leaders with risk management responsibility need a tool that can help validate the effectiveness of a proposed security solution, before you actually invest in that solution. That tool should provide a way to rapidly conduct "what if" analysis related to the various threat profiles that your business is exposed to. That same tool should facilitate the clear communication of the value proposition associated with a specific planned maritime risk management initiative. If you and your team are not so equipped, then it may be time to investigate decision support tools.

The AVERT tool, used as an effective decision support system, has paid for itself many times over in some recent implementations. A U.S. Government agency used this tool to evaluate a planned security upgrade that was budgeted for, but not yet procured. The analysis showed that this planned investment would not actually have resulted in any substantive increase in overall security effectiveness at the facility. The investment was cancelled, and AVERT was credited with total cost avoidance of $5 million. Similarly, a major U.S. port recently used AVERT to validate the design basis of a planned security upgrade, eventually resulting in a successful maritime security grant award of $5.5 million. Separately, a private power generation firm recently used the AVERT tool to reduce their annual security assessment budget by as much as 30 percent.

Marathon, Not a Sprint

Threats to businesses in the maritime domain are increasing, and at an alarming rate. Consequently, the costs associated with security and risk management also continue to increase. It has become more difficult than ever for maritime professionals to optimize security posture, and ensure business continuity.

Every successful company employs practical management systems as the foundation for managing critical business functions – risk management should not be an exception. Decision support tools have been used to support financial management functions in business for decades. Once they are incorporated into a firm's standard management approach, decision support systems can become a trusted and reliable asset. Where risk management is concerned, this is definitely the case. As operating conditions and threat profiles change, these tools can be used, over and over, or even on a continual basis, to compare variables, evaluate options, and work through to a "best-fit" answer, leaving nothing to chance. Decision support tools provide a proven method to continually assess risk, analyze mitigation strategies, manage security budgets, and optimize security posture based on predicted effectiveness.

In today's global maritime domain, where all-hazards risks are persistent and pervasive, and can cause immediate and devastating impacts if improperly addressed, effective risk management must be designated as a core business function. By using decision support tools to systematically invest in risk mitigation initiatives, maritime professionals have an opportunity to pursue return on investment, and create value for their firms.

www.arescorporation.com/security/products/avert/

Boundaries, Standards and the Business of Integrity

By Charlie Butterworth

As maritime security evolves, so too is the need for increased and standardized professionalism in the ranks of Private Maritime Security Companies.

In many respects, the maritime security industry is still in adolescence. The growing pains associated with speed of expansion have led to disparity in terms of acceptable behavior and confusion over appropriate conduct. This disparity is echoed in the PMSCs themselves - there are those who strive to lead the way in terms of professionalism and others who struggle to keep up with reasonable minimum standards. Although some owners may be happy to accept a more liberal approach to maritime security, when it comes to deploying men with guns on ships, there is no room for allowing immaturity. The stakes are too high.

What the industry continues to need are clearer boundaries and standards. This, coupled with an ethos of integrity, is central to securing the confidence and respect of the shipping market, not least so for those shipowners and operators who understand the tangible value attached to reputation.

Fortunately, there continues to be a determination to professionalize the industry; the ISO/PAS 28007 standard, as well as amendments to German law provide clear examples of how private maritime security is maturing.

ISO/PAS 28007

In the short history of private maritime security there has never been one universal standard; a definitive benchmark that comprehensively encapsulates every aspect of a private maritime security company (PMSC) and how it should be delivering its services effectively. Until now, that is.

Initiated in 2012, ISO/PAS 28007 (annexed to the ISO 28000 Security Management System) was formulated within six months, making its establishment one of the fastest in ISO history. However, that speed is in no way reflective of the depth of the standard, but rather the necessity of an internationally recognized standard to support ship owners and operators in effectively evaluating PMSCs. It sets the benchmark for PMSCs who want to demonstrate to the international community that they, and the operatives they supply, are of the right quality to legally, safely and effectively guard commercial shipping on the high seas.

ISO 28000 is a risk based quality management system for the security of operations and activities conducted by organizations. ISO 28007 sets out guidance for applying ISO 28000 to PMSCs and key components fall into two main groups; management of the security system and procedural aspects. Management of the security system includes areas such as security risk assessments, clearly defined management responsibilities, internal audits of operations, and legal and other regulatory requirements. Procedural aspects encapsulate rules of authority, contractor selection, screening and vetting, training, authorizing licensing of firearms, prevention of incidents, incident management and emergency response, investigation and reporting of incidents, procedures for detainment, identification, interface with crew and familiarization.

The United Kingdom Accreditation Service (UKAS) is the sole national body recognised by government to assess evaluating organizations, such as certification bodies, against international standards. UKAS has been appointed to assess companies offering certification to ISO/PAS 28007, verifying that they are using competent assessors with the correct qualifications and that rigorous and tested auditing processes are followed. The importance of thorough and independent assessment against recognized standards (UKAS accreditation) is key to the confidence of the shipping market. It is vital that auditing standards are not undermined and that PMSCs are not tempted by a certification body that is not internationally-accredited.

UKAS began assessment of the certification bodies' in June and aims to complete the pilot project by the end of the year. This will allow appropriate time for those certification bodies taking part to train its auditors to the rigorous requirements demanded by ISO/PAS 28007. In the meantime ship owners can continue to work with the ISO/PAS 28007 document as guidelines to indepen-

dently assess the competency of PMSCs.

PVI is one of the few PMSCs involved in the pilot scheme and is working through the process with Lloyd's Register Quality Assurance (LRQA). As a subsidiary of Lloyd's Register Group Limited, LRQA clearly has strong foundations in the maritime industry and is one of three global management system certifiers participating in the pilot.

Ultimately, ISO/PAS 28007 is all about risk assessment. It has been specifically created for ship owners and operators to support them in deciding whether or not the risk that they are taking has been properly evaluated, calculated and assessed. This can only be welcomed.

German Accreditation

Although the ISO/PAS 28007 represents a landmark in the professionalization of PMSCs and will represent the foundation for future due diligence, certain Flag States continue to adopt their own procedures to determine which companies are approved to protect vessels sailing under that Flag. Panama, Malta, Belgium, Croatia, Greece, the Netherlands, Luxembourg, Italy, the UK and Cyprus, for example, all have particular requirements for the utilization of PMSC services and from 1 December 2013, Germany will join that group. Changes to German law will mean that only licensed PMSCs will be able to provide security services onboard German-flagged vessels.

The updated German regulations are more stringent than any other existing standard and go beyond those of the ISO 28000/28007 certification. It may well be, therefore, that many maritime security companies will not afford the time and resource to achieve this mandatory accreditation.

The German regulations require companies not only to demonstrate due process, but also to evaluate the implementation of those processes. PMSCs are asked to, amongst other things, submit standard operating procedures and company documentation for scrutiny by the authorities. They also place great emphasis on training standards, for example obtaining knowledge and skills relevant to the German public. This includes comprehensive knowledge of German civil and criminal laws – such as width and limits of right of self-defense – crisis handling, de-escalation techniques, the secure handling of weapons and equipment, as well as weapons law and foreign trade law of Germany, and of the relevant harbour and coastal states. In addition, they require the PMSC's Privately Contracted Armed Security Personnel (PCASP) to conduct and evidence regular firearms training.

PVI is committed to obtaining a license from the German Authorities to enable it to place its PCASP on German-flagged vessels. It is undertaking the additional training in-house and has employed independent German legal experts to ensure the accuracy of the German legal training requirements.

Whilst there have been questions over the necessity for such complexity in the German regulations, what is being set out to achieve is obvious; mitigation of risk in an area where the stakes are high. BAFA and the Polizei Hamburg are proactive and knowledgeable in their approach, providing direction and support to interested PMSCs and the German Government should be praised for its attempt to not only regulate this maturing industry but ultimately keep seafarers safe.

As the maritime security industry gradually matures and the risks presented by anything less than an exemplary approach become readily apparent, it stands to reason that ship owners and operators are becoming increasingly discerning in their choice of security partner. This is why accreditation that recognizes and rewards legal compliance, professionalism, quality and excellence is to be applauded and embraced.

The Author

Charlie Butterworth is In House Counsel to PVI and has been a barrister since 2003. She has become one of a few specialist maritime security lawyers experienced in advising on the law relating to shipping and piracy, insurance risk and alleviation, relevant aspects of public international law, rules of the use of force at sea, flag state law and regulation, international conventions such as UNCLOS; SOLAS as they relate to the rights of individuals and matters of legal jurisdiction.

BALLAST WATER TREATMENT

The New Ballast Water Management Regulation Cometh

Ready or not, here it comes. Are you ready?

By Christopher R. Schulz & Randy Kullmann

In March 2012, the U.S. Coast Guard (USCG) amended its regulations on ballast water management by establishing standards for the allowable concentration of marine organisms in ballast waters discharged in ports and coastal areas of the United States. The new regulation includes procedures for independent testing and approval of ballast water treatment (BWT) systems to be installed on ships to meet these standards. According to the USCG, the new requirements will be more effective than ballast water exchange (i.e., flushing our ballast water and replacing it with mid-ocean water while in transit) in controlling the introduction and spread of non-indigenous species (NIS) in waters of the United States. The requirements of the Ballast Water Management (BWM) Regulation (Federal Register, Vol. 77, and No. 57), treatment options to meet these requirements, and what ship owners should be doing now to comply should all be key concerns for today's ocean operators.

BWM Regulatory Summary

Applicability: The regulation applies to all U.S. and foreign commercial vessels equipped with ballast tanks that discharge ballast water into U.S. waters, operate outside the U.S. Exclusive Economic Zone (i.e. more than 200 nautical miles from U.S. shorelines), and practice ballast water exchange. It also applies to ships that do not operate beyond the EEZ but take on and discharge ballast water in more than one Captain of the Port Zone and are larger than 1,600 gross register tons. U.S. Department of Defense or USCG vessels, crude oil tankers engaged in coastwise trade, or vessels that operate exclusively within one USCG Captain of the Port Zone are exempt from the regulation.

Implementation Schedule. The new requirements will be phased in for different types of vessels, as follows;

- *New Vessels (commissioned on or after Dec 1, 2013): on delivery*
- *Existing Vessels (<1,500 cubic meters ballast water capacity): 1st dry dock after Jan 1, 2016*
- *Existing Vessels (1,500-5,000 cubic meters ballast water capacity): 1st dry dock after Jan 1, 2014*
- *Existing Vessels (> 5,000 cubic meters ballast water capacity): 1st dry dock after Jan 1, 2016*

Time extensions may be granted by the USCG case by case if the ship owner or operator can document that BWM regulatory compliance is not possible. However, extension requests must be made at least 12 months prior to the scheduled implementation dates cited above.

Ballast Water Discharge Standard: The ballast water discharge standard replaces ballast water exchange to significantly improve protection of ecosystems within U.S. waters. The requirements, based on organism size and use of indicator organisms, are equivalent to the IMO discharge standard adopted by other countries:

Size-Based Organisms:

- For organisms >= 50 um (zooplankton): < 10 organisms per cubic meter (applies to zooplankton)
- For *organisms* < 50 um to >=10 um: < 10 organisms per milliliter (applies to phytoplankton)

Indicator Organisms:

- < 1 coliform forming unit (CFU) Vibrio cholera per 100 mL
- < 250 CFU Escherichia coli per 100 mL
- < 100 CFU enterococci per 100 mL

As noted in the BWM regulation, the USCG plans a "practicability review" no later than January 1, 2016, to determine whether an even tighter discharge standard is warranted based on available treatment technologies for shipboard applications, environmental impacts and cost.

Ballast Water Management Requirements. To meet the new discharge standard, a seagoing commercial vessel must employ one of the following BWM methods:

- *Install and operate a BWT system approved by the USCG to meet the regulation's ballast water discharge standards at all times.*
- *Install and operate an alternative management system (AMS) that has been type-approved by a foreign administration in accordance with testing requirements of the International Maritime Organization (IMO), for up to five years from the BWM compliance date for that particular vessel.*
- *Only use water from a U.S. public water system for ballast water provided that the ballast tanks have been previously cleaned and no seawater subsequently introduced into ballast tanks or supply lines.*
- *Discharge of ballast water to an onshore reception facility for treatment.*

For most vessels, only the first two methods will be feasible from logistical, safety and operating cost standpoints. And because of the tight regulatory implementation schedule, it is anticipated that most vessels will install an AMS for short-term

(less than five years) compliance, and vessels with previously installed BWT systems (to meet foreign IMO-based discharge standards) will seek an AMS determination from the USCG to continue to operate those systems. Note that systems with AMS approval will become USCG type approved BWT systems if they can meet land-based and ship-based testing requirements.

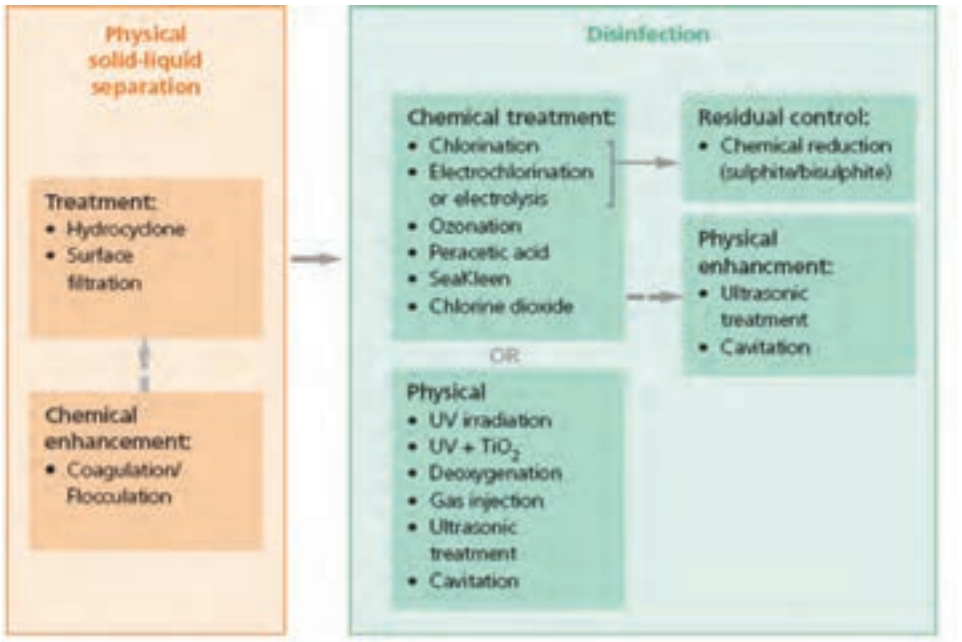


Figure 1: Treatment Technologies Used in IMO-Type Approved Ballast Water Treatment Systems

Reporting Requirements: The operator of a vessel must maintain written records on the ship's ballast water management operations, essentially the same as that required for ballast water exchange. This requirement can be met by using the Ballast Water Reporting Form from the IMO ballast water management guidelines. Monitoring records must be kept for at least two years. The regulation does not specify record-keeping requirements for operating BWT systems, but it is expected that this information will need to be provided to USCG inspectors upon request.

Enforcement and Penalties: Vessels will be subject to USCG inspections, which will include sampling and analysis of ballast water discharges and examination of documents to determine compliance with the BWM regulation. In addition, every vessel will be required to have a specially designed sampling port at each overboard discharge point for use by USCG inspectors for collecting representative ballast water discharge samples. Sampling procedures for shipboard inspections are still under development by the USCG and will be posted on its website when available. The owner or operator of a vessel who violates the BWM management or discharge standard requirements is subject to a civil penalty up to $35,000 per day.

BWT System Approval Procedures: The manufacturer of a BWT system must apply to the USCG for type-approval. The application must detail the design, shipboard installation, component testing and O&M system requirements, and present results of land-based and ship-board testing by a USCG-accepted Independent Lab. Land-based testing must meet the requirements of the Generic Protocol for Verification of Ballast Water Treatment Technologies (called ETV Protocol), published by the U.S. EPA Environmental Technology Verification Program in September 2010. Land-based testing will determine if the BWT system can reliably meet the discharge standard for prescribed challenge water conditions. Shipboard testing must be performed for at least six months to demonstrate that the system will meet the discharge standard when operated in a shipboard environment.

A manufacturer may also submit existing data from type-approval testing by a foreign administration, and work with a USCG-accepted Independent Lab to evaluate data and fill any data gaps by having the system tested in accordance with the ETV Protocol. If the BWT system is approved by the USCG, a certification number and approval certificate will be issued to the applicant specifying acceptable ballast water quality uptake conditions (e.g., freshwater, brackish water or seawater) and engineering parameters for operating the system.

BWT Systems

The global market for BWT systems is predicted to grow to over $34 billion through 2020 in response to IMO and USCG-based ballast water discharge regulations (Frost and Sullivan, 2012). BWT systems are now manufactured by dozens of companies around the world, including traditional suppliers of marine equipment, suppliers of municipal water and wastewater treatment equipment, and shipbuilders. As of November 2013, 35 BWT systems have received IMO-type approval from foreign administrations, and 28 of these have been accepted into the AMS program by the USCG.

As shown in Figure 1 above, these systems include various treatment technologies and combinations but are typically arranged to provide two stages of treatment: (1) physical solid-liquid separation to reduce sediment and remove larger organisms, and (2) disinfection to kill or inactivate smaller organisms. The

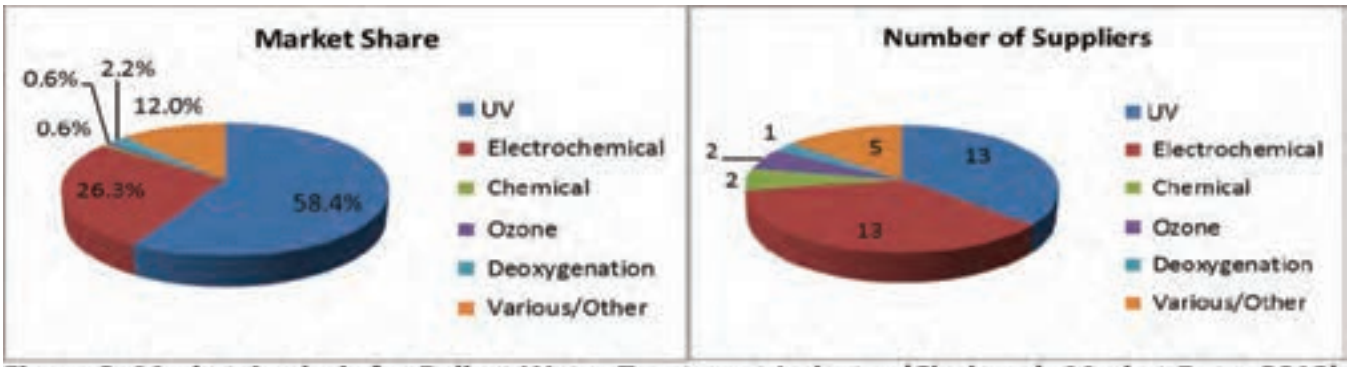


Figure 2: Market Analysis for Ballast Water Treatment Industry (Clarkson's Market Data, 2012)

disinfection processes can be further classified into physical or chemical treatment processes. The latter may involve residual control to meet discharge limits for active chemical substances or physical enhancement technologies to improve treatment performance.

As shown in Figure 2, the global market for BWT systems is dominated by two treatment technologies -- UV and electrochlorination. These are manufactured by 26 equipment suppliers and compose 85% of the approximately 1,500 IMO type-approved BWT systems installed to date. The basic process trains are generally described above.

UV Disinfection: This is a two-stage treatment process with a pressure-rated filter unit (typically with micron-rated disks or membrane elements) to remove sediment and larger organisms, followed by a UV disinfection unit to inactivate smaller plankton, bacteria and viruses. No chemicals are required to operate the system. During ballasting, water is typically processed through both the filter and UV stages as water is pumped into the ballast tanks. Solids captured by the filters are discharged at the ballasting location. During de-ballasting, the filter is typically bypassed and water is treated by the UV unit only before discharging overboard.

Electrochlorination: This is a two-stage treatment process with a micron-rated pressure filter or strainer followed by an electrochlorination unit. The latter is essentially an on-demand chemical system, which uses electrolytic cells to generate a sodium hypochlorite (bleach) solution from seawater and electricity. Some treatment systems pump the entire ballast water flow through the electrolytic cells, whereas others use a small slipstream to generate a concentrated hypochlorite solution, which is then recombined with the main flow. During ballasting, water is processed through both the filter and electrochlorination unit as water is pumped into the ballast tanks. A chlorine residual (or residual oxidant) is maintained in the tanks for a minimum contact time (typically a few days) to improve disinfection and eliminate regrowth of organisms during transit.

(Image courtesy of Severn-Trent deNora)

Shipboard installation of electrochlorination system for generating sodium hypochlorite.

During deballasting, a neutralization chemical (e.g., sodium bisulfite) is added to the water to remove the oxidant residual as it is pumped overboard. Note that this type of system cannot be used in freshwater areas such as the Great Lakes because it requires salinity for hypochlorite production.

Complying with the New Regulations

The new BWM regulation will increase costs for ship owners/operators to evaluate, install, operate (including additional record-keeping) and maintain BWT systems with regulatory compliance dates, starting now for new build vessels and at the next scheduled dry-dock for many existing vessels. They must therefore quickly become familiar with the new requirements, risks of non-compliance, and necessary steps to bring individual ships or fleets into regulatory compliance.

For owners/operators of seagoing commercial vessels, most important will be to select an appropriate type-approved BWT system that is compatible with the ship's existing ballast water system and can be operated to ensure compliance safely by the crew. Key design considerations for BWT system selection include:

- *Ballast pump capacities and operating pressures*
- *Ballast tankage volume (if required for disinfection contact time)*
- *Available space for the BWT equipment*
- *Uptake and discharge piping arrangements*
- *Chemical storage location (if required)*
- *Discharge sample location (for USCG inspection use)*
- *Ship routes (and associated ballast water quality conditions)*
- *Integration of the BWT system controls into the ship's ballast control system*
- *Training requirements for crew members.*

BWT system selection is made more complicated in that the USCG has not type approved or certified any systems yet, although it plans to over the next year or two. In the meantime, AMS-accepted systems must be used with only a five-year regulatory compliance horizon, with no certainty that they will ultimately be approved by the USCG for long-term compliance with the BWM regulation.

Given the complexity and uncertainties of the BWM regulatory requirements, tight implementation schedule, system installation challenges, and the myriad of BWT systems on the market, many ship owners are hiring a qualified engineering firm to assist in selection of the most appropriate BWT system and work with the selected equipment supplier to design and install the BWT system on a particular ship or fleet. The planning, engineering and installation of the BWT system needs to be carefully coordinated with the vessel drydock projects.

Ballast Water Treatment: Decisions, Decisions ...

The IMO's Ballast Water Convention will enter into force 12 months after 30 countries representing 35 percent of the world's tonnage have ratified it. Today's tally exceeds this, totaling 38 countries – a reflection of the international community's response to the impact of invasive species. Total tonnage, however, stands at 30 percent; short of the requirement. According Dr. Stelios Kyriacou of Wärtsilä Water Systems, a key driver for operators deciding to move forward in this environment was the U.S. Coast Guard announcement confirming that performance discharge standards identical to the IMO's D2 discharge standard would be adopted with an effective date of 21 June 2012. The USCG also said that any system that has an IMO Type Approval certificate issued by or on behalf of a non-US flag administration could be accepted under its Alternative Management Systems (AMS) provisions, having been previously subject to a USCG assessment. Approximately 9,000 foreign-flagged vessels visit US ports every year. Compliance with ballast regulations is now mandatory for all. BWT system selection is made more complicated in that the USCG has not yet type approved or certified any systems. In the meantime, AMS-accepted systems must be used with only a five-year regulatory compliance horizon, with no certainty that they will ultimately be approved by the USCG. Kyriacou also said, "Although the overall implementation schedule has been protracted, the US position and introduction of the Vessel General Permit (VGP) from 19 December 2013 will accelerate the need to comply. Shipowners are acting now to find and secure the most effective installation." Key design considerations for BWT system selection include:

- Training Requirements
- Ballast tankage volumes
- Available Space onboard
- Piping arrangements
- Chemical Storage (if needed)
- Discharge Sample Location
- Ship routes (and associated ballast quality conditions)
- Integration of BWT controls into ballast control systems
- Ballast pump capacities / PSIG

The game is moving in one direction: vessels must meet the IMO D-2 standard – which is numerically equal to the U.S. standard. For most, this can only be achieved through the use of technology. There's no silver bullet – no single solution will be suitable across all ship types, sizes and environmental conditions.

The Coast Guard's AMS list – as of November 2013 – is depicted below:

Manufacturer	System Name	Accepted Models	Acceptance Date	AMS Identification No.	Accepted for Use in		
					Freshwater[1]	Brackish Water[2]	Marine Water[3]
Alfa Laval Tumba AB - Sweden	PureBallast	Models 250 to 2500 with associated filters	15-Apr-13	AMS-2013-AlfaLaval-PureBallast-001		X	X
Alfa Laval Tumba AB - Sweden	PureBallast	Models 2.0 and 2.0Ex with associated filters	15-Apr-13	AMS-2013-AlfaLaval-PureBallast-002		X	X
DESMI Ocean Guard A/S - Denmark	OxyClean	Models OxyClean 75, -100, -200, -300, -400, -500, -600, -700, -800, -900, -1000, -1200, -1300, -1400, -1500, -1600, -1700, -1800, -1900, -2000, -2100, -2200, -2300, -2400, -2500, -2600, -2700, -2800, -2900, and -3000, with associated filters	11-Oct-13	AMS-2013-DESMI-OxyClean-001	X	X	X
Ecochlor Inc. - USA	Ecochlor	Series 75, 100, 150, 200, 250, and 300, with filter models BS-050 to BS-1200	15-Apr-13	AMS-2013-Ecochlor-001		X	X
ERMA FIRST ESK Engineering Solutions SA - Greece	ERMA FIRST	Models BWTS 50, -100, -200, -300, -400, -500, -600, -700, -800, -900, -1000, -1100, -1200, -1300, -1400, -1500, -1600, -1700, -1800, -1900, -2000, -2100, -2200, -2300, -2400, -2500, -2600, -2700, -2800, -2900, and -3000, with associated filters	11-Oct-13	AMS-2013-ERMA FIRST BWTS-001		X	X
GEA Westfalia Separator Group, Gmbh. – Germany	BallastMaster	Ultra V 250 and associated filter	11-Nov-13	AMS-2013-GEA Westfalia BallastMaster-001		X	X
Headway Marine Technology Co., Ltd. – China	OceanGuard™	OceanGuard BWTS, with filters HMT-100F to -400F	15-Apr-13	AMS-2013-Headway-OceanGuard-001		X	X
Headway Marine Technology Co. Ltd. – China	OceanGuard™	Models HMT-50, -100, -200, -300, -450, -600, -800, -1000, -1200, -1500, -2000, -2500, and -3000	23-Sep-13	AMS-2013-Headway-OceanGuard-002		X	X
		Associated Filter Units HMT-100F, -200F, 300F, -500F, -600F, -800F, -1000F, -1500F, -2000F, -3000F, -4000F, and -5000F					
		Associated FUT units HMT-50E, HMT-100E, -200E, -300E, -450E, -600E, -800E, -1000E, -1200E, -1500E, -2000E, -2500E, and -3000E					

Hyde Marine, Inc. – USA	Guardian	Models HG-60, -100, -150, -200, -250, -300, -350, -400, -450, -500, -600, -700, -800, -900, -1000, -1250, -1350, -1400, -1488, -1600, -2000, -2500, -2975, -4000, -5000, and -6000, with alternative filters SF50, SF70, and SF90	15-Apr-13	AMS-2013-Hyde-Guardian-001		X	X
Hyundai Heavy Industries – Korea	HiBallast	Models HiB-75, -150, -225, -300A, -300B, -500, -600, -900, -1000, -1200, -1200, -1500, and -2000, with associated filters	24-Jun-13	AMS-2013-Hyundai-HiBallast-001		X	X
Hyundai Heavy Industries – Korea	HiBallast-EX	Models HiB-75-Ex, -150-Ex, -225-Ex, -300A-Ex, -300B-Ex, -500-Ex, -600-Ex, -900-Ex, -1000-Ex, -1200-Ex, -1500-Ex, and -2000-Ex, with associated filters	24-Jun-13	AMS-2013-Hyundai-HiBallast-EX-001		X	X
JFE Engineering Corp. – Japan	Ballast Ace	JFE BallastAce 4500 with Treatment Rated Capacity from 17.5 to 4,500 m^3/h, with associated filters	15-Oct-13	AMS-2013-JFE BallastAce BWTS-001		X	X
Jiangsu Nanji Machinery Company, Ltd. – China	NiBallast	Models NB-200, NB-300, NB-400, NB-500, NB-600, NB-800, NB-1000, and NB-1500, with associated filters	15-Nov-13	AMS-2013-Jiangsu Nanji NiBallast-001	X	X	X
Kuraray Co., Ltd – Japan	MICROFADE	MF-125, -250, -375, -500, -625, -750, -1000, -1250, -1500, -1750, -2000, -2250, -2500, -2750, -3000, -3250, -3500, -3750, and -4000, with associated filters	28-Oct-13	AMS-2013- Kuraray MICROFADE-001		X	X
MMC Green Technology AS – Norway	MMC BWTS	Models 150 and 300, with associated filters	29-Aug-13	AMS-2013-MMC-BWMS-001		X	X
NK Company, Ltd – Korea	BlueBallast	Models NK-GG-010, -015, -030, -040, -050, -075, -100, -150, -200, -250, -300, and -600	15-Apr-13	AMS-2013-NKGG-BlueBallast-001		X	X
OceanSaver AS – Norway	OceanSaver MK II	MK II models C2E-S200/5/13, C2E-S405/5/13, C2E-S610/5/13, C2E-S815/5/13, C2E-S1020/5/13, C2E-M1220/5(S)/13, C2E-M1425/5(S)/13, C2E-M1630/5(S)/13, C2E-M1835/5(S)/13, C2E-M2040/5(S)/13, C2E-M2245/5(S)/13, C2E-L2445/5(S)/13, C2E-L2650/5(S)/13, C2E-L2855/5(S)/13, C2E-L3060/5(S)/13, C2E-L3265/5(S)/13, C2E-L3465/5(S)/13, C2E-L3670/5(S)/13, C2E-L3875/5(S)/13, C2E-L4080/5(S)/13, C2E-S230/5(S)/17, C2E-S460/5(S)/17, C2E-S690/5(S)/17, C2E-S920/5(S)/17, C2E-S1150/5(S)/17, C2E-M1385/5(S)/17, C2E-M1615/5(S)/17, C2E-M1845/5(S)/17, C2E-M2075/5(S)/17, C2E-M2305/5(S)/17, C2E-M2535/5(S)/17, C2E-L2765/5(S)/17, C2E-L3000/5(S)/17, C2E-L3230/5(S)/17, C2E-L3460/5(S)/17, C2E-L3690/5(S)/17, C2E-L3920/5(S)/17, C2E-L4150/5(S)/17, C2E-L4385/5(S)/17, and C2E-L4615/5(S)/17, with associated filters	23-Sep-13	AMS-2013-OceanSaver MK II-001		X	X
Optimarin AS – Norway	Optimarin Ballast System	Optimarin Ballast System and filter modules Micro-Kill BSF Filter, Filtrex ACB Filter, and Micro-Kill Boll Filter Selfclean	18-Jun-13	AMS-2013-Optimarin Ballast System-001		X	X
Panasia Co., Ltd. – Korea	GloEn-Patrol	Models P-50, -150, -250, -300, -350, -500, -700, -750, -800, -900, -1000, -1200, -1500, -2000, -2500, -3000, -3500, -4000, -4500, -5000, and -6000, with associated filters	29-Apr-13	AMS-2013-PANASIA-GloEn-Patrol-001		X	X
RWO GmbH Marine Water Technology, Veolia Water Solutions and Technologies – Germany	CleanBallast	CleanBallast® Models 150, -200, -250, -300, -350, -400, -450, -500, -500-1, -750, -1000, -1250, -1500, -1750, -2000, -2250, -2500, -2750, -3000, -3250, -3500, and -3750 and modular configurations	15-Apr-13	AMS-2013-RWO-CleanBallast-001		X	X
SAMKUN CENTURY Company, Ltd. – Korea	ARA PLASMA	ARA-017, -028, -039, -063, -092, -126, -150, -190, -230, -250, and -300, with associated filters	29-Oct-13	AMS-2013-SAMKUN ARA PLASMA-001		X	X
Samsung Heavy Industries Company, Ltd. – Korea	Purimar	Models SP-25, SP-25(Ex), SP-50, SP-50(Ex), SP-75, SP-75(Ex), SP-100, SP-100(Ex), SP-150, SP-150(Ex), SP-200, SP-200(Ex), SP-250, SP-250(Ex), SP-300, SP-300(Ex), SP-350, SP-350(Ex), SP-400, SP-400(Ex), SP-450, SP-450(Ex), SP-500, SP-500(Ex) SP-600, SP-600(Ex), SP-650, and SP-650(Ex), with associated filters	4-Oct-13	AMS-2013-Purimar BWTS-001		X	X
Severn Trent De Nora, LLC- USA	BalPure	Models BP-500, -675, -1000, -2000, -2650, -3000, -4000, and -5000, with associated filters	15-Apr-13	AMS-2013-STDN-BalPure-001		X	X
SunRui Marine Environmental Engineering Company – China	BalClor	Models BC-300, -500, -1000, -1500, -2000, -2500, -3000, -3500, -4000, -5000, -6000, and -7000, with associated filters	1-May-13	AMS-2013-SunRui-BalClor-001		X	X
Techcross, Inc. – Korea	Electro-Cleen	Models ECS-150B, Ex-ECS-150B, ECS-300A, Ex-ECS-300A, ECS-300B, Ex-ECS-300B, ECS-450B, Ex-ECS-450B, ECS-600A, Ex-ECS-600A, ECS-600B, Ex-ECS-600B, ECS-1000A, ECS-1000B, and Ex-ECS-1000B	4-Oct-13	AMS-2013-Electro-Cleen BWTS-001		X	X
Wartsila Water Systems Ltd. – England	Aquarius UV	AQ-50-UV, -80-UV, -125-UV, -180-UV, -250-UV, -300-UV, -375-UV, -430-UV, -500-UV, -550-UV, -750-UV, -850-UV, and -1000-UV, with capacities up to 6000 m^3/h achieved by using multiple units in parallel Associated filter models BS-025H-03, -050H-04, -050H-06, -070H-06, -100H-08, -100H-T-08, -150H-10, -150H-T-10, -200H-12, -200H-T-12, -300H-14, -300H-T-14, and -400SH-14	28-Oct-13	AMS-2013-AQUARIUS UV -001	X	X	X
Wuxi Brightsky Electronic Company, Ltd. – China	BSKY	Models BSKY100, -150, -200, -250, -300, -350, -400, -450, -500, -600, -700, -800, -900, -1000, -1100, -1200, -1300, -1400, -1500, -2000, -3000, -4000, -5000, and -6000, with associated filters	4-Oct-13	AMS-2013-BSKY BWTS-001		X	X

Notes:

[1]An AMS accepted for use in freshwater must be tested at a practical salinity unit (PSU) concentration of less than 1 PSU ([x] < 1PSU).

[2]An AMS accepted for use in brackish water must be tested at a PSU concentration between 10 and 20 PSU (10 PSU < [x] < 20 PSU).

[3]An AMS accepted for use in marine water must be tested at a PSU concentration between 28 and 36 PSU (28 PSU < [x] < 36 PSU).

Maritime Professional

2014 Editorial Calendar

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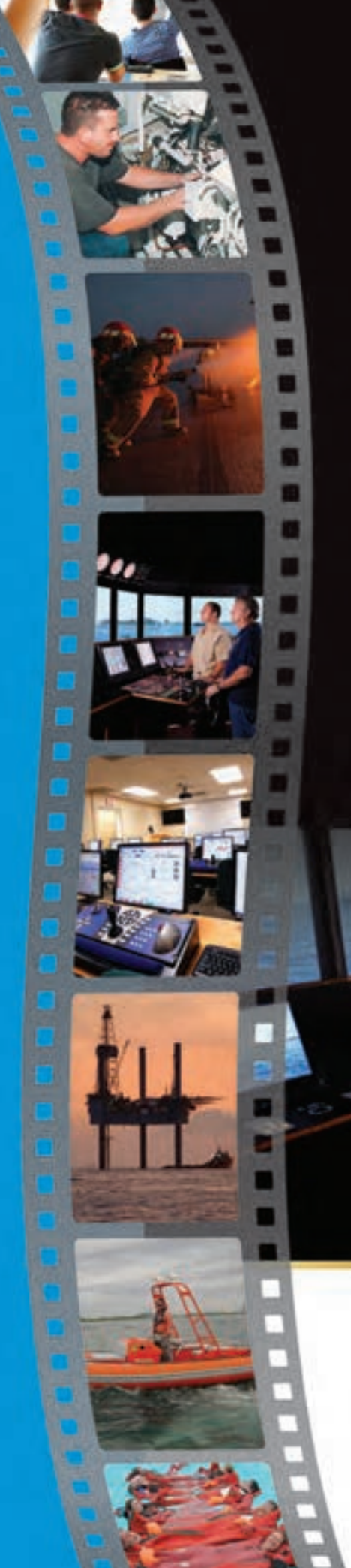

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