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Contents

***Front cover** - Capital Ship Management Corp currently operates a fleet of 67 vessels including 49 tankers (six VLCCs, five Suezmaxes, eight Aframax, 29 MR/Handy product tankers and one small tanker).*
In addition, the company has three drybulk carriers and 15 containerships.
The fleet under management includes the vessels of Nasdaq-listed Capital Product Partners.
Many of the tankers managed by Capital are Ice Class. These include 23 vessels, - 14 Ice Class 1A MRs, eight Ice Class 1C Aframaxes and a Suezmax. Capital's Ice Class vessels have traded to ports, such as Vysotsk, Primorsk, St Petersburg, Quebec, Three Rivers, Montreal, Vitino, Jinzhou and Slavyanka under severe winter conditions.

Shipbuilding at the crossroads - with the inevitable knock-on effect

If the dearth of new contracting continues, a few equipment suppliers and service providers will probably have to re-invent themselves, never mind the shipbuilders.

We have a lot of vessels due to be delivered this year and next. Then what?

As a result of the European shipbuilding industry's terminal illness around 50 years ago or so, we lost all the expertise attached to this sector, namely sub-contractors, designers, naval architects, engineers, etc. They didn't come back.

With a perceived lack of expertise in the back of some shipping peoples' minds, we don't want to see this situation happen again, especially as the next few years could bring a complete revolution in the way ships are operated.

There were some mind boggling losses coming out of South Korea recently on the back the lack of new ordering - the exception being the tanker and cruise ship sectors, but then the South Koreans don't build cruise ships.

Are we about to see another wave of rationalisation in the form of M&A activity? Most probably.

The revolution mentioned above will come in the form of disruptive sustainability, which is the jargon being used by the class societies.

As technology moves on at an extraordinary pace, there could be a fundamental change to the way vessels are managed, as 'smart' data or 'big' data- call it what you will - will result in vessels being run from the office even more than they already are.

A ship will be covered from bow to stern in sensors all making use of high throughput satellites (HTS) via the increasingly sophisticated satcoms service providers. A seafarer would only have to sneeze and it would be recorded ashore. This will bring about a complete culture change as to how ships are run.

Will there be a need for seafarers? There is increasing talk of the autonomous ship but hopefully sense and the regulatory authorities will prevail and only allow crewless vessels to operate in certain remote areas of the world.

Anything possible

With the digital revolution everything and anything is becoming possible. We have robotics in the vehicle manufacturing industry and in certain shipbuilding yard sections, some of which are controlled by a human with a box.

Despite the increased use of robotics, South Korean shipbuilder Daewoo employs some 35,000 people, a figure that is to be slashed considerably in the light of the company's huge losses.

We will not be returning to the electrician/radio officer role on board ship, as this function will be controlled from ashore or so I am reliably informed. A new breed of data crunchers will be employed who will hopefully understand what they are trying to achieve.

Will we become too reliant on digitalisation but then are we not already with the various Google offerings at our disposal to name but one information provider. What about security or cyber security as it has become known?

Will the shore technicians be able to fix a total electrical failure at sea rendering the vessel inoperable? If they can't fix the problems then at least they will be able to talk a seafarer through it and hopefully there will be some sort of redundancy installed on board.

Due to their valuable and sometimes dangerous cargoes, tankers are at the forefront of adopting new technology. Although the fundamental hull design will probably not change that much, how they are operated certainly will.

At a presentation in London recently, satcoms provider/enabler Marlink said that this shipping segment is growing fast in sales terms and had overtaken the offshore sector, which has its own problems today.

There is no doubt that the tanker sector seems to be able to attract the top talent more easily than other shipping sectors, which bodes well for its future.

The tanker companies have and are ordering a few ships, but this is just a trickle compared to what the shipyards need. Of course, here the dilemma is - will sustained ordering kill the 'golden goose'?

We could see Iran return to the shipbuilders later this year or next and the Chinese will always try to prop up their yards, which like their South Korean counterparts, are suffering badly financially.

Due to the shipbuilding downturn, the class societies and some manufacturers have tried to re-invent themselves into service providers and consultancies, but how long will this last? There is only a certain amount of upgrading, retrofit and service work out there.

We need to see the shipbuilders regain their place as technology innovators before the design offices, etc, close for good.

TO

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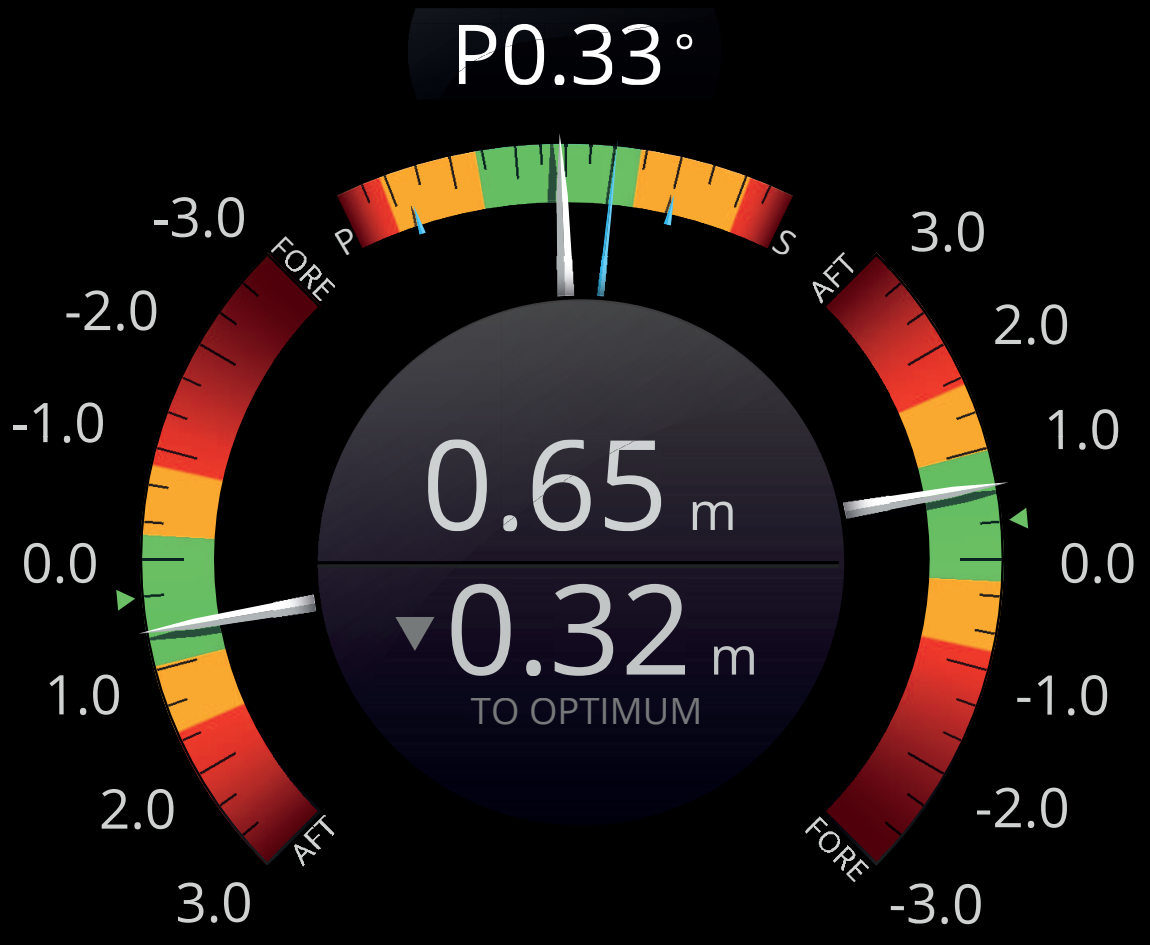

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Handy/MR fleet needs to absorb extra tonnage

Of the global tanker fleet of 25,000 dwt plus, the Handy/MR segment is by far the largest, consisting of 1,895 double hull vessels at the end of February this year.

One of the key strengths of this group size is its wide trading flexibility and growing triangulation opportunities. However, relatively low barriers of entry - compared to larger tankers - mean highly fragmented ownership and nearly perfect competition, Gibson said in a recent report.

At present, the Handy/MR supply is experiencing rapid growth, following a surge in orders in 2012 and in even more in 2013. Last year, 124 tankers were delivered and a similar number of deliveries is expected this year.

In contrast, scrapping activity is minimal, with around 20 reported deletions in 2015. Short term prospects for recycling are also limited, due to healthy earnings and the young age profile of the fleet, with only 5% above 20 years of age. In addition, low bunker prices dramatically reduced the pressure in terms of fuel efficiency, translating into an even smaller pool of scrapping candidates.

Yet, Handy/MR owners enjoyed a spectacular year in 2015, despite the rapidly growing fleet, as spot returns surged to their highest level since 2008, driven by strong fundamental growth in US and Russian clean product exports, the rebound in global refining margins, high volatility in oil prices stimulating arbitrage trade and a firm market for larger product tankers, which had a positive knock-on effect on smaller tonnage.

The dynamics of the market have somewhat changed this year. CPP exports out of the US Gulf and Russia remain strong. The volatility in oil prices is still a feature of the market. Although refining margins have weakened; nonetheless, they remain at healthy levels.

These developments continue to offer support to tanker returns in the West. For example, triangulation earnings for UK/Continent - USAC and USG - UK/Continent averaged around $23,000 per day at market speed up to the end of February this year, Gibson said.

However, the picture is different in the East, with the benchmark Singapore-Australia earnings averaging $17,000 per day thus far in 2016. This softer market is attributed to weaker chartering demand, slower economic growth in Asia and the lack of East/West trade in this specialised market.

In addition, the renewed softening in the larger product tanker market, in particular LR1s, have also had a negative impact on Handy/MR rates.

There are both opportunities and threats going forward, the report said. On the downside, continued expansion of refining capacity in the East suggests significant surplus capacity in the medium term.

Rationalisation needed

Rationalisation is probably needed, with old inefficient refining capacity in Europe being

ONE-YEAR TIMECHARTER MARKET USD/day

(Figures for TORM's fleet in 2015)

LR2	25,250
LR1	21,400
MR	17,300
Handysize	15,975

Source: TORM from a basket of brokers reports.

TORM is bullish going forward illustrated by a number of newbuildings ordered.

the most vulnerable to shutdowns. This is expected to stimulate long haul product movements but impact negatively on the short haul Handy/MR trade. There is also a growing competition from LRs in the traditional MR markets.

The recent lifting of US crude oil exports ban, combined with the decline in US crude oil production could reduce the competitiveness of US refiners; limiting at the very least the growth in US product exports.

As for opportunities, Handy/MR ordering was highly restricted over the past two years, meaning that the number of deliveries in 2017/18 will be considerably more modest, relative to 2015/16.

In addition, 9% of the Handy/MR fleet is 16 - 20 years of age, suggesting a more active demolition market in the medium term. Finally, a sustained lower oil price could stimulate demand in years to come and with it, global products trade for all tanker categories, Gibson concluded.

TORM's take

In its Annual Report, product tanker player TORM also took a look at the products market.

The company said that taking the increased economic uncertainty into account, especially with regard to the financial markets and an increased volatility in the oil price, the supply and demand balance within the product tanker market is expected to remain relatively stable.

Going forward, the company said that it expected increasing oil consumption and increased tonne/mile effects from relocation of refinery capacity to have a positive effect on the demand for product tankers.

Product tanker tonne/mile demand is estimated to grow by a compound annual rate of slightly above 6% during 2016-2018, while the estimated net growth in tonnage supply is around 6%. During the first part of the period, demand is expected to contribute positively for product tanker fleet utilisation, while the second part might see momentum soften somewhat.

As of 29th February, 2016, the one-year timecharter market can be seen in the table on page 4, which corresponds to a weighted average 12-months T/C rate for its vessels of $18,457 per day.

TORM anticipates limited ordering of new product tankers with delivery before the end of 2017 and it expects ordering activity in 2016 to slow compared to 2015's level, as the more stringent Tier III regulations take effect from 1st January, 2016.

During 2016-2018, the product tanker fleet capacity is estimated to grow by a compound annual rate of about 6%. Positive developments in the crude market could potentially lower the growth in available tonnage supply.

While global economic growth remained relatively lacklustre last year, global oil demand increased by 1.8% to 1.7 mill barrels per day (IEA January, 2016). This marked the highest growth in five years and was driven by main economies such as China, the US, India and Europe.

Gasoline dominated demand growth, positively affected by crude oil prices dropping by 46% from the 2014 average level. However, sluggish global economic growth put pressure on demand for gasoil/diesel, with stronger demand from India and Europe only somewhat mitigating this effect.

In 2016, global oil demand is forecast to grow by 1.3% or 1.2 mill barrels per day (IEA January, 2016), closer to its long-term trend pace. Based on the preliminary data, demand for product tankers is estimated to have grown by 11% in 2015.

Low crude oil prices and in particular, strong demand for gasoline, resulted in record high refinery margins in several regions. This, coupled with new refining capacity coming on stream, led to a 1.6 mill barrels per day increase in global refinery runs in 2015.

Surprisingly, much of this increase came from Europe, where refinery runs were up 6% year-on-year, while at the same time, Latin America and the Former Soviet Union witnessed cutbacks (Wood Mackenzie).

As refineries operated at full capacity to meet rising demand for gasoline, gasoil/diesel inventories climbed to new highs, but with subdued global industrial activity failing to absorb the growing supply.

According to TORM's estimates, the net global refinery capacity is expected to grow by more than 3 mill barrels per day during 2016-2018. Much of the refinery additions continue to come from Asia and the Middle East.

In the latter region, new refineries, which experienced start-up problems in 2014-2015, have reached their full capacity. Together with the additional supply, these refineries are likely to lead to more oil products being transported long-haul.

Refinery pressure

Over the medium term, the additional refining capacity will put renewed pressure on European refiners. TORM expects this to lead to cuts in refinery activity in Europe and consequently growing diesel imports from Russia, the US Gulf and – to an increasing degree – from the new refineries in the Middle East.

Currently, high gasoil/diesel stockpiles in Europe, however, could somewhat soften the need for imports in 2016.

Despite weak oil demand in 2015 in several South American countries, the region remains an important product importer in the medium and long term. Continued demand for naphtha in the Far East will increasingly be met by supplies from the Atlantic Basin, adding to average trade distances.

The lifting of the US crude oil export ban, combined with limited pipeline capacity between the US Gulf and the US East Coast and the presence of the Jones Act will lead to sustained gasoline imports from Europe to the US East Coast.

Consequently, the product tanker tonne/mile demand is estimated to grow by a compound annual rate of slightly above 6% during 2016-2018.

The main factors likely to change this outlook in either a negative or a positive way include the impact of sustained low oil prices on demand and trade patterns, a potential trend towards substantial floating storage underpinned by deepening price contango or logistical constraints, higher-than-expected newbuilding contract activ

Other factors that could affect the outlook are slower refining industry rationalisation in Europe, the export strategy of the new Middle Eastern refineries, as well as a slower-than-forecast shift in the Russian refining sector's exports from fuel oil to cleaner products and uncertainty around China's ambitions for product exports. Similarly, product price volatility and the resulting arbitrage flows are potential swing factors.

Tonnage switching

Another swing factor that affects the supply of vessels available for transportation of clean products is switching of tonnage between dirty and clean product trades. With demand for crude tankers expected to stay resilient at least throughout 2016, supported by OPEC's apparent determination to maintain its crude market share, an increasing number of product tankers could switch to the dirty segment, TORM concluded.

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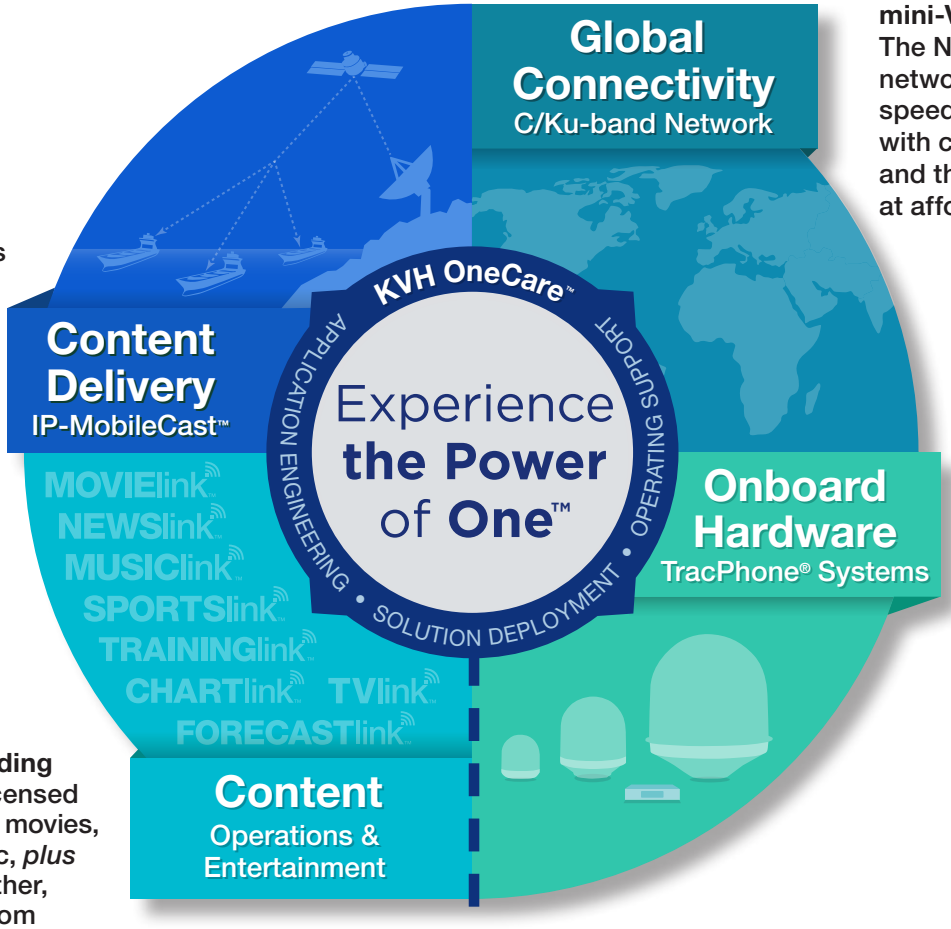

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Where are we going?

In the past few weeks, *Tanker Operator* has attended three seminars aimed at addressing the long term future of shipping.

The speakers included representatives of leading class societies and major equipment suppliers, several of whom have looked into the so called 'disruptive sustainability' idea.

For example, Kirsi Tikka, executive vice president, global marine, ABS gave the class perspective on some of the innovation and sustainability challenges facing the industry and talked about how shipping might respond.

Shipping faces challenges far beyond the need to just be financially sustainable. "Shipping is an industry that is driven more by short term market fundamentals than it is by the application of new ideas – at least in ship design, construction and operation," she said.

Kirsi Tikka.

In a low fuel price/low earnings environment, the appetite for innovation and the development of new concepts are almost non-existent. When markets are good, the ability to trade an asset regardless of its efficiency makes it an equally low priority.

The impetus to change has traditionally tended to be regulatory or evolutionary, rather than innovation-driven. The evolutionary changes have been mainly the introduction of specialised ships, such as containerships, different types of gas carriers, improved cargo handling, and economies of scale, she said.

"Even where time and effort is expended to develop better hull forms, better coatings, more efficient engines, improved materials, these have not had the same impact as conceptual changes and the introduction of ever larger ships," Tikka said. "We are now looking for more disruptive innovation from automation and big data analytics – but for the most part, we don't see a roadmap of how we get there, mainly because it involves expertise not found in our traditional industry and leadership who understands how to apply and benefit from the technology."

She said that collaboration could be one answer, but the stakeholders - owners, shipyards and manufacturers – are worried about losing their competitive edge if they share ideas.

There are publicly-funded research projects but few have yet delivered much by way of concrete results, which could transform worldwide shipping.

"If we take another step back, we may be storing up a bigger problem with the declining interest in marine technology at an academic level. Perhaps this shouldn't be surprising – shipping has no Google, no Twitter, no Intel, no Cisco and competition is tough," she warned.

The reality is that shipping has probably been too fragmented - in ownership profile, in supplier base, in service providers, for the take-up of disruptive ideas. "There are only two major civilian aircraft manufacturers but here it appears to encourage innovation. We have dozens of shipyards and hundreds of OEMs and service providers but we seem to be suffering from a lack of genuine inspiration," she said.

Long term need

Shipping needs an innovation strategy to tackle operational issues, regulatory challenges and to find ways of being more competitive, and environmentally and financially sustainable.

"It seems inevitable that the next generation of ships will feature more monitoring, control and intervention from the shore side than ever before. This is not a doomsday scenario, as it will be harder to find seagoing crew with the range of skills to work with an increased level of technology and automation on board," Tikka said.

Class also has to change and evolve with the industry, to take advantage of the potential of what the technology offers.

Holding all of these elements together is data. "Big data as a concept is happening but I think collectively we still need to figure out how to use it. There are plenty of stories of increasing volumes of data collected from the ships without a clear strategy of how to manage and act on the results," she said. She also called for a common platform to be put in place to enable the industry to share the data.

Tikka warned that there were some large projects on the drawing board that harness data, communications and new ship designs without dealing with the fundamentals of the shipping market. "For example, it is very hard to judge the actual demand for autonomous ships even if you agree with the direction of travel," she explained.

She posed the question, "If we are to do something different, more disruptive, but ultimately more sustainable, the question is how do we do it and who is going to drive it?"

Class has a fundamental role to play to enable the industry to move sustainably towards smarter and safer operations. "Smart use of data means we can be less intrusive and more predictive in the way we work with asset owners and companies and be less bound by calendar-driven events. But to make safety decisions based on data we need to be confident on the quality and the reliability of the data," she said.

She thought that the industry is looking at disruption, innovation and sustainability from the wrong angle. "We are a relatively small circle of people who tend think alike and assume that solving a problem means thinking about it in the same way that has served us well since the 1950s," she explained.

The way forward

Some larger shipowners spend a lot of time and money on the search for better maritime technology – but the discoveries are limited. "Shipping is highly fragmented market marked by volatile earnings. Investor appetite for risk

comes and goes but many struggle to see a return.

"More fundamentally, we appear to lack the intellectual infrastructure to build a long term innovation strategy. We have plenty of associations, professional bodies and internal champions but this critical issue seems always to be left to the market – and that makes it more likely to fail.

"I think the fundamental challenge for the industry is that the circle of input and ideas is too small and too focused on incremental improvements to make the kind of changes we will need in another decade and beyond. If it can happen to the entertainment industry, to leisure and financial services then why not to shipping?

"We know that for many shippers, the ocean transport leg is the piece they see as the weakest link in their logistics chain. They want better control of their supply chain and to derive value from it, not to see it as a cost they can't control.

"If we are truly to tackle the innovation challenges that confront us, the shipping industry needs to open itself up to much wider pool of ideas and be more open-minded to outside influences," she stressed.

The shipping industry may not be able to completely embrace this disruptive, start-up mentality but it should be recognised and the industry should be prepared to 'think different' about what it means and how to respond.

She proposed that shipping embraces 'open innovation', as more companies in other industries are going down this road. They are complementing their in-house research and development with open innovation efforts, which both share and draw ideas from multiple sources, such as start-ups, universities, research institutions, and customer pools.

"Shipping may not attract venture capital in the same degree as some newer industries, but there are lots of creative young people who think different but who need a conduit for their creativity. Class as an independent party can play an important role in providing a platform for new ideas, or even act as an incubator for innovation," she said.

She thought that people skill sets will be different in the future but shipping will still need as many people both on board and ashore. However, she warned that the future seafarers will not have the skill sets required in the future with more control exercised from the office ashore.

DNV GL's new maritime CEO Knut Ørbeck-Nilssen,and outgoing group executive vice president Tor Svensen also examined some of the problems facing the shipping industry going forward and in particular class.

Knut Ørbeck-Nilssen.

Svensen said that there would be more consolidation in the industry going forward but warned that it would not remove the debt attached. He also agreed that new technologies and new ways of working will be on the agenda.

He said that stakeholders should look at the performance of individual class societies, rather than IACS and explained that in particular, the marine insurance sector had realised this. Class should also be transparent by way of accounts, taxes, etc, he said. They should show social responsibility, he said.

He also warned that the regulatory regime should be moved back firmly into the IMO rather than become regional in outlook. "I am sceptical of regional regulations," he said pointing at the European Union and the US.

High competence needs long term investment in R&D, which should be undertaken in the bad times as well as in firm market conditions.

Ørbeck-Nilssen said that the lack of newbuildings was a worry going forward as was the world's economy showing a slower growth pattern, but that Asia and in particular China remained of growing importance in shipping and trade.

Regulations were becoming more complex and higher expectations were evident for environmental and safety concerns. Technology was moving towards digitalisation. Shipping was under pressure in challenging market conditions and the competition remained fierce. Talking of the DNV GL merger, he said that scale matters today as eliminating synergies makes companies more competitive.

"Class is growing in magnitude and complexity," Ørbeck-Nilssen said. The industry needed engineering support, which class can deliver, such as for scrubber and ballast water system technology. Class

societies are now testing the use of drones for surveys, especially in large enclosed areas and DNV GL has a survey simulator fitted at its Poland training facility.

Following a few years into digitalisation, there is an increasing use of land-based monitoring resulting in more sensors being fitted on board ship.

New rules

DNV GL published its new rules on 1st January this year, effectively amalgamating and updating the two previous rule sets. Ørbeck-Nilssen explained the complexity of this operation by saying that over 7,000 pages were reviewed, internally and externally, while more than 2,000 detailed comments were made by 800 stakeholders, including shipyards, manufacturers, owners, flag states, etc, which resulted in more than 700 rule modifications/adjustments being triggered.

Dr Pierre Sames, who recently moved from Hamburg to Oslo to take up the role of group technology and research director, said that by 2020 there will be 25 bill things connected to the internet, which creates both opportunities and challenges.

"Parts of services will become automated," he said, such as reading and enacting upon class society rules. "The data is available, we just need to put it together to gain more of an insight."

"When capturing high quality data, it needs to be checked when entered and we need to understand where it was originated," Dr Sames said. "Enriching it with other data sets will change the way vessels are operated. We have to ensure secure access and domain competence. "

Dr Pierre Sames.

Rune Braastad.

He agreed that there was a knowledge gap, which was the biggest challenge going forward. "We need to be able to attract talent," he said.

As for vessel monitoring, Dr Sames said that the roll of class will involve verifying sensor systems, the monitoring approach, sensor reliability, assuring data integrity, certifying data infrastructures and cyber security in that the data had not been manipulated. There will be a need to test software systems by using other software.

The current big data applications include those for ship and fleet performance management; for using condition-based maintenance and surveys; model-based approvals; safety and environmental dashboards, dynamic barrier management and cyber security.

More sensors will need to be attached to build a picture of the vessel's safety resulting in a digital copy of the physical asset. This digital twin concept will enhance collaboration, as it is a digital copy of the physical asset, comprising descriptions of systems and sub-systems fitted on board. It will also act as the platform to simulate how the digital copy will interact with the environment.

This will be achieved by modelling the vessel and its systems and linking together DNV GL's current simulation tools, such as CyberSea, COSSMOS, Hadoop-tools.

DNV GL came up with the catch phrase 'Nauticus Twinity', which in a nutshell consists of optimising, testing, approving, commissioning, simulation and updating, Dr Sames explained.

More automation

ABB's Rune Braastad, head of marine service for oil and gas vessels agreed that connectivity, automation, environmental issues and measurement/monitoring issues were top of the agenda in shipping today.

He foresaw more automation on the horizon leading to the autonomous ship, which according to DNV GL's Svensen, will probably come in the shape of small craft, such as ferries, possibly operating in the Norwegian Fjords.

Braastad also agreed that the industry would still need people, especially to analyse the data produced. "The challenge is to make big data into small data," he said. For service engineers, by the use of data, visits could be reduced by up to 70%, he claimed. He said that one service centre could advise operators on problems.

"Small business units need to concentrate on data," he said.

Willie Wagen, director of market innovation at Wärtsilä said that the marine industry is under disruptive attack from energy transformation, autonomy/robotics, sharing, economy and competition from non-marine players.

He thought that there would be more use of robotics made in operations, repair and maintenance on board. More asset information sharing would occur, which could lead to the demise of the middle man.

There will be more autonomy in products, systems and vessels with connectivity in all layers. Big data will be used in maintenance, operation and control, enabling new services to be created. 3D printing will also be more widely used when looking into vessel operations and maintenance.

Cyber issues

Lloyd's Register's marine marketing director Luis Benito addressed what is becoming to be know as the 'cyber-enabled' ship.

Willie Wagen.

He explained that today's leading manufacturers and ship operators want to innovate using the latest ICT systems, going beyond traditional engineering to create ships with enhanced monitoring, communication and connection capabilities – ships that can be accessed by remote onshore services, anytime and anywhere.

Despite the fact that ICT systems have the potential to enhance safety, reliability and business performance, there are numerous risks that need to be identified, understood and mitigated to make sure the technologies are safely integrated into ship design and operations. The marine industry faces complex and serious challenges in order to achieve the full benefits of using ICT.

Because a cyber-enabled ship consists of multiple, interconnected systems, and because of the rapid pace of technology development, assuring that a cyber-enabled ship will be safe cannot be prescriptive and cannot rely on knowledge gained from previous systems. Instead, it requires a 'total systems' approach – one that takes account of all the different systems on board and on shore, how they are designed and installed, how they connect and how they will be managed.

Benito explained that this is the approach that LR takes, applying a non-prescriptive, risk-based process from the earliest concept stage, through on board integration, to operations. LR recently published its first guidance to customers operating with cyber-enabled ships.

Section 1 describes what is meant by cyber systems and looks at their impact on shipping, while Section 2 details the six key areas of risk that need to be considered and addressed in order to assure their safety and dependability - system, human system, software, network and communications, data assurance and cyber security.

Section 3 illustrates LR's risk-based assurance process, which culminates in system appraisal and, ultimately, issue of approval in principle.

He said that LR will follow this guidance with full ShipRight procedures for cyber-enabled ships. These will provide a set of goal-based requirements addressing all the requirements for detailed system design.

Basically, ship-based cyber systems include: navigation systems, including electronic charts, global positioning systems (GPS) and dynamic positioning systems (DPS); radar and automatic identification systems (AIS); communications systems, including radio communications (terrestrial and satellite) and data communications (broadband, Voice over IP (VOIP), internet access and e-mail); integrated bridge systems; control systems for the wide range of electro-mechanical systems on board ships, such as main engine, generators, ballast tanks, life support, fuel and oil pumps, water tight doors, fire alarms and controls, cargo hold fans and environmental controls; equipment used by charterers, such as wireless access points, IP ports and wireless phones.

Luis Benito.

Cyber systems transform a ship into a total system of interlinked systems - a 'system of systems'. When designed properly, the use of ICT can increase efficiency and safety through improved monitoring and communication, and greater situational awareness on the bridge, in the engine room and in other operational areas.

The use of digital communications to link seaborne systems to shore-based applications means that vessels are also part of the wider connected world. Specifically, cyber systems impact ships by:

- Interconnecting system through computer networks.
- Integrating systems.
- Creating layers of embedded and/or application software that separate the operator and the ship.
- Hanging the role of the operator to a manager of many linked, complex systems.
- Shifting the operator's perception of the ship and its environment, to one defined by human-machine interfaces.
- Enhancing the ability and efficiency of the crew, or changing the organisation of work, through automation.
- Creating the potential to remotely monitor and change the operation of the ship using a wide range of data, from anywhere in the world.

Benito warned that failure of cyber systems may not only affect safety and security but also impact the business performance of the owner or operator, but also said that there were many reasons for the increase in interest in cyber technology.

Risk areas

In assuring a cyber-enabled ship, there are six risk areas to consider. This means identifying all the risks from and to the ship, its systems, its people (both those on board and working remotely), and its operating philosophy. These then need to be mitigated so that the level of risk is acceptable when compared to the risks presented by a conventional ship.

First of the key areas of risk is general system considerations. These are followed by

five considerations that cross system boundaries - human-system, software, network and communications, data assurance and cyber security.

The maritime industry is increasingly dependent on technology to communicate, organise, streamline and digest information; a situation exacerbated by the proliferation of autonomous shipboard systems and increased remote monitoring. The element that makes the marine environment unique when facing cyber threats is connectivity.

Ships do not usually have the luxury of 50 plus Mb broadband: many share a single 64 Kb Inmarsat connection between a number of on board systems. This means that in the event of attack or infection, any files required to rebuild or repair an on board PC-based system must be on the ship already, rather than having to be downloaded (something that could take a day using Inmarsat).

Most vessels currently do not have operating system disks on board, let alone proprietary software, drivers or patches. This connectivity constraint also provides a single point of failure and vulnerability. These significant issues have to be addressed during the system's design, Benito stressed.

New competences should be discussed with all stakeholders and new types of emergencies should be planned for, including the insertion of wrong software. In the future, software engineers could be placed on board ships, he said. Root causes of problems on board can easily be researched by using data.

In the past, commonly used performance monitoring models consisted of a multitude of incompatible measurement methods, which confused the user rather than bring transparency, DNV GL said recently.

Some of the methods were reasonably good, some really bad, most of them black boxes and virtually all used their own yardsticks.

Varying ambient conditions (waves, wind, current, water depth, etc) and operating conditions (speed, draft, trim, etc) make a direct comparison impossible. Instead a combination of filtering and corrections (normalisation in the jargon of performance monitoring experts) is required.

All hull performance monitoring systems have a similar basic approach: raw data acquired on board is filtered and corrected for ambient and operational conditions.

There are two main sources of errors:

- Data errors: 'Garbage in – Garbage out'. On board sensors, particularly for speed logs, have an inherent limited precision. Reporting errors by crews add to sensor problems. Continuous monitoring, cross-referencing and user-friendly interfaces are levers to improve data quality.
- Model errors: 'Good data in – Still Garbage out'. Hydrodynamic knowledge bases, machine learning approaches and statistical methods are based on certain assumptions. Despite impressive jargon, some models are based on shaky ground when assumptions are violated.

ISO 19030 (expected to be published in June, 2016) is expected to bring major improvements in this respect. The standard outlines general principles of hull and propeller performance for an operating fleet, with a default method and assorted alternative methods. It is expected to align terminology and methodology, bringing more transparency and comparability for the industry.

In the wake of ISO 19030, the 1st Hull Performance & Insight Conference, 13th-15th April, 2016 in Pavone, Italy, will bring developers and users together to exchange experience in the rapidly developing field of performance management. TO

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Marlink reinvents itself

In February, the former commercial satellite communication division of Airbus Defence and Space was re-branded as Marlink under new ownership.

Now owned by private equity company Apax Partners, Marlink will continue to offer communication solutions for maritime and land customers through its established direct and indirect sales channels, the company said at the time of the split. Apax Partners had also owned the company in 2006-2007.

Maritime now makes up around 75% of the company's business with land-based applications making up the remaining 25%

With a market segment focus, Marlink is now offering what it claims is an unmatched portfolio of multi-band satcom and digital solutions, including VSAT (Ku-, Ka-, C-band), MSS (L-Band), M2M and its established value added services, such as the XChange service delivery platform or the SkyFile software suite.

Marlink CEO, Erik Ceuppens, said at a recent presentation that the company is increasingly seeing more requirement for larger bandwidth and connectivity to improve vessel performance management from the shore and also to cater for the well-being and safety of the crew.

Ceuppens claimed that the company was the No 1 VSAT provider/enabler, confirmed by Comsys and, according to a NSR report last year, was also the top satcoms provider.

Marlink was also gearing up to the challenge of the high throughput satellites (HTS), coming on stream soon from the main satellite providers, which should create a large demand for upgrades on board ship.

The company was also benefiting from the higher level of skilled seafarers employed on tankers. Among the tanker companies signed up to Marlink are Stolt Tankers, KOTC, TB Marine, Scorpio, BP, Hartmann, Rigel, MidEast Shipmanagement and Eastern Mediterranean.

At Hartmann, the seafarers pay 50% of their link up costs for their Internet and emails, etc. BP Tankers left for another provider in 2007 but came back to Marlink in the Autumn of last year.

Stolt Tankers claimed a saving of 40% on its installation costs, as by partnering with Palantir and Marlink, the company only had to download the offering. Ceuppens explained that Marlink could offer a complete package direct to the customer or partner with a service provider.

Tore Morten Olsen, president maritime, said that more and more tankers were adopting VSAT and that this sector had taken over from the beleaguered offshore market last year in sales terms.

One brand

For its VSAT offering, Marlink has adopted one single brand name - Sealink - rather than use several different brands as before.

Ceuppens said that in general, shipping companies are now looking for 'smart' data rather than 'big' data to help analyse vessel performance and to make decisions. Disruptive technologies were gaining in popularity, such as sensors placed in strategic areas of a vessel. In addition, in the future, condition-based monitoring could also be undertaken on electrical systems on board, as well as the machinery.

For crew welfare, Marlink has introduced the Universal Card Go, a new single multi-band prepaid solution for crew Internet access and voice calling on all service types.

As a single communication payment solution for seafarers, Universal Card Go makes using the telephone and Internet much easier for crews, while streamlining the billing process for vessel managers, the company claimed.

Universal Card Go is claimed to be the first pre-paid solution in the maritime market that covers both voice and data usage and can be used across all Marlink VSAT services, including new 1GB plans offered with separate prepaid crew access.

The solution is an evolution of Marlink's Universal Card solution, which is today used by over 40,000 seafarers. It was developed in response to demand from shipowners, seafarers and service provider partners for simplified access to voice and data services on VSAT and mobile satellite services (MSS).

By reducing the amount of prepaid methods required for accessing different services to just one, Universal Card Go instantly simplifies the whole process for crew communication facilities, Marlink said.

Marlink CEO Erik Ceuppers.

It works for calling mobile phones and land lines, sending SMS and Internet connectivity over Ku-, C- and in the future Ka-band VSAT, in addition to L-band MSS from Inmarsat and Iridium.

Using a Universal Card Go account, seafarers can communicate using fixed terminals on board or on their own personal devices over Wi-Fi. Airtime and data costs are claimed to be highly competitive, providing crew with value for money in parallel to the benefit of not having to top-up multiple accounts to access different types or services.

Vessel operators also benefit, as Universal Card Go separates corporate and private networks so bandwidth is always available for business critical and operational communication.

"Universal Card Go enables senior officers to concentrate on vessel operations while crew members enjoy hassle-free access to communication facilities. A single payment solution for multiple connectivity services fits perfectly with our multi-band approach, which focus on the application more than the frequency band of the service," Olsen said. TO

The key to recruitment and retention

Recruitment and retention remains an issue for many tanker operators but energy shipping company, MISC Bhd, believed that the provision of high quality training is the key the addressing the problem.

MISC and its wholly owned subsidiary, AET, operates a fleet of more than 120 liquid bulk vessels including VLCCs, Suezmax, Aframax, DP shuttle, CPP, chemical and LNG carriers.

To keep these ships operating, the Group directly employs around 5,000 seafarers. By offering a comprehensive cadet programme followed by the structured delivery of high quality ongoing training through to Chief Engineer or Master Mariner - and then a route from sea to the office ashore - MISC found that it enjoyed an overall retention rate of 93%.

One of the core reasons for MISC's success is its ownership of Akademi Laut Malaysia (ALAM), a maritime education and training facility, which has a consistently high training quality rating from DNV GL.

ALAM is located on a 74 acre site in Melaka, Malaysia and is home to around 1,000 students, including 500 cadets, on any one day. Alongside its cadet intake, ALAM runs more than 150 programmes up to Master Mariner and Chief Engineer level for more than 100 customers, many of whom are leading shipowners and offshore operators. In addition, the college also delivers research and consultancy, as well as performing the entire training requirement for Malaysia's maritime pilots.

Typically, an MISC or AET cadet will join ALAM at 18 years of age, having achieved at least five credits in his/her public examinations. The majority are Malaysian, although the Group also takes cadets from India, the Philippines and China. All of the potential cadets are expected to sit its own stringent series of entrance exams, deliver some written work, undertake psychometric assessments and be interviewed.

However, less than 40% pass this stage as competition is fierce. Both MISC and AET offer sponsored cadetships to those who achieve a certain high standard of academic excellence, which serves as a huge incentive to attract the best.

Different to many maritime establishments, ALAM enforces a semi-regimented regime where cadets are expected to conform to high standards of discipline. The first year and third years of the cadet programme are spent at ALAM and cadets serve their second year learning hands on at sea.

All MISC cadets are earmarked to serve on liquid bulk vessels so their training is customised for this career path. Because of its ownership, ALAM is readily able to instil the MISC culture and way of doing things into cadets during their formative training, which assists with maintaining high standards throughout the fleet.

Tanker familiarisation

Cadets undertake specific tanker familiarisation courses at a series of levels, including simulator work tailored for petroleum tankers, chemical carriers and LNGCs. ALAM's simulators can mimic up to 350 ship types operating in more than 120 different ports and waterways. Cadets undertake familiarisation training using these facilities during their first year and then undergo more stringent 'real' and 'emergency' situations when they return in year three.

A cargo handling simulator provides operational experience for all types of liquids and an engine room simulator sets up more than 200 faults to test the cadet's reactions and trouble-shooting abilities.

Specifically, for the MISC LNG fleet, simulator scenarios include the latest Q-Max LNGC and both steam and dual fuel engine options can be tested. Simulation of a distributed control system for cargo handling operations can also be incorporated.

Due to ALAM's unique ownership structure, the academy benefits hugely from its close connections with a working fleet of ships. Any near miss or other safety or operational issues witnessed at sea in the MISC or AET fleet is fed back to ALAM and discussed by the cadets in a classroom environment. This ensures they learn from the very latest situations currently being experienced at sea.

Alam trains cadets from Malaysia, China, India and the Philippines.

The full three-year programme ends with a Diploma either in Nautical Studies or Marine Engineering, as well as a Certificate of Competency. A handful of high achievers are sent to train at the US Merchant Marine Academy (Kings Point) where they will graduate with a full degree.

After graduation, all officers continue their training through a series of on board computer based courses. They will return to ALAM at regular intervals to qualify for all ranks through to Master or Chief Engineer and to undergo specific training, such as ALAM's VLCC course.

Training to learn lessons gleaned from particular incidents is also given – an example is the creation of a tailored tanker safety course, following the accident suffered by MISC chemical carrier 'Bunga Alpinia' in 2012.

MISC believes in training beyond statutory IMO requirements and the delivery of a holistic experience, which includes encouraging cadets to articulate their own thoughts and ideas throughout their time at the academy. TO

Tankers drive Indian shipmanagement concern

MMS Maritime India (MMSI) has grown its seafarer workforce base by a quarter in the past year.

The shipmanagement company, which is a subsidiary of Japanese shipowner Meiji Shipping Group, said its total crew staff now totals 300, which includes at least 50 new officers and 26 ratings. MMSI primarily supplies seafarers for the global tanker market.

MMSI CEO Dr Sanjay Bhavnani claimed that the company is growing thanks to having a 90% crew retention rate, one of the highest in the industry.

"We are expanding because our seafarers are motivated and tanker owners have confidence that MMSI will supply a highly committed, skilled and experienced crew to look after their ship," he said. "MMSI carefully supports each of our seafarers monitoring their welfare, as well as giving them clear defined steps to advance their career in the long term.

"I, and many of our senior team, are former seafarers. We therefore fundamentally understand the desires, dreams and concerns of our seafarers. We know they need to be truly understood and appreciated for what they do. By ensuring we listen to, and look after, our crew we are generating real job satisfaction in one of the industry's most challenging careers.

"We are actively looking to work with more tanker and drycargo owners and operators offering them all the benefits of having a well-managed and trained crew," he said.

Dr Bhavnani, a former oil tanker chief engineer, said the last year had seen MMSI launch the bespoke training programme designed by the Swedish P & I Club and implemented effectively by its own staff thereby focusing on to be addressed specific operational issues.

"Our Maritime Resource Management course has been meticulously built by seafarers for seafarers," he said."It is founded on understanding what it is actually like to live and work at sea.

"We understand it can be like a goldfish bowl living in close quarters for extended periods of time in the utterly unique environment of the sea. The reality is that most incidents at sea come as a result of incorrect human interaction. So our course looks at key areas, such as communication between different nationalities to ensure the crew properly understand each other's instructions.

"In addition, we look at understanding emotions and the mental state someone may be in when giving instructions. The course arms our seafarers with the tools to do their job and to take them to the next level. We look at areas of performance and provide extra training where gaps in competence have been identified,"he said.

MMSI CEO Dr Sanjay Bhavnani.

More tankers

Dr Bhavnani said MMSI is also seeing increased demand for seafarers from its parent company, as Meiji is expanding its tanker fleet by seven new ships, which are expected to be delivered in 2017-2018.

These include four new MRs to be delivered in the first half of this year for charter to oil majors and other oil companies.

"MMSI is looking to recruit a further 80-90 seafarers from India to help man these new ships," Dr Bhavnani said."The positions we are seeking to fill will be across the full spectrum of roles from officers and Masters to Chief Engineers. A number of senior positions will be filled from our existing workforce to ensure the ships have the right levels of experience and expertise. "

Dr Bhavnani told *Tanker Operator* that training is first undertaken using an e-learning platform while the seafarers are on leave. "This highlights the changes brought about either through the regulations during that period or in the company's system or even both. The fleet experiences are also shared through this platform,"he said.

"Second, every two to three months, MMSI arranges group training sessions, which focus on the above and reinforces the message through discussion, sharing of experiences and an achieved shared goal at the end of it.

"Third, at the time of joining, the same is once again emphasised through a focused one to one basis interaction," he said.

All of the equipment-based training is held at training academies and unless the training programme is mandated by an international regulation, the contents are designed by MMSI and delivered by the academies under the supervision of company trainers.

In addition, audio-visual-based training is used, comprising CBTs, videos and animation movies, which focus on very specific aspects of shipboard operations, such as personal safety, safe shiphandling, equipment operation and maintenance, as well as reliving some of the incidents observed within the industry as lessons learned exercises.

"The methodology is based on group interactions, sharing of experiences and above all within a neutral environment within a fair blames culture. The system encourages learning from others' mistakes," Dr Bhavnani explained.

Making a drama out of a crisis

A rather different approach to training has been devised by Fidra Films, part of the Fidra Group.

This is drama-based training films, rather than the prescriptive and purely educational types of training films currently on the market. After six months of behind-the-scenes discussions, presentations and developments, the first project is now underway and many more are planned.

In another rather unique approach, the company is asking for sponsorship to distribute the first film to every seafarer and those likely to enter an enclosed space through the course of his of her duties, rather than sell it outright.

Fidra has chosen 'Confined/Enclosed Spaces' as the first subject to be tackled, in an effort to reduce the human and financial cost of incidents that frequently result in multiple fatalities.

By using a story telling technique to tackle the behavioural issues that lead seafarers and others on board ship to take unnecessary risks prior to and during enclosed space entry. This includes frequently-fatal rescue attempts, as over half of those that die in an enclosed space do so during an impulsive and lethal rescue attempt, the company said.

As far back as 2008, the UK's MAIB identified four likely contributing factors to incidents in confined spaces:

- Complacency leading to lapses in procedure;
- Lack of knowledge;
- Would-be rescuers acting on instinct and emotion rather than knowledge and training.

It is now 2016, and since that report was written numerous seafarers, frequently experienced and apparently well-trained, have succumbed to the risks of dangerous spaces.

It is clear from the numerous investigation reports that on many occasions the crew members' perception of risk simply didn't fit their situation. Although they may have – indeed should have – known the risk, for whatever reason(s) they chose to minimise it to themselves.

Fidra 's solution, to be used alongside existing training and drills, is an educational resource that tackles the behavioural aspects of these incidents; to tackle the instinct, emotion and complacency that is so frequently fatal.

Solution

The company is working towards the development of an educational drama to address these issues – the complacency that leads someone to take a risk in the first place, and those instincts and emotions that lead so many to their unnecessary deaths in the vain attempt at a rescue.

Drama is a very powerful medium. In films that we might have watched many years ago, we remember the characters, the plot, specific scenes. We can more than likely repeat lines, on the spur of the moment, from programmes we watched 20 years ago. Drama has the power to plant a seed, to embed a memory or response, to change our behaviour, the company said.

'Traditional' training films tend to 'push' information onto the audience. Facts, figures, do this, don't EVER do that! But if we push toward a closed mind, then the information is wasted.

Drama works the opposite way. The viewer is drawn in; they empathise with the characters, and they become receptive. They 'pull' the information – the 'learning' if you like – from the content. It doesn't need to be rammed down their throats. They learn without realising it. Good drama will elicit an emotional response that no drill is ever likely to do.

Fidra's idea is to gain sponsorship rather than fund the production internally, as then the company would have to commercially sell it and that raises a serious barrier to adoption.

By having the freedom of universal distribution, it can be distributed to as many seafarers as possible, not just the privileged few. "We will create something that seafarers will share with their colleagues, that they will talk about. Crucially, they'll remember it. And they'll remember the message," the company said.

Stevedores, inspectors, shipyard workers, as well as employees in other industries beyond maritime could also benefit from an insight into the risks and likely consequences of these dangerous spaces, Fidra said.

Once produced, the film will be freely

delivered to the world's one million seafarers, through all available channels - primarily internet-based. The film will also be promoted and made available for distribution in other industries.

Fidra is looking to secure pledges for six blocks of £20,000 maximum sponsorship from industry stakeholders and organisations. Those who may wish to be associated with this project, include P&I Clubs, shipowners and operators, maritime legal practices, port state control organisations, class societies and regional and international maritime organisations.

When all six pledges are received, Fidra will develop a working creative concept and advise sponsors of the working budget, including likely expenses. This will be lower than the total amount pledged by the sponsors.

The project is being led by director Chris Young, who has had experience with film distributors Walport, now part of KVH.

A question of safety?

Young told Tanker Operator that the tanker industry has a safety record it can be justifiably proud of.

"But just how safe are the world's tankers when they are in close proximity to other vessels?" he asked.

There are many vessels plying the world's shipping lanes that are operated by owners and managers whose first priority is not the safety of their crews and vessels, but generating revenue.

"How often do we read of poorly-maintained vessels suffering a steering failure or power blackout at a critical time? Of general cargo vessels being detained for the inhumane living conditions on board? Or of the owners who vanish, apparently without trace, when the authorities start digging in the aftermath of an incident?", he continued.

"If we consider the above examples as just a few of the ills that the shipping industry suffers, we have to wonder just how safe our ships really are. For the owner who won't provide a washing machine for their crew, never mind fresh food and other basic supplies, we have to wonder what their views are on training and crew education.

"Are they likely to be supplying the vessel with the latest on board training resources, encouraging the carrying out of effective drills and rigorously vetting the certificates of their officers?"

Having highly trained and qualified crews on board vessels should eliminate the possibility of seafarers being the instigators of a company's downfall, but this might not be enough to prevent them being involved in an incident of someone else's making.

The provision of, or at very least access to, effective, quality training and educational resources (the two should be differentiated) should be the right of every seafarer, not just the privileged few. Two of the market leaders in the supply of on board maritime training resources claim about 30% of the world's merchant fleet between them. "Open a web-browser, visit one of the many vessel-tracking sites available, zoom in on the Dover Strait for example and ponder that 30% figure for a minute. Does it give cause for concern?" he stressed.

"Like rogue waves, they are out there:

Chris Young.

under-manned, tired, stressed and poorly prepared physically and mentally, waiting for fortune and circumstance to complete the all-too familiar chain that leads to an incident," Young continued.

On board training provision is costly to the industry; it's estimated that the market is worth in excess of $50 mill per annum. "It is lucrative, but does it deliver value to the industry as a whole? Does the system in effect create a two-tier safety environment – one where we have owners who can (or will) invest in crew education and those poor souls who are largely left to fend for themselves?"

An alternative model for funding and creating training resources would take a slice of the $50 mill pie and deliver it to the hungry. For a modest investment on the part of shipowners, maritime organisations and

authorities, class, P&I clubs, etc, the industry could develop and distribute a wealth of knowledge and training, delivered free at the point of use. No costly multi-year subscription contracts or other purchase fees, just the latest resources available for all seafarers and shore-side staff to benefit from, across the industry.

By utilising all the available distribution channels, the industry can deliver materials to those seafarers who need them most. Distribution will primarily be via the internet, but as access is a long way from universal, this could also be achieved through arrangements with the many seafarers missions and other regular on board visitors to get the materials to those vessels whose owners cannot or will not make provision themselves, thus creating 'Safer, Smarter Seafarers', regardless of who they are employed by.

The new model also allows for the creation of management-level resources (on safety culture, effective inspection procedures, crew welfare issues, etc) of the kind that commercial producers are reluctant to tackle because of low sales volumes.

"Improving the standard of safety across TO

Safebridge teams up with Seagull

Safebridge, a provider of web-based e-Learning products for the maritime industry, has launched a joint initiative with on board training concern Seagull Maritime.

The partners will offer Safebridge's e-learning expertise combined with the on board training platform from Seagull.

A wide variety of ECDIS systems can currently be found on board ships. Today, over 30 ECDIS models are in use in commercial shipping, with a unique selling point claimed for each by way of a competitive offering.

With upgraded models coming to market from established manufacturers, and new producers stepping into this lucrative market, that number of permutations is likely to increase.

To cope with the challenge of offering the required type-specific familiarisation courses for all ECDIS models calls for highly specific input from marine experts, but also a sophisticated interactive teaching method for real hands-on familiarisation.

Seagull Maritime and Safebridge have therefore combined to develop an overall portfolio to get the best out of each training approach, the companies claimed.

Under the agreement, Seagull is entitled to add the complete Safebridge range of ECDIS training packages (presently 25 plus) to its on board Seagull Training System (STS), which is accessible via a laptop or desktop computer. STS hosts the Seagull Training Administrator and the entire on board library of e-learning modules available from the company.

"We feel more than happy to team up also with such a reputable company like Seagull to complement our training delivery methods," said Ulf Steden, Safebridge managing director. "This partnership will give us an additional impetus on spreading our courses to an even larger number of clients and make access to our training for existing Seagull customers

Ulf Steden.

even more comfortable.

"The integrated solution between Safebridge ECDIS training systems and Seagull Training Administrator allows for the automatic transfer of training records between Seagull course department and Safebridge whom issue the course certificates, which is a unique feature offering technical and performance advantages," he said.

Roger Ringstad, managing director, Seagull Maritime, added: "We are very pleased to be working together with Safebridge to offer our clients access to maker-specific ECDIS training utilising the Safebridge ECDIS training platform.

"Seamlessly integrated with the Seagull Training Administrator, this offers a unique solution for the navigators to perform ECDIS familiarisation training, both on board with Seagull and online with Safebridge," he said.

Safebridge develops and provides online-courses for navigating officers and Masters. All of the courses offered are certificated from the particular equipment supplier. One of the important focal points is user interactive training for software-based interfaces.

The Hamburg-based company works with most of the world's leading manufacturers of navigation and bridge systems: ChartWorld, Consilium, Imtech, JRC, Kelvin Hughes, MARIS, Martek Marine, Raytheon Anschütz, SAM Electronics, SevenCs, Simrad, Sperry Marine and Transas.

Safebridge has branches in Limassol, Manila and Hong Kong and together with its worldwide partner-network also offers classroom, on board and on-site training.

Horten-based Seagull Maritime offers a comprehensive library of training and on board courses for regulatory compliance and improved seafarer knowledge.

Founded in 1996 by experienced mariners, Seagull Maritime has grown by partnering with leading shipping companies to deliver a full range of assessment and management tools.

Seagull's solutions have been delivered to more than 9,500 ships and office installations worldwide and as well as the Norwegian headquarters has offices in Tokyo, Singapore, Greece, Germany, Poland and the UK. TO

Roger Ringstad.

Standardisation drives tankers' BWTS control

Moves to standardise control panels for tanker Ballast Water Treatment Systems (BWTS) are being stepped-up as final ratification of the IMO convention approaches.

Ian Hamilton, BWTS project leader at marine electrical wiring control and instrumentation specialists, CMR Group, explains.

Used to maintain balance and stability when a ship is empty of cargo, ballast water can also be responsible for bringing invasive species of micro-organisms into non-indigenous environments, causing a major threat to marine ecosystems.

All vessels involved in international voyages are required to manage their ballast water and sediments under the BWM Convention, adopted by the IMO in 2004. This requires a reduction in the concentration of aquatic organisms in ballast water to below certain levels (D-2 Standard) before discharge in order to prevent across boundary movement of harmful aquatic organisms and pathogens that unmanaged ballast water discharge may cause.

This year will see the convention finally ratified, which will have a significant impact on the marine sector, In particular, the US Coastguard's approval of the new standards are being seen as a major big step towards the final implementation of the regulations. It is estimated that more than 60,000 vessels worldwide, including 5,000 tankers, will need to be retrofitted with BWTS to ensure compliance.

But when it comes to specifying BWTS to manage this process there are different considerations facing newbuild vessels and existing ships. Yards need to identify the options for installing BWTS in original specifications – both within the construction programme or through retrofitting.

This, as advised by Lloyd's Register, may involve providing system drawings to show how a selection of different treatment options could be fitted, ensuring that sufficient space has been allocated for retrofitting treatment systems, if they are not included in the initial build. Service connections should also be fitted to ballast systems in preparation for retrofitting of the selected treatment equipment.

For existing vessels, operators will need to be aware of all modifications necessary to fit systems and it could be necessary to obtain schematic arrangements and equipment drawings from the system supplier in order for the technical department to develop a work plan. This may alternatively be provided by the supplier but the ship operator will still need to provide the vessel's BWTS drawings, functional requirements and details of compartmental spaces where the equipment is to be fitted.

Careful thought

Selecting a treatment system should involve a number of key steps to ensure success. The first is to consider initial aspects, such as vessel type and characteristics, ballast capacity and flow rate requirements before moving onto technical and operational considerations.

These include the time required for treatment to be effective, ballast and treatment pumping rates, characteristics of ballast system, health and safety, in-service operational requirements, explosion proof equipment (particularly apposite for tankers), power requirements and on board systems, controls and alarms, and space constraints.

Following these steps, treatment options need to be considered. For example, will the requirement be for filtration or treatment or a combination of both? What chemical options are required? Will mechanical means such as cavitation (the formation of vapour cavities in a liquid) be required and what about UV radiation and ultrasonic?

Careful thought needs to be given to choosing a supplier and reviewing specifications before moving ahead to the final stage of purchase and installation. And here, experience in the sector counts – the benefit of opting for a supplier that understands the

Ian Hamilton.

legislation, has established marine experience and expertise with a worldwide reach and can ramp up volumes very quickly as the regulations kick-in cannot be overstated if project systems are to be designed and delivered on-time and supported on a global basis.

Shipowner/managers will need to provide a tender specification for the potential BWTS, which includes control suppliers detailing technical requirements covering pump flow rates and diagrams of the pipework with connection details, pumping capacities and valve sections clearly shown. Compartment details, available power supply and routing for control cabling and certification requirements also need to be included.

Furthermore, in addition to price, installation and commissioning costs need to be taken into account in the tender alongside training requirements, forecast operating costs, maintenance and support, delivery times for supply and installation and any special yard facilities or ship modifications for equipment

installation.

BWTS should also include an integrated visual alarm for the purposes of cleaning, calibration and, if necessary, repair and maintenance – and these events should be recorded by control equipment integrated with, or certainly located close to, the ship's BWTS.

Control technology

Total investments of over $30 bill are expected to be made in BWTS over the current decade, according to a Frost & Sullivan study. This will involve thousands of vessels requiring a system to be installed between now and 2020, driving massive requirements for orders. However, all these systems will need control and monitoring systems to ensure proper performance and prevent time consuming and costly damage to components.

The two main water handling methods for BWTS are either systems for treating the water before it reaches the ballast tanks (In-Line) or 'In-Tank', which treats the water in the tanks during a vessel's voyage. Vessel size will affect panel specification but there is also a need for a degree of flexibility for BWTS OEMS and their customers - vessel owners/managers - who will need to blanket-fit thousands of installations with different configurations.

The key to meeting requirements here is to adopt a modular approach - close co-operation with OEMs to modularise and standardise control panels. This can reduce costs and cut delivery manufacturing lead times, allowing OEMs to focus on core components, such as the UV lamps or chlorination while taking advantage of standard parts and consistent pricing as they build their BWTS.

Standardised panel systems, such as CMR Group's Goldfinch are being developed with OEMs, simplifying the process from specification to final delivery and contributing to improving BWTS time-to-market.

Following ratification of the BWM convention, this market will grow significantly, which in turn, is likely to create an extremely competitive market for associated technologies and allied systems. So panel control standardisation and the capacity to cut delivery times, are going to be critical factors in the battle to secure overall system sales.

Shared working in partnership will be important to expanding BWTS OEMs' offering and maximising sales potential, as if it's beneficial for one, then it could be advantageous for all OEMs working alongside companies, such as CMR, who can build common types of panels which ultimately aids industry standardisation.

Control panels are also geared to cover off the requirements for explosion-proof type equipment for tankers. Many OEMs Ex-certify the whole BWTS system and this would incorporate any control panels supplied by CMR.

CMR can add value by bringing its panel building experience and expertise to bear with the capacity to globally source products and components for compliance with classification societies.

This enables the firm to design and develop high quality, cost effective solutions for supply into local marine markets – these are steel constructed local operating panel-based solutions, which provide protection from dust and water ingress (to a minimum of IP54) and incorporate industry standard PLC-based control systems, HMI user interfaces and are suitable for a supply voltage range 380 – 690 V, 3-Phase, 50/60 Hz.

Following manufacture, all panels are subject to rigorous inspection, including high-voltage flash testing to ensure the panels meet customer requirements and class rules.

First Arc7-class tanker launched

'Shturman Albanov', the first of six Arc7 class shuttle tankers for Arctic operations was launched on 20th February.

The six Samsung-built vessels will be owned by Sovcomflot, managed by Unicom and operated by Gazprom Neft to shuttle crude oil from the Novoportovskoye (Novy Port) field on the Yamal Peninsular in the Gulf of Ob, to the FSO 'Umba' moored in Kola Bay near Murmansk, all year round.

The vessels' total cargo capacity is around 38,000 tonnes on a deadweight of 42,000 tonnes — more than twice the Arc5 class tankers currently in service, Gazprom claimed.

They have been designed to operate in the Arctic and more specifically navigate the shallow waters of the Gulf of Ob, having a loaded draft of only 9.5 m. However, their length and width are equivalent to those having twice the loading capacity.

In contrast to Arc5 class tankers, once delivered in July of this year,'Shturman Albanov' will be able to transit channels previously cut by nuclear icebreakers. The tanker's hull has been built with high-tensile tempered steel, with extra-thick walls.

The vessel is equipped with bow-loading equipment, allowing it to

The double-acting Arc7 tankers will be fitted with ABB Azipods.

caption

receive oil from Vorota Arktiki (the Arctic Gate) terminal.

Unaccompanied by an icebreaker, she will be able to independently, negotiate ice up to 1.8 m thick at the stern and up to 1.4 m thick at the bow.

The double-acting vessels will be fitted with two ABB type VII azipods giving a power output of 20 MW able to perform a 360 deg turn on their axis, giving additional manoeuvrability when moving both forward and aft.

Anatoly Cherner, Gazprom Neft deputy CEO for logistics, processing and sales, commented: "The Arc7 class tankers now being built are unsurpassed in Russia: their loading capacity is twice that of tankers currently in use; they are specifically designed for the conditions of the Gulf of Ob and can independently navigate pre-cut ice channels.

"This cuts return-trip lead times and improves the overall logistical efficiency of Gazprom Neft's operations in the Arctic. Once all six tankers have been brought into operation, they will be able to transport about 450,000 tonnes of oil per month, allowing us to despatch up to 5.5 mill tonnes of oil from the Novoportovskoye field every year,"he claimed.

The vessels are dual classed with Russian Maritime Register of Shipping (RS) taking the lead.

Novoportovskoye is one of the largest oil fields in the Yamal Peninsula. The field is located 30 km from the coast in Ob Bay. The oil is transported by pipeline to Cape Kamenny where a terminal has been built. The existing pipeline has a 600,000 tonne capacity per year, which will be increased to 5.5 mill tonnes as soon as a second pipeline is built.

Gazprom started to construct the pipeline in January of this year and the field is planned to be in full production in the course of the year, the company said.

It is also planned to ship oil from Novy Port eastwards along the Northern Sea Route. TO

The Arc7 tankers will shuttle crude oil from the oil field in the Gulf of Ob to an FSO anchored in Kola Bay.

Principal Particulars - 'Shturman Albanov'

RS class notation: KM Arc7 AUT1-ICS OMBO LI CCO ECO-S BWM BLS-SPM Oil tanker (ESP) CSR

Length..... 232 m
Breadth..... 34 m
Draught..... 9.5 m
Total deadweight.....42,000 t
Cargo capacity.....38,000 t
Propulsion.....2 x 10 MW Azipods

Sandwich plate system overlay for Ice Class modifications

Intelligent Engineering (IE) is now ramping up the marketing of its patented sandwich plate system (SPS) to operators wishing to upgrade or convert their vessels to Ice Class.

Since working with DNV GL on a conversion project and gaining the class society's approval, IE is now rolling out SPS as an approved product.

SPS is a structural composite material comprising two metal face plates permanently bonded to a polyurethane elastomer core, which can be used as an alternative to conventional steel construction and repairs. The compact elastomer core provides continuous support to the face plates preventing local buckling and in many cases removes the need for secondary stiffeners.

It was initially developed to provide impact resistant plating for offshore structures and ice islands operating in the harsh ice conditions of the Canadian Beaufort Sea.

Research and development focused on material characterisation, structural behaviour and performance, design principles, energy absorption design philosophies and the development of connection details specific to sandwich plate structures. Physical properties, design parameters and production techniques were established through extensive analytical, experimental and prototype work.

The system has been used in the marine industry since 1999 for both shiprepair and construction. SPS is approved by all major classification societies and regulatory authorities for use in newbuilds and conversion of ships and offshore units. Lloyd's Register published provisional ship construction rules in 2006 [1]; and more recently DNV-GL published Class Note 30.11 [2] describing the classification requirements.

Using the traditional method of replacing shell plating will result in a vessel loosing some of its internal strength. By using SPS to replace external shell plating, the strength remains the same, Ian Nash, IE's maritime business manager told *Tanker Operator*.

When trading in ice conditions, a vessel will come up against localised peaks and ice pressure, which can affect the hull's steel strength. SPS can provide an extra skin on the outside in the ice belt area of the vessel. An Ice Class vessel strengthening requirements is usually split into three areas of the hull- bow, mid-section and the stern.

The bow normally experiences the most impact when sailing in ice and so the SPS plates are around 15 mm thick with the polyurethane being 25 mm thick in between the two plate layers. The mid-body section usually has a lighter impact so the thickness is around 10 mm and 20 mm, respectively.

A study and subsequent conversion of an offshore supply vessel to DNV GL's notation Ice Class 1CE-IC was undertaken a few years ago by IE in tandem with the class society, who then approved the SPS application.

Nash said that going forward there will be more projects to convert to Ice Class 1C and above involving commercial vessels. He claimed that a vessel needing around 1,700 sq m of steel renewal each side for an Ice Class upgrade would mean around two to three months offhire, whereas by using SPS, the time needed would be reduced to around one month.

During the OSV conversion, other requirements were needed to be met before the vessel could meet ICE-IC. These would also apply to other types of vessels and included-

- Stern frame and rudder.
- Engine power for transiting in ice.
- Propeller, shafts and gears.
- Prevention of ballast tank or fresh water tank freezing.
- Sea inlet and cooling water systems.
- Protection from freezing and icing on decks and deck equipment.

These considerations were outside the scope of IE's study while the OSV's owner was aware these requirements were needed to satisfy the ICE-1C notation.

Detailed design work was undertaken to confirm that DNV ICE-1C Ice strengthening can be achieved using SPS overlay with minimal framing modifications. This design work was examined and verified for compliance with the applicable rules and approved by DNV-GL.

Basically, IE claimed that -

- SPS improves the resistance against impact loads associated with operating in ice conditions.
- SPS Overlay solution will save significant cost and complexity over the alternative option of cropping and renewing the shell plating with thicker high strength steel.
- SPS will provide improved lifetime performance, better resistance to abrasions and indentations from impacts; and significant potential for reduced maintenance, repair and downtime costs.

For newbuildings, SPS is claimed to be ideal for all structural elements, including hull plating, decks and bulkheads. In addition, the system is also claimed to be beneficial for shipboard areas requiring special protection from impact, explosion and fire.

For repairs and conversions, IE said that SPS could be used in all areas of the ship's structure and has a fast installation time, minimises the labour needed and saves vessel downtime. TO

Distillates flow varies in cold temperatures

Ultra low sulphur fuels may be the key to compliant operations in ECAs, but they can also open the door to an unwanted, and slimy, guest in your vessels' engines and fuel tanks.

Jonas Ostlund and Sachin Gupta of Wilhelmsen Ships Service (WSS) discussed the cold flow characteristics of distillate fuels and the formation of paraffin wax in cold temperatures.

"It's like mucus," said Ostlund, WSS product marketing manager - oil."When a cold comes on it starts forming in your tubes. As the cold gets worse it gets thicker, slowing you down and eventually, if it gets bad enough, stopping you altogether. But thankfully, unlike a common cold, this can be avoided."

Ostlund's analogy seems appropriate for an issue that afflicts an increasing number of vessels at this time of year – the formation of wax in distillate fuels.

With the introduction of ECAs in January last year, all vessels sailing in the Baltic Sea, North Sea, English Channel and waters 200 nautical miles from the coast of the US and Canada, were forced to reduce sulphur emissions to just 0.1%.

The installation of scrubbers provided one path to compliance, while switching to alternative fuels and distillates opened up another. The distillate option has proved popular for its relative simplicity and cost effectiveness, but it does come with challenges, particularly during wintertime.

"As temperatures drop the wax problem increases," explained Gupta, WSS' business manager oil solutions.Distillate fuel contains paraffins, or wax particles, and colder climates pull these together to create large structures.

"These structures, basically waxy sludge masses, accumulate in fuel tanks and block fuel filters, damaging them and causing an increasing number of loss of power (LOP) incidents.

"This is an obvious technical and safety concern for all vessels and one that must be addressed," Gupta stressed.

The increased take-up of low sulphur distillate fuels, and the growing number of LOPs, is creating greater awareness of the wax issue. However, the industry's understanding of it remains as opaque as the affected fuels themselves.

"It is complex," Ostlund admitted, "and that creates confusion. A key issue is that fuels with only slight differences of the same grade can react very differently at cold temperatures – with some flowing freely, while others have catastrophic effects on fuel filters. It's therefore vital to have a clear picture of both the temperatures vessels will be operating in and the characteristics, quality and specifications of the fuel you intend to use."

Three stages

Ostlund and Gupta noted that there are three measurable stages related to wax formation in distillates that should help owners and operators make informed choices.

They said that it was vital to be aware of these and know the exact temperature at which a fuel will enter the first two of these three phases.

- **Cloud Point (CP)**
  This is the point when the wax particles that have formed actually become visible, causing a clouding or hazing in the fuel (ISO 3015).
  "The CP should act as the first and final warning," Gupta said, "as it gives a very clear indication that action has to be taken."
  But, as he admitted, that's not always as simple as it sounds: "Warnings are only effective if they're seen. When fuel is enclosed in tanks it's not always easy to notice the clouding, so, if there's any confusion over the CP, crews have to visibly check fuel on a regular basis."
- **Cold Filter Plugging Point (CFPP)**
  "CFPP is the point of no return," said Ostlund, explaining that the standard is set by analysing the exact temperature at which a set volume of fuel fails to pass through a 45-micron filter within 60 secs (ASTM D6371)."It effectively marks the temperature at which the build up of wax crystals stops fuel from passing through the filter. Starved of fuel the engine stops, leaving vessels with few alternatives and, quite literally, nowhere to go."
- **Pour Point (PP)**
  "Pour Point is arguably the least useful of the three measures, as it indicates the temperature at which fuel turns solid (ISO 3016)," Gupta explained."That means that a vessel's engines would have stopped operating before the PP is reached. That said, it is the only measure that is required by ISO 8217 fuel specifications, so it is important. But for crews and bunker brokers, it's the CP and CFPP they need to focus on."
  Gupta added that the difference in temperature between the CFPP and PP is typically only between five and 10 deg C.

Jonas Ostlund.

Avoiding sticky situations

The relative immaturity of the marriage between ECA and fuel distillates is causing

Sachin Gupta.

genuine teething troubles, as the industry adjusts to the fuel. WSS noted that filter issues and LOPs are a real concern, rather than just the latest industry scare story, and one that is growing all the time.

"But follow some simple rules and these problems can be avoided," stressed Ostlund.

He said that by knowing the projected operating temperatures at sea will give informed decisions as to the required cold flow properties of potential distillate fuels, with CP and CFPP used as the key metrics.

"If you are unsure, hedge your bets, buy distillates designed for slightly colder waters than your vessels are likely to be sailing in," he advised, adding:"In addition to ensuring crews know pre-determined CP and CFPP figures for the distillate in use, shipping firms also need to make sure they are familiar with using sounding tape and a sounding pipe to measure and analyse the condition of fuel.

"Although this is a rather crude method of assessing fuel, it is the only quick and convenient solution, due to the fact that it's otherwise difficult to visually check fuel that is enclosed in bunker tanks. This kind of disciplined, well-informed approach really is the foundation for trouble-free sailing,"he said.

However, a foundation can be built, strengthening operational integrity, with one more simple action – the routine use of distillate fuel treatments.

Gupta described this as an "extra buffer,"explaining:"Distillate fuel treatments don't have any impact upon the cloud point, but both the CFPP and PP can be extended by the use of cold flow additives. This postpones the formation of wax crystals giving breathing space in terms of both operations and man-hours, reducing the need for constant, close monitoring of tank and fuel temperatures."

"ISO 8217 limits the cold flow properties of a fuel by setting a limit on the PP. However, given that wax crystals form at temperatures above the PP – and can rapidly block filters - fuels that meet PP specification can still be problematic for operations in colder regions. For example, there are industry cases where on board fuel PP has been -6 deg C, but waxy sludge has formed at temperatures as high as 16 deg C!"he said.

WSS markets the Unitor DieselPower distillate fuel treatment range, with DieselPower CFPP claimed to be a proven solution for vastly improving the cold flow properties of distillates.

"It contains a unique mixture of cold flow improvers," Gupta said, "together with a wax anti settling additive (WASA), to ensure no sediment is formed. It's simple to use, being added prior to the filling of fuel tanks, and is dosed one litre to one thousand litres of fuel.

"This kind of treatment represent a minimal cost for maximum peace of mind when it comes to cold climate operations. They can help keep vessels safe when temperatures approach the limits of what a fuel can tolerate and should, along with knowledge of CP, CFPP and projected operating temperatures, become second nature within engine rooms.

"Prevention of this waxy sludge is much easier than finding a cure," he concluded. TO

Facts and advice

The following facts should be born in mind.

Paraffins, or alkanes, are an essential component of petroleum fuel products, offering good combustion properties and burning well within engines.

However, exposure to low temperatures can cause crystallisation, leading to blockages of vessel fuel filters and potential engine shut downs.

Knowledge of marine fuel cold flow properties, sound on board procedures, and additional measures, such as adding specialised treatments to fuel distillates, can help vessels avoid these serious operational issues.

Always consider 'worst case' CFPP and PP properties and characteristics. Assess current and future trading patterns for vessels, and potential sea and ambient temperatures, and err on the side of caution.

As a rule of thumb, always choose distillate fuels that are suitable for slightly colder waters than those where your ships will be sailing.

For further guidance see CIMAC's 'cold flow properties of marine fuel oils'. ■

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Sail Safe

Bunker strategies must be 'rewritten from scratch'

Adrian Tolson*, senior partner at consultancy 20|20 Marine Energy, looks at the pressures that are transforming the bunker industry.

The bunker market is braced for a period of prolonged uncertainty. It is already struggling with the lowest prices in over a decade. But its prime concern is how the market adapts to the loss of its key intermediate fuel oil (IFO) grades.

The issue is fast coming to a head. In October, 2016, the IMO's Marine Environment Protection Committee (MEPC) will consider the findings of a study into the availability of low-sulphur bunkers.

Depending on the committee's recommendations, the introduction of a 0.5% global sulphur cap for bunker fuel will come into force in either 2020 of 2025, although the current industry opinion is that the earlier date will be applied.

On implementation, conventional intermediate fuel oil (IFO), with its 3.5% sulphur content, will become unusable in the vast majority of bunker operations. Fuel procurement strategies, which have evolved over decades, will need to be rewritten from scratch.

The simplest way to comply with the new regulations should be a wholesale switch to low sulphur distillate fuel; the current compliance solution of choice for existing ECAs with a 0.1% sulphur limit.

But this would face the maritime and refining sectors with tremendous challenges. According to the International Energy Agency (EIA), a switch by the world fleet to 0.5% distillate fuel would see global fuel oil demand collapse, while demand for marine gas oil (MGO) would soar.

Only ships equipped with emission abatement technology (scrubbers) would be allowed to continue burning, conventional, high sulphur IFO.

But with a world fleet estimated at around 57,000 vessels and with fewer than 500 currently equipped with scrubbers, the impact of scrubbers on market dynamics looks set to be tiny; certainly in the short-term.

LNG - Clearly, a wholesale switch to distillate fuel would be problematic. Alternative compliance strategies could include bunkering with liquefied natural gas (LNG).

LNG would comply, not only with stricter sulphur caps, but with almost all the environmental rules currently in prospect.

However, while small-scale LNG bunker infrastructure projects have been going ahead and demand for 'dual fuel' engines has been growing, there is no prospect that a well-established, global infrastructure for a major LNG bunker market will be in place by 2020 or even 2025.

'Hybrid' fuels - This scenario leaves the bunker and shipping community facing a dilemma. The short-term answer might be to postpone the new sulphur cap to 2025 but that decision lies outside the industry's hands.

One option that might yet emerge is the development of 'hybrid' low sulphur IFO, a product category still in its infancy.

Some refiners are already blending ultra-low sulfur fuel oil (ULSFO) although the extent to which this fuel category will grow will depend on refiners being able to produce it at a price significantly lower than distillate marine fuel. Early experiments with the fuel have also raised compatibility problems.

Low prices

An even more immediate issue for the bunker market has been the fall in oil prices.

What has turned into a fairly prolonged period of low prices has opened opportunities for bunker suppliers while adding to pressure on bunker traders.

A key function of bunker traders has been to provide credit. When prices were high, traders were effectively bankrolling certain sectors of the shipping market.

But lower fuel costs have meant that shipowners are able to go directly to physical suppliers rather than using a 'third-party' trader. For suppliers with the financial resources this has presented the chance to develop still tighter relationships with their customers.

But for traders, already under scrutiny following the 2014 collapse of OW Bunker, it simply adds to the problems they face.

Two independent buyers were recently quoted as saying they had been avoiding traders and had only been dealing with the companies that were acting as their physical suppliers. Low prices play into this scenario by keeping credit demands within manageable limits.

But physical suppliers too are under pressure. Low prices mean low margins. That reduces their ability to invest in infrastructure and challenges their capabilities to provide value within the fuel supply chain. This is occurring in the very sector that faces the biggest changes in modern memory.

It will be the physical suppliers with liquidity and cash reserves who will have a real opportunity to create significant competitive advantage through investment.

For traders and suppliers, market conditions may encourage consolidation. TO

**Adrian Tolson has been employed in senior positions at marine fuel suppliers, including Chemoil Energy, where he was responsible for successfully driving the company through to IPO. He was also formerly the managing director of Aegean Oil and the general manager of OW Bunker North America.*

Mass flow meters come a step closer

The question of the use of mass flow meters (MFM) has come to the fore in the light of announcements from Singapore regarding their mandatory use within the port area.

For example, the Maritime and Port Authority of Singapore (MPA) has said that it will implement new guidelines for MFM bunker deliveries from 1st June this year.

The Singapore Standards Council recently published Technical Reference for Bunker Mass Flow Metering (TR48:2015) guidelines, which includes the mandatory use of MFAs for bunker deliveries of fuel oil grades from 1st January, 2017 and they sit with the SS600 guidelines, which have been in use since 2008 for traditional methods of measurement.

This technical reference is a provisional standard, which will apply for two years to gain experience enabling the TR48 to be updated so that it can be adopted as a Singapore standard.

For marine gasoil, there is no firm timeline for MFM implementation, but the MPA is working on it, the authority said.

More than 500,000 tonnes per month of bunker fuel is already being delivered via bunker tankers equipped with MFMs in Singapore port, the MPA said.

There were around 64 bunker tankers approved for deliveries of bunker fuel via MFM readings out of a total of 228 approved bunker tankers.

More than 64,000 bunkering operations were recorded in Singapore last year, equating to around 170 operations per day, the authority said.

MFMs are used to measure the pipe's flow rate, gauging the quantity, as well as the mass and density of the bunker fuel passing through it.

This method is claimed to improve the operational tolerance and also cut around three hours off a bunkering operation that normally takes up to eight hours using the traditional sounding tape method, which relies on a quantity reading from the barge fuel tank of the receiving vessel taken prior to transfer.This could save around $5,000 per port call.

The quantity variance using meters is claimed to be a maximum of 0.5% and for the tradition method up to 0.7%.

For smaller stems, such as for MGO, the question of the volume being too small to give an accurate reading could be addressed by checking that the type of meter used was suited to the parcel size being delivered, reportedly said Seah Khen Hee, chairman of the Singapore Standards Council's technical committee for bunkering, at a briefing.

MPA said that it had also been studying the loading of fuel oil onto bunker tankers using MFM technology and was in talks with terminal operators.

The bunker supply industry has called for the mandatory implementation of MFMs for loading bunker tankers from terminals, as well as for bunkering ships, as this would eliminate any variation in volume by using the same method to measure both, market sources said, according to report by Platts.

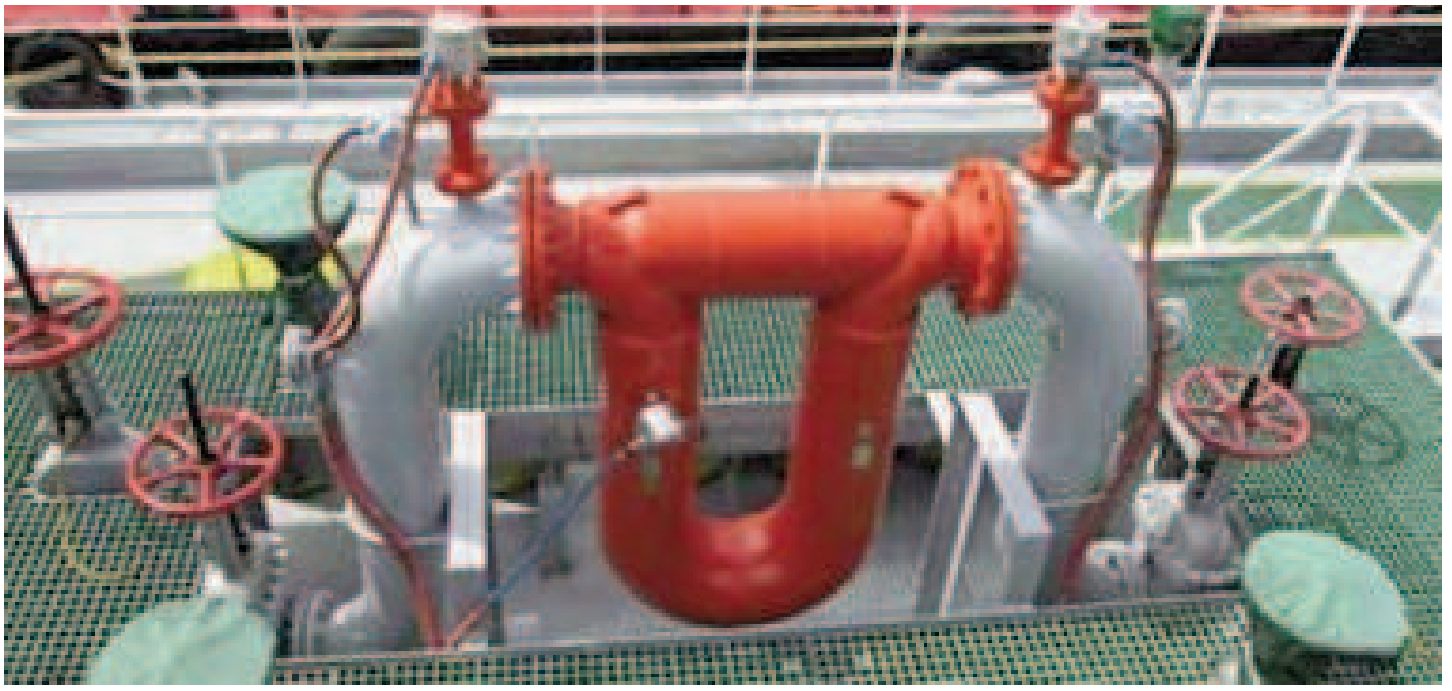
On 3rd March, the MPA sent out a circular confirming that the Technical Reference for Bunker Mass Flow Metering (TR 48:2015) was launched on 16th February, 2016.

It was jointly developed by the Singapore Shipping Association (SSA), International Bunker Industry Association (IBIA), bunker suppliers, bunker craft operators, bunker surveying firms, meter vendors, National Metrology Centre, SPRING Singapore's Weights and Measures Office and the Maritime and the MPA.

TR 48:2015 covers the set of core requirements for metering system qualification, installation, testing, procedures and documentation for MFO deliveries via the MFM system in the Port of Singapore.

From 1st June, 2016, all bunker suppliers, bunker craft operators and bunker surveyors are required to comply with the requirements and procedures of TR 48:2015 for all MFO deliveries via the MFM system in Singapore, the MPA said.

In addition, as part of Singapore's ongoing efforts to enhance the bunker cargo officers and



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bunker surveyors' professionalism and competency, MPA worked with SSA and IBIA to develop refresher courses aiming to raise the technical knowledge of MFM bunker operations, including creating greater awareness for personal safety and professionalism among frontline bunkering officers, it said in the circular.

Meanwhile, ExxonMobil has claimed to be the first bunker fuel supplier to introduce an (MFM) system accredited by a port authority.

The technology, approved for bunker fuel deliveries by the MPA in 2012, was recently introduced in Hong Kong where it was accredited by Lloyd's Register. TO

BIMCO addresses OW Bunker anomaly ahead of ruling

By the time this issue is published, the final English law verdict on whether many hundreds of shipowners should pay OW Bunker's assignee ING Bank or pay the physical suppliers should be known.

This hearing was due take place on 22nd March in London, following the UK Supreme Court granting an expedited hearing to Product Shipping & Trading's case against the collapsed OW Bunker (the 'Res Cogitans').

In October, 2015 it was held by the Court of Appeal that the UK Sale of Goods Act 1979 did not apply to contracts signed with OW Bunker as an intermediary for the supply of bunkers on credit.

The consequence of this decision is that owners may face the risk of having to pay twice for the bunkers they purchased through OW Bunker. The decision has created much uncertainty in the industry and it is hoped that the Supreme Court will soon provide much needed clarity, BIMCO said in a note to members.

Before the decision is reached, BIMCO recommended to purchasers of marine fuels to incorporate into their bunker supply agreements the words 'The United Kingdom Sale of Goods Act shall apply to this Contract'.

The organisation's standard bunker contract (BIMCO Terms 2015), which is accepted by purchasers, bunker suppliers and bunker traders in growing numbers, has similarly been amended.

A new Clause 25 (UK Sale of Goods Act) has been added to the contract incorporating the recommended wording as stated above. The amended terms have been marked 'v1.1' to distinguish them from the originally published terms. TO

VPS realigns with DNV GL

Veritas Petroleum Services (VPS) and DNV GL have launched a new fuel analytics solution.

As part of DNV GL's ECO Insight fleet performance management portal, the tool will enable a systematic assessment of the impact of fuel quality on vessel performance, for the first time. The Fuel Analytics solution is the result of an ongoing close co-operation between VPS and DNV GL. VPS was a subsidiary of DNV before branching out on its own.

"We have been the largest fuel testing services provider since our inception in 1981," said Gerard Rohaan, VPS CEO. "And as a result, we have the world's largest fuel sampling database – over two million tested samples. By extracting valuable information from this extensive database with state-of-the-art analytical tools, we help our customers get the best value from their bunker purchases through fast, accurate performance monitoring and decision making."

The new fuel analytics solution is an online benchmarking tool that shipping companies can use alongside ECO Insight's existing modules, to answer three key questions:

1) What impact does my bunkered fuel quality have on my vessel's performance?
2) What bunker quality have I received compared to a world fleet average of similar vessels in the same time period?
3) Where do I find good quality bunker locations and suppliers?

Fuel quality is calculated in terms of four major benchmarks: technical quality (meeting the specifications of ISO standard 8217), financial quality (energy, water content), statutory compliance, as well as reporting quality (deviation from the bunker delivery note).

By providing aggregated and comparable benchmarks, ship operators can easily assess ports and suppliers globally on a common scale, VPS said.

"By integrating Fuel Analytics within our ECO Insight solution, shipping companies can now get even more analytical depth from the most comprehensive fleet performance portal on the market," said Dr Torsten Büssow, DNV GL's head of fleet performance management. "For the first time, shipping companies can now easily differentiate between the efficiency loss due to fuel quality, voyage performance, and hull, propeller, engine and systems degradation."

VPS delivers testing, inspection and advisory solutions to help customers achieve measurable improvements to fuel management, fuel cost, operational efficiency and marine fuel regulatory compliance. In close collaboration with the industry, the company introduced the first commercial bunker fuel testing and bunker quantity surveys for ships in 1981 and 1987, respectively.

Today the company operates a global network of customer service offices supported 24/7 by technical experts integrated with four specialised and wholly-owned ISO 17025 accredited fuel testing laboratories strategically located in Rotterdam, Singapore, Houston and Fujairah. Its bunker quantity surveys are available at more than 200 key bunkering ports worldwide, it said. TO

> "We have been the largest fuel testing services provider since our inception in 1981..."
>
> **Gerard Rohaan, VPS CEO**

Tanker loading & unloading system proves a success

Techflow Marine's patented Quay Reel terminal loading and unloading system is now available from mooring and offloading systems supplier, Offspring International (OIL), under a worldwide primary agent agreement.

This flexible hose system offers simultaneous product transfer, claiming to reduce loading times by up to 60%.

Conventional quay-based loading/discharge systems use arms, which make the system prone to long loading times, as they cannot cross each other and only one arm could be used at any one time. This arrangement limits the number of products that can be loaded/discharged simultaneously and as a result tankers must move to load/discharge other products.

Quay Reel's flexible loading system allows simultaneous loading and offloading, reducing operation times and enhancing terminal capacity, OIL said.

Dave Rowley, OIL director, said; "Techflow Marine's Quay Reel is based on technology proven in over 100 separate projects in the oil and gas industry. Utilising Quay Reel reduces the service life costs of offloading infrastructure and enhances capacity, allowing for sustainable increases in terminal demand."

The idea was originally developed for Spanish energy concern CEPSA to replace the existing loading arms at its Huelva oil terminal- Reina Sofia Pier.

Huelva was showing signs of saturation at its two loading jetties and in 2014, the delays were deemed to have reached their limit.

For example, OIL claimed that during 2010-2011, the increase in the volume of cargo handled at the terminal caused delays of up to 3,000 hours. It was found that the pier suffered delays when operating at over 50% capacity and this would result in tanker load/discharge operations not being viable by 2015.

The project to fit flexible hose systems at the terminal started in October, 2013 and operations commenced in March, 2015.

Proven Robustness

OIL claimed that since the system's installation, the system now has a proven robustness in all types of conditions and it has class society certification. It allows the simultaneous load/discharge operations with complete flexibility and is a less complex system than the original loading/discharge arms.

In addition, safety measures have been incorporated, including an additional protective shell and it also features WiFi remote control.

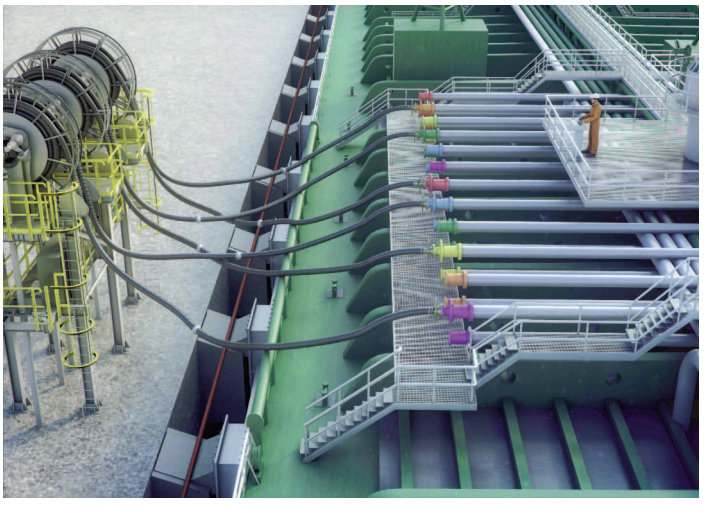
The hose winding reels consist of 5 x 30 m long hoses powered with electro-hydraulic drives, activated by remote control.

As well as reducing the terminal's operation times by up to 60%, the Huelva refinery port facilities' oocupation rate was reduced by around 20% Loading/discharge was claimed to be 125% faster in cu m per hour terms with simultaneous operations from the flexible hose system.

Cepsa has since patented the technology in collaboration with TechFlow Marine. The company claimed that Quay Reel was suitable for operations with 98% of the current chemical products shipped worldwide.

Established over 25 years ago, OIL supplies single point and conventional buoy mooring and offloading systems, hoses, breakaway couplings, pressure surge protection and navigational buoy moorings.

TO



The Quay Reel load/discharge system is claimed to be able to reduce cargo operations time by up to 60%.

Making the unmeasurable measurable

Deterioration in hull & propeller performance between drydockings currently accounts for around 10% of world-fleet fuel costs and GHG emissions, Stein Kjolberg, Jotun's global sales director, hull performance solutions (HPS), claimed.

Hull and propeller performance has become more and more important, and has really been put on the agenda over the past couple of years and of course, the choice of antifouling is a major contributing factor.

There are also many confusing claims on performance. Promises of fuel savings have been given from most suppliers, normally in the range of 5-10%. The question will often be how to justify these claims. For example, fuel saving claims on newbuildings in the range of 5-10%, how can this be verified?

What to measure, how to measure and what to compare with definitely needs to be clarified.

For example, for vessels operating at low activity with a slow actual (slow steaming) and an uncertain operational profile with a risk of idle periods, a faster polishing, higher thickness antifouling will be needed at a higher cost.

For vessels operating at high activity, thus at more normal speeds with a predictable operational profile and limited idle periods will need a slower polishing, lower thickness antifouling, which comes at a lower cost.

Since the entry into force of the IMO's Antifouling Convention (AFS) in September, 2008, there has been no single antifouling coating, which can meet all the operational conditions for a particular vessel.

The market has also expanded with a wide selection of coating technologies, which perform well in certain, limited vessel operating conditions. Shipowners must therefore optimise the specific antifouling paint, using the best technology at their disposal for each ship's specific operative profile, Kjolberg said.

As a consequence of this extensive, and at times confusing, antifouling market, the owner's selection of a suitable antifouling system becomes increasingly difficult. Furthermore, the high cost of many systems coupled with the economic and high regulatory stakes, mean that getting the selection wrong will come with greater negative impact for vessel owners.

Given the vast range of performance enhancing paint technologies, as well as hull and propeller cleaning services already available on the market – why does hull and propeller performance remain poor? The problem is a lack of measurability.

A reasonable degree of measurability has been established for the ship at the newbuild stage (EEDI) and then for overall ship efficiency during operations (EEOI). But the individual contribution of the various factors that impact overall efficiency, such as hull and propeller performance, remains much less understood. And if one cannot measure a return on investment, an investment has no value, he stressed.

In the beginning of 2010 Jotun officially launched the HPS. This concept consists of four building blocks, the product itself - SeaQuantum X200 and additional technical services during drydockings. Once the vessel leaves the dock, the performance monitoring starts and is backed up by a performance guarantee.

SeaQuantum X200 is a self-polishing technology based on nearly 20 years of in-house experience with Silyl Acrylate. The technical services consist of a senior overseas coating advisor acting as a project manager whose sole purpose is to make sure that the application is performed as well a possible.

Jotun's HPS formed one of the building blocks for the new ISO 19030 standard on hull performance monitoring, which should be published in June of this year.

Basically, hull performance monitoring is the change of power required to move the vessel through the water at a given speed, due to changes in the underwater hull and propeller condition. The focus is on long term changes.

Its objective is to recommend practical methods for measuring changes in ship specific hull and propeller performance for use on a voluntary basis. The underlying effect target is to contribute towards a reduction in world fleet energy cost and carbon emissions – as much as possible and as soon as possible.

Stein Kjolberg.

ISO 19030's scope is to measure changes in hull and propeller performance over time to enable the determination of - drydocking performance, in service performance, trigger ad-hoc maintenance and determine its effect.

The standard was put together by 53 representatives of shipowners, shipbuilders, class societies, paint manufacturers, performance monitoring companies, research institutions and others, Kjolberg said.

He said that a commonly agreed method of performance will allow companies to learn from the past to make better decisions tomorrow. It will also provide needed transparency for buyers and sellers of fuel saving technology and enable performance-based contracting and risk sharing.

Understanding pooled tankers performance

One of the most important aspects of the pooling of vessels, from a business perspective, is the accurate assignment of pool points and sharing of revenue.

Applied Weather Technologies (AWT) business development manager Mike O'Brian, writing in the AWT Insights Newsletter, said that the company was keenly aware of the benefits and business necessities of pooling tonnage.

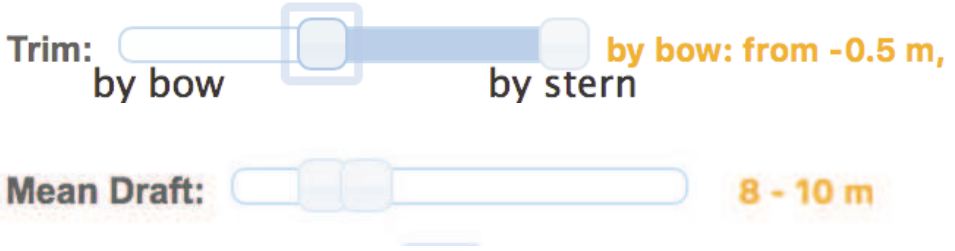
He said that performance is at the centre of pool point assignment, however, the complicating factor is finding an equitable way to understand performance across a range of variables, including different loading conditions, range of speeds and fuel consumptions.

Individual vessel performance against a baseline-performing vessel has been the de facto standard in assessing performance and pool point weighting. By using this system, a vessel can be judged as performing better or worse than the pool norm, thus earning more or less of the pool revenue accordingly.

Vessel owners and pool managers have used AWT data to gauge this type of performance for some time. The benefit of using AWT's independent data and calculations is that pool managers and owners, contributing ships to the pool, are put on a level playing field when it comes to the influence of the ocean environment, O'Brian said.

In consultation with pool managers, AWT has determined that there are tools that can be provided, which will further refine the assignment of pool points. One of the most fundamental questions is, "Should the industry simply analyse ballast voyages and laden voyages?" Is it accurate to say the performance of a partially laden vessel can be compared on the same terms as a fully laden vessel?

Clearly, a partially laden vessel will not consume as much fuel as a similar ship that is fully laden. By using the AWT draft selector, partially laden ships can be compared with similarly loaded vessels and it follows that fully laden ships compared to other fully laden ships.



A sliding bar allows the user to refine the data.

Trim examined

In this example, only ships with a mean draft between 8- 10 m will be evaluated. Furthermore, the precision in ascertaining specific vessel performance among peer vessels can be increased by also looking at the trim. Are the vessels that needed to be loaded down by the head by 0.5 m at a mean draft of 8-10 m performing equally?

The image above is the sliding bar that allows the user to refine the data to show us just that.

Filtering

Using advanced filtering tools, similar ships of similar laden conditions can be graphed for quick visual reference or exported to Excel for further analysis or data extraction into a proprietary pool point calculation system.

In addition to powerful filtering, O'Brian claimed that AWT can put tools in the hands of pool managers or owners allowing them to:

1) Evaluate fuel basis - main engine, main engine plus auxiliary or total fuel consumption. This tool allows bulk liquid pool managers to remove oil used for heating from the calculations.
2) Ability to toggle on/off the use of ocean currents in calculations - adjusting performance for ocean currents is commonplace for drybulk vessels, however, with tankers that is not necessarily the case.
   Charterparty performance calculations for tankers do not include ocean currents and that practice has carried over to pool point calculations for tankers, in some cases.
   AWT gives tanker operators the option to allow for or ignore ocean currents in their performance comparisons, he said.
3) Evaluate performance in light, moderate or all weather conditions- the ability to define 'light' weather as Beaufort force 0-4 for drybulk pools or Beaufort force 0-5 for tanker pools to more closely align with Shelltime performance, are available.

As a full service provider to the maritime industry, support for pool managers has always been a priority, O'Brian said. At AWT, one of the company's core values is 'continuous improvement'.

Creating more accurate and flexible tools for pool managers and owners is one way we strive to improve the industry, he concluded.

Inspecting the tank

DNV GL has invested in a camera system - IRIS - which has been designed to be fitted on a surveyor's helmet.

It is able to send photographs back to the 3D ShipManager hull model onshore.

The camera system is able to track its own position inside a tank and can automatically locate the photos and associate them with the 3D ship model.

Through stereo vision, corrosion and crack lengths can be measured and a recording sent back to the 3D model. The centre of the image can be defined using a laser marker and the system will automatically position the photo in the model.

As a result, the recorded camera track and photo positions are displayed. A position-based search of previous findings are also made possible for the same ship, as well as a sister vessel. An accurate recording of the hull condition is thus undertaken efficiently, DNV GL said.

DNV GL has also introduced what it calls SurveySimulator, which is a solution to help train surveyors in carrying out visual inspections in a more comprehensive, efficient and safe way.

This system makes practical training possible without leaving classroom, the class society said. Thousands of deficiencies can be placed on virtual vessels available for training purposes.

Deficiencies are both safety related and of a technical nature, such as internal coatings failures, cracking, etc.

Drone technology

In addition, the class society is experimenting the survey of internal spaces using drones. By using drone technology, this gives the potential to reduce survey time and negate the use of staging inside a tank or hold, which improves the surveyors safety levels.

At present, the focus is on vessels fitted with large tanks that require extensive staging to conduct surveys. The next step is a customised drone to be built to DNV GL's specification and guidelines issued and training given to surveyors operating drones, which is in progress.

In the future, drones could be operated in areas deemed unfit for humans, such as explosive or toxic internal spaces. If an Ex-proof drone is used, there will be no need to gas free the tank, DNV GL explained.

The first DNV GL tests were carried out on conducting hull surveys by drones at Remontowa shipyard in Poland in November and December, 2015 in oil and chemical tanker cargo tanks and on a drybulk carrier.

Work to extend battery life and improve the light to enhance the drone's marine operation will be undertaken. In the future, the drones will be able to fly autonomously, that is to fly around a tank without external guidance via a 3D model or an on board scanning system.

Potentially, drones could be used for thickness measurement, reflection/deformation assessment, or infra-red observations of equipment or cracks.

DNV GL's tests used a camera-equipped drone to visually evaluate structural components through video streamed to a tablet. One surveyor operated the drone, while a second checked the video feed in real time. The stream was also recorded for review and documentation purposes.

Equipped with a powerful headlight, the drone was able to produce a video of sufficient quality for initial inspection purposes. In the event any damage is detected, a traditional close-up survey may still be required.

DNV GL used a modified off-the-shelf drone for the tests, as at the time, there were no drones formally certified as explosion-proof commercially available.

The class society is currently working on a more advanced tailor-made drone built to its specifications and is developing a special guideline and training platforms for performing drone-based surveys.

"Using a drone in combination with a system like IRIS could be very beneficial to our customers. We have already demonstrated the ability to place images within a 3D model and furthermore to assess the individual findings.

"These are the first steps towards an automated survey process, which might include using a drone to make the initial survey, taking the images generated and then running them through an algorithm to determine the hull condition," said Dr Pierre Sames, director of Group Technology and Research.

Last year, Poland's Remontowa shipyard used a drone to inspect internal spaces on board the 2009-built MR 'CPO Japan' owned by Claus-Peter Offen Reederei. She arrived at Remontowa on 15th June for her first five year class renewal overhaul.

First test at sea

Elsewhere, what was claimed to be the first drone delivery test to a vessel at sea was successfully completed by Maersk Tankers in late January.

The test delivery took place near Kalundborg in Denmark. Using drones to deliver urgent parcels to vessels and conduct inspections has a big cost- and time-saving potential, Maersk Tankers said.

Further tests will now follow before the new drones can become a part of the supply chain for the vessels.

Maersk Tankers said that it faced high costs for on board delivery of small parcels of urgent spare parts, mail or medicine, due to the need for a barge.

The drone used was a LE 4-8X Dual, developed by the French start-up Xamen Technologies. This 6 kg drone, is claimed to be the world's first to be certified ATEX (EXplosive ATmospheres), having been designed to operate in potentially explosive environments, such as oil rigs, chemical processing plants and oil refineries.

"It is fundamental that any drones used by Maersk Tankers are safe for the environment they are operating in. They must be certified as intrinsically safe for most tasks, so they cannot create any spark, even if they were to crash. Some inspections can pose risks if performed by humans. If drones are approved for tank inspections, it will improve safety on tankers and potentially in other oil-related installations," said Kuhn.

As well as delivering urgent parcels, Maersk Tankers agreed with DNV GL and other class societies that are known to be working on the technology that drones have the potential to be used for inspections, eg to take high quality photos or videos of certain areas to identify cracks. Such potential early findings could avoid higher expenses if problems are only discovered later, Maersk Tankers said.

Maersk Oil and Drilling is already testing drones for inspections of for example, flare tips or other installations. APM Terminals and Maersk Supply Service have also started to look into the use of drones.

TO

IPTA highlights cargo carriage confusion

At the recent 'Navigate/IPTA Chemical and Product tanker conference', IPTA's general manager, Janet Strode, gave delegates a regulatory update.

This mainly concerned the carriage of the multitude of different chemical and products cargoes and how their categories might change and what this might mean for the chemical carrier operations.

She first addressed used cooking oil cargoes, which are being carried in ever larger quantities and explained at last year's IMO sub-committee on Pollution Prevention and Response meeting (PPR2), the former Bulk,Gases and Liquids grouping, it was agreed to assign carriage requirements on the basis of a "worst case scenario" pending receipt of the data required for the product to be evaluated.

As a result, pollution Category X was assigned, with other carriage requirements, the same as for vegetable oils. Product data was subsequently submitted. A paper was then submitted to the 21st session of the IMO's sub-committee on Evaluation of Safety and Pollution Hazards (ESPH) proposing that the pollution category be changed to Y.

Concern was expressed by a number of IMO member states, however, that used cooking oil, by definition, could be made up of many different products and there was no guarantee that a product offered for shipment is the same as that submitted for evaluation.

It was therefore decided that the next edition of the MEPC.2/Circ. should contain two entries - a generic entry for 'used cooking oil', with pollution category X, and a second entry, 'Used cooking oil, triglycerides C16-C18 and C18 unsaturated', with pollution category Y.

The cargo as described in the second entry could only be shipped as a category Y cargo if there was evidence that the product was the same as that described.

She said that this had now become academic as FOSFA had decreed that both categories would be added to the banned list of immediate previous cargoes, effective 1st April this year and a revised banned list has now been published. This means that used cooking oil cannot be shipped as the next cargo.

IBC Code changes

As for the IBC Code, under a review, some cargoes are changing between Type 1 and Type 2 categories, while 18 products are changing from Type 2 to Type 3, including acids.

For those cargoes changing from Chapter 18 to Type 3, ie from non-toxic to toxic, the vessels involved need to be fitted with toxic vapour detection equipment or have an exemption from the vessel's flag administration. If the equipment is not available, breathing apparatus must also be worn by personnel working in cargo tanks or cargo handling spaces. She said that around 60% of the cargoes listed were toxic.

For the carriage of toxic products, exhaust openings must be fitted and a vapour return line provided. As for the stowage of toxic cargoes, they must not be loaded into tanks that are adjacent to fuel oil tanks and separate piping systems fitted, as well as separate vent systems. The PV valves must be of a minimum of 0.02 gauge.

For the PPR3 sub-committee meeting, IPTA, ICS and INTERTANKO have submitted a joint paper highlighting issues, such as -

- Availability of detection equipment.
- Which component to test for?
- What about low vapour pressure?
- Are the various requirements still necessary/appropriate?
- The administration burden of obtaining exemptions.

In addition, Strode said that ESPH 22 should consider -

- Is the cut-off point for classing products as toxic too low?
- How to identify components triggering toxicity?
- How to deal with products deemed toxic by long term exposure but which produce little vapour?
- Is instrumentation available to detect concentrations of toxic vapour in low volatility products?
- Validity of other special requirements triggered.

She next addressed the discharge requirements review under MARPOL Annex II.

Floating substances

At MEPC 68, a proposal from a number of European member states was considered to undertake a review in view of continual fouling of beaches with persistent floating substances. This proposal was agreed almost unanimously and the PPR3 sub-committee, at its February 2016 meeting, looked at a number of ways forward.

While some member states were in favour of creating a special area in the North Sea and possibly other area, the majority felt that this would simply push the problem elsewhere. Most felt that the most practical solution would be to require a prewash for all high viscosity and solidifying substances defined as 'persistent floaters'.

It was further proposed that the definition of high viscosity be amended to read "...50 mPa at 20 deg C" instead of ".....at unloading temperature"; and the defintion of a solidifying substance to "....with a melting point above 0 deg C".

This would mean about 160 products being subject to prewash, including all vegetable oils, which would imply a huge commitment from discharge ports and receivers to install reception facilities, which in turn would cause additional port time, operational issues, leading to increased emissions in port areas, She said.

TANKER Operator

KEY PLAYERS IN THE TANKER INDUSTRY
will be profiled giving their views on current legislation, recommendations and trends. These will include chief executives from all sectors of the industry from equipment manufacturers to the top shipowners

INFORMATION
about meeting oil major requirements (TMSA / vetting)

DEVELOPMENTS in management/ safety/ environmental best practice

NEW TECHNOLOGIES
and commercial industry developments

COMMERCIAL TANKER OPERATIONS
including shipbroking, legal matters and financing

IN DEPTH INFORMATION
on the latest newbuilds, sale and purchase, freight rates and derivatives markets, using industry known commentators

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