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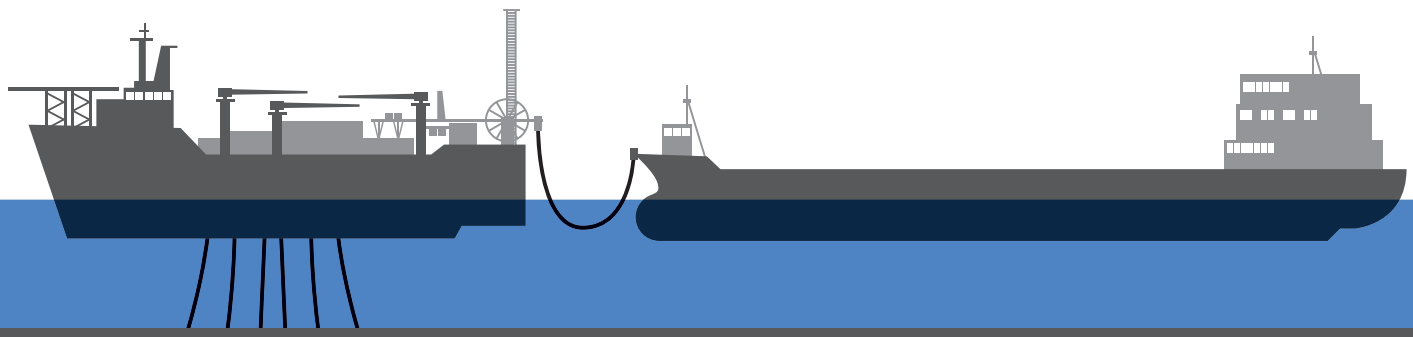

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Front cover

BSM's Loss Prevention, Safety and Quality (LPSQ) section is responsible for verifying compliance with the ISM Code, ISO 9001, ISO 14001, and industry standards such as TMSA.

The LPSQ system allows for a detailed analysis of all fleet data, ensuring that opportunities for improvement are identified and that operational risk is minimised.

This supports BSM's policy of insistence upon the highest standards of quality service, with utmost importance given to safety.

Ballast water - we are going backwards

If the Ballast Water Convention hasn't already descended into farce- it has now!!

On both sides of the 'pond' arguments have increased over whether it is fit for purpose and we still can't ratify it..

We all thought that we had got there at last by November last year when the IMO was believed to have reached the magic 35% of tonnage needed, having already passed the number of countries necessary for ratification by a country mile.

Then came the news early this year that we were still 0.44% short of the tonnage percentage need, which will make ratification this year impossible. Panama was believed to be close to signing but was then said to have doubts over technical issues.

Meanwhile, across the 'pond', in the US, the US Coast Guard's recently announced stance on the use of the Most Probable Number (MPN) has upset manufacturers and organisations alike. The US has unilaterally run with its own rules and guidelines and In December last year, issued a note saying that it had preliminarily banned the use of the MPN method.

This has caused such uproar that a website - www.mpnballastwaterfacts.com - was set up by a group of concerned organisations aimed at dispelling any myths about the MPN method.

In February,, the Chamber of Shipping of America (CSA) took up the baton and wrote to the USCG in support of the MPN method. The USCG's preliminary decision has far reaching implications, particularly for shipowners and ballast water management system suppliers, one manufacturer said.

In the letter, the CSA said; "On December 14, 2015, the (USCG) issued preliminary decisions that would prevent shipping companies, including those that are members of the CSA, from utilising one of the most environmentally friendly and practical Ballast Water Management System (BWMS) developed to-date.

"Specifically, the USCG has preliminarily rejected the MPN method for testing the efficacy of BWMS that utilise ultraviolet (UV) technology to render organisms unable to reproduce.

This action, if affirmed by senior USCG officials, would have significant adverse economic impacts on the entire shipping industry and adverse economic and environmental impacts throughout the world."

Requests for UV approvals

The CSA went on to ask the USCG to approve the requests and type approval applications for BWMS that use UV technology to render organisms unable to reproduce, as measured by the MPN method.

"The USCG's preliminary rejection of the MPN method prevents US type approval of UV technology-based BWMS that render organisms non-reproductive, and therefore unable to colonise, because the efficacy of such systems is determined by using the MPN method.

"This preliminary rejection of the MPN method appears arbitrary and contrary to practice within most, if not all, other IMO member nations, and is even contrary to other use of the MPN method within the US.

"The USCG's failure to accept MPN as an acceptable measurement method results in the imposition of a more stringent performance standard than those contained in the IMO Convention and USCG regulations," the letter said.

The CSA claimed that one BWMS required 400% more power than a typical UV system approved based on MPN. For a 3,000 cu m per hour flow rate, this system would require 630 kW of power, which is roughly equivalent to the full power output of a typical diesel generator set on a bulker/tanker.

Given the typical arrangement on a VLCC with two ballast pumps with capacities of 4,000 cu m per hour, it can be seen that the power supply requirement for this particular system would be around 1.6 MW, the CSA argued.

The Chamber said that about 50% of all IMO type-approved systems utilise UV technology to render organisms non-reproductive. By enforcing more stringent testing requirements on BWMS that enter US waters, it appears that the USCG is attempting to unilaterally make more stringent not only the IMO Convention requirements but also the USCG's own regulations.

"At the same time, however, the US has not actually approved any BWMS that would meet its standard. As a result, there is currently no way for shipping companies to comply with both the IMO convention, which is widely anticipated to be in force in 2017, and the USCG's requirements as articulated in its preliminary decision.

"The USCG's departure from the worldwide standards wreaks havoc on the international shipping industry, constitutes unnecessary regulation without demonstrable corresponding environmental benefit, suppresses innovative and proven technology, and prevents the implementation of BWMS that would prevent and control infestations of aquatic species today.

Tanker Operator is grateful to Trojan Marinex for pointing out this anomaly. The manufacturer also told us that it had joined the ranks of BWMS suppliers to have submitted an appeal to the USCG.

In total over 7,000 pages of documentation have been submitted in the appeal process by the four companies who had received letters from the USCG.

Unfortunately for owners, operator, managers and BWMS manufacturers, this could run and run and get completely bogged down in legalise.

TO

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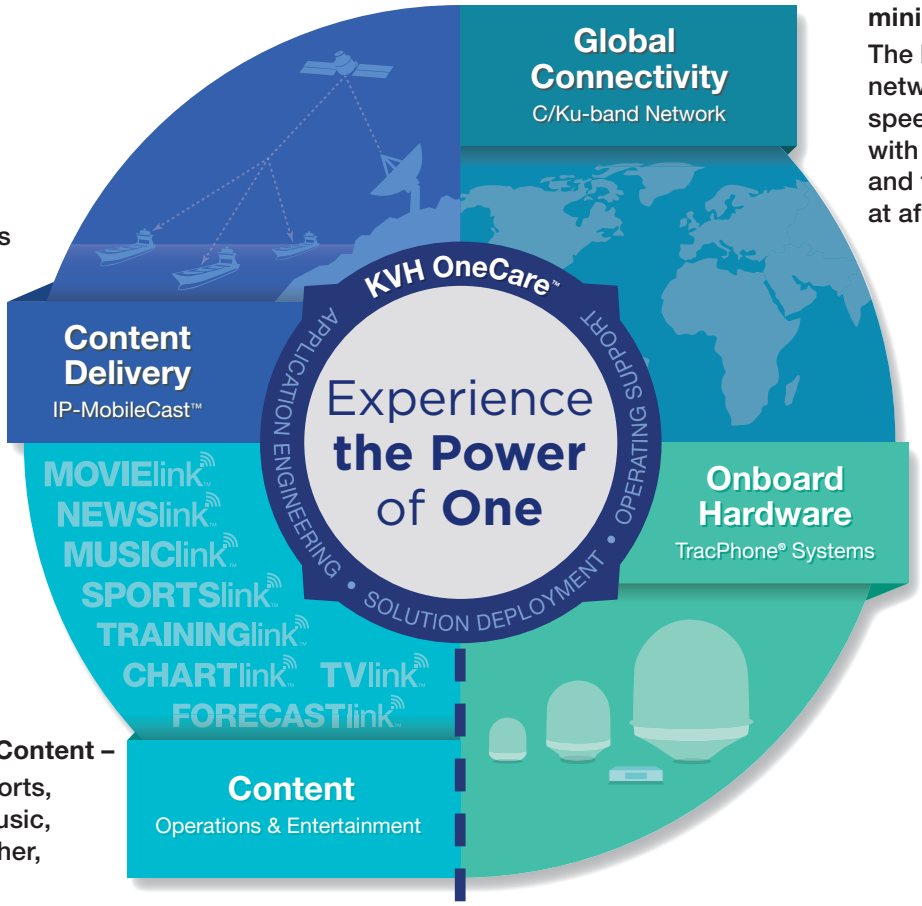

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Most anchor losses are avoidable

The average claim cost for a loss of anchor has grown steadily since 2012, according to The Swedish Club.*

Lost anchors are among the top five claims costs, and are the root cause of many groundings and collisions. Almost half of the reported lost-anchor cases are due to environmental conditions, such as weather, currents and water depth, while one third are related to operational issues.

So what are the reasons for these anchor losses? DNV GL, Gard and The Swedish Club decided to jointly investigate this issue and started to look into their damage records for the last five years related to lost anchors.

Over the past few years, the three organisations have observed increasing losses of anchors and anchor chains. This topic was also addressed in 2011, but after a couple of years of improvements, the past two years showed a negative trend again, with rising numbers of reported anchor losses and associated costs.

The loss of an anchor is often associated with significant additional damage, due, for example, to collisions and groundings, and the increasing cost of recovering and replacing the lost anchor. DNV GL's observations indicate that a high percentage of the anchors are lost during the first five years of a ship's life. This points to possible issues with equipment quality, wrong installation or a potential lack of familiarisation with the equipment. In 36% of the reported cases, both the anchor and chain were lost, and tankers and bulk carriers had the highest loss frequency than other ship types.

First and foremost, the study revealed that most cases are avoidable. Second, it demonstrated that an increased awareness of safe anchoring operations and preventive maintenance procedures was necessary.

The study started off by asking questions such as: Why have so many ships lost their anchors? Is it because of manufacturing problems? Were the accidents a consequence of crew mistakes? Or was the cause a lack of relevant procedures or the crew simply ignoring the procedures?

Early on in the project, three key observations were made:

- A lack of awareness about the maximum environmental loads for the anchoring equipment.
- A lack of awareness about the critical maintenance issues for anchors, chains and windlasses.
- Generally poor seamanship and a lack of proper safe-anchoring procedures.

Port side anchor chain.

IACS unified requirements for anchoring equipment are based on anchoring in sheltered conditions. The environmental loads are 2.5 m/s current, 25 m/s wind and no waves. Under these conditions, the ratio of the length of chain paid out to the water depth (scope) is assumed to be at least 1:6. Thus, depending on the ship size, the chain cable length must be sufficient for anchoring in maximum water depths of between 25 m and 64 m.

The windlass should as a minimum be able to lift the anchor and three lengths of anchor chain, which equals 82.5 m. This is apparently not common knowledge among many seafarers resulting in ships frequently anchored in unsheltered, deeper waters where there is significant wave impact. Excessive environmental loads represent about half of the direct causes of lost anchors.

Three critical components have been reported as a direct cause of many of the losses:

- The D-shackle connecting the anchor to the anchor chain.
- The windlass brake bands.
- The windlass motor.

When ordering new ships, shipowners are encouraged to consider their trading pattern and anchoring locations based on defined limitations. They are recommended to increase the specification for their anchoring equipment to reflect their actual trading pattern. Shipboard personnel need to be aware of the environmental limitations for safe anchoring operations related to winds, currents and waves.

Next, safe-anchoring shipboard procedures relevant for the ship's equipment should be developed and properly implemented. Another factor is that, during routine inspections, there should be an increased focus on key components, such as securing the D-shackle, the wear and tear on the swivel and chain and the proper adjustment of the brake band. And last, it is of vital importance that Masters are encouraged to always put the safety of the vessel before commercial interests. All these factors are low-hanging fruits for shipowners to use to improve their anchor-loss statistics.

The report from the study divides the main causes of lost anchors into two categories – technical issues and operational issues - and emphasizes that they are both of equal importance.

Technical issues

Technical issues account for half of the anchor losses.

D-shackle securing pin- The most critical detail is the D-shackle connecting the anchor to the chain. The D-shackle is often found

D-link becoming loose.

remaining at the end of a chain with the bolt missing when an anchor is lost. The D-shackle bolt is locked in place by a tapered spline pin, which is secured by a lead pellet hammered into a dovetail recess. Without the securing pellet, the pin falls out and the anchor is lost. A similar problem can also be encountered for Kenter shackles. A mitigating action could be to inspect the D-shackle connection at regular intervals.

Swivel- Several cases of the swivel detaching due to excessive wear and tear have been reported. If the swivel is not functioning properly, the chain may twist and cause secondary bending of the anchor shackles. The key challenges for the swivel are corrosion and mechanical wear.

Anchor chain - General wear and tear on the anchor chain must be carefully monitored. The maximum allowable reduction accepted by class societies is 12%, but if the anchoring equipment is used in exposed waters it is recommended to replace the anchor chain earlier. The studs, which are there to maintain the shape of the anchor links, may come loose or fall out. This will seriously weaken the chain and need to be rectified in compliance with class requirements when discovered. Cases have been witnessed involving the unauthorised welding of loose studs, which may seriously weaken the chain's strength.

Chain stopper - Normally, ships are equipped with chain stoppers that secure the anchor while at anchorage. When a chain stopper is present, the design load for the windlass brakes may be reduced from 80% to 45% of the chain's minimum breaking strength. Hence, if the ship is anchored

without the chain stopper being engaged efficiently, the loads on the windlass brakes can become excessive. Damage to the chain stopper can involve excessive wear or a missing securing pin for the guillotine bar. Excessive wear of the edges of the guillotine bar or pawl (for a tongue type stopper) could prevent the proper securing of the chain.

Windlass - The windlass motor is designed to lift three lengths of anchor chain, or 82.5 m, together with the anchor. For ships with a large freeboard, the maximum anchoring depth is about 60 m. Many anchors have been lost due to either anchoring in too deep waters or recovering the anchor during heavy weather, both causing the windlass motor to fail due to overload.

The other main problem is failure of the windlass brakes due to excessive corrosion, wear and tear. When the brake band linings become worn, the winch's braking capacity is reduced. It is essential that the tensioning of the brake bands is adjusted in accordance with the maker's instructions. It is recommended to alternate the use of port and starboard anchors to avoid excessive wear or corrosion on one side. It is strongly recommended to regularly check the wear down of the brake band linings and adjust or renew the brake bands when found necessary.

It is essential to properly secure the anchor when at sea to prevent both any loss of anchor and excessive vibrations which may lead to the D-shackle detaching. Broken claws, hooks, etc, of cable tensioners should be renewed and not repaired by welding.

Key takeaways

In short, here are some key takeaways related to technical failures:

- Check the anchor and chain carefully when in dry-dock for wear and tear.
- Check the securing of the D-shackle pin as often as possible.
- Replace the swivel and forerunner when renewing the chain cable.
- Do not buy secondhand anchors or chains without certificates.
- Watch out for fake certificates. The price may be an indication.
- Adjust the brake band when the lining is worn. Read the instructions.
- Replace the brake lining when required, without delay.
- Consider having a stainless steel brake drum surface.
- For new, large ships: consider increasing the size of the windlass.
- Check the condition of all devices for holding the anchor tight in the hawse pipe.

Operational issues

Anchoring is considered by many seafarers to be a challenging exercise, and about one third of the anchor losses are related to operational issues, according to The Swedish Club. The state of engine readiness, weather conditions, forecast, anchorage location, anchor holding power – all these factors have to be taken into consideration.

Preparing to anchor -Planning the anchoring is an important part of good seamanship and should start with an evaluation of the traffic in the area, the congestion at the anchorage itself and any pipelines or cables in the vicinity of the anchorage. Then the water depths must be taken into account. It is always important to pay attention to the weather conditions and these should be closely monitored during the anchorage. The criteria for aborting the anchoring should be clearly defined by the Master. In addition, the nature of the seabed has a significant effect on the anchor holding power and good holding ground is assumed for the minimum anchor weight required by class.

Dropping of the anchor - The anchor team must be called to stations and the master must determine in advance the side on which the anchor will be used. The standard instructions to the anchor team must cover manning, communications and the orders used for anchor operations. Any deviations from standard procedures need to be communicated up front. The vessel speed must be reduced to nearly zero when the anchor is dropped. There are three ways of letting anchors go - 'From the brake', 'Pay out and drop' and 'Lowering by the windlass'- and they are suitable for different environmental conditions.

At the anchorage - The weather forecast must be monitored continuously and the anchorage must be left in time if heavy weather is approaching. When the anchor is laid out, the chain stoppers and brakes should be engaged to secure the chain and the gear must be disconnected from the motor. When the vessel stays at anchor for a long time, the current and wind may swing it around the anchor, and in such cases the ship should be re-anchored from time to time.

Good position control at regular intervals is required when at anchor. Fixed bearings provide a good indication of whether the vessel is still securely at anchor. Most GPS receivers are equipped with an anchor alarm and some have LCD plotting with a track storage opportunity, which will indicate if the ship starts to drag the anchor.

Heaving the anchor - Heaving an anchor in strong winds and high seas is a challenging exercise. The key is to monitor the environmental conditions and leave the anchorage in time before adverse conditions put the operation at risk. Good practice is to manoeuvre the ship towards the anchor to minimise the tension in the chain. Close co-operation between the bridge and the deck team monitoring the tension in the chain is essential, especially if the waves and ship motions pick up.

The key is to limit the tension in the chain using good seamanship. Under no circumstances can a drifting ship be allowed to pull the anchor chain out of the windlass with the hydraulic motor engaged, as this may cause the engine to explode.

Preparation for a voyage - The anchor should be properly secured to the hawse pipe to prevent it from being lost during the voyage. Excessive slack may also cause 'hammering' on the ship hull and the loss of the D-shackle securing pin. Secured anchors have to be put on tight brakes, the chain stoppers may be engaged as an extra safety precaution, and the chain should be further secured by lashings with turnbuckles or other similar fasteners. The windlass clutch has to be disconnected from the gear at sea to avoid the risk of damage.

A summary of the concerns regarding operational issues:

- Lack of experience.
- Not recognising a dangerous situation.
- Poor maintenance.
- Lowering the anchor while the vessel is at speed.
- Staying at anchor during rough weather.
- Not maintaining or properly adjusting the windlass brake and brake linings.

Regulatory framework - The International Association of Class Societies (IACS) publishes Unified Requirements (UR), which are minimum technical requirements adopted by IACS members, as well as recommendations. Those which are relevant for the anchoring equipment are UR A1 Shipboard Anchoring Equipment, Recommendation No 79, which provides guidance on anchoring equipment in service, and Recommendation No 10, which provides guidance on anchoring equipment for small and special ships and on the design and testing of anchor windlasses. IACS is currently reviewing its requirements and recommendations concerning anchoring. TO

**Tanker Operator* is indebted to DNV GL's Eva Halvorsen for her assistance in compiling this article.

US crude oil export ban - another positive market driver?

A decade ago, three lightering companies based in Houston, Texas, were thriving on the back of robust US crude oil imports - American Eagle Tankers (AET), OSG Lightering and Skaugen Petrotrans.*

At the time they were employing close to 20 Aframaxes unloading VLCCs and Suezmaxes when US crude oil imports were topping 15 mill barrels per day. At present, in a reversal of fortunes, only AET is still active in the business, when US oil imports stand at about nine million barrels per day.

The US shale oil game changer has shifted the energy dynamics worldwide, as crude oil politics and economics have brought profound changes to the world stage. For the transportation of crude via tankers, shale oil has brought a change of trading routes and patterns that has lead to the de-coupling of the tanker market from the drybulk and the other sectors of commodity shipping.

As per the graph below, as US crude oil demand tapered off since the market collapse in 2008, this resulted in fewer oil imports from abroad. Then, production of shale oil grew from a small substitute to oil imports to now being abundant enough to be legally and continuously exported from the US.

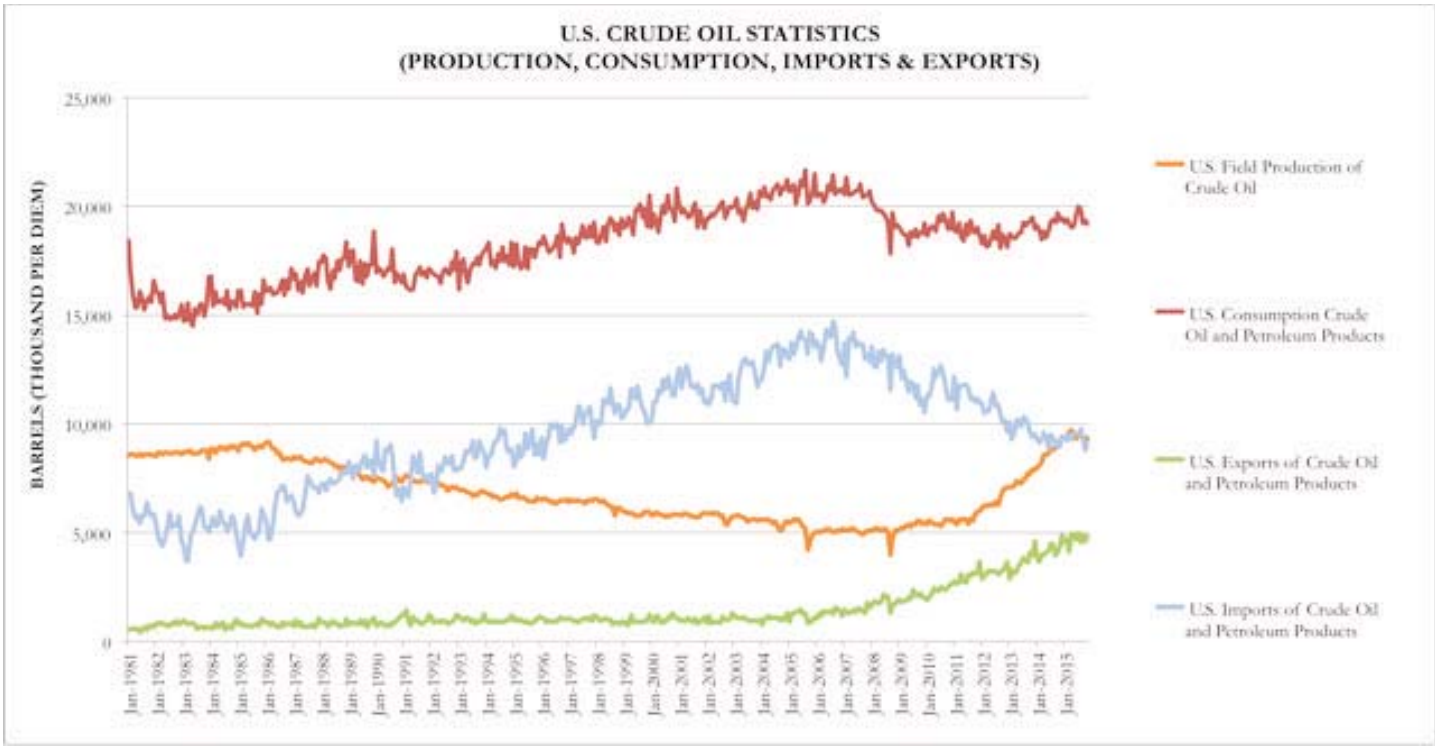
The age of shale oil had been unforeseen even a few years ago, as only recent advanced technologies made production in the US (and elsewhere in the world) technically and financially possible.

Cries of disbelief about such good fortune were soon followed by tremendous capital investments in US drilling and production (estimated at more than $300 bill in the last decade), to the extent that superior quality West Texas Intermediate (WTI) had been trading at discount to Brent Dated oil, the international oil market benchmark.

For the first time in recent memory, the US has had oil aplenty, and despite the trauma to the national psyche of memories of long queues at gas stations, due to the oil embargo in the 1970's, discussions were initiated for possible exports of US-produced oil.

Exporting crude oil is still a politically charged topic in the US, and certain industries – such as the refineries – logically objected to oil exports. A couple of condensate cargoes were quietly exported last year (South Korean Sinopec), and in December, 2015, Washington formally lifted the 40-year old oil export ban. It now seems that the export of crude oil is a *fait accompli*.

There have been many questions from tanker owners on where US oil will be



Source: Karatzas Marine Advisors.

Basil Karatzas.

destined and associated with this question, which type of tankers stand to benefit the most. It's a logical question to ask, but unfortunately the answer is complicated, as there are many variables to consider.

In general, the lifting of the export ban is a positive step for the international tanker market, as landlocked US oil will now be available to trade in the international markets on tankers, and the more cargoes available to trade, the more tonne/miles for the industry, resulting in a net positive effect.

However, trying to analyse the effect on specific markets is difficult: there are many variables, both objective and subjective, and they can change over time, both in absolute terms and in comparison to each other.

The greatest objective driver will be the spread of WTI/Brent, which will lead to refineries sourcing the cheapest oil in the international markets, and if WTI is sufficiently discounted, then US exports stand to replace Brent production.

In subjective terms, oil trading typically takes place with long-term established trading patterns and partners, established financial arrangements, and more importantly, with buyers being happy with the economics and the quality of the oil grade.

Since, the US had been absent from selling oil on the international markets, new patterns have to be established and the dynamics can move in different directions. It has been assumed that given the high quality of the US crude, European refineries are best suited to process such light sweet oil. Also, the distance between US and Europe is relatively short, further helping the dynamics. And, as long as Libyan and Nigerian oil production is kept low, European refiners will be very interested to find a comparable replacement.

So far, in the first two months since the ban was lifted, about two mill barrels have been exported to Europe (and, five mill more to Canada based on long standing trading patterns); the cargoes to Europe (Italy, France and The Netherlands) have been lifted on four separate occasions on one panamax 'Theo T' (first cargo of condensate, dubbed 'Liquid American Freedom') and three Aframaxes 'Seaqueen', 'Minerva Astra' and 'Angelica Schulte'. It is understood from oil traders such as Vitol, that the small parcels

and short distances are indicative of the still exploratory nature of the business.

As the tanker freight market fluctuates, there should be around $2.60 - $3 per barrel discount for WTI over Brent oil for a sustainable transatlantic trade. And, given the relatively short voyage, the first trades have indicated that Panamaxes and Aframaxes stand to benefit most from the export trade to Europe.

A more interesting question would be whether Asian and Chinese refineries could be persuaded to look into sourcing WTI oil. If this occurred, the distance for the cargo to its destination will be quadrupled, meaning a larger impact on the tanker market; further, for the trade economics to make sense, such cargoes will have to be carried on Suezmaxes and VLCCs. Again, given the tanker freight market fluctuations, Asian and Chinese refineries would opt for WTI when it trades $5 - $7 per barrel at discount to Brent. Such trades are more complicated, as Chinese refineries are geared toward processing lower quality crude thus WTI is not the highest yielding margin crude from the refinery's point of view.

A further logistical complication is that US ports typically cannot accommodate Suezmaxes and VLCCs in a laden condition. In such an event, reverse lightering may be possible, where Panamaxes and Aframaxes can ship the cargo from ashore to load larger tankers at anchor. The Louisiana Offshore Oil Port (LOOP), the only terminal in the US Gulf where VLCCs can directly discharge through the underwater pipeline, has been contemplating reversing a line to allow for oil from ashore to reach the terminal and load directly into a Suezmax or VLCC.

The first steps in the export of US crude oil exports seem promising. However, there are still many unknowns that can affect the market dynamics and also shift preferences for tanker trading patterns. For instance, while European refineries seem to be best suited for high quality crude oil, a week European market can soon curtail demand; and while Asian and Chinese refineries would prefer cheaper lower quality oil, a resurgent Chinese economy would make WTI very attractive.

It's interesting to note that the US crude oil export ban lifting took place without any direct 'pork' benefits or concessions for the Jones Act tanker market (although there have been substantial legal benefits for the overall Jones Act cabotage shipping industry).

The Jones Act tanker market will likely sense a negative impact from US crude exports, as they will be undertaken on internationally flagged tankers. Further, higher crude exports mean less cargo to be moved domestically, a likely deflating factor for the stratospheric rates of $120,000 per day timecharters paid by AAA-rated international oil companies for Handymax-sized Jones Act tankers.

It has been debated whether there will be really enough crude oil cargoes to trade from the US: the collapse of the price of oil has translated into delaying or cancelling capital investments in US E&P and domestic oil production has been coming off recently.

Some may say that there may not be enough oil to export. This a hard question to answer when projections for the price of oil range from $25 - $65 per barrel this year alone; on the other hand, there has been a strong argument that shale oil production is here to stay and thrive because of one very strong competitive factor: low overall capex and short lead time.

When an oil company is uncertain of oil demand, it will likely cut deep water drilling projects that cost billions and billions and take a decade of commitment, while shale production can more or less be as responsive as turning the tap in the kitchen.

Small capex and short lead time will give shale oil production the staying power and the advantage over multi-billion dollar projects. And, that may be the greatest argument for the tanker industry to have in an uncertain oil market.

**This article was written by Basil Karatzas, CEO of Karatzas Marine Advisors, a shipping finance advisory and shipbrokerage firm*

Managing the tanker segment

Third party shipmanagement concern Bernhard Schulte Shipmanagement (BSM) manages all tanker types for various owners and actively markets its services for this sector.

Tanker Operator talked with Limassol-based Nicholas Rich, BSM's corporate manager, loss prevention, safety and quality (LPSQ) regarding third party shipmanagement in today's ever changing maritime environment.

The question of the so called 'big data' seems to be currently on everyone's lips but how do companies manage all this data and what do they get out of it?

Rich explained BSM's policy by saying that the company chooses to exploit technology in areas where it offers operational advantages, thus at present, BSM does not feel it advantageous to use fully integrated systems.

Real time data transmission happens instantly – a datum is recorded and sent to the home office immediately. "This is great with applications, such as aircraft or even ship's turbochargers, but for ship performance this is generally excessive. In the BSM fleet, data is captured periodically and then relayed to the shore server via one of the two daily data transfers," he explained.

He said that the drawback with immediate data updating is that an inappropriate decision may be made, for example data that is being recorded as a ship starts to pitch, such as fuel consumption/engine load, power output, etc, will be totally different as the ship completes the pitch.

"Making adjustments under these conditions is pointless – for example a period of time is required to obtain a picture of the overall effect of the weather on the ship. We have found that our data-update every 12 hours is perfectly acceptable for most situations.

"Normal steaming in 'normal' conditions will not warrant real time intervention where a period intervention, eg 12 hours, will give the same results over a time period long enough to evaluate and trend what is happening before

Nicholas Rich.

taking action," Rich said.

'ECO' ships unproven

Addressing criticisms levelled at the so called 'ECO' ships in the light of low bunker costs and unproven results, Rich agreed that controversy over performance data claimed for 'ECO' ships remained.

"While bunker prices are low there is little financial incentive. However, as history shows, bunker prices will not remain low, and with oil reserves often stated to be decreasing, it is surprising that more is not being done now to better manage fuel consumption - both for consumption and emissions reduction.

"Once bunker prices have doubled, the 'ECO' concept will again look interesting but the industry will have lost a significant period during which development could have advanced, " he warned.

Turning to the seemingly never ending issue of ballast water treatment systems (BWTS), Rich explained that in BSM's case, whilst newbuilds are coming out with treatment systems fitted, the owners of the existing ships managed by the company are waiting to see what happens next.

"Once fitted, then the treatment system becomes another system to be maintained within the agreed opex budget for the ship. Central research has been carried out enabling all the management offices in BSM to tap into data in order to make informed recommendations to owners. However, the continued lack of global performance standards, and the consequent lack of approved systems, devalues any recommendations made and this is made clear for each case," he explained.

Specifically for the tankers managed, Rich said that BSM will be complying with TMSA and is awaiting the launch of TMSA3 with great interest, but said that thus far the company has heard very little about the new development.

He concluded by saying that BSM has not seen any substantial changes in owner's policies for maintenance as rates fluctuate. TO

LPSQ - an explanation

BSM's Loss Prevention, Safety and Quality (LPSQ) section is responsible for verifying compliance with the ISM Code, ISO 9001, ISO 14001, and industry standards such as TMSA.

The LPSQ system allows for a detailed analysis of all fleet data, ensuring that opportunities for improvement are identified and that operational risk is minimised. This supports BSM's policy of insistence upon the highest standards of quality service, with utmost importance given to safety by:

- Performing audits and providing training on board full management vessels, not only by qualified and dedicated LPSQ teams, also by experienced training Masters
- Continuously monitoring industry standards and statutory requirements.
- Organising and controlling oil major vetting inspections.
- Continuously improving standards according to ISO 9001 principles. ■

InterManager

Last year was interesting, challenging and at times confusing in terms of the signals that the global market place sent out, InterManager's president Gerardo Borromeo said in his end of the year address.

Aside from the economic challenges faced, political and security flashpoints around the world added yet another layer of uncertainty, which have removed the cyclical predictability hoped for. These included:

- Continuing threat of piracy globally that preys on vessels and crew.
- Migrant issue that threatens to overwhelm all sectors as being yet another humanitarian crisis.
- Rescues at sea, for which InterManager was heavily involved with other trade associations and multilateral agencies

"We must not discount the ongoing discussions on fatigue and the unceasing administrative burdens on board, which can only really be resolved if governments come together and take significant steps forward to streamline the myriad of reporting requirements.

"Inroads have already been made with the EU as well as with NGOs, such as the International Harbour Masters Association (IMHA), towards promoting the concept of the 'paperless ship' as a 'must have' in the near future, as opposed to leaving it just as a far-off idea," Borromeo said.

For the future, he said that the way forward will require several elements:

1) What was previously described as the three Cs – co-operation, co-ordination and even consolidation where needed. Scale is inevitably the name of the game and the ability to find creative ways to effectively scale management solutions is what will allow shipmanagers – in-house, or third party– to remain in the game in the face of dynamic uncertainties globally.
2) A keen eye on the future – this being 2030 and beyond. Keeping the pulse on changing ship technology, and on envisioning and even driving more predictability in the people, process and technology interfaces that will serve as the platform in which to efficiently operate in the years ahead.
3) Unwavering effort to attract the best and brightest of the next generations – Millenials –from all over the world, to consider a career in the shipping industry, which inevitably will include a career at sea. However, the industry must go beyond attracting talent and ensure that, across the board, meaningful and challenging careers for the new entrants can be mapped out, which will go a long way towards retaining this much-needed talent for the future. TO

Tanker sector bonus for Goodwood

Earlier this year, Goodwood Ship Management gave an update on the company's performance thus far and also looked forward to 2016.

Last year, the company went above the critical mass needed to sustain its operations and is currently focusing on delivering economies of scale and a personalised service to customers.

Goodwood currently manages 34 vessels, with another six VLCCs and other projects in hand still to come. By the end of 2016, the company said that it expected to manage about 45 vessels.

As for its Singapore-base the company repeated its assertion (see *Tanker Operator,* November/December issue, page 11) that Singapore is a vibrant shipmanagement centre. "We would not choose to be anywhere else, as it is perhaps the most important centre for tanker managment, which we focus on," the company said.

The business and Singapore Government partnership in the shipping industry means that it is an ideal place for the company. Rising costs are an issue but the strengthening US dollar against the Singapore dollar in 2015 meant that costs have eased a little.

Singapore is one of the world's leading international maritime centres with a great maritime infrastructure including banks, law firms, surveyors, insurance companies. "So this will remain our home for the foreseeable future," the company said.

Goodwood said that the demand/supply equation in shipping was still a concern going forward and there were probably too many tankers being ordered, but as of now, the tanker sector is positive, freight rates are strong and tanker operators are having reasonably good times. "This is all good for tanker managers," the company said.

As for 2016, this will be a year of caution. Although the low oil price does not directly have an impact on the tanker management sector, a falling oil price could have negative knock-on effects in the company's markets and in the world economy in general.

Goodwood's managing director Capt. A.R. Sabnis.

"As a shipmanager, we shall continue to grow with prudence and caution. We intend to continue servicing the top tier owners who value top quality management services and that will always be our benchmark. Overall, we hope 2016 will be positive for Goodwood – another year of steady progress," the company concluded. ■

ClassNK and the newbuilding sector

ClassNK provides the entire spectrum of class services for vessels from the cradle to the grave. However, this article focuses on the 'cradle'.

One of the tasks undertaken by the Tokyo-based class society is to help shipowners with newbuilding programmes to achieve compliance with safety and environmental regulations.

Whilst many classification societies develop and update their design rules in line with IACS and IMO, ClassNK said that it took its commitment to ship design safety one step further.

In addition to updating its rules in line with international regulations, the Japanese class society also carries out damage analysis to improve the safety of all ClassNK-registered vessels. Its extensive survey records have been collected over many years and serve as a knowledge base. When necessary, it uses these survey records whilst conducting damage analysis in order to identify the root causes. The results are then used to improve existing rules.

Supporting the industry's compliance with safety requirements is also a key activity. In December, 2014, the amendments of the IACS Common Structural Rules for Bulk Carriers and Oil Tankers (CSR BC & OT) were adopted.

In response to industry requests to assist in the development of safer ships that are compliant with these amendments, ClassNK released PrimeShip-HULL(HCSR) Ver. 2.5.0. This total design support tool allows shipyards to create newbuilding structural designs based on the latest prescriptive and direct strength calculation requirements.

Furthermore, the powerful data linkage with various commercial computer aided design (CAD) software, including the widely used 3D design model software NAPA Steel, streamlines the design process, dramatically reducing the amount of time typically required.

The new SOLAS regulation II-1/3-10 made goal-based standards (GBS) applicable to bulk carriers and oil tankers of 150 m in length or above for which the building contract is placed on or after 1st July, 2016 or the keel laying data is on or after 1st July, 2017.

This new regulation also requires that a Ship Construction File (SCF) be provided upon delivery of a new ship. The SCF will include important information on ship safety, as well as confidential information related to the ship's design and construction. The file can be kept on board the ship and/or ashore.

ClassNK responded to the need for a GBS-SCF ashore archive centre by joining forces with software giant IBM Japan and The Shipbuilder's Association of Japan (SAJ) to provide owners with a secure storage and enclosure service for SCF information. The service, known as the ClassNK Archive Center, will be online from July, this year.

EEDI calculations

To help shipyards analyse and calculate a ship's speed trial results for EEDI calculation in compliance with the latest IMO guidelines, ClassNK released PrimeShip-GREEN/ProSTA on 1st May, 2015. This software enables ship designers to calculate the vessel's speed in compliance with the new harmonised international standard ISO 15016:2015 and reduces the workload required for EEDI calculation.

PrimeShip-GREEN/MinPower was also developed to help shipyards comply with EEDI requirements by calculating the added resistance in irregular waves, allowing for minimum propulsion power requirements to be determined to an even greater accuracy. In line with its non-profit status, ClassNK provides both PrimeShip-GREEN/ProSTA and PrimeShip-GREEN/MinPower free of charge to shipyards.

An example of ClassNK's R&D programme is the work undertaken on the world's first exhaust gas cleaning system (EGCS) for use outside ECAs. Complying with the revised MARPOL Annex VI, which will limit SOx and PM emissions in areas outside ECAs to 0.5% m/m in 2020 or 2025, is likely to prove challenging for shipowners and operators.

ClassNK is collaborating with key players to develop EGCS as a proactive initiative to ensure that the industry is prepared when this amendment comes into force.

The class society also claimed to act as the infrastructure of the industry by creating smarter, more efficient shipping operations. For example, the ClassNK-NAPA GREEN is a software solution that enables shipowners and operators to realise operational savings through increased awareness and performance analysis.

Key design factors

Whilst currently used for voyage optimisation through minimising pocket time, weather analysis, and trim optimisation, big data collected from ClassNK-NAPA GREEN could be used by shipyards to help create more efficient newbuildings in the future by identifying key design features that increase efficiency.

Similarly, although the main purpose of ClassNK's condition-based monitoring (CBM) system ClassNK-CMAXS is to prevent damage, big data collected from the system could enable manufacturers to monitor the performance of every engine worldwide, enabling them to make improvements to their products.

Hong Kong Convention

Another example is when the Hong Kong Convention (HKC) comes into force, it will become mandatory for all vessels over 500 gt to include an inventory of hazardous materials (IHM).

Since IHM-related documents can easily exceed a few thousand pages, ClassNK joined forces with IBM, Japanese shipyards and manufacturers to develop a software solution to create and maintain a vessel's IHM electronically.

The outcome of this joint R&D was PrimeShip-GREEN/SRM, which is available free of charge.

Measuring up to performance

News that Team Tankers International had invested in Insatech Marine's performance monitoring system, prompted *Tanker Operator* to look into the system.

The system chosen by the chemical carrier operator gathers data, such as fuel consumption on a consumer level, torque, thrust and power use, as well as data about sailing conditions, such as wind and depth.

The performance monitoring system is based on data collected from reliable instruments and sensors. Therefore, all KPIs and values displayed by the systems are based on actual and accurate data, Henrik Nielsen, Insatech's sales manager international business, said.

Speaking of data measurement options, Nielsen said; "You can measure mechanically and make manual readings, and then you will not be needing cables to link up sensors, etc. But we are also of the opinion that the combination of the two will not provide accurate data. Our experience shows that, for example, a mechanical meter will provide a ball park idea of the consumption. However, when we are talking the use of big data for accuracy, being the very technically founded company that we are, our conclusion is that mechanical instruments simply do not offer the necessary accuracy."

When asked the question - does a vessel need broadband/VSAT type communications to send the info ashore - he said that the answer was both yes and no.

"Our system will basically store all data in a database on board, which can, via an on board server, be mirrored into a main database on shore. The mirroring of data will be undertaken when the vessel has an internet connection.

"Should the vessel be out of range for a shorter or longer period of time, the local database on board will continuously and uninterruptedly collect data. Once the vessel connects to the internet again, the system will notify the main database on shore that it is available. The on shore database then tells the vessel when the latest data was collected, and all available new data will by synchronised to the shore," Nielsen said.

Talking of weather routing, he said that Insatech had not teamed up with a specialist weather routing firm and will not in the short term, as the company's system is open ended and can easily take weather data from the system used on a given vessel. "As such, it provides our customers with the possibility to continue with their current weather routing company, without needing to change it. This we see as a benefit.

"In the long run however, it is not at all impossible that we will incorporate weather data and forecasts into the system, in order to provide the crew with even better decision making tools," Nielsen said.

With the downturn in bunker costs, the question comes up whether owners and operators were still keen to save consumption, possibly for emissions purposes.

Nielsen said that this decision was very dependent on the individual client and how they perceive the situation. While the low bunker cost definitely reduces the incentive for some operators and owners to invest in performance systems, others opts to take advantage of the low operational costs.

Tanker interest

Taking tankers for example, a segment which has not been hit as hard as the bulk segment; high interest was being seen in Insatech's solutions. However, some owners/operators in other segments have decided to invest in order to become more competitive in a very tough market.

With a small investment, an owner/operator can see that whether a bust fin propeller cap is chosen or it is decided to coat the hull/propeller with special paint, each project is tested beforehand, proving which investment provides the biggest monetary benefits – before it is rolled out across the entire fleet. As such, it also enhances the decision making in terms of future investments, Nielsen said.

However, there are a few operators and owners who see the environmental factor as part of an incentive to invest in a performance monitoring system. With today's standard of determining emissions of carbon dioxides, this is easily done by given formulae by using the fuel consumption and fuel types as input, Nielsen explained.

Insatech's Henrik Nielsen.

Insatech provides the instrumentation, data collection, on board display and KPIs and the data in a MySQL database ashore. The on board display contains historical data, accumulated data and related trend lines and once installed on board ship, the system's owner completely controls the data.

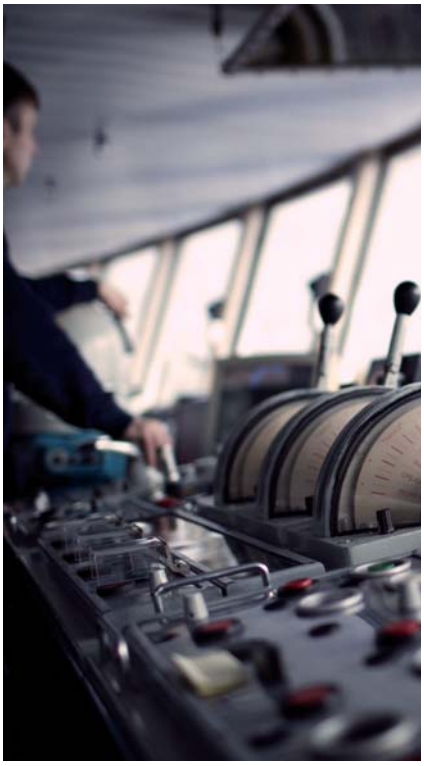
Complete service

In addition, Insatech can provide a service at all levels, from just supplying the systems to full turnkey deliveries, including installation, testing and commissioning. However, Nielsen explained that Insatech was developing a more analytical tool with visualisation and presentation of data aimed at helping the decision making ashore.

He claimed that Insatech's system differs from the majority of other systems, by basing all the presented data on direct measurements and by providing a double open ended interface with other systems.

By being double open ended, this means that the system is not locked into or 'married' to other Insatech Marine products. "We can use existing instrumentation on board - as long as it provides a signal - and we can connect it to any other 'higher hierarchy' systems on board where collected data can be used," he explained.

People. Ideas. Solutions



MARINE

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Insatech marine specializes in solutions designed to reduce fuel consumption. We do so by providing an overview of your consumption via direct measures from a number of consumers and present it on ship (and shore) to increase the awareness level of your crew and administrative personnel. We integrate ship and shore data to enhance decision making, and enable you to reduce operational costs based on reliable information.

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Hempel supports the tanker sector's drive for efficiency

It is well known that a clean and smooth hull reduces friction between the ship and the sea, thus improving the movement of the ship through the water.*

This is important for all vessel types but is a significant issue for tankers whose operating patterns demand them to be flexible and as efficient as possible.

In the current environment where ship operators are under constant pressure to keep operating and fuel costs down, the choice of a marine coating can impact significantly on the performance and efficiency of a vessel. In the highly competitive coatings market the burning question is what is the most efficient hull coating for a tanker?

Leading coatings manufacturers are investing heavily in R&D to develop new paints that save time and cost. Having supplied high performance coatings to tankers for several decades, Hempel understands the importance of a marine coating to this type of vessel and our latest products are optimised to enhance shipping efficiency and performance.

In 2013, we launched an antifouling product the patented Hempaguard, which delivers significant fuel savings and has shown an outstanding resistance to fouling during idle periods of up to 120 days. Hempaguard is distinctive as it provides shipowners with trading flexibility, and unlike regular hull coatings that, in general, are specified according to the vessel's speed and activity level, Hempaguard retains its effectiveness when switching between slow and regular steaming.

Hempel's patented technology behind Hempaguard, ActiGuard, was five years in development and is based on silicone-hydrogel and biocide science. ActiGuard integrates silicone-hydrogel and full diffusion control of biocides in a single coating. Surface retention of the biocide activates the hydrogel, which effectively holds fouling organisms at bay, cutting friction to a minimum while utilising a minimum amount of biocide.

This low amount of biocide ensures that the coating is very smooth after application. It also has the long-term stability and mechanical properties required of a durable solution.

Tanker operators favour Hempaguard, as it can deliver an average fuel saving of 6% compared to a conventional, low-cost antifouling product. Moreover, Hempaguard combines the best of both worlds: the smooth, fuel-efficient surface from silicone coatings and a durable protection against fouling.

Exceeded expectations

To date, over 450 ships have been fully coated with Hempaguard, a result, which has exceeded all expectations after only two and a half years on the market. This is a true testament to how well this product has been received by ship operators and it is the only product of its kind to come with a customer satisfaction guarantee.

In addition, building on our industry proven GLOBIC and DYNAMIC range of antifouling systems, we launched two antifouling products in December, 2014 for drydockings and newbuildings, which deliver fuel savings of up to 3% and provide added flexibility to shipowners and yards.

Based on Nano Acrylate Technology, GLOBIC 8000 is a hydrolysing self-polishing antifouling product that delivers premium performance at a competitive price. Its twin brother - DYNAMIC 8000 - is based on hydrolysing self-polishing Silylated Acrylate technology and was developed to give an outstanding antifouling service for vessels operating at high speed and with high activity level.

More recently, we launched a new, top-line fouling release coating, which appeals to tanker operators, as it delivers optimal fuel savings. The Hempasil X3+ is a top of the line, biocide free, two-component, fouling release coating with a high solids content that ensures clean hulls for longer periods.

Claes Skat-Rørdam.

Hempasil X3+ creates a smooth, low energy surface with unique fouling release properties. Its hydrogel micro layer prevents fouling organisms from firmly adhering to the hull while retaining the self-cleaning properties of silicone. The product is a completely biocide free paint and has no impact on the marine environment, which allows tanker operators to support the environment and protect marine life.

Hempel keeps in close touch with all regulatory developments to ensure that any new coating meets the environmental and efficiency demands of our global customers. Improvements in coatings technology continues to deliver more robust and flexible products that can be tailored to suit particular vessel operating patterns.

With efficiency gains in mind, return on investment in this sector has never been greater and hull coatings have a significant role to play in the never ending search for efficiencies within the tanker market. TO

**This article was written by Claes Skat-Rørdam, fouling control marketing manager, Hempel.*

DYNAMARINe establishes STS training course

Ship-to-ship transfer operations (STS) are considered to be high risk and require a thorough understanding and specialist knowledge.

Athens-based STS consultant DYNAMARINe has joined together with the Maria Tsakos TCM Training Academy to produce a training course in STS operations.

The training course's scope is to provide Masters and deck officers with an extensive understanding in shiphandling principles focused on STS interaction and best operating practices.

A theoretical section incorporates issues associated with the shore and crew personnel's preparedness, due diligence actions, risk management and vetting requirements, according to industry practices and the latest statutory rules and regulations.

The course uses the facilities at the Maria Tsakos TCM Academy, including a full mission shiphandling simulator supplied by Kongsberg.

It integrates both theory and practice when using the simulator. The vital co-operation of shore operators with the crew is thoroughly analysed, whilst focusing on the clearance of the nominated vessels, on the technical assistance from shore to the vessels, necessary compatibility assessments and risk management. In addition, Master and crew duties are clearly defined and discussed.

The course also incorporates the latest MARPOL amendments, IMO Manual on Oil Pollution, OCIMF's 2013 guidelines and the soon to be launched 2016 STS FAQ, published by DYNAMARINe and Clyde & Co.

Practical training while using the simulator entails extensive realistic scenarios with vessels both at anchor and underway. The effect of weather conditions is examined and emergency situations are also incorporated. The training process allows for four officers to be trained simultaneously in different roles overseen by qualified instructors.

A debriefing discussion will summarise the 'lessons learned' and written exams will be included. Upon completion of the course, a certificate is issued.

The Maria Tsakos TCM Maritime Training Centre was established in 2013 by Tsakos Columbia Shipmanagement - a joint venture between the two companies - in order to cater for the rising training needs of officers, crew and shore staff employees.

The centre is located at the Tsakos group's head office and is equipped with state of the art training facilities.

DYNAMARINe was the founder of onlineSTS.net service, which, since 2011 has provided consultancy to tanker owners/operators in exercising thorough due diligence during vessel nominations for STS operations, risk assessment prior to the commencement of an STS operation, screening of the service provider and the POAC, STS record-keeping, statistics and KPIs.

DYNAMARINe has teamed up with the Maria Tsakos TCM Academy to offer STS transfer training

STS forum

On 17th March, DYNAMARINe is holding IFSTS 2016 forum, hosted by Clyde & Co in London.

During the forum, the risk profile of STS operations will be debated. Discussions will include the potential risks involved, risk mitigation measures and industry best practice.

The first edition of 'Frequently Asked Questions in STS Operations', a DYNAMARINe and Clyde & Co publication, will also be launched. This guide will address a number of issues related to the safety and diligent organisation of STS operations and provide practical answers.

The forum will be chaired by Mrs Claudene Sharp, UK Head of Marine, DNV GL Noble Denton marine services and formerly a director Vetting & Audits Europe/Asia, Phillips 66 Limited.

The panelists will include -

Dr Phillip Belcher, marine director INTERTANKO.

Stan Woznicki, Head of Branch - Counter Pollution & Salvage at the UK Maritime and Coastguard Agency.

JC Boon, Sector co-ordinator, Harbour Master Policy Department at Port of Rotterdam.

Stuart Edmonston, Loss Prevention Director, Thomas Miller P&I (Europe).

Lloyd's Register of shipping, name to be advised.

Martyn Haines, Master Mariner at Clyde & Co.

Ed Mills-Webb, Partner at Clyde & Co.

Service provider, name to be advised.

Alexandros Glykas and **Stylianos Perissakis**, Management, Marine Policy, Operations at DYNAMARINe.

Capt George Asteros, Operations Manager at Maran Tankers Management.

Tanker operator, name to be advised.

Stick to industry guidelines when lightering

One of the major STS transfer service providers is SafeSTS. This company has come a long way since its formation just a few years ago.

Norfolk UK-based SafeSTS has recently opened two Japanese bases and has a further three bases under consideration.

Managing director, Yvonne Mason, told *Tanker Operator* that both Nagasaki and Tsushima bases are up and running and now form part of the company's overall global offering of 17 locations.

With regard to the perceived increase in floating storage, SafeSTS will only become involved when market conditions decree it is time to sell the cargoes, she explained.

Speaking of specialist recruitment, she said that the company was lucky in that it was able to attract high calibre professionals who, upon completion of their company and STS specific training, work closely alongside the marine and operations teams.

"We invest heavily in training and the recently published competency guide for mooring masters is an excellent tool to help the industry standardise training to an even higher standard. Classroom, simulator and in the field training with senior mentors ensures a thorough coverage of the required skill sets," she said.

With regards to other 'services' offered by companies, such as DYNAMARINe, there was genuine concern among many people talked to in this particular sector about the service being offered.

"An example is the soon to be launched frequently asked questions (FAQ) book that from our point of view as a service provider is misleading to our clients and other parties involved in the operation in that it purports to give 'definitive' answers on STS," she said. "The inference in the publicity is that this most basic of information is not already available from within the industry. It is and has been for many years. "

Industry has guided the lightering business for over 40 years through OCIMF, ICS, IMO, Intertanko, and the global coastguards. This has created an industry with an excellent track record of producing comprehensive guidance on process, procedure and safety.

"The vast majority of questions raised are answered in the published industry guidelines, in the correct context. These guidelines are provided and carried on vessels and in professionally run owners and managers offices globally," she stressed.

Industry guidance has been written and developed by companies, organisations and professional mariners from within the industry who have invested their time, skills and reputation in producing documents that all the reputable STS companies understand fully and interpret when requested, free of charge to both clients and other interested parties, such as port authorities or vessel owners.

STS transfer operations are well served by industry guidelines.

Focus group

The OCIMF STS focus group, working closely with the three global lightering forums, ITOL, EMEA and SNI, engage freely with charters, owners, shipmanagers, P&I clubs, ports, IMO member states and government organisations, including the global coast guard services. The IMO's Marine Environment Protection Committee (MEPC) produced guidance on the interpretation of the actual law of IMO - MARPOL chapter 8 - which came into force in April, 2012.

The lightering forums members actively engage across all parties involved in the STS operation and offer guidance, free of charge to bring understanding, born of proven expertise and experience to any STS related question, Mason explained.

"Of greatest concern is the claim that STS is high risk, without detailing the high levels of regulation, industry assurance and expertise that is in place to manage that risk to an ALARP state. It is damaging for any industry to be portrayed as high risk for the sake of sensationalising product sales. It is our opinion that publishing guidance that has not been through due process with a recognised industry body is in itself high risk," she said.

"The reputable companies in the STS industry offer a safe repeatable service and act as high reliability organisations within our sector. Any activity can be portrayed as high risk if not carried out correctly and real high risk is when owners or charterers do not engage with the service provider directly to determine the appropriate requirements of the operation," Mason concluded.

Taking the confusion out of tank cleaning

Maritime service supplier Wilhelmsen Ships Service (WSS) has reviewed the state of current tank cleaning regulations and offered advice on how to keep tank cleaning safe, simple, and effective.

Regardless of whether it is the result of poor preparation, lack of knowledge, time constraints or inadequate equipment, an unsatisfactory tank clean can become very costly, very quickly. Extra time in port, additional labour and chemicals, added surveyor charges, and in the worst cases - demurrage claims, can turn what should be a routine exercise into a laborious and dreaded task.

To make matters worse for owners and operators, the issues affecting the tank cleaning process are amplified by the increasingly vigorous ad-hoc cleanliness standards currently being demanded by charterers and cargo owners. Often over-zealous and in many cases totally unnecessary, when it comes to the actual chemistry of contamination, there is unfortunately no officially-defined, universal set of cleanliness standards at present.

Instead, there are just two, very broad and de-facto criteria covering the various tank cleaning requirements currently demanded by charterers.

First - Water White Standard. This means the tank is visually clean, dry and odour-free. A suitable standard for CPP/vegetable oils, this standard does not involve a wall wash test.

Second - High Purity Standard (HPE). This is required for sensitive cargoes, such as products applied in food processing (Food Grade) or in pharmaceutical production (USP), where any contamination is unacceptable. All active solvents, such as chlorinated hydrocarbons, glycol ethers, light alcohols, for example, methanol, ketones such as acetone and many hydrocarbons like hexane also require the HPE.

In addition, many chemical companies require the HPE because the application of the product during processing is very sensitive to contamination.

Though there are guidelines on the procedures and typical level of cleanliness required by the HPE for each and every product available, many companies have additional, off-spec requirements.

Creating unwanted confusion for cleaning crews and posing considerable problems when it comes to demurrage claims, these ad-hoc requirements are why bodies, such as Intertanko, are eager to establish a new, detailed set of cleaning standards.

An ongoing initiative aimed at creating an industry wide set of rules, its acceptance is by no means guaranteed. So, for now we're stuck with the existing pair of standards and the numerous company-by-company and cargo-by-cargo variations demanded by charterers.

In spite of this, with detailed planning, preparation and access to some basic information on the cargo's properties and the conditions inside and outside the tanks, tank cleaning should become a matter of routine. Systematic, efficient and completed quickly to the required standard, whatever that may be. No rejections, hold-ups, incidents or accidents.

Knowing the properties of the products you're discharging and loading, along with understanding how they interact with each other and with the surface of your tanks is obviously key. However, learning this from scratch can seem a daunting prospect, hence the ongoing success of supercargo specialists. But in practice, the vast majority of commercially traded cargoes and their associated tank cleaning processes can comfortably be managed in-house with access to a specific cargo-handling database, such as Miracle or Milbros, and just a little basic knowledge on the major product groups, as outlined below:

- Water-soluble or water-miscible substances are easy to clean with water. In addition, the solubility of such substances might increase at higher temperatures. While the use of a cleaning agent is not required, it can help reduce cleaning times.
- High melting point - Such products should be washed at a temperature of 15-20 deg C above melting point. During washing there should be no ballast water or cold cargoes adjacent to the tank to be cleaned. Special attention must also be given to liquid and vapour line systems to avoid freezing/solidification at cold line segments. Beginning the tank cleaning process as soon as possible after discharge is strongly recommended.
- High viscosity - These products should be washed at higher temperatures. In general the viscosity is closely related to the temperature and will decrease at higher temperatures. During washing there should be no ballast water or cold cargoes adjacent to the tank to be cleaned. As with products with a high melting point, washing should begin as soon as possible after discharge.
- High vapour pressure/boiling point - Products with a high vapour pressure (higher than some 50 mbar at 20 deg C) can be removed from the tank by evaporation. As always, during ventilation, special care must be taken to prevent the risk of explosion (flammable products) and emissions (toxic vapours).
- Polymerisation - The initial wash of products that tend to polymerise should be carried out with cold (ambient) water. Washing with hot water results in polimeric residues being left in tanks and lines, meaning an incredibly difficult clean-up job.
- Evaporation of volatile substances - Cargoes consisting of mixtures with different vapour pressures should neither be cleaned by evaporation, nor pre-washed hot. The evaporation of the light substances from a mixture could result in non-volatile residues, which are very difficult to remove.
- Isocynates - These must never come into contact with water, not even the residues, because the reaction product and insoluble urethane (plus CO2) are very difficult to remove. Such products must be washed with a suitable solvent that does not contain any water.
- Reaction with oxygen - Drying and semi-drying vegetable and animal oils react with

oxygen to form a varnish-like polymeric film. This is very difficult to remove from bulkheads. Since heat increases the speed of the reaction the initial washing of these products must be done with water at ambient temperature and as quickly as possible.

- Reaction with hard water - Formed by the calcium and magnesium present, seawater, for example, has a very high water hardness. This poses no problem for most products, but fatty acids and vegetable oils with a high free fatty acid content will form white sticky residues if they are cleaned with a water of a high water hardness.
- Smell - Minor residues of a smell-producing cargo left in lines, valves and pumps (including pump cofferdams) can contaminate a sensitive cargo. To neutralise the smell of some chemicals (eg Acrylate, Nitrobenzene or Pygas) the use of a smell killer may be recommended.

Along with product knowledge, an understanding of just how the conditions in and outside tanks can affect a cleaning job is vital for consistently successful cleaning:

Temperature is one of the major parameters in any tank cleaning procedure and it must be monitored and managed carefully. The temperature in the cargo tank can be significantly influenced by the surrounding conditions, including outside temperature, seawater temperature, ballast conditions, and the temperature of adjacent cargoes.

Deviations from the desired operating temperature can affect the entire tank or just parts of the tank, typically around bulkheads, tank bottoms or tank walls. Two common results are freezing, due to lower than allowed temperature, and polymerisation/drying due to higher than allowed temperature.

The Tank Surface - Having managed the surrounding conditions, focus should turn to the surface of the tanks. Their composition and condition can have significant implications for the cleaning process.

Stainless steel - Corrosion can occur if there is surface contamination. Both pickling and passivation are chemical treatments applied to the surface of stainless steel to remove contaminants and assist the formation of a continuous, passive chromium oxide film. Pickling and passivation are both acid treatments and neither will remove grease or oil. If the steel is dirty, it may be necessary to use a detergent or alkaline cleaning before pickling or passivation.

Zinc silicate coating - An anti-corrosive paint system made from zinc dust, with certain additives and a binder. The high levels of zinc dust produce a zinc-zinc metal contact resulting in cathodic protection, similar to that obtained from galvanising. However, zinc coatings are inherently porous, presenting a variety of cleaning problems. It is believed that the cargo migrates into the pores and capillaries, similar to fluid adsorption processes. Zinc coatings have a good resistance against solvents, but are not resistant to strong acids and bases.

Epoxy coatings - Pure epoxy, phenolic epoxy and isocyanate epoxy form cross linkages resulting in relatively good resistance to a greater range of cargoes. Epoxy systems are usually resistant to some weak acids and strong alkalis and do not absorb oil-like substances. They are, however, prone to absorbing some solvent-like cargoes, which is caused by swelling and subsequent softening of the coating.

After transporting aggressive cargoes, the coated tank has to be ventilated until the cargo has been desorbed (released) from the coating film, which results in hardening and decreased swelling. This can take several days, depending on the type of cargo, type of coating and film thickness. Water may not be used for cleaning until this ventilation process is finalised, otherwise, the water can lead to blistering and subsequent serious damage of the coating.

The more solvency power a cargo has, the more cargo residues could still be present in the coating. This could lead to either contamination of the next or subsequent cargoes, or breakdown of the coating film.

Seeking common ground

About five years ago, INTERTANKO decided to take a closer look at tank cleaning, one of the key competitive differentiators in the chemical tanker industry. Its conclusion - cleaning technology and competency had almost reached a peak.

"Tank cleaning is where companies try to establish a competitive edge," said Ajay Gour, INTERTANKO's chemicals and vetting expert and regional manager for the Indian Sub-Continent, Middle East and Africa. "This is where they can claim to be better than the competition. But the majority of ship operators are all experienced, and the technology and methodology are pretty much the same across the board. Cleaning chemicals have seen some significant advances, but where we found the biggest change was not in cleaning, but in tank testing."

Testing technology has improved immensely, Gour said, but operators have not necessarily been the drivers behind improvements. "There are many different external influences, including scientific community, and testing today can measure levels of cleanliness far beyond the original requirements for the same cargoes," he said.

Ever more sensitive testing methods beg the question - should tanks be as clean as possible? Or just sufficiently clean?

INTERTANKO studied cases emanating from Houston, a major chemical tanker hub.

"We looked at over 250 different listings," Gour recalled. "We found that there were various cleaning standards and varying results for the same cargo with the same end-use. There was evidence that resources were being wasted in over-cleaning, including manpower, energy, time, chemicals and the resulting emissions were excessive."

In response, INTERTANKO proposed a simplified set of standards in order to bring the high-flying cleanliness requirements back down to sea level. "Product manufacturers realise that they have been pushing unduly stringent standards, and they understand that this is a cost driver. In a number of cases, small deviations will not push the cargo off-spec," Gour maintained.

A working group of chemical tanker operators, owners, charterers, and manufacturers is in the early stages of reviewing existing standards, not for tank cleaning, but for tank cleanliness. "We are not telling anybody how to clean in order to achieve a certain standard," Gour stressed, "just advising on what standard they need to clean to."

Nor do the proposed standards advise on how to test. "For example wall washing," Gour said. "It's been around for a long time, but it has its weaknesses. It gives only a snapshot, not the status of the entire tank." INTERTANKO's aim was not to single out wall wash tests, or any other particular method, the organisation said.

"We are simply trying to refine cleanliness standards," Gour explained, "to make sure they are appropriate for today's needs. High sensitivity testing is feeding anxiety in cargo owners and charterers, and our intention is to ensure quality while improving efficiency in the use of resources."

Regarding the timeline for change, Gour's advice to owners and operators- watch this space! "The process is set in motion, and the first draft of new guidelines should be presented by the end of 2016," he said. "For this to happen, though, operators, shippers, and cargo buyers must all be on board. The drafting process will be used to quantify the overall benefits, but the end result should be that the goalposts are fixed for everybody."

Responsible Cargo Tank Cleaning – Washing Water Analysis (part 2)*

The ability to monitor tank cleaning 'live', without putting people into the cargo tanks is clearly the greatest strength of this process.

Other strengths are directly related to the optimisation of all tank cleaning procedures that as mentioned earlier, would otherwise not be possible to achieve without washing water analysis. If indeed it were possible to reduce a four hour hot water washing cycle to two hours, this is not just a one-off time saving of two hours; it is potentially a two hour time saving per cargo tank, which quickly adds up, particularly when one considers how many times chemical tankers clean with hot water every month.

The fuel savings naturally follow, but this is not just savings in US dollars, there is a very real and positive reduction in carbon dioxide emissions:

For example:

- Each hour of hot water washing can consume as much as 0.6 tonnes of HFO or MGO (in the boiler and the auxiliary engines).
- From published literature, combustion of 1 tonne of HFO releases about 3.2 tonnes of CO2..
- So each hour of hot water washing burns 0.6 tonnes of fuel, which in turn frees 1.9 tonnes of CO2 into the atmosphere.
- Saving two hours of hot water washing per tank therefore saves 1.2 tonnes of fuel and reduces CO2 emissions by 3.8 tonnes.
- Saving two hours of hot water washing in 10 cargo tanks saves 12 tonnes of fuel and reduces CO2 emissions by 38 tonnes.
- Saving two hours of hot water washing in 10 cargo tanks once every month saves 144 tonnes of fuel and reduces CO2 emissions by 456 tonnes per year.
- Saving two hours of hot water washing in 10 cargo tanks once every month in a fleet of 12 vessels saves 1,728 tonnes of fuel and reduces CO2 emissions by 5,472 tonnes per year.

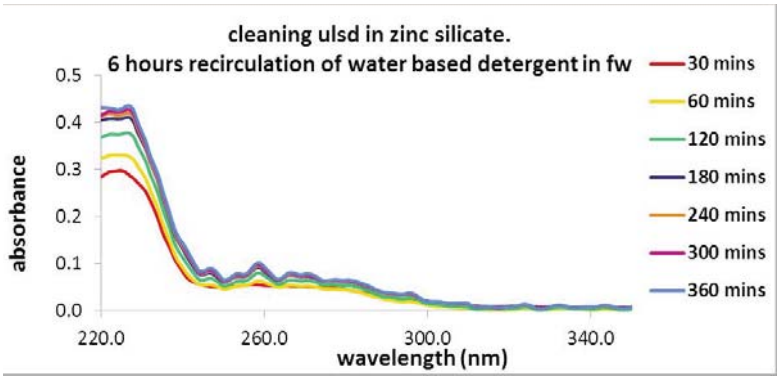
Hot water washing is an integral part of all tank cleaning operations, but it is expensive in many ways, not just monetary, and needs to be effectively and safely controlled.

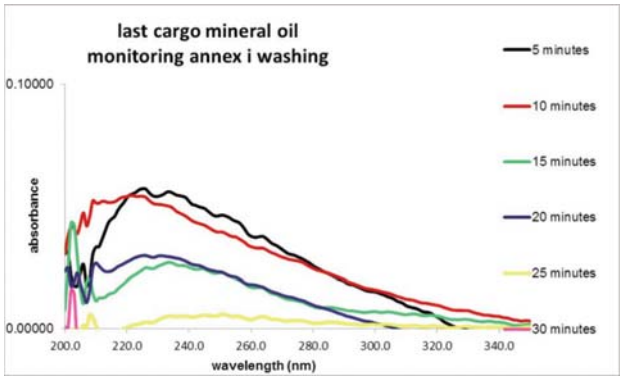
Similarly, the use of cleaning chemicals can also be far more carefully controlled and again, this has the potential to reduce the environmental impact of the vessel by limiting the amount of detergents discharged to sea. All tank cleaning chemicals are regulated by the IMO in terms of their impact on aquatic life, but it goes without saying that if cleaning chemicals are not required for a specific cleaning operation, or they can be used at a lower concentration, the environmental benefits are absolutely evident. Equally, if a cleaning chemical can be used for more than one cargo tank, then this will reduce the amount of waste detergents discharged overboard. Monitoring the use of cleaning chemicals can only be carried out using washing water analysis for the same reasons noted earlier.

The following graph is taken from a zinc silicate coated chemical tanker cleaning from ultra-low sulphur diesel using a water based detergent:

It becomes evident from the washing water analysis that the most significant cleaning effect occurs during the early stages of the chemical recirculation, but thereafter, there is little or no benefit of continuing the cleaning beyond three hours. In this specific case, the vessel from which this information was derived, always cleaned for six hours (historically), but on the strength of this data, has subsequently cut the time for chemical recirculation in half, without losing any cleaning efficiency.

This is another way of saying that one of the key strengths of washing water analysis is





environmental impact and this should not be over-looked.

The first potential weakness could actually result in a significant commercial strength.

As noted, washing water analysis is, and really can only ever be, a live process. In other words, it is carried out by the vessel's crew at sea, meaning there is little or no scope for independent verification of the process. This could be seen as a weakness or stumbling block if, as suggested at this start of this discussion, washing water analysis is to be used as a replacement for the traditional, existing pre-loading inspection processes, which are presently carried out by the independent inspection companies.

Indeed, there has been fairly vocal disagreement of this process from one of the main international inspection companies, which is not completely unexpected when it is accepted that inspecting tankers prior to loading is part of the inspection companies' core business.

But when one considers that a wall wash inspection endorses confined space entry, at the same time providing no guarantee that a vessel can load the next nominated cargo without risk of contamination, the dissent of the inspection companies is probably more driven by loss of revenue, rather than a real desire to protect the loaded cargo.

In reality, if washing water analysis can be used in preference to wall wash analysis, to determine that a vessel is load ready, there are huge benefits to be gained by the very companies who employ (and therefore pay for) the independent inspections - the cargo interests.

That said, and as suggested in the introduction to this discussion, it could be perceived as a quantum leap to present "washing water analysis" as an alternative cargo tank inspection process, when one considers how entrenched the wall wash inspection is in the chemical market. But it is not that far-fetched when the undeniable and irreparable flaws of the wall wash inspection are recognised and accepted. It cannot be denied that the wall wash inspection has been a major part of the chemical tanker business for decades, but just because it has been around for many years, does not make it more valid or less unsound.

The simple fact of the matter is that the wall wash inspection is a random, non-reproducible, legally worthless, spot test, generally taken from the lower 2-3 m of the cargo tank, very often using a solvent that in many cases bears no resemblance to how the loaded cargo might react or interact with the inside of the cargo tank and thus having little influence on whether the loaded cargo will become contaminated or not.

Washing water analysis may not be the perfect solution, but it is far more representative of the entire cargo tank and cargo line system and it is also more robust in so much that the sampling process is reproducible. There are of course limitations, as follows, and these need to be recognised, but the same limitations generally apply equally to the wall wash inspection, so there is actually no change in responsibility or liability with regard to the quality of the shipped cargo.

First, cargoes that are known to be absorbed and retained into cargo tank linings need to be carefully considered. That said, one of the most effective ways of removing cargo residues that are absorbed into linings is to evaporate them by increasing the temperature inside the cargo tank, usually using hot water.

The vast majority of cargoes that are retained in the linings are volatile and at least partly soluble in water, making them readily detectable in the washing water, which at least gives scope to identify whether the cargo is being removed or not.

Looking at the wall wash inspection and how it is used to identify the presence of retained previous cargoes, it has to be accepted that one of the main flaws of the wall wash is the contact time of the solvent on the bulkhead.

In most cases, the contact time is so small that the wall wash sample cannot extract the cargo residues that are retained in the linings. In other words, a successful wall wash sample does not necessarily mean the lining is free from the prior cargo, which in the worst case may give a false-positive to cargo interests that the next cargo can be loaded without risk of contamination.

The absorption and retention of prior cargoes into cargo tank linings is a complex area of the chemical tanker business that needs sound understanding rather than acceptance of an inspection process that is actually not appropriate.

Second, additional consideration needs to be given to cargoes that have a very low UV response, because clearly, washing water analysis is reliant on being able to identify the presence of trace levels of previous cargo residues using UV spectroscopy. In such cases, there are generally alternative checks that can be carried out. The most common group of cargoes that have a very low UV response are inorganic acids and alkalis, but of course such cargoes are characterised by their pH in water, meaning the UV scan can be effectively replaced by pH measurement. When the washing water is pH neutral, it can be considered as free from the previous cargo and the cargo tank can be considered as clean.

Moreover, cargoes that are inherently insoluble in water also tend to have a low UV response because the concentration of that cargo in the water is so low. But in the majority of cases, solubility increases in hot water and it is found that even cargoes, such as mineral oil have sufficient solubility in hot water to be identifiable.

The following graph represents the final 30 mins of cleaning from mineral oil with hot fresh water and shows clearly the decline in UV response down to a point where after 30 mins, there is no longer any trace of the mineral oil cargo:

In this case, the cargo tank was visually inspected after the completion of the hot water washing and found to be free from oil. The use of washing water analysis to confirm that a cargo tank is free from an Annex I cargo is an added benefit, especially if that cargo tank needs to be cleaned further to load an Annex II cargo.

This article is not the forum to discuss this subject, which the author accepts is a moot point, but there are cases of vessels cleaning cargo tanks from Annex I to Annex II using washing water analysis to provide additional information to MARPOL, that the cargo tanks and lines are free from oil.

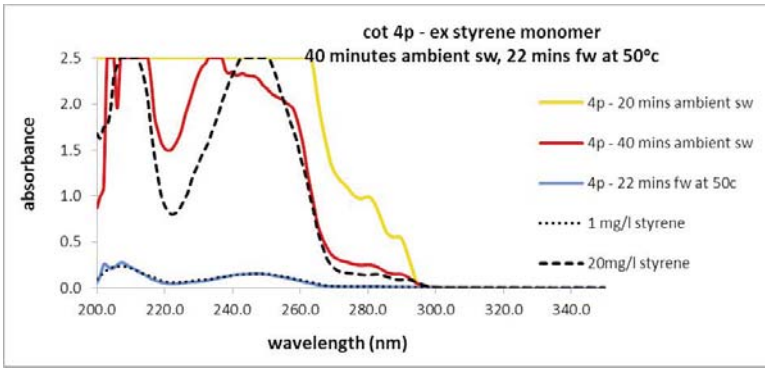
The wall wash inspection also suffers from solubility of the previous cargo into the wall wash solvent. Methanol is the most commonly used solvent, because it is readily available, relatively inexpensive and it has the ability to dissolve both organic and inorganic residues. But there are limitations, which in the worst cases, will again manifest themselves as a false positive wall wash result, giving cargo interests inaccurate information.

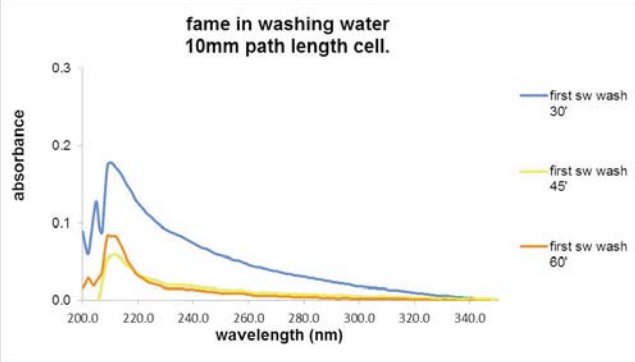
Contrary to the above example of cleaning from mineral oil, when cleaning from cargoes that are partly or completely soluble in water, the UV response is generally far more pronounced and the opportunity to monitor tank cleaning without entering the cargo tanks is significant.

This first example is taken from a stainless steel vessel cleaning from styrene monomer:

According to one of the main industry standard tank cleaning guidelines, cleaning from styrene monomer to a wall wash standard requires a minimum cleaning of:

1) Two hours ambient seawater washing.
2) One hour seawater washing at 50 deg C.
3) Twenty mins ambient freshwater washing.
4) Optional recirculation with chemicals based





on preliminary wall wash results.

The following data shows the washing water analysis which demonstrates that after 62 mins of cleaning, there was less than 1 ppm styrene monomer in the cargo tanks and lines from COT 4P.

The vessel saved a minimum of 1 hour 18 mins compared to the industry standard guideline, before going on to successfully load/discharge a cargo of MEG fibre grade.

The next example is taken from a vessel with epoxy phenolic coated cargo tanks cleaning from fatty acid methyl ester (FAME) to ethyl acetate.

According to another of the main industry standard tank cleaning guidelines, cleaning from FAME to a high purity standard requires a minimum cleaning of:

1) Two hours seawater washing at 50 deg C.
2) One hour chemical recirculation at 50 deg C.
3) Two hours seawater washing at 60 deg C.
4) Twenty mins ambient freshwater washing.

In this case, the following data also shows how the vessel was able to clean much quicker than the recommendation of the industry guideline:

The first graph represents the initial washing with seawater at 50 deg C:

At this stage, the data shows the following key points:

1) After 30 mins washing with seawater at 50 deg C, there is still a significant amount of previous cargo in the washing water.
2) After 45 mins washing with seawater at 50 deg C, the amount of previous cargo has been reduced.
3) After 60 mins washing with seawater at 50 deg C, the amount of previous cargo in the washing water is almost the same as it was at 45 mins, suggesting that this cleaning step is no longer effectively removing the previous cargo residues.

Even though the cleaning guideline suggested washing with seawater for two hours at 50 deg C, the washing water data shows that this is actually not necessary, because the maximum efficacy of washing with seawater at 50 deg C has been reached at one hour.

This is the trigger that the vessel can use to switch from one cleaning step to the next, without having to stop the cleaning and put people inside the cargo tanks. Without washing water analysis, this would not be possible.

The vessel then moved onto step 2 of the cleaning, which involved recirculation with a water based detergent for one hour at 50 deg C; thereafter, the vessel started washing out with clean seawater at 60 deg C. The red line on the following graph represents the quality of the washing water 15 mins into this washing out cycle:

It is quite apparent that the quality of the washing water has deteriorated.

Washing out with seawater at 60 deg C was on going and another sample was taken 30 mins into the cleaning step:

It is now very apparent that the washing water contains no traces whatsoever of the previous cargo and indeed, the observed 'flat-line' essentially means that the quality of the washing water leaving the cargo tank is the same as the quality of the washing water entering the cargo tank. In other words, the tank should be clean at this stage. The tank was then washed out with hot freshwater to remove the seawater residues and was confirmed to be clean to load the next cargo by visual inspection, at which time, the cargo tank was also mopped and dried.

Only one person entry per cargo tank per cleaning operation was needed.

Future Potential

If it is accepted that washing water analysis can be used as a more than viable alternative to internal/wall wash inspection procedures, the benefits are shared equally between charterers, suppliers and operators.

1) Reduced CSE for vessels' crews - As noted, this is one of the primary objectives.

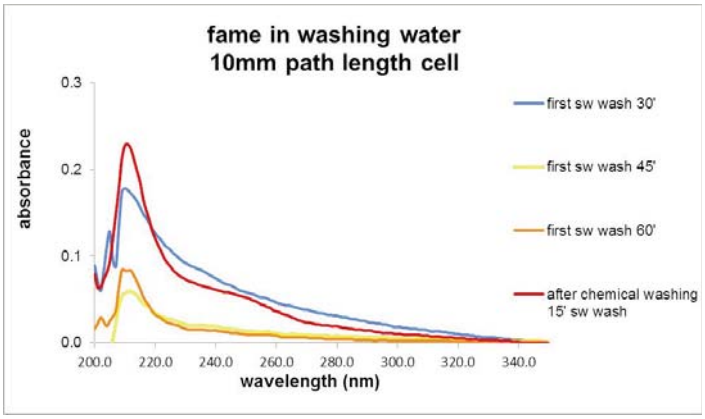
Without washing water analysis, a typical tank cleaning operation may involve four or five separate requirements for one person (or multiple people) to enter each cargo tank.

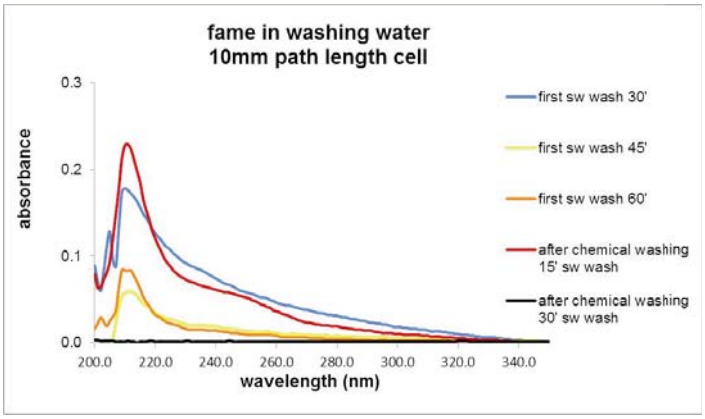
If this can be reduced to one person entry per cargo tank per tank cleaning operation, there is immediately a 75 – 80% reduction in CSE. There are now owners and commercial operators of chemical tankers involved with the carriage of high purity, sensitive, chemical cargoes who have adopted this process, without any negative impact on the operation of the vessel.

2) No pre-inspections at other/lay-by berths - It is common practice, particularly in the larger ports where there are multiple loading/discharging terminals, that many charterers/shippers require a vessel to be 'pre-inspected' before berthing for loading. Presumably this is recognition of the scenario that if a vessel fails the load port inspection there is an instant delay, which immediately has a knock-on effect on the logistics of that terminal and the schedule of the vessel at the cargo receivers' facilities.

But it is also becoming apparent that many shippers/suppliers actually have safety procedures in place that treat loading terminals on a par with the chemical manufacturing plants, where interestingly, CSE is largely prohibited. Clearly, this means it is no longer feasible to have persons (vessels' crew, surveyors, terminal representatives) entering the cargo tanks whilst the vessel is alongside.

In such cases, if there was no pre-inspection, the vessel would not be able to start loading, but just because the inspection is being carried out 'somewhere else' (at anchorage or a lay-by berth) does not make CSE any safer. One could say that this somehow endorses CSE as being 'acceptable' if the endorser cannot see it taking place?





CSE can never be considered as acceptable. What is far more acceptable is having the vessel confirm that the cargo tanks are load ready at sea, using washing water analysis, thus removing the need for any pre-inspection prior to loading.

3) No cargo tank entry when the vessel is alongside - As noted above, many terminals now prohibit person entry into the cargo tanks whilst the vessel is alongside the loading jetty. But as long as the cargo interests demand internal cargo tank inspections, they are exposing their third party partners (the cargo surveyors) to unsafe practices.

   In order to justify this, cargo interests must take out additional insurance to cover the surveyors, because it is clearly recognised that cargo tank entry is unacceptably hazardous above and beyond what a cargo surveyor would otherwise be expected to carry out in the course of his/her daily work.

Again, by negating the need for independent cargo tank inspection, the safety risks (and insurance requirements) are completely removed.

4) Much improved logistics for the cargo suppliers/significant reduction in 'time alongside' for the vessels - Cargo interests already know the value of ensuring that a vessel is load ready prior to berthing alongside the loading jetty, which is one of the reasons why the pre-inspection was introduced.

   The same benefits are achievable without the pre-inspection and knowledge that any vessel can come alongside, connect and start loading without delay, allows the shipper to schedule the jetty with far greater confidence, particularly if that jetty is fully occupied. Moreover, the receiver can be better informed when the cargo will be delivered, which essentially provides far greater control of the entire logistics chain. There are now real examples of vessels saving days (not hours) using this process, which is additional earning potential for the vessels' owners, charterers and also the shippers. This is not biased towards one part of the chain, the potential is shared equally.

5) Nitrogen - From January 2016, the industry is implementing new rules relating to cargo tank inerting with nitrogen. It needs to be understood that whilst these rules will enhance the safety of the carriage of flammable cargoes, the risks associated with CSE are only likely to escalate. There will be real cases where a vessel presents for loading and is being inspected with some cargo tanks empty, some cargo tanks cleaned, some cargo tanks loaded and all cargo tanks potentially containing nitrogen. Nitrogen is colourless and odourless and does not give second chances. One small mistake of inspecting the wrong tank, could be fatal.

In the author's opinion, washing water analysis has the potential to completely re-shape tank cleaning in the future, putting the focus onto quality measurements, rather than historical success. Vessels will be empowered to develop more efficient cleaning operations, which have less impact on the environment and of course are significantly safer for the vessels' crews.

As with current practices, the ultimate responsibility for the quality of the loaded cargo, falls onto the owner of the vessel, regardless of whether the cargo tanks are not independently inspected, inspected from deck level only, internally inspected or wall washed. As long as the vessel is responsible, give the responsibility to the vessel.

Of course, it is not always that simple. The (increasing) reliance on pre-inspection is stifling innovation and in many cases pushing vessels to breaking point, because it is now common to see wall wash specifications that are stricter than the quality of the cargo being loaded.

Charterers still seem to have blind faith in the wall wash inspection, even though it can now be proven that passing the wall wash does not guarantee that the next cargo will be loaded and discharged on specification.

Moreover, for the growing number of charterers who have a strong enough relationship with the shipowner to endorse washing water analysis in place of internal cargo tank inspections, it can equally be proven that sensitive chemical cargoes can be successfully loaded and discharged without having to pass the wall wash inspection.

If one fatality can be avoided because washing water analysis was used to replace a pre-inspection and the cargo can still be accepted by the receivers, then the process is undoubtedly a success; which ultimately begs the final question: Which has a higher price? Cargo or life?

**This concludes the two-part article written by Guy Johnson, Director, L&I Maritime (UK) Ltd; Tel +44 1909 532003; Email - guy.johnson@limaritime.com*

TANKER*Operator's* Top 30 owners and operators

There is consolidation underway particularly in China, which will affect the Chinese entries going forward. Details of exact vessel ownership and/or operating company was not clear by the time this list was compiled.

However, the COSCO-China Shipping Corp (see China Shipping Development Corp and COSCO Dalian) tie up is being rubber stamped almost at the same time as the merger of Sinotrans and China Merchants Group, which it is thought will make subsidiary China Merchants Energy Shipping (CMES) the largest operator of VLCCs, most of which are expected to be commercially managed by China VLCC, which also see.

As usual, the data used to calculate Tanker Operator's Top 30 listing is compiled taking into account the total deadweight tonnage of a company's fleet, including long term chartered in tonnage, ie commercially managed.

The figures were extracted from company websites, the Equasis database and where possible, the companies themselves. In line with previous listings, we have omitted FPSOs/FSOs, LNG/LPG carriers and ATBs from the total tonnage shown for each company.

1 Teekay Group

16 mill dwt, plus a 465,000 dwt newbuildings)

Teekay's rise to the top of the list is primarily due to the group, which includes Tanker Investments (TIL), taking delivery of several Suezmaxes and Aframaxes last year.

The total includes wholly-owned, technically and commercially managed vessels. Although some of the vessels are owned by TIL, they are technically managed by Teekay, which gives the grouping a total of 123 tankers.

These include shuttle tankers, VLCCs, Suezmaxes, LR2s, Aframaxes and product carriers.

In addition, the various subsidiaries own FSOs, FPSOs, floating accommodation units, AHTS, LNGCs, plus LPG carriers, which have not been included in the figures.

At the end of December, it was announced that Bahri had purchased two Teekay VLCCs for $155 mill.

The DSME-built vessels, 'Voss Spirit' and 'Hemesdal Spirit' were expected to be delivered mid to late January.

TIL acquired the two VLCCs from Teekay in May 2014 for a reported $154 mill.

In June last year, Teekay Offshore announced that it had ordered three, plus one optional 155,000 dwt DP2 shuttle tankers for a total of $365 mill on the back of long term charters to provide a shuttle tanker service for Eastern Canada oil production.

The 15-year charter contracts, plus extension options, were signed with a group of companies, including Chevron Canada, Husky Energy, Mosbacher Operating, Murphy Oil, Nalcor Energy, Statoil and Suncor Energy.

The three newbuilding vessels are expected to be delivered in the fourth quarter of 2017 through the first half of 2018.

In August, Teekay Tankers agreed to acquire 12 Suezmaxes from Principal Maritime for $662 mill.

The acquisition was fully financed and did not materially impact Teekay Tankers' financial leverage, the company claimed. ■

Mitsui-OSK (MOL)

(15 mill dwt)

2 **At the end of September last year,** the latest figures available, MOL owned, managed, or commercially operated around 165 tankers of all types, excluding Suezmaxes.

The Japanese major's managed fleet included 33 VLCCs, six LR2s, eight Aframaxes, four LR1s, 21 MRs and six Handysize tankers, according to the Equasis database.

MOL's wholly-owned fleet totalled 11.3 mill dwt with a further 3.6 mill dwt chartered in.

Under MOL's 'Steer for 2020' plan, unveiled last year, one of the objectives is to reduce the number of tankers operated, including chartered-in vessels, from around 170 to 150 by the end of fiscal 2016, the company said.

MOL has become involved in various pools, including the MR Clean Products Tanker Alliance in which, there are four partners - MOL, Asahi Tanker Co, Ultranav and OSG. The pool commercially operates around 60 MRs.

In addition, MOL is a member of the LR1 commercial operation - Straits Tanker Pool - which involves six other partners.

Over a year ago, MOL also entered into the shuttle tanker business by establishing a joint venture to operate five vessels with Norwegian-based Viken Shipping. ■

NITC

(13.5 mill dwt, plus about 259,000 dwt newbuildings)

3 **NITC is looking to re-enter the** tanker markets this year on the back of the lifting of sanctions.

However, it is far from clear if all the fleet will come up to international standards, as many vessels have been used for storage purposes for the past few years and several are now elderly and probably in need of repair and maintenance.

There is also the problems to be overcome of classing, P&I and H&M insurance, drydocking, etc for the vessels used for storage. Some 'experts' claim that the vessels will remain on storage duties for the near future, as Iran does not have a lot of onshore storage capacity.

There is no doubt that the vessels exist. According to various registers, NITC still manages 37 VLCCs, nine Suezmaxes, five Aframaxes, and three Handysize products tankers.

In addition, there are believed to be another three 63,000 dwt tankers and two 35,000 dwt product tankers on order.

There could be others to come, as the country tries to build up its shipbuilding industry, a plan which has been around for many years, but could soon accelerate with the lifting of sanctions. ■

Euronav

(12.9 mill dwt, plus 600,000 dwt newbuildings)

4 **In June of last year, Antwerp-based** tanker owner Euronav agreed to purchase four newbuildings VLCCs for $384 mill or $96 mill per vessel.

This deal came within the company's stated objective of not ordering newbuildings, as they were yard re-sales.

The first vessel was delivered in September 2015 and the second in January 2016, while the remaining two are due for delivery in the first half of this year.

Euronav now controls a total 29 VLCCs (plus two VLCCs under construction) and 22 Suezmaxes, including two chartered-in vessels.

In addition, Euronav has a 50% stake in two V-Plus FSOs jointly owned with OSG. A third sister, a conventional 440,000 dwt V-Plus, operates in the spot market within the Euronav-managed Tankers International pool and is 100% owned by the Belgian company. ■

Euronav's Suezmax *Cap Lara*.

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Bahri

(12.8 mill dwt, plus 3 mill dwt newbuildings)

5 **Bahri and Vela's amalgamated fleet** now stands at 36 VLCCs, one LR2 and four MRs, plus 25 managed chemical carriers.

The total includes two recently purchased VLCCs from Tanker Investments for $155 mill en bloc. The first vessel was believed renamed 'Arsan', while the second will be renamed upon her delivery.

In addition, the VLCC 'Kidan', ex 'Blue Pearl' has joined the fleet and her sister -'Blue Topaz' - will be named 'Weydan' on her delivery, which was expected in January. They were purchased for $157 mill from Daewoo's shipowning arm, DK Maritime.

Last July, the company announced that it had ordered a further five VLCCs, joining the five previously ordered at Hyundai Samho.

These vessels will be delivered during 2017/2018. The VLCCs will be fitted with environmentally friendly specifications with high efficiency claimed in fuel consumption.

In addition, through subsidiary Mideast Ship Management, the company manages 25 chemical carriers - three Handysize, 21 MRs and one 81,300 dwt vessel - which are all operated in co-operation with SABIC.

The company also operates one single hull VLCC FSO and a series of conros and drybulk carriers and has an interest in LPG carrier operator Petredec. ■

AET

(10.7 mill dwt, plus 997,600 dwt newbuildings)

6 **Singapore-based AET is introducing** new, specialist DP Shuttle Tankers to its fleet.

As of November last year, the fleet consisted of 13 VLCCs, four Suezmaxes, 49 Aframaxes (including two specialist Modular Capture Vessels), four DP shuttle Aframaxes, three LR2s, one Panamax and eight MRs.

In October, the MISC subsidiary announced it had ordered another four Aframaxes at Samsung, two LR2s and two Suezmaxes at Hyundai to be delivered in 2017-2018. The contracts were said to be worth around $500 mill in total.

The two LR2 newbuildings are tied to long term time charters while the six other newbuilds will replace older tonnage in the fleet, the company said. ■

AET's *Eagle Bergen*.

China VLCC

(10.5 mill dwt, plus several newbuildings)

7 **China VLCC was set up in 2014 to** operate VLCCs managed by Associated Maritime Corp (China Merchants) and Nanjing Tanker.

It is a joint venture between China Merchants Energy Shipping (CMES), which owns 51% and Sinotrans who has the remaining 49%. The two companies are set to merge this year with claims that once the deal goes through the relevant authorities, this will make CMES the largest tanker company in the world.

Once it started trading, China VLCC immediately started operating the 10 VLCCs purchased from cash strapped Nanjing Tanker for $681 mill, bringing the total up to 28 VLCCs, including two newbuildings delivered in 2014.

In addition, another two VLCCs were delivered last year and at least 11 more were on order at Dalian and SWS.

Last August, CMES said that China VLCC had taken delivery of its 35th VLCC - 'New Triumph' - from Shanghai Waigaoqiao Shipbuilding (SWS), which is a subsidiary of China State Shipbuilding Corp.

No doubt this fledgling company will continue to climb the list, as more VLCCs are delivered as part of China's policy to operate vessels using its own companies and the company will benefit from the merger of COSCO and CSDC's tanker fleets and the merger of CMES and Sinotrans, which are both due to be completed this year. ■

Frontline

(10.4 mill dwt, plus 314,000 dwt newbuildings)

8 **Frontline Ltd and Frontline 2012** merged at the end of last year and together with sister company Ship Finance International, continued to shed older tonnage.

As at the end of 2015, the fleet included 20 VLCCs, 15 Suezmaxes, seven LR2s, three Aframaxes and 14 MRs.

Last year, Frontline agreed to purchase two Suezmax newbuildings from Golden Ocean for $55 mill each. They are under construction at New Times for delivery in the first quarter of 2017.

In addition, Frontline has joined Euronav's VLCC Tankers International pool (which see), forming VLCC Chartering. ■

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Sovcomflot (SCF) Group

(10.2 mill dwt, plus 126,000 dwt newbuildings)

9 **This diversified group has shed some** tonnage during the past year and now has two VLCCs, eight Suezmaxes, six LR2s, 50 Aframaxes, nine LR1s, five Panamaxes and 22 MRs, plus four Handies with another three MRs under construction.

SCF also owns a couple of smaller chemical and bitumen carriers.

Some of the Aframaxes and Panamaxes are specialist ice class shuttle tankers built for projects in the Barents Sea and the Russian Far East.

In addition, the group owns several other types of vessels, including offshore support vessels, drybulk carriers, tugs, LPG carriers and LNGCs, some of which are ice class. There are more large gas carriers to come on the back of the Yamal project.

In December, SCF and Sberbank signed a 14-year $340 mill credit facility agreement to finance the construction of three Arctic shuttle tankers destined for Gazprom's Novy Port project.

Novy Port will handle the large oil and gas condensate deposits found on the Yamal peninsula. The 42,000 dwt vessels will serve as part of the infrastructure designed to enable year-round shipment of crude oil from an offshore loading terminal in the Gulf of Ob.

In addition, Russian state-owned shipbuilding group United Shipbuilding Corp (USC) has signed a co-operation agreement with SCF, which includes the construction of a series of ECO Aframaxes, USC said in a statement.

The tankers will probably be built at USC's St Petersburg-based Severnaya Verf Shipyard, which is undergoing a large-scale modernisation programme into a state-of-the-art shipbuilding complex, scheduled to be completed in 2018.

SCF is also undergoing a privatisation plan organised by the Russian Government. ■

Maran Tankers Management (MTM)

(9.5 mill dwt, plus 2.8 mill dwt newbuildings)

10 **Maran Tankers Management** (MTM), part of the Angelicoussis Group, manages 27 VLCCs, six Suezmaxes and three Aframaxes.

The VLCC total includes seven vessels bareboat chartered to ChevronTexaco.

In addition, MTM has six VLCCs and six Suezmaxes on order.

London-based Maran UK acts as agents for the Group. ■

Maran Tanker's *Maran Pythia*.

NYK Group

(9.5 mill dwt)

11 **According to the Equasis database,** NYK owns or manages 27 VLCCs, four LR2s, 31 MRs, one Handysize and 13 smaller chemical/product carriers.

In addition, NYK has interests in almost all other types of vessels, including a substantial LPG and LNG fleet.

There is other tonnage involved in various joint ventures, which is not included, plus chartered tonnage. ■

China Ocean Shipping (COSCO Dalian)

(8.8 mill dwt)

12 **The proposed merger with China** Shipping Development Corp (CSDC) was still ongoing as *Tanker Operator* went to press.

It seems likely that CSDC will takeover the tanker fleet and put the VLCCs under China VLCC's operational management (which see).

If and when this comes to fruition, it will lead to CSDC claiming to be the world's largest tanker owner.

At the end of last year, the company had 25 VLCCs, three Suezmaxes, three Aframaxes and eight Panamaxes, according to its website.

In addition the company currently manages a fleet of LPG and LNG carriers. ■

Dynacom Tankers Management

(8.5 mill dwt)

13 **George Prokopiou's Dynacom** Tankers Management manages 14 VLCCs, 22 Suezmaxes, one LR2 and another 12 Panamaxes/LR1s.

A couple of the Suezmaxes are listed as LR3s in certain registers. ■

Ocean Tankers

(8.02 mill dwt)

14 **Singapore-based Ocean Tankers** manages 16 VLCCs, one Suezmax, 12 LR2s, five LR1s, 17 MRs, five Handymaxes, plus more than 50 smaller tankers, ranging from IMO II chemical tankers to local Singapore bunker tankers.

The company also has bunker and terminal operations in and around Singapore, managed by subsidiary companies. ■

Maersk Tankers

(6 mill dwt)

17 **Despite the sell-off of its VLCC fleet,** Maersk Tankers is still a considerable force in the tanker market, due to the product tanker pools, which the company manages.

As of December last year, there were 18 tankers operating in the LR2 pool, plus another 100 tankers in the Handytankers pool.

The Handytankers pool consists of tonnage in the range of 29,000 dwt to 50,000 dwt.

In addition, there were around 29 vessels in the intermediate sector, managed by Brostrom.

Maersk has been selling off some of its older tonnage, both Handys and smaller tankers, while at the same time purchasing newer vessels, mainly Handys and MRs and more recently, LR2s. ■

China Shipping Development Corp (CSDC)

(6.8 mill dwt)

15 **Under the China Shipping Tankers** banner, CSDC's fleet was shown on Equasis as 11 VLCCs, seven Aframaxes, 14 LR1s, 16 MRs and 14 Handysize tankers.

In addition, the company operates several smaller coastal vessels.

When the proposed merger with COSCO is finalised, CSDC claimed that it will become the world's largest tanker owner with the VLCC fleet being operated by China VLCC. ■

Overseas Shipholding Group (OSG)

(6.8 mill dwt)

16 **As of 30th September, 2015, OSG's** International fleet was slightly down on the year before; numbering one ULCC, eight VLCCs, seven Aframaxes, eight Panamaxes, one LR2, four LR1s and 13 MRs, plus four Handies.

The International fleet also included four LNGCs and two ULCC FSOs managed in joint ventures, which have not been included in the figures.

OSG's US domestic fleet was unchanged at 12 Jones Act MRs, three of which have now been converted to shuttle tankers, two other non-Jones Act US Flag MRs and 10 Jones Act ATBs, the latter have not been included in the figures.

The figures include long term chartered vessels for more than 12 months. ■

SK Shipping

(6 mill dwt)

18 **The South Korean-based owner has** 18 VLCCs, two LR2s and three MRs on its books, plus a fleet of smaller tankers.

In addition the company has interests in LNG and LPG carriers, plus a large fleet of drybulk carriers. ■

Minerva Marine

(5.9 mill dwt)

19 **Athens-based Minerva Marine** manages four VLCCs, five Suezmaxes, 28 Aframaxes, 17 MRs and one Handysize tanker.

Four of the Aframaxes are LR2s.

In addition, the company manages a small fleet of bulk carriers.

At the time of writing, the company was believed to have ordered Suezmaxes and Aframaxes but they have not been included in the figures, as they could not be confirmed. ■

Navios Maritime Group

(5.9 mill dwt)

20 **Angeliki Frangou's quoted tanker** vehicle, Navios Maritime Acquisition Corp (NNA) is a prolific asset player, buying and selling vessels on a regular basis.

According to the company, NNA has eight VLCCs, eight LR1s, 19 MR2s and four chemical tankers.

In November, 2014, Frangou set up Navios Maritime Midstream (NAP), which purchased four VLCCs from NNA via an IPO.

In June 2015, NAP acquired two VLCCs dropped down from the sponsor. Others will probably follow. ■

Oman Shipping Co (OSC)

(5.9 mill dwt, plus 250,000 dwt newbuildings)

21 **OSC operates or manages 16 VLCCs,** two LR2s, five MRs and three chemical carriers.

In addition, another seven MRs are on order at Hyundai Mipo for 2016 delivery.

OSC also operates or manages a fleet of LNG, LPG, general cargo carriers and VLOCs.

Oman Shipping's VLCC *Saiq*.

BW Maritime

(5.65 mill dwt, plus 660,000 dwt newbuildings)

22 **Singapore-based BW Maritime** currently manages 10 VLCCs, 17 LR1s, 22 MRs and five chemical tankers.

In addition, there are six LR1s building at STX and another 10 newbuilding chemical carriers to come.

The group also has a large fleet of LNG and LPG carriers, plus FSOs and FPSOs, either wholly, or part owned. ■

A BW Maritime VLCC.

Gener8 Maritime

(5.43mill dwt, plus 5.6 mill dwt newbuildings)

23 **This company was formed last year,** as a result of a merger between General Maritime Corp and Navig8 Crude Tankers.

As of 1st November, Gener8 operated 10 VLCCs, 11 Suezmaxes, four Aframaxes, two LR1s and one MR.

In addition, the US-based concern has another 18 VLCCs on order in South Korea, the Philippines and China. ■

Thenamaris

(5.37 mill dwt, plus 1.76 mill dwt newbuildings)

24 **This Athens-based concern has** consolidated its fleet since last year, due to both newbuildings entering service, the acquisition of secondhand tonnage and the sale of vessels.

Today, the company manages three VLCCs, six Suezmaxes, 24 Aframaxes, 11 MRs and seven Handysize tankers.

In addition, there are another two VLCCs, three Suezmaxes and six Aframaxes on order. ■

Tsakos Energy Navigation (TEN)

(5.2 mill dwt, plus 2 mill dwt newbuildings)

26 **As at the end of December, TEN** operated one VLCC, 13 Suezmaxes, two DP shuttle Suezmaxes, eight Aframaxes, three LR2s, nine LR1s, six MRs and seven Handysize tankers.

In addition, the company had an extensive orderbook of two VLCCs, nine Aframaxes, one DP shuttle Suezmax, plus two LR1s.

The Aframax orders were placed on the back of long term charters to Statoil, the LR1s against long-term contracts to a US oil major and the DP Shuttle tanker against a long-term contract to Petrogal.

The majority of the vessels are managed by Tsakos Columbia Management (TCM), a joint venture company formed around six years ago. ■

DHT Holdings

(5.2 mill dwt, plus 1.5 mill dwt newbuildings)

25 **DHT will control 20 VLCCs, once** the five newbuildings are delivered this year.

In addition, the company has one Suezmax and two Aframaxes. Through the acquisition of Samco in 2014, the company owns 50% of Goodwood Ship Management, which technically manages 15 of the company's tankers currently operating.

On 4th January, 2016, DHT took delivery of the VLCC 'DHT Leopard' from Hyundai. She is the second of six VLCC newbuildings for delivery between November, 2015 and October, 2016. The next newbuilding is scheduled to deliver early April, 2016. ■

Formosa Plastics Marine Corp

(4.5 mill dwt)

27 The Taiwanese energy giant's shipping subsidiary currently operates 10 VLCCs, two Aframaxes, six LR1s, 16 MRs and three Handysize tankers.

The Aframaxes are controlled by the Marubeni Group. ■

Shipping Corp of India (SCI)

(4.5 mill dwt, plus 317,000 mill dwt newbuildings)

28 **Due to a few sales, SCI's fleet has** fallen slightly.

Today, the company manages four VLCCs, with another newbuilding to come; seven Suezmaxes; 11 Aframaxes; two LR2s; six LR1s; four MRs and two Handysize tankers. ■

TORM

(4.1 mill dwt, plus 270,000dwt newbuildings)

29 **Restructured TORM now operates a** fleet of 10 LR2s, seven LR1s, 52 MRs and 11 Handysize product tankers.

In January of this year, TORM took delivery of the fifth out of six MR newbuildings from Sungdong Shipbuilding & Marine Engineering in South Korea.

TORM said that it expected to take delivery of the last MR at the beginning of March, 2016.

In addition, TORM has four LR2 newbuildings on order from Guangzhou Shipyard International with delivery scheduled for next year and the second quarter of 2018. ■

BP Shipping

(4 mill dwt, plus 2.2 mill dwt newbuildings)

30 **According to the company, BP manages or** operates, two VLCCs; 16 Aframaxes, which includes the 'British Respect' as of 5th February, this year;12 MRs and five Handysize tankers.

In addition, the company manages four US-based 190,000 dwt Alaskan tankers.

Several Suezmaxes, Aframaxes, MRs and handysize tankers are believed to be on order for imminent delivery either wholly-owned or on a lease basis, as part of the company's modernisation programme. The newbuildings, will however replace some of the current fleet as they get redelivered.

BP also charters in a considerable amount of tonnage. ■

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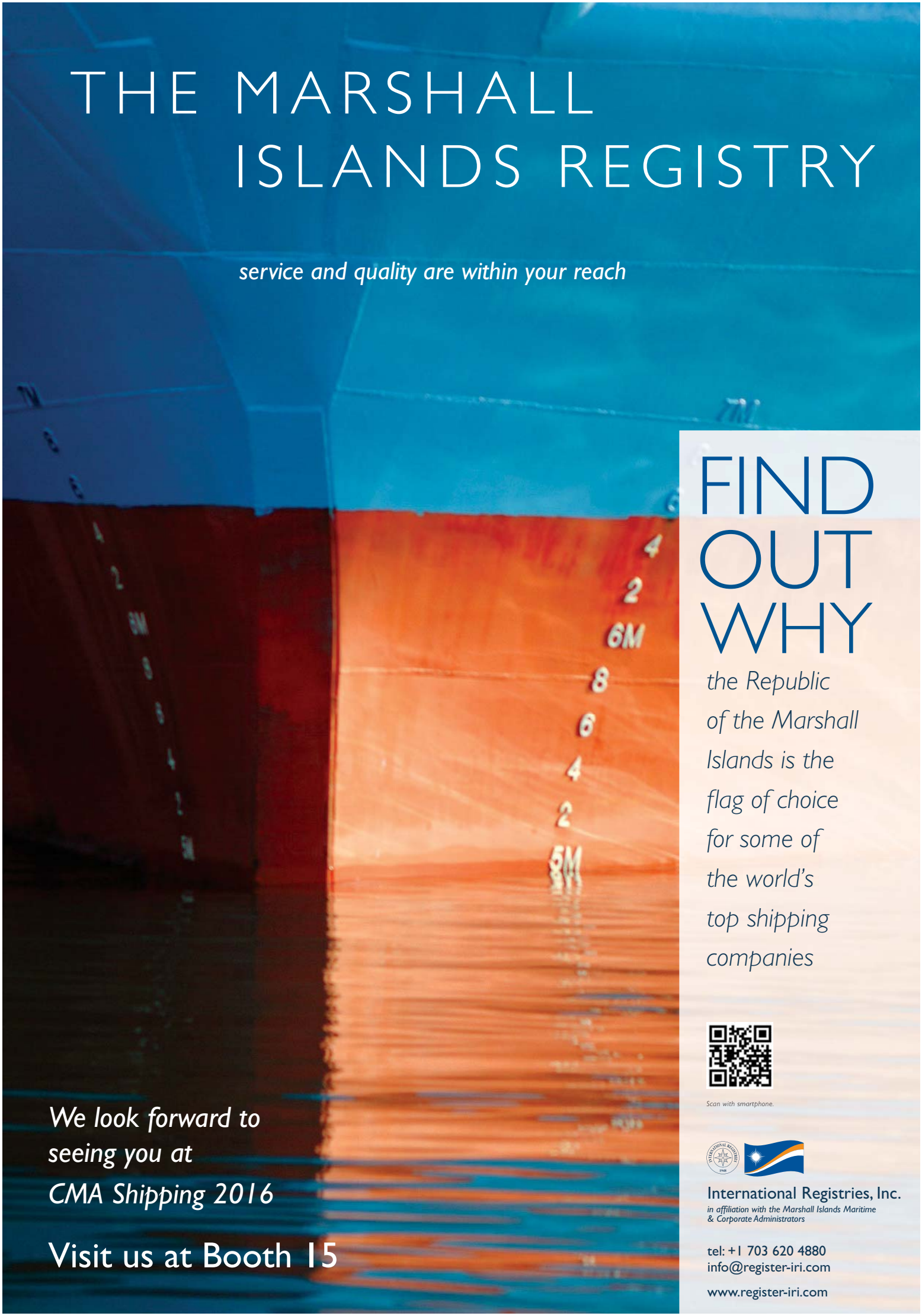

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