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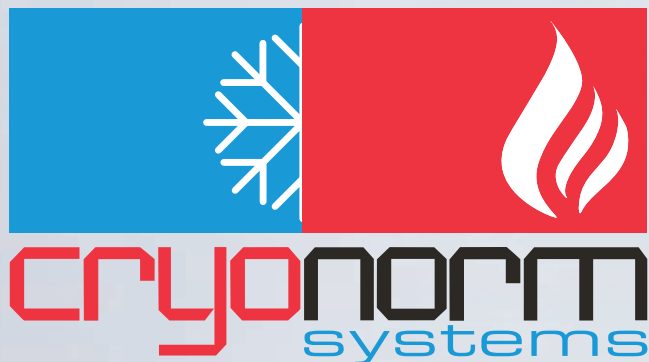
# LNG *shipping*

## REVIEW

- 
- 2014 - a stellar year
  - Voyage charter document near
  - Gas as fuel gaining momentum
  - Yamal vessels taking shape
  - Qatar repair yard success
  - Membranes dominate

# 2015

# TURN-KEY SMALL AND MID SCALE LNG SYSTEMS – ENGINEERING AND INSTALLATION



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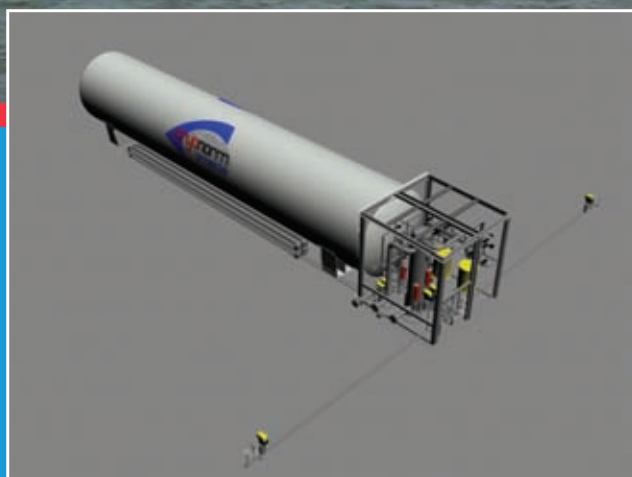
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# THE LNG journal SHIPPING REVIEW 2015

An LNG Journal  
publication

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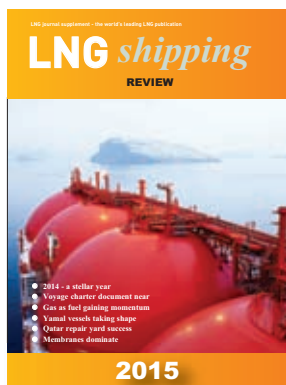
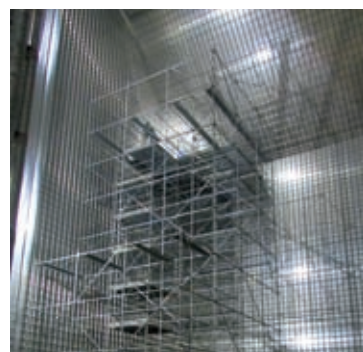
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*Heading North-Despite the political nightmare that seems to be clouding the world's energy sector, the vessels needed for the Yamal LNG project have been ordered as have their propulsion and other equipment (see page 16).*

*European equipment manufacturers and an EU port should benefit from the 15 plus specialist Ice Class double-acting LNGCs needed to transport the gas from Yamal to Asian receiving terminals, as long as the Russian sanctions position does not bar their entry into these lucrative contracts.*

*However, fortunately, the vessels are being built in South Korea and will be owned by parties outside the EU, including the Chinese.*

# No respite from politics

**Consolidation and politics probably don't go hand in hand, but they both are affecting the LNG transportation sector going forward.**

**T**aking consolidation first, BG has confirmed that it is in advanced talks with Shell that could lead to the Anglo-Dutch oil major buying the former British Gas interests. Quite where that would leave Methane Services and GasLog is open for conjecture.

If the merger goes ahead and we see no reason to believe otherwise, Shell could end up managing more than 70 LNGCs - just under 20% of the world's fleet.

BG was already in the process of transferring much of its LNGC fleet to GasLog on a lease back basis and the Greek company had also earmarked at least six of its newbuildings for long term charters to the BG shipping arm.

No doubt how the vessels will fit into the Shell fleet will become clearer by the first quarter of next year when the acquisition is due to be made formal.

There are persistent rumours circulating about the sale of BP but whether the UK Government would allow this to happen, especially if ExxonMobil becomes the suitor, is another matter for conjecture.

From Japan, news has reached us of a joint venture LNG import initiative involving Tokyo Electric Power (TEPCO) and Chubu Electric Power.

From April of this year, this new concern will gradually involve fuel procurement, gas asset investments and the potential for a full blown merger of their respective fossil fuel plants. Could this power house influence the market by forcing the gas price down still further?

Once up and running, the joint venture will gradually overtake KOGAS as the world's largest gas utility, accounting for 16% of all LNG purchases worldwide. In general, gas prices have been falling, as has the oil price, leading to producers changing their selling patterns by offering discounts and other incentives to purchasers.

This has also affected future US shale gas production resulting in a few planned export terminals being shelved for the time being, mainly on cost grounds.

If you believe the rhetoric coming out of

the US, the country is about to become as big as Qatar in terms of gas exports. There are at least four export terminals under construction and the first shipments should begin towards the end of this year/beginning of next, according to the US Energy Secretary speaking at a conference at the end of April, although it is not thought that they have yet been approved by the Obama administration.

At the end of last month, the gas price stood at \$2.60 per mill BTU, but the US Energy Information Administration forecast that gas prices will rise to \$4.88 per mill BTU by 2020 and go up to \$7.85 per mill BTU by 2040, which should help the US fracking industry going forward.

Natural gas is exported from some of the most volatile political regimes in the world. The sanctions against Russia, a huge gas exporter, has led President Putin to woo the Chinese and latterly the Argentinians in a bid to replace western gas sales.

The start up of the Yamal project is now not far away and the specialist Ice Class LNGCs have been ordered. At present, during the winter months, the gas is to be exported via transshipment at Zeebrugge, but if the sanctions are still in place in a couple of years time, this could change. As for Shtokman, this project looks to be as far away as ever in getting off the ground.

## YEMEN CLOSED

Yemen is the latest problem to hound the gas transportation sector. Yemen LNG Company has stopped all export operations, due to further deterioration of the security situation in the vicinity of Balhaf.

As a consequence of the current situation, Yemen LNG has declared *Force Majeure* to its various stakeholders. Yemen LNG is said to be the country's largest-ever industrial investment at around \$4.5 bill.

Iran could come in from the cold and the giant South Pars field could eventually see the light of day, resulting in Iran possibly rivalling Qatar as the Gulf's gas export capital in the future.

Egypt has become a net importer of gas from a net exporter due to a chronic energy



shortage caused by various regime upheavals. The country has made use of a Hoegh storage and regasification vessel over which the gas will be imported.

Turkey has taken the unprecedented step of closing the Bosphorus to LNGCs, thus blocking off countries, such as the Ukraine. However, the authorities claimed that this decision was not political but rather one of safety, as a gas carrier transiting the narrow Straits was deemed as a threat to Istanbul's population. What about the number of LPG and chemical carriers that daily transit the Bosphorus?

It was thought that the Ukraine had plans on the drawing board for an LNG receiving terminal.

Despite the problems, the LNG shipping industry continues to invest time and money in new technologies, including propulsion and containment systems and of course the specialist Ice Class vessels needed to export Yamal's gas. It must not be forgotten that LNG carriers often last for 30-40 years and there are markets opening up for the older tonnage, such as conversion to floating storage, LNGFPSO or reliquefaction facilities.

The so called 'Small scale LNG' move is gaining momentum, despite the sceptics. More and more inland and short sea vessels are being designed to be powered by gas in addition to carrying LNG as a cargo. There are various projects planned and on the go funded by the EU and US authorities. ■



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# 2014- a milestone year

**W**e witnessed a record number of newbuilding contracts, a large number of technological breakthroughs in propulsion techniques, and confirmation of the implementation of the Yamal project and its Arc7 Ice Class LNGCs.

However, a certain number of worrying signals appeared during the year, including the spectacular fall in the price of oil, as well as the difficulties in worldwide shipbuilding, which had repercussions on the distribution of LNG orders among the four main South Korean yards.

According to figures produced by Rogliano Salles (BRS) in its annual report, last year, 65 LNGCs of over 145,000 cu m were ordered at seven shipyards worldwide capable of building vessels of this size. This was a significant increase from the 35 contracts placed in 2013 and the 34 ordered in 2012.

Daewoo (DSME) came out on top with 39 contracts won last year, more than the total number of LNG orders placed worldwide in 2013.

The contracts included 15 icebreaking LNGCs for the Yamal project. Three liquefaction trains, each with a capacity of 5.5 mill tonnes per year, are under construction and upon completion, will require up to 17 Arc7 LNGCs to ship the LNG (see page 16).

Eventually, these ships will have the capacity to transport LNG using the Northern Sea Route (NSR) in summer before switching to Zeebrugge where the gas will be transhipped during the winter months.

Samsung Heavy Industries recorded seven new orders in 2014 and Hyundai Heavy Industries - five. Chinese shipbuilder Hudong-Zonghua strengthened its position in the LNG market with four orders for the Chinese oil company CNOOC.

Meanwhile, Japan's shipyards won seven new orders (three at JMU, three at Kawasaki Heavy Industries, and one at Mitsubishi Heavy Industries).

Thirty-three LNGCs were delivered in 2014, of which just seven had a capacity over 170,000 cu m. Some 80% of these deliveries were vessels between 147,000 cu m and 165,000 cu m ordered in 2011, around one third of these by Greek interests.

At the end of 2014, the LNGC fleet in service totalled 395 ships of over 145,000 cu m capacity, while the orderbook comprised

## The year 2014 was described as exceptional for LNG sea transport.

148 vessels with deliveries stretching through 2020. With the orderbook representing around 40% of the operational fleet, this is unprecedented and reinforces several concerns for the years to come, BRS said.

Given the growth in the orderbook last year, it is important to note the types of new ships ordered by owners.

### CAPACITY INCREASE

The cargo capacity of the ships has increased and is now focused above 170,000 cu m. More than 100 of the LNGCs on order are larger. This is a noteworthy development, as we are approaching an optimum size, which represents a compromise for the various major routes, the broker said.

These ships (less than 300 m in length and under 50 m wide) will be able to pass through the expanded Panama Canal and will offer flexibility when it comes to accessing the main discharge ports, particularly in Asia.

In terms of cargo containment, membrane systems remain the preferred option, as around 120 ships on order will be equipped with this technology. An interesting point to note is the development of a new membrane system by Samsung Heavy Industries, which will be installed on two vessels ordered by South Korean owner SK Shipping.

The Japanese yards continue to offer the prismatic technology, chosen for three ships in 2014, and the Moss system, which will be used on a further six ships. Hyundai Heavy Industries also signed a contract with Petronas during the year for vessels fitted with Moss technology. These are developments on the margins of the market, as membrane technology still holds a 90% market share.

Regarding vessel propulsion, it is worth noting that dual-fuel diesel-electric (DFDE) vessels remain the most represented in the orderbook. However, orders for the new dual-fuel 2-stroke engines continued to grow.

During 2013, only seven dual-fuel 2-stroke engined LNGCs were on order (five for Teekay and two for Knutsen). By comparison, last year, the orderbook included 26 vessels with this new propulsion system, while in addition there were four conversion projects switching from DFDE

to be taken into account. In total, the orderbook includes 37 ships which will be equipped with these engines.

This represents a real technological revolution, BRS said, since among conventional LNGCs (excluding the icebreaking tankers), this propulsion type now represents nearly 30% of the orderbook after little more than a year of active marketing by the shipyards and engine manufacturers. The large majority of these ships are being built at DSME, which by the end of last year had 25 such orders.

The new 'standard' LNGC is therefore moving towards a capacity of 174,000 cu m with a propulsion mainly based on dual-fuel 2-stroke engines and a membrane containment system based on a low rate of natural evaporation (boil-off rate less than 0.1%).

A new market segment also appeared in 2014 - small LNG bunker vessels - aided by the entry into force of new environmental regulations. GDF Suez, in collaboration with NYK and Mitsubishi Corp, was the first to finalise a contract for a 5,000 cu m LNG vessel at South Korea's Hanjin, followed by Shell, which ordered a 6,500 cu m ship of the same type at STX.

This is a promising market for which strong development is expected going forward. In parallel, the market for LNGCs of less than 30,000 cu m is also growing fast, with operators wanting the most flexible methods of supplying small regasification terminals and those closest to the consumers.

### CHARTER MARKET

Timecharter rate levels fell regularly during the course of 2014 to stabilise during the second half of the year at around \$70,000 per day (basis 12 months on a 160,000 cu m vessel with DFDE propulsion).

It is important to note that older ships (between seven and 10 years) with less capacity and steam turbine propulsion, received lower rates. Thus a spot market emerged at several levels. The market remained relatively active, with around 170 fixtures recorded over the full year.

In 2014, just over 245 mill tonnes of LNG was produced and transported by sea, which represents a growth of 2% on 2013. It proved to be a record year, with 30 importing countries and 19 exporting countries, including the addition of ExxonMobil's PNG

project in Papua New Guinea, which began production in the spring of 2014 and added 3.5 mill tonnes of extra production, largely destined for Asia.

The major event of the year was the fall in the price of LNG on the Asian spot market, BRS said, which dropped from a peak of nearly \$19/MBtu in January 2014 to below \$11/MBtu at the end of 2014.

This decrease was directly linked to the fall in the oil price, since in Asia there is a real correlation between the two energy sources. The majority of long term contracts, even those containing oil price adjustment clauses, are also going to lead to a fall in the LNG price. The average price of LNG in Japan should be between \$10-11/MBtu in 2015, versus an average price of around \$16/MBtu in 2014, BRS forecast.

Among the major importers, South Korean imports fell last year (-2.6 mill tonnes versus 2013) due to unusually mild weather, while Japan, India, China and Taiwan continued to contribute to the growth in LNG imports in Asia as a whole (+5.5 mill tonnes per year). Asian countries represented 75% of total LNG imports in 2014.

This year, the Australia Pacific LNG, Gorgon LNG and Gladstone LNG projects (35

mill tonnes per year in total) should start production and absorb a portion of the excess transport capacity already available.

### LOW OIL PRICE QUESTION

However, the lower oil price is going to hold up a number of investments in the LNG sector, notably the North American liquefaction projects using shale gas. Some 30 projects in North America with total production capacity of more than 220 mill tonnes per year are planned - around 130 mill tonnes per year in the US and 90 mill tonnes per year in Canada.

The high investment costs for these projects will almost certainly delay the implementation of a good number of them, the report said and the substitution of gas as a primary source of energy risks colliding with low oil prices. The prospect of American shale gas as an alternative energy source for Asian consumers is going to lose its appeal - already Excelerate has put one of its US projects on 'stand-by' (Lavacca Bay FLNG) for purely economic reasons.

It is clear that few new investment decisions will be taken this year, barring certain US projects (Corpus Christi with 13 mill tonnes per year and perhaps Train 3 of Freeport LNG with 4.4 mill tonnes per year).

As a result, 2015 will be a year of consolidation for investors in liquefaction projects, and the knock-on effect will be felt in several years' time when we could see a shortage of LNG in the market.

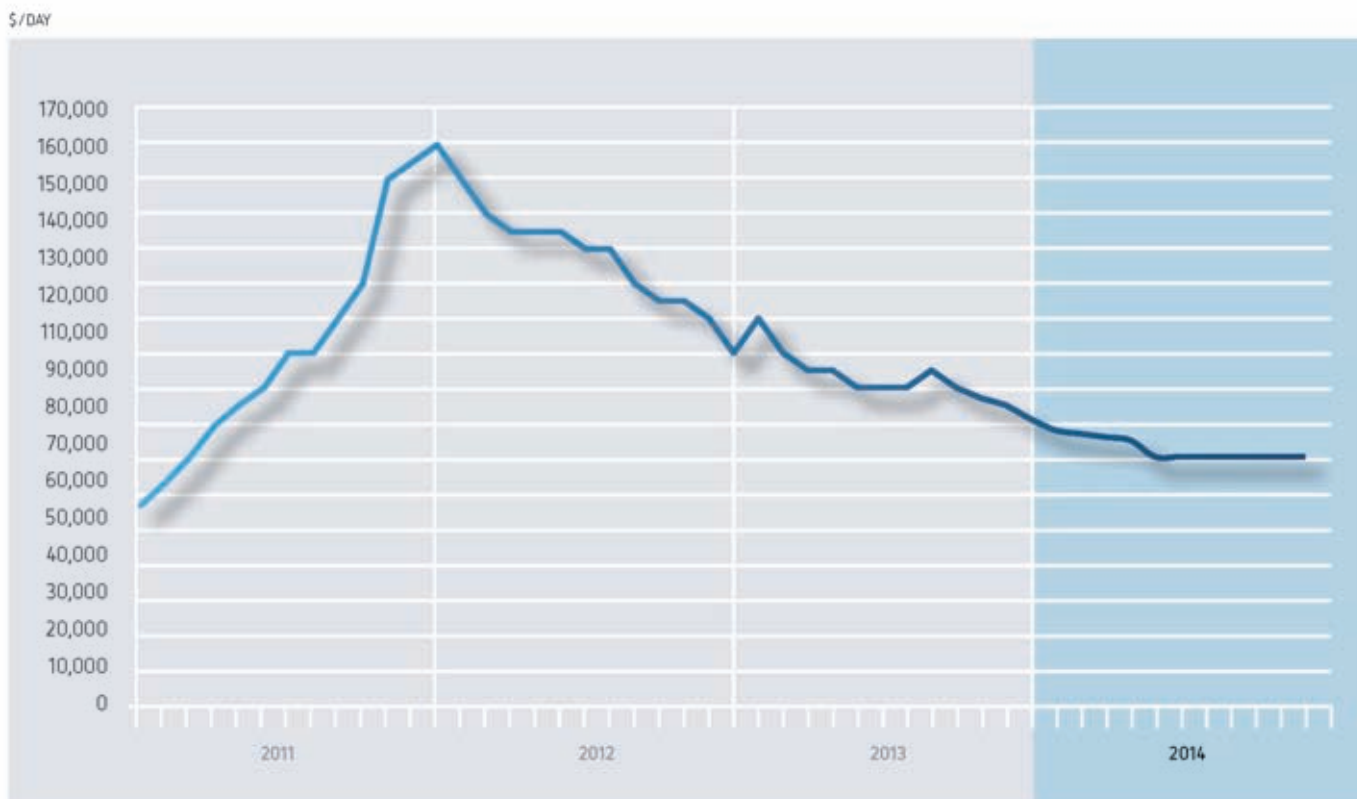
With the steady delivery of LNGCs in the years to come - around 30 ships per year from 2015-2017 - we can expect an overcapacity, which will clearly have a negative impact on charter rates, BRS said.

In this context, there will be a premium for the most fuel efficient ships, particularly on long haul trades, such as US/Asia. Technological developments in the field of fuel consumption, as well as cargo confinement systems, will be decisive in order for shipowners to take advantage in a market where there is excessive competition.

Shipyards were also engaged in a price war last year, and in 2015, we can expect significant restructuring within South Korea's shipbuilding industry; we also expect some consolidation in Japan's shipbuilding industry, which is still focused primarily on the domestic market.

This year will therefore be one of challenges for all the participants in the LNG chain, for the producers, the shipowners, the charterers and also the shipyards, the report concluded. ■

## LNG Spot/Short Term Charter rates



Source: Barry Rogliano Salles.

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# LNGVOY takes shape

BIMCO is drafting a new voyage charter for LNG cargoes, provisionally named 'LNGVOY', together with GIIGNL (The International Group of Liquefied Natural Gas importers), which it hopes to publish later this year.\*

**T**raditionally LNG cargoes have been carried under long term timecharters, since the requirements for shipping were planned years in advance. More recently, however, LNG ships have increasingly been fixed for single voyages. Generally, these have been on trip timecharter terms, but the potential advantages of fixing on voyage charter terms have led to industry interest in a new voyage LNG charterparty.

LNGVOY aims to strike a balance between the interests of owners and charterers, and will offer increased commercial flexibility and an additional means to manage risk and costs. Charterers will be able to fix their costs by agreeing a lump sum freight payment. Owners will have control over operational matters such as stemming bunkers, arranging port call, appointing their agents etc, unlike under a timecharter.

The carriage of LNG raises a number of issues that are unique to this cargo and the trade, which require special attention in any LNG charterparty, such as:

- *Condition of cargo tanks on arrival at the load port:* should the tanks be cooled down, or warm and under natural gas vapours, or warm and inerted?
- *Heel:* who owns it, what happens if there is not enough of it (when the vessel arrives at the load port, or later while waiting to load) and how much heel will be retained by the vessel following discharge?
- *Boil-off:* who is responsible for boil-off in port and at sea, and how is responsibility allocated according to the different causes of delay? How can this be simplified, to give as much certainty as possible to both parties under a voyage charter?
- *Arrival time at the discharge port:* in a trade where arrival times are important, what are the consequences if the vessel arrives outside the desired arrival window?

The approach taken in the current draft of LNGVOY is summarised below.

## (1) Condition of cargo tanks on arrival at the load port

Under a timecharter, the vessel's cargo tanks will generally be kept cold between cargoes, with sufficient heel to reach the next load port. Under a voyage charter, however, the vessel's next employment is less predictable and an owner may not need to maintain cargo tanks cold.

In order to give flexibility depending on factors such as the vessel's last discharge port, whether any heel was retained at the completion of discharge, and the possibility that the vessel's next load port was not known at that time, the draft LNGVOY provides for three options, to be agreed at the time of fixing: (i) the vessel will arrive with tanks cooled down, ready to load, and a min/max quantity of heel that the parties expect to be sufficient until commencement of loading, or (ii) the vessel will arrive with the tanks warm under natural gas vapours, or (iii) the vessel will arrive with cargo tanks warm and inerted.

If option (i) applies, but additional heel is needed before the commencement of loading (eg because the vessel did not arrive in the required condition, or because of a delay before loading):

- (a) Additional heel is provided by the charterer at the commencement of loading, but paid for by the owner unless needed because of the charterer's breach. The owner retains title to all of the heel.
- (b) Any time lost loading additional heel is shared 50/50 between the owner and the charterer, unless it was needed because of either party's breach of charter (in which case time counts, or not, depending on whether lost by the charterer's or the owner's breach).

## (2) Ownership of heel

The draft LNGVOY provides that title to the heel always remains with the owner. At the time of fixing, the parties agree a max/min range for the amount of LNG that the owner can retain as heel at the discharge port for his next voyage. This gives flexibility depending on the parties' requirements. For example, this figure can be agreed as zero, if the charterer needs all of the LNG in the tanks to be discharged as cargo and the owner accepts this. Otherwise, the amount can be based on the charterers' delivery obligations at the discharge port and the owner's potential requirements for heel for the next ballast leg.

Where a range is agreed, the owner must then declare how much heel he requires from within that range, and the charter will include an agreed deadline for such declaration.

A balancing payment is then made after discharge, depending on whether the amount of LNG retained as heel at the discharge port is more or less than was in the tanks at commencement of loading.

Another option for ownership of heel would be for the charterer to buy the heel remaining on board (ROB) at commencement of loading, and the charterer would then own all of the LNG during the voyage. The owner would buy back whatever is needed/agreed for heel following discharge. This is similar to the provisions in a timecharter, although in practice for a single trip these provisions in a timecharter are often amended so that charterers do not buy the heel but simply pay for any difference, assuming owners retain less heel at the end of the voyage. The option of charterers owning the heel has not been adopted in the draft LNGVOY, because of the complications that arise when the bill of lading quantity shows some cargo provided by the load port terminal and some that was already on board the vessel before commencement of loading<sup>[1]</sup>.

LNGVOY aims to strike a balance between the interests of owners and charterers, and will offer increased commercial flexibility and an additional means to manage risk and costs.

It is expected that initially LNGVOY will be used with the current LNG sale contract structure...but in time, LNG cargoes may well be traded on CIF terms.

### (3) Boil-off

With cargo constantly evaporating as boil-off, any delays in the voyage will affect the quantity of LNG that is ultimately delivered at the discharge port. Under an LNG timecharter, the owner accepts liability for cargo boil-off during periods when he takes the risk of delay – ie off-hire periods. The owner may therefore have to pay for cargo loss, regardless of whether he has breached the charterparty (since an off-hire event is not necessarily a breach of the charter).

Under a voyage charter, the owner generally takes the risk of delays during the sea passage. At the load and discharge ports, the risk of delays is allocated according to the laytime/demurrage exceptions. The approach taken in the draft LNGVOY is that:

- The owner agrees to a 'boil-off cap', ie a

maximum total boil-off, for the entire sea passage. This will be calculated taking a number of factors into account, such as anticipated voyage duration, expected daily boil-off, and perhaps a contingency for unforeseen delays.

- If the boil-off during the sea passage exceeds the cap, then the owner pays for any additional boil-off, because he takes the risk of delays during the sea passage. There are a few exceptions, eg boil-off during delay caused by the charterers' breach of the charterparty, seizure or detention by piracy or war risks, blockade, strike or lockouts or where the approach channels at the load or discharge ports are blocked or restricted.
- For boil-off while in port, the owner warrants a daily maximum boil-off rate

(eg 0.15% of tank capacity when laden or 0.11% with only heel). The risk of boil-off within this amount is split between owner and charterer according to the cause of any delay. The owner is only responsible for boil-off in port if caused by owner's breach of charter, or by those laytime/demurrage exceptions which fall into owner's area of risk. Currently these are (broadly) boycott or strike in connection with owners' business or crew, governmental interference with owners' business, breakdown of, or repairs to, the vessel, lack of trading certificates, or the vessel being not ready to load or discharge despite having served NOR. Any other boil-off while in port will be at the charterer's risk.

### (4) Arrival time at the discharge port

Given the importance of arrival times in the LNG trade, timecharters include provisions regarding the vessel's arrival time at the discharge port. For example, Appendix C of ShellLNGtime requires the vessel to proceed (if ordered) at its service speed, and provides in some cases for certain consequences if the vessel arrives after an agreed time. However, it is usual for an owner to be in breach of the

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charter simply for missing an arrival time. This remains the case under the draft LNGVOY.

The approach taken in LNGVOY is that:

- At the time of fixing the parties agree a 'Delivery Window';
- The vessel shall steam at a speed required to arrive within the Delivery Window, up to a maximum of the service speed stated in Form B;
- The owner has only a very limited right to deviate (ie not for bunkers) unless otherwise agreed by the charterer;
- If the vessel arrives more than three hours late as a result of the owner's breach of the charter, laytime will not commence until the vessel has berthed and is ready to discharge.

Under a voyage charter, the owner will of course receive no additional freight if he arrives late and will in any case not be paid for delays during the sea passage. For this reason, it was thought that the provision regarding commencement of laytime when in berth should apply only where the delay is caused by the owner's breach of the charter, rather than for any delay.

In conclusion, the aim of LNGVOY is to

give more flexibility to owners and charterers. After allowing for the differences between a voyage and timecharter, many of the principles of ShellLNGtime are reflected in LNGVOY as well. It is expected that initially LNGVOY will be used with the current LNG sale contract structure, ie the charterer purchasing on FOB terms and selling DES, but in time, LNG cargoes may well be traded on CIF terms. LNGVOY would work for this too. For multiple voyages, LNGVOY would also be suitable for use as part of a contract of affreightment. A bill of lading for use with LNGVOY will also be published.

Members of the BIMCO working group for this project, together with GIIGNL, were due to participate in the Madrid LNG & Shipping Forum on 28th May, as well as other events in the coming months, to introduce the draft forms and to receive industry feedback before the documents are finalised. ■

*Footnote: [1] In a long term timecharter, where the charterer owns the heel, a separate receipt/bill of lading is sometimes issued for the heel. This seems unnecessary in a voyage charter.*



**Stephenson Harwood partner Ingolf Kaiser.**

*\*This article was written exclusively for LNG Shipping Review by Ingolf Kaiser a partner at Stephenson Harwood LLP specialising in maritime law, with a particular interest in the carriage of LNG. He is a member of the BIMCO LNGVOY sub-committee. He can be contacted at (ingolf.kaiser@shlegal.com)*



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# Interest in gas as fuel gradually increasing

In a sort of ‘chicken and egg’ situation, the question remains - are the vessels being designed and developed before the shoreside bunkering facilities are available, or are shipowners/operators waiting to see if the facilities are built in sufficient numbers and of course - what will the cost of the fuel be?

What is certain is that following on from the already mandated ECAs, the IMO plans to enforce a 0.5% sulphur limit on ships globally from 1st January, 2020. However, the organisation is to conduct a review in 2018 to decide if this deadline can be extended to 2025.

Most shipping folk think that LNG use as a fuel will grow rapidly in the next five to 10 years, first on coastal vessels operating in ECA areas where there is a developed, or developing gas bunkering infrastructure, such as northern Europe and the Baltic, second in the US and third worldwide in major centres, such as Singapore.

Shipowners/operators are faced with the dilemma of trying to predict future costs, as a vessel powered by gas is a long term investment. The expansion of gas fuelled ships depends to a great extent on the price differential with other low sulphur fuels and scrubber systems.

DNV GL said recently that the cost of building a new LNG-fuelled vessel can be up to 30% higher than for vessels running on conventional fuels. This is down to the technology not being available on a large enough scale as yet and also a lack of widespread infrastructure network, including import terminals, liquefaction plants and bunkering facilities.

However, DNV GL stressed that sticking with conventional fuels but introducing emissions reduction technology, such as scrubbers, can also significantly add to the cost of a ship. These systems are both space demanding and can increase a ship's fuel consumption by 2-3%.

In a recent report published by FC Gas Intelligence on the Mediterranean LNG bunkering scene, Arthur Barret, programme director, LNG bunkering at French engineering concern GTT, said the biggest

**The LNG fuel revolution is gaining pace despite a certain amount of scepticism from some quarters.**

obstacle preventing development of the sector is uncertainty related to LNG pricing.

“Today many shipowners in Europe are turning to scrubbers, then gasoil. LNG is the third option,” Barret said. “Many shipowners have a very short term view. They want to protect themselves from high (fuel) prices but without locking in investments for years.”

This issue has been brought to a head since European oil prices have almost halved since July last year, causing heavy fuel oil prices to fall dramatically, resulting in the LNG price becoming less competitive.

“Owners will not start using new fuels if infrastructure is not available and energy providers will not finance expensive infrastructure without first securing customers,” DNV GL said in a report on LNG as a fuel published last year. “Breaking this deadlock will require a co-ordinated, industry-wide effort and the political will to invest in the development of new infrastructure.”

Investment in LNG bunkering infrastructure is reasonably high, meaning a significant financial investment is needed.

## **HUGE POTENTIAL**

Ed de Jong, CEO of LNG Bunkering Service, which operates an LNG fuelled barge in the Amsterdam/Rotterdam/Antwerp (ARA) area, expects most northern European development to happen within this range, according to the FC GI report.

“In the Baltics there are already around 150 ships operating on natural gas and going lower into northern Europe, we see a lot of potential,” he said. “We’ve been contacted by several companies with ships already running on natural gas or with plans to do so.”

de Jong said that in Rotterdam there is already strong support for LNG bunkering, available infrastructure and regulations in

place for ship-to-ship transfer. He said that a bigger obstacle to the sector developing was the ability to attract financing for projects.

If the IMO does enforce the 0.5% sulphur limit on ships globally from 1st January, 2020, this will provide a significant incentive for shipowners in the Mediterranean to start using LNG as fuel. There are already some LNG bunkering projects under development in this area, the report said.

For example, Poseidon Med is the first LNG bunkering project in the Mediterranean and Adriatic Sea, which aims to introduce LNG as the main fuel for the global shipping industry and develop a sufficient infrastructure network of bunkering stations.

Greek passenger ferry company Anek Lines, based at Piraeus, is developing LNG bunkering in the Greek Archipelago through its participation in the EC-funded Archipelago-LNG project. The project aims to provide sustainable maritime transport between the Greek mainland and its islands. Qatar Petroleum plans to build LNG bunkering facilities at the port.

Spain's Port of Huelva announced in February, 2015 that it is considering the development of LNG bunkering facilities, as well as other infrastructure improvements at the port. The bunkering facilities would be part of a proposed gas export terminal. The port said it plans to carry out the project in conjunction with other ports, as well as Spanish company Enagas.

Huelva hopes to receive some of the project finance from the €50 bill Connecting Europe Facility (CEF) set up by the EC to invest in transport, energy and digital projects within the European Union.

There is huge potential to adopt LNG bunkering in the Mediterranean, but whether this happens will depend on the scope of environmental regulations, costs and cross-regional support to jointly develop projects. The potential is strong in Barcelona, Valencia and the Canary Islands for local ferries to run on LNG and for other LNG bunkering infrastructure to be developed.

From 2020-2025 some infrastructure will be in place, the report said, to enable large container ships to use LNG as fuel.

DNV GL said in its report that with the LNG price around 10% above HFO, around 7-8% of newbuild ships between 2012- 2020 will be able to run on LNG. However, if LNG prices fall to around 30% below HFO, the uptake of LNG on vessels could rise to 13% - the equivalent of around 1,000 ships. If LNG were to fall to 70% below HFO, the share of newbuilding LNG-fuelled ships would be around 30% of the global total, the class society said.

In northern Europe, apart from Zeebrugge in Belgium, Rotterdam is also creating a small ship LNG terminal. Last October, GATE terminal (majority owned by Gasunie and Royal Vopak) signed a financing agreement with the European Investment Bank (EIB) and four other banks that already participate in the syndicate of 10 international banks, which currently provide long term financing to the terminal.

This additional financing will support the funding of the expansion of the LNG break bulk infrastructure and services at the GATE terminal in Maasvlakte (Rotterdam). The investment in this breakbulk infrastructure, first announced in July, 2014, is expected to boost the use of LNG in the Netherlands and Northwest Europe. Commissioning of the facility and commencement of the first shipments are scheduled for the first half of 2016.

One of the first vessels to use the facility will be a newbuilding Shell LNG bunker vessel under construction at STX Offshore & Shipbuilding. She will be powered by three 8-cylinder Wärtsilä 20DF dual-fuel engines capable of operating on either gas or diesel fuel. The engines are scheduled for delivery in the spring of next year.

The vessel will be based at Rotterdam and will be seagoing thus able to bunker vessels at other locations.

"This new specialised vessel is an important step towards LNG becoming the fuel of choice for shipping in Europe, and Wärtsilä is pleased and honoured to co-operate with Shell and STX in this project. LNG eases compliance with both the new and anticipated future IMO environmental regulations, and we are proud that our development of technologies throughout the gas chain is of increasing value to the marine sector," said Aaron Bresnahan, vice president, sales, Wärtsilä Ship Power.

"This specialised LNG bunker vessel is a pioneering new design," said Dr Grahaeme Henderson, vice president of Shell Shipping & Maritime. "It will have a capacity to carry

6,500 cu m of LNG fuel, and will be highly efficient and manoeuvrable. It will be able to load from big or small terminals and to bunker a broad variety of vessels."

## DUTCH INITIATIVE

In Holland, Dutch entrepreneurs Peter Versluis (Veka Group), Gerard Deen (Deen Shipping) and Ed de Jong (IUVENIS) have joined with Peter Goedvolk who recently started Count - a commodity, trading & logistics company.

Previously, Veka Group and Deen Shipping had launched LNG Bunkering Services and announced the construction of the first LNG bunker tanker - *LNG Prime*. She will be 90 m in length with a loading capacity of 1,000 tonnes of LNG. She will operate in the ARA-region bunkering seagoing vessels as of the beginning of 2016.

"With the experience of Goedvolk, we now add a trade activity to our company and with that a next step is set to further develop the LNG small scale market in the ARA-region," said Deen at the time.

Goedvolk said; "LNG small scale is a challenging new market development and trading LNG fits very well in Counts vision of commodities, trading & logistics. The *LNG Prime* is an important link in the development of the LNG bunker market in the ARA-region.

"After the construction of the first seagoing (small scale) LNGC, the *Pioneer Knutsen*, by the VEKA company several years ago, we had a lot of knowledge to engineer an inland vessel, which is also capable to sail for 100% on its own boil-off. This knowledge is used to design this inland LNG bunker tanker, the *LNG Prime*. The crucial difference will be made in the vessel's design, the special cargo tanks (own design) and propulsion system," said Versluis.

LNG Bunkering Services was founded in 2012 and is a subsidiary of Deen Shipping. In 2011, Deen Shipping brought the first inland barge in Europe powered by LNG - *Argonon* - into service.

As Deen Shipping was increasingly being approached to collaborate on LNG-powered barges, a separate business was established. LNG Bunkering's aim is to assist barge owners by providing solutions regarding the technology, regulation and supply of LNG and by ensuring that a bunker infrastructure is developed.

Until now, the LNG terminal in Zeebrugge (Belgium), the LNG Break Bulk terminal and the GATE terminal at the Maasvlakte in Rotterdam are the only LNG import facilities in Europe that are equipped to load inland

ships and coastal LNGCs.

A number of small scale LNG bunker stations could be constructed along the Rhine in the near future, which will require more inland LNG bunker tankers.

## HAMBURG BUNKER BARGE

In Hamburg, the newly delivered *Hummel* LNG hybrid barge will enable Becker Marine Systems to supply low-emission power to cruise ships at the port. The first container with LNG fuel recently arrived in Hamburg, as part of the barge's testing programme.

"The testing of the gas engines at the Port of Hamburg is a first for both the classification society (Bureau Veritas) and participating authorities," said Dirk Lehmann and Henning Kuhlmann, joint managing directors of Becker Marine.

The gas container from Shell Gasnor was delivered to Becker Marine at the Blohm + Voss shipyard. It had been shipped from the Fluxys LNG terminal in Zeebrugge, Belgium to Hamburg.

*Hummel* is a floating power plant and uses low-emission LNG to supply environmentally-friendly energy to cruise ships. She will commence operations at Hamburg at the beginning of the cruise season in the spring of this year.

"The operation of all five of the *Hummel's* generator sets recently took place as part of class acceptance," reported Dirk Lehmann and Henning Kuhlmann, following earlier trials.

In collaboration with Bureau Veritas, the LNG hybrid barge system was tested and a variety of large load impacts and load spikes were simulated. The overall load transfer of 0 to 7.5 MW of power was achieved well below the time of two minutes set by BV.

The barge was launched in Komárno, Slovakia at the beginning of September, 2014 and was christened *Hummel* following its arrival in Hamburg.

Klaipėdos Nafta, operator of the first full scale LNG terminal in the Baltic Sea region, and Bomin Linde LNG, the Germany-based provider of LNG as a marine fuel, have signed a Memorandum of Understanding (MoU) to jointly develop the LNG fuel market, including the necessary infrastructure in the Baltic.

On 1st January, 2015, Klaipėdos Nafta started to operate its floating storage and regasification unit (FSRU) *Independence*, providing LNG regasification and reloading services on a third-party-access basis.

Next, the company intends to construct an onshore small-scale LNG reloading station in Klaipėda to offer small-scale LNG services, eg

loading trucks to serve the increasing demand for LNG in the Baltic States and Poland.

Bomin Linde LNG will become Klaipeda LNG terminal's user to undertake regulated LNG reloading in order to use the facility as the regional breakbulk hub for the Baltic Sea. The companies also agreed to jointly explore the development of an LNG bunkering vessel, which would provide LNG bunkering services in the region, feed the LNG reloading station in Klaipeda, Bomin Linde's LNG bunkering terminals, eg a planned terminal in Hamburg, and other bunkering terminals in the Baltic.

Bomin Linde's managing director, Mahinde Abeynaike, explained: "We consider this partnership to be an important milestone in the development of an efficient supply of LNG to ports at the Baltic Sea." His colleague, Ruben Benders, added: "Jointly with our partner Klaipedos Nafta, we will build a unique LNG supply chain that is needed to take the regional LNG markets to the next level."

In addition, the Linde Group, via its Swedish Engineering subsidiary Cryo, has been awarded a contract by Meyer Turku Shipyard of Finland to build an LNG fuel gas system for the next-generation high-speed ferry being built for the Tallink Group.

The ferry will operate between Helsinki, Finland and Tallinn, Estonia and has been designed to comply with the ECA limits due to her use of LNG as fuel. The LNG fuel gas system consists of two horizontal, vacuum-insulated 300 cu m tanks, plus gas handling and control systems, which will supply natural gas to the vessel's dual-fuel engines.

The ship's high service speed of 27 knots will be partly attributable to its hull shape, engineered specifically to increase fuel efficiency. The ship will have a capacity of 2,850 passengers and will be delivered at the beginning of 2017.

In June last year, the Finnish Transport Agency commissioned Cryo to build an LNG fuel gas system for a new icebreaker, while in Nynäshamn, south of Stockholm, Linde built Sweden's first LNG terminal in 2011 and a year later, Linde and Bomin formed Bomin Linde LNG.

Moving across to the US, last October, LNG America announced an agreement with Buffalo Marine Service to co-operate on the design of an LNG bunker fuel network for the US Gulf Coast region.

LNG America is developing a hub-and-spoke delivery system for LNG as fuel for the

marine market and other high powered applications. Ultimately, LNG America will establish a delivery infrastructure to ensure the secure and safe delivery of LNG as fuel in major US ports.

Buffalo Marine is one of the premier bunkering companies in the Gulf of Mexico with over 50 vessels dedicated to bunkering in the region.

The agreement will incorporate Buffalo Marine's logistical, commercial, and administrative expertise regarding bunkering operations with LNG America's experience with LNG as fuel for high powered applications; understanding of the emerging demand for LNG as a bunker fuel; and overall business-development efforts related to LNG bunkering.

Meanwhile, GTT North America has received an order for an LNG bunker barge - the first dedicated LNG barge for the marine market in North America.

She will be built by Conrad Orange Shipyard, a division of Conrad Shipyard at its facility in Orange, Texas.

The barge, for WesPac Midstream (WesPac), a provider of energy infrastructure and LNG solutions, and its affiliate Clean Marine Energy (CME), is expected to be



**Hummel seen undergoing trials at Blohm + Voss.**

delivered in the first half of 2016 and will be built with GTT's Mark III Flex cargo containment technology, which allows an optimised boil-off rate of cargo LNG and efficiently utilises available cargo hold space.

The barge will also be fitted with GTT's REACH4 (refueling equipment arm, methane [CH<sub>4</sub>]) bunker mast design, to ensure the simple and safe transfer of LNG fuel to a vessel. The barge will initially serve Totem Ocean Trailer Express's (Totem Ocean) operations in Tacoma, Washington, as well as TOTE's SeaStar operations in Jacksonville.

This initiative is the result of collaboration between GTT North America, classification societies, the US Coast Guard, and industry stakeholders, which started in mid-2013. Earlier this year, Conrad Shipyard signed a technical assistance and license agreement (TALA) with GTT North America for the design and construction of LNG barges and LNG-fuelled vessel bunker tanks using GTT's membrane containment systems.

The first 2,200 cu m barge is expected to be delivered in early 2016. Bristol Harbor Group will be responsible for the vessel's design, with the American Bureau of Shipping (ABS) acting as the classification society.

## DESIGN SERIES

Wärtsilä has launched a series of LNGC designs. This series is the latest addition to the group's ship design portfolio and marks an important part of the company's strategic programme under the theme 'Taking Merchant Shipping into the Gas Age'.

The series comprises four vessel designs - WSD59 3K, WSD59 6.5K, WSD55 12K, and WSD50 20K - all of which have been developed in close co-operation with customers to produce vessels that are appropriate for the global LNG infrastructure and applicable for both oceangoing and inland water operations.

In each case, fuel economy, performance guarantees, optional versions to meet specific needs, and the flexibility to choose particular features and solutions have been taken into account.

"Wärtsilä Ship Design has an extensive reference list dating back to 2003 for vessel designs for LNG fuelled ships. The experience and knowhow that has been built up during these 15 years has been utilised to develop this latest series of world class designs for LNG Carriers.

"The entire concept of these designs is to

enable the lowest possible fuel consumption, to allow owners to select the ship design that exactly meets their needs, and to provide shipyards with the most convenient and cost effective packages possible," said Riku-Pekka Hägg, vice president, ship design, Wärtsilä Ship Power.

The WSD59 3K design offers fuel consumption of 7.5 tonnes per day at a service speed of 14 knots on a design draft of 4.75 m. The fuel consumption for the WSD55 12K design vessels is 13.5 tonnes per day at a service speed of 14.5 knots, on a design draft of 6.2 m, claimed to be the best for this vessel type. The fuel consumption for vessels based on the WSD50 20K design is also claimed to be the best in its class at 18.1 tonnes per day at a service speed of 15 knots, while the WSD59 6.5K design offers a fuel consumption of 11 tonnes per day at a speed of 13 knots and a design draft is 5.8 m.

The new designs were developed at the Wärtsilä Ship Design offices in China and Poland.

In addition, last December, Wärtsilä was given the go ahead from Manga LNG to supply of a LNG import terminal in Tornio, Northern Finland.



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**Wärtsilä has unveiled four new small scale LNGC designs.**

Wärtsilä was due to commence construction of the terminal near Tornio in January of this year.

Manga LNG is a joint venture between the Outokumpu Group, Svenskt Stål (SSAB), Skangass and EPV Energy.

Wärtsilä initially announced this project in January 2014. The order was valued at around €100 mill.

The turnkey delivery of the first import

terminal supplied by Wärtsilä includes complete LNG unloading, storing and regasification equipment. The capacity of the LNG storage tank will be 50,000 cu m. A 10-year maintenance agreement was also signed between the parties.

This first maintenance agreement for an LNG terminal complements Wärtsilä's service proposition and experience within dual fuel and gas engines and related

equipment, the company said.

One of the main users of the imported natural gas will be the Outokumpu Tornio steel mill. A gas pipeline will be built to the nearby Röyttä industrial site, where the mill is located. Additional potential gas users are mines, factories and other industrial customers in Northern Finland and Sweden.

Rail and truck transportation from the terminal will be available and it will also be used for LNG bunkering to supply fuel for LNG-powered ships.

"The world is switching to natural gas, and we make it available in new places. With our unique turnkey offering, we are ready take a leading role in end-to-end LNG systems," said Tore Björkman, vice president, LNG and nuclear, Wärtsilä Power Plants, at the time of the announcement.

Today, Wärtsilä's portfolio includes liquefying technology, various gas-handling solutions, the design of LNG carrying vessels, gas-fired marine propulsion solutions, LNG loading and unloading facilities, storage facilities and regasification. A gas-fired power plant can also be combined with an import terminal in a joint turnkey project. ■

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# Vessels taking shape

Despite increasing political uncertainty, the giant Yamal LNG project appears to be going head without any noticeable delay.

**S**ome 15 firm orders had been placed at South Korean shipyards for the Aker Arctic-designed 172,600 cu m Arc7 Ice Class LNGCs, as had the main propulsion units for the vessels by the end of March this year.

Each vessel will be fitted with two Wärtsilä dual-fuel diesel-electric (DFDE) prime movers connected to three electrically driven ABB patented Azipods. To power the LNGCs, last October, DSME ordered 54 Wärtsilä dual-fuel engines.

The huge engine order was placed with Wärtsilä's South Korean joint venture company, Wärtsilä Hyundai Engine Co, (WHEC). The Wärtsilä machinery is capable of operating on LNG, heavy fuel oil (HFO), or low-viscosity marine diesel oil (MDO) but natural gas will be the main fuel used.

Last September, the SCF Group said that a steel-cutting ceremony had been held for the

lead LNGC for the project. The contract was signed in February, 2014. The prototype vessel will be operated under a long-term timecharter between OAO Sovcomflot (SCF) and JSC Yamal LNG.

She is under construction at Daewoo Shipbuilding & Marine Engineering's (DSME) shipyard in South Korea to Russian Maritime Register of Shipping (RMRS), and Bureau Veritas (BV) class and is due for delivery next year.

Sovcomflot provided JSC Yamal LNG with advisory services for gas tanker design and the minimisation of costs for the project's logistic support, based on the company's long-term experience in the Arctic and with the operation of its own LNGCs, the company said.

## UNIQUE DESIGN

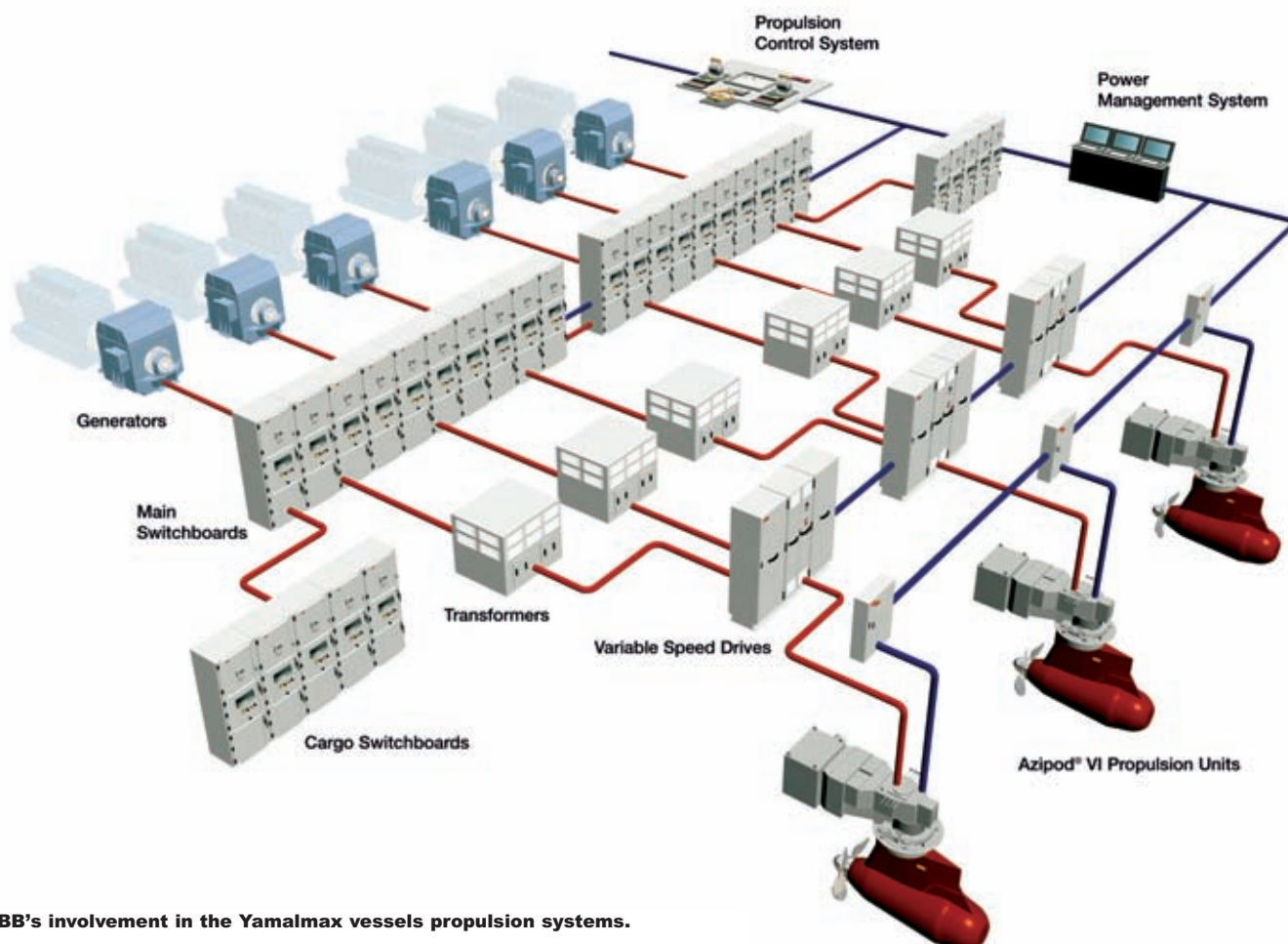
The partnership has developed a unique design for the new vessels code named 'Yamalmax'.

With a capacity of 172,600 cu m, length of 300 m and beam of 50 m, the double-acting LNGCs will be of Arc7 Ice Class (RMRS classification), which denotes an icebreaking capability in an ice field 2.1 m thick, while going astern.

Each ship's propulsion unit includes three ABB Azipods delivering a total power of 45 MW, which is comparable to a Rossija-class nuclear-powered icebreaker of 55 MW, it was claimed.

Reinforced membrane-type tanks will help to ensure safe LNG transportation along the Northern Sea Route (NSR), which has been confirmed by the classification society surveys and test-bed trials held by GTT, the cargo system designer. GTT will supply its NO 96 membrane containment system for the series, adapted for sailing in the Arctic.

The prototype vessel will also be used for training the crews of Arctic LNGCs



ABB's involvement in the Yamalmax vessels propulsion systems.

mainly for navigation in the severe ice conditions of the high-latitude Arctic region.

The Yamal LNG project involves the construction of a liquefied natural gas (LNG) plant with an annual capacity of 16.5 mill tonnes of gas sourced from the South Tambayskoye (Yuzhno-Tambayskoye) field, connected to an export terminal. Yamal LNG is co-owned by Novatek (60%), TOTAL (20%) and China National Petroleum Corp (CNPC) (20%).

Novatek will be responsible for the project in co-operation with energy supplier Gazprom. Yamal is scheduled to start production towards the end 2017 and to reach capacity by 2018.

In January of this year, Gazprom Marketing & Trading Singapore and Yamal Trade signed a long-term sales and purchase contract for the gas. This contract will be effective for over 20 years. It calls for the annual supply of 2.9 mill tonnes of LNG to be delivered to the Asia/Pacific markets, primarily to India.

To ensure year-round shipments of gas to Asia/Pacific and Western European markets, it is planned to use a fleet of 15 Yamalmax LNGCs. At the end of last year, the time scale for bringing the LNG plant to full operational capacity means the delivery of new vessels from 2016 through 2020.

Natural gas will be loaded at a new port -Sabetta - for Asia, via the NSR in the summer months and to Europe for transshipment, primarily at Zeebrugge, during the northern hemisphere winter.

Yamal LNG held an international tender between eight leading shipping companies, all of whom had the requisite experience and qualifications to operate LNGCs. A short list was created, including SCF, Teekay in partnership with China LNG Shipping (CLNG) and Japanese giant Mitsui OSK (MOL), also in partnership with CLNG.

It was accepted that the only company with the relevant experience in the year-round operation of shuttle tankers in the Arctic and sub-Arctic seas was SCF, gained from the Sakhalin-1, Sakhalin-2, Varandey and Prirazlomnoye projects now on stream.

The ships will be split between a joint venture involving Teekay LNG Partners and CLNG and another other joint venture involving China Shipping LNG Investment and MOL.

### ENGINE LOADS

When in Arctic waters, the vessels will be sailing in ambient temperatures down to minus 50 deg C breaking through ice more than 2 m thick, in operating modes that will lead to dramatic variations in engine load within a limited period of time. Wärtsilä's ability to meet these demanding design criteria was claimed to be a key factor in the award of the main propulsion contract.

For each LNGC, Wärtsilä will supply 12-cylinder and 9-cylinder Wärtsilä 50DF dual-fuel engines. The total power output will be 64,350 kW per vessel.

Wärtsilä's 50DF type engine is manufactured in various configurations from a 6-cylinder in-line version to an 18-cylinder version in V-configuration, giving 950/975 kW per cylinder and a total maximum mechanical output of 17,100 kW. The engine speed is 500 or 514 rev/min with 50 Hz and 60 Hz applications. The maximum thermal efficiency is higher than with any other gas engine, the manufacturer claimed.

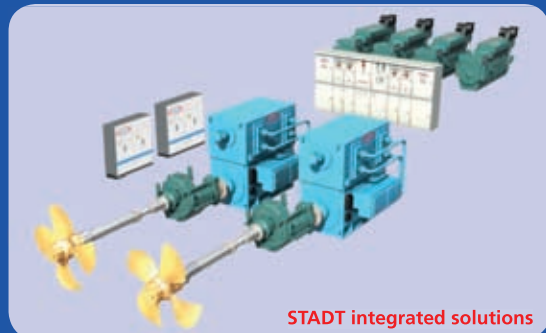
When operating in gas mode, the NOx emissions are claimed to be at least 85% below those specified in the current IMO regulations, and CO2 emissions are some 25% less than those of a conventional marine engine running on diesel fuel. In addition, the SOx and particle emissions are negligible at almost zero per cent.



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In February of this year, Wärtsilä announced a follow up order for another 30 prime movers to power five new Arc 7 design Yamalmax LNGCs being built at DSME. The order was placed in January by WHEC who will also build the engines in South Korea.

Lars Anderson, vice president, Wärtsilä Ship Power, speaking at the time of the announcement of the second tranche of orders, said; "Altogether, Wärtsilä has been contracted within the past 12 months to supply 90 dual-fuel engines to 15 of these Arc 7 ice-class LNGCs for the Yamal project. This is a clear endorsement of the very high efficiency and reliability of the Wärtsilä machinery, which owners and shipyards around the world recognise."

Also last year, ABB announced that the company had been chosen to supply electrical power and propulsion systems for the first tranche of Yamalmaxes. The contract includes options to equip 15 further vessels.

ABB's scope of supply includes turbochargers, generators, switchboards, transformers, electric drives, propulsion control and the company's patented Azipod VI type propulsion units.

The company's type VI Azipods have been fitted on board the Neste double acting tankers *Mastera* and *Tempera*, SCF shuttle tankers operating out of Varandey and on Norilsk Nickel's 'Arctic Express' containerships, among others.

At a recent presentation in London, Juha Koskela, ABB's Senior Vice President, Marine and Ports told *LNG Shipping Review* that a new Ice Class family of Azipods is due to be launched by the end of this year. They will be fitted with enhanced steering compartments and improved bearings, among other differences.

He also explained that retrofitting a vessel



**An illustration of the Yamalmax LNGCs.**

with an Azipod was easy, as fitting the unit was just a matter of cabling and having a flat flange arrangement of the vessel's bottom. He claimed that the Azipods to be fitted on the Yamalmax LNGCs were the biggest yet built in terms of torque and weight.

At the presentation, ABB Marine Managing Director Heikki Soljama said that for LNGCs gas engines control, electrical power would produce - reliability, redundancy, efficiency and variable loads. Cables can be run from anywhere on board the vessel to the propulsion units.

He also said that ABB was marketing its concepts to both shipyards and shipowners, as they were both drivers of innovative solutions. However, in building up the service side of the business, the company was moving more towards the end users.

### ZEEBRUGGE TRANSHIPMENT

To tranship natural gas during the winter period, Yamal LNG and Fluxys Belgium, the operator of Zeebrugge LNG terminal, have signed a 20-year contract to transfer up to 8 mill tonnes of LNG per year at Zeebrugge, to support year-round LNG deliveries from the Yamal Peninsula to Asian/Pacific markets.

In winter, the Arctic LNGCs will tranship

gas through the Zeebrugge LNG terminal where Fluxys LNG will provide services to transfer the LNG onto conventional gas carriers to be used to make the final delivery to Asian/Pacific markets via the Suez Canal.

This new transshipment service will require the construction of a fifth storage tank and additional process facilities, Fluxys said.

Ice load monitoring will be an important part of vessel operations at these longitudes and as a result, Oslo-based Light Structures won a contract from DSME to deliver the company's patented SENSFIB Ice – an ice load monitoring systems for another nine LNGC's ordered at the yard for the Yamal LNG project.

Light Structures had previously been awarded a contract for the first LNGC of the series, which is currently under construction. The 10 systems will be delivered between 2015 and 2017.

"We are extremely proud to have entered this contract; it is a breakthrough for our new ice load monitoring system. The concept has been developed in close co-operation with DNV GL and has previously been installed on both navy/coast guard and commercial vessels.

"We have seen a sharp increase in demand for various systems from both shipping and offshore and with a yearly growth rate of more than 100% the past few years, Light Structures is currently a market leader in both shipping, offshore and navy/coast guard segments" said CEO Inge Paulsen when announcing the order at the end of last year.

Last January, GTT announced that it had won an order to fit another five Yamal LNGCs with containment systems.

The five ARC 7 LNGCs are expected to be delivered between 2017 and 2019 and will be built with the N0 96 GW technology fitted, which allows an optimised gas cargo boil-off rate.

GTT had won the order to fit containment systems for the original 10 in the series last year.

## Yamal outshines Shtokman

**The Yamal LNG project, located on the Yamal Peninsula, is a joint venture between Novatek, Total and China National Petroleum Corp.**

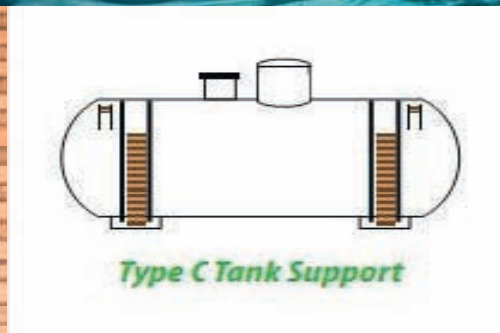
Once in operation, the plant will consist of three LNG trains with a total capacity of 16.5 mill tonnes per annum. It is currently scheduled to start-up in early-2018.

The LNG is expected to be transported from northern Russia to Europe and Asia through a new port on the peninsular called Sabetta.

The Yamal LNG joint venture has publicly said that nearly all of the expected LNG production output has already been earmarked for purchase by affiliates of the project's sponsors and other third parties.

Meanwhile, the giant Shtokman project opening looks to be slipping into the next decade.

It was reported in April that the Barents Sea project would be delayed by a further two years while the politicians fight it out mainly over the Ukraine. ■



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# N-KOM - in the right place at the right time

**T**his yard has traditionally been strong in servicing gas carriers, which today makes up 30% of the shipyard's marine repair business.

Having Nakilat as its parent company and operating out a convenient location next to gas loading terminals at Ras Laffan are factors, which have contributed to N-KOM's rapid rise in this competitive high-value repair market, the company said.

In a matter of four years since the yard opened for business, N-KOM has celebrated its 100th LNGC repair back in January 2015 involving MOL LNG Transport's LNG carrier *Dukhan*, and has since surpassed this figure as of April 2015.

In addition to servicing Nakilat's sizeable fleet of 61 LNGCs, N-KOM also undertakes repairs for LNG and LPG carriers from operators such as Maran Gas Maritime, BW Gas, MOL, NYK, "K"-Line, Iino Marine Services, Teekay, Far East Shipmanagement, Anglo-Eastern Shipmanagement, Consolidate

**One of the major shipyards handling LNGC repair is N-KOM, based at Ras Laffan.**

Marine Management, Pronav and Golar Wilhelmsen.

There have been several notable LNGC repairs undertaken by the shipyard on its journey to the 100th vessel. With a dedicated repair team for gas carriers, the yard has successfully carried out simultaneous dockings of up to seven LNGCs on several occasions. Typical repairs include modifications to ballast water systems, re-liquefaction plants, boil-off gas (BOG) systems, hull treatment and coating work, as well as overhauling machinery, especially cryogenic equipment, in the yard's 750 sq m cryogenic clean room.

N-KOM is currently undertaking a major main engine gas injection (ME-GI) retrofit for

the STASCo-operated Q-Max, *Rasheeda*, to enable the vessel to operate on LNG as an alternative fuel. When completed, the modified Q-Max vessel will have the world's first low-speed marine diesel engine that can also run on LNG.

Integration and completion works is being carried out at the shipyard, with modifications made using MAN Diesel & Turbo's proprietary ME-GI (M-type electronically controlled – gas injection) system that will help vessel engines meet current and future emissions standards set by the IMO.

This project is set to be yet another milestone in Qatar's standing as a reliable provider of clean energy in a safe and environmentally-sensitive manner and further evidence of Qatar's proactive approach to the sustainable development of the country's marine industry. So far, the use of LNG as a bunker fuel in the LNG shipping industry has been applied to conventional steam driven LNGCs and more recently to dual or tri-fuel



N-KOM docked its 100th LNGC in January of this year.

diesel-electric LNG ships fitted with low pressure injected, medium speed 4-stroke diesels.

### A 'GREEN' LNGC

The use of ME-GI as an alternative will allow a cleaner fuel technology with a significant reduction in environmental emissions, cleaner burning engines with potential to increase mean time between maintenance, provide flexibility of fuel supply to react to market changes and reduced bunkering activities, which in turn will offer operations and marine risk reduction.

Another key project ongoing at the shipyard is for NKY LNG Shipmanagement's LNGC *Lusail*, involving major repairs to the vessel's GTT MKIII-membrane cargo containment system. This is the second such repair undertaken by N-KOM, following similar MKIII-membrane repairs for Pronav Shipmanagement's LNGC *Milaha Ras Laffan* last year.

A test was carried out by SGS (South Korea) in the cargo tanks to identify the areas for repairs. Cargo tank containment specialists Gabadi SL were then engaged to undertake repairs in three of the vessel's cargo tanks,

followed by a Helium test and a final round of Global testing by SGS to ensure repairs were done satisfactorily. Other typical drydocking repairs were also carried out for *Lusail*, including hull coating work.

As for the previous repairs undertaken for *Milaha Ras Laffan*, a secondary barrier tightness test (SBTT) and acoustic tests in the cargo tank were carried out by SGS, followed by repairs to all four cargo tanks by Gabadi. The shipyard's project team focused on other areas in the work scope, which were hull treatment and coating, overhauling the high pressure/low pressure turbines, repairs to the boiler and main boiler exhaust bellows, renewal of the main condenser bellows, overhauling of all cargo and spray pumps, as well as the cryogenic valves.

The shipyard also recently completed the installation of a ballast water management

system (BWMS) on board another LNGC, the *Aamira*, operated by STASCo. The patented PURIMAR BWMS from Samsung Heavy Industry (SHI) was installed on board the Q-Max and the complete mechanical and electrical scope of work was executed within the vessel's drydocking and repair period at the shipyard.

Key aspects of the project were the extensive piping work involving the installation of about 300 spools of varying diameters and lengths, equipment installations comprising of two large skids (about 5.5 tonnes) and two 3 tonne large filter units plus the installation of power and control cables termination and breaker with switchboard modifications.

The shipyard has also undertaken emergency repairs on a Q-flex vessel primarily focused on the vessel's hull, involving the



Staging erected inside a gas tank.



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cropping and renewal of the damaged side shell amounting to 180 tonnes of steelwork, deck plating and its attached internals, as well as the vessel's bulbous bow.

### FLOATING DOCK

Looking at facility developments this year, N-KOM has started operating its new Q-Max floating dock, measuring 405 m x 66 m and with a lifting capacity of 120,000 tonnes. This is in addition to the two VLCC-size graving docks (400 m x 80 m and 360 m x 66 m) already operating since 2011 and thus increasing the docking capacity by another 50% and enabling both the shipyard and its clients greater flexibility in scheduling dockings.

In early 2012, N-KOM signed a technical agreement with French engineering company Gaztransport & Technigaz (GTT) to further enhance its range of services and provide membrane tank servicing for LNGCs repaired at the shipyard.

This agreement was of particular importance, as not only is GTT the world's leading company in LNG containment system technology, with its technologies equipping almost 70% of the world fleet, but also, all Q-Max and Q-Flex LNGCs are equipped with GTT containment systems, either Mark III or No 96. The shipyard has since collaborated with GTT to conduct an intensive specialist

programme for its team of welders, whom have been certified by GTT to carry out welding works for the containment systems, thus further enhancing the yard's in-house membrane repair capabilities.

N-KOM has also signed an agreement with Greece's HeLeNGi Engineering to retrofit several commercial Greek ferries to operate on LNG as fuel as part of the EU's Poseidon Med project. This project is set to become the first LNG bunkering project in the Mediterranean and Adriatic Sea and is led and co-ordinated by Q-ENERGY Europe. It is the first cross European border project, which aims to introduce LNG as the main fuel for the world shipping industry and develop a sufficient network of bunkering stations.

Late last year, an agreement was signed with DNV GL to co-operate on future LNG and gas-related projects. DNV-GL has advanced R&D on LNG applications, thereby enabling the class society to offer value-added solutions by providing consultancy and certification services.

Working together with Keppel Offshore & Marine Technology Centre (KOMtech), N-KOM is involved in several notable technology developments and implementations to enhance its standing at the forefront of the LNGC repair market, the company said. These include emission control measures, such as the installation of scrubber systems and other

LNG and marine technology upgrades, refits and modifications.

By being involved in both local and international LNG-related projects, N-KOM is enlarging its footprint as a global LNG solutions provider, the company said.

The long-term future is bright for the LNG repair market, as evidenced by a global orderbook of over 100 LNGCs and reported expansion in both China and India's regasification capacity in the last year, leading to increasing LNG import volumes to both countries.

This bodes well for N-KOM as it is located at the epi-centre of gas production and next to the loading terminals in Ras Laffan. Combined with vast experience in handling all manner of gas carrier repairs, N-KOM is poised to be the centre of excellence for gas carrier repairs in the region, the company claimed.

The company was established in 2007 as a joint venture between Qatar's gas shipper Nakilat and leading Singapore-based offshore rig constructor and shiprepairer Keppel Offshore & Marine. From its strategic location within the Erhama Bin Jaber Al Jalahma shipyard complex, N-KOM offers a comprehensive range of repair, conversion, maintenance and fabrication services for marine vessels, offshore and onshore structures. ■



**N-KOM not only handles LNGCs as this picture proves.**

## Palumbo and MES to join LNGC repair list

**France's Gaztransport & Technigaz (GTT) and Palumbo Malta Shipyard have signed technical service agreement that will enable Malta to bid for LNGC work.**

Palumbo, formerly Malta Drydocks, had to demonstrate its ability to meet the standards of safety and quality required by the containment system designer and supplier and as a result, the yard's personnel will now be trained by GTT engineers.

"The partnership with Palumbo will reinforce the drydock offer in the Mediterranean area, which is located at the crossroads of several commercial routes," said GTT chairman and CEO Philippe Berterotti.

Raffaele Palumbo, sales director of Palumbo Group, said: "The gas sector today is certainly one of the most active and promising in the energy domain, but in response to a growing demand in many

regions, Europe remains currently in the balance between an economic crisis and the hope that demand of LNG may grow.

"Despite this uncertain figure, Palumbo Malta Shipyard has made a giant step towards growth in the LNG repair market having been formally accredited as an approved shipyard by GTT for maintenance and repair works in membrane-type cargo containment tanks fitted in LNGCs.

"Palumbo Malta Shipyard has an established reputation in the maritime industry, having gained experience over the years on board all types of ships. General shiprepair continues as a core activity, but our goal is also to become a strategic partner in Mediterranean for LNG expertise and strengthen our offer to shipowners," he said.

The Palumbo Group has five shipyards in the Mediterranean and 14 docks that handle some 400 vessels each year.

Elsewhere, a new shiprepair yard was

launched in April by Japanese shipbuilders Mitsui Engineering & Shipbuilding (MES) and Kawasaki Heavy Industries (KHI).

The shipyard MES-KHI Yura Dockyard will specialise in LNGC shiprepair, as MES and Kawasaki endeavour to tap into the growing potential of the uptake in North American shale gas transport, which is in turn expected to spur LNG ship maintenance demand.

Market forecasts indicate that the number of LNGCs could reach around 700 units by 2030, adding 300 vessels to the current global LNGC fleet.

The joint venture is 60% owned by MES with the remaining 40% owned by KHI.

Under the contract, announced in December 2014, KHI plans to continue commercial shiprepair business at Kobe and move the Sakaide yard to MES-KHI Yura Dockyard.

The yard will initially have 190 employees. ■

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# Membranes dominate as technology moves on

Despite the membrane and Moss systems traditionally being the mainstay of the containment systems fitted on large LNGCs, there are others that are beginning to see the light of day.

**F**or example, ABS recently granted extended general design approval for the KC-1 LNG cargo containment system (CCS). This new membrane type will be installed on newbuilding LNGCs currently on order for Korea Gas Corp (KOGAS), the world's largest LNG importer.

The new LNG CCS design is a corrugated membrane type based on KOGAS' membrane containment system technology used for land-based LNG storage tanks. KOGAS developed the design concept for the KC-1 CCS in co-operation with the South Korean yards DSME, Samsung Heavy Industries and Hyundai Heavy Industries shipyards.

Beginning in 2005 and expanded in 2008 and 2013 to cover additional components, ABS' work scope was extended to include a sloshing evaluation using model tests, as part of the structural strength assessment of the new CCS type.

The associated pump tower design and sloshing analyses were reviewed in accordance with the ABS 'Guidance Notes on Sloshing and Structural Analysis of LNG Pump Tower', the ABS 'Guidance Notes on Strength Assessment of Membrane-Type LNG

Containment Systems under Sloshing Loads' and other applicable industry standards.

In the final assessment of the containment system, ABS analysed tank and ship motions, including the sloshing impact and fatigue loading, on an LNGC operating in North Atlantic wave conditions.

"We are pleased to extend general design approval to KOGAS for this innovative LNG cargo containment system," said Dr Hoseong Lee, ABS vice president of global Korea business development at the time of the announcement. "To support the safe emergence of the LNG market, ABS will continue to provide technical support to designers, shipowners and operators to achieve regulatory compliance and operational safety. This new membrane-type cargo hold system will be equipped to support the safe storage and transportation of LNG."

According to KOGAS, the basic concept of the KC-1 system is to minimise the effect on the insulation system by the hull and primary barrier deformation. The new system will use a 1.5 mm thick corrugated stainless steel 304L membrane as the primary and secondary barriers and polyurethane foam with a density of 115 kg per cu m as the insulating material.

The proprietary membrane containment system technology has been tested for performance and reliability in cryogenic operating conditions and is being applied to 200,000 cu m in-ground LNG storage tanks in the KOGAS Incheon LNG receiving terminal.

## CYLINDRICAL FLNG

ABS has also granted approval in principle (AIP) for the Sevan cylindrical FLNG production unit concept for offshore production, storage and transfer of LNG, LPG and condensate.

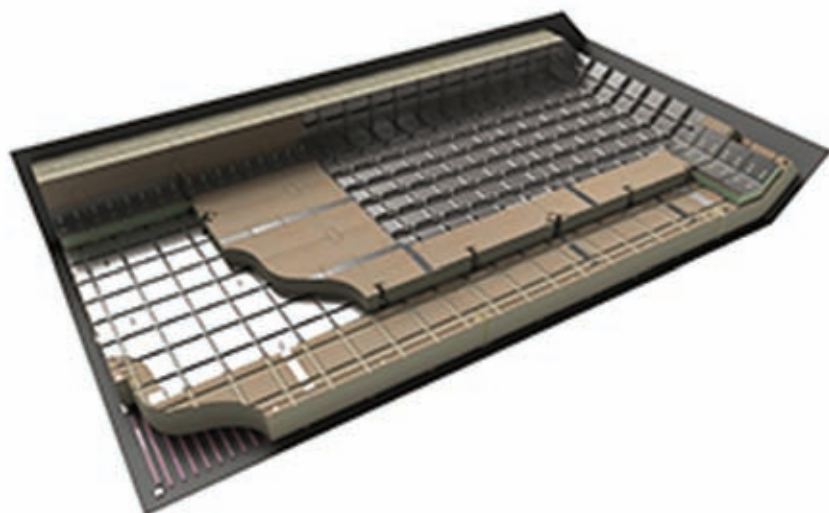
This FLNG design concept is based on the circular and geostationary Sevan FPSO design, which is being used in the Norwegian and Central UK North Sea and offshore Brazil. It is currently under construction, and will be the first FPSO to be installed in the Barents Sea.

The full scope of design review for the FLNG concept includes an assessment of the feasibility of the structural strength of the equipped FLNG hull and process topside structure as well as a global performance and safety analysis conducted in accordance with the ABS Rules and Guides for floating LNG units.

The Sevan FLNG production unit will have a proprietary cylindrical hull capable of operating in more than 3,000 m water depth and in harsh environments, such as extreme North Atlantic and cyclonic conditions. The unit design is based on environmental load calculations for a 100-year return storm in the Barents Sea.

Similar to the Sevan FPSOs, the FLNG unit's axio-symmetric hull shape enables high capacity for LNG storage and deck loads and tolerance for weather spreading and eliminates the need to weathervane in rough seas. The unit can be designed to have gas processing and liquefaction up to 4 mill tonnes per annum and store up to 240,000 cu m of LNG and 36,000 cu m of condensate.

Meanwhile, Braemar LNG BV, the wholly owned subsidiary of Braemar Shipping Services, has signed a licence agreement with



GTT's new Mark V technology (see page 25).

General Dynamics NASSCO to use its patents in the design and construction of FSP LNG containment systems.

The FSP system - a new flat-panel, semi-membrane, prismatic-shaped LNG tank containment system Type B - uses flat plate technology to overcome the issues associated with partial filling and sloshing.

This agreement is the culmination of years of development work undertaken by the two parties, and Braemar said that it was seeing strong potential demand for this system.

"We are delighted that this key stage in the FSP project has now been reached," said Geoff Green, managing director of Braemar Engineering, speaking at the end of last year. "The industry is asking not if, but when, FSP will come to market, and I am pleased to now be in a position to deliver a positive response."

He explained that FSP can be used in a wide range of applications - FPSOs, FSRUs, LNG transportation and LNG marine fuel tanks. It can even be used for offshore storage.

The Type B containment system is designed to be constructed, outfitted, insulated and tested off hull and lifted complete into the vessel while it is still in the construction dock, leading to a significant reduction in vessel construction time, while at the same time, the use of onshore construction facilities ensures the highest standards of quality care and repeatability, Braemar claimed.

Approval in principle (AIP) was obtained from both Lloyd's Register (LR) and ABS.

Braemar LNG has since issued a sub-licence to FSP LNG BV for the design and construction of the containment system, under the terms of the licence it signed with General Dynamics NASSCO.

FSP LNG BV is a joint venture company formed by Braemar, EnTX Tekmar and Jamestown Metal Marine Sales. The joint venture partners will, through Tank Tek, and Hong Kong Tank Tek, take the FSP LNG

containment system through the ABS general approval requirements and bring it to market.

### GTT SYSTEMS

The world's leading containment system designer GTT, has signed a co-operation agreement with Samsung Heavy Industries to bring to market its new Mark V technology. This agreement includes the building of a mock up at Samsung dedicated to final developments and related tests.

Another co-operation agreement is currently being finalised with Hyundai Heavy Industries. These two partnerships will allow the commercialisation of the Mark V technology this year. It has already received approvals in principal (AIPs) from major classification societies.

After some few years of research and development, the Mark V technology is an optimised version of the Mark III system and its sister - Mark III Flex. As of 31st December, 2014, 146 LNGCs had been equipped with these two systems, the company said.

Similar to the Mark III and Mark III Flex, the Mark V is composed of a double insulation with reinforced polyurethane foam. The new system also includes an iron-nickel alloy corrugated secondary membrane and offers significant improvement of the warranted daily boil-off rate, GTT claimed.

GTT has also announced that Temasek will be acquiring a 10.4% stake in the share capital of the company.

Total and Temasek entered into a definitive agreement for the acquisition by the Singapore company of Total's entire remaining interest in GTT. During GTT's initial public offering in February, 2014, Total had reduced its shareholding from 30% to 10.4%.

GTT also said that the company had won 47 orders last year, the highest number for 10 years. These included 36 LNGCs of which 10 were icebreaking, six very large ethane

carriers (VLECs), three FSRUs and one FLNG.

Since then, GTT has won several more orders to fit containment systems on LNGCs. In the company's first quarter 2015 results release, GTT said that it had won another 26 orders, made up of 25 LNGCs and one bunker barge. Most of the newbuildings will be fitted with the No 96 GW technology.

As of 31st March this year, GTT's containment system order book stood at 116 LNGCs and VLECs, six FSRUs, three FLNGs, three onshore storage units and one LNG bunker barge.

In March 2014, GTT introduced the NO 96 Max system (an upgrade of the NO 96 design) and the extension of the Mark V system for LNGCs.

The company also carries out extensive R&D and at the end of 2014 had 690 active and pending patents. GTT technologies, which have been on the market for less than three years, already represented around two-thirds of the order book at the end of last year, the company said.

In addition, GTT introduced several new services in 2014. GTT and its Cryovision subsidiary now offer a patented monitoring system called SloShield, which helps shipowners mitigate the effects of sloshing in LNGC tanks. GTT Training started operations in 2014 with courses that use specialist simulation software to train officers working on LNGCs.

Two new license agreements, including a US-based agreement via GTT North America were signed. An agreement was also signed with Gabadi last year, making the company GTT's first licensed outfitter to provide installation services to shipyards.

In early 2015, GTT North America signed a technical assistance and license agreement (TALA) with Conrad Shipyard, a US shipyard, for the design and construction of LNG barges

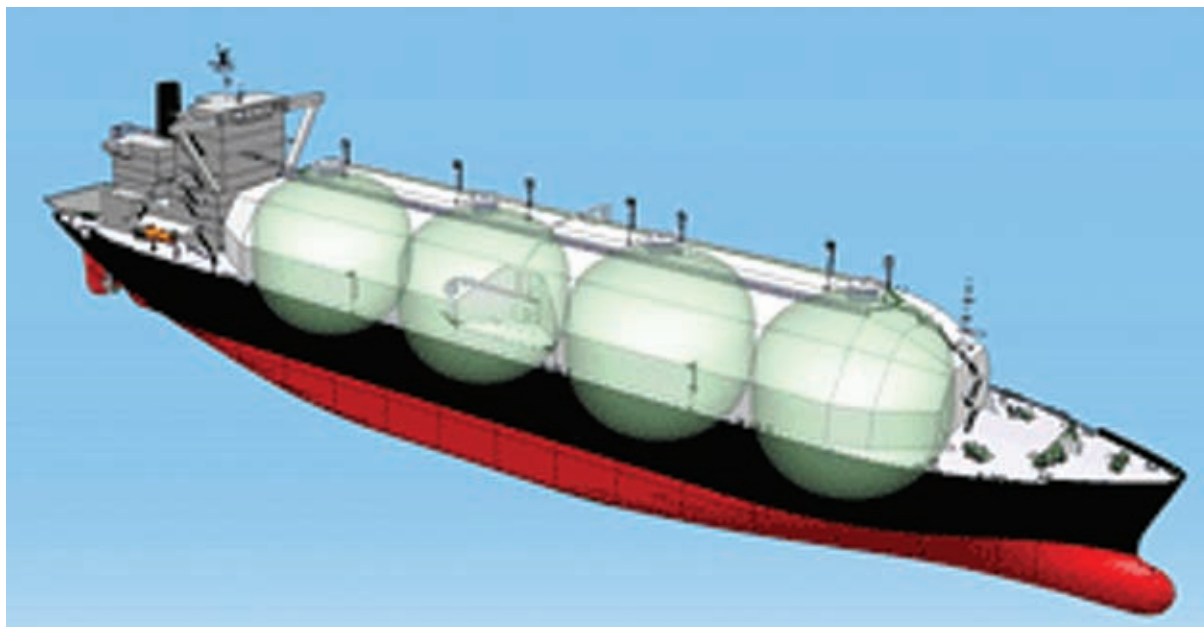


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**The Sayaringo STaGE apple-shaped tanks can be clearly seen.**

and LNG-fuelled vessel bunker tanks using GTT's membrane containment systems.

### JAPANESE INITIATIVE

In Japan, Mitsubishi Heavy Industries (MHI) has completed development of the Sayaringo STaGE, a next-generation LNGC. The new design was developed as a successor to the *Sayaendo*, the company's LNGC evolved from vessels fitted with Moss-type spherical tanks that offer a high level of reliability.

The introduction of apple-shaped tanks has enabled a near 16% increase in LNG carrying capacity without changing the ship's beam, while incorporation of a hybrid propulsion

system has boosted fuel efficiency by more than 20%, compared to the *Sayaendo* (and more than 40% against earlier LNGCs), MHI claimed.

Promoting the Sayaringo STaGE's capacity for transporting North American shale gas safely and efficiently, MHI said that it planned to undertake extensive marketing to promote the new vessel design as a strategic product among its LNGC offerings.

Whereas the *Sayaendo* has a continuous cover over spherical pea-shaped tanks, the tanks adopted on the Sayaringo STaGE have an apple-like shape design with the upper half bulging more than the lower half. The

new apple-shaped tanks are an improved version of Moss-type tanks, and they have been adopted on the Sayaringo STaGE as part of MHI's initiative to develop a vessel to the new Panamax size, ie capable of passing through the newly expanding Panama Canal.

STaGE, an acronym deriving from 'Steam Turbine and Gas Engines,' is a hybrid propulsion system combining a steam turbine and engines that can be fired by gas. The components of the Sayaringo STaGE system are the 'Ultra Steam Turbine plant' (UST), a reheating steam type marine turbine developed independently by MHI, a dual-fuel diesel engine capable of operating on both gas and oil, and an electric propulsion motor.

MHI said that plant efficiency has been significantly improved through the UST's effective use of the engine's waste heat, resulting in a propulsion system enabling high-efficiency navigation throughout a full range of speeds.

The basic design of the Sayaringo STaGE has now been completed, with the vessel's LOA (length overall) set at 297.5 m, width at 48.94 m, depth at 27 m and draft at 11.5 m. Four apple-shaped tanks are featured. The developed design provides 180,000 cu m in total LNG tank capacity, however, the capacity can be designed in accordance with the customer's transport needs.

Since MHI developed the *Sayaendo* in 2011, orders have been steady, commencing with the first order for two vessels. To date a total of eight vessels have been ordered, including one ordered through MI LNG Co, a joint venture with Imabari Shipbuilding, MHI said.

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# FKAB designed LNGC ordered for Baltic operation

A new joint venture company, Sirius Veder Gas, has ordered a 5,800 cu m LNG bunker and feeder vessel from Dutch shipyard Royal Bodewes.

**T**he company - a joint venture between Anthony Veder Group and Sirius Rederi - will operate the vessel for Skangass under a long term charter.

Designed by Uddevalla-based FKAB, to a so called Flexitanker type, the vessel has been named *Celsius*.

Since 2010, Skangass has expanded its seagoing LNG transport capacity by entering into long-term timecharter contracts with Anthony Veder for the LNGCs *Coral Energy* and *Coral Anthelia*.

Once delivered in February 2017, *Celsius* is expected to load LNG in Norway and Sweden for distribution within the Baltic Sea, focusing on the Skagerrak and Kattegat areas. To this end, the vessel will be built to Ice Class 1A notation to Bureau Veritas class.

The vessel's development is a part of the joint industry project FLEXI, included in PILOT LNG, which is part of the co-operative platform Zero Vision Tool ([www.zerovisiontool.com](http://www.zerovisiontool.com)). This project is co-funded by the EU through the TEN-T programme.

Her cargo tanks and cargo transfer system will be delivered by TGE Bilobe. The transfer system will have a load/discharge capacity of 1,000 cu m per hour, giving a nominal discharge time of six hours.

*Celsius*' main propulsion unit will be a MaK 6M34DF type main engine with an output of 3,000 kW at 100% mcr. This will give the vessel a service speed of 13.5 knots at 85% mcr with a 15% sea margin.

Two Mitsubishi clean burn auxiliaries of 375 kW each at 1,200 rev/min and another burning MGO giving 475 kW also at 1,200 rev/min will be fitted in the machinery space.

A 1,000 kW hot water boiler will also be installed able to burn both LNG and MGO, as will a hot water economiser for the main engine. A 300 kW auxiliary boiler will be fitted burning MDO.

For ease of manoeuvrability, a retractable bow thruster of 600 kW able to be continuously operated for a 'take me home' arrangement, will be installed.

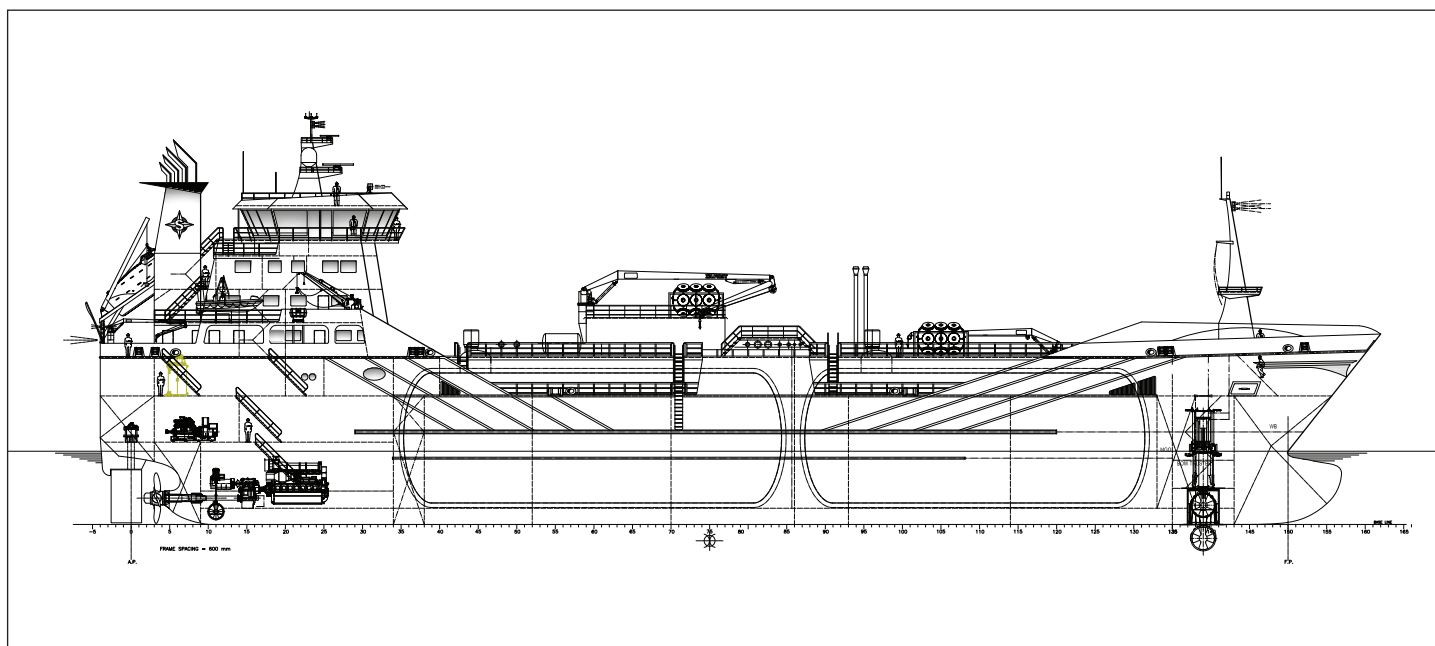
FKAB said that it is now marketing this particular design for both higher and lower capacity vessels.

## Principal particulars

Class....BV: I +HULL +MACH, Liquefied gas carrier, Ship type 2G (-165 deg C, 500 kg/cbm, 4,5 barg), +AUT-UMS, Ice Class 1A, MON-SHAFT, +SYS-NEQ1, COMF-VIB 2, COMF-NOISE 2, CLEANSHIP

|                    |                        |
|--------------------|------------------------|
| Length, oa         | 99.6 m                 |
| Length, bp         | 90 m                   |
| Beam               | 18 m                   |
| Depth              | 10 m                   |
| Draught, scantling | 5.9 m                  |
| Draught, design    | 5.7 m                  |
| Main engine        | MaK 6M34DF             |
| Output             | 3,000 kW<br>@ 100% mcr |

About a couple of months ago, the company won a design contract for a medium size LNGC of 45,000 cu m capacity fitted with A tanks. An extended basic package will be delivered to the shipyard, including the cargo tanks, the company said. ■



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# Momentum continues

Photo credit: Sovcomflot

**Despite political and economic pressures by way of falling oil and gas prices, there has been no let up in investment in new tonnage.**

**T**he big news is Shell's proposed takeover of the BG Group. Although the deal is not expected to go through until next year, today it leaves more questions than answers. For example, what is Shell's plans for Methane Services, the shipping arm of BG?

Although at least eight of the vessels are now owned and managed by GasLog, they are long term chartered to Methane Services. Once the acquisition is completed, Shell would have control of more than 70 LNGCs, as the energy major has also chartered Sovcomflot newbuildings.

Some 57 LNGCs were ordered last year and the momentum has continued thus far in 2015. Around 31 LNGCs are due to join the fleet this year, compared with 29 in 2014 and there have been very few sold off, although a couple of veterans have been sold for conversion projects and storage duties, illustrating there is growing market for storage and regasification vessels, which could suit redundant tonnage.

Earlier this year, there were said to be 32 LNGCs of over 30 years of age, but with

propulsion becoming much more efficient, the end of the 1980s-1990s built steam turbine powered LNGCs can't be far off.

The world's first compressed natural gas (CNG) carrier has been ordered from a Chinese yard, proving that shipyards other than South Korean are picking up orders. Daewoo still heads the newbuildings list and GTT's membrane system remain the preferred method of containment.

More liquefaction and receiving terminals are due to come on stream this year and next, while the Russian Yamal project appears to be on track with some of the specialised vessels already under construction.

The listing has been compiled from many sources, not least the owners/operators themselves and is thought to be accurate as at the beginning of April.

## ALPHA TANKERS & FREIGHTERS

According to French containment system manufacturer GTT, there remained one LNGC on order as at the end of last year.

She is to be fitted with a No 96 LO 3 type system, according to GTT's website.

There was no news of the other vessel originally ordered, but it is believed to be cancelled.

The existence of subsidiary Alpha Gas also could not be confirmed.

## AUSTRALIAN LNG SHIP OPERATING CO (ALSOC)

Still no change at ALSOC, which operates four out of the seven LNGCs originally built for the Northwest Shelf project.

The four entered service between 1989 and 1994.

At least six of the seven vessels have undergone life extension dockings at Sembawang.

## AWILCO LNG

Awilco LNG is a Norwegian based-owner and operator of LNGCs vessels.

The Group currently owns two 156,000 cu m 2013-built LNG TFDE membrane vessels and three 125,000 cu m LNG Moss-type vessels.

Commercial and technical management is handled out of the Group's office in Oslo,

Norway. The Company's shares are listed at the Oslo Stock Exchange under the ticker ALNG.

Last December, the company announced that it was laying up the second of its three older vessels with a view to offering both vessels for storage. As a result, the *WilEnergy* is laid up alongside her sister *WilPower* in Indonesia.

The third of the three older vessels, the 1984-built *WilGas* is still trading on the spot market, following an extensive drydocking last year.

### BERNHARD SCHULTE SHIPMANAGEMENT (BSM)

BSM currently has under management both conventional steam-powered LNGCs and the new-generation Q-flex ships - powered by heavy fuel-oil burning 2-stroke diesels, with cargo boil-off reliquefaction plants.

The third party shipmanagement concern is believed to be involved with the technical management and crewing of Thenamaris' three 160,000 cu m TFDE LNGCs, the last of which was delivered earlier this year, plus the Alpha Gas LNGC scheduled for delivery later this year.

In addition, crewing services are provided for four Q-Flex, plus another 16 LNGCs.

BSM is also involved with the newbuilding supervision and plan approvals for the planned two FLEX LNG vessels.

The group has also developed extensive training courses to prepare crews to take LNGCs out the of delivery yards and into service.

Group fleet director, Chris Clucas is

currently chairman of SIGTTO's general purposes committee, while COO David Furnival sits on the organisation's board. Clucas was also elected inaugural chairman of The Society of Gas as a Marine Fuel (SGMF).

### BG GROUP (METHANE SERVICES (MSL))

At the time of publication, the Shell takeover had still not been confirmed although it looks to be going ahead, thus this shipping review is still treating the companies as separate entities.

BG has confirmed in a statement that it's in "advanced discussions" with Shell but that there is no certainty an offer will ultimately be forthcoming.

Once the merger is formally announced, the fate of BG's shipping arm - Methane Services (MSL) - could hang in the balance.

BG has continued its policy of selling LNGCs on a leaseback basis highlighted in the last *LNG Shipping Review*, published in September, 2014.

The latest disposals were the 170,000 cu m 2010-built TFDE sisters *Methane Becki Anne* and *Methane Julia Louise*, which like the others, have joined the GasLog fleet.

Both vessels were sold to their technical manager GasLog for \$460 mill. MSL will charter the vessels back for between nine and 11 years with options to extend for a further three to five years.

This transaction provides BG with flexibility in managing its future fleet requirements and, as the ships are currently managed by GasLog, leave day to day operations broadly unchanged, the group explained in a statement.

The LNG carriers were associated with a Pension Funding Partnership, which is one element of the Group's funding arrangements for the BG Pension Scheme. Consequently the majority of the proceeds from this sale will be utilised to support the funding of that scheme.

The remaining \$100 mill of the net proceeds from the transaction will be used to reduce the Group's net debt. BG said that the transaction was expected to close in the first quarter of this year, with the charter agreement expected to commence at the same time.

This deal follows last year's sale of six LNGCs to GasLog on a lease-back basis, plus Teekay LNG Partners buying into four 174,000 cu m newbuildings in China. All the vessels will be chartered to MSL, the newbuildings for a 20-year period, plus options (see LNGSR 2014).

In addition, the 2006-built 145,000 cu m *Methane Rita Andrea*, followed by the 2010-built 170,000 cu m *Methane Mickie Harper*, loaded the first cargoes from the group's Queensland Curtis LNG facility at the end of last year and the beginning of 2015, respectively.

The project will expand further with the start-up of the second train in the third quarter of this year. At full production, expected during 2016, QCLNG will have an output of around 8 mill tonnes of LNG per year, BG claimed.

### BONNY GAS TRANSPORT (BGT)

BGT is the shipping arm of Nigeria LNG Limited (NLNG) and was formed in 1989.

The company owns around 13 of the 24 LNGCs operated by NLNG to lift its cargoes. The others are chartered in.

In 2013, BGT ordered six 170,000 cu m LNGCs - four from Samsung and two from Hyundai- for 2015 and 2016 delivery.

As part of this agreement, around 580 Nigerians will be trained in shipbuilding to fulfill the 'Nigerian content' needed for the newbuilding project.

BGT also owns a large fleet of smaller 1970s-1980s built LNGCs, which the company is believed to be keen to sell off.

Indeed in February, brokers reported that the 1984-built LNG *Finima* had been sold to Sahara Energy of Canada for \$15.5 mill for conversion to a floating storage vessel.

The vessels are technically managed by Shell (Stasco) and Anglo-Eastern. Both shipmanagement concerns are taking part in a knowledge transfer project as a result of which, Nigeria LNG Ship Management Services (NLNGSS) was formed in 2009.



One of the Moss-type LNGCs operating on the Northwest Shelf project.



**BP Shipping's *British Emerald* could see some newbuildings joining the fleet soon.**

Two years later, NLNGSS took over the full management of four LNGCs in BGT's fleet.

Recently, it was announced that NLNG had chartered two Golar LNGCs- the 160,000 cu m sisters *Golar Crystal* and *Golar Frost* - for 12 months each having decided to dispose of three of its older vessels earlier than planned, leaving a gap before the newbuildings are due for delivery.

## BP SHIPPING

Last year, it was reported that BP Shipping had received offers from shipbuilders to build up to eight new LNGCs, following a tender process.

Although not confirmed, reports said that BP will make a decision on newbuildings early this year.

It was thought that BP was looking for vessels of around 174,000 cu m capacity, fitted with tri-fuel propulsion systems, for delivery from 2018 onwards. This particular size range has become the popular work horse for the industry.

BP currently manages three 138,000 cu m steam-turbine vessels, which are now around

12 years of age. Another four DFDE LNGCs of 155,000 cu m were delivered in 2007 and 2008.

The company has agreed to purchase 4.4 mill tonnes of LNG per year from the US Gulf Freeport LNG project under a 20-year contract. Shipments are thought to be due to start from 2017.

In addition, BP technically manages the 1991-built *Northwest Shearwater*, which operates for the Northwest Shelf conglomerate.

## BRUNEI GAS CARRIERS (BGC)

Incorporated by the Brunei Government, this joint venture involving Shell Gas and Diamond Gas Carriers was founded in 1998.

BGC currently owns four A-class vessels ranging from 137,000 cu m to 154,800 cu m with another newbuilding due to be delivered this year. The company also provides management services to Brunei Shell Tankers (BST) that owns three B-class vessels range from 75,000 cu m to 77,000 cu m.

The vessels are technically managed by STASCO.

The latest vessel, the 154,800 cu m *Amani*,

was delivered in December last year. She left on her maiden voyage to Tongyeong, South Korea.

## BW MARITIME

Last September, BW Maritime signed contracts with Daewoo for two LNGCs, plus options for additional vessels.

The two firm 173,400 cu m newbuildings will be delivered in late 2017 and early 2018 and will bring the company's LNGC fleet up to 20 upon their delivery.

Earlier this year, BW Pavilion LNG, a joint venture between BW Group and Pavilion Energy, held a naming ceremony at Hyundai Heavy Industries for two Singapore-flagged 161,880 cu m LNGC newbuildings, the *BW Pavilion Vanda* and *BW Pavilion Leeara*.

Pavilion Energy is a Singapore-based Temasek portfolio company and aims to become a global LNG player in Asia. Its wholly-owned subsidiary manages gas operations in Singapore and is also involved in the distribution and trading of LNG in the region.

In addition, two 170,000 cu m FSRUs are due to be delivered from Samsung this year and next.

Among the managed vessels are eight for Nigeria LNG and a further four for GDF Suez. They are also part owned by the group.

## CHEVRON SHIPPING CO

Chevron owns a one-sixth interest in each of seven LNGCs involved in the North West Shelf project in Australia.

Last year, Chevron took delivery of the 160,000 cu m *Asia Vision* from Samsung. It was thought another - *Asia Energy* - is due for delivery early this year.

These will be the first two out of a series of six LNGCs ordered for delivery through 2016, according to industry sources. Four are being shown on containment system

**BW Maritime manages four LNGCs for GDF Suez.**



manufacturer GTT's reference list.

It was believed that the first four newbuildings will be used to ship gas from the Gorgon LNG project in Australia, due on stream this year.

The final two newbuildings could be used to load gas at Chevron's Wheatstone project, which is due to come on stream next year. Earlier, Chevron had said that its Australian interests had signed long term contracts with Tohoku Electric Power to supply gas for up to 20 years from Wheatstone.

Chevron is also involved in the management of at least three LNGCs for Sonangol and has shipped its first cargo from Soyo, the Angolan export terminal, to Brazil.

Last year, Chevron said that it intended to raise its worldwide LNG output by 20% by the end of 2017. The US oil major has major stakes in the two Australian gas fields and has acquired a 50% stake in Canada's planned Kitimat LNG terminal.

### CHINA LNG SHIPPING (INTERNATIONAL) (CLSICO)

China LNG Shipping (International) (CLSICO) was established in July 2004 as a joint venture between COSCO, China Merchants and BP Shipping, initially to serve China's first LNG import project in Guangdong.

The company now manages six vessels serving terminals in Fujian and Shanghai with others to come.

China's LNG industry began in Guangdong, with the development of the country's first LNG terminal at Dapeng Bay, to the east of Shenzhen, later known as Guangdong Dapeng LNG (GDLNG), a project which started in 1998.

In 2002, the North West Shelf project in Australia won the contract to supply 3.7 mill tonnes of LNG, per year, for 25 years; and terminal construction began in December 2003. The first delivery was made in May 2006.

Meanwhile, two leading Chinese shipping companies – COSCO and China Merchants –

formed the Guangdong LNG Transportation Project Office (GLTPO), with the aim of designing and implementing the LNG transportation arrangements.

As part of the tender process for the supply of LNG, bidders offered shipping collaboration proposals, including a commitment to support a new LNG shipmanagement company, which was to be responsible for managing the LNGCs being built in Hudong Zhonghua's yard in Shanghai.

In 2004, the GLTPO became incorporated as China LNG Shipping (Holdings) (CLNG), a Hong Kong registered company owned in equal 50% shares by COSCO and China Merchants.

As one of the participants in the North West Shelf project, BP Shipping agreed to act as the foreign partner in the shipmanagement joint venture and to offer provide support, mainly by secondments of experienced sea and shore staff.

In July 2004, BP Shipping joined CLNG in forming China LNG Shipping (International) (CLSICO). A Hong Kong registered company, CLSICO was owned 60% by CLNG and 40% by BP Shipping. Shipmanagement agreements for the two GDLNG LNGCs - a third was later added - were signed in August 2004.

Subsequently, CLSICO was awarded contracts to manage two LNGCs for Fujian LNG (FJLNG) and, more recently, one LNGC for Shanghai LNG.

CLSICO had become sufficiently mature to enable BP Shipping to exit in mid-2013, under the shareholders' agreement between CLNG and BP. As a result, BP Shipping sold its shares in CLSICO to CNOOC on 1st August, 2013.

However, CLNG as the remaining shareholder decided that CLSICO would continue to use a combination of Chinese and Western seafarers, both in the office and on the ships, for the foreseeable future.

### CHINA NATIONAL OFFSHORE OIL CO (CNOOC)

CNOOC and its partners have at least four 174,000 cu m LNGCs on order at

Hudong-Zhonghua.

Some of the orders were placed in joint ventures with Teekay and the Japanese majors.

### CHINA SHIPPING DEVELOPMENT (CSDC)

CSDC has ordered three Ice Class LNGCs for the Yamal LNG project together with partners CLSICO and MOL.

They will be owned by single vessel joint venture companies.

In addition, six 174,000 cu m vessels are on order at Hudong-Zhonghua in a joint venture with MOL, which are due for delivery in 2016-2017.

The vessels were thought to be earmarked for long terms charters to Sinotrans to serve its Australia Pacific joint venture project.

### CYGNUS LNG SHIPPING

Nippon Yusen Kaisha (NYK), Tokyo Electric Power Co (TEPCO) and Mitsubishi Corp established Bahamas-based Cygnus LNG Shipping, in 2006.

TEPCO provided 70% of the capital while NYK and Mitsubishi contributed the remaining 30% on a 50:50 basis.

As a result, the 147,000 cu m Moss-type LNGC *Cygnus Passage* was built by Mitsubishi Heavy Industries and delivered in 2009.

The LNGC ships gas from the Sakhalin II project loading at Prigorodnoye, located south of Sakhalin for TEPCO's receiving terminals in Japan.

### DYNAGAS LNG PARTNERS

This company was formed by Dynagas Holding to own and operate the company's LNGCs on long term charters of at least two years.

At present, the partnership has five LNGCs on its books- three 149,700 LNGCs and two of seven 155,000 cu m winterised and Ice Class LNGCs. The investment vehicle also has options to purchase the remaining five, the last of which was due to be delivered from Hyundai this year.



**Ob River was the first LNGC to transit the Northern Sea Route.**

LNG OneWorld.com



At least three LNGCs have been long term chartered to Gazprom, the first of which - *Ob River* - became the first LNGC to transit the Northern Sea Route in 2012.

### EMPRESA NAVIERA ELCANO

The Spanish shipping concern manages two LNGCs - a 2003-built 138,000 cu m vessel and a 173,600 cu m gas carrier, delivered by STX in 2010.

The later vessels was built to ship gas cargoes from the Peru LNG facility under a Repsol charter.

Elcano has since signed a contract with Imabari for the construction of two 178,000 cu m LNGCs, which will be fitted with GTT's Mark III Flex containment system and powered by MAN ME-GI propulsion systems.

### EXCELERATE ENERGY

Excelerate Energy (Exelerate) operates a fleet of 10 LNGCs, which include one traditional LNGC and nine patented Excelerate Energy Bridge FSRUs.

All of the nine FSRUs were purpose-built. Once the LNG is loaded, there are three separate ways of discharging the cargo - as liquid at a traditional LNG regasification terminal; as gas via the company's Energy Bridge Gateway buoy-based STL system; and via the dockside GasPort system with an on board high-pressure gas manifold that connects to the dockside off-loading arm.

In August 2011, Excelerate and Petrobras signed a contract for the construction and 15-year charter of a 173,400 cu m, 800 mill cu ft per day FSRU.

As a result *Experience* was delivered to Petrobras' Guanabara Bay facility in Brazil in May of 2014. It is capable of operating as both an FSRU and a fully operational LNGC.

More recently, Excelerate, in co-operation with the Puerto Rico Electric Power Authority (PREPA), has received the final Environmental Impact Statement (EIS) from the US Federal Energy Regulatory Commission (FERC) for its Aguirre Offshore GasPort Project located offshore Puerto Rico.

In the coming months, Excelerate said it will continue to work with FERC and co-operating agencies to obtain the required certificates and permits. The facility is expected to be in service in 2016.

In early January this year, Excelerate undertook its 700th commercial ship-to-ship (STS) transfer of LNG in Escobar, Argentina at the GNL Escobar LNG import facility.

Using Excelerate FSRU *Exemplar*, and the conventional LNG carrier *Cadiz Knutsen*

73,778 cu m of LNG was transferred using the double-banked LNG transfer system. Of the 700 operations, 602 have been with third-party vessels.

Late last year, Excelerate signed an agreement with the Government of Equatorial Guinea and Ophir Energy for the provision of a floating liquefaction storage and offloading vessel (FLSO).

The project, called Fortuna FLNG, will be located at Block R, Equatorial Guinea, which is owned 80% by Ophir and 20% by the national oil company of Equatorial Guinea, GEPetrol.

Excelerate will act as the lead in a consortium of technology providers that is expected to include Samsung Heavy Industries and Black & Veatch. Upon completion of Definitive Agreements and FID, Excelerate will build, own and operate the FLSO and provide liquefaction services to Ophir. First gas is expected in 2019.

In addition, Dubai Supply Authority (DUSUP) has entered into a 10-year charter agreement with the company, by which Excelerate is to provide and operate an FSRU that will be located at DUSUP's existing Jebel Ali LNG import terminal.

The FSRU was expected to be in service in April of 2015 to cover the drydocking of the existing FSRU at the Jebel Ali terminal. The 151,000 cu m FSRU to be used will come from Excelerate's existing fleet and will be upgraded in the latter half of this year to be capable of a regasification capacity of 800 MMcf/d from 2016.

### EXMAR

Antwerp-based Exmar currently manages 10 FSRUs and another five conventional LNGCs. In addition, the company currently has one further FSRU and two FLNGs under construction.

Exmar said that it was not affected by the downturn in the market, as most of its vessels were on long term charters.

Nine of the FSRUs and one of the conventional gas carriers are commercially operated by Excelerate Energy, while one FSRU is commercially operated by OLT (a subsidiary of E.ON and Iren).

The latest LNGRV, the 173,400 cu m *Experience*, was delivered last year and immediately entered into a long term charter with Petrobras to serve the Guanabara Bay receiving terminal under a 15-year deal.

The construction of the 26,230 cu m FSRU, which was ordered jointly by Exmar and Pacific Rubiales at Wison, is proceeding as

planned and will be ready for operation in the second half of 2016. This unit has no contractual commitment thus far, Exmar said. Pacific Rubiales' Caribbean FLNG project in Tolú, Colombia has been postponed, due to changed market conditions.

Pacific Rubiales said that it remained committed to its contract with Exmar and will take delivery of the FLNG barge in the second half of this year. The company is evaluating different alternatives for the FLNG's employment, including moving the barge to another site. Its construction at Wison, Nantong, China is nearing its completion.

As for the Douglas Channel FLNG project in Kitimat, British Columbia, Exmar together with partners AltaGas, Idemitsu and French electricity concern EDF has gained full control of the project and a final investment decision is expected by the end of this year with a view to starting LNG exports in 2018.

Exmar also recently announced an order for a second FLNG barge at Wison. The barge will be self-contained and have a liquefaction capacity of 600,000 tonnes per year and a storage capacity of 20,000 cu m of LNG when delivered in 2017. The company also holds options for another two barges.

In a further initiative, Exmar and the Port of Antwerp recently completed a study for the development of LNG bunkering within Antwerp. It was concluded that the necessary critical demand for this service currently does not exist. It was therefore decided not to jointly invest in an LNG bunker vessel at this point in time.

Exmar was recently appointed by the Port of Dunkirk to work on the development of LNG bunkering services from the LNG terminal at Dunkirk. This project will be developed in joint venture with the terminal operator, Dunkerque LNG and with Air Liquide.

### FLEX LNG

The Norwegian-based innovative LNG concept is back in the news, as it has been announced that the two vessels ordered will have their specifications changed from LNG FPSOs to conventional LNGCs.

In addition, they will be powered by ME-GI propulsion units instead of the original DFDE power plants.

An agreement has been reached with builder Samsung to convert the vessels and the propulsion systems to 2-stroke slow speed ME-GI main engines.

This has resulted in a price increase, due to the change in engine specification, the

deployment of the new engine system and exhaust gas treatment for compliance with new emissions regulations, 0.09% boil-off rate to maintain speed flexibility and the installation of ballast water treatment systems.

In addition, the expected delivery dates of both vessels were put back from the first quarter of 2017 to the first and second quarter of 2018.

FLEX LNG claimed that for a typical long haul trade, the new and more efficient twin-screw LNGC design with ME-GI engines will have average daily fuel consumption (gas and fuel oil) of around 25% less than the DFDE LNGC design recently delivered into the market.

## GASLOG

Earlier this year, GasLog and GasLog Partners announced that they had agreed to charter three newbuildings to Methane Services (MSL).

The BG group subsidiary also has an option to charter an additional six newbuildings provided it firms up the options this year. The highlights of this transaction are as follows:

MSL will charter three newbuildings commencing mid-2018 and early 2019 for average initial terms of about 9.5 years, adding around \$845 mill of fixed rate revenue to GasLog's existing contracted revenue backlog, the company said.

If declared, the six newbuildings will be chartered for average initial term of around 10 years. These vessels would add about \$1.8 bill of fixed rate contracted revenue should MSL exercise the option.

The three ships to be chartered by MSL will be of 174,000 cu m capacity with low-pressure, 2-stroke propulsion technology. Two of the vessels will be delivered from Hyundai Heavy Industries and the other from Samsung Heavy Industries.

Together with MSL's charter of the three GasLog newbuildings and as part of MSL's overall portfolio management, the three existing charters on the *GasLog Shanghai*, *GasLog Santiago* and *GasLog Sydney* (all owned by GasLog Partners) will be adjusted.

MSL will lengthen two of the existing charters by around four months and shorten one charter by eight months. MSL will retain the existing extension options of two consecutive periods of three or four years on all three vessels.

If MSL exercises the options for the other six vessels, the *GasLog Shanghai*, *GasLog Santiago* and *GasLog Sydney* charters would

be further adjusted by a potential shortening of a maximum 31 months in total, with the aim of redelivering these ships to coincide with the newbuilding deliveries in 2017.

This would be the time when management believed there will be a tightening of the supply/demand balance for LNGCs, as currently indicated by new vessel orders and prospective LNG projects.

In addition, GasLog is about to take over another two 170,000 cu m TFDE LNGCs - *Methane Becki Anne* and *Methane Julia Louise* - from MSL, following the six purchased last year.

The vessels will cost \$460 mill in total and will be chartered back for nine and 11 years, respectively, adding \$590 mill to the company's contracted revenue. There are also options to extend the charters by a further three to five years.

The purchase was expected to close by the end of March 2015 and will increase the consolidated fleet to 27.25 vessels.

Similar to most of the other 'Methane' vessels, GasLog supervised the construction of the vessels and has technically managed both vessels since their delivery to a subsidiary of BG Group in 2010.

Under the omnibus agreement with investment vehicle GasLog Partners, the company will be required, within 30 days following the closing of the Pending Vessels Acquisition, to offer the partnership the opportunity to purchase the vessels at the acquisition cost, plus certain administrative costs. At present, GasLog Partners owns five LNGCs.

In December, GasLog launched 'GasLog 40:17' vision, which sets out the company's ambition to increase the consolidated fleet to 40 vessels by the end of 2017.

As of 31st December 31, 2014 GasLog had seven newbuildings on order at Samsung

Heavy Industries and two at Hyundai Heavy Industries.

The wholly-owned fleet consists of 20 LNGCs, including 11 ships on the water and the nine newbuildings. Four of the most recently ordered ships come with the option to change the propulsion from TFDE to 2-stroke diesel engines with low-pressure gas injection (LP-2S). GasLog Partners owns a further five LNG carriers, while GasLog technically manages a further six vessels.

Through the company's wholly-owned subsidiary GasLog LNG Services, 21 LNGCs are operated, which includes the wholly-owned owned ships, as well as five ships owned or leased by BG Group and one additional LNGC in which GasLog has a 25% interest.

Naturally, the commercial and technical partnership with MSL could change next year with the takeover by Shell.

## GAZOCEAN

The Marseille-based company manages five LNGCs and is a joint venture between GDF SUEZ and NYK.

Three of the vessels are operated by GDF SUEZ, which see, while the other two by NYK, which see.

## GAZPROM MARKETING & TRADING (GM&T)

The London-based commercial arm of Russian energy giant Gazprom currently operates five LNGCs on long term charters with another one to come this year.

Three are managed by Dynacom, while the other two are under Sovcomflot management.

In July of this year, GM&T is due to take delivery of another Dynacom LNGC - the 149,700 cu m *Clean Force*, to be renamed *Amur River*. She will be sub-chartered to SEIC.



*Yenisei River* and *Pskov* seen undergoing a ship-to-ship transfer.



**The FSRU  
Independence  
seen at Klaipeda.**

All of the company's chartered vessels are winterised and ice class.

Last December, GM&T conducted its first ship-to-ship LNG transfer, which was undertaken by the chartered Dynacom LNGC *Yenisei River* and the Sovcomflot chartered *Pskov*. The latter was the vessel delivering the cargo, which was loaded in Spain.

The transfer operation took place at sea off Linggi, Malaysia and was successfully completed on 6th December. GM&T was supported by specialist STS cargo transfer operator SPT.

### GOLAR LNG

Last year, Golar LNG took delivery of eight LNGCs and an FSRU - *Golar Eskimo*.

In early 2015, the *Golar Eskimo*, which has a 10-year contract with the Government of Jordan, was sold to Golar's yield based investment vehicle, Golar LNG Partners for \$390 mill.

Following this sale and the subsequent delivery of a further three LNGCs, Golar LNG is today left with a fleet of 14 LNG vessels in operation and one FSRU under construction.

Of the 14 vessels on the water, three are 1970's built carriers, either awaiting or under conversion to floating liquefaction (FLNG) units, one is a modern steam turbine carrier and the remaining 10 vessels are recently delivered larger TFDE carriers featuring new technology.

All of the vessels, except the 1970's conversion candidates, are operating in the spot and short term market and two LNGCs were recently placed on 12 month charters with Nigeria LNG who used Golar's newbuilds to replace three older carriers that have been retired from service.

The FSRU *Tundra*, currently under construction, is scheduled to deliver in November 2015 and will service a project off

the coast of Ghana. This project, led by Quantum Power, is expected to reach a Final Investment Decision in the second quarter of 2015. Golar will, however, continue to market the FSRU for other projects ahead of the FID being concluded.

Golar LNG Partners, a yield-based master limited partnership, has 10 vessels, including the *Golar Eskimo*, six of which are FSRUs and four of which are conventional LNG carriers. All 10 vessels are on long term charters that provide a revenue backlog of \$2.7 bill and an average remaining contract term of around six years.

Over the course of 2014 to date, Golar LNG Limited has taken substantial steps toward its goal, which is to be a leading integrated midstream LNG company, the company said.

To this end, Golar together with Keppel and Black and Veatch, initiated the conversion of the 1975-built LNGC *Hilli* to a Golar floating Liquefaction unit (GoFLNG). In December, Golar executed a heads of agreement with Societe Nationale de Hydrocarbures (SNH) and Perenco Cameroon for the deployment of the GoFLNG *Hilli* to a stranded gas field off the coast of Cameroon.

This project, which aims to take FID by June 2015, requires the GoFLNG *Hilli* to be in place for production of first gas in April 2017. In December, Golar also contracted to convert the *Gimi*, the second of its three conversion candidates into a GoFLNG unit. Although this contract, also with Keppel and Black and Veatch, has certain termination options, Golar said that it was confident that it will proceed with the *Gimi* conversion before the end of 2015.

In addition to encouraging progress on a Canadian FLNG project, Golar is working in British Columbia with the Haisla First Nations.

Golar and Rosneft have also entered into a Memorandum of Understanding aimed at co-operating in the field of FLNG and the transportation of natural gas. Under this MoU the companies will pursue the development of opportunities for the use of GoFLNG facilities to service Rosneft controlled gas reserves in Latin America and elsewhere.

### H-LINE SHIPPING

Private equity concern Hahn & Co completed its purchase of the majority stake in Hanjin Shipping's bulk business during the middle of last year.

As a result, H-Line Shipping was formed, which is 77.8% owned by Hahn & Co and 22.2% by Hanjin.

Hanjin has contributed 36 ships, including seven LNGCs to H-Line Shipping.

The joint venture company has now taken over Hanjin's dedicated bulk business service for Posco, Kepco, Glovis and Kogas, along with all the assets, debts and related contracts, the company confirmed.

H-Line's LNG department operates seven LNGCs, including three shared vessels. Hanjin originally introduced the world's first membrane type gas carrier - *Hanjin Pyeongtaek*.

The LNGCs operate under the 20 - 25 year contracts with KOGAS.

### HOEGH LNG

Last year, Hoegh LNG ordered its seventh FSRU and signed two more FSRU long term contracts.

The FSRU will be built at Hyundai and is scheduled for delivery in the first quarter of 2017. She will follow another FSRU due for delivery from the same shipyard later this year.

The latest order is the fifth in the current newbuilding series and was a declared option.

As for the other FSRUs in the fleet, the GDF *Suez Neptune* is currently operating as an LNGC on the charter market, while the GDF *Suez Cape Ann* in on a 20-year charter operating as an FSRU at Tianjin, China and has been sub-chartered to CNOOC on a medium term contract.

The PGN FSRU *Lampung* started operations on a 20-year charter at Lampung, Sumatra last year, the *Independence* also started operations as an FSRU at Klaipeda, Lithuania in 2014 under a 10-year charter, while the newly delivered *Hoegh Gallant* traded on the spot market as an LNGC before starting operations as an FSRU at Ain Sukhna, Egypt under a five year agreement with EGAS.

The FSRU will allow the country to begin natural gas imports. Hoegh signed a five-year contract with Egypt in November 2014 to provide the import terminal and the country has since agreed to a number of LNG import deals.

EGAS has agreed to import 33 LNG cargoes from Trafigura, nine from Vitol, seven from Noble, and six from Sonatrach, to be delivered in this year and next, a Reuters report said.

In addition, in March, EGAS signed a deal to import 35 LNG cargoes from Gazprom over five years.

Hoegh LNG has also signed a contract with Sociedad Portuaria El Cayao for a new FSRU import terminal in Colombia and also signed a joint development agreement with the project sponsor for a second North American FLNG project.

The company said that it intends to double its FSRU fleet within the next four years.

Hoegh LNG also manages three conventional LNGCs and manages another on behalf of GDF Suez.

In August of last year, Hoegh formed Hoegh LNG Partners, a master limited partnership.

As per the omnibus agreement, the partnership has a right to purchase from Hoegh LNG all or a portion of its interests in the FSRU *Independence* within 24 months after the acceptance of the vessel by her charterer. Hoegh LNG is also obligated to offer to the partnership any FSRU or LNGC operating under a charter of five or more years.

## HUMPUSS INTERMODA TRANSPORTASI (HITS)

The LNGC business is conducted by a subsidiary within HITS Group.

HITS owns the LNGC *Ekaputra* and also manages three gas carriers owned by other parties.

All four vessels are operating under long term charter to Pertamina.

In November last year, HITS said that it intended to invest some \$315 mill on shipping in 2015, included in which is the purchase of three LNG shuttle tankers worth about \$205 mill.

HITS also said that it aimed to double its LNGC business capacity both to import gas and to transport it domestically.

## HYPROC SHIPPING SERVICES

The shipmanagement arm of Algerian gas major Sonatrach, Hyproc has two LNGCs on order at Hyundai for 2016-2017 delivery, plus at least one option.

It is believed that once delivered, the 170,000 cu m DFDE LNGCs will replace elderly LNGCs currently under management.

Japan's Itochu Corp provided assistance up to the signing of the contract and will support implementation until the handover of the vessels, the company said.

Itochu jointly owns and operates three LNGCs with Sonatrach, Hyproc and MOL.

Hyproc currently manages eight LNGCs of which three were built in the 1970s and two in the 1980s.

## HYUNDAI MERCHANT MARINE (HMM)

HMM's LNGC operation was launched in 1994 with South Korea's first natural gas vessel – *Hyundai Utopia* - to execute a 20-year contract with the Korea Gas Corporation (KOGAS).

HMM now operates eight LNGCs transporting KOGAS cargoes from around the world to South Korea.

HMM has also been providing shipmanagement service to Tsakos for the *Neo Energy* since she was delivered in 2007. In addition, it was recently announced that Hyundai will manage two of the KOGAS newbuildings to serve the Cheniere project.

## IINO KAIUN KAISHA

The company claimed that it had been involved in Japanese and other LNG consortia for many years.

In 2005, Iino started to manage LNGCs with the arrival of the *SK Sunrise*, which is chartered to KOGAS.

Three years later, the company entered into a joint venture with Kansai Electric Power Corp (KEPCO) and today, the company is

thought to be involved in 26 LNGC projects worldwide.

## KAWASAKI KISEN KAISHA (K LINE)

At the end of the 2014 fiscal year, K Line had interests in 43 LNGCs.

According to the next five-year plan, the Japanese giant intends to increase its LNGC interests to 47 vessels by the end of the 2017 fiscal year and rising to 61 vessels by the end of fiscal year 2019.

One of the latest contracts was signed at the end of last year when K Line agreed a long-term timecharter agreement for a new 164,700 cu m Moss type LNGC with Chubu Electric Power.

Subsequently, the company signed a newbuilding contract with Kawasaki Heavy Industries (KHI).

Chubu Electric is involved in the construction, as well as the operation of Freeport LNG and this new vessel will ship LNG from the project located in Texas.

K Line had already executed a previous long-term timecharter contract with Chubu Electric in April 2013 for a vessel with identical specifications.

The company is also involved with many consortia including Petronet, INPEX and Total, plus the other Japanese majors- MOL and NYK, which see.

The INPEX project involves a Panamanian-registered company Oceanic Breeze LNG Transport (OBLT), a joint venture between K Line and Inpex Shipping.

OBLT signed a \$125 mill loan agreement with the Japan Bank for International Cooperation (JBIC), Mizuho Bank, and Mitsubishi UFJ Trust and Banking Corporation, to finance the construction of a 155,300 cu m LNGC.

She is being built by Mitsubishi Heavy Industries and upon her delivery late next year, she will be engaged in the transport of natural gas from the Ichthys LNG Project in Western Australia to Inpex's Naoetsu LNG receiving terminal at Niigata.

The company's first LNGC was the 125,000 cu m *Bishu Maru* delivered in 1983.

This year, K Line announced that it is to sell all its shares in FLEX LNG, having received an offer through the Oslo Stock Exchange.

Since June, 2008, as a shareholder of FLEX LNG, the company said that it had promoted the floating LNG business mainly targeting small and medium sized gas fields.

K Line had been the largest shareholder



One of the Madrid-managed Knutsen LNGCs.

and a strategic partner in this business, but said that regretfully the targeted projects have gradually stagnated, due to the economic downturn precipitated by the global financial crisis in 2008. In addition, the US shale gas development brought in a drastic change in the market trends.

FLEX LNG reviewed its strategy and agreed with Samsung Heavy Industries to change the existing LNG FPSO building contracts into LNGCS.

### KNUTSEN OAS SHIPPING

Knutsen has two 176,300 cu m LNGCs on order at Hyundai for delivery during the second half of next year under a 20-year charter agreement with Gas Natural.

They will be powered by MAN ME-GI type engines.

The company's gas business currently has nine LNGCs operating, including the 1,100 cu m *Pioneer Knutsen*, which delivers gas supplies along Norway's West Coast.

Knutsen entered the LNG market with the delivery of its first gas carrier in 2004.

The first 138,400 cu m LNGC carrier series were built in Spain with steam turbine propulsion.

During 2010, Knutsen took delivery of four larger vessels from DSME all fitted with dual fuel engines.

One of the vessels has DNV GL Ice Class 1A and winterisation notation. She was constructed with a super-reinforced cargo containment system.

The fleet is managed from Haugesund and Madrid as the latter looks after the Repsol and Gas Natural chartered tonnage.

### KOREA GAS CORP (KOGAS)

Although difficult to quantify, it is thought that KOGAS charts 25-30 LNGCs to feed the energy company's three receiving terminals.

KOGAS claims to be the world's largest importer of natural gas.

There are also believed to be more LNGCs to come on the back of newbuildings attached to KOGAS charters.

Two 174,000 cu m LNGCs worth around \$417 mill, were recently ordered by SK Shipping at Samsung on the back of KOGAS charters.

The LNG carriers will feature the newly developed KC-1 cargo hold system together with KOGAS' onshore membrane LNG tank.

DSME also concluded a deal with Korea Line and Hyundai LNG for construction of four LNGCs. The shipping companies will manage two vessels each.

This order forms part of KOGAS tender for six LNGCs, awarded last year.

The six vessels will be used to transport an annual 2.8 mill tonnes of shale gas from the Cheniere Energy's Sabine Pass complex in the US to South Korea beginning in 2017.

### KOREA LINE (KLC)

KLC is still shown as owning four LNGCs and is believed to have a part share in another four all operating for energy majors,

such as KOGAS.

It has also been reported that Korea Line will manage two of the KOGAS newbuildings earmarked for the Cheniere project.

The company is also believed to control smaller coastal gas tankers, as is the case with many Asian LNGC operators/owners.

### LNG SHIPPING SPA

This company operates two 1990s-built LNGCs on behalf of parent ENI.

Both are managed by Exmar.

The company is also involved in offshore LNG terminal projects.

### MARAN GAS MARITIME (MGM)

MGM is the gas shipping subsidiary of Angelicoussis Shipping Group Limited (ASGL).

The subsidiary was set up in 2003 and took delivery of its first LNGC in 2005.

MGM manages 11 LNGCs of between 145,700 cu m and 161,870 cu m capacity. In addition, the company has ordered another 15 LNGCs for delivery this year through 2016 split between Daewoo and Hyundai Samho.

They range from 159,800 cu m to 174,000 cu m in capacity.

MGM had chartered its first four LNGCs to RasGas, which has led to the setting up of Maran Nakilat joint venture.

This new co-operative owns 11 LNGCs, some of which were purchased from MGM who kept the management. It is believed that Nakilat owns 40% of the joint venture having obtained considerable funding during the past two to three years.

Other major charterers of MGM's LNGCs include BG and Woodside.



Maran Gas Ascepius seen leaving the River Loire.

ASGL has its own training centre - Delphic Maritime Training Centre - based near its offices.

Apart from bridge and engine room simulators, the centre is equipped with a liquid cargo handling simulator and operates LNGC training under SIGTTO and DNV GL guidelines.

## MISC BERHAD

According to reports from Malaysia, Petronas has sold the five LNGCs being built by Hyundai Heavy Industries to its shipping subsidiary MISC for \$1.1 bill.

Petronas LNG has agreed to charter the five 150,200 cu m newbuildings, expected to be delivered from September 2016 to December 2017, for a period of 15 years, with a five-year extension option.

MISC has also announced that Petronas LNG has extended the charter of five refurbished *Puteri* class LNGCs on a timecharter basis for another 10 years.

The charters will start upon the delivery of the refurbished vessels, expected from September 2015 to September 2017.

In total MISC manages 27 LNGCs, while Petronas is involved with FLNG projects. Two of MISC's LNGCs were converted to FSUs to operate at Malaysia's first regasification terminal, which began operating around 18 months ago.

## MITSUI OSK (MOL)

MOL first participated in an LNG transport project in 1983.

Ten years later, as a representative of a Japanese consortium, MOL played a key role in the conclusion of the largest LNG transport contract in the 20th Century, the Qatar Project, moving 6 mill tonnes of LNG annually from the Middle East to Japan.

In 2003, MOL signed a comprehensive service support contract with the Omani Government to develop the nation's ocean shipping industry by way of operating and managing six co-owned LNGCs.

In 2010, MOL concluded a basic agreement with ExxonMobil for the construction and chartering of four LNGCs, which will load in Papua New Guinea/Australia for China. This agreement set the stage for MOL to become the first non-Chinese shipping company involved in China's LNG import market.

The first vessel - *Papua* - was delivered from Hudong-Zhonghua on 30th January this year. She is the first of four 171,800 cu m LNGCs to be built by Hudong to lift gas from the PNG LNG project in Papua New Guinea

and the Gorgon Jansz LNG project in Australia.

MOL will operate the *Papua* under a long-term charter contract for the PNG LNG project operated by ExxonMobil.

In 2013, MOL signed a contract to build a series of LNGCs through a joint venture with China Shipping and Sinopec.

Last year, the company ordered three double-acting ice-class LNGCs at Daewoo to transport gas from Russia's Yamal LNG project.

MOL's successful relationship with its Chinese partners in the PNG project led to the building of a further six new LNGCs for Sinopec, in which MOL has participated since April, 2013.

These ships are now under construction at Hudong. The 10 Chinese vessels will be completed by 2017.

In MOL's 'STEER FOR 2020' programme, the company aims to increase its LNGC fleet from the current 66 vessels to 120 by 2020, including the 10 vessels serving the Chinese projects, the company said.

Other recent contracts include a joint venture with Itochu to charter two newbuildings to E.ON subsidiary EGC. At the same time, the 179,900 cu m vessels were ordered at Daewoo.

MOL will manage the two new vessels, which will transport LNG from a shale gas liquefying plant in North America to Europe and other destinations around the world upon commencing the 20-year charter in 2018.

On 29th January it was announced that MOL had signed a contract with Mitsui & Co

to charter a new 177,000 cu m LNGC.

She will be the third newbuilding chartered by Mitsui & Co, following a contract signed last September for two LNGCs. MOL will manage the new vessels and transport shale gas-derived liquefied natural gas from the Cameron Project in Louisiana, US.

The company has also concluded a basic agreement on a timecharter contract for a newbuilding LNG carrier with Tokyo LNG Tanker Co, a wholly-owned subsidiary of Tokyo Gas.

At the same time, MOL signed a contract with Japan Marine United Corp (JMU) to build the new vessel.

She will be the third new 165,000 cu m vessel that MOL will manage, following two other newbuilding LNGCs now operating under contract with Tokyo LNG Tanker and built by JMU. These ships were launched on February 28 and November 28, 2014.

Like its sisters, the third vessel will also transport LNG from the Cove Point LNG Project in the US to Tokyo Gas facilities.

MOL is involved in operating 11 of 14 LNGCs owned and managed by Tokyo LNG Tanker, including the newbuilding and directly manages eight.

In total, the Japanese giant claims to be involved with more than 25% of the LNGCs currently in service.

## NAKILAT

Qatar Gas Transport Co (Nakilat) operates more than 60 LNGCs, plus four VLGCs, some of which are wholly owned while the others are jointly owned in consortia.



One of the Maran Nakilat LNGCs taking a well earned rest.

The LNGCs are chartered through long-term timecharter agreements with Qatargas and RasGas. The jointly-owned LNGCs are operated by the vessel's co-owners.

Since the company's inception in 2004, it has diversified into ships agency, shipbuilding and repair.

A large shiprepair and building complex was built at Ras Laffan and is operated by Nakilat-Keppel Offshore & Marine (N-KOM) as a joint venture. The shipbuilding segment is handled by Nakilat Damen Shipyards Qatar in another joint venture.

In April last year, Nakilat added another three LNGCs to its fleet by way of another joint venture with Angelicoussis' Maran Gas - Maran Nakilat.

The trio increased Maran Nakilat's fleet to 11 vessels, giving the Qatari concern 61 LNGCs in total.

Of Nakilat's wholly-owned fleet, 25 vessels are managed by STASCO, including Q-flex and Q-max types, for between eight to 10 years.

Nakilat intends to takeover the technical management of the fleet following the end of the contracts with STASCO.

### NATIONAL GAS SHIPPING CO (NGSCO)

NGSCO was formed in December 1993 to transport gas on behalf of Abu Dhabi Gas Liquefaction Co (ADGAS).

The company still operates the original eight 137,000 cu m vessels, which were the largest in the world when delivered between 1994 and 1997.

Built to a Moss Rosenberg design, the first four vessels were built in Japan, while the final four came from Finland.

Initially, the LNGCs were managed by third parties but since 2007 they have been fully managed by NGSCO.

Two years later, the supporting services were merged with those of ADNATCO to form one management concern.

### NIPPON YUSEN KAISHA (NYK)

At the end of the 2013-2014 fiscal year, NYK operated 29 LNGCs and had interests in a total of 67.

This figure has risen recently as a few gas carriers were delivered towards the end of last year. The company also said that it planned to invest in more LNGCs up to 2018, the end of its current five year programme.

The total number of LNGCs in which NYK could have a share might reach 100 by 2019, the company said.

On 29th January, 2015, NYK concluded a timecharter contract with Mitsui & Co for a new Moss type 177,000 cu m LNGC earmarked for the Cameron LNG project based in the US state of Louisiana.

This is second new contract, following an agreement concluded with Mitsui & Co on 26th September, 2014.

The latest gas carrier will be delivered from Mitsubishi in 2018 and chartered for a maximum of 25 years. The new vessel will be owned by Rosewood Shipping, a wholly owned subsidiary of NYK, while an NYK Group company will be responsible for shipmanagement.

Last year, the NYK/Knutson/TS Shipping Invest partnership announced an order for two 176,000 cu m ME-GI propelled LNGCs that will be chartered to Spanish energy company Gas Natural on a 20-year plus basis from their delivery by Hyundai Heavy Industries in the second half of 2016.

On 11th September, the LNGC *Pacific Arcadia* was named and delivered on charter to TEPCO to ship gas from Papua New Guinea for 15 years under the operational management of LNG Marine Transport.

A few days earlier, the *Seishu Maru* was named at Mitsubishi's Nagasaki shipyard.

Upon her delivery to a joint venture concern involving NYK, Chubu Electric Power and Mitsubishi Corp, she started to transport LNG from Australian and North American projects.

NYK has also become involved with LNG bunkering and will deliver the world's first LNG bunkering vessel to fuel gas powered ships in a joint venture with GDF SUEZ and Mitsubishi Corp.

The vessel will be based at Zeebrugge in Belgium.

### NOVATEK

On 23rd January, 2015, Yamal LNG announced that Yamal Trade and Gazprom Marketing & Trading Singapore had signed a long-term supply and purchase agreement to supply 2.9 mill tonnes of LNG per annum produced by Yamal LNG.

The 20-year agreement stipulates the supply of gas to the Asia/Pacific region, primarily to India, with the LNG price indexed to crude oil.

OAQ Yamal LNG, in which NOVATEK holds an 60% equity stake, holds the license for exploration and production at the South-Tambeyskoye field valid until 2045.

The South-Tambeyskoye field was discovered in 1974 and is located in the north-

eastern portion of the Yamal Peninsula.

The liquefaction plant will include three trains of 5 - 5.5 mill tonnes annual capacity each, as well as LNG storage facilities. The shipment infrastructure will include a jetty with two loading berths at the port of Sabetta equipped with ice protection facilities. Specially designed ARC-7 class LNGCs will be used to transport the gas.

In 2013, a slot reservation agreement was signed with Daewoo for the construction of up to 16 ARC-7 Ice Class LNGCs. The same year, an order for the first 170,000 cu m Ice Class LNGC was also placed by Sovcomflot at Daewoo.

Last year, MOL ordered three double acting Ice Class LNGCs in co-operation with China Shipping LNG, for the project at Daewoo and Teekay LNG together with China LNG ordered another three.

GTT has also announced that it had won orders for "specially adapted" No 96 membrane containments systems for nine Ice Class LNGCs, including the six mentioned above.

The final investment decision for the project was made in December 2013 with the planned commercial launch of the first LNG train due in 2017.

### OMAN SHIP MANAGEMENT

A subsidiary of Oman Shipping Co, this company took delivery of its seventh LNGC last year - the 162,000 cu m *Adam LNG*.

The management arm started operations in 2003 to look after the commercial side of the business. The technical management is undertaken by MOL, which also continues to act as a consultant to the company.

The *Adam LNG* has accommodation for up to six cadets, plus an instructor.

### OVERSEAS SHIPHOLDING GROUP (OSG)

OSG manages four 216,000 cu m Q-flex type LNGCs on behalf of Nakilat.

The company owns 49.9% of the vessels, which entered service in 2007-2008.

They are operating on 25-year charters to QatarGas.

### PAN OCEAN

Formerly STX Pan Ocean, the company has recently been restructured.

Its gas carrier interests began in 2005 when the company was selected as a contractor for a KOGAS project to ship LNG from Yemen to South Korea.

To service this project, the company took

delivery of the 153,600 cu m LNGC *Kolt* in December, 2008.

Another LNGC - the 2010-built STX *Frontier* - was operated from 2010 to 2013 following which, she was sold to GasLog for about \$160 mill.

## PETRONAS

Malaysian oil major Petronas has reportedly sold five LNGCs being built by Hyundai Heavy Industries to its shipping subsidiary MISC for \$1.1 bill.

In return, Petronas LNG has agreed to charter all five 150,200 cu m newbuildings, expected to be delivered from September 2016 to December 2017, for a period of 15 years, with a five-year extension option.

Petronas LNG has also extended the charter of five refurbished *Puteri* class LNGCs on a timecharter basis for another 10 years.

The charters will start upon the redelivery of the refurbished vessels, expected from September 2015 to September 2017.

Meanwhile, the 21 topside modules for the world's first FLNG facility - *PFLNG1* or *PFLNG Satu* - were completed at Daewoo at the end of March with the unit scheduled for completion in March, 2016.

Petronas appointed Technip and Daewoo as a consortium to jointly develop *PFLNG1*, which when completed will have an LNG annual capacity of 1.2 mill tonnes, will be 365 m in length, 60 m beam and a height of 33 m.

Once the construction and installation phases are completed later this year, *PFLNG1* will be moored in the Kanowit field located 180 km offshore Sarawak, Malaysia.

Petronas has since said that the first cargo from the world's first floating liquefied natural gas (LNG) project, is expected in the first quarter of next year.

Petronas is also planning a second FLNG to be moored off Sabah, East Malaysia. When entering service in 2018, this facility will have a capacity of 1.5 mill tonnes of LNG per year.

A consortium has been put together to design and construct the FLNG.

## PETRONET

Petronet LNG was formed as a joint venture by the Indian Government to import LNG and set up LNG terminals in the country.

The joint venture includes India's leading oil and natural gas industry players, such as GAIL (India) Limited (GAIL), Oil & Natural Gas Corp (ONGC), Indian Oil Corp (IOCL) and Bharat Petroleum Corp (BPCL). GDF SUEZ owns at 10% equity stake in the company.

Petronet set up the country's first LNG receiving and regasification terminal at Dahej, Gujarat, which was followed by another terminal at Kochi, Kerala.

Dahej has a nominal capacity of 10 mill tonnes of gas per annum, while Kochi has a capacity of 5 mill tonnes per annum. The company said that it is in the process of building a third terminal at Gangavaram, Andhra Pradesh on India's East Coast.

Some 7.5 mill tonnes per annum of LNG is sourced through a long term contract with RasGas with back to back sales arrangement with GAIL, IOCL & BPCL. Another 1.44 mill tonnes per annum has been agreed from ExxonMobil's Gorgon project in Australia.

During the fourth quarter of last year, the company's Dahej terminal operated at around 110 % of its nominated capacity. The expansion work on the Dahej LNG terminal, enabling it to handle up to 15 mill tonnes per year is on schedule, Petronet said and it is expected that the expansion project will be completed by end of 2016.

At present, the gas is delivered by three LNGCs, two of 138,000 cu m and one of 155,000 cu m. A fourth of 173,000 cu m capacity was ordered from Hyundai for delivery in 2016.

The latest vessel was ordered by Shipping Corp of India together with K Line, MOL and NYK. She will be used to transport gas from Gorgon to Kochi when the vessel is delivered next year.

## PRIMORSK SHIPPING CO (PRISCO)

PRISCO is part of a consortium that operates the 145,200 cu m *Grand Mereya*.

The other consortium members are K Line and MOL who technically manages the Ice Class vessel.

The vessel ships gas from the Prigorodnoye terminal, which serves Sakhalin II, under a long term contract with Sakhalin Energy.

## PRONAV SHIP MANAGEMENT

Pronav still manages nine LNGCs from its Hamburg office.

These include four Q-flex types and five conventional LNGCs, three of which were built in 1978-1979.

They are all operated by an MOL-led consortium.

## RASGAS

According to its website, RasGas has 27 vessels -14 conventional LNG vessels with a cargo-carrying capacity of 138,000 cu m to

151,700 cu m, plus 13 large LNGCs, with significantly greater capacity on long term charters.

RasGas' fleet has been accrued through a series of timecharter agreements, including Qatar Shipping, Maran Gas Maritime, the Japanese-led consortium of Mitsui OSK, NYK, K-Line (an AP Moller and Qatar Shipping consortium), the J5 Nakilat and Teekay Nakilat Corp.

The first ship in the fleet, *Fuwairit* - entered service in February, 2004 and recently celebrated its 100th cargo loading at Ras Laffan.

Between May and September, 2008, RasGas took delivery of 12 Q-flex vessels, each with a capacity ranging from 210,000 cu m to 217,000 cu m. The milestone agreement with J5 Nakilat and Teekay Nakilat was, at the time of signing, one of the largest-ever commercial shipping contracts.

RasGas said that the carrying capacity of the Q-flex ships gave the gas supplier economies of scale, as the vessels can ship more LNG per journey, it also lowered the transportation cost per gas unit. Despite their size, Q-flex LNGCs can access about two-thirds of LNG terminals worldwide.

In October 2009, RasGas took delivery of its first 266,000 cu m Q-max - *Al Dafna* - which completed RasGas' shipbuilding programme.

Since the beginning of its LNG shipbuilding programme, through economies of scale and propulsion, RasGas claimed to have reduced the cost of transportation by 30 to 35%.

## SHELL SHIPPING (STASCO)

Shell has made an audacious takeover bid for the BG Group, which includes its LNGC operations.

The acquisition is not due to go through until next year, so details are still a bit vague at the time this issue went to press.

Shell started the ball rolling in the modern era by operating the world's first two purpose-built LNGCs in the mid 1960s.

The *Methane Princess* and *Methane Progress* were built to serve the Canvey Island, UK gas receiving terminal, principally from Arzew, Algeria.

Today, Shell claims to have interests in about 25% of the world's LNGC fleet, either commercially or technically, or both. Last year, this amounted to more than 50 LNGCs, however, some are being taken back by their operators under in-house management, most notably the Nigerian LNGCs running for Bonny Gas Transport.

Another example is the management of 25 Nakilat Q-flexes and Q-maxes under a 10-year deal which was signed in 2007. Following the 10-year period, it is intended that the vessels switch to Qatari management.

Shell also signed a partnership deal with Samsung to design and build LNGFPSOs over a 15-year period. The world's largest, the 220,000 cu m capacity *Prelude* is nearing completion at Samsung, who designed the vessel in co-operation with Technip. She will go on station near Broome, Western Australia.

Shell also charters in when necessary to cover cargoes and has taken two of Sovcomflot's recently delivered Ice Class LNGCs on long term charter.

In 2013, Shell acquired the LNG interests of Repsol, including its LNGC operating arm, Stream, which gave the company a boost in South American operations.

Shell has also become involved in LNG bunkering and is to build a specialised LNG bunker vessel to deliver gas to LNG-fuelled vessels in northwest Europe, as well as in Rotterdam where she will be based.

The new vessel will load from the new LNG break bulk terminal and jetty to be constructed by the Gas Access to Europe (GATE) terminal.

She will be built by STX Offshore & Shipbuilding and will have a capacity to carry 6,500 cu m of LNG fuel. Featuring an innovative transfer system and sub cooler unit, it will be able to load from big or small terminals.

### SK SHIPPING

SK Shipping was founded in 1982 and has since grown to a worldwide shipping company transporting various cargoes worldwide.

Its fleet comprises 23 tankers, six VLGCs and a controlled fleet of 12 LNGCs.

SK Shipping claims to be the largest owners of LNGCs in South Korea and its in-house shipmanagement has a proven record for last 20 years in LNG transportation.

SK Shipping is also the first in the world to gain experience at operating four types of cargo containment systems - Moss, membrane (Mark III, NO96-GT) and KC-1 (Korean LNG cargo hold).

The company began transporting LNG when it acquired *YK Sovereign* in 1994. In 1996, 1997 and 2001, the company concluded long-term transportation contracts for five LNGCs with Korea Gas Corporation (KOGAS).

Recently, SK shipping has expanded its business by securing long-term overseas LNG



**SCF Melampus has been taken by Shell on long term charter.**

transportation with Total for two LNGCs to lift LNG from Sabine Pass. Also in October 2014, it was awarded two long term LNG transportation contracts in a KOGAS tender.

All of these four LNGCs vessels, fitted with propulsion systems MEGI and XDF, will be delivered in 2017.

### IM SKAUGEN (IMS)

IM Skaugen's (IMS) core business is to provide logistics solutions for seaborne regional distribution of liquefied gasses, such as LNG, petrochemical gases, ethane, as well as LPG.

The Skaugen Group of companies currently operates a fleet of 15 gas carriers under the Norgas brand, including six innovative 'Multigas' vessels with the capability to transport LNG, in addition to all petrochemical gases and LPG.

Currently there are four 10,000 cu m and two 12,000 cu m LNG capable 'Multigas' vessels in the fleet.

In addition, IMS' global teams can provide on-and off-shore LNG terminal management, as well as ship to ship transfer services of LNG/LPG and crude oil, as well as petroleum products.

IMS employs around 525 personnel globally with nearly 30 nationalities represented.

The company manages and operates its activities from offices in Singapore, Oslo, Houston and Sunderland, UK.

### SONANGOL

Subsidiary Sonangol Shipping Holding operates three 173,000 cu m LNGCs delivered from Daewoo in 2007 and 2008.

The Angolan state-owned concern has a 22.8% stake in Angola LNG along with Chevron (36.4%), BP (13.6%), ENI (13.6%) and Total (13.6%).

Exports were loaded at the Soyo Terminal

until an incident on 10th April last year shut the facility. Contractor Bechtel was called in to rectify faults and also to address plant capacity issues.

Angola LNG said last year that it hoped to reopen the plant by the middle of this year. When built it was designed to deliver 5.2 mill tonnes of of LNG per year

At \$10 bill the Angola LNG project is one of the largest ever single investments in the Angolan oil and gas industry. Offering a dedicated fleet of seven LNGCs and three loading jetties (LNG, liquids and compressed butane) the project's mission is to eliminate flaring of gas, provide clean and reliable energy to customers and maximise return on investment, the company said.

### SOVCOMFLOT (SCF)

The fourth 170,200 cu m Ice2 Atlanticmax LNGC newbuilding- *SCF Mitre* - should have joined Sovcomflot's fleet by the time *LNG Shipping Review* went to press.

Her sistership - *SCF Melampus* - was delivered in January, 2015, while the *SCF Mitre's* naming ceremony was held in April this year. They have both been chartered to Shell.

The first two LNGC's of this series - the *Velikiy Novgorod* and the *Pskov* - are in service on long-term time-charter for Gazprom Global LNG. All four were built at STX.

In addition, SCF announced an order for a prototype Arc7 double-acting Yamalmax 172,000 cu m LNGC at Daewoo to serve the Yamal LNG project. She is to be the pioneering vessel for this project and is due for delivery by March next year.

SCF also operates four conventional LNGCs, two of which *Tangguh Batur* and *Tangguh Towuti* were built for a consortium involving SCF, NYK and Samudera, to serve the Tangguh gas project in Indonesia.

Two others, the 145,000 cu m *Grand Aniva* and *Grand Elena*, ship gas from Prigorodnoye,

the loading terminal for the Sakhalin II project.

Earlier this year, *Grand Elena*, jointly owned by SCF and NYK, embarked on her 100th voyage from Prigorodnoye to Japan. The LNG carrier is chartered to Sakhalin Energy Investment Co under a long-term timecharter agreement and is operated along with the sister vessels *Grand Aniva* and MOL's *Grand Mereya*, serving Sakhalin II.

Last year, saw the final voyage of the SCF *Arctic* and SCF *Polar* – SCF's first LNGC's, which were in continuous service for 45 years.

Seen as symbols of excellence in shipping operations, for many years the vessels served as SCF's seafarer training ground, which have now taken the step up to SCF's ultra modern LNGC's.

## STENA BULK

Stena Bulk has signed an agreement to charter the LNGC *Stena Blue Sky* for the North West Shelf Project in Australia.

The duration of the charter will be for up to three years with a possible further extension. She will sail between Australia and Japan, as well as other Far Eastern countries.

The North West Shelf Project is Australia's largest oil and gas development and has delivered more than 4,000 LNG cargoes to customers predominantly in the Asia/Pacific region since it came on stream in 1989.

In addition to the *Stena Blue Sky*, Stena Bulk owns two modern TFDE vessels - *Stena Crystal Sky* - which is on a medium term

charter until this autumn and the *Stena Clear Sky* which was recently redelivered from a three year charter.

In 2011, Stena Bulk invested in the three LNG carriers from Taiwan-based TMT (Today Makes Tomorrow). All three carriers are ice-classed and winterised. Their commercial operation is handled by Stena Bulk's organisation in Gothenburg and the company's offices in Singapore and Houston are also active in this segment. Northern Marine Management is responsible for the technical operation.

Stena Bulk's three LNG carriers are the 145,500 cu m *Stena Blue Sky* (built in 2006) and the two 173,000 cu m sisters the *Stena Clear Sky* and the *Stena Crystal Sky* (built in 2011).

## TEEKAY LNG PARTNERS (TGP)

Last year marks one of Teekay LNG's most successful years since its inception nearly 10 years ago.

During 2014, TGP secured over \$5 bill of new contracts. Currently, Teekay LNG has interests in 48 LNGCs, including one regas vessel, plus another 19 newbuildings.

In early December 2014, TGP continued its newbuilding activity with the announcement of timecharter contracts with Shell for five newbuilding LNGCs. Shell will be among the first oil majors to bring these new innovative vessels into its fleet.

Upon their delivery, between the second half of 2017 and into 2018, the vessels will

operate within Shell's global LNG fleet under timecharters ranging from six to eight years, plus extension options.

In connection with signing of the new charters, TGP exercised its remaining options with Daewoo for the construction of three additional 173,400 cu m LNGCs. The newbuildings will be constructed with twin M-type, electronically controlled, gas injection (ME-GI) engines, which are designed to be significantly more fuel-efficient and have lower emission levels than engines currently used in LNGCs, the company claimed.

The new contracts with Shell will be serviced by two of TGP's three existing ME-GI LNGC newbuildings under construction that were previously unchartered, and the three new ME-GI LNGCs options ordered in December 2014.

In early February 2015, Teekay LNG entered into an agreement with DSME for the construction of one additional 173,400 cu m ME-GI LNGC newbuilding, with options to order up to four additional vessels. TGP said that it intends to secure long-term contract employment for this vessel prior to its scheduled delivery in the fourth quarter of 2018.

TGP was the first shipowner to speculatively order innovative ME-GI LNGCs with DSME in late-2012 with the order of two vessels. Just six months later, TGP was awarded two five-year time charter contracts with Cheniere Marketing on these speculative newbuildings. Upon their



Stena Bulk's *Stena Blue Sky* has been chartered to load in the Northwest project for up to three years.



**One of Teekay's Yamalmax LNGCs takes shape at Daewoo.**

delivery in the first half of 2016, they will each commence their timecharters with Cheniere exporting LNG primarily from the Sabine Pass LNG liquefaction facility in Louisiana.

In July 2014, TGP, through a new 50/50 joint venture with China LNG Shipping (Holdings) (China LNG), finalised agreements to provide six icebreaker LNGCs for the Yamal LNG project in Northern Russia, which is sponsored by Novatek, Total and China National Petroleum Corp and will consist of three LNG trains with a total capacity of 16.5 mill metric tonnes per annum.

The LNG is expected to be transported from Northern Russia to Europe and Asia.

The six 172,000 cu m Arc-7 LNGC newbuildings will also be constructed by DSME for an aggregate fully built-up cost of around \$2.1 bill. Each vessel will be constructed with maximum 2.1 m icebreaking capabilities while sailing forward and astern (double acting).

The six vessels, which are scheduled to deliver between the first quarter of 2018 and the first quarter of 2020, will operate under timecharter contracts until December 31, 2045, plus extension options.

Finally, in June, 2014, TGP acquired interests in four 174,000 cu m TFDE LNGC newbuildings from BG Group, which will be constructed by Hudong-Zhonghua Shipbuilding in China for an aggregate estimated fully built-up cost of around \$1 bill.

The vessels, which are scheduled to deliver

between September 2017 and January 2019, will each operate under 20-year timecharter contracts with BG, plus extension options.

Through this transaction, TGP acquired a 30% ownership interest in the first two LNGC newbuildings, with the balance of ownership held by CETS Investment Management (HK)(CETS) (an affiliate of China National Offshore Oil Corporation (CNOOC)) and China LNG, and a 20% ownership interest in the second two LNGC newbuildings, with the balance of ownership held by CETS, China LNG and BW Group.

### **TIANJIN MARINE**

No news was available on Tianjin Marine's rumoured letter of intent to Dalian Shipbuilding to build four LNGCs by the time this issue went to press.

The Hainan Airlines subsidiary said last year that it was trying to raise \$1.96 bill to help purchase 14 new vessels- four LNGCs and 10 VLCCs.

The proposed LNG fleet would range from 160,000 cu m to 175,000 cu m and cost between \$200-\$230 mill each.

### **TOKYO GAS**

The Japanese energy giant has been importing natural gas for its energy plants since 1969, primarily using receiving terminals in Tokyo Bay.

Tokyo Gas charters in many LNGCs, both on short term and long term contracts, to cover its cargo requirements.

### **TSAKOS ENERGY NAVIGATION (TEN)**

TEN owns one 150,000 cu m LNGC, the *Neo Energy* built in 2007.

Since then, the company has ordered a 174,000 cu m DFDE LNGC at Hyundai for delivery next year. The newbuilding will be named *Maria Energy*.

### **ANTHONY VEDER**

Rotterdam-based small to midscale gas carrier owner Anthony Veder owns and manages three LNGCs - two hybrid and one pure LNGC.

The 2009-built *Coral Methane* was the world's first small scale combined LNG/LPG/LEG carrier, which was built in co-operation with Gasnor, now part of Shell.

She was followed by the *Coral Energy*, the world's first direct drive dual-fuel Ice Class 1A LNGC. This vessel was delivered into a Skangass charter in 2012.

A third vessel, the hybrid LNG/LPG/LEG carrier *Coral Anthelia* entered service last year. The ship is contracted on COA and short term timecharter basis for various charterers, including Skangass.

In addition, Sirius Veder Gas has ordered a 5,800 cu m LNG combined bunker and feeder vessel at Dutch shipyard Royal Bodewes, the first to be built in Europe.

This company - a joint venture owned by Anthony Veder and Sirius Rederi - will operate this vessel for Skangass under a long term charter. ■



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