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SIGTTO NEWS

Issue 37

www.sigtto.org

Spring 2017

MESSAGE FROM GENERAL MANAGER



Full diary for 2017

Andrew Clifton, the SIGTTO

General Manager, highlights how a busy end to 2016 will be followed by more of the same over the coming year

SIGTTO is looking forward to a busy year ahead. Eleven Regional Forums, two gatherings each for the General Purposes Committee (GPC) and the Board of Directors, two Human Element Committee meetings and a Panel Meeting are all planned for 2017. The major event of the year is the 63rd Panel Meeting which is scheduled for 4-5 October in Houston.

The 2016 Board and Annual General Meeting (AGM), kindly hosted by Chubu Electric, was held in the Japanese port of Nagoya on 18 November. There was also an Asia Regional Forum in Tokyo on 15 November where SIGTTO had the opportunity to meet Vice-Admiral Satoshi Nakajima, commandant of the Japan Coast Guard, and set the stage for the development of closer relations between our two organisations.

SIGTTO will be returning to Tokyo for the 75th GPC Meeting and the Gastech conference and exhibition in April 2017. Once again I will be chairing the Shipping Session at Gastech and look forward to meeting many of you there.

The Society appointed a new president at the Nagoya Board and AGM. David Furnival of Bernard Schulte Shipmanagement has succeeded Total's Luc Gillet's in the post, the latter's three-year term having come to an end. Further details about David, who moved up from the position of vice president, can be found on page 5. Chris Bailey of BP Shipping is SIGTTO's new vice president.



A new endeavour for SIGTTO - the first meeting of the Human Element Committee, at London's Baltic Exchange in September 2016

“The dissemination of information stemming from the industry’s collective expertise and experience is the very essence of the Society’s purpose and remit.”

In January 2017 the Society published its latest document. Entitled *LNG Emergency Release Systems - Recommendations, Guidelines and Best Practices*, it is the fifth paid publication that SIGTTO has delivered in the last two and a half years. Two more are scheduled for publication in the next 12 months. It all adds up to a high level of productivity for a small secretariat. SIGTTO is most grateful for the contribution made by those members who participated in the various working groups involved with these five publications. Further information about the emergency release systems (ERS) document is given on page 9.

The GPC work list is gradually being reduced and the SIGTTO Secretariat, with

the support of the members, has worked hard to complete the projects set by GPC. The Society has implemented an improved structure for processing projects, resulting in greater productivity and efficiency.

The revised International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) entered into force on 1 January 2016 and was fully implemented six months later, on 1 July. SIGTTO also issued the fourth >

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MESSAGE FROM GENERAL MANAGER

> edition of *Liquefied Gas Handling Principles*, its premier publication, in July 2016.

The International Code of Safety for Ships using Gases or other Low-Flashpoint Fuels (IGF Code) entered into force on 1 January 2017. Although our sister organisation, the Society for Gas as a Marine Fuel (SGMF), is now more involved with the IGF Code than SIGTTO, we have nevertheless devoted considerable time, resources and effort ourselves to help develop this important new body of rules for the shipping industry. The delivery of both of the IGC and IGF Codes and *Liquefied Gas Handling Principles* means the SIGTTO Secretariat can now focus its resources on other areas of importance to the membership.

The future vision of the Society, as laid out in its *2016 Strategic Plan*, allows for a much larger Secretariat able to meet the needs and expectations of a growing and changing membership. To this end we have appointed a new member of staff, and I would like to extend a warm welcome to Ian Harrison who joined us in February 2017 in the new position of IMO representative.

Ian has worked for Intertanko, Intercargo, Lloyd's Register and the UK's Maritime and Coastguard Agency on technical and policy issues and has extensive experience of representation at IMO. IMO representative is a new job title for the SIGTTO Secretariat and will ensure the Society has continuity and a sustained presence at the UN body for maritime safety and environmental protection. More details on Ian Harrison's background can be found on page 5.

The Society currently has a vacancy for a seconded technical adviser to replace Rick Boudiette who returned to his parent company towards the end of last year. News regarding Rick's successor will be covered in the next newsletter.

The autumn 2016 Panel Meeting was held in Cyprus last October. Kindly hosted by SCF Management Services, the two-day event was a memorable occasion, with good attendance, quality presentations and excellent organisation in a magnificent setting.

Included on the agenda were three presentations which shared lessons learnt; this was a first for SIGTTO Panel Meetings. All credit is due to the members concerned for discussing their experiences with the industry. The dissemination of information stemming from the industry's collective expertise and experience is the very essence of the Society's purpose and remit, and something we have achieved successfully over the 38 years since we were established.

The Cyprus event was also the first for Richard Gilmore of Maran Gas as Panel Meeting chairman. We would

"The new Human Element Committee will accommodate ongoing developments with major accident/process safety risk management tools."

like to thank Richard for the excellent job he did in coordinating a lively set of proceedings. Some of the key Cyprus presentations are highlighted on page 6.

Last December we hosted the second Liquefied Gas Senior Executive Forum in Houston together with the US Coast Guard (USCG) and SGMF. Some highlights of the three-day event, which attracted a huge turnout of over 250, are described on page 6.

Our Regional Forums stirred up a great deal of interest in 2016. One in particular I would like to mention is the South American Regional Forum in Buenos Aires in September. Kindly hosted by YPF, the meeting had a record attendance of 110, an astonishing number for a Regional Forum. The event included a technical visit to the Escobar FSRU. SIGTTO also staged its first ever Regional Forum in India last December and hopes to return there again later this year.

The SIGTTO website is currently being revised and refreshed and the aim is to have the new-look site up and running by the May Board meeting. This update will include a much enhanced members area section and the Secretariat is grateful to the many members who responded to a request for high-quality photographs.

The Human Element Committee (HEC) met for the first time last September and for the second time on 15 February 2017. Similar in setup to the GPC, it will meet twice a year and will deal with human element issues as they relate to the gas shipping and terminal sectors. The coverage will include, but not be limited to, competency and training, design and ergonomics and the human element side of incident investigation.

SIGTTO continues to focus on accident prevention, not least through the use of major accident/process safety risk management tools like "bow tie" and the prioritisation of training on major incident risks and avoidance. HEC will adapt its activities to accommodate ongoing developments in this field. More details on the new Committee can be found on page 5.

I look forward to continuing to serve the members in 2017 during what is a very exciting time for our industry. The LNG carrier fleet is expected to pass the 500 ships in service mark this year a remarkable milestone, considering that as recently as 1997 there were only 100 such vessels in service.

BENEFITS OF SIGTTO MEMBERSHIP

SIGTTO members are actively encouraged to promote membership when dealing with any new players in the industry. Please direct them to our website and to the London Liaison Office for further details of how to join.

In addition to the credibility in the industry that membership brings, SIGTTO members benefit by:

- Access to information that is exclusive to members, such as casualty information and industry statistics
- Regular updates on matters affecting the industry such as legislation, either new or pending, technical or operational developments
- Access to the very comprehensive technical library maintained in the London Office
- Submitting proposals for projects and studies to the General Purposes Committee

- Access to the Technical Advisers in the London Liaison Office who can give advice and obtain advice, on behalf of a member, from within the Society
- Participating in discussion forums with other members each year on topics of particular and mutual interest
- New members receive a copy of all publications, free of charge, produced by SIGTTO
- Free access to the LNGwebinfo portal for updated LNG information as required to conduct compatibility studies. This information is restricted to members of SIGTTO and GIIGNL only



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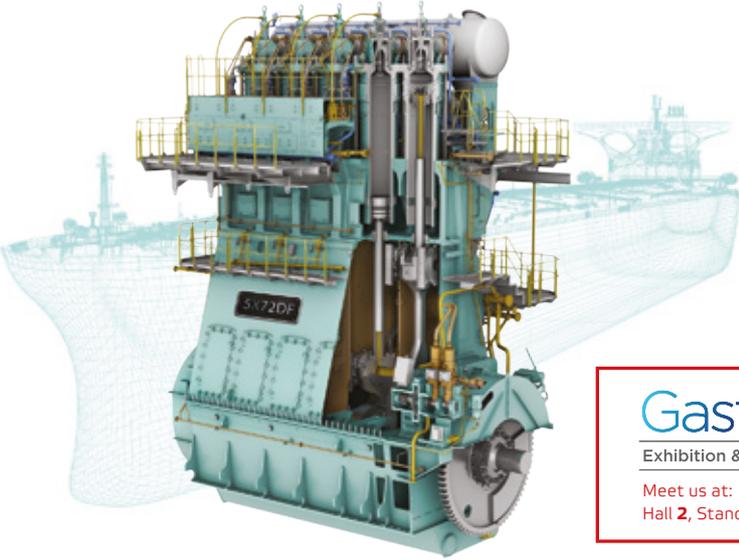
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David Furnival - new SIGTTO president



Following a decision by the SIGTTO Board of Directors at its Autumn 2016 meeting in Nagoya on 18 November, David Furnival of Bernhard Schulte Ship Management

has been appointed as the Society's new President. At the same time Christopher Bailey of BP Shipping has been appointed Vice President. Furnival succeeds Luc Gillet of Total who has stepped down after a three-year term as SIGTTO President.

"I would like to thank Luc Gillet for his service as the Society's President," states Andrew Clifton, SIGTTO General Manager. "During his tenure SIGTTO made very positive progress and fully enhanced its reputation as the industry body for liquefied gas shipping and terminals."

"I now look forward to working with David as the Society presses ahead with the implementation of its new 2016 Strategic Plan. The initiative is aimed at ensuring that SIGTTO meets the needs and expectations of its growing membership in what is a dynamic time for our industry."

"For my part I would like to thank the SIGTTO Directors and the members for their support," comments David Furnival. "I look forward to the years ahead during which I will be fully committed to promoting the activities of the Society for the benefit of the liquefied gas shipping industry."

Ian Harrison in IMO hot seat



SIGTTO has appointed Ian Harrison as its IMO representative. This is a new position for the Society as in the past IMO liaison work was handled by one of the Secretariat's technical advisers.

The appointment highlights the growing importance to the gas shipping and terminal industries of the increasingly complex maritime safety and environmental protection issues discussed at the UN agency.

Ian has extensive experience of developing and representing shipowners' technical and environmental policy at

not only the IMO but also the European Union, the International Association of Classification Societies (IACS) and other fora. Concisely presenting complex technical issues to decision-making bodies and proposing policy actions to achieve defined outcomes are nothing new to this graduate of Newcastle University (in naval architecture), and the Greenwich Maritime Institute (maritime policy).

Ian Harrison commenced his maritime career with Lloyd's Register in 1995, leaving the classification society eight years later as senior surveyor. He then joined the UK's Maritime and Coastguard Agency as policy manager responsible for inland waterways and shortsea shipping (freight) technical policy before rejoining Lloyd's Register for a two-year stint in a principal surveyor

role as bulk carrier business manager.

Bulk carriers provided the link to his next job, as technical manager for Intercargo from 2007 to 2014. At the dry cargo shipping non-governmental organisation (NGO) he was responsible for technical and environmental issues, with an emphasis on bulk carrier safety, including relevant representation at IMO, EU and IACS.

Prior to joining SIGTTO earlier this year Ian Harrison served as senior technical manager at Intertanko in which position he was responsible for various technical and environmental issues as required by the tanker industry body's Technical Committee. In addition to representing Intertanko at the IMO, IACS and other fora he was also secretary to the association's Bunker Sub-committee.

HUMAN ELEMENT COMMITTEE

Laying down a framework

The inaugural meeting of SIGTTO's new Human Element Committee (HEC 01) was held in London on 13 September 2016. The group has 13 members and two observers, while the chairman is John Adams of Teekay. According to its terms of reference, HEC is to report to the SIGTTO Board and liaise with the Society's General Purposes Committee (GPC). It is expected to meet twice a year,

in Northern Europe, and approximately six weeks before GPC meetings if possible.

The initial meeting was all about agreeing the scope and activities of the new Committee. Discussions at HEC 01 were wide-ranging and touched on a range of themes and subject areas, including the definition of the human element, management of incidents and a review of the design and ergonomics of cargo control rooms.

UPCOMING MEETINGS 2017

MEETING	DATE	LOCATION
75th General Purposes Committee	3 Apr	Tokyo
Gastech 2017	4-7 Apr	Tokyo
European Regional Forum	4 May	Southampton
Spring Board Meeting	17 May	Glasgow
Pan American Regional Forum	6 Jun	Houston
Singapore Regional Forum	28 Jun	Singapore
3rd Human Element Committee	30 Aug	London
South American Regional Forum	Sep (TBC)	Buenos Aires
76th General Purposes Committee	3 Oct	Houston
63rd Panel Meeting	4-5 Oct	Houston
Autumn Board Meeting & AGM	14 Nov	Copenhagen
Middle East Regional Forum	15 Nov	Dubai
India Regional Forum	Nov (TBC)	Mumbai
Pan American Regional Forum*	Nov/Dec (TBC)	Houston
China Regional Forum	Dec (TBC)	Shanghai
Australia Regional Forum	Dec (TBC)	Perth
Mediterranean Regional Forum	(TBC)	Athens
Scandinavian Regional Forum	(TBC)	Oslo

Note: * - in conjunction with SIGTTO/USCG/SGMF Joint Forum

CYPRUS PANEL: SCF unveils icebreaking LNG carrier



Sergey Popravko of SCF Management Services (left) and SIGTTO's Andrew Clifton with a model of Christophe de Margerie

SCF Management Services, host of SIGTTO's 62nd Panel Meeting, was proud to tell delegates about the parent Sovcomflot group's newest LNG carrier at the 5-6 October 2016 event in Cyprus. The ship is the world's first icebreaking LNG carrier and the lead vessel in a series of 15 that will load cargoes at the Yamal LNG terminal on Ob Bay high in the Russian Arctic.

Dimitry Rusanov, head of Sovcomflot's gas carrier division, was the first of three group speakers to put the pioneering new ship into perspective for those attending the Panel Meeting. In profiling the SCF gas fleet and the LNGC ice training programme in his keynote speech, Mr Rusanov pointed out that the 172,600m³ icebreaking LNG carrier, named *Christophe de Margerie*, marks the culmination of a rapid gas ship evolution at the company that began in 2006 with the purchase of the 1969-built, 71,500m³ *SCF Arctic* (ex-*Arctic Tokyo*) and *SCF Polar* (ex-*Polar Alaska*). These were the vessels that launched the Alaska-Japan LNG project 48 years ago.

In 2007 and 2008 the SCF group took delivery of its first LNGC newbuildings, the 145,000m³ ice class IC *Grand Elena* and *Grand Aniva*. These Moss spherical tank,

steam turbine vessels are on charter until 2028 lifting cargoes, mostly for Japanese utilities, at the Sakhalin 2 terminal in the Russian Far East, where there is some ice cover during the winter months.

There followed two further pairs of LNGC newbuildings for Sovcomflot - *Velikiy Novgorod* and *Pskov* in 2014 and *SCF Melampus* and *SCF Mitre* in 2015. All four offer 170,000m³ of cargo-carrying capacity in membrane tanks, are propelled by dual-fuel, four-stroke engines and are built to the ice class IC standard.

This LNGC fleet plus Sovcomflot's unprecedented experience of Arctic operations with tankers, dry cargo ships and specialist service vessels built to a high ice class provided an important foundation for the design of *Christophe de Margerie*.

As Sergey Popravko, managing director of SCF Management Services, reported, his company has 167 vessels under full management. As a result of its portfolio of services, encompassing technical, project and commercial management, SCF is able to provide solutions which go well beyond the straightforward operation and crewing of ships.

Amongst the Sovcomflot fleet with a high

ice class are five 70,000 dwt Arc6 shuttle tankers with Azipod propulsion units serving the Varandey and Prirazomnoe projects in the Arctic waters of the eastern Barents Sea. Thus the training programme for the *Christophe de Margerie* crew members has incorporated sea time on not only the company's LNGCs but also the Arctic shuttle tankers. The use of simulators, including at the specialist SCF college in St Petersburg, attendance at targeted STCW/SIGTTO courses and instruction at manufacturers' locations are amongst the other key elements of the training regime.

The final group speaker was Robert Thompson, first deputy managing director at SCF Management Services, who focused on the design and construction of *Christophe de Margerie*, including his company's role in supervising building work at the Daewoo Shipbuilding and Marine Engineering (DSME) yard in Korea.

SCF worked with Yamal LNG, DSME and Aker Arctic Technology, an ice class ship naval architecture firm, on developing the design of the 15-ship *Christophe de Margerie* series. Also closely involved were Bureau Veritas and the Russian Register of Shipping, as the ships' joint classification societies, and Gaztransport and Technigaz (GTT), developer of the reinforced No 96 membrane cargo containment system chosen for the vessels.

The participants agreed that these trendsetting ships should be built to the robust Arc7 ice class standard and as double-acting vessels, able to operate in their icebreaking mode most effectively while moving in an astern direction. Each ship has a modified icebreaker bow and is provided with five dual-fuel, four-stroke engines driving three stern-mounted pulling Azipod propulsion units capable of delivering a total power output of 45 MW.

The arrangement enables *Christophe de Margerie* to move through 1.5-metre thick ice at 2 knots bow first and at 5 knots stern first. When moving in an astern direction, the ship is able to proceed on a continuous basis while breaking ice up to 2.1m thick.

HOUSTON FORUM: Houston focus for US gas

SIGTTO cooperated with the US Coast Guard (USCG) and the Society for Gas as a Marine Fuel (SGMF) in hosting the 2nd Liquefied Gas Senior Executive Forum in Houston in December 2016. The three-day event followed the success of the first meeting in the series a year earlier and the turnout of 260 industry representatives reflects the current high level of interest in gas carrier and terminal activities in the US, due not least to record LPG exports,

the start of worldscale LNG and ethane exports and the introduction of LNG-powered ships and LNG bunkering.

Attendees learned, through the 35 presentations that were made over the three days, about current USCG policy, industry regulations and procedures, and US liquefied gas projects either underway or proposed. The Forum also included a Texas A&M Firefighting training session, a liquefied gas demonstration by

Pivotal LNG and two Enterprise Products technical visits, one to the fractionation/storage facility in Mont Belvieu, Texas and the second to the company's new ethane export terminal in Houston, the nation's largest such facility.

In one of the presentations Commander Jason Smith of the USCG's Liquefied Gas Carrier National Center of Expertise (LGC NCOE) outlined some of the challenges facing the personnel in his agency as

the US liquefied gas surge takes hold.

For a start the domestic seagoing gas carrier regulations, as laid down in Part 154 of Title 46 of the US Code of Federal Regulations (46 CFR), need to be updated and a project is currently underway to harmonise the requirements with IMO's revised International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code). Similarly, the barge rules in 46 CFR Part 38 are dated and inadequate and the intention is to create a new Part for barges carrying bulk liquefied gases.

USCG inspectors are currently handling approximately 1,000 gas carrier arrivals at US ports per annum and this number is expected to climb to 3,700 visits by



Full house for the Houston Forum

2020. The dramatic increase in traffic raises the issue of having a sufficient number of adequately trained inspectors in place, backed by the necessary field support in a nationally consistent manner.

Because many of the technologies

now being developed, not least in the LNG bunkering sector, are innovative, it is important that Coast Guard personnel develop their technical capacity in tandem with the industry. The strengthening of industry partnerships is integral to the establishment of this in-house capability and will enable the USCG, in turn, to provide consultation and advice as the industry grows.

Cdr Smith pointed out that certain topics are still outstanding on LGC NCOE's work agenda, including simultaneous cargo handling/LNG bunkering operations, training course approvals, the use of ISO tank containers, risk assessment criteria, reporting requirements, hot work and the next generation of low flash point fuels.

FROM THE ARCHIVES ... Star-crossed ethylene carrier pair

Einar Bakkevig, one of the pioneering Norwegian operators of gas carriers, had a penchant for naming his ships after famous explorers. Most of the vessels, like *Roald Amundsen*, were named after Norsemen but there were exceptions. One was *Lincoln Ellsworth*, Mr Ellsworth being a noted American polar explorer of the 1920s.

Einar Bakkevig's entrée into ship operations came in the 1950s when he and his father Oscar became partners in the small, family-run firm that managed vessels owned by Laboremus. The newcomers were keen to expand the Oslo-based company and by the end of the decade, following the death of Oscar, Einar had taken over as owner-manager of Laboremus and was in a position to branch out.

Bakkevig had developed an interest in the nascent gas carrier trades in the early 1960s, convinced that this sector had a bright future. He persuaded his fellow shareholders that the hefty investments required for specialised gas ships would bear fruit and in 1965 Laboremus took delivery of its first such vessel, the 2,066m³ LPG carrier *Niels Henrik Abel*.

The 824m³ *Lincoln Ellsworth*, completed the following year, began Bakkevig's long association with ethylene transport. Built by AG Weser of Bremerhaven with a single 5 per cent nickel steel, self-supporting, bilobe tank, *Lincoln Ellsworth* was a pioneering semi-pressurised/fully refrigerated (semi-ref) gas ship. It was the first ethylene carrier with a cargo-handling plant designed by Liquid Gas Anlagen (LGA) and the first fitted with Burckhardt labyrinth-piston compressors.

Roald Amundsen, a 4,100m³ ethylene carrier built by the Moss yard in Norway, joined the Laboremus fleet in 1971.



Lincoln Ellsworth

The ship had four cargo tanks and was equipped with Linde compressors.

Of the two explorers that inspired the names of this early ethylene carrier pair, Roald Amundsen was the most well-known. The Norwegian is down in the history books as the first man to transit the Northwest Passage, having completed the journey in 1906, and the first man to reach the South Pole, achieving the goal in December 1911 just weeks before Robert Falcon Scott's ill-fated expedition.

The paths of Roald Amundsen and Lincoln Ellsworth famously crossed in 1926 when the American joined Amundsen in an attempt to fly across the North Pole. The pair flew in the airship *Norge*, designed and piloted by the Italian engineer Umberto Nobile, from Svalbard to Alaska, passing over the geographic North Pole enroute. Amundsen thus became the first person to reach both poles.

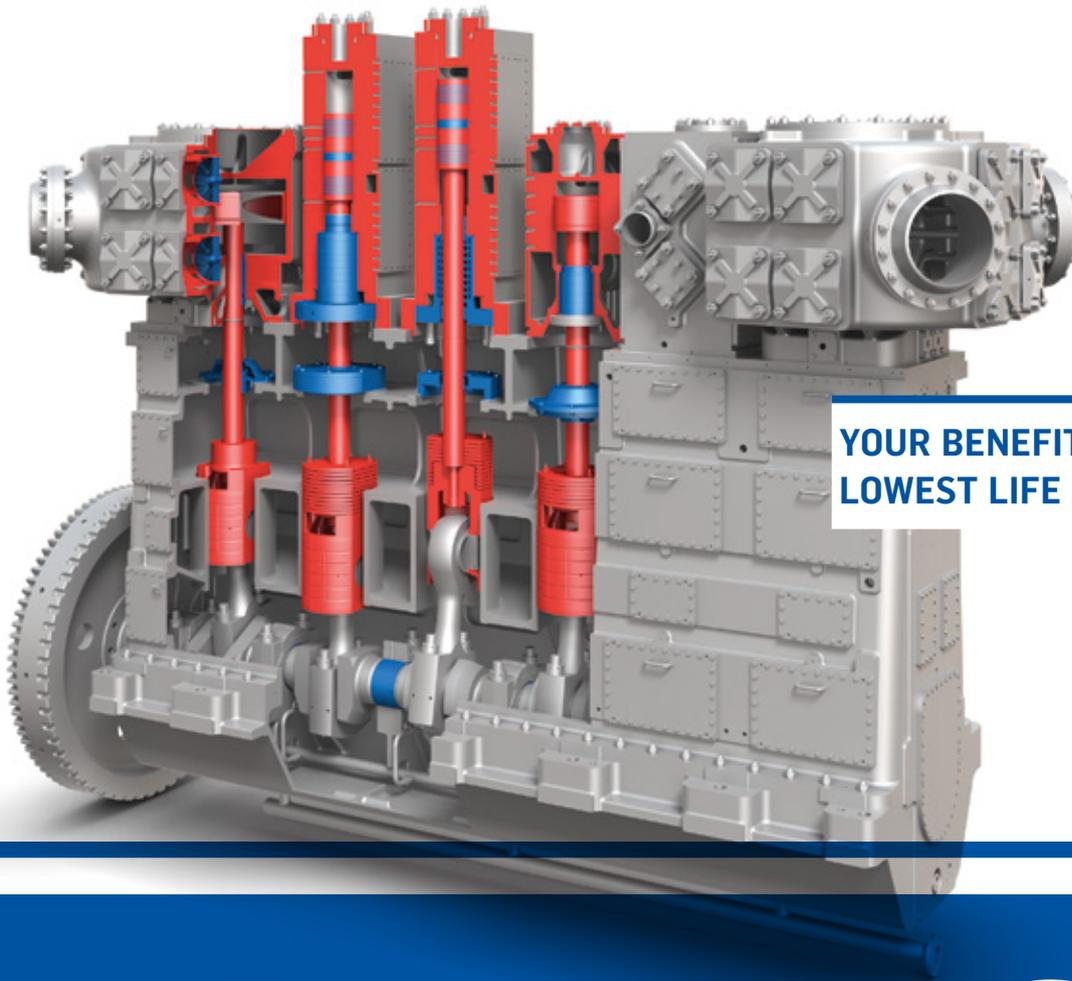
Of their gas carrier namesakes, *Lincoln Ellsworth* had a 45-year working life, with coastal ethylene trading in Brazil featuring prominently. *Roald Amundsen* also spent the latter part of her service life in South America, in this case Chile, and was 34 years old when sent to the breaker's yard.

The heritage of the other eponymous Einar Bakkevig gas ships also merits a

look. Niels Henrik Abel was a 19th century Norwegian mathematician who died of tuberculosis at the age of 26 while Olaf Tryggvason was a 10th century king of Norway. Also of that era, Eirik Raude (Erik the Red) discovered and settled Greenland while Leiv Eiriksson, his son, sailed further west to make landfalls in Helluland, Markland and Vinland in North America, 500 years before Columbus "discovered" the continent.

Another of the fleet's ships, *Einar Tambaraskjelve*, was named after an influential 11th century Norwegian nobleman while *Sigurd Jorsalfar* stems from a work of incidental music composed by Edvard Grieg for a play celebrating King Sigurd I of Norway. The nomenclature of four other vessels that briefly served in the Laboremus fleet - *Vasco de Gama*, *Magellan*, *Marco Polo* and *Thor Heyerdahl* - needs no explanation.

Difficult trading conditions in the late 1970s/early 1980s forced some consolidation of the Norwegian gas shipping sector and in 1982 the Laboremus ships were placed in the Norwegian Gas Carrier (Norgas) pool which today is controlled by IM Skaugen. Einar Bakkevig himself had passed away in 1981, having left an indelible mark on gas shipping.



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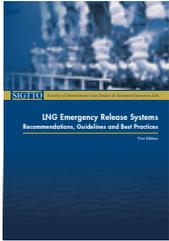
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Emergency release system guidance



SIGTTO's latest publication is entitled *LNG Emergency Release Systems: Recommendations, Guidelines and Best Practices*. In developing the new document the membership recognises

that the safety of ship/shore interface operations and equipment is essential to the maintenance of the industry's exemplary safety record and, at the same time, that the effective performance of LNG terminal emergency release systems (ERS) is key to the safeguarding of life and equipment.

Compilation of the publication was prompted by a number of incidents involving ERS malfunctions at LNG terminals in recent years. A SIGTTO working group was established in 2014 to address the issues, make recommendations and provide guidance to industry.

The new publication has been prepared to provide project development teams, terminal operators and maintenance personnel with a good understanding of the role and functioning of LNG ERS," states David Ervin, senior LNG marine operations adviser at Chevron Shipping and chairman of the SIGTTO working group. "Vessel operators and crew will also find the document a valuable reference tool."

The development of the modern ERS started in the 1960s, when quick connect/disconnect (QC/DC) units were used with marine loading arms and hoses for ambient temperature petrochemical-type fluids. Shell adapted the technology for use at the Brunei LNG export terminal, which opened in 1973, with the addition of separately

supplied self-closing check valves on either side of the QC/DC to provide shutoff protection if the QC/DC was released.

This solution was improved with the next generation of ERS, which incorporated an integral ball valve in the marine loading arm in place of the check valves. Some of these early ERS required dedicated compatible vessels for the systems to work in an integrated manner.

Since then, through continuous improvements, the industry has developed the modern double ball valve with an integrated powered emergency-release coupler (PERC) between the valves. These systems, which are independent of the vessel, are activated by position-monitoring sensors.

When the sensor limits are reached, for example if the vessel moves outside the safe operating limits while the marine loading arms (MLAs) are connected, they send a control signal that starts a rapid sequence of events ending with the closure of the double ball valves and the separation of the PERC. The MLAs will then retract to a safe position, clear of the vessel, protecting both the arms and the vessel manifold from mechanical damage and isolating the LNG carrier from the shore.

Over the years secondary uses of the ERS double ball valves have developed, creating greater complexity due to the need to integrate the primary safety system into the facility's overall distributed control system.

"The SIGTTO working group gave careful consideration to this problem of secondary uses and the increase in risk," continues David Ervin. "The primary recommendation is to use the ERS solely as a primary safety system without modification for secondary purposes. If a terminal chooses to use the ERS for a secondary purpose, the risk should be analysed via a risk assessment."

The working group used the bow-tie

method to analyse the risk of inadvertent actuation and the failure to actuate when required. The bow-tie method qualifies risk by showing the relationship between hazards and top, or possible, events, threats, possible causes, barriers and consequences. Barriers, either proactive or reactive, are measures that prevent certain events happening. Proactive barriers stop the top event from occurring while reactive barriers prevent the consequences.

The SIGTTO working group fed the results of its two bowtie analyses into the the risk discussion and the development of the ERS recommendations and guidance. The two analyses are included in the new document to serve as a template for project teams assessing the risk of their own projects or operating facilities.

The ERS document also includes suggested competencies and training levels for personnel whose job functions bring them into contact with such systems. The working group used standard awareness, knowledge and skills criteria to describe the suggested competency levels for the positions of manager, maintenance technician and operational personnel, while connection/disconnection, cargo transfer and maintenance operations are covered in the training recommendations.

David Ervin concludes, "The SIGTTO working group agreed that the use of the double ball valve for secondary purposes and the added complexity such use introduces increase the risk of an incident. The principal recommendation contained within the document is that the ERS should not be used for anything other than its primary purpose."

This review is an edited version of an article prepared by David Ervin on 12 February 2017 for posting on the website of LNG World Shipping.

WORKING GROUPS

Project updates

The following paragraphs review the progress made by SIGTTO's current two working groups. Both aim to complete their projects during the course of 2017 to enable the publication of the relevant guidance.

1 LPG Ship/Shore Interface

Established at the 70th General Purpose Committee (GPC) meeting in October 2014, this WG held its inaugural meeting in February 2015. The WG is tasked with identifying the possible root causes of LPG ship/shore interface-related

incidents and updating or rewriting SIGTTO's 1997 publication *Ship/Shore Interface Safe Working Practice for LPG and Liquefied Chemical Gas Cargoes*.

The work is being carried out in order to raise the safety awareness of the LPG shipping and terminal sectors and to minimise the risk of LPG ship/shore interface-related incidents in the future. The group aims to complete its work by the end of this year.

2 Gas Carrier Manifolds

At the 72nd GPC meeting, which took place in September 2015, it was decided to form a WG to revise the 2011 SIGTTO publication *Manifold Recommendations*

for *Liquefied Gas Carriers*. The group had two meetings in 2016 and is on target to complete its work in 2017.



Work on an updated LPG ship/shore interface safety document is nearing completion

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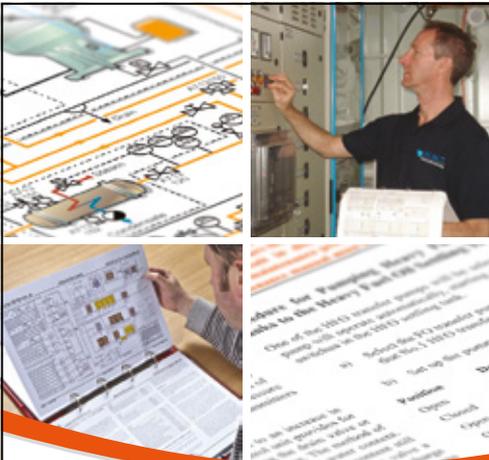
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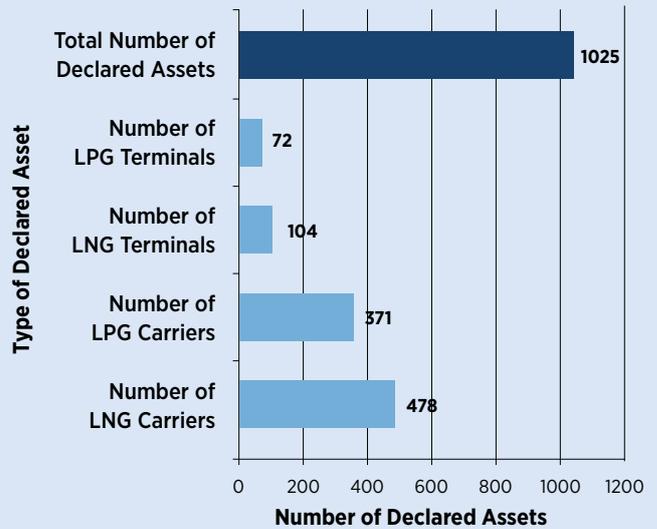
China

Japan

SIGTTO IN FIGURES



SIGTTO Members' Declared Assets



NEW MEMBERS

Quintet onboard

Five companies have joined the Society's membership in the six months since the Autumn 2016 edition of SIGTTO News. The new members and their date of joining the Society are shown below. The SIGTTO membership now stands at 140 full members, 49 associate members and 27 non-contributory members.

KOTUG.....	1 Oct 2016
ElectroGas Malta.....	1 Dec 2016
Meiji Shipping.....	1 Dec 2017
Combined Marine Terminal Operations Worldwide (CTOW).....	1 Feb 2017
Korean Register of Shipping..	1 Mar 2017

Rotterdam-based **KOTUG** provides tugs and towage services at, amongst other terminals, the Lumut LNG export facility operated by Brunei LNG. Three of the company's 80-tonne bollard pull Rotortugs handle LNG carrier berthing and unberthing operations at the site. KOTUG has also been contracted, in tandem with Teekay, to provide a similar tug service for the Prelude floating LNG production vessel when it goes into operation off Australia's northwestern coast in 2018. The partnership will provide three specialist 100-tonne bollard pull escort tugs called infield service vessels to assist LNG carriers loading from the Prelude FLNG.

ElectroGas Malta is the operator of the Delimara LNG import terminal in Malta's Marsaxlokk Bay and the charterer of the *Armada LNG Mediterrana* floating storage unit (FSU) berthed at the terminal.

Converted into an FSU by the Keppel yard in Singapore, the vessel is the former 1985-built, 125,000m³ Moss spherical tank LNG carrier *Wakaba Maru*.

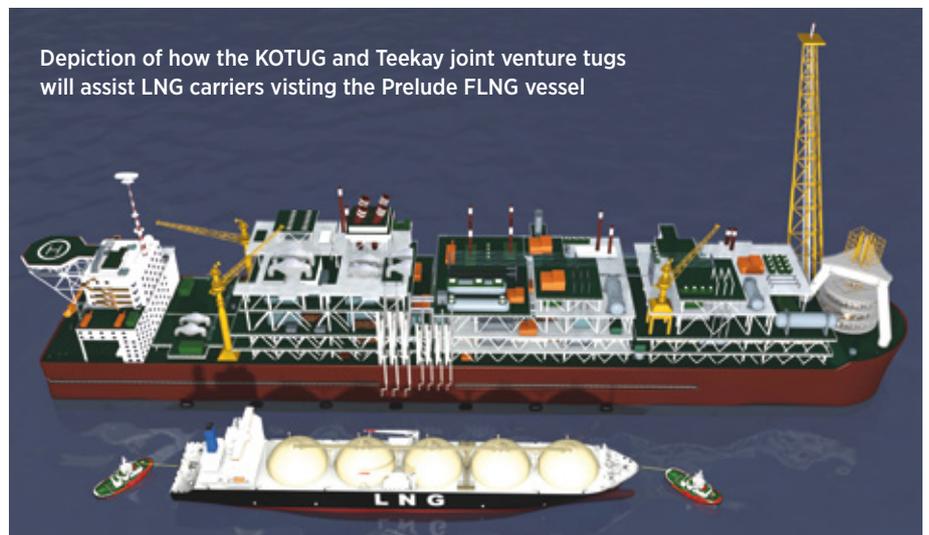
Now in its 106th year, Tokyo-based **Meiji Shipping** owns and operates a range of different ship types. The fleet includes two very large gas carriers (VLGCs), *BW Tokyo* and *BW Kyoto*, built by Mitsubishi Heavy Industries.

Belgium's **Combined Marine Terminal Operations Worldwide (CTOW)** is a joint venture involving Multiship Towage & Salvage, Dredging Environmental & Marine Engineering (DEME) and Herbosch-Kiere and providing services for maritime terminals worldwide. Amongst the Multiship offerings is a tug assist and escort service

and amongst the company's clients is Nigeria LNG's Bonny Island export terminal. Multiship's fleet of azimuthing stern drive (ASD) tractor tugs helps ensure the safety of LNG, LPG and condensate tankers visiting the busy loading facility.

The **Korean Register of Shipping (KR)** has a close involvement with gas tanker design, construction and equipment, thanks to the fact that the classification society's country of domicile is the world's largest builder of LNG and LPG carriers. KR's recent work programme has included the study of the current state and future potential for LNG-fuelled vessels serving the Asia-Pacific maritime trades; class certification for the new KC-1 membrane tank cargo containment system; and the development of a legal framework for LNG bunker vessels.

Depiction of how the KOTUG and Teekay joint venture tugs will assist LNG carriers visiting the Prelude FLNG vessel



Japan celebrates LNG golden jubilee

It is fitting that Gastech 2017 is being held in Tokyo this 4-7 April as it marks 50 years, almost to the day, since Japan signed its first LNG sales and purchase (SPA) contract. In March 1967 Tokyo Electric and Tokyo Gas concluded a deal with Phillips Petroleum and Marathon Oil that led to the delivery of the first cargo of Alaskan LNG to the Negishi terminal in Tokyo Bay in November 1969.

The 1 million tonnes per annum (mta) Alaska-Japan scheme was the first Asia-Pacific LNG project and, with it, Japan became the first Asian and only the third LNG import nation. As was the case in the UK and France, the first two LNG-buying countries, Japanese interest in LNG stemmed from a desire to reduce the then prevailing use of coal as a power station fuel with imports of clean-burning natural gas.

The country rapidly built up its commitment to LNG. The Brunei project - the world's first large-scale LNG scheme - was launched in June 1970 when Tokyo Electric, Tokyo Gas and Osaka Gas signed an SPA with Shell, Mitsubishi Corp and the Brunei government covering the delivery of 3.65 mta of LNG for 20 years. In December 1972 the Brunei terminal shipped its first cargo, to the new Senboku 1 terminal of Osaka Gas. Mitsubishi's 45 per cent interest in the project marked the first involvement of a Japanese company in LNG exports.

In December 1973 Indonesia agreed to become Japan's third supplier when Pertamina concluded an SPA with Chubu Electric, Kansai Electric, Osaka Gas, Kyushu Electric and Nippon Steel. The contract called for the shipment of 8.2 mta for 23 years from export terminals at Bontang and Arun. Bontang shipped its first cargo in August 1977 and Arun in September 1978.

The creditworthiness of the Japanese utility companies and trading houses, as well as the underlying support of the Japanese government, smoothed the country's rising use of LNG. Investors and banks stepped forward without hesitation to finance the construction of the capital-intensive, high-tech liquefaction plants required to supply Japan.

Abu Dhabi, Malaysia and Australia were soon added to Japan's portfolio of long-term LNG providers. In 1984 Japan accounted for 72 per cent of the global trade in LNG and by 1990 the country was importing cargoes at the rate of 45 mta. In the following decades Qatar, Oman and Russia also became major sources of Japanese LNG imports.

Some 83.3 million tonnes (mt) of LNG was discharged at Japan's 34 receiving terminals



Japan pioneered many LNG terminal breakthroughs, including inground and underground storage tanks

in 2016, 2 per cent down on a year earlier and 6 per cent below the record high of 88.5 mt in 2014. Japanese LNG imports surged in the years following the March 2011 earthquake and tsunami and, while future purchases are unlikely to return to the 2014 level, they are not expected to fall much below the current volume. Although there are now 36 LNG-importing countries, Japan still accounts for over 30 per cent of the global trade in LNG.

Japan and SIGTTO (number of Japanese participants)

Member companies	25
SIGTTO directors	4
GPC members	7

Japan built on its status as the world's No 1 LNG importer to become a leading builder, owner and operator of LNG carriers. Kawasaki Heavy Industries completed the country's first LNG carrier, the 125,000m³ *Golar Spirit*, in September 1981, and the first Japanese-owned vessel, the 125,000m³ *Bishu Maru*, in August 1983.

Bishu Maru marked the start of a move towards greater control of the LNG supply chain by Japanese interests through the purchase of cargoes on a free-on-board (FOB) basis. Initially the three major domestic shipping lines - Mitsui OSK Lines (MOL), NYK and K Line - were the sole owners of the new generation of Japanese-controlled LNG ships but the delivery of the 125,000m³ *LNG Flora* in March 1993 marked the first involvement of Japanese utilities in LNGC ownership.

Today Japanese utilities and trading houses control a charter fleet of 55 LNG carriers, including newbuilding orders. The charterers and one or more of the big three shipping lines own stakes in the majority of these vessels. MOL, NYK

and K Line own or operate more than a quarter of the world's LNG carrier fleet, serving not only their Japanese customers but also third party charterers operating in the international market.

"Japan was ahead of its time in recognising the benefits of LNG," points out SIGTTO General Manager Andrew Clifton. "Our industry salutes the country's role as the world's leading importer and a player that has made a great contribution to LNG shipping and terminal safety over the past five decades. It is especially appropriate that Gastech 2017 is being held in Tokyo this April. SIGTTO is marking the occasion by holding its 75th General Purposes Committee (GPC) meeting in conjunction with the event."

SIGTTO

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SIGTTO News is the Newsletter of the Society of International Gas Tanker and Terminal Operators Ltd and is published in March and September each year.

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Design: Jez Harris - jezharrisdesign@me.com

Printing: Warners Midlands

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