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SIGTTO

Society of International Gas Tanker and Terminal Operators Ltd (SIGTTO)
 5th Floor, 42 New Broad Street
 London EC2M 1JD
 Tel: +44 20 7628 1124
 E-mail: reception@sigtto.org
 Web site: www.sigtto.org
 Twitter/Weibo: @SIGTTO
 LinkedIn/WeChat:
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MESSAGE FROM GENERAL MANAGER



Learning to live remotely

The ongoing pandemic

brings continued challenges for the Society and the LNG and LPG industry, as SIGTTO General Manager Andrew Clifton explains

The Covid-19 pandemic has continued to affect us all and it is clear that the restrictions imposed by the virus will continue to be with us in some form or another well into 2021 and, potentially, beyond. All businesses have been impacted to some extent and SIGTTO is certainly no exception. The Society continues to employ remote technologies and practices to ensure that we remain open for business to the optimum extent possible in the circumstances.

The SIGTTO Secretariat's staff have been working remotely since mid-March 2020 and the Society's technical work continues to be carried out through virtual working group meetings. As mentioned, SIGTTO has stayed fully open for business throughout the pandemic; all Secretariat members are accessible through our normal phone lines and emails for any technical, membership or other enquiries.

SIGTTO remains the provider of best practice guidance and recommendations to the gas shipping and terminal industry, and we have continued to develop such guidance, encompassing new publications and updates of earlier documents, despite the restrictions imposed as a result of the pandemic. Examples of this are the Society's two latest sets of guidelines, namely *Guidance on Gas Carrier and*

Despite the trials and tribulations brought about by the Covid-19 pandemic, seaborne movements of LNG and LPG worldwide remained relatively stable in 2020



"Often overshadowed by their bigger LNG carrier brothers, LPG carriers are celebrating their 90th birthday this year."

Terminal Gangway Interface and Floating LNG Installations. Both were approved at the SIGTTO Autumn Board and Annual General Meetings in November 2020. Further details of both of these new publications can be found on page 15.

At this point I would like to pay full credit to my very hard-working Secretariat team and the memberships of our SIGTTO committees. Despite the current unprecedented situation the Secretariat's staff members have maintained impressive productivity levels while committee members have continued to shoulder their usual rigorous workloads. While

SIGTTO's very new Environmental Subcommittee (ESC) was initially chaired by Rahul Kulkarni of BP, that position has now been taken by John Boreman, also from BP, due to Rahul's appointment to the >

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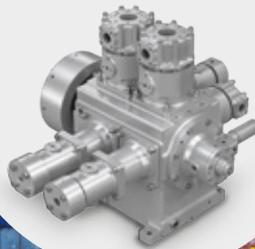
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MESSAGE FROM GENERAL MANAGER

SIGTTO Board of Directors. The General Purposes Committee (GPC) continues to be chaired by Mark Hodgson of Shell while Steve Allibone of MOL remains the chair of the Human Element Committee (HEC). Steve's annual review and update on the latest progress being made with the HEC workload can be found on page 12.

At the November 2020 Autumn Board and Annual General Meetings a further six terms of references were approved for those new projects that have been agreed and are commencing. This means that SIGTTO now has 26 projects underway, the most in the Society's history. A total of 35 persons attended November's virtual Board Meeting and there were 55 at the AGM. Three director changes and SIGTTO's 2021 budget were also approved at these meetings; amongst other things, it was agreed there would be no membership fee increase for 2021. Other key agenda items discussed at length at the two meetings were the Covid-19 impact and mitigations, SIGTTO's current marketing initiatives and the progress being made with the GPC and HEC work programmes.

While it is well known that the first commercial cargo of LNG was transported in October 1964, the 50th anniversary of which was celebrated at SIGTTO's 60th Panel Meeting in Livorno, Italy in October 2014, not many will be aware that the LPG shipping industry is celebrating its own birthday this year. Some 90 years ago, in 1931, Shell's 3,552 gt *Agnita*, the first vessel able to carry LPG, was delivered by the UK's Hawthorn Leslie shipyard. The tanker was able to accommodate not only gas oil in conventional cargo tanks but also, through the provision of 12 cylindrical pressure vessel tanks constructed of 24 mm thick boiler plate, up to 2,100 m³ of either LPG or sulphuric acid.

Unfortunately, *Agnita's* service life was cut short by the ravages of war. World War II was only a few months old when the tanker endured its first attack, by enemy aircraft. It's robust construction obviously helped it survive that first onslaught but the ship was not so fortunate on 22 March 1941 when it was spotted by the German surface raider *Kormoran* while on passage from Sierra Leone to Venezuela. The firepower of the *Kormoran's* deck guns soon became apparent and Capt Stanley Algar, the *Agnita's* master, was quick to surrender to avoid an unnecessary loss of life. After the crew took to the lifeboats, *Agnita* was summarily dispatched, becoming the only gas carrier to be sunk in conflict. All crew members survived without injury and were rescued. Capt Algar remained a prisoner of war until released by the Welsh Guards in 1945!



Agnita, the world's first gas ship, was delivered to Shell in 1931

A large part of SIGTTO's engagement with its membership is through the face-to-face encounters at the Society's range of ongoing meetings, including Regional Forums, Panel Meetings and the technical committee and working group sessions. We have continued this engagement during the pandemic by means of a series of webinars for members.

Following on, on 15 April 2021, SIGTTO will hold its first ever Virtual Panel Meeting, and a full and exciting agenda for the day has been drawn up. Two of the key presentations will be by the Panama Canal Authority (ACP) and MOL. Raúl Brostella of ACP will discuss the lessons learnt from over four years of large gas carrier transits through the Canal's new, enlarged locks while the representative from MOL will discuss that group's gas-to-power projects.

The SIGTTO Secretariat hopes that the Society's regular Regional Forums and other

face-to-face meetings can resume in the near future. At present we are not scheduling any such meetings until the situation becomes clearer. SIGTTO's 65th Panel Meeting, which had been due to be held in Athens in April, 2021 has been postponed for 12 months for the second time, and is now set to take place in April 2022, also in Athens.

The 83rd meeting of SIGTTO's GPC (GPC 83) is still due to be held in September 2021 in Singapore in conjunction with the Gastech conference and exhibition. SIGTTO will decide whether GPC 83 will go ahead in Singapore as planned nearer the time, when the situation is clearer.

My final thoughts, once again, are with those who have been directly impacted by Covid-19 – the families and friends and the loved ones they have lost. We hope that we can all draw a line under this issue very soon and that life returns to normal.

UPCOMING MEETINGS 2021	DATE	LOCATION
82nd General Purposes Committee	13 Apr	Virtual
Virtual Panel Meeting	15 Apr	Virtual
Spring Board Meeting	26 May/TBC	Virtual
11 th Human Element Committee	8 July TBC	Virtual
Gastech 2021	13-16 Sep	Singapore*
83rd General Purposes Committee	17 Sep	Singapore*
Autumn Board/Annual General Meetings	18 Nov TBC	TBC

UPCOMING MEETINGS 2022	DATE	LOCATION
GPC 84 Pre-Meeting/Environmental Sub-committee	28 Mar	Athens
84 th General Purposes Committee	29 Mar	Athens
65 th SIGTTO Panel Meeting	30-31 Mar	Athens
Panel Technical Visit	1 Apr	Athens

***ASSUMING AN END TO ALL RESTRICTIONS AND THAT TRAVEL ARRANGEMENTS, ETC ARE BACK TO NORMAL**



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HUMAN ELEMENT COMMITTEE WORKING GROUPS



The new, third publication from SIGTTO's Cargo Control Room (CCR) Ergonomics Working Group focuses on the human/machine interface

The following paragraphs provide updates of progress being made by currently active SIGTTO Human Element Committee (HEC) working groups.

Cargo Control Room Human Machine Interface (HMI)

Chaired by Ray Gillet of GTT Training, the Cargo Control Room (CCR) Ergonomics Working Group has finalised the third document in the CCR series, *Recommendations for Cargo Control Room Human Machine Interface (HMI)*. Recommending the use of established human factor principles and processes

in the design of the CCR human/system interface, the document aims to maximise the safe, reliable, efficient and comfortable use of CCR displays and controls. The final draft of this document was approved at HEC's 10th meeting (HEC 10) in January 2021 and will be submitted for SIGTTO Board approval in May 2021.

LPG Shipping Suggested Competency Standards

This working group, which is chaired by Steve Allibone of MOL, is revising and updating *LPG Shipping Suggested Competency Standards (2008)*. The

revision focuses on how working practices and competencies have been affected by changes in the industry, new technologies and improvements in safety, as well as lessons learnt from past incidents. A major addition to this revision is coverage of the use of LPG as a fuel.

The working group has held five meetings so far, most recently in February 2021. The initial draft of this document was shared at HEC 10 for comment in January and a final draft will be submitted to HEC 11 for approval in July 2021.

Shore Staff Competency Management System Standards

Chaired by Jo McDade of Chevron, this working group continues to gather and refine information associated with suggested best practices. They aim to identify and develop a competence management system for shore staff that adds to a company's human factor toolkit. The group will submit a framing document to HEC 11 for comment in July 2021.

Cargo Resource Management

Chaired by Steve Allibone of MOL, this working group is developing a document on a model gas cargo resource management training course. The revised terms of reference for this project were approved at HEC 10 in January 2021 and the group has held two meetings, most recently in February.

GENERAL PURPOSES COMMITTEE WORKING GROUPS AND SUB-COMMITTEES

The following paragraphs provide updates of progress being made by currently active working groups and sub-committees established under the auspices of the SIGTTO General Purposes Committee (GPC).

Emergency Shutdown (ESD) Systems

Chaired by Ajay Edakkara of Shell, this working group has finalised the revision of *ESD Arrangements and Linked Ship/Shore Systems for Liquefied Gas Carriers (2009)*. This second edition, with an updated title of *Recommendations for Emergency Shutdown and Related Safety Systems* will be submitted to the GPC's 82nd session (GPC 82) in April 2021 for approval.

Design and Operation of Liquefied Gas Terminals

This working group, chaired by Guy Nicholls of Cheniere, is combining two existing SIGTTO documents, *Site Selection and Design for LNG Ports and Jetties (1997)* and *LNG Operations in Port Areas – Essential*

Best Practices for the Industry (2003). The single revised document will use a risk-based approach and consider technical advances made and lessons learnt from incidents since the original documents were published. The working group has met three times since its formation in June 2020 and work on the compilation of the draft document continues.

Gas Carrier Propulsion Systems

This working group is the outcome of a GPC member survey and is now chaired by Philip Ryan of BP. The working group continues to work on an initial draft document on environmental and operational issues associated with gas carrier propulsion systems. The document deals with the International Gas Carrier (IGC) Code, the Energy Efficiency Design Index (EEDI), the Energy Efficiency Existing Ship Index (EEXI) and lessons learnt from incidents.

Gas Carrier Reliquefaction Systems

Also chaired by Philip Ryan of BP, this

working group is producing a document on the safety, environmental and operational issues associated with gas carrier reliquefaction systems. Like the Gas Carrier Propulsion Systems working group, it will cover the IGC Code, EEDI, EEXI and incident lessons.

Gas Carrier Salvage

This member-initiated project is chaired by Ian Wolfarth of Chevron. The working group continues to gather information related to potential salvage situations on gas carriers, with the primary focus on prevention and preparedness. The initial draft document is being generated.

The Selection and Testing of Valves for LNG/LPG Applications

Chaired by John Taylor of Shell, this working group is combining two existing documents, i.e. *The Selection and Testing of Valves for LNG Applications (2008)* and *The Selection and Testing of Valves for LPG Applications (2012)*, into a single revised >

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Yacht Registration



Investigations

publication. The working group has met twice since its formation in June 2020 and is compiling an initial draft document.

Guide for Planning Gas Trials for LNG Vessels

This working group, chaired by Rose Brooks of BP, will revise the existing SIGTTO publication *Guide for Planning Gas Trials for LNG Vessels (2008)*. The updated version will take into account recent technology advances, including Type A and large Type C cargo containment system developments. The working group plans to hold its first meeting in March 2021.

Gas Concentrations in the Insulation Spaces of Membrane Gas Carriers

This new working group will revise *Gas Concentrations in the Insulation Spaces of Membrane LNG Carriers (2007)*. The group's terms of reference were approved at GPC 81 in October 2020 and its revision work will recognise, for example, new reference material and environmental considerations.

Gas Carrier CO₂ Emissions

The terms of reference for this new working group were submitted by SIGTTO's new Environment Sub-committee and approved at GPC 81 in October 2020. The working group aims to identify all distinct processes that generate CO₂ emissions on board gas carriers and outline guidance to assist standardisation of reporting methodology.

The first meeting of the Gas Carrier CO₂ Emissions Working Group will be held in March 2021. This group will work in collaboration with a separate group, the Reduction of Gas Carrier CO₂ Emissions Working Group, which also



Development of the latest guidance on gas carrier propulsion systems is taking account of the tightening IMO regime governing fuel efficiency

had its terms of reference approved in October 2020 and is set to begin work.

LNGC Fugitive Methane Emissions

This working group aims to identify all distinct equipment and systems that could generate fugitive methane (CH₄) emissions on board LNGCs; consider best practice measurement and monitoring functions; and outline guidance to assist standardisation of reporting methodology. Its terms of reference were submitted by the Environment Sub-committee and approved at GPC 81 in October 2020. The LNGC Fugitive Methane Emissions Working Group will hold its first meeting in March 2021.

As is the case with the CO₂ emissions initiative, the LNGC Fugitive Methane Emissions Working Group will work in collaboration with a separate group, the

Reduction of LNGC Fugitive Methane Emissions Working Group, which also had its terms of reference approved in October 2020 and is set to begin work.

Jetty Maintenance and Inspection Guide (OCIMF/SIGTTO)

The Oil Companies International Marine Forum (OCIMF) is establishing a working group to lead the revision of *Jetty Maintenance and Inspection Guide (2008)*, a document that it produced jointly with SIGTTO. That collaboration will continue with the new edition and SIGTTO Technical Advisor Rob Farmer is acting as liaison with this working group and will assist in aligning it with SIGTTO publications. SIGTTO's GPC will review and comment on the revised document.

Environmental Sub-committee

Chaired by John Boreman of BP, SIGTTO's new Environmental Sub-committee is comprised of GPC members representing BP, Cheniere, Chevron, Enagas, ExxonMobil, Maran Gas, Shell and Total. A revision of the GPC Constitution, which incorporates the remit of the Environmental Sub-committee, was approved in October 2020.

The Environmental Sub-committee has held three meetings so far, most recently at the end of January 2021. During this meeting the four new working groups on gas carrier CO₂ emissions and LNGC fugitive methane emissions were reviewed. The EEDI and EEXI requirements were also discussed, with the focus on ongoing IMO correspondence groups and the ratifications expected at the upcoming 76th Session of IMO's Marine Environment Protection Committee (MEPC 76) in June 2021.

VIRTUAL PANEL MEETING

Extending member outreach to your desk

SIGTTO will hold its first-ever Virtual Panel Meeting on 15 April 2021, from 0930 BST to 1630 BST. To be similar in format to the Society's long-running series of face-to-face Panels, the onscreen meeting will feature approximately 10 topical presentations by the Society's members and invited guests.

Registration is free for SIGTTO members and is part of the Society membership benefits. Every attendee will need to register. If you have not done so, please use the link below to provide your relevant registration details. There is no limit to the number of registrations from any one member. SIGTTO will also be supplying a one-to-one meeting service

for those attendees wishing to discuss with a SIGTTO officer any matter relating to the Society's activities. These meetings can also be booked through the link below.

The SIGTTO Spring 2021 Virtual Panel will be held using the Swapcard platform which allows networking and other opportunities, including virtual exhibition stands. The event will be recorded and available to view on demand after the event. There will be an opportunity to ask presenters questions after each presentation.

As of press time for this edition of *SIGTTO News*, the following Virtual Panel speakers and their topics had been confirmed.

David Colson of GTT – The new lower boil-off GTT NO 96 system and onboard boil-off gas monitoring and optimisation
Carlos Guerrero of BV – The challenge of

decarbonisation for the gas carrier fleet

Raúl Brostella of the Panama Canal Authority – Experience to date with LNGC/LPGC use of the Panama Canal

Stavros Niotis of ABS – Design and development challenges of very large ethane carriers (VLECs)

Christian Bale of MOL – Challenges of the LNG-to-Powership solution

Kristof Coppé of EXMAR – Using LPG as fuel onboard gas carriers

Frank Ollerhead of Shell – CO₂ gas carriers for carbon capture and storage (CCS)

HySTRA and KHI – *Suiso Frontier*, first liquefied hydrogen carrier

Douglas Rowat, Göran Hermansson and George Mermiris of Stena

- Jettyless Terminal (JFT)
<https://sigtto.wufoo.com/forms/zmlgp3u0zq5dbf/>

Golden anniversary of pioneering days

Fifty years ago, at the start of 1971, there were only five LNG carriers, two LNG export terminals and three LNG import terminals in commercial service. Although Libya's new liquefaction plant, at Marsa El Brega, as well as the scheme's two receiving terminals, one in Spain and one in Italy, and the four Esso LNGCs built to carry its cargoes had been completed in 1970, the overthrow of the country's monarchy by the military under Colonel Muammar Gaddafi had delayed project start-up by a year. Only about 1.5 million tonnes of LNG was moved by sea in 1970.

Yet, after the LNG industry's tentative early years, there were to be a number of developments in 1971 that laid the groundwork for both the expansion of the LNG supply chain and the advance of gas shipping and terminal technology on a global scale. The year's breakthroughs were the beginning of commercial operations at two new import terminals, i.e. Everett in the US and Panigaglia in Italy, and the deliveries of the 50,000 m³ membrane tank *Descartes*, a prototype spherical tank ship named *Euclides* and the first of a quintet of small multipurpose gas carriers from the Heinrich Brand yard in Germany.

Meeting New England's needs

The Distrigas LNG import terminal at Everett, Massachusetts, a suburb of Boston, opened for business in November 1971 when the newly completed *Descartes* delivered an inaugural cargo loaded at the Camel plant in the Algerian port of Arzew. Located on the Mystic River, Cabot Corp's Distrigas facility was the first US LNG import terminal. It was built to meet the growing natural gas demands of the six northeastern New England states, a region prone to particularly cold winters and remote from the country's primary gas-producing states of Texas and Louisiana.

Built of 9 per cent nickel steel, the two 80,000 m³, double-walled Everett storage tanks were the largest such units yet provided for a baseload LNG plant. The suitability of 9 per cent nickel steel in this application was already acknowledged and the alloy quickly became the most popular construction material for LNG storage tanks worldwide.

Everett now has a nameplate capacity of 5.4 million tonnes per annum (mta) of LNG and received its 1,000th cargo in December 2010. Both Everett and Panigaglia are still in service and will be celebrating their golden jubilees later this year.



The Everett terminal has been lighting up New England for 50 years

Panigaglia blends in

The Snam SpA-operated 2.5 mta Panigaglia terminal on Italy's Tyrrhenian Sea near La Spezia was built as part of the Esso project to export Libyan LNG to Spain and Italy over a period of 20 years. Construction of Italy's first LNG import terminal, with its two 50,000 m³ single-wall storage tanks, required a top-level government approval, due to its location within an environmentally sensitive National Protected Site.

As mentioned, commercial operations commenced in 1971 following a year's delay to the planned start-up due to the political turmoil in Libya. Because the Libyan LNG contained heavy hydrocarbons, Panigaglia was originally provided with process equipment able to fractionate, separate and remove the heavy compounds. By the early 1980s Libyan supplies of LNG to Panigaglia had become intermittent at best and a decision was taken to simplify the facility's regasification capabilities. In 1992 a less complex vaporisation arrangement capable of handling LNG from many different sources and encompassing an updated boil-off gas recovery system was installed.

In addition, Pittsburg-Des Moines (PDM), the designer of the original 9 per cent nickel steel storage tanks, carried out a project to convert the Panigaglia units to the double containment design. This was done by constructing a prestressed concrete wall immediately adjacent to the original carbon steel outer walls on the two tanks. Following an 18-month conversion programme, the upgraded Panigaglia tanks were recommissioned in February 1997.

Descartes introduces Technigaz

The ship that delivered the inaugural Everett cargo back in 1971, *Descartes*, was the first LNGC in commercial service to be provided with the famous Technigaz waffled stainless steel membrane. The vessel's containment system, known as the Technigaz Mark I design, had been developed by Conch Ocean,

a 60 per cent Conch/40 per cent Gazocean venture, and featured Conch's balsa insulation and plywood secondary barrier in addition to the Gazocean/Technigaz waffled stainless steel primary barrier.

Descartes had been ordered speculatively to a design that enabled the carriage of LPG as well as LNG. This capability allowed Gazocean to operate the vessel in the LPG trades, where it was a major player, in those instances where prospective LNG employment had not yet materialised.

Although the Conch Ocean partnership had dissolved before *Descartes* was completed, development of the Technigaz membrane system continued under Gazocean's guiding hand. French engineers added polyurethane foam insulation and a secondary barrier made of a composite material called Triplex and by the end of the 1970s the Technigaz Mark III containment system had been born.

Today, Technigaz is part of the GTT organisation and the Mark III system, in its various forms, is one of the world's two leading LNG containment systems, the other being GTT's NO 96 membrane design. According to figures compiled for SIGTTO's 2019 Annual Report, 202 ships in the active fleet of 584 LNG carriers as of 31 December 2019 sported Technigaz Mark III tanks while 86 of the 154 LNGCs on order were specified with the Mark III system.

Spheres come full circle

Although the central focus of Gazocean's president Rene Boudet was LPG shipping, he was a pioneer in many aspects of LNG transport. In addition to his promotion of the Technigaz membrane, he was the first to put spherical tanks on an LNG carrier. Designed by Gazocean's Technigaz technical division and able to carry LPG and ethylene as well as LNG, his 4,000 m³ *Euclides* was delivered by Ateliers et Chantiers du Havre in 1971 as a prototype spherical tank LNGC with the fallback ability to carry other

liquefied gas cargoes. It was also the first LNG ship built without a secondary barrier.

The Technigaz spherical tank containment system on *Euclides* differed from the famous Kvaerner Moss spheres only in the manner in which the spheres were supported by the hull structure. The four 9 per cent nickel steel cargo tanks on *Euclides* were effectively hung from the main deck using a complex linkage arrangement. Seagoing experience with *Euclides* revealed that scaling up the system for use on large LNGCs would pose design problems and the Technigaz spherical tank concept did not progress any further.

However, the Kvaerner Moss IMO Type B spherical tank design, featuring cargo tanks supported by an all-round cylindrical skirt, would prove eminently suitable for use with large LNG carriers. For three decades, up until the turn of the millennium, Moss tanks would prove to be the most popular containment system amongst LNGC owners. At that point the pendulum swung in favour of membrane tanks. The figures compiled for SIGTTO's 2019 Annual Report revealed that there were 132 Moss ships, all with aluminium spherical tanks, amongst the 584 LNGCs in service as of 31 December 2019.

However, there were no Moss spherical tank ships amongst the 154 LNGCs on order.

Small-scale LNG precursors

In June 1971 the Heinrich Brand yard in Oldenburg, Germany delivered the 2,420 m³ *Melrose*, the first in a series of five semi-pressurised/fully refrigerated (semi-ref) multipurpose gas carriers. The ships were capable of not only carrying LNG, ethylene, LPG and a range of chemical gases in their IMO Type C pressure vessel tanks but also burning natural gas in their medium-speed main propulsion diesel engines. Each vessel was provided with two aluminium bilobe cargo tanks with a maximum design pressure of 5.0 barg and three reliquefaction plants, to handle ethylene, LPG, anhydrous ammonia and VCM cargoes.

Of the quintet, *Melrose* and *Heriot* were built for George Gibson of Edinburgh while *Anna Schulte*, *Sophie Schulte* and *Lissy Schulte* were handed over to Bernhard Schulte of Hamburg. SIGTTO General Manager Andrew Clifton reports that he served as chief officer onboard *Heriot* in 1989.

In the absence of any small-scale LNG

markets 50 years ago the Brand quintet spent their working lives engaged in the carriage of LPG, ethylene and other chemical gases. In fact, it was to be the best part of four decades before a small-scale LNG sector began to emerge and when it did one of the early solutions – the multipurpose gas carrier – was modeled on the Brand design.

The most direct descendants of the Brand ships are four multipurpose gas carriers of 10,000 m³ and two of 12,000 m³ delivered by Chinese shipyards to IM Skaugen of Norway over the 2009-11 period. These semi-ref vessels are able to transport ethylene and LPG as well as LNG.

In the early years of the new millennium the global LNG supply chain had spread to such an extent that orders were placed for small dedicated LNG carriers, particularly for service in European, Japanese and Chinese coastal distribution operations. More recently, the LNGC fleet has been augmented by a growing number of purpose-built LNG bunker vessels, all of which are also capable of carrying out small-scale LNG distribution duties. The Heinrich Brand ships set down an important small-scale LNG benchmark 50 years ago.



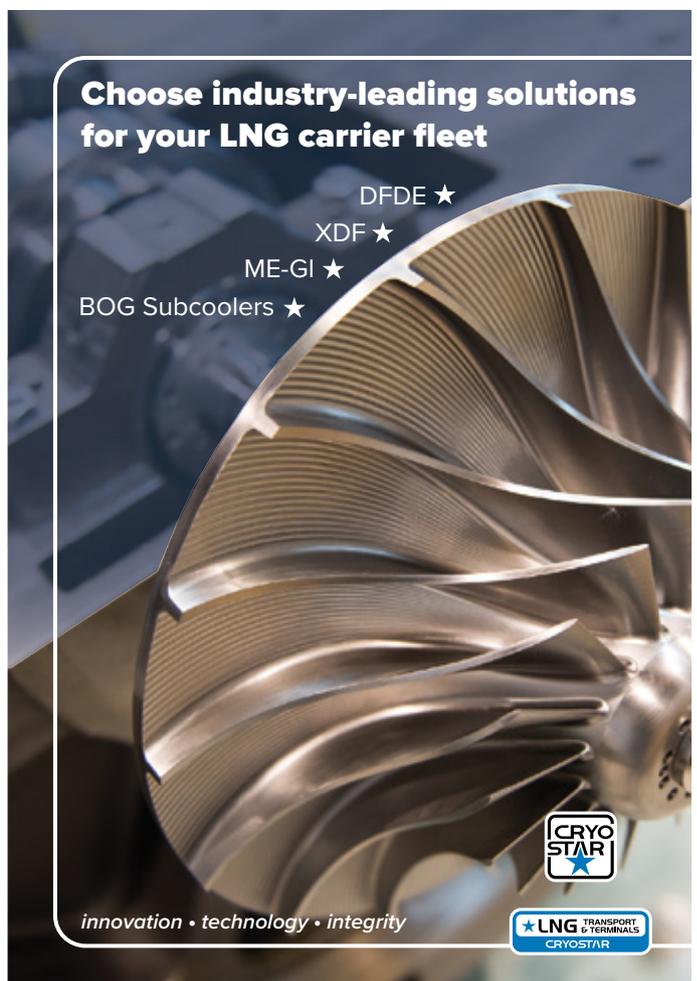
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Principal committees make gas ship progress

The following paragraphs detail the most recent decisions impacting gas carriers taken by the International Maritime Organization's Maritime Safety and Marine Environment Protection Committees. MSC and MEPC are the IMO bodies responsible for maritime safety and environmental protection matters, respectively.

Maritime Safety Committee

IMO's Maritime Safety Committee met virtually for its 102nd Session (MSC 102) in November 2020. Although working on a much-reduced agenda, the Committee did consider several issues relating to gas carriers. These had been previously agreed at IMO's Sub-committee on Carriage of Cargoes and Containers (CCC).

MSC 102 adopted an amendment to the IGC Code on welding (paragraph 6.5.3.5.1) and approved an amendment on watertight doors (paragraph 2.7.1), to be adopted at the next session. In addition, 15 Unified Interpretations (UIs) of the International Gas Carrier (IGC) Code were approved. The 15 UIs are listed on page 11 of the Autumn 2019 edition of *SIGTTO News*.

A SIGTTO paper proposing a focused review of the IGC Code was deferred to the next session, MSC 103, to be held in May 2021.

Marine Environment Protection Committee

IMO's Marine Environment Protection Committee met virtually for its 75th Session (MEPC 75) in November 2020. The cut-down agenda mainly focused on measures for the reduction of greenhouse gases (GHG). The measures concerned are those given in the Energy Efficiency Design Index (EEDI) and the newly established Energy Efficiency Existing Ship Index (EEXI) and Carbon Intensity Indicator (CII).

EEDI The Energy Efficiency Design Index (EEDI) regulations were introduced in 2011 for new ships in the drive to promote the use of more energy efficient vessel equipment and engines. The EEDI requires a minimum energy efficiency level per capacity mile for different ship type and size segments and, through periodic reassessment of targets and performance, encourages a process of continued innovation and technical development in the fuel efficiency of new ships.

The EEDI regulations include a clause requiring a review of the status of technological developments and, if proven



The proposed EEXI requirements would impose the ship energy efficiency regime on existing vessels, including gas carriers

necessary, amendment of the time periods, the EEDI reference line parameters and reduction rates. Such a review has recently been conducted and MEPC 75 adopted an amendment to MARPOL Annex VI to bring forward Phase 3 for LNG carriers and gas carriers $\geq 15,000$ dwt to 1 April 2022. The established 2025 deadline date remains in place for smaller gas carriers.

EEXI and CII Pursuant to the initial IMO GHG Strategy, MEPC has recently been considering short-term measures for the reduction of GHG with a view to agreement by 2023. MEPC 75 approved a package of new measures including the Energy Efficiency Existing Ship Index (EEXI) and an annual operational Carbon Intensity Indicator (CII).

The draft amendments to MARPOL Annex VI will be considered for adoption at MEPC 76 in June 2021, with a view to entry into force on 1 January 2023. Further work on the supporting guidelines is underway in a correspondence group and will be further considered at an intersessional meeting in May, prior to deliberations at MEPC 76. An impact assessment is also being

developed in association with UNCTAD.

In essence, the EEXI is the application of the EEDI to existing ships, with additional guidance to aid application to the existing fleet. It will apply to the same ship types as the EEDI and will use the same EEDI baselines.

The reduction factor for LNG carriers in the proposed MARPOL Annex VI amendments is 30 per cent from the baseline, while for other gas carriers it is between 0 and 30 per cent, depending on ship size. Verification that the ship's attained EEXI is in accordance with the requirements is to take place at the first annual, intermediate or renewal survey after entry into force which, as mentioned, is anticipated on 1 January 2023. The EEDI must be calculated for each ship and be accompanied by an EEXI technical file, which will form the basis for verification by the flag administration or recognised organisation on its behalf.

A ship subject to the EEDI regulations may use the verified EEDI to demonstrate compliance, provided the attained EEDI is equal to or less than the required EEXI. Verification will be documented in the International Energy Efficiency (IEE) Certificate.

The proposed CII, applicable to ships of 5,000 gross tonnage and above, determines the annual reduction factor needed to ensure continuous improvement of the ship's operational carbon intensity within a specific rating level.

The actual annual operational CII achieved will be documented and verified against the required annual operational CII. This will enable the operational carbon intensity rating to be determined. The rating will be given on a rating scale - A, B, C, D or E - indicating a major superior, minor superior, moderate, minor inferior or inferior performance level.

The performance level should be recorded in the ship's Ship Energy Efficiency Management Plan (SEEMP). A ship rated D for three consecutive years or E in any one year would have to submit a corrective action plan, to show how the required index (C or above) would be achieved.

It should be noted that the regulations are in draft form and subject to adoption at MEPC 76 in June 2021. Also, the detailed guidelines, including the method of calculation, are still being developed.

Fourth IMO GHG Study MEPC 75 also approved the Fourth IMO GHG Study 2020. The study contains an overview of GHG emissions from shipping between 2012-2018 and covers developments in carbon intensity and emission projections towards 2050.

Insights from the HEC chair

Steve Allibone writes ...



It is a year on from my first *SIGTTO News* Insights article as chair of the SIGTTO Human Element Committee (HEC) and much has happened in

the interim that has impacted the work of the Committee and its Working Groups.

SIGTTO's vision for the role of its Human Element Committee (HEC) can be summarised as follows: *An efficient, committed and well-organised committee producing quality gas-specific human element guidance which helps prevent accidents; makes gas shipping and terminals safer; and acts as an example to other sectors of shipping.*

More specifically, the Society has tasked HEC with focusing on the following work programme items:

- Identifying gas-specific human element issues
- Determining major incident risks and adopting a risk-based approach to safety
- Reviewing incidents to determine human element impacts and solutions
- Preventing the occurrence of incidents
- Communicating the human element message to all those on the frontline
- As a result of progress on the above items, achieving marked improvements in safety

As part of implementing its defined strategy, HEC makes use of various analysis and measurement tools, including key performance indicators (KPIs). This approach enables us to clearly define targets and, at the same time, makes us more accountable to the SIGTTO Board of Directors.

The last 12 months have presented SIGTTO with many challenges as a result of the global Covid-19 pandemic. SIGTTO's traditional face-to-face gatherings have been replaced by virtual get-togethers, a development which has had an effect on the style of the meetings we hold. Despite being restricted to virtual meetings, however, the HEC Working Groups have continued to take place according to a timetable which is not markedly different from our pre-Covid pace. As a result, the Committee's productivity, in terms of the rate at which new guidance is being prepared, remains uncompromised and, in fact, is being stepped up.

The SIGTTO Secretariat has given

NO.	TITLE	TYPE	TARGET
1.	Human Element Guide and CEO Letter	Project	HEC 11
2.	CCR – HMI Ergonomics	Working Group	HEC 10
3.	Shore Staff Suggested Competency Management System Standards	Working Group	HEC 13
4.	SIGTTO Competency Guidelines	Working Group	-
4.	LPG Shipping Competencies	Working Group	HEC 11
5.	Gas Carrier Competencies for Engineers	Working Group	HEC 13
6.	Crew Safety Standards & Training for Large LNGCs	Working Group	HEC 15
7.	Cargo Resource Management	Working Group	HEC 13
	High Priority		
	Awaiting Further Information		

The current work programme of HEC and its Working Groups

us tremendous support as regards the organisation of virtual meetings and it is pleasing that our Working Groups are able to perform in the virtual world and still uphold the Society's high standards. Great credit for maintaining the momentum in the pursuit of the HEC work programme must also be given to all active Committee and Working Group members.

Since the spring of 2020 the terms of reference have been approved for the Cargo Resource Management Working Group and this unit has now had two meetings and is making good progress on the development of a document on a model gas cargo resource management training course. Elsewhere, the Cargo Control Room (CCR) Ergonomics Working Group has finalised the third document in the CCR series, *Recommendations for Cargo Control Room Human Machine Interface (HMI)*. The completed draft was approved at HEC's 10th meeting (HEC 10) in January 2021 and will be submitted for SIGTTO Board approval in May 2021.

I am very pleased with the progress that the HEC Working Groups are making and over the coming year we are poised to complete more documents to assist and guide the industry. Further details of the latest progress made by the various current HEC Working Groups, as well as of the Committee's latest publications, can be found on page 5.

In addition to our normal HEC work I was involved in three SIGTTO webinars held during the latter half of 2020. As SIGTTO was unable to organise its usual schedule of Regional Forums around the world over the past year, the webinars were welcomed by the Society's membership as helping to fill the void created by the lack of face-to-face encounters. Following on, the Society will hold its first Virtual

Panel Meeting in April, further details of which can be found on page 7.

One of the key ways in which the gas shipping and terminal sector continues to refine and improve its exemplary safety regime is to learn lessons from incidents that have taken place. Fortunately, in our industry virtually all such incidents are either minor in nature or near-miss occurrences. Nevertheless, each such event provides a valuable insight into potential problem areas. The human element has shown itself to be an important factor in a significant number of the incidents that occur.

Both HEC and the General Purposes Committee (GPC), SIGTTO's other principal working body, are active in evaluating the lessons learnt from these incidents and both have accumulated considerable experience from their work in this area. While HEC considers such incidents from a human element perspective, GPC investigates the relevant issues from a technical point of view. SIGTTO then shares the experience and the remedial measures that have been agreed as a result of its investigations throughout the industry. On a personal level I would like to request all participants in the gas shipping and terminal to share their experience of incidents, however minor, with SIGTTO so that our industry as a whole can benefit.

The past year has been a very busy period for us all, despite the many challenges the industry is facing. I am most pleased with the way that SIGTTO in general and my HEC colleagues in particular have adapted to the circumstances to maintain our output of quality industry best practice guidance. However, like all of us, I am looking forward to the added buoyancy that putting the worst of this pandemic behind us and returning to some degree of normality will undoubtedly bring.

BOARD/ANNUAL GENERAL MEETINGS

Setting the agenda for 2021

Participants in the year's Autumn Board of Directors and Annual General Meetings met virtually on 19 November 2020. There were 35 present at the Board Meeting and 55 at the AGM. The latter gathering was SIGTTO's first-ever virtual AGM.

The Board of Directors approved two documents for publication, i.e. *Guidance on Gas Carrier and Terminal Gangway Interface and Floating LNG Installations*, as well as the amended Constitution of SIGTTO's General Purposes Committee (GPC). The GPC Constitution was revised to incorporate the remit of the Society's new Environmental Sub-committee.

In addition, the Board approved the terms of reference drawn up for the following new GPC Working Groups:

- (a) Gas Concentrations in the Insulation Spaces of Membrane LNG Carriers;
- (b) Guide for Planning Gas Trials for LNG Vessels;
- (c) Gas Carrier CO₂ Emissions;
- (d) Reduction of Gas Carrier CO₂ Emissions;
- (e) LNGC Fugitive Methane Emissions; and
- (f) Reduction of LNGC Fugitive Methane Emissions

Following discussion and approval of the 2019 finances and audit at the AGM, the Society's current finances were reviewed and the draft budget for 2021 was also approved. It was agreed that there would be no membership fee increases in 2021.

A key topic on the AGM agenda was the Covid-19 pandemic, in particular its impact on the activities of SIGTTO and the relevant mitigation measures adopted to maintain the Society's work programme. The remote technologies and practices that the Secretariat has employed to ensure that SIGTTO remains open for business to the optimum extent possible in the circumstances were acknowledged.

The AGM participants were provided with updates of progress being made by the GPC and the Human Element Committee (HEC) and their various Working Groups as well as a review of SIGTTO's extensive marketing campaign launched early in 2020. Finally, three changes to the SIGTTO Board were approved at the AGM and the new Directors – Rahul Kulkarni of BP Shipping, Øivin Iversen of Höegh LNG and Chris McDade of Teekay Shipping – were welcomed.

OTHER VIRTUAL MEETINGS

Elsewhere in the virtual world

Following on from the adjacent Autumn 2020 Board of Directors and Annual General Meetings reports, SIGTTO has organised and participated in several other virtual events over the past six months. As the Society's General Manager Andrew Clifton states in his opening remarks on page 1 of this issue, SIGTTO continues to employ remote technologies and practices to ensure that business carries on as usual to the optimum extent possible in the face of the current Covid-19 pandemic.

Amongst the other notable virtual in-house meetings organised recently by SIGTTO are the 81st session of the Society's General Purposes Committee (GPC 81) and three webinars in which the Secretariat and the Committee chairs provided the membership with progress reports on work currently underway to expand and update the Society's portfolio of industry best practice guidelines.

The terms of reference for the six new GPC Working Groups approved by the SIGTTO Board and listed above were first cleared at the GPC 81 meeting on 1 October 2020. Revised terms of reference for two other Working Groups - Design and Operation of Liquefied Gas Terminals and Gas Carrier Salvage - were also agreed at GPC 81. A total of 51 attendees participated in the virtual GPC 81 gathering, comprising 30 GPC members, 15 observers and six SIGTTO Secretariat staff.

The approvals for the new GPC Working Groups boosted the number of technical projects currently underway at SIGTTO to 26 as of 31 December 2020, the Society's largest ever such total. The complement comprises 17 under the aegis of the GPC and nine coordinated by the Human Element Committee (HEC).

To update the membership on the

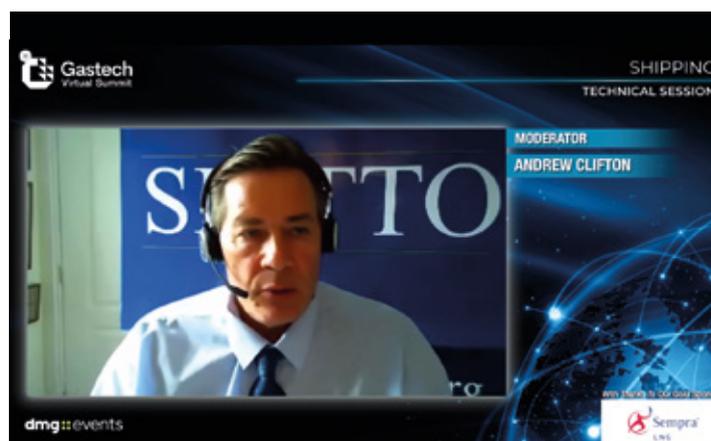
progress of these SIGTTO projects as well as on industry issues and the Society's marketing campaigns and general news, the Secretariat organised three webinars in the second half of 2020, in July, October and December. On average there were around 250 registrants for each of the webinars, with 150 attendees from amongst current and potential member companies joining on the day.

The content of each webinar varied, reflecting the latest progress being made. In the last of the year's webinars, that on 9 December 2020, for example, there was a presentation on *Floating LNG Installations* by SIGTTO Technical Adviser Rob Farmer. This has been edited into a short video and published on the SIGTTO YouTube channel: bit.ly/sigttoyoutube.

SIGTTO's General Manager Andrew Clifton was also able to fly the flag for the cause of its membership's commitment to gas ship safety and environmental protection at a number of recent independent industry events. At the Gastech Virtual Summit 2020 on 7-11 September 2020 he served as technical co-chair and also moderated the event's shipping sessions. In addition, SIGTTO hosted a virtual exhibition booth at Gastech.

The Society also had a presence, and enjoyed member discounts, at the LNGgc, Gas Shipping Virtual and LNG Ship/Shore Interface events. The first two virtual meetings were organised by Energy Informa Connect in October and November 2020, respectively. For both events Andrew chaired the opening session and moderated live and lively Q&A panel discussions, while the Society maintained a virtual exhibition booth.

Finally, at the LNG Ship/Shore interface conference hosted by Riviera Maritime Media on 19-20 November 2020, SIGTTO was a supporting organisation and Andrew Clifton provided the attendees with an update on the Society's activities.



Andrew Clifton moderates the technical shipping session at the Gastech Virtual Summit 2020 event

ALL FLAGS ARE NOT ALIKE

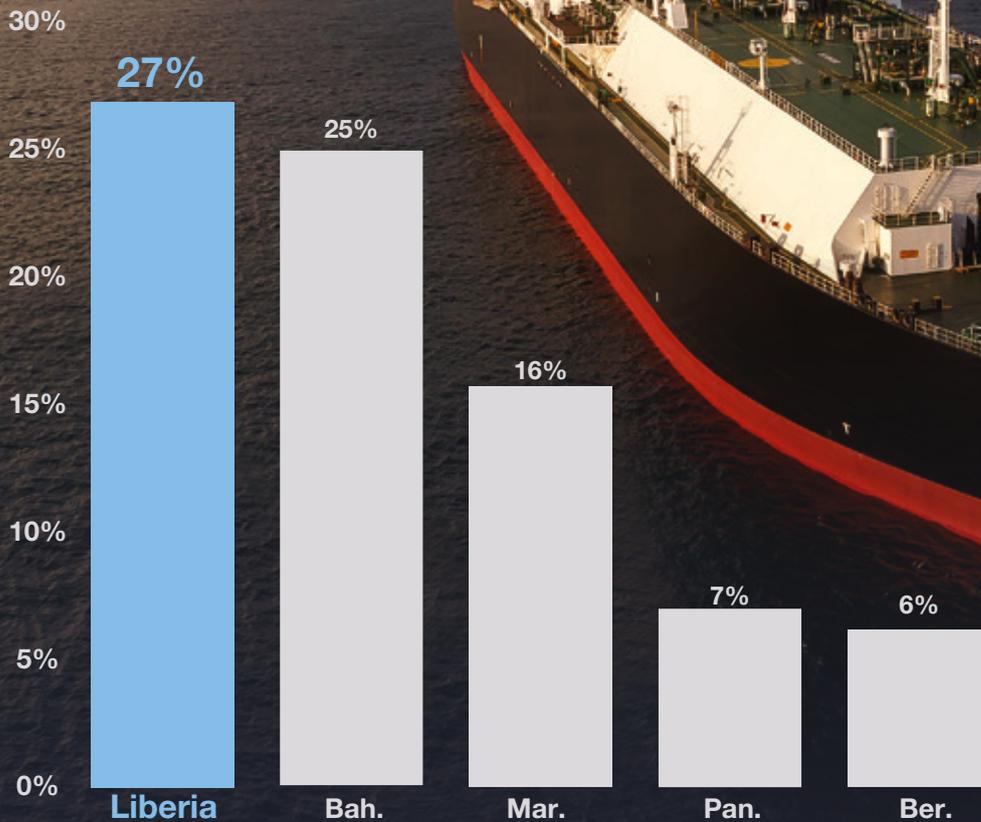
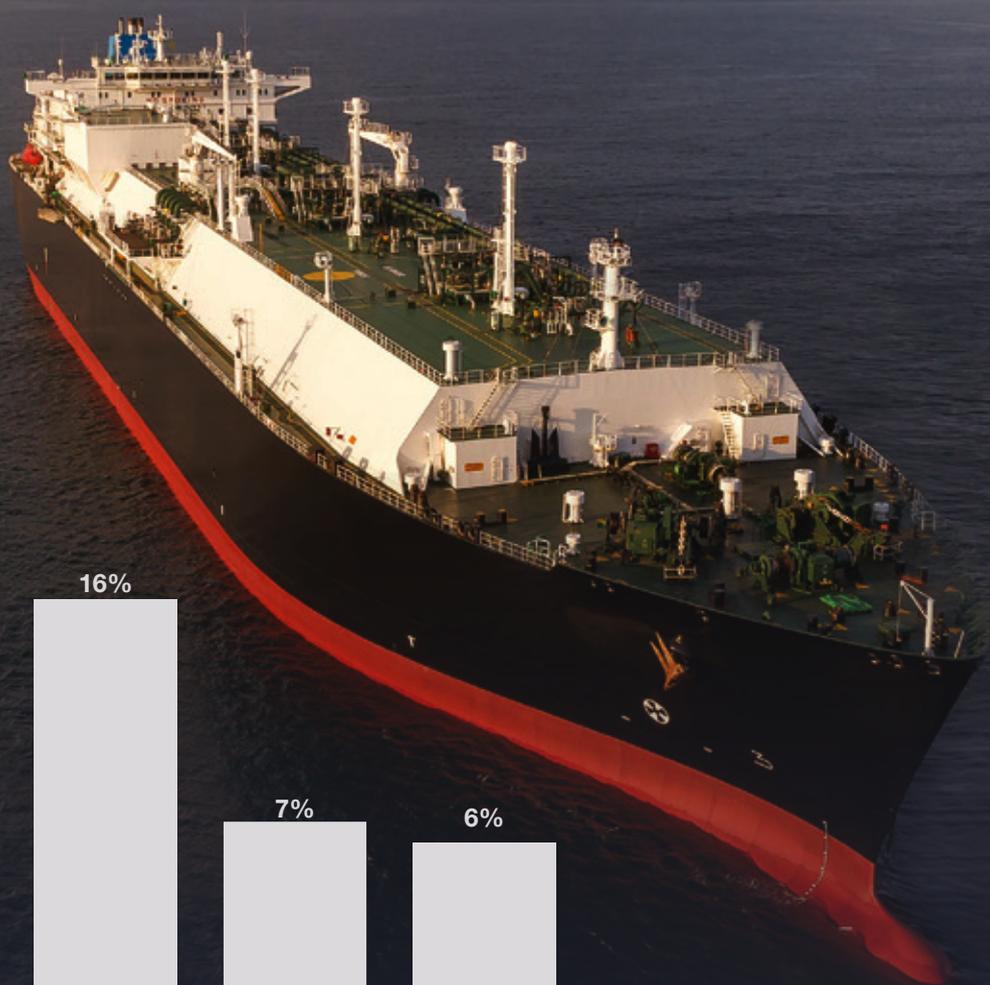


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The Liberian Registry has a dedicated global gas team of industry experts.

Liberia and its dedicated gas team are committed to reducing costs for owners, while providing regulatory and commercial expertise.

This commitment is the reason the Liberian Registry is the fastest growing flag in the world.



Source: Clarksons WFR 01/2021

Gross Tons Growth for Gas Carriers since 2018

Guidance on Gas Carrier and Terminal Gangway Interface



In October 2017, at the 76th meeting of SIGTTO's General Purposes Committee (GPC 76), it was recognised that there was insufficient guidance available on the ship and terminal gangway

interface and that a working group should be set up to address the issue. The Gangways Working Group, consisting of ship operators, manufacturers and terminal operators and with Rick Boudiette in the chair, was duly established.

The document produced by this working group, *Guidance on Gas Carrier and Terminal Gangway Interface*, was approved by the Society's Board in October 2020 and is now available to download from the SIGTTO website.

Gangways are the primary means of safe access to a ship that is alongside a jetty. However, due to the variety of gas carrier and terminal designs, it is difficult to get a perfect fit between the two in every situation. The new gangways document has been provided as a means of addressing this compatibility issue and to minimise, as much as possible, any access difficulties that may arise.

The document provides ship and terminal designers and operators with guidance on gangway design, operations and compatibility determination. The guidelines cover different gangway types and configurations and provide recommendations designed to maximise safe access to the ship via the gangway. After laying down guidance on shore gangways utilised for access to large gas carriers, the document then highlights specific challenges associated with the use of gangways on smaller ships.

Floating LNG Installations



Approved by the SIGTTO Board in October 2020 and now available to purchase, the Society's new *Floating LNG Installations* publication is the outcome of a GPC member survey initiated in 2017. The aim of this exercise was to identify and address possible

gaps in available SIGTTO guidance covering nearshore and offshore floating LNG assets.

The terms of reference for the creation of a Floating Systems Sub-committee as a GPC subsidiary body were approved at GPC 77 in Spring 2018 as was the formation of three working groups. The groups were focused on site assessment, design criteria and operational guidance, respectively, and tasked with jointly developing a new industry best practice document on floating LNG systems that dealt with all three of these key areas. Working group members were drawn from a variety of experts in the LNG industry.

Chaired by Edward Scott, the Floating Systems Sub-committee tasked the three working groups with identifying the hazards associated with the siting, design and operation of floating LNG installations and then creating the guidance that serves to mitigate against such hazards. The floating installations covered by the new document encompass floating storage units (FSUs), floating and storage regasification units (FSRUs) and LNG floating production, storage and offloading (LNG FPSO) units.

The guidance in this document is primarily aimed at developers of projects

making use of floating LNG installations; LNGC owners whose vessels are called upon to serve floating LNG installations; and organisations that interact with floating LNG installations, including port authorities and marine service providers.

The new *Floating LNG Installations* publication primarily focuses on the floating asset, with consideration of the interfaces with topside equipment and systems, fixed marine structures, and gas/LNG operations within project boundaries or established battery limits.

The finished document is split into technical assessment and operations sections. The technical assessment part addresses site assessment and design considerations chronologically, covering the entire asset lifecycle in the process, while the guidance in the operations section is primarily focused on commissioning and start-up, operational safety, standard operations and emergency response planning.

A total of 24 SIGTTO member companies and four classification societies contributed to the drafting and finalisation of the *Floating LNG Installations* publication.

NEW MEMBERS

Trio joins membership

Three companies have joined the Society's membership since the Autumn 2020 edition of SIGTTO News was published. The new members and their dates of joining the Society are shown below. The SIGTTO membership now stands at 134 Full Members, 44 Associate Members and 29 Non-contributory Members.

China Classification Society (CCS)	1 Feb 2021
Thome Ship Management Pte Ltd	1 Feb 2021
Pan Ocean Co Ltd	1 Feb 2021

China Classification Society has joined SIGTTO as an Associate Member and is the eighth class society to do so. Established in 1956 and headquartered in Beijing, CCS has a number of LNG and LPG carriers on its register. The society has recently been making a major commitment, in terms of research and rule development, to LNG bunkering and LNG-fuelled shipping.

Based in Singapore, **Thome Ship Management Pte Ltd** has joined SIGTTO as a Full Member. The ship manager was previously a member of the Society but resigned in 2015 when the company no

longer had any LNG carriers under its management. Thome has now rejoined SIGTTO, having recently become involved with the technical management of LNG carriers once again. Thome is also responsible for the management of a number of semi-pressurised/fully refrigerated (semi-ref) ethylene carriers.

Also signing on as a Full Member is the South Korean shipping company **Pan Ocean Co Ltd**. Known primarily as a global operator of bulk carriers and tankers, Pan Ocean also has one LNG carrier in its fleet, the 2008-built, 153,000 m³ *LNG Kolt*. The company ordered a second LNGC at Samsung Heavy Industries in December 2020.



LNG Kolt is engaged in the carriage of LNG import cargoes to Korea on behalf of Korea Gas Corporation

exercise was to identify and address possible

MEMBER PROFILE

Cheniere – more than your average energy company

Cheniere Energy, Inc was founded in 1996 as an oil and gas exploration business. Early in the new millennium the company shifted its focus to LNG regasification, and started building the Sabine Pass LNG import terminal in southwestern Louisiana's Cameron Parish. As Sabine Pass was being commissioned, however, the US had begun to develop large new reserves of unconventional natural gas and, in response to changing global energy market conditions, Cheniere initiated a project to add liquefaction and LNG export capabilities at Sabine Pass.

Cheniere began producing LNG for export in 2016, becoming the first company in the lower 48 US states to do so. Today the company is the largest producer of LNG in the US and the second largest LNG operator in the world. Cheniere's LNG has reached dozens of markets on five continents, and the demand for this fuel is expected to grow as countries around the world seek cleaner ways to power their economies.

Cheniere's energy infrastructure, which is centred around Sabine Pass and the newer Corpus Christi LNG export terminal in Texas, represents an investment of more than US\$38 billion in the future of energy. Cheniere has established industry records for bringing new liquefaction units, or trains, online ahead of schedule and is the fastest company to export 1,000 LNG cargoes. Cheniere now has eight liquefaction trains in operation at Sabine Pass and Corpus Christi, all of which were built on or ahead of schedule and within budget.

Cheniere reports that its strong business model and the long-term contracts in place with a wide-ranging customer base worldwide have helped it weather the negative market impacts caused by the Covid-19 virus. The company now has a global network of offices and employs more than 1,500 employees and contractors.

Following on from the five fully operational liquefaction trains at Sabine Pass, Cheniere is constructing a sixth train at the terminal which is expected to be completed in 2022. When all six trains are in service, the aggregate nominal production capacity of Sabine Pass is expected to be approximately 30 million tonnes per annum (mta) of LNG.

The company's Corpus Christi LNG terminal, which began operations in 2018, is the first greenfield LNG export facility in the lower 48 US states. Trains 1 and 2 are operating and Train 3 is under construction and due for completion in the first quarter of 2021. When all three trains are in operation, the aggregate nominal production capacity of the Corpus Christi facility is expected

A sixth liquefaction train is currently under construction at Cheniere's Sabine Pass LNG terminal



to be approximately 15 mta of LNG.

Although its sale of cargoes to customers makes Cheniere similar to other LNG producers, there are a number of factors that differentiate the company. Firstly, Cheniere is a full-service LNG provider. The company purchases natural gas from the robust, transparent and liquid North American gas market, liquefies it and offers customers the option of loading the LNG onto their own vessels at Cheniere terminals. Alternatively, Cheniere will transport the LNG to regasification facilities worldwide for those customers seeking deliveries to their door. Furthermore, US natural gas is transported to Sabine Pass and Corpus Christi through third-party pipelines on which the company owns firm transportation capacity, as well as through Cheniere's own pipelines.

Approximately 85 per cent of Cheniere's expected aggregate LNG production capacity is contracted through long-term take-or-pay style agreements with creditworthy counterparties. The remaining LNG volumes from Sabine Pass and Corpus Christi are available for the company's integrated marketing unit to sell into the market. That gives Cheniere the unique combination of stability and opportunity—long-term, contracted, stable cash flows, plus marketing opportunities driven by shorter-term natural gas supply and demand fundamentals in markets worldwide.

Cheniere has been a SIGTTO member since its early LNG import terminal days. In 2016, when it started exporting LNG, Cheniere became a member of SIGTTO's General Purposes Committee (GPC). Cheniere is also a founding member of the Society's recently established Environmental Sub-committee (ESC). This participation aligns with Cheniere's commitment to supporting environmental protection and sustainability across the LNG value chain, a commitment which starts with the provision of the cleanest-burning of the fossil fuels. More recently, the company announced that it is about to launch Carbon Emissions Tags (CE Tags)

in order to provide its LNG customers with greenhouse gas (GHG) emissions data associated with each LNG cargo produced.

In addition to hosting SIGTTO leadership meetings and its involvement with the Society's North American Panel and Regional Forum, Cheniere chairs the SIGTTO Working Group on Design and Operation of Liquefied Gas Terminals. This body is benefitting from Cheniere's experience in making Sabine Pass a bidirectional terminal in 2016 and constructing the first greenfield facility in the contiguous US.

Reflecting its rich experience of functional transformation, overcoming challenges, capitalising on opportunities and focusing on transforming the future of energy, Cheniere's story is one of ingenuity and innovation. The company continues to adapt to market needs by bringing reliable, clean-burning energy to power economies worldwide in a sustainable fashion.

SIGTTO

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Editor: Mike Corkhill

SIGTTO Contact: Erin Rydings
Administrative Assistant
reception@sigtto.org

Advertisement Sales: Ian Pow,
Riviera Maritime Media Ltd
ian.pow@rivieramm.com

Design: jezharrisdesign.com

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