GTT Inside

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Message from the GTT Technical VP

Improving ship performance is one of our major concerns

Welcome to this first issue of GTT Inside for 2016.

You will learn more about the LNGreen project development carried out in close cooperation with Hyundai Heavy Industries, Gaslog and DNV-GL. This study was designed to improve vessel consumption by around 8% by optimizing the vessel form and the LNG tank dimensions. Initially studied with Mark III, this vessel design can also incorporate the latest Mark V technology to further optimize construction and guaranteed daily boil-off rate.

Such technological innovation is enabled partly because GTT participate fully in gas trials of LNG, that we are speaking of on page 2. This and other returns on experience allow us to adjust our technologies to real operational constraints. Our contribution to these trials will be further explained.

Other highlights are the inclusion of membrane land storage technologies on the US (NFPA 59A) and Canadian (CSA) standards as well as the availability of the new GTT LNG operations simulator, G-Sim. This software will contribute further to the training of gas officers and improve safety in operation.

I hope that this issue will be of interest.

Karim Chapot, Technical Vice-President

INNOVATION / LNGreen project reawarded

GTT, Gaslog, DNV GL and HHI have recently received the *CWC LNG Technological Innovation Award 2015* for *LNGreen*, a LNGC project dedicated to the new spot market, developed in parallel with the traditional long-term charter contract market.

The joint project was to develop a new-generation of LNG carrier better suited to current trading patterns than existing vessels, within the bounds of the existing shipbuilding methods. This state-of-the-art LNG carrier concept has a significantly improved environmental footprint, a higher level of energy efficiency, as well as an improved boil-off rate and cargo capacity. It has gathered experts from the different companies involved, who brought their unique expertise and experience concerning the latest technologies under construction, with regards to cargo containment, propulsion efficiency and hydrodynamics.

Gaslog contributed their operational profiles; DNV-GL simulated the efficiency of different machinery arrangements assisted by COSSMOS, whilst GTT enhanced the fitting of the cargo hold space within the optimized hull shape supplied by HHI. The cargo capacity of the ship has been increased from 174 000 m^3 to 182 800 m^3 within the same main characteristics and fully complies with the new IGC code. The Mark III Flex technology has been applied to an innovative tank layout, made of a hybrid bi-oblique tank No4 and an enlarged and convergent tank No1, to the benefit of a specifically low Boil-off Rate (0.085%vol/day). Further to these assessments, Mark V technology can be incoporated for an even lower BOR (down to 0.07% V/Day).

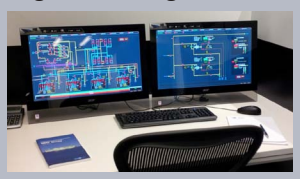
This award underlines GTT's innovation efforts and its ability to work closely with industrial partners. GTT has previously received the CWC innovation award in 2013 for developments in low Boil-off constainment systems.

Focus

TRAINING / G-Sim now available

G-Sim, GTT's LNG Operations Simulator is now available for purchase by its clients for their own purposes.

Used since June 2014 to deliver training to leading ship-owners and classification societies at GTT's training centre in Saint-Remy-lès-Chevreuse, the simulator provides a very effective training platform. Designed to run on standard PC hardware, G-Sim can be used as a 'stand-alone' training solution or in an instructor/multiple student networked configuration. It also provides the user with the capability to select the LNG Carrier configuration based on 16 possible options including vessel size, propulsion systems and tank containment systems, allowing the training session to be based on a particular type of vessel operated by the client, ensuring very effective knowledge transfer and training.



GTT Training can assist with the supply and installation of the software, training of instructors and in the provision of 'off the shelf training materials' allowing the simulator to be used almost immediately. ■

OPERATIONS / Gas trials

GTT's scope of competence is wider than the design of membrane containment systems and assistance during shipbuilding. GTT experts also provide advisory service during gas trials.

This compulsory stage is necessary before the vessel's delivery and consists of fully testing the cryogenic equipment in real conditions during several weeks. As an expert in LNG containment systems, GTT supports the shipyards commissioning teams in order to make its expertise available directly during these trials.

Over the last three years, GTT representatives have participated in 64 such trials. They have provided advice and assistance on many subjects related to GTT containment systems, cargo handling design and operations. During the time spent on board, many questions have been answered, some tricky situations have been solved, and a lot of feedback has been shared between all the participants.

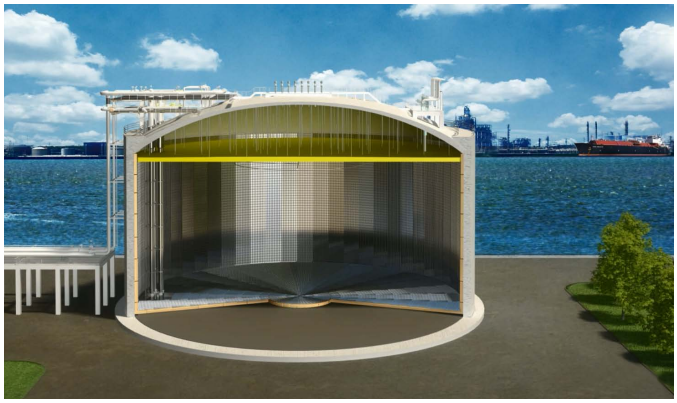
Gas trials are an important opportunity for gathering experience. They allow GTT to pass on its knowledge and advise to the LNG market. It also proves its involvement and expertise on operational matters, as well as allowing to better assess the global requirements of its partners.

STANDARDS / Land Storage Membrane Full Integrity gets full recognition of the world leading US STD NFPA 59A

The world leading standards organization for onshore LNG facilities has recently issued an update of its 2016 Standard which now includes provisions for the use of membrane full integrity tank designs for onshore tanks.

Unlike standards for LNG shipping, which mainly rely on the IGC code; applicable standards for onshore LNG storage design, construction and operation fall under national or multi-country standards. Many countries use NFPA 59A, EN1473, or a combination of both. Major oil and gas companies are however more comfortable with the US Standard, as it is known as more conservative and uses a more prescriptive approach.

Absence of the Membrane Full Integrity technology from NFPA 59A was a significant barrier to implementing Membrane onshore technology in North and South America, Africa, Middle East, and Asia Pacific. This new recognition is a major step forward for acceptance of the Membrane Full Integrity tanks in future LNG onshore projects worldwide. This new update also shows a trend toward developing alternative technologies, providing benefits in CAPEX and construction schedule without compromising safety.



Earlier in 2015, Canada also issued its new LNG facility Standard (CSA Z276) including full requirements for use of Membrane Full Integrity.

Save the dates

GTT will be at
LNG 18,
Perth, Australia,
12-15 April 2016

LNG 18

GTT's 2016 Training Courses
on Membrane Containment Systems:

- **14-20 March 2016**
- **23-27 May 2016**
- **17-21 October 2016**
- **21-25 November 2016**