

Message from Frédérique Coeuille, GTT Innovation Vice-President



« I am very pleased to have the opportunity to write my first editorial for GTT Inside, a newsletter where we are trying to keep the industry abreast of our developments, particularly with the objective of further increasing industry efficiency and maintaining its outstanding safety record. My role in GTT began several years ago within the Innovation Directorate, taking on the responsibility for Materials R&D, then subsequently assuming the leadership of the Materials & Laboratory Department, a field that I know very well from my previous professional experience with SAIPEM.

Since last September, I am in charge of the Innovation Directorate, a very exciting challenge in an industry which may appear conservative but which at the same time is looking for and adopting many enhancements. What pleases me most today is to present you some of these developments which may significantly ease the day-to-day life of LNGC owners. For example, with our new technical solution designed to avoid the formation of gas pockets at the top of the tanks, it is now possible to increase the quantity of LNG transported by new-build vessels equipped with this modification. It may appear as a slight improvement; 1% of the cargo volume, but this is far from being insignificant. You will read also that we have obtained General Approval for Ship Application for the Mark III Flex+ technology from four major classification societies. Mark III Flex+ brings a BOR of 0.07%V per day and has already been adopted by one owner. Enjoy reading this issue and please share with us your opinions and comments, not only on the content of this newsletter, but also on all of what we are doing. »

Frédérique Coeuille, Innovation Vice-President

INNOVATION / "B-Free LNGc" - Development of an LNG carrier free of Ballast-water

A majority of merchant vessels worldwide use ballast water when the units are empty or partially loaded in order to maintain seaworthy conditions. This ballast is needed to reach sufficient draft for propeller immersion and avoid excessive bow-slaming.

For these reasons, a considerable quantity of ballast water is transported by ships every day from one side of the ocean to the other. However, this implies investment in related systems and substantial operating costs. In addition, the vessel's operation can be impaired by the quantities of cumulated sediments at the bottom of the ballast tanks. On the environmental side, transporting ballast water leads to the risk of transferring harmful aquatic organisms and pathogens if ballast is discharged in the arrival port during the cargo loading operations.

Concerned by the severe environmental impact, IMO has recently adopted the "Ballast Water Management Convention", dealing with this major global problem.

The cheapest way to be rules-compliant in the future is by not using ballast water at all. GTT has reinvestigated this ship-design problem of a ballast-free ship for LNG carriers using its membrane systems. Knowing that previous proposals of ballast-free vessels were somewhat different and not yet built, GTT has focused on small and medium-size LNG carriers which are not as restricted by draft limits as the larger vessels.

The advantages of a ballast-free vessel are numerous, in terms

of investment, operating costs, simplification of the vessel operation, reduced corrosion and prolonged lifetime. Especially in coastal trades with frequent calls in major rivers, the operators can benefit greatly from of the Ballast-Free design.



B-Free Design

The proposed solution targets a higher draft in the design load case, and thus obtains a sufficient draft in the empty-ship condition. This is reached by use of a trapezoidal mid-ship section, also sometimes called shortly a "V-shape". This shape reduces the vessel block-coefficient, therefore increasing the draft. The membrane technology is well adapted to this design feature. Since membrane type carriers are lighter than those with independent cargo tanks, in many cases a substantial initial draft margin is available.

GTT, Lloyd's Register and Dalian Shipbuilding Industry Corporation (DSIC) decided to join forces in a joint Industry Project (JIP) named "B-Free LNGC".

For a 30k LNGC, key operational questions are addressed and the necessary project work for full contractual maturity.

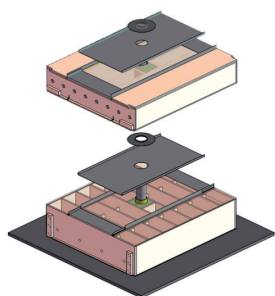
The present concept can be developed in practically all small to medium-size vessels. Larger ships can be considered on a case by case basis.

The Ballast-Free carrier is both environmentally friendly and of high economic interest. Ship-owners and Operators have largely understood this already.

Going further through 2018, a first "B-Free LNGC" could begin the next decade as a real breakthrough in the shipping industry. ■

TECHNOLOGIES / Solution for isolated vapour pocket management

The latest IGC code has enforced new restrictive constraints on increased tank filling limits, the most being that no isolated vapour pocket can appear and remain out of pressure control or means of pressure safety in case of severe damage condition of trim and list of the vessel following a grounding or collision.



Gas crossing solution for NO technologies

In parallel with the elaboration of operational procedures for such an event, GTT has developed a design solution for tanks in order to maintain connected each part of the vapour space and thus avoid isolation of a vapour pocket. This fully meets IGC requirements.

A crossing at the ceiling of membrane tanks has been developed. These connections cross the

containment and trunk space, and permit the connection of the tank to the vapour header and pressure safety valves. For a typical vessel configuration, only two crossings are necessary to deal with all trim and list conditions, each of them located close to the middle of the upper tank dihedrons, sufficiently recessed from sloshing areas.

Currently, solutions for NO family and Mark III Flex 400 mm are available and can soon be applied to newbuildings. For each containment technology, the secondary barrier remains complete, as well as the secondary space. For a typical large tank, a gas pipe crossing of 3" is sufficient to deal with the generated boil-off gas.

Henceforth, a greater filling limit could be allowed for vessels which will be equipped with these gas crossing solutions. This system evolution has received an AIP from BV and is under approval by other Classification Societies. ■

TECHNOLOGIES / NO96 Pressurization system Evolution 3 based on Mark solution

A new pressurization system for NO technologies has been developed to provide enhanced maintenance flexibility for LNGCs and particularly for FSRUs.

The NO96 pressurization system will soon experience a significant evolution. The current pressurization system equips more than 250 NO LNGC carriers and FSRUs. A new pressurization system for NO technologies has been developed in order to provide enhanced maintenance flexibility and safety.

The new pressurization system Evolution 3 allows first an easier maintenance of the insulation spaces of one tank while the other tanks remain in laden cargo conditions and in operation.

Furthermore, in case of gas leak in one space, the new arrangement will prevent contamination of other tank spaces.

Based on Mark pressurization system principle, the main feature of the new system for NO is a full independency of each insulation spaces. >>>>

SERVICES / GTT strengthens its service activity by the acquisition of Ascenz

Smart shipping is how digitalization can be applied to the shipping industry to improve fleet management and ship performance, especially with regards to energy efficiency and environmental compliance. The aim is to offer onboard decision support systems to the crews and inform onshore management on how the ship is performing and how it could be improved. In this area, some skills are critical to provide value to customers; sensors and data quality, experience of the maritime environment and its constraints, and the ability to integrate this in reliable and user-friendly tools.

This is precisely what Ascenz is proposing to its customers. Founded in Singapore in 2008, Ascenz has installed its proprietary Shipulse system, which includes sensors and data collection systems on more than 400 ships, from OSVs to container ships and bunker barges. Data is accessed and visualized through its Shipulse online portal, allowing onshore teams to gain insight on their current and past performance. In February, the company has also launched an EU-MRV module, aimed at automating the reporting requirements of the European environmental regulation. To prepare the future, Ascenz is also applying artificial intelligence techniques to the operational data, in order to improve the understanding of fuel consumption and to optimize performance.

On December 6, GTT has announced the acquisition of a 75% stake in Ascenz. Our common goal is to bring value to the shipping industry by combining LNG expertise and digital solutions. ■



Mark III Flex+ obtains 4 general approvals

Last September, GTT launched Mark III Flex+, a variant of its Mark III Flex solution. At the end of 2017, it successively obtained the General Approval from 4 classification societies: ABS, Lloyd's Register, DNV GL and Bureau Veritas. Mark III Flex+ reduces the guaranteed Boil-Off Rate, reaching a performance of 0.07%V per day instead of the 0.085%V per day guaranteed by Mark III Flex. Such an advance is made possible thanks to an increased insulation thickness and a reinforced arrangement of the secondary barrier. These approvals confirm the maturity of GTT's latest solution. ■

>>>> The resulting feature is the removal of both the cryogenic pressurization headers which simplifies the piping arrangement; the supply of nitrogen is now replaced by one single conventional non cryogenic line.

One of the most remarkable improvements concerns the gas maintenance header which can also be used for insulation space maintenance of one isolated tank.

Pressurization system Evolution 3 now allows an enhanced flexibility and strengthened safety on NO insulation spaces and provides a particularly improved solution for FSRU operators.

This system could be particularly interesting for FSRUs in order to facilitate maintenance operations in the event that tank segregation is required. ■