

LNG tank design facilitates fuelling integration

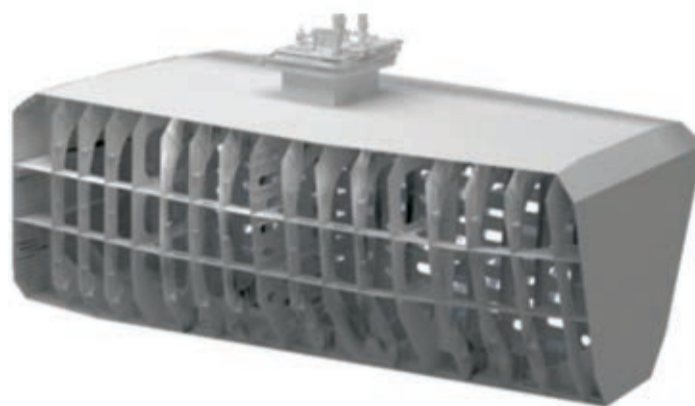
LNG is frequently cited as a solution in providing cleaner and more sustainable fuel but the reality for many operators is that switching fuel is prohibitively expensive. Typically, a switch to LNG has meant major investment in new vessels or costly and difficult retrofitting but a range of new innovations now aim to simplify the construction process for shipbuilders, broadening the pathways for firms seeking to transition to LNG. Fuelling Editor Malcolm Ramsay has more.

An example of this approach is the Fuel-BOX system, developed by Singapore-based developer LNT Marine, which offers a comprehensive containment system for LNG-fuelled vessel. Featuring a semi-pressurized prismatic fuel tank, this solution builds on the core principles of the firm's successful A-BOX containment system and can be modified and optimized to meet individual vessel requirements.

"With flexible shape and high-volume utilization, the system is considered an attractive solution for large scale LNG and/or ammonia fuel tanks," Kjetil Sjølie Strand, CEO of LNT Marine tells *LNG Journal*. "Type A tanks offers lower weight and costs than type B and C tanks. In addition, the self-supporting tank with internal structure is not prone to sloshing and can operate at any filling level without an extra strengthening – different than certain other containment system technologies."

The semi-pressurized nature of the tank, coupled with a low BOR, provides operational flexibility and extends the holding time compared to atmospheric tank designs. This means that the system not only offers enhanced efficiency but also allows for prolonged periods between refuelling, contributing to improved operational feasibility for ocean-going vessels.

"In addition, as the only tank system with all insulation outside of the secondary barrier, there is no compatibility issues with ammonia," Strand adds. "The technology has been tested and approved for ammonia applications, and can even be made as an



Fuel box design

ammonia ready LNG tank, i.e. a tank that can carry LNG now and ammonia whenever this becomes available."

Designed with a Limit State Design approach in accordance with the IMO IGC standards, the technology has earned Approval in Principle (AiP) from the American Bureau of Shipping (ABS) class and UK classification society Lloyd's Register, further validating its compliance and safety measures within the industry.

"The unique arrangement with a cold interbarrier space offers safety advantages as a potential leak would not generate rapid vaporization and offers a more manageable vent handling requirement – which is key for the adoption of ammonia as fuel," Strand notes.

Established as a merger between LNG New Technologies and MGI Thermo in 2017, LNT Marine can trace its origins back to Norwegian shipping pioneer Drammen Slip & Verksted in the 1960's. This firm was a niche player in refrigerated cargo ships and built in total 45 reefers and freezer vessels, building unrivalled



LNT Fuel-Box

experience in marine insulation systems.

Simplifying design

The success of the Fuel-BOX technology is based on LNT's A-BOX design which uses IMO type A tanks as the primary tank/barrier, allowing shipbuilders to benefit from one of the simplest designs in the IMO IGC code. Constructed primarily of flat surfaces and aluminium, the system is a cost-efficient solution and can offer expanded capability thanks to the surrounding insulated cargo hold with a full secondary barrier.

"The insulation and secondary barrier in the LNT A-BOX is based on a proven panel system which is light, flexible and easy to install," Kjetil Sjølie Strand, CEO of LNT Marine tells *LNG Journal*. "Moreover, this design offers reasonable cost levels and enables more shipyards to build LNG carriers, which in turn offers more building capacity and competition which further drives down costs."

Last year, LNT signed a framework agreement with Singaporean conglomerate Keppel to provide access to its A-BOX technology for construction of new vessels. Having converted one vessel already, LNT Marine is now forecasting a strong uptick in deployment in 2024.

"As this solution enables more shipyards to build LNG carriers, we are now in a position to offer the sector more capacity, competition and flexibility in the field of LNG shipbuilding, which we believe is in the interest of the entire LNG industry," Strand, says.

Slosh mitigation

One key advantage of the A-Box system is the ability to mitigate sloshing and,

coupled with full visual condition monitoring of all barriers, this ensures the system can continue operating in a robust set of conditions.

"As an independent self-supporting tank, the type A tank has internal structure for strength purposes which is also acting as swash bulkheads and mitigating any sloshing loads on the tank," Strand explains. "Since the cargo tank is supported by a cargo tank support system transferring all static and dynamic loads to the hull structure, whilst the insulation system is fitted on the hull compartment plating, there is not compression loads on the insulation system."

As a result of these design features, the insulation surrounding the fuel cargo does not need reinforcements for compressive strength but can instead be optimized for thermal performance. As a result, the design can utilise low density PU foam which offers the lowest thermal conductivity, and achieve market leading boil-off rates (BOR).

"Since the insulation system with secondary barrier is not fitted directly on the tank, but on the hull side of the compartment there is an interbarrier space between the tank and the secondary barrier. When ventilated and warmed-up, this interbarrier space is accessible and offers full access to visual inspection and condition monitoring of the tank, secondary barrier and tank support system," Strand adds.

The firm has also partnered with ship design firm SDARI and classification society ABS to conduct comprehensive technical assessment and robustness analysis, including detailed FE analysis and fatigue assessment. ■



Artist's rendition of LNG A-BOX vessel