



Mitigating the sloshing risk through astute voyage planning

boil-off gas is generated in the cargo tank.

The Seaware onboard vessel route optimisation system based on weather patterns, in tandem with GTT's sloshing prediction program, is designed to help avoid an excessive tank sloshing incident at sea. The package takes into account the detailed hull lines of the ship, the actual loading condition, roll damping, wave spectrum and ship speed/heading. The ship's master and his deck officers can, prior to departure, simulate and plan a sailing route mitigating potential tank sloshing risks as part of an optimised route recommendation calculated by Seaware.

As the loading condition, weather and sea states can change during transit, Seaware's ERL uses its tactical alerting mode to warn crews of potential excessive tank sloshing risks as they evolve. Such alerts provide enough time to change course or speed while the system assists in choosing the most efficient mitigation action.

GTT and StormGeo point out that their collaboration also enables the development of sloshing impact monitoring systems that can be used at sea to monitor real-time sloshing activity in the tanks and check the efficiency of mitigating action. Based on GTT's expertise on statistical sloshing data analysis and Seaware ERL monitoring/recording capacities, post-voyage analysis can also be performed, enabling constant improvement in the management of fleet operations.

Tank in a box containment from LNT

A new IMO Type A containment system for LNG carriers developed by Norway's LNG New Technologies (LNT) has been prototype-tested at the Xiamen Shipbuilding Industry yard in China. Called LNT A-BOX™ and featuring a Type A tank positioned in an

insulated hold, the system won an approval in principle (AiP) from DNV GL in mid-2013.

The test project was carried out in close co-operation with MGI Thermo as well as the yard, and the testing was witnessed by class surveyors from ABS, BV and DNV GL. LNT points out that the Type A tank is equipped with a full secondary barrier and that the LNT A-BOX system combines proven technologies in a new robust, safe and cost-effective configuration.

LNT is promoting the following attributes for the system:

- self-supporting, solid primary barrier backed by a full, independent secondary barrier
- full access to both barriers for inspections and maintenance
- cost-effective design and construction
- easy fabrication, facilitating the entry of new yards into LNGC construction
- a prismatic design, yielding good volume utilisation and a flat deck layout
- no loading limitations as sloshing risk mitigated

The prototype tests in Xiamen were carried out for procedure qualifications and to demonstrate and verify the arrangement, particularly in regard to the insulation system with the integrated secondary barrier. The system was exposed to extreme tests by simulating tank collapse with liquid nitrogen at -196°C. The secondary barrier was flooded with liquid nitrogen on four occasions and no leaks or major cold spots were observed during any of the cooldown cycles. Internal inspections, including by class surveyors, showed no evidence of thermal damage.

LNT is now embarking on the next phase of development. This includes project-specific designs for conventional LNG carriers and floating LNG vessels fitted with the LNT A-BOX containment system. The development of LNT A-BOX has been supported by the Research Council of Norway and Innovation Norway. *LNG*



Cross section of the LNT A-BOX containment system