Dynamic positioning and LNG offloading

A combined Marin/SBM research project on the use of multibody dynamic positioning has implications for LNG tandem offloading operations

Marin, under a commission from SBM, has demonstrated the feasibility and performance of offshore LNG cargo transfer operations involving shuttle tankers that use multibody dynamic positioning.

Side-by-side offloading and tandem offloading are the main options for the transfer of cryogenic cargoes between two floating units. Experience suggests that side-by-side operations should be limited to relatively benign conditions while tandem arrangements allow for offloading in more severe sea states.

For tandem offloading, the options are hawser mooring or dynamic positioning (DP) of a shuttle tanker. Floating LNG production units (FLNGs) under consideration will have large topside processing and hull structures and these can shield a shuttle tanker positioned for tandem cargo operations from some of the vessel movements caused by wind and current. However, the relative motions of both vessels remain a critical factor in the accurate and efficient position keeping required to maintain safe loads in the offloading system during transfer operations.

Jorrit-Jan Serraris, Marin project manager, Jean-Robert Fournier, SBM test manager, and Marie-Laure Becel, SBM hydrodynamic engineer, performed model tests for the DP Tandem Offloading of LNG project, using the research institution's in-house DP software RUNSIM.

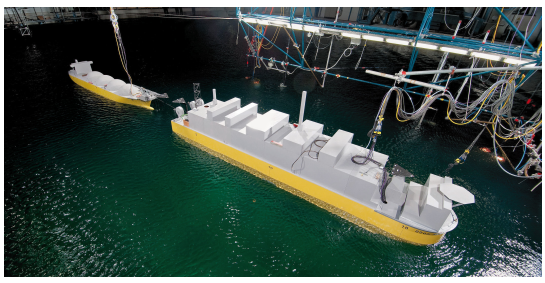
"Our model tests show that there can be some weather-vaning effects when the carrier is only connected with a hawser and delivering backward thrust. The weather-vaning motions of both vessels result in larger relative motions. Using DP the shuttle can more accurately follow the motions of the FLNG, and this results in less relative motion," states Mr Serraris.

In the tandem configuration the shuttle tanker is submitted to a disturbed wave field accentuating the wave frequent motions, which, in DP mode, could result in frequent thruster corrections that would generate undesirable wear on the propulsion system. "Every time a wave comes to the vessel, it is moved. It is undesirable if the DP system reacts to these wave frequent motions as it means the azimuth thrusters are turning with each wave cycle," adds Mr Serraris. "DP systems need to ensure that the thrusters only respond to the low-frequency wave motions reaching the vessel."

Marin researchers have enhanced the RUNSIM functionality to include algorithms that incorporate motion information from the FLNG as dual input, along with the shuttle tanker's motions. Marin and SBM researchers and engineers have also worked closely together on generating, validating and interpreting model test data for both hawser and DP tandem operations.

In the DP configuration the shuttle tanker follows a reference point on the FLNG in order to minimise relative motion between the vessels. In practice, the project team believes, multibody DP functionality could be achieved by using a beacon on the stern of the FLNG that communicates relative position information to the DP system on the shuttle tanker. Alternatively the shuttle tanker system itself could measure the relative motions of the FLNG.

Experience from the evaluation of different types of tandem offloading operations through the various projects Marin has been involved with has demonstrated that there are several possible algorithms that could be used to track the vessels' relative motions and to minimise thruster activity. Future research at Marin will evaluate these with the aim of further improving the results achieved through multibody DP for offshore LNG operations. *LNG*



Marin and SBM collaborated on the LNG dynamic positioning test programme