

FLNG ASV - Bridging engineering to operations

An impressive operation and an impressive project! FLNG ASV highlights MARIN's strategy of linking the engineering phase to the operational phase. Noël Bovens & Gerrit van der Want, n.bovens@marin.nl



MARIN's simulation services for this particular project consist of fast-time and real-time simulations. In support of the operational phase to install and commission Shell's FLNG Prelude in northwest Australia, MARIN was contracted to conduct a feasibility study. During the installation and commissioning, an Accommodation Support Vessel – the POSH Arcadia – will be closely positioned to the FLNG. It is fitted with two bow thrusters and seven ASDs and throughout the operation, the ASV will try and maintain position on DP while the walk-to-work arm is connected with the FLNG.

The installation operations will comprise a heading control phase during the mooring hook-up, riser and umbilical pull-in, and water intake riser installation. This will be followed by a free weather-vaning phase, during which the FLNG's seawater discharge may be activated.

Verification study – Fast-time simulations One of the objectives of the verification study is to make sure that there is an optimal transfer of knowledge from the earlier engineering phase by Shell and TechnipFMC to the operations phase. To this extent, the fast-time simulation work is about the assessment of the motions of the FLNG and of motion sensors placed at positions 1 (aft) and 2 (port) for the intended location of the ASV. These form an initial assessment of the ability of the walk-to-work arm to stay connected. At the same

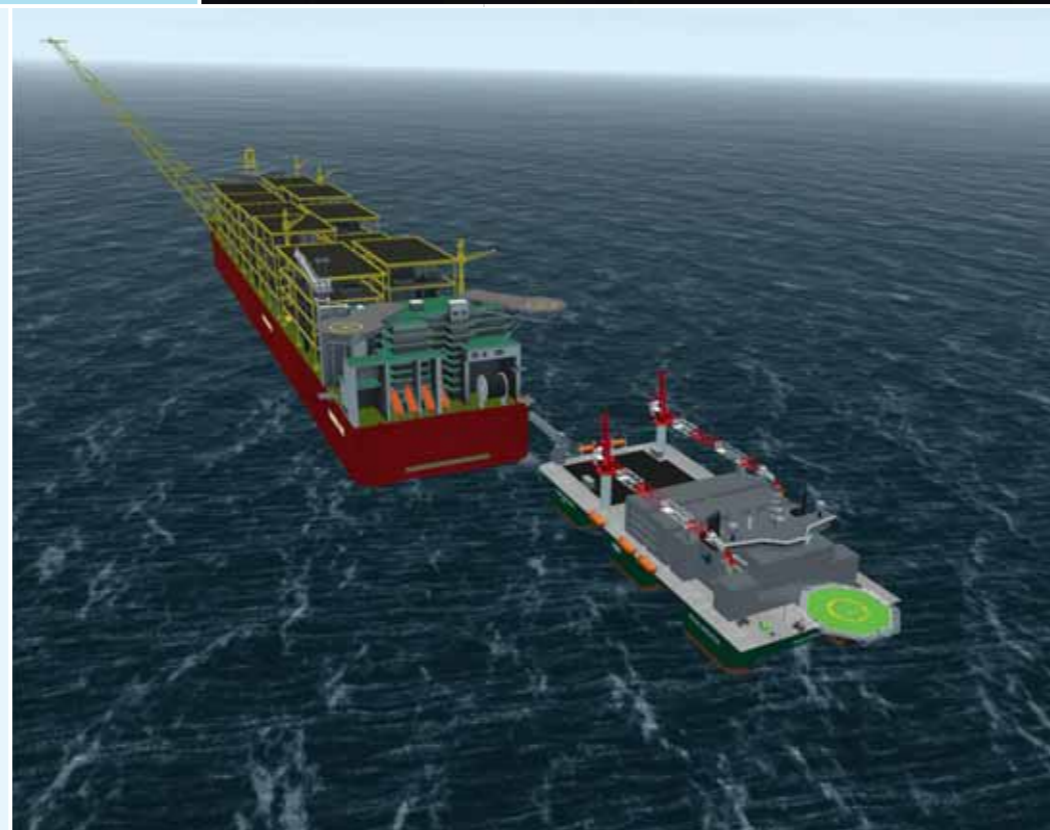
time, these results give valuable insight into the relevant environmental situations that will be investigated in the real-time simulations. An additional objective was to assess the effect of the FLNG seawater discharge on the stationkeeping ability of POSH Arcadia.

MARIN's in-house diffraction analysis program DIFFRAC and the aNySIM XMF time domain simulation code were used for the simulations. aNySIM is used to verify the properties of the complex composition of lines connected to the FLNG, the ASV vessel and the seawater discharges.

An accurate simulation model is essential for this type of training programme. The hydrodynamic behaviour of the components of the simulation model is reflected in natural periods and damping of the FLNG and ASV and the stiffness of the mooring system. By means of numerical decay and static load tests, the hydrodynamic behaviour of the components is calculated.

Results are documented in a preparation report, which enables TechnipFMC to verify the simulation model against its design calculations, prior to the full mission simulation study.

Full mission simulations – Real-time simulations Following the verification study a five-day simulation programme was carried out. The complete team of seven operators played an active



role in the simulations, which were carried out on a set of MARIN bridge simulators. The newly developed DOLPHIN simulator system uses the same modelling technology as aNySIM XMF. This means that the components could be imported directly into the simulator database.

The five-day, real-time programme was jointly developed by MARIN and TechnipFMC/Shell. The input data was agreed and

database development was coordinated. This resulted in a carefully thought out simulation programme.

Important input In the simulation sessions the crucial parts of the operation were executed under various weather conditions. Using the DOLPHIN software, scenarios could be amended at very short notice, allowing the programme to be adjusted whenever necessary.

The operations investigated the heading control phase towards the end of the hook-up stage with all 16 lines connected and the subsequent weather-vaning phase. Heading control was mainly achieved by using three AHTS vessels, which were positioned up-weather. For the free weather-vaning operations, various environmental situations in terms of wind, wave and current were investigated. Solitons and squalls were also considered.

During the programme contingencies were checked for events such as sudden increase/shift in wind, line breaking, the ASV's thrusters malfunctioning while on DP, etc. Results from the project will provide important input for the definition of the Activity Specific Operating Guidelines (ASOGs). ▢

