



Aerial view: simulation of the complete operation

Dockwise pushes the boundaries in Aasta Hansteen T&I project

MARIN Several years of preparations are behind the complex Aasta Hansteen Transport & Installation (T&I) project, which will culminate in a unique catamaran floatover operation. In light of this, the Maritime Research Institute Netherlands (MARIN) has been contracted by Dockwise, a wholly owned subsidiary of Royal Boskalis Westminster NV, to carry out an entire range of simulation services. The two are working closely together to create a dedicated training programme for the Dockwise team.

With a length of 198m, diameter of 50m and operating displacement of approximately 150,000 tonnes, the *Aasta Hansteen* platform will be the world's largest spar hull and the first of its kind on the Norwegian continental shelf. The Statoil-operated platform is a spar FPSO with gas production through SCR risers and 25,000m³ of storage capacity for condensate. The *Aasta Hansteen* gas field is owned by Statoil, together with ConocoPhillips, OMV (Norge) and Wintershall.

Being built by Hyundai Heavy Industries (HHI) in South Korea, the platform is set to be transported by two of the world's

largest heavy-lift carriers, the *Dockwise Vanguard* (spar) and *Dockwise White Marlin* (topside), and installed in water depths of more than 1,300m.

Bas Polkamp, Dockwise's senior project manager, and tow master Capt Hans Bosch have outlined the importance of simulation exercises, especially for the intricate catamaran floatover operation.

Aasta Hansteen has to be one of the most complex offshore projects ever carried out, pushing the boundaries in every sense. The topside (100m x 50m x 56m) alone weighs 25,000 tonnes, while the spar hull weighs 47,000 tonnes and is 198m long and 50m wide. Additionally,

the location itself is in challenging waters, with depths of a staggering 1,300m plus. The 52,183-tonne *Dockwise Vanguard* is also a unique vessel and has been designed to be able to handle a spar hull in a horizontal position.

Unimaginable forces

Polkamp explained that Dockwise's core activity involved moving large production platforms or floating structures using its fleet of semi-submersible transport vessels and installing large topside facilities on fixed jackets and floating structures, so it is used to handling these immense structures. But despite the company's dec-

ades of experience, this project is still in a league of its own.

“Given the huge structure, moving and installing it involves almost unimaginable forces. And when it comes to installation, the sea state, currents, wind and waves are major factors, and this makes the need for simulation exercises an absolute necessity,” Polkamp said. He explained how the T&I would be carried out. A key part of the project is the catamaran operation, and although Dockwise has performed this delicate procedure in the past, the *Aasta Hansteen* takes it to another level. Dockwise has to transport both the topside and spar hull to an inshore location near Stavanger, Norway, and combine the two elements in a state-of-the-art floatover operation.

“The location was chosen because the fjord gives protection against swell, waves and other environmental actions and at the same time provides sufficient depth for the spar hull,” Polkamp said. In addition to this, Dockwise has to transport the living quarters from the Netherlands to Ulsan, South Korea.

Following the transport of the living quarters, *Dockwise Vanguard* first has to carry out the horizontal transport of the spar hull from the yard in South Korea to the fjord near Stavanger. The hull will be upended and submerged (the spar hull will have a freeboard of 6m when ready for “mating” with the topside and will eventually be submerged 198m) by Technip and installed in an anchor spread to fix it to the seabed. The hull is then ready to accommodate the topside. Dockwise will then carry out the next phase and transport the topside from South Korea. Dockwise’s new vessel and one of the largest in its fleet, *White Marlin*, will carry out this transport, and then the topside will be installed on the hull.



Transport of the hull of the Lucius spar (2013)

Topside mating operation

However, because Dockwise cannot sail its ship over the spar hull, an alternative approach had to be designed for installation of the topside. “We will be using two of our smaller, Swan (S-class) vessels. Large steel nodes will be mounted on the topside, and once *White Marlin* arrives in Norway with the topside, the two S-class vessels will manoeuvre alongside. The two vessels will have been fitted with four enormous support structures for the nodes, which include leg mating units. They are tailored precisely to manage the weight of the topside and the prevailing dynamic of wind, weather, waves and currents,” Polkamp said.

Once the two ships have been positioned on either side of the *White Marlin*, they are raised and Dockwise will retract the *White Marlin* to create the “catamaran configuration” by ballasting the *White Marlin* down and the two S-class vessels up.

This results in a catamaran structure with the topside linking the two hulls. Dockwise then deploys tugs to move the topside into position above the spar hull and couple them together. “Although this is not the first time we have deployed this catamaran configuration, it is the first time we have been doing it with such a huge 25,000-tonne unit,” Polkamp remarked.

Twelve vessels

Capt Bosch explained that some twelve vessels would be involved, including the *Dockwise Vanguard*, two S-class, *White Marlin*, and then four tugs will be rigidly connected and two auxiliary tugs will assist, alongside smaller line handlers and personnel transfer vessels. “This is precision work. We first have the transfer from the *White Marlin* onto the two S-class; we take the *White Marlin* out of the catamaran phase and then there is the moment when we



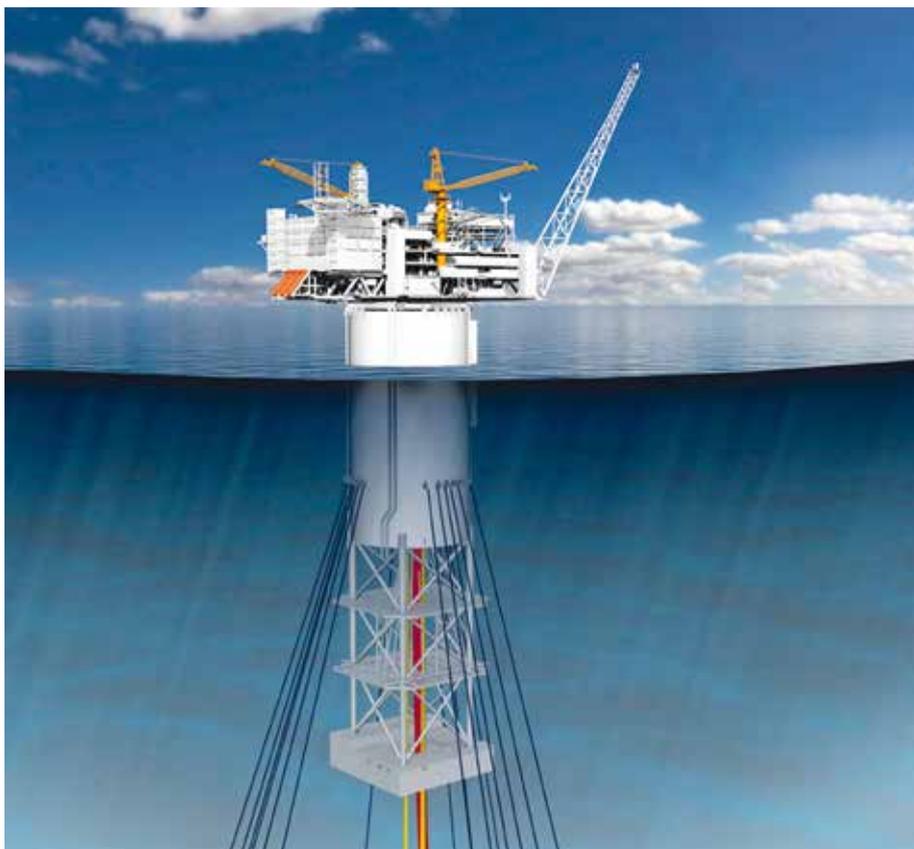
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Artist's impression: The entire structure – the upper and lower parts – make up the spar. The lower part is the spar hull – the upper part is the spar topside.

are physically moving over the spar. It is the combination of physically bringing her over the spar by manoeuvring but also by connecting all the mooring lines to fix it in its final position.”

Years of preparation, precision calculations and simulation exercises are all vital to the success of the project, both Bosch and Polkamp pointed out. MARIN is involved in several aspects of the project. The scope ranges from a motion verification study, to

ensure the proper transfer of findings from the engineering phase to the operations phase, to simulating the transfer of the topside from the *White Marlin* to the two Swan vessels to create the catamaran configuration. MARIN and Dockwise will also simulate towing the catamaran vessels to the spar using the tugs and installing the topside on the spar via the floatover method. Crucially, the simulations will look at various ways of how all the procedures can best be done

given the operational parameters (wind, wave, current) and the available catamaran and tug capabilities.

Matching reality

Polkamp said it was vital that engineering matched reality. “Essentially, we wanted MARIN to help us examine three critical aspects – manoeuvrability, the feasibility of the marine spread and how the team behaves. It is all about risk mitigation; we wanted to assess the configuration with the rigid-connected tugs, manoeuvrability and how we can best position the vessels – the whole dynamics of the configuration.” Simulations are also important as a marketing tool,” Polkamp added. “This project has many of the major players involved. We are keen to show them that we deliver state-of-the-art engineering, and show them what we are capable of operationally. Both HHI and Statoil are very keen to see the simulation exercises and will be attending some of the training days at MARIN.”

Creating the team

The simulation exercises are also very important when it comes to building the right team, Bosch emphasised. “With any project there is the added complexity: people. We want to find the best team. We have learnt from other projects, where we carried out simulations at a much later stage, that the earlier they take place, the better. Simulations make things run a lot easier. You need to have good cooperation and understand each other. If you simulate in the preparation stages, it is possible to get a very good team at an early stage of the project. Everyone involved has to know exactly what they are doing.”

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