Boskalis
Dredging & Marine Experts

PROJECT SHEET

SU TU VANG FSO INSTALLATION
MOORING LEGS AND RISER SYSTEM
INSTALLATION AND HOOK-UP

BOSKALIS ENERGY SOLUTIONS

Boskalis is a leading global dredging and marine expert. With safety as our core value we provide innovative, sustainable and all-round solutions for our clients in the energy market. Realizing projects in remote locations with a heightened environmental focus is one of our specialties. Under brands such as Boskalis, Dockwise, SMIT, Asian Lift, Fairmount, VBMS and Smit Lamnalco we offer more services than any other company in our industry, making us your next one-stop solution provider.
We support the development, construction, maintenance and decommissioning of oil and gas import and export facilities, fixed and floating exploration and drilling facilities, pipelines and cables, and offshore wind farms.

SU TU VANG FSO INSTALLATION PROJECT

The Cuu Long Joint Operating Company (CLJOC) was planning to develop the gas finds in Block 15-1 southeast of Vung Tau, Vietnam. The water depth of this Su Tu Vang Field is approximately 54 meters.

Smit Singapore Pte Ltd, a wholly-owned subsidiary of Boskalis, was awarded the contract for the FSO installation work involving the mooring of the FSO with a 360-degree-weather-vaning external turret mooring system. The work also included the permanent attachment of a catenary anchoring system (consisting of nine mooring legs) to the turret of the FSO using variable lengths and sizes of chain and connected to the piles at the bottom end. Two flexible riser systems were connected from the FSO, via a mid-water arch, to the PLEM of a gas & oil subsea piping system.

EXECUTION OF THE PROJECT

Smit was responsible for project management, and the engineering and execution of the work.

FEATURES

Company	Cuu Long Joint Operating Company (CLJOC)
Loading location	Southeast of Vung Tau, Vietnam
Period	Preparation Jan 2008 – Aug 2008 Execution Sep 2008 – Nov 2008
Contractor	Tanker Pacific Offshore Terminals
Subcontractor	Smit Singapore Pte Ltd

A Location map
B Flexible riser installation
C Smit Borneo working near FSO turret

The installation works included the following activities:

- Installation of anchor piles and mooring legs. The mooring leg pattern of the FSO turret is 3 x 3 cluster system.
- Pre-tensioning of nine (9) mooring legs
- Hook-up of the nine (9) mooring legs to the FSO
- Installation of mid-water arch system ("MWA")
- Installation of the flexible risers and leak testing of the product flow system
- FSO rotation test

The equipment was mobilized at the SMIT yard in Singapore. The installation vessel deployed was the Smit Borneo, a 500 ton revolving crane work barge. Before the loading of the equipment, the barge was adapted specifically for this work. Installation support frames, overboard chutes and a large raised deck were engineered and installed on board to accommodate the saturation diving and ROV spreads.

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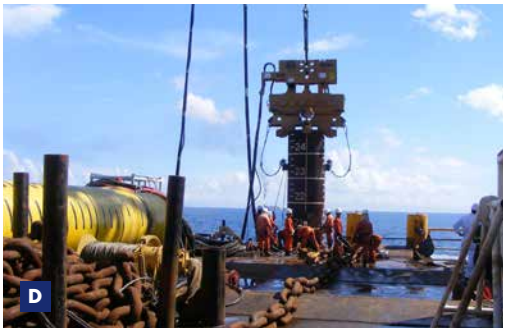
D

When the equipment arrived at the site, a ROV was deployed to confirm the position of the pre-installed PLEM before sweeping the intended pile landing locations prior to the start of the piling operation. The piles were upended and mooring chains were connected on the deck of Smit Borneo before the piles were deployed overboard to the designated locations for installation. Piles were installed to the correct depth, orientation and verticality, all within the specified installation tolerances. Each mooring chain was positioned in the required corridor, pre-tensioned to different loads depending on the cluster, and buoyed off subsea for later recovery.

The FSO was towed into position and set up for the hook-up operation when all the mooring legs had been installed and accepted by the MWS. The FSO was held in position by several SMIT tugs. The mooring chains were recovered by ROV onto the deck of the Smit Borneo before being transferred to the FSO for the hook-up operation. The chains were secured by the FSO chain stoppers once it had been tensioned to the specified angle. The position of the turret center was constantly checked and calculated by the engineer and, upon acceptance, the excess chain lengths were cut.


F


E

The assembly of the MWA and its gravity base on board the Smit Borneo started upon completion of the operation to hook up the mooring legs. The whole assembly was lifted and installed smoothly by the crane of the Smit Borneo on the seabed to the specified tolerances. The risers were then installed and the subsea tie-in was performed by the saturation divers. The riser systems were successfully installed and leak tested.

The entire installation operation was completed with the rotation test and the installed FSO was handed back to the Contractor.

SAFETY
Safety is an essential component of all Boskalis projects. Safety performance on this project was good. All equipment and procedures were vetted to identify and remedy any discrepancies with the various requirements applicable. Due to the short execution period, the vessel's own system was leading and it was complemented with the additional items to cover the requirements of both the contractor and the subcontractor.

PROJECT CHALLENGES
The main challenges that were dealt with effectively during project preparation and execution were:

- Quality equipment, subcontractors and all steel-related works were in very high demand due to the upturn of the marine industry during the project period. It was a challenge to secure all the supporting works and equipment and to work within the constraints of the project planning.
- SIMOPS were inevitable due to the tight development plan for the field. It was challenging to de-conflict activities for the various contractors working there.
- During the later stage of the offshore operation, the NE monsoon began, leading to prolonged rough weather and sea conditions, and slowing down the execution of the work as extra caution was taken.

CONCLUSION
The Su Tu Vang FSO was successfully completed before the full force of the NE monsoon impacted the site. Industry best practices were adopted and implemented, with the Engineering and Operational teams collaborating with the client's project team to work within the constraints of the project. The safe and controlled execution testifies to the fact that the combination of best operational practices with good engineering will eventually lead to the successful completion of the challenging project.

D Pile Installation
E FSO installed and handed over
F Preparation for hook-up of FSO mooring legs

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