Boskalis
Dredging & Marine Experts

PROJECT SHEET

MALAMPAYA PHASE 3
TRANSPORT AND INSTALLATION OF DEPLETION COMPRESSION PLATFORM

GENERAL

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, 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.

THE MALAMPAYA PHASE 3 PROJECT

The Malampaya gas-condensate field is located offshore Palawan in the Philippines. This field provides 45% of the gas needed to generate electricity for the island of Luzon, including Manila.

In order to maintain the current gas production, Shell Philippines Exploration (SPEX) installed a new Depletion Compression Platform (DCP) next to the existing Shallow Water Platform (SWP) in a water depth of approx. 45 m. The DCP is a self-elevating steel platform with four tubular legs with footings. A 45 tonnes steel bridge connects the SWP and the DCP.

As a result of Boskalis' broad capabilities and to minimize interfaces, SPEX awarded Boskalis a combination of two contracts; one for the Seabed Preparation, consisting of excavation of unsuitable soil and installation of four rock pads to serve as a firm and level foundation for the DCP and a second contract for the Transport and Installation of the DCP, involving towing the DCP from the fabrication yard at Subic to the Malampaya gas field, positioning and installing the platform along with the connecting bridges and finally ballasting of the DCP's footings with iron ore.

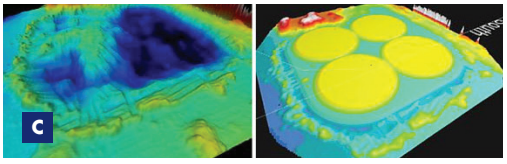
FEATURES

Client	Shell Philippines Exploration (SPEX)
Location	Offshore Palawan
Period	2014 - 2015

A Location map
B Ndeavor working in close proximity to the SWP
C Malampaya foundation area: after excavation and after completion of rock pads
D Team spirit while the Ndeavor is preparing the seabed in the background

INNOVATIVE APPROACH: SWISS ARMY KNIFE AT SEA

Given its close proximity to the existing live SWP and subsea infrastructure (umbilical's, gas pipelines and risers), a Dynamically Positioned vessel was required for the operations. A standard approach for the wide variety



of scopes to be handled, would have been to perform the various parts of the works using different types of vessels.

Boskalis innovative one-stop-shop approach was based on utilizing its DP2 Construction Support Vessel Ndeavor and fitting this vessel out with the necessary special equipment and purpose-built tools to perform the works, a swiss army knife at sea if you will. Entirely developed by Boskalis' in-house engineers, these specially designed pieces of equipment represent the most advanced and innovative technologies in the respective fields:

- A dredging arm incorporating a drum cutter to disintegrate the hard rock, a submerged pump to transport the dredged material and a retractable discharge bow sprit to place the excavated material at the designated disposal location;
- A rock placement fall pipe capable of placing rock with a high degree of accuracy;
- A wave compensating platform to facilitate the installation of the permanent bridge; and
- A solid ballasting system, complete with ROV for preparing the iron ore slurry and pumping it into the footings.

SEABED PREPARATION WORKS

The first task was the excavation of the seabed with the dedicated dredging tool to remove the limestone and sand material to create a suitable foundation footprint. Once completed, in the same operation, four pads were constructed for the DCP footings. These four rock pads were constructed with the vessel in fall pipe mode to meet the highest levels of accuracy with respect to level, inclination and density. Prior to being loaded on board of the CSV, some 68,000 tonnes of gravel material was produced at a local quarry, tested and transported to the purpose-built rock load-out facility in Batangas.

PLATFORM TOWING AND INSTALLATION

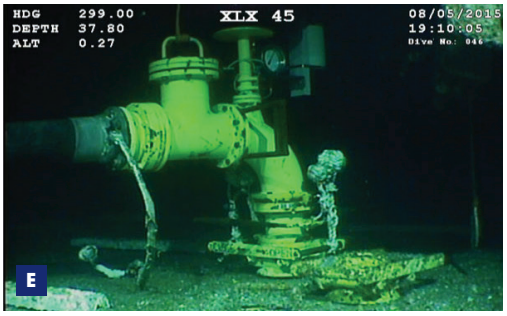
Following the installation of the required temporary equipment on the DCP at the fabrication yard the platform was floated out of dry dock and towed safely to the Malampaya field. The platform was initially positioned using four 150 ton bollard pull anchor handling tugs (AHT), followed by the precise positioning using constant tension winches connected to the SWP legs and when the DCP reached its exact position, the legs were lowered to touch down. Once the position of the platform within the tolerances, had been established, the barge deck was raised to its final level and the temporary bridge to provide initial access to the DCP from the SWP was installed. Shortly thereafter the approximate 151 tonnes permanent bridge was installed. The permanent bridge was safely installed using a wave compensating platform to keep the bridge steady in respect to the DCP and SWP decks.

PLATFORM BALLASTING

For the DCP to withstand the high forces caused by tropical typhoons ballasting was required. The purpose built ballasting system included sophisticated mixing, measuring and pumping equipment able to ensure controlled filling operations. Boskalis work class ROV's were used to connect the filling hoses to the DCP footings, allowing for a complete diverless operation. A total of over 9,000 t of iron ore was placed within the footings.

BOSKALIS SAFETY PROGRAM NINA

The project was completed safely and LTI free. The implementation of NINA, Boskalis' own safety program, proved once again to be effective and able to match and exceed the highest safety standards of the oil and gas industry.



E Ballasting hose and valve connected to the DCP footing, monitored by Ndeavor onboard WROV
F The temporary bridge in place and the permanent bridge going to be lifted from Ndeavor deck.
G Ndeavor during ballasting operations

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