

PROJECT SHEET

DAN BRAVO RATIONALISATION (DABRAT)

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 Offshore, Dockwise, SMIT 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.

MAERSK OIL DAN BRAVO RATIONALISATION (DABRAT) PROJECT

The oldest Maersk Oil field, Dan Bravo, is located in the Danish sector of the North Sea. The first platform in the complex was installed in 1972. The complex consists of platforms A, B, C and D. The Dan B platform forms the production hub of the Dan Bravo Complex and Dan A platform is one of the wellhead platforms at the Dan Bravo complex.

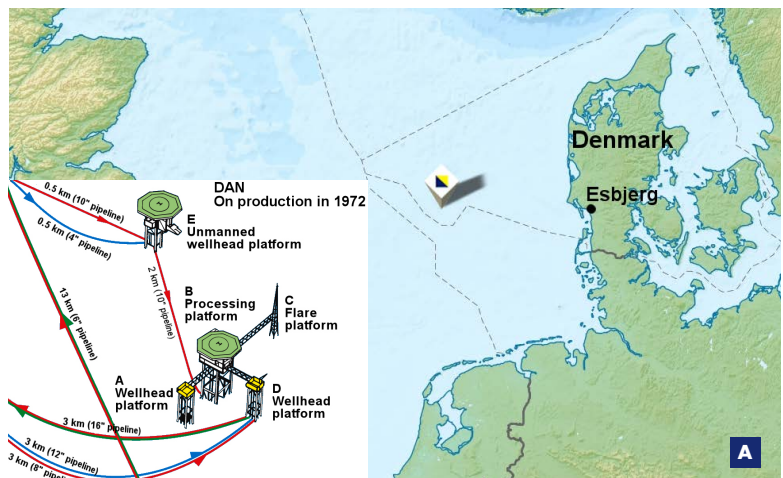
Maersk Oil decided to carry out a platform lifetime extension program for the forty year old jacket structure to extend the service period of the structure until 2042.

Boskalis Offshore was awarded a contract by Maersk for the DABRAT project, involving both the preparation and construction work to the Dan A and Dan B offshore oil production facilities. The extensive scope not only included the subsea installation and removal work, but also fabrication of structural items, procurement, setting up and testing of lift equipment and structural examinations. The works covered the years 2013 and 2014.



FEATURES

Client	Maersk Oil
Location	North Sea, Danish Sector
Period	2013 – 2014
Contractor	Boskalis Offshore Subsea Services



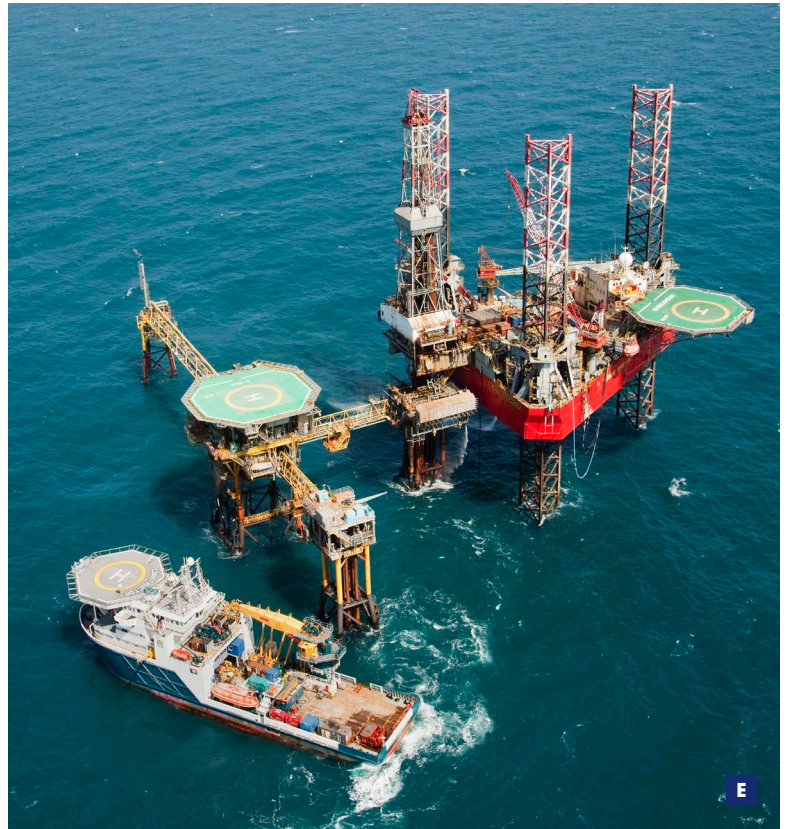
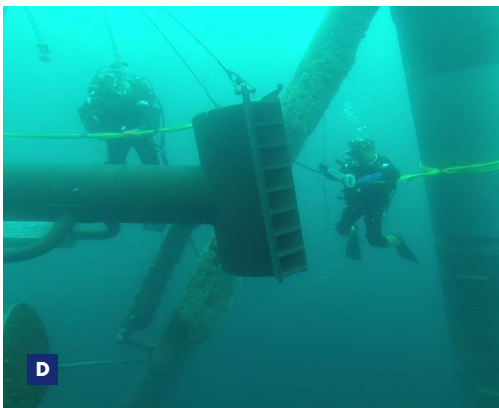
A Location map (inset Dan Field layout)
B Maersk Dan complex

General summary of the work scope:

- Reduce sea wave load onto the jacket structure by removing old boat fenders and pump caissons.
- Inspection history enhancement by investigating all available inspection data, searching for known cracks in the subsea structure and inspecting potential problem areas.
- Remove crack or damaged areas and replace with new structure (e.g. Conductor guide level).
- Reinforce subsea structure by adding retrofit (clamped) structures to strengthen key areas.
- Renew consumables by retrofitting additional anodes by means of clamps due to depletion and removing some of the original anodes.

The 2013 offshore campaign started in July and was completed in September. During this campaign Boskalis performed the 3D subsea photogrammetry activities, classified as world's largest ever undertaken, by air/saturation diving and ROV operations acquiring exact geometrical information of subsea K-joints to be able to design reinforcement clamps.

Operations were performed on depths varying from 10 to 41 meters. Besides the technical challenges the environmental conditions as sea-state, fog and subsea reduced visibility (minimum 2 meter required for image taking) dictated the progress of the work.



Detailed activities of the 2013 campaign:

- Determining exact placement of conductors to prepare the new conductor guide level.
- Determining position of welds for reinforcement clamps installation.
- Subsea cleaning of structural members from soft marine growth with high pressure water jets to hard marine growth by grit blasting.
- Manufacturing of approximately 3,000 magnetic markers outfitted with coded targets and positioning of the markers by divers.
- Photogrammetry scope with high definition camera operated by the work class ROV resulting in approximately 20,000 overlapping images mapping the objects in X, Y and Z direction and covering the total survey area.
- Detecting same numbered targets and calculating the exact position by image processing software.
- Exporting information from the 3D photogrammetric point model to 3D and CAD software for construction designing purposes.

For the subsea works two of our Diving Support Vessels (DSVs) were deployed, namely DP3 Protea, equipped with two air dive spreads and work/inspection class ROV, and DP2 Constructor with 12 men saturation dive spread and work/inspection class ROV.

The winter period of 2013/2014 was used to draft the installation procedures for the 2014 campaign, to process the 3D photogrammetry results and to engineer and manufacture the steel structures weighing in total more than 200 tons.

In the summer of 2014 the new conductor guide frame and K-node reinforcement clamps were successfully installed.

The Boskalis NINA (No Injuries No Accidents) program was assessed by Maersk Oil to comply fully with the Maersk Oil Incident Free Orientation Session, compulsory for every person to attend prior to mobilization to a Maersk Oil offshore site.

Both DSVs had a safety advisor on board to ensure safe performance of the work. No lost time injuries were experienced during the project.

- C** Diver grinding flush appurtenances on one of the platform members
- D** Divers installing new conductor guide frame
- E** DSV Constructor working on site

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