

### 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, 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.

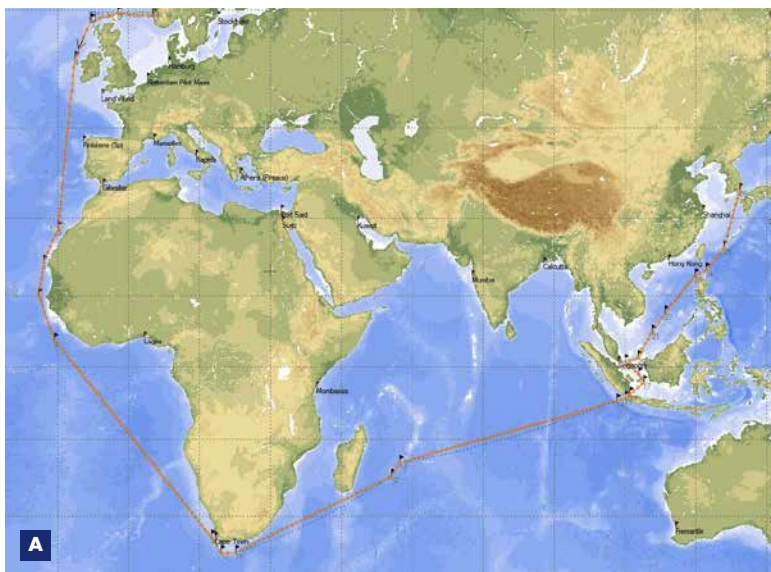
### FPSO PETROJARL KNARR

The Petrojarl Knarr is one of the world's largest floating production and storage units (FPSO) for harsh environments. The FPSO is owned by Teekay, a market leader in FPSO solutions for companies that produce oil and gas in deep waters and harsh weather conditions, and it is the company's largest project to date. Petrojarl Knarr, which was newly built by Samsung Heavy Industries in Geoje, South Korea, is 256.4 m long and 48 m wide with a deadweight of 135,000 tons. It has a production capacity of 63,000 barrels a day and a storage capacity of 800,000 barrels. The FPSO will operate on the Knarr oil and gas field in the Norwegian North Sea for BG Norge.

Teekay awarded Fairmount Marine, a 100% subsidiary of Boskalis, a contract for the tow-out and towage of the FPSO from Geoje, South Korea to the port of Haugesund in Norway.

### FEATURES

Company	BG Norge
Location	Geoje, South Korea to Knarr Field, Norway
Period	Preparation April 2014 to June 2014 Execution July 2014 to September 2014
Contractor	Teekay Knarr AS
Sub-contractor	Fairmount Marine B.V.



**A** Route map  
**B** Three tug towage in shallow waters of South China Sea



**TOW-OUT AND TOWAGE**

Fairmount Marine deployed three ocean-going tugs - the Fairmount Sherpa, Glacier and Expedition - for the towing operations. The tugs were inspected prior to mobilization and found fit to execute the towage safely. The tugs arrived in South Korea in early June 2014, where several pre-departure meetings were held with warranty surveyors, client representatives, captains and local pilots. The FPSO Petrojarl Knarr was moved from the Samsung Heavy Industries yard to the inner anchorage on 10 July and the Fairmount Sherpa (leading tug) and Fairmont Glacier connected their towing gear the next day. After the hook-up, the tow-out began with assistance from local pilots and harbor tugs. Offshore Okpo the Fairmount Expedition connected and the convoy set course for Port Louis, Mauritius.

During the voyage north of the Philippines the convoy changed course to avoid Typhoon Rammasun. The Cape of Good Hope was rounded during the local winter but, thanks to good planning

and weather forecasts, no adverse weather conditions were encountered. On her way to Norway the convoy made stops in Singapore, Port Louis (Mauritius) and Las Palmas (Canary Islands) to bunker and for replenishments. On the last leg of the voyage, the convoy sailed west of Ireland via Fair Isle (just south of the Shetland Isles) towards Norway.

After almost 16,000 miles of towing, the Petrojarl Knarr was safely delivered ahead of schedule in just 61 towing days offshore the port of Haugesund on 16 September.

**SAFETY**

Safety is an essential component of all Fairmount Marine projects. Safety performance on the project was good. All the vessels were inspected beforehand and found suitable to undertake the towage operation safely. The vessels' own systems were leading, and a mutual Emergency Response Plan was in place.

**PROJECT CHALLENGES**

The main challenges, which were dealt with effectively during project preparation and execution, were:

- Weather: The typhoon season in the Northwestern Pacific starts at this time of year. In addition, the Cape of Good Hope was rounded during the local winter. Several weather agencies monitored the weather under way closely and forecasts were used as a basis for decisions by the experienced crew on board.
- Towage by three tugs: Well-documented and well-trained procedures were in place specifically for three-tug towage to prevent any unsafe situations during the tow.
- Logistics: The various scheduled port calls were carefully planned and executed with assistance from local port agents to prevent unnecessary loss of time.

**CONCLUSION**

The FPSO Petrojarl Knarr was towed effectively and safely, despite the distance and weather limitations along the route. With an average speed of 10.74 knots the three Fairmount tugs towed the FPSO more than 16,000 miles from South Korea to Norway in just 61 towing days, which is extremely fast, especially for an FPSO this size. Evaluating the project preparation and execution, it can be concluded that the operational best practices with the experienced crew on board were decisive for the safe, controlled and successful execution of this towage.



- C** Fairmount Glacier connecting to the FPSO at departure from SHI yard
- D** Fairmount Expedition performing cargo runs for the FPSO at Port Louis, Mauritius
- E** Fairmount Sherpa assisted by local harbor tugs towing in the FPSO at Haugesund

Royal Boskalis Westminster N.V.  
PO Box 43  
3350 AA Papendrecht  
The Netherlands  
T +31 78 69 69 000  
F +31 78 69 69 555  
royal@boskalis.com  
www.boskalis.com