Study of Operational Characteristics for an All Year Intervention Vessel for the Barents Sea

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ABSTRACT

Interest in oil and gas exploration and production offshore northern Norway is growing. The subsea gas production system at Snøhvit has been in operation since 2007, while oil production from a Sevan type FPSO on the Goliat field will start in 2013. The Skrugard exploration drilling results from 2011 (and Havis from January 2012) shows the potential of the Norwegian part of the Barents Sea as a new oil and gas province. Combining this with the 2010 maritime border delimitation agreement between Norway and Russia, both nations have increased their seismic survey activities in the previously disputed section of the Barents Sea.

The harsh environmental conditions, with seasonal ice in the eastern part of the Barents Sea, will probably lead to subsea systems being selected for production. Even though such systems will be installed during the summer season, it must be possible to perform unplanned maintenance and repair operations on the systems on a year-round basis. During the winter, an all-year construction and intervention vessel (CIV) will work together with ice management vessels. These vessels will need to carry the environmental protection preparedness equipment needed to handle an acute oil spill.

KEY WORDS: Offshore vessel; Design; Operational characteristics; Model tests; Emissions; Arctic waters; Oil and gas

INTRODUCTION

Oil production in Norway has shown a steady decline in the last decades. To maintain production, new oil fields must be discovered and developed for production. Some of those will be in mature areas such as the North Sea (the Aldous/Avaldsnes discovery in September 2011) while others are expected to be in new areas of the Norwegian and Barents Seas. In Arctic waters the operators will have to take into account the vulnerable ecosystems there. In addition to improving barriers against acute oil spills, all units involved in oil exploration and production must have a low operational emissions footprint. The recently updated Norwegian Management Plan for the Barents Sea provides guidelines on the precautions needed when operating in Barents Sea waters under Norwegian jurisdiction (Ministry of Environment, 2011). A study led by DNV has looked at harmonization of operational conditions in the Barents Sea for the oil and gas industry (DNV, 2011).

One of the main challenges in designing a vessel for operation in Arctic waters is the lack of high-quality meteorology, oceanography and ice parameter data. ISO 19906 gives a brief overview on ice types and morphology, meteorological and oceanographic data for Arctic waters (ISO, 2010). The Barents Sea is a separate region in this respect. Some more information on metocean and ice conditions in the Norwegian part of the Barents Sea has been collected by the PetroArctic research project (PetroArctic, 2010), the Norwegian Polar Institute and the Norwegian Meteorology Institute.

The first part of the paper is a review of intervention tasks on subsea production systems, task duration and related weather window requirement. Based on the task requirements and a selected location in the eastern part of the Barents Sea, a field-specific vessel design was developed and tested with respect to open-water characteristics such as resistance, propulsion and seakeeping. The results were compared to those of existing intervention vessels of similar size.

Using Finnish expertise on ship handling in ice, the draft design was subsequently modified to improve its operational performance in ice. CFD studies were also employed in developing the new design, especially with respect to new design of the large Azipod headboxes that were to be an integrated part of the aft hull design. The results of the studies were subsequently compared with a new set of resistance and propulsion tests made with the modified model. This model was