Sidestep Capability for Platforms in Arctic Using Steel Lazy Wave Riser Configuration

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ABSTRACT

This paper introduces a potential novel concept for glacial ice management. The concept involves the capability of a platform and its riser and mooring systems to shift for a relatively large distance—hence the ‘sidestep’ term—in order to bypass the glacial ice. However, in order for the platform to be able to sidestep, the platform needs to be equipped with features which support the large distance movement.

For floating platforms like semi-submersibles, the sidestep movement may be accomplished by varying the tension rate of the mooring system to make it more slack or taut. However, a turret-moored FPSO needs to have a larger thruster capability, since the sidestep movement will be executed by the use of thrusters.

This sidestep capability can be used as an additional safety measure for floaters operating in deep-water regions, which are susceptible to glacial ice. In particular for a turret-moored FPSO, this capability may be beneficial as an option prior to the turret disconnection.

For this concept, the configuration of risers and mooring system should be carefully designed to withstand the shifting conditions, as the riser and mooring system will still be attached to the platform during the sidestep process. A steel riser in a lazy wave configuration (SLWR) is proposed to fulfill this requirement.

This paper discusses the benefits and challenges of the sidestep concept. This paper also presents the analysis results of a lazy wave riser during the sidestep condition. Analysis works are carried out using the OrcaFlex simulation program.

KEY WORDS: Glacial ice; Sidestep; Steel Lazy Wave.

INTRODUCTION

Oil and gas activities have now reached the ‘new frontier’ areas within the Arctic Circle. This area has always been regarded as challenging due to the harsh environmental conditions, which are characterized by sub-zero temperatures, severe sea-states, intensive seasonal fog and glacial ice masses.

Glacial ice occurs in many areas of the Arctic and sub-Arctic regions, for example west and south east of Greenland, west of Baffin Island, on the Green Banks and in the Russian Arctic. Each of the field developments in the area above has its own specific ice management strategies. However, the strategies generally have two objectives: to ensure the safety of the assets (people, installations and environment) and to maximize operational efficiency.

This paper discusses a novel concept which can be used as an additional safety option for ice management. The proposed concept is to shift the platform for a relatively large distance—hence the term ‘sidestep’—in order to bypass glacial ice. In particular for a turret-moored FPSO, this capability may be used to prevent turret disconnection. Even though floater disconnection is generally practiced as the last solution in respect of glacial ice, this option is considered unfavorable since it affects the operational efficiency.

During the sidestep process, the risers and mooring system would still be attached to the floater; hence, the floater needs to be equipped with specific features that allow it to move for a large distance with its riser and mooring system still attached. For floating platforms like semi-submersibles, the sidestep movement may be accomplished by varying the tension rate of the mooring system to make it more slack or taut. However, it is more challenging to perform a similar kind of operation for a turret-moored FPSO due to the space limitation within the turret. Therefore, a turret-moored FPSO needs to have a larger thruster capability, since the sidestep movement will be executed by the use of thrusters.

Furthermore, the riser and mooring system should also be designed to be able to tolerate the sidestep distance. The lazy wave configuration is selected to be used as the riser configuration. When a lazy wave configuration is applied in a deep-water area, the configuration can utilize a large and high arch for its lazy wave shape. This arch shape allows the riser to have extra flexibility to move freely when required.

This paper discusses the background of the sidestep concept and also its benefits and challenges. In addition, this paper also presents the