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Philosophies for Dynamic Positioning in Ice-Covered Waters

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Abstract

Approximately one third of the world's known and not yet exploited reserves of hydro carbons are in Arctic and Subarctic areas. Consequently, the offshore technology is going towards Arctic. New developments for operation in ice are generating new exiting challenges for offshore and ship building industries all over the world.

The paper describes the major challenges of dynamic positioned vessels in ice-covered waters. As the forces acting on vessels in ice and also their response are substantial different from the behavior in open waters, new philosophies and strategies have to be developed: How to keep vessels or offshore structures at a given position.

Based on model test results from HSVA the paper explains the main challenges of dynamic station keeping in ice and describes the consequences on station keeping philosophies and strategies for ships and offshore structures in ice. As up to now no dynamic positioning system exists for ice covered waters the paper illustrates a new approach in order to reach this goal.

The paper gives by far not a complete description of dynamic positioning of vessels in ice. But it summarizes where we are and what needs still to be done.

Introduction

It is estimated that the Arctic contains more than one third of the world's undiscovered oil and gas reserves. Although some development has already been undertaken, the region remains one of the last energy frontiers. At the same time, the region is also one of the most difficult areas in the world to work in, due to its remoteness, the extreme cold, dangerous sea ice, and its fragile environment. Major energy companies are already getting prepared to get into the Arctic, taking precautions to operate safely and responsibly.

This is not the first run to the Arctic. Petroleum companies entered into the Arctic already half a century ago. Experiences from past Arctic developments show the potential hazards of further exploration in the area. A key challenge will be developing and deploying solutions, which are currently at the cutting edge of technology. The Arctic Ocean is the only major sub-basin of the world's oceans that has only occasionally been sampled by deep sea drilling. Today the properties of the Arctic Ocean are being focused upon by both researchers and commercial oil and gas drilling companies. Research core drilling is of great importance for the researchers because it allows them to increase their knowledge about that large ice covered area. And, of course, high energy prices in the future, similar to the ones we have already seen during last summer, make it profitable to explore for reserves and to produce energy even in the ice covered waters of the "High North".

Drilling operations in ice have already been carried out at the ice border using "open water drill ships", mainly with the support of icebreakers. Some drill ships are reinforced for operation in ice, but this reinforcement is limited to the strengthening of the ship structure and does not include the propulsion and operational outfitting. An ice-breaking drill ship should be capable of keeping its position so that the drilling operation can be continued, even