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Setting course for a polar-class drillship

Risk- and scenario-based design concept projects will progress best through cooperative efforts.

James Bond, ABS

Ice-capable drillships are going to be needed when the oil and gas industry makes its inevitable push into deeper Arctic waters. And operating companies are going to demand vessels that can safely work in this exacting area of the world.

Today there are rules for awarding transiting vessels various polar-class notations, but no guidelines exist for assigning an ice capability notation to a site-specific structure. For the industry to have confidence in the integrity of arctic drillships there must be some set of performance standards against which to measure and class them. These guidelines would facilitate station-keeping system design and would establish parameters for ice management requirements that reasonably limit the load on the structure and moorings.

Any drillship working in the Arctic should have the ability to operate in a mobile, thick, first-year ice regime that could contain old ice inclusions. It is not difficult to imagine that a vessel keeping station while drilling could be subjected to pressure and ridged rubble ice fields. The resulting global loads on the structure and the mooring and positioning system are substantially greater than those experienced by an ice transiting ship for which the polar-class notation was developed.

Polar-class rules were developed using ice interaction scenarios as a basis for the loads on and the structural design of each area of the hull. Validation was performed against existing ships, particularly those that had suffered light damage during operation. It is important to note that the master of an ice transiting ship has some freedom within the limitations of safe navigation and hydrography to select a route that directly influences – and in most cases lessens – the ice loads on the ship. The maximum global load on the side of a polar-class ship often results from the ship being caught in pressure when an opening in the ice closes. In some cases the master can manage ice loads by allowing the ship to drift with the ice until the situation resolves itself, often without having to request icebreaker assistance.

While efficient ice management could lessen these loads on a drillship, this requires that ice detection, ice characterization, load prediction, physical management capability, and success rate be taken into account in the risk assessment that accompanies the decision to continue drilling or to move off station.

Predicting loads from a given ice interaction event is critical for designing floating arctic offshore units, but there are many questions about how this can be accomplished. While ice load prediction continues to be a topic of research, R&D is hindered by limited design validation points. This is the reason that a great deal of research focuses on ice mechanics, structure/ice interaction, numerical simulation of the understood physics, and interaction permutations with the goal of developing load-prediction models that can be validated via small- and large-scale testing.

Considerably more research is needed, and class societies like ABS need to continue to work with the industry to find solutions. Clearly, risk- and scenario-based design concept projects can progress most effectively through cooperative efforts that bring the industry's best minds together. Involving class in technology validation through an approval-in-principle process and novel concept guidance will help the industry push through the ice barrier. E&P

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Based in Houston, James Bond is Director, Shared Technology in the American Bureau of Shipping Corporate Technology group. In this role he is responsible for guiding ABS research, ABS rule development and industry guidance performed by a group of 30 dedicated professionals covering a diverse portfolio that includes Harsh Environment, Risk, Safety and Human Factors, Materials, Coatings, Computational Fluid Dynamics and In-Service technologies (all areas that overlap between the shipping and offshore industries).

Bond has worked in the marine and offshore industries for more than 25 years, primarily in the fields of structural design and analysis and large-scale, experimental laboratory testing of Arctic structures. He has spent time in the Canadian Beaufort Sea and designed instrumentation programs for the resolution of vibration problems on an icebreaker. He has experience in Class work, engineering consultancy services and shipyards.

Bond has a Master of Engineering degree from Carleton University (Ottawa) and a Bachelor of Applied Science in Engineering degree from the University of Waterloo. He is a register Professional Engineer in the Province of Ontario and a member of the Society of Naval Architects and Marine Engineers.

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