Frontier plays & Arctic update

Deepwater well construction

Rig day rate analysis

Drill rig/riser selection

Produced water solutions
Arctic reserves are enormous, and industry interest in Arctic E&P is huge. U.S. Geological Survey (USGS) numbers published in the 2008 “Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle” indicate approximately 90 Bbbl of oil, 1.7 tcf of natural gas, and 44 Bbbl of natural gas liquids may remain to be found in the Arctic, of which approximately 84% is expected to lie in offshore areas.

With the realization that huge volumes of conventional oil or oil equivalent lie north of the Arctic Circle, the oil and gas industry renewed its interest in operating in the Arctic. The vast quantities of untapped potential offer enormous incentives for developing technologies that will allow E&P activities to move safely into one of the most challenging operating environments in the world.

Mooring challenges

Harsh operating conditions are an obvious concern for Arctic E&P. Frigid conditions and ice loading issues are the two biggest operational considerations impacting nearly every aspect of Arctic operations. These conditions compound the technical challenges associated with operations in remote areas with limited infrastructure. As Arctic offshore exploration moves from coastal zones to deeper water, technical issues associated with mooring and station-keeping come to the forefront.

Ice-strengthened drillships moored in shallow water operated in the Beaufort Sea from the mid-1970s through the early 1990s. These operations provide valuable operational data for researchers and designers interested in mooring and station-keeping in Arctic waters. But while historical information provides a foundation for research, it is location/season specific, and extrapolation to other locations or conditions is difficult.

Although there have been advances in understanding the physics of ice interaction with structures and other Arctic technologies in general, considerable work remains to be done if the industry is to pursue deepwater operations safely in such a harsh environment – particularly in light of the fact that the regulatory environment governing offshore Arctic operations today is far more stringent than during earlier exploration periods.

Working together

Improving the industry’s ability to contend safely with Arctic conditions is a focus area for ABS. In the interest of gathering industry expertise, the company hosted a workshop in 3Q 2012 to provide a forum where experts could present their views on key issues, engage in discussion, and explore the need for a joint industry effort in the related topics of mooring/station-keeping and ice management. There were 80 attendees at the workshop, where 14 presenters provided information on a range of topics on mooring systems for Arctic operations. A survey of participants at the conclusion of the workshop identified the most challenging subjects in developing Arctic mooring systems: ice management, guidance on global ice load prediction, and safer mooring systems.

Ice management

Ice management systems typically consist of a series of processes and procedures outlined in ISO 19906. In ice management operations, a sequence of events takes place near the installation site including ice forecasting, ice detection, and physical ice management. The sequence of events is considered during the design cycle of the offshore unit to determine the effectiveness of the ice management system as it influences the global ice loads and ultimately the estimated operational downtime for the unit.

For a moored system, physical ice management can include icebreaking, ice clearing, or iceberg towing to reduce the mooring loads on the drilling or production unit. Threat evaluation can be based on the level of probable mooring loads and the mooring system capacity in the managed ice. These two processes, which are part of the ice management system, also can be considered the key elements in the design of the moored structure. To fully address ice management issues for moored structures, the industry has to contend with a number of challenges:

• Quantitative assessment of the effectiveness of physical ice management, i.e., how many icebreakers of varying capability are available and whether they can reduce the ice loads effectively
• Configuring the ice management system to fulfill the standards in ISO 19906, which requires a certain level of overall system
Specialized centers invest in Arctic technology development

Six years ago, the belief in the value of cooperative R&D led ABS to begin establish technology centers around the world to help experts and specialists to be co-located with customers and to partner more closely with local industry, government, and academia.

The ABS Harsh Environment Technology Center (HETC) was set up on the campus of Memorial University in St. John’s, Newfoundland and Labrador in 2009. Since then, HETC researchers have developed capabilities for scenario-based ice load modeling to evaluate the effects of ice impacts where little service experience exists. HETC is engaged in an experimental study where real ice and a realistic hull structural panel will be used on a large-scale collision apparatus. HETC researchers have also evaluated several global ice load models for offshore structures: analytical method, Particle-in-Cell (PIC) method, Finite Element Method, Discrete Element method (DEM), and a numerical method using Graphics Processing Units (GPUs). Continued development of some of these methodologies at HETC is being undertaken with the goal of simulating the effectiveness of physical ice management and estimating ice loads on offshore installation/mooring/DP systems.

HETC is one of five technology centers ABS has established in dynamic offshore areas of the world to promote collaborative research. ABS set up the Brazil Offshore Technology Center in Rio de Janeiro in 2010; the ABS China Offshore Technology Center, established in partnership with Shanghai’s Jiaotong University in 2011; the Korea Energy Technology Center in Busan, South Korea, in 2012; and the ABS Singapore Offshore Technology Center, which opened six years ago and has become a key research and development facility supporting developments in Southeast Asia and engaging in significant Arctic research, particularly on ice interaction with jackups.

The continued success of these centers is based on local capabilities and relationships coupled with access to additional extensive resources at the ABS global technology center in Houston.

The road ahead

The ABS Arctic Mooring Workshop was set up as a forum where industry experts could present their views on key issues and participate in discussion that would allow them to explore together the need for a joint industry projects in the related topics of mooring/station-keeping and ice management.

While considerable work remains to be done, the industry is moving consistently in the direction of safe Arctic operations, a goal that will be reached more quickly through collaboration. ABS plans to be part of that effort by continuing to seek input and guidance from the industry and by partnering in technology development.

The hope is that workshops such as this will lead to small group-based joint development efforts or even larger-scale joint industry projects that will expedite the development of the technology necessary to safely develop the vast resources of this inhospitable area.