

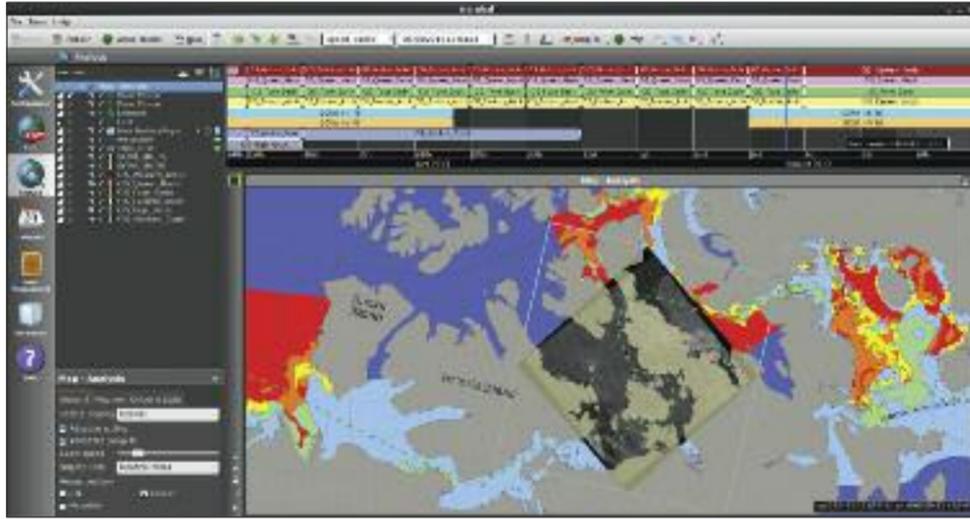
Caution, Ice! Managing Drilling and Seismic Acquisition Operations in the Arctic

System indicates vast hydrocarbon potential.

Contributed by ION Geophysical

ION Geophysical is introducing Narwhal, a solution for integrated ice management services. ION has been pushing operational boundaries of exploration in the Arctic since its first regional seismic survey in 2006. Each year since then, the company has been delivering data for oil and gas companies to accurately assess prospectivity in one of the largest potential untapped petroleum resource areas in the world. ION has conducted 13 projects over eight operating seasons and collected more than 64,000 km (39,767 miles) of data for the industry, 30,000 km (18,641 miles) of which have been acquired under ice. This data has revealed valuable new insights into the subsurface of the region and helped to suggest that the area has a greater hydrocarbon potential than previously believed.

Building on this Arctic acquisition experience,



This image from Narwhal shows a vessel's planned route through the Northwest Passage, including areas where the ice conditions provide different levels of risk (color coding) based on the vessel's ice classification. The view integrates ice charts, satellite imagery, and other data types, while the calendar feature (top) allows users to time-slide through the data to understand what happened in the past and predict what will happen in the future. (Image courtesy of ION)

ION's Concept Systems team developed Narwhal, its first commercial software for Arctic operations. Narwhal is a solution for integrated ice management that provides visualization, analysis, tracking, prediction, monitoring, and risk mitigation tools, all designed to address offshore Arctic drilling and seismic acquisition operations.

During Arctic operations, there are substantial environmental challenges and operational risks

to be considered throughout every phase of the program including preparation, mobilization, seismic acquisition, drilling operations, emergency response and preparedness, supply/crew change, and demobilization. Robust ice forecasting and tracking technology, as well as information sharing off- and onshore, are essential to managing key challenges, such as operational efficiency, HSE risks, and trafficability. "Trafficability" is, based on a specific vessel's ice classification, the ability to use all the ice information to define no-go areas, plan routes, optimize operations, and identify of escape routes.

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Analysis Service Aids In Forecasting

Relating the orientation of principal strain axes within the reservoir develops stream lines to visualize fluid flow paths.

Contributed by ESG Solutions

ESG Solutions has released an advanced microseismic analysis service that describes hydrocarbon drainage as a result of hydraulic fracture stimulation. The service was introduced as a new component of the company's existing Seismic Moment Tensor Inversion (SMTI) Production Suite, a patent-pending process that helps clients better understand reservoir processes, optimize completions, and improve production from unconventional reservoirs.

Microseismic monitoring is a tool for reservoir surveillance that has traditionally visualized fracture geometry and inferred the stimulated reservoir volume (SRV). However, microseismicity may be fluid-induced, or it may be caused by changing stress conditions in the reservoir; therefore, not all seismicity will contribute to production. Advanced microseismic analysis methods using moment tensors can describe the mode of failure and orientation of fractures generated in a reservoir, but further interpretation is required to determine whether these fractures will impact reservoir drainage.

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