Offshore Arctic Exploration and Production

An Opportunity with many Challenges

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Overview

Great rewards are generally preceded by great risks. As the world price for crude oil has risen and remained close to $100 per barrel, Arctic OCS waters "black gold" beckons producers to "come and get it." The challenges are considerable, as Shell's long-awaited attempts to develop its $2.4 billion leases in the Beaufort and Chukchi Seas amply demonstrate.

The last great wave of oil and gas activity in the U.S. Arctic occurred with development of the onshore Prudhoe Bay fields in the 1970s, but new exploration offshore was stymied by declining prices, the *Exxon Valdez Alaska* tanker oil spill, environmental opposition (Arctic National Wildlife Refuge), and the inherent challenges involved in remote areas with ice-covered waters. Yet, as former Deputy Interior Secretary David Hays put it: "Regardless of what happens in the United States, there is no question there is going to be offshore development in other Arctic nations." Activity today now in Russian Arctic OCS waters and Russia's long-term LNG contract commitment with China validates this earlier observation made by David Hays.

With the 2005 and 2008 sales of Arctic offshore leases, the U.S. government has essentially prepared for the U.S. to follow suit. With Prudhoe Bay fields in decline and the Alaska Pipeline carrying only a fraction of its capacity, developing additional oil fields in the area have broad national implications.

What are the rewards?

The U.S. Geological Survey's often-quoted 2008 estimates contend that the Arctic contains 13% of the planet's undiscovered oil reserves and 30% of the planet's undiscovered natural gas reserves. This coincides with results from a study performed by U.K. consultants Wood Mackenzie and Fugro Robertson Ltd. Moreover, the North American Arctic is believed to be particularly attractive, with about 65% of the undiscovered Arctic oil reserves. The USGS notes that although there is considerable uncertainty regarding undiscovered Arctic oil and natural gas resources, the potential rewards are huge. In a world with burgeoning energy demands, particularly in China and India, Arctic energy will undoubtedly play a significant role.

What are the obstacles?

Three decades of relative inactivity in U.S. Offshore Arctic oil and gas activity have taken a severe toll on the availability of experienced offshore Arctic personnel. The skilled and experienced people who developed the 15 large oil and gas fields discovered more than 30 years ago are likely no longer in the work force. The people who designed the equipment used in field activities, planned and executed the drilling operations, developed the safety plans, established emergency

procedures and contingences to be utilized, and actually worked onboard the offshore drilling vessels have long since either retired or otherwise left the industry. Because of this period of inactivity, it can be assumed that a significant amount of offshore Arctic design and drilling operation "knowledge and experience" gap exists, just as demand for this type of expertise is also increasing rapidly in other sectors of the Arctic.

In 2009, a U.S. Geological Survey Report cited the following factors as slowing or preventing Arctic offshore development:

- Harsh winter weather requires that the equipment be "specially designed" to withstand cold temperature extremes.
- In Arctic seas, the icepack can damage offshore facilities, while also hindering the movement of personnel, materials, and equipment for long periods of time.
- Long supply lines from the world's manufacturing centers require equipment redundancy, and a large inventory of spare parts and materials to insure reliability.
- Limited transportation access and long supply lines reduce the transportation options and increase transportation costs.

These factors can be overcome with the application of appropriate technology and adequate resources. More challenging is the recent change in the U.S. regulatory environment, particularly changes resulting from the *Deepwater Horizon* incident in the Gulf of Mexico. The Macondo well blow-out and subsequent clean-up brought intense scrutiny of offshore drilling activity in the popular press and among environmental groups. It also prompted a division of the former Minerals Management Service (MMS), creating the Bureau of Ocean Energy Management (BOEM) and Bureau of Safety and Environmental Enforcement (BSEE).

As a new agency focused on industry regulation and enforcement, BSEE issued a comprehensive new policy on August 17, 2012 that clearly extended regulations for the offshore oil and gas industry to contractors and their subcontractors. This new paradigm means that contractors must be concerned about legal liability and the risk that they and their insurers now incur.

Ice challenges

Dealing with the ever-changing ice cover in Arctic waters is one of the most challenging issues for any human activity there. Whether the task is moving vessels through the ice to their destinations or keeping ice clear of drilling vessels or production facilities, ice management requires the right resources (both physical and informational), sufficient expertise, and the right plan.

Getting the job done requires an effective ice management program which must have a clearly defined purpose with specific goals. The location or region to be serviced must be identified, based

on the activity to be protected, whether it is a stationary drilling operation, production facility, or maintaining access for regular supply or support vessels.

Ice management vessels protecting a target location must have the specific capabilities needed to deal with the likely ice conditions within the region, whether first-year sea ice in varying concentrations, more challenging multi-year ice, ridges, or icebergs. The vessels to be utilized must have the ability to not only detect ice by radar and visual observation, but to operate safely in close proximity to identify ice concentration and thickness, and to break up large floes that might threaten operations whether they be drilling, production, or supporting functions.

Ice forecasting is a critical task involving information gathering and monitoring of sea and wind conditions, as well as general weather conditions for any ice management program to be developed. These activities are necessary to determine the movement, direction, and speed of ice concentrations or floes, so that their threat level to a stationary structure can be evaluated and a mitigation plan initiated in a timely manner.

If the protected structure (drilling unit or production facility) is to be safe, large ice floes must be broken into smaller pieces and those pieces managed so they do not threaten the structure. In some cases, large ice pieces may need to be diverted away from the endangered structure. Ice alert procedures must be established for the protected structure and the crews on the ice management vessels, and coordination between ice advisers and vessel masters must be clearly established. The chain of command for decision-making responsibilities and criteria for terminating operations and moving off the site must be thought out, in place, understood, and agreed to by all participants.

It is important to recognize that ice-class vessels have a wide range of capabilities and all are therefore not the same. They are built to different standards, depending on the country of operation and the classification standard to which they were both designed and built, as well as their intended use and function. Determining the right mix of ice-capable vessels is thereby critical for any successful ice management program.

In simple terms, ice classification reflects design requirements for safety and survivability, not performance in ice. The International Association of Classification Societies (IACS) Requirements for Polar Class states: “The IACS Unified Requirements state that they apply to ships constructed of steel and intended for navigation in ice-infested waters. Icebreakers may have additional requirements and are to receive special consideration (see Sections1.1 and 1.3).”

Arctic oil spill issues

With the increased interest in Arctic OCS drilling, the possibility of oil spills in the highly remote regions offshore of Alaska (U.S. waters) also increases and has become a key focal point for the U.S. Coast Guard (USCG) and BSEE to ensure that drilling and production is not only done in the safest

manner, but that adequate oil spill response resources are readily available to handle the harsh environment if a spill occurs. Many lessons were learned during the April 2010 Macondo incident in the Gulf of Mexico, and as a result, both the USCG and BSEE have increased their oversight of Oil Spill Response Plans (OSRP) and their ability to rapidly coordinate with local, state and federal agencies, as well as with local communities, to bring resources to bear to effectively handle a theoretical Worst Case Discharge (WCD).

By all measures, the Arctic OCS Region will be more challenging than the Gulf of Mexico for well blowouts, oil spill containment, and oil recovery due to the remote and unforgiving environment, lack of infrastructure, logistical difficulties, potential ice, harsh weather, and high sea states. Environmental conditions can be at their most extreme in the Arctic's OCS waters with limited visibility from fog, haze, or darkness thereby increasing the risk from ice. Moving ice, storms, high winds, low temperatures, and long periods of darkness present operational challenges and increased risk to the safety of life, on-water assets, and existing well operations. Limited visibility reduces the amount of information that crews can gain from direct observation. Navigation by dead-reckoning becomes problematic, so sophisticated global positioning equipment and vessel and oil tracking tools are needed to coordinate any cleanup activity.

While prevention is always the key with plans and contingencies required for the most likely scenarios, BSEE has issued more stringent regulations, such that oil spill planning will inevitably spill over into more restrictive requirements for offshore operations in the Arctic.

Controlling and recovering oil from Arctic OCS spills will depend heavily on prepositioned equipment, adequate ice-capable vessel support, and highly-trained personnel with Arctic cleanup experience. These must have the ability to rapidly organize into a highly-effective Incident Command System (ICS) organization that can integrate government agencies and affected stakeholders. Because of the potential expense of dealing with an Arctic OCS spill, the experiences gained from the Macondo spill will greatly assist those companies in developing OSRPs that will satisfy regulators and prepare companies to deal with any exigent circumstance.

Oil & gas development and the transport of oil are not new to the Alaska and other arctic OCS frontiers. U.S. and other Arctic OCS Regions have always adapted to the needs of its citizens to protect the environment. For example, oil spill response organizations such as SEAPRO, Chadux, SERVS, and CISPRI have carved out niches within the state of Alaska to provide coverage in specific regions for shipping and refining of oil. Others, such as Alaska Clean Seas (ACS) on the North Slope, ASRC-Response Organization and Arctic Response Services (ARC) provide oil spill coverage specifically for the exploration & production industry. Many of the best oil spill response manufacturers in the world, such as Lamor, Elastec, and Desmi are developing new oil spill response equipment that will effectively contain and cleanup oil in ice. The ability to find oil through ground penetrating radar and to corral oil in ice and to "in situ" burn, are at the forefront of improved technologies.

Even with these ongoing efforts to improve spill response in this region, in this new post-Macondo paradigm, E&P companies will need to heed the lessons learned from 2010 and incorporate them into their OSRPs. For example, similar type subsea containment equipment currently in the inventory of Helix Well Containment Group and Marine Well Containment Corporation in the Gulf of Mexico will be required to effectively deal with an unsecured source. It is expected that the current BSEE regulations, which determine Effective Daily Recovery Capacity (EDRC) of spill response equipment, will be overtaken by a new model known as the Estimated Recovery System Potential (ERSP) that incorporates such variables as swath width, speed, and on-site recovery capacity into its calculations.

There will be a high degree of emphasis on proven mobilization times of prepositioned equipment and the ability for oil spill response equipment to operate 24/7 and in high sea states. Companies will be required to keep rigorous documentation on personnel training, exercises, and equipment deployments in accordance with 30 CFR 254 and be prepared for unannounced equipment deployments. Companies will have to become intimately familiar with the experienced personnel of local spill response organizations and must keep abreast of, and invest in, new technologies that will improve spill response in the Arctic OCS. Experience gained from a history with real OCS oil spills is literally worth its weight in gold.

Personnel

Finding, developing, and renewing the personnel resources for Arctic OCS operations to successfully explore and develop offshore oil and gas resources depends on identifying individuals who possess:

- Wisdom – from Knowledge gained
- Knowledge - from Understanding
- Understanding - from Experience
- Experience - from “hands-on” application.

These personnel must have professional backgrounds in:

- Naval Architecture: stability, structural, drilling and production vessel design and operation
- Marine Engineering: power, propulsion, marine systems
- Mechanical Engineering: equipment design, subsea, pipelines
- Ocean Engineering: ice mechanics, drilling and production rig design
- Winterizing technology and techniques for structures and equipment
- Business Administration
- Field Development and Production.

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Having A little knowledge can be dangerous, if not properly supported and utilized!

The 2009 U.S. Geological Survey (USGS) report revealed that oil and gas exists below the OCS waters of the Arctic in significant quantity in more than one or two reservoirs. This estimate made the Arctic OCS Region that much more alluring to risk takers willing to explore and develop the regions due to the potential reward. However, knowing there are petroleum resources is one thing, but safely overcoming the significant challenges and obstacles presented in the Arctic outer continental shelf (OCS) is another.

Developing this remote and environmentally extreme region can be compared to the challenges that were overcome putting a man on the moon; similar to when NASA began developing manned space flight over 50 years ago. That feat was not achieved through the efforts of the U.S. government and one or two commercial companies only, but rather through the successful management of "teams" of experienced, technically-proven individuals with varying, but complementary, backgrounds and experience. These individuals, when given a specific challenge, worked together and with other teams, also with varying backgrounds, to integrate ideas and focus their combined efforts to achieve a specific goal.

Successfully and safely producing oil and gas from the Arctic OCS Region creates a similar situation today. On October 19, 2009 USGS published a report titled "Arctic Oil and Natural Gas Potential," which laid out the potential "undiscovered recoverable" oil and natural gas reserves in the Arctic including its OCS Regions, and those of the Alaska OCS. That report concluded that the Arctic as a whole holds approximately 22% of the world's undiscovered conventional oil and gas resources, producing high stakes specifically for Arctic OCS oil development.

The good news regarding the size of potential reserves was countered with bad news: high costs, high risks, and lengthy lead times to production thanks to other noted factors. This "bad news" was confirmed by the report's "included fact" that 15 large Arctic oil and natural gas fields "are awaiting development" and that most of these fields were discovered in the 1970s and early 1980s. Forty-plus years have passed since these initial discoveries were made with little if any development activity to date.

Any group of teams assembled to address Arctic exploration, and especially the OCS, must have a background and experience in:

- Design
- Regulatory Compliance (example: United States law for U.S. Regulated Regions)
- Operation
- Planning
- Maintenance
- Logistics (including ice management)

with all these skills derived from:

- High latitude Arctic experience (including daily perils)
- Understanding and respect for the challenges of the environment and success in overcoming those challenges
- A keen awareness of local people, their cultures, and ways to address their concerns
- Knowing and understanding the rules and regulations to be applied to operate safely and incident free
- Knowing and understanding how to protect people, so that they can function and work safely
- Knowing and understanding local response capabilities for any emergency response
- Knowledge of local assets available to respond to unforeseen situations
- Staying abreast of technology advances and their application for use in the Arctic Region
- Looking for ways to successfully apply new technology to address the challenges faced.

This is today's challenge and reality for oil exploration in the Arctic and specifically its OCS regions. It must be balanced with the following observation made by the Department of the Interior (DOI) report to the Secretary of the Interior: "Review of Shell's 2012 Alaska Offshore Oil and Gas Exploration Program," dated March 8, 2013. The traditional operator-specific, "go it alone" model, common with exploration programs in other regions, is not appropriate for Arctic OCS operations. The DOI report appears to be calling for the industry to come together and develop a joint approach for exploring and for developing Arctic OCS oil and gas resources. Like the 1960s moon shot, a joint effort by focused teams can create ways to overcome common challenges, deal with unexpected circumstances, and safely operate in high latitude environments.

The industry's business model, however, has always been to consolidate companies and protect "intellectual property" developed to overcome obstacles, such as those to be encountered when exploring and developing the Arctic OCS, rather than working "together" to collectively overcome shared obstacles. Today we see some operators with vested Arctic OCS interests partnering with others to work together and move steadily forward to explore, develop, and produce oil and gas from the Arctic OCS. This is a first step toward what the DOI report calls for the industry to do. Operators must depend heavily on many subcontractors to operate in the Arctic's extreme environment. Will segments of this support industry follow suit in partnering and working together for the collective good it could accomplish?

The Bottom Line

The roll call of obstacles – scarce and fragmented expertise, environmental and operational challenges, and intensive regulatory requirements predicated on a recent mishap – appears daunting. Though the potential rewards for oil and gas development in the U.S. Arctic OCS as well as other OCS regions are huge, they come with high risks, high costs, and lengthy lead times – and the risks could easily become catastrophic.

Ice management is a complex and critical component of any oil and gas program envisioned for Arctic OCS waters. A successful ice management program must be carefully constructed to reflect environmental conditions in the particular geographic location for the intended operation, and it must be developed in accordance with regulatory rules in effect for the specific geographic location of intended operations. Clearly, having the right expertise to develop and implement an ice management plan is as important as having the right assets to do the work intended, but ice management expertise is not widely available, particularly in the U.S. for U.S. Arctic OCS Waters.

The same can be said for oil spill containment. Equipment resources and experienced personnel are in limited supply. While there is some established oil spill response capability (primarily port based) in the Arctic, the industry will need to preposition resources and personnel during the drilling season for many years to come.

Both operators and contractors need to be aware of the additional responsibility now required by U.S. authorities and develop appropriate approaches to Arctic OCS operations. One only needs vision and knowledge of where to look, and what to look for, to complete the picture and achieve success for the industry: helping it to successfully and safely explore and develop the Arctic OCS.

About Endeavor

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