



**IOGCC Chairman's Stewardship Award Application
Small Company - Apache Alaska Corp.**

**Using Wireless Seismic Technology to Overcome
Environmental Challenges in Alaska's Cook Inlet**

**Nominated by the Alaska Oil & Gas Association
September 3, 2013**

Brief description of project

Five years ago, the future of the Cook Inlet, Alaska's first oil region, looked grim. Historically a reliable and steady region for oil and gas production, it appeared as though the best days were behind her. Following the 1957 Swanson River field discovery, Cook Inlet oil production peaked at 230,000 barrels per day (b/d) in the 1970s, but has since dwindled to around 12,000 b/d. In 2009, additional incentives were put into place that when coupled with a favorable tax structure, served to reinvigorate the region.

In 2010, Apache Corporation began acquiring exploration leases and agreements in Cook Inlet because of the region's immense promise: the U.S. Geological Survey estimates that up to 1.3 billion barrels (bbl) of oil can be recovered from the area, as well as 13.7 trillion cubic feet (Tcf) of natural gas. Add to that a steady consumer market in Southcentral Alaska, which is home to 63 percent of the state's population, and you had a winning investment combination.

Apache faced challenges right away. Although the first seismic work occurred in Cook Inlet in 1955, the area remains underexplored. Only a few, small advanced seismic surveys have been conducted in recent years. With 850,000 acres under lease, Apache needed a large-scale, multi-year seismic program that could overcome enormous physical and environmental challenges. The solution was wireless 3-D seismic, which would enable Apache to capture accurate imaging of the region's subsurface without leaving its footprint behind.

Describe purpose of the project

Cook Inlet is one of the world's most difficult places to conduct seismic operations. Cook Inlet's tidal range is among the largest on Earth – a mean 30 feet between high and low tide, resulting in currents that regularly exceed six knots. These water conditions, coupled with the shallow nature of the majority of the historical oil and gas targets, meant most existing seismic data sets were recorded with short cables or limited offsets.

Onshore, the land is rugged and dotted with lakes. The federal government owns 60 percent of the acreage and much of it is classified as park, national forest, wildlife refuge or critical habitat. Work on land is done primarily in the wintertime to minimize the environmental impact and overcome access barriers presented by swamps, bogs and a limited road system. Winter brings its own hurdles with periods of extreme cold, and blizzards that can dump feet of snow at a time.

Apache's commitment to minimizing the impact of its activities on communities and wildlife adds to the challenge. Brown and black bears share the land with local residents, along with moose, wolves, coyotes and even a few caribou. Additionally, many protected animals call Cook Inlet home, including Beluga whales, which are endangered; killer whales; harbor porpoises, harbor seals; and Steller sea lions, which are classified as threatened.

While the work was difficult, Apache was determined to go far beyond the basic mandates of law and regulation. In so doing, the company found an innovative solution by developing the first wireless seismic node survey in Alaska. The company first conducted a side-by-side comparison with traditional cable systems. The test found the quality of data gathered on land was similar for wired and unwired receivers, but wireless performed far better offshore.

Process taken to complete the project

Alaska is one of the most regulated areas in the world in terms of resource development. As such, before Apache could begin its survey, it needed to acquire permits from the U.S. Army Corps of Engineers; U.S. Fish and Wildlife Service; National Marine Fisheries Service; the State of Alaska; and the Kenai Peninsula Borough, among others. It also had to obtain permission from individual property owners. To expedite the process, Apache divided Cook Inlet into regions and permitted the regions one at a time, all while realizing that it takes, on average, anywhere from six months to a year to secure each major permit. Apache's diligence paid off. The company received a three-year permit from the U.S. Fish and Wildlife Service to survey private lands within the Kenai National Wildlife Refuge.

Permits in hand, the first survey and drilling operations began in late fall of 2011 on the west side of upper Cook Inlet. The area was divided into 2.5-mile blocks, each of which contained 256 shot points. The plan called for the operation to move west and enter the Trading Bay state game refuge in early November, the earliest date allowed by the permit. An unusually cold and early winter forced Apache to significantly revise its plan, something it would have to do repeatedly over the next 12 months. That first winter turned out to be the snowiest in history with a record 132.6 inches (the average snowfall is 75 inches).

In the meantime, planning was underway for the marine survey, which had to be conducted during non-ice months. The initial concept was a patch-by-patch method: the patches would be acquired individually with all the receivers deployed before shooting began. During acquisition of one patch, the receivers for the subsequent patch would be deployed. The plan was simple, but it turned out that once deployed, the nodes had a limited lifetime that resulted in duplication of up to 50 percent of the shots between adjacent patches. A new technique called the segmented roll dramatically improved productivity.

Protecting marine mammals – Working closely with scientists, stakeholders and state and federal agencies, Apache developed a marine mammal observer program as part of its permit from the National Marine Fisheries Service (NMFS). Apache conducted (and still conducts) aerial surveys, and has two NMFS-qualified Protected Species Visual Observers (PSVOs) on board all its vessels. Other PSVOs are assigned to an onshore station to monitor marine mammal activity. A 9.5-kilometer exclusion zone surrounds the vessels, and seismic source operations are shut down if a Beluga whale or other protected species enters the zone. Operations cannot resume until the mammal leaves the zone or has not been observed for a designated period of time.

Apache also deploys a passive acoustic monitor to listen for mammal activity after dark and in times of limited visibility.

Environmental highlights

Apache has helped pioneer a wireless seismic technology that significantly reduces the impact of seismic surveying on communities, wildlife and the environment, yet produces high quality data both onshore and off.

Traditional marine seismic has been used sparingly in Cook Inlet, and for good reason. The area's strong currents and extreme tides make traditional technology dangerous to use. Grounded vessels, tailbuoys overtaking their tow vessels, and bottom cables being retrieved a mile from where they were initially dropped are among the risks associated with conducting seismic in the basin.

Land-based seismic also presented a challenge for Apache. Laying out long lines of receivers connected by cables was problematic: using cables would have required clearing of brush or construction of roads. Additionally, access was limited, much of the land was in protected status and some parts of it were not passable during the summer. These limitations led to the decision to conduct land operations during wintertime when the ground is frozen, and to utilize heli-portable drills. As a result, when Apache finishes operations in an area, it leaves virtually no trace.

Wireless technology continues to allow Apache to avoid areas where there is potential for wildlife disturbances, such as locations close to salmon streams, eagle and owl nests, and denning bears.

Apache regularly communicates with Cook Inlet area residents, holding town meetings, sending out mailers and placing advertisements. It strives to keep citizens informed ahead of its activities, and all communications include a phone number for residents to call should they have any questions or concerns. Because of the proactive outreach to neighbors, few have complained even when multiple helicopters are working in an area.

Accomplishments

Throughout the project, Apache demonstrated exemplary environmental stewardship. Despite working in some of the most challenging marine environments and extreme weather conditions, Apache has recorded 320 square miles (more than 215,000 square acres) of contiguous 3D coverage on Cook Inlet's west side, crossed onshore, and included more than 200 square miles of marine coverage, all with no marine spread downtime. The work was completed without a single recordable incident and with no Beluga whale encounters. A handful of other marine mammals were spotted inside the exclusion zone, but operations ceased and no mammal was harmed. After more than a year of assessment, the U.S. Fish and Wildlife Service recently granted Apache a three-year permit to survey lands within the Kenai National Wildlife Survey.

Apache continues with its seismic operations, and plans to move into exploration and eventually a development phase to extend the life of a legacy region of Alaska.

You can view videos of the marine and land surveys at:

<http://www.apachecorp.com/Operations/US/Alaska/index.aspx>.