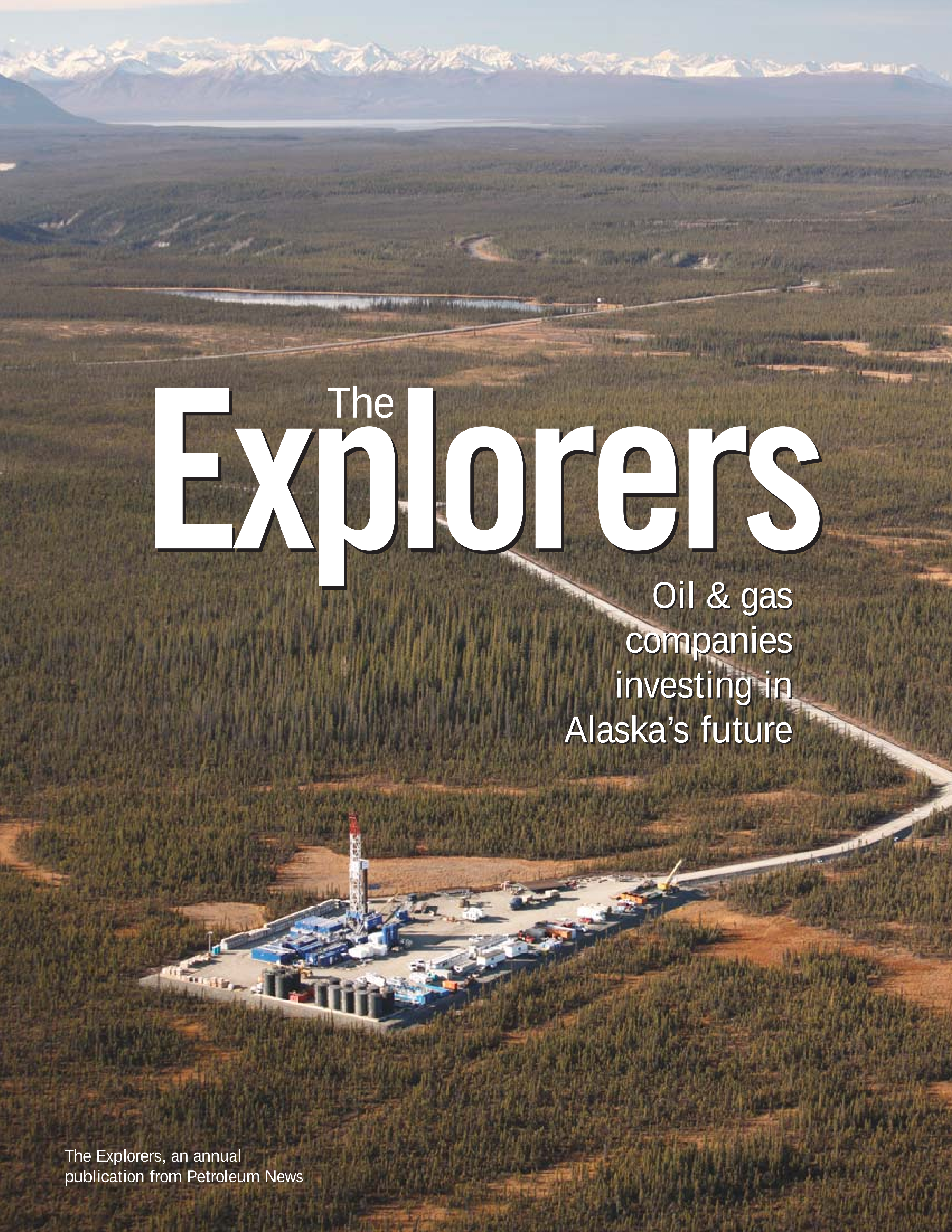

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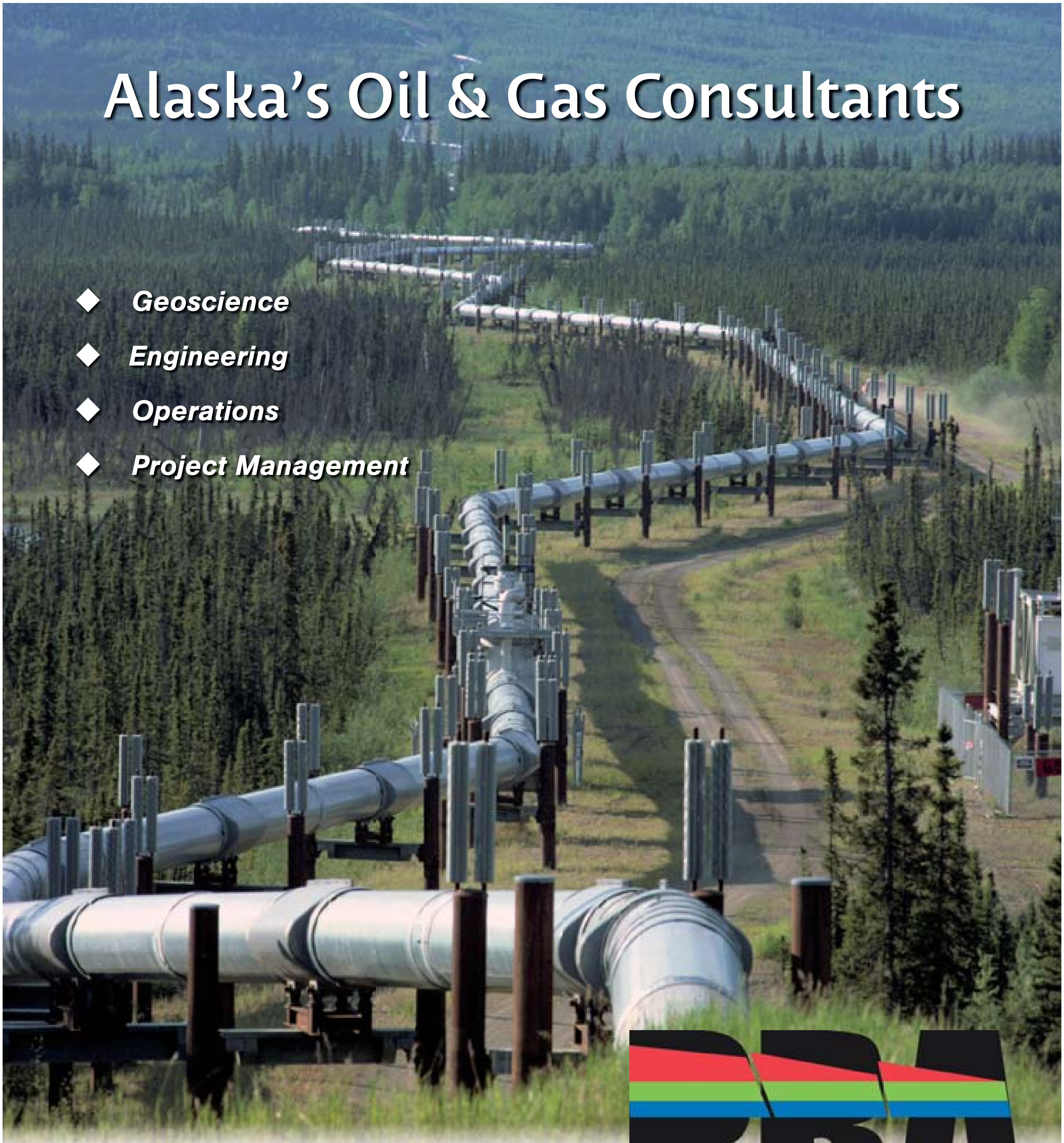

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High highs, low lows for exploration

Exploration drilling is down, but discoveries have far surpassed expectations

By ERIC LIDJI
For Petroleum News

There are a lot of mixed messages in Alaska oil and gas exploration at the moment.

The recently completed winter exploration season generated only one well and an associated sidetrack at the Horseshoe project, although Accumulate Energy Inc. was still planning to drill its Icewine No. 2 well as this issue of the Explorers was going to print.

Either way would give 2017 the smallest North Slope well count since 2011.

But while exploration drilling has been sluggish for several years now, exploration results have rarely been as exciting. Between early 2016 and early 2017, Armstrong announced a 1.2 billion barrel discovery between its Pikka unit and the associated Horseshoe prospect; Caelus announced a 6 billion to 10 billion barrel discovery in Smith Bay; and ConocoPhillips announced a 300 million barrel discovery at its Willow prospect. If developed, those three discoveries would impact North Slope development for decades.

A small number of wells and a large number of discoveries would seem to suggest a disparity between outlook and reality. But more likely it represents the oddities of Alaska, where only a few companies are operating in a region with large opportunities.

To better understand the state of Alaska exploration, consider four trends:

The first trend is the Nanushuk formation.

The major discoveries of the past year were all in the Nanushuk or the closely associated Torok formation, and are believed to represent a new type of play on the North Slope. Early indications suggest that the next few years could led to more discoveries in this Brookian play, as companies directly target those two formations with exploration wells.

The second trend is increased activity from Alaska Native corporations.

After decades of relying on private sector companies, Ahtna Inc. took the lead on exploration activities in the Copper River region near Glennallen this past year. ASRC Exploration LLC finally operated its first North Slope exploration well after nearly two decades as an informal "apprentice" to other North Slope operators. And Doyon Ltd. continues to see opportunities for an oil and gas discovery in the Nenana basin. The company is currently partnering on its exploration program with Cook Inlet Region Inc.

The third trend is the ongoing story of unconventional oil exploration.

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Cover photo, an aerial of the Tolsona No. 1 drilling pad, courtesy of Ahtna, Inc. ©2017 Judy Patrick Photography

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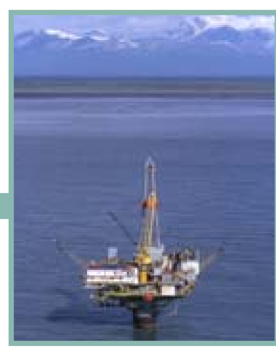

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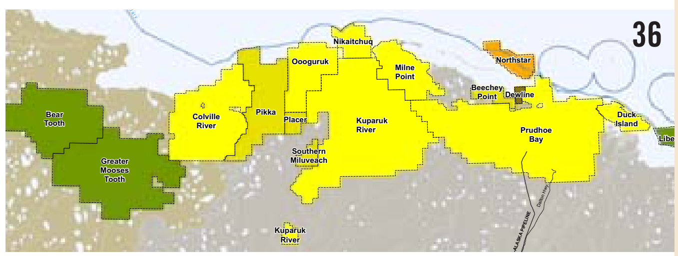

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Maps courtesy of the Alaska Department of Natural Resources, Division of Oil and Gas

State managing 5 exploration licenses

Interest in the program waxes and wanes but is crucial for certain opportunities

By ERIC LIDJI
For Petroleum News

The state of Alaska launched the exploration license program to create a pathway for companies to explore corners of the state excluded from the regular cycle of lease sales.

And although no production in the state can yet be traced to the program, exploration licensing can take credit for a range of drilling programs, especially in the Interior.

The program creates a system that mimics the competitive aspects of lease sales, which are designed to fulfill the "maximum benefit" clause in the state constitution. Every April, the Alaska Department of Natural Resources accepts applications for potential exploration licenses covering areas between 10,000 and 500,000 acres. The applicant proposes the geographic area, a work commitment and a term limit. The process allows other companies to make competing bids, in an effort to get the best deal for the state.

As of early 2017, according to information available on the Alaska Division of Oil and Gas website, the state was overseeing three current licenses (Healy, North Nenana, and Tolsona basins) and two pending requests (Gulf of Alaska and Houston-Willow basins).

Healy

The three current licenses cover activities in the Interior region.

Usibelli Coal Mine Inc. applied for an exploration license in the Healy area in April 2004, looking to add natural gas exploration to its traditional coal mining operations.

The state issued a favorable review of the project, but local groups challenged the project on environmental grounds, leading to a decade of cases that were resolved in 2014.

The state eventually approved the 204,883-acre Healy basin exploration license for a 10-year term starting at the beginning of 2011, which gave Usibelli until the end of 2020 to conduct exploration activities. The license required a $500,000 work commitment.

Usibelli met the work commitment by drilling the 1,265-foot HC No. 1 coal-bed methane test well in mid-2014. The company initially permitted a four-well program, to provide operational flexibility, but has only drilled one well to date. "It was successful in confirming the existence of gas in the basin, but it's inconclusive on a commercial level," Usibelli company representative Mitch Usibelli told Petroleum News in January 2017.

By satisfying the work commitment, Usibelli was able to create some space to decide what to do next. The company is still deciding whether to drill a follow-up well.

North Nenana and Tolsona

The state issued a five-year license for the North Nenana basin to Rocky Riley of Tolovana Construction Co. in early July 2015. The license covers 25,294 acres in the Minto Flats State Game Refuge and includes a $500,000 initial work commitment.

The region is located some 35 miles west of Fairbanks and just north of the Nenana basin where Doyon Ltd. has been exploring for natural gas over the past decade. According to the state, the North Nenana region has "low to moderate potential for discovery of conventional and unconventional natural gas" and oil potential "is also considered low."

As of March 2017, no work plan had been publically announced for the license area.

The active Tolsona exploration license, located in the Copper River region near Glennallen, is discussed more fully elsewhere in this issue, in the profile of Ahtna Inc.

Inactive licenses

In addition to the five active or pending licenses, the exploration license program has also been responsible for many licenses that are not active. Those include two rejected applications (Susitna Basin III and Susitna Basin IV), two expired licenses (Copper River Basin and Susitna Basin II), two terminated licenses (Susitna Basin I and Holitna Basin), three relinquished licenses (Susitna Basin IV, Susitna Basin V and Southwest Cook Inlet) and one license that has been converted to traditional leases (Nenana Basin).

EXPLORATION *continued from page 5*

Both Accumulate Energy Inc. and Great Bear Petroleum Operating LLC have decided to accompany their longer-term desire to develop source rock on the North Slope with near term conventional exploration as a way to develop infrastructure and generate cash flow.

The fourth trend is the expansion of existing developments.

Although exploration activity in the Cook Inlet basin has been lagging recently due to commodity prices, market conditions and bankruptcies, four companies have plans (or at least desires) to explore around existing developments: BlueCrest Alaska Operating LLC, Furie Alaska Operating LLC, Glacier Oil & Gas Corp. and Hilcorp Alaska LLC.

And on the North Slope, Eni U.S. Operating Co. LLC has been quietly permitting a proposed Nikaitchuq North project to explore in federal waters near its Nikaitchuq unit.

Contact Eric Lidji at ericlidji@mac.com

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Long-term vision critical now

Political easy decisions, short-sightedness in government threatens the survival of an industry that has brought wealth and prosperity to Alaska for 40 years

By SEN. CATHY GIESSEL
For Petroleum News

On June 20, 1977, history was made and the Trans-Alaska Pipeline System transported the first North Slope oil out of its Arctic confines. Since then, more than 15 billion barrels of crude would make the 800-mile journey across the largest state in America, providing energy security to the United States and transforming the state of Alaska.

It is remarkable that the Trans-Alaska Pipeline System, TAPS, came so close to never leaving the engineering drawing room. It took the persistence of the Humble Oil and Atlantic Richfield teams to weather the frigid winter of 1967, and several dry holes, to locate what is still North America's largest oil field at Prudhoe Bay. It took a tie-breaking vote from the then U.S. vice president to stop a colossal lobbying effort from environmentalists in order for construction to forge ahead. It took thousands of dedicated workers, engineers and project managers to overcome some of the world's largest construction challenges ever faced. And it took money: the building of TAPS was the most expensive private infrastructure project in history.


CATHY GIESSEL

Forty years, 15 billion barrels and tens of billions of dollars later, Prudhoe Bay has created wealth for Alaskans in ways unimaginable in 1977. Optimistic projections at the time the first tankers left the marine terminal in Valdez was that the boom would last, at best, 20 years and recover 9 billion barrels of oil. Through innovation and hard work, the oil and gas industry poured two generations of wealth into our communities, our state treasury, and most importantly, into the homes of hardworking Americans.

This reminiscence is important on the fortieth anniversary of the Prudhoe Bay field development, not because we should look upon the past with nostalgic complacency, but because history, without the ability to inform the future, is not helpful to us. We need to reflect on the lessons of the past and assess where Alaska has been. We need vision for the future to remain relevant in a globally competitive commodity market.

The most important element for Alaska in attracting international investment to Alaska is in the reduction and management of risk.

Remoteness makes doing any type of business more costly; the larger the project, the greater the costs. Alaskans have wrestled endlessly with ways to overcome deal-killing project costs for decades.

One of our efforts to offset those high costs was through targeted incentives. Alaska became unique in the world by offering an up-front cash credit to an explorer, developer or producer that had yet to develop a substantive tax liability. By forward funding these projects, our end-goal was to maximize the time value of money and get production on line sooner, recouping investment more quickly for both Alaska and industry.

We worked to lower costs so that our basins would attract new entrants. Prudhoe Bay comprises only a fraction of the area available for exploration on the North Slope. After four decades, the assemblage of companies doing business in the north began to dwindle, and the rate of new discoveries decreased as well. By inviting a wider array of aggressive, independent explorers into the basin, we hoped to unearth its untapped wealth and prolong the life of our brownfield infrastructure.

The question I am often asked is, "Did those credits work?" Consider Hilcorp, who came to Alaska as a player in the Cook Inlet, who turned that basin around and secured the gas needs for Alaska's major population centers. Then Hilcorp subsequently acquired North Slope leases and infrastructure, and is now bringing its dynamic and bullish approach to Prudhoe Bay and beyond. Caelus Energy made an extremely promising find in Smith Bay, which, if proven, would send over a billion more barrels down TAPS. Repsol, with partner Armstrong Energy, has made prospectively the largest find in North America in over a generation. These companies came to Alaska to do business because of the incentive structure we put in place.

Our greatest challenge now is managing the other aspect of risk: the risk of frenetic government interference. The oil price collapse in 2014 bludgeoned the budgets of companies and the governments that rely on energy production and revenue.

When faced with a massive drop in revenue, prudent managers reduce costs strategically, yet with forward vision. The rationale for this discipline is simple: do not destroy tomorrow's seed corn to fix today's problems.

Yet in 2015 and 2016, over half of a billion dollars in promised credits were unilaterally delayed by our state government, with no plan or modified payment schedule in place. Additionally, Alaska lawmakers counterproductively locked horns in the 2016 legislative session on this during a recession on this vital sector of our economy that was, by then, bleeding cash.

As this Thirtieth Legislature progresses, policy makers and citizens continue to engage in heated debate about the future of our state, and how essential services will be funded. Oil has paid for most of Alaska's budget since 1977, and a portion of our fiscal gap will likely be funded through the earnings of our Permanent Fund. This fund turns our finite hydrocarbon resources into a perpetual, generational source of income that grows annually with royalties from oil and gas production.

The challenges we face as policymakers are daunting. The politically easy solution is to forgo the hard work of restructuring how our government is built and funded. It's politically easy to look to industry cash flows every time we face a budget challenge. It's politically easy, but short-sighted.

We Alaskans need the discipline to reflect upon the past 40 years, appreciate the delicacy of our resource inheritance, and recognize how precarious its survival is when short-term wants undermine long-term vision.

The discoveries announced in the last year have the potential to extend the life of our oil wealth heritage well into the future. I can think of no better legacy for Alaska than seeing its natural resources developed, creating opportunity and stability, while continuing to benefit future generations of Alaskans.

State Sen. Cathy Giessel represents District N

Accumulate returning to Icewine

Second-year activities include both conventional and unconventional targets

By ERIC LIDJI
For Petroleum News

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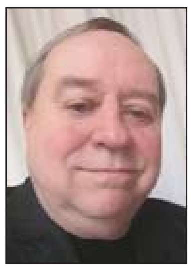
Although it is the smallest company operating on the North Slope, Accumulate Energy Alaska Inc. has been expanding and exploring its leasehold over the past two years.

The local subsidiary of Australian independent 88 Energy Ltd. drilled the Icewine No. 1 exploration well in late 2015, acquired 2-D seismic information over its leasehold in early 2016 and was preparing to drill the Icewine No. 2 follow-up as The Explorers went to print. Along with its joint venture partner Burgundy Xploration LLC, Accumulate also expanded its holdings in the central North Slope through lease sales in 2015 and 2016.

Accumulate drilled the 11,600-foot Icewine No. 1 vertical well in the Franklin Bluffs region in late 2015 to test the potential of the HRZ shale and conventional targets. The company originally planned to return to the Icewine project this winter to drill a lateral with multistage fracturing to provide points of comparison to Icewine No. 1. But after reviewing results from its $3 million 2-D seismic acquisition, the company decided to drill, hydraulically fracture and flow test the 11,200-foot Icewine No. 2 vertical well.



ERIK OPSTAD

The company changed its plans because the vertical well was both cheaper and simpler to drill. The vertical well would save about $5 million over the cost of a horizontal, according to the company. The vertical well also allowed the company to choose from a wider array of available drilling rigs on the North Slope, according to the company.

Even with those advantages, Icewine No. 2 should cost some $17.7 million, according to 88 Energy. A similar well in a play in the Lower 48 would cost about half as much.

By late March 2017, Accumulate had mobilized the Doyon Arctic Fox rig to the well site, set the conductor and was installing the cellar. The company received final permits for the well in early April. The company said that it planned to spud during the week of April 24, and to stimulate and flow test the HRZ shale formation in June or July.

The well site in the Franklin Bluffs region allows the company to access the drilling location year-round, providing an advantage over seasonally restricted sites farther north.

If the results from Icewine No. 2 prove to be intriguing, Accumulate wants to return next winter to sidetrack or deepen the well or to drill the Icewine No. 2H horizontal lateral.

According to descriptions from July 2016, the horizontal well would proceed directionally for 14,877 feet to a depth of 11,100 feet and include a 3,000-foot lateral.

Quick turnaround

88 Energy and Burgundy Xploration formed their joint venture in November 2014 and have since expanded their land holdings in Alaska through various lease sales.

The project reached its first milestone with the Icewine No. 1 well, the following year.

According to 88 Energy, the well proved the presence of working petroleum systems in the Brookian and Beaufortian sequences. By mid-September 2016, the company was touting shows in the Brookian and a conventional discovery in the Kuparuk formation.

In early 2016, the independent firm DeGolyer & MacNaughton estimated that the HRZ shale at the Icewine prospect contained some 985.3 million barrels of liquids in a mean case. The estimate included oil, wet natural gas and condensate. Using internally generated figures, the joint venture estimated that the prospect contained more than 2.6 billion barrels of liquids in a mean case. The difference between the estimates, according to 88 Energy, came from a disagreement over how much of the acreage is productive.

In earlier investor presentations, 88 Energy proposed even

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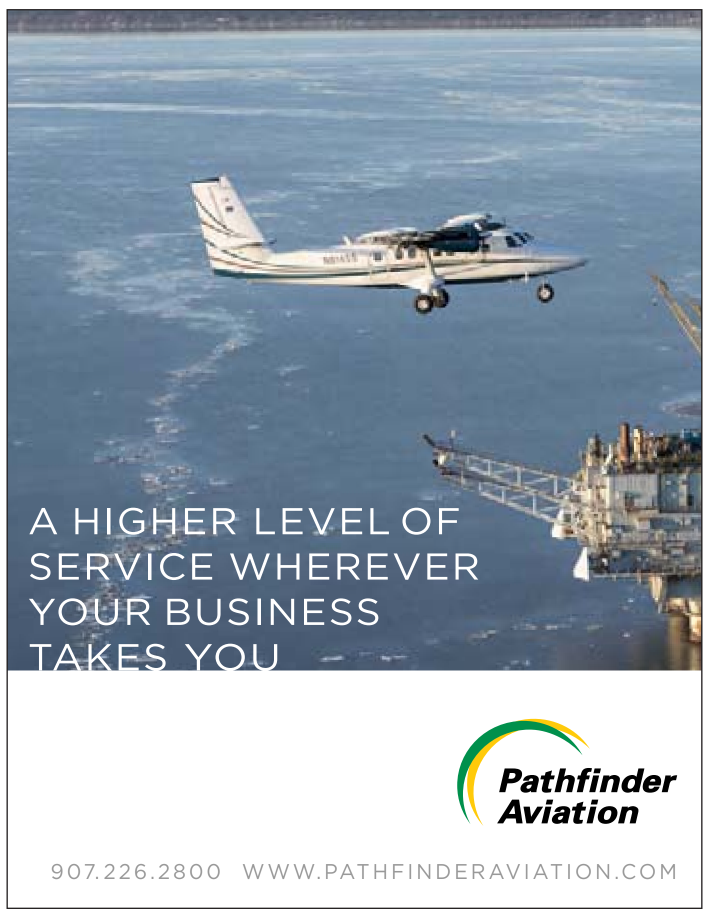

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Ahtna completes Tolsona exploration well

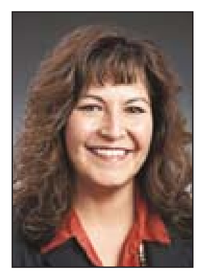
Successful program could yield a local supply of gas for the Copper River region

By ERIC LIDJI
For Petroleum News

In the first week of this year, Ahtna Inc. announced that its subsidiary had completed operations at its Tolsona No. 1 exploration well, but wouldn't have results for months.

By the time The Explorers went to print, those results had not yet been released.

The results will determine whether the Alaska Native corporation for the Copper River area is able to progress its long-standing goal of reducing energy costs in the region by replacing oil-based and other energy sources with a local supply of natural gas.


MICHELLE ANDERSON

Early news from the drilling site contained both encouraging and challenging news. The well encountered natural gas and provided several leads for the company to pursue during flow testing. But the complex geology of the region continued to beguile drillers.

In the latter half of 2016, Ahtna drilled and flow-tested the 5,500-foot Tolsona No. 1 well in thick Nelchina sandstone intervals of a natural gas-prone region near Glennallen.

The 11 previous exploration wells drilled in the Copper River basin all encountered natural gas. But all encountered complex geology, too, which thwarted development. The most recent was the Ahtna 1-19 well that Texas-based independent Rutter & Wilbanks Corp. drilled about two miles east of the current Tolsona well between 2005 and 2007.

Like previous wells, the Ahtna 1-19 encountered natural gas. But high subsurface pressures and water encroachment forced the company to plug and abandon the well.

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Armstrong discoveries rock Alaska

The Pikka/Horseshoe discoveries promise a new kind of play for the North Slope

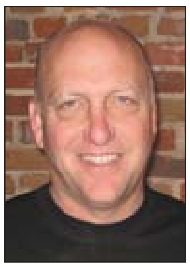
By ERIC LIDJI
For Petroleum News

NAME OF COMPANY: Armstrong Oil & Gas Inc.
COMPANY HEADQUARTERS: Denver, Colorado
TOP EXECUTIVE: Bill Armstrong, president
TELEPHONE: 303-623-1821

Judging by completion reports alone, Armstrong Energy LLC drilled its first North Slope exploration well this past winter with the Horseshoe No. 1 well and No. 1A sidetrack.

But that measurement fails to capture the full scope of the company's work in Alaska.

Through joint ventures, Armstrong is directly or indirectly connected to nearly 50 North Slope exploration wells drilled since 2000. By that measure, the company has been the second-most prolific exploration company on the North Slope after ConocoPhillips.



BILL ARMSTRONG

In its role as a partner and a facilitator, Armstrong is also connected to three of the most important discoveries made on the North Slope during the 21st century: Oooguruk, Nikaitchuq and the recently announced Pikka/Horseshoe discovery west of Kuparuk.

The Oooguruk unit and the Nikaitchuq unit are responsible for expanding North Slope development beyond BP Exploration (Alaska) Inc., ConocoPhillips Alaska Inc. and ExxonMobil Alaska Inc. The Pikka/Horseshoe discovery represents the beginning of a new type of play that could reap benefits across the North Slope for several decades.

Additionally, through a brief foray into the Cook Inlet region, Armstrong brought the North Fork unit into production. The unit expanded regional development into the southern Kenai Peninsula and finally connected the city of Homer to a natural gas supply.

Repsol partnership

The current exploration on the North Slope dates to a large lease position that Armstrong began acquiring in 2008 and 2009 through a new subsidiary called 70 & 148 LLC.

Working with the independent GMT Exploration Co. LLC, Armstrong brought the Spanish major Repsol YPF to Alaska in March 2011 to operate a major exploration program at the leasehold. The leasehold was mostly situated between the Kuparuk River unit and the Colville River unit, with an additional section south of the Prudhoe Bay unit.

Under the deal, Repsol acquired a 70 percent interest in 494,211 acres across the North Slope and planned to spend around $768 million, with most going toward exploration.

The joint venture eventually increased both its land position and its budget, leasing some 750,000 acres across the North Slope and spending about $1 billion on exploration work.

The exploration program eventually included 16 wells or sidetracks, two 3-D seismic surveys and the formation of the offshore Qugruk unit and the Pikka unit along the Colville River Delta. After hinting at results for years, the joint venture provided some brief details in mid-2015 for discoveries in the East Alpine and Nanushuk formations.

By early 2016, Armstrong founder and top executive Bill Armstrong was estimating that the field could produce 120,000 barrels of oil per day at its peak. A project of that size would increase current throughput on the trans-Alaska oil pipeline by nearly 25 percent.

At that time, the companies were reporting proven contingent oil reserves of 497 million barrels, probable contingent reserves of 1.4 billion barrels, and possible contingent reserves of 3.7 billion barrels. And the Alpine and Nanushuk represented just two of the six notable horizons, suggesting the possibility for even higher estimates in the future.

Along similar lines, those early exploration activities only covered about 10 percent of the total Armstrong leasehold, creating many opportunities for exploration nearby.

Although the oil was spread across multiple reservoirs, those estimates were billed at the time as a discovery to rival the legendary giants on the North Slope. As then-Alaska Department of Natural Resources Commissioner Mark Myers described it in February

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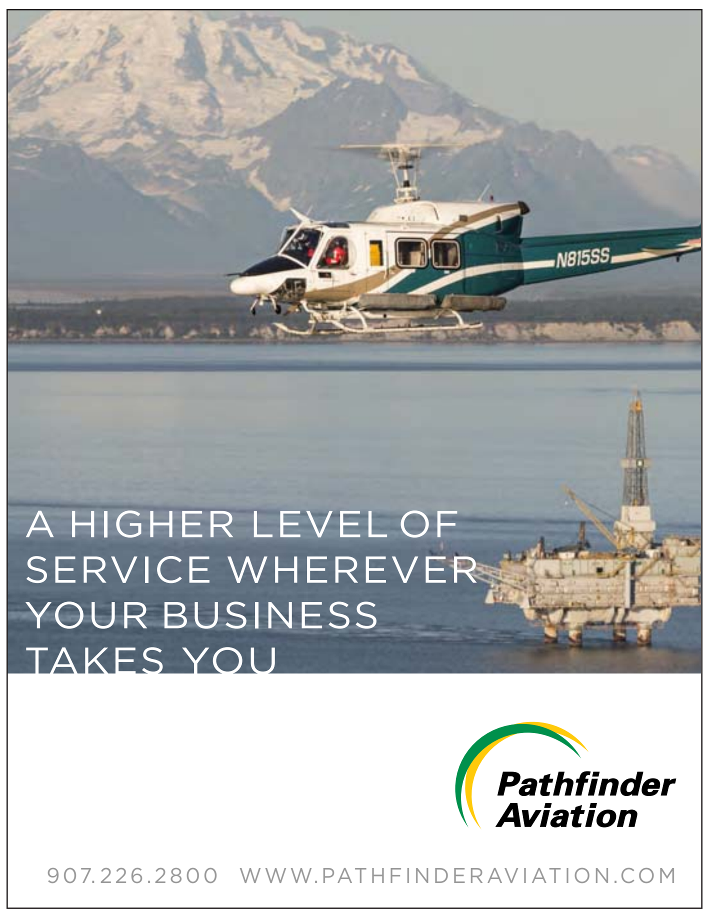

ARMSTRONG *continued from page 13*

2016, "the proven contingent oil reserve number makes the discovery the largest since the Alpine field, the probable contingent reserve number the largest since the Kuparuk field, and the possible contingent number makes the discovery the largest since Prudhoe."

The Alpine discovery would have been notable on its own, but the Nanushuk discovery has since inspired the greatest interest in the Alaska oil patch. Armstrong described the discovery as "a new and different play for the North Slope," with thicker pay at shallower depths. "That's what makes it so exciting. Nobody has seen this formation productive in this depositional environment before. You look at how thick it is, how good the oil is, how good the reservoir is — it all bodes really well for the play," he said in early 2016.

More to the point, Armstrong noted, "there are more fields out there to be found."

Speaking to the Alaska Geological Society in mid-April 2016, U.S. Geological Survey geologist Dave Houseknecht gave credence to that notion. He said that the initial Armstrong/Repsol discovery in the Nanushuk had revealed the possibility of major undiscovered oil resources along a fairway extending perhaps 100 miles to the west.

Over the past year and a half, ConocoPhillips makes a discovery in the Nanushuk at its Willow prospect in the Greater Mooses Tooth unit in the National Petroleum Reserve-Alaska, and announced plans to explore the Nanushuk south of the Colville River unit.

And Caelus made a discovery in the related Torok formation in the Smith bay region.

After making its initial discovery announcement, the Armstrong/Repsol joint venture soon began the early stages of permitting a development at Pikka. The U.S. Army Corps of Engineers is currently preparing a draft environmental impact statement and expects to be finished this summer. Armstrong believes it can begin production as soon as 2021.

Horseshoe

Around the time of the first discovery at Pikka, Repsol was planning to make a public decision about how it would approach a development program in the Pikka region.

But instead, the joint venture reorganized. After the shuffle, Armstrong became the project operator and got a majority interest in the exploration and development acreage, and Repsol took a minority position — handing over control but remaining engaged.

The joint venture lost a year of drilling to the reorganization effort, but still conducted some limited fieldwork and reprocessed some 3-D seismic information from the region.

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ACCUMULATE *continued from page 11*

higher estimates. The company described a potential Icewine development program consisting of 40 pads with 30 wells each — for some 1,200 wells total — targeting between 10 billion and 21 billion barrels of oil in place at the prospect. By comparison, more than 3,400 wells have been drilled to pursue the approximately 25 billion barrels of oil in place at Prudhoe Bay.

Alpha and Bravo

After processing its 420-mile 2-D seismic acquisition over the Icewine area, 88 Energy identified some 20 conventional oil prospects in the Brookian sequence, according to 88 Energy. They estimated that five of those conventional prospects — Alpha, Bravo, Golf, India and Juliet — might hold a combined mean volume of 758 million barrels of oil.

The company has since narrowed its focus to the Alpha and Bravo prospects.

The Bravo prospect is the largest of the group, with a mean estimate of 273 million barrels of oil, according to internal company estimates. The Alpha prospect is smaller, with a mean estimate of 118 million barrels, but is closer to the Dalton Highway corridor.

88 Energy has generally divided the Icewine region into three fairways: Eastern, Central and Western. The Alpha prospect is part of the Eastern region. The Bravo prospect is part of the Western region, which includes some of the more recently acquired acreage.

The company has described the conventional leads as being "predominantly stratigraphic" and geologically analogous to the Tarn oil pool at the Kuparuk River unit.

Those prospects could improve the economics of an HRZ shale development.

Accumulate is the third company to explicitly target source rock in Alaska, after Great Bear Petroleum Operating LLC and Royale Energy Inc. Great Bear was the first of the group and continues to pursue its project. Royale was the second and has left the state.

All three companies have found conventional exploration and development to be a pre-requisite for source rock developments in Alaska. The size and scale of source rock operations requires infrastructure and cash flow, which conventional work could provide.

With "further successful appraisal at Icewine No. 2; based on type curves from internal resource estimate combined with fiscal/cost assumptions," an unconventional development at the Icewine project could break even with oil prices at about $40 barrel, according to an 88 Energy investor presentation from mid-September 2016. In earlier presentations, the company presented a range of exploration and development costs between $27 and $68 per barrel, depending on the size and scope of the resource. In its most recent presentation, from February 2017, the company reiterated the $40 figure.

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AHTNA *continued from page 12*

Ahtna and its contractors considered those problems when they designed the Tolsona well, and they successfully isolated the potential natural gas zone from the high-pressure water zone above it. To accommodate the complex geology, Ahtna had to drill the well approximately 700 feet deeper than it had original planned, leading to some delays.

"We had to drill the well deeper than we had proposed because the formations were coming in deeper in the fault block that we were in," drilling manager Marty Lemon said in December 2016. Even though the company had 2-D seismic over the area, the details of the geology were complex. And although the company had a previous well in the vicinity for guidance, the Ahtna 1-19 well was in a different fault block with different geology.

To manage the high pressures, drillers used especially large diameter casing strings to accommodate additional casing when the well encountered water. The drillers also used "managed pressure drilling" to respond to high pressures encountered in the well. And the drillers started with a small 1,100-foot pilot hole before setting the first casings.

The Tolsona well encountered five distinct intervals of interest for the company to consider during flow testing operations, according to Lemon. In December, the company said that testing would involve a section of the well between 5,000 and 5,220 feet.

Licensing and tax credits

As with all oil and gas exploration outside of the North Slope and Cook Inlet basins, the Tolsona program was conducted through the state exploration license program.

The state issued a five-year license for the Tolsona basin in December 2013. The license covered 43,492 acres and required Ahtna to spend at least $415,000 on exploration.

By February 2015, Ahtna had already spent $3 million on the program and expected to have spent between $10 million and $15 million by the time the well was finished.

As the project progressed, Ahtna also made use of the "Middle Earth" provisions in the tax code that provide credits for Interior exploration. "Ahtna would not be doing this exploration if the tax credits were not in place. A substantial discovery would benefit not only the Copper River region but the state at large, helping to address high-energy costs in the region and beyond," Ahtna President Michelle Anderson said in August 2016.

The exploration program began in late 2014, when Ahtna commissioned Global Geophysical Services to conduct a 2-D seismic survey covering some 40 miles. Ahtna also reprocessed some 80 miles of existing 2-D seismic data. The seismic effort revealed portions of a geologic structure some 14 miles west of Glennallen and gave the company a 60-to-70 percent chance in finding natural gas with a new well, Ahtna Vice President of Land and Resources Joe Bovee told the House Energy Committee in February 2015.

Although the primary goal of the program is to improve the local economy by reducing energy costs, Ahtna has said it might export any excess supplies. Before drilling, the company applied to the Regulatory Commission of Alaska for permission to create a distribution utility that could deliver natural gas to homes and businesses throughout the region, figuring it would import liquefied natural gas if exploration were unsuccessful.

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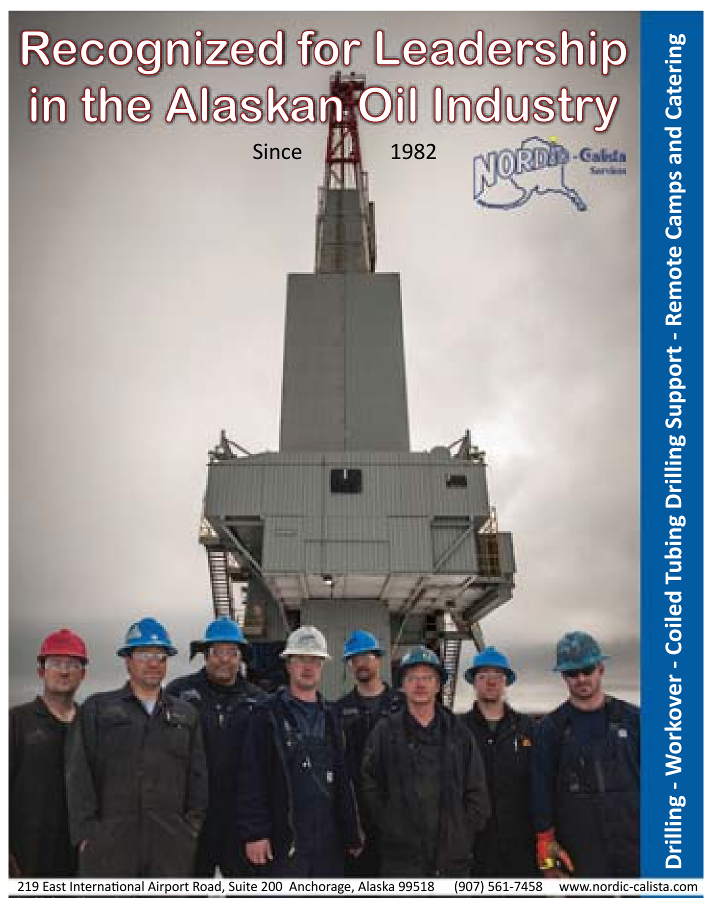
Tolsona No. 1 drilling in progress



ARMSTRONG *continued from page 14*

In an interview with Petroleum News in the summer of 2016, Bill Armstrong contrasted the discovery with the unconventional projects gaining attention across the Lower 48.

"We believe we have proven an oil pool that covers more than 25,000 acres, at a shallow depth of only 4,100 feet, with an oil column of 650-plus feet, up to 225 feet of net pay and an average porosity of 22 percent. Individual wells should be in excess of 10 million barrels each," he said, noting, "to put it in perspective, this is 25 times larger than the average Bakken well," referring to the famous tight oil play in the North Dakota region.

"Dream oil fields are still out there to be found, especially in Alaska," he added.

This past winter was the first drilling season with Armstrong at the helm.

Armstrong initially planned to drill two wells. The Pikka No. 1 well would appraise the previous discoveries in the southern tip of the Pikka unit. The Horseshoe No. 1 well would be a wildcat well some 20 miles south of the Pikka unit, near a horseshoe bend in the Colville River, and was designed to "test a new idea," according to Armstrong.

Concern from villagers in nearby Nuiqsut led Armstrong to cancel plans for the Pikka No. 1 well. The company struck a deal with ConocoPhillips to share information from the proposed Putu No. 1, which was located in the vicinity. But ConocoPhillips ultimately cancelled its plans as well, also in response to concerns from villagers in Nuiqsut.

The Horseshoe project went ahead.

The project involved a group of leases in a small swath of acreage that Armstrong acquired from the independent Royale Energy Inc. in late 2015. Royale had been at least partly interested in the source rock potential in the acreage, as well as the conventional potential of the Brookian and Beaufortian in the region. But Armstrong was exclusively interested in exploring conventional opportunities along the lines of its Pikka project.

After acquiring these leases in 2012, Royale touted both the conventional potential of the Brookian and Beaufortian in the region as well as source rock potential. Along with its partner Rampart Energy Inc., Royale commissioned the Big Bend 3-D seismic program and began permitting a two-well Aki exploration program. In early documents, Royale pointed to a June 2014 report from Netherland Sewell and Associates Inc. estimating that two prospects identified through the seismic program might contain between 17.8 million and 325.3 million barrels of oil in place, with a best-case scenario of 77.5 million barrels.

continued on page 18

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ASRC makes progress on Placer well

Early hints suggest favorable results from first well operated by ASRC Exploration

By ERIC LIDJI
For Petroleum News

The odds of ASRC Exploration LLC becoming a producer in the near future increased in mid-2016, when the operator applied for an extension of the terms of its Placer unit.

In its request, the exploration subsidiary of Arctic Slope Regional Corp. told state officials that the Placer No. 3 exploration well from early 2016 had expanded the known size of the Placer reservoir and also appeared to be capable of producing economically.

According to a July 26 letter to the Alaska Department of Natural Resources and an associated plan of development, the well "confirmed extension of the Placer reservoir beyond the central Placer No. 1 location." As of now, the Placer No. 3 well only identified one productive interval at the unit. But the company intends to determine, at a later date, whether other zones at the unit also have the capability to be productive.

REX ROCK, SR.

Although the company asked for a five-year extension to the unit terms, Department of Natural Resources Commissioner Andrew T. Mack only approved a two-year extension, giving the company until September 2018 to complete the next stage of its activities.

The state felt that a five-year extension "would be contrary to the public's interest in maximizing competition among parties and offering acreage for lease if resources are not diligently developed" and a shorter extension balanced the needs of the company and the public. Without an extension, the leases would become available to other operators.

Without an extension, the unit would have expired in September 2016.

Under its first plan of development, ASRC intends to "re-evaluate and incorporate new seismic into our model to complete geological mapping of the area; perform reservoir engineering for reserves estimates; perform facilities engineering for a development plan; and perform economic evaluations with the goal to sanction the project development."

Between September 2016 and September 2017, according to the plan, ASRC Exploration will use previous wells to estimate the "extent, size and continuity of all producible reservoirs;" will obtain information from the "CGG Tabasco 3D seismic" and merge the findings into other seismic surveys to better map the geologic structure; and will develop a high-level cost estimate for infrastructure. And it would start discussions with Brooks Range Petroleum Corp. and ConocoPhillips Alaska Inc. about sharing existing facilities.

Between September 2017 and September 2018, the company would use the results of its reservoir mapping to plan future development well locations, begin engineering work for drilling pads, roads and pipelines, and propose the first participating area for the unit.

In the nearly 13 years ASRC Exploration has been pursuing the Placer project, the region between the Kuparuk River unit and the Colville River unit has become increasingly active. Brooks Range Petroleum Corp. is working to develop the Southern Miluveach unit to the south. A joint venture led by Armstrong has announced the massive Pikka/Horseshoe discoveries stretching throughout the region. And ConocoPhillips is currently looking to explore the Putu prospect in the area south of the Colville River unit.

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Two decades

Through its various subsidiaries, Arctic Slope Regional Corp. has been an active landowner and oil field services provider on the North Slope for many years.

Nearly 20 years ago, the company decided to take a more active role in exploration and began negotiating a "mentoring" agreement with BP Exploration (Alaska) Inc. in 1999.

The agreement signed in March 2003 established "a framework for sharing data and technical knowledge," including information about in-unit and near-unit oil and gas investment opportunities on the North Slope, the two companies said at the time.

In its first project under the agreement, ASRC farmed in acreage at the Placer prospect located west of the Kuparuk River unit. ConocoPhillips Alaska Inc. drilled the Placer No. 1 and Placer No. 2 exploration wells in early 2004. Through its farm-in, ASRC acquired a 35.7 percent working interest in the Placer No. 1 well. Although the well appeared to have favorable results ConocoPhillips and its other partners never pursued development.

ASRC acquired the Placer prospect in a March 2006 lease sale, the Placer No. 1 well in June 2010 and a license over an earlier seismic survey of the region by early 2011.

In the midst of those negotiations, ASRC also created the subsidiary ASRC Exploration to serve as its operating arm for future exploration and development projects. One of the first projects of the subsidiary was acquiring a minority interest in the Badami unit from BP. The company continues to hold a minority interest in the eastern North Slope unit.

With the five-year leases at Placer about to expire in early 2011, ASRC Exploration applied to form the Placer unit over four state leases covering some 8,769 acres. The state instead approved a 1,480-acre unit covering portions of four leases around Placer No. 1.

The company argued that the larger unit was necessary to explore beyond the Placer No. 1 well. If the reservoir expanded far enough to the south, for instance, it would present an opportu-

continued on page 18

ASRC *continued from page 17*

nity to partner with Brooks Range Petroleum Corp. on a regional development.

Although the two companies were unable to come to terms on a program, the state ultimately approved the unit expansion in November 2014. The expansion required ASRC Exploration to post a $2.5 million performance bond by mid-January 2015 and meet a series of commitments culminating in a well by May 2016.

ASRC Exploration completed the 6,380-foot nearly vertical Placer No. 3 well in March 2016, according to Alaska Oil and Gas Conservation Commission records.

In late 2016, ASRC Exploration acquired oil and gas leases in the Camden Bay region of the Beaufort Sea from Shell, as well as data for the Sivulliq and Torpedo prospects.

At the time, ASRC was still waiting for governmental approval of the transfer and was also looking into extending the leases beyond their October 2017 expiration deadline.

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ARMSTRONG *continued from page 16*

Royale proposed eight potential well locations at its Aki prospect in an oil discharge prevention and contingency plan released for public comment in August 2014.

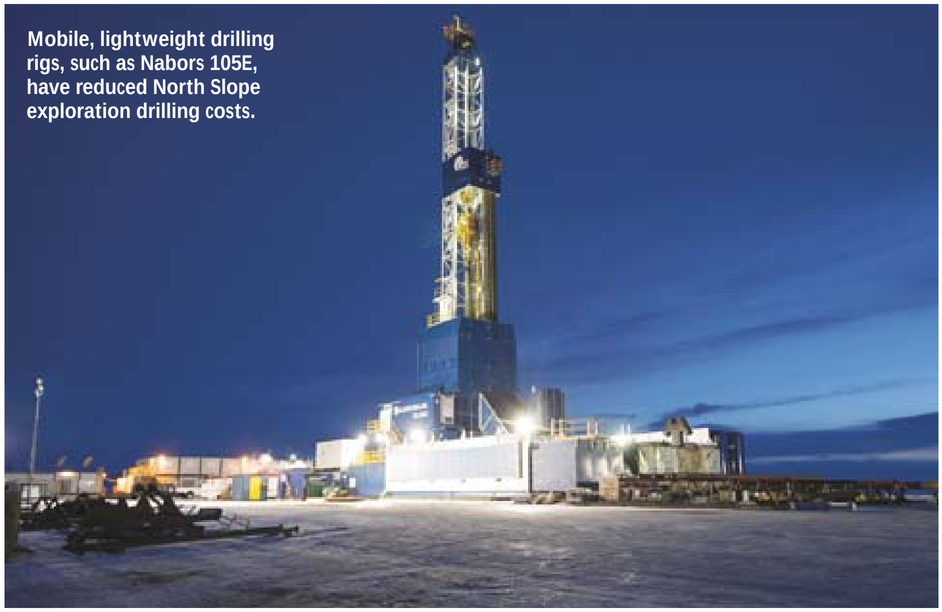
In a proposed plan of operations for Horseshoe No. 1 released in October 2016, Armstrong said that it intended to drill a 9,000-foot nearly vertical well from a 4.5-acre ice pad. The ice pad would be connected to a 200-foot square staging pad at the existing Drill Site 2P at the Meltwater satellite of the Kuparuk River Unit by a 17.5-mile road across Great Bear Petroleum and ConocoPhillips Alaska leases. The drilling pad would include space for a drilling rig, maintenance buildings and a 60- to 90-man camp. The company eventually used the Doyon Arctic Fox drilling rig for the Horseshoe program.

While the Royale program, in theory, would have used conventional discoveries to create infrastructure and cash flow for an unconventional work, Armstrong was only interested in conventional. Armstrong is betting that oil prices will rise over the coming decade. The company believes existing conventional fields and even unconventional fields will fall short of demand by 2020, sending oil to "$70 to $80 per barrel at a minimum," Armstrong explained in an August 2016 interview with Petroleum News.

The bet is paying off, so far.

After drilling a well and a sidetrack at the Horseshoe prospect earlier this year, Armstrong increased the size, scale and importance of the earlier discovery. The joint venture now estimates that it has made a 1.2 billion barrel discovery, which it described as being "the largest U.S. onshore conventional hydrocarbons discovery in 30 years."

The Horseshoe 1 discovery well was drilled to a total depth of 6,000 feet and encountered more than 150 feet of net oil pay in several reservoir zones in the Nanushuk section, according to Repsol. The Horseshoe 1A sidetrack was drilled to a total depth of 8,215 feet and encountered more than 100 feet of net oil pay in the Nanushuk interval as well.



Mobile, lightweight drilling rigs, such as Nabors 105E, have reduced North Slope exploration drilling costs.

JUDY PATRICK

"The successive campaigns in the area have added significant new potential to what was previously viewed as a mature basin. Additionally Alaska has significant infrastructure which allows new resources to be developed more efficiently," Repsol said in a statement.

Partner to leader

Armstrong is one of several smaller companies that came to Alaska in the late 1990s and early 2000s, when a series of mergers was changing the operating environment on the North Slope and when the basin as a whole was beginning to pass into operational maturity.

These smaller companies saw opportunities to reconsider mid-size fields that had been overlooked by the major players on the North Slope over the first five decades of exploration and development. Added to these geological opportunities was a range of regulatory opportunities, as the state and the companies agreed to sharing agreements.

Starting around late 2001, Armstrong began pursuing prospects that were too small to be of interest to the majors but would be big by the standards of just about any other basin.

Through its exploration and partnering efforts, Armstrong brought Pioneer Natural Resources, Kerr-McGee and Eni Petroleum to Alaska by proving up the Northwest Kuparuk, Nikaitchuq and Tuvaaq prospects in the nearshore waters of the Beaufort Sea.

In time, the Northwest Kuparuk prospect became the Oooguruk unit, first operated by Pioneer Natural Resources Alaska Inc. and now operated by Caelus Natural Resources Alaska Inc. Nikaitchuq and Tuvaaq jointly became the Eni-operated Nikaitchuq unit.

Those two projects saw Armstrong acquiring prospects, finding larger partners to finance and operate exploration activity at those prospects and watching as those larger companies reaped the glory of bringing the prospect into production. But with the North Fork project in the Cook Inlet basin, Armstrong oversaw the work from drilling to pipeline construction to development before selling the unit to Cook Inlet Energy LLC.

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BlueCrest exploration plans uncertain

Company eyes exploration options as it undertakes initial development at Cosmopolitan

By ERIC LIDJI
For Petroleum News

Over the next few years, policymakers debating oil and gas exploration in Alaska are likely to turn the experience of BlueCrest Alaska Operating LLC into a case study.

BlueCrest became one of the newest producers in Alaska last year when it brought the offshore Cosmopolitan unit into production after decades of delays by several previous operators. The company is now in the early stages of an oil development program.

But momentum for additional exploration drilling stalled last year after the state vetoed tax credits. Now plans to expand operations at the Cook Inlet unit have become uncertain.

J. BENJAMIN JOHNSON

BlueCrest brought the Cosmopolitan development into production from the Cosmopolitan No. 1 well, which the company had helped drill in 2013 as an exploration well and later converted to development. Throughout 2016 and the early months of 2017, the company began drilling the first wells in a five-well development program and built facilities that could accommodate current drilling plans as well as some future expansion.

The Hansen drilling pad near Anchor Point includes slots for as many as 20 wells, and the associated production facility can accommodate as much as 10,000 barrels per day. The 38-acre parcel is much larger than the current pad and facilities, allowing for expansions.

The current development program is using an onshore pad near Anchor Point to drill directional wells to an offshore target. But operator BlueCrest Alaska Operating LLC has also talked about its desire to use the Spartan 151 jack-up rig to drill offshore wells into shallower oil and natural gas prospects located above the main oil reservoir at the field.

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In an application to the U.S. Fish and Wildlife Service in early 2016, BlueCrest described a three-well exploration program that included offshore and onshore components. The company would test offshore gas prospects by drilling two directional wells from the same location as the Cosmopolitan No. 1 well from 2013 and would collect geological information about oil formations using a third well drilled from a nearby surface location.

By July, the company had withdrawn the application. Even at the time BlueCrest submitted it, the likelihood of it pursuing gas exploration anytime soon was doubtful.

That was partly because of frustration about the tax credit veto.

"What (the governor's action) did is create a tremendous distrust of the state's integrity going into the future," BlueCrest President J. Benjamin Johnson said in July 2016. "Unless something is worked out to help the small oil companies work through the payment delay, this is going to have a long term negative impact to the state and will surely come into play as the state tries to obtain financing for new capital programs."

In addition to uncertainty about tax credits, the company was worried about the state of the local natural gas market, which is largely satisfied through contracts expiring in early 2018.

In previous years, BlueCrest had announced a partnership with the liquefied natural gas company WesPac Midstream LLC. Under the terms of the deal, WesPac would have financed the entire natural gas development program and would have controlled all of the production from the field, although BlueCrest would have technically operated the program and would have gradually increased its ownership to as high as 80 percent. The program initially called for drilling in 2016 with production starting as early as 2018.

BlueCrest has also pointed to other exploration opportunities at Cosmopolitan.

According to the company, a 3-D seismic program from 2005 "suggests that the southern exploratory blocks potentially have producible hydrocarbon deposits at a deeper depth," which would require some "additional evaluation" to determine if the deposits are economically viable. Both the oil and gas developments are focused on leases near the center of the unit, leaving areas to the north and the south for future exploration work.

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In particular, the company has identified a prospect worth exploring in the south, located predominately within ADL 391899 and potential extending into two neighboring leases.

AIDEA financing

A difficult financial situation even forced BlueCrest to ask the Alaska Industrial Development and Export Authority to revise the terms of a loan issued to the company.

Citing a combination of the loss of tax credits and delays bringing a rig to the region, the company asked the public corporation to delay some of the early timelines of the loan and to change the terms of a reserve account established as part of collateral for the loan.

In April 2015, AIDEA agreed to lend BlueCrest $30 million toward the $40 million cost of manufacturing, transporting and building a new custom drilling rig for Cosmopolitan.

As part of the deal, AIDEA used the drilling rig as collateral and required BlueCrest to establish a reserve account to offset any potential difference between the purchase price and future sale price of the rig. BlueCrest intended to use tax credits to fund the account.

AIDEA approved the extension in late 2016.

Half-century odyssey

Using the previous tax credit program, and the particulars of the market, BlueCrest was able to accomplish what five previous operators had failed to do over 49 years.

Pennzoil discovered Cosmopolitan in 1967 but never pursued development. The results of its two-well drilling program failed to interest the company, and the southern Kenai Peninsula was well beyond the terminus of the Cook Inlet distribution system at the time.

ARCO Alaska acquired the prospect in the 1990s, and Phillips Inc. inherited the leases after it acquired ARCO's producing assets in Alaska in early 2000. Using new drilling technology, Phillips drilled the Hansen No. 1 exploration well in 2001. The well confirmed the original discovery and also found productive sands in a deeper formation.

After acquiring the prospect in a merger, ConocoPhillips Alaska Inc. drilled the Hansen No. 1A sidetrack of the original well in 2003 and conducted a promising flow test.

ConocoPhillips brought Pioneer Natural Resources on as a partner in 2005. The companies commissioned a 3-D seismic survey but did not pursue any drilling.

After they dissolved their partnership, Pioneer became operator of the field. The company drilled the Hansen No. 1A-L1 long-reach undulating lateral off of the sidetrack in 2007.

Although it slowed its activities at Cosmopolitan in response to the financial crash of late 2008, Pioneer eventually fracture stimulated an interval in the Hansen No. 1A-L1 well in 2010 and flow tested the well. Under a pilot program to truck Cosmopolitan oil to the Tesoro refinery to the north, Pioneer produced more than 33,000 barrels from the field.

By early 2011, the company had soured on the project. It terminated the Cosmopolitan unit and relinquished all its leases except the two that were held by wells, which it sold to BlueCrest and its operating partner at the time, the independent Buccaneer Energy Ltd.

After drilling the Cosmopolitan No. 1 well, Buccaneer announced previously unknown oil-bearing intervals, and some gas production, too, but postponed a "more extensive flow test." Before it could drill a follow-up well, Buccaneer sold its minority stake in the Cosmopolitan prospect to BlueCrest in an attempt to improve its financial situation.

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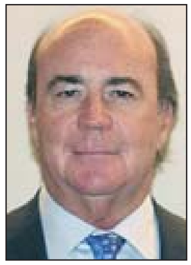
Caelus sitting on a Smith Bay elephant

A major discovery at Tulimaniq would require money and expertise to develop

By ERIC LIDJI
For Petroleum News



JAMES MUSSELMAN

After completing a two-well program at the Smith Bay prospect in early 2015, Caelus Energy Alaska LLC announced one of the largest oil discoveries in the history of the North Slope: a 6 billion to 10 billion barrel oil field, according to company estimates.

The Tulimaniq discovery promises to be a major story on the North Slope over the next few years. But the prospect is remote, which means that Caelus needs oil prices to climb high enough to support an expensive infrastructure commitment. And the prospect is near a region of the North Slope with a history of environmental debate, which could make permitting even more challenging than the typical oil and gas development in Alaska.

The local subsidiary of the Dallas-based independent post-

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poned its plans to return to the area this winter, citing persistently low oil prices, ongoing fiscal uncertainty in Alaska and the recent veto of state tax credits. The company currently intends to continue its exploration program in the Tulimaniq region during the 2017-18 winter drilling season.

Although a decision about sanctioning remains years off, the company believes it could bring the prospect into production within five years from the start of development work.

And while the Tulimaniq prospect is the highest exploration priority for Caelus at the moment, the company is also touting the potential of a large swath of acreage it holds on the eastern North Slope between the Prudhoe Bay unit and the Point Thomson unit.

Caelus acquired the assets of Pioneer Natural Resources Alaska Inc. for $300 million in early 2014, after months of negotiations. The company currently operates the Oooguruk unit. The company has sanctioned the Nuna satellite of the North Slope field, although it recently delayed some work on the project in response to the current economic climate.

CT-1 and CT-2

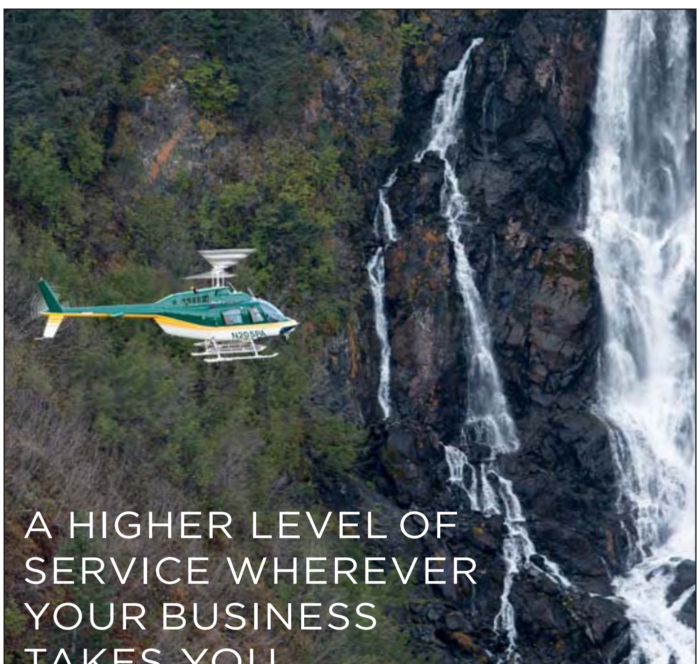
Caelus acquired a 75 percent working interest in 26 leases in the Tulimaniq area from NordAq Energy Inc. in June 2015 and built upon existing NordAq permitting activities to quickly plan a two-well exploration program for the following winter drilling season.

The company permitted the CT-1 well as an amendment to an existing plan of operations from a previous drilling season and the CT-2 well under a separate plan of operations.

The two stratigraphic test wells were located near the mouth of the Ikpikpuk River, some 59 miles southeast of Barrow. The primary purpose of the exploration program was to collect rock samples and to conduct vertical seismic profiling within the wellbores.

Within a few weeks of finishing the program, Caelus was dropping optimistic hints.

"We've had very exciting and encouraging results from those two wells," Caelus Energy Alaska Senior Vice President Pat Foley told state lawmakers at a Senate Resources Committee hearing in April 2016. "We are currently trying to plan activities to be back out there again next winter to continue with an appraisal pro-



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gram. I hope someday to get to appear before you to talk about our development plans at Smith Bay." Speaking to the Alaska Support Industry Alliance in May, Foley added that the company was eager to return. "If you're out here looking for oil, you're looking for elephants, and that's exactly what we're doing," he said. "We're really excited about the wells that we drilled and the results that we found. We're making plans right now to be back out again next winter."

The upcoming program, according to Foley, would include a third well with a short horizontal lateral. The program would also include fracture stimulation and a flow test.

"We know that we're on a path to a very giant oil field over there," he added.

Those announcements came as Caelus was scaling back near-term Alaska operations. The company suspended drilling operations at its flagship Oooguruk unit and reduced its Alaska workforce by 25 percent, citing low oil prices and fiscal uncertainty in the state.

By the middle of the summer, those issues appeared to be complicating exploration activities, as well. "Those (issues) all go into the final hopper for planning and none of those are looking overly optimistic," Caelus Alaska Director of Public Affairs Casey Sullivan said. "We're continuing to evaluate our future plan and are hopeful for an additional price uptick and a time when we see some certainty in the fiscal system."

Size and scope

Before embarking on its program, Caelus estimated Tulimaniq could be a 1 billion barrel field. But in an October 2016 announcement, the company far surpassed that estimate.

The two wells and the earlier seismic survey suggested the possibility of 6 billion barrels of oil in place at the Smith Bay leases, with the possibility of 10 billion barrels or more across the complete Smith Bay area, according to the company. A field of that size would rival the Kuparuk River field and could add some 200,000 barrels per day to the trans-Alaska oil pipeline — a 40 percent increase from current throughput along the pipeline.

"This discovery could be really exciting for the state of Alaska," Caelus CEO Jim Musselman said in early October 2016. "It has the size and scale to play a meaningful role in sustaining the Alaskan oil business over the next three or four decades."

The two CT wells found oil in a 1,000-foot vertical interval in the Torok formation. One well encountered 183 net feet of pay, and the other encountered 223 net feet of pay, according to Caelus. Although the initial program did not include flow testing, the company believes that its rock samples and seismic information support its claims. The company ran simulations suggesting potential production rates from 8,000 to 10,000 barrels of oil per day per well, or a total of 8 million to 9 million barrels of oil per well.

With additional testing, according to the company, the estimates might grow. And a sizeable natural gas resource at the field could support an enhanced oil recovery program, allowing the company to recover between 60 and 70 percent of the oil in place.

Challenges

Even with those impressive estimates, the Tulimaniq field is hardly a sure thing.

The geology is somewhat challenging. The oil is located in the Torok formation, which is part of the Brookian sequence. The sequence is known for having multiple sand bodies, rather than being a single massive sandstone unit, and often requires more advanced drilling techniques. But while the sands are fairly tight, the oil in the reservoir is light. The company believes it could develop the field using mechanical fracturing, which it also uses at Oooguruk. "We're confident that the rocks here are fine," Musselman explained in October. "It's going to require horizontal wells. It's going to require fracking."

Because the Torok formation at Tulimaniq is equivalent to the Torok formation underpinning the Nuna development at Oooguruk, Caelus would be able to leverage its experience at the Nuna project to assist with its understanding of the Tulimaniq project.

And the Brookian formation is an important component of the exploration acreage that the company holds on the eastern North Slope, proving more opportunities for symbiosis.

Another major hurdle at Tulimaniq is the cost.

Developing the field would cost between $8 billion and $10 billion, requiring sustained oil prices in the mid-$60 per barrel range, according to Caelus CEO Jim Musselman.

A major portion of that hypothetical Tulimaniq budget would go toward an $800 million pipeline to connect the field to existing North Slope infrastructure, some 125 miles away. In addition to being remote, the Tulimaniq field is located in near-shore waters ranging from 4 inches to 10 feet in depth, which adds engineering complications.

The ongoing development costs would also likely include four pads to support some 400 wells, as well as building independent processing facilities, according to Caelus. By comparison, ConocoPhillips Alaska Inc. has drilled nearly 200 wells from five drilling pads at the Colville River unit since bringing the main Alpine field online in 2000.

In an idealistic aside, Musselman noted that road from the Colville River unit facilities to Barrow, passing the Smith bay field, would knock $1 billion off the project price tag.

Previous work

The Caelus program followed previous exploration activity in the area.

The nearby Cape Simpson is home to a well-known natural oil seep and various companies throughout the decades have encountered oil with explorations wells.

The largest and most comprehensive program dates to the second half of the 2000s.

The Talisman Energy Inc. subsidiary FEX commissioned a seis-

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On the morning of June 20, 1977, attention was focused outside pump station 1, near Prudhoe Bay, where history was about to be made.

Celebrating 40 years of Prudhoe production

BP's top Alaska exec speaks out

Janet Weiss talks about Prudhoe's first and next 40 years, what state can do to attract business, stay healthy economically

By KAY CASHMAN
Petroleum News

On March 30, BP Alaska President Janet Weiss answered the following questions for Petroleum News about BP's first 40 years and its next 40 years in Alaska, as well as questions about the number of rigs currently running in the giant oil field and what state government can do to insure oil production remains stable and the state attracts investment.

The most startling facts: Prudhoe Bay produced 55 percent of all the production in the trans-Alaska oil pipeline, in 2016 output from Prudhoe declined less than 1 percent, but without continued investment Prudhoe production would decline at more than 10 percent per year.

JUDY PATRICK

BP Alaska President Janet Weiss

Petroleum News: What does Prudhoe Bay's next 40 years of production look like?

Janet Weiss: Prudhoe Bay remains one of North America's largest oil fields and its production declined less than 1 percent over the past year, averaging 281,800 barrels of oil equivalent each day. The Trans Alaska Pipeline System grew its overall throughput by 2 percent, at 517,868 barrels a day. Prudhoe Bay will continue as an important foundation for Alaska's oil and gas industry well into the future.

Another promising part about the future of Alaska's North Slope is the list of companies operating successfully and the list of companies exploring: Caelus, Hilcorp, ENI, Repsol and Armstrong. The interest of these companies demonstrates that Alaska is open for business. It's important for the future that we keep Alaska open for business.

With more companies operating on the North Slope, the cost structure changes for the better. This change means that more development opportunities become competitive sooner — which leads to more oil down TAPS.

Q AND A

Petroleum News: BP, or British Petroleum, opened its first office in Alaska in 1959. In two years it will celebrate its 60th anniversary in the state. What does the future hold for the company in Alaska?

Janet Weiss: Yes, BP was here at Alaska statehood in 1959. It was that Alaska can-do spirit that made the start of Prudhoe Bay possible 40 years ago, and I'm proud that BP was there on day one. It's a challenging environment today, where hydrocarbons are actually more abundant and therefore low cost oil is the name of the game.

Like other Alaska oil and gas companies BP is challenged to become more competitive in a low oil price environment. The Alaska oil and gas industry cannot wait for oil price to save us; we need to ensure we continue to have options that compete at these lower oil prices.

I believe it takes three things to make this step change: it takes efficiencies; it takes technologies; and it takes Alaska fiscal policies that keep us competitive.

Across the North Slope, new companies and existing operators are partnering creatively with our suppliers to reduce costs. Developments that used to take $80/bbl oil price may be possible to be developed at $50/bbl oil price — that is a really big deal.

The good news is that another 40-plus years of opportunity and economic strength from the oil and gas industry can happen in Alaska. This seems a tall order when we face such challenging times as a state with such sizeable budget woes.

Petroleum News: In November 2016 you said BP was operating at a $1.5 million per day cash flow deficit in Alaska, even after reducing activity on the North Slope and cutting operating costs. At the same time, I believe you or another BP executive said BP's Alaska production was stable in 2016. Is the company still operating at this cash flow deficit in 2017? What do you expect the deficit, or gain, to be by the end of 2017?

Janet Weiss: We expect to be cash flow positive in 2017. While not offsetting the losses of the last two years, our focus on efficiency is delivering results. Even in the low price environment BP invested $1.8 billion in its Alaska operations ($1.2 billion operating expense, $600 million capital). Of that we spent more than $1 billion with 300 Alaska vendors. Economics impact our investment decisions and without continued investment, the field production would decline at more than 10 percent per year — not less than 1 percent decline we celebrated for Prudhoe's 40th.

Petroleum News: How many drilling rigs are currently working at Prudhoe? Do you expect that number to increase in the next year?

Janet Weiss: In the low price environment we've reduced our activity down to two rigs at Prudhoe Bay and improved our efficiency. We are pursuing wellwork which can be done less costly and more efficiently by non-rig equipment such as coil tubing. We're working to continue to improve our efficiencies so that in 2017 at $50/bbl we want to be at least break even in the state of Alaska. That's how BP Alaska continues to compete for investment dollars.

There has been a fundamental shift in our industry — this is not just cycle change in commodity price. Alaska needs to be on the front foot of this change. We cannot wait for oil prices to rise.

Petroleum News: When you were appointed to your current position BP was operating four fields on the North Slope and had about 2,200 employees and more than 6,000 contractors. What are those numbers now in first quarter 2017?

Janet Weiss: Today Prudhoe Bay supports more than 16,000 Alaska direct and indirect jobs. In Alaska BP employs 1,700 employees and 78 percent are Alaska residents: Recruiting, training and hiring Alaskans remains among our top priorities. There are also more than 4,000 contractors doing work for BP in Alaska. In 2016, we spent $1 billion with 300 Alaska vendors.

Petroleum News: How much longer do you expect to be in your position in Alaska? Is it correct to say you have been working for BP since 1986, starting in Alaska? I know you also worked in Wyoming and the Gulf of Mexico for the company. How many total years have you worked in Alaska for BP?

COURTESY BP

The Prudhoe Bay oil field production facilities are situated on Alaska's North Slope, a flat, treeless plain that covers 88,000 square miles, an area slightly larger than Idaho. With more than 25 billion barrels of oil place (15 billion barrels recoverable using current technology), Prudhoe Bay contains the largest oil reservoir in North America.

Janet Weiss: I've spent 23 of my 31 years in oil and gas industry here in Alaska. I plan to be here as long as I'm adding value and inspiring our employees to take on the ownership role of a safe and sustainable business in Alaska. At BP safety is the foundation of everything we do, every single day.

My leadership role is about finding ways every employee can begin to engage more fully in the Alaska business and so that every employee, not just leadership, can begin to improve the business and to think like owners. It's about having our whole team engaged and improving our bottom line.

Petroleum News: As BP's chief executive in Alaska, what do you consider your greatest accomplishments to date? What more do you want to achieve in your time here?

Janet Weiss: Prudhoe Bay produces 55 percent of all the production in the Trans Alaska Pipeline System. That's a huge responsibility — one I do not take for granted. I'm very humbled and inspired to be in this job at this time. Not just as the first woman in the job, but the first long-time Alaskan to earn this job. It's given me a unique perspective during a very challenging period of low oil prices. I know great challenges bring out the best in Alaskans, and I'm most proud of the way our employees and contractors have taken on this lower for longer oil price environment, working to make the future more sustainable, more enduring.

Petroleum News: What has BP (in North America) done over the past decade to do away with the "glass ceiling" for the advancement of women in upper management and executive positions?

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Workers flared the first gas flow from the Ivishak (Sadlerochit) formation during drill stem test No. 2 of the Prudhoe Bay State No. 1 well on Dec. 27, 1967. No oil flowed to the surface during the test, but natural gas flowed from the well with a rumble and roar that sounded like a jet plane overhead.

COURTESY GIL MULL

Christmas at Prudhoe Bay

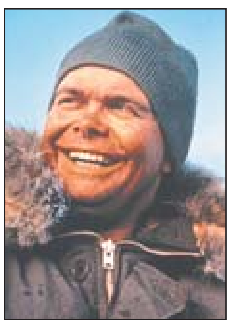
Personal reflections from Alaska geologist Gil Mull, who sat on the Prudhoe discovery well for Humble, ExxonMobil predecessor

By GIL MULL
For Petroleum News

It was totally unexpected; it was mid-December 1967, not long before Christmas, and there I was, suddenly on an airline flight from Los Angeles to Fairbanks, where I transferred to a bush flight heading for the Prudhoe Bay State No. 1 drill site.

Although ARCO was the operator on the well, Exxon's Humble Oil & Refining was a 50 percent partner in the well and wanted to have its own geologist there to observe operations and to assist the ARCO geologists with sample examination and evaluation of the stratigraphy encountered in the well.

The well was a rank wildcat, located 60 miles from the nearest well or outcrop control, so that prediction of the stratigraphy to be expected in the hole was based on seismic control and projections from what we had seen in our outcrop mapping during our summer field work.



COURTESY GIL MULL

An oil-splattered C.G. "Gil" Mull, Humble Oil (predecessor to ExxonMobil) geologist at drill stem test No. 5, Prudhoe Bay State No. 1 discovery well on March 15, 1968. The oil flow measured 1,152 barrels per day. Mull was one of several geologists who actually "sat" on the discovery well. The photo was taken by Bob Jacobs of Interior Airways.

Company mergers, acquisitions and name changes

Over the years the major owners of the Prudhoe Bay oil field have merged or been acquired by larger companies; some have simply sold their assets or changed their names. On the left of this chart is the company name as it was first used in Alaska; the name on the right is what it's known as today:

Formerly	Now
Amoco	BP
ARCO Alaska assets	ConocoPhillips
Atlantic Refining	ConocoPhillips
Atlantic Richfield	ConocoPhillips
British Petroleum	BP
Exxon	ExxonMobil
Humble Oil	ExxonMobil
Mobil	ExxonMobil
Pan American	BP
Phillips Petroleum	ConocoPhillips
Richfield	ConocoPhillips
Sinclair	ConocoPhillips
Sohio	BP

I'm sure management had not originally planned to send me up as the Humble well site geologist, because I was a relatively inexperienced, recently hired junior geologist with less than six months with Humble. But, unexpectedly, my colleague Bill Schetter, who was the Humble well site geologist on the well, announced that he had accepted a college faculty position to teach geology, and suddenly the company needed someone to replace him.

I had had three years of field mapping experience with Rich-

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COURTESY BP

The Seawater Treatment Plant at the end of the West Dock Causeway on the North Slope is an important component of the processing facilities for the Prudhoe Bay oil field. Through December 2016, Prudhoe produced about 12.5 billion barrels of oil compared with the original recovery estimate of 9.6 billion barrels when the field started up in 1977. The improvement came through a combo of expanded gas cycling and reinjection capacity, drilling innovations, with new types of wells such as multi-laterals, where several new wells are drilled off an older well bore and sidetracks are drilled with coil-tubing units. There were also new developments in enhanced oil recovery and pressure-maintenance projects, such as the injection of seawater into Prudhoe's gas cap to maintain pressure, which began in 1984. Prudhoe's wells today average 400 to 500 barrels per day, although there are still some that produce 3,000 to 4,000 bpd — a far cry from the early days when they typically yielded 10,000 bpd, and the best could achieve 50,000 bpd.

WEISS *continued from page 27*

Janet Weiss: When I joined the oil and gas industry in the mid-80s, it was a challenging time and place. The price of oil was low, companies were consolidating and there were not a lot of women in industry. I had to prove myself. Prove that I had the intellect, prove that I could solve problems, and prove that I belong here.

I've spent 23 of my 31 years in oil and gas industry here in Alaska. During my career, I led the Gulf of Mexico Shelf operations with 150 production platforms; I also ran our western Wyoming gas fields. Sometimes it was an issue to be the only woman on an offshore oil platform, but our leadership has responded to change.

Today we have a lot more women joining industry and more in leadership, and, education has made that possible. At BP we work to attract, motivate, develop and retain the best talent from diverse perspectives — our ability to be competitive and to thrive globally depends on it.

Petroleum News: What can state government do to improve its policies so as not to encourage more production and exploration on the North Slope?

Janet Weiss: Alaska has a choice. Yes, the state is facing a fiscal crisis, but it can still have a healthy and competitive oil and gas industry. There are three key principles that will determine if Alaska's oil and gas industry is the economic engine that continues to drive the state.

• First, the state must encourage (not discourage) more oil down TAPS.

• Next the state needs to keep the new explorers and new operator companies on the North Slope. That means keeping them there with good policy, don't drive the new entrants away.

• Finally the state should not shorten the life of the backbone fields, Prudhoe Bay and Kuparuk. We need Prudhoe Bay and Kuparuk to continue to build upon. A shorter economic life comes from diminishing the competitiveness of the opportunities, or excessively penalizing the base economics of these fields.

Contact Kay Cashman at publisher@petroleumnews.com

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field Oil (ARCO Alaska/ConocoPhillips predecessor) in the Brooks Range and on the North Slope before I joined Humble and thus was familiar with the North Slope stratigraphy and the Prudhoe prospect. And, I also had well site experience as one of the ARCO well site geologists the previous winter on the Susie Unit No. 1 well — a dry hole in the foothills 60 miles south of Prudhoe Bay.

Thus, although my specialty was outcrop geologic mapping, I was nominated to spend Christmas on the North Slope for the second year in a row, to represent Humble and assist ARCO geologist Marv Mangus and his alternate Bill Pentilla.

Things were becoming interesting

As the bush flight crossed the Brooks Range and out onto the North Slope in the mid-winter darkness, a single light in the distance became visible — the rig lights at the Prudhoe Bay well site — our destination. The airstrip was a snow and ice strip on the tundra, and in the mid-day twilight the plane taxied up to an unloading ramp right outside the camp and the drill rig.

The camp consisted of two parallel rows of ATCO trailers strung together end-to-end and roofed over with sheets of plywood, and was about three quarters buried by drifting snow. The drill rig stood about 100 yards away at the east end of the camp.

Only a short time before my arrival, the well had reached the top of the Sadlerochit formation (also known as the Ivishak formation) at a depth of 8,208 feet, and things were beginning to become interesting. In the nearest outcrops 60 miles to the southeast in the Brooks Range, the Sadlerochit is hard dense sandstone, but at Prudhoe the bit penetrated porous sandstone and conglomerate.

And, even more interesting — although there had been some oil and gas shows higher in the well, methane gas readings in the drilling mud abruptly went off-scale in the Sadlerochit — which was a really encouraging sign. Inasmuch as there was no way of predicting with any level of confidence how thick this interval might be, drilling progressed slowly, we cut several cores, and

Partners Richfield Oil and Humble Oil move the Loffland Bros. drill rig from the Susie well north to drill Prudhoe Bay State No. 1 with a cat train in February 1967. Bob Jacobs, a pilot for Interior Airways, took the photo.

C.G. "GIL" MULL

C.G. "GIL" MULL

H.C. "Harry" Jamison, Richfield Oil Co.'s exploration supervisor for Alaska confers with Ben Ryan, Richfield district geologist for Alaska, during a visit to the company's first seismic operation on the North Slope in December 1963

wire-line logs were run in order to get a better idea of the reservoir quality of the sandstone and conglomerate.

Communication limited to radio

In the early stages of drilling at Prudhoe Bay, the only means of communication between the rig and the ARCO and Humble offices was by single side band HF radio — there were no telephones on this part of the North Slope and the nearest public telephone was at Barrow, 200 miles to the northwest.

The daily drilling reports and geological reports were transmitted to the ARCO office in Anchorage on an open radio frequency that anyone could listen in on. On a few occasions when the single sideband radio signals were out, a ham radio operator who had his ham set there in camp was sometimes able to contact someone on the ham network. In these cases, the daily drilling and geological reports were relayed to the ham radio operator on the other end, whoever and wherever he was, who then placed a collect phone call to the ARCO office in Anchorage to relay the reports.

Inasmuch as the radio link was often unreliable, company management gave the drilling and geological personnel on the rig a great amount of autonomy to proceed using their best judgment. This was a level of autonomy that is unheard of today in an era in which satellites enable continuous communication between remote rigs and the headquarters offices. But in 1967, the management folks in Anchorage and Los Angeles, where the Humble office was located, knew that if they did not receive a daily report from the rig, it was undoubtedly due to poor radio signals, and assumed that things were okay at the rig. They knew that if the rig personnel needed help or advice, they would be contacted somehow.

A thousand mile daily commute

But after the well penetrated into the Sadlerochit Formation with its high gas readings in the drilling mud, it was obvious that things were getting more interesting by the day, and this sort of casual communication between rig and town came to a screeching halt.

Thus began a new daily routine. The first thing the geologists did in the morning was to update our sample logs and reports, and then picked up the daily drilling report from the tool pusher. Then one of us, usually me — leaving the ARCO geologist to monitor the drilling activity — hopped in the Interior Airways Beach Kingair that pilot Bob Jacobs was warming up.

Depending upon the weather, we flew to either Barrow or to Fairbanks to phone the reports in to the offices in Anchorage and Los Angeles. When we flew to Fairbanks, this was a daily commute of over a thousand miles to make two or three telephone calls, and I was usually back to the rig by early afternoon.

By Christmas day, the well had penetrated over 350 feet of predominantly sandstone and conglomerate, accompanied by continued high gas readings in the drilling mud, and oil shows in some of the lower core samples.

This was a phenomenal thickness of potential reservoir beds and the decision was made to run an open-hole drill stem test to determine the flow capability of the lower 180 feet of the Sadlerochit formation.

The test tool was opened early in the morning of Dec. 27, 1967, with a result totally unlike anything I had ever previously experienced in a drill stem test, or DST. In the tests that I had witnessed in the past on other wells, all that happened when the tester was opened was a weak puff of air flowing from the drill pipe, which then died to nothing. In this test, there was an immediate roar of high-pressure gas flowing to the surface, which was diverted to a flow pipe and ignited to make a flare that was up to 30 feet long blowing into the teeth of a headwind.

The gas flow was estimated at 1.25 million cubic feet per day (1.25 MMCF/D) through a 1/8 inch choke at a pressure of over 3,000 psi; this continued all day, with a rumble that shook the rig and resembled the sound of a jet plane overhead. The pressure was so great that after the test tool was closed late in the afternoon, the flare burned most of the night as the high pressure in the drill pipe bled down.

Looks like gas discovery

By the morning of Dec. 28, the gas pressure in the drill pipe was finally exhausted and at last the drill crew was able to begin to come out of the hole with the drill pipe and test tool.

But by that time, the bottom of the hole had begun to cave, and the 8,500 feet of drill string and DST tool could be moved only a few feet up and down. The tester and lower part of the drill string were stuck in the hole, and a fishing job was begun.

Although no wire-line logs were available for the lower part of the hole and the charts in the test tool could not be recovered, the test showed that the well had penetrated a high-pressure gas reservoir that was at least 385 feet thick, with no indication of either a gas-oil or gas-water contact.

It was beginning to appear that Prudhoe Bay might very well be a significant gas discovery. This was exciting, but oil, not gas, was the objective and the full significance of the discovery was going to have to await further drilling - and that was not going to occur until the fishing job was completed.

Clearly, there was going to be no need for geologists at the well site for some time, so I flew back to Anchorage and then on to the office in Los Angeles. The results of the DST were headline news in the Jan. 16 Anchorage Times.

Begin drilling sidetrack

After several days of unsuccessful attempts to free the stuck drill string and test tools, the decision was made to side — track the lower part of the original hole and drill around the stuck fish. This took a couple of weeks, and when drilling into

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How Prudhoe Bay was named

The first mention of the name "Prudhoe Bay" was a brief entry in the journal of British explorer Sir John Franklin, dated Aug. 16, 1826.

Franklin saw the bay during an expedition by boat down the Mackenzie River in Canada (the river flows from south to north) and then west along the Arctic coast.

The name honors a fellow naval officer and explorer-scientist, Captain Algernon Percy, Baron of Prudhoe.

The word "prudhoe" itself is a Saxon term meaning "proud height," and a Prudhoe castle was built in the 12th century on a hill overlooking the river Tyne in Northumberland, England.

new geology resumed in late January, Hank Repp, one of the Humble senior geologists, went back as the Humble well site geologist.

The base of the Sadlerochit sandstone and conglomerate interval was finally reached at 8,670 feet — an interval thickness of over 460 feet with about 300 feet net sandstone and conglomerate as potential reservoir beds. Even more significantly, the lower 40 feet of the sandstone was oil saturated, and no oil/water contact was encountered.

After wire-line logs were run, a string of casing was set through the Sadlerochit and drilling continued into the underlying Lisburne formation, which was found to consist of hard limestone with interbedded brown, porous, oil saturated dolomite.

Another open-hole drill stem test in the top of the Lisburne recovered light oil that flowed intermittently with a high volume of gas. This test showed that the Lisburne was also an oil reservoir, but the flow of gas suggested that there was communication with the overlying Sadlerochit formation, which was behind casing.

During the DST, some of the high-pressure gas from higher in the well was apparently bypassing the cemented casing and into the lower part of the hole, where it flowed with the oil from the Lisburne.

The level of excitement on the well was increasing. Although the rate of oil flow during the test could not be measured, the discovery of oil in the well was headline news in the Feb. 16 Anchorage Times.

Back on well with Pentilla

When drilling in the Lisburne resumed after that drill stem test, ARCO geologist Bill Pentilla and I were back on the well, which was then drilling in dense limestone with more beds of brown oil-stained dolomite.

By the end of the first week of March, we had drilled and cored over a thousand feet of Lisburne that contained a number of thin beds of oil-saturated dolomite. Another drill-stem test was run, to test a 320-foot interval in the lower part of the Lisburne. This test was a spectacular success.

About 20 minutes after the test tool was opened, the light flow of air from the drill pipe was followed by gas to the surface and then in about two hours oil began flowing to the surface.

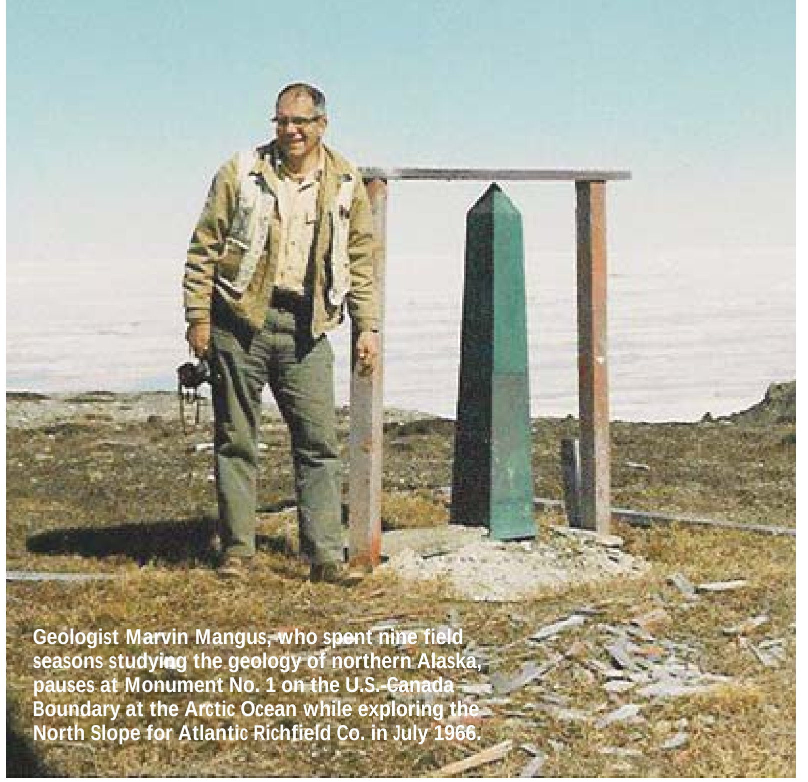
Oil flowed for seven hours at a measured rate of 1,152 barrels of oil per day; this test confirmed beyond any question that Prudhoe Bay State No. 1 was a significant oil and gas discovery.

In addition to the oil saturated dolomite beds in the Lisburne, the Sadlerochit formation was clearly an even better reservoir unit with as much as 300 feet of net sandstone and conglomerate in an interval about 460 feet thick.

And more importantly, there was no indication of an oil-water contact in either the Sadlerochit or Lisburne. The wire-line logs, core data, and drill stem test data indicated a gas column of about 420 feet in the Sadlerochit, and no way of knowing the height of the oil column.

Sag River confirmation well

Evaluation of the drilling results to this point clearly indicated to ARCO and Humble management that additional evaluation was necessary. A second well was going to be needed to determine the lateral extent of the Sadlerochit reservoir beds and to find the oil-water contact to determine the height of the oil column. A drill rig that BP and Sinclair Oil had used to drill a dry hole near the Colville River west of Prudhoe Bay was brought along the coast by cat train over a winter road on the sea ice.



C.G. "GIL" MULL

Geologist Marvin Mangus, who spent nine field seasons studying the geology of northern Alaska, pauses at Monument No. 1 on the U.S.-Canada Boundary at the Arctic Ocean while exploring the North Slope for Atlantic Richfield Co. in July 1966.

And, clearly, more detailed seismic data was needed.

Thus began a major mobilization of equipment unlike anything seen before in Alaska. In mid-March, while drilling continued at Prudhoe Bay No. 1, a massive airlift began and two Alaska Airlines C-130 Hercules cargo planes began flying around the clock from Fairbanks. The Prudhoe well site was a beehive of activity as about every two hours, night and day, another Hercules would taxi into the ramp just outside our sleeping trailer and offload another 40 tons of equipment. On some occasions, two Hercs were on the ramp at the same time.

The planes flew in thousands of feet of drill pipe and casing, thousands of sacks of drilling mud and cement, seismic equipment, seismic camps, trucks and construction equipment to build a second drill site — all of the supplies needed to support another large camp for the drilling of the second well. This location, named Sag River State No. 1, was to be near the banks of the Sagavanirktok River, seven miles southeast of the Prudhoe Bay drill site and, based on the available seismic data, was predicted to be three to four hundred feet structurally lower than Prudhoe Bay State No. 1.

By May, drilling at the Prudhoe Bay well had ended and the well was undergoing a very detailed testing program. Meanwhile, the Sag River drill site had been completed and drilling was progressing rapidly.

Hank Repp, Dean Morgridge and I took turns as the Humble well site geologists, working with ARCO geologists Marv Mangus, Bill Pentilla, and Bob Anderson (no relation to R.O. Anderson).

In some ways, this well was even more interesting than the Prudhoe Bay discovery well. By early June, the top of the Sadlerochit was reached and was being evaluated by almost continuous coring. Most of the Sadlerochit was within the oil column, and some of the sandstones and conglomerates appeared to have even better reservoir quality than at Prudhoe Bay State No. 1.

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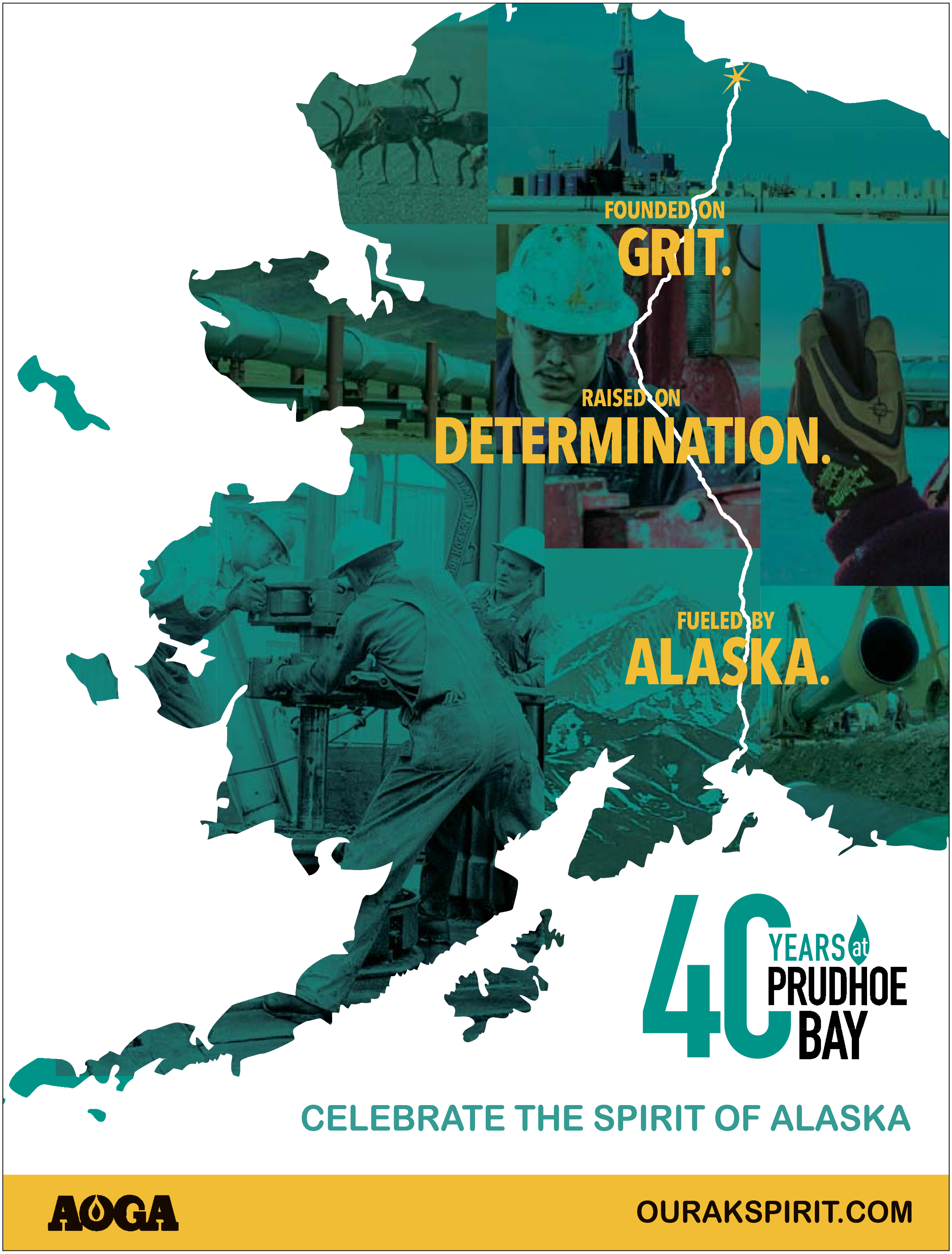
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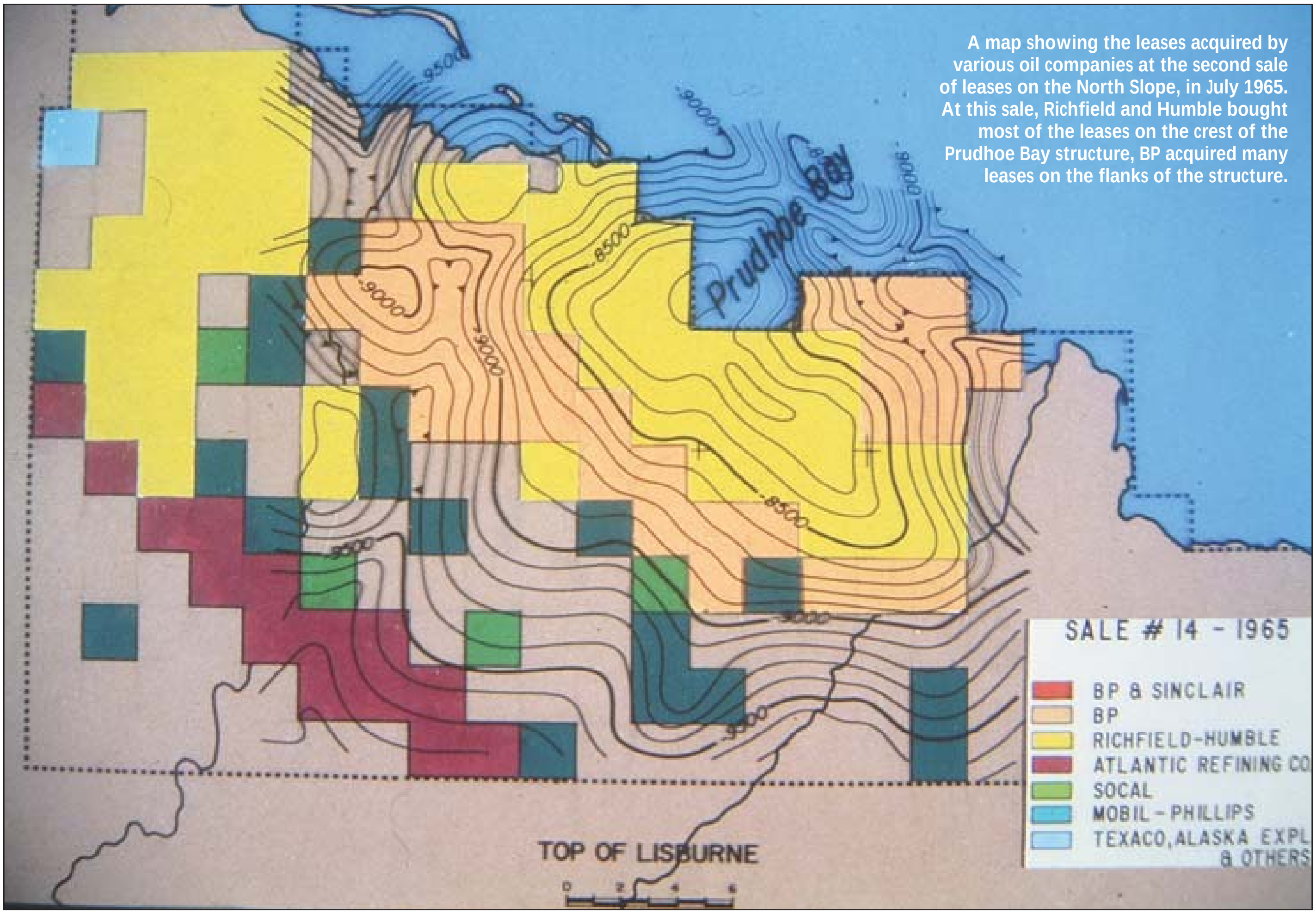

A map showing the leases acquired by various oil companies at the second sale of leases on the North Slope, in July 1965. At this sale, Richfield and Humble bought most of the leases on the crest of the Prudhoe Bay structure, BP acquired many leases on the flanks of the structure.

C.G. "GIL" MULL

CHRISTMAS AT PRUDHOE *continued from page 32*

More than 500 feet thick

Security was very tight, and only the geologists were supposed to see the rocks that were being extracted from the core barrels, but one 20-foot core was particularly memorable. Usually, a solid cylinder of rock came out of the core barrel and was laid out in trays to be examined in detail. But in this case, with the core barrel hanging vertically in the derrick, when the core bit was removed from the barrel, out poured a pile of unconsolidated sand, gravel, and oil — which flowed through openings in the derrick floor and into the rig cellar. The porosity and permeability of this interval was fantastic. The entire drill crew soon saw and knew exactly what we were finding.

The Sag River field confirmation well showed that the Sadlerochit reservoir interval was over 500 feet thick, with at least 300 feet of net reservoir-quality sandstone and conglomerate, and a 400-foot oil column below a gas cap that was also about 400 feet thick.

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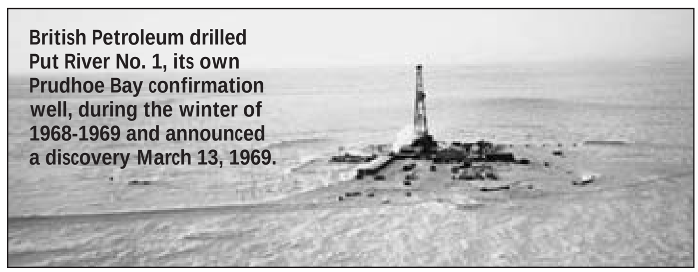

British Petroleum drilled Put River No. 1, its own Prudhoe Bay confirmation well, during the winter of 1968-1969 and announced a discovery March 13, 1969.

BP EXPLORATION (ALASKA) INC.

The drilling and test data from the Prudhoe Bay State No. 1 and Sag River State No. 1 wells, along with the seismic maps of the area were given to the consulting firm DeGolyer and MacNaughton for an independent evaluation of the significance of the discovery.

And on July 18, ARCO and Humble released the results of this independent evaluation, which estimated that Prudhoe Bay contained between 5 billion and 10 billion barrels of oil, which would make it the largest oil field in North America.

But by the time the announcement made the headlines, my field partner Howard Sonneman and I were back in the Brooks Range for another season pounding on rocks and making geologic maps.

Editor's note: Gil Mull submitted the above in March 2011, when it was first published by Petroleum News in a special publication, Exxon in Alaska.

CAELUS *continued from page 25*

mic survey in the region and drilled three National Petroleum Reserve-Alaska wells — Amaguq No. 2, Aklaqyaaq No. 1 and Aklaq No. 6. All three wells found oil, but FEX never pursued development.

FEX considered Amaguq No. 2 to be "subcommercial given current infrastructure" and plugged the well. The company suspended the other two wells, which had better results.

FEX provided "initial estimate of contingent resources present" between 300 million and 400 million barrels net for its 80 percent working interest in the leases. The wells had encountered more than 225 feet of net hydrocarbon-bearing sandstones. Talisman also touted "significant follow-up potential on many similar structures on Talisman's acreage if commercial productivity is proven," based on log analysis and "strong gas and oil shows, including oil staining and free oil in the drilling mud in one of the wells."

The ongoing development costs would also likely include four pads to support some 400 wells, as well as building independent processing facilities, according to Caelus.

But the company eventually left Alaska, having grown frustrated by the challenging logistics of operating in the Arctic and the inconsistencies of the federal leasing program.

For the winters of 2013-14 and 2014-15, the small Alaska independent NordAq Energy Inc. permitted a two-year eight-well program in the same area. The proposal included 14 well locations, including 10 sites at the Tulimaniq prospect in Smith Bay.

Logistical issues forced the company to delay its program by one year, to the start of 2015. The company permitted the Tulimaniq No. 1 well in February 2015 but never drilled the well and sold a majority interest in the leases to Caelus a few months later.

Eastern acreage

While the Tulimaniq prospect is the main exploration focus at the moment, Caelus has also been making progress at its acreage on the eastern end of the central North Slope.

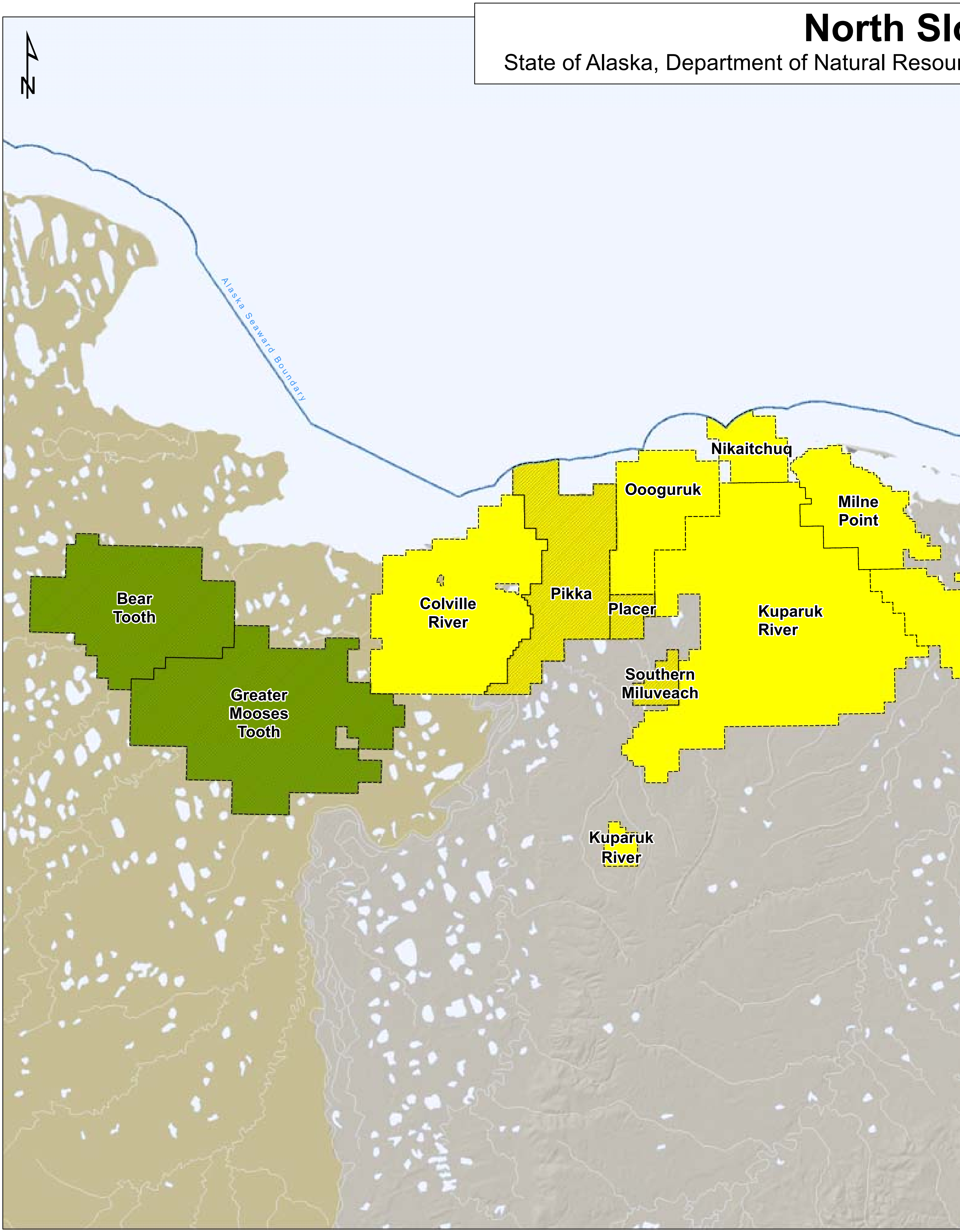
Prior to the Smith Bay acquisition, the company began compiling more than 350,000 acres between the Prudhoe Bay and Badami units. By early 2016, the company had completed a seismic program over the acreage. "We started to work on that data and we've found some really exciting turbidite fans on that," Foley said in May 2016.

The layers and channels of turbidite formations typically create compartmentalization, which can make development tricky. Caelus has been focusing on these formations at Oooguruk, Tulimaniq and apparently at its eastern exploration acreage as well. The idea is to chase sizeable plays that were passed over when technology was more rudimentary.

In addition to the Brookian targets, the company is also considering some significant possibilities in an older and deeper sequence in the region known as the Ellesmerian.

When Caelus announced its Smith Bay discovery, in October 2016, Musselman estimated that the eastern leasehold could contain some 500 million to 750 million barrels of oil.

Contact Eric Lidji at ericlidji@mac.com



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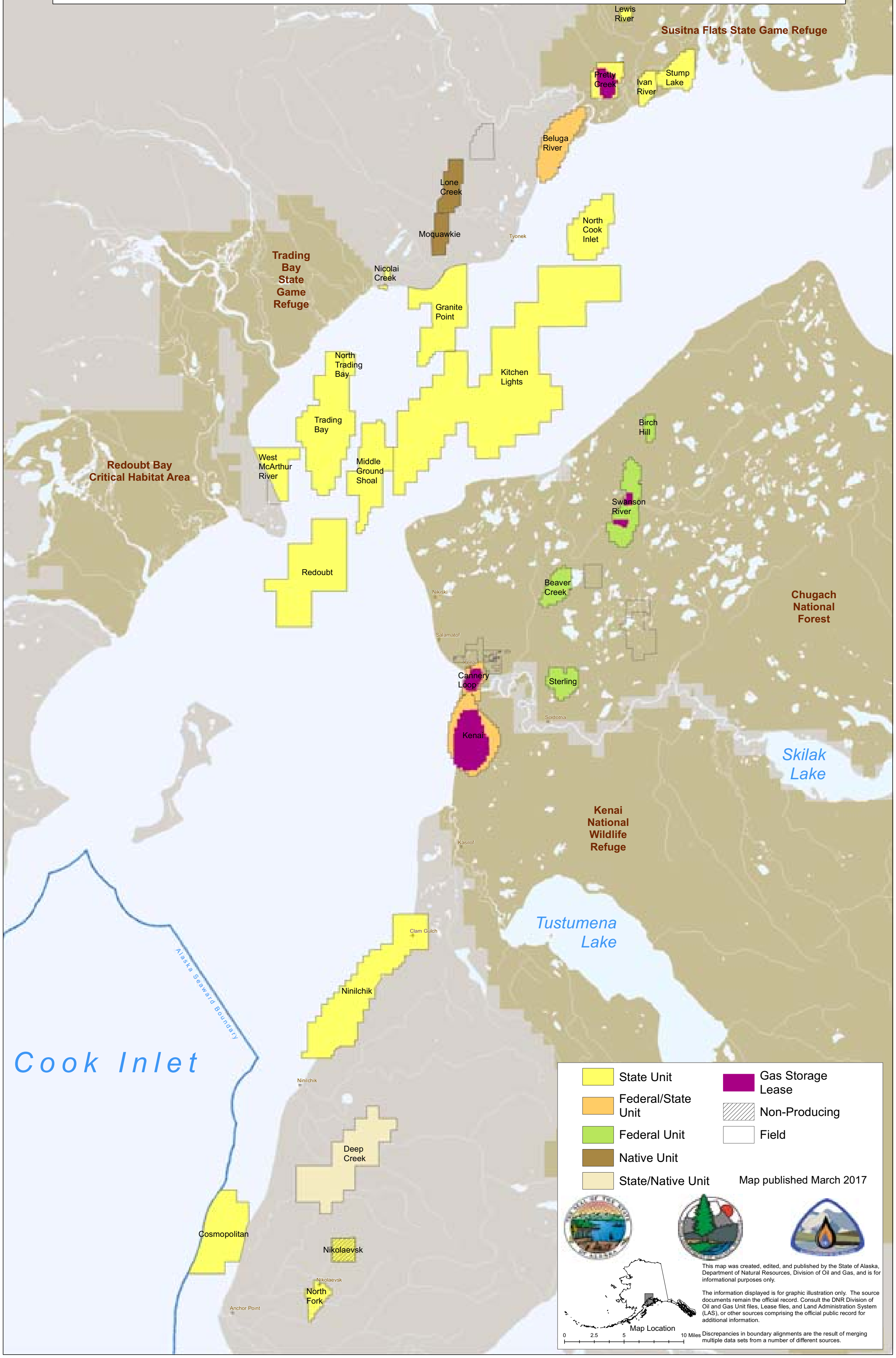
Alaska Seaward Boundary
Nikaitchuq
Oooguruk
Milne Point
Pikka
Colville River
Placer
Kuparuk River
Bear Tooth
Greater Mooses Tooth
Southern Miluveach
Kuparuk River

lope Units

urces, Division of Oil and Gas, as of March 2017

Cook Inlet Units and fields

State of Alaska, Department of Natural Resources, Division of Oil and Gas, as of March 2017



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Celebrating the 40 year anniversary of TAPS

May 31, 1977: Final pipeline weld near Pump Station 3.

Looking back to beginning, startup

It was hard to know when to begin this section because the story of the trans-Alaska oil pipeline really started more than a decade earlier on the North Slope with the exploration taking place there, followed by the discovery of the giant Prudhoe Bay field. So, we began this story there, adding photos not already included in the Prudhoe Bay section of this edition of Petroleum News' Explorers magazine. Happy reading.

—Kay Cashman

Exploration, discovery years

1950-55

•Iran and other Middle Eastern countries nationalize oil and gas industry.

•Oil companies look for new prospective areas, including Alaska.

1953

•First exploration phase in NPR-A ends (started 1943); between 1923-1953 U.S. Navy drilled 37 wells, only two of nine discoveries considered sizable — Umiat and Gubik.

1958

•President Dwight D. Eisenhower signs Alaska statehood bill,

EXTRA Anchorage Daily Times EXTRA

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64-20 VOTE MAKES ALASKA 49th STATE

Victory Brings Quick Reactions

She Goes Up Tonight

Historic Vote Ends 6 Days Of Debate

Little activity followed Richfield's initial 1959 North Slope exploration until 1963 when Harry Jamison, Richfield's exploration director out of Los Angeles, dispatched Gil Mull, Gar Pessel and two additional geologists from California to Umiat, to the northern foothills of the Brooks Range, asking them to do some mapping and "to get a feel for what the geology was," Mull told Petroleum News in 2007.

"I guess you could say that he had sort of an intuition that it looked like a good prospective petroleum basin."

The team covered an area from Umiat eastward into the Arctic National Wildlife Refuge, in a three-month field season.

"We had seen an oil sand over in ANWR — a really good oil sand," Mull said. "We had also seen oil sand in the river bank … at Sagwon."

On Aug. 2, 1963, Pessel, co-party chief of the field team, summarized the party's conclusions: "We have a good section with excellent reservoir possibilities and positive proof of the petroliferous nature of these sands. If one cannot get an oil field out of these conditions, I give up!"

continued on page 42

July 7, 1958.

•Department of Interior, Bureau of Land Management, opens North Slope lands for competitive bidding — 16,000 acres offered in area of Gubik gas field.

•BLM opens 4 million acres south, southeast of NPR-A (then named NPR-4) for simultaneous filing and subsequent drawing.

1959

•Alaska becomes nation's 49th state, its constitution takes effect.

•William Egan (D) sworn in as state's first governor (1959-1966).

•Alaska conducts first oil and gas lease sale, Cook Inlet basin.

•First oil and gas revenues in Alaska generate $3 million.

•Richfield Oil and other oil companies send first surface geological mapping parties to North Slope.

1960

•British Petroleum and Sinclair conduct North Slope geological survey.

1961

•In January, Gov. Egan says Alaska will face $15 million budget deficit by 1963.

•In December, Cook Inlet lease sale brings in $14 million rather than $1-$7 million expected.

1962

•State petroleum revenues double in two years, from $10 million in 1960 to $26 million in 1961, due to Cook Inlet basin activity.

1963

•Richfield geologists find oil-saturated sandstone outcrops near Sagavanirktok River, some in ANWR's 1002 area.

Congratulations Alyeska Pipeline Service Company on the 40th anniversary of the Trans-Alaska oil pipeline.

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TAPS TIMELINE *continued from page 41*

The party recommended a seismic survey to investigate geological structures north of Sagwon where the surface rocks disappeared beneath the North Slope coastal plain.

Jamison presented the findings to Richfield management in California and quickly received the go-ahead to mobilize a seismic crew for that same winter.

Jamison's drive, followed by promising seismic, led to the first Prudhoe Bay lease sale in 1964.

"The seismic crew started shooting long, north-south reconnaissance lines," Mull said. They shot three lines, he said.

"The second line … ran over a pretty good looking anticline, called Susie." Susie, north of Sagwon on the Sagavanirktok River, was the site of the first Richfield exploration well on the North Slope.

1964

•State selects land on North Slope under Alaska Statehood Act.

•Richfield and Humble join forces as partners to explore North Slope.

In the summer of 1964, Richfield geologists extended North Slope field mapping west to Cape Lisburne and more seismic followed that winter.

Sinclair Oil, British Petroleum and Atlantic Refining obtained lease positions on the North Slope.

Richfield entered a 50 percent joint agreement on its North Slope interests with Humble, which became a full participating partner, with its geologists and geophysicists joining field studies.

"Humble bought a half interest in everything that Richfield had gotten," geologist Gil Mull said, "a half interest in the surface work, half interest in the seismic work and in the federal leases that Richfield had acquired in the foothills, for what had to be the all-time best deal ever — $5 million."

•First oil industry cat train hauls seismic equipment overland from Fairbanks to North Slope.

In February 1964, John C. "Tennessee" Miller wanted to prove the feasibility of using a "cat train" of bulldozers for overland transport of the oil industry to the Arctic. A veteran catskinner — a virtuoso of heavy equipment — and a salesman; he found an oil man, Charlie Selman, then division geophysicist for Richfield, to back the experiment.

John C. "Tennessee" Miller, instigator of 1964 North Slope cat train

Selman wanted to add a second geophysical crew on the North Slope. The crew would need a cook shack, bunkhouse and three D-7 Caterpillar tractors to plow snow and haul supplies on logging sleds. Selman agreed to use Miller's tractors, and in the bargain Miller would use them to haul the camp and supplies from Fairbanks to Sagwon on the North Slope.

It was 70 degrees below zero in Fairbanks when Miller staged the equipment and scouted the trail, with the weather staying brutally cold for the entire 40-day expedition.

Mechanical delays, a Yukon River crossing on creaking ice, and some close calls kept the going interesting at speeds averaging 3 miles per hour — on a good day. The open cabs of the tractors were only partially screened, leaving the upper bodies of the operators exposed to cold blinding winds and snow.

The cat train made Sagwon in mid-April, proving both the difficulty and the possibility of overland transport to the North Slope.

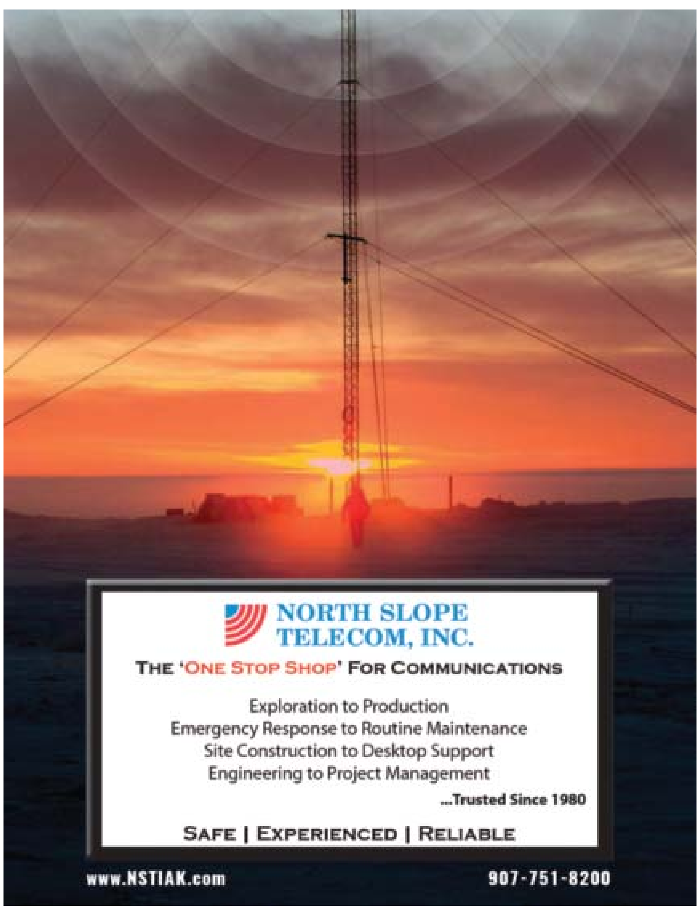
•First exploration wells in Brooks Range foothills by British Petroleum and Sinclair, dry holes.

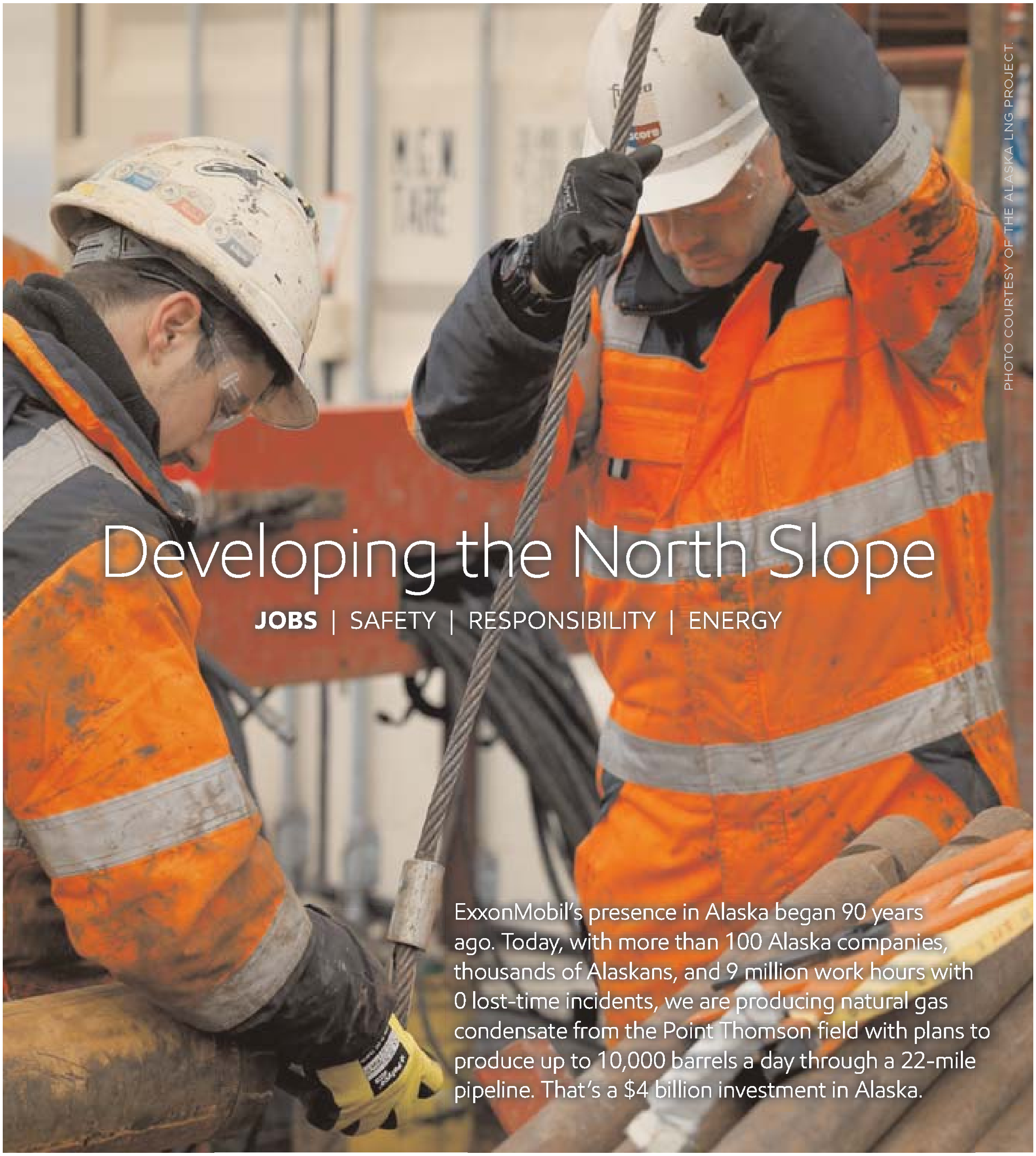
continued on page 44

Company mergers, acquisitions and name changes

Over the years the major owners of the Prudhoe Bay oil field have merged or been acquired by larger companies; some have simply sold their assets or changed their names. On the left of this chart is the company name as it was first used in Alaska; the name on the right is what it's known as today:

Formerly	Now
Amoco	BP
ARCO Alaska assets	ConocoPhillips
Atlantic Refining	ConocoPhillips
Atlantic Richfield	ConocoPhillips
British Petroleum	BP
Exxon	ExxonMobil
Humble Oil	ExxonMobil
Mobil	ExxonMobil
Pan American	BP
Phillips Petroleum	ConocoPhillips
Richfield	ConocoPhillips
Sinclair	ConocoPhillips
Sohio	BP





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TAPS TIMELINE *continued from page 42*

•State holds first North Slope lease sale.

1965

•Sinclair quits on partner too soon.

Before the discovery at Prudhoe Bay, British Petroleum and its partner Sinclair drilled a dry hole at their Colville River leases. Because of the failure, Sinclair dropped out of the bidding on the next North Slope lease sale. British Petroleum ended up bidding at Prudhoe Bay alone. Sinclair went away.

"They got faint of heart," said Gil Mull. "Sinclair bailed at exactly the wrong time."

Later, Atlantic Richfield ended up swallowing Sinclair, a company that could have been a very large part of things at Prudhoe Bay, he said.

"A couple of people at Sinclair were disappointed that management let them down," Mull said. "They were sick about it."

•Prudhoe Bay beckons

Harry Jamison, who was directing exploration from Richfield's Los Angeles office, was the first Alaska district manager for the company. In the winter of 1964-65, the Richfield Oil and Humble seismic crew worked north toward the coast of the Arctic Ocean and found the Prudhoe Bay structure.

When the Prudhoe Bay area was offered in a July 1965 state lease sale, Richfield and Humble bid aggressively, especially on the crest of the structure, which turned out later to have more gas than oil. A bid of $94 per acre bested British Petroleum, Atlantic Refining, Mobil and Phillips for the coastal tracts.

Short of dollars and a partner, BP decided it could not compete with American companies for expensive leases in the center of the structure. Instead, it gambled on the striking similarity of the Prudhoe Bay structure to the company's discovery in Iran — where the oil-bearing rocks had proved to be thicker and more prolific around the edges, the flanks.

GIL MULL

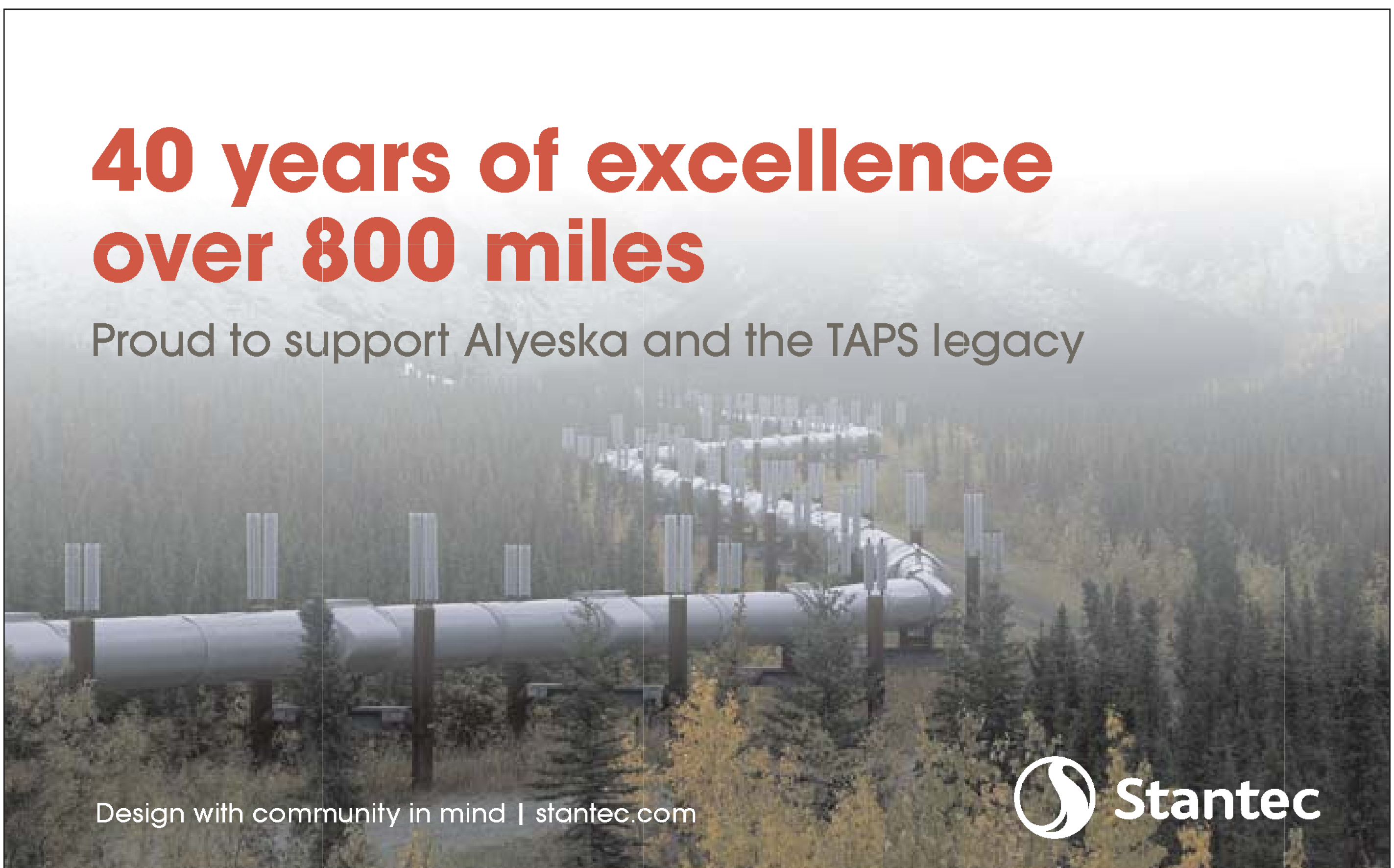
Richfield geologist Milt Norton (right) and Harry Jamison.

In some instances, BP did bid on what were considered prime tracts at the crest of the Prudhoe structure, but was outbid by Richfield.

When the bidding closed, BP had acquired 90,000 acres at an average price of just over $16 an acre — compared with the $93 an acre Richfield paid for leases in the central, crest area.

BP acquired more acreage along the flanks in 1967, ending up with more than half of the oil in Prudhoe Bay. Atlantic Refining picked up leases on the southern flank of the structure.

Later in 1965, Atlantic Refining purchased Richfield and in 1966 the companies became Atlantic Richfield, eventually ARCO.



The stage was set for one of the most remarkable oil finds in North America history.

But first — and later — oil companies would spend huge amounts of money on exploration drilling. Without modern day technology this translated into lots of dry holes.

According to a 2006 IHS Energy report on Alaska's Arctic, there were 10 dry holes drilled on the North Slope between 1964 and 1968 when Prudhoe Bay was discovered, and 53 dry holes compared to four discovery wells (including Kuparuk and Milne Point) between 1969 and 1971.

1966

•Atlantic Richfield gets approval for civilian use of C-130

In January 1966 Atlantic Richfield obtained U.S. Department of Defense approval to use a Lockheed C-130 Hercules cargo aircraft for civilian purposes: to fly in the drill rig, camp and supplies for the Susie No. 1 well in the Brooks Range foothills.

It was the first time an aircraft had ever been used to mobilize a drill rig in a remote location.

The rig move required more than 80 flights from Fairbanks to the well site over three weeks using the C-130 and another cargo plane.

Before the airlift could proceed, an airstrip was needed at the Susie well site. Construction equipment was landed on a river bar gravel airstrip at Sagwon for overland transport to the Susie location where crews constructed a winter strip out of snow and ice.

The Herc, as the big birds are affectionately called in the oil patch, is a workhorse that can carry 48,000 pounds of outsized cargo.

•Susie No. 1 spud by ARCO and Humble in February 1966

GIL MULL

The Lockheed C-130 Hercules is a military bird that adapted readily to Alaska's oil patch

and plugged as dry hole in late December.

Atlantic Richfield and Humble decided to try one more well, this time in Prudhoe Bay. "If the Prudhoe well had been dry, we were going home," ARCO Chairman Bob Anderson told Jack Roderick in "Crude Dreams." "It was our last shot."

*Walter Hickel (R) elected governor (1966-1969)

*Interior Secretary Stewart Udall imposes "land freeze" to protect Native use, occupancy of Alaska lands.

1967-1968

•State's third North Slope sale, offshore Prudhoe Bay area, Atlantic Richfield and Humble pick up leases.

•Drill rig moves by cat train 65 miles north from Susie No.1 to Prudhoe Bay discovery site, the Prudhoe Bay State No. 1.

continued on page 46

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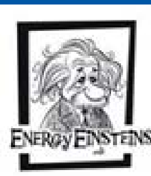

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TAPS TIMELINE *continued from page 45*

•Atlantic Richfield and Humble begin drilling what would be the Prudhoe Bay discovery well. (See the Gil Mull story in the Prudhoe Bay section of this magazine.)

1968

•Atlantic Richfield and Humble announce Prudhoe Bay discovery on North Slope, largest oil field in North America, estimated 9.6 billion barrels.

•State petroleum revenues double in six years to $52 million.

Aircraft flying supplies to BP's Put River No. 1 drilling site.

BP

1968-1969

•BP drills own Prudhoe confirmation well on flank.

The summer of 1966 saw little drilling activity by BP. Some were surprised when the company bid on some Sag Delta tracts in a 1967 state lease sale. BP acquired six offshore tracts northeast of Prudhoe Bay, in the vicinity of today's Niakuk and Endicott fields.

But cash-strapped and discouraged by nine successive dry holes, the company decided to sit tight and see what its new neighbors, Atlantic Richfield and Humble, would do at their new well, Prudhoe Bay State No. 1.

In March 1968, Atlantic Richfield announced a strike at Prudhoe Bay State No. 1 — at the center of the structure, on the crest. The deposit was the largest ever found in North America.

Three months later ARCO drilled a second well — Sag River State 1 — seven miles southeast of Prudhoe Bay State 1, which confirmed that discovery. Ironically, the well was drilled with a Canadian rig that BP had relinquished.

BP turned down an offer from Atlantic Richfield to purchase all its Prudhoe Bay leases, and then quickly decided to resume drilling.

With 48 hours' notice, a barge and drilling rig were acquired in southern Alaska. Along with 4,500 tons ancillary equipment, the rig was barged through the Bering Sea to Prudhoe Bay before encroaching ice made the Beaufort Sea impassable.

Drilling began Nov. 20, 1968, on BP's Put River No. 1, on the banks of the Putuligayuk River, three miles from the Arctic coast and three miles south of ARCO's initial discovery well.

In an interview with Jack Roderick in the book "Crude Dreams," released in 1997, BP geologist Geoff Larmanie noted that Put River No. 1 was designed to be located outside the edge of the gas and in the oil leg of the Prudhoe Bay structure.

"BP wanted to determine the thickness of the Prudhoe col-

continued on page 48

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"As drilling continued throughout the winter, communications security was a problem. People at the well had to communicate with company officials, but without others listening in.

"Everyone was sharing these terrible radio frequencies. We had a very good radio man in London who knew the international system … frequencies, the VHF and rural problems, but we didn't have FCC authority to use the frequencies. So, as we were getting closer to the target at Put River No. 1, we were sending information out in sealed bags — airlifted hand-carried stuff."

Larmanie noted that on one occasion messages were exchanged by two Welsh-speaking geologists, one on the rig and the other at Anchorage. "Welshmen Harvey Jones and Ron Walters conducted a conversation in their native language, transferring all the Put River information from the rig to Anchorage," he said.

Finally, on March 13, 1969, BP made brief announcements in London and New York: "Oil had been discovered in porous sandstone below 8,000 feet," with an oil column thickness greater than that at Prudhoe Bay."

The announcement was extremely significant. It was a major extension of the Prudhoe Bay discovery, like the Sag River State No. 1 well.

BP had acquired enough leases in preceding years to lay claim on about 60 percent of the entire Prudhoe Bay field.

After further drilling and analysis, BP announced six months later — in a Sept. 28 announcement — that an independent review of eight of its Prudhoe Bay wells indicated that nearly 5 billion barrels of recoverable oil lay under its leases. The total field was then estimated to contain about 9.6 billion barrels of recoverable oil and 26 trillion cubic feet of natural gas — a super-giant oil field of Middle East proportions.

With improved technology and additional investments, Prudhoe Bay's recoverable oil reserve figure would later be revised to about 15 billion barrels.


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BIGGEST SALE EVER

Bid Total Climbs Toward $1 Billion

Offer On Single Tract Is Higher

1969

•Feb. 10, Atlantic Richfield, Humble, British Petroleum announce plans for trans-Alaska pipeline (Feb. 10, 1969).

•State holds lease sale No. 23, fourth North Slope sale, record $900 million.

•Alaska Gov. Walter Hickel appointed Secretary of Interior.

•Congress passes National Environmental Policy Act; U.S. enters new era of environmental awareness.

•Pending settlement of Native land claims delays Congressional OK of TAPS construction

•Hickel orders Alaska land "freeze" until Native claims settled.

•America's second largest oil field, Kuparuk River, discovered on North Slope by Sinclair Oil.

•Conoco discovers Milne Point field east of Prudhoe Bay.

•First shipment of 48-inch pipe for trans-Alaska oil pipeline arrives at Valdez.

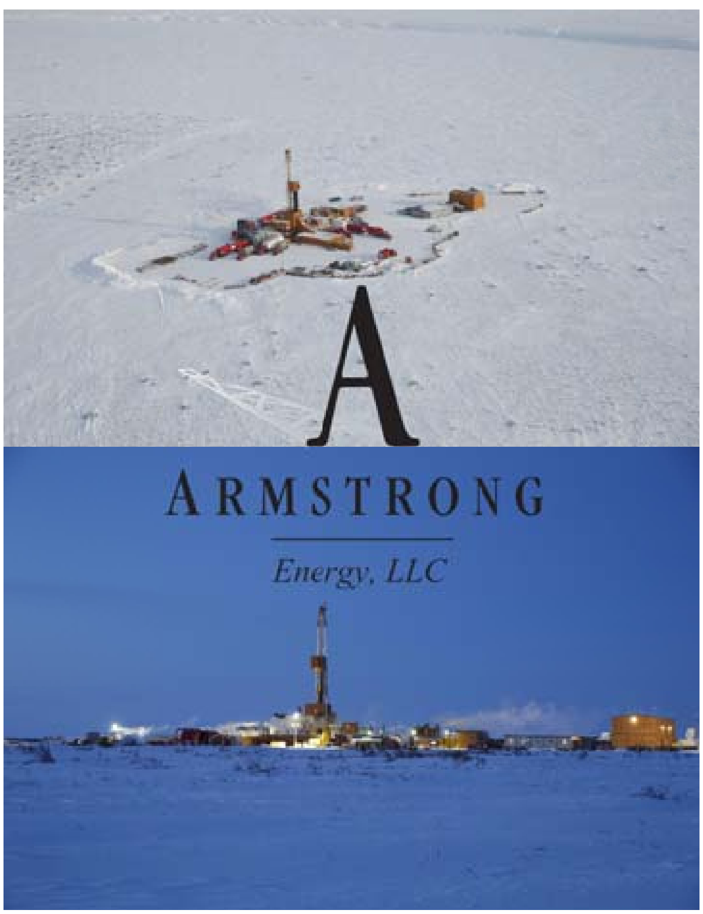
•First sealift to Prudhoe Bay delivers 70,000 tons.


CROWLEY

Crowley's 1970 transport of 187,000 tons of cargo to Prudhoe Bay was the largest commercial sealift in maritime history. The 400-foot barges were towed 4,000 miles from Puget Sound to the Beaufort Sea.

1970

•Alyeska Pipeline Service Co. founded to construct, operate trans-Alaska pipeline.



COURTESY ALYESKA PIPELINE SERVICE CO.

On March 27 the first pipe is laid at Tonsina River. A total of 534 rivers and streams were crossed in the construction of the 800-mile trans-Alaska oil pipeline..

•Cook Inlet basin oil production peaks at 225,000 barrels per day.

•Largest sealift in state history delivers 187,000 tons to Prudhoe Bay.

•West Sak River State No. 1 discovery by ARCO announced 25 miles west of Prudhoe Bay.

1971

•Congress passes Alaska Native Claims Settlement Act, 44 million acres to go to newly established Native corporations.

1973

•Arab Oil Embargo reduces America's oil supply and causes gasoline shortages.

•Agnew breaks deadlock on pipeline act.

In the early 1970s, Vice President Spiro T. Agnew became a pivotal figure in Alaska politics when he broke a Senate deadlock on approval of a bill that called for construction of the trans-Alaska oil pipeline.

SPIRO AGNEW

As Congress worked in 1971 to solve Native land claims issues, environmental groups filed suit to stop construction of the trans-Alaska oil pipeline. The groups complained that industry plans for the line did not meet requirements of the newly passed National Environmental Policy Act. A federal judge granted an injunction to stop pipeline construction.

The oil industry pushed forward with an expensive planning process to answer the unprecedented environmental and engineering challenges, under a cloud of debate in Washington, D.C., about whether or not there should be a pipeline at all.

Environmentalists pressed the idea that America's last great wilderness should remain untouched by industry in order to be preserved for future generations.

Congress held Alaska's destiny in its hands. The House of Representatives approved pipeline construction in 1973, but the issue bogged down in the Senate.

Senators ground to a 49-49 deadlock on the issue. In the end, Agnew cast the deciding vote to approve the Alaska Pipeline Authorization Act on July 17, 1973.

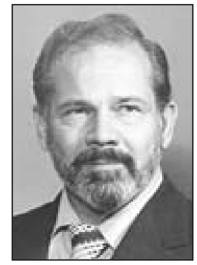
•BP's first permanent base camp shipped in modular form from Seattle to Prudhoe Bay.

Construction of TAPS begins

1974

•Jay Hammond (R) elected governor (1974-1978).

1975



Gov. Jay Hammond, "father" of the Alaska Permanent Fund

•State of Alaska's annual budget exceeds $500 million.

•534 rivers and streams crossed.

•Trans-Alaska pipeline workforce peaks at 28,072 in October.

1976

•Constitutional amendment passed by Alaskans establishing Alaska Permanent Fund to receive "at least 25%" of petroleum royalties.

•Alaska receives nearly $400 million in petroleum taxes and royalties.

•Federal Land Policy and Management Act adopted.

1977

•Trans-Alaska oil pipeline completed on May 31.

•First oil into Pump Station 1 on June 20, reached Valdez July 28; time delay due to fire and explosion on Pump Station 8 on

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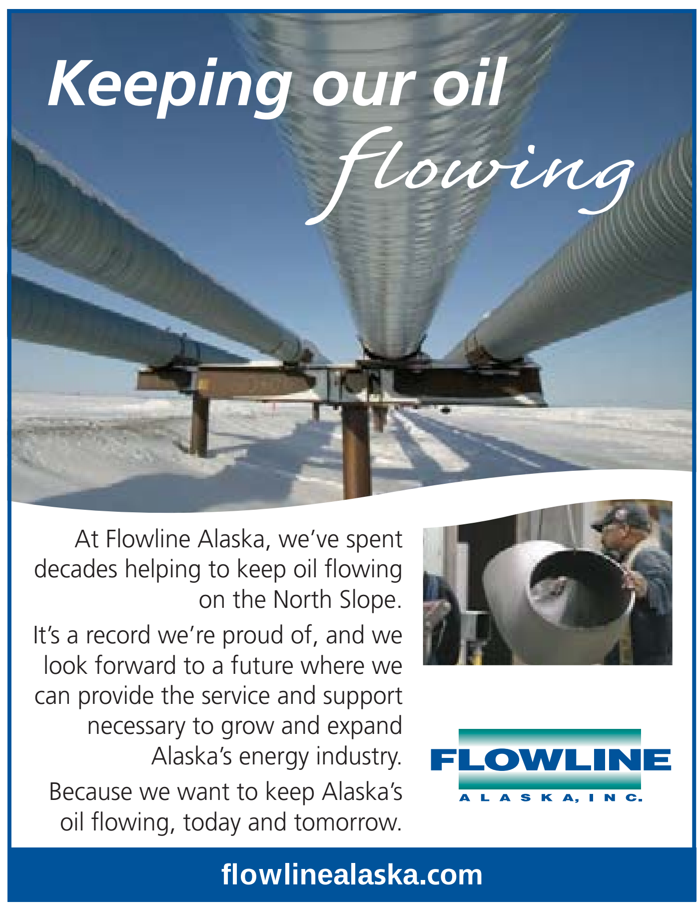
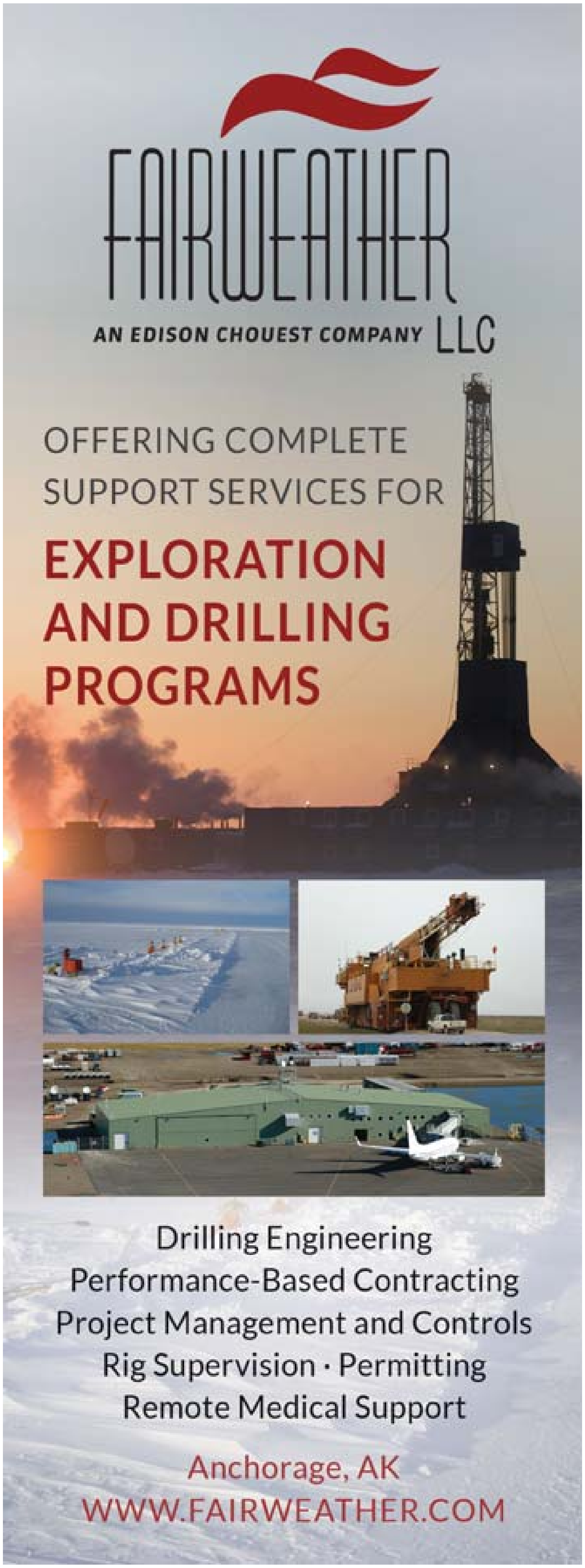





COURTESY ALYESKA PIPELINE SERVICE CO.

The first oil is shipped on the ARCO Juneau from Valdez on Aug. 1, 1977.

TAPS TIMELINE *continued from page 49*

July 8.

•Prudhoe Bay production begins.

•First tanker load of North Slope crude oil departs Valdez Aug. 1.

•State of Alaska's annual budget exceeds $700 million.

•Alaska Permanent Fund receives first deposit of dedicated oil revenues: $734,000

A man-made wonder

"A silken thread, half hidden across the palace carpet," former University of Alaska President William R. Wood wrote about the 800 mile trans-Alaska oil pipeline.

Constructed by its operator, Alyeska Pipeline Service Co., in a three year period beginning in April 1974 and ending with the final weld in May 1977, the trans-Alaska pipeline system was built to transport petroleum from the North Slope oil fields to the marine terminal in Valdez where it is loaded aboard tankers for the journey to U.S refineries. At the time it was the largest construction project ever undertaken by private industry.

The cost to build this manmade wonder? $8 billion, Alyeska said (although its original price estimate was $900,000). And that doesn't include interest on capital investment or capital construction after 1977.

Five hundred and fifteen federal and 832 state permits were required to build the pipeline. Two thousand contractors and subcontractors worked on it.

During the peak of construction in October 1975, approximately 28,072 people were employed by Alyeska and its contractors to build the pipeline.

Twenty-nine temporary camps were set up, used and dismantled in the three-year construction period. The largest was at the marine terminal. It had 3,480 beds.

Seven airports were constructed — two airports, Prospect and Galbraith Lake, continue to be used for pipeline purposes.

The total weight of the materials shipped to Alaska for the construction of the trans-Alaska pipeline system was approximately 3 million tons, the largest being a floating tanker berth at 3,250 tons.

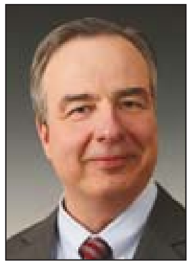
Forty-two thousand, double joint welds and 66,000 field girth welds were made along the line.

Finally, and something that is seldom mentioned, 31 lives were lost in construction-related incidents during the three-year period.

Nanushuk invigorating ConocoPhillips

A newly intriguing oil play is part of two exploration projects for the company

By ERIC LIDJI
For Petroleum News



JOE MARUSHACK

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ConocoPhillips Alaska Inc. is currently exploring in two directions on Alaska's North Slope — to the west and to the south. But the company is seeing a similar opportunity in both places.

The Houston-based independent's generation-long move to the west reached a new milestone in early 2017 with the announcement of the Willow discovery at the western edge of the Greater Mooses Tooth unit of the National Petroleum Reserve-Alaska.

The company is also working on a project south of the Colville River unit that was previously associated with the unit before passing into the hands of another company.

In both cases, ConocoPhillips is considering the potential of the Nanushuk formation, which is probably the most important North Slope exploration story of the past year.

The two exploration efforts come amid a renewed interest in Alaska for the company.

ConocoPhillips has been the most prolific exploration company on the North Slope for two decades. But those activities have become more important to the company over the past few years, as relinquishments and market conditions have changed its portfolio.

Willow

In mid-January 2017, ConocoPhillips announced a discovery to-

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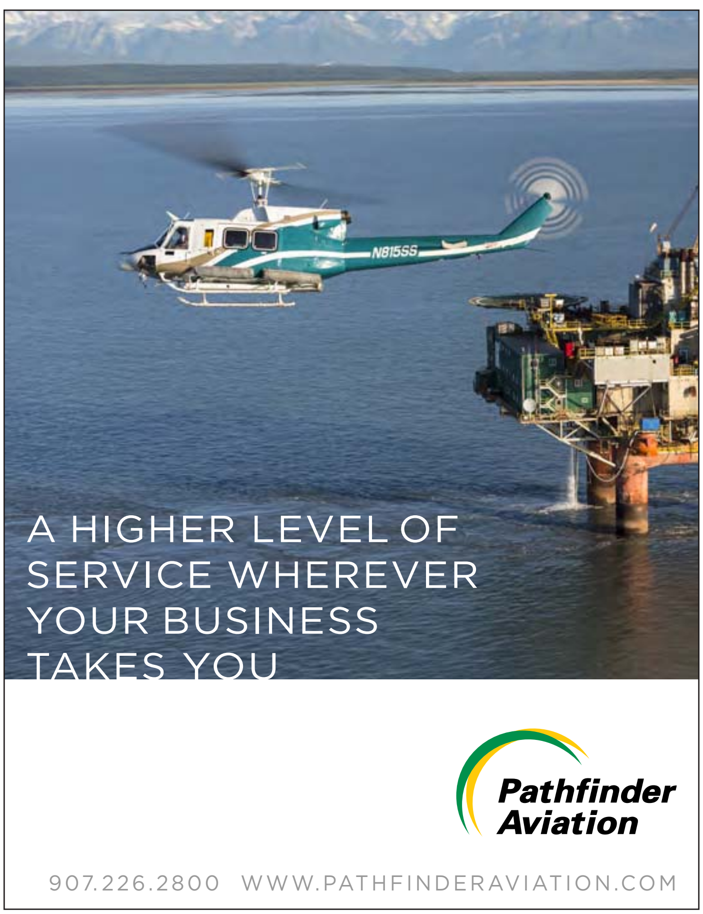

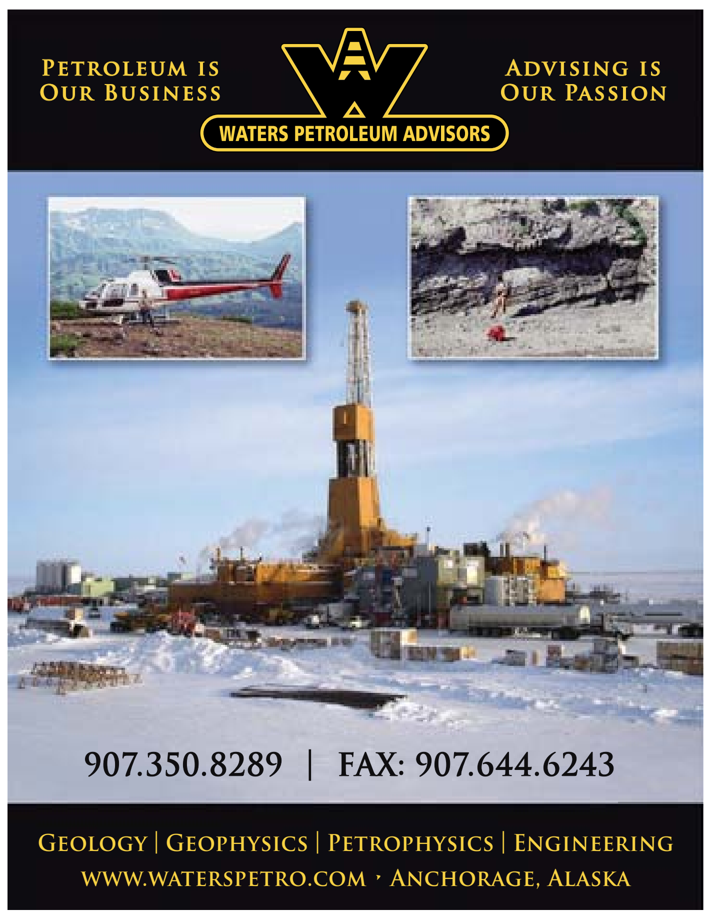

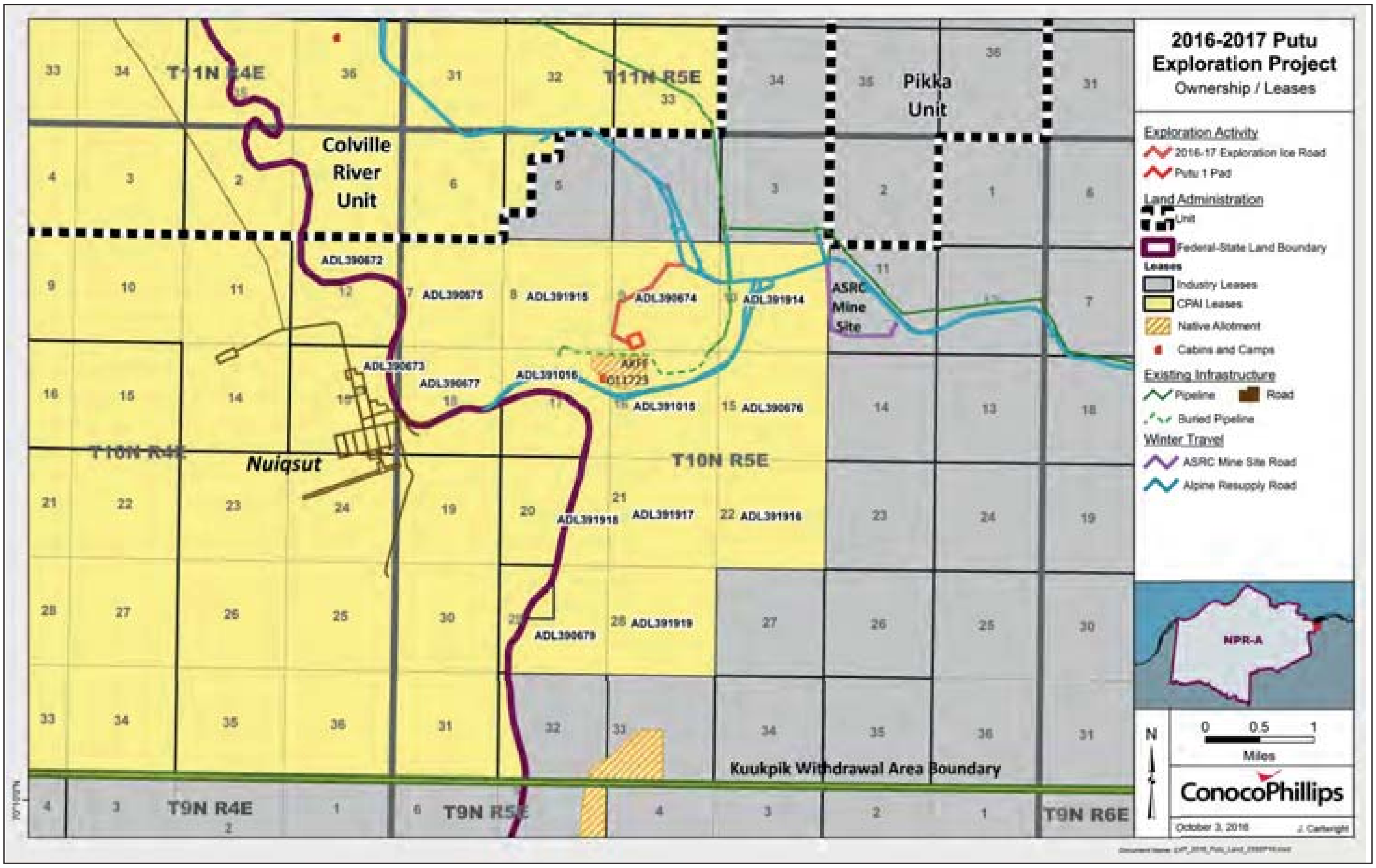

CONOCO *continued from page 51*

taling some 300 million barrels of recoverable oil at its Willow prospect in the Greater Mooses Tooth unit.

The discovery was based on the Tinmiaq No. 2 and Tinmiaq No. 6 exploration wells that the company had drilled at the western end of the federally managed unit in early 2016.

A test of the Tinmiaq No. 2 well produced 3,200 barrels per day of light 44 degree API oil over a 12-hour period, according to the company. Depending on the development strategy the company chooses, the discovery could potentially produce as much as 100,000 barrels per day. ConocoPhillips commissioned a 3-D seismic survey over the region earlier this year to collect more information about the geology of the region.

As with its leases at the Colville River and Greater Mooses Tooth units, ConocoPhillips has a 78 percent interest and Anadarko Petroleum a 22 percent interest in the discovery.

Willow marks a continuation of the westward expansion that has governed most ConocoPhillips exploration activities on the North Slope over the past twenty years.

Those efforts began with the creation of the Colville River unit and the development of its satellites, culminating in the recent CD-5 project. The construction of the CD-5 pad allowed ConocoPhillips to cross a key waterway and better access its federally managed leases in the National Petroleum Reserve-Alaska. The company is currently developing the GMT-1 project in the eastern edge of the unit and permitting the GMT-2 project in the center of the unit. The Willow discovery is situated at the western edge of the unit and could provide a useful geographic link to the federal Bear Tooth unit just to the north.

A major outstanding question for ConocoPhillips is how to develop Willow.

Over the past decade, the company has preferred a sequential development approach at its properties west of the Kuparuk River unit. The approach involves timing new developments against the capacity restrictions of existing Alpine facilities, thereby allowing the company to bring satellites into development without building new facilities.

Willow could be developed either as another Alpine satellite or as a standalone project with independent facilities. A satellite would likely produce no more than 40,000 to 50,000 bpd while an independent field could reach 100,000 bpd.

ConocoPhillips expects GMT-1 to come online in late 2018 and produce 30,000 bpd. If sanctioned, GMT-2 could come online in late 2020 and produce 30,000 bpd, although concerns from Nuiqsut villagers have the potential to push back that timetable. Each of those

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CONOCO *continued from page 52*

projects is expected to cost $1 billion, according to the company.

In February 2017, ConocoPhillips offered 2023 as an estimated timeframe for bringing Willow into production, but acknowledged the risk of permitting and regulatory delays.

In a quarterly earnings call for investors, Executive Vice President of Production, Drilling and Projects Al Hirshberg said that the company had recently established a team in Alaska "to figure out what's the most optimum way to develop this new discovery."

Given the size of the project and the recent acquisition of nearby acreage, "we need to think hard about how we move forward around infrastructure, et cetera," he added.

The Nanushuk formation

The Willow discovery was one of three major oil discoveries announced by North Slope operators over the past year, following Armstrong Energy's discovery from Pikka to Horseshoe in the region between the Kuparuk River unit and Colville River unit, and Caelus Energy's Tulimaniq discovery in Smith Bay. All three of those discoveries have been either in the Nanushuk formation or in the closely associated Torok formation.

ConocoPhillips is clearly optimistic about the Nanushuk. In December 2016, before announcing its Willow discovery, the company acquired 65 tracts covering 594,972 acres in a federal lease sale and 74 tracts covering 142,280 acres in a nearby state lease sale.

And in a presentation to the Alaska Support Industry Alliance's Meet Alaska conference in mid-January 2017, ConocoPhillips Alaska President Joe Marushack described Willow as being part of a new oil play running east to west through the leases that the company holds in the northeastern National Petroleum Reserve-Alaska and adjacent state lands.

Titania/Tofkat

Although the Alpine field and its satellites are located in the reservoirs in the older and deeper Beaufortian rock sequence, rather than the shallower Brookian sequences of the Nanushuk and Torok, ConocoPhillips also appears to be interested in a Nanushuk target south of the Colville River unit — a region that is at the center of a permitting dispute.

The company wants to incorporate the leases into the Colville River unit. But the state is requiring a series of bonds, payments and work commitments in return for the expansion.

By the time The Explorers went to print, the Alaska Department of Natural Resources had agreed to a request from the company to reconsider its decision to require bonds and payments in return for expansion, but had yet to issue an updated decision about the case.

The matter stretches back nearly 15 years. ConocoPhillips first asked the state to include the acreage in the Colville River unit back in 2002. The state agreed, but contracted the acreage out of the unit in 2004 after ConocoPhillips failed to meet a drilling commitment.

At the time, ConocoPhillips referred to the expansion acreage as the Titania prospect. A joint venture operated by Brooks Range Petroleum Corp. subsequently acquired the acreage through a lease sale and began referring to the leases as the Tofkat prospect.

Brooks Range Petroleum Corp. drilled the Tofkat No. 1 well and two sidetracks in early 2008 and encountered hydrocarbons. The company formed the Tofkat unit in late October 2011 and proposed various drilling programs over the years. But the state terminated the unit in late March 2016, after the company missed work commitments.

On March 31, 2016, ConocoPhillips asked the state to expand the Colville River unit to include the former Tofkat unit. The state re-

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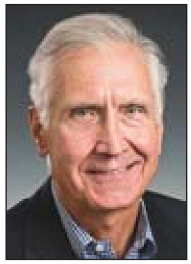
Three wells in, Doyon remains persistent

Promising geology is encouraging the company to explore the Nenana Basin

By ERIC LIDJI
For Petroleum News


JAMES MERY

NAME OF COMPANY: Doyon Ltd.
COMPANY HEADQUARTERS: 1 Doyon Pl., Ste. 300, Fairbanks, AK 99701
TOP ALASKA EXECUTIVE: James Mery, Doyon Ltd. senior vice president, lands and natural resources
PHONE: 888-478-4755 • **COMPANY WEBSITE:** www.doyon.com

Sometime this spring, Doyon Ltd. expects to have results from a 64-square-mile 3-D seismic survey it recently commissioned over the northern end of the Nenana basin.

The Alaska Native corporation for the Interior region commissioned the survey late last year, shortly before announcing that its third exploration well in the basin, like the previous two, had failed to discover a commercially viable hydrocarbon resource.

The work began in February 2017.

"We're very hopeful that the results of that will prove interesting enough to drill well number four in the basin," Doyon President and Chief Executive Officer Aaron Schutt said at the annual conference of the Resource Development Council in November 2016.

Geology, he noted, was a primary reason for Doyon's persistence. "If we had a well where the geology was not encouraging we would not be continuing," he said.

Doyon drilled the 11,379-foot Toghotthele No. 1 well in partnership with Cook Inlet Region Inc. Doyon operated the program and holds a 55 percent working interest in it.

A confidentially agreement between the two companies prevented Schutt from providing any specifics about the Toghotthele well, other than to note that it had been the first of the three wells to

continued on page 56

CONOCO *continued from page 54*

jected the application less than a week later, claiming that ConocoPhillips had no working interest in the leases. The company filed the appropriate lease assignments in mid-May and again requested a unit expansion.

Of the 22 leases in the former Tofkat unit, seven were still within their primary term and the remainder had already expired and passed into their 90-day secondary term. In mid-June, the state approved the assignments for those leases still within their primary terms but rejected the remaining assignments. ConocoPhillips appealed the decision and re-filed its request toward the end of June. But the state denied the request again in late July.

One issue at play was the original failure to drill, in the early 2000s. The state initially used that missed work commitment as justification for rejecting the current project.

After a personnel turnover at the state, the new Department of Natural Resources Commissioner Andrew Mack allowed ConocoPhillips to keep all the leases and asked the company to file a revised request to incorporate those leases into the Colville River unit.

But when the company filed a new request, the state remained skeptical.

In a decision from mid-February 2017, Mack denied the request unless ConocoPhillips provided a $2.5 million performance bond for an exploration well initially planned for this winter, a $10 million performance bond to guarantee oil production from the area within the next five years and a $1.5 million "bonus bid replacement payment" to compensate the state for theoretical loses it might incur by not re-leasing the acreage.

The state gave ConocoPhillips a 10-day window to agree to the terms. Instead, the company asked the state to reconsider the ruling, and the state accepted the request.

Putu

One major complication is the proposed exploration well.

ConocoPhillips began permitting a Putu No. 1 exploration well in the expansion acreage in 2016, but cancelled the well in December, citing concerns from the village of Nuiqsut.

According to Mack, the company had claimed to have a valid and active surface use agreement with the village, which should have addressed any community concerns. The company later challenged that claim, saying that other regulatory issues still persisted.

The decision to reconsider the ruling put a stay on the drilling commitment.

In its request, ConocoPhillips asked the state to approve the expansion with a clause requiring the company to drill an exploration well into the Nanushuk formation by May 31, 2018, or immediately relinquish the acreage, which would allow the state to make the leases available in the next North Slope areawide lease sale toward the end of 2018. The relinquishment clause would make the bonds and bonus bid payments unnecessary.

Another major complication is the potential design of any future development.

ConocoPhillips would prefer to bring a future Putu discovery into the sequential development model in place at the Colville River unit. But the state believes a sequential development would create unnecessary delays, and that a different company might be able to explore and develop a future discovery more quickly as a standalone project.

An expedited development, either through a standalone project or through extended reach drilling from the existing CD-4 pad, would likely bring oil online quicker than the time-consuming process of revoking acreage and making it available through a new lease sale.

A standalone project would trigger an environmental review from the U.S. Army Corps of Engineers. The review could take at least three years to complete, according to ConocoPhillips. The company projected production in 2022-24 under that option.

But using the existing CD-4 pad could tax the limits of extended-reach drilling.

DOYON *continued from page 55*

include rock samples and associated down hole data. Efforts to collect this information from the previous two wells had been prevented by outside circumstances, including later drilling schedules, a nearby forest fire and down-hole complications.

Doyon drilled the Nunivak No. 1 well in 2009 and the Nunivak No. 2 well in 2013 before completing the Toghotthele No. 1 in 2016. To allow for a potential two-well program last year, the company began permitted a potential Toghotthele No. 2 well alongside the initial well and started its summer drilling program earlier than it had during its 2009 and 2013 programs. The results of the first well halted immediate plans for the second.

In addition to recent 3-D seismic, Doyon commissioned wide 2-D surveys in 2005 and 2012, a targeted 3-D survey in early 2015 and a targeted 2-D survey in early 2016.

High hopes

Toghotthele No. 1 was disappointing in light of the hopes Doyon had expressed early on.

At a June 2016 press briefing in the middle of the drilling campaign, Vice President for Lands and Natural Resources James Mery said that previous drilling and seismic activities in the Nenana basin had established the prerequisites for a significant discovery. He pegged the program as having a 50 percent chance of finding a viable gas resource and a 25 percent chance of finding a viable oil resource. He offered estimates of 70 million barrels of oil or 200 billion cubic feet of gas in the targeted structure.

Although the abundant coal seams in the region would suggest a gas-prone basin, Doyon cites the results of soil samples and previous drilling, in addition to geologic and geophysical information from recent surveys, as signs of potential oil accumulations, too.

And the wet-gas encountered in the Nunivak No. 2 well from 2013 suggests a thermal source for hydrocarbons that could possibly include oil, rather than biogenic source.

The results of recent exploration activity are pushing Doyon further north. All three wells to date were drilled in an area between two sub-basins in the region. But a pair of 2-D seismic surveys in 2012 and early 2016, as well as the recent 3-D survey, focused on the northern end of the basin. Each of the three surveys was designed to pursue a specific area of the previous survey in greater detail in the hope of determining drilling locations.

Persistence

The current exploration program in the Nenana basin builds on unpromising exploration activities in the region by Unocal in the early 1960s and ARCO in the early 1980s.

Those early efforts were largely interesting in oil, though, and may have overlooked the natural gas potential in a region of the state with many methane-bearing coal seams.

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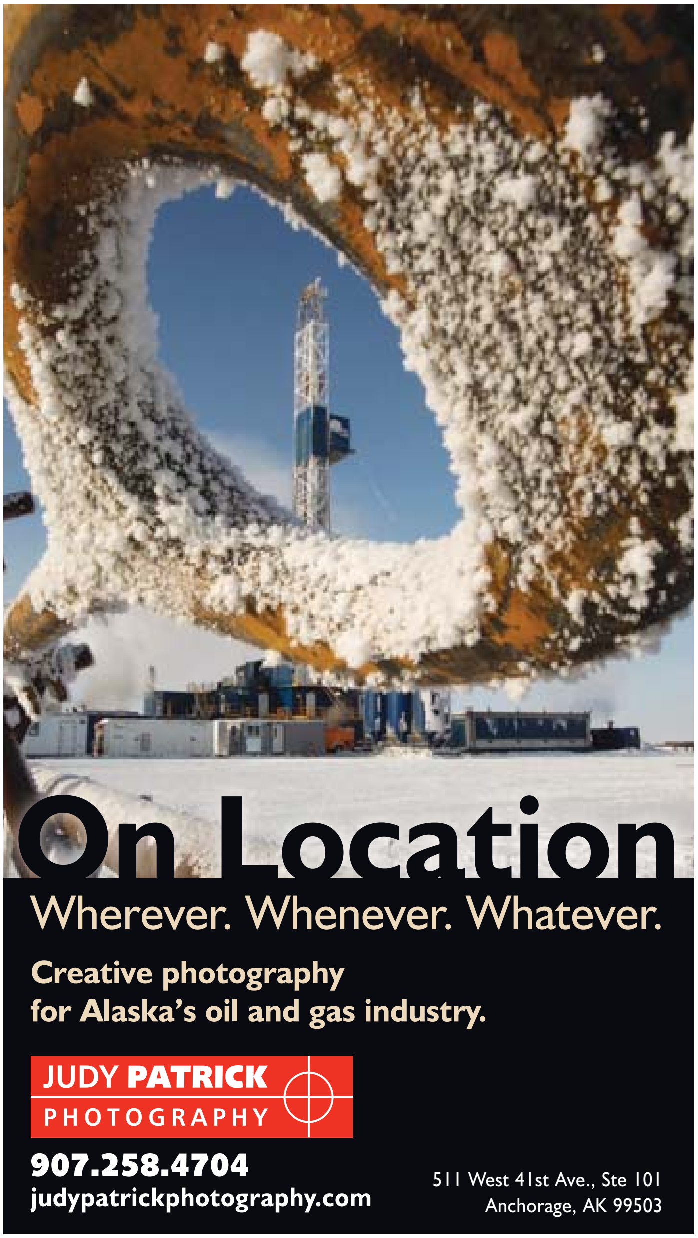
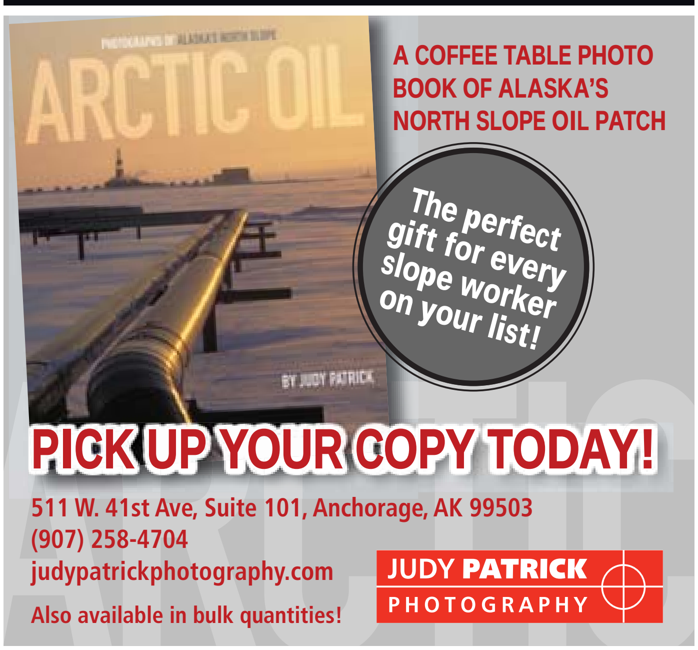




DOYON *continued from page 56*

After private industry lost interest in exploring the region, Doyon began organizing a program on its own. It formed a joint venture with the independent Andex Resources LLC in late 2001. The state issued an exploration license to Andex in mid-2002. The joint venture acquired adjacent Alaska Mental Health Trust leases in early 2003.

Despite a 2-D seismic survey in early 2005, and optimism from the companies, political uncertainties stalled the program. Andex delayed its activities in 2006 and 2007, while policymakers were debating the Petroleum Profits Tax and negotiating terms for a potential North Slope natural gas pipeline. Those efforts made no accommodation for Interior projects, and Andex had bowed out by the time the state rectified the oversight.

Doyon received a three-year extension of its license, through mid-2012, and arranged a five-party joint venture led by Denver-based independent Babcock & Brown Energy (later Rampart Energy Co.) in early 2009. The partnership drilled the 11,100-foot Nunivak No. 1 that summer. The roughly $15 million well failed to find commercial volumes of natural gas but geological information from the well intrigued Doyon.

State-backed plans to bring North Slope liquefied natural gas to the Interior and to unify the regional electrical grid again created uncertainty for the program. By the time Doyon felt comfortable continuing its work, its four partners had lost interest in the project.

Doyon continued alone. It commissioned a 2-D seismic survey in the northern end of the basin in early 2012 and drilled the 8,667-foot Nunivak No. 2 well in mid-2013.

Even though the well was failed to yield a big discovery, it provided some intriguing geologic information, including the wet-gas that suggested a petroleum system with oil.

After completing its 3-D seismic survey in 2015, Doyon intended to continue the program alone for its third well. But the company announced a partnership with CIRI in mid-2016.

Yukon Flats

Although the Nenana program has accounted for the bulk of Doyon's exploration resources in recent years, the company is also interested in exploring the Yukon Flats.

The company owns about 1.5 million acres of subsurface lands in the area north of Fairbanks and believes the geology of the region is similar to the Nenana basin.

The program was delayed for five years as Doyon and the U.S. Fish and Wildlife Service tried to negotiate a land swap in the region. The effort failed, although Doyon later determined that its existing acreage was more promising than it had originally thought.

SAExploration conducted a 3-D seismic survey in the Stevens Village region of the Yukon Flats in the winter of 2012 and 2013, on behalf of Doyon. But Doyon subsequently put its Yukon Flats program on hold to focus its resources on Nenana.

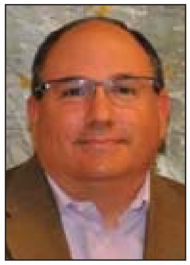
In early 2017, the state Division of Geological and Geophysical Services published the results of the fieldwork it conducted over the Yukon Flats back in 2002, in partnership with the U.S. Geological Survey. "Test holes at Fort Yukon demonstrate the presence of coal seams in the shallow subsurface," the DGGS wrote in its more recent report. "If coals, carbonaceous mudstones or other petroleum source rocks are present in the deeper stratigraphy of the basin, a functioning petroleum system may be present."

Contact Eric Lidji at ericlidji@mac.com

Eni looking north from Nikaitchuq

As initial development phase ends, company is looking for options to expand

By ERIC LIDJI
For Petroleum News



WHITNEY GRANDE

In the final weeks of 2016 and the first few months of this year, Eni U.S. Operating Co. LLC took early steps toward launching an exploration program at its Nikaitchuq unit.

The program would focus on targets in the Nikaitchuq North field, in the federal waters north of the offshore Nikaitchuq unit in Harrison Bay, north of the Kuparuk River unit.

The first indication of the project came in May 2016, when U.S. Bureau of Safety and Environmental Enforcement Alaska Director Mark Fesmire told the Society of Petroleum Engineers that the company was considering an exploration project north of Nikaitchuq.

Eni applied for a unit in the region in late December 2016 and the BSEE approved the Harrison Bay Block 6423 unit in late February 2017. The unit includes 13 federal leases in the waters immediately north, northeast and northwest of the existing Nikaitchuq unit.

In early March, the local subsidiary of the Italian major submitted a proposed exploration program to the U.S. Bureau of Ocean Energy Management. Although the federal agency was required to determine the completeness of the application within 15 days, it had yet to publicly announce any decision about the application by the end of March 2017.

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PHONE: 907-865-3300 • **PARENT COMPANY WEBSITE:** www.eni.it

For years, Eni has held a working interest in a block of 29 federal leases north of the unit, in the Arctic Outer Continental Shelf. Of those, two will expire in July 2017 and the rest will expire in December 2017. The leases are outside of the region that the Obama Administration withdrew from oil and gas activities in late 2016. Eni holds a 40 percent interest in the leases, with Shell holding 40 percent and Repsol holding 20 percent.

The Nikaitchuq North program would likely involve extended-reach wells drilled from the existing Spy Island Drill Site, which the company has been using for years to target the outer reaches of the unit. The wells in the new exploration program

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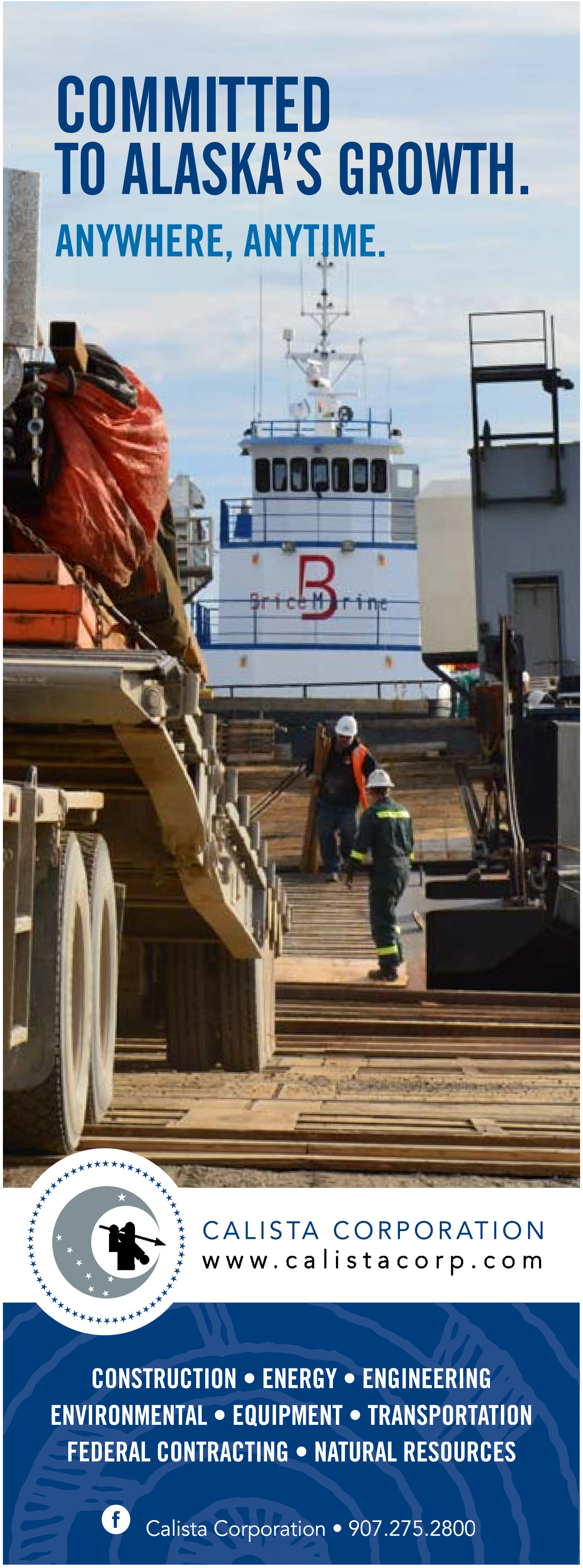


ENI *continued from page 59*

could be among the longest extended-reach wells ever drilled, according to the Fesmire presentation.

Expansion opportunities

The proposed project follows a year when Eni suspended development drilling activities at Nikaitchuq and reduced its workforce in Alaska in response to low oil prices.

But even though the Nikaitchuq North project appears to be at least partially motivated by pending lease expirations, it fits into a larger company strategy of shifting the Nikaitchuq unit into a new phase of operations. Eni recently completed its initial slate of drilling activities at the unit and is looking for opportunities to expand its operations.

The opportunities are partly exploration and partly development in nature. They include aerial expansion, developing new formations and improving the design of existing wells.

On the agenda for this year is the East Extension Project, which the company launched in the third quarter of 2015 but suspended last year. The project would follow the West Extension Project that the company conducted from the third quarter of 2014 to 2015.

All development activities to date at the Nikaitchuq unit have targeted the Schrader Bluff OA sands. But Eni has floated the idea of targeting other intervals and formations.

One potential is the shallower N Sands. After preliminary studies suggested between 40 million and 100 million barrels of "contingent resources" in the N sands, Eni drilled an appraisal well in 2013 and hopes to return this year to test a new completion technique.

A less immediate prospect is the Sag River formation at the unit.

Sag River oil is deeper and generally lighter than Schrader Bluff oil, but the formation is "plagued with poor quality reservoir rock" and would be "marginal at best unless there are significant advances in stimulation or enhanced oil recovery technology," according to the company. In a July 2014 plan of development, Eni said it intended to submit a proposal for a Sag River development to upper management within 18 months. But the company left the Sag River project out of its 2015 and 2016 plans for development.

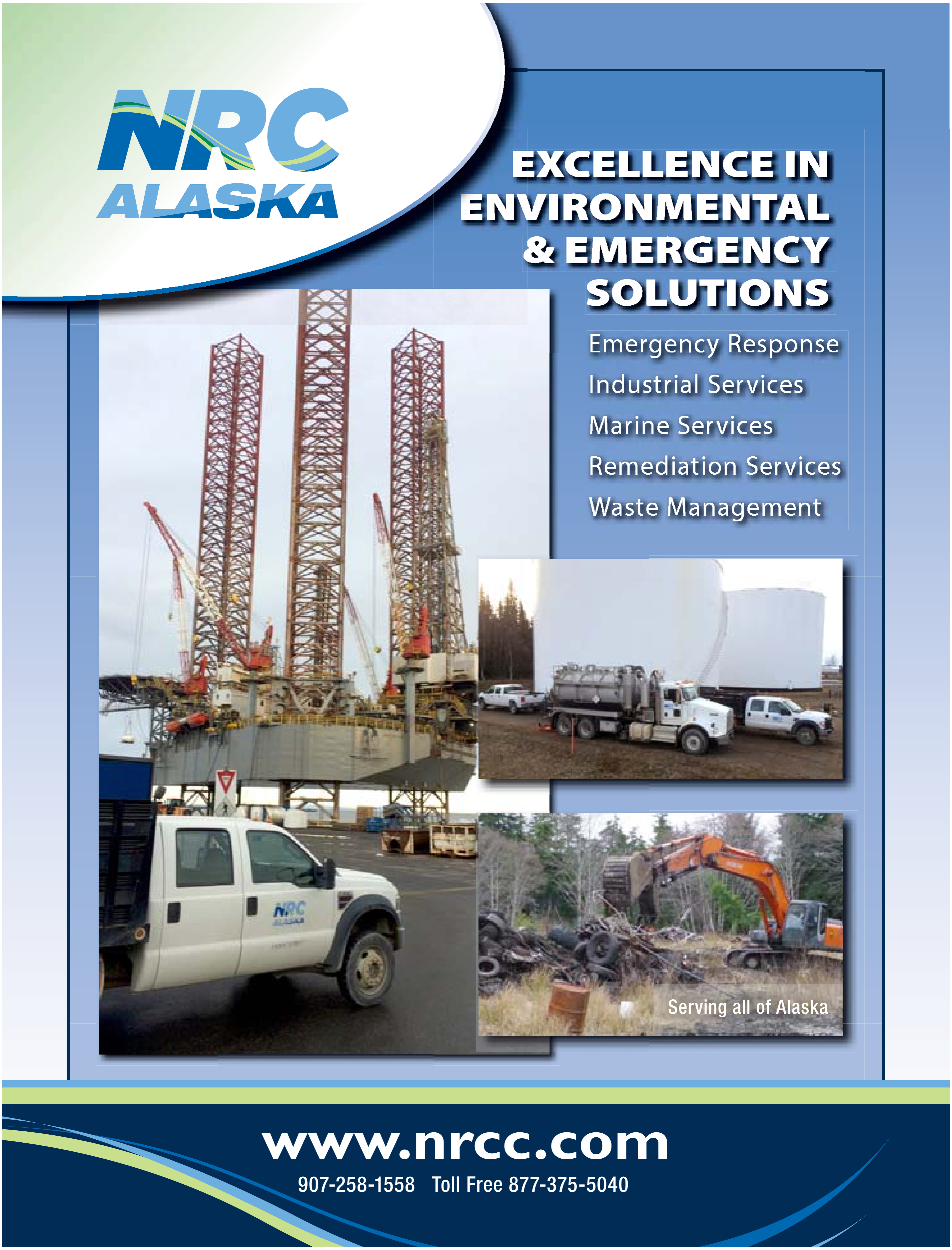
Minimal exploration

Eni has never been a major explorer in Alaska. Even its current development activities at Nikaitchuq are built upon the prior exploration efforts of other oil and gas companies.

Aside from a stint in Cook Inlet in the late 1960s through its affiliate Agip Petroleum, the company arrived in the state in 2005 when it acquired a minority interest in several properties operated by Armstrong. Eni expanded its interest in those prospects over the following years, becoming the owner and operator of Nikaitchuq and a minority owner of the Oooguruk unit, which is currently operated by Caelus Natural Resources Alaska LLC.

Early on, Eni showed an interest in exploring other leases it had acquired in Alaska, including the Maggiore and Rock Flour prospects south of Prudhoe Bay and Kuparuk River. The company explored both prospects in 2007 and relinquished both prospects in 2010. If federal authorities classify the current Nikaitchuq North as exploration, it would technically be the first exploration drilling in Alaska for Eni since the 2007 campaign.

Contact Eric Lidji at ericlidji@mac.com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Furie planning Jurassic well at KLU

Proposed 20,000-foot well would fulfill a long-standing desire of the company

By ERIC LIDJI
For Petroleum News

With the right resources and market conditions, Furie Operating Alaska LLC could become the most prolific exploration company in Cook Inlet over the next few years.

In a plan of operations submitted to the state in March 2016, the local independent announced a five-year plan to drill as many as 10 exploration wells at its offshore Kitchen Lights unit. But those plans remain flexible, as the company evaluates options.


BRUCE WEBB

In its 2017 plan of development for the unit, submitted to the state in late 2016, the company only mentioned a plan to potentially deepen an existing exploration well. And in March 2017, the company told Petroleum News it was planning to drill the Kitchen Lights Unit No. 6 exploration this year to a depth of 20,000 feet, into the Jurassic.

As the largest unit by area in the Cook Inlet region, Kitchen Lights will likely require a combination of widespread exploration activities and focused development activities. The 83,394-acre unit combines at least three previously distinct offshore prospects into a single administrative entity. Previous agreements with the state require Furie to spread its ongoing exploration activities over four blocks: North, Corsair, Central and Southwest.

To date, Furie has drilled three exploration wells and a sidetrack in the Corsair block, one exploration well in the Northern block and one exploration well in the Central block.

Furie drilled KLU No. 1 in 2011 and 2012, KLU No. 2 and KLU No. 2-A in 2012 and KLU No. 3 in 2013. All three wells and the sidetrack were in the Corsair block. Over the end of the 2013 season and the beginning of the 2014 season, Furie drilled KLU No. 4 in the northern block. At the end 2014, the company drilled KLU No. 5 in the central block.

Following that initial run of exploration, Furie shifted its focus to development activities, which included bringing the unit into production and drilling two wells and a sidetrack.

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Revised program

As early as 2012, Furie was talking about drilling a KLU No. 6 well in the northern block. In late 2014, the company proposed drilling the well in the southwest block in early 2015. By late 2015, Furie had plans to drill the well in the southwest block in 2017, although final determination would depend on the results of a recent 3D seismic survey.

Instead, in its most recent plan of development from late 2016, Furie said it planned to focus primarily on development

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FURIE *continued from page 62*

activities at the unit during 2017. But the company said it might swap one development well for an exploration project: deepening the existing KLU No. 4 well to penetrate the Sunfish Channel of the lower Tyonek formation.

In a plan of operations submitted to the state in early 2016, Furie proposed a much broader exploration program for Kitchen Lights, in the years after the KLU No. 4 project.

The plan called for drilling KLU No. 9 and KLU No. 12 in the 2017 season, KLU Osprey and KLU Deep Jurassic in 2018, KLU No. 10 and KLU No. 11 wells in 2019, KLU No. 6 and KLU No. 8 in 2020 and KLU No. 7 in 2021. The program proposed beginning in the northern end of the unit and moving progressively southward over the five-year program.

The wells would also vary in depth. The KLU No. 9 and KLU No. 12 wells would be approximately 17,000 feet deep. The KLU Osprey well would be approximately 7,230 feet deep. The KLU Deep Jurassic well would be approximately 24,000 feet deep.

A decision from the state Division of Oil and Gas in late May 2016 allowed the company to proceed with the KLU No. 4 project in the Corsair block and the KLU No. 9 and KLU No. 12 wells immediately. As for the remaining seven wells in the program — Osprey, Deep Jurassic, No. 6, No. 7, No. 8, No. 10 and No. 11 — the state required Furie to seek approval for each project on an annual basis from 2018 to 2021 by requesting a "letter of non-objection." In its decision, the state wrote that it would "consider and evaluate drilling progress, operations, compliance and other relevant information compared with the original plan when considering the issuance of a letter of non-objection."

By early this year, Furie had revised its exploration plans for Kitchen Lights again. In March 2017, Furie told Petroleum News that it planned to drill a deep exploration well later this year into the Jurassic. The company planned to begin the proposed KLU No. 6 well after completing the KLU A-1 development well, which would fulfill a two-well requirement in a gas supply agreement with Enstar Natural Gas Co. LLC starting in 2018.

The company would use the Randolf Yost rig to drill the well. The rig spent the winter in Nikiski, on the Kenai Peninsula, until it could be mobilized for the 2017 drilling season.

The proposed KLU No. 6 well would need to descend more than 20,000 feet to reach the Jurassic, where geologists have speculated there might be undiscovered resources. The company did not disclose the location or exploration block for the proposed well.

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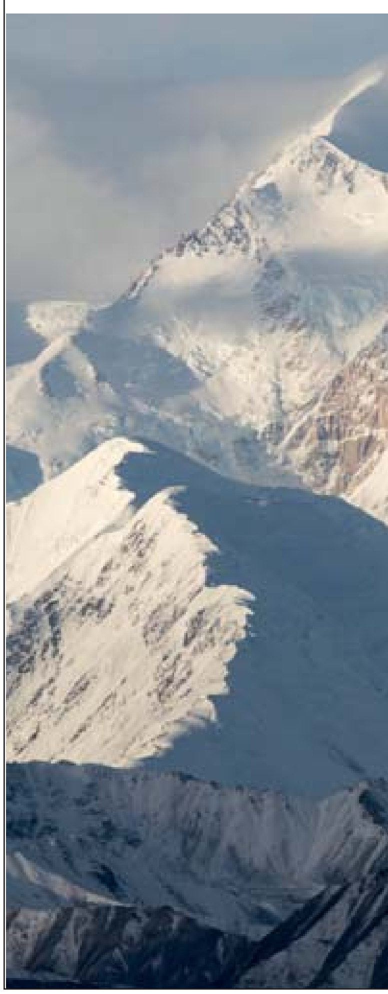

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Glacier returning to exploration

Permitting for Sabre project would revive a long-dormant target in Cook Inlet

By ERIC LIDJI
For Petroleum News

Glacier Oil & Gas Corp. is getting back into exploration. As this issue of The Explorers was going to print, the independent company was permitting a proposed exploration program at its Sabre prospect in the Cook Inlet region.

If the company follows through with the offshore project during the current open-water drilling season, it would represent a return to exploration drilling after a two-year hiatus where the company entered bankruptcy protection and emerged under new ownership.

Its predecessor company Miller Energy Resources Ltd. was one of the most ambitious small exploration companies in Alaska. Over a period of a few years, it acquired a slate of properties on the west side of Cook Inlet through operator Cook Inlet Energy LLC, acquired the North Fork unit from operator Armstrong Cook Inlet Inc. and acquired a stake in the Badami unit on the eastern North Slope through operator Savant Alaska LLC.

Through its various subsidiaries, Miller Energy Resources also pursued several exploration licenses throughout the Susitna basin and another in the Iniskin Bay region.

All those exploration and development projects overextended the company, and the drop in oil prices starting in late 2014 eventually forced the company into bankruptcy.

The company emerged from reorganization in early 2016 as a new privately held company called Glacier Oil & Gas Corp. Although its two subsidiaries still exist, Glacier prefers to be thought of as a single independent operator pursuing multiple projects.

In addition to a new name, the reorganization brought a more cautious approach.

Glacier slowed exploration and development plans at the North Fork unit and Badami unit, surrendered all of its exploration licenses and relinquished its Otter unit, which had been an early exploration prospect for the company but had yet to reach development.

The company also devoted considerable time and resources to closing the processing facilities at the West McArthur River unit and shifting operations to the Kustatan facility.

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Sabre

Those activities suggested a company with a greater interest in maximizing existing development than pursuing exploration. But over the past year Glacier has been creating a new exploration strategy that fits within its new cautious and measured approach.

Sabre is the most immediate exploration project on the agenda.

Through its subsidiary Cook Inlet Energy, Glacier amended its oil discharge prevention and contingency plan in May 2016 to add use of the Spartan 151 jack-up rig to drill the Sabre exploration well in offshore Trading Bay region on the west side of Cook Inlet.

The amendment signaled renewed interest and a new approach to an old project.

Cook Inlet Energy acquired a 70 percent interest the Sabre and nearby Sword prospects in its initial acquisition of Alaska properties from the bankruptcy proceedings of Pacific Energy Resources Ltd. in 2009, and farmed-in the remaining 30 percent from Hilcorp Alaska LLC in September 2012. A former executive had touted estimates as high as 20 million barrels of oil and 14.3 billion cubic feet of natural gas for the two prospects.

The company brought the Sword No. 1 well into production in November 2013 and began discussing plans to either develop additional intervals or drill a second Sword well.

Instead, Cook Inlet Energy began considering the nearby Sabre prospect. The company described the project as a potential six-well development with the first extended reach well costing between $25 million and $30 million. By late 2014, the company was "evaluating joint venture offers for participation in the project," to defray the cost.

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GLACIER *continued from page 65*

Although the program never came to fruition, the company incorporated the Sword and Sabre prospects into the boundaries of the existing West McArthur River unit in 2015.

Cook Inlet Energy continued to include both prospects as potential near-term projects in its unit plans of operation for West McArthur River. A plan from early 2014 envisioned a Sword No. 2 and Sabre No. 1 well by April 2016. A plan from early 2015 pushed the Sword well into 2017 and said the Sabre well was still being evaluated. As an extended-reach well, Sabre conflicted with a new strategy of "developing lower risk targets." The company expected to delay exploration until it had finished drilling proven prospects.

In a late January 2016 plan of development for West McArthur River, the company said it would drill a second Sword well by April 30, 2018, "if appropriate to increase recovery, and if economic conditions warrant." The company reiterated its plans to postpone work at the Sabre prospect until it finished developing proven prospects.

By its next plan of development in January 2017, Glacier said it was "seeking partners in the Sabre prospect to reduce risk factors associated with drilling the Sabre No. 1 well."

Around the same time, Glacier continued its permitting activities by applying to the U.S. Army Corps of Engineers for permission to drill the Sabre No. 1 well. The application proposed an estimated 70-day drilling schedule starting in late March or early April.

The application proposed using the Spartan 151 jack-up rig, rather than drilling extended reach wells from onshore facilities, which the company had proposed back in 2014.

North Fork and Badami

Although the natural gas production at the North Fork unit is somewhat shielded from the currently depressed oil markets, it is challenged by supply agreements in Southcentral.

For that reason, Glacier announced a year of "small ball" development projects at the onshore unit in the southern Kenai Peninsula, rather than new exploration activities.

But in mid-2016, Glacier announced plans to take the lead as operator on an exploration project at the nearby West Eagle prospect on behalf of lessee Aurora Gas LLC.

The project was announced as part of bankruptcy proceedings and has yet to appear in any publically available permitting documents or any recent regulatory filings.

Buccaneer Energy Ltd. drilled a dry hole at West Eagle in early 2014. The Badami unit on the eastern North Slope presents a similar situation to the North Fork unit: a small producing field with the potential for exploration activity in the vicinity.

In its last plan of development for Badami in mid-April 2016, Savant announced plans to undertake a review of the exploration and development opportunities at the Badami unit.

A range of immediate development opportunities was stymied by oil prices and the bankruptcy proceedings and also because of delays bringing equipment to the region.

And the most promising exploration project at the region has been tied up in a long-running administrative dispute with the Alaska Department of Natural Resources.

The project involves drilling an exploration well through the Canning formation and into the Hue Shale on leases adjacent the eastern boundary of the unit to evaluate the potential of the Killian interval as previously encountered in the East Mikkelsen Bay No. 1 well.

Contact Eric Lidji at ericlidji@mac.com

Great Bear eyes conventional oil

Sees traditional prospects as an early step toward source rock development

By ERIC LIDJI
For Petroleum News

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In late September 2016, Great Bear Petroleum Operating LLC announced that it had identified eight conventional oil prospects on its leases south of Prudhoe Bay.

The announcement highlighted the unusual situation of source rock exploration and development on the North Slope at the moment, where the few companies interested in the play have decided to pursue conventional targets in the short term as a way to establish infrastructure and cash flow to support unconventional work in the future.

Great Bear officials have described an "Alaska Shale Play Catch 22." Source rock exploration and development can only become profitable through a large economy of scale. But creating a large economy of scale would require some early profitability.

"What we recognized was that we really needed to find a more conventional play first and have that be the backstop to justify the infrastructure investment," Chief Commercial Officer and general counsel Pat Galvin said during the Alaska Oil and Gas Congress. "Once the infrastructure is in place, the unconventional play would be economic."

Although the company has no firm exploration plans at the moment, Galvin said that the current crop of leads were stacked, allowing all eight to be targeted with two wells. All but one of the leads are in the Brookian sequence; the outlier is in the Kuparuk. A majority of the prospects connect to oil shows from the nearby Pipeline State No. 1 well.

The new prospects follow five seasons of seismic activity. The company permitted an additional seismic program — its sixth — over a portion of its lease earlier this year.

In a move that might prove to be related, or at least adjacent, to its short term shift toward pursuing conventional oil targets, Great Bear purchased a small working interest in the Badami unit on the eastern North Slope from Arctic Slope Regional Corp. in mid-2016.

Oilfield services company Halliburton Co. and Australian independent Otto Energy both have minority interests in a portion of the leases in the Great Bear holds in Alaska.

2010-2013

Great Bear purchased its initial 500,000-acre leasehold during a state sale in 2010, when unconventional oil was overhauling domestic energy production in the Lower 48.

The company envisioned launching a similar revolution in Alaska.

From a geological standpoint, the idea was to trace the oil in the prolific conventional reservoirs on the North Slope back to their source rocks, and develop those directly.

Studies had indicated that the source might be three stacked rock formations to the south of the Prudhoe Bay and Kuparuk River units. Using horizontal drilling and hydraulic fracturing, Great Bear saw the potential for developing all three source rocks at once.

The location of the leasehold initially seemed ideal. Being so close to the Dalton Highway allowed the company to avoid seasonal restrictions and work year-round.

Great Bear identified six well locations and drilled two stratigraphic wells — Alcor No. 1 and Merak No. 1 — in the summer and fall of 2012. The smaller than anticipated drilling program was the result of a later than expected start and the pending end of a rig contract. In addition to collecting core samples, the company also commissioned a 3-D seismic survey to identify future drilling locations and possibly some conventional leads.

Early on, Great Bear touted its potential to revolutionize the Alaska oil industry with source rock development. The program would require significantly more wells than a conventional development and could theoretically add hundreds of thousands of barrels of oil production each day to the waning throughput on the trans-Alaska oil pipeline.

2013-2015

The results of the initial drilling program revealed the difficulties in reaching that goal.

While the location of the leases was useful from a logistical standpoint, it was less than ideal from a historical standpoint. The area had relatively little prior exploration activity.

Great Bear prioritized additional seismic activities as a way to expand and refine its inventory of high-impact prospects across the leasehold. The company commissioned 3-D seismic surveys in 2012, 2013 and 2014 and assembled a team of geoscientists to compile a database to help identify potential sweet spots for future source rock development.

After completing those 3-D seismic surveys, Great Bear launched a second round of drilling activity designed to target both conventional and unconventional prospects.

The original program called for drilling three exploration wells, although Great Bear was only able to complete one — Alkaid No. 1 — before the end of the drilling season in early 2015. And the flooding along the Dalton Highway that winter prevented the company from testing the well. "We're looking for an opportunity to go back and test it, but we're encouraged by what we found there," Galvin said at the Alaska Oil and Gas Congress.

2016 on

In early 2016, Great Bear returned to seismic activity. The company hired Geokinetics Inc. to conduct a 3-D seismic survey over some 450 square miles immediately south and southwest of Deadhorse in early 2016. For this year, Great Bear hired the company to conduct a 3-D seismic survey over some 64 square miles south of the village of Nuiqsut.

In early 2017, a Great Bear subsidiary called Great Bear Petroleum Ventures I LLC transferred 1.61 percent royalty interest in 31 North Slope leases to Geokinetics USA Inc.

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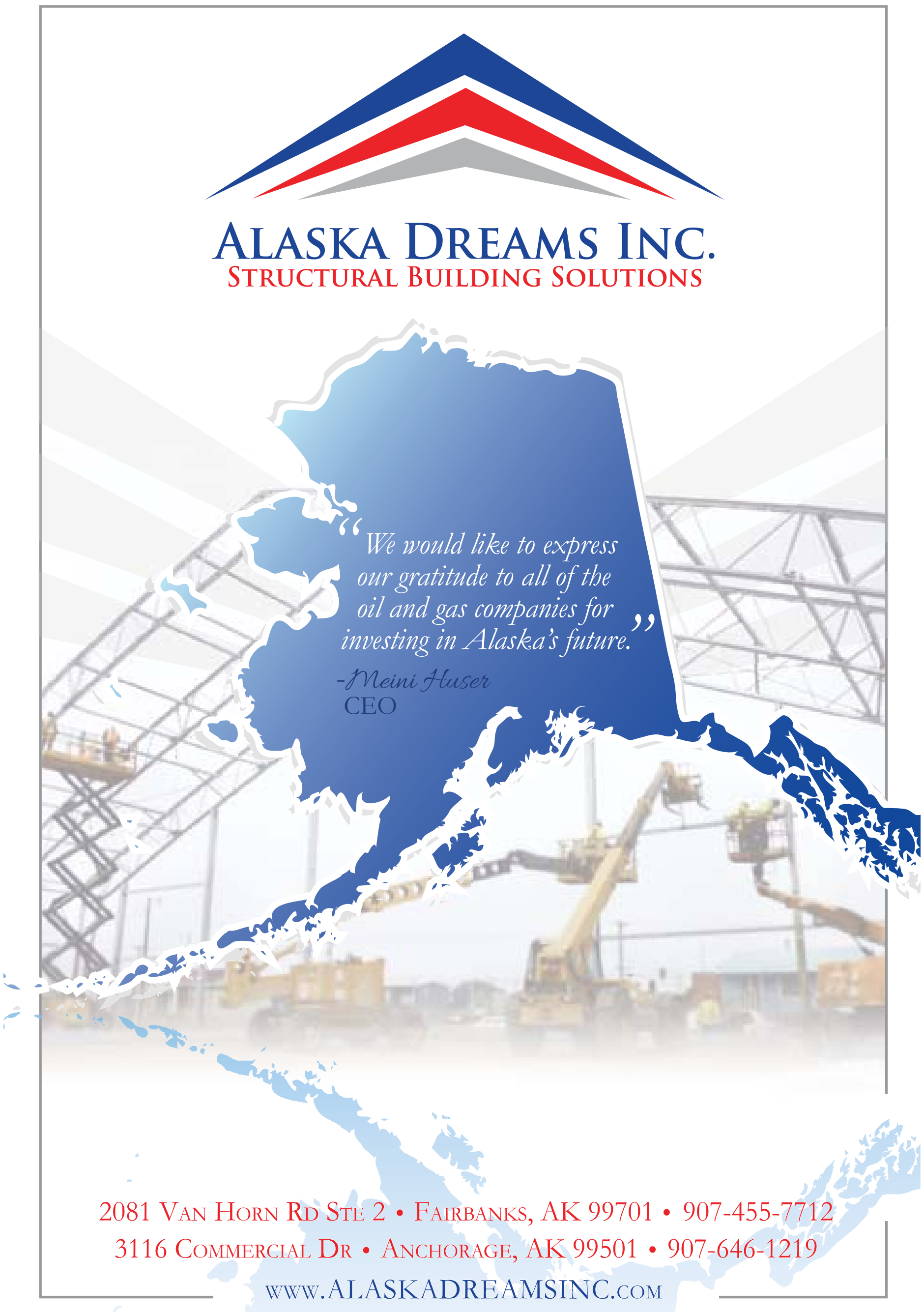
Hilcorp exploring at existing units

Company uses exploration in the service of expanding existing developments

By ERIC LIDJI
For Petroleum News

Although it has been one of the most active operators in Alaska over the past five years, Hilcorp Alaska LLC has only drilled five wells classified as "exploratory" by the state.

The local subsidiary of the Texas-based independent has been focused more or less entirely on reviving aging fields since it arrived in Alaska. Through three purchases of properties from Marathon Oil Corp., Union Oil Company of California and BP Exploration (Alaska) Inc., as well as some smaller acquisitions, the company has become the dominant operator in Cook Inlet and increasingly important on the North Slope.



The five exploration wells have all been located within or near three units that the company operates in the southern Kenai Peninsula: Ninilchik, Deep Creek and to a lesser extent Nikolaevsk. The wells were attempts to expand into underdeveloped corners of those existing units, or to develop acreage just beyond those unit boundaries. In many cases, the wells allowed the company to avoid losing acreage to automatic contractions.

For those reasons, the line between exploration and development drilling can be less sharp for Hilcorp than for other operators. While the Alaska Oil and Gas Conservation Commission lists five "exploratory" wells for the company, the company listed many more in planning documents. The AOGCC classified the others as "development" wells.

Either way, the two sets of categories tell the same story: of an operator using exploration drilling in a limited and targeted way to expand development around its existing units.

Deep Creek

The current and future exploration activity at the Deep Creek unit is focused on areas outside of the Happy Valley participating area — both geologically and also aerially.

Hilcorp drilled the 2,005-foot Happy Valley B-14 well in July 2012.

The company drilled the well from the existing B-pad at the Deep Creek unit. The well was likely classified as exploratory because it targeted formations shallower than the previously producing formations at the unit. Since then, Hilcorp has drilled the Happy Valley B-15, B-16 and B-17 wells at the unit, all of which were labeled "development."

At the time Hilcorp acquired Deep Creek from Unocal, the state was prepared to contract the unit unless either operator explored outside of the Happy Valley participating area.

By targeting the Sterling formation, the Happy Valley B-14 well met the letter of that requirement, if not the spirit. The state wanted a company to explore the Middle Happy Valley prospect in an area south of the Happy Valley participating area, where previous data from Unocal had suggested

continued on next page

HILCORP *continued from page 68*

the potential of a significant natural gas accumulation.

Over the past few years, Hilcorp has proposed and even permitted portions of a new Happy Valley C Pad and a Middle Happy Valley No. 1 exploration well at Deep Creek.

Both projects have been regularly deferred.

"Hilcorp remains committed to building the road and pad required to drill the Middle Happy Valley well, but cannot commit to drilling this exploratory prospect under the current economic and market climate," Hilcorp wrote in a March 2016 plan of development. Instead of exploration drilling, Hilcorp said it would commission a 2-D seismic survey in the southern end of the unit for the second quarter of 2016.

Ninilchik

The exploration activity at Ninilchik has also focused on areas between existing pads.

The coastal nature of the unit necessitates more pads than an onshore development, because the company is often using directional drilling to reach targets located offshore.

Hilcorp drilled three exploration wells at the Ninilchik unit in late 2013 and early 2014.

Hilcorp completed the 2,618-foot Paxton No. 5 well in November 2013 from the Paxton pad and completed the well as a producer from the Beluga formation on a tract basis.

At the time, the company said that the well could become the basis for future development drilling and also for administrative changes. Specifically, the company proposed a new Susan Dionne/Paxton Beluga participating area. In mid 2014, the AOGCC used the Paxton No. 5 and previous Paxton No. 1 wells to define the Ninilchik Beluga/Tyonek Gas Pool, which the company had applied for earlier in the year. Hilcorp eventually completed three more Paxton development wells in late 2014 and early 2015.

In early 2014, Hilcorp completed the Susan Dionne No. 8 and Frances No. 1 wells. The two wells represented the first oil exploration in the Ninilchik region in several decades.

Although the 12,000-foot Susan Dionne No. 8 well was non-commercial for oil, the company completed the well for gas production from the Tyonek formation in the Susan Dionne participating area and from the Beluga formation on a tract basis within the unit.

The results convinced the company to build a new Bartolowitz pad and drill the Frances No. 1 well. The first Frances well was also non-commercial for oil and promising for gas.

Greystone

In early 2016, Hilcorp began permitting the Greystone No. 1 well from a new drilling pad built on Cook Inlet Region Inc. leases between the Deep Creek and Nikolaevsk units.

The company completed the 13,500-foot deviated well during the second half of the year and has since been producing natural gas from it, according to AOGCC well reports.

The well was the first time the company had drilled outside of its existing units in Alaska, although its proximity to Deep Creek suggests that it is closely connected to unit activity.

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Hilcorp Energy Company

GREAT BEAR *continued from page 67*

The five previous surveys provided Great Bear with more than 1,000 square miles of coverage across its acreage. The company focused on the central section of its leasehold from 2012 to 2015 and has moved farther west and east in its more recent surveys.

At a Resource Development Council meeting in mid-November 2016, Galvin said that Great Bear and its investors had spent about $80 million on exploration and were waiting on tens of millions of dollars from the state in the form of outstanding tax credits.

In early 2017, the state terminated six leases held by a Great Bear subsidiary for failure to pay rent. The leases were located in two clusters and were scheduled to expire in 2025.

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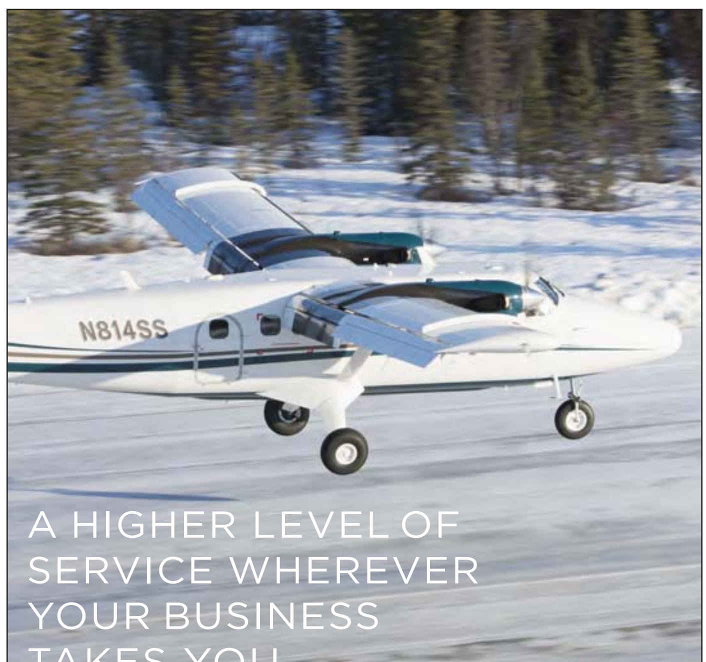

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