



page 6 Gil Mull: celebrating his life & contributions to Alaska geology

## Southcentral utilities make progress in pooling power generation

Southcentral Alaska electric utilities Chugach Electric Association and Matanuska Electric Association have been making significant progress in implementing what is termed a tight power pool, in which the utilities reduce the cost of electricity for their customers by jointly making maximum use of their most efficient power generation units. The ultimate objective is to combine the utilities' service areas into a single load balancing area, in which efficient power generation is shared and continuously balanced against the varying electricity load. In an Oct. 13 presentation to the Regulatory Commission Alaska executives from the two utilities overviewed progress in achieving the tight pool.

A pooling agreement signed in August 2020 went into see **POOLING POWER** page 14

## AOGCC further reduces CIE bond requirement, based on an EPA bond

In an Oct. 20 order the Alaska Oil and Gas Conservation Commission has made a second reduction in plugging and abandonment bonding requirements for Cook Inlet Energy, based on bonding in place with the U.S. Environmental Protection Agency. The bond CIE has with EPA covers P&A of a Class I disposal well under EPA's underground injection control program.

The bonding requirement reduction in this order is based on the bond in place for the UIC Class 1 disposal well at Badami.

The commission said Savant Alaska LLC, the owner and previous operator of the Badami unit, appointed CIE as operator of the unit effective March 1, 2021.

see **CIE BONDING** page 12

## Vision gets good DNR review to operate, own North Fork Pipeline

On Oct. 13, Glacier Oil and Gas received conditional approval from the Alaska Department of Resources' Division of Oil and Gas, State Pipeline Coordinator's Section, to transfer its interest in the North Fork Pipeline right-of-way lease, ADL 230928, to Gardes Holdings company, Vision Resources.



MARK LANDT

Vision was previously approved by the division to assume ownership and operation of the southern Kenai Peninsula North Fork unit. Once Regulatory Commission of Alaska approval has been issued Vision will officially operate the

see **VISION REVIEW** page 12

## Canada sends huge delegations to UN global summits; pledges not met

It has been said that if Canada's noise about tackling climate change was music it would be a big brass band.

Instead, it has become a global laughingstock for showing up at United Nations climate change conferences with overwhelming delegations, while underwhelming the events with its plodding progress towards targets set at previous global summits.

The exact size of the team for Glasgow on Nov. 1-12 has yet to be disclosed, but there is little reason to expect that Canada will show modesty having set benchmark attendances of more than 300 at the 2015 COP24 gathering in Paris and at least 200 at the COP25 assembly in Madrid two years ago.

In contrast, Germany sent a team of 100 to Madrid in 2019, while China confined itself to 76 and the United States to 71.

see **GLOBAL SUMMITS** page 12

### EXPLORATION & PRODUCTION

## Heckuva bunch of work

Under ownership of HEX, Furie worked on all Julius R platform wells & more

By KAY CASHMAN

Petroleum News

On Oct. 15, Furie Operating Alaska LLC, under the ownership of HEX LLC, filed its eighth plan of development for the northern Cook Inlet Kitchen Lights unit with Alaska's Division of Oil and Gas. The eighth POD period runs from Jan. 3, 2022, through Dec. 31, 2022.

Although Furie and HEX CEO John Hendrix told Petroleum News Oct. 19 that Furie will file an addendum to the eighth POD listing more well work that it hopes to do in the unit, Furie did commit to some things in the Oct. 15 filing, as well as describe an appreciable amount of work accomplished so far this year.



JOHN HENDRIX

Furie said it plans to continue efforts ongoing from the seventh POD, which ends Jan. 2, along with evaluating development options for the state leases it won in the June Cook Inlet areawide lease sale. Specifically, Furie will:

- Continue development of proven gas reserves in the KLU. The 2021 well intervention campaign is still in progress; results or new information are coming in almost daily. The specific activities planned for individual wells in 2022 will be determined after the 2021 intervention campaign is complete and sustained production results available.
- Continue efforts to optimize production,

see **FURIE POD** page 15

### FINANCE & ECONOMY

## Hello to upper \$80s

Tight market, draws on inventories drive oil prices to seven-year highs

By STEVE SUTHERLIN

Petroleum News

Alaska North Slope crude closed at \$86.78 per barrel Oct. 20, a gain of \$1.07, while West Texas Intermediate rose 91 cents to close at \$83.87. Brent closed at \$85.82, a gain of 74 cents.

The gains took prices to seven-year highs. For ANS and Brent, it was the second consecutive close above \$85.

Bullishly, U.S. oil demand continued to show strength despite prices above \$80.

U.S. commercial crude oil inventories fell by 431,000 barrels for the week ended Oct. 15, the U.S. Energy Information Administration said on Oct. 20. Analysts that answered a Reuters poll had

*If other countries follow the Japanese pattern, the resulting return of mobility would accelerate demand for motor fuels and return jet fuel usage to pre-pandemic levels.*

expected a build of 1.9 million barrels. At 426.5 million barrels, U.S. crude oil inventories stood at about 6% below the five-year average for this time of year.

Prices have been bolstered by robust draws on global oil inventories, averaging 1.9 million barrels

see **OIL PRICES** page 5

### GREEN ENERGY

## Canada chases green

TC Energy links with Nikola to develop US, Canada hydrogen production plants

By GARY PARK

For Petroleum News

Clean, renewable energy plans are rolling off the design table at a steady rate in Canada, most recently led by a partnership to build and operate large-scale hydrogen hubs in North America and a proposal to embark on a massive expansion of an Alberta petrochemical complex.

The hydrogen initiative is a collaboration by Canadian pipeline operator TC Energy (previously TransCanada) which aims to establish plants near highly travelled truck corridors in Canada and the United States with the objective of achieving net-zero carbon emissions "over time."

The hubs would produce 150 metric tons a day said the partnership of TC Energy and U.S.-based Nikola which plans to have its first "trial" generation of Class 8 fuel cell trucks delivered to five customers later this year.

The two companies plan to co-develop, construct, operate and own large hydrogen production facilities in the two countries, taking advantage of TC's existing pipeline network and storage assets to distribute hydrogen and ship carbon emissions from the hydrogen process to permanent storage sites.

Initially the hydrogen would likely be produced in a liquefied form and transported by truck, then by rail, to fueling stations and to other industrial users,

see **CHASING GREEN** page 13



● EXPLORATION & PRODUCTION

# A new DGGGS exploration data portal

State agency publishes maps and database of all oil and gas exploration wells and their drilling targets in Arctic Alaska

By ALAN BAILEY

For Petroleum News

Alaska's Division of Geological and Geophysical Surveys has published a completed database, with accompanying maps and charts, for all of the exploration drilling that has been conducted offshore and onshore Arctic Alaska over the years. The agency's goal in publishing the database is to provide a window into publicly available oil and gas exploration data. In addition to its data portal, DGGGS, through its Geologic Materials Center, maintains a massive inventory of rock samples, including drilling cores, from exploration activities in Alaska.

DGGGS says that the data in its new database have come from public sources, primarily state and federal well histories, unit decisions by Alaska's Division of Oil and Gas, articles published by Petroleum News, Alaska industry news articles, federal well summary reports and press releases issued by oil and gas lessees. After gather-

ing data from these sources, the authors of the new database assessed the data, conducting additional research as necessary, before documenting the determined well exploration targets. Data for some wells remain confidential under Alaska Oil and Gas Conservation Commission rules.

## Wells categorized

Ultimately, the DGGGS authors categorized 346 wells as having publicly available drilling target information. Drilling targets could be inferred from data such as core and drill stem tests for an additional 161 wells. Well test and oil or gas show data are available for 21 wells. It did not prove possible to determine the exploration targets for 11 wells, despite the availability of public data for these wells. And data remain confidential for eight wells. The authors also identified the discovery well for each oil pool that subsequently went into production. The identification of discovery wells also encompasses a few development wells that had themselves made new dis-

coveries.

In synchronization with Alaska oil and gas resource assessments conducted by the U.S. Geological Survey and the Bureau of Ocean Energy Management (formerly the Minerals Management Service), the DGGGS authors categorized drilling targets into five main play types, plus an "other" category for targets that did not fit into one of these types. The five main types consist of Ellesmerian clastics and carbonates; Jurassic shoreface sands; Cretaceous rift sands; Brookian turbidites; and Brookian topsets. "Other types" include methane hydrate and coalbed methane exploratory wells.

## Ellesmerian clastics and carbonates

The Ellesmerian forms the deepest and oldest of the North Slope petroleum bearing rock sequences and includes the reservoirs for several fields including the giant Prudhoe Bay oil field and the huge Endicott field.

see DATA PORTAL page 4

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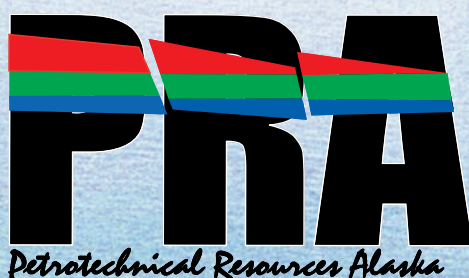
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## LAND & LEASING

### Bidding opens for fall O&G lease sales

The Alaska Division of Oil and Gas said Oct. 15 that bidding has opened for the Department of Natural Resources' fall 2021 oil and gas lease sales.

The bidding is online through EnergyNet Services LLC, with bidder registration and bid submission at the government listings site at [www.energynet.com](http://www.energynet.com).

The fall areawide sales include Beaufort Sea, North Slope and North Slope Foothills.

The division said bidding closes Oct. 28 at 4 p.m. Alaska daylight time.

Assistance accessing sale documents is available by email to [dog.leasing@alaska.gov](mailto:dog.leasing@alaska.gov). The division said EnergyNet offers assistance with bidding at a tollfree number, 1-877-351-4488.

Bidding results will be available to the public online at <http://dog.dnr.alaska.gov> Nov. 3 at 9 a.m.

—PETROLEUM NEWS

## EXPLORATION & PRODUCTION

### Baker Hughes rig count gains 10 to 543

For the week ending Oct. 15, the Baker Hughes U.S. rotary drilling rig count was up by 10 rigs from the preceding week to 543, an increase of 261 from 282 a year ago.

When the count dropped to 244 in mid-August 2020 it was the lowest the domestic rotary rig count has been since the Houston based oilfield services company began issuing weekly U.S. numbers in 1944.

Prior to 2020, the low was 404 rigs in May 2016. The count peaked at 4,530 in 1981.

The count was in the low 790s at the beginning of 2020, where it remained through mid-March, when it began to fall, dropping below what had been the historic low in early May with a count of 374 and continuing to drop through the third week of August 2020 when it gained back 10 rigs.

The Oct. 15 count includes 445 rigs targeting oil, up 12 from the previous week and up 240 from 205 a year ago, with 98 rigs targeting gas, down by one from the previous week and up 24 from 74 a year ago, and no miscellaneous rigs, down from one the previous week and down by three from a year ago.

Thirty-two of the rigs reported Oct. 15 were drilling directional wells, 481 were drilling horizontal wells and 30 were drilling vertical wells.

#### Alaska rig count up by one

Texas (250) had the largest week-over-week gain, up by three.

California (9), Louisiana (47) and Oklahoma (43) were each up by two rigs.

Alaska (6) and West Virginia (11) were both up by one rig.

New Mexico (85) and Ohio (10) were each down by a single rig from the previous week.

Counts in all other states were unchanged, week over week: Colorado (11), North Dakota (22), Pennsylvania (17), Utah (10) and Wyoming (18).

Baker Hughes shows Alaska with six rigs active Oct. 15, up by one from the previous week and up by four from a year ago, when the state's count stood at two.

The rig count in the Permian, the most active basin in the country, was up by one from the previous week at 267 and up by 137 from a count of 130 a year ago.

—KRISTEN NELSON



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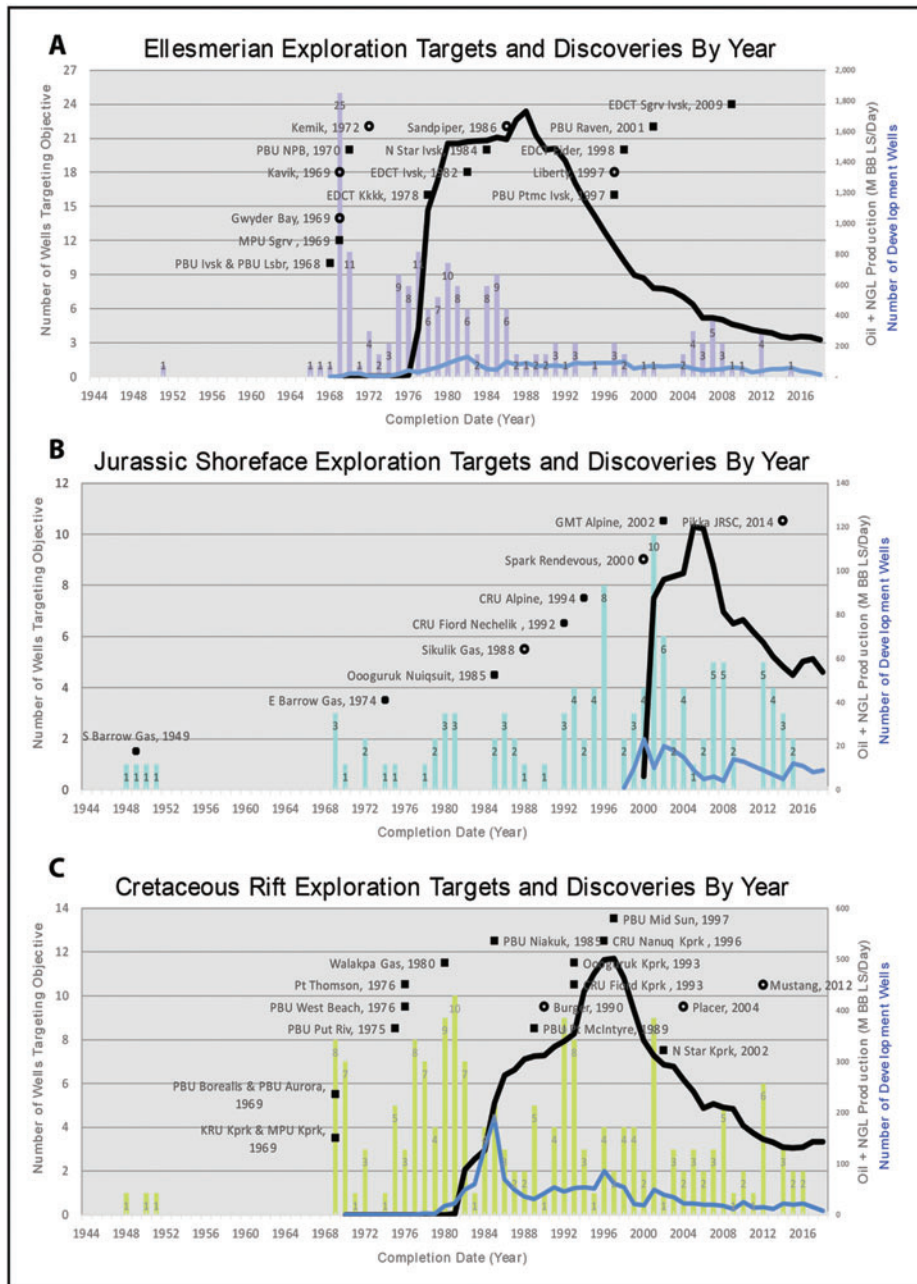
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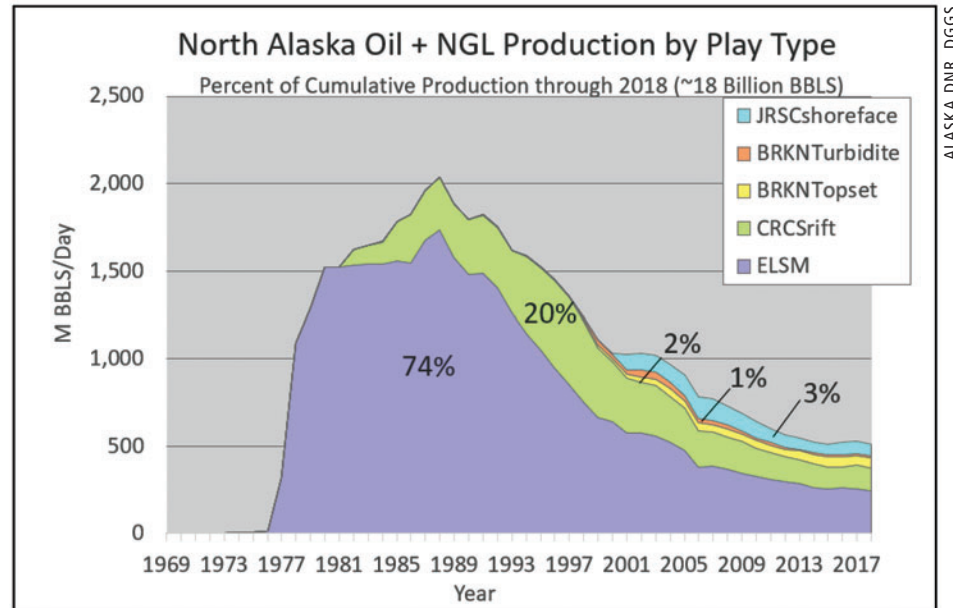
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The drilling and oil production profiles for the major North Slope oil plays. The black lines show annual oil production, the solid blue lines show the annual development well counts, and the vertical lines show the annual exploration well counts. Closed squares show discoveries that have gone into production, while open circles depict undeveloped discoveries.



Oil production from each of the major North Slope oil play types tends to increase rapidly after initial development, before steadily declining. The Ellesmerian play (ELSM) includes the giant Prudhoe Bay field that has dominated North Slope oil production. The Cretaceous rift (CRCSrift) includes the huge Kuparuk River field. The Jurassic shoreface play (JRSCshoreface) includes the Alpine field. Brookian turbidite play (BRKN Turbidite) includes the Badami and Tarn fields. Brookian topset play (BRKN Topset) includes viscous oil production in the central North Slope and recent Nanushuk discoveries.

continued from page 2

## DATA PORTAL

The discovery of the Prudhoe Bay field in 1968 led to major interest in Ellesmerian exploration, with exploration drilling in this play peaking in the mid 1980s. Oil production from the Ellesmerian dominates the total North Slope oil volume produced since the trans-Alaska oil pipeline went into operation in 1977.

### Jurassic and Cretaceous

The Jurassic shoreface facies, which holds the major Alpine oil field in the Colville River Delta region, is found within the Beaufortian rock sequence, above the Ellesmerian. The discovery of the Alpine field in 1994 fueled interest in exploration in Jurassic targets, with this exploration moving west into the northeastern National Petroleum Reserve-Alaska. The Jurassic shoreface facies also formed the target of U.S. military exploration in the 1940s and early 1950s. The facies hosts the South Barrow and East Barrow gas fields, towards the western end of the North Slope.

The Cretaceous rift sands also lie within the Beaufortian sequence and hold the reservoir rocks for the huge Kuparuk River and Milne Point fields, discovered in 1969. The largest number of exploration wells targeting this play were drilled between 1969 and the early 1980s, with development at Kuparuk beginning in 1981. Discoveries in the play are associated with a major geologic structure called the Barrow Arch and encompass a large region, extending from NPR-A to the western border of the Arctic National Wildlife Refuge. Exploration in the play in the late 1980s and 1990s resulted in several discoveries, most notably the Point McIntyre field. Exploration in the early 2000s resulted in some further discoveries. The Burger gas field, discovered offshore in the Chukchi Sea, also has a reservoir associated with this play.

### Brookian plays

The Brookian turbidites are in the

Brookian sequence, the shallowest and youngest of the North Slope petroleum bearing rock sequences. The turbidites consist of thinly layered sands deposited by turbidity currents at the base of an ancient marine basin. Initially explored in the early 1950s, there has been almost continuous interest in this play since the early 1960s, with discoveries in the 1990s leading to the development of the Badami field to the east of the central North Slope, and the Tarn field in the southwestern part of the Kuparuk River unit.

The Brookian topsets, also in the Brookian sequence, were deposited from rivers as large sand bodies on a marine basin edge. In recent years this play has become the focus of major oil discoveries in the Nanushuk formation, including the Pikka discovery to the east of the Colville River Delta and the Willow discovery in the northeastern NPR-A. In the 1940s and early 1950s the U.S. Navy made several minor gas discoveries in this play in the NPR-A and the Brooks Range foothills, while also discovering a sizable oil field at Umiat. The discovery of viscous oil in the West Sak formation near the Beaufort Sea coast led to viscous oil development that has continued to the present day in the West Sak and Schrader Bluff formations. The Nikaichuq field, discovered in 2004, has a reservoir in the Schrader Bluff formation.

### Oil production

Oil production associated with each play type in general follows a profile, in which there is an initial peak some time after initial exploration in the play and shortly after initial development drilling. Production gradually drops thereafter, while exploration and development drilling in the play type continue. The exception to this profile is the Brookian topset play type, where production is still climbing following much development drilling in, for example, the Schrader Bluff and West Sak formations, while Pikka and Willow have yet to be developed. ●

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## OIL PRICES

per day during the first three quarters of 2021, according to the EIA.

Total motor gasoline inventories decreased by 5.4 million barrels for the period to 217.7 million barrels, the lowest level since November, 3% below the five-year average for this time of year, the EIA said.

Hot early trading Oct. 20 was cooled by an announcement by the Chinese government that it wants to combat record high coal prices by ensuring that coal mines operate at full capacity to ease a power shortage, according to an Al Jazeera report. Oil markets have been supported by a global coal and natural gas shortage, which has driven a switch to diesel and fuel oil for power generation.

“Ultimately, China’s coal output needs to increase to remedy its energy woes,” Vivek Dhar, Commonwealth Bank commodities analyst said in a note.

China’s National Development and Reform Commission said it will aim to achieve at least 12 million metric tons per day of output, up more than 1.6 million metric tons from late September.

Oil markets recovered from the Chinese coal announcement later in the trading day.

Markets remain tight, as evidenced by WTI futures contracts in steep backwardation, with later-dated contracts at lower prices than the current contract, according to a Reuters report.

Later months usually trade at a higher price, reflecting the cost of storage. Backwardation prods companies to sell oil immediately rather than store it.

Brent and WTI drifted lower in early trading Oct. 21 as Petroleum News went to press.

*Hot early trading Oct. 20 was cooled by an announcement by the Chinese government that it wants to combat record high coal prices by ensuring that coal mines operate at full capacity to ease a power shortage, according to an Al Jazeera report. Oil markets have been supported by a global coal and natural gas shortage, which has driven a switch to diesel and fuel oil for power generation.*

### Japan COVID levels in freefall

The delta variant seems to have rapidly lost its grip on Japan. For reasons unknown, the country has staged a dramatic turnaround in its COVID-19 cases since highs set in August.

Tokyo reported only 40 cases Oct. 17, the lowest level all year, while Japan reported 429 cases nationwide.

The case counts are a far cry from a spike that followed the Tokyo Olympic Games.

On Aug. 13, Tokyo reported a record 5,773 new cases, according to a report in The Guardian. Nationwide the total exceeded 25,000.

Hospitals were maxed out, and the shortage of beds forced thousands of patients to recuperate or die at home.

Experts contend that Japan’s COVID vaccination levels — 70% of its 126 million residents — explain the improvements in case levels, aided by widespread wearing of masks.

If other countries follow the Japanese pattern, the resulting return of mobility would accelerate demand for motor fuels and return jet fuel usage to pre-pandemic levels.

Commuters have returned to the country’s railways as many companies no longer allow employees to work from home. Leisure travel in the country is recovering.

Bars and restaurants are again serving alcohol, although they will be encouraged to close early until the end of October.

Experts have warned that cases could begin to rise again with colder weather, especially as people mingle in poorly ventilated bars and restaurants during the Bonenkai office party season.

“The end of the emergency doesn’t mean we are 100% free,” Shigeru Omi, Japan chief medical adviser said. “The government should send a clear message to the people that we can only relax gradually.”

### World leaders must avoid politicizing energy

A discussion group at Russian Energy Week in Moscow Oct. 15 warned of the dangers of politicizing energy development. The energy sector needs to become cleaner in a way that does not adversely affect global energy security, it concluded.

“People are not only expecting

improvements in terms of the climate and environment, they also expect their homes to be heated, and to have light,” said Alexander Novak, deputy prime minister of the Russian Federation.

Politicians must collaborate with professionals to develop a balanced approach to energy, he said.

“It is not about making a choice between energy security and the environment — the two issues are not mutually exclusive,” said Prince Abdulaziz bin Salman Al Saud, Saudi Arabia minister of energy.

“We must also not forget about the issue of energy poverty,” he said, adding that billions of people suffer from energy poverty and lack rudimentary access to energy resources.

The group also concluded that a diversity of energy sources is needed.

“We must approach this issue in a rational way and use all forms of resources at our disposal,” said Parviz Shahbazov, minister of energy of the Republic of Azerbaijan. ●

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## A T R I B U T E T O G I L M U L L

### Celebrating the life & contributions of Gil Mull

C.G. "Gil" Mull, who recently passed away, was not only a friend of Petroleum News, but a close friend of mine.

Starting in the mid-1980s, Gil helped me understand the geology he loved most, that of northern Alaska, where he loved to "pound rocks."

Not only did he help map and interpret northern Alaska's geology, but Gil was also a talented photographer and writer who captured much of the history around the discovery and early development of Prudhoe Bay.

He patiently edited many of my articles to make sure they were accurate and understandable to non-geologists.

On a personal note, in more recent years we talked about his eventual death and the hereafter. Our philosophical discussions toward the end had to occur in late morning or early afternoon when he was best able to talk as he fought his battle with a disease that ate away at his ability to communicate the musings and memories of a great mind.

Gil was a man who felt it was important to contribute, which is evident in all that he accomplished in his life, even after his official retirement.

Contained in this section are just a few of the articles Gil wrote or was featured in in Petroleum News.

He will be remembered.



Gil Mull came to Alaska with Richfield Oil Corp. (predecessor to ConocoPhillips Alaska) in 1961 as a well site geologist.

Kay Cashman, founder and publisher  
Petroleum News

# Nominated to spend 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  
Reprint from April 3, 2011 PN*

**I**t 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% 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.

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 Richfield Oil (ARCO) 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

see PRUDHOE CHRISTMAS page 7

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continued from page 6

## PRUDHOE CHRISTMAS

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 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 OK 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



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.

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 (DST) 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 Daily Times.

### Side-track to oil

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 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 Daily Times.

### Mull, Pentilla back on well

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

see PRUDHOE CHRISTMAS page 8

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## PRUDHOE CHRISTMAS

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 7 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 eval-



Prudhoe Bay State No. 1 drill site and winter airstrip, early February 1968.

uation 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.

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 (figure 10), and 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.

### 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.

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. ●

C.G. "GIL" MULL



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# Mapping the North Slope

By ALAN BAILEY & KAY CASHMAN

Reprint from Oct. 28, 2001, PN

Surprisingly, for an area as geological-ly significant as Alaska's North Slope, the only readily available, color, geologic rendition of the entire area is a statewide map made in the 1970s by the U.S. Geological Survey at a scale of 1 inch per 40 miles. Although there are more recent and precise maps of various portions of the North Slope, some are private maps not available to the public and those that are available are a hodge-podge of different scales, styles and geologic interpretations.

Trying to make sense of the North Slope's geology is a difficult exercise, especially for anyone new to the region.

In an attempt to bring order from a certain amount of chaos, a team of specialists from the USGS and the Alaska Division of Oil and Gas is compiling an up-to-date set of geologic maps for the North Slope.

By early 2004, the team expects to have completed maps of a swathe of 15 quadrangles stretching south to north from the northern part of the Brooks Range to the edge of the Arctic coastal plain. From east to west, the project begins at the western edge of the Arctic National Wildlife Refuge and runs across the entire North Slope to the coast of the Chukchi Sea.

According to Gil Mull, veteran Alaska petroleum geologist working for the division on the project, the northern tier of quadrangles from Umiat to the west coast will be released at 1 inch per 4 miles.

"The southern tier of quadrangles will be released at 1:125,000 — 1 inch equals 2 miles — because back close to the mountain front, in what is informally called the disturbed belt, the geology is so chopped up and so complicated that it is really hard to portray at 1 inch per 4 miles," Mull said.

The team's 15 quadrangle maps will eventually be combined with USGS's contemporary Arctic coastal plain (home to Prudhoe Bay and other producing fields) and ANWR maps to make up an overall map of the North Slope. Published at a scale of 1 inch per 16 miles, this map will include everything north of the Brooks Range from the western to the eastern borders of Alaska.

The USGS is providing most of the funding for the effort. The division is contributing Mull's time.

## Mapping has a long history

The USGS first started mapping on the North Slope at the end of the 19th century. However, the establishment of the Naval Petroleum Reserve stimulated particularly intense mapping activity in the 1920s, as well as a flurry of mapping projects from the mid-1940s to 1970s.

"This mapping was carried out by numerous geologists, and thus was published at a variety of scales using evolving stratigraphic nomenclature that changed over time," Mull said.

Between 1963 and 1966 Mull participated in an ARCO project to reconnaissance map a line of quadrangles extending east to west across the middle of the North Slope. He took part in a similar, but more detailed, mapping exercise for Exxon between 1968 and 1972. "We ... (concentrated) mostly on the southern tier of quads and up in ANWR," Mull said.

*"What makes this project inexpensive is Gil's (Mull) 35-plus years mapping. There's no question that he is one of the few active geologists who have mapped, from one side of the state to the other, the Brooks Range foothills for 50 to 60 miles north of the range."*

—Dave Houseknecht, USGS

Beginning in 1975, Mull began participating in USGS mapping projects across the North Slope. He is currently with the state Division of Oil and Gas and the state Division of Geological and Geophysical Surveys.

## The older mapping

The older maps are an excellent basis for a new set of maps," Mull said.

Consequently, the USGS is digitizing many of the older maps as a starting point for its current project.

"We don't want to use the older maps as is because since they were done there have been a lot of changes to the stratigraphy, nomenclature and geologic interpretation," Mull said. "I'm sort of lucky by virtue of the fact that working for these various organizations at one time or another I've seen most of the (geology) from the east end to the west end (of the Slope)," Mull said.

In addition to incorporating new geological work and interpretations, the team is also using maps contributed by a number of sources, including companies working on the North Slope.

"The intent is to produce a modern suite of maps that will have consistent style, consistent nomenclature, consistent structural interpretation and consistent overall interpretation of the geology," Mull said.

Working with Mull are USGS geologists Dave Houseknecht, who spearheaded the project by obtaining the funding, Ken Bird and Tom Moore.

"What makes this project inexpensive is Gil's (Mull) 35-plus years mapping. There's no question that he is one of the few active geologists who have mapped, from one side of the state to the other, the Brooks Range foothills for 50 to 60 miles north of the range," Houseknecht said.

## USGS is digitizing maps

Philip Freeman of the USGS is in charge of the digitization. Having the maps on computer in digital form enables the team to make updates and modifications with relative ease. The maps can be revised electronically, so that whole maps don't have to be redrafted, Mull said.

Publication of the maps will occur progressively, a quadrangle at a time. The team has already revised the Umiat quadrangle. It and the Killik River quadrangle are scheduled for publication sometime this winter.

All quadrangles should be published by the spring of 2003. The more generalized map of the entire North Slope is tentatively slated for completion in early 2004.

The maps will be available to the public both in digital and paper form.

"The big benefit will be particularly to new organizations coming in; where they'll have a consistent nomenclature and maps to start off with," Mull said. ●



Geologist Gil Mull in the summer of 2000 on the top of Kayak Mountain, one of the higher ridges in the foothills fold belt on the north side of the Brooks Range. A number of leases were picked up in this area in the state's areawide lease sale in May 2021.



Geological field camp at north side of Brooks Range near Pump Station 4 on trans-Alaska oil pipeline, summer 2001. This camp was put in for Anadarko Petroleum Corp. and its partners BP Exploration (Alaska) Inc. and Alberta Energy (AEC) by Mike Tolbert's Taiga Ventures. Gil Mull and fellow state of Alaska personnel established their camp next to it.

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COURTESY GIL MULL

C.G. "GIL" MULL



# Veteran geologist Gil Mull retires

*Career of more than 40 years started before discovery of Prudhoe Bay field*

By ALAN BAILEY

*Petroleum News  
Reprint from Nov. 16, 2003, PN*

Veteran geologist Charles G. “Gil” Mull has retired from the Alaska Division of Oil and Gas after working for the state for 22 years. Mull, with his vast knowledge of Alaska geology, has become something of an institution since he first arrived in the state in 1961. He was part of the team that discovered the giant Prudhoe Bay oilfield.

Mull and his wife Yvonne are now moving to Santa Fe, N.M. However, his plans do not include retirement from geology.

“I tell people that I’m not retiring from geology, I’m just moving my files to a different location — I’m retiring from a regular paycheck,” Mull said. “... I just couldn’t see myself in a sun-city sort of thing.”

Mull expects to do Alaska-related geological consulting and will continue working with the U.S. Geological Survey on the preparation of new digital maps of Alaska.

## This little outfit called Richfield

Mull’s eventual connection with Richfield Oil and Alaska came about by chance.

While doing his geology degree, Mull funded his winter skiing by working during the summer as a geological field assistant for oil companies. During the winter he earned his meals by working as a sorority houseboy.

“With summer income and meals supplied during the winter that left me with enough money to spend a lot of time skiing — life was pretty good,” he said.

After doing a summer job in 1956 for Gulf Oil, Mull went to Casper, Wyoming, to scout out a job for the next summer season. While waiting for an interview at one oil company he noticed that there was another company located in the same building.

“Upstairs there was this little outfit called Richfield. I’d never heard of it,” he said. “I thought ‘well, while I’m waiting I’ll go up and talk to this little Richfield outfit’ ... and I got a summer job (with them).” Mull did three successful summer seasons with Richfield in the Rocky Mountains.

## A ‘temporary’ Alaska assignment

In 1958 Richfield started sending field parties up to Alaska as a follow up to the Swanson River discovery. After several unsuccessful attempts at landing a summer job in Alaska, Mull finally found an opportunity to see the Last Frontier after he joined Richfield as a full-time employee in the spring of 1960.

“They said ‘well, we’re sending people up for two years ... if you want to come back we’ll ship you back to the Lower 48,’” Mull said, chuckling as he remembered thinking that two years would be ample time to see Alaska.

He arrived in Alaska in March 1961 and immediately took a liking to his new situation.

“Alyeska ski resort had just opened,” Mull said. “The



Charles G. “Gil” Mull

first time (my colleagues) took me down there ... it was 20 above, there was probably 15, 18 inches of fresh snow and there was probably all of 15 cars in the parking lot.” This seemed a whole lot better than the crowded Aspen scene.

And work proved pretty exciting as well, with plenty of exploration funding for the new oil province.

“We got up here and they said ‘here’s \$20,000 and a helicopter and a floatplane — go pound on rocks,’” Mull said.

During his initial two-year assignment in Alaska, Mull became involved in several projects. His main job involved exploration and well geology around Cape Yakataga on the Gulf of Alaska. In 1962, however, he did some fieldwork on the Alaska Peninsula and in the Kandik basin along the Yukon, near the Canadian border.

“(We) chartered a river boat from Circle and steamed up the Yukon to Eagle,” Mull said. “So, we’d camp on shore and then fly with the helicopter out to adjacent outcrops of rock.”

Mull saw no reason to return to the Lower 48 — life was becoming pretty good.

## Discovery of Prudhoe Bay

In the early ‘60s, there were limits on how much exploration acreage an individual company could lease either north or south of the Alaska Range. With a full quota of leases in the southern part of Alaska, Richfield started picking up leases in the Interior and on the North Slope, Mull said.

“In June of ‘63 they sent a whole bunch of us to the North Slope,” Mull said.

Mull started working with another young geologist name Gar Pessel, doing broad reconnaissance mapping

between Umiat and the Canadian border. After finding some oil seeps, oil sands and oil bearing sandstones, Pessel sent the following note to the district geologist for Richfield: “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!”

Harry Jamison, a manager in Richfield’s Los Angeles office, took decisive action by dispatching a seismic crew to the North Slope for the winter of 1963-64. In the following winter the seismic crew found the subsurface structure of the Prudhoe Bay field.

By the time of the Prudhoe Bay discovery well was drilled in the winter of 1967-68 Richfield Oil had merged with Atlantic Refining, to form Atlantic Richfield, and Humble Oil (predecessor to ExxonMobil), had bought into the leases.

Gil Mull was one of the well geologists at the Prudhoe Bay State No. 1 discovery well drilled in the winter of 1967-68 — he had quit Richfield and joined Humble Oil in May 1967.

## Continuing fieldwork

While seismic surveys and drilling activities moved ahead on the North Slope during the winters, the geologists continued their fieldwork during the summers.

“In ‘68 and ‘69 we were working mainly in the central and western Brooks Range,” Mull said. This phase of fieldwork in the Brooks Range and on the North Slope continued into the early ‘70s. Then in 1974 and 1975 Mull returned to Cape Yakataga, working down the coast to Yakutat, doing reconnaissance mapping in the Chugach Mountains and Mount St. Elias country.

“I spent part of the summer (of 1975) on the North Slope and then, about the end of July, went to McCarthy,” Mull said. “You could have flown anywhere at any time ... with day after day of sunny (weather). (We were) working up around Mount St. Elias and Mount Logan, up on the Bagley Ice field and the Malaspina Glacier — life was tough!”

## Moving to USGS

By this time Exxon had taken over Humble Oil and had plans to centralize its exploration operations out of Houston, Texas. Mull started hearing hints that his boss was going to move him to an office job. On one occasion, after Mull had volunteered to lead another field party, his boss’s words seemed particularly ominous: “You just talked yourself into another field program this summer, didn’t you? You’re going to have to settle down to a desk job one of these days — learn to be an oilman.”

Realizing that this scenario did not fit his game plan, Mull decided to quit Exxon. In the summer of 1975 he joined the U.S. Geological Survey in Menlo Park, California.

When the Naval Petroleum Reserve Alaska became the National Petroleum Reserve-Alaska, the USGS started an NPR-A exploration program and in the spring of 1977 Mull saw an opportunity to return to Alaska.

“I spent three years on the NPR-A operation and also worked for the (USGS) Branch of Alaska Geology,” Mull said. The Branch of Alaska Geology dealt with the whole of Alaska and tended to focus on mining and mineral studies.

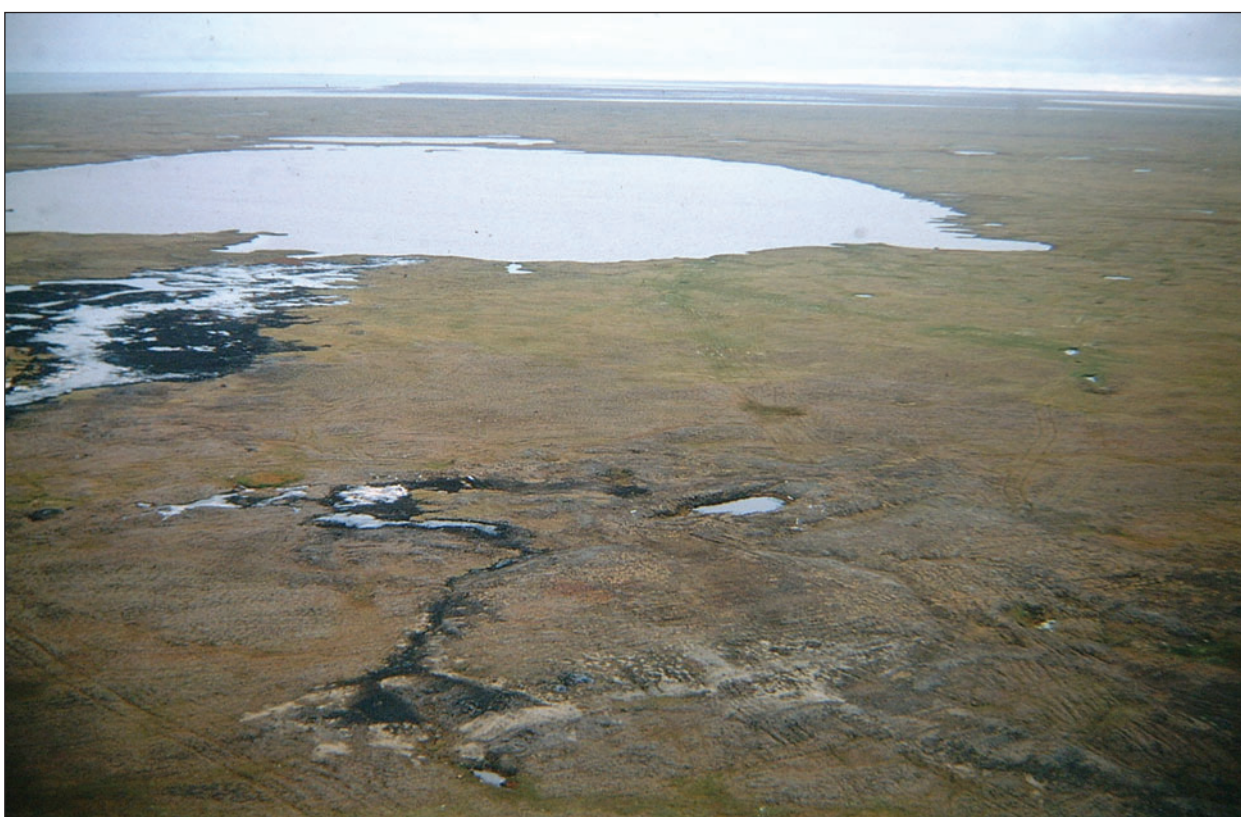
## The Alaska state survey

1980 brought the era of land withdrawals and the beginning of the ANWR controversy. And by 1981 the budgets for the USGS were running down. Mull decided to leave the USGS and join the Alaska Division of Geological and Geophysical Surveys. He worked for the state of Alaska from then until his recent retirement, moving from the DGGs to the Division of Oil and Gas in 2001.

In his years of working for the state, Mull has done fieldwork almost every summer, mainly in the Brooks Range and on the North Slope. A list of more than 60 published reports and maps that he has authored or co-authored attests to his knowledge of Alaska geology; Mull regularly talks about Alaska geology at professional meetings.

Mull feels particularly strongly about the role of the government geological surveys. He thinks that in the past the state of Alaska could have provided more funding for the DGGs to prime the pump for future oil exploration.

“I don’t think that there’s any question the USGS work that had been done (prior to the discovery of Prudhoe Bay)



Natural oil seeps near Cape Simpson, southeast of Barrow, visible for centuries, were first visited by Natives who collected the surface crude for heating fuel. The seeps first sparked the interest of western explorers in the early 20th Century.



# Gil still contributing his expertise

*An old oil target: Nanushuk formation prime drilling objective prior discovery of Prudhoe Bay*

By ALAN BAILEY

For Petroleum News  
Reprint from Jan. 13, 2019, PN

The Nanushuk formation, the rock unit that has become the focus of new major oil discoveries on the North Slope, has acquired a reputation as something of a new kid on the block, a new oil play, overlooked in the past but now the known reservoir for finds such as Pikka and Willow. Apparently, however, the Nanushuk was a prime target of early North Slope exploration, prior to the discovery of the massive Prudhoe Bay field in 1968.

Veteran North Slope geologist Gil Mull explained to Petroleum News that early interest in the Nanushuk emanated from U.S. Navy exploration in the 1940s and 1950s in what is now the National Petroleum Reserve-Alaska, a region underlain by a vast quantity of lower Cretaceous Nanushuk strata. The Nanushuk had been a focus of that Navy exploration, which discovered high quality oil in Nanushuk sands in the Umiat oil field, in what is now the southeastern corner of NPR-A.

Surface outcrop mapping from Umiat found the Nanushuk to become thinner and more fine-grained towards the north and east, an observation that appeared consistent with a theory that the sediments, formed from ancient river deltas, were sourced from the emerging Brook Range to the south, pouring northward into a marine basin, Mull said.

## The Susie well

This particular theory in part underlay the drilling in 1966 and early 1967 by ARCO and Humble Oil & Refining of the Susie No. 1 well, in the more southerly part of the coastal plain, immediately west of the Sagavanirktok River and some distance east of Umiat. The Susie well sought two main targets: the Nanushuk and several hundred feet of shallower and younger medium to coarse-grained sandstone, upper Cretaceous and Tertiary in age, Mull said. A north-south seismic line, shot in the winter of 1963-64 by Richfield (subsequently to merge with Atlantic Refining Co. to form ARCO), had revealed an un-breached anticline in the subsurface near the Susie location, he said. As a

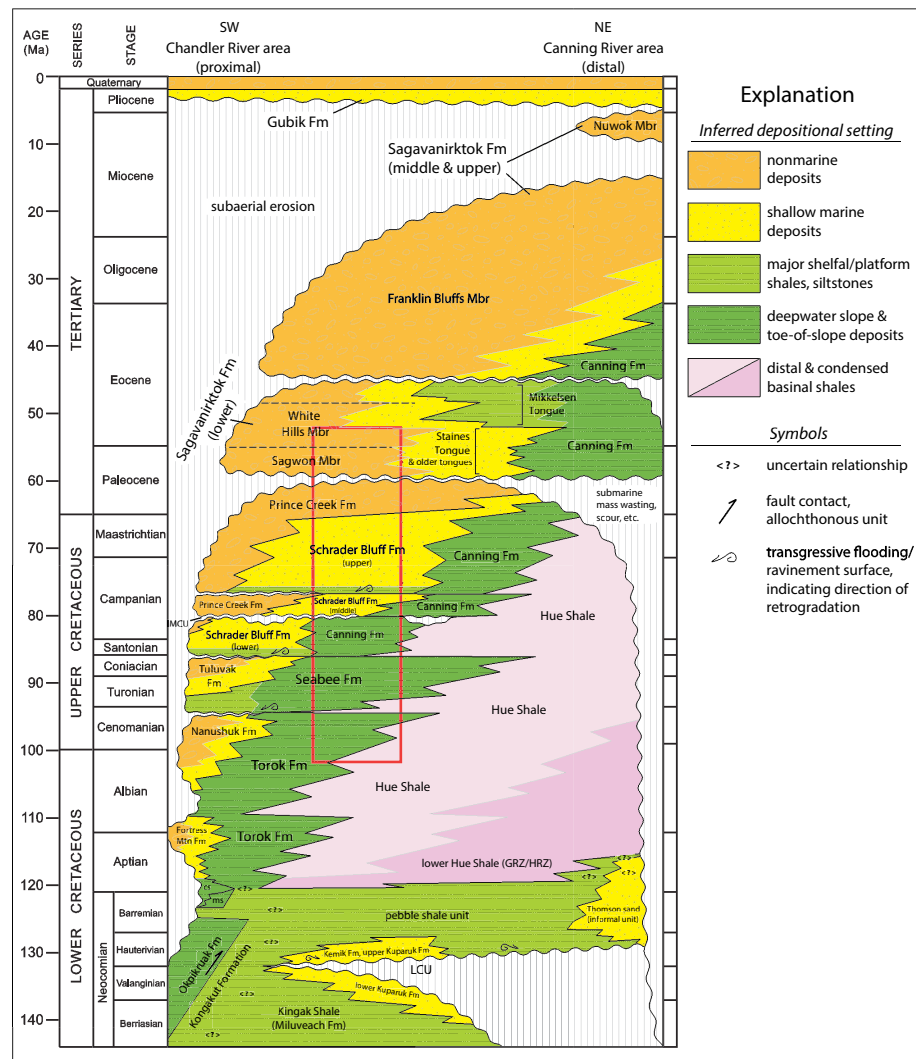


Figure 4. Chronostratigraphic column for the Colville basin, Alaska, revised from Mull and others (2003) and Garrity and others (2005). Abbreviations as follows: Fm = Formation; Mbr = Member; Mtn = Mountain; LCU = Lower Cretaceous unconformity; MCU = mid-Campanian unconformity; cs = Cobblestone sandstone of Fortress Mountain Formation (informal); ms = manganiferous shale unit (informal). The red box approximates stratigraphy exposed in map area.

geologist working for Humble, Mull had sat the Susie well.

Those shallower strata turned out to include sands with good oil shows but no commercial oil pools. However, underneath, instead of Nanushuk sands, came black silty mudstone for thousands of feet. At a depth of 12,900 feet the well encountered the lower Cretaceous Pebble Shale, with the Kemik sandstone appearing at 13,000 feet. These formations are older, and hence should be deeper, than the Nanushuk.

Subsequent exploration and geologic research have revealed the reason for the absence of the Nanushuk in the Susie well. It turns out that the sediments that formed the Nanushuk in the NPR-A actually flowed

in from the west, and not from the south — river delta sands deposited high on the ancient basin margin formed the Nanushuk, while sand and mud layers deposited at the base of the margin formed what is now called the Torok formation. As the basin filled, the basin margin migrated from west to east, eventually coming to a halt to the east of what is now the Colville River. It is now obvious that the Susie well location is some distance east of that ultimate Nanushuk/Torok basin margin — the silty mudstones found where the Nanushuk had been expected were probably deposited far out in the deeper part of the basin.

On the other hand, to the south of Umiat the eastward migrating margin does merge

with a region in which Nanushuk equivalent sediment did flow north from the emerging Brooks Range. Mark Myers, formerly commissioner of the Alaska Department of Natural Resources and director of the U.S. Geological Survey, commented to Petroleum News that the presence of the age-equivalent Fortress Mountain sandstone, deposited northward from the Brooks Range, does indicate Nanushuk potential to the south of the Susie well.

The discovery of the Prudhoe Bay oil field shortly after the drilling of the Susie well caused attention to shift to the coastal region of the central North Slope, and to the reservoir potential of rocks older and deeper than the Nanushuk.

The main reservoir at Prudhoe Bay is in the Triassic Ivishak formation, in what geologists refer to as the Ellesmerian sequence. Subsequently, the Kuparuk River field was discovered, with oil in lower Cretaceous sands in what is referred to as the Beaufortian sequence, above the Ellesmerian. The Nanushuk and Torok are in the Brookian sequence, the youngest and shallowest of the petroleum bearing rock sequences.

Some smaller fields, such as Meltwater, were found in Brookian reservoirs.

## Re-emergence of the Nanushuk

The Nanushuk seems to have been largely forgotten until 2015, when Armstrong Oil & Gas Inc. and Repsol E&P USA Inc., taking a contrarian view of conventional North Slope exploration strategies, made the Pikka discovery to the east of the Colville River delta. Myers, who a number of years earlier had worked as a geologist for ARCO, predecessor company to ConocoPhillips, commented at the time of the discovery that the company had been aware of evidence for oil in the Nanushuk but did not realize the size of the accumulation.

The Pikka discovery, and subsequent finds in the Nanushuk at Horseshoe and Willow, have upended the North Slope oil exploration scene. After many decades, attention has returned to the Nanushuk, the rock formation that was a focus of early exploration on the North Slope. ●

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## MULL RETIRES

... probably advanced industry studies by 20 years,” Mull said, “... industry can take that (framework) and do more detailed studies and do seismic work ... focusing more on what they do.”

And industry tends to move geologists around to different parts of the world to broaden their experience, while the surveys provide a continuity of knowledge a single region.

“The continuity is something that generally the industry does not have ... so that’s one of the real values of the publicly funded surveys — establishing a baseline, establishing a framework,” Mull said.

## Back to the Southwest

So, more than 40 years after first arriving in Alaska, Mull is returning to live in the Southwest. Although he will greatly miss immediate contact with his many colleagues in Alaska, Mull is looking forward to Santa Fe’s full four seasons and flourishing cultural scene.



H.C. “Harry” Jamison is generally regarded as the Richfield Oil Co. executive most responsible for the discovery of the Prudhoe Bay oil field, though he steadfastly maintains that the feat was the best of team efforts.

“It’s a diverse, multicultural community,” Mull said. “There’s a big arts scene ... there’s a diversity of people doing a diversity of things.”

In fact, Mull enjoys music and art, especially ethnic weaving and pottery. His new home will provide ample opportunity to follow up on these interests. He’ll also be able to pick up again on a fascination with archaeology that he developed during his

youth in Colorado.

However, his enduring interest in geology will ensure that he continues to play his part in the Alaska geology scene.

“Geology is a mixture of science and art ... nothing is fixed and determined,” Mull said. “There’s a lot of interpretation and uncertainty.”

Mull just loves to piece together the evidence from the rocks to try to make sense of Mother Nature.

“I guess that’s why I like geology,” Mull said. “It’s an intellectual challenge, combined with all the other good things that you get to do.”

Although the fieldwork can bring its own set of challenges.

“There’s times when you think ‘what the hell am I doing here’ ... you’re on a mountain top and the wind is blowing snow at you or your mountain tent is surrounded by six inches of snow that fell the night before — and it’s July,” Mull said.

But days of clear weather and unparalleled Alaska scenery have made up for that, especially when coupled with piecing together the never-ending puzzle of how the earth evolved. ●



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## VISION REVIEW

pipeline. Gardes received an analysis of the transfer of interest that carried conditions the company must sign off on before approval is final, but Mark Landt, who runs Vision, told Petroleum News Oct. 19 that the company will accept the terms.

“It was what we expected, and fair,” he said. “There were no obligations that we did not expect.”

The North Fork Pipeline was built in the winter of 2011 and consists of dual pipelines and their related facilities. It is unique among pipelines in Alaska in that the majority of it is a glass-fiber reinforced epoxy pipe instead of the stan-

dard steel pipe.

SPCS reviewed the pipeline’s case file for a history of lease compliance, including technical obligations, such as spill reports. No outstanding concerns were found, SPCS said.

As part of its review, SPCS also conducted an aerial and ground surveillance of the pipeline in May.

“Despite heavy public use of the ROW as a transportation corridor for all-terrain vehicles and snow machines, the ROW has been maintained well,” SPCS said.

Based on its review, SPCS said it found no outstanding lease compliance or technical issues with the pipeline and that “Gardes, through Vision, is technically capable of operating, maintaining, and terminating the North Fork Pipeline.”

The division’s Commercial Section conducted a thorough review of Gardes’ financial documents using a five-criteria assessment method for evaluating a lessee’s ability to carry out present and future obligations in the oil and gas sector.

DNR found that “Gardes should have sufficient financial capability to meet the obligations of the ROW lease.”

DNR required several mitigation measures be enacted before the acknowledgement of transfer of interest is issued, such as additional insurance policies, guarantees, and revised bonding.

—KAY CASHMAN

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## GLOBAL SUMMITS

At both Paris and Madrid, Canada became a target for international ridicule after years of declaring lofty goals for shrinking greenhouse gas emissions, then putting itself at risk of missing the 2030 Paris goal by a wide margin.

### Collaborative investigation

In 2016 Canada’s federal, provincial and territorial auditors general launched a collaborative investigation into the country’s progress on climate change action and released their findings in 2018 which detailed a lack of cohesion and implementation, with several of the jurisdictions having failed to even set goals.

The report said Canada was on track to be nearly 20% above the UN targets of lowering GHG emissions to 30% below 2005 levels by 2030. And that did not take into account the federal government’s revised pledge to reduce emissions by 40% to 45% over the next decade.

In response, Canada’s Prime Minister Justin Trudeau, who is leading the delegation to Glasgow, and his environment ministers (Catherine McKenna and now Jonathan Wilkinson) have insisted they were “absolutely committed” to the 2030 target, despite the resolve among Canada’s fossil-fuel producing provinces to fight any federally imposed carbon tax, currently set at C\$100 per metric ton by 2030.

### Newly released study

A newly released study by the Institute for Sustainable Finance at Ontario’s Queen’s University said Canada will need to spend about C\$201 billion to achieve the revised target, almost C\$73 billion more than the institute’s previous estimate.

The findings are based on average historical costs estimated by industrial sectors and calculations that Canada has to cut 1.2 billion metric tons of CO<sub>2</sub> a year from the production of energy sources and equivalent emissions from atmospheric output by energy users by 2030.

Although it is among dozens of countries that pledged to eliminate emissions by 2050, Canada has failed to disclose the details of how it plans to reach that target.

A year ago, while committing to spend hundreds of billions of dollars to keep its economy afloat through COVID-19, the Trudeau administration unveiled a C\$15 billion plan to incentivize reducing emissions through a bundle of new programs and strategies.

Meanwhile, the government had projected a 2% reduction in CO<sub>2</sub> for 2020, when emissions actually edged up by 0.28%.

The Queen’s institute report said that although the rise “may seem trivial, it highlights the difficulty in projecting GHG growth rates and how hard actually reducing emissions is in Canada.”

The institute’s projected spending of C\$201 billion is the most pessimistic among several estimates outlined in

the report.

It assumes the price to cut carbon will remain unchanged until 2030, doubting that even new technologies and efforts to invest in new abatement methods, alongside system changes in consumption behavior, will reduce the amount of capital required to cut emissions.

Report co-author Ryan Riordan said “technology is going to help us a lot, but I don’t think it’s going to cut down the cost dramatically in the next nine years.”

However, he said the C\$201 billion estimate will be only 1.3% of gross domestic product, which “should be pretty easy for us to mobilize.”

The Queen’s co-authors, Riordan and Simon Martin, said Canada has to spend double that of other developed nations relative to GDP to meet its goal, with Alberta needing to fork over C\$68 billion in the process.

The report estimates transportation faces the highest cost of about C\$86 billion to eliminate 305 million metric tons of CO<sub>2</sub> this decade, while the oil and natural gas industries would face a cost of C\$39.5 billion to cut carbon by 314 million mt.

Whether Glasgow will be the turning-point experts insist is vital and whether Canada will be an active participant will be the test of the 12-day summit.

—GARY PARK

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## CIE BONDING

CIE and Savant are Glacier Oil & Gas companies.

CIE applied to the commission on Aug. 12, 2021, for a reduction in bonding due to the bonding in place with EPA to cover P&A of the Class 1 disposal well at Badami.

Under the commission’s new bonding

requirements, based on the number of permitted wellheads a company has, CIE with wells 29 fell within the 21-40 well tier, equating to a \$6 million bonding requirement. Even if the three UIC Class 1 disposal wells, the Badami well and two in Cook Inlet, are dropped from the company’s well count, that count still falls in the 21-40 well category, the commission said.

CIE had a \$200,000 bond in place with the commission, meeting the earlier

bonding requirement for all of a company’s wells.

### Previous reduction

In 2020 the commission reduced CIE’s bonding requirement under the new regulations based on a \$324,000 bond the company has with EPA, dedicated to P&A of the West McArthur River unit 4D and Redoubt unit D1 disposal wells.

The commission denied a request to

reduce bonding because of a dismantlement, removal and restoration bond CIE has with the Department of Natural Resources, saying of the \$500,000 DR&R bond that there is no evidence “that any of the DNR bond is exclusively dedicated to the costs to properly P&A CIE’s wells.”

In its 2021 order the commission said it requested more detailed information on actual cost to P&A the UIC Class 1 disposal well at Badami.

CIE submitted a third-party P&A cost estimate to P&A the Badami disposal well, and the commission said it “has determined that the \$470,000 average well abandonment cost is reasonable and would be reflective of the actual cost to P&A the UIC Class 1 disposal well at Badami,” and has determined that CIE’s total bonding “should be reduced by an additional \$470,000 on top of the \$324,000 reduction approved” in the 2020 order.

CIE currently has an active bond with AOGCC of \$2,690,000, the commission said, and less the \$794,000 EPA bonding in place, the remaining bonding obligation is \$2,516,000.

The commission said the company has five installments remaining to increase its bonding to the total obligation of \$5,206,000. The next four installments would be a minimum of \$504,000, the commission said, with the fifth and final installment \$500,000. Installments are due by Aug. 16 of each year starting in 2022 and running through 2026, the commission said.

—KRISTEN NELSON

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## CHASING GREEN

said Pablo Koziner, Nikola's president of energy.

Nikola signed a deal in September with Germany's Bosch Group to build fuel-cell power modules at the U.S. vehicle maker's facility in Arizona.

It aims to design and manufacture zero-emission battery-electric and hydrogen-electric vehicles, electric vehicle-drive trains and components.

Nikola's shares have dropped from a peak of US\$65.90 in mid-2020 to about C\$10.70 after U.S. federal prosecutors unveiled a criminal indictment of the company's founder and former chief executive officer Trevor Milton, alleging he made false statements about the company's technology and prospects.

### Dow Chemical ethane cracker

The second major undertaking involves a venture by Dow Chemical that some experts believe will cost up to C\$10 billion, marking the largest capital investment in Alberta in 15 years.

Dow aims to build an ethane cracker with capacity of 1.8 million metric tons a year at its complex near Edmonton, while achieving a three-fold boost to its ethylene and polyethylene output.

The cracker, which is the first step in transforming ethane into plastics products, would drive up natural gas demand in Alberta by 200 million to 400 million cubic feet per day, said Calgary-based consultancy Inccorrs.

At the same time, Michigan-based Dow said it intends to retrofit its natural gas-to-plastics complex by capturing the facility's gases and pumping them into an existing carbon capture pipeline.

Dow said its hopes the new venture will achieve its targeted volumes by 2030, allowing it to produce about 3.2 million mt of low- or zero-carbon ethylene for its customers.

Ethylene gas, which is derived from oil or natural gas, is

*Kennedy's government and its predecessor New Democratic Party administration have tried for years to attract additional petrochemical investment through tax incentives, including a 12% rebate on capital costs as part of an economic diversification push away from purely upstream oil and gas investment.*

transformed into a range of chemical compounds for use in food packaging, anti-freeze vinyl and medical devices.

"This investment builds on Dow's strong leadership position and allows us to meet the increasing needs of customers and brand owners seeking to lower the carbon footprint of their products," said Dow chairman Jim Fitterling.

If the project gets the final go-ahead from Dow's board, the company expects to allocate about C1 billion a year of capital spending to the project.

### Alberta goal to attract petrochem dollars

Alberta Premier Jason Kenney said that by choosing Alberta as its initial base for a net-zero emissions ethylene plant Dow "is highlighting our growing global leadership in emissions-reducing technology like carbon capture, storage and utilization."

Kennedy's government and its predecessor New Democratic Party administration have tried for years to attract additional petrochemical investment through tax incentives, including a 12% rebate on capital costs as part of an economic diversification push away from purely upstream oil and gas investment.

But Alberta's Associate Minister of Natural Gas Dale Nally declined to disclose what incentives were offered to Dow.

However, he said the province has received additional submissions for petrochemical projects.

"Our goal is to take the petrochemical industry and

increase it by C\$30 billion by 2030. (The Dow plan) is a giant step forward in this direction," he said.

Fitterling said Alberta is "clearly a first mover" in carbon capture through its capture infrastructure and pipeline, along with government incentives and Canada's carbon tax.

"In Canada right now, you have a C\$40 per metric ton price on carbon. It's going to more than C\$100 in the time frame that we're talking about for this investment and the carbon trunk line is in place," he said.

Fitterling said his company supports a "market-based price" on carbon in the United States that would lead to similar investments in the U.S.

### Other plans announced

In the last month, two other eco-friendly plans have been announced:

- ATCO Group says it will build two solar installations in Calgary with capacity to power more than 18,000 homes that will cover a site equal to 170 football fields. The company hopes to start construction early in 2022 and have the solar panels operating before the end of 2022. The locations are former industrial sites that have limited other options. ATCO has already completed two solar projects in Canada's North and more are planned for Mexico, Chile and Australia.

- Pacific Cambrian Energy is gearing up to put an environmental stamp on the natural gas it produces to distinguish its molecules from those of its more carbon intensive rivals. The company has just undergone a third-party audit by New York-based Equitable Origin which granted Pacific Cambrian a sustainability certificate for responsible energy development. Pacific Cambrian has spent more than C\$100 million investing in water recycling initiatives since 2008 and has tried to eliminate the use of diesel at its natural gas plant by using flue gas and diverting waste heat for energy. ●

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## Oil Patch Bits



### Lynden Air Cargo completes campaign in Afghanistan

As reported by Lynden News Oct. 15, Lynden Air Cargo completed its campaign in Afghanistan in June after flying six flights and over 68 flight hours for the U.S. military. "We operated out of Bahrain for just under a month providing scheduled service and hauling Cargo Returning West out of Bagram, twice a week," says Flight Engineer Mike Schuler. One Lynden crew was dedicated to Afghanistan flights while other crews served

Kuwait, Qatar, Jordan and Saudi Arabia. "The June Afghanistan campaign was a short one compared to the ongoing services we are providing around Kuwait," Mike explains. "No day was the same. We adapted and performed in true Lynden Air Cargo fashion despite changing and often challenging circumstances."

"This was a volunteer campaign, and we really appreciate all the crew members who accepted this duty," says Michelle Fabry, director of safety. "The security situation required good communication with the crew prior to every flight to ensure each mission could be safely operated. They did an excellent job."



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## POOLING POWER

effect with the start of tight pooling on April 30, 2021, Mark Fouts, Chugach Electric vice president for fuel and corporate planning, told the commission. The pooling arrangements are now in a one-year transition phase, with full implementation of the single load balancing area scheduled for completion by April 30, 2022, Fouts said. Savings for each utility from the pooling arrangements up to the end of September have amounted to around \$740,000.

### Use of most efficient power generation

The general concept is to make maximum use of the most efficient power generation plants. In Anchorage these consist of two state-of-the-art combined cycle gas fired power stations operated by Chugach Electric: the Southcentral Power Project and Plant 2A. To the north of Anchorage MEA operates the modern Eklutna Generation Station. The two combined cycle plants work most efficiently when operating at maximum capacity. MEA's EGS plant uses an array of gas-fueled reciprocating engines, an arrangement that enables the rapid ramping up and down of power output, to follow variations in power demand or power output from other generation facilities.

Both utilities also make significant use of hydropower, primarily from the Eklutna hydroelectric power plant, north of Anchorage, and the Bradley Lake hydroelectric power plant in the southern Kenai Peninsula. The hydropower, while relatively cheap, is subject to supply limitations related to the amount of water available in the hydro reservoirs.

### Several complications

A complication in utility power pooling is the need to regulate the power supplies in response to the varying electricity load, to ensure that the voltage and frequency of the supplied power remains within required limits. In addition, the utilities need to retain what are referred to as "spinning reserves," as contingency generation should there be an unplanned interruption in output from one of the scheduled power generation plants.

The utilities also need to be able to regulate "non-dispatchable" generation resources, in particular wind and solar, which are subject to the intermittent nature of wind and solar resources.

Another complication arises from the procedures whereby either Chugach Electric or MEA can make what are called "economy energy sales" to Fairbanks based Golden Valley Electric Association. Essentially, GVEA can sometimes purchase power at attractive rates from Southcentral, for delivery to Fairbanks over the Railbelt electricity transmission system.

In addition to all of this, it is necessary to maintain an acceptable procedure for distributing the cost and benefit of the shared electricity generation between the two utilities.

Given all of the various complications, the two utilities have hired subject matter and project management experts to help develop the power pool program. Eight working committees, overseen by an operating committee, build and operate the required procedures. An executive committee from the two utilities makes policy decisions.

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*For the period April through September, preliminary results, using procedures as they currently stand, indicate that total fuel cost savings from the tight pool amounted to \$985,000.*

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### Operating procedures

Ed Jenkin, MEA chief operations officer, told the RCA that at this stage of the tight pool transition the utilities try to run the two combined cycle gas-fired generation plants at full capacity, while bringing generation units within the EGS facility online as required to meet demand, subject to a limitation that a minimum of three generation units in the EGS system must be in operation. The two utilities share the output from the three gas-fired plants, while each utility separately schedules the required gas supplies necessary to meet its generation needs.

"By operating in this way we do manage to avoid starting less efficient peaking units and provide a general dispatch that is more efficient and burns less gas for the combined pool," Jenkin said.

Hydropower will become fully part of the tight pool arrangement by the end of the transition period. However, at present the hydro resources are combined for the benefit of the power pool, but with each utility setting its own targets for hydro production.

Similarly, the incorporation of spinning reserves and power supply regulation into the pooling arrangements is a work in progress, to be completed by the end of the pooling transition period. Some spinning reserves are maintained at the hydro facilities, and some in gas-fired power stations.

### A single scheduling service

The operation of a tight pool clearly requires a single power scheduling service, rather than having each utility conduct its own scheduling, as in the past. During the tight pool transition period, Chugach Electric is conducting the joint scheduling, although this is expected to transition to MEA once the single load balancing area is in full operation.

Jenkin explained how the scheduling procedure operates. Each day the scheduling service develops a draft power generation schedule for the following day, based on the anticipated electricity load profile for the day. The objective is to provide the greatest value for the electricity consumers, with each utility reviewing the dispatch schedule before it goes into operation.

GVEA can request and agree economy on energy sales from either utility independently. The requirements of any agreed sales are incorporated into the generation schedule — if the resulting schedule causes any degradation in the efficiency of the pooled power generation, the utility selling the power must hold the other utility harmless while also factoring the efficiency impact into the economy energy sales price.

Obviously the actual electricity loads during the course of a day will differ to some extent from the loads anticipated in the planned generation schedule. Jenkin said that, although the utilities may be able to accommodate these differences using any available capacity in online generation units, they tend to manage load deviations using hydro resources. The objective is to con-

form to the planned power generation unit commitment as closely as possible, he said.

Jenkin presented data that demonstrated the operation of the tight pool arrangements, as they have been implemented to date. On Oct. 7, for example, all generation units at Southcentral Power Project and Plant 2A were in full operation for the full 24-hour period. EGS output increased in the morning, as the regional electricity load increased, dropping lower again in the late evening. Hydropower from Bradley Lake and Eklutna continued throughout.

### The accounting procedure

Fouts then described the accounting procedure for the power generation, and for calculating the power generation cost savings from the tight pool. The daily savings from the pooled operations are calculated by running a model for determining the amount of fuel each utility would have used if operating independently, and then running the model for the joint dispatch arrangements. The difference in the fuel costs represents the cost savings from the power pooling for the day. The savings are equally split between the utilities. A settlement committee completes the settlement process by close of business on the following day, with an operating committee approving a monthly settlement used in billing each utility for the month. The billing process also includes a procedure for each utility to reimburse the other utility for its share of the operation and maintenance costs for each utility's power generation equipment.

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*Ed Jenkin, MEA chief operations officer, told the RCA that at this stage of the tight pool transition the utilities try to run the two combined cycle gas-fired generation plants at full capacity, while bringing generation units within the EGS facility online as required to meet demand, subject to a limitation that a minimum of three generation units in the EGS system must be in operation.*

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### Significant benefits

For the period April through September, preliminary results, using procedures as they currently stand, indicate that total fuel cost savings from the tight pool amounted to \$985,000. Operations and maintenance savings resulting from each utility's partial use of the other utility's generation equipment totaled nearly \$500,000. The sum of these savings divided equally between the two utilities resulted in that total value of about \$740,000 for each utility.

Jenkin said that next steps to be taken during the tight pool transition period include the implementation of more comprehensive scheduling software and the development of methodologies for transacting spinning reserves and power regulation. Hydropower will become part of the tight power pool. The utilities also need to develop auditing procedures for the power pool.

—ALAN BAILEY

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## FURIE POD

enhance safety and minimize environmental footprint of KLU related infrastructure.

- Continue progress on establishing a participating area along with a possible unit expansion.

- Evaluate drilling of additional wells on existing lease acreage and new acreage acquired in the state's June 2021 Cook Inlet areawide lease sale.

"At this time we are trying to bring all wells back online," Hendrix told PN, noting KLU A-1 is giving them some difficulties.

### Work for seventh POD period

In its review of work promised for the seventh POD period of July 1, 2020, through Jan. 2, 2022, Furie said that under the new ownership of HEX it would do the following, noting in the eighth POD if it had met commitments:

- Met — Continue development of proven gas reserves in the KLU.

- Met — Continue and increase production of natural gas on the Julius R. platform.

- Met — Continue exploration of the KLU, including the new analysis of seismic data and offset wells to identify specific targets for exploration outside of the Corsair Block.

- In progress — Update joint operating agreement to reflect the realities of operating in Cook Inlet.

### A load of work

In support of the seventh POD Furie said all four wells on the Julius R. platform have had one or more downhole interventions completed, or intervention work is in progress to continue development and increase production from the KLU, specifically:

- Well KLU A-1 had dozens of feet of fill bailed from the tubing to allow access for reperforations and additional perforations in the Beluga interval. The perforations were successfully executed. The well was incapable of sustained flow during the initial post intervention startup attempt. Further diagnostics were performed and another attempt to initiate flow is in progress. (The old Furie, prior to HEX's ownership, had never produced this well from the Beluga formation.)

- Well KLU A-2 had additional perforations added in the Beluga interval.

- Well KLU 3 had two sliding sleeves shifted to the open position to allow additional Beluga formation production.

- Well KLU A-4 had never produced from the Beluga formation due to a plug in the tailpipe with several feet of solids above it, along with multiple wireline tool strings and wireline in the well. The tubing tailpipe was perforated above the fish to allow production from the Beluga.

- Well KLU A-4 also had a wireline tool string fish retrieved from the well, several dozen feet of slickline recovered, and several dozen feet of solids bailed out of the tubing tailpipe. Bailing and fishing efforts are ongoing. The objective is to allow access to the liner below the tailpipe for additional Beluga perforations.

- A produced water handling system was installed primarily for the Sterling formation, and appropriate permits obtained to allow production of gas zones with higher water content. This may result in increased gas recovery once the formation is brought on production.

- A detailed assessment of the KLU area and adjacent acreage was completed and led to Furie being the high bidder on adjoining leases at the June 2021 lease sale.



The Julius R platform offshore in the Cook Inlet produces gas from the Kitchen Lights field.

- An amendment to the joint operating agreement was submitted to the working interest owners. No agreement has been reached regarding this amendment.

### Division's modifications

The division approved the seventh POD with modifications on Nov. 13, 2020. The modifications imposed conditions on Furie that included completing its existing participating area applications or submitting a new PA application on or before Dec. 31, 2020. Furie said in its eighth POD that it continues to evaluate available data to submit a draft PA application for review.

In an August 2021 meeting with the division, agency staff suggested that Furie consider unit expansion prior to finalizing the draft PA application.

Another modification called for Furie providing a technical presentation to the division by July 1, 2021, detailing with specificity the progress made on the subsurface description of the KLU along with any other activities undertaken by Furie related to further development of the KLU and exploration activities.

Furie said its personnel spent much of the first half of 2021 analyzing all available data in preparation for the June Cook Inlet lease sale. Due to confidentiality concerns prior to the sale, the company told the division that it "preferred not to provide specificity regarding progress on the subsurface description."

During its August 2021 meeting with the division Furie offered to provide a technical presentation at its Anchorage

office for division personnel. This presentation has not yet been scheduled, but there are ongoing conversations between the agency and Furie.

### KLU development opportunities

"If a number of obstacles are reduced Furie believes there is potential development opportunity within the Kitchen Lights unit and adjacent acreage to provide clean, reliable energy for Alaskan residents for many years. Furie's participation in the June 2021 Cook Inlet lease sale provides clear evidence of this premise," Hendrix told the division and PN.

The company's high bids at that lease sale totaled \$325,605.23.

"Unfortunately, enthusiasm for development must be tempered with the reality of the unfavorable economic climate in the state of Alaska," Hendrix told PN and

expressed in his remarks to the division "The delay in paying earned tax credits and excessive tax valuation of the KLU infrastructure are a couple of examples that conspire to limit both internal and external capital availability for development," he said.

The previous owners of the Kitchen Lights assets are still owed \$103 million by the state of Alaska for tax credits that will flow through a HEX company to them (and if the state doesn't pay the \$103 million by 2025, HEX is on the hook to pay an additional \$15 million to the previous owners).

Furthermore, the Alaska Department of Revenue imposed a property tax on the fixed assets and related infrastructure of Kitchen Lights, assessing its value at \$81.2 million, even though its value in bankruptcy court was the \$5 million paid by HEX.

That DOR assessment earned Furie a \$1.6 million tax bill, which Hendrix told PN was "unfair and excessive." It was money that should be allocated for well work, he said.

The Covid 19 pandemic has also had "significant impacts on KLU activity over the last year and may continue into 2022," Hendrix told the division in his concluding remarks.

"I took a gamble on buying Kitchen Lights; I know that. But I figured I should be able to trust my state government to treat me fairly," he told PN. "Obviously, that's not what's happening at this time. The state agencies need to quit operating in silos and start cooperating and working with each other."

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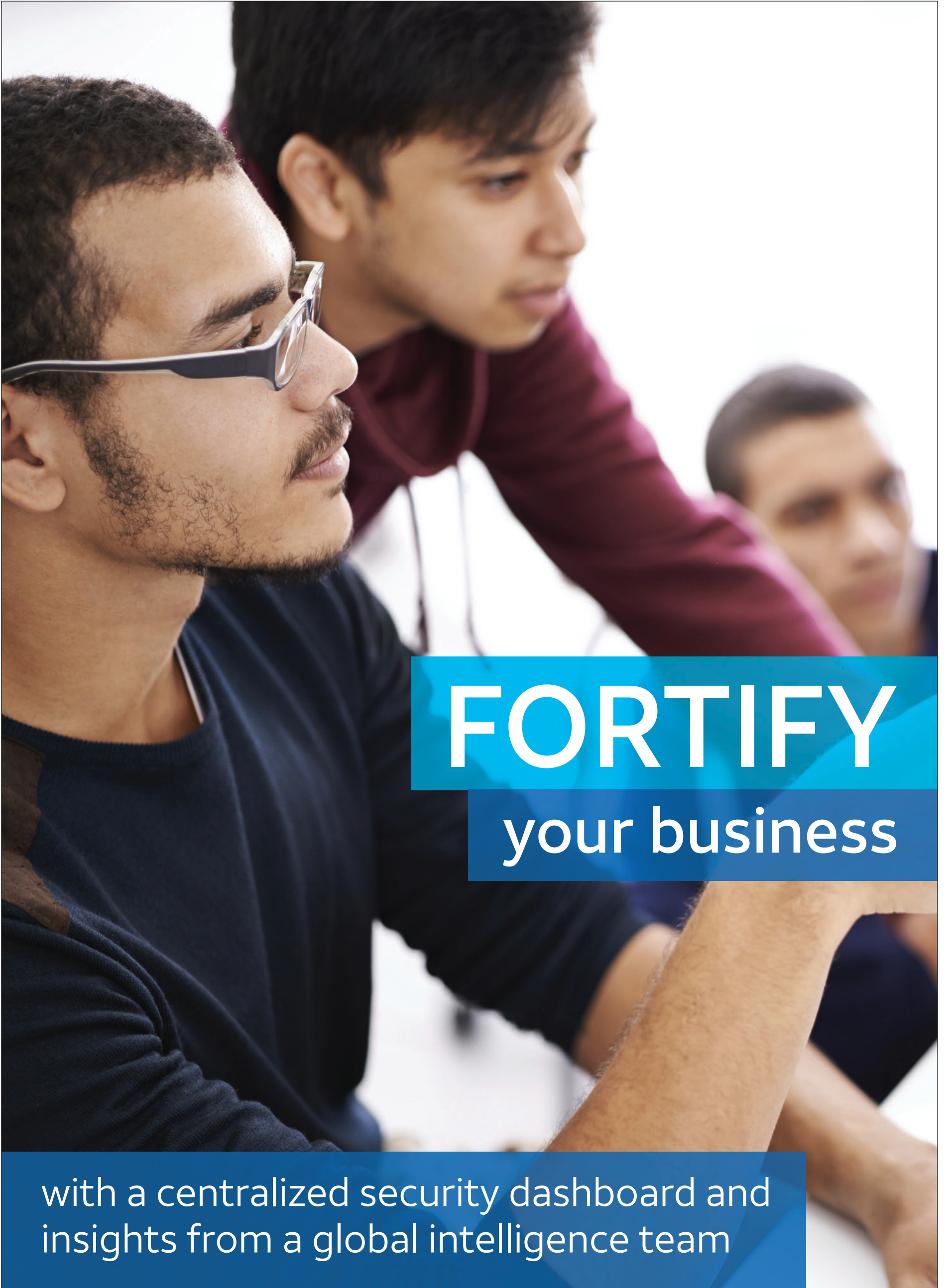
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