

**EXTRA!**

# BP in Alaska



*Celebrating 50 years in The Last Frontier*



Geologists were the true pioneers of Alaska's oil exploration efforts in the late 1950's and early 1960's.

*BP in Alaska: Half a century gone by, half a century to go ...*

BY FRANK BAKER  
*For Petroleum News*

This year as BP observes its 100-year milestone as a company, one of its upstream business units, BP Alaska, also has cause to celebrate, as the company opened its first office in Alaska in 1959. For half a century BP has remained one of the state's leading investors, private employers, energy producers, corporate taxpayers and corporate citizens.

Arriving in the state in 1960, BP's geologists and geophysicists were among the first explorers in search of oil and gas on Alaska's remote North Slope. Atlantic Richfield (ARCO) was also exploring the North Slope, and its early drilling efforts led to the 1968 discovery of North America's largest oil field — Prudhoe Bay.

BP and its partners then embarked on one of the most ambitious and costly projects in America's history: developing the super-giant oil field and constructing an 800-mile pipeline to transport that oil to tanker ships and ultimately, to an energy-hungry nation.

National attention was focused on Alaska on June 20, 1977, as the trans-Alaska pipeline received its first oil. Prudhoe Bay production reached its plateau rate of 1.5 million barrels per day in 1981 and began its natural decline in 1989. More than 15 billion barrels of oil have been produced from the North Slope. Of that, more than 11 billion barrels has come from the Prudhoe Bay field alone. And today, with advancements in oil field technology, BP believes another 2-3 billion barrels can be recovered.

*see page A8 HALF A CENTURY*

## North to Alaska

*BP's trail to Prudhoe Bay: Opened office in 1959, geologists arrived in 1960*

BY FRANK BAKER  
*For Petroleum News*

Alaska was first mentioned within BP in a 1952 world survey of oil prospects compiled by the company's exploration department in London. The north of Alaska was included because of oil and gas discoveries made there by the U.S. Geological Survey, which drilled exploratory wells there in the 1920s, during World War II, and in post war years. The primary mission of that drilling was to find strategic fuel reserves for the U.S. Navy. The finds were small, but the 100,000-square-mile plain of frozen tundra sloping down from the Brooks Range to the Arctic Ocean clearly contained several big geological structures of the kind BP was familiar with in the Middle East.



Helicopters were vital during BP's early field geological surveys.

But the North Slope was only one of many prospects around the world. The harsh conditions there, as well as a shortage of dollars, pushed Alaska exploration to the bottom of the list.

In the middle of 1957, however, a small company named Richfield Oil struck oil at

Swanson River on the Kenai Peninsula south of Anchorage, sparking an exploration boom. While most oil companies focused on this area, BP's interest in the North Slope grew after its chief geologist, Peter Cox, reconnoitered the area and reported: "There is a similarity between the foothills of the Brooks Range and the Zagros mountains in Iran. The North Slope contains a wealth of drillable anticlines on the Iranian scale, with lengths in the order of 20 miles."

In 1958, BP teamed up with Sinclair, an established U.S. oil marketer and refiner. Sinclair promised to serve as a major outlet in the United States for BP's great quantities of Middle East crude oil. Sinclair also had some experience in

*see page A12 NORTH TO ALASKA*

## Bidding around the edges

*BP attains strong lease position, waits on neighbors, drills to confirm Prudhoe discovery*

BY FRANK BAKER  
*For Petroleum News*

In 1964 the first state land at Prudhoe Bay was put up for auction. By that time, other oil companies were beginning to take more interest in BP's lonely quest.

Disheartened by the failures in the Brooks Range, Sinclair opted out of the sale, which proved to be a fateful decision.

Short of dollars, BP decided it could not compete with American companies for expensive leases in the center of the structure. Instead, it gambled on the striking similarity of the Prudhoe Bay structure to

its discovery in Iran — where the oil-bearing rocks had proved to be thicker and more prolific around the edges.

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

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

BP acquired more acreage along the flanks in 1967.



*see page A10 BIDDING* BP confirmation well

## Alaska's 1969 windfall

*Prudhoe Bay discovery attracts bidders from around world to lease sale auction*

BY FRANK BAKER  
*For Petroleum News*

The size of the Prudhoe Bay field attracted worldwide attention, and this translated into an enormous level of interest. By the time the sale rolled around on Sept. 1, 1969, the Anchorage airport was home to at least a dozen corporate aircraft and the city's hotels were bustling. Companies went to extraordinary lengths to maintain secrecy. All of the major U.S. companies were, if not participating, at least represented along with many independents.

Charles Towill, one of BP's first public affairs representatives in the U.S., recalls employing a resourceful communications method to relay sale information to BP management.

"At the time of the September 1969 Prudhoe Bay lease sale, Anchorage was a community of 125,000, almost half of the state's total population," says Towill. "There was no satellite link, so TV programs, including news, were sent up in cassette form from Seattle — making everything a day late. I was running public relations for BP in New York at the time, but was paying my first visit to Alaska when the lease sale occurred.



The Anchorage times bannered the 1969 Prudhoe Bay lease sale.

"Because of communications difficulties, BP's office in New York had no means of following the lease sale bidding, which was only broadcast on local (Anchorage) TV. To overcome this, I set up an open telephone link from Anchorage to New York from a room in a local hotel, and relayed the bids I was seeing on TV. This worked well and New York immediately passed the bidding results to BP corporate headquarters in London."

*see page A8 WINDFALL*

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Historic photo of BP's Northstar Island under construction in the Beaufort Sea.

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# Contents



### ON THE COVER

#### North to Alaska

*BP's trail to Prudhoe Bay: Opened office in 1959, geologists arrived in 1960*

#### Bidding around the edges

*Attains strong lease position, waits on neighbors, drills to confirm Prudhoe discovery*

#### Alaska's 1969 windfall

*Prudhoe Bay discovery attracts bidders from around world to lease sale auction*

**BP in Alaska:** *Half a century gone by, half a century to go ...*

### INSIDE SECTION A

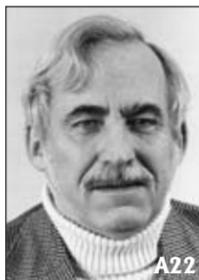
**A9** *Chronology of BP Exploration (Alaska) Presidents*

**A18** *BP's early history: Company's origins go back 100 years*

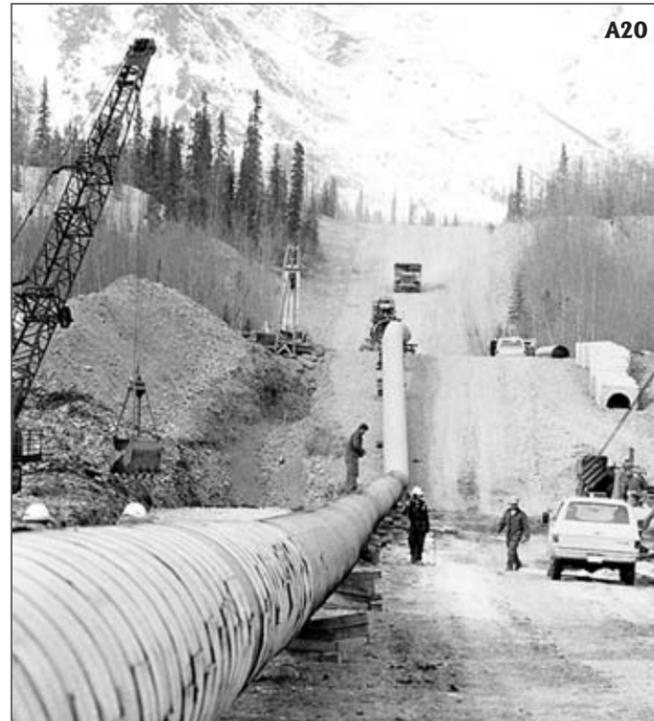
**A20** *Moving the oil – pipeline challenges*

**A23** *Initial Prudhoe field development*

**A25** *Building the Trans Alaska Pipeline System*



A22

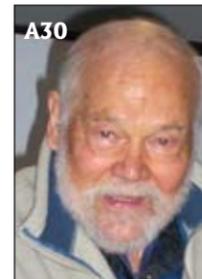


A20

**A28** *Prudhoe Bay production begins*

**A29** *After startup – a new era for Alaska*

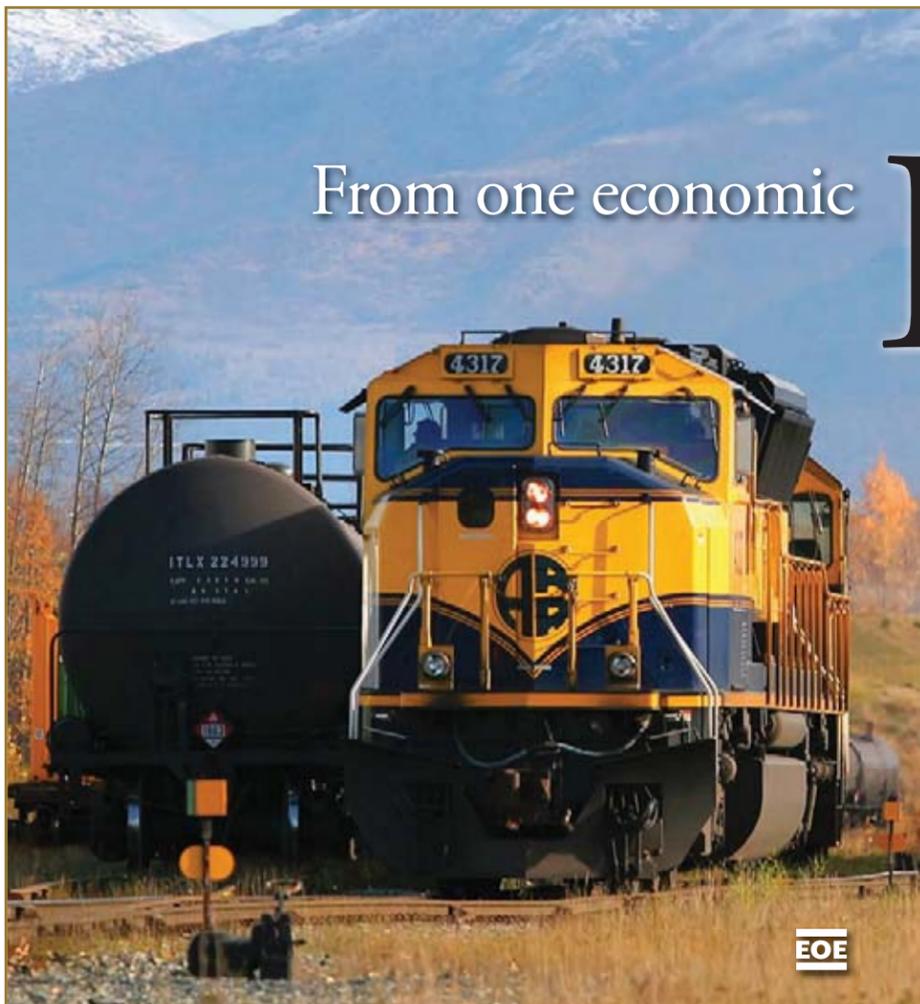
**A30** *Prominent Alaskans reflect on significance of Prudhoe Bay, North Slope oil fields*



A30



A29



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# Contents



**B16** Legacy of corporate citizenship, social investment



**B20** North Slope oil yields economic benefits: University of Alaska economist describes how North Slope oil transformed Alaska's economy

**B22** 50 more years in Alaska...

**B22** Sidebar: Prudhoe surpasses expectations

**B23** Sidebar: Alaska gas pipeline gains momentum with Denali

**B24** Sidebar: Advancing technology maximizes light oil production

**B25** Sidebar: Alaska heavy oil test yields positive results

**B26** Remembering the best times: BP and heritage employees reflect on their favorite memories during their time on the North Slope



**B28** 50 year timeline: Significant events in BP's Alaska history

**B3** Evolving oil field technology: Technology, innovation on the North Slope has helped reduce environmental impacts, reducing industry's footprint



**B6** Offshore challenges – Endicott, Northstar, Liberty

**B7** Sidebar: Endicott poses environmental challenges

**B8** Sidebar: Ultra extended-reach drilling at Liberty

**B14** Mergers, acquisitions mark transition to new millennium

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First installation was at Tonsina River in the spring of 1975. The pipe was weighted with concrete anchors for burial below the river bed.

continued from page 1

## HALF A CENTURY

In the 1980s BP and its partners expanded Prudhoe Bay production facilities to process more oil, developed several neighboring oil fields, and with evolving technology, moved offshore to construct new fields like Endicott and Northstar. Along with advancements in oil field technology, improvements in environmental monitoring and stewardship allowed BP and others to minimize impacts to the Arctic ecosystem.

In 1998-2000, with the acquisitions of Amoco, ARCO, Castrol and Vastar, BP became a much larger company. But it retained its dominant position in Alaska as a major investor and energy producer. Through its acquisition of ARCO, equity interests among Prudhoe Bay producers were realigned — and BP became the field's sole operator.

Moving into a new decade, BP began looking ahead to what it calls a "50-year future," anchoring its plans on continued development of the North Slope's light oil, using evolving technology to produce vast reserves of heavy oil, and commercializing the Slope's tremendous natural

gas resources. In 2008 with the formation of Denali, BP and its partner ConocoPhillips launched preliminary work on a \$40 billion gas pipeline project from Alaska to Canada.

The company recently launched a new offshore project — Liberty — in which the world's longest extended reach wells will tap an oil reservoir with an estimated 100 million barrels of recoverable oil.

A key part of BP Alaska's next 50 years is renewal of its North Slope infrastructure — updating pipelines and facilities that were built in the 1970s and 1980s. Included in these upgrades are significant advancements in corrosion detection and prevention, leak detection, fire and alarm systems and other production operations controls.

From its earliest days in Alaska, BP has been a leading corporate citizen, and today that legacy continues. In 2008, for example, BP contributed more than \$10 million to support more than 200 nonprofit and educational organizations and programs in Alaska. The company's employees are actively engaged across Alaska, supporting more than 250 community organizations and 150 youth teams in more than 30 Alaska communities, either in direct contributions or volunteerism.

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**"At the time of the September 1969 Prudhoe Bay lease sale, Anchorage was a community of 125,000, almost half of the state's total population. There was no satellite link, so TV programs, including news, were sent up in cassette form from Seattle — making everything a day late. I was running public relations for BP in New York at the time, but was paying my first visit to Alaska when the lease sale occurred. —Charles Towill, one of BP's first public affairs representatives in the U.S.**

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continued from page A1

## WINDFALL

The lease sale — by auction — was carried out in public with the companies' sealed bids opened before an audience of oilmen, bankers and journalists. The state received the largest windfall in its history to that point — some \$900 million for the oil and gas rights on the blocks it offered. There hadn't been a bonanza like this in Alaska since the gold rush at the turn of the century.

BP had been joined by a new partner, Gulf Oil. While Gulf provided most of the cash for their bids, BP contributed its knowledge of the North Slope.

This new partnership acquired six blocks at a cost of \$97.7 million covering a promising area in the Colville River delta, some 20 miles to the west of Prudhoe Bay, in the general area of the Prudhoe Bay field. However, BP and Gulf's bids were topped by other groups, including Phillips-Mobil-Socal, and Amerada Getty.

While BP heritage company ARCO reaped the glory of discovering Prudhoe Bay, BP belatedly claimed a bigger prize — in that roughly 60 percent of the oil bonanza was under leases it acquired in earlier sales. The lion's share of the natural gas, or what is called the gas cap, however, was within the ARCO and Humble (later to become ExxonMobil) lease area.

The debate continues today over whether it was BP's technical prowess in seismic survey interpretation or serendipity that led to its success in acquiring Prudhoe's prime oil tracts.

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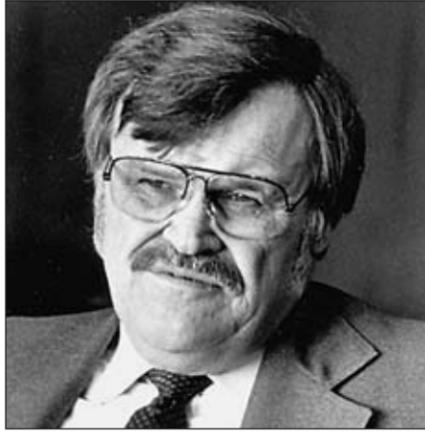
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### *Chronology of BP Exploration (Alaska) Presidents*

*1967-70 Geoff Larmanie*

*1970-71 John Cooper*

*1971-74 Laurie Gray*

*1974-77 Dr. Ken Keep*

*1977-81 John Saint*

*1981-90 George N. Nelson*

*1990-94 Julian R. Darley*

*1994-97 John C. Morgan*

*1997-01 Richard Campbell*

*2001-05 Steve Marshall*

*2006-08 Doug Suttles*

*2009-Present John Mingé*

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Truck convoy en route to BP drilling site.



Aircraft flying supplies to BP's Put River No. 1 drilling site. "I can recall those great Hercules thundering through the winter night and the great flurries of snow whirling up along the lights burning at the side of the icy runway." —John Matyr, then general and vice president of BP Alaska.

continued from page A1

## BIDDING

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

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

In March 1968 Richfield Oil and Atlantic Refining, which had merged three years earlier to become Atlantic Richfield (ARCO), announced a strike at Prudhoe Bay State No. 1 — at the center of the structure. The deposit was the largest ever found in North America.

In a 1970 interview with BP's corporate magazine BP Shield, truck driver Burn Roper vividly described the weather conditions as ground-based crews scrambled to deliver BP's critically needed drilling equipment. "We needed almost as much fuel to keep warm as to run the rigs," noted Roper. "The temperatures were something fierce, running down to minus 65 degrees Fahrenheit. At this temperature steel was as brittle as candy; human flesh froze in 30 seconds. Engines had to be kept running round the clock — from fall to spring they never stopped."

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

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

With 48 hours' notice, a barge and

drilling rig were acquired in southern Alaska. Along with 4,500 tons ancillary equipment, the rig was barged through the Bering Sea to Prudhoe Bay before encroaching ice made the Beaufort Sea impassable.

In the late 1960s, two other rigs were flown to Prudhoe Bay on Hercules C-130 transport planes and another lighter rig was also airlifted in.

### Difficult conditions

The BP airlift comprised five chartered C-130s, each costing about \$250,000 a month, plus three Super Constellation aircraft. John Matyr, then general manager and vice president of BP Alaska, described the difficulty of these early logistics efforts: "I can recall those great Hercules thundering through the winter night and the great flurries of snow whirling up along the lights burning at the side of the ice runway," he said.

"It was the most difficult operation that I've ever been associated with," adds Matyr, a veteran of Kuwait, New Guinea,

Trinidad and Libya oil fields, as well as the gold mines of southern India.

In a 1970 interview with BP's corporate magazine BP Shield, truck driver Burn Roper vividly described the weather conditions as ground-based crews scrambled to deliver BP's critically needed drilling equipment.

"We needed almost as much fuel to keep warm as to run the rigs," noted Roper. "The temperatures were something fierce, running down to minus 65 degrees Fahrenheit. At this temperature steel was as brittle as candy; human flesh froze in 30 seconds. Engines had to be kept running round the clock — from fall to spring they never stopped."

One inexperienced pilot who flew a light plane from Fairbanks was foolish enough to switch off his engine as he came to the end of his taxiing. It took three days to get it started again.

Roper drove a 20-ton transport truck in a convoy that in 1968 made the 11-day, 600-mile trip up the winter Arctic Ice Road from Fairbanks over the Brooks Range to the North Slope. (The road was sometimes referred to as the Hickel Highway, named after then-Alaska Gov. Walter J. Hickel, who spurred the road's construction).

"We had a tractor with us to pull us over the ice ledges we met along the way," Roper said. "These ice steps were more than two feet high. We had radios in our cabs, and though we were alone, we could talk to each other and to the convoy leader."

The Hickel Highway followed old

see page A11 BIDDING

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continued from page A10

## BIDDING

Native trails and much of the route was bulldozed by Boyd Brown, Tennessee Miller and others during the famous 1964 cat train, which transported seismic exploration equipment to the North Slope. No road was actually built — only a simple path cleared across the tundra. Other cat trains had made their way north in the mid-1950s in connection with the military Distant Early Warning system, or DEW line, west of Prudhoe Bay.

### BP makes Prudhoe Bay confirmation

Using a rig that had been barged from Kenai in late summer, drilling began Nov. 20, 1968, on BP's Put River No. 1, on the banks of the Putulgayuk River, three miles from the Arctic coast and three miles south of ARCO's initial discovery well. In an interview with Jack Roderick in the book *Crude Dreams*, released in 1997, BP geologist Geoff Larmanie noted that Put River No. 1 was designed to be located outside the edge of the gas and in the oil leg of the Prudhoe Bay structure.

"BP wanted to determine the thickness of the Prudhoe column at Put River and to then use this information to re-evaluate its seismic data," Larmanie said. "As drilling continued throughout the winter, communications security was a problem. People at the well had to communicate with company officials, but without others listening in.

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



Geologists examining outcroppings in the foothills of the Brooks Range, south of the Colville River delta.

Short of dollars, BP decided it could not compete with American companies for expensive leases in the center of the structure.

Instead, it gambled on the striking similarity of the Prudhoe Bay structure to its discovery in Iran — where the oil-bearing rocks had proved to be thicker and more prolific around the edges.

tion out in sealed bags — airlifted, hand-carried stuff."

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

Finally, on March 13, 1969, BP made

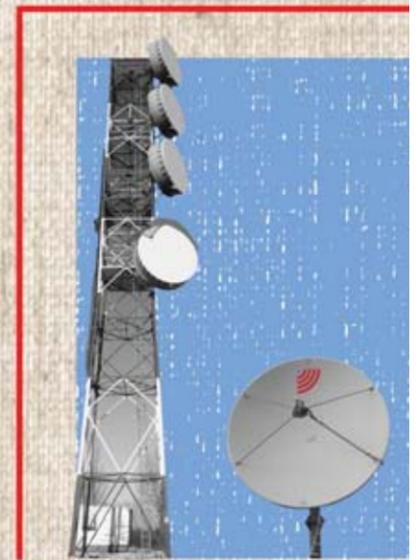
brief announcements in London and New York: "Oil had been discovered in porous sandstone below 8,000 feet," with an oil-column thickness greater than that at Prudhoe Bay. It was a major extension of the Prudhoe Bay discovery, like the Sag River State No. 1 well.

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

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

With improved technology and additional investments, Prudhoe Bay's recoverable oil reserve figure would later be revised to about 13 billion barrels.

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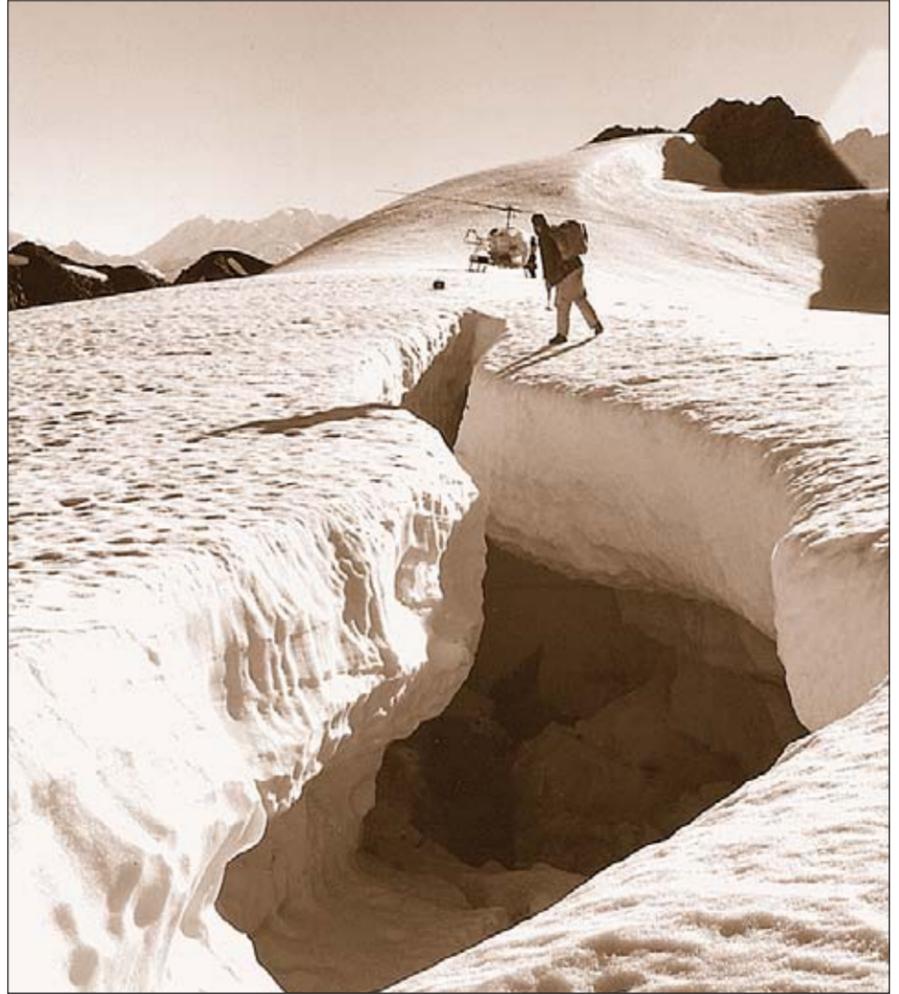
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Roger Herrera, now retired from BP and living in Anchorage, was a member of the first geologic survey team. Here, Herrera fishes in a North Slope stream. COURTESY ROGER HERRERA



BP's early search for oil and gas in Alaska took them as far south as the St. Elias mountains.

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*continued from page 1*

## NORTH TO ALASKA

Alaska.

The first step for BP and Sinclair was to conduct geological surveys on the North Slope. In 1959 BP opened its first office in Alaska, in downtown Anchorage, and the following year the first team of geologists arrived.

While BP's main focus was the North Slope, primarily the foothills north of the Brooks mountain range, southern Alaska was also an area of interest. For several years BP conducted exploration near Yakutat, the Alaska Peninsula, Cook Inlet, and even a well on the lower Yukon River near Nulato —with less than promising results.

At a fairly early stage, BP's Cox recommended that the company should step up its efforts in northern Alaska. The first part of the operation involved geological surveys.

Roger Herrera, now retired from BP

and living in Anchorage, was a member of the first team. "There were very few maps available in 1960 for those parts of Alaska," said Herrera. "Those that were available were of poor quality, so we relied heavily on aerial photographs."

Herrera said that their assignment was to define the geologic structures more exactly, and to identify more promising reservoir rocks and develop a picture of the regional, geologic trends. They lived in tents, moving by float plane from site to site and landing in the numerous small lakes that dot the Slope. Sometimes they would travel by helicopter.

"We'd go out in the morning to get rock samples, and since we had many miles to go, we only carried essentials — a map, compass, rock hammer, good hiking boots, plenty of mosquito repellent and, in the event of bad weather, patience," Herrera remembered. "I recall many nights spent out on the tundra because the weather was too poor for pilots to fly. Sometimes when the airplanes couldn't make it in, we ate fish that we caught in nearby streams and lakes."

Geoff Larmanie, exploration manager then based in Anchorage, also ventured into the field with survey crews. "It could get pretty rough, especially in the mountains," he recalled. "There we'd sit, our heads in the sky, our backsides in the snow for days on end. Living cheek by jowl with people under these cramped conditions could result in certain psychological tribulations, when we might all run out of both work and reading matter."

### Seismic surveys

When BP began seismic work on the North Slope in 1963, geophysicists had little or no experience in seismic reflection surveys in permafrost. With Slope permafrost thickness at some 2,000 feet, it was feared the readings would be severely distorted. New methods of interpreting seismic logs would prove beneficial in BP's early exploration efforts.

BP management in London accepted the team's recommendations to proceed with exploration drilling. By the end of 1963, BP and Sinclair had acquired options to lease about 150,000 acres.

Since the North Slope was isolated

*see page A14* **NORTH TO ALASKA**

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Exploration staging area near Colville River delta.

continued from page A12

## NORTH TO ALASKA

from the rest of the world, transporting drilling equipment there was a major logistical effort. BP's first drilling rig was brought by rail from Calgary, Alberta (Canada) to the Hay River in the Northwest Territories. It was barged down the Hay River into the Mackenzie River to the Beaufort Sea Coast, west to the Colville River, and finally upriver.

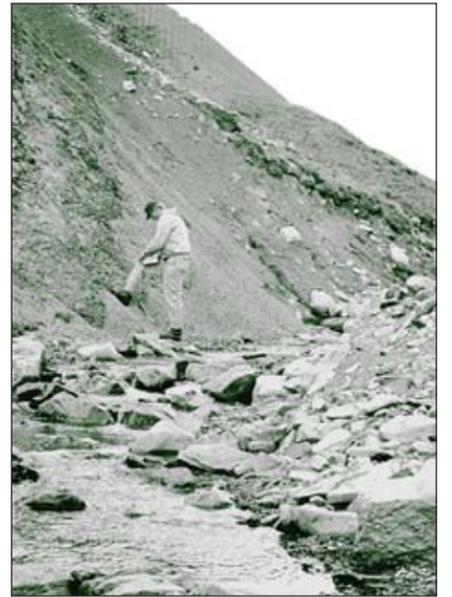
Six wells were drilled reasonably quickly by the Canadian crews under difficult and unfamiliar conditions — through about 2,000 feet of permafrost, with temperatures so low that steel equipment fractured and normal lubricants solidified.

BP's efforts in the foothills of the Brooks Range and the Colville River delta would prove to be unproductive — to the tune of \$30 million and nine dry holes. Dreams of an Eldorado in this northern frontier quickly faded.

"It's remarkable how little notice people take of you when you're drilling dry holes," said Mike Savage, a senior BP executive, at a 1987 ceremony in Anchorage to commemorate the 10th year of Prudhoe Bay oil production. "The odds of success in an entirely new exploration area were at least 20 to 1 against."

### How Prudhoe Bay was named

The first mention of the name "Prudhoe Bay" was a brief entry in the journal of



A BP party leader takes notes on the geological structure in a stream bed in the northern slopes of the Brooks Range.

British explorer Sir John Franklin, dated August 16, 1826. Franklin saw the bay during an expedition by boat down the Mackenzie River in Canada (the river flows from south to north) and then west along the Arctic coast. The name honors a fellow naval officer and explorer-scientist, Captain Algernon Percy, Baron of Prudhoe.

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

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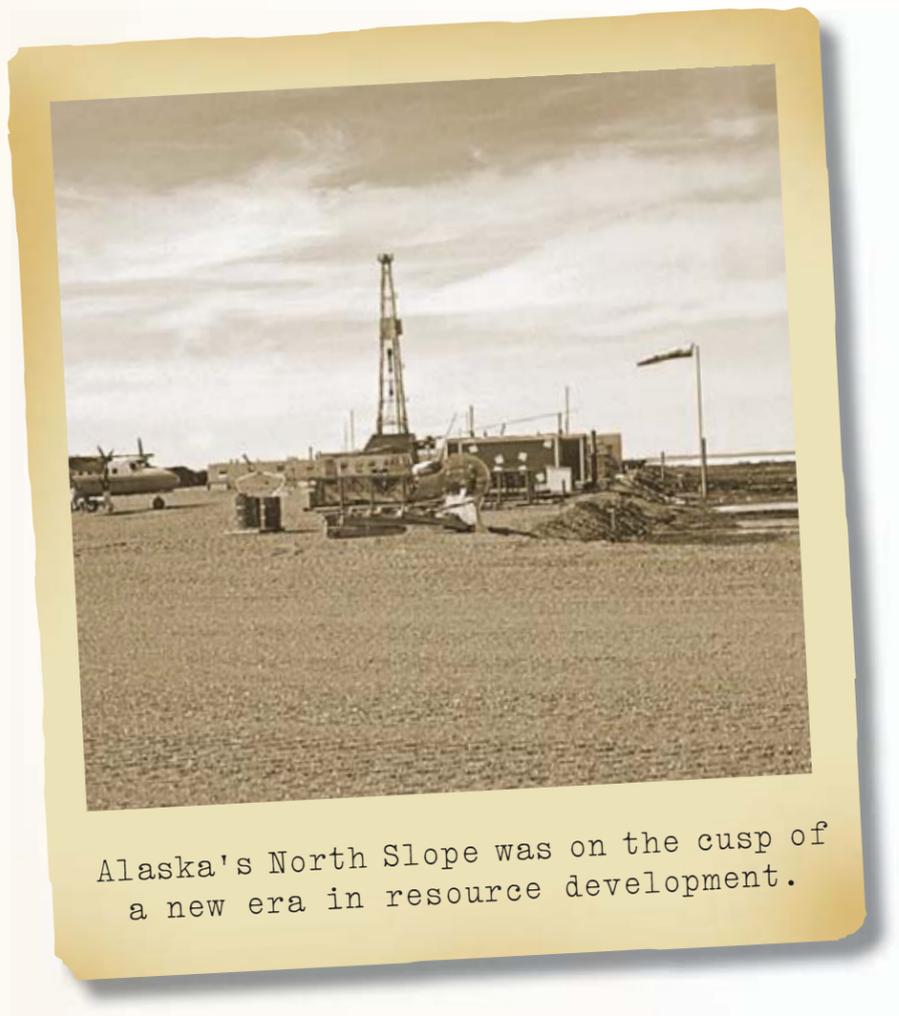
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# BP's early history

*Company's origins go back 100 years*

**BY FRANK BAKER**  
*For Petroleum News*

The first commercial oil discovery in the Middle East in 1908 brought about the birth of British Petroleum a year later, and it quickly grew into one of the world's largest oil companies.

In the years that followed, BP became well-established in the Middle East, with subsequent discoveries of large fields — some super giant in size. By the 1950s BP produced about 5.5 million barrels a day of oil, more than most members of the Organization of Petroleum Exporting Countries produce today.

**By the 1950s BP produced about 5.5 million barrels a day of oil, more than most members of the Organization of Petroleum Exporting Countries produce today.**

Starting in the 1950s, however, a tide of nationalism swept across the Middle East. This sentiment eventually led to the formation of the Organization of Petroleum Exporting Countries (OPEC) and the takeover of Middle East production by national producing countries.

Even before BP's expulsion from Iran (formerly Persia) in 1951, the company's management in London had decided it was time to search elsewhere in the world for oil and gas reserves. The company was also looking to find new markets for its vast Middle East reserves.

British government ownership in BP began in 1914 during the company's infancy. This was driven by the company's need for a fuel oil outlet and new capital, and a desire by the British Admiralty to obtain secure supplies of fuel oil. In exchange for 2 million pounds sterling, the government received a majority stake in the company. By the mid-1980s the government held nearly 32 percent of the company's stock. Three key events in 1987-88 however, would ensure BP's privatization and a major course change in the company's history:

- sale of British government holdings in BP;

**Major acquisitions and mergers announced in 1998 and 1999 — Amoco, ARCO, Castrol, Solarex — vaulted BP into the top three integrated, super-major energy and chemicals companies, which include ExxonMobil and Shell.**

- BP's \$7.7 billion buyout of America's Standard Oil Co. outstanding stock shares;

- acquisition of Britoil, doubling BP's exploration acreage in the North Sea and reinforcing BP's position as the largest oil and gas producer in the area.

Through divestitures beginning in the late 1980s, the company focused on its core businesses, petroleum and chemicals, and began the quest to find new sources of oil and gas in areas that for political or technical reasons had remained relatively unexplored — such as Colombia, republics of the former Soviet Union and deepwater areas of the Gulf of Mexico.

Major acquisitions and mergers announced in 1998 and 1999 — Amoco, ARCO, Castrol, Solarex — vaulted BP into the top three integrated, super-major energy and chemicals companies, which include ExxonMobil and Shell.

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# Moving the oil – pipeline challenges

BY FRANK BAKER  
For Petroleum News

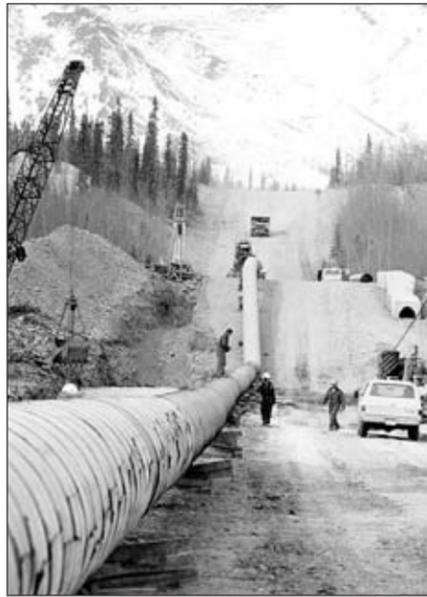
Designing a pipeline that would transport Prudhoe Bay oil from Alaska's northern coast to its ice-free port of Valdez on Alaska's southern coast was an unprecedented engineering challenge. Three basic types of mainline pipe construction would be used along different parts of the 800-mile route to address different soil conditions: 1. buried in a conventional manner; 2. buried with special systems to reduce or prevent heat transfer to the ground; and, 3. above the surface mounted on support platforms.

The 48-inch-diameter mainline pipe was delivered to Alaska in the early 1970s from three companies in Japan — Sumitomo Metal Industries, Yawata Iron and Steel, and Nippon Kokan. The 69,000 lengths of pipe were stockpiled at large sites in Valdez, Fairbanks and Prudhoe Bay. The pipe cost about \$120 million.

The pipe had to be strong with wall thicknesses of 0.462 and 0.562 inches and specified minimum yield strengths of 60,000-70,000 pounds per square inch. These specifications would meet or exceed the requirements for safety and special low temperature considerations as well as all U.S. government and American Petroleum Institute standards.

The pipeline system had to be built to withstand the combined stresses of internal pressure and of thermal, bending and seismic forces.

At river crossings and in certain flood plains, it required anti-corrosive coating



At left, sections of 48-inch pipeline at Tonsina prior to burial in the Tonsina River. Right, the SS Manhattan forces her way through Arctic pack ice in 1969.

and an outside layer of concrete to anchor it to the stream bottoms.

Buried sections had to be coated and cathodically protected with zinc anodes to prevent chemical and electrolytic corrosion, while above-ground sections (about half the line) required thermal insulation to slow the drop in oil temperature in the event of a pipeline shutdown.

The size and scale of the project was daunting. The 800-mile pipeline would cross three mountain ranges (the highest point at 4,739 feet), 800 streams and rivers, and the Denali fault, an area known to be seismically active.

It would be built in both continuous



permafrost and highly unstable discontinuous permafrost (that thaws and melts each year).

Geotechnical, geological, civil and Arctic engineering, stress analysis, thermal engineering, agronomics, hydraulics, mechanical and welding engineering were all required. This wide-ranging array of engineering disciplines produced the most detailed design of any pipeline ever constructed. Also significant was that it was constructed within a short period of time — a mere three years.

Thousands of borehole core samples were analyzed. Seismic experts at Menlo Park, Calif., reviewed reams of data to assess earthquake risk. Extensive stress analyses on the pipe were conducted.

## Legal, environmental hurdles

Since Sohio had no large oil production organization of its own, BP agreed to manage construction and development of the Prudhoe Bay field through a new subsidiary, BP Alaska Inc.

Sohio would look after its own interest in the proposed trans-Alaska pipeline in helping supervise the colossal project. It was also responsible for major expansion of the Sohio tanker fleet to accommodate the expected flow of oil from Alaska.

Unlike many American oil companies working in Alaska, BP had no U.S. producing operation from which to draw

By 1969, BP had about 35 people headquartered in Anchorage at its Fireweed Lane office. Among them was John Browne, a young physicist and petroleum engineer. Browne would quickly ascend to senior management and would eventually become the company's chief executive officer and main board director, based in London.

experienced staff. Some BP management and technical staff were brought in from the U.K. and the Middle East, and Sohio was able to offer some experienced staff from its small oil-production operations in Oklahoma. At the same time, BP launched an ambitious recruiting effort for new U.S. staff.

By 1969, BP had about 35 people headquartered in Anchorage at its Fireweed Lane office. Among them was John Browne, a young physicist and petroleum engineer. Browne would quickly ascend to senior management and would eventually become the company's chief executive officer and main board director, based in London. Browne retired in 2008.

By 1970, BP's Alaska workforce was about 150, and the company was quick to establish its name throughout the state as it began adding staff to meet the challenges ahead. Despite the fact that federal approval of the 800-mile pipeline faced opposition in Washington, D.C., industry planners were confident that a go-ahead would be secured, so they moved forward.

As BP, ARCO and Exxon began the early phases of oil field development and planning of an oil transportation system, major issues were looming on the nation's horizon — most notably, Alaska Native Claims.

Alaska Natives, the Inupiat and Yupik Eskimos in northern and western Alaska, Athabaskan Indians in the Interior, Aleuts in Southwest and Southcentral Alaska, and Tlingit and Haida people in the Southeast panhandle came forward with claims to Alaska lands which they had traditionally used. They argued that these claims were recognized by the U.S. treaty with Czarist

see page A21 CHALLENGES

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continued from page A20

## CHALLENGES

Russia when Alaska was purchased in 1867, and then reaffirmed by the U.S. Congress in 1884.

In 1884 Congress had reserved to itself the authority to settle the land claims. But the issue languished for decades — through the years of the Gold Rush, the settlement of some of Alaska by non-Natives, World War II and finally, creation of the state of Alaska.

The Alaska Federation of Natives (AFN) had formed only in 1966, bringing all of Alaska's diverse Alaska Native groups together. AFN's ability to persuade the U.S. Secretary of Interior to halt grants of land under the 1958 Alaska Statehood Act halted the proposed pipeline project.

A leasing freeze, made official in January 1969, stopped the state from leasing the oil companies a right of way for the pipeline until the question of Native rights was settled. Sixty-six Natives living on its proposed route, from Prudhoe Bay to Valdez, obtained an injunction in Washington against the pipeline being laid across their land without their consent.

Getting clear title to lands and a right of way along which the pipeline would be built was an absolute necessity. A congressional act to settle the long-standing Native claims issue was needed before the federal government could grant a right of way for the project. This brought the interests of Alaska Native people, who desired a land claims settlement; BP and the other companies involved in TAPS; and the State of Alaska, which needed the pipeline to be built, into a historic alliance to get a land claims bill through Congress.



ED PATTON

### Moving land claims legislation

Alyeska Pipeline Service Co.'s first chairman, Edward L. Patton, as well as Hugh Gallagher, BP's lobbyist in Washington, D.C., were instrumental in helping move Native Land Claims legislation. The two worked to get oil industry backing for the claims settlement bill, and the support of congressional delegations from other oil-producing U.S. states. John Gore, formerly a senior group executive in BP's corporate office in London, also played a pivotal role in Washington, D.C., in facilitating the claims act.

Success came in December 1971, when Congress approved the Alaska Native Claims Settlement Act, ANCSA, granting Alaska's indigenous population more than 40 million acres and \$962 million in settlement of their hereditary claims.

Each individual village could be incorporated within one of the 12 regional Native corporations the act created and a 13th corporation was to be set up for Alaska Natives living outside the state. ANCSA had provided that \$500 million — half of the cash settlement for Alaska lands that would not be returned to Native ownership — would be paid to the new Native regional and village corporations from a temporary royalty override on Prudhoe Bay oil production. To get the money, the pipeline had to be built so that the oil field could be put into production.

Willie Hensley, a prominent Alaska Native leader, walked the halls of Congress in 1973, pushing for the pipeline legislation to be passed. Hensley and other Native leaders were able to see influential eastern senators and congressmen, such as Sen. Edward Kennedy of Massachusetts,

see page A22 **CHALLENGES**



C-130 aircraft hauls vital supplies to remote locations along the trans-Alaska oil pipeline route during the projects pre-construction mobilization. This Hercules is shown at an ice strip on Galbraith lake.



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Truck supplies BP drilling rig on the North Slope.

continued from page A21

## CHALLENGES

who was not ordinarily receptive to oil industry interests. Hensley and the others also proposed that special Native-hire and training commitments be included in the act, which Congress did.

The land freeze was lifted, and ANCSA was signed into law by President Nixon Dec. 18, 1971.

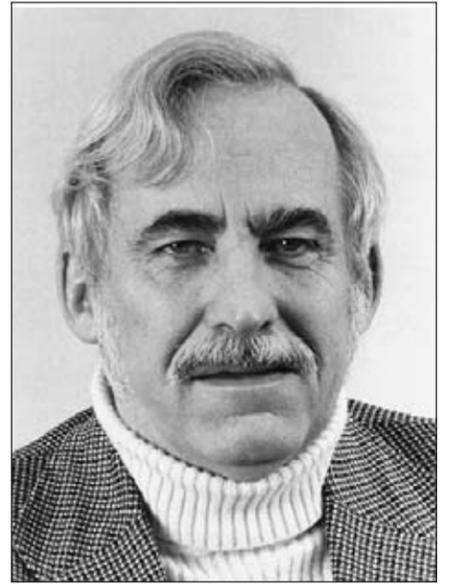
### Environment takes center stage

Running parallel to the Native claims issue was a growing national concern about how oil development would affect Alaska's environment and wildlife. Citing the National Environmental Policy Act of 1970, newly formed environmental organizations such as the Friends of the Earth, the Environmental Defense Fund and the Wilderness Society, won a federal injunction against the right-of-way permit in April of that year. They claimed the 200-page Environmental Impact Statement (EIS) for the trans-Alaska oil pipeline did not adequately address the pipeline's potential environmental impacts.

In 1972 a new EIS was drafted. It was encyclopedic in content — its volumes towering seven feet when stacked on top of one another.

The impact statement was only one delay among many. Environmentalists also unearthed a little-known provision in a 1920 federal minerals law that limited the amount of right of way that could be granted on federal land. The limit, unless changed, could have blocked the pipeline and the 360-mile gravel haul road that parallels it (now the James Dalton Highway) from the Yukon River to the North Slope.

Charlie Elder, a retired BP executive (deceased), played a key role in helping



BP's Charlie Elder, who died of natural causes in September 1999, played a key role in securing a TAPS right-of-way permit and in the early phases of pipeline design and construction.

secure a right-of-way permit.

"There was a bill introduced in Congress that cured the right-of-way matter," Elder recalled. "There would have been no problem getting it passed, but unfortunately, just about then, in addition to the environmental impact stuff, the word got around from somewhere that we were going to export oil to Japan. It was 1972-73, and the nation was experiencing an energy shortage because of the Arab oil embargo. There were concerns by folks in the Midwest."

After beating back Midwest efforts to delay the project in order to explore a Canadian route, pipeline proponents gambled and backed Sen. Mike Gravel and Sen. Ted Stevens' amendment that would remove the right-of-way hang-up. It was known as the "no more" rider, which said in effect, that enough was enough on debate and lawsuits. In the national interest, work on the pipeline should proceed immediately.

"That amendment cost us some votes," Elder said. "A lot of purists, particularly those folks who were lawyers, felt that the amendment removed due process. We were up all hours of the night among ourselves saying, 'Is it smart to leave that in or take the chance and have no more lawsuits?' I guess in retrospect, we were smart."

The vote for the pipeline bill limiting any further judicial review of the project tied 49-49 on the U.S. Senate floor, with Vice President Spiro Agnew breaking the tie in favor of the amendment.

The pipeline authorization act was passed by both the House of Representatives and Senate. On Nov. 16, 1973, President Nixon signed it into law. The primary federal right-of-way permit for construction was signed by Secretary of Interior Rogers Morton on Jan. 23, 1974. After years of delay, North America's largest privately funded project — the trans-Alaska oil pipeline — was finally under way.

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# Initial Prudhoe field development

BY FRANK BAKER  
For Petroleum News

In the late 1960s and early 1970s development drilling was under way at Prudhoe Bay, using Nabors 18-E and Brinkerhoff Rig 36. Everett Potter, now retired, was a drilling consultant for BP. Potter says modern rigs are better insulated and heated than the old ones, and much more transportable.

"We used to have to tear the rigs down to the ground to move them by truck from one well location to another," he remembers. "A rig move could take as long as seven days, especially during the winter months. Now, some of the rigs can be moved in half a day, and wheel-mounted rigs can simply be rolled to other locations." Modern cantilevered rigs can be moved from one well location on a pad to another location in just a matter of hours.

Brian Rose, a retired drilling superintendent for BP, joined the company in 1974 and became drilling foreman on Brinkerhoff Rig 36 and Nabors 18-E.

"I got off the plane at Deadhorse and it was about minus 20 degrees with a 30-mile-per-hour wind. A guy named Swede Swenson, a drilling foreman, picked me up at the airport in a yellow station wagon. I remember thinking to myself, 'What have you gone and done now?'"

The first sealift to Prudhoe Bay occurred in the summer of 1969, when about 70,000 tons of stores and equipment were barged from Seattle. The 1970 barge sealift was the largest in the North Slope's history — when 70 barges containing more than 175,000 tons of equipment journeyed north through difficult ice conditions.

From 1974 on, sealift shipments to Prudhoe Bay would contain oil production modules, buildings, modularized camps and other support facilities from the U.S. West Coast. The barge shipments were made by Seattle-based Crowley Maritime Inc.

The sealifts also brought large modules for BP's three gathering centers, which would separate gas and water from produced oil. ARCO would have three similar facilities, called flow stations, on its side of the field. Under a unit operating agreement, BP would operate the western



After a sea-journey of 3,000 miles from the U.S. West Coast, BP's 1975 sealift arrives at Prudhoe Bay with critically needed modules and equipment.

side of the Prudhoe Bay field, or western operating area (WOA), and ARCO would operate the eastern side, or EOA.

The plan called for the six facilities to handle up to 1.8 million barrels of oil per day. By 1975 two of BP's gathering centers were in place — each capable of handling about 300,000 barrels of oil per day.

During this time, a gravel "spine" road was built from east to west through the heart of the oil field, using gravel from approved material sites. Later, extensions and fingers off this road would access the many gravel "pads" from which development wells would be drilled. Pads were assigned letters on the western or BP-Sohio side of the oil field and numbers on the eastern, or ARCO side.

While initial facilities were being installed, expansions to those facilities were already being designed by BP in San Francisco. During the mid-1970s, when major capital expansions reached a crescendo on both sides of the Prudhoe Bay field, the areawide population peaked at about 8,000.

## Extreme climate fosters innovation

As Prudhoe Bay Field was being planned in the early 1970s, challenges of an extreme climate moved BP toward two other innovations. Both were motivated by the company's caution in working in a new environment.

The major concern was whether people could really work effectively outdoors

"I got off the plane at Deadhorse and it was about -20 degrees with a 30 mile-per-hour wind. A guy name Swede Swenson, a drilling foreman, picked me up at the airport in a yellow station wagon. I remember thinking to myself, 'what have you gone and done now?'"

—Brian Rose

during the frigid Arctic winter, according to Brian Davies, a former BP Alaska vice president, now retired, who had been involved with the North Slope since the early 1970s. This led the company toward a concept of building large processing modules, and even living quarters, in warmer climates and moving them by barge to the North Slope.

Davies says BP was the first to build and move large modules to a remote site. It was a concept borrowed from offshore oil platforms, which are built in modules and towed on barges to the final location. But building very large modules weighing thousands of tons and moving them thousands of miles by barge and then several miles inland was a first. What made it possible was technology borrowed from the space industry, the specialized tracked vehicles that could move very heavy weights like rockets for several miles, Davies says.

ARCO Alaska, BP's co-operator at Prudhoe, chose at first to build its flow stations by traditional methods, where structures were largely fabricated on site,

see page A24 DEVELOPMENT

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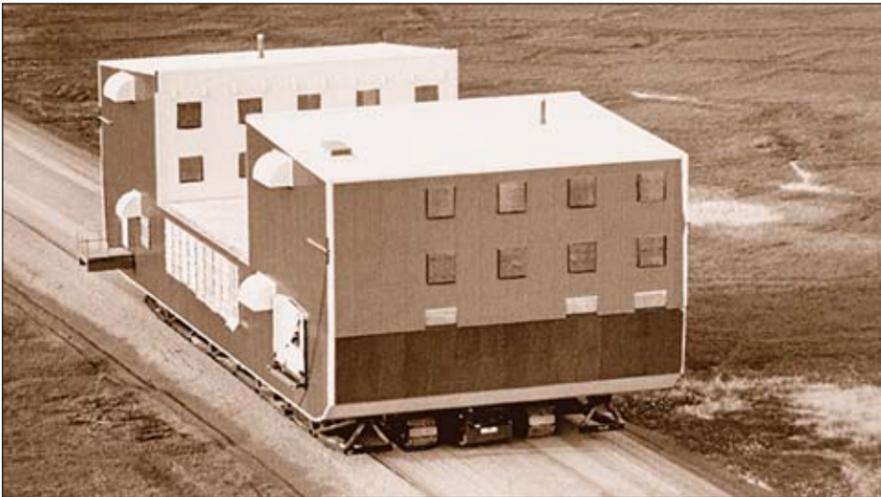
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BP base camp, BP's first operations center at Prudhoe Bay, was Spartan by today's standards.



A lonely job: Clearing snow from one of the main roads near Prudhoe Bay during the field's early development.



Early phases of BP's base operation center move along the west dock causeway on tracked crawlers into Prudhoe Bay field.

continued from page A23

## CHALLENGES

but later followed BP's lead in modularized construction.

ARCO's later start in modularized construction was to have benefits, however. Being able to learn from BP's experience, ARCO was able to incorporate improvements, particularly in the size of the facilities, which was of benefit to BP in its own expansions of production facilities.

### Centralized control

BP's centralized field control system, developed in the mid-1970s, was a revolutionary concept for the industry at the time. It allowed controllers in one location in the field to manage hundreds of individual wells as well as many functions in the field crude-oil gathering centers by telemetry and microwave transmission. This took less time than sending people out to the production sites. It was also safer when weather was bad.

"At first BP's plan was to have even the field Gathering Centers unmanned, operated remotely from the Main Operations Center (MOC)," recalls Dave Catchpole, a BP process engineer who along with fellow BP engineer Tom Adzima, developed Prudhoe's Supervisory Control and Data Acquisition (SCADA) system in the early 1970s.

Automation gave BP significant operational advantages: It provided the ability to quickly adjust production rates of wells on the western side of the Prudhoe Bay Field in as little as two or three minutes,

and to shut the entire western side of the field down in less than 30 minutes.

BP's ability to react faster in controlling its well flow if the trans-Alaska oil pipeline had to temporarily slow its crude oil throughput made it the "swing producer" for Prudhoe. Through automation, BP could react faster in slowing or shutting-in production than ARCO, which at first relied on more traditional oilfield control systems, with people posted at the drill sites. ARCO later automated its system and developed several innovations of its own.

### BP's first camp

BP's first camp in 1969, Mukluk Camp, consisted of a few trailer units. The company's permanent base camp was shipped in modular form from Seattle to Prudhoe Bay in mid-1973 on eight barges. The following year the first phase of the Central Power Station (CPS) arrived, which consisted of two turbine generators and a control room. The Prudhoe Unit agreed to locate it on the western side of the field — making it a BP-Sohio-run facility.

According to Jim Barrett, then a supervisor at the station, the facility generated about two megawatts during its first year of operation. Later sea-lift shipments would bring the other three phases, which included five more Frame-5 turbine generators which were fueled by natural gas produced in the Prudhoe Bay field. Today, the CPS has a maximum output capacity of 160 megawatts, making it the second-largest single power station in Alaska. The CPS provides all electrical power for Prudhoe Unit oil production operations, and current plans call for its expansion. Diesel generators throughout the field provide a backup to provide life support, such as heating and emergency lights.

In 1976 the three-story BP-Sohio center, sometimes called the BP Hilton, was expanded from 90,000 to 137,400 square feet, providing living and working room to accommodate about 264 people. BP also built two 500-person camps for contractors developing the field.

Bill Lorenz, a BP North Slope construction veteran of about 25 years, now retired, notes that when Prudhoe facilities were first being installed, he couldn't foresee what they would eventually look like, or how big they would become. "Most of the production modules and buildings were designed by BP and Ralph M. Parsons Inc. of Pasadena, Calif., and came from the U.S. West Coast as increments," he remembers. "They were like jigsaw pieces of a bigger whole that we never saw until it was completed."

"The initial gathering centers were almost 'pass-through' facilities compared to today's multi-faceted complexes, and about one-third the size," recalls Fritz Wiese, who spent many years on the North Slope as BP production manager.

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# Building the Trans Alaska Pipeline System

BY FRANK BAKER  
For Petroleum News

In order to begin construction on the pipeline, Alyeska Pipeline Service Co. needed to put in a road to service its construction. The road would start at the Yukon River, at the end of the 53-mile Elliot Highway from Fairbanks to Livengood, and continue north some 360 miles to the North Slope.

Anticipating an earlier passage of a trans-Alaska pipeline right-of-way permit, tons of road building equipment and camp units were distributed along the proposed route of the haul road beginning in 1969-70. One of the main obstacles on the route was the Yukon River, so ice roads were constructed each winter to keep material supplies moving north.

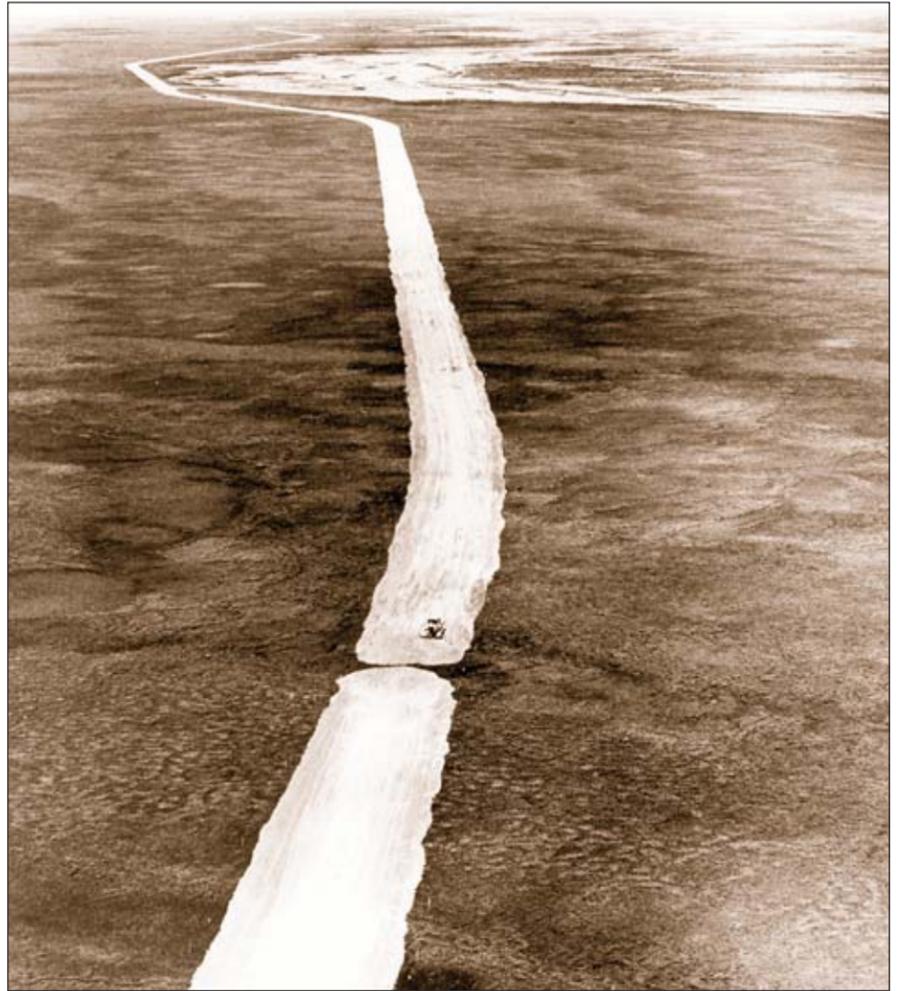
With receipt of the right-of-way permit in 1974, the project moved into high gear. The logistics of the northward flow that began in the winter of 1974 would dwarf heroic episodes of the past like the Berlin airlift and some great overland efforts in Alaska itself, such as the gold rushes in the 1890s and early 1900s; and some military movements during World War II.

In 83 days, from late January to mid-

April 1974, a force that at one point reached 680 workers moved some 34,000 tons of machinery and materials into northern Alaska. This took 671 aircraft flights — a large number of those C-130 Hercules cargo aircraft — and 1,285 trips by truck. Seven moth-balled construction camps were opened and enlarged, and five new camps were built. Five temporary airstrips were built over the snow and ice, to be replaced in spring by a permanent gravel-based runway at each camp. Crews kept at it around the clock in temperatures that dropped as low as minus 68 degrees F.

Michael Baker Jr. Inc. was the firm selected for the planning and civil engineering portion of the road project, which included the first permanent bridge over the Yukon River. The bridge was designed by Nottingham and Associates, of Anchorage. A joint-venture firm, Manson-Osberg-Ghemm, was the construction contractor for the 2,295-foot bridge, which was completed in 1975 at a cost of \$30 million.

Haul Road construction officially began in April 1974, and at the peak of the effort, Alyeska and its contractors had



**Haul road linkup:** One of the first linkups of the 360-mile Prudhoe Bay to Yukon River highways occurred when construction crews working from the north and south met at this site on the tundra between Prudhoe Bay and Franklin Bluffs construction camp. A total of 32 million cubic yards of gravel were required to build the road.

more than 3,400 workers deployed over the route, which was divided into eight sections. The sections would be built north and south from a center point until they all connected. Four execution contractors selected for the job were Green Associated and General-Alaska-Stewart, both joint-venture companies; Burgess

Construction Co.; and Morrison-Knudsen Co. Inc. Each of these contractors would build two sections.

Supply flights during the winter had just been the beginning. Now a squadron of more than 60 aircraft, ranging from helicopters to big, fixed-wing transports

see page A26 **BUILDING**

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## TAPS facts

- Approximately 330 archaeological sites excavated along route
- 515 federal permits required
- 832 state permits required
- Seven 3,000-foot airfields; seven 5,000-foot airfields (three remain permanent)
- 29 construction camps
- Some 3 million tons material and supplies shipped to Alaska
- Largest piece of material shipped: floating tanker berth, 3,250 tons
- 42,000 double-joints welded
- 66,000 field girth-welds
- Peak workforce: 28,072 in October 1975
- More than 2,000 contractors
- Total workforce over life of construction project (1969-1977) 70,000 approximately
- Minority hire: 14-19 percent
- Female hire: 5-10 percent
- 31 lost lives in incidents directly related to construction (inclusive of Alyeska, contractors, subcontractors; excludes commercial trucking companies and freight haulers.)
- Area covered by entire pipeline system: 16.3 square miles

continued from page A25

## BUILDING

and air tankers, was crisscrossing the skies over northern Alaska in support of the road building effort. More than 127,000 flights were made, an average of about 700 per day. Eight and a half million gallons of fuel were flown in to power the construction equipment and camps. Another 160,000 tons of supplies and material were also transported by air. And, by early summer, barges were being used to take materials directly to Prudhoe Bay.

### Road completed in 154 days

Alyeska named Bechtel Inc. of San Francisco as Construction Management Contractor for construction of the road, 29 camps and the pipeline. The following year Alyeska became CMC for the pipeline portion of the work, which included nearly 800 miles of mainline pipe installation, the 12 pump stations and marine Terminal in Valdez.

Trucks carried more than 31 million cubic yards of gravel and another million cubic yards of rock to bring the 28-foot-wide road up to state secondary standards.

Work on the 360-mile gravel road was completed on Sept. 29, 1974, only 154 days after work was started. In 1981 the road was named the Dalton Highway after Alaska engineer James B. Dalton, who was involved in early oil exploration efforts on the North Slope. This 3 million-man-hour, single-summer project was unprecedented in Alaska history.

### Pipeline construction gets started

Early cost estimates for the pipeline



system alone were about \$900,000, but ultimately its cost would soar to nearly \$8 billion, primarily as the result of inflation and environmental requirements which caused re-engineering and re-design. Financing such a massive project was mind boggling, and innovative approaches were developed by both BP and Sohio. U.S. insurance companies and pension funds were invited to invest in trans-Alaska oil pipeline bonds. Other companies, like Atlantic Richfield and Exxon, went to corporate bond markets to finance their shares of the pipeline. It was an unusual approach at the time, which today is considered conventional.

Dr. Ken Keep, a retired director for BP Exploration in London who was based in Anchorage during the 1970s, recalled the mood in 1975 during the ramp-up of pipeline activity.

"It was like a 20th century version of the gold rush, with all the trappings of the 20th century," he said. "If you went along the pipeline route there were camps to house thousands of men and women representing about every skill or specialization imaginable."

There were 29 temporary camps from Pump Station No. 1 to the terminal camp in Valdez, housing anywhere from a handful to several thousand workers. Each facility ran like a self-sufficient

see page A27 BUILDING



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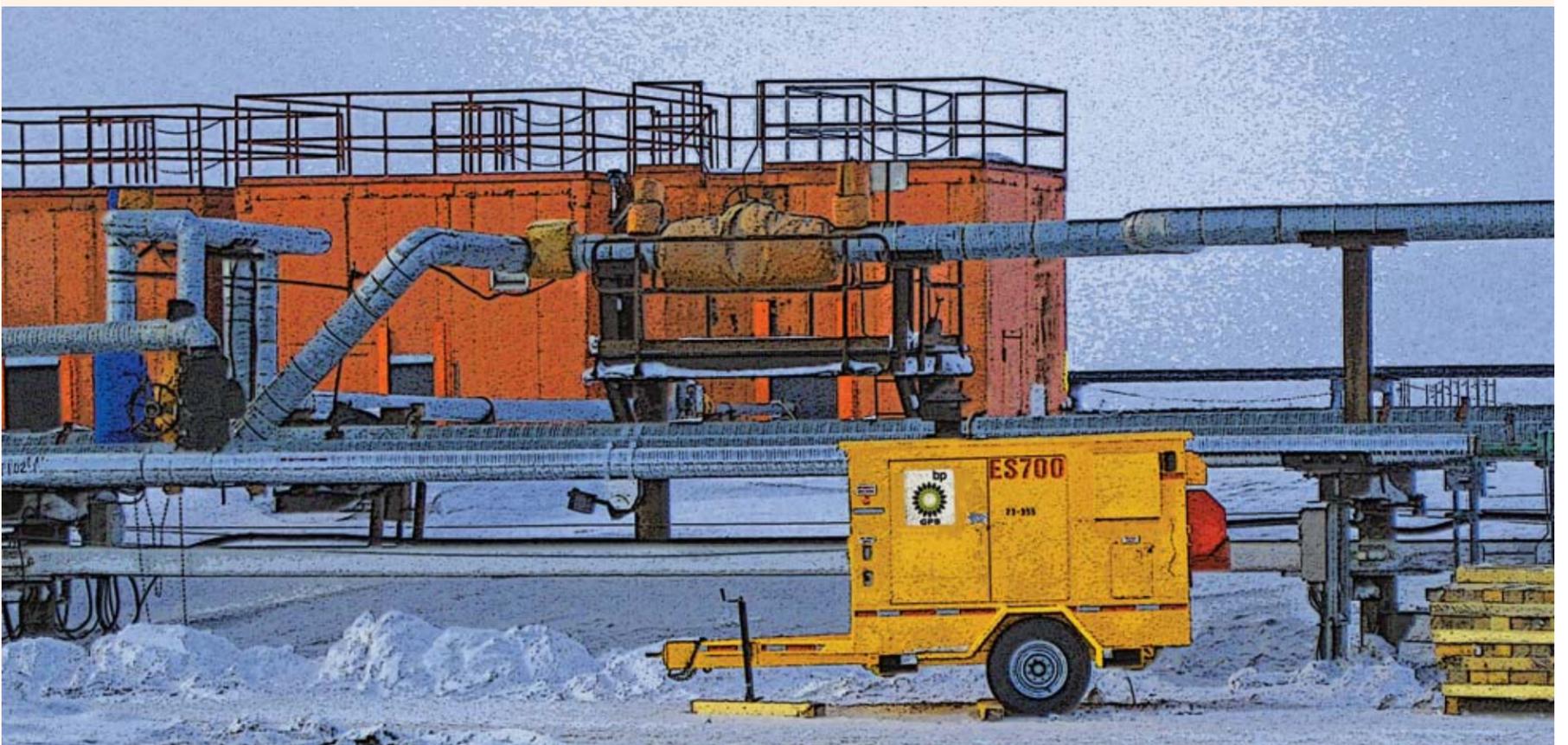
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continued from page A26

## BUILDING

miniature village, with colorful names like Coldfoot, Prospect, Sourdough, Five Mile and Happy Valley.

The average pay for working seven 12s (seven days a week, 12 hours a day) was \$1,000 per week for a general laborer. Welders and other skilled crafts generally took in a bit more. Even though money was the big drawing card that kept most pipeliners in the game, the employee turnover rate was about 20 percent.

In Fairbanks, the primary transportation hub for pipeline materials moving north, small apartments rented for more than \$600 per month. A cab-over shell mounted on a pickup truck went for about \$500 per month. Telephone lines were constantly jammed; grocery stores struggled to keep shelves stocked; school enrollments doubled, and crime rates escalated. To a lesser extent, these impacts were also felt in Anchorage and Valdez.

Pipeline construction during the first part of 1975 was devoted largely to access roads, land clearing operations, workpad construction and placing of vertical support members or VSMS. Ultimately, some 88,000 VSMS would be required for the above-ground portion of the 48-inch mainline. Actual installation of mainline pipe didn't begin until March 27, 1975, and then moved into high gear. Progress goals for the year were ambitious: By year end Alyeska hoped to have 45 percent of the mainline finished.

The 800-mile pipe laying job was programmed to come along fastest of the system's three major parts — which included the mainline, pump stations and

### *They didn't know it couldn't be done...*

Inscription on a monument at the Valdez Marine terminal as a testament to the thousands of men and women who worked on the trans-Alaska oil pipeline, 1974-77

Valdez Marine Terminal.

Construction and engineering challenges included more than 34 major river crossings, about 800 smaller stream crossings, and three major mountain ranges: the Brooks, Alaska and Chugach. The highest elevation on the line was to be 4,739-foot Atigun Pass in the Brooks Mountain Range. The steepest grade along the line was encountered at Thompson Pass, in the Chugach Range, at 55 degrees.

On another major construction front, Fluor Alaska Inc. was the management contractor responsible for the construction of 12 pump stations. All relevant data from the stations, including line pressures, flow rates and temperatures, would be telemetered to Valdez, where operations would be continuously monitored at the Operational Control Center.

During normal operations, the OCC would also monitor the more than 160 valves along the pipeline and have direct control over the remote gate valves placed strategically near environmentally sensitive areas, such as creeks and rivers.

Overall, the OCC was designed to scan about 2,000 status and alarm points on the pipeline and at the stations, taking a reading from each one every 10 seconds.

Integral to the OCC was a microwave communication system that required

building 40 relay stations along the pipeline route, many of which were sited on remote mountain tops. Backing up the microwave network was a satellite system. Each of the line's 62 remote gate valves was tied into the pump station immediately to its north, and then linked to Valdez via microwave and also by an independent VHF radio channel. In 2008 the OCC was moved to Anchorage to better meet expectations for performance and reliability.

Covering more than 1,000 acres, the Valdez Terminal was a massive project which overnight transformed the fishing port of Valdez into a bustling communi-

ty. At a cost of about \$1.4 billion, the terminal was designed with four berths and tankage to hold a total of 9 million barrels of crude oil. Sophisticated equipment to handle oily ballast water and hydrocarbon vapors from tankers was also installed and later upgraded.

The pace of pipeline construction activity accelerated in 1976 as crews scrambled to complete pipeline and ancillary projects. The last of some 100,000 welds of the 48-inch pipe was made on May 31, 1977, and on June 20 of that year, all of Alyeska's computer models, studies and analyses would be put to the test.

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# Prudhoe Bay production begins

BY FRANK BAKER  
For Petroleum News

June 20, 1977, 10:26 a.m.

Operations Control Center Valdez:  
"Gathering Center 1, we have verified with Pump Station 1 that you are authorized to start production at a rate of 100,000 barrels per day."

Gathering Center 1: "Affirmative. We have advised Pump Station 1 that we are opening the valve at Skid 50 to begin production."

With the words above, North America's largest oil field came to life 32 years ago, charting a new future for Alaska, BP and the nation.

June 20, 1977, was a gray, overcast day at Prudhoe Bay as scores of reporters, dignitaries and others huddled around the pipeline outside Pump Station 1, listening for the "clanker pig" that would signal Prudhoe Bay's first crude oil was moving through the 48-inch pipeline on its 800-mile journey to Valdez.

At BP's Gathering Center 1, board operators Jim Blythe and Lowry Brott engaged the electric shipping pumps to begin the flow of oil. Weeks and months of preparations would now be put to the test.

"We had some wells with pressures of 2,000 p.s.i. and higher," Blythe recalls. "Well F-2, for example, was producing at 23,000 barrels per day. One of our wells on D-pad, D-5, was so strong that the thermal expansion popped it right out of the flowline bundle. We were careful not to open the chokes too much, because we could easily over-pressure our equip-



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

ment."

Gene Smagge, formerly a production operator, was at Skid 50 — across the road from Pump Station 1. Smagge opened the valve to send Prudhoe Bay's first oil to market.

"There was friendly competition with ARCO, operator of the eastern side of the field," says Smagge. "We were trying to see who could get their oil into Pump Station 1 first. I think we beat them by a shave."

Eyes from across Alaska and the nation were focused on Prudhoe Bay during the critical startup phase.

"We had a desk full of telephones," recalls Lowry Brott, currently Northstar operations support manager. "We were connected to everyone — Pump Station 1, ARCO, Valdez, Anchorage, even Cleveland. Sohio had heavily extended itself financially to build the trans-Alaska

pipeline and get Prudhoe developed. Because of the permitting delays in getting the pipeline built, folks were very interested in getting oil flowing as soon as possible."

While field production startup proceeded relatively smoothly, the first month was not without problems. On June 25 an over-pressured relief valve in Skid 40 blew a hole through the roof of Gathering Center 1. No fire or injuries were reported. Vibrations in plant equipment caused temporary shutdowns. Of a more serious nature, an explosion and fire July 8 at Pump Station 8 of the trans-Alaska oil pipeline killed one worker.

The oil front arrived at the Valdez Terminal uneventfully late on the evening of July 28, and the first tanker load left for the U.S. West Coast on August 1.

"It was an exciting time," reflects Jim Gilroy, who was a production superin-

"There was friendly competition with ARCO, operator of the eastern side of the field. We were trying to see who could get their oil into Pump Station 1 first. I think we beat them by a shave." —Gene Smagge, formerly a production operator, was at Skid 50 — across the road from Pump Station 1. Smagge opened the valve to send Prudhoe Bay's first oil to market.

tendent and now retired from BP.

"Everything was new. We were moving into uncharted territory."

With the addition of Gathering Center 2 in July and Gathering Center 3 early in 1978, BP and ARCO achieved an average daily production rate of slightly over 1 million barrels per day. The 1.5 million-barrel-per-day Prudhoe Bay plateau rate was achieved in 1981, and was sustained until 1989, when the field declined by 10 percent to 1.4 million barrels per day.

### Three decades of operations

By the end of 2008, the pipeline has delivered more than 15 billion barrels from the North Slope to the Valdez Marine Terminal. During the more than 30 years of operations, the pipeline's reliability factor — the time it has been operational — has been 99.4 percent. Three decades after startup, the trans-Alaska oil pipeline is receiving major upgrades to extend the system's economic life and improve its efficiency.



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Board operator Jim Blythe communicates with the operations control center in Valdez during Prudhoe Bay start up in 1977.

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# After startup – a new era for Alaska

BY FRANK BAKER  
For Petroleum News

By mid-1977, when the pipeline tapped into the waiting Prudhoe Bay production, some 125 wells had been completed — about 65 by BP/Sohio and another 60 by ARCO and Exxon. With an average expected output of 10,000 barrels of oil per day from each well, the field was ready to meet initial pipeline throughput demands.

In 1978, BP assumed 54 percent ownership interest in Standard, as prescribed in the 1970 agreement. Until then BP Alaska had been a subsidiary of British Petroleum Ltd. in London. At this point it became the production subsidiary of Cleveland-based Standard Oil. The name changed to Sohio Alaska Production Co. (In 1986 the name was changed again to Standard Alaska Production Co.)

BP's planning teams realized early that maximizing recovery from the big Prudhoe Bay field would require ongoing investment. During the 1980s Sohio, and later Standard, embarked upon a multibillion-dollar capital development program which would virtually quadruple the size of its Prudhoe Bay production facilities and increase the field's expected recoverable oil reserves from 9.6 billion barrels to 10.8 billion barrels. These and other expenditures by Standard and its partners would result in the startup of three additional North Slope oil fields — Kuparuk, Lisburne and Endicott.

The Kuparuk field, about 30 miles west of Prudhoe Bay, came on stream in December 1981 and today remains, after Prudhoe Bay, the second-largest producing oil field in North America. In addition to its vast reserves, Kuparuk would ultimately become a gateway to further exploration and development to the west of Prudhoe Bay.

Capital expenditures in the Prudhoe Bay field paid for additional facilities to handle increasing quantities of water and gas produced with the crude oil. For example, in 1978 producing one barrel of oil required processing about a pint of water. That figure increased sharply in just a few years to tens of gallons. Production of gas also increased significantly.

Major recovery programs, such as the \$2 billion fieldwide waterflood program and the miscible gas injection, or Enhanced Oil Recovery program were initiated to help sustain production levels. Ultimately the EOR project was credited with adding some 800 million to 1 billion barrels of oil to Prudhoe's recoverable reserves.

This and other projects, each costing hundreds of millions, and even billions of dollars, came in alphabet soup names like Produced Water Expansion, Low Pressure Separation, Wellpad Manifolding, Artificial Gas Lift, Distributive Control System.

In the early to mid-1990s, a billion-dollar-plus project to increase the field's gas-handling capacity — called Gas Handling Expansion, Phases 1 and 2 — created the largest gas handling system of its kind in the world. The two large facilities — the Central Gas Facility and Central Compression Plant — were expanded to handle about 8 billion cubic feet of gas per day.

The BP-ARCO Miscible Injectant Expansion project, or MIX, was brought on line in 1999, and increased Prudhoe Bay liquids recovery by 50 million barrels.

MIX facilities were built in Anchorage



Lisburne production center in the Prudhoe Bay field.

by VECO Construction Inc. at the Port of Anchorage site developed by BP Exploration and its contractors for fabrication of modules for its Northstar development.

Natural gas liquids are extracted by a refrigeration process at the CGF and shipped down the trans-Alaska oil pipeline with the crude oil. This facility came on line in 1987.

A portion of the natural gas liquids is combined with dry gas (methane) to produce a miscible (mixable) gas injectant, which is used for enhanced oil recovery. The remaining gas is routed to the CCP, which came on line 10 years earlier. At the CCP gas is compressed for re-injection into the gas cap of the reservoir to maintain pressure. Processed gas is used as field fuel.

These and other development projects, along with aggressive development drilling programs, were vital in boosting

Prudhoe Bay's production to the plateau rate of 1.5 million barrels per day in the mid-1980s, and in delaying the inevitable production decline to 1989 — about three years later than anticipated when production began.

Improved drilling technology, primarily horizontal and multi-lateral drilling, as well as coiled tubing drilling, also helped improve oil recovery in the big Prudhoe Bay field as it continued its natural decline. Collaborative studies with ARCO also played a major role in helping optimize recovery from Prudhoe's main producing reservoir — the Sadlerochit — and boosting the recovery factor to more than 50 percent, a success rate unheard of in fields this size. Eventually, that recovery factor would increase to about 60 percent.

#### Looking beyond the North Slope

During the late 1970s and early 1980s the company conducted an active explo-

ration program in the Beaufort Sea. Some of that drilling activity, such as the Sag Delta wells, led to discoveries like the Endicott and Niakuk fields.

Plans were also under way to explore off Alaska's western coast, which included Bristol Bay, and the Navarin, Norton and Chukchi basins.

Other ventures were considerably more costly and less successful, like the Mukluk well, a dry hole which cost Standard about \$1 billion — more than any exploratory well in history. Located in Harrison Bay about 65 miles northwest of Prudhoe Bay, Mukluk No. 1 was drilled from the largest gravel island ever built in U.S. waters.

With the fall of oil prices in 1985, BP shifted its emphasis from finding new oil to maximizing production from known oil accumulations in proximity to the Prudhoe Bay industrial complex. During the 1980s and early 1990s the company improved its knowledge of areas in and around Prudhoe Bay through 3-D seismic surveys and continued drilling. During this period the company continued to improve its lease position both east and west of Prudhoe Bay, and in the Beaufort Sea just northwest of Prudhoe Bay.

In 1986 the Lisburne field was brought on stream. The Lisburne formation lies beneath the Prudhoe Bay reservoir, but is a tighter formation consisting of limestone and dolomite (carbonate). These characteristics made development of this region more challenging. But in the early 1990s the Lisburne Production Center (LPC) was expanded to allow the facility to receive fluids from other nearby fields, like Niakuk and Point McIntyre.

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# Prominent Alaskans reflect on significance of Prudhoe Bay, North Slope oil fields

"If it weren't for Prudhoe Bay, there wouldn't be anything else going on (on the North Slope). It's hard to imagine Alaska without oil."

—*Scott Goldsmith, economics professor, University of Alaska Anchorage*



"From health care to education to social issues, oil benefits every resident of this state. Oil provides 85 percent of the state operating budget and this money affects the entire state and its people. We need to stop and remind ourselves that the partnership between Alaska and the oil and gas industry is too important to jeopardize."

—*Gov. Bill Sheffield, Alaska governor 1982-86, currently director of the Port of Anchorage*



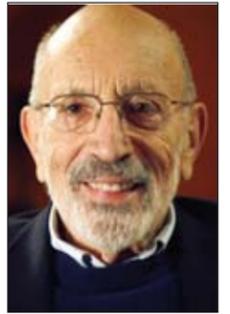
"At the time of the Prudhoe Bay discovery, the state needed to build roads and other infrastructure. We had some very big land issues to resolve. Prudhoe Bay's development was the impetus and made decisions come faster. Without question, oil has been a big factor in the state's economy."

—*Arliss Sturgulewski, former Alaska legislator*



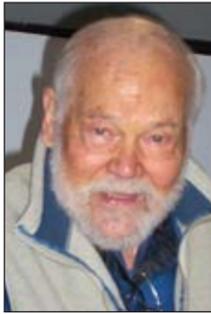
"The Prudhoe Bay discovery was a great day for Alaska. It proved we would have a new resource coming on line that would provide significant economic progress for the state. Without North Slope oil there would be no Permanent Fund dividend, which plays a role in the economy and helps lower-income Alaskans psychologically — people get to share in the state's oil wealth."

—*Vic Fischer, former territorial legislator, delegate to Alaska's 1955 Constitutional Convention, currently a state senator and director of University of Alaska Institute of Social and Economic Research (ISER)*



"To the United States, with its insatiable appetites, Prudhoe Bay's billions of barrels of oil (were) heralded as but one more fat item on the energy menu. But to Alaskans, it was seen as the end of dark poverty, and the dawn of prosperity."

—*Gov. Jay S. Hammond, Alaska governor 1974-82, died in 2005*



"It is clear to me now that Alaska may well not have survived as a state had oil not been found and produced. When I first was elected to the legislature in 1966, Alaska was running a deficit government and could barely pay for the little government we had, let alone deal with all the needs of the cities and villages. We were living hand to mouth. Oil revenues have enabled Alaskans to have a lifestyle comparable to many states in the Lower 48, if not better. Had oil not been found, taxes would be astronomical and our infrastructure would still be primitive."

—*Willie Hensley, a Native Alaskan born in Kotzebue, served in Alaska Legislature for 12 years and also served as Alaska Commissioner of Commerce and Economic Development*



"The long-term partnership between Alaska and the oil and gas industry and the resulting wealth brought Alaska into the 21st century with a strong, viable economy. This partnership has improved all facets of our lives, providing for public education, public health and public safety for all Alaskans and assuring benefits that have greatly improved our quality of life. The partnership has allowed us to safely prepare for Alaska's future."

—*Gail Phillips, lifelong Alaskan, former Speaker of the House in Alaska Legislature, active civic and community leader*



—*compiled by Frank Baker*



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The BP-operated Central Gas Facility (CGF) at Prudhoe Bay is the largest of its kind in the world.

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# Evolving oil field technology

*Technology, innovation on the North Slope has helped reduce environmental impacts, reducing industry's footprint*

BY FRANK BAKER  
For Petroleum News

Through decades of oil production at Prudhoe Bay and other North Slope oil fields, producers have significantly advanced technology in drilling, Arctic engineering, waste disposal and environmental management, and have developed better tools to locate underground structures that contain oil. Combined, these advancements have greatly reduced the impact or "footprint" of oil field development on the North Slope.

To locate underground structures that may contain oil, geologists survey land with technologically sophisticated gravity meters and magnetometers. They use seismographs, similar to those that measure earthquakes, to explore what they cannot see by sending sound waves underground and measuring how long it takes the waves to reflect off rock layers and return to the surface. Geologists feed that data into computer models to create 3-dimensional pictures of underground formations. With computerized areal tomography (CAT) scans and magnetic resonance imaging (MRI) — the same technology doctors use to peer inside the human body — they use modern imaging rooms to visualize the presence of oil in the rocks.

With grind-and-inject technology, drilling waste is safely re-injected underground into isolated geologic formations, eliminating the need for surface storage areas, or reserve pits, used during Prudhoe's early development.

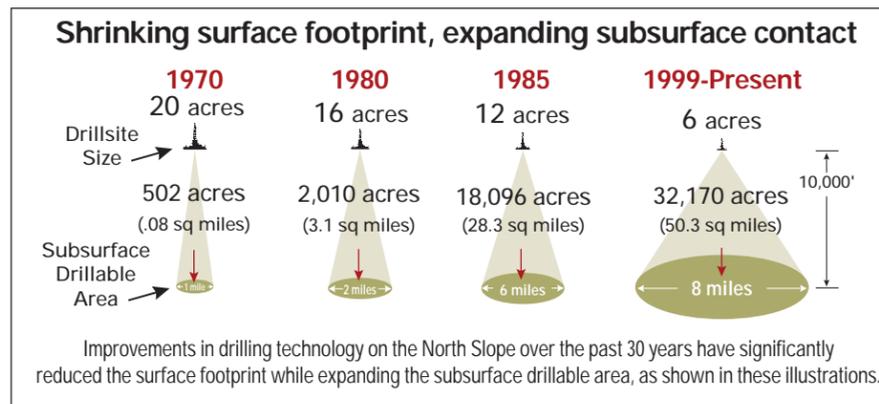
This information helps companies pinpoint where to drill. Today's drilling techniques include extended-reach, horizontal and multilateral wells, which are multiple wells drilled off a common hole to the surface. These wells are based on real-time information about what is happening down-hole. From surface locations miles distant from the down-hole target, they can reach small pockets of oil never thought possible by the Slope's pioneer drillers.

The advent of new down-hole directional equipment and drilling motors has made it possible to drill new wells with coiled tubing units that for years have been used to perform maintenance work on North Slope wells. With this new method, new wells are drilled through the production tubing of existing wells, eliminating the need to pull the tubing out of the ground as a conventional drilling rig must do. Also, the job can be done with the well's "Christmas tree," the surface assembly of valves, in place.

Coiled tubing wells can be drilled at a fraction of the cost of traditional rotary rigs.

## Footprint reduction

An immediate benefit of drilling advances and improved waste management techniques has been a marked reduction in the land area needed for oil field development. Wells that once were spaced about 120 feet apart are now drilled as close as 10 feet. With grind-and-inject technology, drilling waste is



safely re-injected underground into isolated geologic formations, eliminating the need for surface storage areas, or reserve pits, used during Prudhoe's early development.

Prudhoe Bay development directly covers about 5,000 acres, or less than 2 percent of the field's total surface acreage. As an example of evolving

technology, the 40,000-acre Alpine field to the west of Prudhoe Bay has been developed from facilities covering about 100 acres or less than 0.2 percent of the land.

Today exploration drilling is conducted from temporary pads of ice that disappear after the well has been drilled, leaving virtually no trace. Construction

of pipelines and other facilities is also done during winter from ice roads or pads. From design through construction and operation, there is a continual dialogue between the industry and regulatory agency personnel to ensure the best methods are used to minimize environmental impacts.

## Environmental stewardship

More than four decades of oil exploration, development and production on Alaska's North Slope have resulted in it being one of the most intensively studied and surveyed regions in North America, and the best understood environment of the circumpolar Arctic.

Environmental studies include air and water quality sampling, documenting baseline conditions prior to new devel-

see page B4 TECHNOLOGY



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Fish and Wildlife researcher Steve Amstrup with sedated polar bear during tagging project. Each year Amstrup uses BP's Endicott facility for his research staging area.



Oil spill response training on the Knik River, north of Anchorage.



Studies of area vegetation for future reclamation are continuing.

continued from page B3

### TECHNOLOGY

opments. The data is used to assist project engineers with the routing and placement of gravel roads and pads to minimize environmental impacts. Examples of such studies include mammals and bird surveys and habitat mapping to determine important wildlife habitats, including those of marine mammals offshore.

Example of studies to support permits include water source sampling for ice road construction and cultural resource clearance to ensure that activities avoid known cultural or historic sites.

Wildlife studies assessed the impact of ongoing operations. Examples include aerial surveys of spectacled eiders as a threatened species, and acoustic surveys of bowhead whales to understand their response to offshore operations, such as at Northstar Island.

Extensive research has shown that North Slope development has had minimal impacts on fish and wildlife populations. For example, the number of Central Arctic Herd caribou moving through the Prudhoe, Kuparuk and Alpine oil fields has increased from 3,000 in 1972, when development began, to about 32,000 today.

More than 200 species of waterfowl and shorebirds migrate to the North Slope each spring. These include Canada geese, snow geese, tundra swans, white-front geese, loons and waterfowl such as long-tailed duck, pintail, scaup and four species of eider ducks.

Barren-ground grizzly bear, Arctic fox, wolf, Arctic hare, musk oxen, ground squirrel, lemming and other wildlife roam the North Slope as they did prior to development.

Fish such as Arctic char, whitefish and grayling spawn in the upper reaches of rivers such as the Sagavanirktok, Kuparuk, Canning and Colville.

In coordination with the Alaska Department of Natural Resources, National Marine Fisheries Service and other interested agencies, industry expends considerable effort in identifying fish habitat important to life-cycle periods before any development activity can begin.

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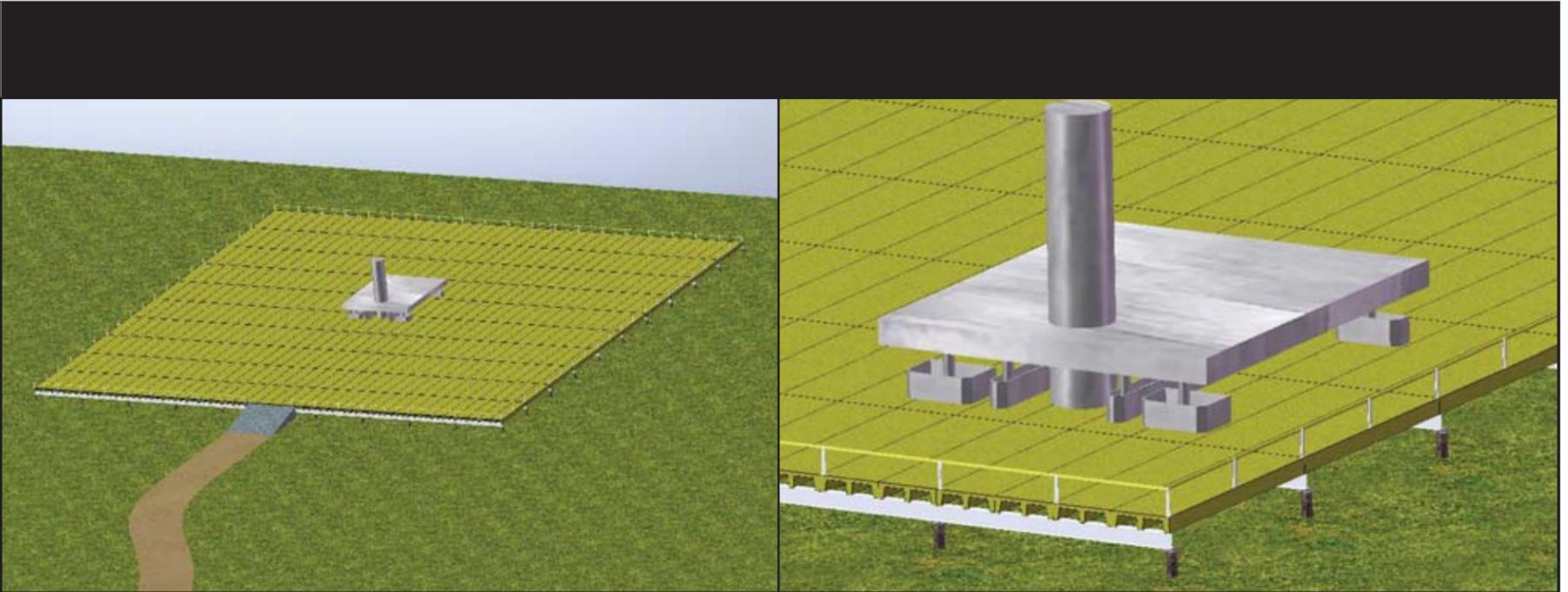
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# Offshore challenges – Endicott, Northstar, Liberty

BY FRANK BAKER  
For Petroleum News



Aerial of Northstar Island (view to south) showing pipeline access route (dark road) and haul road in April 2000.

Following Prudhoe and Kuparuk, Endicott was the third major oil field developed on the North Slope by BP, the field's major interest owner. The Sag Delta discovery, 10 miles northeast of Prudhoe Bay and two miles offshore, was made by BP in 1978. Development, however, didn't begin until 1985, when more than 6 million cubic yards of gravel was trucked from shore to create a five-mile-long causeway and two islands.

Endicott represented the third generation of North Slope oil field facilities, benefiting from lessons learned in the construction of Prudhoe Bay and Kuparuk.

One of Endicott's main features was its compactness: The entire production facility, along with initial drilling site, worker housing, utilities, warehouse and other facilities, would fit onto a 45-acre island. A causeway would connect this island, called the Main Production Island, to shore and to a smaller island, called the Satellite Drilling Island.

To prevent erosion from wave action due to summer storms, the perimeters of the islands were lined with large concrete blocks and bags. Large breaches or bridges were built into the causeway to allow fish movement. Wells were drilled 10 feet apart — closer together than in any previous Slope development. This helped significantly reduce the amount of space needed for field development.

The production modules were built in Louisiana and barged to Endicott in 1986 and 1987. Although some of the facilities were the largest ever brought to the Slope — fitting through the Panama Canal with only inches to spare — they were built for economy and purpose.

Unlike some Prudhoe Bay installations, which include multiple backup systems, Endicott's facilities were kept simple.

In addition to ARCO and Exxon, partners with BP at Endicott included three Native corporations: Cook Inlet Region Inc., Doyon Ltd. and NANA. Doyon was also one of the field's main drilling contractors for several years.

Completed a year ahead of schedule

see page B7 OFFSHORE

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Endicott production modules, right, arrive in 1987 sealift.



Alaska interstate construction crew laying mats for slope protection at Northstar Island June 29, 2000. Underwater divers complete the process of linking the mats together.

continued from page B6

## OFFSHORE

and about \$600 million under budget, the Endicott field began producing in October 1987 and has produced more than half of its 600 million barrels of recoverable oil. Field development costs were slightly more than \$1 billion. Endicott production began in October 1987 and in the early 1990s achieved a peak rate of 120,000 barrels per day. It is currently producing about 15,000 barrels per day.

Endicott was one of the first North Slope fields to achieve Voluntary Protection Program status through the U.S. Occupational, Health and Safety Administration. VPP is a merit program based on exemplary safety performance that allows operators greater autonomy and self-regulation in administering health and safety programs.

### Endicott poses environmental challenges

Endicott's environmental challenges proved to be as great or greater than engineering and construction hurdles. Located offshore, its proximity to fish and wildlife habitat resulted in substantial environmental scrutiny.

During project planning, great care was taken to ensure environmental and habitat protection. Prior to development, an unprecedented number of government approvals and environmental permits established that the project could be developed based on a breached causeway approach which would allow fish migration through three breached gaps.

Endicott's environmental monitoring program — the largest of its kind ever conducted in the Arctic — ran for about 10 years, at a cost of about \$5 million each year. It included:

- a seven-year assessment program to evaluate fish movement, distribution and prey;
- an oceanography program to evaluate water quality;
- a terrestrial program directed toward caribou and snow geese concerns.

Over the years, the studies revealed there were no significant changes in nearshore water quality

see page B12 **ENDICOTT**

### Endicott preparing for future

Beginning in 2008, the Endicott field embarked upon a five-year renewal plan that will ensure operations integrity and prepare the field for increased oil production rates for decades to come.

Twenty-one years after its startup, Endicott has yielded more than 500 million barrels of oil equivalent, and is still producing about 15,000 barrels of oil per day. But with current development plans,

which include processing oil from the nearby Liberty field, Lo-Sal production, carbon dioxide injection and facility upgrades, the facilities' daily oil production rate could more than triple and extend the field's life to 2040.

Endicott Field Manager TJ Barnes says that major infrastructure upgrades — from wellhead to oil processing facilities — are at the heart of the five-year renewal plan.

Alaska Consolidated Team (ACT) Resource Manager John Denis says that a logical progression in Endicott's development will be LoSal™ enhanced oil recovery (EOR) followed by CO2 recovery when major gas sales begins.

CO2 will need to be extracted from the gas used for sales to the Lower 48 and the CO2 can then be used as a solvent to extract more oil from existing

see page B8 **OFFSHORE**



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Aerial view of trench preparation.

## Ultra extended-reach drilling at Liberty

The oil industry has long used directional drilling, but extended-reach drilling has allowed dramatic increases in drilling distances. The measurements used to describe ERD drilling include total vertical depth (vertical depth below the surface), horizontal departure (horizontal distance from the well's surface location to the surface above the well's endpoint in the reservoir), and measured depth (length of well bore).

The technology of ERD makes the development of Liberty from shore a possibility.

The ERD drilling envelope is anchored by a BP Wytch Farm well with a horizontal departure of about 35,000 feet (6.6 miles) at about 5,500 feet TVD. However, Liberty will require wells with horizontal departures from about 34,000 to 44,000 feet (up to nearly 8.3 miles) to reach the reservoir at about 11,000 feet deep. The current North Slope record for horizontal departures is 19,825 feet for a well at Niakuk that reached 9,380 feet TVD.

Because of their great departures, the Liberty wells are termed ultra extended-reach, or ERD. Successful ERD requires that drillers know where the drill bit is at all times and that a rig be able to lift and rotate miles of drill pipe. Improvements in drilling technology that make ERD possible include rotary steerable drilling systems, larger top-drive units, measurement while drilling (MWD), logging while drilling (LWD), smart completions, and mechanical tractors that operate inside wells.

Drilling ERD wells at Liberty will require a very powerful drilling rig not currently available on the North Slope. BP is building a new rig with requisite hydraulic, hoisting, and drive systems. The new rig will be the most capable in the world designed specifically for delivering the Liberty wells.

—Frank Baker

continued from page B7

## OFFSHORE

reservoirs. CO2 EOR is a proven technology that will have broad applications across the North Slope.

“We’ve rebuilt our reservoir models and have developed a comprehensive depletion plan for Endicott,” notes Denis. “We’re into the fourth year of a program to stabilize and improve the reliability of our facilities and wellstock,

we have brought OMS to Endicott, and we have a robust program under way to renew our facilities. With the development of new technologies like LoSal and production from the new Liberty field, we’re looking ahead to a very bright future for Endicott.”

At any one time there are between 70 and 90 workers at Endicott, which consists of two man-made, gravel islands connected to each other and to shore by a five-mile-long gravel causeway.

Beginning in 2007, Endicott was also among 16 BP-operated sites across the world to pilot the Operations Management System (OMS), the company’s global, overarching standard for safety and integrity management in construction and operations.

As part of an ongoing effort to make the site a safer and more efficient place to work, Endicott personnel have advanced several continuous improvement projects and adopted Control of Work tenets that exemplify OMS principles.

BP holds a 67.9 percent interest in Endicott. Other major owners are ExxonMobil, 21 percent and Chevron, 10.5 percent.

## Northstar shines bright for today, tomorrow

Nearly a decade after field startup, Northstar is producing about 34,000 barrels of oil per day, a significant contribution to BP Alaska’s North Slope net production.

As Northstar’s operator, BP Alaska has a 98.6 percent interest in the field.

The field is located offshore in the Beaufort Sea, about five and a half miles northwest of Prudhoe Bay in about 39 feet of water.

Northstar is the first Arctic offshore field connected to shore only by pipeline, delivering its oil via a six-mile, subsea line.

Construction of the Northstar field began in late 1999.

In the winter and spring of 2000, construction crews rebuilt Seal Island, an existing artificial gravel exploration island, into the permanent production island for Northstar. Production facilities were built in Alaska and barged to the North Slope.

see page B10 OFFSHORE

SURFACE SYSTEMS

# Performance

## IN EXTREME CONDITIONS



### Cameron salutes BP for 50 years of successful operation in Alaska.

Like BP, Cameron has been in operation in Alaska since the 1950's and has been an active participant in the oil and gas industry on the North Slope. From its base in Anchorage, Cameron operates a complete CAMSERV™ Aftermarket Services facility geared specifically to meet the needs of the Alaskan market and customers such as BP.

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Geotechnical engineer Beez Hazen, Northstar contractor, and BP Exploration (Alaska) island construction engineer Earl Beverly at Northstar Island June 29, 2000.

continued from page B8

## OFFSHORE

The modules were the largest oil production facilities ever fabricated in Alaska, and required a peak workforce of 1,000.

Workers also installed a 17-mile pipeline connecting the island to the trans-Alaska oil pipeline.

A six-mile section of the 10-inch-diameter oil line was buried in the sea floor. Crews installed the offshore section of the line by cutting a slot in the sea ice.

Seal Island was built by Shell Western E&P in the early 1980s after it discovered the Northstar field. Shell and its partner Amerada Hess drilled five appraisal wells, but the field was never developed because development costs were too high.

BP Exploration (Alaska) Inc. acquired Shell's and Amerada's interests in the field in early 1995 and authorized construction in 1996 after Alaska Gov. Tony Knowles and the Alaska State Legislature agreed to change a high percentage net profits royalty into a 20 to 27.5 percent sliding scale royalty tied to oil price.

Despite construction delays caused by permitting delays and legal challenges, Northstar was back on track in 1999. The project workforce peaked in spring 2000 with more than 1,000 people employed on the project in Anchorage, Fairbanks and the North Slope. Northstar began production in October 2001.

With about 176 million barrels of recoverable reserves, Northstar is a small field when compared to the very large North Slope fields developed earlier.

## Lots of 'firsts' at Northstar

Northstar development involved a number of "firsts" for BP and the petroleum industry:

- It is the first Arctic offshore field connected only by pipeline to shore. (The larger Endicott field, which has been producing since 1987, is closer to shore and is connected by a gravel causeway.)
- The six-mile pipeline has a wall thickness triple those of typical onshore North Slope pipelines, and is state-of-the-art. The pipeline has three separate leak detection systems, including a system capable of detecting very small leaks (as little as one barrel per day).
- BP committed to the state that it would construct large sea-lift modules in Alaska and conduct training for Alaskans. Module units built in Anchorage were the largest ever constructed in the state.

Other special engineering and design features include pipe burial to nine feet below the seafloor — almost three times the ice gouge depth that would be caused by a 100-year event; high strength, pipe; and two types of corrosion protection: double thickness fusion bonded epoxy coating and aluminum anodes to provide cathodic protection.

With a 98.08 percent interest, BP Exploration (Alaska) is the Northstar operator. Murphy Oil holds a 1.92 percent interest.

## Environmental issues

Northstar is a state-of-the-art facility that produces and processes the field's fluids from a five-acre production island, with a footprint of about .05 percent of the reservoir's area.

Northstar is a zero-discharge facility. Waste is re-used, recycled, or taken ashore for proper disposal.

Numerous environmental studies have been undertaken in the area to determine potential impacts of Northstar island operations on marine mammals and fish. Air and water quality are also monitored on a regular basis.

## Liberty: the extended reach

One of the most exciting projects in BP Alaska's business portfolio is Liberty, an offshore oil field located in the Beaufort Sea. With about 100 million barrels of recoverable oil, it is one of the largest undeveloped reservoirs of light oil on the North Slope. The entire field is located in federal waters.

BP will develop Liberty from existing infrastructure using world-class ultra

see page B12 OFFSHORE

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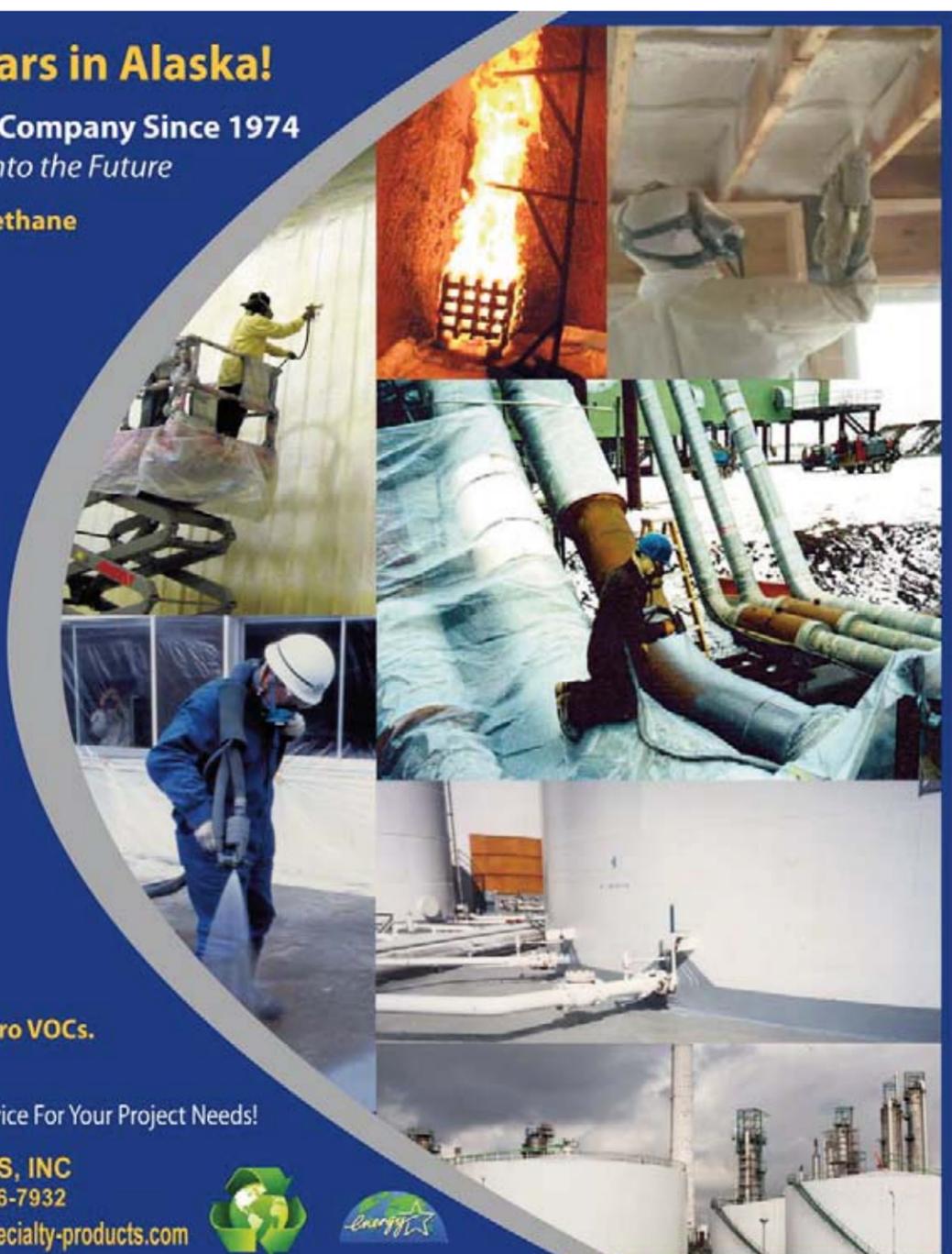
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continued from page B10

## OFFSHORE

extended-reach drilling technology. The Liberty field lies under federal waters of the outer continental shelf some 15 miles east of Prudhoe Bay and ranges from 7 to 10 miles east of BP's existing Endicott development. The center of the reservoir is approximately 5.5 miles from the nearest land.

Historically, the only way to develop a field like this was to construct an artificial gravel island and a subsea pipeline

**Parker Drilling Co. was constructing a special drilling rig for Liberty that will be capable of drilling the ultra-long, extended-reach wells. ... It will be the largest land-based drilling rig ever built.**

to get production to shore, as was done at Northstar, a field BP developed in the late 1990s. Or, in the case of BP's Endicott field, a causeway was built to connect the islands to shore.

However, with advances in drilling

technology, like the ultra-extended-reach wells BP pioneered, it is now possible to develop fields like Liberty in a very different way.

BP's plan is to drill wells from the easternmost drill pad at Endicott — the Satellite Drilling Island. The SDI will be enlarged to process Liberty fluids through the existing Endicott facilities. The SDI's working surface will be expanded from about 11 to 31 acres.

Endicott has been a very successful development, but has seen oil production decline from peak rates of some 120,000 barrels per day to less than 20,000 at present. As a result, Liberty will be able to take advantage of Endicott's under-used facilities.

Using existing facilities tied into the North Slope road system enhances safety by providing year-round overland access and maximizes environmental protection by avoiding construction of new offshore or onshore drilling pads or pipelines.

### Environmental concerns

Through its decades of experience in the Arctic, BP recognizes the concerns of North Slope residents over the potential environmental impacts of offshore development. Before, during and after construction, and after the field begins producing, environmental monitoring will be conducted in the area. Studies will include assessments to determine whether fish, marine mammals (including whales), birds and other wildlife are impacted.

The Liberty project will generate significant revenues to the North Slope Borough and to the state and federal governments through taxes and royalties.

The total investment at Liberty is expected to exceed \$1 billion, and at peak production in 2012-13, Liberty is expected to produce about 40,000 barrels of oil per day.

Production will be sent by the Endicott production flowlines from the SDI to the Endicott Main Production Island for processing. The oil will then be transported to the trans-Alaska oil pipeline via the Endicott sales oil pipeline. Produced gas will be used for fuel gas and artificial lift for Liberty, with the balance being re-injected into the Endicott reservoir for enhanced oil recovery. Water for waterflooding will be provided via the existing produced-water injection system at the SDI. This supply will be augmented by treated seawater if

needed from the Endicott Seawater Treatment Plant.

### Liberty moves ahead on several fronts

By early 2009, BP Alaska's Liberty project was in high gear, with drilling rig fabrication under way and North Slope activities focusing on Endicott Satellite Drilling Island (SDI) expansion, camp and facility fabrication and improvements to the Sagavanirktok (Sag) River bridge, which are nearing completion.

Parker Drilling Co. was constructing a special drilling rig for Liberty that will be capable of drilling the ultra-long, extended-reach wells. Major fabrication and outfitting of the rig was being completed in Vancouver, Wash., at Thompson Metal Fab Inc. Fabrication of the rig power module was under way at ASRC shops in Anchorage and on the Kenai Peninsula. It will be the largest land-based drilling rig ever built.

The rig was expected to be moved to the Endicott SDI in the summer of 2009 by barge during the ice-free period. Plans call for the rig to be fully commissioned and ready to begin drilling during the first quarter of 2010. The first ultra extended-reach well is expected to begin in the second quarter of 2010.

During the winter of 2008 and spring of 2009, Endicott's Satellite Drilling Island was being expanded to accommodate the new drilling rig and the five to six wells that will be drilled. Facilities for the expanded island, which include a camp and production facilities, were being fabricated in Anchorage.

Another phase to the Liberty project involves improvements to the Sagavanirktok River bridge on the eastern side of the Prudhoe Bay field. The bridge has been in service for more than 30 years to support Endicott as well as many other North Slope operations and developments. To prepare the aging bridge for many more years of service and to support Liberty construction and drilling activities, the existing bridge pilings were to be reinforced and the main structure replaced.

The Liberty project will set standards for Arctic development while minimizing the onshore and offshore environmental footprints. Liberty will take advantage of existing infrastructure in Endicott field, which has been producing oil since 1987.

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continued from page B7

## ENDICOTT

or in fish movements. The nearby snow goose population increased steadily. The Endicott road and pipeline were not observed to pose a barrier to snow goose or caribou movements.

During Endicott's production life, it has served as a base of operations for a number of scientific studies, including polar bear research.

Resolution of Endicott's environmental issues was a critical step in the development of the Point McIntyre field, developed by ARCO, BP and Exxon on the western shoreline of Prudhoe Bay — also considered an environmentally sensitive area. Discovered in 1988, Point McIntyre didn't go into production until 1993 and by early 1997 became one of the top 10 producing oil fields in the United States.

—Frank Baker



## *We've Come a Long Way BP!*

Parker Drilling congratulates BP on the success of its 50 years in Alaska. 2009 is also a year of accomplishment for Parker, as we celebrate 75 years of advanced drilling solutions.

Parker is proud to partner with BP on the next chapters of its Alaska history, a development drilling program in Greater Prudhoe Bay utilizing two new Parker arctic land rigs and the Liberty project, powered by the Parker-designed and constructed Liberty ultra-extended-reach drilling rig. Liberty promises to set a new standard for arctic oilfield development, pushing the boundaries of extended-reach drilling technology to minimize the on-shore and offshore environmental footprint.

Here's to the next 50 years of safe, responsible expansion of Alaska's energy horizon.

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# Mergers, acquisitions mark transition to new millennium

BY FRANK BAKER  
For Petroleum News

Positioning itself for a highly competitive, tough global marketplace in the 21st century, BP merged with Amoco on Dec. 30, 1998. With a market capitalization of \$143 billion at the time of the merger, BP joined the ranks of the world's three largest super-major energy companies and became the largest producer of gas in the U.S.

At the time of the merger, Amoco was the largest natural gas producer in North America, with a reach that stretched well beyond its home continent: exploration in 20 countries, production in 14 countries. Amoco produced 13 million tons of chemicals a year and was the world's largest producer of purified terephthalic acid, or PTA, a chemical used in the production of polyester fibers. Amoco was big in solar power, too, with a 50 percent stake in a leading solar company.

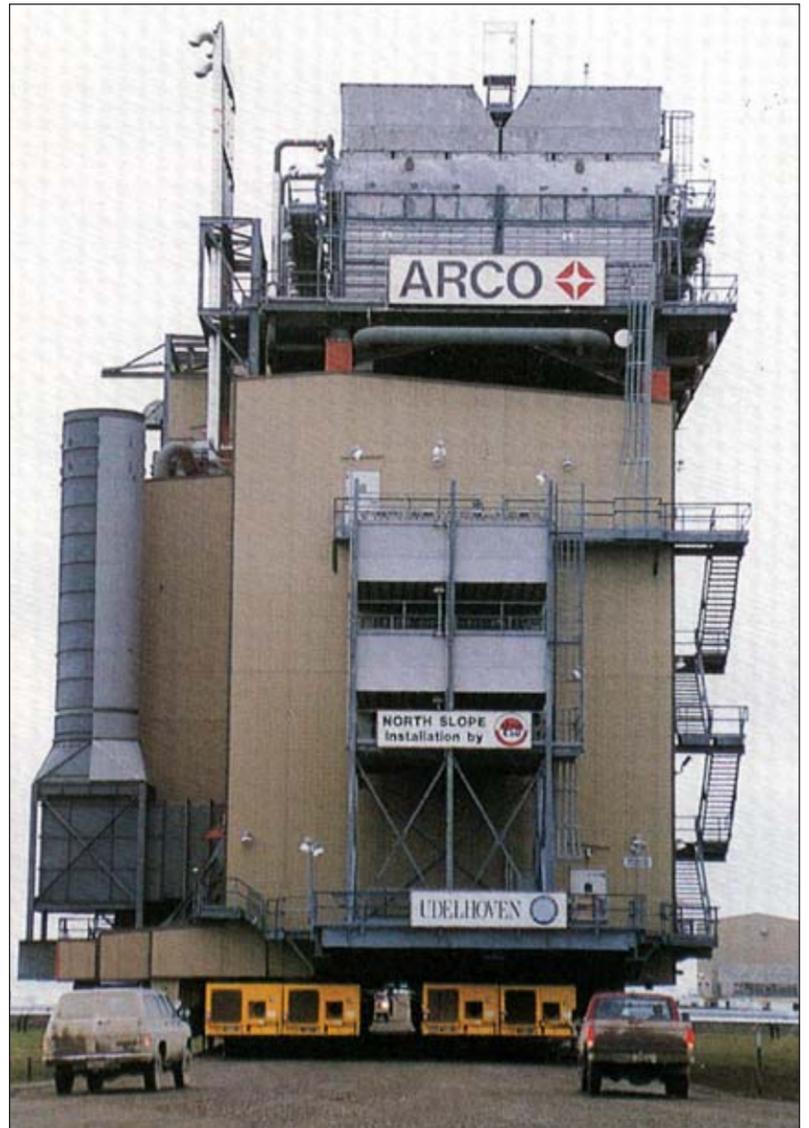
Early in its history Amoco invented a process called thermal cracking, which doubled the amount of gasoline that could be made from a barrel of oil, and also boosted the gasoline's octane rating.



Signing the charter for development of the Alaska North Slope: Richard Campbell, president, BP Exploration (Alaska); Rodney Chase, deputy chief executive officer, BP Amoco; Revenue Commissioner, Wil Condon; Natural Resources Commissioner, John Shively; Alaska Gov. Tony Knowles.

## ARCO approaches BP

Reeling from the impact of low oil prices on its global operations, ARCO approached BP Amoco in late 1998 about a possible buyout. Seeing the attractiveness of ARCO's assets in upstream oil and gas, as well as downstream operations in the western U.S., and strong gas development position in Asia, BP Amoco decided early in 1999 to pursue the acquisition, valued then at about \$26 billion.



GSX-2 gas handling modules were among the largest ever fabricated for Prudhoe Bay.

see page B15 TRANSITION



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continued from page B14

## TRANSITION

The U.S. Federal Trade Commission (FTC) approved the BP Amoco-ARCO combination on April 13, 2000, more than a year after the deal was first proposed. The union created a combined group with more than 100,000 employees and operations in more than 100 countries.

FTC approval came after BP agreed to sell all of ARCO's Alaska businesses to Phillips Petroleum. It also followed an agreement between the major owners of the Prudhoe Bay field aligning their interest in ownership of all oil and gas resources within the Prudhoe Bay unit. The agreement also established BP as the single operator of the Prudhoe Bay, Point McIntyre and Niakuk fields, and overall improved the competitiveness of the Alaska oil industry.

The charter also provided for BP and Phillips to make natural gas available to a gas project at market prices, make significant new expenditures on cleanup of "orphan" contaminated sites on the North Slope, ... do new research and development on spill cleanup technology, and commit to ongoing contributions to Alaska charities and the University of Alaska.

The interest alignment of the major owners — BP Amoco, Exxon and the new owner, Phillips — was an event heralded by some observers as one of the most significant events in the field's history.

"It's a landmark development," commented Brian Davies, a retired BP executive who lives in Anchorage. "The deal positions BP for a long and successful future in Alaska."

BP's \$7 billion sale of ARCO's Alaska businesses to Phillips Petroleum included 1.1 million net exploration acres, a 22.3 percent interest in the trans-Alaska oil pipeline and ARCO's crude oil shipping fleet, including six tankers in service and three under construction. The booked reserves sold totaled 1.9 billion barrels of oil equivalent.

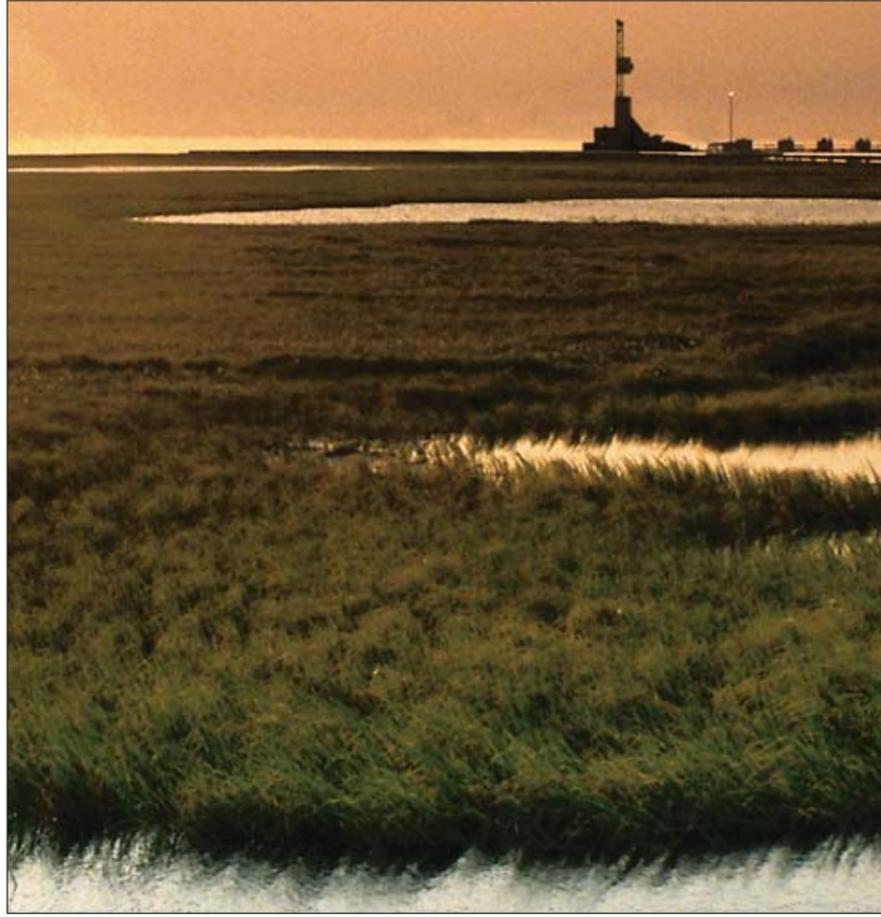
The properties, by themselves, made Phillips Petroleum one of the top 10 oil and gas companies in the United States.

### Charter with State of Alaska

The agreement with the FTC was foreshadowed by a landmark agreement with the State of Alaska called the Charter for the Development of the Alaskan North Slope, which was signed Dec. 3, 1999.

The agreement, negotiated by Alaska Gov. Tony Knowles and key members of his administration, called for the continued presence of two major operators on the North Slope and the sale of reserves, exploration acreage and a portion of the trans-Alaska oil pipeline to that new North Slope operator.

The charter also provided for BP and Phillips to make natural gas available to a gas project at market prices, make significant new expenditures on cleanup of "orphan" contaminated sites on the North Slope (exploration or support sites abandoned by other companies), do new research and development on spill cleanup technology, and commit to ongoing contributions to Alaska charities and the University of Alaska.



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A Minority Business Enterprise (MBE)

# Legacy of corporate citizenship, social investment

BY FRANK BAKER  
For Petroleum News

Alaska is large in landmass but small in population, and today more than ever, the company's 2,000 employees are making a difference across the state. Employees currently support more than 700 community and education organizations and 150 youth teams in about 40 Alaska communities, either in direct contributions or volunteerism.

"BP Alaska has long believed it can best support communities by helping to build skills and leadership, growing community capacity, and helping to bring about measurable and long-term community improvement," says Carla Beam, BP Alaska's director of community affairs. "Today, in the spirit of BP's Fabric of America philosophy, our employees represent the frontline in

reaching out to Alaska communities in a very direct and personal way, and ultimately making those communities better places to live."

During its long history of social investment in the state, BP has been a private sector leader in the advancement of education, health care and social services. Major, multiyear contributions to the University of Alaska at Anchorage and Fairbanks, Providence Hospital, and the Alaska Native Heritage Center have dramatically improved the quality of services provided by these and other Alaska institutions.

BP is one of the largest private sector investors in Alaska, but its investments extend beyond business to the communities where it operates and where its employees and their families live.

## Fostering financial literacy

For more than 30 years, BP has partnered with the Alaska Council on Economic Education to promote teaching of economics in Alaska's public schools. BP's support has helped teachers incorporate economics into the classroom, promoted teacher certification in economics and sponsored advanced placement courses, required for schools that want to offer advanced placement economics.

## Nurturing a new workforce

Recruiting and training a skilled Alaska workforce is key to BP's long-term success. Since 2006, the company has increased its Alaskan workforce by more than 40 percent to nearly 2,000 employees. As BP's workforce ages and retires, the company actively supports statewide vocational and college programs that promote careers in oil, gas, mining and other process industries.

Since 1999, the Alaska Process Industry Careers Consortium has been cultivating the next generation of employees through information and training, as well as scholarships, internships and career awareness activities for Alaska students.

Through APICC, industry-related companies develop definitions for industry job classifications, which are implemented in university and other training curricula.

## Alaska Grown Engineers

The Alaska Native Science and Engineering Program at the University of Alaska Anchorage is now recognized nationally for its groundbreaking work in attracting Native students to the hard sciences and busting stereotypes in the process. But it wasn't always that way, according to Herb Schroeder, the engineering professor at UAA who founded the program in the late 1990s.

Schroeder worked with BP to start the Summer Bridge Program with eight students in 1998. The program, one of five components of ANSEP, takes recent high school graduates through a nine-week regime to prepare them for college-level math and science. The Summer Bridge Program has grown to 36 students from all over Alaska.

BP also hires interns and graduates. The latter is significant, Schroeder said, because it means ANSEP graduates are

For more than a decade BP has been a major corporate sponsor of Alaska Special Olympics.



## CH2M HILL Congratulates BP on 50 Years in Alaska

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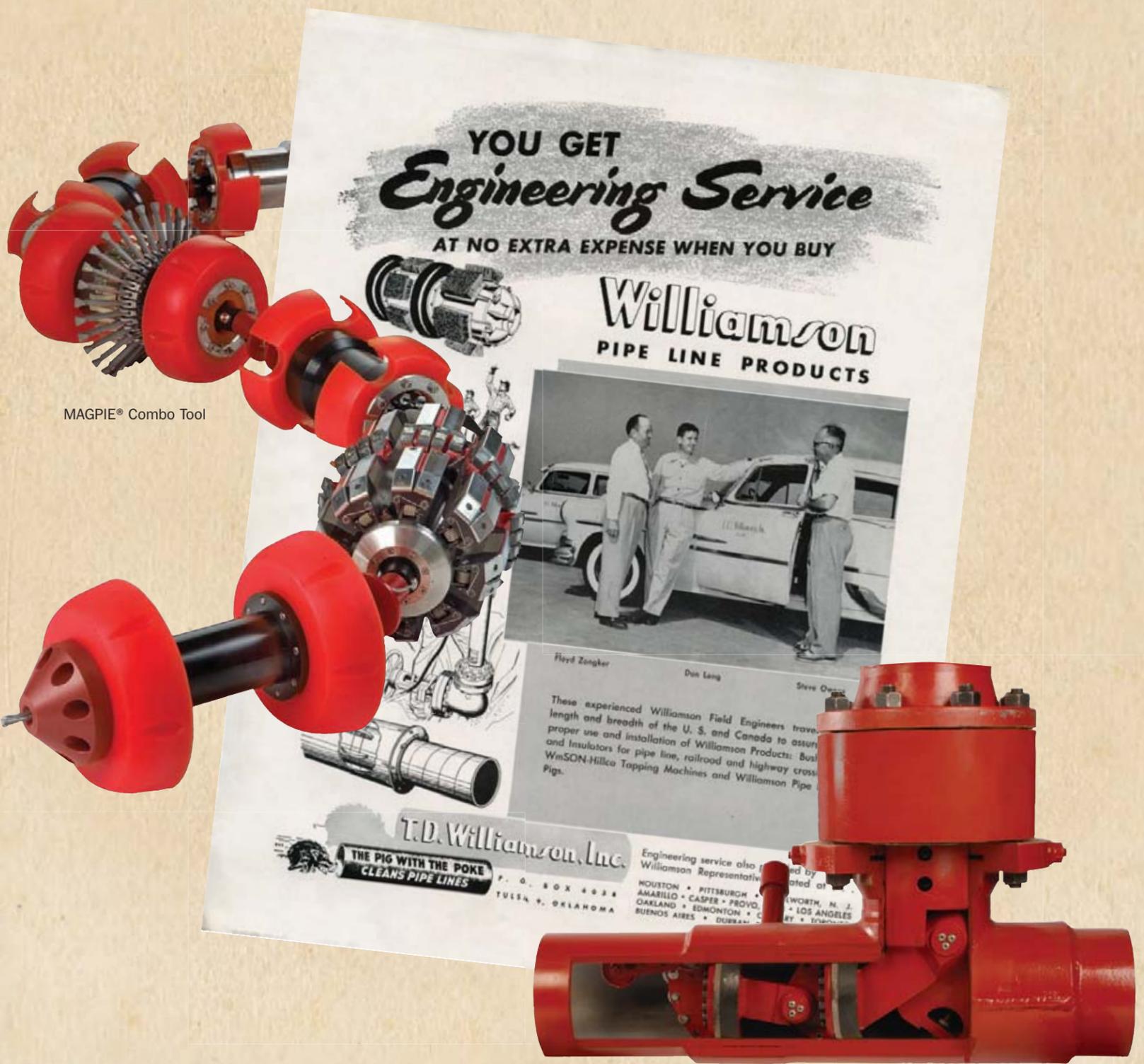


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University of Alaska Anchorage campus. BP Exploration (Alaska) is a major contributor to the university statewide systems.

continued from page B16

## INVESTMENT

competing successfully with college graduates from schools in the Lower 48 states.

### Investing in higher education

The partnership between BP and the University of Alaska goes back decades and spans a broad array of programs, initiatives and academic disciplines. BP has long supported petroleum engineering and research, including training and scholarship programs to increase the number of students going into science and engineering fields.

The partnership stepped up to a new level in 2000, when as part of the provisions in a Charter agreement with the State of Alaska, BP committed to a defined level of charitable contributions each year based on the production and price levels of Alaska North Slope crude. Thirty percent of each year's total contributions go to the University of Alaska Foundation.

In 2007 alone, the contributions supported hiring or continuation of professors in educational technology, public health, education and fine arts. Charter funds support research and instructional initiatives in fields such as human development in the Arctic, distance learning and educational technology, fisheries and marine science, and Alaska's 50th Anniversary Statehood Project. Since 2000, BP has contributed \$30 million to the University of Alaska.

### Knowledge source of comfort, hope

A diagnosis of cancer is shocking, terrifying, bewildering. Many cancer

patients and their families have a voracious need to learn: They want to read everything they can get their hands on. Yet the resources themselves can be confusing at best and more often overwhelming. A partnership between BP and Providence Alaska has resulted in a new information program that makes such information easily accessible.

Early learning: BP was an early and committed partner in Best Beginnings, a public-private initiative organized to promote early learning and literacy.

Studies are showing unequivocally that early learning experience from birth to age 6 has a profound impact on later success in school and in life. Economists say that investments in early learning yield impressive benefits through higher productivity and far fewer social costs.

Best Beginnings is mobilizing people and resources to establish the systems required to ensure that every child in Alaska has the knowledge and skills to be ready for school.

### Investing in alternative energy

BP is looking to alternative energy to help meet the world's demand for energy that emits little or no carbon — such as biofuels, solar, wind, hydrogen and gas-fired power.

That effort is embodied in BP's partnership with the Cold Climate Housing Research Center in Fairbanks. The work is a demonstration project that combines several sources of renewable energy to power small-scale energy demands in Alaska on a year-round basis.

The Hybrid Micro-Energy Research Project consists of solar photovoltaic tracking solar arrays, two different types of solar hot water collectors, wind generation and a biomass-fired combined heat

see page B19 INVESTMENT

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continued from page B18

**INVESTMENT**

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Large sealift modules for oil and gas fields are now built in Alaska, such as this module built in Anchorage for BP's Northstar field.



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Swan Lake dam near Ketchikan is one of several hydro projects built with state oil revenues in the 1980s.

# North Slope oil yields economic benefits

*University of Alaska economist describes how North Slope oil transformed Alaska's economy*

BY FRANK BAKER

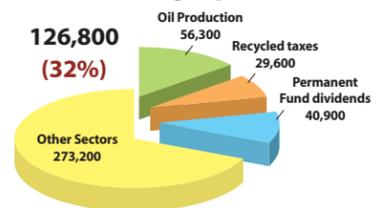
For Petroleum News

The success of BP and its partners in optimizing North Slope oil production for more than three decades spurred an economic bonanza in Alaska that has also benefited the nation, providing about 15 percent of the U.S. domestic oil production for most of that time period. North Slope oil production has reduced the cost of foreign imports by hundreds of billions of dollars, significantly improving the U.S. balance of trade and strengthening the national security.

University of Alaska economist Scott Goldsmith, with the Institute of Social and Economic Research, compiled a report in spring 2008 detailing the economic impacts of the North Slope oil industry. In 30 years, the North Slope has produced 15 billion barrels of oil, according to his research. That volume tallied up to \$378 billion — in 2007 dollars — based on value at the wellhead. That would equal 5,400 of BP's Anchorage high-rise headquarters, based on a recent tax assessment of \$70 million.

And North Slope oil has landed \$118 billion in cumulative revenue to the State

## Jobs due to oil and gas production



of Alaska, Goldsmith cited, generating about 80-85 percent of the state's general fund revenues for nearly three decades. In fiscal year 2007, that figure was 87 percent. These revenues also helped build Alaska's savings account, its Permanent Fund, which is shared by all of Alaska's permanent residents in the form of an annual dividend check. In mid-summer 2008 the fund was valued at \$36 billion.

## Without Alaska's oil industry:

This massive infusion of petro-dollars means Alaska's other industries have been able to enjoy a very light tax burden, Goldsmith says. Also, without the oil industry, Alaska's other main economic sectors like fishing and tourism would be less competitive internationally.

They would lack infrastructure purchased with oil-industry-infused state funds.

The Alaska oil industry also helps stabilize the state's work force year-round, so that the labor market isn't skewed by seasonal jobs. The oil sector adds high-paying jobs, Goldsmith points out. The oil industry registers the highest wage average in Alaska — a monthly wage of about \$12,737 — roughly 3.5 times higher than the statewide average.

One of the most striking developments in Alaska's private economy has been the creation of a vibrant, Alaska-owned and Alaska-based oil services industry. Drilling companies, service companies and contractors owned by Alaska firms today employ most Alaskans working in the industry.

Economists like Goldsmith estimate that over the years, petroleum directly and indirectly has accounted for about a third of Alaskans' jobs and gross state product.

## Quality of life improvements

Over the past half century Alaska has grown as a state and the lives of its citizens have improved dramatically, from the most northern community of Barrow to other population centers across the state.

North Slope oil has not only led to infrastructure improvements to facilities across the state, such as schools, hospitals, roads, airports, docks, bridges, shopping centers and cultural facilities. It has also lifted a huge income tax burden from the shoulders of Alaskans. The state

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see page B21 **BENEFITS**



Alaska-class double-hull tanker

JUDY PATRICK

continued from page B20

**BENEFITS**

repealed its income tax in 1980 amid oil industry payouts to the government, and has never reinstated it.

Goldsmith estimates Alaskans would have had to pay an average of 34 percent in personal income tax — since 1970 — to generate the same amount of state revenue for the general fund as the petroleum industry.

**Energy for the future**

Phil Budzik of the U.S. Energy Information Administration notes that North Slope oil amounts to 15.4 billion barrels produced through 2006, and another 6 billion barrels is currently expected to be produced, not counting new discoveries.

“All of these Alaska North Slope

The state repealed its income tax in 1980 amid oil industry payouts to the government, and has never reinstated it.

developments, both past and future, pivoted on the development of Prudhoe Bay,” he said. “In other words, without Prudhoe Bay, North Slope oil and gas production wouldn’t have taken place.”

Budzik estimates Prudhoe Bay natural gas resources at 23 trillion cubic feet — one year’s worth of total U.S. gas consumption.

“Prudhoe Bay natural gas resources will be the anchor field for the development of a 4.5 billion-cubic-feet-per-day pipeline to the lower 48,” Budzik said. “Development of Prudhoe Bay as an oil field paved the way for development of a natural gas pipeline.”



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# 50 more years in Alaska...

**BY FRANK BAKER**  
*For Petroleum News*

**B**P Alaska is planning a 50-year future and is continuing on an ambitious course of renewal that could rival everything it has achieved to date.

“Looking forward, our priorities are safe, reliable and efficient operations, managing the light oil decline, renewal of North Slope infrastructure and facilities and unlocking heavy oil and gas, which are immense resources,” says John Mingé, who on Jan. 1, 2009, became BP Alaska’s president, succeeding Doug Suttles. “We have built our workforce and are making the large investments necessary to create a sustainable, long-term future.”

From 2006-08, BP Alaska’s workforce grew by more than 40 percent, to almost 2,000 employees, and its contractor workforce increased by about 2,500, to more than 6,000 jobs. The last time the workforce reached this level was in the 1970s and 1980s, during development of the Prudhoe Bay field.

“BP Alaska has invested about \$30 billion over the past decade to manage

the light oil decline,” says Mingé.

“That has included drilling 800 additional wells in the Prudhoe Bay field, and developing satellite fields. This year, we’ll invest about \$800 million to sustain our Alaska operations — about half of that will be on facility and infrastructure projects that increase safety and reliability.”

Mingé adds that BP Alaska’s Liberty project, currently under way, will push the limits of extended-reach drilling technology to tap an offshore field that contains an estimated 100 million barrels of recoverable oil. Production is expected to begin in 2011.

BP Alaska currently operates 13 oil fields on Alaska’s North Slope (including Prudhoe Bay, Northstar and Milne Point), and owns an interest in six other producing fields, as well as four North Slope pipelines. The company’s 26.4 percent interest in Prudhoe Bay also includes a large undeveloped natural gas resource.

*see page B24 50 MORE*

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# Congratulations to BP for 50 years in Alaska.

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## *Prudhoe surpasses expectations*

Further advancements and improvements in drilling technology, reservoir management — aided by advanced imaging techniques — enhanced recovery methods, production operations, communications and control systems, have helped mitigate the effects of the field’s natural decline, which began in 1989.

Prudhoe’s recovery factor today is expected to be more than 60 percent, compared with less than 40 percent when production began in the late 1970s. “At the start of the 1980s, the field was expected to last about 30 years,” says Howard Mayson, BP’s vice president of technology. “There could easily be another 50 years to go,” he adds. “It’s very long-legged, and a lot of that is down to technology.”

Prudhoe’s total recoverable reserves are now estimated at about 13 billion barrels — several billion barrels more than what was envisaged when production started in 1977.

Development of Prudhoe Bay and the transportation system necessary to move its crude oil to market cost more than \$40 billion, which includes the recent addition of four modern, Alaska-class double-hulled tankers. To date, more than 1,500 wells have been drilled in the field. Ownership in the field includes ConocoPhillips and ExxonMobil Alaska Production Inc., with about 36 percent each; BP at 26 percent, and others 2 percent. BP operates the field under an agreement reached with partners in 2000 after it acquired ARCO.

—Frank Baker



### Alaska gas pipeline gains momentum with Denali

In April 2008 BP and ConocoPhillips formed Denali — The Alaska Gas Pipeline LLC, and got the long-awaited Alaska natural gas pipeline project under way.

In June 2008, BP Alaska’s Bud Fackrell was named President of Denali, and throughout the summer other top Denali executives were selected.

Denali headquarters is in Anchorage and a small field office was opened in Tok, Alaska, near the proposed pipeline route. By the end of the year, a third Denali office was opened in Calgary, Alberta, Canada.

The largest private sector project in North American history, Denali is estimated to cost more than \$30 billion. It will extend about 2,000 miles from Alaska’s North Slope to Alberta, British Columbia, Canada, with a possible 1,500-mile leg to U.S. markets.

The large-diameter (48-to 52-inch), high-pressure pipeline will carry about 4 billion cubic feet of natural gas a day from the North Slope for delivery to Alaska, Canada and lower 48 markets. At that rate it will supply about 6 percent to 8 percent of U.S. consumption. Studies of long-term in-state gas needs will begin in 2009 and at least five gas take off points are planned.

**Design features:** A major component of the project will be construction of a gas treatment plant on the North Slope that will remove carbon dioxide and other impurities. The plant will dehydrate, compress and chill the gas for its shipment through the pipeline. The new facility will dwarf the existing gas facilities, the Central Compression Plant and Central Gas Facility, which are already the largest of their kind in the world.

Most of the chilled pipeline would be buried, while segments through earthquake-prone areas and major river crossings would be built above ground. Above ground portions would be placed on supports similar to those used for the trans-Alaska oil pipeline.

Upgrades of key infrastructure in Alaska will be required, mainly on bridges, highways and ports needed to support heavy loads during construction. The one-inch-thick-walled pipe will be very heavy and loads on highways and bridges will be substantial.

At peak construction, the pipeline project will require 10,000 construction workers.

—Frank Baker

# 50 years

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## Advancing technology maximizes light oil production

Extracting as much oil as possible from Prudhoe Bay and other mature North Slope fields remains a top priority for BP, ConocoPhillips and others. Using advanced imaging technology, BP remapped much of Prudhoe Bay in 2003, and in 2009 completed more 3-D and 4-D seismic surveys.

New data acquired through these surveys has helped the company reach small pockets of oil through side-track wells, which are wells drilled

directionally with great precision through existing wellbores. BP drills more than 100 new well penetrations each year and the program has significantly reduced production declines at Prudhoe Bay. As summer comes to the North Slope in 2008, a total of 13 drilling rigs were operating in and around Prudhoe Bay.

A key element of sustaining oil production is developing satellite accumulations around the Slope's major fields. These relatively small oil pools can be produced from existing facilities and could yield millions of barrels of recoverable oil. New drilling technologies, sophisticated enhanced oil recovery programs and new, innovative well maintenance techniques are coaxing more oil from existing fields.

A collaborative effort among the North Slope producers to drive down costs and add hundreds of millions of barrels of recoverable oil is making significant progress.

—Frank Baker



continued from page B22

## 50 MORE

Overall during 2008, BP Alaska produced an average of around 204,000 barrels of oil per day from North Slope fields. Production came from nearly 2,000 wells.

One of BP Alaska's big resources — heavy oil — presents technical and economic challenges. Around 20 billion barrels of it lie in the Ugnu deposit, a reservoir overlying the Milne Point, Prudhoe Bay, and Kuparuk River oil fields. But it is as thick as molasses and doesn't flow freely into wells like the lighter oils of Prudhoe Bay, Endicott and Northstar.

BP's reservoir scientists and engineers estimate that roughly 10 percent of that resource, or 2 billion barrels, could be recovered. A heavy oil production test, part of a five-year testing program, was conducted on the North Slope in August and September 2008.

### Gas pipeline progresses

This past April, the formation of Denali — the Alaska Gas Pipeline LLC — by BP Alaska and its partner, ConocoPhillips, got a long-awaited pipeline project under way.

In June 2008, BP Alaska's Bud Fackrell was named president of Denali, and in the summer other project executives were selected.

Denali is headquartered in Anchorage

and a small field office was opened in Tok, near the proposed pipeline route. In the summer of 2008, fieldwork began to support permit applications. The work, done by around 60 people, included cultural resource identification and research, hydrology studies, soil and air monitoring and aerial photography and mapping.

"The fieldwork is a critical step toward meeting the target of a 2010 open season, when buyers and sellers of pipeline space reach agreement," says Fackrell. "Our pre-filing and ongoing communication with the U.S. Federal Energy Regulatory Commission will ensure we progress the project on a timely basis."

The largest private sector project in North America, if Denali is built it will extend 2,000 miles from Alaska's North Slope to Alberta, Canada, with a possible 1,500-mile leg to U.S. markets.

The buried, large-diameter, high-pressure pipeline will carry about 4 billion cubic feet of natural gas a day from the North Slope for delivery to Alaska, Canadian and lower 48 markets. At that rate, it will supply around 6 percent-8 percent of U.S. consumption.

At peak construction, the pipeline will require 10,000 workers on the Alaska portions of the route.

### Modernizing field infrastructure

BP Alaska is also working on several fronts to modernize its oil field infrastructure. One of these was a two-year project to replace 16 miles of oil transit pipelines in the Prudhoe Bay oil field. Completed at the end of 2008, it includes pig launchers and receivers, anti-corrosion chemical injection facilities and leak-detection systems.

Another major effort, an in-line inspection program using state-of-the-art corrosion detection technology, is also under way. About 140 miles of North Slope pipelines were inspected last year.

Some of the planned Alaska North Slope Renewal (ANSR) projects under the projects directorate organization include consolidating oil and gas separation facilities (called gathering centers) and flow stations, building new power stations, installing more gas handling and water injection capacity, building new worker housing facilities, and constructing flowlines and transit lines. In addition, facilities will be updated with more sensitive safety equipment that automatically detects and responds to gas leaks or fires.

"With ANSR, we're talking about the potential for investing \$5-\$10 billion over the next 10 years," says Gary Boubel, who heads up the projects directorate organization. "These renewal projects easily rival anything done on the North Slope to date."



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## Alaska heavy oil test yields positive results

A heavy oil production test program on the North Slope in August-September 2008 was an important step toward extracting vast deposits of heavy oil that lie above established fields such as Milne Point and Kuparuk.

Using the cold heavy oil production with sand (CHOPS) technology for the first time in Alaska, the test brought oil and sand to the surface reliably and sustainably.

Production at the Milne Point site to the west of Prudhoe Bay peaked at about 120 barrels a day of a sand/oil mixture before the test period ended Sept. 15. During the course of the test, about 700 barrels of heavy oil — API gravity 10 — was processed at Milne Point and shipped down the 800-mile-long trans-Alaska pipeline.

“Part of the test was to determine if the progressive cavity pump, driven from the surface, could pull sand and oil from the reservoir,” notes Eric West, BP Alaska’s manager of heavy oil. “This clearly worked, and the reservoir formation had characteristics that may sustain higher production rates as testing is resumed next summer.”

The Ugnu reservoir contains roughly 20 billion barrels of oil in place. BP’s reservoir scientists and engineers conservatively estimate that roughly 10 percent of that resource, or 2 billion barrels, could be recoverable — a world-class prize. But it’s as thick as molasses and doesn’t flow freely into wells like the lighter oils of the Prudhoe Bay, Endicott or Northstar fields.

“In the light oil business we try to keep the sand out of the wellbores,” says West. “The CHOPS method has the opposite intent. We intentionally produce sand into the wellbore, and with the sand comes the oil. As sand production continues, channels in the reservoir called ‘wormholes’ will form representing a multi fold increase in the surface area of the reservoir being contacted. At the surface, oil will be separated from the sand in heated tanks and will ultimately be processed by existing facilities and shipped down the trans-Alaska oil pipeline.

“Timing is everything on advancing and deploying this technology,” West adds. “After it’s separated from the sand, the oil is still too thick to flow down pipelines to the refineries. It must be mixed with lighter crudes which serve as a diluent. The use of light oil as a diluent creates a hard link between the existing light-oil business and the potential heavy-oil business. If we didn’t have an established light-oil business all around us it is unlikely that we could make heavy oil work on the North Slope.”

To draw cold, heavy oil, sand and water from 4,000 feet below the ground to the surface, a key piece of equipment called a progressive cavity pump is needed. The pump includes a long metal rod with cavities along its length. As the cavities are progressed up through the pump, sand and oil are pulled from the formation into the wellbore.

Grant Encelewski, heavy oil operations team lead, says the first phase of the CHOPS testing program requires an investment of about \$70 million. It includes expanding S-Pad, designing and constructing a purpose-built, long-term test kit, and four new wells. The second phase, in 2009-10, will require an investment comparable to the first phase, and will include further expansion of S-pad, drilling, testing four more wells, and possibly adding more well test facilities.

The 20-person heavy oil team, or HOT, will grow with project success.

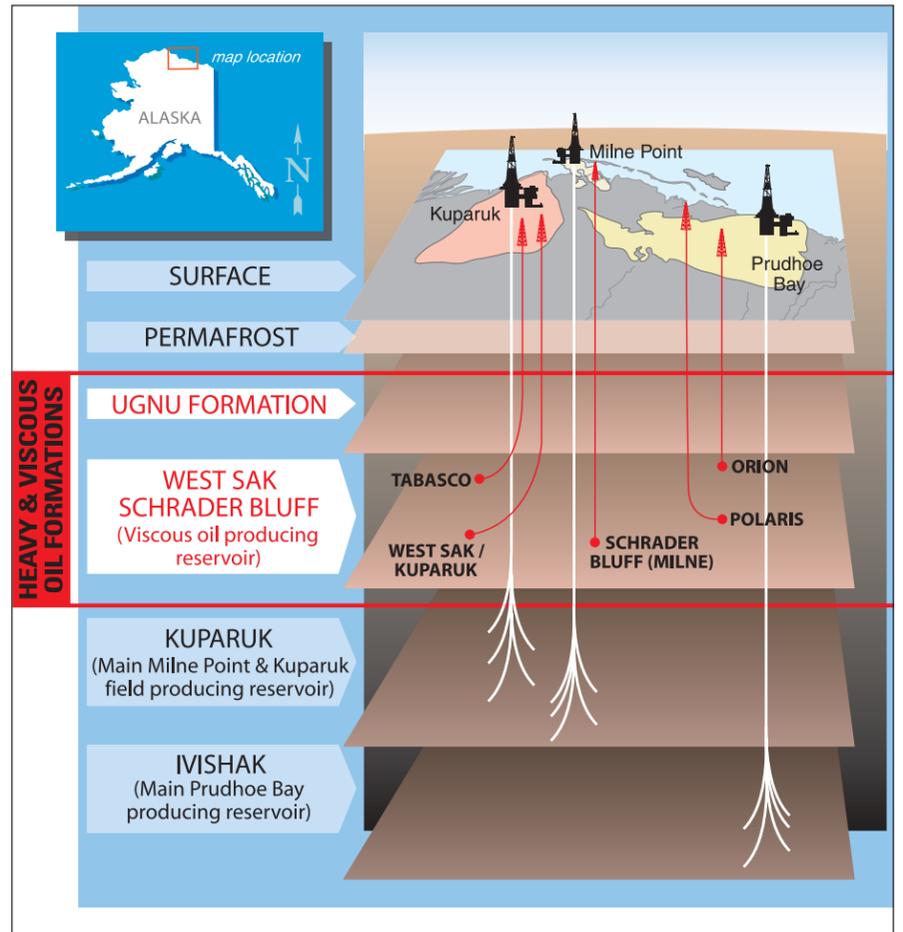
Viscous oil is currently under production on the North Slope at about 50,000 barrels per day, primarily from the Schrader Bluff

Formation. About 100 million barrels of viscous oil have been produced to date. However, the large, heavy oil resource is colder and much thicker than viscous oil.

Commercial production of heavy oil in Alberta, Canada, comprises both cold and thermal recovery processes. Likewise, North Slope heavy oil development will likely involve both cold and thermal development techniques. BP Alaska is currently testing CHOPS in the field, but thermal field tests are on the drawing board. Thermal recovery involves introducing heat, such as steam or electrical heating.

“Most heavy oil technologies have required years to mature and prove,” adds Max Easley, BP Alaska’s senior vice president and business unit leader, Alaska Consolidated Team. “But we are aggressively pushing this resource to further underpin Alaska’s 50-year strategy. Heavy oil has and will continue to generate a lot of attention in Alaska and across the entire E&P segment and this first success is quite encouraging as we continue this effort.”

—Frank Baker



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# Remembering the best times

BP and heritage employees reflect on their favorite memories during their time on the North Slope



"My fondest memories over the past 28 years are being part of the fire-safety team which is now called the HSE department. I have worked on the Slope since 1979 and must say the good times outweigh the bad. We have seen many workers come and go. Some have moved on to different jobs while others have moved on to the promised land. All are missed because they were all 'family.' All of my children were born during these years and have grown to exceptional adults."

—John C. Rychlinski

"I was there at GCI when the first oil went down the line to PSI in June 1977. I heard it going through the gathering center. It was a big day for all of us."

—Robert Cardon

"I arrived in November 1978. My father George A. Schuitt was the Flow-2 supervisor and was the supervisor who gave the request to open the valve to start the first oil from the ARCO side of the field. He and John Harvel were in a movie made by ARCO, and it shows them receiving the call and opening the valve."

—George Paul Schuitt



Rosemary Nichols doing the manifest the old way.

"The fun we used to have on the Fourth of July with the regatta and other events. Especially the Miss Prudhoe Bay Contest."

—Duane Stanley

"I was on shift the night we sent oil to Alyeska Pump Station No. 1 (ALPS). We started packing the line to skid 50 a few hours before Alyeska gave the okay to start the flow. When they called and gave the OK to start, I hit the button for skid 50 SDV to open and nothing happened. Ted Bear and his helper Bob Balth had to go to skid 50 and manually handjack the valve open. We were going straight into the ALPS No. 1 storage tanks. With the transit line packed going into empty tanks with no pressure downstream, the guys at ALPS No. 1 said it sounded like a freight train hitting Alyeska right at first."

—Lowry Brott, Northstar Operations Support Manager

"At the time I was recently married and just glad to have a slope job even though we were working 2 weeks on and one week off."

—Jerry Bixby

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*"Prudhoe Bay and Alaska have always been a magnet for outstanding, committed people with whom it has been an honor to work."*

—Bob Hawley

*"For a number of years, while the waterflood was in its prime, and enhanced oil recovery (EOR) was just starting, I endured lots of jokes about EOR. My favorites were the various terms the people used to refer to Miscible Injectant (MI), which included 'Magical Injectant,' 'Mystical Injectant' and 'Miserable Injectant.' However, as waterflood rates fell and the EOR rates increased, I began to hear about the 'MI Buzz.' For years I had felt like Rodney Dangerfield. It was nice to finally get some respect."*

—Pat McGuire (former ARCO petroleum engineer, today retired BP)

*"The lasting friendships made, the competitive but friendly atmosphere, the drilling exploration season, the arrival of rig 18E, delivering tools to the drilling rigs from the Colville Delta to Alaska Island before the advent of 'phase weather,' the journey to "zero discharge," summer softball league, the Big Lake Regatta, the steam house on the Kuparuk River, heli-fishing (maybe I should leave those last two out). Lots of fond memories; the problem is the recall."*

—Scott Grieve

*"We did not realize at the time what the significance of this monumental occasion would become. We were too*

*busy drilling new wells to have the time to enjoy the time."*

—Jo McInnis

*"Seeing hundreds of caribou migrating across Greater Prudhoe Bay in the summertime. A beautiful and awe-inspiring sight."*

—Janet Platt

*"Working on the Slope, at the top of the world, experiencing the vitality of an oil and gas operation in such an exciting place."*

—Nancy Joseph

*"At the airport in Anchorage, they were selling little bottles of crude oil from the first barrel of oil down the pipeline. I have been here for the duration. The good people and hard work they have done is still impressive."*

—James Willingham, aka Snake

—compiled by Frank Baker



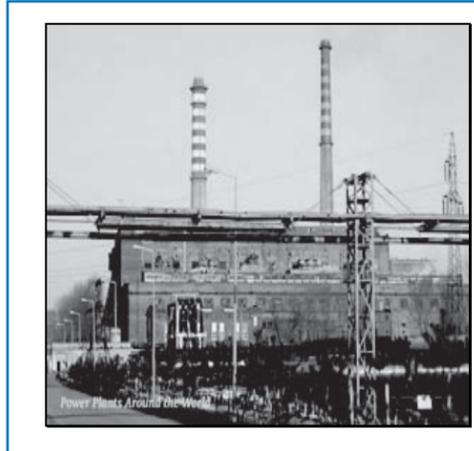
**Running events, a popular pastime for employees at Prudhoe Bay and other North Slope fields.**



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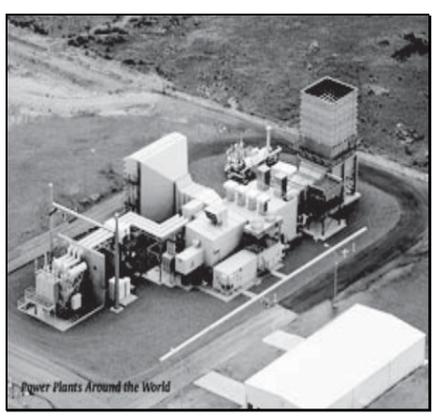
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# Significant events in BP's Alaska history



**1959**

BP opened its first office in Alaska

**1960**

The first team of BP and Sinclair Oil Company geologists arrived to conduct geological surveys on the North Slope, Yakutat, the Alaska Peninsula, Cook Inlet and lower Yukon River

**1963**

BP and Sinclair began seismic work on the North Slope; BP and Sinclair acquired options to lease about 150,000 acres

**1964**

First exploration wells (all dry holes) drilled in foothills of the Brooks Range and the Colville River delta; first state land at Prudhoe Bay put up for auction but disheartened by drilling results, Sinclair decided not to take part in the sale; BP bid and won on 90,000 acres around the rim of the Prudhoe Bay structure

**1968**

Atlantic Richfield announced a strike at Prudhoe Bay State No. 1; BP began drilling its Prudhoe Bay leases; an independent review of eight BP Prudhoe Bay wells indicated that nearly 5 billion barrels of recoverable oil lay under its leases (total field was then estimated to contain about 9.6 billion barrels)

**1969**

Trans-Alaska Pipeline System (BP, ARCO and Humble) announced plans to construct an 800-mile crude oil pipeline from Prudhoe Bay to tidewater at Valdez; first shipment of 48-inch pipe arrived at Valdez; a federal leasing freeze stopped the state from leasing TAPS a right of way for the pipeline until the question of Native

rights was settled; first sealift to Prudhoe Bay comprised of 70,000 tons of stores and equipment barged from Seattle

**1970**

The Standard Oil Company of Ohio (Sohio) and BP merged marketing interests; Alyeska Pipeline Service Co. was incorporated; the largest barge sea lift in state history journeyed north with 70 barges containing more than 175,000 tons of equipment

**1971**

Congress approved, and President Nixon signed, the Alaska Native Claims Settlement Act; the land freeze was lifted; citing the National Environmental Policy Act of 1970, newly formed environmental organizations won a federal injunction against the pipeline right-of-way permit, claiming the Environmental Impact Statement for the trans-Alaska pipeline did not adequately address the pipeline's potential environmental impacts — the first of many delays instigated by environmentalists;

**1972**

A new EIS was drafted for the trans-Alaska pipeline

**1973**

The Arab oil embargo provided incentive for Congress to pass, and the president to sign, the trans-Alaska Pipeline Authorization Act; BP's first permanent base camp was shipped in modular form from Seattle to Prudhoe Bay on eight barges.

**1974**

The primary federal right-of-way permit for construction was signed by Secretary of Interior Rogers Morton; Haul Road construction officially began and in 83 days, from late January to mid-April 1974, a force of up to 680 workers moved some 34,000 tons of machinery and materials into northern Alaska via 671 aircraft flights — a large number of those C-130 Hercules cargo aircraft — and 1,285 trips by truck; work on the 360-mile gravel Haul Road, later named the Dalton Highway, was completed in 154 days, encompassing 3 million man-hours; the first phase of the Central Power Station arrived in Prudhoe Bay

**1975**

By this time, two of BP's Prudhoe Bay gathering centers were in place — each capable of handling 600,000 barrels of oil per day

**1976**

The first pipe was laid in place for the trans-Alaska oil pipeline; because of the pipeline project's unprecedented size, it was divided into six projects, or sections, each issued to a separate subcontractor; 515 federal and 832 state permits were required to build the pipeline; at its peak, the pipeline construction workforce was 28,072 in October 1975

**1977**

The Prudhoe Bay Unit Operating Agreement, a 1,200-page document involving 16 field owners, went into effect; crude started flowing through TAPS; first tanker left Valdez; by midyear 125 wells had been completed throughout the two halves of the Prudhoe Bay field — about 65 by BP

**1978**

According to the 1970 agreement, BP assumed an overall 54 percent ownership

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# Advertiser Index

## A

ACS .....	A7
Acuren .....	B2
Air Liquide .....	B26
Airgas Norpac.....	A32
Alaska Airlines Cargo .....	A21
Alaska Calibration .....	A32
Alaska Cover-All .....	A15
Alaska Dreams .....	A20
Alaska Frontier Constructors (AFC) .....	A16, A17
Alaska Instrument .....	A32
Alaska Interstate Construction (AIC) .....	A5
Alaska Railroad .....	A4
Alaska Rubber & Supply .....	B26
Alaska Steel .....	B18
Alaska Tent & Tarp .....	A20
Alaska Valve & Fitting Co. ....	B7
Allied GIS Inc. ....	A32
AMCO Industrial .....	B30
American Marine .....	B3
Arctic Controls .....	B26
Arctic Foundations .....	B10
Arctic Slope Telephone (ASTAC) .....	B8
Arctic Wire Rope & Supply .....	A24
ASCI-Alaska Supply Chain .....	A3
ASRC Energy Services .....	A13
AT&T .....	B19
Atigun .....	B22
Automated Laundry Systems & Supply .....	B26

## B-F

Beacon OHSS Inc. ....	A6
Big State Logistics .....	B4
Birchwood Homes .....	A12
Brice .....	B8
Brooklyn Iron Works Inc. ....	B24
Brooks Range Supply .....	B6
Cameron .....	B9
Canadian Mat Systems (Alaska) .....	5b
Caribou Construction .....	B26
Carlile Transportation .....	B12
CCI .....	A15
CH2M Hill .....	B16
Clover Global Solutions.....	A8
CN Worldwide .....	A14
Colville Inc. ....	B4
CONAM Construction .....	B23
Control Contractors .....	A32
Craig Taylor Equipment .....	B15
Crowley .....	A2
Cruz Construction .....	B11
Delta P Pump and Equipment .....	A20
Denali Industrial Supply .....	A23
Dowland Bach .....	A26
Doyon Drilling .....	A18
Doyon Universal Services .....	A32
Dresser-Rand .....	A30
Dukowitz Machine .....	A22
Duoline .....	A31
Enerflex Systems .....	B23
Equipment Source .....	A26
ERA Helicopters .....	A14
Expro Group .....	A25
F. Robert Bell & Assoc. ....	A24
Ferguson Enterprises .....	A19
First National Bank of Alaska .....	B10
Florcraft .....	A18

Flowline .....	A28
Fluor Corp. ....	B31

## G-M

GBR Equipment .....	A12
GCI .....	A23
General Teamsters Local 959 .....	B24
Glacier Services .....	A32
Global Land Services .....	A32
Global Offshore Divers .....	B18
Golder Associates .....	B20
Guess & Rudd .....	B28
Hawk Consultants .....	B14
Ice Services .....	A27
Jackovich Industrial .....	A29
Junior Achievement .....	A30
Kenworth Alaska .....	A28
Koniag Development Corp. ....	A32
Kuukpik Arctic Services .....	A14
Lynden .....	B32
Mayflower/ Worldwide Movers .....	A20
McJunkin Red Man Corp. ....	A32
Meridian Management .....	B14

## N-P

Nabors Alaska Drilling .....	B21
NANA Development Corp. ....	A13
NANA WorleyParsons .....	B22
National Oilwell Varco .....	B27
NMS .....	B15
North Slope Telecom .....	A11
North Star Equipment Services (NSES) .....	A32
North Star Terminal & Stevedore (NSTS) .....	A32
Northern Transportation .....	B18
Northwest Technical Services .....	B30
Oil & Gas Supply AK .....	B14
Parker Drilling .....	B13
PCE Pacific .....	A32
PDC Harris Group .....	B27
Petroleum Equipment / MRO Sales .....	A32
Petrochemical Resources of AK (PRA) .....	A9
Pipeline Systems Inc. ....	B6
PND Engineers .....	A25
PotelCom Supply .....	B27
Price Gregory International .....	B12

## Q-Z

QUADCO .....	A22
Residential Mortgage .....	A22
Rim Architects .....	A6
Rotating Services .....	A30
Smith International .....	B25
Specialty Products .....	B11
Stoel Rives .....	A32
Surveyors Exchange .....	A27
T.D. Williamson .....	B17
Thompson Metal Fab .....	A32
ThyssenKrupp Safeway .....	A10
TIKIGAO .....	B18
TTT Environmental Instruments and Supplies .....	B26
Tubular Solutions Alaska .....	A10
Udelhoven Oilfield System Services .....	A11
UMIAQ .....	A32
Unique Machine .....	B21
Univar USA.....	A18
URS .....	A32
Weatherford Laboratories .....	B19

continued from page B28

## EVENTS

in Sohio; BP Alaska, until then a subsidiary of British Petroleum Ltd. in London, became the production subsidiary of Cleveland-based Standard Oil, and changed its name to Sohio Alaska Production Co.; Endicott (Sag Delta discovery) was discovered by BP in 1978; Endicott was the third major oil field developed on the North Slope by BP, the field's major interest owner



### 1981

The Kuparuk field, about 30 miles west of Prudhoe Bay, came on stream; Kuparuk remains the second-largest producing oil field in North America, after Prudhoe Bay

### 1984

Prudhoe Bay Waterflood Pilot Project begun

### 1985

Chevron and BP completed the first wildcat well, K.I.C. No. 1, on Native land on the Coastal Plain of the Arctic National Wildlife Range; development of Endicott fields begun when more gravel was trucked from shore to create the five-mile-long causeway and two islands; Milne Point field startup; March 11, 4 billionth barrel of oil arrived at Valdez

### 1986

The company name was changed to Standard Alaska Production Co.; Prudhoe Bay large-scale enhanced oil recovery begun, involved injecting miscible injectant throughout the reservoir to aid recovery; through construction of the Central Gas Facility, more MI and natural gas liquids were produced; Lisburne field startup

### 1987

The Endicott field began producing

### 1988

Point McIntyre field discovered

### 1989

March 24, major oil spill in Prince William Sound when the tanker Exxon Valdez ran aground at Bligh Reef

### 1990

GHX-1 gas handling facilities installed at Prudhoe Bay

### 1991

Jan. 1, 8 billionth barrel of oil arrived Valdez; work started on the new Badami field, to the east of Prudhoe Bay

### 1992

GHX-2 gas handling facilities installed at Prudhoe Bay

### 1993

Point McIntyre field went into production

### 1994

The Niakuk field was brought into production

### 1996

President Clinton signed an order lifting the 23-year ban on exporting Alaska's North Slope oil

### 1997

For the first time in the life of North Slope oil production, BP began to trade oil on the world market — at world prices; the first export oil shipment was sent to Taiwan

### 1999

The BP-ARCO Miscible Injectant Expansion project, or MIX, was brought on line, MIX expected to ultimately increase Prudhoe Bay liquids recovery by 50 million barrels; construction begun on BP's Northstar project, a new offshore oil field about six miles from Prudhoe Bay; ARCO approached BP Amoco about a possible buyout; BP Amoco decided early in 1999 to pursue the acquisition; Landmark agreement, Charter for Development of the Alaskan North Slope, signed by BP, ARCO and state of Alaska

### 2000

FTC approves BP combination with ARCO pending sale of ARCO's Alaska assets to a major oil company, which is Phillips Petroleum Inc.; alignment of interests among Prudhoe Bay field interest owners; BP becomes single operator of Prudhoe Bay, Niakuk and Point McIntyre fields.

### 2002

Northstar field begins production

### 2002

State of Alaska renews TAPS right of way for 30 years

### 2003

BP divests its North Slope exploration acreage to focus on known oil and gas resources

### 2004

First of four new double-hull "Alaska Class" oil tankers begins service in the Alaska trade

### 2005

BP and ConocoPhillips sanction West Sak, largest viscous oil program on the North Slope

### 2006

Alaska adopts Petroleum Production Tax based on net profits, a major re-write of oil taxes; BP temporarily closes half of Prudhoe Bay field after finding corrosion problems in oil transit lines; BP commits to rebuilding 16 miles of lines to support another 50 years of production

### 2007

Design work begins on Liberty project, an offshore field requiring longest extended-reach wells in the world and largest land drilling rig

### 2008

BP and ConocoPhillips announce formation of Denali—The Alaska Gas Pipeline LLC, to build \$40 billion Alaska gas pipeline to Canada. BP Alaska's Bud Fackrell is named president of Denali.

### 2009

First successful Ugnu heavy-oil production test made in Milne Point field

—compiled by Frank Baker



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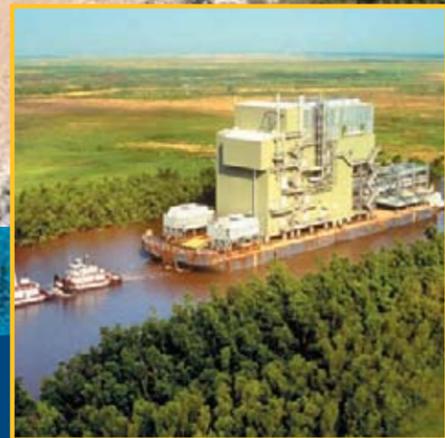
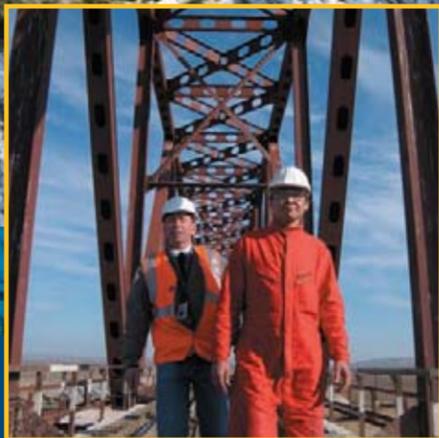


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