Industry / Oil & Gas

The Trans-Alaska Pipeline

By Kaylene Johnson

On December 27, 1967, a fireball of white and yellow flame shot into the Arctic sky as workers lit the natural gas roaring out of a test well in Prudhoe Bay. The flare, which could be seen for miles, was just a glimmer of what was soon to come. The discovery of the single largest oil field ever found in North America would soon set into motion the construction of one of the largest, most complicated, and controversial engineering feats of its time—the Trans-Alaska Pipeline. Thousands of laborers, welders, engineers and other skilled workers would ride a wave of historic change on the Alaska frontier, helping to shape a construction project that the pipeline's Senior Engineer Frank Moolin, Jr. compared to the Great Wall of China.

Nearly a decade later, the first barrels of crude oil flowed into the hold of a giant tanker 800 miles away in Valdez, having traveled through a 48-inch pipeline that crosses 34 major rivers, 800 smaller streams and tree mountain ranges. By its thirtieth birthday, the pipeline had moved more than 15 billion barrels of oil and now supplies nearly 17 percent of domestic crude oil production.

The Prudhoe Bay discovery wasn't the first oil find in Alaska, but certainly it was the largest. At its location along the state's northern Arctic Ocean coast, presented challenges. The big question was how to get upwards of two million barrels of oil a day to market. One idea was to ship the oil by super tankers directly from the Arctic coast. In a $50 million experiment, Humble Oil Company—which eventually became Exxon—converted the SS *Manhattan* into an icebreaking tanker. Even with additional ice-breaking escorts, however, the polar ice pack proved too formidable.

Brainstorming continued. If not through the ice, why not under it? Perhaps a fleet of 900-foot nuclear submarines could do the job. Others suggested flying the oil out on super tanker versions of Boeing's 747. All options were on the table.

In the end, the most realistic choice was an overland pipeline. Traversing 800 miles of some of the most challenging terrain and pristine wilderness in the world, the 48-inch diameter pipeline would cross three mountain ranges and more than 800 rivers and streams before reaching Valdez, the northernmost ice-free port in the United States. From there, the oil would travel south by tanker ships to refineries in the Lower 48.

In 1969, a great airlift was underway as tons of equipment and supplies were air freighted to the North Slope. DC-3s, Hercules C-130s, small Bush planes and other aircraft brought in drill rigs, pipe, and the people needed to coax the vast reserve of oil from the ground. By 1975, the largest private airlift in history had transported more than 150,000 tons of equipment to camps north of the Yukon River.

In 1970 a consortium of seven oil companies formed the Alyeska Pipeline Service Company to design, construct, and operate the Trans-Alaska Pipeline System (TAPS). Early estimates predicted that the pipeline would take roughly two years and $900 million to build. However the North Slope was unlike any place that oil had ever been developed. Engineers had not yet created the technology needed to deal with permafrost, bitterly cold temperatures, or the extreme terrain. Nor did oil producers anticipate extended legal delays as environmental and Native groups brought their concerns to court.

Events unfolding halfway around the world brought legal wrangling to an end. In October 1973, Arab oil countries declared an oil embargo on the United States. Within the year, oil prices quadrupled and long lines at the gas pumps around the nation reflected America's first fuel shortage since World War II. Suddenly the need for a large domestic source of oil became urgent.

On November 16, 1973, Richard Nixon signed the Alaska Pipeline Authorization Act, effectively clearing the way for construction to begin. What followed was a boom bigger than all of Alaska's gold rushes combined. People flooded into the state from all over the world. Employment during pipeline construction peaked in October 1975 with 28,072 workers. Over the course of its construction, the pipeline would employ more than 70,000 people. Along with pipeliners, the project required an army of support staff to sustain workers and maintain the construction camps.

The community most impacted by pipeline construction was Fairbanks. In 1968 the area had roughly 42,000 people. By 1975 the population had exploded to 70,000—an increase of nearly 67 percent. The housing shortage in Fairbanks was so acute that families often moved into one room of their homes in order to rent out the rest of their floor space to workers who threw down sleeping bags. It was difficult to plan or build new housing since most skilled trades people were at work on the pipeline.

Wages across the board, including state and local government, increased in order to retain workers. A dishwasher in Fairbanks, for example, made $3.68 an hour in town. But the same work in a pipeline camp earned $8.31 plus overtime. Law enforcement in Fairbanks became a major concern as police officers and state troopers hung up their badges to work at higher paying security jobs on the pipeline. Meanwhile, health care professionals found ample work in Fairbanks. Prior to the pipeline, the town had only two small clinics.

As in Alaska's gold rush days, not everyone who stampeded north struck it rich. Employment lines at the union halls sometimes wrapped around city blocks as people tried to get on work crews. Pipeline jobs went first to members of unions, followed by experienced workers, and Alaskans.

Construction of the Haul Road between Prudhoe Bay and the Yukon River began April 24, 1974. The first section of pipe was laid at the Tonsina River on March 27, 1975. In order to complete the pipeline as quickly as possible, the project was divided into six sections with 29 construction camps that made up what became known as "Skinny City" along the length of the pipeline route.

Bill Howitt was one of the "Group of Twelve" senior project engineers. No one had ever built a pipeline through the Arctic, nor had anyone built a pipeline in so sparsely populated an area where roads and infrastructure were mostly nonexistent.

"Mile by mile design of the pipeline was largely a misnomer," Howitt said. "It was more like foot by foot."

Alaska's permafrost, which underlay nearly 75 percent of the pipeline route, created unprecedented challenges for engineers and contractors. Oil came out of the ground at 158-176 degrees Fahrenheit. Traditional methods of burying the pipeline would have caused permafrost to thaw, creating an unstable soup of silt and water. So engineers came up with H-shaped vertical supports that that could hold the pipe above and away from the frozen ground. At first, construction of these new structures was slow.

"A pipeline had never been built above ground before. The first week we did ten VSMs (Vertical Support Members), the week after that we did another ten and the week after that it was even less," Howitt said. "At that rate we figured it would be the year 2010 before we finished. We continually had to ask ourselves how are we going to do this? There was a steep learning curve."

By figuring out the best equipment to use and changing the construction cadence–the pace and placement of workers–it wasn't long before crews were constructing up to 4,000 VSMs a week. In the end, more than 78,000 vertical supports were used to hold 420

miles of pipe above ground–more than half the distance of the pipeline. Placing the pipe in zig-zag configuration above-ground helped accommodate potential seismic activity and extreme temperature changes along the line.

The other 380 miles of pipeline went below ground. Depending on soil conditions, the pipe was buried at depths between three and twelve feet. Four miles of buried pipeline in avalanche-prone areas were refrigerated to protect permafrost.

Permafrost required that work be done in a tight succession of events. Holes drilled and ditches dug in the morning would often fill up with mud and water by the end of the day. Howitt explained that immediately after a hole was drilled, another crew would set the vertical support pipe, followed by another crew that quickly filled the hole so that the permafrost could freeze back into place. “Instead of an operation spread over hundreds of miles, the way it was done in the Lower 48, we had operations spread over a few hundred feet,” Howitt said.

Life in the twenty-nine work camps was intermittently exhausting and tedious for pipeliners. They might work eighteen hours, day after day, then sit and wait while a contractor scrambled to get a ten dollar repair part flown into a camp. During winter, shift workers at the north end of the project might see the sun only rarely. Camp laborers might work four to six weeks straight, and then have a week or two off.

“Probably the most remarkable thing about construction of the pipeline was the scale of the project and the logistics to complete it,” said Dave Norton, who worked as a field

engineer during pipeline construction. He was fresh out of engineering school when he came north from Texas to work on the pipeline. “To lay that much pipe in that amount of time–in basically two and a half construction seasons–was unbelievable.”

He recalled one situation in which engineers discovered ice where the pipeline was supposed to cross the Gulkana River. Original plans to bury the pipe had to be scrapped; builders now needed a bridge and they needed one fast. Without it, completion of the pipeline would be delayed for a full year.

A bridge was found in Japan, one that the manufacturers could redesign to support pipe, disassemble, and ship to Alaska. “It was the last minute, the eleventh hour.” Norton said. “We had the bridge designed, shipped and erected within four months.”

One of the most harrowing tasks was construction of the pipeline over Thompson Pass, a 2,678-foot obstacle near Valdez.

“It was extremely steep, almost vertical, and there was no alternate route,” said Dave Norton. “It was so gnarly that it was one of the last pieces of pipe to be installed.”

Engineers devised an aerial tramway–like a ski lift–then hooked the pipe to cables and “flew” it into position. Welders hung off safety harness and off of each other to weld the pieces of pipe together.

Even with delays and learn-as-you-go engineering, the 800-mile pipeline was completed in just three years and two months. Total cost of the project: $8 billion. Development of the drilling facilities at Prudhoe Bay ran another $3 billion. On July 28, 1977, the first oil reached Valdez from the North Slope. It had taken 38 days, 12, hours, and 56 minutes for the first barrel of oil to arrive from Pump Station No. 1 in Prudhoe Bay.

In the pipeline's first thirty years, more than 15 million barrels (more than 630 billion gallons) have moved through the pipeline from Prudhoe Bay to Valdez.

In 2007, oil taxes and revenues fund more than 80 percent of state government. Alaskan residents pay no state income tax and as a bonus, annually receive a check from the Permanent Fund Dividend, the state nest-egg which distributes interest from investment on oil revenues. In 2006, each qualified Alaska resident received a check for $1,107.

Development of the pipeline propelled not only the Alaska Native Claims Act, but eventually led to the Alaska National Interest Lands Conservation Act of 1980 which set aside 104 million acres of land for federal protection–the largest act of wilderness preservation in U.S. history.

In the 1970s, construction of the pipeline provoked intense debate. Today the debate continues. While some environmentalists see the pipeline as a symbol of lost wilderness, state residents recognize it as a lifeline of the Alaskan economy.

Norton reflects that building the pipeline was as much a mental exercise as a physical feat. The innovation of early engineers was tested on November 3, 2002, when a 7.9 earthquake ripped through across the state's Interior.

"It was a full-scale bench test," Norton said. "The pipeline went right across the Denali fault, which moved fourteen feet relative to itself."

At the time of the earthquake, the owners of the pipeline were applying for renewal of rights of way permits with the Bureau of Land Management and the State Department of Natural Resources.

"People were asking legitimate questions about whether the thirty-year-old seismic design needed to be updated," Norton said. Then the earthquake struck–one of the largest tremors ever recorded in the United States–and the pipeline held true. Only a few of the support structures suffered any damage. Everyone just looked and each other and thought "Hell, it works," Norton said. Not long afterward, the company received a thirty-year extension of the rights of way to operate the pipeline.

The long-term achievements of the pipeline are not only a testament to innovation but also to the hard-working people who labored on the line under extreme conditions said project engineer Bill Howitt.

Without question the thirty-year-old pipeline's economic, environmental, and human impact transformed the face of Alaska like no other human endeavor before or since. The

atmosphere and attitude of the times was aptly stated on a plaque that workers received when the pipeline was finally finished. Etched next to an Alaska-shaped piece of pipeline were the words: "We didn't know it couldn't be done."

LINKS:

Alyeska Pipeline Service Company:
http://www.alyeska-pipe.com

Valdez Convention & Visitors Bureau, Pipeline History:
http://www.valdezalaska.org/history/transAlaskaPipeline.html

Greenpeace Archive:
http://archive.greenpeace.org/climate/arctic99/reports/nslope2.html

Trans-Alaska Pipeline Authorization Act:
http://www.usdoj.gov/crt/cor/byagency/doi1651.htm

More on the Structural Integrity of the Pipeline:
http://www.technet.pnl.gov/dme/structural/pipeline.stm

Environmental Updates on *Exxon Valdez* Oil Spill:
http://www.valdezscience.com/

VISIT THE LIBRARY FOR MORE INFORMATION:

Alaska's libraries include plenty of audio, visual, and written material about the building of the trans-Alaska pipeline. Visit your local library or go online to see what's available in holdings all over the state. Take these simple steps:

1. Acess **SLED** (State Library Electronic Doorway) at http://sled.alaska.edu/library.html.

Click on the listing for **ALNCat** (the Alaska Library Network Catalog) to view the Basic Search window. Go to the Keyword field, and type in **TRANS-ALASKA PIPELINE.**

MORE READING:

Berry. Mary Clay. *The Alaska Pipeline: The Politics of Oil and Native Land Claims*. Bloomington: Indiana University Press, 1975.

Campbell, John Martin. *Archeological Studies along the Proposed Trans-Alaska Oil Pipeline Route*. Washington, D.C.: Arctic Institute of North America, 1973.

Coates, Peter A. *The Trans-Alaska Pipeline Controversy: Technology, Conservation,and the Frontier*. Fairbanks, Alaska: University of Alaska Press, 1993, 1991.

Cole, Dermot. *Amazing Pipeline Stories*. Fairbanks, Alaska: Epicenter Press, 1997.

Dixon, Mim. *What Happened to Fairbanks?: The Effects of the Trans-Alaska Oil Pipeline on the Community of Fairbanks, Alaska*. Boulder, Colo.: Westview Press, 1978.

Mead, Robert Douglas. *Journeys Down the Line: Building the Trans-Alaska Pipeline.* Garden City, N.Y.: Doubleday, 1978, 1st ed.

Page, Robert A. *Ground Motion Values for Use in the Seismic Design of the Trans-Alaska Pipeline System*. Washington, D.C.: U.S. Geological Survey, 1972.

Roderick, Jack. *Crude Dreams: A Personal History of Oil & Politics in Alaska*. Fairbanks, Alaska: Epicenter Press, 1997.

Roscow, James P. *800 Miles to Valdez: The Building of the Alaska Pipeline*. Englewood Cliffs, N.J.: Prentice-Hall, 1977

Rozell, Ned. *Walking My Dog, Jane: From Valdez to Prudhoe Bay along the Trans-Alaska Pipeline*. Pittsburgh: Duquesne University Press, 2000.

Wickware, Potter. *Crazy Money: Nine Months on the Trans-Alaska Pipeline.* New York: Random House, 1979, 1st ed.

For Juvenile Readers:

Coombs, Charles Ira. *Pipeline across Alaska*. New York: Morrow, 1978.

Doherty, Craig A. and Katherine M Doherty. *The Alaska Pipeline*. Woodbridge, Conn.: Blackbirch Press, 1998, 1st ed.

AUDIO/VIDEO:

http://vilda.alaska.edu/cgi-bin/showfile.exe?CISOROOT=/cdmg11&CISOPTR=2379
AAF-6041
Link up of the Haul Road, 1974-1976. From the KTVF Television Film Collection, Alaska Film Archives, University of Alaska Fairbanks. 34-second film clip, color/silent, of aerial view of the completion and dedication of the North Slope Haul Road. Two bulldozers close the last section of road and, as a crowd looks on, a woman cuts the ribbon.

http://vilda.alaska.edu/cgi-bin/showfile.exe?CISOROOT=/cdmg11&CISOPTR=8250
AAF-6109

Senator Ted Stevens discusses opposition to building the pipeline. From the KTVF Television Film Collection, Alaska Film Archives, University of Alaska Fairbanks. Title from title frame. 44-second clip, color/sound.

http://vilda.alaska.edu/cgi-bin/showfile.exe?CISOROOT=/cdmg11&CISOPTR=2381
AAF-6042
Trucks hauling pipe, 1974-1976. From the KTVF Television Film Collection, Alaska Film Archives, University of Alaska Fairbanks. 31-second film clip, color/silent, of loading pipe on a truck and hauling the pipes on trucks.

The Alaska Pipeline. Mark J. Davis and Joe Morton. Alexandria, Va.: Distributed by PBS Home Video, 2006. DVD video explores the impact of the Trans-Alaska Pipeline on culture and society in Alaska, as well as on the environment and Alaskan wilderness. Features commentary by the men and women who worked on the line, as well as long-time Alaska residents, members of the Native Alaskan community, environmentalists, government geologists, and local and national politicians. Examines the conflict between the desire to bring Alaskan oil to market and increase the energy supply versus the desire to protect the land and wildlife. Discusses the engineering feat of building an 800-mile pipeline that traverses three mountain ranges and thirty-four rivers, and that has to withstand earthquakes and subzero temperatures.

The Alaskan Oil Pipeline. The History Channel; a presentation of A & E Television Networks. New York: A & E Home Video: Distributed by New Video Group, 1996. VHS tape describes the operation of the Alaska pipeline that runs from Prudhoe Bay in the Arctic Ocean to Valdez on Prince William Sound.

Boom Times: An Alaskan Portrait. Tom Sadowski. Anchorage, Alaska: Counter Cine and T. Sadowski, 1977. 16mm film compares and contrasts the oil pipeline with the old Kennicott copper mines by juxtaposing current footage with still photographs of the previous boom. Interviews workers from both projects.

Oral History Interview: Kilbourne George. Interview conducted by John Alfonsi. Fairbanks, Alaska: KUAC-FM, 1989. University of Alaska Anchorage, Library and Archives. Three audio cassettes containing a recording of an interview with Kilbourne George. The interview was conducted by John Alfonsi over three days in November of 1989. The interview focuses on the history of Stevens Village. Interview topics include: a discussion of the "Old Ways" and how they compare to the "New Ways" of hunting, trapping, subsistence, and day to day living, the perceived impact of state projects such as the Trans-Alaska Pipeline on Native lands, locations of old traplines, cabins, settlements, and burial sites, and education and law in the village.

A Pipeline—and Animals; ***Pipeline***; ***The Permafrost Frontier***. Anchorage, Alaska: KAKM Video. Alyeska Pipeline Service Company.; William Bacon Productions.; Trailwood Films.; Pendleton Productions.; Corporate Productions, 1998. VHS tape and teacher's guide. *A Pipeline—and Animals* demonstrates how modern technology and wildlife exists side-by-side along the trans-Alaska pipeline. Shows the lifestyles and antics of animals living near the pipeline. *Pipeline*: Description of the physical, climatic, and environmental difficulties encountered in the construction of the Alaskan pipeline.

Permafrost Frontier. Uses live action and animation to illustrate the properties of permafrost and to explain the engineering methods used to design and build the trans-Alaskan pipeline.

Trans-Alaska Pipeline: A Sound Adventure. Fairbanks, Alaska: Arctic Productions, 1982. Cassette tape recordings of lectures and speeches.

ARCHIVAL MATERIALS:

Northern Alaska Environmental Center Records, 1971-1999. Archives, University of Alaska Fairbanks. The Northern Alaska Environmental Center records contain administrative documents as well as subject files relating the various environmental issues the Center has engaged in since its creation in 1971. The present collection is a merger of two collections: the Fairbanks Environmental Center Papers and the Northern Alaska Environmental Center records.

Papers, Jack Roderick, 1900-2002. University of Alaska Anchorage, Library and Archives. The collection consists of the personal, political, and historical papers of Jack Roderick, most of which concern his research and writings on the history of oil resource development in Alaska. The collection is divided into fifteen series: personal papers (biographical and Anchorage mayoral materials), "Oil in Alaska" course at Alaska Pacific University, Royalty Oil and Gas Development Advisory Board, Amerada-Hess oil royalties litigation, editions and drafts of the book *Crude Dreams*, oil in Alaska-related oral interviews on audiocassettes, oil in Alaska related reference files on individuals, oil in Alaska reference files, oil in Alaska related maps, oil in Alaska related photographs, a photographic exhibition on the history of oil exploration and development in Alaska, Alaska oil and gas publications, Alaska natural gas publications, oil and gas related periodicals, and miscellaneous materials. Types of materials found in the collection include newspaper clippings, articles, copies of legal and governmental documents, publications, reports, interview recordings and transcripts, photographs, and maps.

Pipeline Clipping Files, 1973-1980. University of Alaska Anchorage. The collection consists of three reels of microfilm containing copies of newspaper clippings, articles, and reports from Alaskan and Canadian newspapers and journals concerning the planning, development, construction, and management of the Trans-Alaska Oil Pipeline. In addition, they also concern the proposed construction of a trans-Alaskan or trans-Canadian natural gas pipeline from the North Slope of Alaska.

Pipeline Design and Feasability Studies, Alyeska Pipeline Service Company, 1971-1973 University of Alaska Anchorage, Library and Archives. The collection consists of technical design and feasibility reports concerning the construction of the Trans-Alaska Pipeline. The reports were prepared by the Alyeska Pipeline Service Company between 1971 and 1973.

Trans-Alaska Pipeline Construction Collection, 1976-1977. Alyeska Pipeline Service Company. Alaska State Library. Collection includes 589 color slides and 127 black-and-white photographs of pipeline construction. Images of personnel, equipment, the winter

environment, wildlife, pump stations, Valdez and the terminal. The slides generally correspond to typewritten progress reports which begin in March, 1976, when the pipeline was about 45 percent complete, and ending in April, 1977 at 95 percent completion. Construction began in April 1974. The 4-foot diameter pipeline spans 800 miles from Prudhoe Bay to Valdez, crossing tundra, three mountain ranges and hundreds of streams, requiring a number of various-sized bridge structures. 132 million man-hours went into the effort, which included construction of a 360-mile all-weather road from the Yukon River to Prudhoe Bay. [From *Alyeska Pipeline Service Co. Progress Report*, April 1977.].