Laying Pipe Along The Montana Northern Border

by Steve Shuck

The Alaska Natural Gas Transportation System. This name identifies the largest privately financed construction project in the history of the world. Since oil was discovered on Alaska's North Slope, developers have pondered how to transport the accompanying natural gas to United States markets. The Prudhoe Bay gas field was estimated to contain over 26 trillion cubic feet of saleable natural gas or 13% of the nation's known reserves—our largest reserve.

Between 1974 and 1976, three proposals for transporting the natural gas to the lower 48 states were submitted to the Federal Power Commission (FPC). The first proposal, submitted by Arctic Gas, was to deliver the Prudhoe Bas gas as well as natural gas discovered in MacKenzie River Delta in the Yukon Territorry via overland pipeline across Canada. The second proposal was submitted by El Paso Alaska Company. They wished to transport the Prudhoe Bay gas via a pipeline paralleling the Trans Alaska Pipeline System (TAPS) crude oil line to Valdez, Alaska. The gas then would have been liquified and shipped via Liquified Natural Gas tanker to west coast markets. Upon arrival it would have been regassified and put into existing pipeline distribution systems. Alcan Pipeline Company and Northwest Pipeline Company (Alcan) filed the third proposal with the FPC. This plan called for a pipeline following existing utility corridors through Canada to U.S. markets.

Aware of the demand for natural gas in the lower 48 states, the large gas reserves in Alaska, and the potential for delay in the regulatory process authorizing a project of this magnitude, Congress passed the Alaska Natural Gas Transportation Act (ANGTA) in October 1976. This legislation was designed to provide for the expeditious selection of a transportation system, as well as for its construction and initial operation while maintaining construction quality, cost control, safety, and environmental protection. This was done by two provisions of the Act. The Act gave Alaska Natural Gas Transportation System (ANGTS) applications precedence over similar applications, and called for the creation of the Office of the Federal Inspector. The Office of the Federal Inspector (OFI) became the federal government's single contact point. Sponsors and applicants were to work through the OFI, rather than dealing with the maze of federal agencies having enforcement responsibilities.

Another provision of ANGTA directed the President to designate the preferred transportation system. The decision was to be based on recommendations of FPC, land management agencies, environmental impact statements, and the Canadian government, with full consideration given to the economic feasibility of each proposal. On September 22, 1977, President Carter declared that the Alcan proposal would be the Alaska Natural Gas Transportation System.

The Alcan proposal included an Alaskan Segment, a Canadian Segment, a Western Leg, and an Eastern Leg. the Alaskan Segment originates at Prudhoe Bay and parallels the TAPS line to Delta Junction in central Alaska where it turns southeast to the Alaska-Yukon Territory Border. The Canadian Segment starts at that border, travels along southern Yukon Territory, cuts across the northeast corner of British Columbia, and runs along the western edge of Alberta. South of Calgary the line splits into a western pipeline heading southwest to the U.S. boundary near Kingsgate, British Columbia and an eastern line heading southeast to the U.S. border near Monchy, Saskatchewan. The Western Leg begins at the border near Kingsgate, travels through north-

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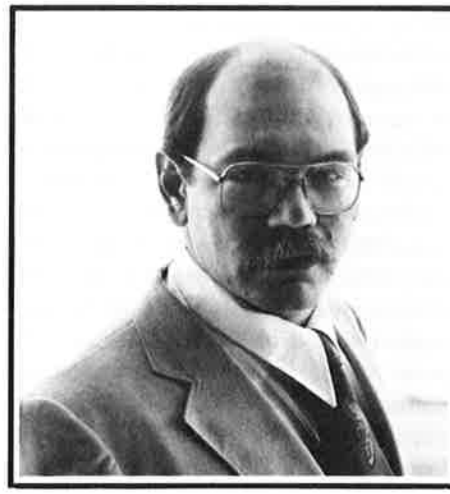

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western Idaho, eastern Washington, Oregon and terminates near San Francisco (see Figure 1).

The Eastern Leg, built during the summer of 1981 by its sponsor Northern Border Pipeline Company, begins near Monchy at the U.S. border and cuts across northeastern Montana, North Dakota, southwestern Minnesota, and Iowa terminating outside Chicago. Its construction provides some interesting insights into how a project of this magnitude is undertaken.

Northern Border Construction

Northern Border split the line into nine separate construction spreads to be constructed simultaneously. About 20 miles of Spread One (beginning at the Canadian border and continuing southeasterly approximately 90 miles east across Montana) cross public lands administered by the Bureau of Land Management (BLM). The BLM had worked with Northern Border helping them with route selection, landowner contact and other preconstruction activities prior to the arrival of the Office of Federal Inspector's people in the area. When the OFI arrived on site, they established a joint, cooperative effort between the OFI and the BLM. The OFI recognized the BLM's knowledge of the area and redelegated environmental enforcement responsibilities on public land back to the BLM while retaining the responsibility for technical, economic, and administrative matters.

Actual construction on Spread 1 of Northern Border Pipeline began on May 5, 1981 at the Canadian border. The company had been granted a 54 foot permanent right-of-way across public land by the BLM with an extra 46 feet temporary construction width. In places where extensive cutting or more operating space was necessary, up to an additional 100 feet temporary space was granted.

While much of the land along the right-of-way was flat to gently rolling, extensive blading was often necessary to obtain a level work pad. A 42 inch pipeline, weighing about 20,000 pounds must be precisely centered with its weight evenly distributed to prevent rolling. On flat ground, the right-of-way was high-bladed by skimming the surface of the ground to knock off humps, fill in ruts and remove rock to obtain a smooth working area. In all areas which required blading, topsoil was preserved for replacement over the right-of-way after the pipeline was in place and the right-of-way had been recontoured.

Once a level working area was obtained, pipe stringing began. As many as 23 trucks hauled two 80 foot joints per load from the pipe stockpile to the right-of-way. Initially, the stockpiles and right-of-way were about 100 miles apart, leading to only two loads per truck per day. The pipe was strung along the staked centerline in preparation for ditch construction.

As much of the ditching as possible was done by trenching machines. The trenchers were capable of providing a ditch 66 inches wide by 78 inches deep to accommodate the pipe. In places along the route, the trenchers could not operate. Curves, muddy soil, rocky ground and heavy clay soils required that backhoes dig the trench. The backhoes dug an adequate trench but were slower and less efficient. While the trenchers did an admirable job of keeping loose soil and rock out of the trench, further work was still necessary to obtain a usable trench. A small dozer pushed unwanted material into piles on the trench floor to be removed with a bucket. This was followed by a team of people with hand tools who put the finishing touches on the pipe bed.

A Cleveland Trenching Machine (BLM photo)

After the trench was completed, the trench was measured by a surveying crew for angles, bends and sags. This information, measured to ½ degree was written on the pipe alongside the trench. The pipe was bent in a hydraulic bending machine to match the trench configurations. Specifications for pipe allowed for a bend of up to ½ degree every 14 inches. Thus, each 80 foot pipe section could be bent between 20 and 25 degrees.

After the pipe was bent it was welded. A total of 16 welders (working on the top half and bottom half on each side) applied the stringer bead after a line-up clamp inside the pipe aligned the ends of the pipe joints being welded. These were followed by a team of six welders who added a second weld called the first hot pass followed by two more welders who applied the second hot pass. Teams of two welders each then added four more passes (called filler welds) and a final team applied the cap welds.

Each weld was marked to identify each welder's work. In this way the inspectors could determine the quality of each welder's work from the X ray. The pipe section number, weld and welder information, and X rays are kept in a permanent file on the line for future reference during maintenance and operation of the pipeline.

The large number of required welders quickly presented a slight problem. The 75 contract welders each had their own truck which caused significant congestion problems on the right-of-way and excessive off right-of-way travel. Northern Border and the pipeline contractor solved this problem by requiring the welders to put their equipment onto wheeled sleds. The sleds were pulled from one station to another by tractor, eliminating much of the right-of-way traffic.

Northern Border used a method to conserve pipe in case of a blowout. If a blowout would occur the pipe will split laterally along the pipe seams faster than the pipe will depressurize. A break of several thousand feet can develop. Crack arresters designed to reduce a potential split's length were installed on average 3000 foot center and absorb shock rather than allow it to continue along the line. This substantially reduces the risk of pipe ruptures.

The pipe was coated and taped after it had been welded and X rayed. The machine that did this encircled the pipe and moved along it. A series of brushes first cleaned rust and dirt from the pipe. A primer was then applied and covered

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Tape (cont. from pg. 34)

by two layers of corrosion resistant polyvinyl tape. Coating and taping increased the pipeline's life by making it much less subject to corrosion.

The pipe was lowered directly from the taping machine into the ground. If the tape was damaged by the sidebooms or side of the trench, it was repaired by hand. Added protective measures were undertaken by Northern Border at river and stream crossings. The pipe must be weighted down in saturated soil to avoid floating. To prevent this, a protective padding was put over the polyvinyl tape and concrete weights, about 10,500 pounds each, were placed on the pipeline. The weights were spaced as necessary to keep the pipe buried.

Immediately after the pipe was placed in the trench, backfilling was accomplished in several stages. First, an auger-backfiller (a bulldozer with an auger blade mounted on the front) moved the trench spoil into the trench. As the spoil was augered, most clumps broke down allowing for complete filling around the pipe. Augering also helped keep rocks from resting against or damaging the coating. If either clumps of soil or rock lodged against the pipe, not only did the risk of damaging the tape arise, but also the possibility of voids in the fill. Voids would eventually fill in and cause the filled trench to settle.

The auger-backfiller was followed by a modified dragline and dozer that finished filling in the trench. A loader

Pictured is a Roscoe-Brown auger backfiller followed by a drag, dozer, and loader. (BLM photo)

with weighted tires or a dozer then drove along the trench to help pack the soil.

When the pipe was securely in place, hydrostatic testing operations began. As a final check, the pipeline was filled

A CRC coating machine cleaning, priming, and covering the pipe with tape. (BLM photo)

Pipe being weighted down at a stream crossing. (BLM photo)

with water and pumped to a pressure far exceeding the operating pressure. It is much safer to test with water rather than gas (air or natural gas). Should a rupture with water occur it depressurizes rapidly. Gas on the other hand will propogate the rupture causing much more damage as well as causing a much greater safety hazard.

As hydrostatic testing was completed, clean-up operations began. Spoil removed during blading was replaced and the right-of-way was recontoured as close as possible to original contour. The topsoil was replaced across the right-of-way. The right-of-way could then be reseeded.

Reseeding did not occur as designed. The original plans required 12 pounds native seed per acre to be drilled into the soil where the right-of-way crossed native rangeland. Due to logistics problems and time constraints, the OFI and BLM approved a plan to allow aerial broadcasting of seed. To help promote good seedling establishment, the rate of seeding was doubled to 24 lbs/acre and a mulch/tackifier was to be applied. The mulch was to help protect the seed with the tackifier helping to bind the seed to the soil.

Bitter Creek

The Bitter Creek area along Spread 1 deserves special mention. In 1976 Congress mandated that all public land administered by the BLM be inventoried for its potential for congressional designation. An 80,000 acre area encompassing the Bitter Creek drainage was tentatively found to possess the characteristics which would lead to establishing a wilderness study area. This meant no new activities could have occurred in this area that would affect wilderness suitability.

The proposed route for Northern border Pipeline and the 4½ mile wide construction corridor authorized by President Carter traversed the Proposed Study Area. The BLM was left with two contradictory laws with one saying naturalness in wilderness study areas could not be impaired and another law requiring the agency to promote the construction of ANGTS.

Based upon public review of the proposed wilderness study area, the BLM went back to the field and identified a heavily used trail and reclassified it from a "vehicular way" to a "road". This opened a corridor between the wilderness study areas which could be used for the pipeline. The corridor, still within the 4½ miles identified by President Carter, ranged in width from 300 to 1000 feet and both sides of the corridor were extremely sensitive to disturbance.

Due to the sensitivity, both environmental and political, Northern Border and its contractors worked in close cooperation with the BLM in centerline staking and resource protection. No further problems in the Bitter Creek corridor were noted until blading was almost completed.

On a slope leading to the creek, a temporary construction width of 200 feet had been granted but the blading foreman felt 500 feet would be disturbed due to centerline location. The line had been staked along the east side of a ridge, dropping about 20 feet down the slope. The pipeline required a base of solid ground and could not be laid in fill material which would have resulted in minimum blading. A solid ground base would cause much more cutting and other disturbance.

The problem was resolved by moving the centerline from the ridge's side to its top. This allowed the dozers to blade all

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Energy (cont. from pg. 46)

To Open" these sections of the pipeline was granted by the National Energy Board in April and May 1981. On October 1, 1981, ceremonies were held in Los Angeles to commemorate the arrival in California of the first shipments of natural gas from Alberta to America through the Alaska Highway Gas Pipeline.

On May 22, 1981, following the same procedure as outlined for the Western Leg, the first "Leave To Proceed" with construction was granted for the Eastern leg through southeastern Alberta and Saskatchewan to a point near Monchy, Saskatchewan, on the Canada/United States border.

On the American side construction is well under way by Northern Border, which will interconnect with the Canadian line at the International boundary and, when completed, will deliver natural gas to the U.S. Midwest.

The target date for the opening of this portion of the system is the fall of 1982.

It is worth noting that the Northern Pipeline Agency has a statutory 'sunset clause', which means that it will cease to exist one year after the last Leave to Open has been granted for the Alaska Highway Gas Pipeline, unless by joint resolution of Parliament the Agency is authorized to regulate and oversee the construction of a Dempster Lateral. From this point onwards, the National Energy Board will take over jurisdictional responsibility for the pipeline.

On December 15, 1981, the President of the United States officially signed the legislation termed the "Waiver Package" which consists of amendments to the **Alaska Natural Gas Transportation Act** of 1976.

Approval of this legislation provided Foothills Pipe Lines (Yukon) Ltd. and the Canadian Government with assurances given originally by President Carter in July 1980 that the U.S. Government would at the appropriate time through Congress remove any impediments as may exist under present law and which might have impeded the financing of the project.

In Canada, approval of the "Waiver Package" now provides the Foothills group of companies with the right to collect their full cost of service as soon as the Canadian segment of the pipeline is completed, or at a targeted completion date for the whole project, whichever comes later. In the United States, the approval permits the major Alaskan gas producers to own a non-controlling interest in the project.

In both countries, the approval of the "Waiver Package" is viewed as a most positive step in assuring the necessary financing and eventual completion of the entire project.

Despite the many delays and difficulties experienced in putting together this project on both sides of the border, the regulatory process has been used to successfully build the Alaska Highway Gas Pipeline to date. I am convinced that we will see it completed.

Centerline (cont. from pg. 35)

soil to one side and they were able to stay within the 200 foot work area.

All other operations in the corridor were completed without major difficulty.

Progress to Date

Of the four parts of ANGTS, three have pipe in the ground. The Alaskan Segment has yet to begin construction. That is expected to commence in 1985 or 1986. The Canadian Segment has 400 miles of completed pipeline. Phase I of the Western Leg is almost complete and Canadian natural gas is being pumped through portions of it at the present time.

The Eastern Leg is also nearing completion and is scheduled to be in service in the fall of 1982. With the exception of the North Dakota spreads, it is finished from the Canadian border to northern Iowa. When complete the pipeline will transport up to 2.4 billion cubic feet of natural gas per day.

Construction work on Spread One was of high quality and surpassed the standards for a project of this trype. Since large pipelines are new to this region of the country, satisfactory performance of the pipeline coupled with the responsiveness of the company to public concerns and the return of productivity to the right-of-way will greatly affect future proposals for utility transmission systems.