America's Greatest Projects and Their Engineers III

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Introduction

While many of our greatest American projects were conceived by the federal government as a means of national security or growth, the private industrial sector occasionally entertained a project that would provide a measure of national security and also prove to be profitable. One such project was the Trans-Alaska Pipeline, an 800-mile long, 48-inch outside diameter pipeline system that pumps crude oil from the North Slope at Prudhoe Bay south to the terminal at Valdez, Alaska. Following the oil embargo of 1973 and the experiment with price controls on everything from pizza to most commodities, long lines of automobiles formed whenever the word got out that a certain gas station either had received, or was about to receive, a tanker truck full of gasoline, and grade was irrelevant.

A. Initial Project Activities

1. Major Oil and Gas Reserves Are Discovered

The natives of North Alaska as well as those who operated in those areas such as whalers and fishermen always recognized the seepages in those lands as some form of petroleum. As the economy of the United States developed in the post-World War I era, our country became very dependent on a stable oil supply. Accordingly, in the early 1920's President Warren Harding had designated an area in northern Alaska as one of four future oil reserves, due in large part to the fact that the U. S. Navy was converting their fleets from coal-burning to fuel oil.

During World War II the U. S. Navy had funded oil exploration, and several surveys were made to determine the extent of oilfields in Alaska, but the navy terminated the program in 1953 as the first nuclear submarine was being commissioned. These reserves lay largely dormant, even after World War II, as other sources of energy, particularly nuclear, became popular. In fact, nearly all of the one hundred nuclear power generating plants in the United States were either built or in the process of being developed between the period between the end of World War II and 1973.

However, Richfield Oil Company drilled an enormously successful oil well in northern Alaska in the late 1950's, which became the first oil field in commercial production. Known as the Swanson River Oil Field, it spurred the development of others, so that by 1965 at least five oil fields were in production. The obvious conclusion was that the areas north of the Brooks Range, which is actually above the Arctic Circle, would contain vast amounts of oil. In 1967 the Atlantic Refining Company and their new partner Richfield Oil Company began surveying and exploring for oil in the Prudhoe Bay area. In March of 1968 the new company (ARCO) drilled a well that began producing over 1,000 barrels of oil per day, and in June of that year drilled a second well

that was producing oil at a similar rate. This newest oil field confirmed the existence of a mammoth oil reserve in Prudhoe Bay. The geological estimate was that this new oil field contained more than 25 billion barrels of oil, making it one of the largest oil fields in the world.

Ways to Transport the Oil

The problem as ARCO envisioned it was not so much developing the oil fields in the harsh conditions and environment, but rather how to get the product to market. A pipeline connecting the rich oil fields on the North Slope of Alaska to the ice-free port in the south at Valdez was one of the first considerations, but no oil pipeline of the length being proposed had yet been constructed. Boeing Corporation had proposed the RC-1, a gigantic 12-engine tanker aircraft, which would have needed extremely long runways for takeoff and landing. General Dynamics had proposed a group of submarine tankers, probably nuclear-powered, in order to travel under the Arctic ice cap. Still a fourth proposal was to extend the Alaskan Railroad from Prudhoe Bay to the Valdez Area. Humble Oil even sent an oil tanker specially fitted with an icebreaker bow and powerful engines and propellers to plow through the ice-laden Arctic Ocean surrounding Prudhoe Bay, but its cargo hold suffered severe damage even before it arrived in Prudhoe Bay, necessitating extensive repairs before it could be rerouted.

In October 1968 a joint group made up of Atlantic-Richfield (ARCO), Humble Oil (Esso, or Standard Oil of New Jersey, which became Exxon in 1972), and British Petroleum (B/P) was formed. The three companies, moving swiftly in anticipation that approval of the drilling for oil and the construction of the oil pipeline would be a foregone conclusion, formed a task force of representatives from the three companies. The group was initially made up of executives, operators, and engineers and was known as the Arctic Task Force. Meeting as often as three days a week, they concluded within a few months that the only viable option seemed to be a pipeline running from the northeast corner of Alaska at Prudhoe Bay almost due south for a distance of approximately 675 miles to Valdez, the northernmost ice-free port in Alaska. Once the Arctic Task Force concluded that a pipeline would be the only viable option, the group was whittled down to a smaller group of engineering representatives from each company with the responsibility for developing the pipeline design and specifications.

Then known as the Trans-Alaska Pipeline System (TAPS), the TAPS Task Force proceeded to prepare all-inclusive specifications for a pipeline that would carry enough oil to allow the three companies to achieve their return on investment within three years from startup. The initial estimated cost of the project was established at $1.5 billion. The mathematics and the throughput objectives gave the engineers the result that a 48-inch outside diameter pipeline with a wall thickness of about 1/2 inch would be required, and that the only viable producers of that type of pipe would be the manufacturers of SAW (Submerged Arc Welded) pipe.

Originally hoping to begin laying pipe by September of 1969, TAPS believed that substantial orders had to be placed in advance for the pipe, since time was of the essence. Although the optimum size of pipe needed for the projected oil flow across Alaska was determined by TAPS to be 48 inches in outside diameter, at that time there were no large diameter pipe mills in the United States or Canada that could satisfactorily produce more than 36inch diameter, SAW pipe at anywhere near the rates of production that would be needed for an estimated 800 miles long pipeline. Furthermore, there were only a few large diameter pipe mills in the United States or anywhere else in the world that could properly tool up for even 42 inches outside diameter SAW pipe.

After some delay due to necessary planning, TAPS had submitted a formal plan In June of 1969 to the Department of the Interior which included the pipeline routing accompanied by a 100 foot right of way. Also included in this plan was a request for an additional 100 foot right of way for the construction of a maintenance and supply road that would run parallel to the pipeline. The reason for the 100 feet right-of-way was never really fully explained until now, but review of the company's early records reveals that the obvious plan by the three original oil companies was to build a separate natural gas pipeline running parallel to the oil pipeline.

The oil companies believed, rightfully so, that there would be billions of cubic feet of natural gas in the Prudhoe Bay oil fields. Consequently, they had charged their Task Force with planning a quiet, unpublicized program to develop a natural gas pipeline simultaneously with the oil pipeline. Unfortunately for American consumers the controversy over the oil pipeline became so contentious and political that the natural gas pipeline concept was eventually placed on the "back burners" (more on that later). The Alaska Pipeline Task Force, which gave way to the Alyeska Task Group, continued to explore the concepts of a natural gas pipeline while concentrating most of their efforts and resources and attention on the oil pipeline

2. Securing/Storing the Pipe

Pipe Manufacturing

Once the TAPS Task Force had drawn the conclusion that 48-inch outside diameter pipe would be needed for the oil pipeline, they set about scouring the world for manufacturers of such a product. They knew that spiral welded pipe would not stand up under the harsh conditions of the Alaskan environment, and determined that there was the necessity to find a UOE pipe manufacturer who could provide the 48-inch SAW (Submerged Arc Welded) pipe.

NOTE: UOE stands for U-Press, O-Press, Expander. The process involved:

1. the rolling of a relatively high-strength (X-52 or greater) steel plate, approximately 1/2 inch thick by slightly over 150 inches wide by anywhere from forty to sixty feet in length,

2. processing the raw plate through a planing machine to give the butting edges on each side of the plate a smooth surface, while at the same time cutting a 30° bevel on the top and bottom edges of each side of the plate to permit consistent inside and outside welded joints.

3. crimping (turning up the side edges of the plate) each side of the plate at about a 22 1/2° angle,

4. conveying the crimped plate into a U-Press, which had 48-inch inside diameter rounded bottom dies and a u-shaped anvil that would lower and create a half round when lowered to the bottom,

5. conveying the half round plate into an O-Press which had 48-inch top and bottom dies and created a fully rounded shell when the top dies were lowered.

6. conveying the rounded shell with the outer edges pressed together, through submerged arc welders on the inside and outside diameters (at that time by two-wire welders each, one for the root pass and one for the crown pass),

7. end facing the ends of the pipe ("cans") to provide a squared end surface while simultaneously adding an outside bevel to allow for uniform joint welding in the field,

8. mechanically expanding the welded "cans" in three to four feet increments in order to give the pipe its final outside diameter and roundness, and to also add metallurgical strength to the pipe.

Task Force Seeks Suppliers

With the anticipated construction to begin on some portion of the pipeline in September 1969, even though surveying was far from complete, the TAPS Task Force issued a pipe specification to several foreign and domestic UOE manufacturers. The three principal engineers who developed the pipe specification were:

1.	Rado Loncaric	Atlantic Richfield
2.	Edgar Von Rosenberg	Esso (Exxon)
3.	Harry Cotton	British Petroleum

Beginning in late February of 1969 Loncaric and Von Rosenberg began to review proposals and to visit the plants and mills of the many companies around the world who were interested in supplying the 48-inch O.D. pipe for the oil pipeline. TAPS made a concerted effort to find manufacturers of 48-inch O.D. submerged arc welded (SAW) pipe in the United States and Canada. The reality was that there were none anywhere in North America, or even Europe, at that time. The Task Force (primarily Von Rosenberg) visited plants at Napa and Kaiser Steel, and discussed the specifications with numerous U. S. SAW manufacturers such as Bethlehem Steel, Kaiser Steel, and U. S. Steel. Most of the SAW domestic producers proposed 36-inch O.D. pipe, or 42-inch O. D. pipe as alternatives (only two or three companies in the United States actually had the capability to produce up to 42-inch O.D. pipe at that time), but no U. S. manufacturer was willing to make the investment to go to 48-inch unless they were assured of a purchase order.

In April of 1969 Von Rosenberg traveled to Germany to review a proposal by Hoesch and to visit plants at Mannesmann and Thyssen. While Hoesch was willing to make the investment in their plant to convert to 48-inch O.D pipe, their asking price per ton was considered too high by Loncaric (Von Rosenberg agreed), and their proposal was rejected. Von Rosenberg later flew back to England and visited British mills at the request of British Petroleum, but with the same negative results. While in London he communicated his findings with Harry Cotton, B/P's member of the TAPS Task Force, and Cotton's boss Phil Ford. Cotton, who was being promoted to Chief Engineer of BP and was about to be transferred to New York, related to him that the necessity for a pipe purchase was very near, and that the Japanese seemed to be the only ones who would meet the specification and the price and were willing to make any investment necessary to produce 48-inch O. D. pipe.

Believing that they were running short on time, the TAPS Task Force visited Japan and discussed the likelihood of issuing contracts to the three manufacturing/trading companies that had submitted the lowest proposals. The strong selling points to the members of the Task Force were:

1. the Japanese mills seemed willing to invest in the 48-inch mills without a firm commitment.

2. the Japanese mills would be able to provide their pipe in longer lengths between forty and sixty feet, whereas the U. S. and European mills could have only produced forty feet lengths.

Sumitomo Metal Industries had three major manufacturing plants, and was well-known following World War II for its ability to produce oil country tubular goods OCTG) such as seamless pipe and tubing. Sumitomo was both a trading company and a manufacturer, and was

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