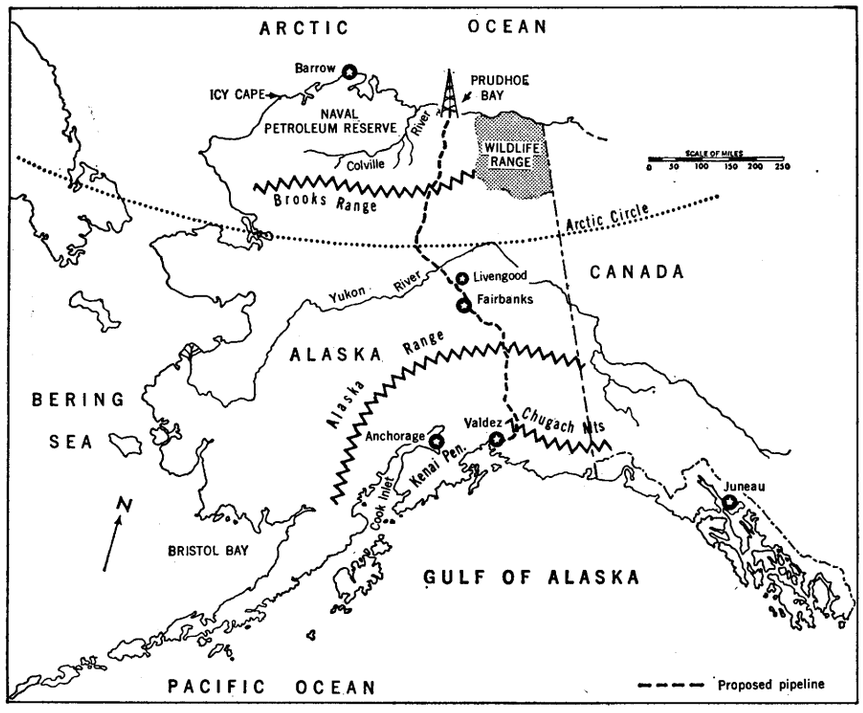


North Slope: Oil Rush

Alaska May or May Not Become a Kuwait of the Arctic but the Oil Men's Arrival Is Changing a Wilderness

Until the current rush to exploit its oil, the North Slope of Alaska was a place that relatively few white men knew or had any interest in, financially, esthetically, or otherwise. Now, suddenly, this wild, remote, and still almost uninhabited land has become a symbol of a question that has sometimes gone unrecognized in more familiar regions: Can the hunger of the modern industrial economy for fuel and other materials be satisfied without despoiling the few wild places left on the face of the earth?

Much of the North Slope is a vast, nearly flat, coastal plain—a treeless tundra region where the vegetation is principally grasses, sedges, mosses, and lichens. In the continual daylight of summer, wild flowers, such as poppies, purple and white anemones, roses, and saxifrage, bloom in brief profusion, adding a passing touch of vivid color to a landscape of beiges and browns. Great snowy owls cruise the tundra, preying upon lemmings, and the swift, gull-like jaeger, another relentless predator, swoops and wheels in its search for the nests of plover, sanderlings, and other shorebirds.

The North Slope is so named because, as one goes farther inland, the land rises into foothills and eventually into the Brooks Range, a spectacular jumble of barren peaks (many rising to heights of 7000 feet or more), craggy ridges, and deeply incised valleys. Together, the flat coastal plain, the foothills, and the Brooks Range form a wilderness which, as a measure of its vastness and past isolation, sustains enormous herds of caribou. At least 440,000 of these large, splendidly antlered beasts live in the North Slope region and there are perhaps far more.

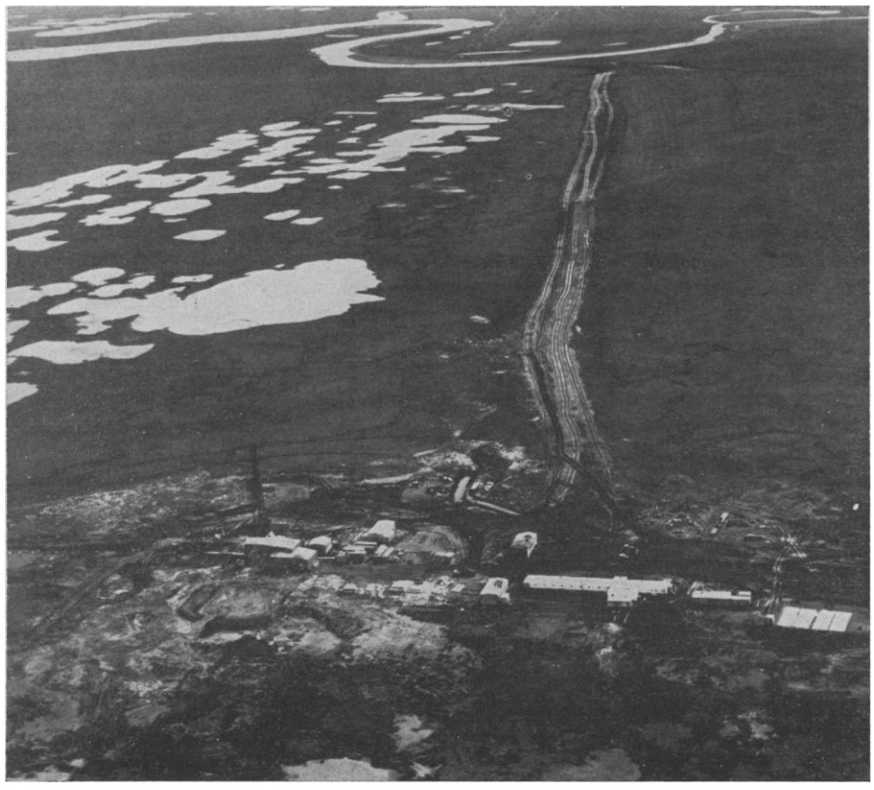
Their migrations, from their wintering grounds in protected valleys and spruce forests on the south side of the Brooks Range back to the North Slope in spring, are as dramatic a part of the seasonal rhythm as the thunder and roar of the rivers when the ice goes out. The caribou are shadowed by huge wolves, which pull down the weak or unwary with lethal efficiency. One of the rarest of the great carnivores, the barren ground grizzly, also prowls the slope; and, off the arctic coast, polar bear hunt seal tirelessly on the pack ice. In the Brooks Range, the Dall sheep, a regal animal that is incredibly hardy, lives through the harshest winters browsing on high, northerly slopes where the ridges are kept clear of snow by the winds.

Often called an arctic desert, the North Slope does not receive much rain or snow, for the winds blowing in from over the Arctic Ocean ice pack bear little moisture. Yet, in summer, one of the striking features of the slope's coastal plain is its thousands of shallow lakes and innumerable sluggish streams which wend their way seaward in oxbows or more contorted patterns. And the tundra itself, or much of it, is boggy underfoot.

This paradox of abundant water in an arid land can be largely explained in a single word: permafrost, the permanently frozen ground that lies a foot or so beneath the thawed surface of the tundra and keeps the surface water from being absorbed and lost to the subsoil. In the permafrost, which in places is as much as 1300 feet thick, are veins of ice that have formed beneath the tundra as the result of melt water flowing into and refreezing in contraction cracks in the frozen ground. These ice veins are responsible for the tundra's patterned or "polygonal" ground which, seen from the air, rather resembles alligator skin.

On the North Slope, and especially along the coast at places like Prudhoe Bay, site of the discovery well that has brought in the oil rush, the wind blows constantly, usually from over the ice pack. Even during the short summer, temperatures sometimes drop below freezing and the fur-trimmed parka is worn year-round. In winter, subzero temperatures, high winds, and blowing snow combine to make the North Slope environment harsh indeed. The lakes, the streams, and the tundra freeze hard, and summer's soggy landscape becomes an unbroken expanse of snow and ice. The midnight sun of summer is extinguished and the slope becomes a place of shadows and darkness, scarcely relieved by the brief twilight at midday.

The only people to make the slope their permanent home are the Eskimos, who traditionally have looked to hunting and fishing for subsistence. Even today, fish and game—whitefish, grayling, seals, walrus, whales, eider duck, caribou—provide an important part of



Prudhoe Bay State No. 1, the discovery well which started the oil rush.

their livelihood. In fact, many of the some 2500 Eskimos on the North Slope live on the fringes of the cash economy, spending much of the little money that comes their way to acquire more modern means for their traditional pursuits—for instance, Eskimo hunters now generally have snowmobiles, using them to replace dog teams, which, besides being slow on the trail, have a ravenous appetite for frozen fish.

"The Eskimo is the proudest man on earth because, even if the white man left, he believes he could provide for himself," says Al Hopson, proprietor of Al's Cafe in Barrow and son of a 19th century whaler who settled there, married an Eskimo woman, and brought up his children more or less in the native tradition. Hopson relates that as a younger man, in the early 1930's, he set forth each winter with his wife, a half dozen children, a team of up to 13 dogs, and a sled loaded with camping equipment, traps, and 1000 pounds of dog food. Traveling from along the coast well into the foothills and highlands of the Brooks Range, Hopson would hunt caribou for food and trap such furbearers as white fox, wolves, and wolverine for money.

"The fish and game we feel should be protected," Hopson told a visitor. "We've always had these things. They are the only means we have had to survive in this country." The old way of life has been fading as Eskimos of newer generations have attended school, visited other parts of Alaska, taken jobs, or gone on welfare rolls. But, in Hopson's view, what once was done for survival will continue to be done for pleasure as well as for fresh meat. "These people," he says, "will always hunt and fish, and they will always go whaling."

First White Explorers

The first recorded visit to the North Slope by white explorers occurred in 1778 when Captain James Cook passed through the Bering Strait and stopped briefly at Icy Cape, some 140 miles southwest of Point Barrow. Cook was later followed by others, such as Sir John Franklin, who, while exploring the Northwest Passage in 1826, traveled west to a point about midway on Alaska's arctic coast—a place he named Prudhoe Bay.

But no major intrusion by the white man into arctic Alaska occurred until 1848, the year an American whaler sailed north through the Bering Strait and discovered whales to be abundant in the arctic waters. The arrival of American whalers and traders eventually broke up the patterns of trade that had developed historically between Eskimos of the coastal and inland regions; largely as a consequence of this, most of the inland Eskimos found themselves forced to move to coastal settlements such as Barrow.

Exploration of arctic Alaska by parties sent out by various federal agencies, such as the Army, Navy, and the U.S. Geological Survey (USGS), began after the United States' purchase of Alaska from Russia in 1867 for $7.2 million. (The Brooks Range is named for the late Alfred H. Brooks, who was director of the USGS Alaska survey during the early part of this century.) These explorers returned from the North Slope with reports of natural oil seeps and other signs of large hydrocrabon deposits. In 1923 President Harding ordered that a 37,000-square-mile area, covering most of the slope's western half and extending south into the Brooks Range, be set aside as Naval Petroleum Reserve No. 4.

Twenty years later, in 1944, the Navy was in its third year of a global war and did not know how much longer the war would last or whether its oil supplies were sufficient to see it through. Accordingly, exploration of "Pet 4" was begun that year and continued through 1953, carried on principally within the boundaries of the reserve but also in and beyond the Prudhoe Bay area to the east. Although the few oil fields discovered were disappointingly small, six gas fields, some of substantial size, were found. Moreover, a large body of geologic and geophysical information was gathered about the North Slope sedimentary basin.

Also, much was learned about how to carry on large-scale engineering enterprises in the arctic. The Pet 4 exploration involved up to 500 or more men at times and required the building of base camps and airstrips, the hauling of heavy tonnages over hundreds of miles of roadless tundra, and the drilling of test wells to depths as great as 12,000 feet.

One of the lessons learned, and now having to be relearned by some of the oil companies and geophysical firms on the North Slope, is that tractors and other heavy equipment cannot be operated over unprotected tundra in summer without doing serious damage to the environment. When the tundra's thin surface layer of thawed ground is broken, the permafrost beneath loses

its insulation and begins to melt and erode. Often, tracks left by a tractor or "cat" train will become a deep ditch, impassable to vehicles and capable of altering the surface drainage over a wide area. Also demonstrated in Pet 4 was the fact that, when the open tundra is littered with trash, empty oil drums, and discarded drilling equipment, this unsightly rubbish will remain indefinitely and may be visible for miles. In the Arctic the natural processes of biodegradation work slowly on such materials.

In early 1968, the Atlantic Richfield Company (ARCO), after 10 years of exploration and one very costly dry hole, finally struck oil a few miles inland from the coast, bringing in Prudhoe Bay State No. 1. A few months later ARCO brought in another wildcat, Sag River State No. 1, this one 7 miles from Prudhoe but on the same Triassic formation as the discovery well. ARCO and its partner, Humble Oil, had tapped into an oil field estimated to contain at least 5 to 10 billion barrels. Later, British Petroleum (BP) brought in a well in the same field. The Prudhoe Bay strike was probably the largest ever made in North America, and the Alaska oil rush was on.

However, the stage had been set for the present furious pace of development on the North Slope several years earlier. The State of Alaska had obtained and leased out the oil land in a manner that neglected the interests of the North Slope's Eskimos and which may have slighted the state's own interests. The Alaska Statehood Act of 1958 gives the state the right to select about 104 million of Alaska's 365 million acres and withdraw the chosen acreage from the federal domain. (Only a miniscule part of Alaska is now in private ownership.) Aware that the North Slope was a potentially rich petroleum province, the state, in 1964, applied to the federal Bureau of Land Management (BLM) for about 2 million acres lying along the arctic coast between the Colville and Canning rivers, an area which includes Prudhoe Bay.

Although this region was part of the Eskimos' traditional hunting and fishing grounds, the state application said that it was free of aboriginal use and occupancy. BLM, for its part, published a legal notice in several issues of *Jessen's Weekly* of Fairbanks, a newspaper with a circulation of a few hundred in the villages of arctic Alaska, saying that any persons claiming land for which the state had applied should file an objection.

No claimants appeared, and the land went to the state for it to dispose of as it chose, with or without regard for native interests. Commenting on this, Jane Pender, an Alaskan journalist, has suggested that, even though the procedure followed by BLM was legal, its morality was dubious. "The bur-

Brooks Range viewed from head of the Dietrich River. The oil pipeline is to go through Dietrich valley. [U.S. Bureau of Commercial Fisheries Photo by C. D. Evans]

den of proof," she wrote, in an article last March in the Anchorage *Daily News,* "was placed upon people who could not be expected to untangle the legal phraseology, who might not even have seen the notice in the first place, and whose knowledge of the far-reaching consequences of that simple small print notice might be said to be minute." The state moved promptly to put up its North Slope land for competitive lease. The first sale was held in late 1964 and two others were held in 1965 and 1967, with the sale of oil leases covering altogether some 900,000 acres. The oil rush had not yet begun, however, and in these first three sales the state received bonus bids of only $12 million for drilling rights now worth billions.

Following ARCO's big strike last year, oil company base camps and drilling sites on the slope became scenes of frenetic activity. Drilling on the leased tracts proceeded round the clock, 7 days a week, often in weather no Texas roughneck or roustabout should have to endure. Exploration of other state acreages by companies interested in the lease sale scheduled to be held this year also proceeded furiously. By this past August, 21 drilling rigs were on the slope and additional rigs were coming in.

At various points along the coast, from Prudhoe Bay to Barrow, millions of tons of supplies were being hurriedly unloaded from barges in a race against the offshore ice pack, which is open to navigation for only a few months in summer. Also, construction crews were busy building new camps and putting in the roads, airstrips, and other appurtenances of a large oil field. Numerous geophysical crews and geological field parties also were at work.

The slope's "big three"—ARCO, Humble, and British Petroleum (BP), all with proven wells at Prudhoe—are now pushing to start production by 1972. Anxious to begin receiving the handsome returns promised by their investment, these companies plan to build a $900-million pipeline from Prudhoe south for 800 miles across Alaska to Valdez, from which the oil will be shipped by tanker to the "Lower 48." Their joint Trans Alaska Pipeline System (TAPS) organization already is taking delivery of mammoth, 48-inch steel pipe from Japan, even though the federal government has not yet granted the pipeline right-of-way. And Humble Oil's ice-breaking supertanker *Manhattan* has just bulled its way through the Northwest Passage in a voyage intended to test the feasibility of transporting North Slope oil across the top of North America to markets in the eastern United States.

On 10 September, the State of Alaska cashed in big on the oil rush, leasing another 450,000 acres of its North Slope land; this time it received bonus bids totaling $900 million, compared to the $12 million it received for twice that acreage in the three earlier lease sales. The fact, however, that ARCO, Humble, and BP left the aggressive bidding mostly to others, especially the newcomers, has suggested to some Wall Street observers that the lease tracts of the greatest productive potential were those obtained in earlier sales, at bargain prices.

The significance of the North Slope oil rush to Alaska, a pauper state, is enormous. The $900 million just received in bonus bids is money enough to cover all state government expenditures, at the current budget level, for 4½ years. Production on the Prudhoe field will begin at the rate of 500,000 barrels a day and later rise to at least 2 million barrels, the pipeline's maximum capacity. The state will receive, at these levels of production, from $50 million to $200 million a year from its 12½ percent royalty (on the well-head value) and 4 percent severance tax—and much more if the legislature should raise the severance tax from its present low rate.

Kuwait of the Arctic

In fact, oil may make Alaska the Kuwait of the Arctic. Discovery of other oil fields on the slope and development of additional means of transport, whether by construction of more pipelines or use of ice-breaking supertankers, could produce huge new revenues, in addition to those from Prudhoe. And oil strikes on federal as well as state lands will be highly profitable for the state. The Statehood Act, drafted at a time when Alaska's economic prospects looked bleak, gives the state 90 percent and the federal government only 10 percent of the revenues from oil and minerals developed under federal leases.

Furthermore, the North Slope is not Alaska's only petroleum province, for there are other onshore and offshore areas, such as the Kenai Peninsula, Bristol Bay, and the Gulf of Alaska, which are known or believed to have significant oil reserves. Already, development of moderately productive oil and gas fields on the Kenai Peninsula and in Cook Inlet, beginning in the late 1950's, has brought Alaska revenues which may have kept it out of the red during its first decade of statehood.

Yet, if some large and enduring good comes to the state from the oil development, it will be the first time Alaska has so profited from the exploitation of its natural resources by outsiders. The Russians, who were the first white rulers of Alaska, ruthlessly pressed the Aleuts into virtual bondage and severely depleted the once abundant sea otter and fur seal. New waves of "colonial" exploitation followed the United States' purchase of Alaska. Gold and copper worth many millions were mined, mostly to the benefit of outside firms and investors, and rich salmon stocks were heavily overfished, again with outsiders reaping much of the profit.

Severe climatic conditions and a scarcity of good agricultural land has discouraged settlement, and Alaska remains not far from a state of nature. Its population, now estimated at about 270,000, is the smallest of any state's; yet, with 586,000 square miles, Alaska is larger than Texas, California, and Montana put together. With few exceptions, its cities and towns are no more than toeholds on the wilderness.

Juneau, the state capital, and a charming relic of the gold mining and frontier days, has a population of about 12,000 and is strung out along the Gastineau Channel below heavily forested mountains. The capitol building resembles a small town office building of the kind commonly erected 40 years ago, and, as such, it neatly symbolizes a state administration that has been too underfinanced, too understaffed, and too provincial to cope with anything so big as the oil rush.

Fairbanks, a town born at the turn of the century during the gold rush, is a jerry-built place of about 46,000, situated on the Chena slough of the Tanana River. It has become a way station for oil field workers and a staging area for flying equipment into the North Slope. Big Hercules transports, operated mostly by a firm run by a former bush pilot, are kept busy hauling drill pipe and other supplies for the rigs at Prudhoe and elsewhere. Almost overnight, Fairbanks has been changed by the oil rush from a depressed area to a boom town. For a stuffy single room at a Fairbanks motel, such as the Travelers Inn owned

by Walter J. Hickel, former governor of Alaska and now Secretary of the Interior, a visitor can pay as much as $31 a night, and the summer rates become effective long before the arrival of picnic weather. Workers on "debushing" leaves from the slope can find topless entertainment at downtown bars and saloons.

A bumpy highway and short-line railroad lead from Fairbanks to Anchorage, some 265 air miles to the south. They pass through thousands of square miles of rugged mountains, alpine meadows, and vast stands of spindly spruce trees. The wilderness is broken only here and there by roadside villages and lonely cabins, often displaying moose antlers above the door. Anchorage, having an area population upward of 100,000 and serving as the focal point of most of the state's business activity, has lost the frontier flavor and is Alaska's only real city. The oil companies have their Alaska headquarters here, and, as representatives of a dominant species in the political ecology, their executives mix comfortably with the state's business and political leaders at spots like the Petroleum Club, atop the Anchorage Westward Hotel.

By offering a large new source of public revenue, the North Slope oil is giving Alaskans hope of attaining greater prosperity, better state services, and a solution to one of their most vexing problems—the native land-claims controversy. This controversy has led to a freeze on all further state withdrawals of land from the federal domain and has been a major source of tension between the state and federal governments. In recent years, as a reaction to the state's ignoring their interests in incidents such as the North Slope land withdrawals and lease sales, the Alaskan natives—Eskimos, Indians, and Aleuts—have come alive politically. As a minority representing a fifth of Alaska's total population, they are now a potent force in state affairs.

Not only do the natives hold the balance of power in close statewide elections, but also they are pressing claims for over 80 percent of the land in Alaska. Former Secretary of the Interior, Stewart L. Udall, initiated the land freeze in 1967, pending a settlement of their claims. "The natives are using the land as their weapon, just as the Negroes in the ghetto have used violence as theirs," George W. Rogers, an Alaskan economist and social critic, told *Science*.

NEWS IN BRIEF

● **VIETNAM MORATORIUM DRAWS FACULTY SUPPORT**: A faculty call for a student moratorium of classes on 15 October as a demonstration against the war in Vietnam has been signed by two dozen of the nations' leading professors, including MIT linguist Noam Chomsky, Harvard biologist George Wald, MIT biologist S. E. Luria, Yale psychologist Kenneth Kenniston, and Harvard biologist James Watson. The call urges faculty participation in the student moratorium to provide "massive evidence" that the majority of Americans want to end the Vietnam War and that President Nixon's "gradual partial displacement" of American troops is not "the substantive change in policy" needed to end the war. The Vietnam Moratorium Committee, a nationwide effort to organize students, faculty, and others to spend one class day in October campaigning door to door in their communities about ending the war, is organized and financed by former supporters of the McCarthy and Kennedy presidential campaigns. Also among those signing the call are Berkeley physicist Charles Schwartz, a co-founder of Scientists and Engineers for Social and Political Action, and Jay Orear, past president of the Federation of American Scientists.

● **NERVE GAS TESTING IN HAWAII**: The Pentagon acknowledged on 20 September that the Army in 1966 and 1967 tested GB and BZ nerve gases at a site on the side of Hawaii's second highest volcano, Mauna Loa. In a letter to Rep. Patsy Mink (D-Hawaii), a Pentagon spokesman said the tests, conducted 7 miles from inhabited areas, were made to determine the effectiveness of the gas in a tropical environment. The Army has a 5-year lease for the site, which expires in 1971 and stipulates that the land be used only "as a site to conduct classified meteorological and related tests."

● **NIXON BACKS SST**: The Nixon Administration has sent a proposal to Congress to continue development of the Supersonic Transport (SST). The White House has requested $96 million for the current fiscal year to work on two prototype models, and authority to use $99 million in carry-over funds from previous years for further research and development. The decision to go ahead with the SST, which has been delayed until now by the new administration, would call for a total of $662 million more in federal outlays during the next 5 years to complete the prototype. To date the federal government has invested more than $500 million in the SST. Officials estimate that if the Nixon proposal is adopted, the plan will cost a total of about $1.3 billion in federal funds before flight tests are completed in 1974. Congressional opponents in both Houses are expected to rally support against Nixon's proposal.

● **AEC OPPOSES DEATH PENALTY FOR SPYING**: The Atomic Energy Commission (AEC) has urged Congress to remove the death penalty for nuclear espionage so that an accused person may be assured a jury trial. Under the present AEC act, if an accused spy asks for a jury trial, he may risk the death penalty, whereas if he stands before a single judge, he cannot be sentenced to death.

● **NIH SPECTROMETERS AVAILABLE FOR USE**: High-resolution mass spectrometers may be available for use free of charge under contract to interested scientists engaged in timely biomedical research. The Division of Research Resources of the National Institutes of Health (NIH) has established a high-resolution mass spectrometry service program. In providing scientists with this service, NIH officials say that primary consideration will be given to projects supported by NIH funds, but that all interested scientists are eligible to apply for contracts. Scientists may address inquiries to Michael Oxman, Division of Research Resources, Building 31, Room 5B13, NIH, Bethesda, Maryland 20014.

● **AMERICANS ELECTED TO ROYAL SOCIETY**: Two American scientists—Alfred Romer, professor of zoology at Harvard, and Kenneth Thimann, professor of biological sciences and provost, Crown College, University of California—have been chosen this year as foreign members of The Royal Society of England. The Royal Society, regarded as the first modern scientific society in the world, was officially organized in 1660.

Proposals for settling the land-claims issue have been made to Congress by the state, the Federal Field Committee for Development Planning in Alaska, the Department of the Interior, and the natives themselves. These proposals are varied, complex, and in some cases unclear. But all except the one offered by the Department of the Interior would include, as part of the settlement, some provision permitting the natives to share in the revenue from state and federal lands. The alternative is for Congress to appropriate funds for a large cash settlement, such as the $500-million settlement proposed by Interior. But Congress may never be willing to dip so deeply into the till for the natives of far-off Alaska, despite the high unemployment among them and the squalid condition of their villages.

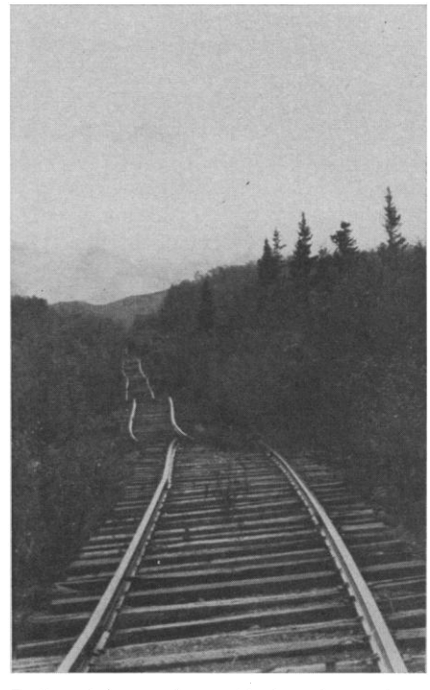
The state government, though it has yet to take an unambiguous position on sharing its oil and gas revenues with the natives, is impatient with the continuing land freeze and the Department of the Interior's delay in acting on the TAPS' application (filed in June) for the pipeline right-of-way. Granting the right of way will require an exception to the land freeze. While such an exception is in the making, Interior is taking elaborate precautions to see that the pipeline project does no avoidable harm to federal lands, including, of course, those to which natives have filed claims.

Two book-thick sets of stipulations to be followed in building the pipeline and its ancillary construction service road have been prepared by the department. These include requirements for such things as the following: a substantial performance bond; contingency plans for coping with oil spills; and construction designs that account for stresses resulting from earthquakes, land erosion, subsidence, and other causes.

Nevertheless, some conservation groups, such as the Sierra Club, say that the pipeline should not be built at all, certainly not before the environmental hazards have been more carefully evaluated. And there is some cause for their concern. During 1968 nearly 500 oil pipeline leaks, each involving the loss of 50 barrels or more, occurred in the United States, and about a fifth of those were spills of between 1000 and 12,000 barrels. The pipes involved in these spills were mostly in the 8- to 12-inch range and none was larger than 20 inches. The 48-inch trans-Alaska pipeline will be the largest ever built and, at capacity, will carry 500,000 gallons of oil per mile of pipe.

Between the Yukon River and Valdez, the pipeline will be passing through an earthquake-prone area, crossing at least two major fault zones which could become seismically active. An even greater hazard to the integrity of the pipeline may be that arising from melting or differential settlement of the permafrost, in which, according to TAPS' present plans, the pipeline will be buried for all but about 40 miles of its 800-mile length.

The oil will enter the pipeline at a temperature of about 160°F, and there will be a further input of heat due to friction and pumping energy as the oil moves through the large pipe at high rates of flow. Despite the loss of heat to the frozen ground surrounding the pipe, the oil is expected to reach Valdez at a temperature of 100°F. Studies by the U.S. Geological Survey indicate that, in many more areas than TAPS believes, the pipeline may have to be erected on pilings above ground in order to avoid thawing action which could leave the pipe foundering in an enormous ditch or cause it to be carried away by a mud slide. A major oil spill in, say, the drainages of the Yukon or Copper rivers could cause heavy losses to salmon runs, nesting waterfowl, and other fish and wildlife resources. Elevation of the pipeline to escape permafrost problems raises other questions, such as whether this large above-ground structure would interfere with the migration of the caribou herds.



Railroad in southern Alaska, shown in a 1960 photo by USGS, is like a roller coaster from differential settlement of disturbed permafrost. The Trans Alaska Pipeline, carrying hot oil, may face worse problems. [L. A. Yehle]

Commenting on some of these hazards in a letter to the Department of the Interior, Daniel W. Swift, of the University of Alaska's Geophysical Institute and president of the Tanana Yukon Chapter of the Alaska Conservation Society, observed: "It can be argued that the oil industry has a sufficient interest in ensuring the integrity of the pipeline. However, it must be realized that the public has much more to lose than the industry, should a spill occur. The industry has so much to gain by getting the oil to market in an economical way that it may be worth the risks, whereas the dangers of a spill to the public may outweigh the benefits."

Although Alaska's Governor Keith Miller recently has set up a group to work with Interior on the stipulations, he was critical earlier of federal officials for delaying construction of the pipeline. His view was that the state itself should withdraw the land for the right-of-way from the federal domain and award it to TAPS. U.S. Senator Ted Stevens, whom Hickel (before leaving the governorship) appointed to succeed the late Senator Bob Bartlett, has expressed the state's impatience at the pipeline delay. Addressing the 20th Alaska Science Conference in late August, Stevens said, "Alaskans know Alaska. I'm fed up to here with people who try to tell us how to develop our country." As for the proposed stipulations, he said they were "stupid, absolutely stupid."

But, thus far, state efforts to tighten regulation of the activities of oil companies have proceeded slowly, and the past record is not encouraging. For example, in Cook Inlet oil drilling has led to more than 150 recorded instances of pollution since 1965, but in only five cases have the polluters been prosecuted, either by state or federal authorities.

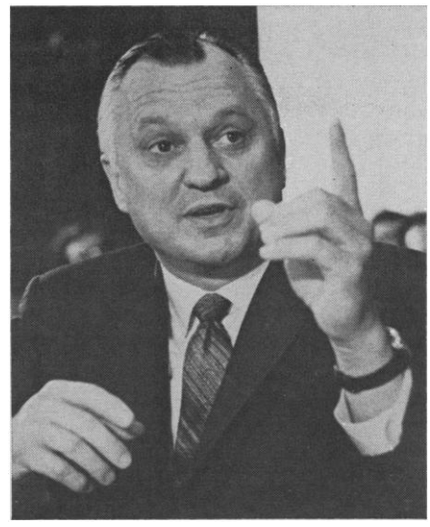
The North Slope oil development has come to represent a test of the federal government's ability to make development consistent with good conservation practices in those situations over which it has some control. Attention has thus far focused principally

on the pipeline project, but there are a variety of other matters which demand attention also. Exploration for oil is taking place on federal as well as state lands on the North Slope, and it appears that the federal regulations governing these activities are not much better than the state's. For example, no permit is demanded of crews making geophysical surveys, and, if they violate official guidelines and disturb the tundra, BLM can act only after the fact and make them repair the damage, if that is possible. Moreover, the building of numerous airstrips and camps on the North Slope is making this region easily accessible. This could mean, for one thing, that caribou, Dall sheep, and other game will come under heavy pressure, and stronger hunting regulations may be required.

Ultimately, the government will have to make intensive land classification studies for Pet 4 and the Arctic National Wildlife Range and decide whether these areas shall be opened up for oil exploration and development—and, if so, what restrictions shall apply. The Wildlife Range, extending over almost 9 million acres, is at the eastern and most beautiful end of the Brooks Range. Looking to the possibility that the *Manhattan* voyage will establish the feasibility of using the Northwest Passage, Humble Oil already has been investigating, as one possibility, the establishment of a deep-water terminal for supertankers in the Yukon Territory at Herschel Island, which has the only natural harbor reasonably near Alaska's North Slope. But to do this would require building a 200-mile pipeline from Prudhoe to Herschel, through the Wildlife Range. And a Vancouver firm has indicated already that it will seek to extend an as yet unbuilt Canadian gas pipeline through the Wildlife Range to Prudhoe Bay.

Land classification studies are needed for the Brooks Range generally, to consider what transport corridors are to be established, what lands opened to mining, and what parks designated (Hickel has set up a committee, with broadcaster Lowell Thomas as chairman, which is to recommend establishment of new parks in Alaska). In short, a comprehensive set of policies for arctic Alaska is required.

Protection of "environmental quality" has become a politically significant issue in the United States, and, to many people, Alaska offers the last chance to keep some vast tracts of wilderness largely undisturbed. Within Alaska itself there are two relatively new groups, the Alaska Conservation Society and the Alaska Chapter of the Sierra Club, which are speaking out loudly for wilderness protection, and some ambitious politicians in Anchorage and elsewhere are listening. However, the greatest influence of these groups probably comes through their ties with national conservation organizations which, in turn, have their friends in Congress, such as Senator Henry Jackson of Washington, chairman of the Senate Interior Committee.



Walter J. Hickel

An Ironic Switch

By an ironic turn of events, Secretary Hickel himself, despite and partly because of his background as an Alaskan businessman and real estate developer, has been the one to slow up the pipeline project. When his predecessor, Secretary Udall, first ordered the land freeze, Hickel, who was then governor, protested. But late last year Hickel was nominated secretary. And after some incautious remarks made at a press conference (such as his widely quoted statement about not believing in "conservation for conservation's sake"), he found that his nomination was in trouble. Senators were receiving thousands of letters urging that the nominee be rejected. At his confirmation hearing, Hickel was in no position to argue with members of the Senate Interior Committee, some of whom (George McGovern of South Dakota being one) were demanding to know whether he planned to lift the land freeze before settlement of the native claims. Thus pressed, Hickel agreed to extend the land freeze through the end of the 91st Congress, in 1970, and to consult the Interior committees of the Senate and House before making any exceptions.

Hickel has had to handle the TAPS application with care, and he has in fact done so. He has been aided in this by his Under Secretary, Russell Train, chairman of an interagency task force charged with setting guidelines for North Slope oil development affecting federal lands. President Nixon has publicly praised Hickel for setting up the task force, a show of presidential interest helpful in giving the work of this group a high priority.

The irony of Hickel's present situation is pointed up by the fact that one of his last major acts as governor was to have his highway department bulldoze a winter ice road from Livengood (a village about 50 miles north of Fairbanks) to the North Slope. It was built in a manner that left the permafrost exposed and subject to thawing action, with the result that last summer the road was a water-filled ditch for much of its length. But Hickel is unrepentent. "So they've scarred the tundra," he remarked in a recent interview with *Science*. "That's one road, 12 feet wide, in an area as big as the state of California."

But, whatever his past mistakes, Hickel is ambitious and too shrewd not to realize that he must build a record as a conservationist. Some of his actions, such as his insistence that the Miami jetport project not harm the Everglades National Park, bear this out. Moreover, Hickel talks with what seems earnest conviction about the necessity of close regulation if oil development is to be kept compatible with environmental protection in the arctic and in places like Santa Barbara Channel. The oil industry is now adjusting well to regulation of its operations, he said, just as, 40 years ago, the motorists in Wichita (Hickel is a native Kansan) finally accepted stoplights.

Stoplights do no good unless you know where to put them, however, and a major problem for industry as well as government has been to learn enough about the arctic environment. Since the oil rush began, there has been a procession of information seekers—mostly government officials and oil industry people—to the Navy's Arctic Research Laboratory (ARL), which was established at the Pet 4 base camp at Barrow in the late 1940's.

Max Brewer, director of ARL and an expert on permafrost, likes to show visitors two photographs taken last fall, one of the ARCO base camp soundly

built on a thick pad of gravel, and the other of ARCO's discovery well, which, being in something of a mudhole, looked like a costly place to operate. "I have been in touch with the oil companies," Brewer says. "I tell them: 'Don't you like your stockholders? When you tear up the country, it costs you money.' I find that when I talk that way, it gets close to their hearts."

The oil companies and TAPS have conducted environmental studies of their own and have also been supporting some studies at the University of Alaksa, which for a small institution carries on a surprising amount of research. For example, TAPS is sponsoring a study by the university's Institute of Arctic Biology on methods of revegetating tundra that has been disturbed by engineering operations. "They want quick answers, but unfortunately there are none," Peter Morrison, director of the institute, told an interviewer last summer. "Frankly, I'm not too happy with this kind of research."

Despite all the unanswered questions about hot pipelines and permafrost, the restoring of tundra, and other things, construction of the pipeline is virtually certain to be allowed, and reasonably soon. The momentum of the North Slope development is irresistible. In fact, on 13 August, Secretary Hickel granted the state an exception to the land freeze so that TAPS could build a road quickly from Livengood to the Yukon River. This winter, pipe and other materials will be shipped north and moved across the Yukon over an ice bridge during the freeze-up.

In an effort to respond to the challenge in Alaska, the Department of the Interior is assigning 130 additional personnel there to improve its research, supervisory, and other capabilities. Close federal and state supervision of the oil development would appear to be the minimum environmental safeguard that the public has a right to expect. But, ideally, one might have wished for more—for a program of environmental studies, land classification, and risk analysis *preceding* the oil development, rather than following or accompanying it. Although Alaska still has vast wilderness areas, the oil rush promises to be an open-ended thing which, unless carefully controlled, may deprive the state's inhabitants of much of the beauty, the abundant wildlife, and the sense of freedom and uncluttered spaciousness that makes Alaska attractive to them.

Last March in a talk given at a Sierra Club wilderness conference in San Francisco, George Rogers noted that the aboriginal Eskimos and Indians of Alaska could have had no concept of either wilderness or development. These peoples were not separate from nature but a part of it. They were not manipulators, and the best they could do was to accept nature as they found it and adapt to it. The coming of the "European-American colonists" changed all this. The self-sufficient and limited economy of the aboriginal people was disrupted because it depended upon an interaction of all things in the environment, whereas the exploitative economy of the white man did not.

In the Alaskan arctic, Rogers said, wilderness must be made a part of development and not just in a token way with bits of tundra preserved as museum pieces. If Alaskans, he concluded, can realize the importance of wilderness as something that enters into their whole life stream, and not something to be exploited or preserved off in a corner for its own sake, then Alaska may become what Alaskans want it to become.—LUTHER J. CARTER

Nobel Symposium: Super Bowl of the World Conference Circuit

Stockholm. The prestige of the Nobel Foundation is such that, when it beckons, few decline, even when beckoned to spend a week discussing "The Place of Value in a World of Facts." And so they were here, from 15 to 20 September—35 certifiably accomplished scholars from 18 countries and at least as many disciplines—for a sort of Super Bowl of the international symposia circuit. Altogether a most improbable collection, including W. H. Auden, the poet; Glenn Seaborg, chairman of the U.S. Atomic Energy Commission; Arthur Koestler, the author; Joshua Lederberg and Linus Pauling, both of Stanford; C. A. Doxiadis, the city planner; Konrad Lorenz, of *On Aggression* fame; Margaret Mead, the anthropologist; Harrison Brown, of Caltech; Jerome Bruner, the Harvard psychologist; Mikhail D. Millionshchikov, vice president of the Soviet Academy of Sciences; Harold D. Lasswell, the Yale political scientist; and John Pierce, of Bell Labs. And then there was a handpicked contingent of eight students, present, according to an official announcement, "as a practical measure towards bridging the generation gap." As politically aroused students go these days, they were a pretty tame collection, though possibly in response to being egged on by the daily press, which had come a long way to find little to write about, the students distributed buttons proclaiming "I Am A World Citizen." Accompanying these was a statement to the effect that wearing of the button signified opposition to "research for direct military purposes. . . ." as well as opposition to "all wars that are supported by the idea of defense." To which the statement added, "A different thing is when oppressed people for their mere survival take to arms." About half the participants wore the buttons. Some were quite euphoric about the symposium. Koestler, for example, came out of one session declaring that "it was the best discussion I have ever attended," though he expressed annoyance at the seeming reverence shown "students with half-baked ideas." An American from a major university said he was certain he could "whip up a better discussion of values among the juniors on my campus."

However, just what happened when all the participants and students got together is not altogether clear, since the plenary sessions were closed to outsiders, though each session was followed by a press conference at which a spokesman summarized the discussions. ("Professor Pauling spoke of the vast waste of resources today. Dr. Seaborg called for concerted intellectual leadership to convince the political leadership of the desperation of the situation, but he also warned of anti-intellectualism.") The summaries were followed by a brief period at which questions