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# PICO Bulletin

Editor: John Kelley Technical Editor: H. Stockholm

## PICO AT UAF

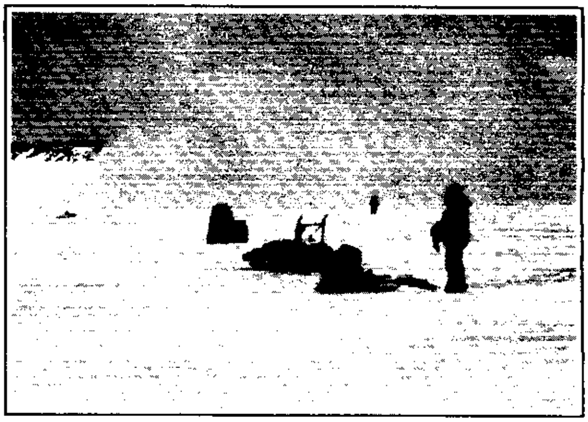
*Dr. Luis Proenza*
*Vice Chancellor for Research*

The University of Alaska Fairbanks (UAF) is one of many U.S. Institutions involved in Arctic research and we are pleased to host the Polar Ice Coring Office (PICO). PICO administrates logistical support and technical services and development for the National Science Foundation's Polar Programs-sponsored projects nationwide. As the only U.S. institution in the Arctic regions, the University takes keen interest in the welfare of the Arctic research community and the success of the enterprise which PICO represents.

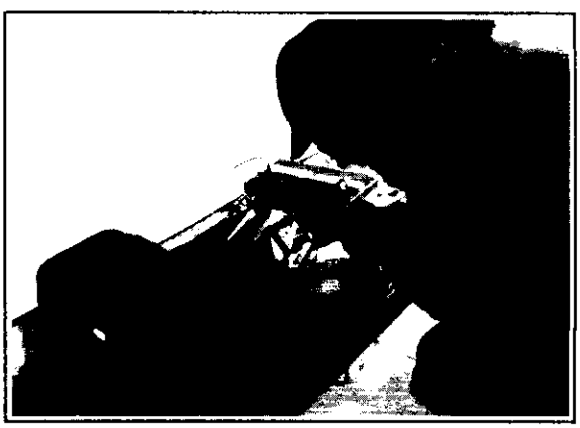
Several new ice drills and components are credited to PICO's excellent engineers, who make up only part of PICO's diverse polar science and engineering faculty and staff. We at the university have made several investments in PICO, both financial and in the skill and time of our faculty and students. We are committed to continually improving our ability to serve the Arctic research community. For example, PICO facilities have recently been improved and we are working diligently to streamline administrative processes common to public institutions. My office has brought on board a talented director for Sponsored Programs to facilitate additional aspects of PICO's life at UAF, and most importantly, we have a fine team of people in the PICO family.

## GLACIER RESEARCH GROUP

The Glacier Research Group (GRG) of the University of New Hampshire was organized in 1978 as a research team aimed at specializing in the recovery and interpretation of glaciochemical data series of snow and ice samples from high latitude and/or high altitude low to middle latitude sites which address key issues related to global change. In 1985 GRG joined with four other global change research centers on the campus to form the Institute for the Study of Earth, Oceans and Space. To date, we have undertaken sampling programs (e.g., major anions and cations, radionuclides, hydrogen peroxide, dissolved organic carbon, nutrients and particle analysis) at numerous locations in Antarctica, Greenland, the Himalayas, China, Iceland, the U.S. Rockies and have also been involved in the analysis and interpretation of glaciochemical data series collected by other investigators working in Asia, South America, Antarctica, Greenland, Yukon Territory and Alaska. We have developed new techniques for minimizing contamination of snow and ice samples during both collection and analysis and continue to intercalibrate our chemical techniques with several laboratories. Our research programs standardly include on-site glaciological assessment (i.e., radio-echo sounding and general surface studies) and sample recovery as spatial representativeness of the chemical species under study, understanding of the local and regional distribution of chemical species and the significance of glaciochemical data sets with respect to air/snow fractionation.



*Glacier Research Group field party employing a portable radio echo sounder to determine ice thickness on Newall Glacier, southern Victoria Land, Antarctica. (Photo: C. Wake)*



*Glacier Research Group member analyzing surface and reflected electromagnetic waves with an oscilloscope in order to determine ice thickness on Newall Glacier, southern Victoria Land, Antarctica. (Photo: C. Wake)*

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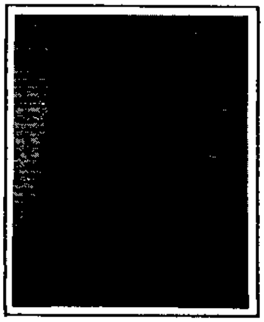
Occasional publication of the Polar Ice Coring Office at the University of Alaska Fairbanks operated under contract to the National Science Foundation, Division of Polar Programs. Inquiries should be adressed to Director, PICO, University of Alaska Fairbanks, Fairbanks, Alaska 99775-1710, (907) 474-5585.

## GRIP – A EUROPEAN SCIENCE FOUNDATION PROJECT



*Niels Gundestrup*

The Greenland Ice Core Project (GRIP) is a multinational European research program, organized under the auspices of the European Science Foundation (ESF) and funded by its member organizations in Belgium, Denmark, France, Germany, Iceland, Italy, Switzerland and the United Kingdom, and by the CEC. GRIP's goal is to retrieve and analyze a 3000-m long ice core drilled through the Greenland ice sheet at Summit, its highest point. Our goal is to learn about past environmental changes, particularly changes in the climate. This information is stored in the ice as trapped gases or other physical and chemical phenomena. The ice core will provide samples of each annual layer, deposited originally as snow, for the last 200,000 years or more.

The GRIP deep drill is an updated version of ISTUK (IS = Ice in Danish, TUK = drill in Greenlandic). This drill was constructed in 1978, and used successfully under a U.S.-Danish-Swiss GISP-I program near the DEW Line station, DYE 3, in South Greenland, where it reached bedrock at 2037 m in 1981. The 11-m drill is battery powered and suspended from a cable to a winch on the surface where its functions are electronically controlled. The drill produces 2.5 m of core per cycle and is operated by two people in three shifts around the clock.

ISTUK was installed at GRIP in the summer of 1990. At the end of the 5-week season, it had reached a depth of 770 m, where the ice is 3840 years old. GRIP hopes to reach bedrock in 1992.

*Continued on page 4*

## Glacier research *(continued)*

The primary research interests include:

- climatic change (e.g., Little Ice Age, Climatic Optimum, Younger Dryas, major transitions, abrupt change events) and forcing functions that could affect such change (e.g., aerosol concentration and composition, precipitation rate, volcanic activity, biogeochemical cycling);
- change in the chemical composition of the troposphere and stratosphere;
- regional to global scale trends in atmospheric chemistry ranging over time from seasons to glacial/interglacial cycles;
- transport pathways, sources, input timing, partitioning, reservoir exchange and production rates of the chemical species found in snow;
- change in the characteristics of atmospheric phenomena (e.g., inland penetration or marine air masses, stratospheric injections, circulation intensity, ENSO events, dustiness, wind strength and precipitation rate);
- volcanic event histories and the effect of such events on the remote atmosphere;
- biogeochemical cycling (e.g., N and S);
- air-sea-land-ice interactions (e.g., documentation of change in the geographical setting of the WAIS);
- anthropogenic impact on the remote atmosphere;
- air-snow fractionation and small-scale controls on the deposition of the chemical species in snow and ice;
- regional to global scale stratigraphic markers in ice cores.

Research scientists in GRG interact regularly with other groups interested in solving problems in global geoscience such as: mathematical modelers, statisticians, oceanographers, physicists and several types of geochemists. We have worked closely with the Polar Ice Coring Office in several of our coring programs, including, most recently, GISP-2, whose scientific management is handled by members of GRG under the auspices of the GISP-2 Science Management Office.

Graduate students in the Glacier Research Group can receive M.Sc. and Ph.D. degrees either through the Department of Earth Sciences or jointly through the latter and the Institute for the Study of Earth, Oceans and Space. Undergraduate students are involved in our research projects as associates or assistants, depending upon their level of experience. We also cooperate on a regular basis with other glaciologists, air chemists, geochemists and atmospheric modelers both nationally and internationally (e.g., France, Denmark, India, China, Soviet Union).

Funding for the group has been provided by the National Science Foundation (Polar Programs, Climate Dynamics, Atmospheric Sciences and International Programs), the Electric Power Research Institute, the Environmental Protection Agency, the Keck Foundation, Sea Grant and the North Atlantic Treaty Organization.

*Article provided by Dr. Paul A. Mayewski, Director, Science Management Office, GISP, University of New Hampshire, Durham, N.H.*

*Members of the Glacier Research Group collecting surface snow samples from the Bogda Shan in northwest China as part of a regional snow and ice chemistry survey in the mountains of central Asia. (Photo: P. Mayewski)*

# HIGH ALTITUDE ILLNESS ON THE GREENLAND ICE CAP

On the Greenland Ice Cap, the barometric pressure at 10,000 feet is lower than the barometric pressure at the same altitude in the Colorado rockies, or at any lower latitude. This means that the stress of hypoxia (lack of oxygen) is greater, and therefore problems due to the altitude are likely to occur. Abrupt transport to the sleeping altitudes in Greenland (over 10,000 feet) commonly results in a syndrome called acute mountain sickness, which is the most frequent type of high-altitude illness. Acute mountain sickness, or AMS, is characterized by headache, lethargy, lack of appetite, and trouble sleeping. It feels very much like an alcohol hangover. Usually the syndrome lasts twelve to seventy-two hours and resolves spontaneously. Sometimes, however, it can progress to a more severe form and even to life-threatening pulmonary edema (water in the lungs) or cerebral edema (swelling of the brain). Predisposing factors include exertion in the first twenty-four hours at altitude, the use of any medications or drugs which may depress the breathing center of the brain (especially alcohol), and cold. However, the greatest factor is an individual's own particular susceptibility, which appears to be inherent in one's physiology. A person prone to altitude illness is likely to develop AMS on repeated exposures, given the same rate of ascent.

Risk of illness is reduced if:

- one takes time to acclimatize at intermediate altitudes;
- exertion is kept to a minimum the first twenty-four hours at altitude;
- alcohol and any other respiratory depressants are avoided;
- one uses a diet high in carbohydrates (70% carbohydrates).

Younger people are slightly more susceptible and both men and women are susceptible. Curiously, good physical fitness confers no advantage whatsoever on risk of developing AMS.

Medications are available to prevent mountain sickness in the setting of an abrupt ascent. Although most persons will acclimatize to the altitude with minimal symptoms, flying to the polar ice cap allows no time for acclimatization and therefore is likely to bring on altitude illness in susceptible persons. Acetazolamide (Diamox) is the medicine most commonly used to prevent altitude illness. This is a prescription drug, and should not be used in persons allergic to sulfa. The other medication which can be used is dexamethasone (Decadron), which is a potent steroid and also a prescription item. Since individuals may not know if they are susceptible and since it is essentially unpredictable, all persons being deployed to the ice cap must be aware of the symptoms of altitude illness and should undertake the usual preventive measures listed above. Most important, workers and managers must be able to recognize the symptoms of serious illness. The two forms of serious illness, the brain edema and the lung edema, can be recognized by careful observation. With brain edema, the first ominous sign is the inability to walk a straight line, or staggering as if one were drunk. This indicates severe dysfunction of the brain, and coma may develop within twelve to twenty-four hours if treatment is not undertaken at this stage. Therefore, everyone with symptoms of AMS should be asked to walk a straight line and, if staggering is evident, then evacuation to a lower altitude or immediate treatment with oxygen and Dexamethasone is necessary. Pulmonary edema can be recognized by the symptom trait of weakness, cough, and shortness of breath. Typically, it is the more fit individuals who succumb to pulmonary edema, for reasons that are unclear. Of course, in the cold, high dry air, everyone may have a bit of a cough, but the association of cough with weakness should ring a bell, especially if a person also complains of shortness of breath at rest. As the lungs fill with fluid, oxygen is not exchanged across the air sacs into the blood, and other symptomsof lack of oxygen develop, such as trouble with walking, extreme fatigue, and even coma. Listening to the chest may disclose the presence of a bubbly sound. As soon as pulmonary edema is recognized, it also must be treated with either descent or oxygen, or both. A pressurized chamber, since it increases barometric pressure, is also effective.

Although the severe forms of altitude illness sound scary, and they are, they are fortunately quite uncommon. The incidence of life threatening illness in persons flying onto the ice cap is probably less than one in a hundred. The incidence of some degree of mild mountain sickness, based on studies at comparable barometric pressure in ski resorts and on mountains, may be around 30%.

Another factor to take into account other than altitude illness is the decrease in exercise performance at this reduced barometric pressure. Exercise is perceived to be more difficult because of the limitations imposed by the hypoxia. As with athletes who must compete at altitude, workers must learn not to expect as much of themselves in this environment and to do physical work at a slower pace. This will help prevent exhaustion and aid acclimatization.

Another complicating factor is the severe cold. Cold receptors on the skin and in the nose, as well as temperature sensors in the brain, cause an increase in the activity of the sympathetic nervous system, which results in more intense constriction of the blood vessels to the skin, more loss of fluid because of increased urination, and higher pressures in the lung circulation, which help contribute to pulmonary edema. Therefore, on the ice cap the effects of hypoxia are somewhat augmented by the cold, and it is important to stay well clothed and as warm as possible. The use of a face mask, even a bandana, which traps some exhaled moisture and heat, is helpful.

Working on the polar ice cap of Greenland has many challenges in addition to the problems of coring ice samples, but with proper education and preventive measures, altitude illness can be minimized and serious illness avoided.

*Article provided by Peter Hackett*

# LOGISTICS RESEARCH WORKING GROUP

PICO staff, in association with the UAF School of Engineering and several private companies, has established a Logistics Research Working Group. The group will develop a value-added Logistic Information and Planning System (LIPS) especially for remote polar operations. An intensive literature search and synthesis for the group is already underway by Dr. L. Bennett, School of Engineering.

## GRIP – *Continued from page 2*

The GRIP Operation Center (GOC) is located in Søndre Strømfjord, 800 km southwest of Summit. Two operation managers support the traffic of GRIP personnel and cargo, and maintain communication with the camp. They transport heavy cargo with a ski-equipped U.S. Air Force C-130 Hercules chartered from the 109th New York Air National Guard and by a Twin Otter aircraft provided by the British Antarctic Survey. The GOC also handles the logistics for other programs that use the GRIP camp at Summit. These projects include atmospheric observations, surface strain rates, regional gravity, ground truth information for the ERS-1 satellite, and several other projects.

The U.S. GISP-2 project is located about 30 km west of GRIP to provide maximum scientific output, including collaboration on scientific results and publications. Personnel at the GRIP Operations Center and the PICO Field Operations Office closely coordinate their efforts at Søndre Strømfjord.

*Information for this article was provided by Dr. Niels Gundestrup, GRIP Operations Center, Geophysical Institute, Department of Glaciology, University of Copenhagen, Copenhagen, Denmark.*

# FOSSIL ATMOSPHERE – ITS DISCOVERY

Would it surprise you to learn that the concept of examining gas bubbles trapped in polar ice caps was originated by a biologist? Professor Per Scholander (called "Pete" by everyone who knew him), working 40 years ago at the original Naval Arctic Research Laboratory at Point Barrow, Alaska, was excited to find that certain small organisms remained embedded in ice throughout the winter. This observation led him to question the possible diffusion of atmospheric gases through ice. Finding little information on this topic in the literature, he undertook some simple experiments to determine its nature. Scholander concluded that diffusion of oxygen and carbon dioxide through ice was extremely slow. The results were published in a now-classic paper: P. F. Scholander, W. Flagg, R. J. Hock and L. Irving, 1953, Studies on the physiology of frozen plants and animals in the arctic, *J. Cell. Comp. Physiol.* 42, Supplement 1, 56 pp.

Scholander recognized the possibility that this discovery might lead to the determination of fossil atmosphere composition. He launched a series of expeditions, modest by modern standards, to test the idea in mountain and tidewater glaciers. The first publication (P. F. Scholander, J. W. Kanwisher and D. C. Nutt. Gases in icebergs. 1956. *Science* 123:104-105) stated the concept: "The rate of gas diffusion through ice is no more than 1/40,000 to 1/70,000 as fast as it is through water (Scholander *et al.*, 1953). Considering this extremely slow rate, the relatively enormous diffusion distances in the glacier and the large quantity of gas held under pressure in the ice, it would seem possible that gas trapped in the glacier would remain unchanged for millenia. Analysis of such gas could therefore give information about the atmospheric composition at the time the ice was formed."

Subsequently, the following publications were produced:

Coachman, L.K., E. Hemmingsen and P.F. Scholander. 1956. Gas enclosures in a temperate glacier. *Tellus* 8:415-423.

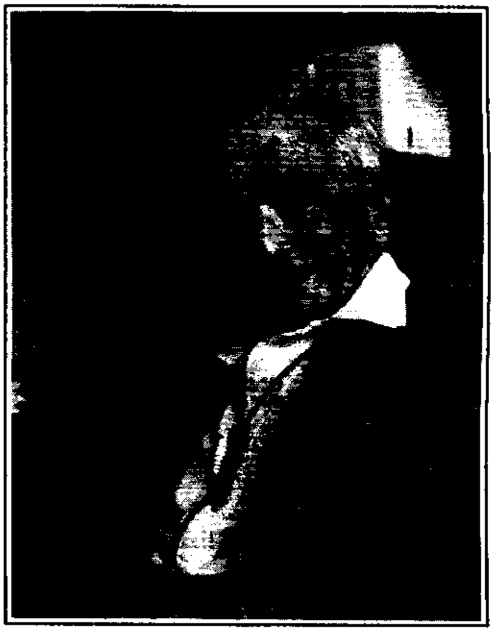
Coachman, L.K., E. Hemmingsen, P.F. Scholander, T. Enns and H. de Vries. 1958. Gases in glaciers. *Science* 127:1288-1289.

Scholander, P.R., E.A. Hemmingsen, L.K. Coachman and D.C. Nutt. 1961. Composition of gas bubbles in Greenland icebergs. *J. Glaciol.* 3:813-822.

Scholander, P.F., W. Dansgaard, D.C. Nutt, H. de Vries, L.K. Coachman and E. Hemmingsen. 1962. Radio-carbon age and oxygen-18 content of Greenland icebergs. *Meddelser om Gronland* 165(1), 26 pp.

The story is told in Scholander's own colorful words in his posthumously published autobiography, *Enjoying A Life in Science*, University of Alaska Press, 1990. It pleasingly illustrates the universality of science that a biologist with an eye for Nature's curiosities and an insightful mind would have been the one who took the conceptual leap which has led to the present-day usefulness and importance of this technique for understanding the history of global climate change in centuries past.

*Article provided by Robert Elsner, Professor Emeritus of Marine Science, University of Alaska Fairbanks.*



*Per Frederik Scholander*

## NEW PUBLICATION SERIES

The PICO Technical Services and Operations department has received occasional inquiries about drill design and construction and support facilities. PICO announces a new series of two-page technical notes on these subjects. Six *Technical Notes* have been issued in 1991:

- Materials Available for Mountain Glacier Research, TN-91-1
- Clean Power at Remote Sites, TN-91-2
- Methods for Straightening Bore Holes, TN-91-3
- Rock Drilling under the Greenland Ice Sheet: Tentative Plan, TN-91-4
- Development of a Solar-Powered 40-m Drill, TN-91-5
- Review of Methods to Section Ice Core During Processing, TN-91-6*

A future Technical Note will provide a summary of failure testing and published strengths of wet drill components.

*A VHS tape illustrating this process is also available from PICO.

# FROM THE DIRECTOR

*Dr. John Kelley*

Most of PICO's Technical Services and Operations Division personnel are currently in Greenland where our most ambitious and extensive project will again be the GISP-2 program. Last year we had hoped to set up the GISP-2 camp and begin drilling early, using our new drill in a fluid-filled hole, but many delays and problems kept us from achieving our goal of 1000 m. Fortunately, the new drill design proved effective and by the end of the season we had acquired 335 m of core – about one third of our first-year goal. At present, we are nearing the 900-m depth.

We are especially grateful to the scientific party at the GISP-2 camp who so generously helped establish the camp. We are also very pleased with the cooperation from the Science Management Office at the University of New Hampshire and the Greenland Ice Core Project Office in Copenhagen. Without their help, we could never have gotten as far as we did. Our aim is to provide as much quality ice core as the scientific party can handle during the 1991 field season.

We learned a lot about the PICO drill and its use in a butyl acetate-filled hole during 1990. Before it arrived back in Fairbanks, modifications at the Geophysical Institute were already underway to correct deficiencies and decrease turn-around time. We tested all our modifications in a 16-m deep by 1.2-m wide test well designed and installed by the School of Engineering at a U.S. Army (CRREL) test site before shipping the drill back to Greenland. Tests were completed by March 15, in time to meet the shipping schedule and begin drilling early at the GISP-2 camp this year.

Although the GISP-2 program takes up a lot of our time, we are also deeply involved in planning the McMurdo Dome project in Antarctica in 1991 and 1992 and other projects in Greenland and the U.S. We were also pleased to help establish a long-term ultraviolet radiation-monitoring project at the UIC/NARL facility at Barrow, Alaska. We were asked recently to support NSF science projects destined for the Soviet nuclear icebreaker *Sovietskii Soyuz*, which will traverse the Arctic Ocean via the North Pole this summer. Finally, I am happy to announce that Mr. Kerry Stanford joined PICO on April 1 as Manager of the Technical Services Division (see below).

## SWEDISH STUDENTS STUDY DRILL WEAR

During the fall semester of 1990, Torbjorn Henriksson and Åsa Hagberg completed their Masters' theses requirements working with PICO. The students conducted a study of wear on components in the motor and gear reducer of a PICO deep ice coring drill. The thesis, published as PICO report TR-90-4, was required for their Master of Science in Mechanical Engineering degrees at the University of Lulea. Their Swedish advisor, Erik Hoglund, is with the Department of Mechanical Engineering, Division of Machine Elements at the University of Lulea. Professor Terry McFadden from the School of Engineering at the University of Alaska Fairbanks initiated the contact between the Swedish students and PICO.

# TECHNICAL SERVICES MANAGER JOINS PICO

*Kerry L. Stanford*

Kerry L. Stanford, P.E., Professionally Registered Mechanical Engineer, began as the Technical Services Manager for PICO in April of this year. Stanford has an industrial background in geologic drilling management and aerospace engineering. He has been a project engineer with such drilling equipment manufacturers as Totco (drilling sensors), Geolograph Pioneer (drilling sensors, solids control) and the Drilling Research Laboratory in Salt Lake City (bit tests, downhole tools, design of test equipment).

Stanford gained aerospace engineering experience with Hercules Aerospace (Trident Program, composites) and with HEBCO, Inc. (Air Launched Cruise Missile and various jet powerplants). He spent three years as an independent engineering consultant in a variety of areas requiring analysis, design, test and fabrication. Stanfords's overall engineering experience totals 13 years, 8 of which have been acquired as a Registered Professional Engineer.

## UV MONITORING PROJECT

In December 1990, the NSF Division of Polar Programs established an ultraviolet spectroradiometric facility at Barrow, Alaska through PICO. The facility is housed at the UIC/NARL station operated by the Ukpeagvik Inupiat Corporation, and is cooperative with the NOAA-GMCC program. The high spectral resolution scanning spectroradiometer was provided and is operated by Biospherical Instruments, Inc. under the Direction of C. R. Booth.

A student training program for Alaska Nature college students is associated with the UV monitoring project under the direction of Dr. David Norton and through an NSV/OCE grant to Drs. V. Alexander and J. Kelley.

## RECOVERY OF WORLD WAR II PLANES ON THE GREENLAND ICE CAP

In July of 1942, a squadron of two B-17 bombers and six P-38 escorts was en route from the United States to England when they received word that the field on which they were to land and refuel in Narsarsuaq, Greenland, was shut down because of bad weather.

In fact, the weather was clear. German U-boats had surrounded the coast of Greenland and intercepted the communication, forcing the "Lost Squadron" into the unfamiliar winds of the Arctic jet stream. Running low on fuel, the pilots were forced to land on the ice cap of the southeast coast of Greenland. They bellied in with minimal damage and only minor injury to one of the 25 crewmen.

Forty-eight years later, in the summer of 1990, Rolls, Ltd. Vermont, became involved with the location and recovery of the planes. The planes were located by steam probe about 250 feet below the surface and two methods were used to reach them. The first used a hot-water gopher designed by the Greenland Expedition Society from Atlanta, Georgia. The gopher was fed by a steam boiler which circulated hot water through copper tubes around a three-foot core. As the gopher descended, the melted water was pumped from the hole by deep well pumps. This scheme was successful down to 250 feet, and one B-17 was thoroughly explored and some pieces salvaged.

The second recovery method used a modified silo unloader to create a 17-foot diameter hole. A silo unloader is a farm machine used to chop and remove frozen silage from a silo. As the silo unloader worked its way down the hole, the chopped ice and snow were blown into a two-cubic-yard canvas bag which was then hoisted to the surface by a high speed electric winch. This descended to the 150-foot level before the entire project was closed down for the season in early September. It is expected to resume in 1991.

Both methods worked well after initial de-bugging. The most significant problem was flooding during July during which operations had to be suspended. Many findings were completely different from initial expectations. For example, at the 150-foot level of the 17-foot diameter hole, the ambient temperature was a constant 37°F. The ice formations became solid ice at about the 100-foot level.

*Article provided by Angelo Pizzigalli, Pizzigali Construction Co., Vermont*

*Gun turret of B-17 in the hole melted by the steam gopher. (Photo provided by Angelo Pizzigalli)*

### IN MEMORIAM

*Doug Epps*

An adventurer, pioneer, politician, friend, husband and father was lost this summer when retired Delta Airlines Captain Doug Epps died peacefully in his sleep on August, 2, 1990. Doug had just returned home from Greenland where he had participated in the expedition to reclaim the "Lost Squadron" which crashed there during World War II. It was on this expedition that Doug's path crossed with that of PICO. All projects in remote areas establish mutual assistance between groups as was the case with Doug and the Greenland Expedition Society and PICO. From moving cargo in Sondrestrom to telling late night stories, Doug was always a welcome sight.

Doug has been instrumental in opening new frontiers in the air and he converted flight from a nebulous dream into a common means of transportation. Though he will be missed, there was much laughter at his funeral as friends shared many pleasant and funny memories, reminiscing of times they had shared with this great man. He was a man loved by many and he will be missed by many.

## FIELD ENGINEER JOINS PICO

*Harm DeBoer*

Harm DeBoer joined PICO as Field Engineer in February, 1991. DeBoer obtained his Petroleum Engineering degree in 1967 from Colorado School of Mines and joined Shell Oil Company as a Drilling Engineer in California. In 1969 he joined British Petroleum to work in Alaska's newly discovered Prudhoe Bay oil field. He spent most of the next 20 years in the petroleum industry, both domestic and foreign, in various drilling engineering and supervisory positions and most recently spent four years for Mobil Oil in Norway. DeBoer also spent three years working for Bechtel Corporation in Alaska during construction of the Trans-Alaska oil pipeline.

Though similarities exist between drilling for oil in hardrock and coring ice at great depths, the equipment used is vastly different. DeBoer has voiced amazement at the sophisticated technology employed in the ice coring business. Electronics and instrumentation only recently available in the oil and gas industry is already being used in ice coring operations.

DeBoer looks forward to spending time on the Greenland ice sheet this summer as part of the PICO team.

## PROENZA APPOINTED SCIENCE ADVISOR TO GOVERNOR

Governor Walter J. Hickel appointed Dr. Luis M. Proenza as his Science and Technology Advisor on April 18, 1991. Dr. Proenza will continue to serve as the UAF's Vice Chancellor for Research. One of Dr. Proenza's projects will be an "Institute of the North", the Governor's idea for the University to provide arctic knowledge and applications to make effective use of our talents.

# MUSK OXEN AND JOB OPPORTUNITIES IN WEST GREENLAND

Most everyone visiting the NSF/PICO facility in Søndre Strømfjord, Greenland, is aware that there are musk oxen in the nearby hills. These animals provide a potential resource each year - their extremely warm and soft undercoat, called "qiviut".* Qiviut, which is shed when the temperatures rise, acts as an efficient downy insulation against the cold throughout the winter. Each adult loses 2-3 kg of qiviut and by early July most animals have left their undercoats in shreds throughout the landscape.

Qiviut is one of the finest, softest, and warmest animal hair fibers in the world. It becomes rapidly damaged when exposed to the sun and dry air, but if gathered soon after it leaves the protection of the guardhairs, qiviut has high tensile strength, and can be cleaned, spun, and used to make lovely, exclusive garments.

This valuable resource has been underutilized in Greenland. In recent years, Wendy Elsner has encouraged the development of a small home industry through the offering of courses, exhibits and demonstrations on the use of qiviut. The objective is to start a work cooperative, similar to the Musk Ox Producer's Co-op in Alaska. The project in west Greenland is being conducted with the interest and support of the Alaska Co-op.

As in rural Alaska, settlements along the coast of Greenland often have very few employment opportunities. Although textiles are not a tradition in Greenland, high quality handwork is traditional. If accepted in these communities, a qiviut home industry could offer part-time employment and income to both women and men and would require only low technology and a small capital investment.

The Women's Association in Greenland has responded with enthusiasm to this idea. During the courses used to introduce techniques of processing raw qiviut to finished garments, Greenlandic women have shown ambitious interest in further development. As a result, two additional courses are planned for March and October 1991.

A 1990 study, conducted by Ms. Elsner and supported by the Bank of Greenland Employment Fund, has yielded information vital for the continuation of this project. In the spring of 1991, Wendy will take a small group of gatherers into the mountains, 15-25 km southeast of Søndre Strømfjord, to collect enough qiviut to make a modest start for the home industry in 1991.

* *This undercoat is called qiviut in several Inuit languages, including Greenlandic.*

*Article provided by Wendy Elsner, who has lived in Greenland periodically since 1975. She is from Fairbanks, Alaska, where she has studied and worked at the University of Alaska Fairbanks.*

*School children in Søndre Strømfjord learn about qiviut from W. Elsner. (Photo: U. Fisker)*

# LIGHTWEIGHT STRUCTURAL SYSTEMS FOR GLACIOLOGICAL AND SEA ICE RESEARCH PROJECTS

Logistics costs for glaciological and sea ice research remain high and will continue rising. However, cost reduction looks very promising in the weight and shipping cube of structural systems for base camp facilities. The Department of Civil Engineering and the Polar Ice Coring Office at the University of Alaska Fairbanks have recently begun research into this very topic.

Funded by the University of Alaska Fairbanks, the project will investigate alternative foundation schemes for building systems on permanent snowfields. Phase I efforts will focus on reducing the resources required to prepare and establish spread footing and grillage foundation systems for semi-permanent structures for base camp facilities. Phase I testing will be conducted in both Alaska and Greenland during the spring and summer of 1991.

*Article provided by Dr. Kevin Curtis, University of Alaska Fairbanks School of Engineering*

# THE DANISH POLAR CENTER

*Karsten Secher*

The Danish Polar Center is an institution affiliated to the Danish Ministry of Education and Research with the task of supporting and coordinating research on the arctic and the Antarctic in Denmark and Greenland.

Denmark has a long tradition for arctic research. The Commission for Scientific Research in Greenland began its work in 1878 and is probably the oldest institution of its kind in the world. This has given Denmark a strong position within the research on the arctic. As a secretariate for the Commission for Scientific Research in Greenland, which funds research on the arctic, Danish Polar Center helps to secure that this position is preserved.

The Danish Polar Center is in charge of the authorization of scientific and sporting expeditions in Greenland, and it supervises researchers and provides administrative assistance. The Danish Polar Center is also setting up a special library on the arctic and it contributes to the spread of knowledge of arctic research to a broader public through press releases, articles and through various publications:

- "Newsletter" contains English language news, which in very short articles give information on current and forthcoming research projects on Greenland. It is distributed all over the world free of charge and it is issued twice a year.
- "Forskning i Grønland/Tusaat" is a popular scientific periodical issued four times a year in Danish and in Greenlandic. It contains articles about research in Greenland covering all fields, current Greenlandic institutions, etc.
- "Meddelelser om Grønland" is a scientific research series which Danish Polar Center issues for the Commission for Scientific Research in Greenland. The series has been published since 1879. In 1979, the series was divided in three, called Bioscience, Geoscience and Man & Society.

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