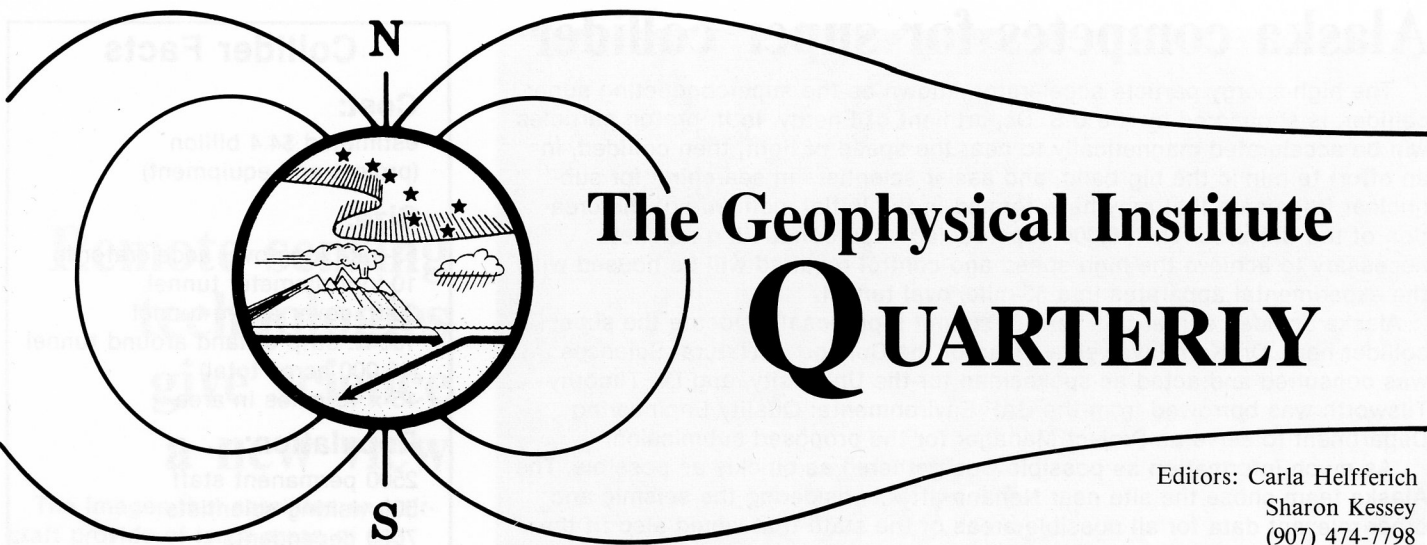




Editors: Carla Helfferich
Sharon Kessey
(907) 474-7798

Vol. 6, No. 1

University of Alaska Fairbanks

October 1987

Collider proposal relies on past research

As federal requests for proposals go, this one was for a whopper: "Kindly tell us if you'd care to build a 53-mile loop tunnel, with attendant support facilities, and in the process become a world center for particle physics research." With this superconducting super collider would come joy not only for scientists but for the state economy, since the enormous construction project would mean plenty of jobs, and the need for support services would require many of them after construction.

With its bid for the super collider, the state is offering the land, the heavy construction experience, and a wealth of scientific information and expertise.

Due to delays in starting, the super collider proposal had to be created in only three months, and information was required on several critical environmental conditions at the site. Among these were subjects that have been investigated by researchers at the Geophysical Institute.

The questions were crucial. What is the seismic hazard at the site? Answering this required long-term records of the locations and sizes of earthquakes in a large area around the site, an understanding of the tectonic setting within which the seismicity occurs, and an analysis of this seismicity as it pertains to the specific site. Due to work by seismologists at the Geophysical Institute, decades of seismic data were available, the basic tectonic setting was well understood, and a seismic exposure calculation for the Nenana Agri-

cultural Area, which included the proposed super collider site, had already been done.

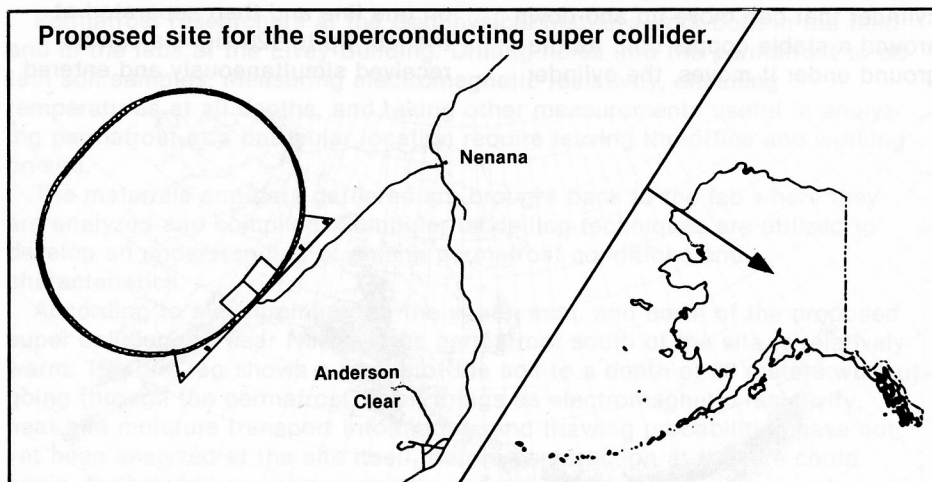
Could the soils at the site, including those that are perennially frozen (permafrost), support such a large structure? Studies on permafrost have been going on for a number of years at the Geophysical Institute. Drill logs from a study site near Nenana, as well as sites around the proposed project area, already exist, with information on temperatures, water content, and soil.

What about icing and flood hazard? Images and photos from remote sensing equipment in satellites and aircraft have been accumulated and used by numerous investigators at the Geophysical Institute to study geologic, hydrologic, glacial and biologic phenomena. The experience of these investigators, the local archives of

Alaskan images and photographs, and readily accessible image processing facilitate using remote sensing in the analysis of environmental conditions.

It is not that Institute personnel initiated the drive for Alaska to enter a competition with a few dozen other states; that was the decision of State government. But it was no coincidence that the scientific spokesmen appearing on the videotape that accompanied the proposal to Washington were from here either. The Institute has amassed decades of data and decades of experience analyzing that data. The information and expertise both were available when Alaska called for them.

Whether Alaska wins or loses on its super collider bid, the process of applying has made clear that the knowledge and abilities available here are themselves powerful resources.



Alaska competes for super collider

The high-energy particle accelerator, known as the superconducting super collider, is sponsored by the U.S. Department of Energy. In it, proton particles will be accelerated magnetically to near the speed of light, then collided, in an effort to mimic the big bang, and assist scientists in searching for sub-nuclear fragments that may have formed in the initial moments of the creation of the Universe. The 10,000 supercooled superconducting magnets necessary to achieve the high speed and control required will be housed with the experimental apparatus in a 53-mile, oval tunnel.

Alaska decided earlier this year to submit a proposal to locate the super collider here. Dr. Kolf Jayaweera, Dean of the College of Natural Sciences, was consulted and acted as spokesman for the University, and Dr. Timothy Tilsworth was borrowed from the UAF Environmental Quality Engineering Department to serve as Project Manager for the proposed submission.

As much information as possible was gathered as quickly as possible. The Alaska team chose the site near Nenana after considering the seismic and other relevant data for all possible areas of the state that would also fit the requirements that the facility be near an international airport, a metropolitan area, and necessary power and roads. The information about the site was compiled into an 8-volume proposal, and was submitted in early September with a video tape presentation on Alaska and the proposed site.

Here is a look at some of the Geophysical Institute's areas of research that provided information used in evaluating possible sites for the proposed super collider.

Earthquake history recorded daily

The five largest earthquakes recorded so far in interior Alaska were of magnitude 7.25, far stronger than the recent California earthquake that caused millions in property damage. The most recent large earthquake in the interior was centered near Huslia in 1958.

Earthquake recording has been done at the Geophysical Institute since 1965 when the first site was set up near McKinley Park headquarters. Now there are 40 sites around the state relaying information to the seismic laboratory at the Geophysical Institute.

At each site, a seismometer is set up. This is a small machine consisting primarily of a magnetic cylinder that can move up and down around a stable copper coil. As the ground under it moves, the cylinder

moves, and a voltage is produced which varies in amplitude with the motion of the cylinder, increasing as the ground moves up, decreasing as it moves down.

The seismometer is levelled, on a concrete base, buried in a shallow hole, and attached to an above-ground amplifier/voltage-controlled oscillator which produces a tone that is modulated in frequency in proportion to the ground motion. The seismic signal or tone is fed to a transmitter or phone line and then transmitted by phone line or radio to the Geophysical Institute lab.

Since each site produces a different tone (varying from 400-3000Hz), signals from eight sites can be sent on one line and then separated at the lab. Up to 128 signals can be received simultaneously and entered

Collider Facts

Cost:

estimated \$4.4 billion
(project and equipment)

Size:

53-mile long oval accelerator in
10-foot diameter tunnel
30-ft. cover above tunnel
100-ft. strip of land around tunnel
(16,000 acres total)
15 x 19 miles in area

Population:

2500 permanent staff
500 visiting scientists
7000 dependents

Annual Budget:

\$300 million

Electric Power Required:

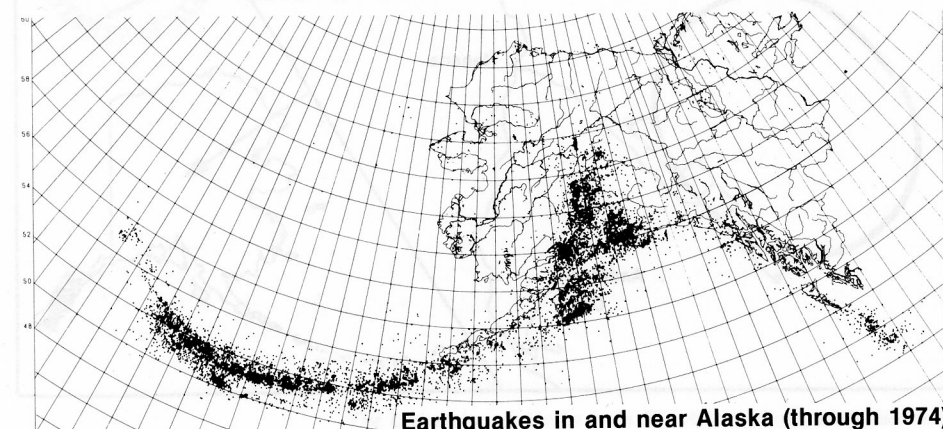
200 MW/day

Construction:

\$25 million R&D funds
\$10 million construction funds
7 years construction time
(beginning in 1989)
4500 construction workers

into the seismology lab computers. Some of the signals also go to Helicorder pens, which "draw" the record of seismic motion at the sites onto large paper-covered cylinders. Still other signals are fed into a Develocorder, which can store a day's signals from twenty stations on 16mm film. The information recorded on the Helicorder charts and Develocorder films can later be "read", and earthquake locations and magnitudes plotted on maps. Eventually, patterns emerge on the maps, showing where earthquakes most frequently occur.

Utilizing the decades of such records that have accumulated at the Geophysical Institute, and the maps showing where earthquakes have occurred, a seismic exposure calculation can be made for a specific region. According to the one that was done for the Nenana Agricultural Area, it is estimated that within fifty years there is a 10 percent chance that earthquake shaking exceeding .22 g (g is the force of gravity at the surface of the earth) would occur. That means the force shaking a building during such a quake would equal 22 percent of the weight of the building.



Remote sensing technologies give science a new view

The images that satellites and aircraft provide of large areas of the earth's surface are much-used and very helpful tools in evaluating geological and ecological features on the land surface. Analysis of Landsat Thematic Mapper (TM) and Multispectral Scanner (MSS) data, combined with aerial photographs and field observations, can provide maps of the distribution and extent of plant communities and landforms and record changes in the land and water conditions. Although permafrost cannot be seen directly in these ways, its occurrence when near the surface can be inferred to some extent from the maps of plant communities and landforms.

Data gathered both by remote means and in the field can provide a good overview of a particular location, such as the proposed site of the super collider. The Nenana area is located along the margin of a broad flat valley where the land is covered by forests and wetland tundra, over discontinuously frozen ground. While numerous lakes and wetlands are present north of the Tanana River, the Nenana area (south of the river) is on stabilized sand and silt dunes. Some stream icings (a hydrologic hazard that can cause difficult engineering problems) have been observed near Clear; however, the area is warm enough so that the ice melts annually and the icings would only be a problem if buildings were put in the immediate vicinity.

Information gathered by remote sensing platforms can not only be helpful prior to construction, but can also provide views during and after construction of a project. Thus remote sensing data could help in evaluating the impact of the super collider project on the subarctic environment of the area.



Landsat image of Alaska's interior valley showing Nenana area (upper left). Ak. Landsat 5, Band 4, Scale 1:1,000,000, Lat. 64.28 N, Long. 148.01, 84-09-29.

Permafrost information required

Permafrost researchers at the Geophysical Institute work both in the field and in the labs at the Elvey Building. Drilling holes into the permafrost to obtain soil samples, measuring electromagnetic resistivity, checking temperatures at all depths, and taking other measurements useful in analyzing permafrost at a particular location require leaving the office and working on-site.

The materials and data gathered are brought back to the lab where they are analyzed and compiled. Computer modelling techniques are utilized to develop an understanding of on-site permafrost conditions and characteristics.

According to measurements to the south, east, and north of the proposed super collider site near Nenana, the permafrost south of the site is relatively warm. The drill log shows a profile of the soil to a depth of 30 meters without going through the permafrost. Such things as electromagnetic resistivity, heat and moisture transport information, and thawing probabilities have not yet been analyzed at the site itself. Before construction at the site could begin, further drilling, measurements and analyses would be required to get a more complete picture.

Arctic engineering conference held

With support from many industrial and governmental organizations, the ninth in a series of biennial international conferences on Port and Ocean Engineering under Arctic Conditions (POAC) was held at the University of Alaska Fairbanks, on August 16-21, 1987.

Local organization efforts for the conference were chaired by Professor William Sackinger, who is also Chairman of the U.S. National Organizing Committee, and the POAC Secretariat.

Over 200 scientists and engineers gathered from all parts of the northern hemisphere to exchange information and ideas on technical and environmental aspects of northern development, with a coastal and offshore perspective.

The primary focus of the program was ice, and session titles included Icebreaking Vessels, Ice/Structure Interaction, Ice Properties, Spray Ice, Ice Morphology, Ice Dynamics, Ice, Climate and Forecasting, and Ice Modeling. In addition, topics relevant to arctic coastal engineering were discussed, including Arctic Database, Geotechnical, Noise and Marine Mammals, Composite Materials, Remote Sensing, and Arctic Port Design and Construction. Over 120 papers were presented in the four days of the conference.



Gulf Canada's Malikpak, an offshore oil drilling structure, surrounded by annual ice, 1985. (Photo courtesy of K.R. Croasdale.)

Two symposia were included in the conference. One, co-sponsored by Le Comite Arctique International, of Monaco, focused on the effects of noise on marine mammals. The second symposium, on the use of composite materials for building offshore structures, was co-sponsored by the Centre for Frontier Engineering Research, in Edmonton, Alberta. Topics included the strength of composite steel-concrete materials, their resistance to ice loading, and their use in offshore structures.

Sponsors of the conference included

the University of Alaska Fairbanks; Minerals Management Service, Technology Assessment and Research Program; the National Science Foundation; Minerals Management Service, Environmental Studies Branch, Alaska OCS Region; and the Alaska Oil and Gas Association, Lease Planning and Research Committee.

Proceedings of the conference are being published in three volumes and will be available later this year through Dr. William Sackinger, Geophysical Institute, UAF, Fairbanks, Alaska 99775-0800.



GEOPHYSICAL INSTITUTE
University of Alaska Fairbanks
C.T. Elvey Building
Fairbanks, Alaska 99775-0800

Nonprofit
Organization
U.S. Postage
PAID
Permit No. 2
Fairbanks, Alaska
99775

The University of Alaska is an EO/AA employer and educational institution.