The Geophysical Institute
QUARTERLY

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Earth system science gains importance

Changing times for planet Earth

When the first Earth Day was carried out in 1970, most participants were characterized as oddballs or hippies. Twenty years later, the anniversary celebration of Earth Day included national celebrities starring in a network television drama on ailing Mother Earth.

The acceptance of environmental concern as a mainstream issue shows an increased public awareness of our planet as a complex and delicate life-support system. "Think globally," we advise ourselves and others, using a catchphrase that echoes the concern of the international science community.

Earth system science, global system, and global change have become bywords for public action, science funding, and serious scientific debate. In the world of public affairs and science, what has motivated this change? Part of the answer can be found in two relatively new technological developments, satellites and computers. Information from space and increasingly powerful computers for data analysis are giving us a new view of our planet as a complex network of interacting systems—systems that make it both habitable by humans and vulnerable to the effects of human activity.

The earth system idea and evidence of global change have challenged researchers to answer serious and complicated questions about the future of our planet: are human activities accelerating change or distorting the environmental processes that support life; if so, what does this mean for humans in the next century and beyond? These sweeping questions have already inspired much debate. The work of the scientific community is to articulate precise questions and carry out research projects that contribute substantial information on earth systems and global change.

UAF takes research initiative

An organization for interdisciplinary research has been created at the University of Alaska Fairbanks (UAF) to coordinate and carry out work related to the Arctic and its role in global environmental change. The new Center for Global Change and Arctic System Research was announced March 26 by Chancellor Patrick O'Rourke.

"Twenty-five years ago, the Geophysical Institute, the Institute of Marine Science, and the Institute of Arctic Biology were considered major interdisciplinary efforts," O'Rourke said in a campus-wide convocation. "I think it's a tribute to our scientific evolution that, in many ways, they are not interdisciplinary enough to address some of the major problems in the scientific world today."

At UAF, annual funding for studies related to earth system science and global change is already about $6.17 million; if the Bush administration secures the $1 billion it has proposed for global change research, federal funding could increase substantially. O'Rourke pointed out that UAF is in a strong position to participate in this emerging field. The faculty has the experience, interest, and capability to participate in interdisciplinary research, and Alaska, as a high-latitude region, holds many sensitive indicators of global change.

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Scientists to meet on global change

As world leaders take an increased interest in the economic and social implications of global environmental changes, both natural and human-induced, scientists have been meeting throughout the world to examine the present state of knowledge and plot the course of future research. At the University of Alaska Fairbanks (UAF), one such international meeting takes place June 11-15, when more than 400 researchers from 15 nations will meet for the first International Conference on the Role of Polar Regions in Global Change. The conference was organized by the ARCUS, the Arctic Research Consortium of the United States; Dr. Gunter Weller of the Geophysical Institute chairs the organizing committee.

"Our goal is to define and summarize the state of knowledge on the role of polar regions in global change and to identify gaps in our knowledge," said Weller. "To this purpose, experts in a variety of relevant disciplines are invited."

The major sessions on global change will focus on several topics as they pertain to polar regions: monitoring and early detection of climate change; permafrost sources of carbon dioxide and methane; ozone holes and their biological effects; arctic haze effects on biota and climate; snow and ice feedbacks; deep-water formation and carbon dioxide sinks; glaciers, ice sheets and sea level; socio-economic effects of global change; and paleoclimatic data from the polar regions. More than 200 papers will be included in presentations and poster sessions.

Questions scheduled for panel discussions are: priorities and problems of coordinating research in the arctic and antarctic regions; strategies, monitoring sites, and systems for obtaining data in the polar regions; global change and society—

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Initiative

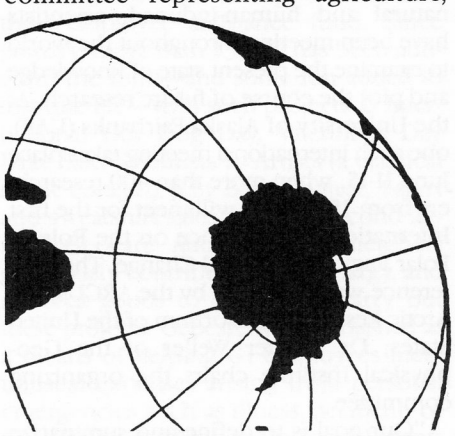
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Dr. Gunter Weller, professor of geophysics at the Geophysical Institute, has been named scientific director of the center.

"I plan to use the center to strengthen ties among the various research institutes and among the faculty of various disciplines at UAF," Weller said. "In this way we can make the best use of our resident expertise. We are encouraging the participation of everyone with an interest in global change."

Working with Weller at the center is associate director Laura Lee McCauley and administrative assistant Deby Chapman. Center development will be guided by a policy board of deans and institute directors to ensure cooperation and coordination within the university. It will also address such issues as faculty appointments for new positions, facilities, overhead distribution, and funding requests. Leadership and guidance on research themes come from a scientific steering committee representing agriculture, forestry, ecology, engineering, geophysics, marine science, social science, anthropology, archaeology, and economics. It will also initiate workshops to involve interested faculty.

For more information, contact the center at 474-5425.



Polar Regions and Interdisciplinary Research

Considerable attention has been focused on the polar regions of the earth in connection with atmospheric pollution and global climate concerns.

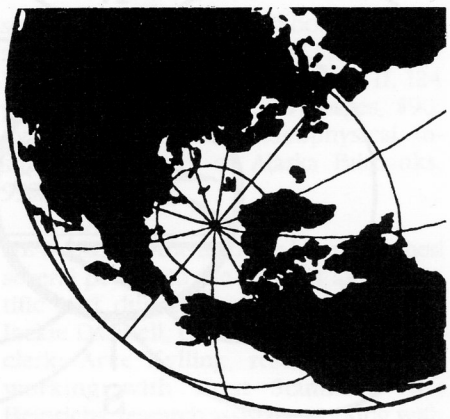
Evidence is growing that polar regions play a key role in processes responsible for global climatic fluctuations. In many instances, these regions may be the prime source of such fluctuations.

Polar regions are now widely recognized as important repositories of information on past climates and the causes of past climatic fluctuations.

There is mounting concern that systematic warming in polar regions will alter the equilibrium of the polar ice masses and in this way affect the global sea level.

Induced changes in the chemistry of high-latitude air are viewed with increasing concern, based on dramatic trends in ozone depletion.

The framework for research recommended by the U.S. Arctic Research Commission assigns first priority to integrated investigations of the coupled atmosphere and land components and how their interaction governs the terrestrial environment.



Conference

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policies, effects of change, and mitigation of those effects.

The meeting is sponsored by the new UAF Center for Global Change and Arctic System Research, ARCUS, the U.S. Arctic Research Commission, the Polar Research Board of the National Academy of Sciences, the American Meteorological Society, the American Association for the Advancement of Science, the Arctic Institute of North America, the International Glaciological Society, the Oceanography Society, and the Scientific Committee on Antarctic Research of the International Council of Scientific Unions.

For general information on the International Conference on the Role of the Polar Regions in Global Change, contact the office of the conference chair at the UAF Geophysical Institute, Fairbanks, AK 99775-0800; (907) 474-7954. Registration information can be obtained from Conferences and Institutes, 117 Eielson Building, UAF, Fairbanks, AK 99775; (907) 474-7800.

New Device makes underwater video images

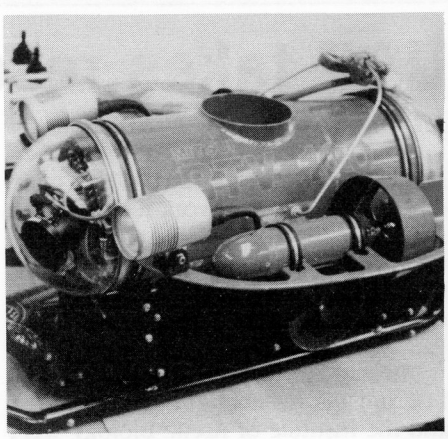
A new tool for underwater research has been acquired by the Geophysical Institute. The remotely operated television device (RTV) was donated to the institute by Dr. Noboru Hamada, president of Japan Marine Machinery Development Association. Built by the Japanese company Mitsui Engineering and Shipbuilding, it is valued at approximately $80,000.

"Where equipment is concerned, university scientists are continually challenged to keep pace with technological advances," said Syun-Ichi Akasofu, institute director. "The generosity of Dr. Hamada and his association gives us research capabilities that would otherwise be unaffordable."

The RTV-100 is a compact underwater vehicle with a television camera system that can transmit high-resolution video pictures to the surface through special optical fibers in a tether cable. The system is equipped with two 150-watt quartz halogen lights that enable it to obtain images even in murky water.

Geophysical Institute researchers will use the device for research on such topics as lake sediments, sea ice, sea ice effects on off-shore oil platforms, and sea floor gouges produced by sea ice. They will be trained to use the RTV by a manufacturer's representative who will come to Alaska.

The self-propelled RTV-100 is controlled by four battery-powered thruster motors. It can be operated to a depth of about 330 feet (100 meters). Highly maneuverable, it can be directed to turn left and right or move forward, backward, laterally, and up and down.



Researchers can operate this underwater television device from a vessel or platform on the ocean surface.

Satellite survey system to aid research

Special receivers for a new space-age surveying system are now available to Geophysical Institute researchers. The Global Positioning System (GPS) uses signals broadcast by a suite of NAVSTAR System satellites operated by the U.S. Department of Defense. Acquisition of the $98,000 system, funded primarily by the University of Alaska Fairbanks, was announced in March by UAF Chancellor Patrick O'Rourke.

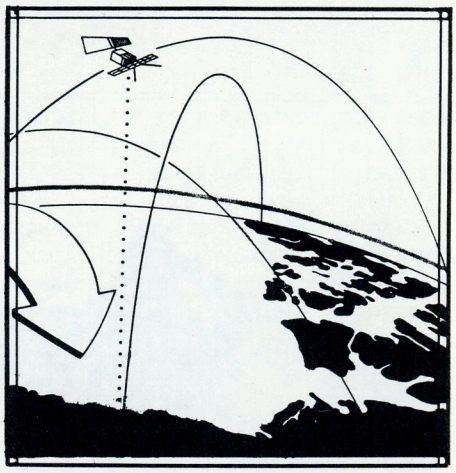
NAVSTAR will eventually employ eighteen satellites. Six are in orbit now, and the remainder will be launched during the next 18 months. By receiving signals from four or five of the satellites at one time, the receivers can be used to determine, within two or three feet, the position and elevation of a given point anywhere on earth. Relative measurements will be accurate to better than a half-inch.

GPS surveying is considerably faster, and in many applications, more accurate than conventional survey methods. Because of its speed and cost advantages, it is rapidly becoming the technique of choice for many research applications.

"We will now be able to teach students how to use this state-of-the-art device for standard surveying applications as well as for research projects," said John Davies, state seismologist and institute research associate. "For example, it can be used to directly measure the very slow motion of the earth's lithospheric plates."

These large pieces of the earth's crust move with relative speeds as high as several inches a year. A related research project is being planned by Dr. David Stone, who wants to measure the movements that occur between the Aleutian Islands.

"This would be very difficult to do using conventional surveying techniques," said Stone, a professor of geophysics. He said the system can also be used to measure such phenomena as the movements of glaciers, the swelling of a volcano prior to eruption, and even the movement of the earth that is due to the pull of the moon.



Researchers using images obtained by the new synthetic aperture radar (SAR) at the institute's Alaska SAR Facility can use the surveying technique to find locations on the ground which correspond precisely to features shown in the radar images.

Seismic network benefits from cooperation

Earthquake monitoring and research is benefiting from an agreement for closer cooperation between the U.S. Geological Survey (USGS) and the Geophysical Institute. Participants expect the agreement, formalized last fall, to contribute substantially to the earthquake monitoring program for Alaska.

"This agreement should improve our capability for providing timely information about earthquakes that occur over a larger region of the state," said state seismologist John Davies, a research associate at the institute. "By joining forces, we also should expect a more vigorous exchange of information and ideas to enhance the research effort of both groups."

The USGS programs involved are now centered in Denver, Colorado; Menlo Park, California; and Fairbanks, Alaska. Visiting Fairbanks to sign the agreement were two USGS scientists: Robert Wesson, Chief of the USGS Office of Earthquakes, Volcanoes and Engineering in Reston, Virginia, and Robert Page of the USGS Alaska Earthquake Studies Project in Menlo Park.

"This is a major step toward consolidating USGS seismic monitoring in Alaska with the university program and the eventual development of an Alaska Earthquake Information Center," said Davies.

In the past, both the USGS and the institute have operated separate networks of seismographic stations in adjacent regions of Alaska. The information from each was independently recorded and analyzed.

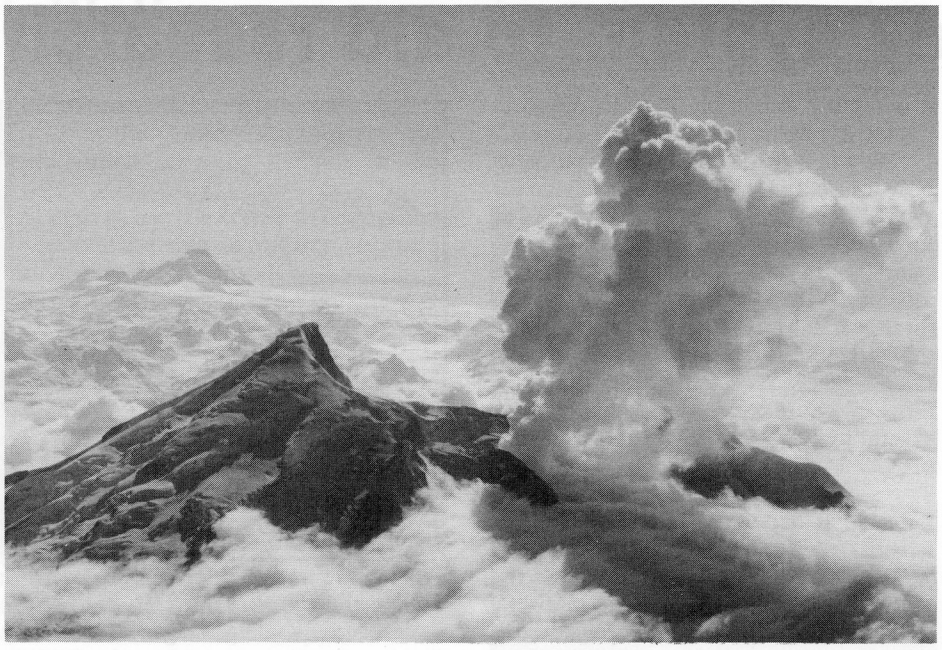
"The first phase of this agreement allows us to record the data from both networks at the institute seismology laboratory," said Davies. "The USGS has hired one person here to help handle the data. Analyzing the data for both networks at one location will eliminate some duplication of effort."

Integration of the USGS data into a new computer system at the institute has been underway since last summer and is basically completed. Davies said he expects that further cooperation with the USGS National Earthquake Information Center in Golden, Colorado, will extend Alaska's local earthquake monitoring and information capabilities.

JIM COCCIA



An earthquake monitoring agreement between the U.S. Geological Survey (USGS) and the Geophysical Institute was signed by Robert Wesson, chief of the USGS Office of Earthquakes, Volcanoes and Engineering in Reston, Virginia; Syun-Ichi Akasofu, institute director; John Davies, Alaska state seismologist; and Robert Page of the USGS Alaska Earthquake Studies Project, Menlo Park, California.



JUERGEN KIENLE

Fire & Ice

When glaciers adorn the flanks of an active volcano, the combination of fire and ice has the power to change the landscape dramatically. Such is the case on Mt. Redoubt, where current eruptions are causing debris flows and floods. Along with a change in geological features, the effects of melting ice and moving debris threaten the nearby works of man, particularly the Drift River oil-tanker terminal.

Looking at the present situation with an eye toward the future, researchers have a base of information from which to work, thanks to a long-term study conducted after the eruptions of 1966 to 1968. "Recent glacier-volcano interactions on Mt. Redoubt, Alaska," was reported by Matthew Sturm, Carl S. Benson, and the late Peter MacKeith. Participating in the fieldwork were Gary Bender, Carl F. Benson, Ted Clarke, Juergen Kienle, Roman Motyka, Dan Solie, Betsy Sturm, and Carl Tobin.

"Active volcanoes covered by glaciers generally pose unique geologic hazards," said Benson, professor emeritus and senior consultant at the Geophysical Institute. "Explosive eruptions combined with the melting of ice and snow can produce glacier outburst flooding and lahars."

Lahars are rapidly moving slurries of water-saturated mud, ice, and rock. Their destructive power was recently illustrated at Mt. St. Helens in 1980 and Nevado del Ruiz, Colombia, in 1985. A study of Mt. Redoubt's volcanic history has revealed a past of vigorous eruptive events accompanied by massive lahars. It was conducted by Juergen Kienle, professor of geophysics at the institute, with Jim Riehle (now with U.S. Geological Survey) and

DENNIS TRABANT



Above left, Mt. Redoubt Volcano; above, Drift Glacier ice field.

Karen Emmel of the Alaska Division of Geological and Geophysical Surveys, and Alison Till and others of the U.S. Geological Survey.

Mt. Redoubt is one of the more than 40 active volcanoes in Alaska; it lies on the west side of Cook Inlet, about 175 kilometers southwest of Anchorage. Heavy precipitation on the volcano feeds several distinct glaciers that radiate from the summit region. The youthful volcano is not heavily dissected by valleys, and the glaciers form an ice-cap complex. The largest and most deeply incised glacier flows north from Mt. Redoubt's Summit Crater, and is known by the unofficial name of "Drift Glacier."

Drift Glacier has a complex geometry, including steep icefalls over large cliffs at the confluence of its two main branches. Intense avalanching and trapped wind-blown snow in the summit crater and deep canyons that channel the glacier create a vigorous system with high ice flux. The Drift River flows past the glacier's terminus in a narrow gorge with steep rock walls on the other side.

The 1966-68 eruptions, studied by Robert Forbes, Kienle, Ken Klopf and Charles Wilson of the Geophysical Institute, removed essentially all of the glacier ice from the main branch of the glacier's upper part, decoupling it from the lower part in a sequence of outburst floods that originated in the crater of the volcano and flooded the Drift River. The eruptions blanketed the lower part of the glacier with sand and ash, insulating the ice so that ablation was reduced.

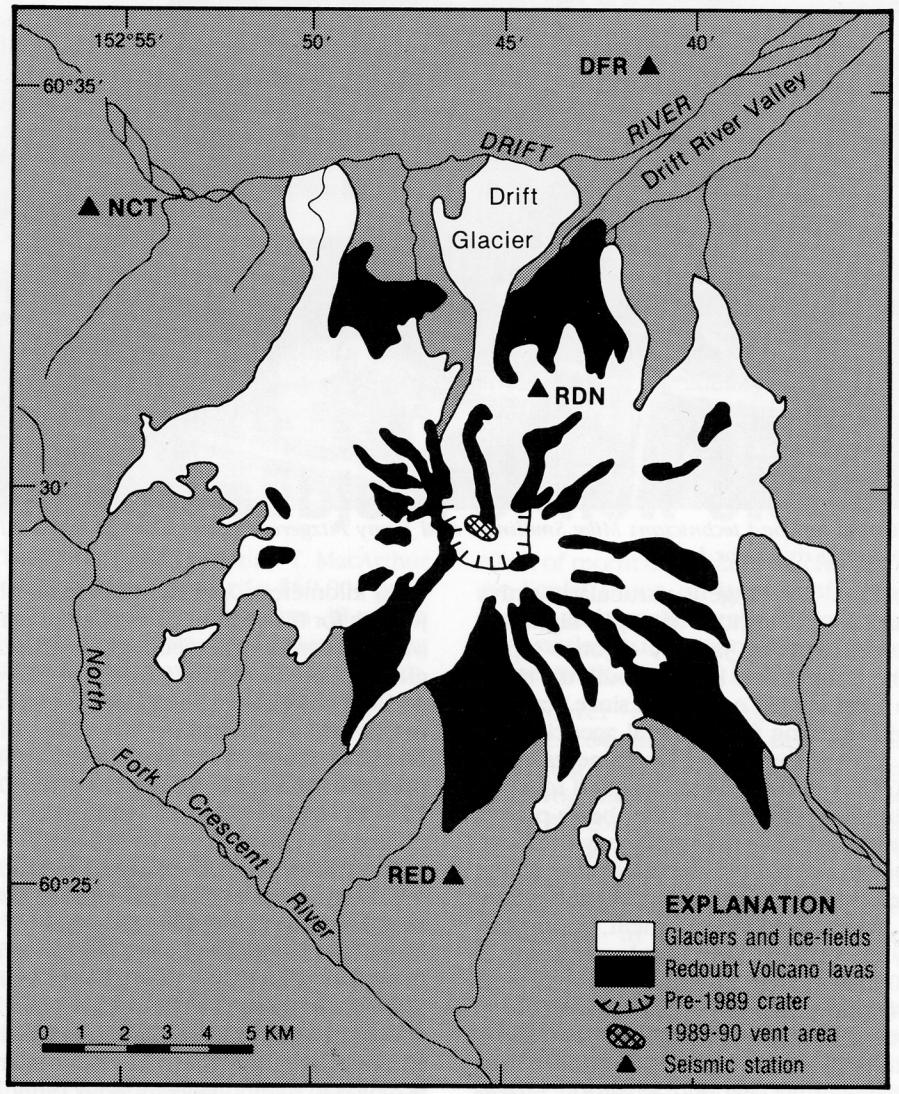
After Mt. Redoubt quieted down in 1968, it took only eight years for normal snowfall, augmented by intense avalanching, to regenerate all of the upper part of Drift Glacier. When the regenerated segment connected with the rest of the glacier, it triggered a wave of thickening ice with increased flow speed. As this wave passed through the lower part of the glacier, the ice thickened by about 70 meters, and surface velocities increased by an order of magnitude. At the same time, upper parts of the glacier thinned by similar amounts.

If these events had caused the terminus to advance sufficiently to block the Drift River, an unstable, ice-dammed lake would have been created, posing another catastrophic flood hazard for the oil-tanker terminal downstream. Lakes of this sort have formed in the past, as demonstrated by lake sediments upstream of the Drift Glacier. The discharge of such glacier-dammed lakes produces outburst floods, known by the Icelandic term, jökulhlaups. Well-known examples in Alaska are Lake George, dammed by the Knik Glacier, and Strandline Lake, dammed by the Triumvirate Glacier.

In the late 1980s, Drift Glacier appeared to be regaining its pre-eruption equilibrium, but that was to last only until the most recent natural experiment occurred there when the current eruptive sequence began on Mt. Redoubt in December 1989.

"We now have a good picture of Drift Glacier for the twenty years following the 1968 activity," said Benson. "This gives us a basis for studying the aftermath of the current series of eruptions." Benson has also studied volcano-glacier interactions on Mt. Wrangell.

"Long-term studies on natural phenomena such as glacier-volcano interactions are extremely valuable," he said. "Natural forces create experiments with these enormous systems over and over again. They would be beyond anyone's means to operate, yet they are done without cost to us. All we have to do is invest the time and resources to measure the effects of such occurrences to understand not only the experiments, but the phenomena that produce them. Among other things, these studies give us information necessary to reduce some of the risks involved in living on this exciting part of our planet."



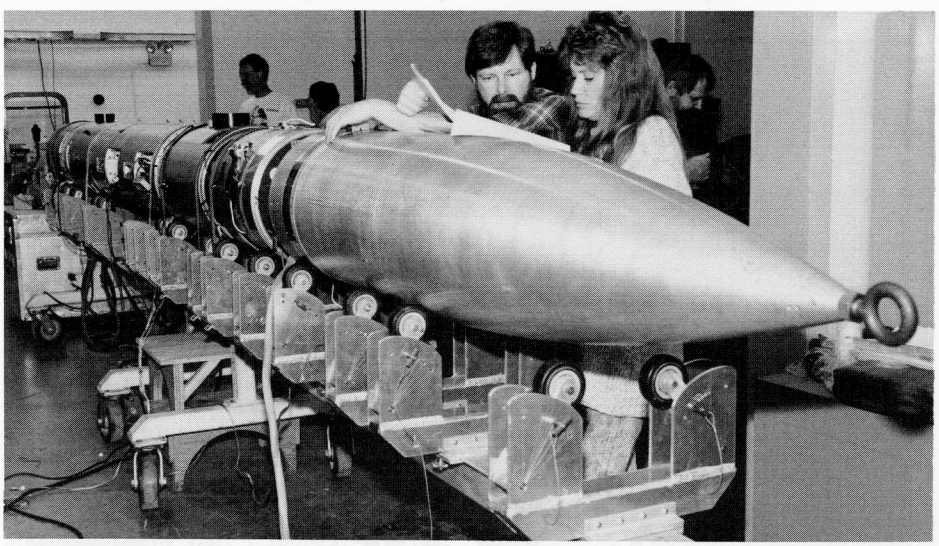
This generalized map from the Alaska Volcano Observatory appeared in "The 1989-1990 Eruption of Redoubt Volcano," Eos, Feb. 13, 1990, Vol. 71, No. 7.

Launch record set during winter season

A record was set at Poker Flat Research Range this winter when the staff handled the longest sounding rocket yet launched at the facility. The Black Brant XI sounding rocket, launched on February 1, was more than 68 feet long. Using the same principle applied to throwing a football, two spin rocket motors were used to stabilize the flight about one second after first-stage ignition.

The nighttime launch took place during the occurrence of stable auroral arcs, the appropriate condition for the twenty experiments carried by the rocket. Dr. Paul Kellogg of the University of Minnesota was principal investigator for the project, SCEX 3 (Several Compatible EXperiments).

Poker Flat is frequently used on a contractual basis by visiting scientists engaged in research requiring the use of sounding rockets. The range is particularly active during the period of high nighttime auroral activity, January through April. The Geophysical Institute built the range in 1969 and has operated it since that time with funding from federal agencies.



JIM COCCIA

Visiting payload technicians Mike Smolinski and Jenny Fitzgerald ready a Black Brant XI sounding rocket for launch.

Most of the twenty experiments in the SCEX 3 mission were designed to study different aspects of the beam-plasma discharge in the near-space environment. One measured the electric charge on the vehicle itself and at various distances from it. For far-field measurement, booms carrying probes were deployed using a 60-meter tether. Also on board were electrostatic analyzers, particle detectors, electron accelerators, photometers, two television systems, and equipment for telemetering data and television images back to Poker Flat.

On February 23, a three-stage Black Brant X was launched into a bright, active auroral storm. The mission, called HEEPS/ARCS4 (HEmispherical Energy Pitch angle Spectrometer/Auroral Rocket for Control Studies), had two objectives: first, to measure turbulence in field-aligned electron fluxes using high time-resolution electron measurements and wave data; second, to continue the argon plasma release experiments of past ARCS projects. Researchers hope to resolve the question of how, during an auroral storm, two very distinct features of the auroral electron spectrum can occur simultaneously. Dr. Roger Arnoldy of the University of New Hampshire was the principal investigator.

The March 22 launch of a four-stage Black Brant XII took place during nighttime auroral activity to study auroral acceleration phenomena at altitudes up to 1500 kilometers. Among the several objectives for this flight: better measurement of the recently observed high-frequency electron fluxes; further study of wave-particle correlations; extended measurements of electrostatic shocks; and characterization of ion phenomena. The principal investigator for this work was Dr. Charles Carlson of the University of California, Berkeley.

A sensitive camera designed to study the X-ray structure of the aurora was tested during the March 22 launch of a Nike-Orion sounding rocket. Researchers from the University of Houston conducted the mission. The rocket vehicle was launched during darkness and active auroral conditions. The mission's primary goal was to flight qualify an X-ray pinhole scintillation camera being developed for use on parachute-borne sounding rocket payloads. The sensitive camera is expected to provide high-resolution images of the X-ray aurora. Obtaining useful scientific data on the aurora's X-ray structure was a secondary objective. As the camera parachuted to earth, it was operated from approximate altitudes of 90 kilometers down to 25 kilometers.

Six rockets bearing instrument packages were launched this month. The midday launch of three major sounding rockets (two Taurus-Orions and one Orion), and three Super Loki meteorological rockets took place on May 13 and 14. The meteorological rockets were launched just before and after the larger rockets to gather information on the direction and speed of the wind and on air temperature and density.

The two-stage Taurus-Orion rockets took data at approximate altitudes of 135 kilometers down to about 48 kilometers above the earth's surface. The Orion continued gathering data at lower altitudes. Instrument packages aboard the Taurus-Orions measured X-rays and conductivity, as well as the energies and numbers of electrons precipitating down into the middle atmosphere from higher regions.

The team responsible for the Taurus-Orions is led by Dr. Daniel Baker of the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center. Dr. Les Hale of Pennsylvania State University and Dr. Richard Goldberg of Goddard head the team for the Orion sounding rocket. Dr. Francis Schmidlin of Goddard is the principal investigator for the meteorological rockets.

Poker Flat is the largest overland research range in the world, and the only high-latitude launch facility in the United States. The range is northeast of Fairbanks at 30-mile Steese Highway. Geophysical Institute staff members for range operations and administration are currently working on an extensive upgrade of the facility, which will be developed as the national Arctic Space and Environmental Research Center.

Scientific Director Charles Deehr reports that preliminary work on the federally funded upgrade has begun. When completed, the improvements will include substantially improved rocket assembly and launch facilities, a new optical observatory and command center, and a climate monitoring station with data-handling capabilities. The improvements to site, buildings and equipment are expected to cost roughly $30 million. The current $1.5 million annual operation of the range is funded through the institute by NASA.

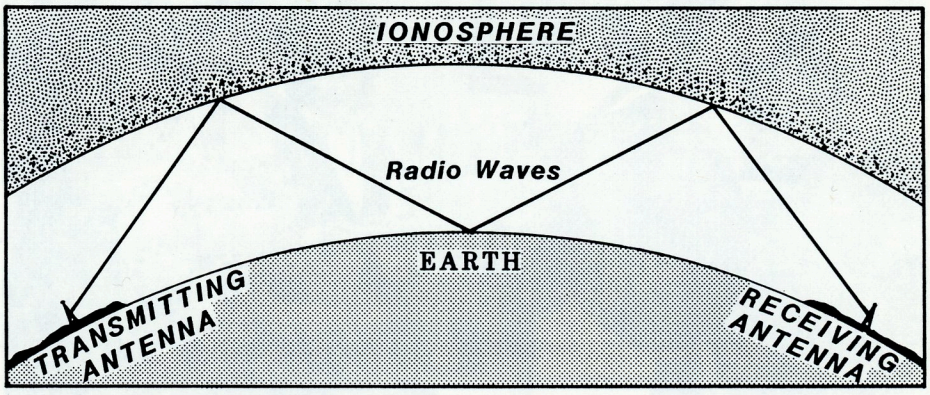
New rules aim for better radio reception

Radio listeners can expect better reception on the AM band under new rules unanimously adopted by the Federal Communications Commission (FCC) in April. Some of the changes were directly influenced by Geophysical Institute research, particularly those related to nighttime broadcasting.

"The FCC has to see to it that broadcasters fairly share the frequencies of the AM broadcast band," said Bob Hunsucker, leader of the institute's research effort. "Past decisions were based on what was known of radio wave propagation, but data gathered in the temperate zone didn't necessarily apply in the high latitudes." Hunsucker is professor emeritus and senior research consultant at the institute.

One of the changes involves FCC calculations of groundwave and skywave field strength. Hunsucker's radio wave research suggested that shifts in FCC policy were appropriate for higher latitude AM radio stations. He recommended a shift in FCC technical criteria for assigning AM frequencies, as well as for nighttime operation strengths, interference calculations, and antennas.

The FCC will replace the existing AM broadcast skywave propagation curves with a new propagation model developed at the institute. The new skywave model, a key to improving AM service during nighttime hours, gives engineers more accurate information on the likelihood of interference. It also lends itself easily to computerization,



which should improve accuracy and usefulness for all 50 states. Working with Hunsucker on the research were Brett Delana, Stan Schwafel, Kay Lawson, Rick Guritz, and Celia Rohwer.

The key to nighttime radio interference is interaction between radio waves and the ionosphere, a layer of the earth's atmosphere. For radio waves in the AM broadcast bands, the ionosphere acts almost like a mirror, reflecting them back to receivers that could not otherwise receive them due to distance or hills and buildings. Skywaves are only present in the AM band at night, because the daytime ionosphere absorbs the medium-frequency waves.

"If you drive past a transmitter, your car radio picks up the groundwave portion of the broadcast," Hunsucker said. "At distances greater than several hundred miles from the transmitter, the groundwave fades out and, at night, the signal bounces off the ionosphere. You might receive it on your car radio, and it can cause interference to other broadcast stations."

The bounce can be deflected when the ionosphere is warped by conditions in the earth's magnetic field, as often happens in the far north.

"A good aurora show can be a sign of real trouble for radio stations," said Hunsucker. "It means things are stormy—in an electrical sense—in the ionosphere."

The recent study built on several years of basic research by Hunsucker and colleagues in the fields of ionospheric physics and radiowave propagation. The most recent work was supported by funds from the FCC and the state of Alaska.

To help alleviate the interference and congestion experienced by the country's 5,000 AM stations, the FCC is opening a new AM bandwidth (1605-1705 kilohertz) and plans to gradually reduce the number of AM stations during the 1990s.

East-West cooperation subject of new study



Juan Roederer, professor of physics

The John D. and Catherine T. MacArthur Foundation has awarded a $60,000 grant to Dr. Juan Roederer for an 18-month study on East-West confidence building through cooperation in arctic research. The Chicago-based MacArthur Foundation has a strong interest in policy-oriented work on peace, security, and international cooperation. The grant to Roederer is the first awarded in Alaska by the foundation.

"I hope this marks the beginning of a long and fruitful association between the university and the MacArthur Foundation," said Roederer, professor of physics at the Geophysical Institute. "It may serve as the germinal step toward establishing a program of arctic policy studies at UAF."

He will use the grant to study several little-explored subjects: the psychological motivation of scientists to engage in international cooperation, the psychological effect of recent organizational changes in the Soviet Union on its scientific community, and the persistent national security obstacles to international cooperation in the Arctic.

Roederer expects to develop a confidence-building plan that includes proposing a series of joint US-USSR scientific programs that would gradually increase in economic, military, or social sensitivity. The grant will also allow him to develop seminars and lectures at UAF to involve graduate students and young researchers in arctic science policy questions.

Although his principal research achievements are in space physics and psychoacoustics, Roederer has published extensively on science policy and planning issues. He currently chairs the U.S. Arctic Research Commission.



JIM COCCIA

Jeanne Hume samples the goods as she and Bob Hunsucker oversee the German table during the International Hot Dog lunch, a benefit for the Geocare fund.

GI Notes...

GEOCARE—GI people have come up with creative ways to support Geocare, their employee assistance fund. Since January, more than $3,300 has been added to the fund—and some fun added to institute life—with such projects as International Hot Dog Day, Valentines Day Bake Sale, Scientists as Artists (a classical music concert), Jelly Bean Contest, T-shirt and sweatshirt sales, and the second annual Geocare Auction. Staff members generously contributed time, energy, and material goods to create and carry out these projects. Geocare was established as a means of helping GI employees meet unusual expenses arising from personal emergencies such as illness, accident, or fire. The fund is financed by special events and tax-deductible contributions, and is administered by the University of Alaska Foundation, 910 Yukon Drive, Suite 202, Fairbanks, AK 99775.

ARCTIC ENGINEERING—In a review published by the *Journal of Coastal Research*, the three-volume book, *Port and Ocean Engineering Under Arctic Conditions*, is described as a "valuable contribution" and "landmark guide to future Arctic engineering endeavors." Based on a historic symposium of the same name (1987, in Fairbanks), the book contains 131 refereed papers. It was edited by **Drs. William Sackinger** and **Martin Jeffries** of the Geophysical Institute. The papers cover engineering and scientific advances made in the Arctic during 1977-1987, a decade of activity inspired by the promise of petroleum and concern for the arctic environment. They present a broad overview of recent observations combined with current theory, computer modeling, and laboratory simulation. The authors are civil, mechanical, ocean, and geotechnical engineers, physicists and geophysicists, oceanographers, meteorologists, geographers, mathematicians, marine biologists, and environmental scientists. The clothbound books include many color photographs and illustrations. Volume I, 763 pages, $95; Volume II, 124 pages, $24; Volume III, 707 pages, $90. Available from POAC, Geophysical Institute, University of Alaska Fairbanks, 99775-0800.

NEW FACES—the institute has welcomed several people to the support and scientific staff during the past few months: **Jackie Dashiell**, business office accounts clerk; **Arve Kylling**, research assistant working with Knut Stamnes; **Tom Heinrichs**, research assistant working with Will Harrison; **Carl Byers**, student assistant working with Bill Stringer; **Georgina Price**, post-doctoral appointment with Roger Smith. Graduate student **Paula Kankaanpaeae** arrived in January for a six-month visit from the Finnish Institute of Marine Science; **Mark Mandt**, a 1988 Ph.D. graduate in space physics has returned to work with Dr. Lou Lee for several months; **Dr. Yu-Qing Lou** is new on the faculty of the space physics group.

THANKS AGAIN—to GI staff members, who helped the institute exceed its 1989 United Way campaign goal of $9,000. Professor **Glenn Shaw** led the campaign.

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