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Pavlof Volcano Erupts Right on Time

Pavlof Volcano awoke from an eight-year slumber and began to erupt violently just two months after a new network of seismometers was installed on its flanks by a team of Alaska Volcano Observatory scientists from the Geophysical Institute.

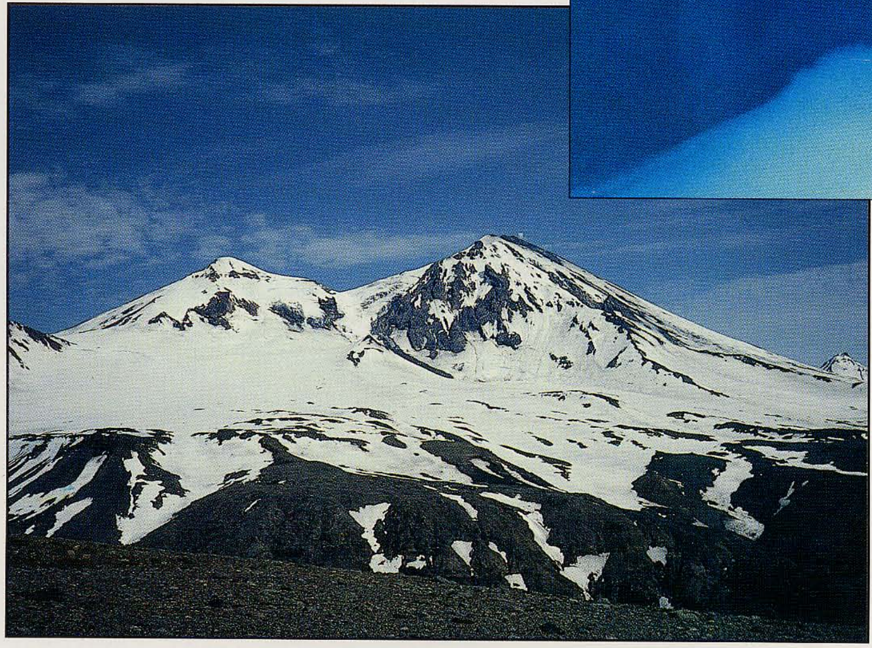
One of the most active volcanoes in the world, Pavlof exploded in September and continued to erupt throughout the winter. While car-sized pieces of rock spewed out of the 8,261-foot volcano, the new network enabled AVO researchers to monitor the activity from the safety of their offices in Fairbanks and Anchorage.

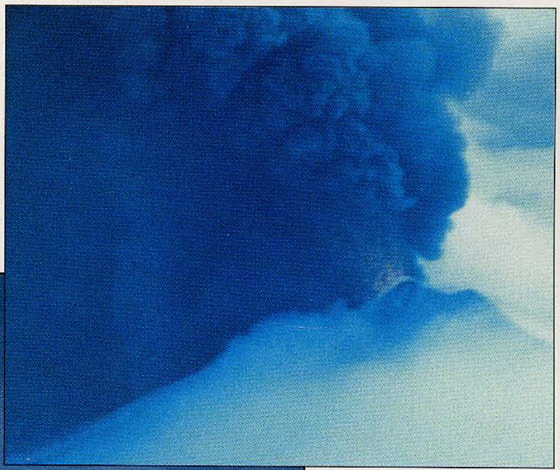
The new network is part of AVO's Central Aleutian Expansion, which is designed to monitor active volcanoes in the Aleutian chain that have presented serious hazards to high-flying jet aircraft in the past. Funds for the new network were provided by the Federal Aviation Administration.

"Many people don't realize that about 10,000 passengers and most of the air cargo between eastern Asia and North America pass over Alaska's volcanoes every day," said Professor of Volcanology John Eichelberger, AVO's coordinating scientist.

The Pavlof network was installed by GI Volcano Seismologist Steve McNutt, Geophysicist Guy Tytgat, and graduate student John Benoit before autumn for a reason.

Pavlof has erupted 41 times since the 1700s, and the volcano's last three periods of eruption—from 1973-'76, from 1980-'83, and from 1986-'88—all started with increased seismic activity in autumn. McNutt theorizes that Aleutian weather patterns may stimulate Pavlof's eruption cycle.





A quiet Pavlof Volcano is pictured in the photo at left as the large cone to the right of center. The inset photo shows Pavlof Volcano erupting after an eight-year slumber. The volcano exploded in September and continued to erupt throughout the winter. Photos by Steve McNutt (left) and Donald Morris (inset).

"In the fall, Aleutian low-pressure systems cause sea level to become deeper by about a foot," he said. "The increased water pressure on Pavlof's base may force magma to move in a way that is similar to squeezing a tube of toothpaste from bottom."

The Pavlof network is designed to provide AVO scientists with immediate information about the location and strength of earthquakes beneath the volcano. Such earthquakes, caused when molten rock rises toward Earth's surface, can be used to forecast an eruption or to confirm that an eruption is occurring.

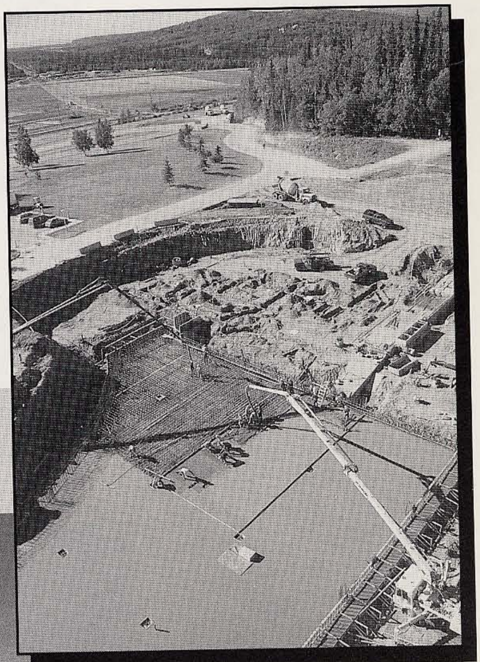
The new network, which was installed by helicopter, is made up of 10, self-contained, remote stations designed to radio information about earthquakes to nearby King Cove, and then over telephone lines to the Seismology Laboratory in the Geophysical Institute. Similar networks were installed on volcanoes near Akutan and Dutch Harbor.

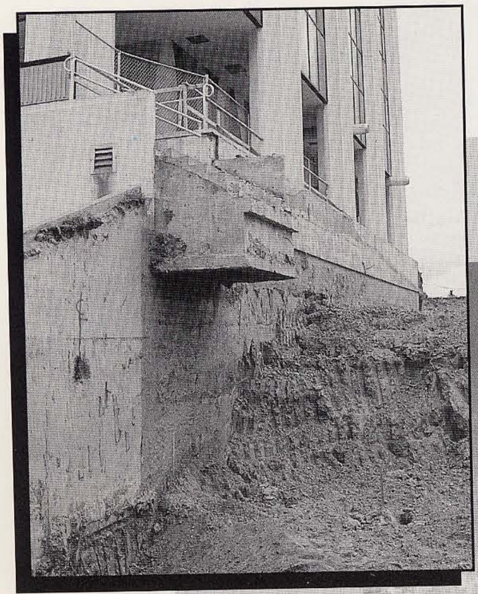
AVO is a cooperative project of the U.S. Geological Survey, the Geophysical Institute, and the Alaska Division of Geological and Geophysical Surveys.

INSIDE THIS ISSUE

The Foundation of the International Arctic Research Center

This winter, the Kiewit Construction Company finished the foundation of the International Arctic Research Center, a 100,000 square-foot structure that will attach to the Geophysical Institute's Elvey Building. Bids to finish the five-story center, which will serve as a headquarters for scientists studying arctic and global research from around the world, are expected to be awarded in December. Construction will resume in spring.



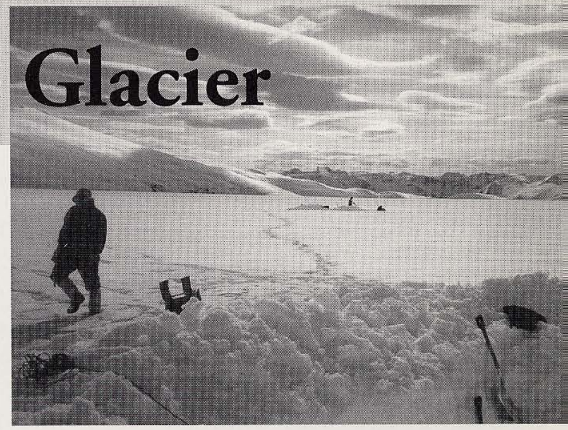


The images on this page show the foundation of the International Arctic Research Center in various stages of construction. They were taken by Geophysical Institute Photographics Supervisor Evelyn Trabant.

Clockwise from left are photos showing where the center will attach to the Elvey Building; concrete being pumped to form the foundation of the first floor; and a temporary access ramp. The construction project began in July and ended in October.

The $30 million project is being financed with funds from local, private, state, federal, and international sources. Scientists plan to occupy the International Arctic Research Center in January of 1999. The Geophysical Institute's Atmospheric Science Group, GeoData Center, Map Office, and the Keith B. Mather Library will be among the first to move into the center, along with the Fairbanks Forecast Office of the National Weather Service and the College International Geophysical Observatory of the U.S. Geological Survey. Japanese agencies scheduled to occupy the building include the National Space Development Agency, the Japan Marine Science and Technology Center, and the National Research Institute for Earth Science and Disaster Prevention.

Discovering the World's Thickest Temperate Glacier



Taku Glacier has been studied for decades, but it took data gathered by a team from the Geophysical Institute to prove that it is the deepest and thickest temperate glacier yet measured in the world.

Using seismic reflection methods to calculate its depth, Geophysical Institute Professor Keith Echelmeyer and doctoral graduate student Matt Nolan discovered that the Taku Glacier is an alarming 1477 meters thick, which is more than four times thicker than previously thought.

Prior to their research, most scientists believed the glacier averaged between 300 and 350 meters thick, based on measurements taken in 1949.

Scientists also believed that only 7 kilometers of the glacier rested below sea level, but Nolan and Echelmeyer's research revealed that at least 35 kilometers, or more than half the length of Taku Glacier, rests below sea level.

"The most alarming part of the discovery is realizing scientists have been using the wrong depth measurements for the glacier for more than 40 years," Nolan said.

Nolan took his first depth measurements of Taku Glacier while enrolled in the Juneau Ice Field Research Program, formed nearly four decades ago to bring students of all ages onto the 55 kilometer-long glacier. To measure its thickness, Nolan used the seismic reflection method, which involves creating a loud noise with dynamite on the glacier and listening for its echo with a seismograph.

Roman Motkya, with the Alaska Division of Geological and Geophysical Surveys, and Dennis Trabant, with the U.S. Geological Survey, assisted in revealing the unusual depth of the Taku Glacier by measuring it with radar. Eventually, however, the team had to resort back to seismic reflection methods because the glacier was too thick to return a radar signal.

Today, the only glaciers in the world known to be thicker than the temperate Taku Glacier are polar glaciers in Greenland and Antarctica, which are composed of ice between 20 and 40 degrees below zero. Temperate glaciers contain ice that hovers near melting point.

Taku Glacier, the largest glacier draining the Juneau Ice Field in Southeast Alaska, gained notoriety in the year 1750 when it blocked the nearby Taku River and created a large lake within its valley.

A repeat performance today would be particularly hazardous because residential developments are located in the valley carved by the Taku River, which starts in Canada and runs into the ocean. In addition to its potential for causing flooding, the unusual past of the glacier has caused many scientists to ponder its future.

At the turn of the century, Taku Glacier was a calving tidewater glacier. During its advance, it built up a high moraine then overrode it. This action ended calving, placed the glacier terminus above sea level, and cut it off from the ocean.

As a landlocked temperate glacier, it distinguished itself for years by advancing at high rates even though other glaciers fed from the same ice field retreated.

Although the ice volume of the Taku Glacier continues to increase, it stopped advancing in 1988. Nolan and Echelmeyer suspect high rates of erosion under the glacier may be contributing to its current standstill.

By comparing recent and historic measurements, they theorize that a weak layer of sediment, which lies between the Taku Glacier and its bedrock, is being eroded at a high rate. The sediment released during the erosion of this layer may be entrenching the glacier into the moraine at its terminus, keeping the Taku Glacier landlocked and preventing it from rising enough to advance.

Their theory is described in detail in a paper recently published in the *Journal of Glaciology.* The paper was coauthored by Motkya, and Trabant.

Like others, the researchers expect the Taku Glacier to someday resume a gradual advance, but no one is willing to say when.

PHOTOS BY MATT NOLAN

ECHOES—*To discover the depth of Taku Glacier, researchers used the seismic reflection method, which involves creating a loud noise with explosives (pictured at left) and listening for its echo with a seismograph. Roman Motyka is pictured above stringing out geophone cable prior to the explosion.*

The FAST Way to Study

While the aurora decorates Alaska's dark skies this winter, scientists from around the country will gather at Poker Flat Research Range to participate in one of the most intensive studies ever performed on the northern lights.

While a small satellite orbits high overhead, researchers will monitor brilliant auroral displays simultaneously in three dimensions: from space, from jet aircraft, and from the ground.

The satellite, known as the Fast Auroral Snapshot (FAST) Explorer, will guide the three-dimensional study as it gathers data about the aurora while orbiting 4200 km (2610 miles) above the polar north. The unusual experiment is designed to help scientists understand the physics behind what is happening at high altitudes to energize brilliant auroral displays seen from Earth.

Scientists know that auroras are created when electrical energy extracted from solar wind flows down Earth's magnetic field lines to form ring-shaped regions around the north and south geomagnetic poles. However, they don't know what causes the aurora to appear as thin, undulating curtains, or in shapes as various as folds, curls, rays, or flickering arcs.

"The physics governing what shapes the aurora is important because it is similar to the physics governing little-understood processes that occur throughout 99 percent of the universe," said FAST principal investigator Charles Carlson, a research physicist at the University of California at Berkeley.

Geophysical Institute Professor Hans Nielsen compares the auroral displays seen on Earth to an image seen on a television screen. Scientists know the sun is the power source of the aurora, just as electricity is the power source of a television set.

"Using this analogy, the FAST satellite is designed to fly back in the inner workings of the TV, where the picture is forming," Nielsen said. "We want to find out exactly how the auroral picture forms and what processes create it."

Nielsen will participate in the FAST campaign by flying in a jet equipped with cameras needed to capture the aurora on video tape at the same time the satellite is flying overhead. Auroras generally arc from east to west across Interior skies, while the 400-pound satellite, which was launched in August from under the belly of a jumbo jet, is traveling in an elliptical orbit that runs north and south.

FAST STUDY—Researchers will study the aurora in three dimensions this winter: from space, from jet aircraft, and from ground stations equipped with all-sky cameras. The graphic at right, designed by Geophysical Institute Graphics Artist Deborah Coccia, depicts the FAST satellite flying over an aurora while a Saber 60 jet flies under the display at the same time it is being tracked by ground stations in Alaska at Poker Flat Research Range, Fort Yukon, Kaktovik, and Kotzebue, and in Canada's Northwest Territories at Fort Smith.

Nielsen will fly above any potential cloud cover to the place where the aurora lies directly under the path of the satellite and take simultaneous measurements with a narrow field, high-resolution camera. In a special Saber 60 jet, Nielsen is scheduled to make at least 15 flights under the satellite as it passes over different auroras.

"By combining the measurements from air and space, we'll be able to see each aurora from the north, south, east, and west," Carlson said. "We'll get detailed measurements of a much bigger area than is possible with a satellite track alone."

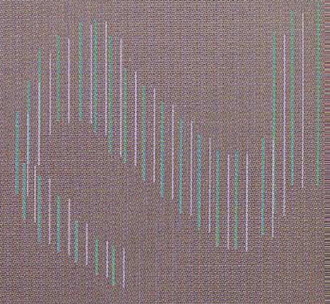
Meanwhile, Geophysical Institute Professor Tom Hallinan will record the aurora with all-sky cameras at ground stations in Alaska at Poker Flat, Fort Yukon, Kaktovik, and Kotzebue and in Canada's Northwest Territories at Fort Smith. The all-sky camera images will show general broad-scale features of each aurora being analyzed by the satellite and jet aircraft.

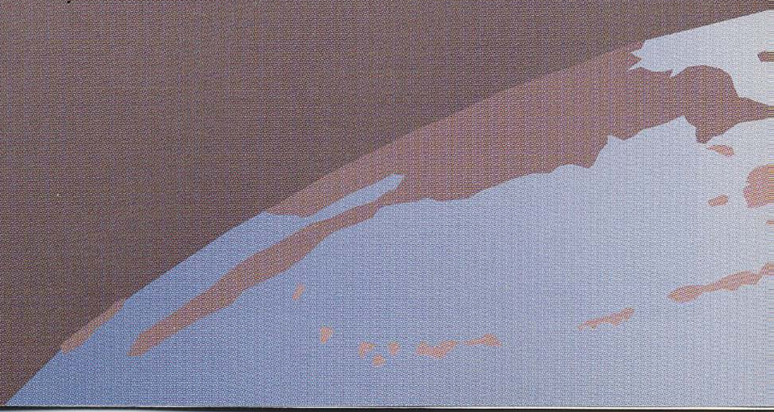
Carlson chose to base his research out of Poker Flat because the range is equipped to gather data from the FAST mission and because it lies in a good position on the globe.

FAST travels in an eccentric orbit, which means it circles the planet in an elliptical pattern, coming close to Earth on one side and flying high above it on the other. During January and February, the FAST satellite will orbit high enough above the northern hemisphere to view auroras daily throughout the entire polar region. "The satellite will be orbiting high enough that it will be possible to see FAST from the tracking station at Poker Flat even when it orbits over Sweden," Carlson said.

As the satellite travels over the northern aurora, it will send data directly to the ground in real time. Instant data collection and the ability to control the instruments aboard FAST from the ground are two reasons why a team of scientists will remain at Poker Flat throughout all of January and February.

"Scientists will analyze data on the spot with every pass FAST makes over the aurora," Carlson said. "We will be able to identify key new measurements and reconfigure instruments immediately to make sure we are maximizing the quality of the data."





the Aurora

FAST, the second satellite in a series of small explorer missions launched by the National Aeronautics and Space Administration, carries "burst detectors" so the ground-based crew won't be overwhelmed with data. Burst detectors are designed to turn on and start recording in high-resolution mode only when parameters indicate that auroral conditions are interesting. "We only want to receive data on what we consider to be the absolute best auroral conditions," Carlson said.

Those parameters can be changed from the ground to suit a researcher's needs. "With selective data gathering, we can avoid collecting hours and hours of empty data taken when the satellite is not traveling through an aurora," Carlson said.

While scientists at Poker Flat view the aurora on the night side, an international team of researchers in Svalbard, Norway, including professors and graduate students from the Geophysical Institute, will observe the aurora on the day side.

Day side auroras, which look similar but are more broken and not as brilliant as those occurring on the night side, make it easy for researchers to investigate Earth's magnetospheric cusp, the chimney that lets particles from the solar wind directly into the atmosphere, according to Charles Deehr, Poker Flat's scientific director. When FAST travels through the magnetospheric cusp over Svalbard, it will send data to the European Space Station in Kiruna, Sweden, for analysis later.

The FAST mission was designed to produce data similar to that obtained from sounding rockets Carlson launched from Poker Flat during the 1980s. Sounding rockets can transmit high-resolution data from a single aurora rapidly, while most satellites can measure only the general properties of many auroras. Small satellites combine the best of both methods because they permit high-resolution data transmission while analyzing a variety of auroras. "In the late 1980s, interest grew in small satellites and the study of the aurora was perfectly suited," Carlson said.

While FAST is in orbit, scientists throughout the northern hemisphere will collect data to support the mission from a variety of sources, including magnetometers, rockets, and other satellites. University of California Professor Cynthia Cattell, one of the 10 coinvestigators for the FAST mission, and a former Geophysical Institute graduate student, started an International Aurora Study to encourage researchers from around the world who are taking measurements on the aurora to share them on a homepage. The address for the new International Aurora Study homepage is http://bolero.gsfc.nasa.gov/ias/ias.html.

GI News

Hammer Award

Vice President Al Gore gave one of his 1996 Hammer Awards to Alaska Volcano Observatory employees for developing a system to warn airline pilots about ash clouds ejected from erupting volcanoes.

Deborah Williams, Special Assistant to the U.S. Secretary of the Interior for Alaska, presented the award to AVO, a joint effort of the Geophysical Institute, the U.S. Geological Survey, and the Alaska Division of Geological and Geophysical Surveys.

AVO employees were honored for "playing a key role in implementing an effective mitigation strategy to reduce human and economic losses from aviation hazards due to volcanic ash," Williams said.

AVO monitors Alaska volcanoes and provides near-real-time eruption warnings and the prognoses of likely activity to the National Weather Service, the Federal Aviation Administration, air carriers and local emergency officials.

The Hammer Award consists of employee certificates signed by Gore and a $6 hammer tied with a colorful ribbon, symbolizing Gore's answer to the $600 hammer of yesterday's government.

From left, Chris Nye, Bob Hammond, Steve McNutt, and John Eichelberger show the Hammer Award.

ARCO Award

The 1997 *Science for Everyone* free public lecture series recently received a $3,200 grant from ARCO Alaska, Inc. The popular lectures will be held in public libraries weekly throughout January and February on Wednesdays in Fairbanks and Thursdays in Anchorage.

During the series, university lecturers will talk about a variety of subjects, including the aurora, comets, volcanoes, earthquakes, moose, dinosaurs, and even music in science. Information about the free public lecture series is available on the institute homepage (http://www.gi.alaska.edu).

Earthquake Workshop

Groups of high school students will soon help locate earthquakes around Alaska from workstations set up in their own classrooms. The installation of seismometers for use in high school classrooms is the national goal of the Princeton Earth Physics Project (PEPP), a program steered in Alaska by State Seismologist **Roger Hansen**, Deputy State Seismologist **Charlotte Rowe**, and Geophysical Institute graduate student **Kent Lindquist**.

As part of the project, 20 Alaska high-school science teachers participated in a seismology workshop presented in the Geophysical Institute. Teachers who attended the workshop are candidates to receive a low-cost, high-quality seismograph in their classroom sometime next year, courtesy of the National Science Foundation, which funds PEPP.

The earthquake-monitoring equipment installed by PEPP will be used as both a hands-on learning tool and a real source of information for professional seismologists.

Comet Watch

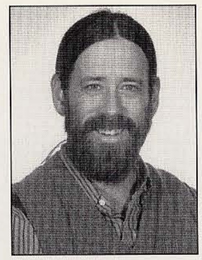
Professor of Geophysics **Hans Nielson** and Associate Professor **Channon Price** organized a "Comet Watch Party" in March. On three consecutive nights, hundreds of Fairbanks residents watched comet Hyakutake through one of three telescopes set up in the parking lot outside the Natural Sciences Facility. Graduate students **Laura Peticolas, Tom Immel**, and **Andrea Freitag** provided the telescopes. Coffee was donated by the Alaska Coffee Roasting and the North Pole Coffee companies. Another comet watch party is planned for March of 1997, when Hale-Bopp will be visible.

Moore Prize

Wadati Professor of Seismology **Max Wyss** received the 1996 Terris and Katrina Moore Prize for his work on seismic quiescence as it relates to the potential for major earthquakes. Using a data set from Japan's National Research Institute for Earth Science and Disaster Prevention, Wyss and graduate student **Stefan Wiemer** developed a method to determine the potential for earthquakes in three areas of seismic quiescence near Tokyo. Wyss plans to map all of Japan for seismic quiescence.

Promotions

Associate Professors **Jim Beget, Keith Echelmeyer** and **David Sentman** recently were promoted to the rank of professor while Professors of Geophysics **William Sackinger** and **David Stone**, were emeritized by UAF.



Peter Olsson recently was hired by the Geophysical Institute as an assistant professor of atmospheric sciences with a joint appointment to the physics department. Previously, he worked as a research associate at Colorado State University, where he earned his M.S. ('89) and Ph.D ('94) in atmospheric science. After earning a B.S. in physics from Montana State University ('84), Olsson worked as a physicist with the Orionics/Ametek Corporation in Bozeman, Montana, where he developed and tested optical fiber instrumentation.

At the institute, Olsson's specialties are mesoscale atmospheric dynamics and numerical modeling. His research focuses on arctic stratus clouds and the interrelationships among clouds, snow pack and mesoscale flow patterns during spring breakup.

Student and Staff Awards

Post-Doctoral Fellow **Sergei Maurits** received a second-place award for the best-student poster presented at the annual Coupling, Energetics, and Dynamics of Atmospheric Regions meeting in Boulder, Colorado. The poster was coauthored by Professor of Geophysics **Brenton Watkins**.

Science Editor-in-Chief **Kathy Berry**, Graphic Artist **Deborah Coccia** and Publications Assistant **Cheryl Katje** earned an APEX Award of Excellence for the 1993-1994 *Geophysical Institute Biennial Report*.

The competition is sponsored by the editors of *Writing Concepts: The Business Communications Report*, which recognizes achievement for overall communications effectiveness and excellence.

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Kathy Berry—Editor and Writer
Deborah Coccia—Graphic Artist
Cheryl Katje—Publications Assistant

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Retirees

Recently retired Professor of Geophysics **Wilford Weeks** joined the Geophysical Institute as chief scientist for the Alaska Synthetic Aperture Radar Facility in 1986. He worked concurrently as a research glaciologist for the Alaska Projects Office of the Cold Regions Research and Engineering Laboratory until 1989.

Prior to that, he worked as a glaciologist for CRREL ('62-'86), as an adjunct associate professor at Dartmouth College ('62-'72), as a contract researcher and assistant professor of geology at Washington University ('57-'62), as project leader for a joint Navy and Air Force sea ice physics project ('55-'57), and as a geologist for USGS ('52-'55). Weeks earned his B.S. ('51) and M.S. ('53) in geology at the University of Illinois and his Ph.D. in geology/geochemistry at the University of Chicago ('56).

Weeks, who has been emeritized, is a fellow of AGU and AINA, a National Science Foundation Fellow, a R.D. Salisbury Fellow, and a member of Sigma XI, Phi Kappa Phi, and Phi Beta Kappa. He received numerous awards throughout his career, including the Emil Usibelli Prize for Excellence in Research ('96).

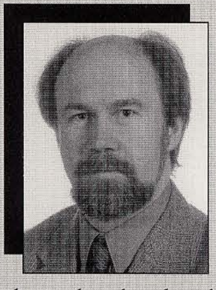
Hans Pulpan, who recently retired as an associate professor of geophysics, joined the Geophysical Institute as an assistant professor in 1968, a title he held until his promotion in 1980. Pulpan earned his Diplom-Ingenieur in petroleum engineering at Montanistische Hochschule in Leoben, Austria ('61), and his M.S. ('64) and Ph.D. ('68) in mining engineering from the University of Illinois.

Prior to his work at the institute, Pulpan worked as a field engineer for the Schlumberger Well Surveying Company ('62-'63) and as a research assistant for the Department of Mining, Metallurgy and Petroleum Engineering at the University of Illinois ('63-'68).

DuWayne Bostow recently retired as the institute's professional instrumentation technician. Bostow joined the Geophysical Institute in 1975 to work on the International Magnetospheric Survey. During his career, he helped set up the all-sky camera chain, the camera instrumentation at Poker Flat and the two optics labs on the first floor of the Elvey Building.

He also worked as a payload engineer on the barium rocket program, helped install the antenna fields at Poker Flat and the Sheep Creek field site, and worked on the lidar system at Poker Flat. He plans to spend his retirement in North Dakota.

In Memoriam



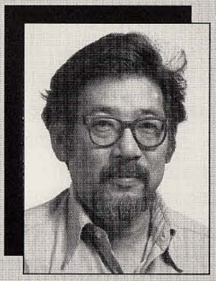
Victor Filyushkin died of brain cancer in October at the age of 42. Born in Volodarsk, Russia, Filyushkin joined the Geophysical Institute in 1993 to study the physics of clouds and the role clouds play in global climate change. As a schoolboy in Russia, he excelled at an "Olympiad of Physics" competition, which enabled him to enroll in the Moscow Institute of Physics and Technology when he was 17 years old. Six years later, Filyuskin received his master's degree in nuclear physics. At the age of 26, he earned a Ph.D. in plasma physics and chemistry.

After becoming the senior scientist at Moscow's Central Aerological Observatory, he left Russia to work as a visiting scientist for the National Center for Atmospheric Research in Boulder, Colorado.

After working there two years, he accepted a position at the University of Oklahoma, where he coauthored a successful proposal with Geophysical Institute Professor of Physics Knut Stamnes. He later joined the institute as a research associate.

A refined man, Filyushkin was thoughtful and reserved, with a kind and gentle disposition. Despite his illness, he maintained an interest in his work. He is survived by Lyudmila Shilin, his wife of 15 years; Alex, his son; Vladimir Filyushkin, his father; and Natalia Dergunova, his sister.

Koji Kawasaki died on June 14 while on a fishing trip in Chitina, Alaska. Born in Stockton, California, on March 15, 1938, Kawasaki earned his A.A. in physics and advanced math at Reedley College in California ('58), his B.A. at the University of California, Berkeley ('60), and his M.S. ('67) and Ph.D. ('71) in geophysics at the University of Alaska. Kawasaki served the Geophysical Institute as a teaching assistant ('64), senior research assistant ('65-'71), post-doctoral fellow ('72, '80), assistant professor ('81-'91) and associate professor ('91-'96). He also worked as a research associate and as a visiting assistant professor at the University of Alberta, Canada ('75-'78), and as a geophysicist with the U.S. Geological Survey in Denver, Colorado ('78-'80).

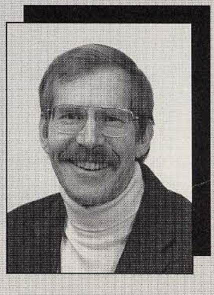


Kawasaki, who was a member of AGU, AAAS, the Society of Exploration Geophysics, and Sigma XI, also earned the title of Foreign Research Fellow from the Japan Society for the promotion of science at the University of Tokyo.

His research included studies of snow, ice and permafrost, general geophysics, geomagnetic phenomena, space science, and science education.

He is survived by Virginia, his wife of 27 years; Scott, his son; Sonja, his daughter; Utako, his mother; and Glen, Victor, and Ernest, his brothers.

Juergen Kienle died at his home on Sunday, April 28. Born on December 7, 1938, in Reutlingen, Germany, Kienle earned his diploma in earth sciences from the Swiss Federal Institute of Technology in Zurich, Switzerland ('64) and his Ph.D. in geophysics from the University of Alaska ('69). He joined the Geophysical Institute as a post-doctoral fellow a year later, then became an assistant professor ('71), an associate professor ('74), and a full professor of geophysics ('83).



He began concurrent work as an affiliate graduate faculty member with the Department of Geology and Geophysics at the University of Hawaii at Manoa in 1993.

Kienle was a dynamic man who was well known nationally and internationally as a creative scientist. His interests included volcano structure, seismicity, deformation, microgravity and hazard evaluation.

His research focused on the volcanism of subduction zones, and his studies concentrated on active volcanoes in Alaska, the Pacific region, and Antarctica. He is coauthor of the book, *Volcanoes of North America,* and he published many articles about the relationship of Aleutian Arc volcanism to subduction-zone seismicity and about Augustine Volcano, the subject of his career-long research.

He is survived by Linde, his wife of 30 years; Stefan and Florian, his sons; Gertrude Lutz, his mother; and Hans Kienle, his brother.

Balloons Help Satellites Measure Ozone Layer

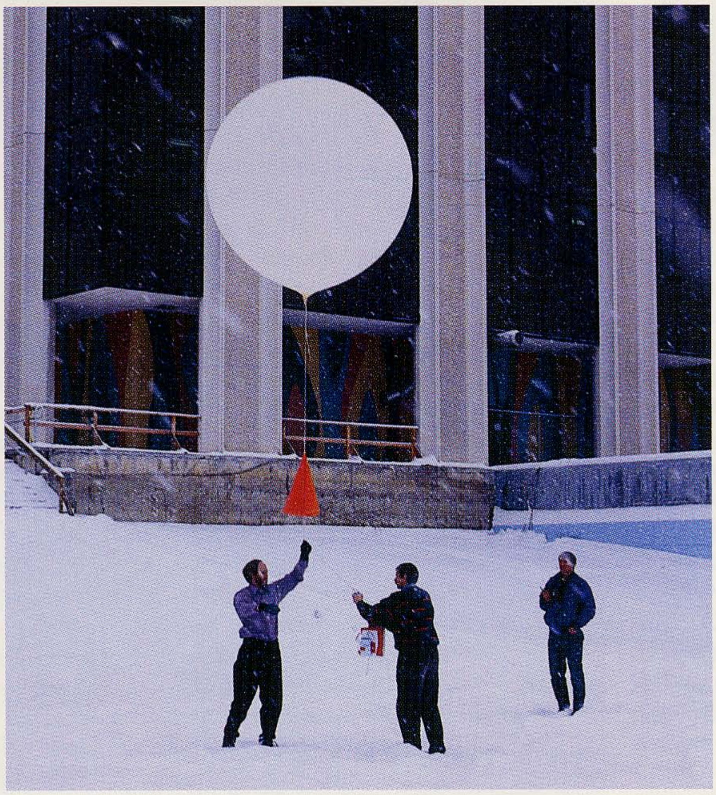
Balloons launched from the Geophysical Institute this winter traveled to the ozone layer to help scientists calibrate satellite-borne instruments.

Two satellites, ADEOS and Earth Probe, measure ozone by comparing wavelengths of sun light passing through the atmosphere.

Because the satellites orbit 500 miles above Earth, ground-based data are need to fine-tune their ozone measurements.

The ground-based measurement were made with ozonesondes and radiosondes lofted by 100-foot tethers under eight-foot diameter balloons released from the institute parking lot.

Each ozonesonde consisted of a small pump that forced air into a chemical solution. Ozone molecules reacted with the airborne chemical solution, causing voltage changes.



By analyzing those voltage changes, scientists were able to determine the amount of ozone present in the atmosphere.

Each radiosonde measured the balloon's altitude, and the air temperature and relative humidity surrounding it.

The balloons each took two hours to float up to the lower stratosphere, where ozone molecules occur.

Those molecules, collectively known as the ozone layer, float about 9 to 22 miles above Earth's surface, where they block damaging ultraviolet rays.

Associate Professor of Chemistry Dan Jaffe, Visiting Scientist Leonid Yurganov, and Bryan Johnson of NOAA (pictured at left) worked with GI Research Technician Jennifer Kelley and a crew of graduate students to conduct the experiments for NOAA and NASA.

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