GEOPHYSICAL INSTITUTE *QUARTERLY*

Remote sensing images aid firefighters

As wildfires grew in number and size during a hot July, images of Alaska's expansive terrain became an important resource for firefighters. Landsat satellite imagery and high-altitude infrared photographs were supplied by the institute to the Bureau of Land Management (BLM) Alaska Fire Service for use in mapping fires and planning campaigns against those that threatened life and property.

When an escalating fire near Tok caused the evacuation of that village during the July 4 holidays, the Geophysical Institute's GeoData Center and Photo-Graphic Services were able to provide visual information to aid the fire fighting effort. On the evening of July 5, a university holiday, three staff members were at work producing images from the Alaska High-Altitude Aerial Photography Program.

"Two years ago the Livengood fire began over the Fourth, and we were closed when the BLM needed photos of the fire area," said data specialist Rose Watabe. "This year, with fire conditions high, I made sure they could contact us in case our services were needed."

The aerial photography program was formed in 1978 by state and federal agencies, including the University of Alaska, to create and maintain a uniform aerial photography database for mapping and related uses. Approximately 90 percent of Alaska has been photographed and the images are available at the institute and the U.S. Geological Survey in Anchorage. Because of their scale, they are useful for determining the placement of fire breaks, locating water sources, and solving problems of logistics.

Aircraft operated by the National Aeronautics and Space Administration are used to obtain photos of the terrain from altitudes of 60,000 to 65,000 feet. The planes cruise at 400 knots along prescribed flight lines. Two cameras operate simultaneously. One makes black and white photos on a scale of one-half inch to a mile (162 square miles per frame); the other makes color-infrared photos on a scale of one inch to a mile (81 square miles per frame). The images are filed as negatives or positive color transparencies, and prints are made as requested.

When the need for photos arose on July 5, the prior arrangement with the BLM made it possible for Evelyn Trabant and Jim Coccia of Photo-Graphics to work with Watabe to produce the requested images.

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New research aimed at smokey skies

Where there's fire, there's smoke, and as a dry July nurtured wildfire on over two million Alaskan acres, smoke threatened health, obscured spectacular views, and was at best a nuisance. For a few people, it was also an opportunity to learn.

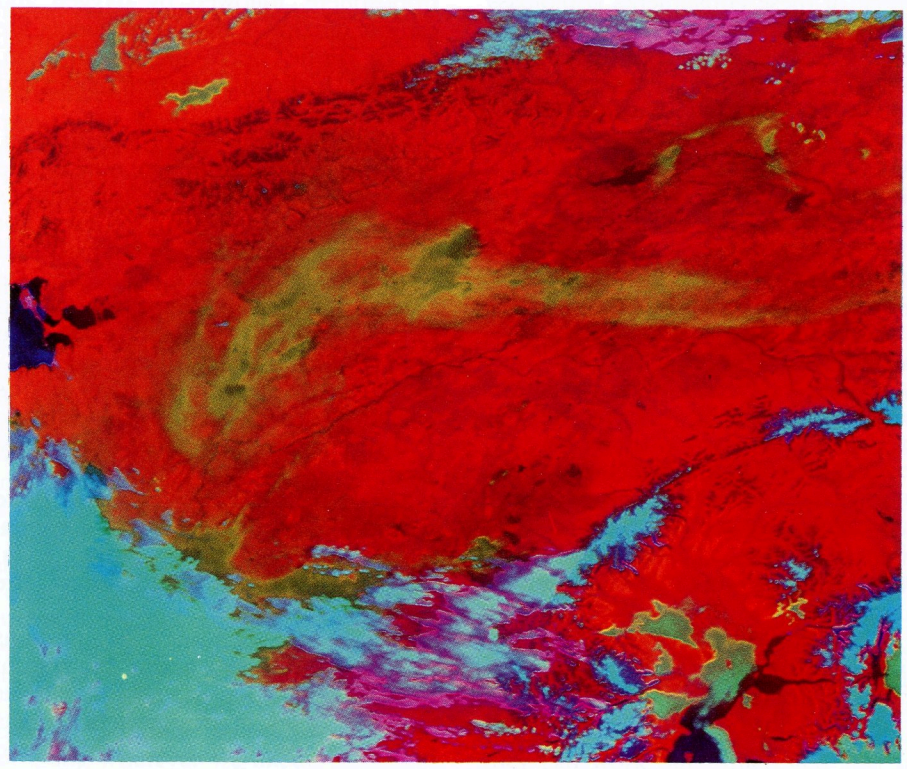
"This is another case where Alaska presents us with a natural laboratory," said Glenn Shaw, professor of geophysics and atmospheric scientist at the Geophysical Institute. "Little is known about the atmospheric effects of wildfire smoke, so last spring Dan Jaffe and I decided to begin a pilot study on its fundamental atmospheric chemistry."

Jaffe is an assistant professor of chemistry at the institute and the UAF chemistry department.

To understand basic atmospheric processes, as well as global patterns of

continued on 2

K. DEAN & H. JIAO



This composite color AVHRR satellite image shows wildfire smoke in green sweeping across central Alaska; burned areas are black, clouds and ice are light blue. The Yukon-Tanana river junction is at center, Cook Inlet at lower right, and Kotzebue Sound at center left.

Atmospheric gases flag Arctic pollution

Air quality in the once-pristine Arctic is no longer perfect, and it's getting worse. The background for this bad news is Dan Jaffe's hunting ground.

Jaffe, an atmospheric chemist at the Geophysical Institute, is principal investigator on two projects studying atmospheric pollutants near the earth's surface, or on it, north of the Brooks Range in Alaska (see "Earthwatch").

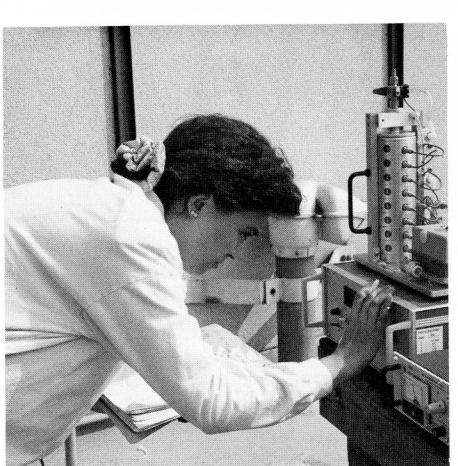
The troposphere, Jaffe's chief area of interest, is the shell of breathable air supporting terrestrial life. It extends up to about 20 kilometers over the Equator but only to near 10 kilometers at the poles. Most of the gas in the troposphere is nitrogen, with enough oxygen and carbon dioxide to keep animals and plants alive, but it also contains small quantities of other components. These trace gases are important indicators of the planet's health.

It's the measured increase in the Arctic of one such gas, ozone, that triggered Jaffe's current research. The National Oceanic and Atmospheric Administration operates a station near Barrow for the purpose of establishing a baseline record of the atmosphere there; over the past two decades, the NOAA record shows a clear increase in surface ozone concentrations.

That might not seem particularly alarming at first, since recent publicity surrounding the decline of stratospheric ozone—especially the *ozone hole* over Antarctica—has made it seem as if this three-atom form of oxygen is a planet's best friend. But ozone in the stratosphere, where it serves to protect the earth from the sun's output of high-energy ultraviolet light, is very different from ozone in the troposphere. Down here it is more a life-threatening than life-protecting component of the atmosphere. Ozone is powerfully reactive, playing an important role in the oxidizing chemistry of the lower atmosphere; that reactivity makes

continued on 3

EVELYN TRABANT



Graduate student, Laura Willman

JIM COCCIA



Summer intern, Bianca Cerundolo

surrounds the earth in the troposphere (up to 12 miles altitude) and the stratosphere (12-30 miles altitude) and the changes that take place in these regions. Nitrogen is the most abundant gas in the troposphere, followed by oxygen and carbon dioxide. Other constituents are argon, ozone, neon, helium, krypton, methane, hydrogen, nitrogen oxides and water vapor.

"With the exception of sulfuric acid, the air around Fairbanks right now has the same ingredients as the Los Angeles smog," Jaffe said. "When trees burn, hot combustion produces carbon dioxide and nitrogen oxides, while incomplete combustion produces carbon (soot), and other organic molecules. This in turn affects photochemical processes—nitrogen oxides and hydrocarbons interact with sunlight to produce nitric acid and tropospheric ozone" (see story above).

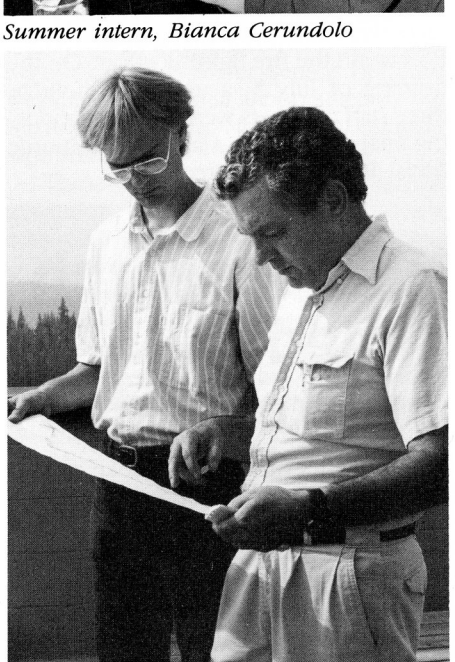
The experiment will compare three different types of air masses: a natural interior Alaska background, local Fairbanks pollution, and forest fire emission plumes.

"It relates to such scientific questions as effects on human health, the role of tropospheric ozone and soot in climate, and the cycles of tropospheric ozone, hydrocarbons, nitrogen oxides and aerosols," said Jaffe.

Undergraduate students working on the project are participants in summer intern programs at UAF. They are Alex Smith of UAF, Kathy Zelenski of the College of St. Benedict, Justin Glass of Trinity University, and Jenifer Kelly of Mt. Holyoke College. The two graduate student participants are Laura Willman, working under Dr. Shaw, and Tim Quakenbush, working under Gerd Wendler, professor of geophysics at the institute.

—Doreen Fitzgerald

EVELYN TRABANT



Tim Quakenbush and Glenn Shaw monitor the wildfire smoke experiment.

Smoke *from 1*

weather and climate, researchers study atmospheric gases and particles. One source of these constituents is biomass burning—either naturally occurring wildfire or deliberate fires such as those being set to clear the rain forest in South America.

To learn something from northern wildfire during the summer of 1990, Jaffe, Shaw and colleagues set up instruments on the 8th floor deck of the institute and at Poker Flat Research Range north of Fairbanks to study the characteristics of smoke particles and gases in the air.

"We've called this the Alaska Photochemical Experiment," Shaw said. "It's a small-scale, independent effort that may provide the groundwork for further research."

Working with Jaffe and Shaw is co-principal investigator Richard Stolzberg of the UAF chemistry department, two graduate students, and several student interns who are working at the institute this summer.

"This experiment is designed to investigate the fluxes and reactivities of photochemically active gases and aerosols produced from human activities, forest fires, and other natural sources, and under the influence of long hours of low intensity light," said Jaffe.

Atmospheric chemists study the composition of the gaseous envelope that

Gases *from 2*

it toxic to plants and animals at concentrations not far above normal. It is also a greenhouse gas, like carbon dioxide and methane, capable of trapping infrared radiation and thus contributing to global warming. Too much ozone down here is as bad, for different reasons, as too little up there—and unfortunately changes for the worse seem to be going on in both spheres.

Jaffe's goal is to identify the cause of the increased ozone the NOAA instruments recorded. It's not a local problem: concentrations of tropospheric ozone have been increasing all over the Northern Hemisphere. Compounds of nitrogen and oxygen are known to play a role in generating ozone. In more densely populated areas, nitrogen oxides are common pollutants; they're byproducts of combustion, and automobile exhausts are laden with them. (Many people are familiar with one of these compounds, nitrous oxide or laughing gas, because dentists use it as a mild anaesthetic.) Jaffe suspected nitrogen oxides might be implicated in the growing ozone concentrations near Barrow as well.

Though no one had attempted to measure nitrogen oxides near Barrow, it was a safe assumption that they couldn't be present in the Arctic in the quantities to be found near Los Angeles, for example. The first task for Jaffe and his coworkers, Richard Honrath and the UAF chemistry department's John Herring, was developing computer models to see if—in theory at least—low concentrations of nitrogen oxides could account for an increase in ozone. The models suggested that it is in just such comparatively clean locations as northern Alaska that ozone production from nitrogen oxides will be most efficient.

Their next task thus was to devise and build complex instrumentation capable of measuring very low concentrations of nitrogen oxides. With that successfully accomplished, during the summer of 1988 and spring of 1989, the team made the first nitrogen oxide measurements ever reported from NOAA's Barrow station. The measurements clearly showed that nitrogen oxides from pollution do reach the Arctic.

The next phase of the project, presently under way, is the careful analysis of data gathered so far. New measurement campaigns are in the planning stage. If, as seems likely, Jaffe's team establishes that nitrogen oxides are responsible for the increased ozone concentrations seen at Barrow, it will be one more bit of evidence that the most remote locations on Earth are no longer safe from damage begun in the most densely populated places. The atmosphere exemplifies a point that still trips up politicians: our planet is truly one world.

—Carla Helfferich

Earthwatch volunteers lend a hand to research

The answers to big questions can lie in small details. In one of Dan Jaffe's research projects, establishing the accuracy of models of global climate and atmospheric chemistry starts with little bottles of snow.

This spring, those bottles were in the gloved hands of nonscientists—volunteers in the Earthwatch program. "Sometimes," Jaffe said, "the most useful solution for a given problem involves extra people. This was one of those problems."

The problem in question is only one aspect of assistant professor Jaffe's overall interest in the chemistry of the high-latitude atmosphere (see story on page 2). In this case, he envisioned a two-year project in which air and snow samples from two sides of the Arctic—the North Slope in Alaska and Franz Josef Land, an island north of the Soviet Union—would be analyzed for certain significant pollutants. The results would not only provide more understanding of sources and removal mechanisms for these compounds, with their attendant implications for possible effects on ecosystems, but also would provide a check on the accuracy of global climate and chemistry models that have predicted a significant concentration gradient of these pollutants in the Arctic.

When Jaffe explained the possibilities to Earthwatch officials, they were interested. The Earthwatch mission is given as, "to improve human understanding of the planet, the diversity of its inhabitants, and the processes which affect the quality of life on earth." The Earthwatch practice is to give people who want to engage in that improvement a chance to do so directly. Volunteers support projects through money as well as hands-on contribution of effort, and they pay all their own expenses to boot.

The volunteers came through for phase one of Jaffe's project. Accompanied by an Earthwatch staff member, four of them arrived at the Fairbanks airport on April 29. There Jaffe met his team—all athletic (three cross-country skiers, one long-distance runner) and eager, but none trained in science. A realtor, an importer, a software engineer, and a builder—two men, two women, all from eastern states—had a day in town to learn the basics and arrange for supplies, then piled into a van for the drive north along the Dalton Highway.

The UAF Institute of Arctic Biology's station at Toolik Lake, on the northern face of the Brooks Range, was the team's first base camp. They took their first samples close to the station; on May 3, the skilled skiers of the group followed Jaffe to a peak some 15 miles away to collect samples of snow uncontaminated by immediate human activity.

On May 4, the group proceeded to Prudhoe Bay, taking samples in and around the North Slope's only industrial complex. "Representatives of ARCO and British Petroleum met us, gave us a tour of the facilities, and guided us on our snow sampling at Prudhoe Bay," said Jaffe. "The companies treated us very well and gave us complete access to do snow sampling wherever we liked."

Richard Honrath, research assistant in the UAF chemistry department and Geophysical Institute, took over for Jaffe on the return trip down the Dalton. The team gathered more samples on the way home, and returned to Fairbanks to begin getting their samples ready for analysis. The volunteers learned how to filter samples and analyze them for conductivity and for how acidic they were.

That completed the Earthwatch volunteers' portion of the first-phase work. UAF students performed further measurements, and Honrath and Jaffe carried out analyses. That process still continues, but preliminary results have already provided some information. Dust from the Dalton Highway contributes contaminants to snow even as far as two kilometers (over a mile) away from the road. The background samples collected on the long ski trip show concentrations of sulfate and nitrate about twice those found in interior Alaska; the suspicion is that these pollutants are residues of arctic haze, the far-traveling industrial exhalations of Eurasia. The Prudhoe Bay samples, with two to four times higher concentrations of all the measured contaminants, are a challenge to unravel: the researchers are trying to determine what portion of the pollutants may be attributed to arctic haze, to the local traffic, and to the industrial activities of the complex itself.

While analysis continues, Jaffe is also busy for next year's part of the study. "The Soviets are definitely interested," he said, "but it really depends now on what they can work out." Interested also are some Earthwatch volunteers, who hope they can continue contributing to science in the north—on either side of the Arctic.

—Carla Helfferich



This cumulonimbus cloud, or thunderhead, was photographed by Glenn Shaw, a serious critic of climate models without clouds.

Clouds: a vital piece of the climate puzzle

Glenn Shaw, atmospheric scientist, astronomy buff, and professor of geophysics at the Geophysical Institute, is a person of strong opinions.

"How can anyone call it simply the Ocean Planet?" His finger stabs indignantly at a print of an astronaut's prized color photo, the Big Blue Marble of the home world hanging in black space. "Just look at it—clouds everywhere. It's obviously the Ocean-Cloud Planet." The finger traces white bands swirling thickly around the marble. "And credit me with that name, would you? It's already starting to catch on."

Many of Shaw's interests have started to catch on. He still endures some razzing from colleagues for his showmanship on the public television documentary covering arctic haze (see *Quarterly* v. 7, no. 4). Shaw definitely helped bring the term—and the problem—to public attention. Now he's helping generate fuss about another timely topic.

"Climate models right now, even the supposedly best ones, aren't worth much," he said. "They're not good enough because no one's found a way to deal accurately with clouds. So they get left out, or stuck in only as crude approximations. Total nonsense."

The core problem is feedback: cloud cover would certainly be affected by a changed climate—somehow—but cloud cover could also buffer climate change—again, somehow. Most Alaskans develop some feeling for the complexity possible just by living through a set of seasons in the north: When a cloud bank arrives in winter, the weather warms up; clouds in summer cool things down. Physicists have a far longer list of cloud effects toward both cooling and heating of the earth below.

Trying to decipher how such processes would interact and tip the global atmospheric temperature balance one way or another is complicated by the enormous amounts of energy that clouds absorb, transport, and release. To convey the proper image of that amount to students, Shaw has come up with a vivid unit of measurement: the 18-wheeler.

"It's what anthropologists call a barterable term," he said. "To get a feeling for something, it can be helpful to convey it in terms that are intuitively perceptible." Thus he asks students to envision a fully loaded tractor-trailer wheeling along at high speed: that's 80,000 pounds moving at 65 miles an hour. Then he asks them to consider a single thunderhead, a cumulonimbus cloud of 10 kilometers diameter with its base 3 km above the ground and its top at 10 km altitude, translated into 18-wheeler amounts of energy.

The results are awe inspiring. The updraft kinetic energy, the power in the column of air rising within that single cloud at speeds up to 20 meters every second, is equivalent to 9100 18-wheelers. The potential energy of lifting, assuming that all the water vapor composing the cloud evaporated from a source directly below it, matches that in 680,000 speeding, fully loaded 18-wheelers. The heat of condensation, the energy released by condensing the liquid droplets in that simplified cloud, equals 2,600,000 18-wheelers.

And what might be considered the negative energy of that cloud, the amount of solar energy it intercepts over a one-hour lifetime, is in 18-wheeler terms a stunning 13,000,000.

"Remember," Shaw said, "that's only one cloud, not a whole cloud system. And it doesn't take into account all energy terms—thermodynamic expansion of air, for example, or lightning strokes." It also doesn't take into account a feature of clouds implicit in the one-hour lifetime given the idealized thunderhead analyzed above: they are what Shaw describes as "frantically varying entities."

No wonder climate modelers grow miserable when confronting the reality of clouds. Yet, in his less rabble-rousing moods, Shaw admits they're making some progress: "At least someone got some real numbers." The someone is actually a team of researchers who used satellite-borne instruments to determine that during April 1985, the cooling caused by clouds' reflecting solar energy back into space exceeded the heating they caused by trapping infrared energy being radiated from the earth's surface. What Shaw calls "cloud refrigeration," the increase in Earth's albedo that reflects away heat, amounted to minus 44 watts per square meter; the infrared radiative heating due to clouds was 31.3 watts per square meter.

Yet that's only one reliable number in a marvellously messy situation. It looks even messier when the climatologists turn from measurement to prediction. "It's the feedback problem again," said Shaw. "If global temperatures go up, more water will evaporate. Water vapor is a greenhouse gas, just like carbon dioxide. So increased water vapor will feed back into the greenhouse effect and amplify the warming. But with increased atmospheric water vapor, one might expect water content of clouds to increase. Clouds with higher water content are more highly reflecting, so this effect would reduce the solar radiation absorbed by the Earth-atmosphere system. Now, will these effects cancel one another out, or will one prevail? Which one?" Shaw notes that estimates now tip the balance toward slight negative feedback—a cooling effect—"but they're estimates."

Other estimates focus on specific portions of the globe. Over the Great Plains of North America, the general circulation models predict that the greenhouse effect will be accompanied by drought. The tendency toward drying decreases cloudiness, which would lead

to increased solar heating of the soil; that means more drying, more clear skies, and yet further drying—another unpleasant feedback possibility. In the tropics, the warmer oceans accompanying the buildup of carbon dioxide and other greenhouse gases are expected to increase the height of the tropical cloud systems. Higher clouds are more efficient on the warming side of the balance, so the net result is positive feedback and an amplification of the greenhouse warming.

Higher clouds, in fact, will be the pattern worldwide—or at least will be if the computer simulations in the present crop of general circulation models covering the greenhouse warming prove true. This has especially interesting implications in the Arctic, where the temperature increase is expected to be greatest. Here the feedback cycle includes a lessening of the icepack, which means more open water to feed water vapor into the air, which means in turn more raw material for those high, heat-holding clouds. It would seem that the ultimate point of the positive feedback would be palm trees lining the streets of Barrow.

"Of course," Shaw said, "those same models say there will be less cloudiness overall. Most people take that to mean more sunshine reaching the surface and thus an enhancement of the heating. But consider what happens at night when the sky is clear—the planet just radiates heat away. Desert nights are cold. Now, when we've got several months straight of night in the Arctic, we have a fine potential radiator. The presence of clouds, and the kinds of clouds present, will have an enormous effect on the heat balance at high latitude."

The extent and kind of cloudiness at high latitudes may also play into another of the possible complex feedback cycles. Snow and ice have a very high albedo—they don't absorb solar energy, they reflect it away. If the warming climate leads to more atmospheric moisture and water-laden clouds over the right terrain at the right time of year, that in turn will lead to more precipitation adding to the area covered by snowpacks and icefields: negative feedback.

Fertile high-latitude seas harbor a life form that may be part of a biologically driven cloud feedback loop. Phytoplankton produce sulfur-containing gases as a byproduct of their physiological processes. Through a chain of chemical reactions, the gases eventually oxidize in the atmosphere into sulfuric acid droplets. These droplets serve as nuclei for cloud condensation. Like all plants, phytoplankton need sunlight to live; if they thrive excessively, they may generate enough cloud to cut off their own light.

"There's a terrific amount of work to be done," said Shaw. "We know more every day about the human activities forcing climate change, from burning fossil fuels through cutting rain forests. We have to recognize that our ignorance of clouds' response to such changes and the climate's response to new cloud patterns constitute the single largest obstacle to intelligent forecasting of climate change."

—Carla Helfferich

Satellite carries chemical release experiments

A satellite carrying experiments designed by two Geophysical Institute researchers was launched July 26 from Cape Kennedy, Florida, by an Atlas-Centaur rocket.

Eugene Wescott and Hans Stenbaek-Nielsen are principal investigators for several chemical release experiments aboard the Combined Release and Radiation Effects Satellite (CRRES). The scientists, who are both professors of geophysics at the institute, are working on the project under a $1.5 million contract with the National Aeronautics and Space Administration (NASA).

CRRES is part of a major space plasma program to study the space environment surrounding Earth and space radiation effects on satellite electronic systems. The satellite contains 24 NASA chemical-release canisters for experiments that will be carried out at various altitudes as it orbits the earth.

"Chemical releases are powerful tools for use as tracers in the ionosphere, magnetosphere, and interplanetary space, and for modifying the ambient space environment in a controlled way," said Stenbaek-Nielsen.

Above the earth's atmosphere, the environment is the realm of magnetic fields, electric fields, radio waves, and atomic particles. There, a state of matter exists called plasma, where positively charged atoms share space with free negatively charged electrons. The plasma conducts electricity and interacts strongly with electric and magnetic fields.

Although scientific work over the last 30 years has produced a model of the essential features of the earth's magnetic field and plasma environment, there are many unanswered questions about processes and interactions in the ionosphere, which begins at approximately 80 kilometers altitude, and the magnetosphere, which extends from approximately 100 kilometers out to interplanetary space.

"Because magnetic field lines are invisible to the eye, they can normally be seen only when auroral particles illuminate them in the ionosphere, at altitudes of 100 to 300 kilometers," said Wescott. "However, chemical releases enable us to *paint* magnetic field lines in space and observe the plasma motion. This is roughly analogous to sprinkling iron filings on a piece of paper over a magnet to make the orientation of the magnetic field visible."

Knowing the satellite's orbit to a high degree of accuracy, the researchers will

continued on 6



In April 1990, the first CRRES-type canister release from the PEGSAT satellite was photographed after 48 seconds. The violet, striated cloud is ionized barium distributed from the release point along the path of the expanding green neutral barium gas shell. Pre-CRRES releases were made to study the release plasma and auroral physics; low-altitude CRRES releases are expected to look similar. This release, over Great Slave Lake, Canada, was photographed by Gary Emerson from the GI optical site at Stony Rapids, Saskatchewan.

Range upgrade office opened

The extensive upgrade of Poker Flat Research Range has mandated the creation of a project office.

Stan Schwafel, who has worked with the institute's technical services since 1979, is project manager for the upgrade. He serves as liaison with state and federal agencies and university departments and, within the institute, coordinates the work of individual researchers who are responsible for various scientific aspects of the project.

Among the facilities to be renovated or rebuilt during the estimated $30 million upgrade are rocket assembly and launch areas, communications, and the institute observatory.

Assisting Schwafel is technical secretary Deborah LaBarre. The upgrade office is located in room 615 Elvey Building and can be reached at 474-7413.

Manager hired at Poker Flat

A manager has been hired to oversee the operation of Poker Flat Research Range, the institute's sounding rocket and observatory facility. Jack Dillard, who joined the staff July 1, brings to the position 28 years experience in engineering and technical management, particularly in the aerospace and aircraft industries.

During an interview shortly after his arrival, Dillard said he was attracted to the position by the extensive upgrade that began at Poker Flat this spring.

"If you've got the best, the scientific community will use it," he said.

The federally-funded upgrade is designed to create a world-class research facility in step with advances in rocket and observation technology.

As manager, Dillard will be responsible for all launch-related and administrative activities at the range. He was formerly vice president of engineering for the Dee Howard Company/Aeritalia of San Antonio, Texas. His background includes ten years with the Martin Marietta Corporation, where he was manager of manufacturing engineering before joining Dee Howard in 1988.

Although small compared to military facilities, Poker Flat is the only high-latitude range on U.S. soil and has the most extensive land-based recovery area. Since it was established in 1969, 233 large research rockets have been launched for upper- and middle-atmosphere experiments.

JIM COCCIA



Syun-Ichi Akasofu and Jack Dillard review the launch facilities at Poker Flat Research Range.

Future developments on agenda

A group of distinguished government and military officials was at Poker Flat Research Range July 8 to review the sounding rocket launch facility at 30-mile Steese Highway north of Fairbanks.

Visiting the range were U.S. Senators Ted Stevens (R-Alaska), Robert Kasten Jr. (R-Wisconsin), and Charles Robb (D-Virginia), General Samuel Ebbesen of the U.S. Army 6th Light Infantry Division, Adjutant General John Schaeffer of the Alaska Air National Guard, and other representatives of the Army, National Guard and Air Force.

The research range is currently undergoing the first phase of a major upgrade. Funded by federal appropriation, the improvements to physical plant and equipment will increase capabilities for sounding rocket research and ground-based observations.

The visitors were briefed on the project by institute director Syun-Ichi Akasofu and Charles Deehr, the scientific director of the research range. Also attending from the university were range manager Jack Dillard, upgrade project manager Stan Schwafel, range safety officer Daniel Osborne, operations controller Mary Farrell, and Luis Proenza, vice chancellor for research at the University of Alaska Fairbanks.

Another federal project, the proposed High-frequency Active Auroral Research Program (HAARP) was also presented to the guests. HAARP is managed by the U.S. Air Force Geophysics Laboratory and the U.S. Office of Naval Research.

The institute is involved in site development, scientific participation, and facility management for the program, which will develop experiments related to the modulation of electric energy in the earth's ionosphere at altitudes of approximately 50 to 500 miles.

Experiments *from 5*

determine the exact point a chemical release should occur. Twenty-five minutes before release, the canisters are ejected by springs from the satellite. To protect delicate surfaces and instruments, the canister will be three or more kilometers away from the spacecraft at the instant of ignition.

The institute research includes two critical velocity ionization experiments scheduled for September 10 and 12 above the vicinity of American Samoa. Later there will be several high-altitude auroral releases over Canada (January-February 1991) and a sequence of low-altitude releases over the Caribbean in June 1991. Observations on the South Pacific releases will be made from two aircraft instrumented by the institute and from a land-based site on Samoa.

Getting there may be half the fun, but for researchers who rely on rockets and satellites, a trip to the ionosphere can be fraught with problems and delays.

"These experiments were scheduled to be carried out from the space shuttle in 1986, but were delayed after the shuttle failed," Stenbaek-Nielsen said. "Now, based on orbits we already know for the CRRES satellite, we are able to schedule the critical ionization velocity experiments for September."

Wescott and Stenbaek-Nielsen are also co-investigators on a number of other releases for the CRRES program. The space plasma research is sponsored by NASA and the Department of Defense.

—Doreen Fitzgerald

GI Notes...

NEW FACES—Laura Willman is working as a research assistant with Glenn Shaw; Fred Sigernes, a graduate exchange student from Norway, is working with Chuck Deehr; Georgina (Gina) Price is doing post-doctoral work with Roger Smith; Craig Lingle has joined the staff as research associate professor and will be working with Gunter Weller; Jack Dillard is the new range manager at Poker Flat.

APPOINTMENT—Director Syun-Ichi Akasofu has asked Gunter Weller, professor of geophysics, to serve as his deputy director. Weller is project director for the Alaska Synthetic Aperture Radar (SAR) Facility and scientific director of the UAF Center for Global Change and Arctic System Research. He also chairs the Polar Research Board for the National Academy of Sciences. During the years 1978 to 1986, Weller was associate director and deputy director of the institute, where he has been a faculty member since 1968.

NEW LOCATION—The UAF Center for Global Change and Arctic System Research is now at 208 O'Neill Building, telephone 474-5698. The center coordinates interdisciplinary work related to the Arctic and its role in global environmental change. It is staffed by scientific director Gunter Weller, associate director Laura Lee McCauley, and administrative assistant Deby Chapman.

GEODATA CENTER—Katherine (Katie) Martz retired from her position as supervisor in April. Her institute career began in 1972 when she joined the staff to work on the NASA Earth Resources Technology Satellite (Landsat) project. She began supervising the archives (now GeoData Center) in 1976 and became well known for the informed and friendly assistance she offered users of the image files. Rose Watabe has been named GeoData Center specialist to oversee center operations.

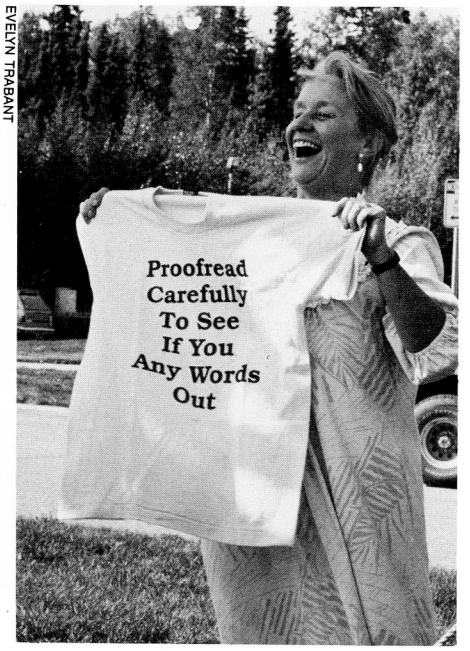
FINLAND—The recently formed Arctic Centre, a research institute at the University of Lapland in Rovaniemi, Finland, has asked William Sackinger of the Geophysical Institute to chair its first advisory board. Sackinger specializes in geophysics and electrical engineering at UAF and has conducted research on a broad range of problems related to development activities. He has been a UAF faculty member since 1970. Sackinger also coordinates the cooperative research agreement between UAF and the Technical Research Centre of Finland.

PUBLICATIONS—Carla Helfferich retired from full-time editorial work in July after more than a decade as the institute's guardian of English. She nurtured numerous institute publications into print and was editor of *The Northern Engineer* from 1976-1986. As managing editor of the University of Alaska Press since 1985, Helfferich directed its revitalization when it was transferred to University of Alaska Fairbanks. She will continue writing "Alaska Science Forum," the popular weekly column provided by the institute and published in Alaskan newspapers.

VOLCANOES—Institute volcanologist Juergen Kienle is co-editor of *Volcanoes of North America, United States and Canada*, published by Cambridge University press. Kienle worked with Charles Wood of the Johnson Space Center to compile this encyclopedic work, which includes contributions from 81 authors. The 350-page volume covers the volcanoes of Alaska, Canada, the western United States, and Hawaii, and is well illustrated with maps and photographs.

GEOCARE—A volunteer Golden Days food fest (breakfast, lunch and ice cream sale) netted $1,000 for the institute's employee assistance fund. The activities included a drawing for a lithograph donated by Fairbanks artist Ray Sandberg. Evelyn Trabant, chairperson of the GeoCare Committee reports that the GI staff has raised more than $8,000 since the fund was established 18 months ago to help coworkers meet unusual expenses arising from personal emergencies. Three $1,000 grants have been made from the fund.

EVELYN TRABANT



Carla Helfferich displays a remembrance presented to her by Carl Benson during the institute's Golden Days celebration.

SEA ICE—William Sackinger and Martin Jeffries are editors of *Port and Ocean Engineering Under Arctic Conditions*, a three-volume work containing 131 refereed papers on advances in arctic science and engineering, 1977-1987. 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, GI, UAF, 99775-0800.

EVELYN TRABANT



Jeanne Hume directs the lineup during an informal Golden Days costume contest at the institute.

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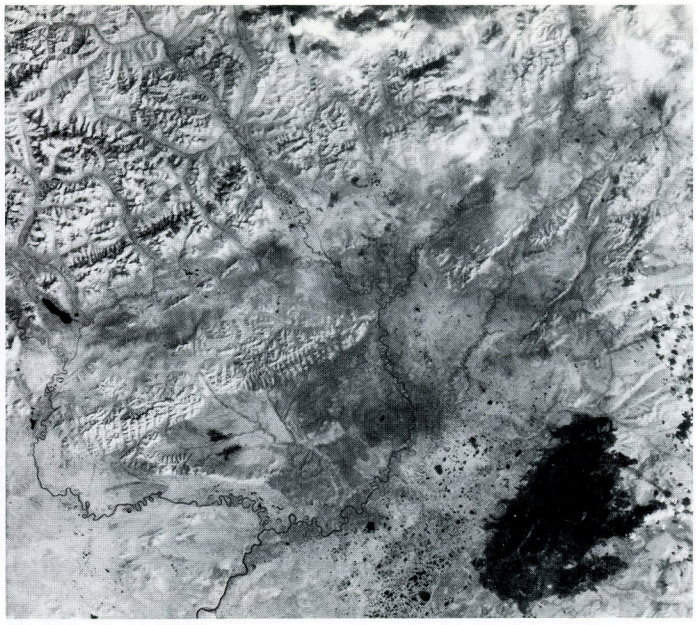
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Aerial photographs such as this taken in the Bettles area are used to plan an attack on a wildfire. Images from the Alaska High-Altitude Aerial Photography Program are archived at the institute.



Landsat images can give a day-to-day picture of the course a wildfire takes. In this image, the burned area of the 1990 Kanuti Flats fire is the dark area at lower right.

Images *from 1*

By mid-July, with wildfire acreage increasing daily, the number of fires, atmospheric conditions, haze and ground smoke made it difficult to map fire boundaries by standard means, and the fire service requested satellite imagery from the institute's Quick-Look Project.

"Landsat satellite imagery is acquired in near real-time through a direct downlink at the institute," said research technician Greta Reynolds. "Quick-Look is recorded in four spectral bands, two visible and two near infrared. By processing the imagery in one of the near infrared bands, the effect of low-level smoke and haze is reduced so that burn area boundaries can be mapped."

The fire service and the institute began a cooperative effort to provide satellite images, fire boundary maps, and acreage estimates to the fire service mapping section.

"Working with a BLM list of fires, we were able to view the data, produce an image, and generate a map within four hours of the time the satellite passed over a given area," she said.

After the data is acquired, it is enhanced and enlarged to a scale of one inch to four miles, which provides optimum interpretation of the burn area for mapping purposes. Once a burn area image has been produced, overlays of the fire boundary are generated that can be registered on USGS Quad sheets. After the maps are made, acreage estimates are run using an overlay and grid system. A final map of the fire boundary with acreage estimates (scale 1:250,000) is produced.

"One set of maps and images is given to the fire service mapping section at Ft. Wainwright and another is faxed to the regional office responsible for the fire covered," said Reynolds. "During this fire season we worked predominantly with the Galena and Central offices."

New computer imaging techniques at the institute have introduced another use for satellite imagery—assessing the overall effect of a season's wildfire throughout the state. The technique uses tapes of digital data from the Advanced Very High Resolution Radiometer sensor onboard weather satellites that are operated by the National Oceanic and Atmospheric Administration.

"These images are of lower spatial resolution, but a larger geographic area is covered," Reynolds said.

The color computer images produced can be manipulated in a variety of ways to enhance certain features in distinct ways, depending on what kind of information is desired. The images are created by the Alaska Data Visualization Analysis Laboratory at the institute.

—Doreen Fitzgerald

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