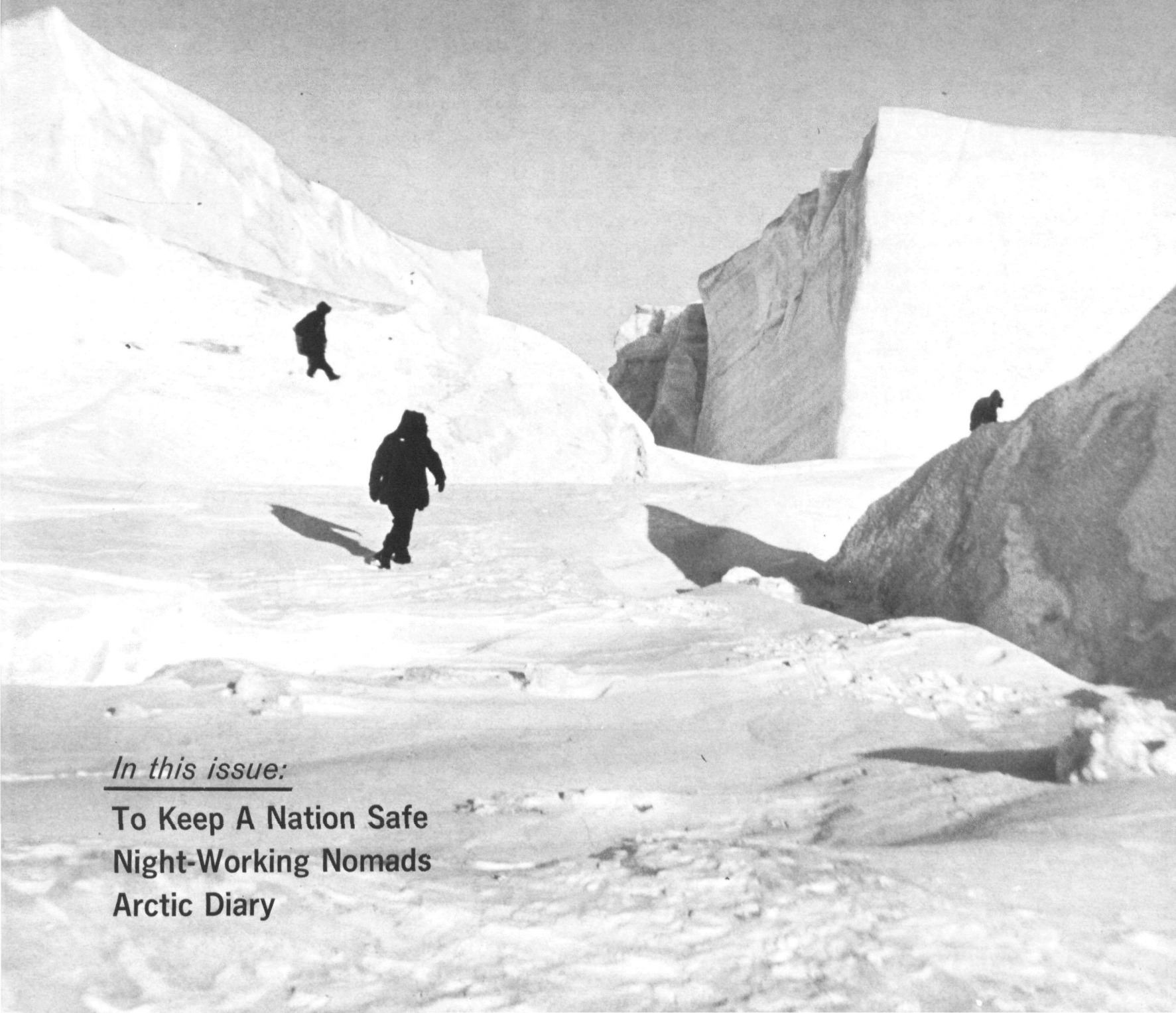


Second Anniversary Issue

# essa world



In this issue:

To Keep A Nation Safe  
Night-Working Nomads  
Arctic Diary

# **National Oceanic and Atmospheric Administration**

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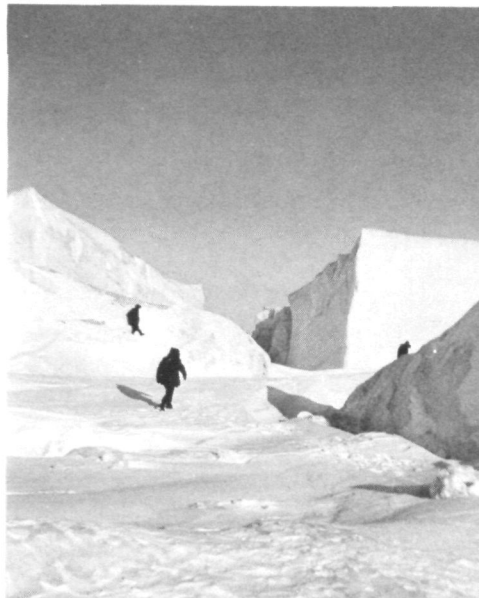
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Dr. Werner A. Baum, Deputy Administrator

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**COVER**

The cover photo, by Sumner Barton, was taken at Station Alert, northernmost permanent weather station in the world. Through the iceberg walls lie the Arctic Ocean and, 500 miles due north, the Pole.



**STANLEY B. EAMES**  
Director, Public  
Information

**MAX M. CHESY**  
Art Director

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**DR. WERNER A. BAUM**  
DEPUTY ADMINISTRATOR

# A Look Back, a Look Ahead

## An Editorial

Any merger, private or governmental, demands a unique effort from those upon whom its success depends.

What about our own merger, two years after the fact? Where do we stand, at least in the eyes of one who has only recently become an insider?

Obviously, I am biased, having joined ESSA in the firm conviction that its concept is eminently sound. ESSA is succeeding; it will continue to succeed — but the degree of that success rests with every man and woman in the agency.

In ESSA, we have an exceptionally challenging situation — challenging because the opportunities it presents mean so much to our Nation. It was born of already-great organizations with diverse missions; under its mandate from the President, ESSA and its components possess the mechanism for brilliant, even historic accomplishment.

Much has been accomplished. To cite but some examples: Members of our Commissioned Corps hold responsible posts throughout ESSA, Weather Bureau communications circuits carry earthquake information, weather satellites will soon be gathering vital information for ITSA and subsequently will become completely “environmentalized”, and joint computer usage makes available more data processing power than could be afforded by individual units.

These are significant steps, but they mark only a beginning. In the final analysis, the merger will succeed not on such means toward an end but on achievement of the end itself: better information for the Nation through improved understanding of our environment, and effective application of that understanding and of our human and material resources to the products and services we provide.

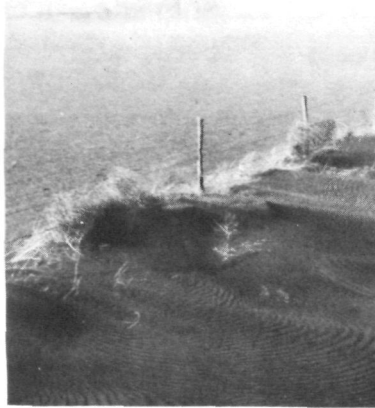
The ESSA concept holds great promise for enhancing the Nation’s health, wealth, safety, and welfare. But this promise will be fully realized only if we, all of us, understand the ESSA concept, believe in it, live it in our day-to-day work, and continuously seek ways to implement it, and if we do this for a much longer time than two years.

The most precious commodities to ESSA’s success at this juncture are spirit and ideas. Without them, money is of little avail. If they exist, and are communicated, the necessary money will certainly be forthcoming.

Both spirit and ideas must be generated throughout the organization. Each of us 10,000 or more can contribute both. Let’s get on with it so we may be even more successful, so we may share in the satisfaction of having done something new and better. □

This summer, ESSA launches a bold, imaginative plan

# TO KEEP A NATION SAFE



On Palm Sunday, 1965, a series of incredibly savage tornadoes ripped through the Midwest. They killed 272 persons, injured hundreds more, and inflicted property damage of more than \$250 million.

President Johnson surveyed the scenes of destruction and promptly ordered that the Department of Commerce assume the lead in devising the best possible disaster warnings for the public safety.

From the tragedy, and the President's concern, grew NADWARN—the Nation-wide Natural Disaster Warning System, designed to cut the toll of death and damage visited annually upon us not only by tornadoes but by every other manifestation of nature's fury.

The Weather Bureau had given excellent predictions that tornado-breeding conditions existed on that fatal Sabbath; even so, the fatality statistics were convincing testimony to the need for a hard look at every possibility for increased protection.

For every state experiences natural disasters. Hurricanes, floods, tsunamis, blizzards, forest fires, earthquakes, local storms and other weather phenomena cost the nation between 500 and 600 lives and more than \$11 billion in damage during an ordinary year. The impact in human suffering and sorrow is, of course, past all calculation.

Representatives of six Federal agencies joined in forming the Natural Disaster Warning Survey Group, which immediately launched an intensive four-month study. Its recommendations resulted in the NADWARN System plan, announced by the President on March 1, 1966.

The NADWARN System is based on the broad Government services and community cooperation that have long been employed to protect the nation against the anger of the elements. Its immediate aim is to expand and intensify services that are already established, and to concentrate on technically feasible improvements in detection, analysis and communications that need only manpower and resources to be put to use.

After identification of problems requiring research and development, NADWARN will benefit from the cooperation of ESSA's Institutes for Environmental Research in their solution. The ultimate system is designed to distribute by every

practicable means timely and effective warnings of the occurrence of natural disasters, to educate and warn the public so it may better escape their consequences, and to support the efforts and planning of relief agencies when disaster does strike. It continues to rely on the excellent cooperation of the mass media in disseminating the warnings to the ultimate user—the public.

NADWARN now is more than a plan. The first major steps toward its implementation have been announced by Dr. Robert M. White, ESSA Administrator.

This year, ESSA will purchase new detection devices, expand its communications network and initiate new river forecast services. These improvements will give residents of 25 states earlier warnings of impending natural disasters and provide additional time for action to protect life and property.

The most important step to be taken in 1967 is the establishment or expansion of ESSA's teletypewriter circuits in states with the highest tornado frequency. These circuits, called the ESSA Weather Wire network, will bring warnings directly to the press, radio, and television for rapid dissemination to the public.

Statewide circuits are already in operation in Arkansas, Indiana, Kentucky, New Jersey, Oregon, and South Carolina, and similar communications systems serve portions of Alabama, Florida, Georgia, Idaho, Illinois, Louisiana, Maryland, lower Michigan, Mississippi, Missouri, Tennessee, Texas, Virginia, and West Virginia. Originally set up as part of the Weather Bureau's agricultural weather service in these areas, the circuits will now be incorporated into the ESSA Weather Wire network.

By mid-June, ESSA Weather Wire circuits were scheduled to be established throughout the States of Iowa, Kansas, North Carolina, Ohio, and Oklahoma, and the present circuits in Alabama, Georgia, Illinois, Louisiana, Mississippi, and Missouri will be extended statewide. Also, the service will be extended to the remainder of lower Michigan, to southern Wisconsin, the far western end of Florida, and all of Texas except for the extreme southwest portion.

ESSA Weather Wire circuits will link ESSA Weather Bureau stations within each state, and lines will be extended so that the service can be made available to any daily newspaper, radio station, or television station within the area covered by the circuit. The only cost to these media is for installation and rental of teletypewriter receiving equipment and local line charges to connect to the statewide teletypewriter circuit. Subscribers to the ESSA Weather Wire can render a valuable public service and protect lives and property by helping to disseminate disaster warnings.



BY PAUL H. KUTSCHREUTER  
Director Of User Affairs

In addition to speeding the distribution of natural disaster warnings, the ESSA Weather Wire circuits will extend the benefits of regular 24-hour-a-day weather services throughout the states where they are established. On a daily basis, they will carry a full schedule of weather reports, forecasts, and special advice for agricultural and forestry interests to an additional 789 communities which do not now have such services.

Eight weather radar instruments will be purchased for installation in about two years in the vicinity of Garden City, Kansas; Grand Island, Nebraska; Midland and San Antonio, Texas; Springfield, Missouri; Waycross, Georgia; Nashville, Tenn.; and Bristol, Virginia/Tenn. These new radars will be equipped with emergency power plants to permit continuous operation when local power fails.

Weather radar vastly extends the area which can be observed from a single location and supplies vital information for public weather warnings and for short-range forecasts for air routes, airports and metropolitan areas. Day and night, the radar screen presents a continuous picture of the location, extent, and intensity of thunderstorms, rain, snow, hail, and other important weather phenomena within a radius exceeding 100 miles. Radar has demonstrated its value most dramatically in tracking severe storms and has contributed greatly to the improvement of storm and flash-flood warnings.

Equipment to receive and display information from nearby radars will be purchased for later installation at about 25 ESSA Weather Bureau offices, providing a picture of area weather not previously available to most of these stations. In some places, the remote displays will replace obsolete, short-range radars.

A comprehensive river forecast service for the entire Delaware and Susquehanna river basins will be established this year

by ESSA in cooperation with the Delaware River Basin Commission, the Commonwealth of Pennsylvania, the State of New Jersey, the U. S. Army Corps of Engineers, the U. S. Geological Survey, and other participating agencies. In the past, river services in this area have been limited to issuing flood forecasts and warnings. However, the opening of a River Forecast Center at Harrisburg, Pa., in 1967, and the expansion of the Trenton, N. J., office will not only improve flood warnings, but also will provide streamflow and water supply forecasts which are needed for management decisions in recreation, pollution control, and water supply programs.

A new regional tsunami warning system will be established in Alaska this year to provide more rapid watches and warnings of these destructive seismic sea waves. An observatory now being constructed at Palmer, Alaska, will serve as the system's regional headquarters. Using telemetered seismic data from three sites near Palmer and from observatories at Adak, College, and Sitka, the Palmer Observatory will be able to issue timely tsunami watches and warnings soon after a major earthquake occurs in the region. As part of the developing system, new recording equipment and communications systems will be installed, and a network of seven telemetering tide stations is nearing completion.

ESSA's space disturbance forecast program will provide more effective services for telecommunications, high-altitude flights, and space flights, as a result of increased effort in collection, analysis, and dissemination of data associated with solar disturbances.

An expanded research program to advance weather hazard forecasting techniques and observing equipment is being conducted. These efforts include the development of better techniques of forecasting tornadoes and severe thunderstorms and of predicting the intensity of lightning, wind gusts, and hail associated with them. Work will begin on the development of observing equipment capable of withstanding the destructive forces of hurricanes and tornadoes. New instruments for measuring various aspects of hurricanes and severe storms will be added to ESSA's research aircraft. A planning study will seek new ways to further improve ESSA's warning system. As progress is made through these research efforts the results will be applied in future phases of the NADWARN program.

In summary: the NADWARN program is not a static system. It is a dynamic and flexible system designed to incorporate new and improved techniques as they are developed and to apply each year's operational experience in designing next year's program. □



# The Night-Working Nomads

who take the nation's measure

**N**ewspapers across the Nation are printing this intriguing question:

"Have you been seeing men wearing orange-colored vests and holding orange-colored umbrellas over their heads on a bright, sunny day?"

"Have you seen tall steel towers which sprang up suddenly on the landscape and then as suddenly disappeared? Perhaps you've noticed large white balloons dangling high in the air between them."

"And if you've been up in the dead of night, have you witnessed strange lights blinking between the towers?"

And the answer —

"No, these are not Martians, nor spies, nor unidentified flying objects. They're a mobile field party of the Coast and Geodetic Survey, and they're busy surveying the land."

They lead a nomad life, traveling with their wives and children as their work requires. Like true nomads, they follow the sun. The summer warmth takes them to Northern climes. When the air grows blustery and cold and snow dots the landscape, they move South.

Since 1871 they've been determining with fantastic accuracy the elevation of thousands of locations throughout the United States and the distance between them. At each point (called benchmarks) a bronze marker is imbedded in cement or bedrock. More than 500,000 of these markers have been placed in the U.S., its possessions, and the Philippines.

Various types of mobile parties travel around the country. The major groups, and the largest, are triangulation parties, which determine linear distances and latitudes and longitudes, and leveling parties, which determine elevations.

## Men In Orange Vests

Members of the leveling parties which operate along highways generally wear orange vests to warn oncoming traffic of their presence. The orange-colored umbrellas are not for their protection from the elements, but provide shade for the surveying instruments whose accuracy would otherwise be affected by the sun's rays. Those who work along railroad right-of-ways wear khaki-colored vests and use khaki-colored umbrellas.

In calculating heights above sea level, the leveling party starts from a tidal benchmark on the shore. Then the crew moves inland, sighting on a level rod step by step. The height of inaccessible peaks is calculated by mathematics.

## They Work by Night

The triangulation parties work primarily at night, in contrast to the leveling parties, whose operations are conducted

BY RAYMOND WILCOVE, Coast & Geodetic Survey

during the day. The triangulation parties make extensive use of demountable Bilby steel towers in order to see over obstacles and make up for the earth's curvature. These triangular towers can range from 37 to 116 feet tall and consist of a tower within a tower. The center one holds only the surveying instruments so the personnel can stand on the outer tower platform without disturbing the delicate adjustments. A crew of five or six men can put up a tower in a day and dismantle it in a few hours.

The survey crews operate from the towers at night because the atmosphere then is clearer. The instruments they use are the theodolite, which measures angles, and the geodimeter, which measures linear distances.

The geodimeter, which utilizes the speed of light for measuring, is so accurate that distances are determined to within one part in a million (an error of one mile in a million miles).

Indicative of the thoroughness of their work, the men repeat their readings 32 times and compute the mean of their findings to one-100th of a second. This amounts to one-300th of an inch as observed from a distance of one mile.

### Those Mysterious Lights

The men in their towers communicate with each other by Morse code. Thus the blinking lights which often mystify observers.

Blimp-like helium-filled balloons, about 12 feet long and four feet in diameter, are flown near the mid-point of the line being measured to obtain the temperature of the air through which the light beams pass. Light travels slower in colder air.

The use of mobile field parties began shortly after World War I, but was very limited then. Parties were sent out from Washington whenever funds were available and the weather permitted. They did a specific task and then returned.

The present system of permanent, year-round mobile parties began in the early 1930s. Since the men were away from home all the time, married personnel took along their families.

There are now 25 to 30 mobile parties, each consisting of from two to 30 Coast Surveymen. Including women and

children, some parties may contain as many as 70 people, equipped with scores of government trucks and office trailers and privately-owned house trailers. The men receive no financial support for their families. They do receive a per diem subsistence allowance, smaller than that received by other government personnel who travel only occasionally.

The large parties may remain at one location from one to three months. During their stay at each locale, they become part of the community, attending its schools and houses of worship, participating in its civic events, and adding substantially to the economic well-being of the community.

### On The Move

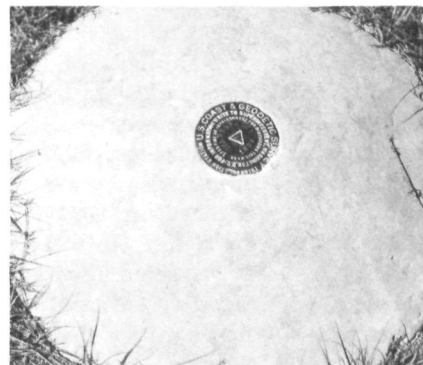
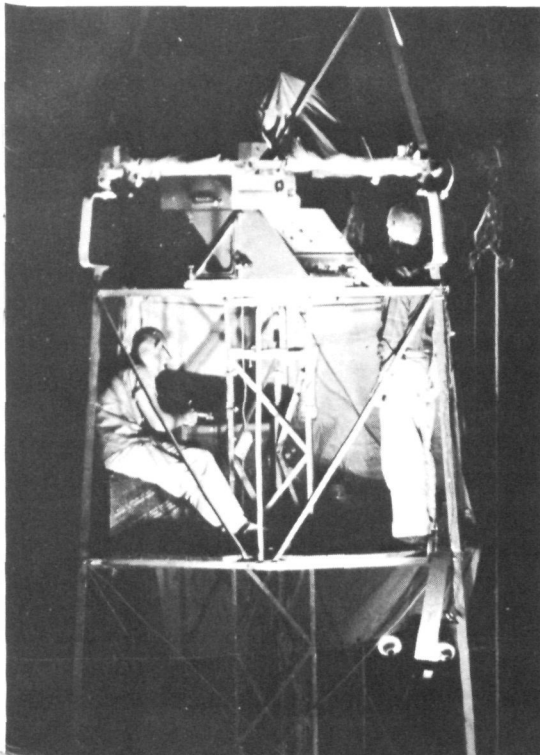
The constant moving about — one family lived in Minnesota, Illinois and Florida in one year — poses a problem in schooling for the children. In one family, Rita, a high school senior, had previously attended 57 schools; Pat, a junior, 42; Jean, a fifth-grader, 19; and John, in his first grade, two.

There are hardships and dangers on many of the trips. One officer was crippled by Moro knives in the Philippines, the leg of another was crushed in the jaws of a crocodile, and three men who ventured away from a base camp in the Arctic were never seen again.

The nomadic existence of the field parties often has its pleasant surprises: early this year Triangulation Party G-18, headed by ESSA Lt. John W. Carpenter, arrived in Childress, Texas, from Alamogordo, New Mexico. Press interest in field parties is almost always keen, and this was no exception: the *Childress Index* and the *Childress Reporter* covered the arrival exhaustively, as did Station KGNC-TV of Amarillo and Station KBGH of Memphis.

All of this was most pleasant, but not unusual. What was extraordinary was the way the community turned out to welcome Lt. Carpenter and his group.

On March 13 all members of the party, their wives and children were given a reception by the Childress Chamber of Commerce. And, as Lt. Carpenter told Chamber President Robert Carter: "Now I know what Southern hospitality means." □



(Top) Bench mark at Meades Ranch, Kansas, geographic center of the United States.

(Left) Survey crew taking night measurements with a geodimeter.

(Right) ESSA Lt. J. W. Carpenter and Chamber of Commerce President Robert Carter at a reception for field party and families, Childress, Texas.





Webster defines geodesy as "That branch of applied mathematics which determines the exact positions of points and the figures and areas of large portions of the earth's surface, or the shape and size of the earth, and the variations of terrestrial gravity."

*Six lady geodesists  
prove that no  
place, but  
no place  
is*

BY KAY CAWLEY  
Coast & Geodetic Survey

NO PLACE FOR A WOMAN



Would you believe forty-four men and six women and no problems? This is the case in the Coast and Geodetic Survey's Geodesy Division, where ESSA's 50 geodesists are employed. ESSA's lady geodesists — among the few in government service — have carved a solid niche in a profession begun in the United States in 1816 and kept a masculine domain until World War II.

Varied paths and circumstances led the six ladies to geodesy and ESSA. A would-be teacher was discouraged by low salaries; a prospective chemist found she was allergic to common chemicals; and an aspiring artist began to realize artists are born, not made. The convenience of the bus stop at the door of the Commerce Department launched one career, and one lady was "invited" into the elite club. Of the six, only one became a geodesist for geodesy's sake.

Jeanne L. Hess, of Bethel, Conn., holds the undisputed record for bravery among the women for her climb this spring to the top of a 90-foot tower, but admits she was so scared at first that her fingerprints are probably still in the metal.

The others, confirmed desk geodesists, are: Catherine C. Mortenson, of Long Island, N. Y.; Jean S. Campbell, of Hampton, Va.; Roma W. Miller, of Hyattsville, Md.; Helen Stettner, of Kensington, Md.; and Maralyn Louise Vorhauer, of Manassas, Va.

While all became geodesists for different reasons, on this there is mutual agreement: their work is fascinating, and—best of all—very satisfying.

Their efforts contribute to useful work that, because it is concerned with the application of mathematics to "the here and the now", does not end up buried in a file cabinet.

Their projects have included: computation of the distance of Astronaut Alan Shepard's first sub-orbital flight and of

Arthur Godfrey's 1966 round-the-world airplane flight; analysis of the effect of the 1964 Good Friday earthquake on the earth's gravity in Alaska; determination of the variations in latitudes on the surface of the earth caused by the "wobble" of the earth as its

north-south pole rotation axis changes; the analysis of data from earthquake investigations in California, Nevada and Alaska; adjustments on the North American 1927 Datum for the precise transcontinental traverse being measured to provide a more accurate determination of the size and shape of the earth; and quality control work in satellite triangulation, the new geodetic concept of determining precise locations by simultaneously photographing a satellite from two or more points on the earth.

During World War II a few women geodesists were assigned to field parties, but the practice was discontinued. The average woman is not physically or psychologically conditioned to expect her duties to include carrying heavy instruments, negotiating 90-foot towers, and working outside at night. This can put a strain on domestic harmony, if either party happens to be married.

According to CAPT. John O. Phillips, Chief of the Geodesy Division, another objection to assigning women to field parties is that when they get married they leave the party; whereas, when men marry, their wives join the party. (His case in point is the girl who eloped from a field party and was never seen again!)

Therefore, simply because they are women, ESSA's lady geodesists are limited to some extent because they lack the practical experience and insight into the profession the men gain from working regularly on field parties.

From time to time, however, a woman may be assigned on a temporary basis for a special project with field parties.

**JEANNE L. HESS** was detailed this spring to instruct field technicians in the use of a new computer and spend a few days observing field procedures. She said, "I really didn't give up teaching—only the subject has changed and my schoolroom is now a trailer, and my students—real great guys." She was impressed with the work the men are doing in the field and with their cooperation and teamwork.



After her field experience, Miss Hess is convinced she made the right decision last year when she resigned her teaching position at Wilton (Conn.) High School to become a geodesist.

Among the materials available for the school's bulletin board display on mathematics had been a poster on which the word "geodesy" was listed. Miss Hess researched the subject. Subsequently, she was referred to ESSA.

To what resulted in a fruitful interview Miss Hess brought her interest, enthusiasm and background, including a B.S. summa cum laude in mathematics and physics from Central Connecticut State College and a Master of Arts in Teaching mathematics from Harvard University. A member of Kappa Delta Pi (honorary education society), she was listed in Who's Who in Colleges and Universities, and had taught at Phillips Andover (Andover, Mass.) Academy for Boys before accepting her present position.

On her return to Wilton, she thanked her students for arousing her interest in geodesy, resigned her position, and returned to Rockville to begin her new career in the Triangulation Division.

She likes her new life and enjoys associating with geodesists—especially one in the Leveling Branch, Sandford R. Holdahl, with whom she is planning a fall wedding!

**CATHERINE C. MORTENSON**, for example, supervises a group of Triangulation Branch geodesists whose computations for C&GS certification for the Federation Aeronautique Internationale (F.A.I.) included the distance of Astronaut Alan Shepard's first sub-orbital flight and of Arthur Godfrey's 1966 round-the-world airplane flight. (The



F.A.I. racing sphere is the internationally accepted standard for measuring distances of airplane races, test flights, etc.)

She and her group also compute for certification by the C&GS for the National Aeronautical Association the distances and speed records set in airplane races and test planes. Also, they make computations for control stations for state and interstate highway systems, for the Pacific Missile Range at Point Mugu and San Nicholas Island, Calif., and for the White Sands (Utah) Missile Range.

Miss Mortenson entered Hunter College with the intention of becoming a teacher, but, succumbing to the lure of the more attractive government salaries, became a geodesic mathematician in the Survey's New York Computing Office after receiving her B.A. in mathematics. A year later she was offered a tempting teaching position, which she refused.

She has never regretted her decision—for 24 years she has continued to appreciate and enjoy the professional atmosphere in the Survey, and feels it is almost like an extension of college because she associates with people she likes and with whom she shares common interests and mutual respect.

She transferred to the Survey's Washington, D.C., headquarters in 1950, and now lives in Rockville, Md.

**JEAN S. CAMPBELL** took a roundabout route to the geodesy field.

She was born in Panama, where her Army officer father was stationed with the Coast Artillery, and subsequently lived in various parts of the world. After spending two years at Fort Mills High School, on the island of



Corregidor in the Philippine Islands, she graduated from East Lansing (Mich.) High School.

Concurrent with receiving her B.A. degree in chemistry from Randolph Macon Woman's College in Lynchburg, Va., came the crushing discovery that she had developed allergies to several common chemicals. Cheated by fate of her career as a chemist, she studied engineering and mathematics at the University of Rochester (N. Y.) and the University of Virginia extension school at Hampton, Va.

After working as a mathematician for the National Advisory Committee for Aeronautics and the Office of Naval Intelligence, she edited the Office of Naval Research Logistics Quarterly and the Digital Computer Newsletter, and subsequently was a scientific writer and editor for the National Aeronautics and Space Administration.

In 1963 she joined the Survey's Scientific and Technical Publications Staff as an editor. When an opening for a geodesist was announced in 1965, she applied for the position, and was selected. She now does quality control work in satellite triangulation. She lives in Washington, D.C.

**ROMA W. MILLER** literally became a geodesist overnight. One day in 1955 when she went home from work she was a mathematician; the next day she was a geodesist. Her work did not change—a Civil Service Commission review resulted in the decision that it had become too specialized for her to be called a mathematician.



Following her graduation from high school, she had entered New York University's School of Commercial Art. Six months later, she transferred to Hunter College, where she subsequently received a B.A. in mathematics. During World War II, she was employed as a statistician with the Department of Agriculture and the War Production Board. With the Korean conflict she returned to the government to work for the National Production Administration, and at its termination in 1952, became a mathematician in the Survey.

Mrs. Miller's duties in the Astronomy and Gravity Branch include computation of latitudes, longitudes and azimuths for control of triangulation surveys for Air Force missile bases and for the Geodetic Satellite Program's worldwide triangulation net. She has also computed gravity surveys in the United States, including those made in Alaska since the 1964 Good Friday Earthquake, and has worked on the Survey's Latitude program. In conjunction with our observatories at Gaithersburg, Md., and Ukiah, Calif., the Branch is seeking to determine the variations in latitudes on the surface of the earth caused by the "wobble" of the earth as its north-south pole rotation axis changes.

Her most important title is not geodesist-mathematician-statistician, but the one two-year-old Robert Woodyard calls her—"Grandma."

Mrs. Miller and her husband, Frederic, live in Hyattsville, Md.

**HELEN STETTNER.** Fate, in the guise of a convenient bus stop on a rainy day, led Helen Stettner into geodesy.

Having arrived for a job interview in another government agency too late to see the proper person, between showers she dashed out to catch a bus, which stopped next at the door of the Commerce Department. Hoping someone



in the Commerce Department was looking for someone with her qualifications—B.A. in mathematics and chemistry from Brooklyn College—she alighted from the bus and ran inside. That day in 1948 she became part of the Triangulation Branch.

As her husband's work dictated frequent family moves, she had also been an inspector of contact lenses for a private industry firm, and a gage inspector and engineering aide for the Army Ordnance Division.

In 1950, when motherhood was imminent, she resigned and did not work until 1961, when she became a mathematical statistician for the National Institutes of Health in Bethesda, Md. When the Survey moved to its Rockville headquarters, she again joined the Triangulation Branch.

Mrs. Stettner is engaged primarily in analysis of data from the earthquake investigations in California, Nevada and Alaska, the ultimate goal of which is the ability to predict earthquakes.

She and her husband, Max, have two daughters, Barbara and Arlene.

**MARALYN LOUISE VORHAUER** was "invited" by the Survey to be a geodesist. Following receipt of her B.S. in mathematics from George Washington University she was rated by the Civil Service Commission as a mathematician. She received a letter from the Survey indicating interest in employing her if she could be rated as a geodesist. She

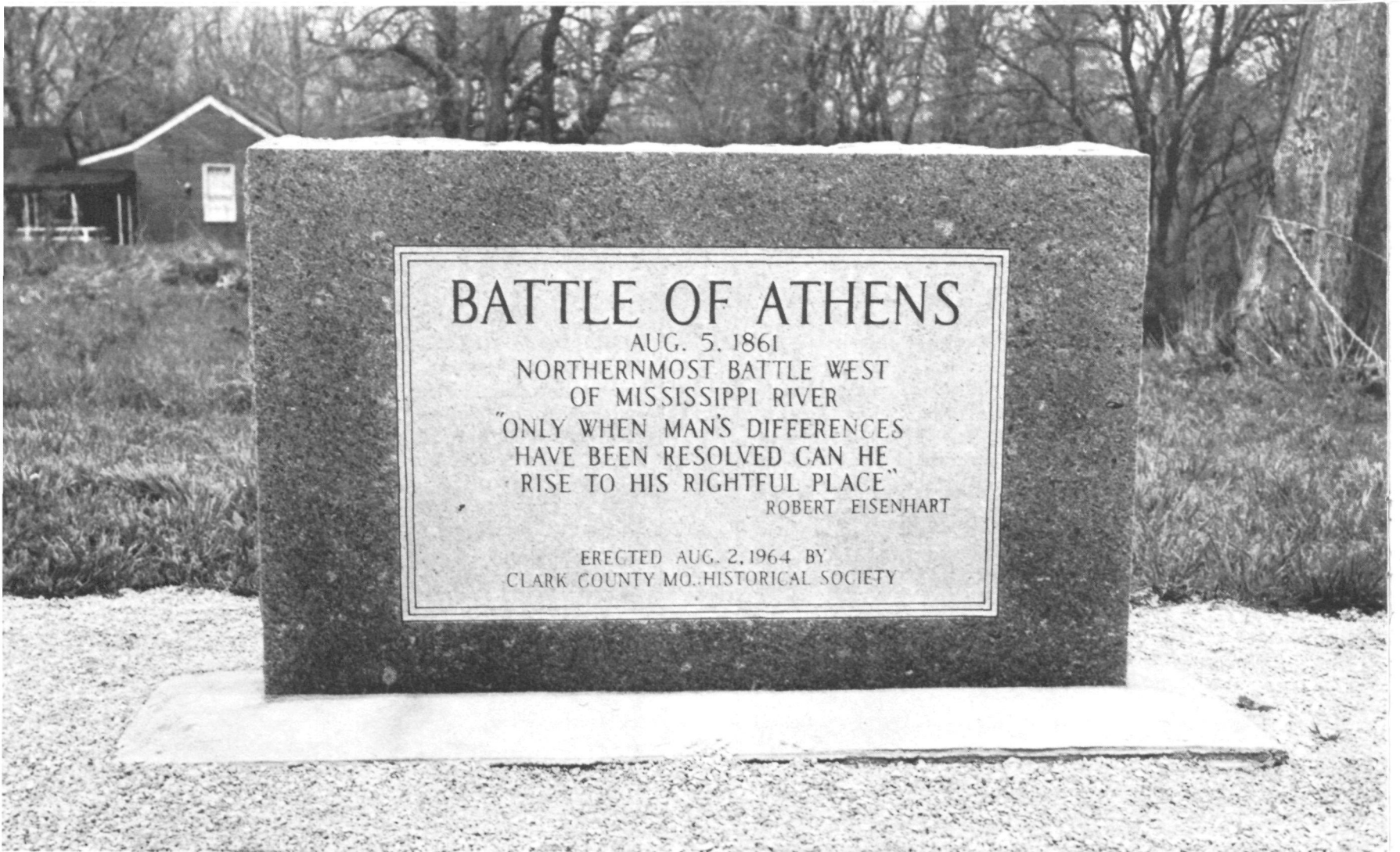


secured the rating and since June 1965 has been working in the Triangulation Branch.

She computes adjustments on the North American Datum from data submitted by field parties working on the precise transcontinental traverse being measured to provide a more accurate determination of the size and shape of the earth. This involves determination of latitudes, longitudes and elevations of points on the continent which will ultimately permit full coordination and correlation of surveys, maps and charts of the country.

Mrs. Vorhauer and her husband and their young son, "Dusty", live in Falls Church, Va.

Geodesy will probably remain pretty much a man's world, but ESSA's lady geodesists are glad they share it, and urge other women to investigate opportunities in it and other fields commonly recognized as exclusively male realms.



*Athens is in the northeast corner of Missouri. The northernmost battle of the Civil War was fought near there in 1861.*

# VIEW FROM A CIVIL-WAR CORNFIELD

The Notes of Joseph T. Caldwell



**E**SSA's Cooperative Observer Program has a long and often colorful tradition behind it. In earlier days some volunteer weather observers commented upon more than the elements; through their eyes we get a vivid glimpse of life as it was lived in a simpler America, long gone.

One such observer was Joseph T. Caldwell, a farmer in the village of Athens (pronounced with a long "a") Missouri, who, from 1863 to 1866 made three daily observations of temperature, clouds, precipitation, and wind as one of a network of volunteer weather observers established by the Smithsonian Institution. Beginning in January 1864, Caldwell began adding lengthy notes to his observations, comments which today

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BY WILLIAM T. HODGE  
National Weather Records Center  
Environmental Data Service  
Asheville, North Carolina



provide a fascinating insight into life in Missouri during the Civil War period.

These records exist only on microfilm in the National Archives. The extraction of the following text was complicated by unusual handwriting, lack of punctuation, and quaint spelling. Where necessary to clarify meaning, punctuation has been added and spelling corrected.

#### Notes from the observer

Athens, Clark County, Missouri, Latitude 41°31', Longitude 14°45' (west of Washington, D. C.) Observer: Joseph T. Caldwell.

**January 1864** This month of January, 1864 is the coldest weather that has been experienced for a number of years. From the 23rd day of December to the 23rd day of January, the ground has been covered with snow . . . on a level of 17 inches and has drifted to the height of the fences. Many roads that run south in course are full and (so) impassable that the community has to shovel out the snow that they could pass. The general depths of the drifts, six feet . . . The beech and small timber was bent to the ground and a quantity of timber broken . . . I will say that the tenth part of the timber will die on account of the snow-storm. The cattle . . . those that had sheds they lost none, but when they had to stay in the storm, 1/4 have died. The cattle that has not been put in the enclosures, many of them stampeded to the timber and died before they could be found. Sheep that had sheds or houses done well, but where they had to stem the storm, 1/4 have died, caught in the drifts and perished. Hogs that had good sheds would pile up and I would say that 1/2 of them were dead in that situation, but those that had to stand the storm, 3/4 of them have died. The prairie chickens, they have 1/2 of them died; the quails have many of them died. Half the rabbits, many of them have been found dead for want of food. There has been many persons froze to death and many frosted badly. This winter will be a lesson long . . . remembered by all persons, that they must have their wood and coal ready for winter use, and not wait till winter to get it. They must have sheds for their stock and their feed at the barns (so) they can feed handy. There has been stock enough lost . . . this winter to have built every farmer sheds . . . I will say that the farmers and all other branches of business have become careless in the last two years . . . Their minds have been on the war, which I hope will wind up in the course of this year . . .

**May 1864** In regard to this part of the country and affairs, there are 2/3 of the men in the Army . . . 1/4 of them are in the Rebel Army or left the state. This leaves the country with many widows

## CASUAL PHENOMENA.

### Note observations of the following:

**THUNDER STORMS**—Time of occurrence and direction of motion. **TORNADOES**—Time of occurrence, with and direction of path, effects produced, and whether attended by electricity or hail. **LIGHTNING AT A DISTANCE**—Time of occurrence, direction from observer, whether zigzag, forked, or diffuse. Objects struck by lightning, as trees, buildings, &c. **HAIL STORMS**—Time of occurrence, direction and width of path, size and quantity of stones, and amount of injury. **AURORA BOREALIS**—Time of appearance and disappearance; time of the formation of arch, banner, and corona, and whether there is a dark band below the arch. Direction and time of occurrence of **METEORS**. **SHOOTING STARS**, **SOLAR** and **LUNAR HALOS**, **PARHELIA** and **PARASELENES**. Time of early and late **FROSTS**, particularly first and last. **DEPTH OF GROUND FROST**, in feet and inches; disappearance of frost from the ground. Time of closing and opening of **RIVERS**, **LAKES**, **CANALS**, and **STREAMS**, and their extreme rise and fall. **TEMPERATURE** of wells and springs at least once each season. **EARTHQUAKES**—Time of occurrence, direction of impulse, number of shocks, and effects produced.

This month of January 1864 is the coldest weather that has bin experienced for a number of years from the 23 day of December to the 23 day of January the ground had bin covered with snow to the extent on a level of 17 inches and has drifted to the height of the fences many roads that run south in course are full and impassable that the community had to shovel out the snow that they could pass the general depths of the drifts six feet we have had as deep snow before but our snow cover and not drifted snow had the timber was loaded down with snow the beech and small timber was bent to the ground and quantity of timber broken especially the Pine Oaks and Black Sycamore which had their leaves on I will say that the tenth part of the timber will die on account of the snow storm the cattle when the storm came those that had sheds they lost none but when they had to stay in the storm one 1/4 have died the cattle that had not bin put in the enclosures many of them stampeded to the timber and died before they could be found sheep that had sheds or houses done well but where they had to stem the storm one 1/4 have died caught in the drifts and perished Hogs that had good sheds would pile up and I would say that 1/2 of them were dead in that situation but those that had to stand the storm 3/4 of them have died the prairie chickens they have 1/2 of them died the quails have many of them died half the rabbits many of them have been found dead for want of food there has bin many persons froze to death and many frosted badly this winter will be a lesson long to be remembered by all persons that they must have their wood & coal ready for winter use and not wait till winter to get it they must have sheds for their stock and their feed at the barns so they can feed handy there has bin stock enough lost in this vicinity this winter to have built every farmer sheds that their stock would look well if they had provided with them we would not get them but they have had something to learn them that a few leisure spots would be a fortune to them I will say that the farmers and all other branches of business have become careless in the last 2 years in this part of the country their minds have bin on the war which I hope will wind up in the course of this year their minds will return to the farms the Mercantile in this State is different from that of Iowa or Ill. we have had the two Army to destroy and there had become disheartened they would put in one half they could attend to the Mercantile had nothing to do that of Iowa & Ill the farmer tries to do all in his power and many buildings have gone up the by reason that we have had last year we have never before seen so much snow to any thing all that I recollect last year have proved a failure on the account of drought if you have any further observations we would like for you to remember us and remain your most obedt servant  
Joseph T. Caldwell

Mr. Caldwell's observations and remarks in his own hand, recorded on the form (two sides) provided by the Smithsonian Institution.

who are dependent on the husband's wages for support. Provisions is very high and has caused great economy, and has started many to industry, not only in the homes but many in the cornfields, thinking, while the husband is defending the government, she can raise enough to support a family. Home manufacturing is becoming common at every house.

I do not think there will be half the farms put in cultivation. Many are trying to put their farms in grass and gone into raising sheep. I think that there will be thousands shipped here to stock the county and, in doing, in a few years

more, we will have one of the first wool states in the Union . . . Before, our state was fenced in too much, cattle, mules and hogs was profitable, but the range is gone. The land is wore out to some extent and people are in the Army and manuring land is almost stopped here.

**June 1864** On the night of the 1st of June, we had frost enough to bite the vines, and kill some of the hickory leaves, and turn the corn yellow . . . Rye, wheat, oats and barley will make a fine crop, and busy commencing harvesting and hands scarce and commanding \$2.00 per

continued

day, but the prices will justify the wages well. There will not be wheat enough for consumption, but there will be a fine surplus of rye and oats. Potatoes, onions and all other vegetables bid fair to make fine crop. Navy beans, and unless rain comes soon, they will not do well . . . As for the season to put in crops, it has been fine and easy to attend to. There has been 1/4 of the labors performed by women . . . Taking all in consideration, there will be 2/3 as much as was raised in 1862 . . . the Spirit of Agriculture never was greater. And Domestic Manufacture—some five years ago there was not one wheel to every 20 families in this county. Now there is 9 out of 10 have them, and are putting them to use as in the days of '76. Who can make the finest piece of linen of the finest piece of janes(?). Economy is the conversation of the fireside, and a speedy end of this war; unconditional surrender to the Stars and Stripes . . .

**July 1864** . . . has been a fine month for closing out harvest and the most of it is in the stacks and barns and all . . . is fine, and a better prospect for corn never has been had than at this time . . . There has been more work done to the land than I ever saw before. We have been blessed with rain, but the rains are sectional. We have some excitement here . . . on account of some bushwhackers but all quiet now . . .

**February 1865** In the Mississippi River, the ice moved out clear past Keokuk, Iowa. The evening of the 20th February, ice 14 inches thick. The Des Moines River, the ice broke up the 22nd February. The ice on mill ponds, 18 inches. This has been the greatest weather for putting ice up that has been for years. Ice very clear and sound, and large amounts put up here . . .

26th, 27th, some rain but our water courses have not risen only some seven feet which is less than usual. The frost on the ground in the prairies froze 18 inches; in the timber, froze 10 inches. The deepest freezing we have had for 4 years. Navigation of the Mississippi River resumed to Keokuk, Iowa. First Steamboat, KATE KERNEY, landed. Belonged to the Keokuk and St. Louis Packet Company.

**March 1865** . . . For the first time in 20 years, on the 9th, the thermometer was 1 degree below zero.

On the 10th, in the morning, the thermometer was down to 4 degrees; 2:00 p.m., 10 degrees; 9:00 p.m., 15 degrees with an east wind which was uncommon to be so cold in this climate. On the 13th, heavy sleet, so as to break many limbs of timber such as willow. . .

On the 18th, the wind south 45 in the morning. At 2:00 p.m., southwest 60 miles. At 9:00 p.m., 25 southwest. Some

REGISTER OF METEOROLOGICAL OBSERVATIONS, UNDER THE DIRECTION OF THE SMITHSONIAN INSTITUTION, ADOPTED BY THE COMMISSIONER OF AGRICULTURE FOR HIS ANNUAL REPORT.

Form with handwritten entries for 'Atcham' in 'Clarks' County, 'Missouri' State, for the month of 'January, 1864'. The table includes columns for 'THERMOMETER IN THE OPEN AIR', 'RAIN AND SNOW', 'WINDS', and 'WINDS'. It contains 31 rows of daily data with handwritten values for temperature, precipitation, and wind direction/speed.

THE OBJECT of these observations is to enable the Smithsonian Institution, in connexion with the Patent Office, to prepare a series of Maps to illustrate the face of the sky, &c., over the United States, for each day in the year, and thus to study the rise, progress, and course of American storms. Observers who have a Barometer, Psychrometer, &c., will be supplied with other blanks, and also full directions for using all the instruments, by the Smithsonian Institution.

EXPLANATION OF THE ABOVE COLUMNS. THERMOMETER IN THE OPEN AIR. This is intended for the register of the thermometer, and for the daily mean or average of the three observations. RAIN AND SNOW. Under this head are entered the time of beginning and ending of the fall of rain or snow, and the amount, in inches and hundredths of an inch or sixteenth parts of an inch, as the case may be. WINDS. This is for the record of the direction, from which the wind is blowing as indicated by a rain, and its force by estimation.

Second side of the form used by Mr. Caldwell for his observations.

buildings unroofed. Great destruction with fencing and timber. The heaviest wind for six years.

**October 1865** . . . The first frost, 16th, not too much damage. The 19th, eclipse of the sun 7:00 a.m. to 9:00 a.m. Appearance of the atmosphere, clear and visible to the eye. Snow the 24th, the first for the season. 1/16 of an inch. Ice, the first of the season, 1/4".

**March 1866** (Note: Apparently Caldwell was ill; his weather entries are shakily written and the comments appear to have been written by his wife or daughter.)

Fickle March fairly outdid herself this year and more than sustained her fabled fickle reputation. 2nd, Des Moines River broke up. Ice gorged. Water overflowed everything higher than was ever known before. Great destruction of property. 13th, snow. 14th, snow all disappeared. 15th, snow in morning, all off before night. 17th, snow. 18th, rain accompanied by heavy thunder. 19th, misty rain and heavy hail, large as quails egg.

20th, foggy. 22nd, smoky, rain. 24th, snow. 27th, raining, sleet and snow. 30th, smoky. If the above is not a "bundle of contradictions," we will be indebted a new "Easter" to some correspondent that will oblige us with one.

**April 1866** . . . Fruit of all kinds, except peaches, showing a favorable prospect. Peaches failed to put in an appearance this spring owing to the excessive cold of the winter. Fall wheat on the prairie is generally killed. Other cereal OK. Farmers have made good progress in spring work. Providence interposing between us and frost, we may reasonably expect bountiful crops of every description.

Joseph Caldwell's record ended in July 1866: the tradition of citizen service that he embodied did not. Today volunteer weather observers man some 12,000 ESSA climatological and/or hydrologic stations across the United States. Their observations are apt to be more pertinent and precise—as befits the Space Age—but the spirit is still that of Joseph Caldwell.

# Tropical Analysis Center



Mapping the weather at Tropical Analysis Center in Miami are (from left) Dr. Robert H. Simpson, slated to become Director of National Hurricane Center in 1968, David Shideler and Miles Lawrence.

**W**ith the formation of the new Tropical Analysis Center in Miami, Florida, the Weather Bureau has added a formidable weapon to its first line of defense against the tropical storms and hurricanes which are generated each year in the warm waters of the South Atlantic and Eastern Pacific Oceans.

In the late fall of 1965 the Weather Bureau concentrated the nation's Hurricane Warning Services in the National Hurricane Center in Miami in accordance with plans to centralize data processing and prediction programs for the tropical and equatorial areas. As a component of the National Hurricane Center, TAC provides a coordinated facility for the analysis and prediction of tropical perturbations and storm systems and of the energy processes which cause their intensifications and changes in direction of movement. Under the leadership of Head Analyst David H. Shideler, the unit operates with a staff of 10 analysts and 10 chartists.

Dr. Robert H. Simpson, who will assume his duties as Director of NHC in January 1968, points out that weather prediction problems in the tropics involve different processes from those of the mid-latitudes. "In temperate zones", says Dr. Simpson, "the movement of air masses of contrasting temperatures and of the fronts which separate them produce large-scale weather changes. While the mid-latitude data available are not as abundant as the meteorologist would like—especially for detailed regional analysis—they are sufficient to describe the characteristics of the migratory weather pattern.

"Relatively", continues Dr. Simpson, "the tropical meteorologist has a much more difficult problem. He deals with air masses in which there are few temperature contrasts horizontally. Disturbances here are first evidenced on a much smaller scale. Small depressions or vortices can easily be lost in the vast ocean reaches where ships and planes are the only observers, and yet they can quickly grow into major tropical storms. To add to his difficulties the tropical forecaster has only a sparse and widely scattered group of weather reporting stations on land. Weather satellites, although very effective in spotting large storm systems, are still incapable of making temperature, humidity and pressure measurements, and these data are vital in studying the sources and processes for fueling or energizing storm systems and predicting their growth and movement."

The Bureau employs a number of numerical prediction models which are programmed into the computer complex at the National Meteorological Center at Suitland, Md. At present most of these are designed primarily for use in mid-latitudes, and use a data grid too large or coarse to deal effectively with many small-scale perturbations in the tropics. The tropical meteorologist must hand-tailor the analyses and prognoses of perturbations and storm systems in low latitudes.

Another basic difference distinguishes the circulations of mid-latitudes from those of the tropics. Whereas in higher latitudes the storm systems are closely geared to the circulation throughout the troposphere, in the tropics there are distinct fields of motion in the lower and

upper troposphere which seem to act independently. The tropical meteorologist is continually seeking a more coherent means of describing these independent motions, and this is one of TAC's basic responsibilities.

These are essential first steps in developing dynamical models with which the computer should ultimately make as accurate predictions for the tropics as it now does for mid-latitudes.

The area of analysis and prediction at TAC extends from the Eastern Pacific across the Atlantic and Africa, and from about 40° N latitude to 35° S. TAC's products are transmitted by facsimile to the National Meteorological Center at Washington, and Atlanta, San Antonio, Fort Worth and San Juan forecast offices whose responsibilities extend into the tropical Atlantic. The products include forecasts both for aviation and general public use, with emphasis on tropical disturbances, their intensification and movement.

Beginning in July of 1967 a radio facsimile broadcast will be initiated to transmit analysis and forecast products of the Center to the community of nations of the Gulf of Mexico, and Caribbean Sea region.

In the words of Dr. Simpson: "The Tropical Analysis Center may eventually add greatly to man's three-dimensional understanding of the global atmosphere. It already provides our forecast offices with a more comprehensive and accurate view of tropical and equatorial weather, including the pull and tug of forces which spawn and maintain storm systems large and small in low latitudes." □



# THE SKY'S THE LIMIT

for ESSA's aerial photographers. They pinpoint the earth with fantastic accuracy.

**A**erial photographers of the Coast and Geodetic Survey's Photogrammetry Division pinpoint landmarks with fantastic accuracy from heights of one to three miles.

Chances are if you live in a suburban development, one of their enlarged photos of your area would enable you to pick out your home.

Of course, the task of the aerial photographers is not to photograph homes. They use their sophisticated cameras as surveying tools for measuring tidal currents and making coastal movement, land and sea boundary surveys, as well as for general purpose uses. The latter include new or revising existing nautical charts and charts of airport obstructions for supporting inshore hydrography.

Four highly skilled aerial photographers take thousands of aerial photographs each season in planes piloted by USESSA officers. Many officers are assigned to the Coast and Geodetic Survey; among them are four pilots trained at the Army Flight Training School. The aerial photographers are civil service employees.

Aircraft crews are pilots Lieutenant Commander Raymond L. Speer, Lieutenant Commander Robert W. Franklin,

Lieutenant Francis D. Moran, and Lieutenant Frederick H. Gramling, and aerial photographers William G. Riggs, Maurice E. Weiss, James L. Jardwick, and Charles R. Johnson.

The Photogrammetry Division is headed by Captain V. Ralph Sobieralski who reported for duty last November 1, replacing Captain L. F. Woodcock, recently appointed Associate Director of Geodesy and Photogrammetry.

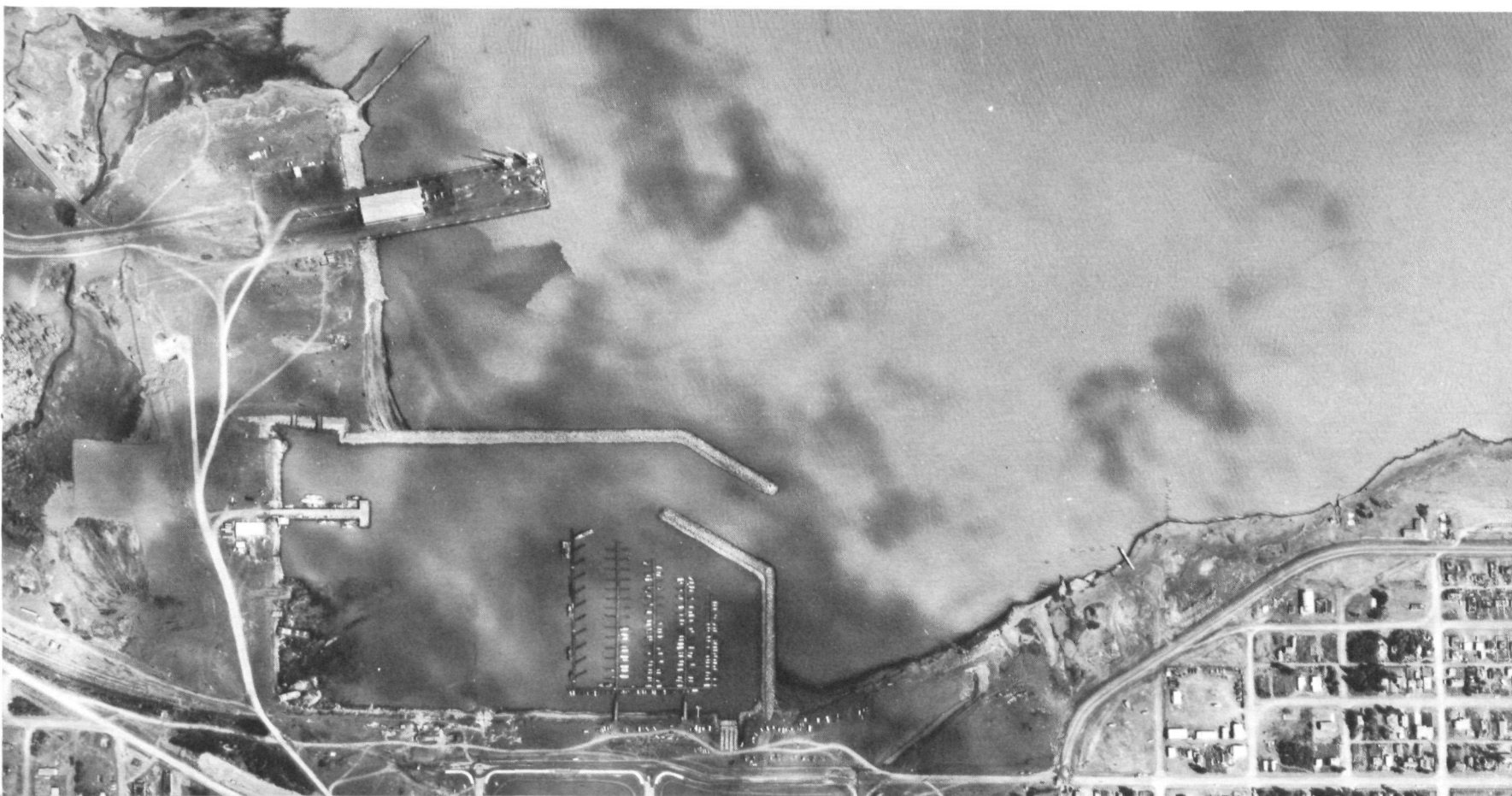
Operations Officer for the air photo missions is Harland R. Cravat, chief, Technical Planning and Operations Branch. Operations are located in Building 1 at the Rockville, Md. headquarters of the Coast and Geodetic Survey.

## Coast-to-Coast Operation

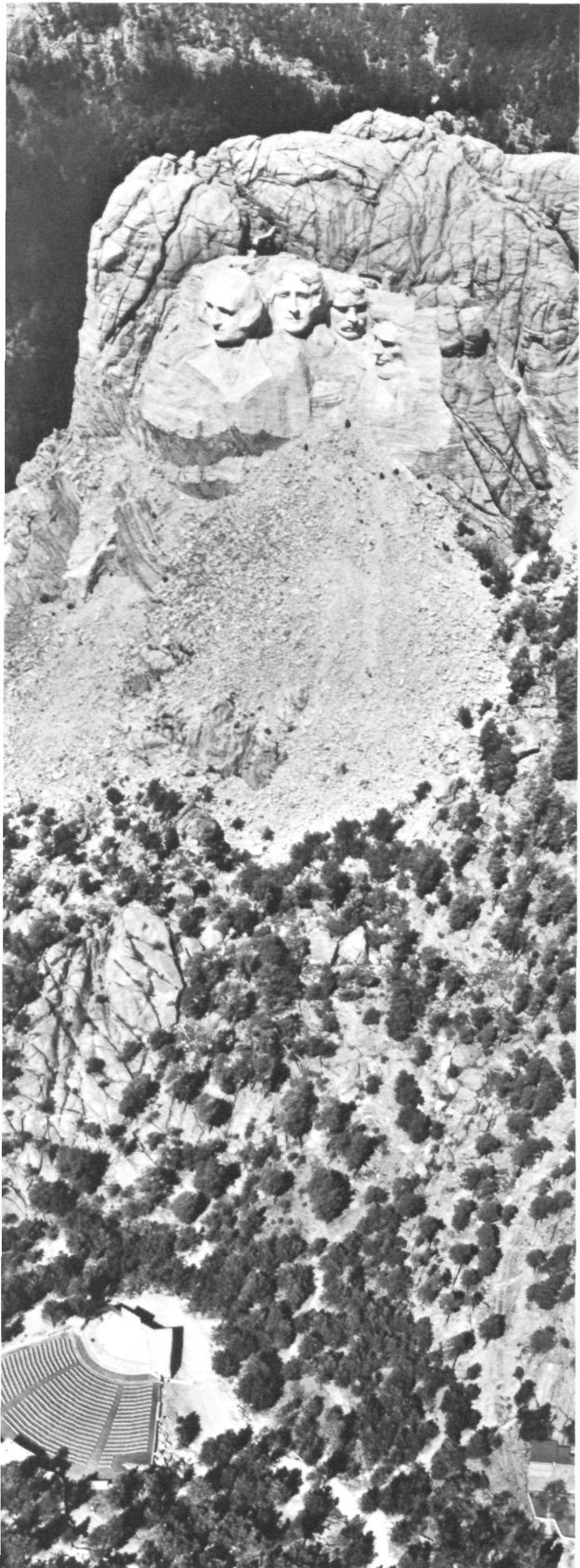
"We operate with leased planes, especially equipped for our work," explained Cravat. "Our men carry out their activities from Alaska to Florida, across the entire expanse of the continent, and wherever else the United States flag may fly, and some places where it doesn't."

Operations are conducted ten months of the year. Cravat explained that low sun angle and wintery weather terminate

*The top photograph was taken at Seward, Alaska, on August 29, 1964, a few months after the Alaska earthquake. The lower photo shows the same area on July 13, 1966, just two years later, revealing the rapid rate of new construction.*



## Coast & Geodetic Survey uses highly sophisticated cameras for surveying.



aerial photography operations around December 1. The next two months are used for aircraft maintenance for the following season's activities.

Requests for aerial photographs are received from all quarters of the globe. The scale at which they are taken is quite small. Houses look like dots about the size of a pinhead, but quality is unusually good, permitting almost incredible enlargements.

"If someone should ask," Cravat said, "chances are good that we have a recent photograph of his home town, local airport or favorite beach resort. Sometimes the aerial photograph will be in color.

"Aerial photographs are reproduced normally as nine-inch square prints, from which more conventional enlargements can be made. We are going in more and more for color photographs, as the color brings out much more clearly than black and white film the fine details of the land and sea. The color film, when developed, is in positive form very similar to 35-mm slides, except it is on 100-foot long rolls, and each frame is nine inches square. The color rendition and definition are of su-

perior quality. An observer, using a high-powered magnifier, can discern such small details as piling, aids to navigation, trees, and, with not too much imagination, a blonde sunbather on the white sandy beach of Waikiki."

### Alaska Earthquake Pictured

Cravat termed color films and plates for metric photogrammetry superior to black and white photography. Metric photogrammetry, he explained, was the process of reducing aerial photographs to precise horizontal and vertical measurements. Thus, at Anchorage, Alaska, after the 1964 earthquake, measurements of two or three inches were made photogrammetrically of the earth's movement.

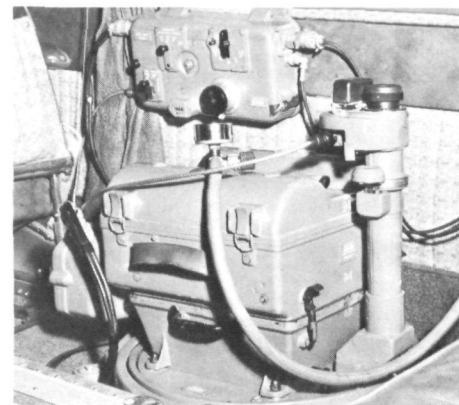
Cravat lauded the Weather Bureau for the assistance its personnel has given his people over the years.

"I have been sitting at this desk for a long, long, time," he stated, "and this is my chance to thank the Weather Bureau for the excellent support they give me and the air photo missions. It is a dedicated group that can be depended upon in any emergency." □



*Photo mission aircraft is a Grand Commander especially modified for aerial photography. A forward hatch receives the Wild Universal RC Camera shown on the right. The mission is operated by a crew of three, an ESSA officer who is pilot and chief of party, another officer who is copilot and navigator, and a civilian photographer.*

*(Left) Aerial view of Mt. Rushmore, South Dakota.*





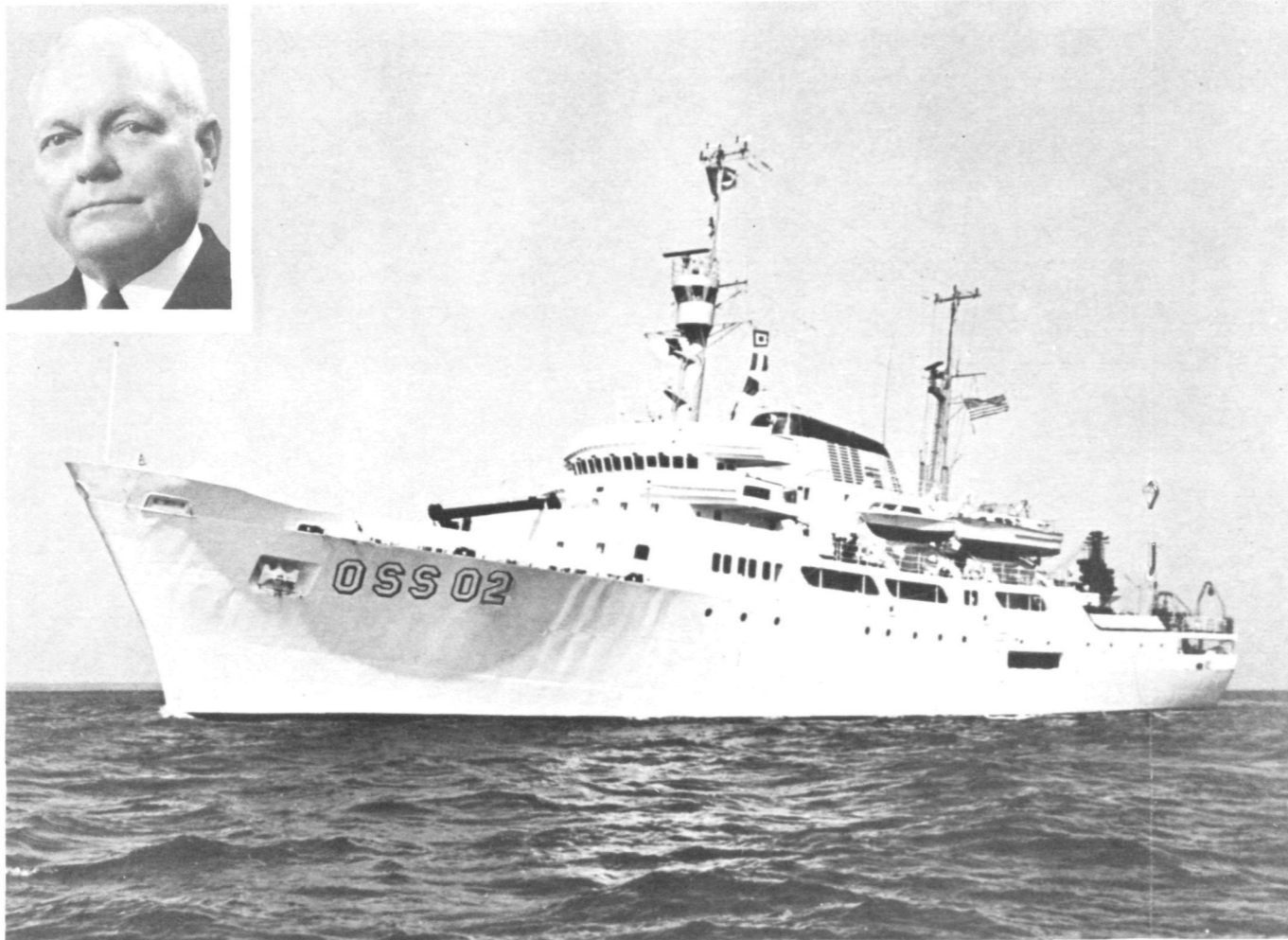
*The photos across the top were taken in the vicinity of Edgartown, Mass., demonstrate how films with built-in characteristics perform special tasks. The first photo was taken with panchromatic film, the second with infra-red, bringing out shoreline detail with remarkable clarity.*

*(Right), Aerial photo of Nantucket Mass. Underwater relief is plainly visible and appears in 3-dimension when viewed with its overlapping pair through a stereoscope. Photogrammetry is a valuable aid in studying underwater topography in researching bathymetric charts for oceanography.*

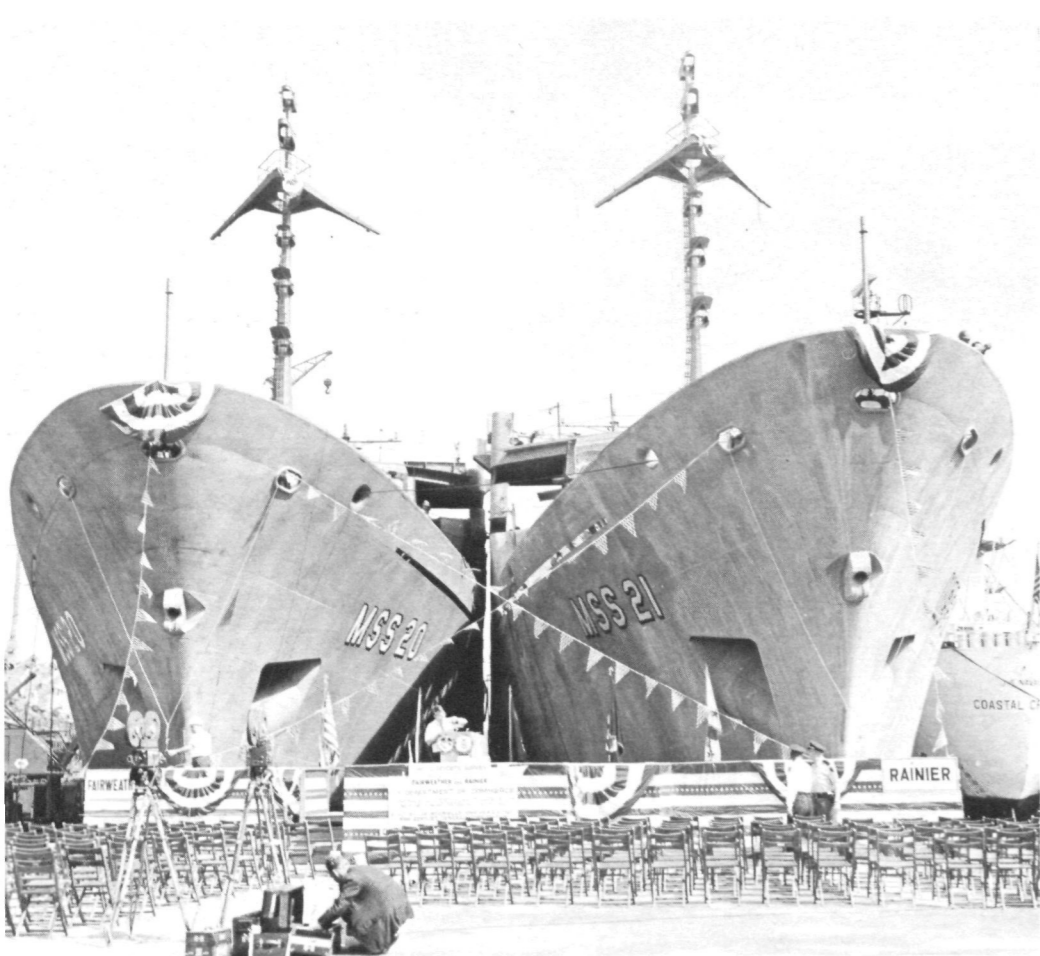
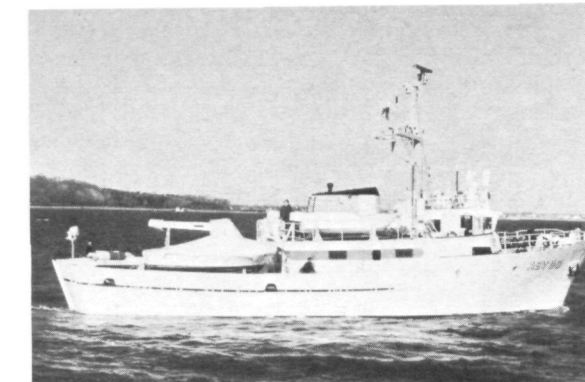




Proud new queen (with the OCEANOGRAPHER) of the Coast and Geodetic Survey fleet, the USC & GSS DISCOVERER is commissioned with speech by Dr. Donald F. Hornig, the President's Science advisor (left). DISCOVERER, to be displayed at Montreal's Expo '67 before embarking on her assignment, is skippered by Capt. William F. Deane of Kingsville, Texas.



Ships recently commissioned include the USC&GSS DAVIDSON (above), RUDE and HECK (right). Participants included (from left) Congressman George P. Miller of California (Davidson), Rear Admiral James E. Tison, Jr., C&GS Director and Lt. Donald Florwick, commanding officer of the RUDE and HECK.



Hefty swings of the bottle christened the RAINIER and FAIRWEATHER (left). Doing the honors for RAINIER (top) was Mrs. Robert M. White, pictured with husband and Mrs. John H. Eberly, matron of honor. At bottom, Mrs. J. Herbert Hollomon, pictured with Martin Kirwin, Jacksonville Shipyard head, christens FAIRWEATHER.

## ESSA's Research Fleet Growing

It was a record-breaking March and April for the Coast and Geodetic Survey's fleet.

Two ships were christened, four were commissioned and another left the United States on a historic global scientific expedition.

The USC&GSS DAVIDSON, a hydrographic survey vessel, was commissioned on March 10 at the Atlantic Marine Center, Norfolk, with U. S. Representative George Miller of California as principal speaker.

The wire-drag ships RUDE and HECK were commissioned at Norfolk on March 29, with Rear Admiral James C. Tison, Jr., Director of the Coast and Geodetic Survey, as speaker.

On March 31, the USC&GSS OCEANOGRAPHER left Jacksonville, Florida, to begin a round-the-world scientific expedition. The RAINIER and FAIRWEATHER, survey ships, were christened on April 15 in Jacksonville simultaneously by Mrs. Robert M. White, wife of ESSA's Administrator, and Mrs. J. Herbert Hollomon, wife of the former Acting Under Secretary of Commerce.

And, on April 29, the USC&GSS DISCOVERER, like the OCEANOGRAPHER, an oceanographic research vessel of unparalleled capability, was commissioned in Jacksonville with Dr. Donald F. Hornig, the President's science advisor, as the main speaker. □

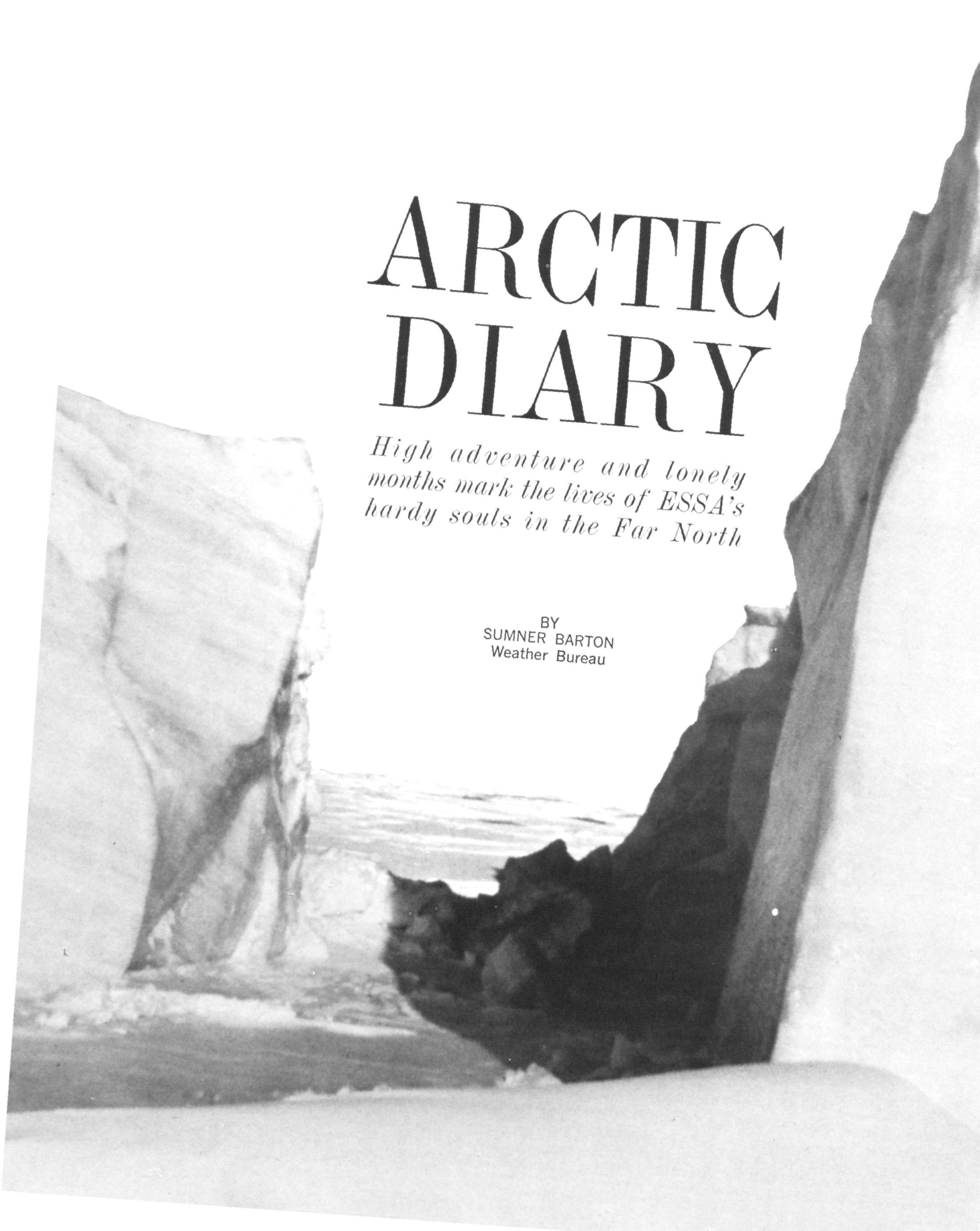


Among high points of USC & GSS OCEANOGRAPHER's global scientific expedition was visit to Monaco, where she is pictured. Among visitors to ship were Prince Rainier and Princess Grace of Monaco. Ship's crew later were warmly received in Odessa. OCEANOGRAPHER, which left Jacksonville on March 31, is due in Seattle next December.

# ARCTIC DIARY

*High adventure and lonely  
months mark the lives of ESSA's  
hardy souls in the Far North*

BY  
SUMNER BARTON  
Weather Bureau



“WE ARE GOING TO THE ARCTIC,” I told a friend, “to visit the weather stations operated jointly by Canada and the United States.”

His reply was surprising. “Well, he said, “have a good time in Alaska.”

Alaska? It is odd how many Americans know so little about the Arctic. There may be a logical reason. There are no travel bureau brochures or guide books to inform them since tourism has not yet extended into the Arctic. Neither are there Olympic teams, historic edifices, political uprisings, revolutions or any of the other exciting happenings that would direct attention to the “land of the midnight sun.”

Certain individuals combine, therefore, some meager geographical knowledge acquired during their early school days with the developments that led to the adoption of our 49th state and they equate Alaska with the Arctic.

While it is true that the top third of Alaska lies above the Arctic Circle, this is only a mere beginning. The hard, icy core of the Arctic lies far to the north, terminating at the North Pole.

The proposed trip that I had mentioned would take us to a point only 500 miles from the North Pole. This would be Alert, one of five weather stations created after World War II to observe and report surface and upper-air conditions.

There was good reason for these stations. The Arctic is the cold factory of the Northern Hemisphere. The wintry blasts that carry into the lands to the south have their source in this giant ice field and it is imperative that we know what is going on up there. Airplanes flying the polar routes must have reliable weather information. New satellite programs, advanced scientific exploration, the quest for complete knowledge of the earth at the surface, below and above it all have a link with the Arctic as with every other region of this planet.

On the proposed trip of nearly 9000 miles I was to accompany Vaughn D. Rockney, chief of the Weather Bureau's Overseas Operations Division, which has supervision over United States participation in the joint Arctic program. We were to be joined by two Canadians, Donald C. Archibald, chief of the Basic Weather Division, and Charles G. Goodbrand, superintendent of Arctic Operations.

This visit was to inspect the scientific program being conducted and to see what was needed in the way of runway and

*North Pole straight ahead—The view between two icebergs at Alert shows the frozen Arctic Ocean. The North Pole lies roughly 500 miles away.*

equipment maintenance and repair, communications, food and recreational benefits. This was to be an opportunity to talk to the men first-hand, to obtain their suggestions toward improvement and to answer questions troubling them.

There are four to seven Americans at each of the five stations, depending on the season, and a like number of Canadians. These men live in isolation, with no civilization nearby to break their routine. The names of the stations—Resolute, Mould Bay, Isachsen, Eureka and Alert—all can be found on a map depicting the Queen Elizabeth Islands in the Canadian Northwest Territories, but they are only names, and not places of settlement. They refer, essentially, to the weather stations.

When Rockney and I left Washington on April 2, the temperature was 65 degrees and headed for the 80's that day. We were to come into really cold weather, with temperatures down to 30 degrees below zero. The slightest wind would cause this frigid air to pierce the exposed skin like icy needles.

We were to learn that the Arctic is a stubborn mistress, who gives of her favors with great reluctance, and only then during the brief polar Summer when the sun is constantly above the horizon, providing sufficient warmth to open the waterways for resupply vessels to Resolute and Eureka. During Winter, when total 24-hour darkness returns, she again turns her cold shoulder to man and demands a staggering price for any advance.

This means that the principal effort toward exchange of personnel and replenishment of supplies must be reserved for the Spring and Autumn. Although every station maintains a runway, built with gravel on top of the permafrost (ground that never thaws), the costs involved in year-round air transportation would be insurmountable. Roughly \$1.5 million goes into these stations annually, barely enough for a tight, efficient operation.

Our first overnight stop after leaving Washington was Edmonton, Alberta. Here we were to meet the two Canadians, Archibald and Goodbrand, and boarded a Royal Canadian Air Force C-130 Hercules at Namao Airport for our first Arctic stop—Resolute.

Before leaving, we donned our Arctic clothing — thermal underwear, wool shirts, heavy parkas and mitts and white, felt high shoes that the men call bunny boots. We learned later that some modification could be made in the prescribed gear, depending on the severity of the weather and the length of exposure, but

the warmth was comforting when we reached Resolute because the temperature was 20 degrees below zero.

The flight from Edmonton to Resolute covered 1600 miles and took less than five hours. The huge, cavernous belly of the plane bulged with supplies and the 51 passengers who were to board her had to climb over mountains of cargo to reach their bucket seats.

Rockney and I had discussed earlier, by way of passing the time, how American cities conform to each other, losing the individuality that gave them unique interest. Everywhere in the country, we joked, we now get breakfast with a serving of jelly prepared via automation in a tiny, sealed plastic container.

This banter was to come alive during our flight. We had paid \$1 for a box lunch, appetizingly prepared with fried chicken, a salmon salad sandwich, a canned fruit drink and other tasty tidbits. Nesting snugly in a corner of the cardboard box was—you guessed it—a tiny, sealed plastic container of cranberry jelly. And here we were over the Arctic circle!

The reality of the Arctic north came to us gradually but strikingly. A couple of hours out of Edmonton we left the brown earth where trees grow and came upon the stark nakedness of craggy white snow and ice, as far as the eye could reach. Everything was frozen, the land and the water, and they blended into each other so that it was difficult to tell one from the other until you learned to distinguish the depressed, smoother expanses of the lakes. It was frightening and awe-inspiring, but it was also magnificent and beautiful, an introduction of what was later to come—glaciers, icebergs by the hundreds, huge crevasses, towering ice ridges caused by the pressure of the Arctic ocean advancing on the shoreline.

We reached Resolute at 2:05 p.m. on April 4 and were met at the plane by Danny Foster of Londonville, Ohio, the Weather Bureau's executive officer at this station. By agreement, the officer in charge at the Arctic posts is a Canadian and the next in line, an American, is the executive officer. Foster was an old hand at polar life, having served three years in the Antarctic and three years at Resolute.

This was far longer than usual, since men are signed to contracts that run from six months to a year, depending upon their tasks. The complements consist of radiosonde, upper air specialists, electronic technicians, equipment mechanics who repair and build up the runways, and cooks.

*continued*



*(Left) This little vehicle can speed over the Arctic ice and snow at 35 miles an hour. Driver is Donald C. Archibald, chief of Canada's Basic Weather Division.*

*(Top) Vaughn Rockney of the Weather Bureau's Overseas Operations Division, pats a huge, white wolf at Eureka. Actually, the wolf is dead, having been shot when it invaded the camp.*

*(Top right) the Big Cat digs through the snow and ice, driven by Sydnor Geiman, the executive officer at Mould Bay. Geiman, from Leesburg, Va., transferred to Alert for another year.*

*(Right) the new replaces the old—Clyde Harper (right) of Newburgh, N. Y., veteran cook at Isachsen, checks out Tommy Lester of Valdosta, Ga., in kitchen duty.*

This is a demanding life, especially for married men with children, and there should be good reason for them to sacrifice a year for a job in the lonely, isolated Arctic. There are many reasons, but the main one is money. With the bonuses they receive, these men can make up to \$13,000 a year, a nice nest egg to buy a new home, to satisfy a debt or to send the kids to school. There's gold in that thar' ice and a man still has a chance to stake a claim.

Resolute, on Cornwallis Island, is a big station compared to the other four since this is the headquarters for the Arctic program. Accessible by ship, it is the staging area from which supplies are relayed to the rest. It is the only one with a native settlement, a tiny Eskimo village a few miles away. Not igloo dwellers, these Eskimos lived in make-shift, but clean, oil-heated one-room houses and both man and wife had developed a taste for beer and cigarettes.

The next stop on our itinerary was Mould Bay on Prince Patrick Island. Here we were to get our full appreciation

of the effects of 24-hour daylight. This was to become most pronounced when reached the northernmost point, Alert, at latitude 82 degrees 30 seconds north. Here there was sunlight around the clock and it was an uncomfortable feeling to watch the nighttime hours tick by and still have the bright rays coming in the windows. Man, is it 1 a.m. or 1 p.m.?

We were flown from Resolute to Mould Bay in a chartered Nordair DC-4 (after this year all supply flights will be by chartered instead of RCAF planes). The terrain beneath us became more rugged and forbidding and one wondered that anything could live on that mass of ice. But we came across several herds of muskoxen and one herd of caribou. The pilot, told of our desire to take pictures, descended and circled the animals, which live off the sparse vegetation unseen beneath the snow.

It must be remembered that the temperatures climb into the 50's and 60's in Summer and the Arctic is dotted with beautiful growth when the ice melts, with such flowers as the pretty yellow

poppy and the purple saxafrage. The latter would do justice to any rock garden.

The temperature was 30 degrees below zero when we reached Mould Bay and we stepped out of the plane into total, bleak isolation. There were only 16 men here. Strangely, most of the men seem to prefer complete isolation to the frustrating distractions of teasing interruptions. They are more content with their hobbies—photography, reading, a game of pool, a new rock find—than with an un nourishing taste of pseudo civilization. All or nothing.

One major item for which no expense is spared is food. They get the best in meats and canned and frozen fruits and vegetables. Periodically, they get the fresh variety. The cooks, all qualified through previous experience, prepare more than ample, balanced diets, with home-baked bread and pastries that would do grandma proud.

Although alcoholic beverages can be obtained through one means or another, there is surprisingly little drinking. A





*Eating, a favorite Arctic pastime—Warner E. Chapman, a radiosonde operator at Alert, has been with the program, on and off, since 1945.*



*His hobby: ham radio—Clayton E. Benjamin of Fairhaven, Vt., radiosonde operator at Eureka. He soon starts his third contract with Overseas Operations.*

can of pop wets the whistle with as much satisfaction as a powerful belt. The executive officer at Mould Bay was Syndor Geiman, 31, of Leesburg, Va. He is married and has two sons, 12 and 2. He had been with the Weather Bureau for eight years but left in 1965 to try the restaurant business. He sold out and would like to rejoin the Weather Bureau on a permanent basis (Arctic men need not be regular civil service employees). He hopes this assignment as radiosonde specialist will help him get back in.

Mechanical difficulties were a major cause of concern at Mould Bay. Winter cold is an unyielding foe. Machinery made to run at normal temperatures is put to the punishing test in the Arctic. Metal freezes, oil freezes, water freezes, everything freezes, quickly and disastrously. Maintaining tractors, vehicles, generators and other equipment strains every resource and calls for greater ingenuity.

Diesel fuel is blended to withstand temperature of 70 degrees below zero to

prevent it from turning into a useless jell. Water, for drinking, washing and other purposes, is a constant problem. The sites of the bases were chosen because of their proximity to sources of fresh water. But this can be obtained only in summer when lake ice has melted. Since pumping would involve an overwhelming expense, it is trucked to huge storage tanks that, combined, hold between 45,000 and 60,000 gallons. These are kept in a heated room, the water supply for a year. There is enough for normal needs and the men are careful to avoid waste. Instead of automatic washing machines they have the wringer type, which uses less water. Showers are taken less frequently. Who's worried about perspiration in the Arctic?

I talked with Gary McEachern, a native of Presque Isle, Me., but now of New Britain, Ct. McEachern is determined to buy a house before he is 35 (he is 33 now). He signed up as a mechanic. To help him achieve his goal, his wife and daughter Susan, who turned 11 on the day of our discussion, April 6 will move in with her mother to save expenses.

After Mould Bay, we made a brief stop at Isachsen to drop off supplies and transfer men. The Arctic became increasingly more severe and the terrain, as seen from the plane, could well have been a bit of the moon—cold, lifeless, like a dead planet.

The cook at Isachsen, Clyde Harper, 51, of Newburgh, N.Y., was finishing his tour of duty, being relieved by Tommy Lester of Valdosta, Ga. Harper, a former Navy cook, was at Pearl Harbor at the time of the bombing. He has been with the Arctic program since 1958. Now he just wants to loaf for awhile. Lester, his successor, was an Air Force cook for six years. He wants to buy a house for wife and two children, a girl, 6, and a son, 16 months.

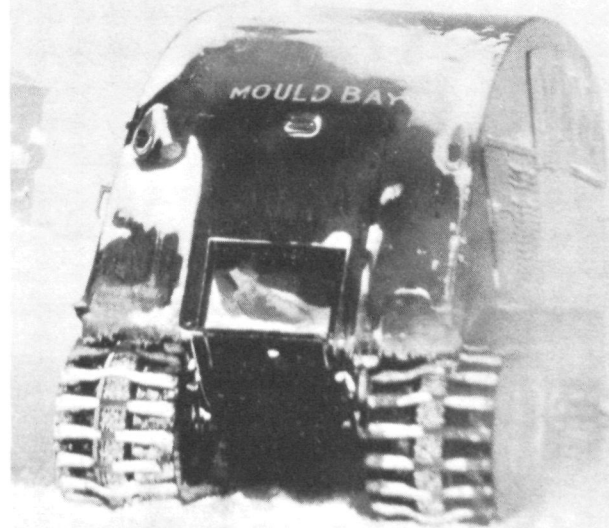
Robert A. Fuller of Agawam, Mass., an electronic technician serving his second year in the Arctic, is achieving his ambition. The first year he saved \$8700 and made a down payment on a house. This year he hopes to pay off the mortgage. He is making plans for a third year on the ice island, T3.

We reached Eureka at 1 a.m., Atlantic Standard Time on Friday (April 7). Although it was well after midnight, the sun was shining brightly and we took pictures in temperatures 15 degrees below zero. Still cameras seemed to function properly, but the cold air froze the mechanism of motion picture cameras after a few minutes and they would stop

*continued*

*The vehicle of the Arctic—The Bombardiere plows itself through a blast of snow at Mould Bay.*

## *The Arctic is the cold factory of the Northern Hemisphere*



dead. We soon were to learn that the best of professionals also experienced this disappointment.

Eureka was the base camp of the Plaisted Expedition, which was determined to cross the ice of the Arctic Ocean and make the first surface traverse to the North Pole since Adm. Peary accomplished it in 1909. Peary used dog sleds, but the Plaisted party was trying "Skidoos." These are a cross between a motor scooter and a snowmobile. They weigh only 275 pounds and have 10 horsepower that propel them over snow and ice at speeds up to 35 miles an hour.

The leader of the party was Ralph Plaisted, a 39-year-old Minneapolis insurance broker and snowmobile aficionado. When we arrived, he was out on the ice with three others, only 10 miles toward his goal, out of fuel and awaiting replenishment by air. Five others in the volunteer adventure party, including two doctors and a dentist, were back at the base, maintaining regular radio communications. The expedition was being thwarted by high ridges of ice that blocked the path and a new attempt toward success was to be made after refueling. A Columbia Broadcasting System photographer was in the group and he, too, complained of camera freeze-up.

One of the Weather Bureau men at Eureka was Clayton E. Benjamin, 46, of Fairhaven, Vt. He was leaving on annual leave, but was to return to fulfill his third contract. He has three sons, two of them in the Air Force, and a daughter, 11. Benjamin is a radiosonde operator with dreams of having his own farm in Vermont. "Maybe one day, with the money I have earned up here, I will be able to sit back and put my feet on a desk," he said.

Benjamin and Dennis Stossel, the Canadian officer in charge, took us out with them to measure the depth of ice on Slidre Fjord at the foot of the camp. This is done each Friday to determine the extent of ice accretion. With a long bore, they drilled until they reached water and then dropped a weighted tape measure into the hole. The ice measured 91 inches, still on the increase. It will start to decrease in July, the men said.

On Saturday, April 8, we left Eureka for Alert, the northernmost permanent base in the world, 452 nautical miles from the North Pole. Living was a little easier here since there was a good-sized Canadian Army compound nearby and there was a regular spring supply urn, known as "Box Top", from the U.S. Air Force base in Thule, Greenland, to Alert.

Since Alert was at the shore of the Arctic Ocean, it was possible to actually stand on the polar ice and inspect a large iceberg that had run aground. The ice is a deep blue and, chipped off with a knife, has a fine, pure taste.

A somber experience was a visit to the memorial grave site of the Arctic explorer, Lt. Col. Charles J. Hubbard and eight Canadians, all victims of a crash of a Lancaster while making a parachute drop of emergency supplies on July 31, 1950. The wreckage is still sprawled out at Alert, within a short walking distance of the camp.

There were a number of incentive stories at Alert. Carson B. Walker, 36, a mechanic from Columbia, S.C., has built a \$28,000 home and paid off \$20,000.

A former Navy man with service in the Antarctic, he has been with the Arctic program for 3½ years. Although he appreciates the money, he also likes the variety of tasks at Alert and intends to come back for another year.

Walker was asked how his wife reacted to his lengthy absences from home. "She doesn't especially like it," he answered, "but she doesn't raise any firm objection. If she says 'No', I feel I can win her over to my side. But if she ever said 'Absolutely no', then I wouldn't come back."

Norman T. Rothwell, a cook who formerly served at Mould Bay, had been in the Air Force for 20 years and said that, as far as his wife was concerned, his job was just like another military assignment. Rothwell, who was a GSA guard in Washington for four years, wants to save \$4000 to go into business.

Warner E. Chapman is a 47-year-old bachelor, who looks like a cross between Fess Parker and Walter Brennan. A native of Weston, W. Va., he now calls Daytona Beach, Fla., his home. A radiosonde operator, he has been in the Arctic since 1945, with occasional breaks during which he served at Canton Island in the South Pacific and Montgomery, Ala. He said he helped build the Resolute station and was one of 26 survivors of ice island Charlie when it broke up on Jan. 6, 1960.

Chapman, as do others, likes the adventure associated with his job and a chance to see unexplored areas of the world. He was prepared to leave Alert April 20 to spend two years in the Panama jungle as a radar operator in the Isthmian Canal project, a feasibility program associated with the proposed construction of a new canal.

Our trip was coming to an end. We had visited the five joint Arctic weather stations and were headed for Thule, Greenland, on the way home. Thule, although it had no Weather Bureau personnel, was on the other end of the "Box Top" supply route and merited official attention by Vaughn Rockney, the Overseas Operation chief.

One last comment for the benefit of the friend who bade me farewell! We spent nearly two weeks in the Arctic and didn't touch Alaska once! □



*Measurement of ice depth is a weekly duty and this crew at Eureka drilled 91 feet before reaching water. Putting anti-freeze in the hole Clayton E. Benjamin of Fairhaven, Vt. Holding the drill is Dennis Stossel, Canadian officer in charge.*

## ... for 2 Upper Air Soundings a Day

The Weather Bureau's Arctic stations have one essential purpose: the acquisition of two upper air soundings a day.

The frustrating problems of logistics—supplies, manpower and equipment—revolve about that one objective.

Temperatures may get down to 60 degrees below zero with winds blowing at gale to hurricane velocities, but the show must go on—the launching of huge balloons (600 to 1200 grams) that lift rawinsonde equipment to altitudes of 100,000 feet so that the world may know the winds, pressures, temperatures and humidity aloft.

To sustain the operations at the five Arctic stations supported jointly by the United States and Canada, runways must be constructed and maintained, huge land-moving equipment must be transported, oil for heating and machinery operation must be flown in at costs of \$1 and more a gallon, a water supply must be assured.

The rawinsonde observations are taken in the early morning and at night every day of the week. Each observational crew consists of two men, a task shared by Canadians and Americans. One fills a balloon from a hydrogen generator in a nearby building and launches it on signal from the other. Detection gear picks up the radio "voice" of the sonde after launch and keeps a fix on its travel. Then both men calculate from the signals received the elements that must be relayed to Canada and the United States.

An entire operation, from launch until transmission of the final message, requires 3 hours. Each man has approximately 7 of these assignments a week.

The mechanics at the station have the responsibility of maintaining the equipment and, in the Summer seasons, strip mechanics work on the runways.

Each station has an electronics technician who repairs and maintains radiosonde and other circuitry and also takes a hand with radiosonde observations when his schedule permits.

The men enjoy sharing in other than their assigned tasks. Monotony is the chief villain and the big problem is how to spend free time.

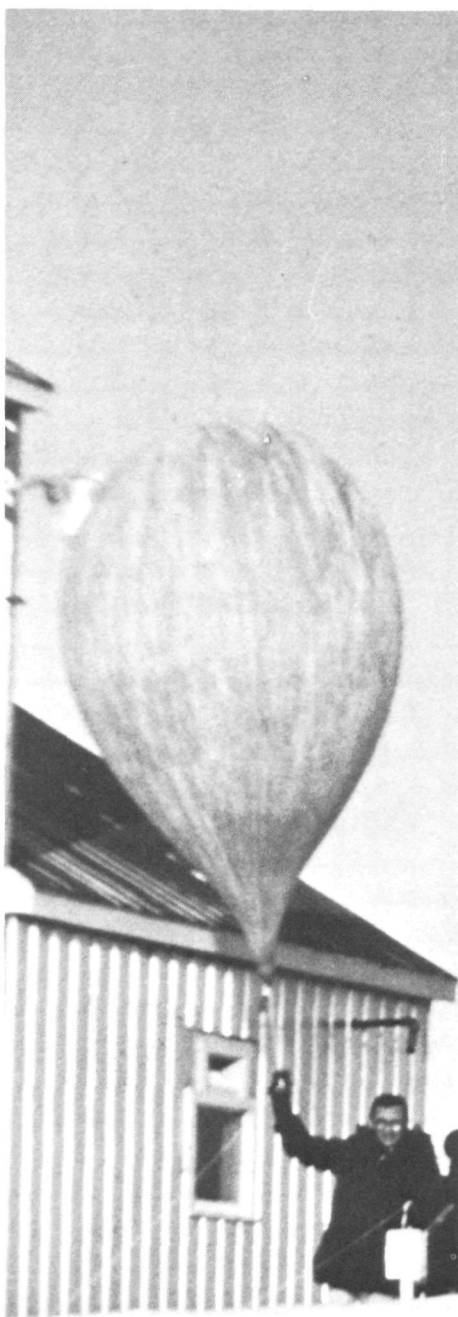
Some of the Arctic workers have become highly skilled photographers. Each station has a well-equipped darkroom and some men have learned to develop their own color pictures.

Diversion is a problem. There are libraries, pool tables, motion pictures. Fishing is popular in season where available and adventuresome hikes bring some relief.

A man can have a conversation with his family by means of a "phone patch." By prearrangement, he makes radio contact with another ham who lives in his area. The latter makes a telephone call to the originator's home, holds the telephone mouthpiece to the receiver and a brief reunion via electronics takes place. A moment of warmth in the Arctic!

A question frequently asked is, "What happens if a man is injured or becomes ill? Is there a doctor at camp?"

There are neither doctors nor dentists. One of the requisites of an Arctic assignment is that the applicant be in perfect health. However, accidents happen and continuity of good health cannot be predicted. First aid treatment is available at each camp, but if there is the slightest suspicion of serious illness, the victim is flown as soon as possible to the nearest hospital facility in Canada. This is expensive (\$1200 for a flight in some cases), but the physical well-being of the personnel must be assured. □



*A Radiosonde carrying balloon is launched at the Canadian-U.S. station at Resolute. The instrument will send back information on winds, temperature, humidity and pressure.*



*Arctic Memorial to Lt. Col. Charles J. Hubbard, polar pioneer, and 8 Canadians killed in a plane crash in 1950 dropping emergency supplies at Alert.*

# The Tale of TABLE MOUNTAIN

**T**able Mountain, six miles north of Boulder, Colo., with its bristling arrays of antennas is the chief field site for ESSA's Boulder Laboratories. The 1800-acre flattop butte is the huge electronic ear where data are received for experiments ranging from studies of effects of the atmosphere on radio signals to remote probing of the state of the oceans, satellite communications, and signals from "radio stars" in far space.

The choice of Table Mountain as the site of a ten million dollar investment in sensitive-receiving stations was based on its size, elevation above any surrounding man-made structures, convenience to the Boulder Laboratories, and most important, the availability of a "radio quiet" area. The required sensitivity of the equipment used to detect minor changes in radio signal paths and field strengths and the low power of the signals being studied demanded an area of extremely low interference from man-made sources. Due to its isolation and relative unsuitability for agricultural or residential uses, Table Mountain provided the low radio interference levels or "radio quiet" required by the nature of the scientific activity conducted by the Institute of Telecommunication Sciences and Aeronomy (ITSA), so the site was leased in 1954 and finally purchased in 1961.

The most familiar feature at the site to most residents of Boulder County is the 500 foot red and white vertical tower which stands midway of the western edge of Table Mountain. Clearly visible to travelers on the Boulder-Lyons highway, the tower supports ten antennas used in high frequency radar studies. In conjunction with 25 antennas mounted on 80-ft. poles which are in a horizontal line 1392 feet long to the north of the tower, this equipment is used to study high frequency ground backscatter, direction of arrival of signals, signal phase variation, fading characteristics, and signal intensities. The antenna arrays are steerable and provide one of the most flexible and versatile systems to study ionospheric radar in the United States. The system is so sensitive that radar signals transmitted from Erie or Platte-

## Boulder's hush-hush hilltop

ville, Colorado, are reflected from the ionosphere to earth at the Atlantic Ocean and returned to Table Mountain again by reflection from the ionosphere. These echoes are of such a nature as to indicate the state of the ocean, and in the future oceanographic studies may be conducted at Boulder in the heart of the United States, thousands of miles away from the ocean surface being studied.

### Antennas Probe Atmosphere

At the extreme northeast edge of the site are two large parabolic antennas used for lower atmosphere studies. The 60-ft. dishes are rotated both vertically and horizontally by motor-driven gear trains. The signal is gathered by the metal dish and focused on the receiving element mounted at the apex of the tripod which extends from the surface of the reflector. Experiments using this station include studies of the effects of mountain ridges on a radio signal, thermal radio emission from thunderstorms, and the evaluation of the characteristics of large antennas. This station has also been used for lower-atmosphere radio propagation experiments in support of communications systems installed by the Department of Defense.

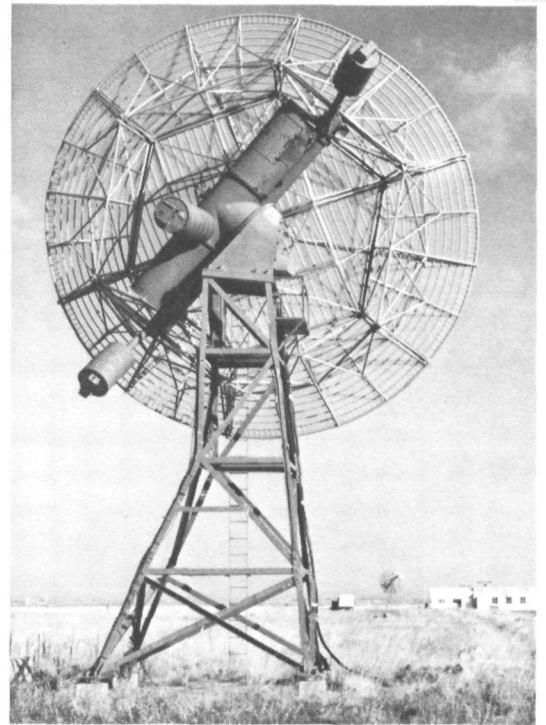
From the very beginning of the space age, ITSA has been actively involved in satellite communications and the use of satellites to gather data about our physical environment. Near the center of the broad, flat top of Table Mountain, a satellite monitoring station receives transmissions from OGO-I and OGO-III to study the ever-changing upper atmosphere (ionosphere). Two 28-ft. dish antennas monitor signals at 40 MHz and at 360 MHz. By comparison of signal characteristics on the two frequencies, scientists arrive at the electron content of the ionosphere and the total integrated electron content along the line-of-sight path from the satellite to the station. These data are used in studies of ionospheric radio propagation.

Just north of the satellite station, a large radio telescope yields information on the nature of extra-terrestrial radio sources as seen in the high frequency range around 10 MHz. Typical of the information received are sporadic radio emissions of Jupiter, the nature and extent of regions of ionized hydrogen gas in the plane of our galaxy, the structure and extent of the galaxy, and the physical nature of certain "radio stars" outside our galaxy.

The High Altitude Nuclear Detection Studies stations adjacent to the radio telescope monitors changes in the geophysical environment by means of an assemblage of radio, optical, acoustic, and magnetic sensors. The data are immediately analyzed by an "on-line" computer which determines within a few minutes when a natural event or man-made disturbance such as a nuclear explosion occurs above the earth's surface. Solar flare effects constitute another type of disturbance detected, and this information is transmitted immediately to the Space Disturbance Forecast Center for use in its forecast and warning service to NASA and other federal agencies.

This describes only a small portion of the experimental work being conducted at the fifteen stations located on Table Mountain. ITSA, largest of the four Institutes in the Institutes for Environmental Research, is the chief civilian research agency of the Federal Government in the field of electromagnetic telecommunications. In carrying out ITSA's responsibilities to provide research support for the twenty billion dollar annual expenditure in telecommunications, the Table Mountain field site is a vital component.

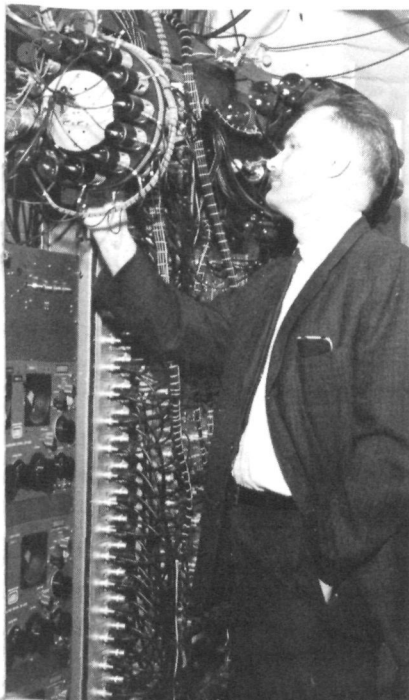
Plans for the Table Mountain site call for a continuation and expansion of present research activities and the possibility of intensified efforts assuming that the necessary freedom from interference or "radio quiet" can be maintained. With spread of residential areas and increased industrialization in the United States, the availability of suitable locations for the sensitive monitors are increasingly difficult to find, and the importance of the Table Mountain site will greatly increase. □



Antenna used to receive radio transmissions from the Ionospheric Beacon experiments on Satellites OGO-I and OGO-III.



Table Mountain's 60-foot parabolic antennas used for radio propagation experiments in the troposphere.

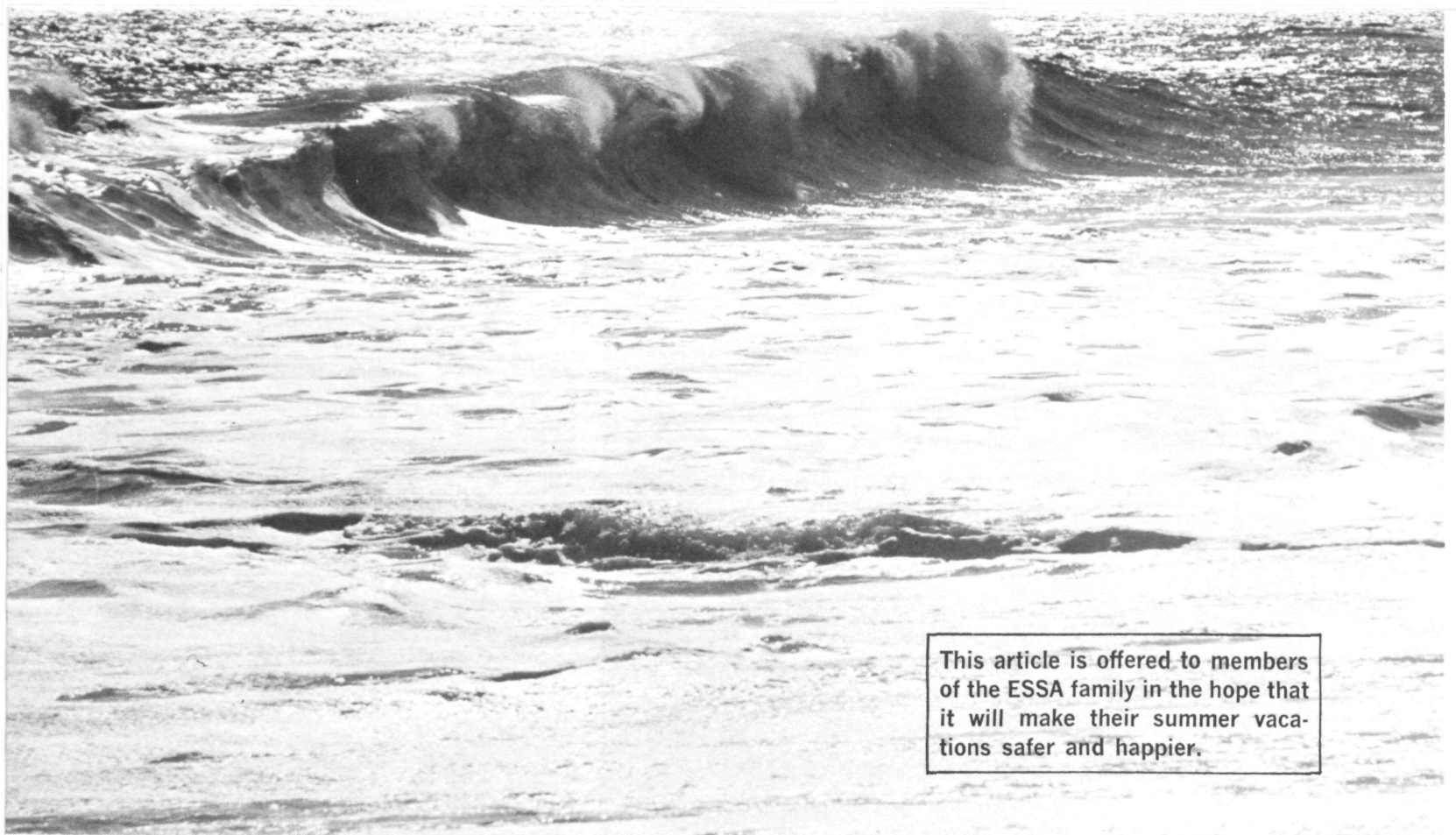


(Top), High frequency steerable, narrow beam receiving antenna arrays. The lower array consists of 25 log periodic elements, the vertical array of 10 similar elements. This facility is one of the most flexible and versatile systems in the United States for use in the study of high frequency propagation and ionospheric radar systems problems.

L. H. Tveten, head of the Ionospheric Radar Program, Ionospheric Telecommunications Laboratory, inspects radar circuitry.

(Right), VHF high resolution rapid-scan antenna on Table Mountain. This 25-element antenna is known as a Yagi array.





This article is offered to members of the ESSA family in the hope that it will make their summer vacations safer and happier.

*This summer, make sure you outwit the*

# KILLER AT THE SEASHORE

**T**his summer your child could drown—needlessly—at the seashore.

He may be an able swimmer. He may be in very shallow water perhaps only up to his chin. It is a warm sunny day, with a good surf running. Lots of other children are playing in the shallows, and tragedy seems far removed.

But suddenly, and quite unexpectedly, he may feel the bottom moving fast beneath his feet and realize he is being swept out to sea. Knowing that he can swim well, he may strike out hard against the current for shore. But after a few minutes, he will find that he is not making any headway, that the water around him is over his head, that he is almost out to the surf zone.

He may call for help, but no one will hear him above the surf's roar. Panic will take over, along with exhaustion, and maybe a bad cramp. And in another moment, he will be dead by drowning.

Every year, many persons unfamiliar

with rip currents lose their lives unnecessarily.

They may be excellent swimmers, but they may not know what to do when caught in a rip current. And they will die, as victims of killer currents, in fact, but as victims of the exhaustion and panic that would never have occurred if more swimmers know how to recognize a rip current and how relatively easy it is to swim out of one.

The Institute for Oceanography has gathered and facts about rip currents that endanger the lives of swimmers and developed some simple rules of coping with them. It would be useful, and even life-saving, for every swimmer to know them as he prepares to take a summer vacation at the beach.



**What is a rip current?** Technically speaking, it is a strong narrow current flowing out to sea perpendicular to

the shore and carrying back to sea the water brought in by waves and longshore currents. It is part of a generally-circular pattern of water movement found off most long, gently-sloping sand beaches. It can travel at speeds up to two or even three miles an hour, and change its position from day to day and even during the same day. The same beach may have several rip currents operating at one time, and then go weeks with none at all.

Once outside the surf zone, the rip current dies rapidly, spreads out, and often forms a big sluggish eddy which oceanographers call a "rip head".

**How do you recognize a rip current?**

Rip currents are usually easy to see once you know what to look for. In general, the pattern of the sea surface between the beach and the area where the waves are breaking offshore, is one of long lines that run parallel to the beach. A rip current makes a break in this pattern by providing a cross-pattern line running perpendicular to the beach. Sometimes small choppy waves form a line out to the surf zone indicating a rip current. Often, a foam line will show where it is.

BY HARRIS B. STEWART, JR.  
Acting Director, ESSA Institute  
for Oceanography

At other times, when there is suspended sediment in the water, a rip current may be marked by a long brownish band of darker water.

Usually the surf is lower where a rip current passes through the surf zone, and there will be a break in the line of breakers. Or if a rip current has been stabilized in one place for a while, there is often a short sand spit built out from the beach at the base of the rip.

If, as you are swimming, you notice that you tend to move faster in one direction along the shore, there are probably strong longshore currents, and you should expect rip currents to be developing. Or if you are walking from the beach into shallow water, and you feel a longshore current pulling at your legs, you may be able to see a spot down-current where a rip is moving water seaward. Or look at the outer end of any jetty, groin, or other solid obstruction to the longshore movement of water, and there likely will be a rip current where the water has been deflected seaward.

**How do you get out of a rip current?**

Fortunately, you will know when you are in one. Your first indication, if your feet touch bottom occasionally, will be a feeling that the bottom is moving fast toward shore. It's a strange feeling, for you have no nearby frame of reference to show that you yourself are moving, and you feel as though the sand beneath your feet is moving. When your feet aren't occasionally touching bottom, you will soon notice that you are much further out to sea than you expected to be, or moving out faster than other swimmers near you, or that the area where the waves are breaking seems to be approaching fast.

This is the point where most swimmers who lose their lives start swimming their hardest toward the beach and where they make a fatal mistake. Since the rip current is seldom more than ten or twenty feet wide, swimmers should *swim parallel to the beach*, and they can very soon be out of it.

An alternative is to relax and let the current carry you seaward through the surf zone and into the rip head where the current slows down, and from where you can then have a leisurely swim back to the beach on a course parallel to the rip current. Surfers along the California coast actually search out rip currents and ride them on their boards back out through the surf zone to the place where the big ones are humping up.

The rules are simple. Knowing them may save your life: (1) Learn to recognize a rip current; (2) Look for them every time you go to the beach; (3) Point them out to the children and tell them about them; (4) Avoid them if possible; but (5) If you do get caught in one, swim parallel to the beach, and you will soon be out of it. □



Photo courtesy Miami-Metro News Bureau

A small,  
select service  
marks

# THE FIRST HALF CENTURY



THE WHITE HOUSE  
WASHINGTON

May 18, 1967

I congratulate the commissioned officer corps of the Environmental Science Services Administration on the fiftieth anniversary of the corps.

As the commissioned corps of the Coast and Geodetic Survey from 1917 until 1965, you had a central role in an agency whose services and high standards are known, not only to those who use our sea lanes and airways, but to engineers and scientists the world over. The record of accomplishments during those years is one in which you may all take pride.

Today, as the commissioned corps of ESSA, you now have duties fully as exacting as before, and more diversified than ever. I am confident that you will meet your new challenges with the same high standards and devotion to duty so firmly established during your first half century.

A handwritten signature in black ink, appearing to be 'Lyndon B. Johnson', written in a cursive style.

**T**he Nation's smallest uniformed service celebrated its golden anniversary in May.

ESSA's Commissioned Corps, a select organization of fewer than 300 men, with a formidable array of scientific and engineering skills, noted its 50th year of service to the Nation.

The Coast and Geodetic Survey's Commissioned Corps was created by an act of Congress on May 22, 1917. When the Survey became a major element of ESSA in July 1965, the Commissioned Corps was transferred to the new agency. Its ratings range from ensign to vice-admiral.

It operates across a wide range of environmental programs, in the Coast Survey, the Weather Bureau, the Institutes for Environmental Research, the National Environmental Satellite Center, the Environmental Data Service, and at ESSA headquarters in Rockville, Maryland.



Assignments include such diverse responsibilities as ship command, piloting photogrammetric planes, research and administration. Interdisciplinary participation extends to telecommunication sciences, aeronomy, meteorology, hydrology, oceanography, geodesy, geomagnetics, seismology, satellite technology and cartography.

Officers' duties take them almost anywhere in the world. In a 30-year career, a Corps member will devote approximately half his time to combined sea, mobile and remote-area duty. It is not uncommon for a Corps family's children to attend as many as half a dozen schools in one year when the officer is serving with a mobile field party.

Candidates must have bachelor or higher degrees in civil, electrical or mechanical engineering, mathematics, physics, oceanography or other scientific disciplines useful to the ESSA mission of understanding, describing and predicting the geophysical environment.

Although the Commissioned Corps is not one of the armed services, its officers are subject to wartime transfer by the President to the military services. Its men and the Survey's ships have served with distinction in World Wars I and II.

In World War I, the SURVEYOR disabled the notorious German submarine U-39, which had sunk the LUSITANIA. At the war's end, the Coast Survey's ships and men were transferred back to the Department of Commerce.

In World War II, every phase of the Coast Survey's activities was geared to the needs of the military establishment. Most of its commissioned officers were transferred to the armed forces, serving

MAY 19, 1967

**TO THE MEMBERS OF  
ESSA COMMISSIONED CORPS**

**I am pleased to offer congratulations to you on the golden anniversary of the ESSA Commissioned Corps.**

**To those officers who retired from the Coast and Geodetic Survey before the Environmental Science Services Administration was formed, I express deep appreciation for establishing the high caliber of scientific standards that have characterized the work of that agency. These standards formed the basis for the Corps which was transferred to ESSA by the President's re-organization plan in 1965.**

**To the officers of ESSA today, I call attention to the many challenges we face as we move forward with the renewed vigor of a young and vital agency. Our programs, reaching across the lands and oceans, and into the atmosphere and space, provide an unlimited horizon for the imaginative and creative man of science.**

**We are happy to have you aboard and playing vital roles in ESSA's missions. . . .**

**ALEXANDER B. TROWBRIDGE**  
*Secretary of Commerce*

in the Army, Navy and Marine Corps. They mapped isolated regions of Asia, Africa, Alaska and South America, directed fire-control in frontline observation units, engaged in amphibious landing operations, and developed methods and served as instructors in surveying and mapping.

The Coast Survey's vessels were transferred to the Navy, serving a variety of functions. In addition to performing defensive coastal surveys, they surveyed such other areas as Guadalcanal, Okinawa and Tokyo Bay. The PATHFINDER, veteran of 50 bombing raids, sustained a kamikaze hit at Okinawa and, although she was frequently reported by Tokyo Rose as having been destroyed, survived the war.

Target charts of Hiroshima and Nagasaki and of Romania's Ploesti oil fields were compiled and published by the Survey under officer direction during World War II. In 1944 the bureau produced two million copies of target charts. It was the principal source of world aeronautic charts during the war. In 1944 and again in 1945 the Survey produced 13,500,000 U. S. charts, as well as four million copies of foreign charts. Another eight million copies of specialized charts also were produced during each of those years.

Among their other duties, ESSA Commissioned Corps officers today man the Coast Survey's 15 vessels engaged in deep-sea research, hydrographic coastal surveys and the search for underwater hazards. Survey ships include such sophisticated floating laboratories as the OCEANOGRAPHER and DISCOVERER, and such small ships as the wiredrag vessels RUDE and HECK.

wiredrag vessels RUDE and HECK.

The OCEANOGRAPHER is now on a global scientific expedition; her sister ship, DISCOVERER, was commissioned April 29. The RUDE and HECK operate as a team seeking out navigational hazards; to the commanding officer of these ships goes

*continued*



*ESSA Commissioned Corps' golden anniversary was celebrated on May 19 with a dinner-dance at the Washington Naval Shipyard Officers' Club. Among speakers: ESSA Associate Administrator, Rear Adm. Don A. Jones.*



the distinction of being the only captain of two ships in Government service.

The Corps is headed by Rear Admiral Don A. Jones, ESSA Associate Administrator.

When the commissioned service came into being in 1917, 119 men were sworn

as officers. Of them, 3 were commissioned ensigns, 53 lieutenants (j.g.), 22 lieutenants, 10 lieutenant-commanders, eight commanders, and three captains. One lieutenant, junior grade, already had served 49 years in the Coast Survey, while a full lieutenant had served 53

years of prior service. They were probably the Nation's oldest lieutenants.

Of the original 119 men, 15 died on active duty, 55 retired and 49 resigned. Five of them became Directors or Assistant Directors of the Coast and Geodetic Survey.

## "Whither Thou Goest . . ."

has special meaning for the wives of ESSA Commissioned Corps

BY ANN K. COOK

**A**merican families are moving more than ever, but the moving-est group of professional people of all may be the officers of the ESSA Commissioned Corps, which observes its 50th anniversary this year.

Basically, the job of the Commissioned Corps is to explore and measure the earth and its environment, which naturally requires a lot of moving. In a 30-year career, an officer will spend about half his time in sea, mobile, or remote area duty, and may move more than 25 times.

For an officer's wife, this usually means either that her husband is at sea or that the whole family is traveling from place to place in a trailer with a field survey party.

Mrs. Lorin F. Woodcock was born to this kind of life. Her father, George D. Cowie, was one of the first officers commissioned when the Corps was created. At the beginning of World War II, the Cowies were stationed in Manila, where Commander Cowie was director of the C&GS field office. Cdr. Cowie was killed in the bombing of Manila, and Theodora Cowie and her mother were interned by the Japanese for three years until the liberation of the Philippines. She describes these years as "mostly boring."

Three years after the war, Theodora Cowie married Lorin Woodcock, now a Captain and Associate Director of the Coast and Geodetic Survey. The Woodcocks have moved frequently from coast to coast, usually living in port cities and now in Maryland near ESSA headquarters. From 1951 to 1956, the Woodcocks traveled in a trailer through Kentucky, New York, West Virginia, Michigan, Wisconsin, California, Utah, Nevada, Massachusetts, Texas, Arizona, South Carolina, Idaho, and Montana. They began this trek with one child and ended it with the fourth on the way.

Life in a trailer is easier with preschool children, the ESSA Corps wives agree, if you can solve the laundry and storage problems. Cecille Holmes, wife of Commander Alfred Holmes, lived in a trailer with two small girls for four years, moving about every three months. In one remote location, the nearest laundromat was 40 miles away. Cecille resigned herself to a galvanized tub and washboard. More than once, she has taken an injured child many miles to a doctor.

Mrs. Holmes had her own solution to the problem of storage in a trailer. When field parties move, the officer drives a vehicle pulling the trailer. Wife and children go in the family car. Mrs. Holmes hauled a second, smaller trailer—dubbed "the attic"—which contained out-of-season clothes, as well as toys, bicycles, and much, much more.

These moves have certain perils for the families. Some wives follow the practice of driving right behind the trailer, never losing sight of it. They know that families on the road have often become separated for a day or two. Most

husbands and wives have a prearranged "message center" to call if they become lost.

Generally, field work is scheduled so that parties will be in warmer climates in winter. Sometimes, however, weather catches up with them. Mrs. Woodcock has a vivid memory of a trip south from Missoula, Mont. With her three small children, she was driving the family car over a mountain pass, closely followed by another wife with two small children. Near the top of the mountain, blizzard conditions made the road impassable. Their husbands were lower down, struggling to pull the trailers up the grade. Unable to go on, the women gathered all five children in one car and waited without food for seven hours until their husbands rescued them.

When the children grow older, this life becomes more difficult. It is not unusual for children of the Corps to change schools five or six times a year. A son of Captain William E. Randall attended 19 schools before completing high school, but won a National Merit Scholarship nevertheless. The Randalls were still on the move when their children were reaching their teens. "Would you believe six people and a five-gallon hot water tank?" asks Jean Randall.

Another problem of trailer life, Mrs. Randall points out, is entertaining. Such simple things as disposing of guests' wraps become major obstacles. With no spare closet space and beds occupied by four children, Mrs. Randall's solution was to take coats at the front door, carry them through the trailer and out the back door to the family car. "Do you suppose they ever wondered why their coats were cold?" she muses.

Sea duty for the husband is a recurring feature of an ESSA Corps wife's existence. The average officer will spend about nine years at sea during his career, which leaves the wife to cope alone with the normal crises of home and family.

But Mary Lou Natto, wife of Commander Merlyn E. Natto, remains enthusiastic about the life. "I have been able to do things that I never could have otherwise," she says. While moving frequently, Mrs. Natto kept her furnishings to a minimum, so that nothing hampered her from going wherever her husband might be. "We have been so many places and been fortunate enough to be able to stay long enough to see everything. It's not an easy life, but I have thoroughly enjoyed it all," Mrs. Natto says.

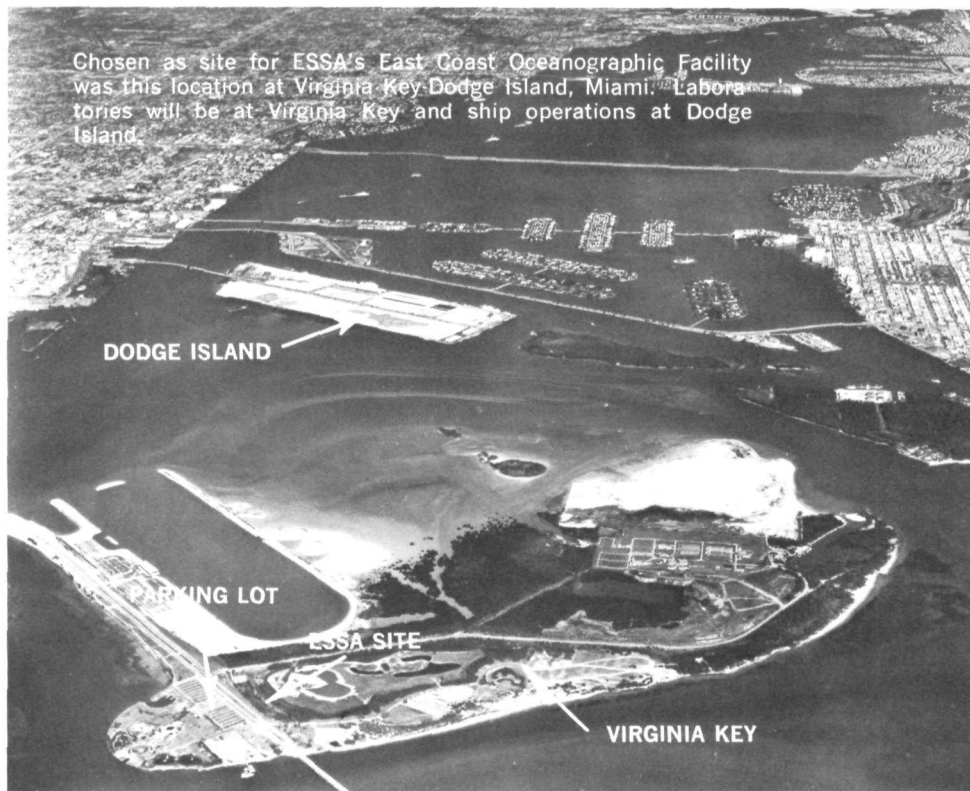
The small size of the Corps, and the singular quality of the life they share, have created a close-knit family feeling among its members, all the wives agree. Their experiences have made them adaptable and resourceful, and have given them a knowledge of the United States that would be hard to match.

But I think it would be very interesting," one says wistfully, "to stay in one place for awhile." □

# ESSA NEWS BEAT

## New Miami Research Center

# ESSA's New Oceanographic Site Chosen



## ESSA MARKS ITS SECOND ANNIVERSARY THIS JULY 13

Created by Presidential order in July, 1965, the new agency brought together the functions of the Weather Bureau, the Coast and Geodetic Survey and the Central Radio Propagation Laboratory of the National Bureau of Standards. Organizational changes have brought into being the Environmental Data Service, the National Environmental Satellite Center, and the Institutes for Environmental Research.

To celebrate our second birthday, ESSA will welcome thousands of persons across the Nation and in remote locations around the world in annual open house festivities. Our installations are holding open house on various dates between July 8 and 16, with most observing the anniversary on July 13.

Virginia Key-Dodge Island, Miami, Florida, will be the site of ESSA's East Coast Oceanographic Research Facility.

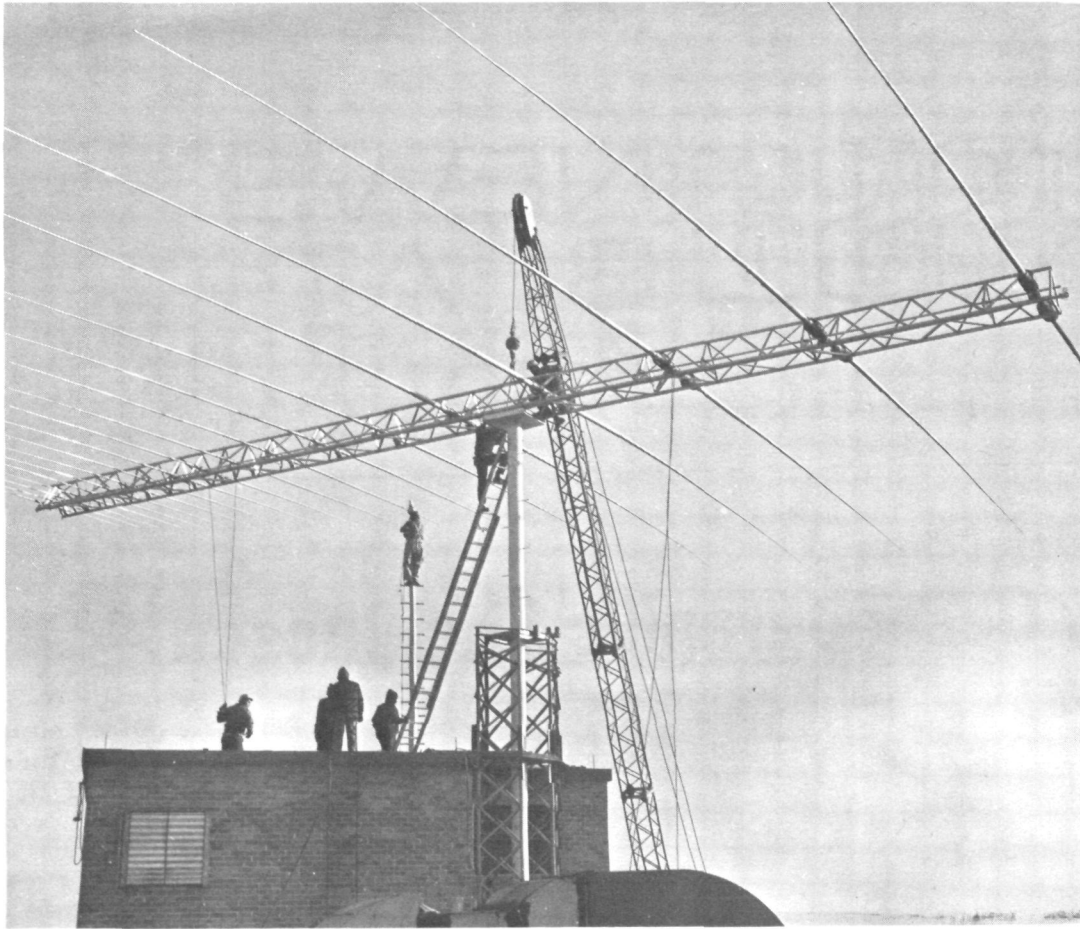
Virginia Key-Dodge Island will become a major center for the programs of ESSA's Institute for Oceanography, headed by Dr. Harris B. Stewart, Jr. It is one of ESSA's four Institutes for Environmental Research. Berthed at the site will be the ESSA Coast and Geodetic Survey's Atlantic oceanographic research ships.

The facility is expected to have a complement of approximately 300 persons and a \$3.5 million annual payroll. It will centralize three Institute research groups: the Marine Geology and Geophysics Laboratory, headed by Dr. George Keller; the Physical Oceanographic Laboratory, headed by Bernard D. Zetler; and the Sea-Air Interaction Laboratory, headed by Feodor Ostapoff.

Ships to be berthed at the facility include the DISCOVERER, commissioned April 29 in Jacksonville, Florida; the RESEARCHER, being built in Toledo, Ohio, and a coastal survey ship.

Before submission to the Department of Commerce, the sites were studied by two ESSA groups: Site Evaluation and Site Recommendation Committees. These groups visited all 115 locations bidding for the center.

The Dade County Commissioners have offered to provide without charge sufficient land on Virginia Key for location of the facility. In addition, the County agreed to provide adequate space for ship operations at Dodge Island, the new Port of Miami.



## Rare Antenna is Installed At Gramax

“What a crazy clothesline!!” That was the comment of an interested bystander as he watched a huge metal arm with nearly 20 metal crossbars being installed atop the Weather Bureau’s Gramax Building in Silver Spring, Maryland.

More than 160 feet above the ground, this unusual display commands the attention of motorists and pedestrians along busy Georgia Avenue, and numerous inquiries have been received from occupants of the motels that surround the building.

This crazy clothesline actually is an antenna of rare sensitivity, capable of picking up high frequency radio signals from virtually any part of the globe.

Its primary purpose is to provide an emergency communications link during the hurricane season in the event other systems become inoperative. It will also be used to monitor weather communications networks.

Described as a rotatable log periodic antenna, it rises 36 feet above the Gramax Building and occupies a space 80 feet by 70 feet.

Similar antennas have been installed at various military bases. The one at Gramax is unique in that it was the first put up in a downtown metropolitan area, in this case on a 15th floor penthouse roof.

The Weather Bureau’s Engineering and Communications Divisions joined in executing a contract with the Hy-Gain Electronics Corporation for development and installation of the antenna.

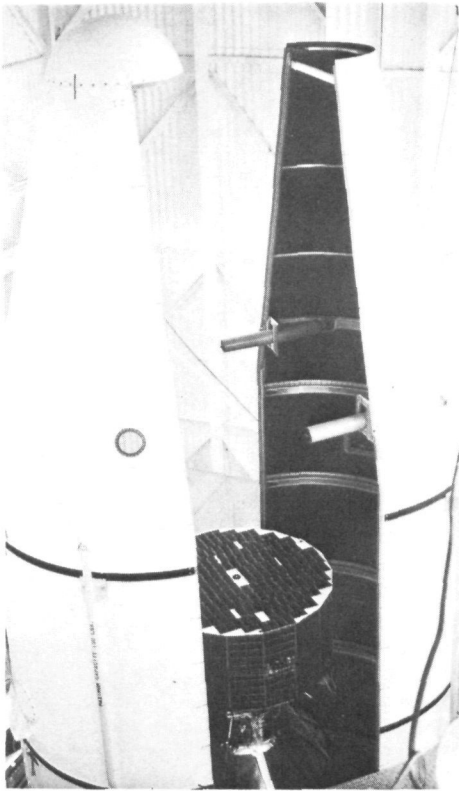
The uses to which the antenna can be put have been listed as follows:

1. Quality control monitoring of a high frequency single side band Weather Bureau emergency communications network.
2. Emergency communications between the Weather Bureau Central Office and the National Meteorological Center.
3. Emergency communications with Boston, New York, Miami, New Orleans, and San Juan in case of communications failure of the hurricane hot line.
4. Emergency communications with radar stations in the hurricane belt on the Atlantic and Gulf Coasts.
5. Alternate control for relaying information between Weather Bureau stations in an emergency and when they are unable to contact each other.

The antenna was installed in February to permit adequate testing time before the hurricane season.



Meteorological agreements for New York-Moscow air route were signed recently in Geneva by ESSA Administrator Dr. Robert M. White (left) and Academician E. K. Federov of USSR. Witnessing ceremony: G. D. Cartwright. Arrangements supplement Civil Air Transport agreement between the two nations.



## ESSA's Fifth Weather Satellite Is Launched

ESSA took over operational command of its latest weather satellite—ESSA 5—from the National Aeronautics and Space Administration on May 8. ESSA 5 was launched on April 20 from NASA's Western Test Range in Lompoc, California.

ESSA 5's orbit ranges from 840 statute miles to 883 statute miles. It circles the earth every 113.5 minutes, and is producing cloud photographs of excellent quality. It supplements ESSA 3 in the National Environmental Satellite Center's operational weather satellite system. Like ESSA 3, it contains an array of atmospheric radiation sensors to gather information for research on the earth's heat balance. ESSA 3 was supplemented because of the failure of one transmitter and of the radiation system recorder.

Since its beginning in February 1966, the operational usefulness of the data gathered by the TOS system has been improved in several ways. Starting with ESSA 2, the spacecraft were placed in orbits nearly 400 miles higher than earlier weather satellites. The Advanced Vidicon Camera System (AVCS), first used in the TOS system on ESSA 3, takes photographs that cover 4 million square miles. The larger area coverage afforded by the improved cameras and the higher orbit reduces the number of pictures

## Unique Radio System Serves Public

"Young people, if it snows, remember that the forecast came from your Mayor; if it doesn't—blame the Weather Bureau!" So went the first message of a new service, developed locally and entirely privately financed to meet a need in Baton Rouge, La.

On February 8, Mayor-President Dumas read the first message of the Baton Rouge and Vicinity Forecast. It is a new and unusual VHF FM broadcast service operated by the Weather Bureau which provides current weather data and forecasts to radio and television stations, and industrial and private subscribers within a 30 to 40-mile radius of that city.

At five minutes past each hour the transmitter is activated to broadcast routine data and also at 6-hour intervals to transmit the scheduled forecasts. A transmitted tone signal activates the receivers which may use an associated tape recorder to automatically record the message even if the receiver is unattended.

When emergency weather warnings are necessary the Weather Bureau will send a characteristic tone signal which feeds through the receiver to turn on a light or other signal at the radio or TV operating console. The key EBS station can then



*First message broadcast by new service using Weather Bureau information in Baton Rouge, La., is read by Mayor-President Dumas. MIC Cecil Palmer looks on.*

send out the EANS signal to other stations in the EBS system to alert them to a forthcoming weather warning message. Sixty seconds following the Weather Bureau tone signal, the warning message is transmitted for simultaneous broadcast or relay via commercial radio and television facilities.

Since its operation began, the radio program has been received well. The subscribers to this service are pleased with the information being broadcast and it has eliminated the necessity of a great many inquiries to the WBAS in Baton Rouge. This 60-second broadcast has also improved our aviation weather service to pilots.

required for global coverage from 450 to 144 per day, and thereby decreases the time needed for processing and analyzing them.

A major advancement has taken place in processing and operational use of the ESSA satellite pictures. Shortly after the launch of ESSA 3, the National Environmental Satellite Center began preparing digital global mosaics of the cloud pictures each day. To produce global cloud mosaics, picture signals received from the satellite are converted into digits representing gradations of brightness in the picture images. These digital brightnesses are then mapped by computer onto standard map projections. Three digital mosaics, one each for the Northern and Southern Hemispheres, and one for the equatorial regions, show

the earth's cloud cover each day. The digitized photomosaics—composite pictures of the earth's weather—are routinely sent through ESSA-Weather Bureau communications systems to weather stations throughout the Nation. The information is used in preparing forecasts and briefing pilots, and will be valuable during the 1967 hurricane season.

The fifth ESSA spacecraft, like its predecessors in the TOS system, is a cartwheel satellite of the TIROS type. It rolls along in orbit like a wheel, and each of the two cameras on its rim points directly toward the earth once during every revolution. In a nearly polar, sun-synchronous orbit, the satellite views weather all over the earth once every 24 hours, photographing a given area at the same local time each day.



Dr. Robert M. White, ESSA Administrator, presents scroll to Drs. Robert H. and Joanne Simpson at good will luncheon March 16 prior to their departure for new assignments in Miami. Dr. Robert, former Weather Bureau associate director, will replace Dr. Gordon Dunn as head of the National Hurricane Forecast Center. Dr. Joanne will continue her research into tropical storm systems. The scroll being held by Dr. White was signed by all who attended the luncheon.



Ted Butts, ESSA exhibit designer, recently was praised by the Washington Star's columnist, Betty Beale. "Washington is jumping with talent these days," she wrote. "There is a new art find here, Ted Butts, who can't even have a one-man show because his work is snapped up so fast he has nothing to exhibit. His only available paintings were grabbed by the State Department and are hanging on the walls of our embassies."



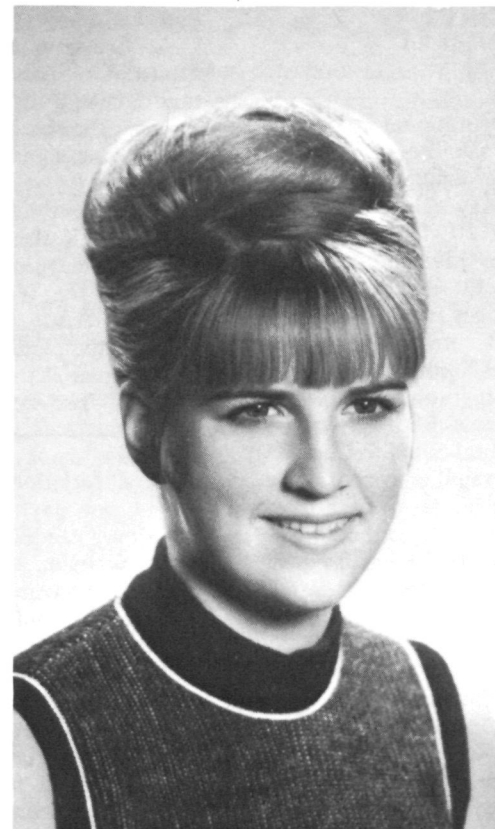
HOLLYWOOD MAGIC—When the Weather Bureau's Overseas Operations Division wanted a cover picture for its field publication, "Oops Scoops," Secretary Judi Zidar posed on a platform of a Gramax Building terrace to depict the balloon launching of a passive radar target (left). Not shown was how the balloon was kept from flying away. Arthur W. Youmans, chief of the Operations Branch, also held onto the balloon with a string tether (top).



Seventh anniversary of commissioning of USC & GSS SURVEYOR was celebrated off California coast April 30. Cutting the cake were (from left) Second Cook F. J. Jayectin, Chief Yeoman Edward Machnik, Second Cook E. B. Wate, Chief Boatswain Jerry Randall, Second Assistant Engineer John Hardy and Chief Quartermaster Patrick Neal.



Edmund D. V. Dickey (left), Placement Officer for the Boulder Laboratories, U. S. Department of Commerce, receives a certificate of appointment to the Colorado Governor's Committee on Employment of the Handicapped from Dr. George S. Benton, Director of the Institutes for Environmental Research.



Patricia Craig, daughter of Mr. and Mrs. Robert W. Craig of Bethesda, Md., was named May Queen of Fort Belvoir, Va. Mr. Craig is chief of ESSA's Emergency Hazards Warning Information Center. Patricia, 18, is a high school senior.

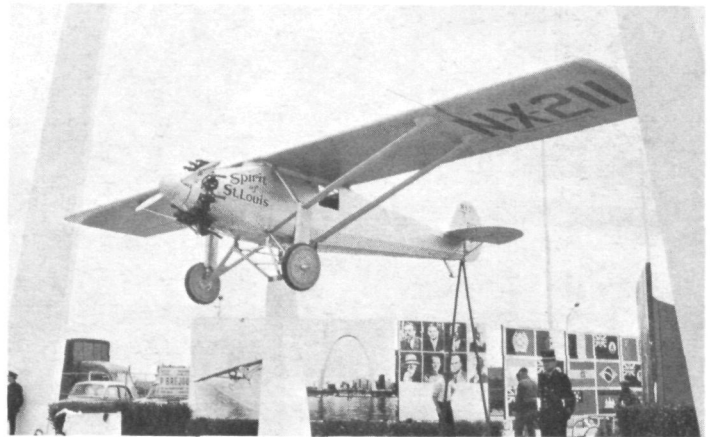
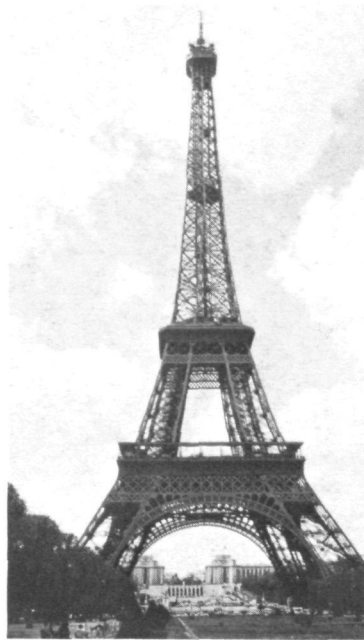


Visiting Boulder Laboratories member Soong Yung Cho, chief of the Technical Standards Branch, Radio Regulatory Office, Republic of Korea. He is here to study and observe aspects of radio frequency management and modern techniques of radio communications in relation to frequency conservation and usage. Mrs. Vicki Bryan of the IER Computing Lab demonstrates procedures to Mr. Cho.



A weather-minded family is that of Anthony Veith of Weather Bureau's communications division, shown at his Washington home with his wife, Ann, and their 13 children. From left, in front: James, Patrick, John, Margaret, Mary Ann, Catherine, Danny, William, Barbara and Theresa. Rear: Bridget (in Mrs. Veith's arms), Michael, and Anthony.

# ESSA goes to Paris...



*Among displays at Paris' International Aeronautical and Space Show was an ESSA exhibit depicting the agency's aviation services. At right: J. Bessemoulin, director of France's meteorological service (left) and Gordon D. Cartwright, U.S. science attache in Geneva, view exhibit.*