U.S. DEPARTMENT OF COMMERCE ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION JANUARY 1967

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In this issue:

National Oceanic and Atmospheric Administration

The Polar Times

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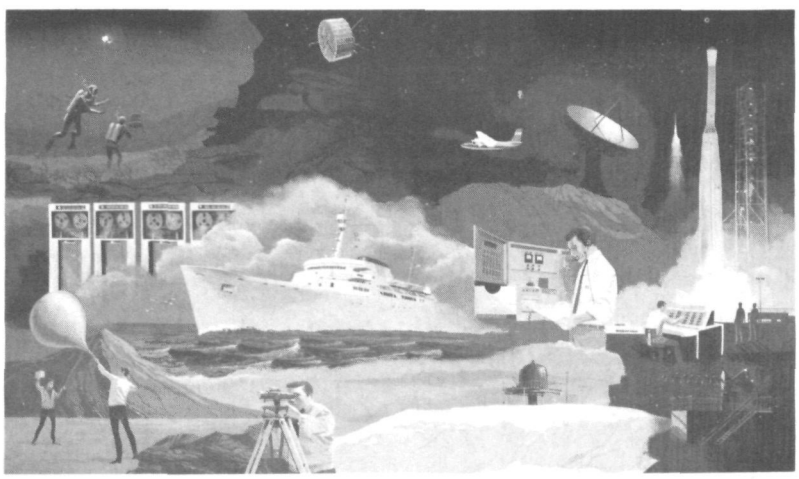
JANUARY 1967 VOLUME 2 NUMBER 1

U.S. DEPARTMENT OF COMMERCE, John T. Connor, Secretary
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION, Robert M. White, Administrator
Werner A. Baum, Deputy Administrator

page

COVER

The cover of January's ESSA WORLD symbolizes the far-flung activities and the diversity of skills and disciplines required to carry out the ESSA mission as a focal point for understanding, describing and predicting the state of the oceans, the atmosphere, and the size and shape of the earth. A copy of this cover, without lettering, 21½ by 16 inches and suitable for framing, will be mailed without charge to any ESSA employee requesting it.



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Words for 1967

An Editorial

The coming of the New Year is a time when man's instinctive and unending search for guidelines to live and labor by is intensified. Human existence is a complicated affair at best; one faces a new year seeking new strength and new wisdom to meet new challenges.

Nowhere is this more applicable than in the lives of ESSA's personnel, upon whose talents and dedication depend the future of an organization less than 18 months old and charged with a responsibility so encompassing and complex that it starts literally beneath the ocean floor and reaches to the sun.

Recently Vice-Admiral H. Arnold Karo, a valued associate and friend who is retiring as ESSA's Deputy Administrator, was honored at a farewell dinner. In his speech, I found the inspiration to guide us in the year to come:

"I have had the opportunity to serve my country for over forty-three years, a privilege which I greatly cherish. It has been a good way of life. I have enjoyed being a public servant. Most of you know my personal creed, the philosophy that has helped me chart my course over the years.

"To my old shipmates, Coast and Geodetic Surveyorites, and ESSAites all, I commend:

"Love of country and steadfast devotion to duty and to the public service.

"Personal integrity—integrity and belief in one's self, one's service, and one's country. To thine ownself be true.

"The search for excellence—the desire to excel, not for personal glory but to improve the quality of public service.

"Courage to stand for principles and not to compromise under pressure. By this I do not mean to the point of obstinacy or contentiousness, although I suspect I have been accused of that. But rather as Theodore Roosevelt once said, 'On the Ten Commandments and the Sermon on the Mount, uncompromising rigidity; on all else the widest tolerance.'

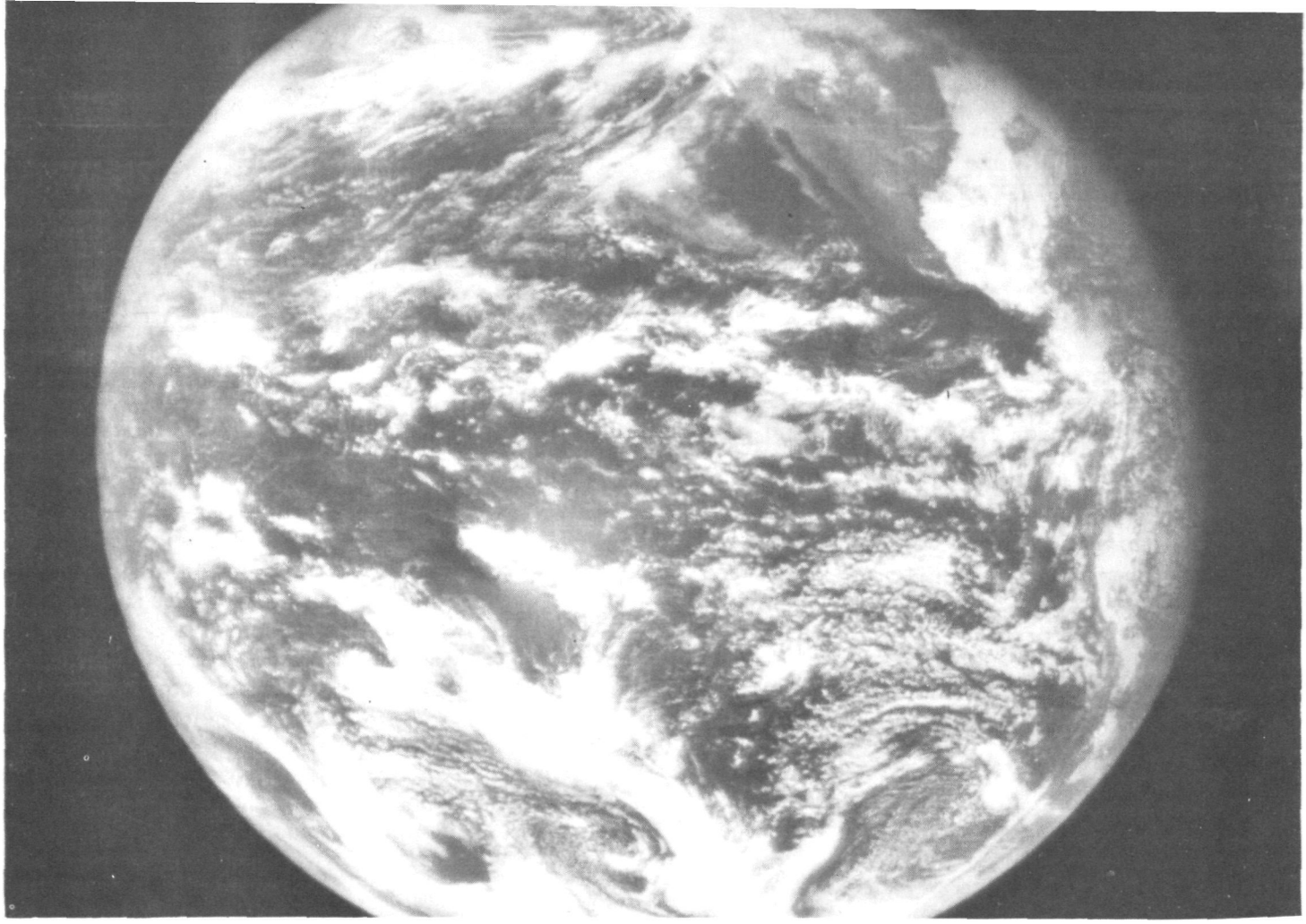
"Never to order an assignment or duty for another you will not undertake yourself.

"Always be alert to new possibilities and for new and better ways of doing things.

"My life has been rich and rewarding, perhaps because I have been given an opportunity to use whatever talents and abilities I possess in the service of my country and for the good of all mankind.

"In closing, I want to express my confidence in the organization of ESSA. This, I firmly believe, is the dynamic new structure which will form the springboard for greater service to our country and so to all mankind. Its concept is so right that I marvel someone did not take the plunge before. My best wishes go too all of you who continue to serve. May you be ever blessed with fair winds, sunny skies, and following seas."

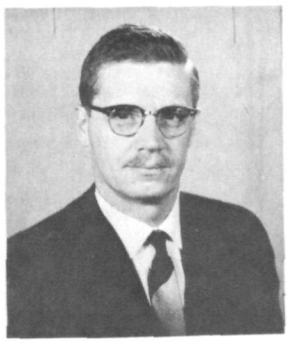
I commend Admiral Karo's message to everybody in ESSA. A happy New Year to you all.



This photo, first of the Earth's disc, taken by the ATS-1, covers the east Pacific and shows existing storm systems.

Forecast For '67—

MORE SERVICE



By DR. GEORGE P. CRESSMAN
Director, Weather Bureau

The hazard of forecasting has reached a critical dimension. The Weather Bureau has been asked to issue a prediction about itself.

Weather prognosis, difficult though it may be, is child's play in comparison to a mission of introspection. The variables involved in self-analysis can confuse the outlook and a slight shift in the budget can upset the verification.

With that conservative prelude, I venture into the future, confident that my associates, who know what it is to miss a forecast, will understand. If there seems to be greater emphasis on what has happened, rather than on what will happen, it is just that one must use the past as a jumping off point for the leap into tomorrow.

There are honest questions that deserve honest answers, at least to the extent that I can give them.

Where is the Weather Bureau going? Does the future hold nothing but further economies and retrenchments and are we to experience gradual collapse or will the present tendency be reversed? Old time forecasters have learned through experience not to extrapolate short range tendencies into long range evaluations, and as meteorologists we know enough to look at the larger scale picture.

Let me start by discussing our severe storm warning service. Congress has authorized completion of our radar network and we are going ahead on this as expeditiously as possible, establishing on the average of five or six radar stations a year.

Radar has proved itself to be one of the best tools in modern meteorology for the detection of severe storms—tornadoes, hurricanes, thunderstorms. When radar stations, under the NADWARN system, are tied in with teletype links to radio and television stations throughout the nation, the public will have the best immediate warning protection ever devised.

The value of satellite pictures to the meteorologist has become well known. Starting with ESSA 1 and continuing with ESSA 2 and 3 and NIMBUS 2, virtually the entire inhabited world is exposed to our cloud-photographing cameras.

West Coast stations with APT receiving equipment get a first-hand look at approaching Pacific storms that frequently had been inadequately positioned with our sparse ocean observational reports.

Once we had to rely on ship reports to give us first clues to suspicious hurricane areas, but now the satellite detects tropical storms almost at their point of

origin and we have plenty of time to vector reconnaissance aircraft to the trouble spots. Research into hurricane genesis and development is enhanced by more thorough observation and experimentation permitted by the time extension.

In addition, we see future application in our discovery, through satellite observation, of the existence of the many hurricanes that were off the shipping lanes and previously undetected. A good example is the area west of Mexico and southern California. Recently, in San Francisco, I saw an APT picture that showed three hurricanes at once in the ocean region between Mexico and Hawaii. Only one of these would have been detected by the surface data.

Substantial advances were made in numerical forecasting in 1966. We have begun to realize the payoff of almost a decade of research on the more general type of prediction models now coming into use. The parallel advances in computer development have given us the opportunity for the first time to apply these powerful (and expensive) models in daily use. Month-by-month new records of accuracy are becoming common-place. Straight-out extension of daily numerical forecasts into the five-day realm looms for the near future.

We can see the distinct possibility that our technical capacity in forecasting now promises to exceed our financial ability to support the calculations. While this is a problem, it is a pleasant problem to have, much better than if the situation were the reverse.

New tools, improved programs pay dividends to the public

The new information coming from Suitland calls clearly for a change in our thinking about our field forecasting roles. It seems increasingly evident that the need for intermediate guidance will diminish in favor of direct interpretation of central prognostic information by the local forecast office. This should enable us to shift resources to strengthen the local forecast offices and in doing so to increase our capacity for providing better service.

To allay the fears of our people who feel that they might somehow be dispossessed by such changes, let me say again that small-scale weather problems connected with the increasing service problems provide a tremendous variety of professional challenge.

Orientation of our activity has been primarily toward the saving of life, but the economic spinoff must not be overlooked in our agricultural, river and flood and fire weather programs. There has been a return of $30 to $50 for each dollar spent, a high percentage gain by any standard.

In this regard, let me single out the river and flood service because completion of the national coverage, started 20 years ago, is within sight. In a few years we expect complete coverage for the entire continental United States, with a minimum economic return of $30 for every dollar spent. That's a good buy. This shows that we can obtain complete coverage by our special service programs. The implications with respect to the other service programs are encouraging.

Another item of interest in our discussion of the future is air pollution. This begs for increased emphasis on our part since the atmosphere is the conveyer of contaminants. Increased public awareness of the problem, together with the results of past years' development efforts, calls for increased operational activities in assessing the atmosphere's ability to concentrate or disperse pollution.

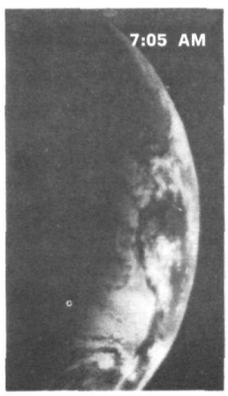
We also hope to direct our strength toward a major marine weather program, which will logically tie in with the new look in oceanographic research as well as with the greater use of the seas by small boats and ocean-going vessels.

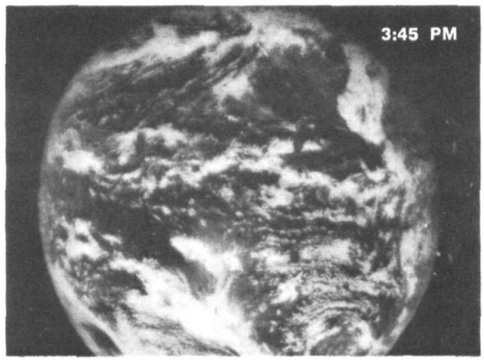
The forecast of the Weather Bureau's future begins to emerge as we relegate the short range tendencies to the proper place and concentrate on the long term trends. These show us a picture of dramatically increasing ability to provide not only more service but also more useful service. □

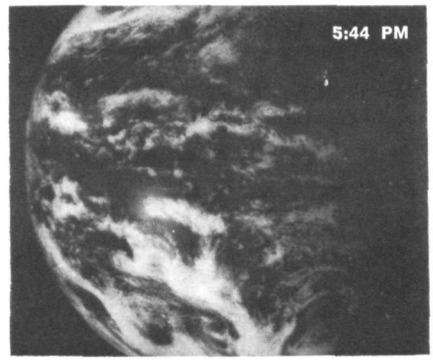
THE DIFFERENCE BETWEEN NIGHT AND DAY

These photos were taken from 22,300 miles above the earth by the Applications Technology Satellite-1 on Sunday, December 11, 1966. All times listed are EST.

Each photo took 20 minutes to record, and together they show the changing cloud pattern over the world for an entire day.







WARNING! Storms in Space

Institute for Environmental Research in Boulder, Colorado, forecasts radiation from solar flares affecting space travel, supersonic transports and radio communications.

TWO UNITED STATES astronauts are digging around the moon, collecting specimens requested by the scientific fraternity. Suddenly an urgent radio message crackles through their headgear. A warning from Earth: "Radiation—return to command module."

The astronauts drop their space picks and hurry to the excursion module that carried them to the lunar surface from the "parked" mother ship command module orbiting a hundred miles above. Soon they will be back, safe from exposure, content to sit it out until the radiation hazard subsides or until they set off on the return journey to Earth.

In this procedure, envisioned as a possibility for the future, a new and expanding Space Disturbance Forecast Center at Boulder, Colo., very likely would have one of the key responsibilities.

The center, a unit of the Environmental Science Services Administration's Institutes for Environmental Research, is charged with monitoring, through a world-wide network of optical and radio telescopes, violent eruptions of the sun (solar flares) and predicting the increased radiation that results from them.

Large solar flares, researchers have discovered, sometimes produce a surge of protons (electrically-charged particles) in dangerous quantities. Here is a new area of concern for travelers who had, before the space age, been protected against this radiation by the Earth's atmosphere.

Venturing outside this shield, either in satellite or in deep space probes, they expose themselves to new environmental hazards, a major one being the radiation associated with proton storms. Even the supersonic air transport of the future may, on rare occasions, when traveling at high altitude in the polar regions, experience undesirable radiation fluxes from proton storms penetrating the Earth's upper atmosphere.

The Space Disturbance Forecast Center was an outgrowth of the concept of ESSA to coordinate public warning systems.

Proton storms, although unlike those on earth, are potentially serious disturbances from which man, venturing further

and further from this planet, must be protected to the limit of scientific knowledge.

The space disturbances center might be considered a parallel to the Weather Bureau, one predicting conditions within the atmosphere, the other beyond. The conditions may be different, but the mission is the same—warning of environmental hazards to life and property. Energetic particles, if encountered in sufficient quantities, not only are a danger to life, but also to the sensitive electronic instrumentation that will guide man through space.

The Space Disturbance Forecast Center, a part of the Institute for Telecommunications Sciences and Aeronomy, became an operational reality in late 1965 with the systematic preparation and dissemination of daily "space weather" forecasts. Since that time, a number of communication teletype circuits that link many solar and geophysical observatories have been installed to permit immediate, real-time alerts of the beginning of important disturbances.

Recently the National Aeronautics and Space Administration has decided to reduce its own observational program in this area and to a larger extent to the space disturbance center for necessary observational and forecast support.

At the present time, the Center routinely issues a daily forecast of solar activity covering the following three days. However, when conditions warrant, it will issue shorter term forecasts for periods of 12 hours or less, and longer, more general predictions which are keyed to the 11 year solar activity cycle.

Under the general supervision of Robert B. Doeker, a former Air Weather Service officer, and the specific direction of Dale Brickman, the forecast center is finding it necessary to broaden its horizons to include a number of new responsibilities: The upcoming supersonic transport, commonly referred to as the SST, poses a full range of technological and environmental problems that have been directed toward a spectrum of scientific agencies, from aeronautical to meteorological to space.

The Space Disturbances Laboratory, under which the forecast center operates, has the task of devising a warning system that would apply to the SST. Under the leadership of Robert W. Knecht, who also happens to be the mayor of Boulder, this laboratory is very active in ionospheric research about 50 to 300 miles above the Earth, as well as in the field of solar-terrestrial relations.

The SST will fly at altitudes between 60,000 and 80,000 feet, a region that could be vulnerable to occasional radiation outbursts. If there should be such an occurrence, warning procedures might direct descent to lower heights to eliminate any undesirable radiation that might otherwise be encountered by the aircraft. That, at least, is one direction in which the system would find application.

The success of the forecast center depends on good observations and immediate communications. These are being accomplished through a closely-coordinated program involving global facilities of ESSA, the Air Force, and NASA. When a solar flare is sighted or an high altitude nuclear explosion detected (this also contributes toward a substantial increase in potentially damaging energetic particle activity), word must be, and is, relayed immediately for evaluation and warnings.

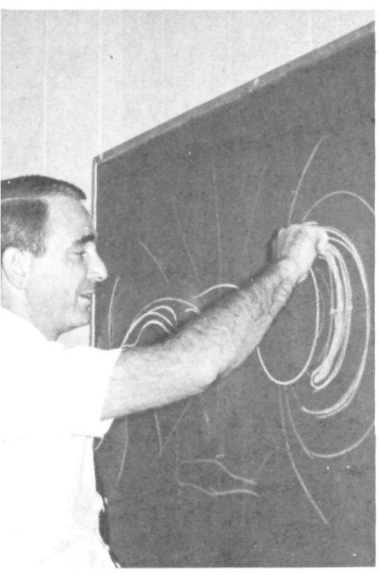
Sunspot activity will be reaching maximum in the next two to three years and this will add to the workload of the center. Although the relationship of sunspots to solar flares is not fully understood, one thing is known: the greater the sunspot activity, the more frequent and the larger the flares.

How are solar flares forecast? So far, primarily by empirical methods such as those that dominate many meteorological predictions. Past history of flare activity in a given solar region is a prime consideration. The current behavior and activity of the region also is an important factor. The presence of strong magnetic field gradients often signals the buildup to a large flare. The evolution and growth of active regions are observed carefully through the 27 day solar rotation cycle.

The effect of solar outbursts on communications which depend upon the reflecting properties of the Earth's ionosphere also is of vital concern. High flying aircraft suffered a complete HF radio blackout in August at a time when large solar flares were reported.

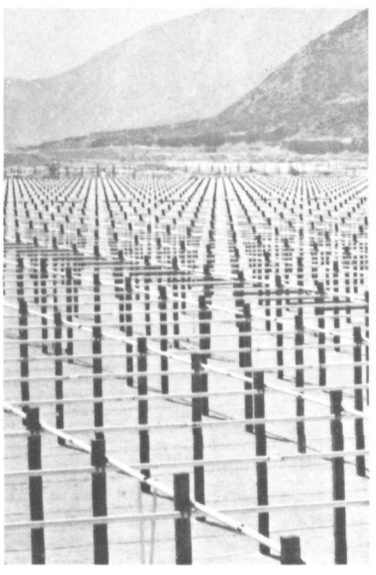
The sensors in satellites, manned or unmanned, can be seriously affected by large energetic particle flares. This poses another forecast problem—determination of the best time to launch to obtain optimum results. Energetic particle flares covered by nuclear blasts are known to have been responsible for sudden satellite instrumentation failure in the past.

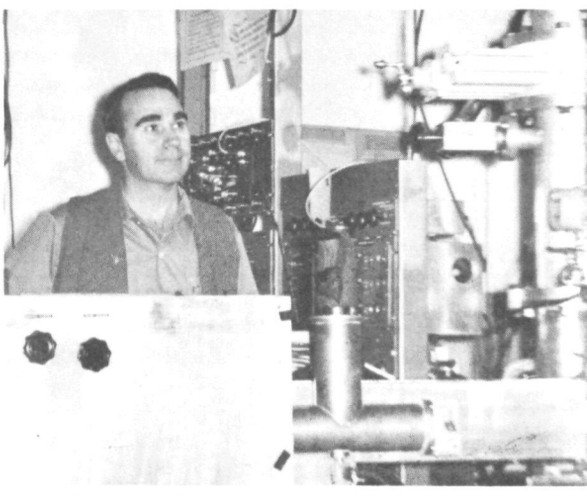
Much research remains to be done concerning the problem of forecasting space radiation. But the doors to our understanding are opening wider and the day may not be too far distant when a space traveler will go to his phone and dial SPace 1212 for the latest advisory. □



Robert W. Knecht, Director of the Space Disturbance Laboratory, Boulder, Colo., (photo at left), describes radiation field around the earth.

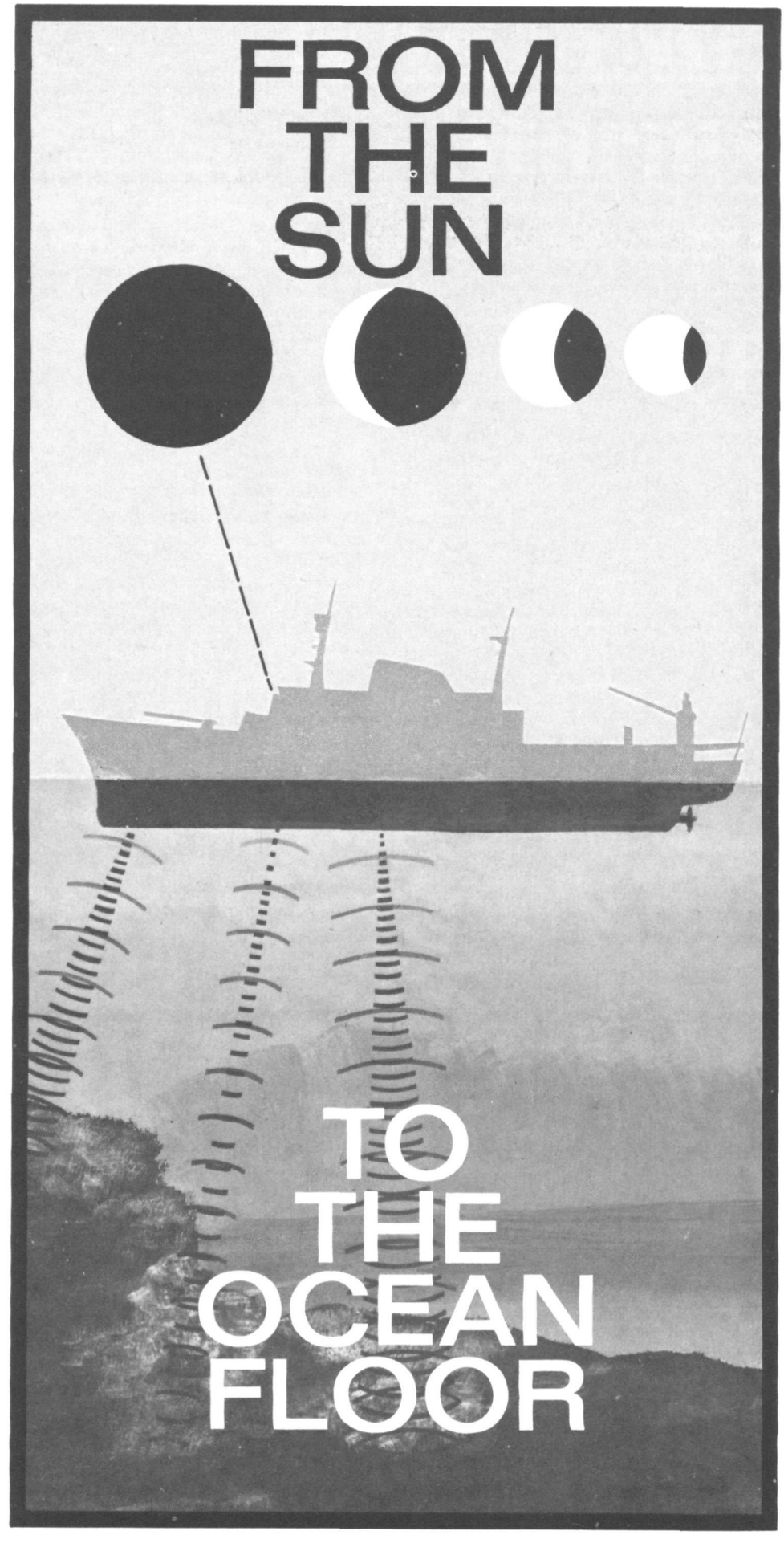
At right are 23 acres of antennas for pulse radar at Jicamarca, Peru.





Dr. Eldon E. Ferguson at work in his molecular physics laboratory in which ionospheric reactions are measured.

A report of USC&GSS OCEANOGRAPHER's role in Operation Eclipse and oceanographic research in South American waters.



NOT TOO MANY YEARS AGO, scientists believed the floors of the oceans were mostly flat, like the Great Plains and prairies of the Southwestern and Midwestern United States. It was only after the start of ocean-bottom exploration and mapping that the true grandeur of the sea floor was revealed—lands and mountain ranges that lay submerged within more than 300 million cubic miles of ocean water on the globe.

Contributing to this intensive investigation of sea bottom terrain is the USC&GSS Oceanographer, the largest research ship built by the United States.

In October of last year, Oceanographer sailed from Jacksonville, Fla., and took part in Operation Eclipse from a South Atlantic noon point. The expedition was a study in interdisciplinary research, combining en route geophysical investigations with on-station eclipse observations.

The objectives of the expedition were to make a scientific observation of the total eclipse and to conduct research along the continental margins of Brazil, Uruguay and Argentina.

It checked for evidence along the continental margin regarding a belief that the earth's continents were once part of one or two supercontinents which split aeons ago and have been drifting ever since. It has been estimated by some scientists that the continents drift one centimeter a year. The expedition may throw light on the concept that South America and Africa were once together forming a single continent. An exponent of the continental drift concept, Dr. Robert Dietz of the Institute for Oceanography, participated in this phase of the research.

According to Dietz, not only does the bulge of Africa fit snugly into the bight of South America but also the lesser bumps fit as well, like the pieces of a jig-saw puzzle. This fit suggests, but does not prove, the drifting apart of these two continents.

As with a jig-saw puzzle, the picture, as well as the pieces must fit. In geologic terms, this "picture" remains unknown since broad continental shelves, about which there is no geologic or geophysical information, fringe both continents.

Data collected by Oceanographer on the continental shelf and slope around the bulge and stems of South America will provide some of the necessary geologic detail needed in order to know if that continent and Africa were once joined into one giant supercontinent.

Such information will contribute to our knowledge of the mechanisms and processes of the solid earth—knowledge that is essential for the formulation of theoretical models that will explain and predict areas of earthquake activity and other crustal motions.

Louis W. Butler of the Institute for Oceanography, coordinated the studies of the continental margin. Butler was on leave from the University of Illinois and was assisted by Paul B. Boyer and Peter J. Ealey of the university. Dr. Adrian F. Richards, also of the university, acted as advisor to the group. These studies were conducted along the coast from the Amazon River to the vicinity of Buenos Aires.

The research included a determination of the topography of the continental shelf and slope in this area and the nature of the ocean's sub-bottom. Measurements of the earth's magnetic and gravitational forces also were made to better understand the earth's crust—bottom samples were taken to add to sea floor information data.

Similar investigations were conducted by Dr. Jack Pierce, Curator of Sedimentology of the Smithsonian Institution, and an associate, William Roberts, south of Buenos Aires near the Gulfo San Matias and the Rio de la Plata.

Preparation for the Operation Eclipse portion of the expedition began when the ship docked at Buenos Aires. There Oceanographer was joined by personnel from ESSA's Institute for Telecommunication Sciences and Aeronomy who took aboard special optical and electronic equipment needed for the observations. Two days before the eclipse, the ship sailed from Buenos Aires and on November 12, took up a position along the path of total eclipse.

The solar eclipse was the 39th in this century. The zone of total blackout (or path of totality) formed a 55-mile-wide strip across South America beginning in the Pacific Ocean west of Peru, crossed southern Peru, Bolivia, northern Argentina, the southern tip of Brazil and extended into the South Atlantic.

Scientists measured changes in the ionosphere and disturbances near the surface of the sun as the moon temporarily blocked out radiation from the sun.

It is hoped that such observations will furnish a better understanding of earth-sun relationships by seeing the effects of more rapid changes of illumination than can be seen near sunrise and sunset.

Such an eclipse presents an opportune time to study the disturbances that occur near the sun's surface and their effects on the earth's environment, especially on weather and communications. The sun is now beginning its upward swing of its 11-year cycle of solar flares and sunspot activity. Knowledge gained from this research will be made available to the world scientific community.

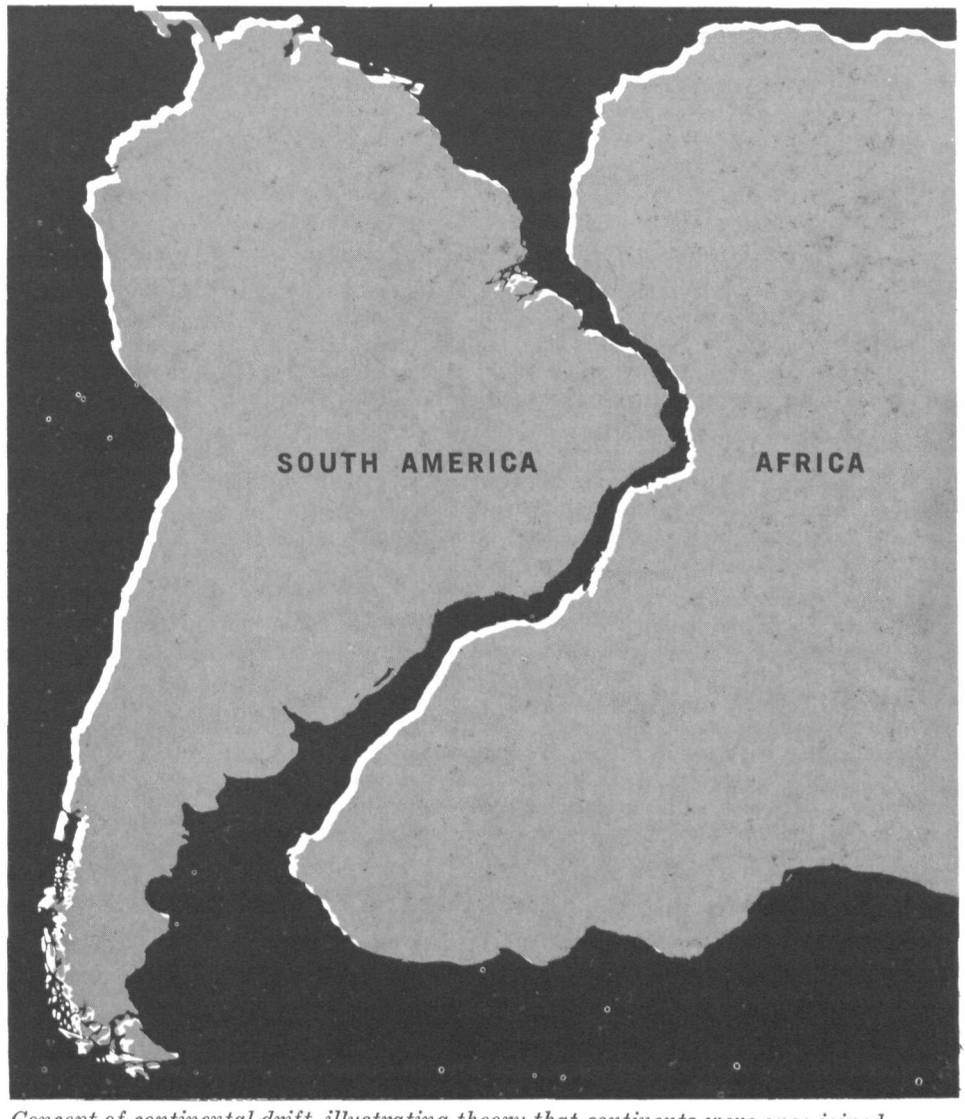
The oceanographic phases of ESSA's program are conducted by the Coast and Geodetic Survey and the Institute for Oceanography. The C&GS is principally responsible for the operation and maintenance of ESSA's research fleet and facilities and for oceanographic services—hydrographic surveys, measurement of tides and currents, and nautical charting.

The Institute for Oceanography conducts ESSA's oceanographic research programs, which include tidal and tsunami investigations, air-sea interaction studies, the ocean survey (SEAMAP) program, and projects in marine geology and physical oceanography.

The interplay between the two functions is apparent: Much of the Institute's work is laying the foundation of future, routine operations of the C&GS; and the geophysical, oceanographic, and marine geological data gathered during survey operations are studied by Institute scientists.

In the spring of 1967, Oceanographer will hoist anchor from the east coast of the United States and sail on a round-the-world oceanographic trip which will wind-up at her permanent home port of Seattle. The eight-month, 35,000-nautical-mile journey should be productive, both in terms of data collected and analyzed, and in terms of information and opinion exchanged. The ship's scientific complement will be filled by USESSA officers and scientists, and by guest scientists from participating institutions.

[JMO]



Concept of continental drift, illustrating theory that continents were once joined together and are drifting apart.

The Watch On Our Rivers

Workmen at Ottumwa, Iowa, rebuilding a sandbag barrier to divert Des Moines Rivers.
(Associated Press Photo)

A vital program looks ahead to 1967.

By WILLIAM E. HIATT
Associate Director-Hydrology
Weather Bureau

Man long ago recognized that he must constantly reappraise himself and his surroundings if he is to keep pace with his rapidly-changing environment. This is important to the management of our Nation's water resources.

A century ago, pioneers of this country were concerned mainly with navigation, irrigation, winning the West, and minimizing the effects of floods. Now our citizens seek to perpetuate and enhance the natural environment. This is leading to new approaches toward recreational facilities, pollution abatement, wilderness preservation, water supply, hydroelectric power production, navigational improvement, and flood and drought control.

All of these are demanded by a modern America, and they impose a challenge upon the Environmental Science Services Administration to help provide them.

How will ESSA-Weather Bureau carry out its assigned function? A brief review of past accomplishments will point the way to future responsibility.

Consider the River and Flood Prediction and Warning Service, which is recognized as a vital contributor to the designer, planner, and operator involved with water problems. From its beginning about 1890, it has regularly revised its area of activity to meet the demands of society.

First requirements were associated with flood warnings and navigation on the principal waterways. Subsequently, daily forecasts were issued for key locations in the Mississippi River System.

Beginning in the 50s, 30-day forecasts were instituted for key points on the lower Ohio and Mississippi Rivers. Expansion was tailored to the needs.

Simple statements describing expected conditions have given way to specific forecasts of river levels, mean daily discharges, stream velocity forecasts, and storm runoff potential. The original concept of the River and Flood Warning Service has been left far upstream.

Traditionally, ESSA-Weather Bureau is the only Federal agency providing a formal and continuous real-time "river watch" for the Nation. This is a logical role for an organization charged with coordinating the natural hazard warning systems of the United States. ESSA-Weather Bureau has raised its sights again and, with new vigor, is reappraising itself and its environment.

A task force by the Bureau of the Budget established a course of action with this recommendation: "An improved system for flood forecasting should be developed by the Environmental Science Services Administration as a part of the disaster warning service."

This was an expression of confidence as well as a mandate, and President Johnson submitted it to Congress with this comment: "We must constantly strive to develop new means to meet the needs of the people. . . . I am asking that agencies of the Executive Branch begin immediately taking additional action and conducting studies in accord with the task force recommendations."

Here is a challenge to each of us to carry out an assignment with new and imaginative action. Here, too, is formal recognition that flood forecasting, coupled with appropriate evacuation measures, is one of the important nonstructural methods in a unified program to reduce flood damages.

Nonstructural methods. Think of that for a moment. What are the other methods?

First response to flood disaster was in the construction of dams, levees, with supplementary projects in channel and engineering improvements. These were structural methods from which there evolved a multi-purpose approach to include water supply, hydroelectric power, navigation aids, and other services that fit neatly into the package.

Telephone men hook up Automatic Hydrologic Observing System equipment to transmit data to Weather Bureau on Shenandoah River's levels. (Western Electric Photo)

Precipitation sensor is connected to Weather Bureau's Automatic Hydrologic Observing System, now under test, in Blue Ridge hills. (Western Electric Photo)

Since 1936, when a national flood control policy was adopted, the Federal investment in structural, or physical, works has cost more than $7 billion.

In spite of this, annual losses from floods continued an upward trend. The present estimate of annual flood damage exceeds $1 billion. Loss of life and personal hardship cannot electric power production, Navigational improvement, and Service, which is recognized as a vital contributor to the be calculated in dollars. This raises several questions. Are the physical methods by themselves sufficient? Should we not consider non-structural methods—flood plain zoning, flood insurance, flood forecasting—in a unified approach directed toward the saving of life and property?

The task force of the Bureau of the Budget said "Yes," and President Johnson concurred. Our objectives become clear.

The task force report provides us a point in time for review of past actions, for the analysis of short and long range objectives, and provides a perspective, or common reference, to the alternatives for flood prevention. How will it affect the ESSA-Weather Bureau River and Flood Prediction and Warning Services? We feel that it adds important support in the executive side of the Government to reach agency objectives, including the development of a modern system for river and flood forecasting as part of a national natural disaster warning system.

What are our plans? During the last half of Fiscal Year 1967 we will implement a Congressional authorization to establish a river forecast center for the Delaware River Basin, including the adjacent service area, and provide specialized river forecasting services for the Delaware River Basin Commission. For this, the staff of the Weather Bureau Office at Trenton will be increased, and the present Federal-State Flood Forecasting Service, considered a part of the Harrisburg Weather Bureau Airport Station, will become a separate River Forecast Center with enlarged staff and digital computer capability.

Late last year, River Forecast Centers located at Sacramento, Calif., Kansas City, Mo., and Fort Worth, Tex., received additional equipment for their digital computer systems. This enlarged computer capacity will be brought into full production in the current year, resulting in more timely and accurate forecasts to meet the ever-increasing demands.

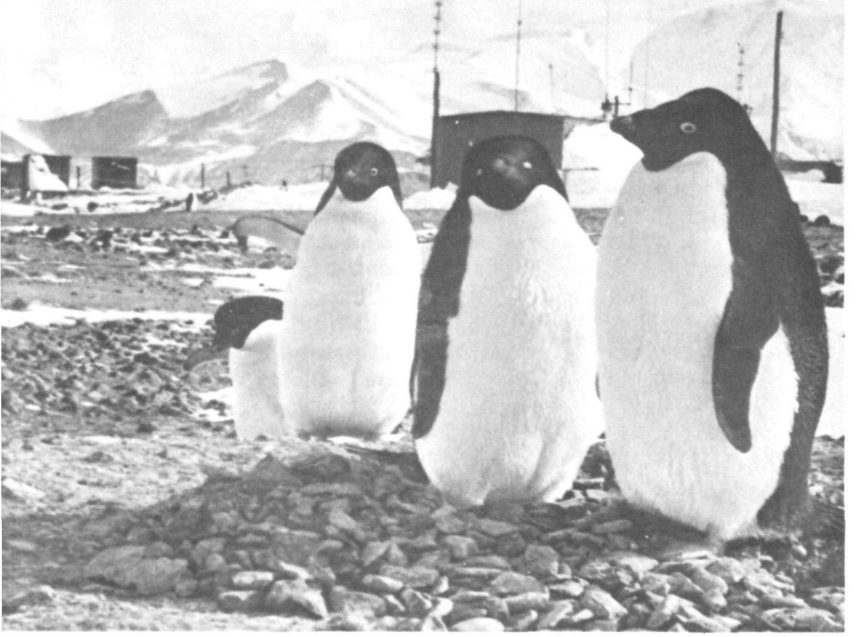
The Ohio River Forecast Center, located in Cincinnati, recently received an IBM 1130 computer system, and the transformation from manual to computer techniques will be accomplished during 1967. This will be considered the most important advance in service for the Ohio River Basin since the establishment of the Center in 1946.

Experiments will be initiated with NASA for the communication of river and rainfall information via a synchronous satellite. Selected units of the Western and Southern Regions have pledged their support for these experiments—an ESSA first in the communication of such data.

Automating networks for the collection of river and rainfall data to complement the use of computers for forecasting is a long-range goal. Each year since 1960 there has been progress in this area. In 1967, we will make the first use of a high-speed collection system in Northern California, working cooperatively with the State. In the Northwest—the Columbia River Basin—there has been considerable progress in network automation which will near completion in 1967.

Our long-range objective is to have every Weather Bureau Office equipped to give the public the best possible hydrologic service. An important step toward this goal in 1967 will be the field testing of an in-service Hydrologic Public Service Sourse at selected offices prior to its general release.

The future of hydrologic research, basic and applied, is challenging and exciting. The use of the digital computer is making possible the design of sophisticated hydrologic models directed toward the preparation of more accurate forecasts. □



In the Arctic and Antarctic . . .

In the jungles . . .

. . . and the high seas

Wherever the Weather vane Points...

You'll find Weather Bureau personnel stationed all over the globe.

By CHARLES G. THOMAS

WANT TO RIDE an iceberg circling the North Pole . . . drift in the middle of the Atlantic Ocean for about a month . . . stew in a tropical jungle which someday may be resculptured with nuclear explosions . . . live under tons of ice and snow to escape temperatures which could drop below minus 100 degrees?

A number of ESSA-Weather Bureau people have found that for downright interesting assignments it would be hard to beat a tour of duty with the Overseas Operations Division.

The Overseas Operations Division, or "OOPS" as it is lightheartedly called, conducts the Weather Bureau's programs which are carried out on foreign soil, on the high seas, or in the Polar regions. (The "Overseas" in OOPS does not include any of the 50 states, U.S. territories or dependencies, or the Commonwealth of Puerto Rico.)

Programs are presently being conducted in the Atlantic, Pacific, and Arctic Oceans, the Antarctic, India, Israel, the Caribbean, Mexico, and in Central and South America with the cooperation of a number of other U.S. Government agencies and foreign meteorological services.

Although all Weather Bureau overseas programs aren't as exotic as those carried out on the pole-circling iceberg or in the possibly doomed jungle, these examples indicate the lengths to which the Bureau goes to obtain meteorological data on a worldwide basis — both for day-to-day weather forecasting and for research.

Perhaps the most unusual site for a weather station is T-3, a tabular iceberg which has been floating in the Arctic Ocean Basin since about 1951. When it broke away from the Ellesmere Ice Shelf its dimensions were 15 by 11 miles; but the years of constant melting and grinding as the ice island made its tortuous way around and around the North Pole have reduced T-3 to a mere 4½ by 6 miles.

The U.S. Navy's Office of Naval Research has first claim on T-3, but arctic researchers from other Government agencies and scientific interests may be found aboard. At the Navy's request, the Overseas Operations Division established an upper-air and synoptic weather observing station on T-3 in mid-June of 1966.

So, as the dark arctic winter set in, four Weather Bureau men were drifting on a speck of ice slowly moving around the North Pole.

On more stable and even colder terrain several hundred miles to the east of T-3, more OOPS personnel are snugged in for the winter.

In Canada's Northwest Territories, the island dotted region known as the Canadian Archipelago extending above the main

Welcome link with the outside—coming through Tanguary Fiord on an Arctic resupply mission.

North American Continent far above the Arctic Circle, men of the Overseas Operations Division are working with the Canadian Meteorological Service at weather stations at Alert, Eureka, Isachsen, Mould Bay, and Resolute.

These stations, far above the North American Defense Command's DEW Line, provide vital "top of the world" weather information. Meteorological data are made available for research by ESSA's Institute for Atmospheric Sciences and other agencies of the scientific community.

The living isn't easy for the 22 Weather Bureau men wintering at these Joint Arctic Weather Stations, but every effort is made by OOPS to make their tour as comfortable as possible.

Many times these men must "make do" as when, a few years ago, a Christmas tree parachuted down to one station landed with such a bump it was completely denuded of its needles. The weathermen decorated the skeletal tree anyway.

The Weather Bureau operates *on* the seas as well as overseas. To serve the steadily growing stream of transoceanic flights which began during World War II, an international network of ocean-going weather ships was established at fixed locations in the North Atlantic and North Pacific Oceans. The United States operates four such stations in the Atlantic and two in the Pacific. The Coast Guard operates these weather ships which each carry four specially-trained OOPS technicians to make surface and upper-air reports on daily schedules.

These floating weather stations, which remain "on station" about 21 days, always seeking to stay within a 10-mile square, also collect oceanographic data, provide navigational aids to ships and aircraft, and perform search and rescue duties as required.

OOPS also operates 18 Moving Ship Radiosonde Programs (MSRP) aboard ships sailing through data-sparse ocean areas. Each of these ships carries two OOPS technicians. Their tours of duty are rotated between the moving ships and the fixed station ships. Military Sea Transport Service ships, Coast Guard icebreakers, oceanographic survey vessels, Maritime Academy training ships, and privately-owned merchantmen are currently in use as weather observing platforms in the MSRP.

In addition to providing weather information to ocean-crossing ships and planes, the meteorological data gathered by these deep-water weathermen is valuable in determining large-scale weather patterns which may affect land masses.

OOPS' far-flung network stretches south to more hospitable climates, too. Following its policy of encouraging other meteorological services and offering advice and technical help whenever possible, the Weather Bureau has agreements with the governments of 12 Caribbean and Latin American countries.

Weather information from Mexico, Central and South American countries such as Nicaragua, Honduras, Colombia, Equador, Peru, and Chile is invaluable to the Weather Bureau's services to aviation and general meteorological studies.

The Caribbean Sea, a hurricane hotspot, is ringed on the north and east by islands—each a potential "listening post" for tropical storms. The cooperative Caribbean upper-air network density approaches adequacy for accurate weather analysis.

The Weather Bureau works closely with the meteorological services of these countries—in some cases providing advisors and certain equipment and expendable supplies to help strengthen the Western Hemisphere's meteorological networks.

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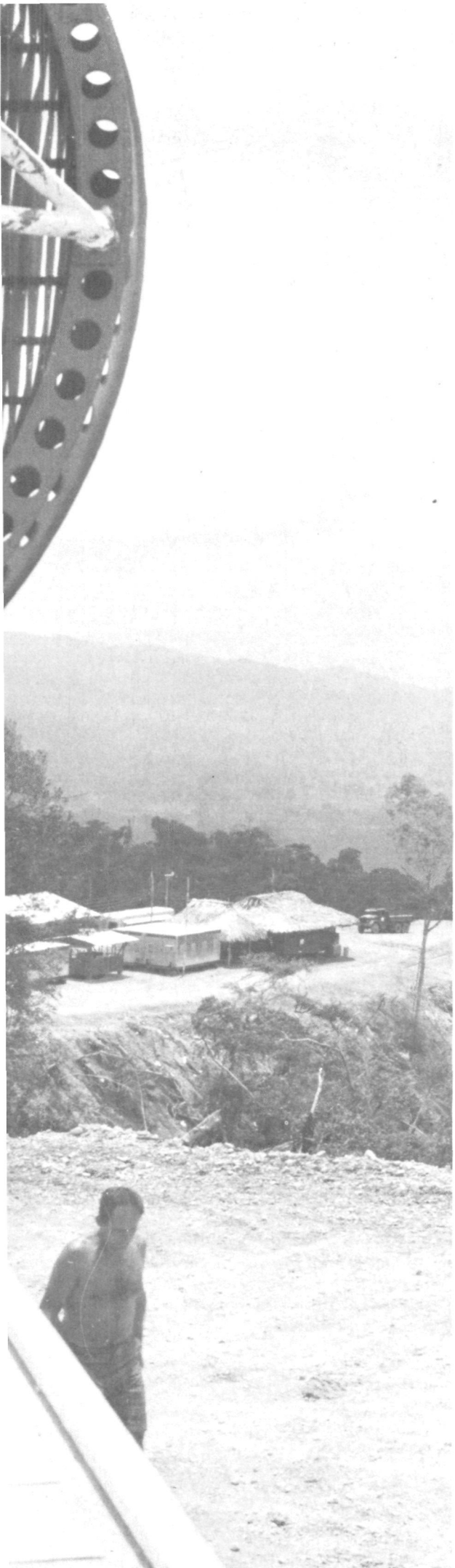


In Panama and Colombia the Overseas Operations Division is taking part in what could become man's most audacious construction project. At the request of the Atomic Energy Commission, ESSA's Institute for Atmospheric Sciences and OOPS are conducting a two-year meteorological study in connection with feasibility studies for the construction of a sea-level Atlantic-Pacific canal. The studies are to consider converting the present Panama Canal to a sea-level canal by conventional means, or the use of nuclear or conventional excavation along two possible alternate routes in remote, undeveloped jungle areas: one in the Darien region of Panama, and the other in northwest Colombia. Studies to date indicate that nuclear excavation may be considerably less expensive than present methods and that the hazards to mankind can be controlled.

In stark contrast to the lush tropical jungle of Panama is the frozen wasteland of Antarctica, but men of the Overseas Operations Division can be found there too.

Far out on the continent's glacial ice at Byrd Station and at the South Pole itself, OOPS personnel are active in an intensive meteorological research program. This is an important part of a coordinated international scientific investigation of Antarctica, mainly in the geophysical sciences. The National Science Foundation and cooperating agencies such as the Weather Bureau supports these investigations for the United States.

"Isolation" is the keynote of living conditions in the Antarctic. At Byrd and South Pole stations, which are located on the continental ice cover, OOPS personnel live in prefabricated buildings connected by tunnels. The buildings must be accessible without going outside because these bases usually are completely buried beneath drifted snow. During the Antarctic winter, it can be difficult and even dangerous to check instruments located only a few hundred feet from the living quarters.

An almost Oriental OOPS may be found on a little speck of land on Japan's doorstep called Marcus Island where seven Weather Bureau men lay claim to the division's Pacific land operations. At Marcus, the program lacks only Army support to be a completely cross-service project, in that funds are provided by the Air Force and Navy and the OOPS weather observers are tenants of the Coast Guard.

The men of OOPS would be the first to disclaim any talk of glamour in their jobs despite the unusual conditions under which they often work. But there is a certain romantic air about the division even at its highly civilized headquarters in downtown Silver Spring, Md., where a polar bear, stuffed but very fierce-looking, guards the halls. □

Looking northwest from top of X-band radar van in Pidiaque.

GUINEA WEATHER SERVICE AIDED

The U.S. Agency for International Development (AID) program to help improve weather services for the Republic of Guinea should meet its early 1967 deadline, thanks to a boost from the Weather Bureau's Engineering Division.

From May through September, Engineering's William A. Kuning was in the Oregon-size West African nation working on the program with Guinean government officials and the local AID Mission.

Fighting two to three-week delays in obtaining vehicles and getting excavation work done, faulty fittings on a number of parts, and other setbacks, Kuning and Donel Frazer of ESSA's Institute for Telecommunication Sciences and Aeronomy completed the installation of meteorological and communications equipment on September 20.

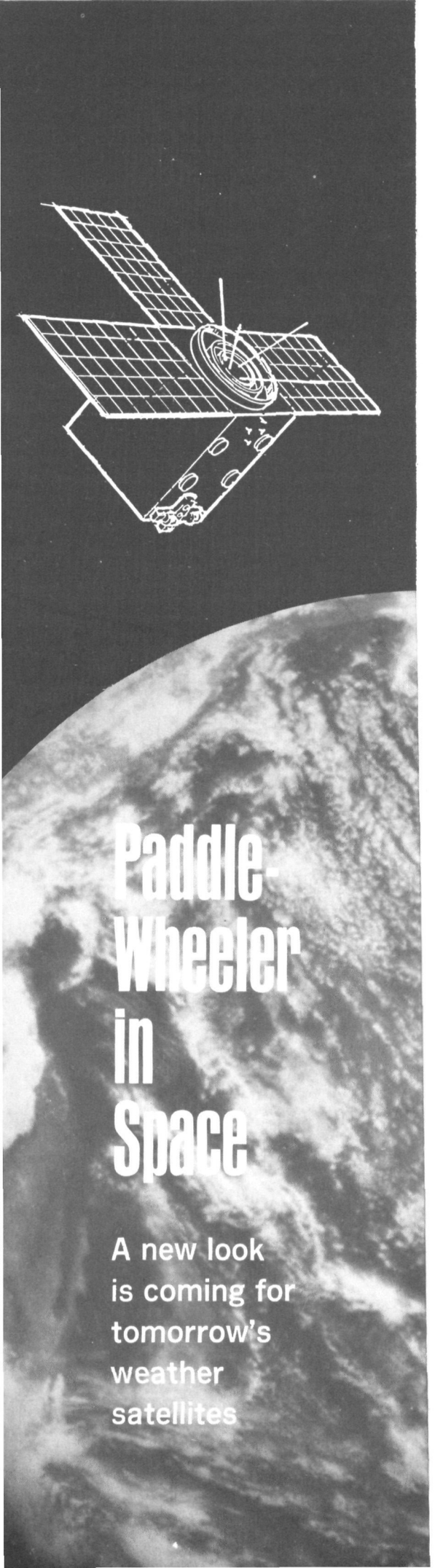
Installed under Kuning's directon, four new teletypewriter receivers are now in 24-hour-a-day operation at Conakry International Airport picking up air traffic and weather data from Dakar, Algiers, and Paris, and a 70-foot vertical radio antenna sends and receives clearly to African stations at Accua, Abidjan, Robertsfield, Freetown, Bathurst, Dakar, and Algiers.

Guinea, formerly a territory of French West Africa, has been an independent nation since 1958 and has been receiving economic and technical aid from the United States since 1960. Following a 1963 survey, AID set to work to assist Guinea in the expansion and improvement of its aviation programs, including its meteorological services. Guinea's capital, Conakry, is an ideal "jumping off" point for north-south and Africa-South America airliners.

The AID Mission at Conakry has commended Kuning for his work and recommended him for similar assignments saying, "his patience, imagination, perseverance, and happy relationship with foreign personnel can be exploited with confidence in any culture."

Kuning himself would like to return to Africa next year to see how the Guinea weather program is working out.

"It's really beautiful country," Kuning says, "even if it does get a bit wet at times." During his four-month tour in Guinea there were 13.5 feet (162 inches) of rain.



Paddle-Wheeler in Space

A new look is coming for tomorrow's weather satellites

By J. GORDON VAETH
Director, Office of System Engineering
National Environmental Satellite Center

A new environmental satellite which, like the moon, will continually keep its face toward earth, is being developed for a scheduled launch date in late 1968 or early 1969.

Known as TIROS M, it will be built and orbited by NASA and used to prove out the subsystems and performance to be incorporated in the Improved TOS, ESSA's follow-on to its current TOS (TIROS Operational Satellite) System.

The design borrows a mechanical trick from engineering achievements of the past to overcome one of the limitations of the current TIROS. This is a flywheel to reduce the spacecraft's spin to one revolution per orbit around the earth. By so doing, M-type satellites will be so oriented that their earth-viewing sensors will always be pointing straight down.

This constant earthward orientation is important in the case of the High Resolution Infrared Radiometer (HRIR) which M and Improved TOS will carry. These HRIR devices, developed by the NASA Nimbus program and useful for nighttime cloud cover observations, scan across the orbital path. If they had to do so from a spinning spacecraft, their observations would be distorted by skewing.

The present TOS system, the result of design decisions made three or more years ago, consists of two spacecraft types: one equipped with the APT (Automatic Picture Transmission) capability by which individual stations with suitable receivers can directly receive weather data within range, and the other possessing a stored picture and heat budget measurement capability. These functions will be merged in the Improved TOS.

The new operational environmental satellite system will:

1. **Combine within a single satellite the direct picture readout and stored picture readout that now necessitate the orbiting of two separate TOS models.**
2. **Provide nighttime cloud observations in both the direct readout and stored modes.**
3. **Continue the gathering of heat balance data via use of flatplate radiometers.**
4. **Introduce a capability for sensing solar protons and electrons.**

The solar radiation monitoring capability is a new and important requirement reflecting the participation of the Institute for Telecommunications Sciences and Aeronomy (ITSA) and the incorporation of its needs in ESSA's satellite activities.

To meet these objectives, spacecraft weight has approximately doubled. Current estimates run to 633 pounds. The Thor Delta can still be used as the launch vehicle to put the craft into the desired 750-nautical-mile sun-synchronous orbit. But to do so, it too must be improved upon. Improvements to the booster will essentially take the form of a longer Thor or first stage and a new third stage rocket. The volume of "M," although twice that of previous TIROS spacecraft, can be accomplished within the nose housing or shroud currently used for TOS launches.

As presently the case with TOS, the new satellite will be despun, by releasing yo-yo weights, upon its separation from the booster rocket's third stage. Despinning will reduce it from about 90 to 3 revolutions per minute. At this point, the flywheel will be energized and, through transfer of momentum, will decrease the satellite's spin even more, to about 1.5 revolutions per minute. Magnetic torquing will align the craft along the orbital plane. When the spacecraft finally "settles down," its flywheel will be spinning at 150 revolutions per minute while the sensor-carrying body of the satellite rotates at one revolution per orbit.

The appearance of the new NASA/ESSA satellite will differ substantially from that of previous NASA/ESSA TIROS-type vehicles.

Instead of solar cells mounted on the spacecraft "hat," they will be deployed on paddles.

Instead of the drum-shaped structure, a boxlike arrangement will be used, the sides of which will mount the subsystems required. These sides or panels will be hinged to facilitate access to the subsystems during assembly and checkout periods.

In terms of the prospective design's ability to accommodate additional payload, the capability of an approximate 25% increase in on-board space, weight, and power are expected to be provided beyond the system configuration presently planned. The solar panels can be lengthened and components re-arrranged as required.

The Improved TOS and its prototype, TIROS M, are the objectives of a collaborative effort between ESSA's National Environmental Satellite Center, NASA's Goddard Space Flight Center, and RCA.

The availability of these spacecraft will provide a spaceborne environmental sensing platform of historic versatility and usefulness. □

By JAMES M. BEALL, Acting Director, Alaskan Region

'ALAYESKA'

Alayeska in the aboriginal Aleut language means great land. And the name was aptly chosen, for Alaska is a great land.

ALASKA DAY IS CELEBRATED on October 18, for it was on this date in 1867 that the huge piece of real estate, one-fifth the size of the Continental United States, was turned over from the Russians to the United States for $7,200,000. A hundred years ago man's fight against his environment in the subarctic was sometimes a race with the grim reaper, immortalized by Robert Service. Even then scientists were concerned with the description of man's environment. Rainfall measurements are continuous from mission days in Sitka, beginning in 1842.

With the transfer imminent, the Coast and Geodetic Survey was on the scene with its cutter, "Lincoln," under the command of George Davidson, in 1866. The "Coast Pilot of Alaska" was published in 1869, based on Davidson's work.

Today, ESSAites of the Coast and Geodetic Survey and the Weather Bureau are working busily in our fabled 49th state in a variety of vital assignments.

The Alaska Purchase Centennial will be celebrated during 1967 by Alaskans. It is now a vigorous State of 250,000 citizens wrestling a living out of a hostile environment, America's "last frontier." Today Alaska's economy is based on its fisheries, mineral extractions, fossil fuels, forest products, tourism, transportation, and the defense establishments.

Its people are, on the whole, better educated, better paid, younger, and politically more liberal than the rest of the country. They pay more for goods and services, are less urban, and enjoy the great outof-doors more. They are more aviation conscious. One person in 50 holds a pilot's license (versus one-in-496 for the national average).

continued

Giant Totem pole in Sitka National Park towers 60 feet.

Pioneer Peak and a homestead.

St. Michael's Cathedral, Sitka, Alaska, formerly was a museum which contained religious treasures. It was destroyed by fire in early 1966.

(Right photo) John Kuhn (l), chief, Weather Bureau's Aviation Section, and Harold F. Consaul, chief of FAA's Operations Evaluation Staff, prepare to make an evaluation flight of ESSA's and FAA's services in the Alaskan Region.

(Bottom right)
Some thirty youngsters of ESSA-FAA employees attend King Salmon grade school. Two teachers are kept busy teaching grades one through eight at this two room facility on the station.

continued

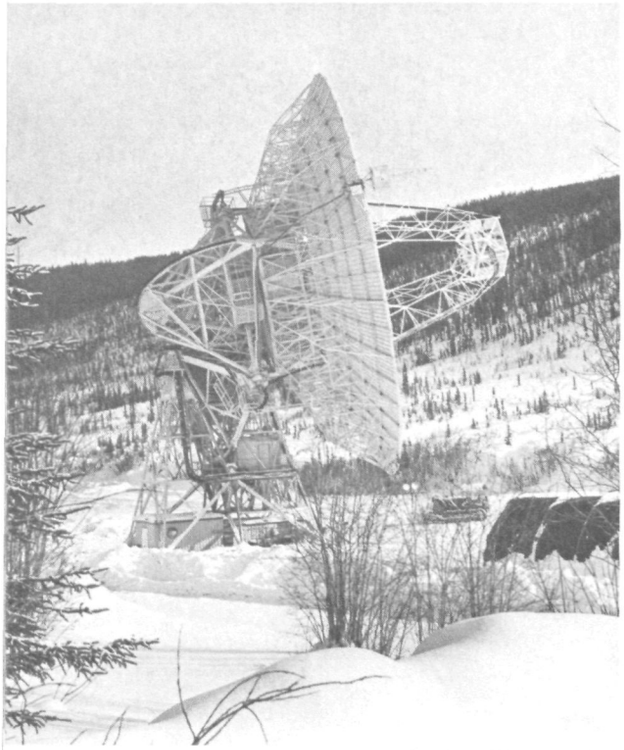
America's Last Frontier

One who has been away for two decades cannot help but note the change in Main Street. It has evolved from the bars and flophouses that enticed the easy money from the prospector, the construction worker, the lumberjack, and the fisherman to shining department stores, prosperous banks, and enterprises providing the full range of goods and services available elsewhere in the nation.

The international airports at Anchorage and Fairbanks have a cosmopolitan flavor. Alaska is truly the "Air Crossroads of the World." President Johnson recently spent the night in Anchorage on his return from his Asian Conference, because Anchorage is the shortest way home from Seoul, Korea.

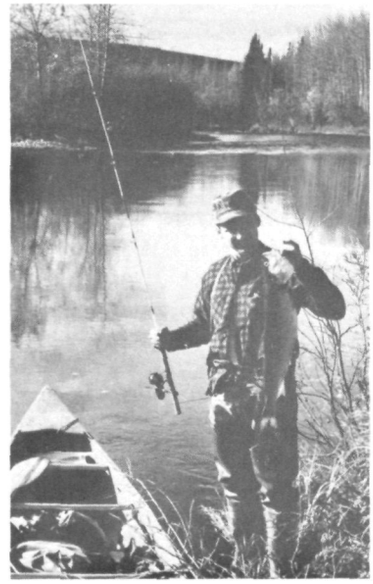
ESSAites have interesting and challenging tasks, from the Weather Bureau stations in Eskimo villages on the Arctic slope to the rain forests of Southeastern Alaska to the very tip of the Aleutian Chain. The Coast Survey parties chart the more than 34,000 miles of coastline, as well as the ocean depths in the Gulf of Alaska where the most violent winter storms in the world are spawned.

This is a kind of assignment where the man must be as vigorous as his environment. It takes a special quality that those who live and stay in Alaska all have. We all look forward to the new and challenging technology that has already made the Space Monitoring Center in Anchorage and the Satellite Data Command and Acquisition at Gilmore Creek in Fairbanks a reality. □



Antenna at the Satellite Station at Gilmore Creek, Alaska.

Dr. Robert M. White, ESSA Administrator, Mr. Emerson, and Ashly Craft inspecting a skin boat at Nome, Alaska.

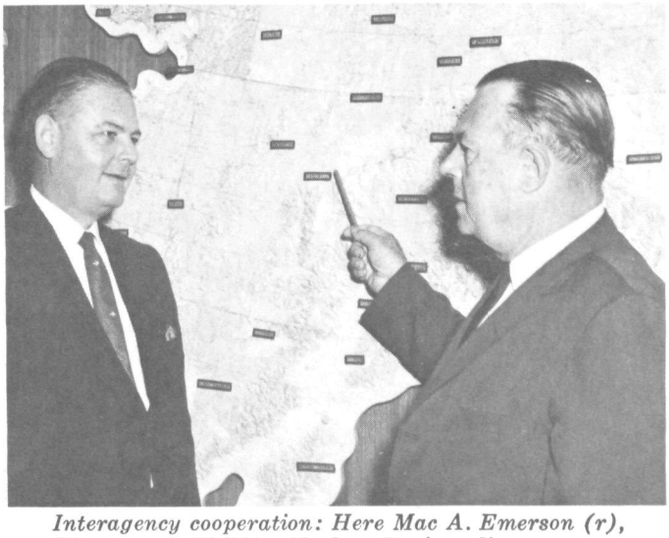


Alaska sports fishing.

Eskimos drying fish at Norton Sound, Alaska.

Anchorage is Alaska's largest city. Biggest building at left is ESSA Headquarters.

Helicopter supplies C&GS mountain triangulation party.



Interagency cooperation: Here Mac A. Emerson (r), Director of ESSA's Alaskan Region, discusses programs with his counterpart, George M. Gary, of FAA's Alaskan Region.

Weather Bureau-Federal Aviation Agency personnel work in this Weather Bureau Airport Station at Cold Bay, an Alaskan outpost.

Pacific Haven...

A center of marine activity

Rear Admiral Harold J. Seaborg, Director of the Pacific Marine Center, and Paul M. Fisher, technical assistant to the Director.

Hydrographic Data-Processing Branch, from left, William M. Martin, branch chief, observes C. A. J. Pauw, cartographer, at work.

THE SCOPE of the Coast and Geodetic Survey is enormous, fascinating and challenging. As our last frontier on earth, the oceans and seas are a largely unexplored area. ESSA's scientists know that they still hold secrets that are far more extensive and significant than ever believed several years ago.

Future explorations and studies have a potential that will be of major value to the people of the world through careful research and application. Under ESSA, the C&GS and the Institutes for Environmental Research are stepping up their investigations and studies by rapidly automating operations and converting to electronic processes.

So, while satellites, spaceships and astronauts make the headlines, teams from the C&GS and IER go about their work, probing the seas for data that will bring still more benefits to mankind.

One of the larger C&GS and Institute for Oceanography operations is the Pacific Marine Center in Seattle, where it has been since July 1963. In addition to the C&GS, the center includes the Pacific Oceanographic Laboratory, a component of the Institute for Oceanography.

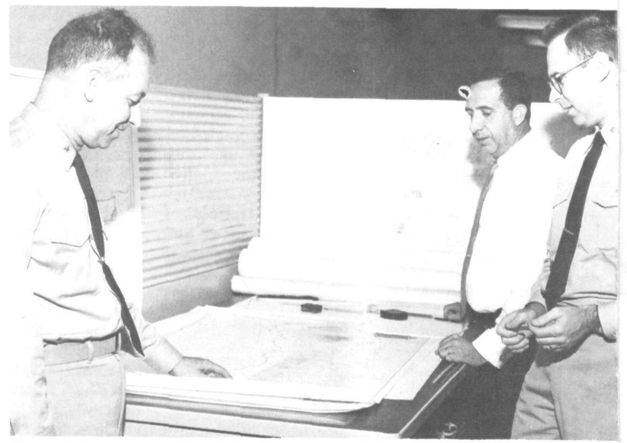
Rear Admiral Harold J. Seaborg has been Director of the Marine Center since early 1965; prior to that he was captain of the USC&GSS PATHFINDER.

Under Admiral Seaborg's command are 47 USESSA officers, 45 civil service employees and 219 shipboard crew members. Doing research at the center are scientists, engineers and technicians in cartography, geodesy, geomagnetism, gravimetry, oceanography, photogrammetry, and seismology.

One of the primary functions of the center is ship operation in the Pacific and the Seattle office is home base for six of C&GS's 15-ship fleet. Later this year ESSA's newest oceanographic ship, the USC&GSS OCEANOGRAPHER, will join the fleet in Seattle. □

Pacific Marine Center, on the east shore of Lake Union, Seattle

Computer Branch—Richard D. Lynn, cartographer, and Kay Kuhn, computer operator, watch Gerber Digital Plotter work from taped data.

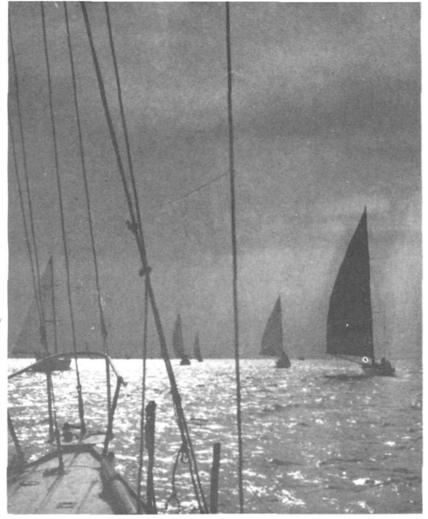


From left: Commander John Boyer, Operations Division chief; George Fernandos, cartographer, and Lt. Com. George Poor, projects officer.

From left: C. E. Pedersen, Facilities Branch maintenance officer; Henry Shek, chief, and Commander Ralph Uhrich, chief engineer.

A Nation of Sailors

...is served by ESSA with growing marine safefy programs



"NAVIGATE SAFELY!" With this slogan, ESSA will bring to the attention of hundreds of thousands of boating enthusiasts a new, colorful exhibit which will be displayed for the first time at 16 boat shows across the country. By word and picture ESSA will strive to acquaint them with its work, including vital services to operators of the almost eight million recreational boats in the United States. The exhibit will emphasize the navagational products and services of ESSA's Coast and Geodetic Survey and the Weather Bureau's marine weather services.

This is the second year that ESSA has entered exhibits at boat shows. Last year, during its formative months, ESSA exhibits consisted largely of combined Weather Bureau and Coast Survey displays. In previous years, both agencies had separate exhibits.

ESSA exhibits will be on display between January 11 and April 2 at boat shows in New York City and West Hempstead, N. Y.; Los Angeles and San Francisco, Calif.; Miami, Fla.; Chicago, Ill.; Baltimore, Md.; Boston, Mass.; Philadelphia, Pa.; Dallas, Ft. Worth, and Houston, Tex.; Norfolk and Richmond, Va.; Seattle, Wash.; and Washington, D. C. In each location nautical charts will be on display and material will be distributed explaining ESSA's services to mariners.

ESSA's boat show exhibits are designed to encourage mariners to make safety a habit through use of its services and products, which are free or sold at nominal cost. With boating expected to increase by an estimated 175,000 boats annually, the exhibits will stress each mariner's responsibility and obligation to navigate safely.

ESSA offers multiple services to mariners. They include C&GS nautical charts, tide and tidal current tables, and Coast Pilot (sailing) publications, and Weather Bureau warnings and forecasts via AM, FM and VHF radio, television, radiotelephone, and warning signal displays of strong winds, bad weather and sea conditions in coastal and inland waters.

Free catalogs showing area coverage of all C&GS nautical charts for inland and coastal waters of the United States, a compilation of 600 sales agents, a listing of latest editions of charts, and copies of a brochure entitled, "Navigate Safely," will be available at the exhibits. Also, Coastal Warning Facilities Charts of each area, showing radio weather broadcast schedules and locations of warning displays will be distributed free.

Since the mid-19th century, C&GS nautical charts have played an important part in the nation's economic growth and national security. The ever-increasing congestion on the nation's waterways made it essential that accurate, adequate and up-to-date nautical charts be available. C&GS nautical charts measure up to the high standards of accuracy necessary for the nation's commercial shipping, recreational boating and the national defense. They are continually up-dated to show navigational hazards located during surveying operations, reported by Government, state or private sea-going observers, and through user evaluation studies.

Four types of conventional charts are available: Harbor charts, for navigation in harbors and small waterways; coast charts, for inshore coastal navigation; general charts, for offshore navigation; and sailing charts, for offshore sailing between distant ports.

Small-craft charts, including Intracoastal Waterway dual purpose charts, are designed for easy handling where space is at a premium and produced on a large scale for easy interpretation. They include tide tables, current and weather information, broadcast schedules, Rules of the road, whistle signals, docking facilities and supplies and services ashore.

The exhibit describes how ESSA converts global weather observations into forecasts and speeds them to the small-craft operator. These observations are made at special Weather Bureau reporting stations and supplemented by information received from weather satellites and floating weather stations, and from merchant ships and boaters. Data are constantly being collected and analyzed by electronic computers and automatic data processing equipment and the resulting forecasts transmitted to ships and boats by high-speed communications.

The Weather Bureau's Marine Weather Service issues weather forecasts for boating areas in the United States every six hours. Latest forecasts are available via AM and FM radio and television, from marine radiotelephone broadcasts, by telephone from Weather Bureau offices, and through newspapers.

A new Very High Frequency (VHF) radio communications system devoted exclusively to continuous FM transmissions of weather information speeds the latest forecasts to mariners. The bulletins include local marine forecasts and warnings of approaching storms; reports of weather, wind, visibility and sea conditions at coastal and harbor stations; and severe weather warnings often based on radar reports. The broadcast bulletins are revised every three hours (or more frequently if warranted) and transmitted on a frequency of 162.55 megacycles. They are available for the greater portion of each day and can be received within approximately 40 miles of each station.

This network of VHF stations includes New York, Chicago, Kansas City (Mo.), and Honolulu. During 1967 stations will be installed at Providence, R.I.; Boston, Mass.; Atlantic City, N.J.; Washington, D. C.; Norfolk, Va.; Wilmington, N. C.; Charleston, S. C.; Jacksonville, Tampa, and Miami, Fla.; Lake Charles and New Orleans, La.; and Galveston, Corpus Christi and Brownsville, Tex.

An experimental service now available only to mariners in the Chesapeake Bay area enables them to speak with a marine forecaster by radiotelephone. By asking the Wilmington, Del., marine operator for "Boat-to-Forecaster Service," a boatman is connected with a marine forecaster at Washington, D. C. This service may be extended to other areas.

Attendants at the exhibits will answer questions concerning the ever-advancing technology of the meteorological sciences, the charting program, and other ESSA services. □

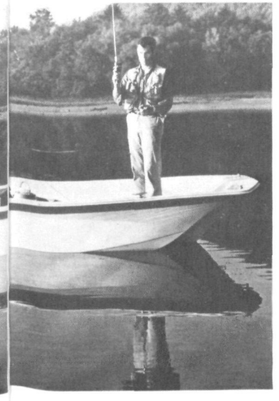
ESSA PARTICIPATION in 1967 Boat Shows

Jan. 11-22	National Boat Show New York, N. Y.
Jan. 14-22	Seattle National Boat Show Seattle, Wash.
Jan. 27-Feb. 5	Southwest Boat Show Dallas, Tex
Jan. 31-Feb. 5	Houston International Boat, Sport & Travel Show, Houston, Tex.
Feb. 3-12	San Francisco National Sports & Boat Show, San Francisco, Calif.
Feb. 4-12	Chesapeake Bay Boat Show Baltimore, Md.
Feb. 4-13	Marine Recreation Boat Show West Hempstead, N. Y.
Feb. 15-19	Fort Worth Boat & Sport Show Fort Worth, Tex.
Feb. 17-22	Miami International Boat Show Miami, Fla.
Feb. 17-26	Southern California Boat Show Los Angeles, Calif.
Feb. 18-26	Philadelphia Boat Show Philadelphia, Pa.
Feb. 18-26	Washington International Boat & Sport Show, Washington, D. C.
Feb. 22-26	Virginia Boat Show Richmond, Va.
Feb. 25-Mar. 5	*New England Boat Show* Boston, Mass.
Mar. 24-Apr. 2	Chicago National Boat, Travel & Outdoors Show, Chicago, Ill.
Mar. 31-Apr. 2	Waltonian Sports Show Norfolk, Va.

Section of ESSA's Boat Show exhibit is inspected by J. George Hankey (right), Chief of Exhibits Section, and Visual Information Specialist Richard Feeney.

"NAVIGATE SAFELY!" ESSA's boat show exhibits are designed to make safety a habit

1967 BOAT SHOWS



Chris Craft photos

. . . Why are weather balloons circling the earth?

Space-Age Ghost Story

One of the most important experiments in global meteorology will be completed in March. And if the results are as exciting as first reports indicate, there is great promise for a major breakthrough in atmospheric observations.

The experiment is a joint United States-New Zealand pilot project to test the Global Horizontal Sounding Technique (GHOST)—one of the ways proposed to provide adequate weather observations from the entire globe.

Project GHOST is a plan for using satellites to locate and receive information from large numbers of balloons floating around the earth at constant altitudes. It was conceived and is being managed by the National Center for Atmospheric Research at Boulder, Colo.

The pilot test, called the Southern Hemisphere balloon experiment, began last March at Christchurch, New Zealand. It is sponsored by ESSA and the National Science Foundation with the endorsement of the World Meteorological Organization. ESSA's National Environmental Satellite Center has the technical coordination responsibility for the Government.

The Southern Hemisphere GHOST experiment is being conducted by a group under the direction of Vincent E. Lally of the NCAR Scientific Balloon Facility. The principal aim of the experiment—to prove that balloons can be launched and remain aloft more than a few days—has been accomplished. Successful, long-lasting balloon flights are the key to the GHOST system's eventual use.

The GHOST balloons were designed and developed under Lally's direction. They are made of *Mylar,* a strong and essentially non-expansible laminate. They are inflated with helium to a slight over-pressure so that they will float at a constant atmospheric-pressure level in spite of daytime heating and nighttime cooling.

They carry a sensor package which contains instruments to measure temperature, humidity and atmospheric pressure as well as a radio transmitter for sending this information to ground stations (or to satellites later). The telemetry system used in the experiment is powered by solar cells. They transmit a Morse-code letter which identifies the balloon. Tracking stations equipped with a high-frequency receiver, a stop watch, and sun tables locate and position them.

More than 50 balloons have been launched since the test program began. The most successful test flights have been at 40,000 feet. Many of them have been tracked for more than three months. One launched on April 28, 1966 was tracked for over six months and made 16 orbits of the hemisphere. It takes about 12 days for one to circle the hemisphere.

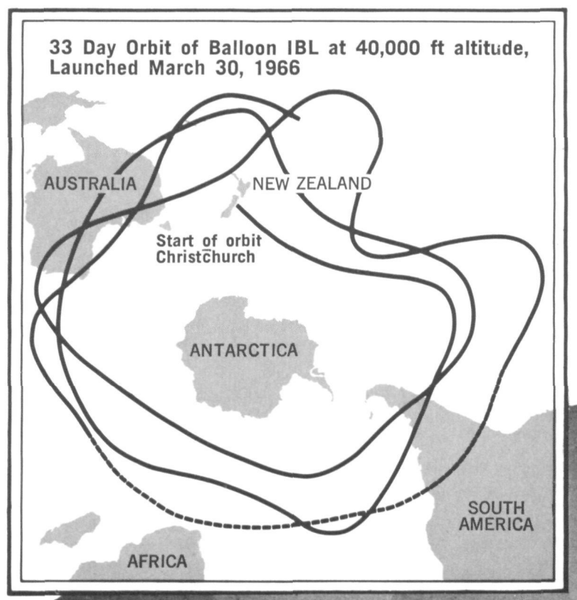
The average lifetime for the 5-foot balloons at 20,000 feet has only been about ten days because of the moisture and icing problems found at that level. Project scientists are now developing a coating process to lick the problem and hope to have the balloons at 20,000 feet up for as long as 180 days. The balloons being flown at 80,000 feet are expected to provide new information on the climatology of the stratospheric easterlies.

Tracking stations at Christchurch, Tahiti, Lima, Rio de Janeiro, Buenos Aires, Pretoria, Luanda, Zambia, Mauritius, and Melbourne participate in the program. In addition, Djakarta has furnished data on balloons which have moved near the Equator. Those stations in good listening locations have tracked them at distances over 5,000 miles and have located their positions within 30 miles. On one occasion, a balloon "lost" five days after launching reappeared two months later. How it managed to survive for 60 days and escape the tracking network remains a puzzle to project scientists.

The number that can be tracked at one time is limited to less than 100. Larger numbers must await the development of the balloon-satellite system.

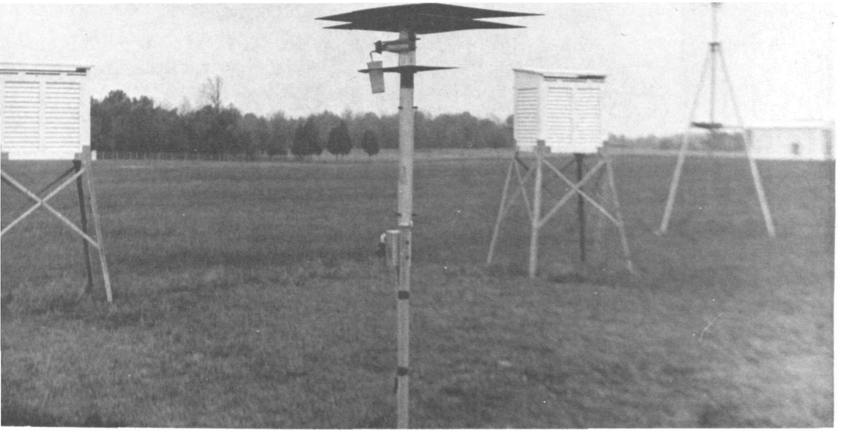
An operational GHOST system is still in the future. It envisions a fleet of 10,000 or more balloons scattered through the atmosphere at many levels. It would employ one or more earth orbiting satellites to relay the data to ground stations where super computers, programmed with a mathematical model of the atmospheric general circulation, would use the data to produce accurate and long range global weather forecasts.

Such a global meteorological observing system is the vision of meteorologists the world over who have been plagued by the lack of weather observations in their attempts to understand and predict our atmosphere. The Southern Hemisphere experiment may be a first step toward the realization of that goal. □

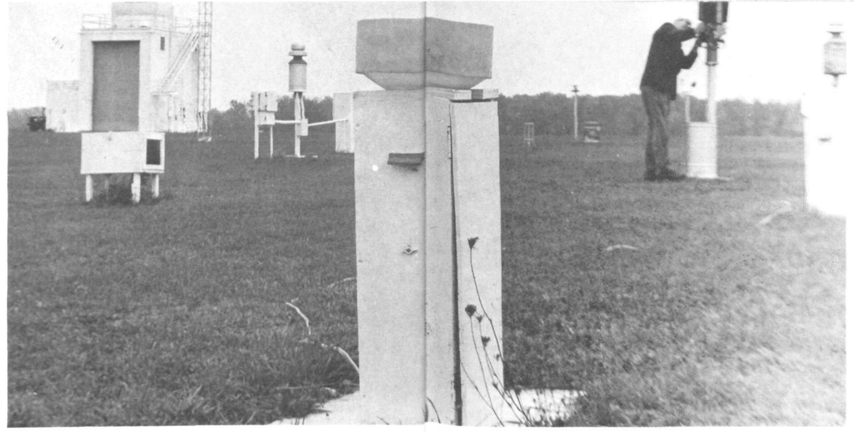


GHOST balloon with five-ounce power-generating payload.

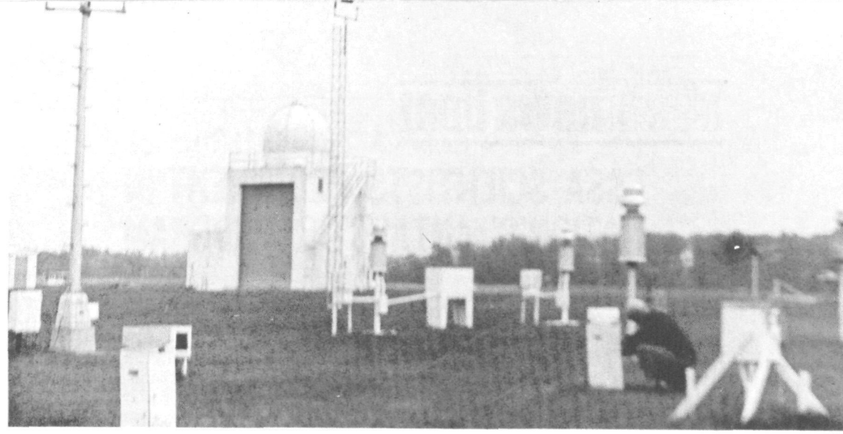
Five-ounce payload suspended from GHOST balloon with a top-deck of fuel cells to generate electricity from sunlight.



A mortarboard psychrometer (named for its design) is tested for accuracy of humidity measurements.



A new rain guage dominates the foreground as a technician adjusts a weather sensor in the background.



Vast array of instruments is spread out over the testing grounds of the Weather Bureau evaluation facility at Sterling, Virginia.

It's do or die for new tools of the weatherman's trade at the Sterling, Va., home of

'The Men From Missouri'

By SUMNER BARTON
Weather Bureau

Less than a runway's length from Dulles Airport, blending into the rural environment that surrounds it, is a little-known but integral part of ESSA's Weather Bureau.

It is the Test and Evaluation Laboratory, the proving ground where new equipment and techniques that grow out of the Systems Development Office are run through the wringer to prove or disprove their worth under field operating conditions.

Some 30-odd buildings of various types, small and low, are scattered over 400 acres of country land near Sterling, Va., once occupied by the Central Radio Propagation Laboratory (now the Institute of Telecommunication Sciences and Aeronomy) before the Weather Bureau inherited it in May, 1960.

They operate in a quiet, undisturbed setting in harmony with the dairy grazing grounds a short way down the road. A traveler could easily pass it by unnoticed, were it not for a small sign at the gate entrance, the only identification. A closer look reveals clusters of experimental instrument shelters that break up the expanse and give a hint of activity going on.

The true mission of this facility is fully appreciated only from within when the staff of 20 scientific and technical personnel under the direction of William E. Eggert explain their work.

Eggert, a former Fulbright scholar, has returned to the Weather Bureau after having transferred from the Federal Aviation Agency where he directed the Aviation Weather Research and Development Program. In earlier Weather Bureau assignments he headed up visibility research projects at Newark, N.J. and Atlantic City, N.J.

The laboratory, one of four of the Office of Systems Development, determines the suitability of meteorological systems for field use from all aspects—performance, reliability, efficiency, cost, durability, and maintenance. Its staff men, like Missourians, have to be shown.

It also performs other tasks by agreement, such as data gathering and comparative testing for the World Meteorological Organization which is concerned with international standardization of equipment. But the principal function is to suggest, after testing, what weather devices will best serve this nation's extensive array of Weather Bureau stations, offices, and centers.

Some two dozen or more evaluations could be going on at any one time under the supervision of Eggert's assistants at Sterling (there are other units at Atlantic City, N.J.). The Engineering Test Branch is headed by Robert E. Johnson, who also was with the FAA. Elbert W. Atkins is chief of the Functional Test Branch and Maurice Cummings heads the Facilities and Operations Branch. The Observations and Methods Branch, located at the FAA's Experimental Center near Atlantic City, is led by Matthew Lefkowitz.

One of the newer projects under study is a Radar-Telephone Transmission System with which a weather radar image is transferred over telephone lines to other stations which pick up the signal and amplify it on one or more television screens. The purpose of this is to give as many stations as possible radar coverage at a minimum cost.

Automatic observing and reporting equipment is getting a full share of attention. This is a difficult area and the field experiments to date have had only marginal success. Yet, the obvious value in having unmanned observatories capable of transmitting automatically and with minimum maintenance to a central collecting point from remote sections of the United States has been a continuing stimulus toward improvement.

The latest advance is the AMOS V (Automatic Meteorological Observing System), a computerized console that picks up observational signals and transmits them, as programmed, over high speed teletype.

One of the major problems in automated systems is development of sensors reliable enough to respond with the true observational values. How, for example, is it possible for an instrument to read a mercurial barometer, which is standard for the Weather Bureau, and transmit the signal in a form suitable for recording in a computer memory? Under test in connection with AMOS V is an ingenious device with a float of magnetic material riding on top of a mercury column. When the mercury rises or falls, the motion of the float is detected electrically and a motor that rides up and down a parallel arm is actuated in sympathy with the change in atmospheric pressure. The synchronous motion is converted into an electrical signal that can be digested by the computer.

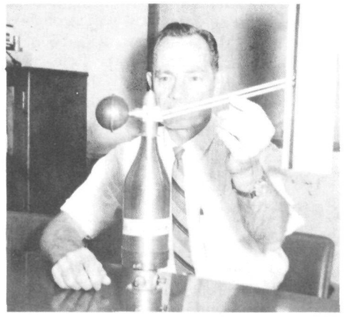
In the automated spectrum are a series of other instruments including a cloud height measuring device, a digital wind system, a battery-operated transmitting station designed to function self-sufficiently in time of disaster, and a selective precipitation indicator.

The indicator was developed by Richard C. Peck, an ESSA electronics technician. This instrument, through use of specially designed electronic grid arrangements, is capable of telling the difference between rain, snow, dew, and frost—and even freezing rain under some conditions.

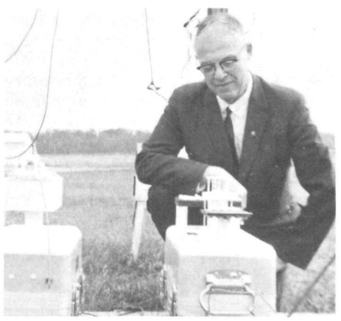
A new project under evaluation is a gyro-stabilized antenna for radiosonde tracking from shipboard. Pitching and tossing of a vessel at sea creates an unstable platform making it difficult to obtain upper air observations. At the test laboratory a platform is being built to simulate the motions of a ship and permit a more realistic appraisal of new equipment, developed to help solve this problem. If all goes well, the project directors hope to field test the equipment later under actual operating conditions on one of ESSA's new ships, either the DISCOVERER or OCEANOGRAPHER.

Also on the test list is an electrolytic hydrogen generator designed to make cheaper hydrogen from water for use in upper air balloons. An efficient system with maximum safety is desirable to permit the transition from the use of helium, which is four times more costly than hydrogen.

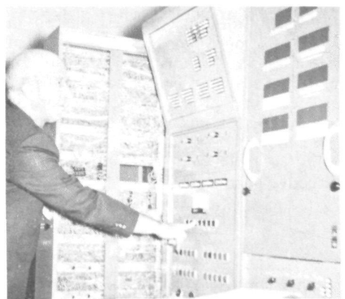
On and on it goes—development of a model bench mark station, evaluation of a spectrophotometer to measure the atmospheric ozone content and of a mortarboard psychrometer, or humidity meter (the name comes from the design), that is used by the Forest Service. □



Viscous-damped wind vane is examined by Maurice Cummings, chief of the Facilities and Operations Branch.



Selective precipitation indicator is inspected by developer, electronics technician, Richard C. Peck.



Automatic weather station is put into operation by Elbert W. Atkins, chief of the Functional Test Branch.

ESSA SCIENTISTS PROMINENT IN NATION'S ANTARCTIC PROGRAM

Twenty-two ESSA scientists will participate in the Nation's 1966-67 Antarctic Research Program.

Their work is being financed with $802,000 in grants from the National Science Foundation, which is coordinating and funding the overall program in which about 150 U. S. and foreign scientists are participating.

Fifteen of the ESSA scientists will spend the winter in Antarctica, remaining until around December 1967; the balance will conduct their research during the Antarctic summer and will probably return next March. They will be stationed at the Byrd, South Pole and Plateau Stations and on the USNS ELTANIN, a research vessel.

Two ESSA scientists will act as the Scientific Leaders at the South Pole Station and the Plateau Station in Eastern Antarctica. They will be the senior scientific representatives there with responsibility over all scientific personnel. They are James B. Pranks, of St. Paul, Minn., at the Plateau Station, and Richard B. Weininger, of Whitestone, N. Y., at the Pole Station. Both will winter over.

The following ESSA scientists are participating in the Antarctic Research Program:

1966-67 Summer Party

Coast and Geodetic Survey: Joseph Zebro, Buffalo, N. Y. (Byrd).

Institute for Telecommunication Sciences & Aeronomy: Charles J. Roubique, Boulder, Colo. (Byrd); Jean P. Whitcomb, Arvada, Colo. (Byrd).

Weather Bureau: Rifaat S. Zabalaoui, New Orleans, La. (Byrd); Herbert L. Monson, Bismarck, N. Dak. (Pole); Brent E. Scudder, Bronx, N. Y. (Byrd); Jerry L. Hollingsworth, North Nampa, Idaho (Pole). Hollingsworth and Scudder were members of the 1966 wintering over parties and are remaining through the summer season.

Wintering Party, 1967

Coast and Geodetic Survey: Graema C. Wilmot, Melbourne, Australia (Byrd); James B. Pranks, St. Paul, Minn. (Plateau); Richard V. O'Connell, State College, Pa. (Pole).

Institute for Atmospheric Sciences: Michael Kuhn, Innsbruck, Austria (Plateau).

Institute for Telecommunication Sciences & Aeronomy: F. Michael Maish, St. Louis, Mo. (Byrd); Donald C. Shepherd, Ann Arbor, Mich. (Byrd); Richard B. Weininger, Whitestone, N. Y. (Pole).

Weather Bureau: Lawrence L. Manthe, Arlington, Wis. (Byrd); Edward C. Velis, Jr., North Tonawanda, N. Y. (Byrd); Harold E. Slusher, Fairborn, Ohio (Byrd); and John C. Plankington, Jr., Corvallis, Ore., Philip H. Postel, Mesa, Ariz., and a third still to be selected, at the Pole Station.

Two Weather Bureau shipboard radiosonde observers, yet to be selected, will conduct observations aboard the ELTANIN from March to October 1967.

Gentry Is Appointed Stormfury Director

Dr. R. Cecil Gentry, Director of the National Hurricane Research Laboratory, has been named Director of Project Stormfury—a joint Department of Defense-Department of Commerce program of hurricane experiments.

Dr. Gentry will succeed Dr. Joanne Simpson. Dr. Simpson, who has been Project Director since 1965, will continue in a Stormfury advisory capacity in addition to her post as Chief of the Experimental Meteorology Branch in ESSA's Institute for Atmospheric Sciences.

As Director of the National Hurricane Research Laboratory in Miami, Fla., Dr. Gentry leads ESSA's research efforts in the field of tropical meteorology. He will retain that position. He has been associated with the Laboratory since it was organized in 1955 and has served as Alternate Director of Project Stormfury.

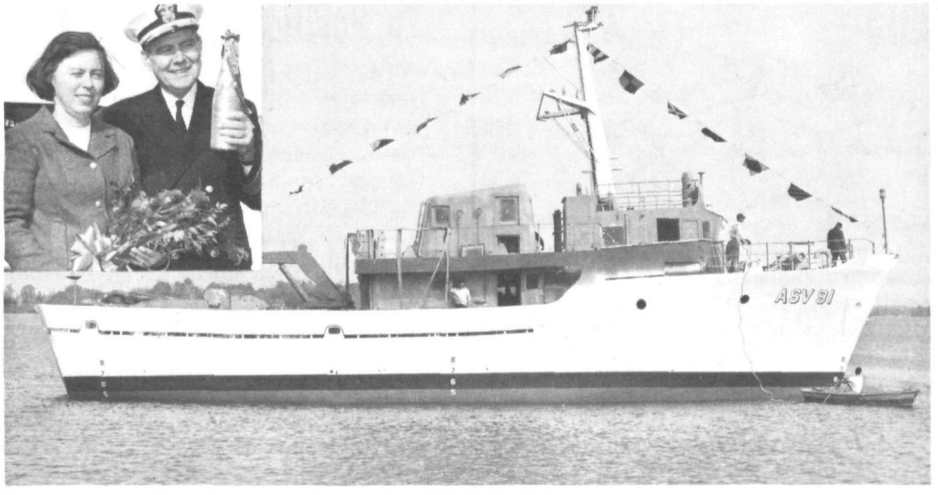
Project Stormfury was established in 1962 as a joint Navy-ESSA program of scientific experiments designed to explore the structure and dynamics of hurricanes. The Project's objectives are to achieve better understanding, improved prediction, and to investigate the possibility of modifying some effects of destructive hurricanes.

NEW ESSA DEPUTY ADMINISTRATOR VISITS HEADQUARTERS

Dr. Werner Baum, incoming ESSA Deputy Administrator (right), recently toured headquarters offices with Dr. Robert M. White, Administrator. They are pictured chatting with Rear Adm. James C. Tison Jr. (left), Director of the Coast and Geodetic Survey.

THREE NEW USC&GS SHIPS JOIN ESSA FLEET

Mrs. John T. Connor christens the USC&GSS MT. MITCHELL as Secretary looks on. Hydrographic survey vessel is one of three under construction. Others: USC&GSS FAIRWEATHER and RAINIER.



Second of two wire-drag ships, USC&GSS HECK, is launched at Jakobson Shipyard, Oyster Bay, L. I. Mrs. D. Thayer Heath, sponsor, is pictured at ceremony with Rear Adm. James C. Tison Jr., USC&GSS Director. HECK is sister ship of RUDE.

Survey vessel USC&GSS McARTHUR was commissioned in Norfolk, Va., Dec. 15. Mrs. George Ashbridge, great-granddaughter of man for whom ship is named, presents a trophy to commanding officer, LCDR Ronald L. Newsom.

". . . peace may well hinge on whether man's needs will forever outrun his ability to supply them. The ocean offers our last and best hope. . . ."

Secretary of Commerce Connor spoke these words at the christening of the USC&GSS MT. MITCHELL Nov. 29 in Jacksonville, Fla. They apply equally to the missions of all ESSA ships, two more of which are approaching service.

The USC&GSS McARTHUR was commissioned Dec. 15 in Norfolk, with Rep. Porter Hardy, Jr. of Virginia as the speaker; and the USC&GSS HECK, a wire-drag vessel, was launched Nov. 1 in New York.

The MT. MITCHELL, christened by Mrs. Connor, with Mrs. J. Herbert Hollomon, wife of the Assistant Secretary for Science and Technology, as matron of honor, is one of three sister ships under construction at the Jacksonville Shipyard by the Aerojet-General Corporation. The others: USC&GSS FAIRWEATHER and RAINIER, all scheduled for completion next year, and designed for charting coastal waters and for oceanographic work on the continental shelves and slopes. Each accommodates 80 officers, crew and scientists.

The McARTHUR, a 175-foot hydrographic-oceanographic survey vessel, will make gravity measurements off the East Coast until June, and will ultimately be based in Honolulu.

The HECK, a sister ship of the USC&GSS RUDE (launched Aug. 17), will team with the RUDE to locate underwater obstructions for the improvement of nautical charts. They will replace the WAINWRIGHT and HILGARD, which have been decommissioned, and will be the only vessels of their kind operating in the United States.

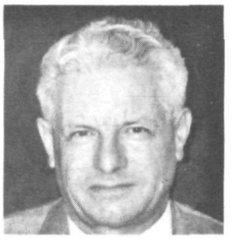
ESSA's growing fleet contributes in a variety of ways to increasing the Nation's knowledge of the sea around us.

VICE ADMIRAL KARO IS GIVEN A FAREWELL TO REMEMBER

Assistant Secretary of Commerce for Science and Technology, Dr. J. Herbert Hollomon speaks at retirement dinner honoring Vice Admiral H. A. Karo, ESSA Deputy Administrator. With Karo are his daughter Kathryn and his wife, Elsie.

retirements

DR. HELMUT E. LANDSBERG, Director of the Environmental Data Service, will join the University of Maryland faculty. He has headed the Nation's climatological program since 1954, when he became Director of the WB Office of Climatology. In a long and distinguished scientific career, he has received many honors, including the Department of Commerce Gold Medal in 1960 for major contributions to meteorology and climatology and administrative leadership.



HAROLD R. McBIRNEY, Chief of the Engineering Division at the Weather Bureau headquarters in Silver Spring, retired Dec. 29, after 38 years with the agency. He began as an observer at Boise, Idaho and served in numerous spots before supervising weather forecasters stationed in Europe from 1946 to 1948. He then became Chief of the Weather Bureau's Manila mission, came to headquarters in 1951, and has headed its Engineering Division since 1963.

LLOYD E. BROTZMAN, on Dec. 30, concluded 46 years of service to the Weather Bureau—a career which began as a printer's helper in Pittsburgh, Pa., and ended as Deputy Director of the Eastern Region. In the early 1940's he was assigned to the central office in Washington. He became Regional Administrator of the New York Regional Office in 1959 and was named Deputy Director in 1965. He and Mrs. Brotzman plan extensive travel through the United States.

RAYMOND A. GIRARD, Deputy Assistant Administrator for Administration and Technical Services, became Director of ESSA's Office of Administration in July, 1965, after serving as Assistant Director of Administration in the Coast and Geodetic Survey. Previously, he was in the Office of The Secretary of Commerce, with responsibility for evaluating programs, policies and budget for Weather Bureau and the Survey. He is concluding a Federal career which began in 1930.

Three Men Appointed To Positions In ESSA

The following ESSA appointments have been announced:

—Capt. Lorin F. Woodcock, 47, of Alton, Calif., as Associate Director for Geodesy and Photogrammetry, Coast and Geodetic Survey. He succeeds Capt. Joseph E. Waugh, retired. Capt. Woodcock's former post as Chief of the Photogrammetry Division, has been assumed by Capt. V. Ralph Sobieralski, 57, of Tampa, Fla.

—Robert B. Rollins, 37, of Silver Spring, Md., as Deputy Director, Executive and Technical Services Staff, Coast and Geodetic Survey. A career employee, recipient of 12 awards for outstanding performance, he formerly served as Administrative officer for Executive and Technical Services.

—Dr. George H. Keller of Wethersfield, Conn., as Director of the Marine Geology and Geophysics Laboratory of the Institute for Oceanography. He previously served as head of the geological laboratory of the U.S. Naval Oceanographic Office.

A Flag for Mr. Oswald

Three score and four years of volunteer weather watching

Picture, if you will, a piece of furniture in a home in Bridgeport, Md., crammed so full of weather records that the drawers can't be opened without a hefty tug.

Exaggeration? Not in the least—it's in the home of D. Paul Oswald who's been a cooperative weather observer for 64 years carrying out a tradition that began long before the American Revolution. Oswald holds the record for the longest series of weather observations made by one man in the history of Maryland and is coming close to an all-time national record as far as length of service as a volunteer weather observer is concerned.

Weather Bureau officials paid tribute recently to the 80-year-old volunteer weatherman (one of 12,000 throughout the United States) by presenting him with a United States flag which had flown over the State Capitol. W. J. Moyer, WB state climatologist for Maryland and Delaware, estimated that the octogenarian has contributed the equivalent of more than three years of full-time work to his country. This estimate is based on the time spent on weather observations by the average volunteer—15 minutes daily.

"I'm sure," said Moyer, "that Oswald has devoted far more time than that because of his cooperation with the newspapers and radio stations."

Clarence W. Reynolds, meteorologist-in-charge of the Baltimore Weather Bureau office, made the flag presentation. The flag was promptly run up a brand new pole which Oswald had installed on the front lawn of his home. Oswald also has received the Thomas Jefferson award in 1960 and a letter of commendation from President Kennedy in 1963.

In 1898 his father, Daniel E. Oswald, agreed to set up a Weather Bureau cooperative station at his home, mainly to provide a worthwhile hobby and the beginning of a scientific education for his sons. Young D. Paul, born in Chewsville, Md., in 1886, began his weather observing in 1902, sending in reports for several years over the name of his brother E. Ingram, who had operated the station from July 1898 after his father had completed the first three months.

Oswald left the station in care of his father in 1918 to accept a position with the Weather Bureau at the Baltimore Custom House as assistant observer, where he learned WB operation and practices which helped to make him the outstanding observer that he is. "Weather reporting," said Oswald, "has been my most important and enjoyable avocation."

How does volunteer weather observing benefit the nation? Here is a partial list of uses that the WB has found for the data gathered by these observers:

- **When fuel supplies should be delivered.**
- **Computing snow melt rates over watersheds where dams are planned.**
- **Surveys for airport development.**
- **Evaluating insurance liability risks and verifying claims.**
- **Evaluating prospects of commercial vegetable growing in various states.**
- **Adapting school construction to climatic conditions.**

ESSA is able to help industry with these and many other problems and also assist researchers in their attempts to learn more about our climates from the weather records at various locations kept faithfully by cooperative weather observers for many decades.

For Mr. Oswald, a flag . . . and our sincere thanks. □

New Use For Sky Eye— It May Become Snowbird

Successful tests point the way to a new use for the satellite—the measurement of snowfall.

A study performed for the Weather Bureau's Office of Hydrology showed that one inch or more of continuous snow cover could be reliably identified from satellite pictures.

The finding was significant since snow is a major contributor of water to many of the nation's rivers and streams. If a satellite system for measuring snow depths is developed, it could be an important supplement to existing procedures and contribute toward more rapid evaluation of snowmelt at time of thaw.

Snow distributions, according to the Office of Hydrology report, can be mapped with an accuracy of about 20 miles. Sufficient detail in the snow pattern can be recognized to permit mapping in individual river basins as small as 400 square miles.

The study, performed by ARACON Geophysics for the Office of Hydrology, indicated a valid application in non-forested regions.

In exposed areas, snow depths of three inches or less showed reflectivities lower than those of greater depths. That means that heavy snow cover stood out more brightly on the satellite pictures, in sufficient contrast for practical evaluation.

In forested regions, however, there was no discernible variation in reflectivity with snow depth.

The report was based on investigation of TIROS and ESSA satellite pictures, which were analyzed with reference to actual snow depth data for the Missouri and upper Mississippi river drainage area.

Greater detail in snow cover mapping could be achieved, it was stated, with higher resolution satellite cameras.

The Office of Hydrology is considering additional studies of satellite snow mapping to obtain a broader view of the possibilities of exploiting this technique as part of standard operating procedures.