World Weather Watch: Meteorologists of the World Unite

Geneva. A truly global system of weather observation, a dream which meteorologists and atmospheric scientists share, moved closer to realization at the 5th congress of the World Meteorological Organization, held here in April.

The congress was the month-long, quadrennial meeting of the WMO, a special agency of the United Nations and the international key club of chiefs of national weather services. Major business at the 5th congress was adoption of plans for the first phase of a World Weather Watch to cover the years 1968 to 1971. The WWW builds on the foundations of existing arrangements, and the plans provide essentially for extension of the world weather observation network and improvement of global data-processing and telecommunications systems.

This first phase is expected to make possible a more rapid exchange of weather information and to permit the making of longer-term forecasts. But the contemplated advances are seen by the planners as preliminary steps toward creation of a global observational network which will yield data enabling scientists to understand the general circulation of the atmosphere and, eventually, to take effective measures in modifying the weather.

No date is set for the coming of the meteorological millennium, but the progress in technology of the past few years has been remarkable. The concept of a World Weather Watch was given great impetus by the first successful flight of a weather satellite, Tiros I, in 1960. And, on the ground, the satellite has found its complement in computers used for handling vast quantities of data, assisting with forecasts, and even drawing weather maps.

With its neat, alliterative title, the WWW has won a fair amount of publicity, and the impression has sometimes been given that a weather watch is mainly a business of satellites talking to computers. Extraordinary as technological progress has been, the fact remains that there are many things satellites cannot yet do, and that computers fed inadequate or inaccurate data are notoriously unhelpful. So, in the first phase of the WWW, much effort will go toward extending conventional, ground-based observational techniques to the less-frequented reaches of the land and, especially, the sea.

Like all international projects, the WWW has a limited financial ceiling. Weather is a universal concern, however, and as it relates to such things as agriculture and aviation, weather forecasting is an important government responsibility. The WWW, therefore, has a stronger-than-usual appeal to the national self-interest of each of the 130 member countries of the WMO.

The WMO is an intergovernmental organization, and the WWW is essentially a cooperative venture operating largely on the basis of each participating country's paying according to its ability and according to the use it makes of WWW services. Implementation is to be achieved through a "voluntary" program with four components. "National implementation programs" are the key to the WWW, since the new system really depends on the willingness of participants to adapt their national services to the world service. Wealthier nations will also be expected to finance "hub" installations for the communications network. The United Nations Development Program will be asked to provide money from its special fund to help less-developed countries with projects (mainly in applied research), training of technical staff, and acquisition of equipment and building of facilities. Bilateral assistance in the field of meteorology is now substantial, and efforts will be made to expand this assistance in behalf of the WWW. These forms of aid will be supplemented by a "Voluntary Implementation Fund," to be administered by the WMO. Donor nations will make available funds, services, or equipment which will be distributed by the WMO on a priority basis to fill gaps in the WWW apparatus.

Perhaps the touchiest matter with which the congress dealt was the routing of the global telecommunications system. Anchoring the system are three World Weather Centers, in Melbourne, Moscow, and Washington, connected by a main trunk line comprising telephone-type circuits capable of exchanging both digital and nondigital signals at high speed. The function of these centers is to collect, check, and edit weather data from lower levels and transmit processed weather information on the main trunk circuit.

Regional trunk centers will serve as intermediate points for relaying data and processed information to and from national and world centers. The congress named the regional centers but did no detailed routing of lines. This is a sensitive matter because being host to a regional center on the main trunk circuit involves both advantages and costs. The congress prudently left the details of routes to regional associations.

As for the observational network, plans for the next 4 years aim for achievement of what are described as "limited objectives." Deficiencies in the network are glaring in most ocean areas, in the tropics, and in other remote land areas, such as Siberia. It is hoped that about 40 new land stations and five to ten new weather ships will be added during the first phase and that perhaps 100 merchant ships will cooperate and be equipped to launch radio balloons effective up to an altitude of 32 kilometers (20 miles). A spacing of weather stations at not more than 1500-kilometer intervals by the end of the period is the aim.

Well-publicized expectations that satellites will play an increasing role in weather observation seem to be justified, although satellites are far from achieving their full potential. The satellite is simply an observing platform. Operational satellites now have equipment aboard which takes pictures of cloud patterns and either stores them for later transmission or broadcasts them continuously via an Automatic Picture Transmission (APT) system (*Science*, 11 March 1966). Nighttime coverage is obtained from radiation measurements made by Nimbus infrared radiometers.

It now appears practicable to gain vertical temperature readings by means of satellites carrying spectrometers for measuring radiant energy in different parts of the atmosphere. What is needed is continuous measurement of mass, wind, and moisture fields, and people familiar with sensor instrumentation indicate that satellites can

fairly soon be equipped to do this sort of monitoring. Along with the more sophisticated satellites, coming years will see the deployment of other observational devices such as constant-level balloons, oceanographic buoys, and automatic weather stations.

Prospects of a radically improved observational network, the means for taking a synoptic look at the world's weather, are bringing meteorologists and atmospheric scientists closer together. A century ago, those active in meteorology were concerned mainly with theory. As techniques for forecasting improved and the demand for forecasts increased, a split occurred. Meteorologists clustered in the government weather services and researchers gathered mainly in the universities, and, while it should not be exaggerated, a service-versus-science conflict developed. In the United States, the Weather Bureau over the years provided only a part of the funds for research in atmospheric science; the military services, NSF, and, lately, NASA provided a larger total. The phenomenon has not been limited to the U.S.; in the Soviet Union there has been a stiffness in relations between the Soviet Academy and the hydrometeorology ministry. In the United States, recent creation of the Environmental Science Services Administration (ESSA) has symbolized a trend toward reunion. In practical fact, scientists can't carry on research on a global scale without a working WWW, and the meteorologists need the scientists in order to make the theoretical most of WWW data.

For WMO the logical step was to seek a closer relationship with its U.N. sibling, the International Council of Scientific Unions, and particularly with the ICSU member organization, the International Union of Geodesy and Geophysics. This was done, and if things go according to plan, the research part of the WWW will be organized jointly by WMO and ICSU. A draft agreement between the two organizations was approved by the WMO congress and will be put before ICSU at its big meeting later in the year. A joint committee with members drawn from WMO and ICSU will recommend to the parent organizations goals and detailed plans for a WWW scientific program and will define requirements for implementing the plans. The joint undertaking is known as the Global Atmospheric Research Program (GARP), and the planners are looking beyond 1972 to a time when it will be

NIH: Lister Hill Criticizes LBJ Budget

The Senate Appropriations Committee is in the process of taking testimony on the budget for the National Institutes of Health, and, while it will be several weeks before the final figure for medical research is set, NIH and its friends are looking toward Senator Lister Hill (D–Ala.) in the hope that he may be able to improve their prospects.

It is a role that Hill traditionally shared with the late John Fogarty, his counterpart on the appropriations committee in the House. With Fogarty's death, however, one half of the tandem is gone. The House unit, influenced by the expense of the war and affected by the presence of newcomers who entered the subcommittee after the last election, has already voted to stay within the administration's figure of $1,187,250,000 (*Science*, 26 May). So Hill has his work cut out for him, and, while he is a sensitive politician who is apt to take his stand on the politically possible, it is of interest to note that he has recently stepped up his public criticism of the administration's requests.

Speaking on 9 June at commencement exercises at Baylor University Medical School, where he received an honorary degree, Hill defended NIH against "irresponsible charges" that its appropriations in the past have been too high. "In our federal research effort we have sometimes been criticized as having 'money to burn,'" Hill said.

> The truth of the matter is that over the past several years the National Institutes of Health has turned down more than one half of all research investigators coming to it for support. Furthermore, of those applications which are *scientifically approved* for payment by a rigid double review system, millions of dollars in potential grants are not funded each year because NIH lacks the necessary funds.
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> One reason is that federal matching support for medical research and laboratory facilities construction has been seriously curtailed by severe Administration cuts in the program. In 1965, the Congress by an overwhelming vote authorized $280 million over a three year period in support of this activity. Last year the Administration requested only $15 million for the first year of this new authorization; the Congress, after a fierce and arduous effort, raised this sum to $50 million. This year the President recommended only $35 million for this program, and we in Congress have our work cut out for us in attempting to increase this figure to meet a current backlog of $75 million in *scientifically approved* applications for which the matching monies, raised under the most trying circumstances by medical schools and universities in all parts of this land, are already available.

Hill also expressed concern about the inadequacy of the administration's programs for increasing the supply of physicians. He quoted figures indicating that the number of doctors will need to be increased by 50 percent by 1975 and that medical schools will need to increase yearly graduates from the current level of 7500 to about 11,000 during that period. He commented:

> Frankly, we are falling short of these goals. Here, too, the Administration has submitted budget requests to the Congress far short of the authorizations voted in the landmark 1963 and 1965 medical education legislation. In official testimony this year, the Director of the PHS Bureau of Health Manpower estimated that an additional $400 million would be needed over Administration requests to meet matching monies already raised or projected by public and private medical schools for expansion of enrollment.

Not far beneath that criticism lies Hill's conviction that anyone who disagrees with him about the importance of medical research must do so out of ignorance of its beneficial results. Hill has lived with its success stories year after year and is deeply touched by them. "Perhaps," he speculated, "the reason those who oppose acceleration of our medical research efforts, of our battle for the health of our people, persist in being so readily heard is that we are not doing a good enough job in telling the story of our achievements, of our record, of our partnership." To Hill, the case is clear, and he ended by reminding his audience—and, implicitly, NIH—that they have a job to do in making it clear to others as well.—E.L.

possible to conduct a truly comprehensive and possibly definitive experiment on global weather.

Insiders acknowledge that it will be difficult to satisfy both groups. Meteorologists see GARP as chiefly a means of improving service. Scientists say that they have come to the point where theory on atmospheric movement has outrun data. Each group sees the other as a means to achieving its ends. The advantages of collaboration are so great, however, that GARP is likely to flourish. And the WWW itself is evidence that, with nations as with the subdivisions of science and technology, self-interest smooths the way for cooperation.—JOHN WALSH

Appointments

Jack Rosen, consultant on the staff of the Joint Committee on Atomic Energy, to special assistant to commissioner Gerald F. Tape, Atomic Energy Commission. He succeeds **William C. Bartels**, who is to become chief of the terrestial Low-Power Reactor Branch, Division of Reactor Development and Technology, AEC. . . . **Robert B. Uretz**, professor of biophysics at the University of Chicago, to chairman of the department of biophysics at the University. . . **C. Donald Van Houweling**, acting director of the Food and Drug Administration's Bureau of Veterinary Medicine, to director of the Bureau, succeeding **M. R. Clarkson**, who has become executive secretary of the American Veterinary Medical Association. . . . **Preston S. Abbott**, director of the Social Science Research Institute, American University, to director of the Center for Research in Social Systems at the university, succeeding **T. R. Vallance**, who has become chief of the National Institute of Mental Health's Office of Planning. . . . **James G. Miller**, professor of psychology and psychiatry and director of the Mental Health Research Institute, University of Michigan, to vice president for academic affairs at Cleveland State University. . . . **Arthur W. Busch**, professor of environmental engineering at Rice University, to chairman of the newly established Environmental Science and Engineering Program at the university. . . . **Alan J. Brook**, professor of botany in the University of Minnesota's College of Biological Sciences, to head a new department of ecology and behavioral biology at the university. . . . **Thomas F. A. Plaut**, research associate and co-director of the national survey of services and programs for the Cooperative Commission on the Study of Alcoholism at the Institute for the Study of Human Problems at Stanford University, to assistant director of the National Center for Prevention and Control of Alcholism, recently established within the National Institute for Mental Health. . . . **Serge A. Korff**, professor of physics, New York University, to president of the Ameican Geographical Society, succeeding **Walter A. Wood**, who has become chairman of the council of the society. . . . **Ralph B. L. Gwatkin**, research assistant professor of reproductive physiology, University of Pennsylvania, to director of the Tissue Culture Laboratories, Merck Sharp and Dohme Research Laboratories, Rahway, New Jersey. . . . **Daniel Billen**, chief of the section on radiation biology, University of Texas M.D. Anderson Hospital and Tumor Institute, to director of the University of Florida's Radiation Biology Laboratory. . . .

Gladys M. Kammerer, director of the Public Administration Clearing Service, University of Florida, to the National Advisory Heart Council, National Institutes of Health. . . . **Jane C. Wright**, associate professor at New York University School of Medicine and director of cancer chemotherapy at the medical center, to associate dean at New York Medical College. . . . **C. Carl Robusto**, dean of St. John's University Junior College, to dean of the proposed School of General Studies at St. John's. . . . **Joseph B. Sprowls, Jr.**, dean of the Temple University College of Pharmacy, to pharmacy dean at the University of Texas. . . . **Robert H. Maier**, assistant dean of the Graduate School of the University of Arizona, to assistant chancellor of the new campus of the University of Wisconsin at Green Bay. . . . **Robert I. Weed**, associate professor of medicine and of radiation biology and biophysics, University of Rochester School of Medicine and Dentistry, to head of the Hematology Unit of the Department of Medicine, at the University, succeeding **Scott N. Swisher, Jr.**, who has been appointed professor and chairman of the Department of Medicine in the College of Human Medicine at Michigan State . . . . **Richard W. Hudgens**, assistant professor of psychiatry, Washington University School of Medicine, to assistant dean in charge of student curriculum at the School. . . . **James Austin**, professor of neurology, University of Oregon Medical School, to professor and head of the Division of Neurology, University of Colorado School of Medicine. . . . **Charles G. Wilber**, director of the marine laboratories and professor of biological sciences, University of Delaware, to chairman of the department of zoology, Colorado State University. . . . **Henry C. Rubin**, chairman of the Oil Import Appeals Board, to special assistant to the assistant secretary of the Interior for Mineral Research. . .

Recent Deaths

Irving W. Bailey, 82; professor emeritus of plant anatomy, Harvard University; 16 May.

William D. Collins, 91; formerly chemist in charge of the Quality of Water Division, U.S. Geological Survey; 8 May.

Frank Crippen, 47; assistant professor of mathematics, Fordham University; 27 May.

Percy A. Fitzgerald, 71; professor of dentistry, Howard University; 26 May.

Mabel K. Frehafer, 80; professor emeritus of physics, Goucher College; 10 May.

Peter Heinbecker, 71; professor emeritus of clinical surgery, Washington University School of Medicine; 22 May.

Donald B. McMullen, 63; a scientific adviser to the director of the Walter Reed Army Institute of Research and former chief of the Institute's Department of Medical Zoology; 27 May.

Jerome J. Morgan, 86; professor emeritus of chemical engineering, Columbia University; 19 April.

Joseph H. Roe, 74; former chairman of the biochemistry department, George Washington University School of Medicine; 18 May.

George B. Roth, 88; professor emeritus of pharmacology, George Washington University School of Medicine; 23 May.

Erratum: Figure 1 of the paper "Long-term activity in small aquatic animals" by A. A. Heusner and J. T. Enright (28 Oct. 1966, p. 532) is ambiguous to the extent that the two negative terminals might be interpreted as a common point in the circuit. In fact, these two points must be kept separate for the proper operation of the instrument.

Erratum: In the report "Martian relief and the coming opposition" (3 Mar., p. 1100), D. H. Harris stated that, ". . . the reduced contrast with decreasing (terminator distance) just balances the increase in visibility due to shadow length." This is obviously erroneous. A more careful examination of the problem shows that for favorable values of the Aerocentric Earth-Sun angle, visibility of relief increases toward the terminator, clouds not withstanding.